1. Declaration

1.1 Site Name and Location

This Record of Decision (ROD[1]) documents the selected remedy for UXOs 12 and 14, located on the former Vieques Naval Training Range (VNTR) in Vieques, Puerto Rico. UXOs 12 and 14, together comprising just over 4,800 acres, make up the majority of the former Eastern Maneuver Area (EMA), which was established in 1947 to provide areas and ranges for the training of Marine amphibious units and battalion landing teams in exercises that included amphibious landings, small-arms fire, artillery and tank fire, shore fire control, and combat engineering tasks. The former VNTR is part of the Atlantic Fleet Weapons Training Area (AFWTA)-Vieques, which was placed on the National Priorities List (NPL) on February 11, 2005 (Superfund Enterprise Management System [SEMS] identification number: PRN000204694). UXOs 12 and 14 are also known as Operable Units (OUs) 23 and 25, respectively, in SEMS. UXOs 12 and 14 are part of the Vieques National Wildlife Refuge, which is managed by the United States Fish and Wildlife Service (USFWS), a bureau of the United States Department of the Interior (DOI).

UXOs 12 and 14 are sites where munitions and explosives of concern (MEC) were found as a result of historical military training there and where munitions response actions (MEC removal) were conducted. Although a relatively low quantity of MEC is anticipated to be present based on the type of historical training activities and the number of MEC recovered during past MEC removal activities, it is possible MEC may be present in areas planned for future use. Therefore, because a future land user (e.g., recreational user, maintenance worker, or construction worker) may encounter MEC at UXOs 12 and 14, a Remedial Investigation/Feasibility Study (RI/FS) was conducted to assess the nature and extent of MEC and potentially related contamination and to evaluate remedial alternatives to address potential MEC explosive hazard to future land users.

1.2 Statement of Basis and Purpose

The remedy described in this ROD was selected in accordance with the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA), as amended, and the National Oil and Hazardous Substances Pollution Contingency Plan (NCP). The Department of the Navy (Navy), Naval Facilities Engineering Command (NAVFAC) Atlantic, United States Environmental Protection Agency (EPA) Region 2, Commonwealth of Puerto Rico, and DOI entered into a Federal Facility Agreement (FFA) in 2007, as a result of the NPL listing and pursuant to CERCLA. The FFA establishes the procedural framework and schedule for implementing CERCLA response actions for Vieques.

[1] This acronym, and all the others used in this document, can be found in alphabetical order in Section 4 of this document.

This decision is undertaken pursuant to the President's authority under CERCLA Section 104, as delegated to EPA and the Navy in accordance with Executive Order 12580, and in compliance with the process set out in CERCLA Section 120. The selection of the remedy is authorized pursuant to CERCLA Section 104, and the selected remedy will be carried out in accordance with CERCLA Section 121. The Navy is the lead response agency for AFWTA-Vieques and is responsible for taking all appropriate CERCLA response actions necessary to protect public health, welfare, and the environment.

This remedy is being jointly selected by the Navy and EPA, with concurrence of DOI and the Puerto Rico Department of Natural and Environmental Resources (PRDNER). This decision is based on information contained in the Administrative Record file for UXOs 12 and 14. Information not specifically summarized in this ROD or its references, but contained in the Administrative Record, has been considered and is relevant to the remedy selection for UXOs 12 and 14. Thus, the ROD is based upon and relies on the Administrative Record file for UXOs 12 and 14 in making this decision. This ROD was prepared in accordance with EPA ROD guidance, specifically *A **Guide**[1] to Preparing Superfund Proposed Plans, Records of Decision, and Other Remedy Selection Decision Documents* (EPA, 1999) and ***Toolkit**[2] for Preparing CERCLA Records of Decision* (EPA, 2011), a supplement to the 1999 guidance for producing higher quality and more user-friendly RODs. The result is a ROD format that is conducive for the general public to read and understand the information upon which the decisions for UXOs 12 and 14 were made, including providing links to the technical details presented in the Administrative Record for these OUs.

1.3 Scope and Role of Response Action

Although a low number of MEC relative to other sites within the former VNTR have been identified and removed from UXOs 12 and 14 (a total of 53 MEC), previous MEC removal was performed prior to USFWS' identification of planned land uses within the sites. While a relatively low quantity of MEC is anticipated to remain within UXOs 12 and 14, there is potential explosive hazard posed by MEC that may be present in the planned land use areas. However, based on the RI findings, no chemical contamination was identified posing unacceptable human health or ecological risks associated with current or planned use. Therefore, the selected remedy will address the potential remaining explosive hazards to ensure UXOs 12 and 14 can be used as planned. Although there is no groundwater contamination requiring remediation (i.e., no promulgated standard exceedance, no unacceptable risk), groundwater monitoring has been included as part of the remedial action as a conservative measure for assuring that any potential long-term impacts associated with any remaining munitions can be evaluated and addressed. Additionally, no potable groundwater use is anticipated at UXOs 12 and 14 because all potable water on Vieques is supplied by the main island of Puerto Rico and because this type of use is not part of the USFWS long-term land use plan.

UXOs 12 and 14 are two of 19 munitions response sites associated with AFWTA-Vieques that have been or currently are being evaluated in accordance with CERCLA under the Navy's Munitions Response Program (MRP). The Site Management Plan for Vieques further details the investigation history and the schedule for CERCLA investigations/response activities at the former AFWTA-Vieques, and it is updated annually. The response action selected in this ROD is intended to be the final remedy for UXOs 12 and 14 and does not include or affect any other OUs at AFWTA-Vieques under the CERCLA process. The final determinations for the other OUs within AFWTA-Vieques have been documented in past decision documents or will be documented in future decision documents.

UXOs 12 and 14 are the fourth and fifth MRP sites within AFWTA-Vieques for which a final remedy determination has been made.

1.4 Description of Selected Remedy

The selected remedy for UXOs 12 and 14 is Focused MEC Removal, Land Use Controls (LUCs), and MEC Inspections to address MEC that potentially remains onsite, as described in Sections 2.7 and 2.8. This remedy reduces potential explosive hazards, preserves important ecological habitat, is protective of human health, and supports public access under the USFWS land use plan.

The components of the selected remedy are:

- Surface and subsurface MEC clearance within areas identified by USFWS for land management and recreational activities.
- LUC implementation (e.g., educational kiosks and administrative mechanisms, such as special use permits) to guide access to approved areas and control unauthorized access.
- An MEC long-term monitoring (LTM) program, including periodic site inspections for trespassing, erosion, MEC/ munitions debris (MD) recurrence in public-access areas, and the integrity and effectiveness of physical LUCs. Any MEC/MD discovered during implementation of the LTM program will be removed.
- A groundwater LTM program to evaluate long-term trends in contaminant concentrations.

1.5 Statutory Determination

The selected remedy for UXOs 12 and 14 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 to the remedial action, and is cost-effective.

Because MEC posing explosive hazards may remain at UXOs 12 and 14 following implementation of the remedial action, in addition to this remedy the Navy will conduct statutorily required reviews every five years to ensure that the remedy remains protective of human health and the environment.

1.6 Navy Authorizing Signature for the Record of Decision for UXOs 12 and 14, Atlantic Fleet Weapons Training Area – Vieques

12 Nov 2020

J. R. Cirvello
Environmental Business Line Manager
Naval Facilities Engineering Command, Atlantic

Date

1.7 EPA Authorizing Signature for the Record of Decision for UXOs 12 and 14, Atlantic Fleet Weapons Training Area – Vieques

Evangelista, Pat

Digitally signed by Evangelista, Pat
Date: 2021.01.14 15:23:57 -05'00'

See signature block

Pat Evangelista
Director, Superfund and Emergency Management Division
Environmental Protection Agency, Region 2

Date

1.8 DOI Concurrence Signature for the Record of Decision for UXOs 12 and 14, Atlantic Fleet Weapons Training Area – Vieques

Digitally signed by SCOTT CAMERON
Date: 2020.11.30 11:47:11 -05'00'

11/24/20

Scott J. Cameron
Principal Deputy Assistant Secretary for Policy, Management and Budget
United States Department of the Interior

Date

1.9 PRDNER Concurrence Signature for the Record of Decision for UXOs 12 and 14, Atlantic Fleet Weapons Training Area – Vieques

Cynthia Rivera Morales

FEB 27 2020

Cynthia I. Rivera Morales
Acting Secretary
Puerto Rico Department of Natural and Environmental Resources

Date

2. Decision Summary

Vieques is approximately 7 miles southeast of the eastern tip of the main island of Puerto Rico (**Figure 1**). Aside from mainland Puerto Rico, Vieques is the largest island in the Commonwealth of Puerto Rico, encompassing 33,088 acres (51 square miles).

The Navy purchased large portions of Vieques in the early 1940s to conduct activities related to military training. Operations within the former VNTR included various aspects of naval gunfire training, such as air-to-ground ordnance delivery and amphibious landings, as well as housing the main base of operations for these activities at Camp Garcia. The former VNTR is approximately 14,600 acres and is comprised of former military training areas known as the EMA, Surface Impact Area (SIA), Live Impact Area (LIA), and Eastern Conservation Area (ECA) (**Figure 2**).

The Navy ceased training exercises at the former VNTR on April 30, 2003, in accordance with the Presidential Directive to the Secretary of Defense dated January 30, 2000, when the land was transferred to the DOI, to be managed by USFWS as a National Wildlife Refuge. On February 11, 2005, the AFWTA–Vieques was added to the NPL, which required all subsequent environmental restoration activities for Navy sites on Vieques to be conducted under CERCLA. On September 7, 2007, the Navy, DOI, EPA, and the Commonwealth of Puerto Rico finalized an FFA that established the procedural framework and schedule for implementing the CERCLA activities for Vieques. The Navy retains the primary responsibility under the FFA for conducting the environmental investigations and cleanup of the property, as warranted.

2.1 UXO 12 – EMA Interior

2.1.1 Site Description and History

UXO 12 is approximately 4,026 acres and comprises interior portions of the former EMA (**Figure 2**). Artillery exercises were conducted in the EMA using live Marine artillery, including 76-millimeter (mm), 81-mm, 90-mm, 105-mm, 106-mm, and 107-mm rounds, fired from the gun positions in the EMA toward targets located within the SIA and LIA. Twenty-four gun positions were located in UXO 12 that were used for mortar or artillery gunfire (**Figure 3**). Gun positions 1 through 6 were known artillery gun positions that were approved to fire 300 rounds of 155-mm projectiles per day; other, potential gun positions were identified from historical aerial photographs. Additionally, five photo-identified (PI) sites (PI 2, PI 3, PI 12, PI 18, and PI 19) were identified that include three potential small arms ranges and water production wells (**Figure 3**). The roads that bound or traverse portions of UXO 12 are being addressed as separate UXO sites (i.e., UXO 6 - EMA/SIA Planned Public Roads and UXO 11 - EMA Planned Public Roads).

2.1.2 Site Characteristics

UXO 12 contains multiple terrestrial and aquatic habitats including thick thorn scrub, grassland, forest scrub/dry scrub forest/lowland forest habitat, gallery forests, mangrove forests/lagoons, and ephemeral streams. The area is underlain by marine sedimentary, volcanic rock, and granodiorite bedrock; alluvial deposits overlie bedrock near the coastal areas adjacent to UXO 12. The ground elevation at UXO 12 ranges from about 360 feet above mean sea level (msl) in the central-western portion of the site to just above sea level near the coast. An east-to-west drainage divide runs along the central portion of the site, where surface runoff flows to the north toward the ocean and UXO 13 in the northern portion of the site, and to the south toward UXO 14 in the southern portion of the site. Two lagoons (Laguna Monte

Largo and an unnamed adjacent lagoon) occur within the northern portion of UXO 12 (**Figure 4**). These lagoons are not tidally influenced and the temporal presence of surface water is believed to be wholly or primarily the result of precipitation. A number of ephemeral streams occur within UXO 12 that drain toward the ocean, lagoons, and UXOs 13 and 14. The ephemeral streams generally contain water only during sustained precipitation events. Numerous wildlife species exist at UXO 12, including abundant insects, many bird species, various reptiles, and some mammals (**Figure 5**).

Generalized groundwater flow across UXO 12 is consistent with what would be anticipated in that region. Groundwater flows within the bedrock from the topographic high along the approximate east-west center axis within UXO 12 (**Figure 4**) toward the northern and southern coasts. Groundwater adjacent to the coastline is expected to be brackish to saline from seawater intrusion and unsuitable for potable use unless treated. There is currently no public access allowed, and there is no current, planned, or likely groundwater use within UXO 12.

2.1.3 Summary of Previous Investigations for UXO 12

Environmental investigations of the former VNTR that are relevant to UXO 12 have been conducted since 2002, and investigations/munitions removal activities were performed specific to UXO 12 since 2012. **Table 1** summarizes the purpose, scope, and pertinent results of previous investigations and munitions removal activities performed at or relevant to UXO 12.

Table 1 - Previous Investigations and Munitions Removal Activities

Previous Investigation*	Date	Investigation Activities
Preliminary Range Assessment (PRA)	2002-2003	A Preliminary Range Assessment [3] (NAVFAC, 2003) was conducted in 2002 consisting of personnel interviews, archive records search, and inspections, including magnetometer transect survey of six gun positions (G-1 through G-6) at UXO 12 to provide information about the types, quantities, and other factors related to military munitions used, and to identify the types and locations of any targets that may have been used at the former VNTR. The information was used to help identify areas for further consideration. No MEC were found at UXO 12 during the PRA.
Expanded Range Assessment/Site Inspection (ERA/SI)	2005-2008	An Expanded Range Assessment/Site Inspection[4] (CH2M, 2010) was conducted between 2005 and 2008 that included surface inspection at an additional six gun positions (G-14 through G-19). No MEC were found at any of the gun positions. Additional ERA/SI transect inspections for surface munitions were performed throughout the historic area of UXO 12 (including each of the PI sites), covering an area of 274 acres. Only five MEC were identified during the transect inspections. Transect inspections for surface munitions were also performed over most of historic UXO 14, covering an area of 42 acres (approximately 4 percent of UXO 14). Only four MEC were identified during the transect inspections. Transects could not be performed within some areas of UXO 14 due to inaccessibility (i.e., steep terrain, uncut vegetation, and/or standing water) (CH2M, 2010). Based on the results of the ERA/SI, an RI was recommended for both UXO 12 and UXO 14 to delineate the nature and extent of MEC and environmental impacts in soil, and to complete a background study for soil and groundwater.

Table 1 - Previous Investigations and Munitions Removal Activities

Previous Investigation*	Date	Investigation Activities
Background Investigation	2006	A Background Investigation[5] (CH2M, 2007) was conducted in 2006 for the eastern portion of Vieques to develop a set of background values for inorganic constituents (a.k.a. inorganics) in soil for comparison to soil data to be collected during future investigations. This Background Investigation included the same soil type encountered at UXOs 12 and 14.
Non-Time-Critical Removal Actions (NTCRAs)	2012-2013	A Non-Time-Critical Removal Action[6] was conducted in 2012 to perform surface clearance at Laguna Monte Largo and an unnamed adjacent lagoon (when dry), together comprising approximately 25 acres. The work was performed in accordance with a work plan prepared by CH2M (2009). One MEC and 230 MD were recovered during the removal action. Additional removal action was performed in 2013 to remove munitions in a 282-acre area where vegetation was burned by a fire suspected to have been set by trespassers. Seventeen MEC and 4,288 MD were recovered during the removal action.
Remedial Investigation/ Feasibility Study (RI/FS)	2012-2014	An RI/FS[7] (CH2M, 2018) was conducted to assess the nature and extent of MEC and environmental media contamination, to assess potential risks to human health and the environment, and to evaluate remedial alternatives for UXOs 12 and 14. There were no unacceptable risks to human health or the environment[8] posed by constituent concentrations in site media, so no action is required for environmental media. However, because MEC were identified and removed from the sites and because additional MEC may be present in areas intended for future use, an FS was warranted to address these potential explosive hazards. The FS analyzed remedial alternatives to address potential explosive hazards[9] associated with the potential presence of MEC at UXOs 12 and 14 in accordance with EPA guidance. A more detailed description of the FS for UXO 12 is presented in Section 2.1.4 of this ROD.

* Documentation associated with the listed activities is available in the Administrative Record and provides detailed information used to support the remedy selection for UXOs 12 and 14. The relevant referenced information is also accessible by the hyperlinks in the interactive version of this document.

Figure 1 - Regional Location Map

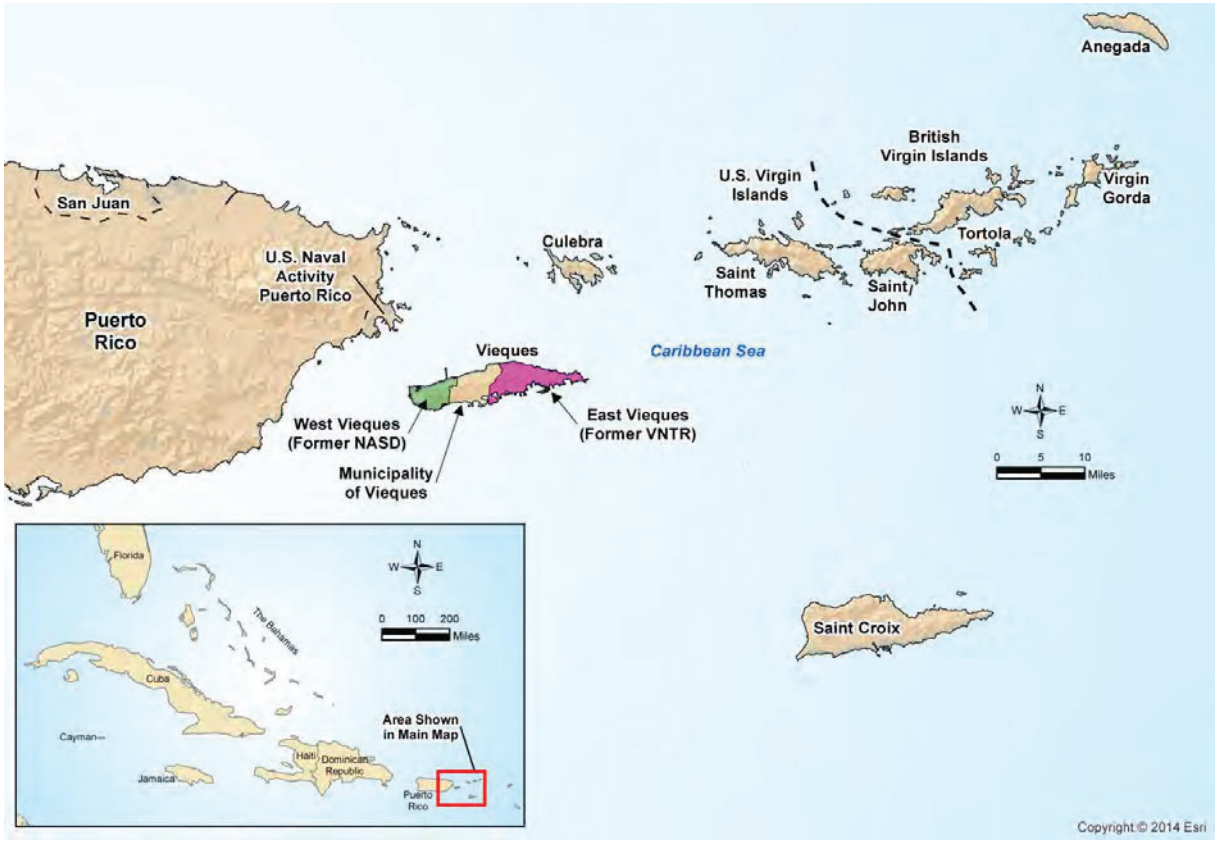


Figure 2 - UXOs 12 and 14 Location Map

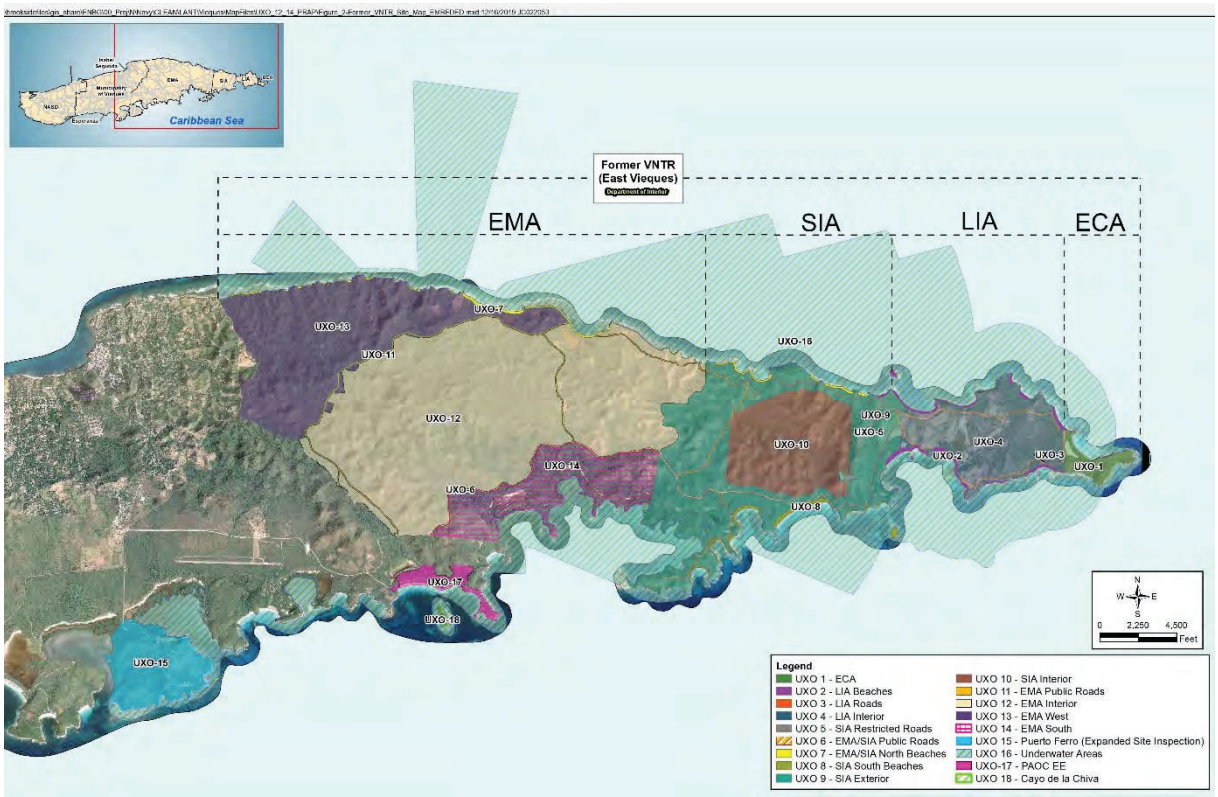


Figure 3 - UXO 12 Site Features

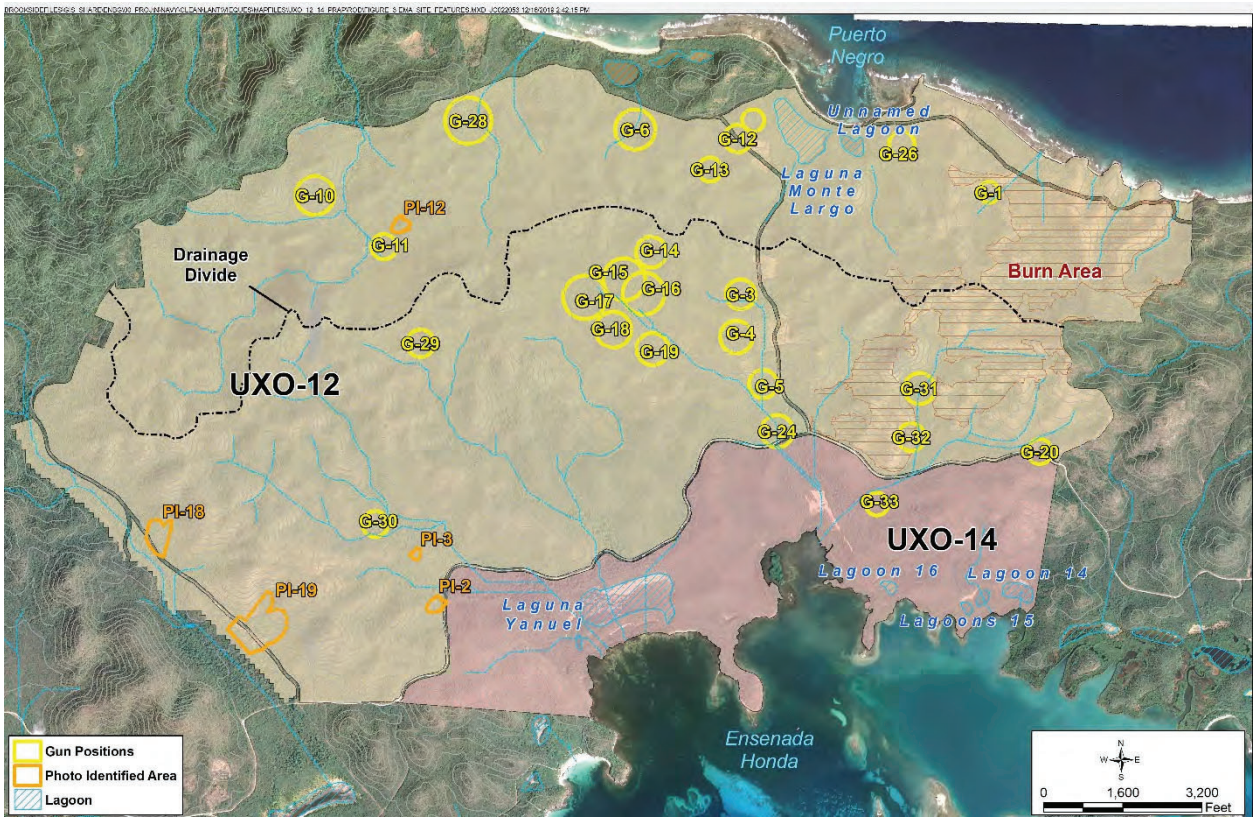


Figure 4 - UXOs 12 and 14 Site Features

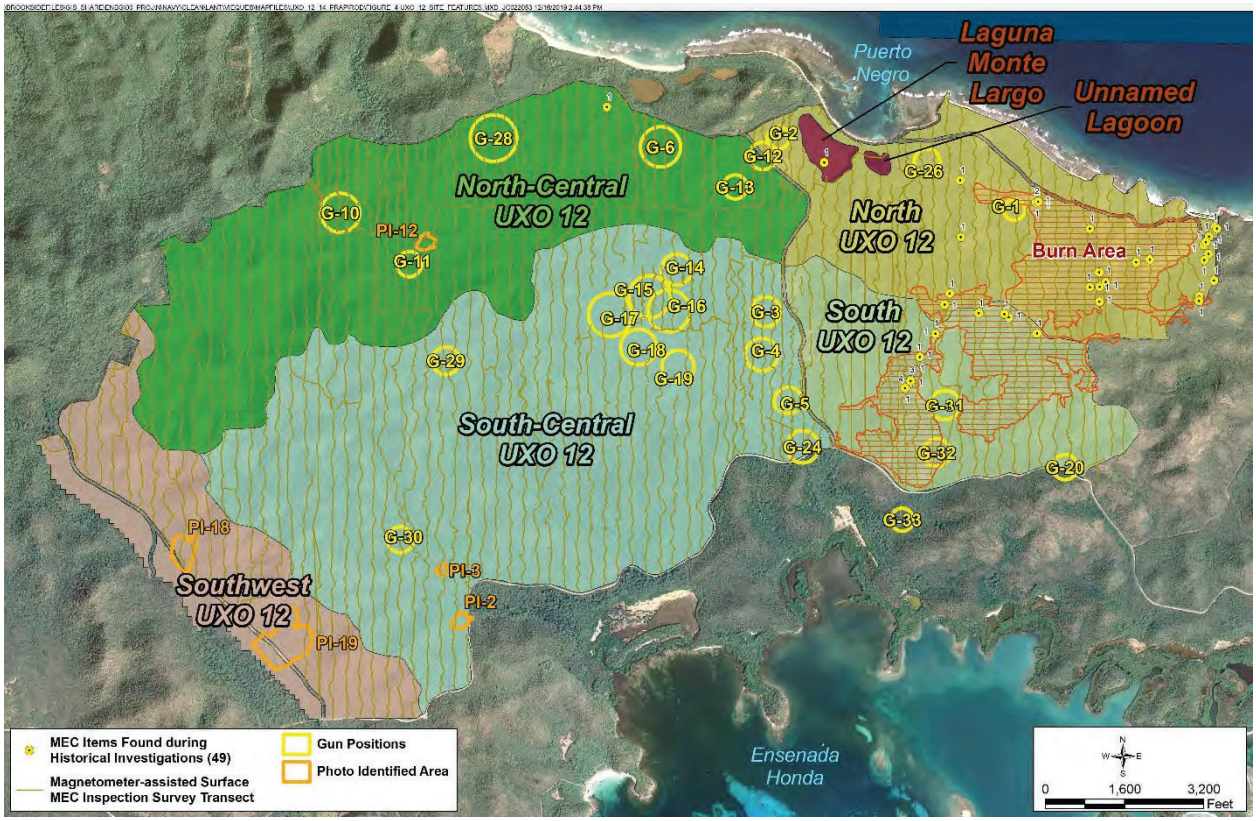
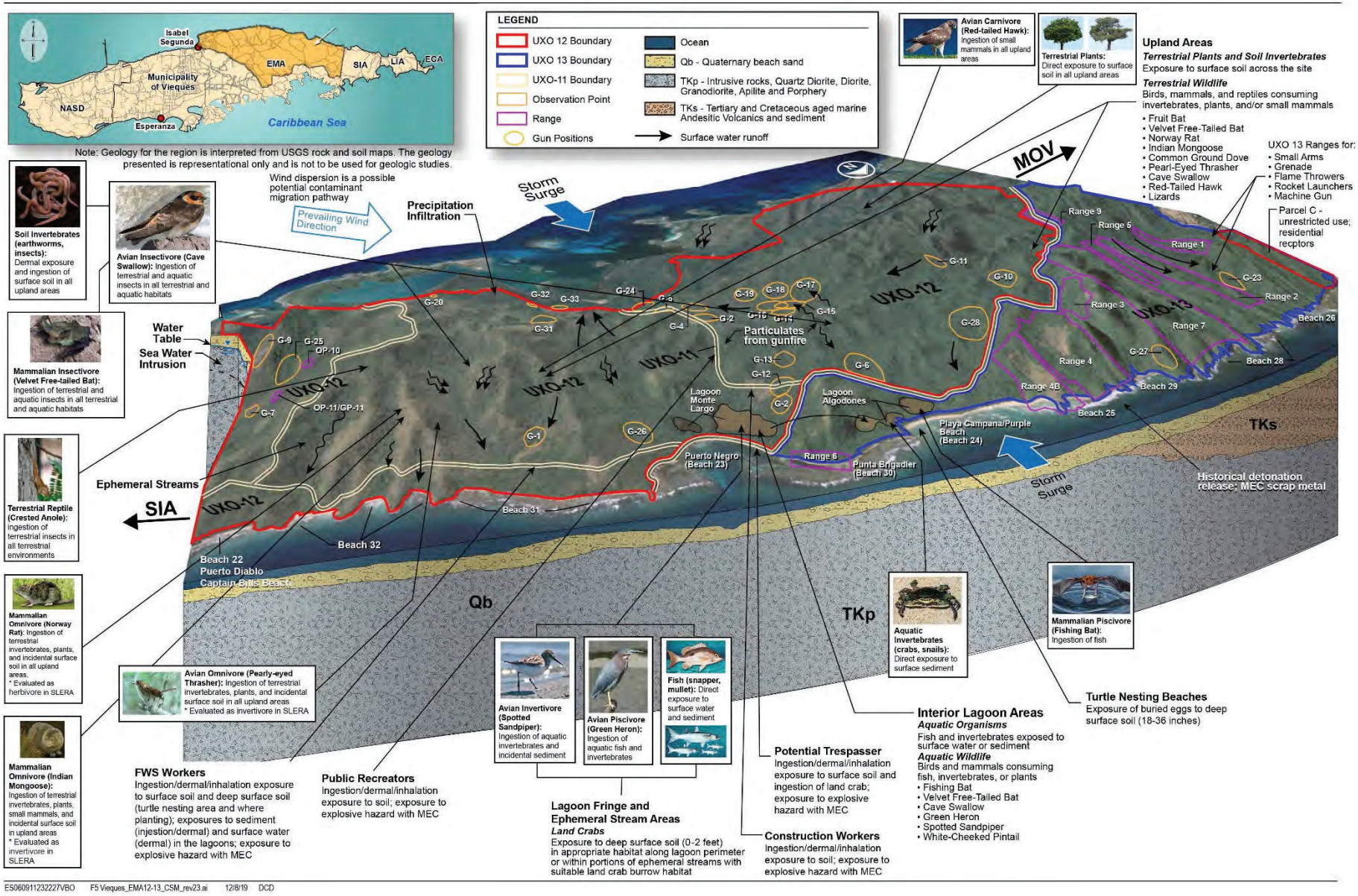


Figure 5 - UXO 12 Conceptual Site Model



2.1.4 Nature and Extent of Contamination

As discussed in Section 2.1.3 and summarized in **Table 1**, beginning in 2003, a number of investigations and an NTCRA were conducted in UXO 12 to determine the nature and extent of MEC. During the Expanded Range Assessment/Site Inspection (ERA/SI), transect inspections for surface munitions were performed throughout the historic area of UXO 12, covering an area of 274 acres (approximately 6 percent of UXO 12). Surface munitions clearance activities were conducted across Laguna Monte Largo and an unnamed adjacent lagoon (approximately 25 acres). Surface munitions clearance activities were also performed within all accessible portions of the burn area, which was approximately 282 acres. Only 49 MEC were identified on the surface within UXO 12, primarily within the eastern portion of the site near the SIA and most were 75-mm, 105-mm, 3-inch, and 5-inch projectiles; only one MEC (a calcium hydride charge) was identified west of the north-south road that cuts through the eastern third of the site (**Figure 3**). No MEC were found at any of the gun positions or PI sites. Further, while MEC may be present in the subsurface, no MEC were identified within the subsurface of where RI sampling was conducted. All MEC discovered were destroyed through controlled detonation. The 49 MEC found within UXO 12 constitute a density of approximately 0.09 MEC per acre surface cleared. For perspective, over 20,000 MEC have been identified within UXO 9 (to the east of UXO 12 within the SIA), constituting a density of over 100 MEC per acre surface cleared at that site.

Environmental media (soil, groundwater, surface water, and sediment) samples were collected and analyzed for explosives and inorganics. Sampling activities focused on areas with the highest potential for contamination to provide for the most conservative evaluation of releases and nature and extent of contamination and potential risk, such as in areas that best represent potential releases, potential contaminant types, highest contaminant concentrations, key transport pathways, and key exposure areas for potential receptors. As shown in **Table 2**, explosives were not detected in the majority of environmental media samples. No explosives were detected in surface water or sediment samples and the few explosives detected in soil were all below risk-based screening criteria. Relatively low levels of perchlorate and pentaerythritol tetranite (PETN) were detected in groundwater, but only PETN was detected at a concentration above the EPA Regional (risk-based) Screening Level (RSL) for tap water in one well, MW-16, and only during one sampling event. While perchlorate was detected above the adjusted EPA RSL, the concentrations were below the unadjusted screening level (see “adjusted screening level” explanation under “Notes” at the bottom of **Table 2**). Inorganic detections were evaluated following a process developed by the stakeholder agencies, which is based on a scientific assessment of the concentration of each inorganic to determine whether it is associated with a munitions constituent, such as its location relative to other detections, whether it is a natural constituent of environmental media, and whether it is present at levels consistent with background. Based on this evaluation, the vast majority of inorganic constituent concentrations detected in all media are attributable to background. This determination is supported by lines of evidence that include relatively low magnitude of background exceedances, relatively uniform distribution across the site indicative of natural conditions, relatively minor or lack of contribution in munitions, and/or likely association with lithology present at UXO 12.

Table 2 - Soil, Groundwater, Surface Water, and Sediment Exceedances for UXO 12

Environmental Media	COPC	Maximum Concentration Detected Above Screening Criteria and Background	West Vieques Background Value (Kv)	Screening Criteria		
				Soil Screening Level (risk-based if no MCL) (June 2017)	Adjusted Regional Screening Level for Industrial Soil (June 2017)	Ecological Screening Value
Surface Soil	***Total Inorganics (mg/kg)***					
	Antimony	0.41	--	0.27	47	78
	Arsenic	2.0	1.6	0.29	3	18
	Cadmium	0.44 J	2.2	0.38	98	32
	Chromium	33.5	72	100,000	6.3	64
	Cobalt	13.1 J	26	0.27	35	13
	Iron	31,400 J	43,200	350	82,000	--
	Manganese	720 J	1,630	28	2,600	220
	Selenium	1.9 J	0.51	0.26	580	0.52
	Thallium	0.3 J	0.13	0.14	1.2	1

Environmental Media	COPC	Maximum Concentration Detected Above Screening Criteria and Background	West Vieques Background Value (Kv)	Screening Criteria	
				Soil Screening Level (risk-based if no MCL) (June 2017)	Adjusted Regional Screening Level for Industrial Soil (June 2017)
Subsurface Soil	***Total Inorganics (mg/kg)***				
	Aluminum	46,100	35,000	30,000	100,000
	Antimony	1.4	--	0.27	47
	Arsenic	14.8	1.6	0.29	3
	Barium	174	212	82	22,000
	Cadmium	0.83	2.2	0.38	98

Environmental Media	COPC	Maximum Concentration Detected Above Screening Criteria and Background	West Vieques Background Value (Kv)	Screening Criteria	
				Soil Screening Level (risk-based if no MCL) (June 2017)	Adjusted Regional Screening Level for Industrial Soil (June 2017)
Subsurface Soil	***Total Inorganics (mg/kg)***				
	Chromium	67.6	72	6.3	100,000
	Cobalt	22.3	26	0.27	35
	Copper	160	94	46	4,700
	Iron	66,600	43,200	350	82,000
	Lead	116	3.3	14	800
	Manganese	1,810	1,630	28	2,600

Table 2 - Soil, Groundwater, Surface Water, and Sediment Exceedances for UXO 12

Environmental Media	COPC	Maximum Concentration Detected Above Screening Criteria and Background	West Vieques Background Value (Kv)	Screening Criteria	
				Soil Screening Level (risk-based if no MCL) (June 2017)	Adjusted Regional Screening Level for Industrial Soil (June 2017)
Subsurface Soil	***Total Inorganics (mg/kg)***				
	Nickel	26.4	41	26	2,200
	Selenium	1.3	0.51	0.26	580
	Silver	2.7 J	0.22	0.8	580
	Thallium	0.535 J	0.13	0.14	1.2
	Vanadium	199	144	86	580
	Zinc	509	32	370	35,000

Environmental Media	COPC	Maximum Concentration Detected Above Screening Criteria	Screening Criteria		
			Adjusted Regional Screening Level for Tap Water (June 2017)	Maximum Contaminant Level	Puerto Rico Water Quality Standard Class SG (August 2016)
Groundwater	***Explosives (µg/L)***				
	Perchlorate	3.5 J	1.4	--	--
	PETN	33	3.9	--	--
	Dissolved Inorganics (µg/L)				
	Antimony	1.61 J	0.78	6	5.6
	Arsenic	2.37 J	0.052	10	10
	Cobalt	110	0.6	--	--
	Cadmium	1.4	0.92	5	5
	Nickel	50.9	39	--	610
	Manganese	5,050	43	--	--
	Selenium	68.3 J	10	50	50

Environmental Media	COPC	Maximum Concentration Detected Above Screening Criteria	Screening Criteria		
			Adjusted Regional Screening Level for Tap Water (June 2017)	Maximum Contaminant Level	Puerto Rico Water Quality Standard Class SG (August 2016)
Groundwater	***Total Inorganics (µg/L)***				
	Antimony	1.92 J	0.78	6	5.6
	Arsenic	3.79 J	0.052	10	10
	Cadmium	1.1	0.92	5	5

Table 2 - Soil, Groundwater, Surface Water, and Sediment Exceedances for UXO 12

Environmental Media	COPC	Maximum Concentration Detected Above Screening Criteria	Screening Criteria		
			Adjusted Regional Screening Level for Tap Water (June 2017)	Maximum Contaminant Level	Puerto Rico Water Quality Standard Class SG (August 2016)
Groundwater	***Total Inorganics (µg/L)***				
	Chromium	265 J	220	100	100
	Cobalt	120	0.6	--	--
	Manganese	5,180	43	--	--
	Nickel	140 J	39	--	610
	Selenium	66.9 J	10	50	50
	Thallium	0.19 J	0.02	2	0.2
Environmental Media	**COPC**	**Maximum Concentration Detected Above Screening Criteria**	**Screening Criteria**		
			Adjusted Regional Screening Level for Tap Water (June 2017)	**Marine Surface Water Ecological Screening Value**	**Puerto Rico Water Quality Standard Class SB/SC (August 2016)**
Surface Water	***Total Inorganics (µg/L)***				
	Arsenic	0.87 J	0.052	36	36
	Chromium	0.46 J	0.035	--	50
	Iron	481	1,400	50	--
	Manganese	164	43	100	--
	Dissolved Inorganics (µg/L)				
	Arsenic	0.87 J	0.052	36	36
	Chromium	0.26 J	0.035	--	50
	Iron	133	1,400	50	--
	Manganese	143	43	100	--

Table 2 - Soil, Groundwater, Surface Water, and Sediment Exceedances for UXO 12

Environmental Media	COPC	Maximum Concentration Detected Above Screening Criteria	Screening Criteria	
			Adjusted Regional Screening Level for Industrial Soil (June 2017)	Ecological Screening Level Marine Sediment
Sediment	***Total Inorganics (mg/kg)***			
	Aluminum	24,500	100,000	18,000
	Arsenic	4.8	3	8.2
	Barium	98.4 J	22,000	48
	Chromium	21.1	6.3	81
	Cobalt	15.1	35	10
	Copper	38.6 J	4,700	34
	Manganese	1,400	2,600	260
	Vanadium	59.9	580	57

Notes:

Adjusted Regional Screening Level (RSL) corresponds to a risk of $1x10^{-6}$ and an adjusted hazard quotient (HQ) of 0.1, as applicable. The adjusted HQ is used for initial screening of data from sites where more than one constituent with the same toxic endpoint (e.g., target organ, reproductivity, etc.) might be present. EPA RSLs are not adjusted for carcinogenic constituents; therefore, adjusted and unadjusted RSLs for carcinogenic constituents are the same. The June 2017 RSLs were available during the Remedial Investigation; although several RSLs (as well as other screening levels) have been updated since that time, the updated values do not alter the human health or ecological risk assessment conclusions.

µg/kg = micrograms per kilogram
µg/L = micrograms per liter
J = estimated value
MCL = maximum contaminant level
mg/kg = milligrams per kilogram

2.1.5 Current and Potential Future Land and Resource Uses

The former VNTR occupies approximately 14,600 acres, most of which is undeveloped, and is bounded by the Municipality of Vieques to the west, and the Caribbean Sea to the north, south, and east. The land that includes UXOs 12 and 14 is under the administrative jurisdiction of the DOI, to be managed by USFWS as part of the Vieques National Wildlife Refuge, as mandated by legislation. Accordingly, USFWS prepared a Comprehensive Conservation Plan/Environmental Impact Statement (CCP/EIS) for the Vieques National Wildlife Refuge that provides long-term guidance for the management and public use of these lands for recreational purposes (USFWS, 2007). Based on this plan, USFWS has identified and mapped locations of planned future recreational features and public use areas, including areas/trails for hiking and birdwatching, parking, and picnicking. These planned public use areas are shown in **Figure 6**. There are currently no planned fishing and land crabbing areas. However, USFWS has stated that land crabbing could occur in habitats that are appropriate, such as to the east of Laguna Yanuel. Therefore, the land crab exposure scenarios were included in the risk assessment to account for potential trespasser receptors.

There is currently no public accessed allowed, and although groundwater in Vieques is classified as a potable water supply by the Commonwealth of Puerto Rico, there is no current or planned groundwater use within UXO 12. Potable

water supply on Vieques is derived from the Rio Blanco on the main island of Puerto Rico and supplied to Vieques via pipeline by the Puerto Rico Aqueduct and Sewer Authority (PRASA).

2.1.6 Summary of Site Risks

The results of the Human Health Risk Assessment (HHRA) and Ecological Risk Assessment (ERA) conducted for UXO 12 during the RI are discussed in the following subsections and summarized in **Table 3**. The complete HHRA and ERA are provided in the RI/FS Report, which is available in the Administrative Record file.

Figure 6 - USFWS Planned Land Use at UXOs 12 and 14

Table 3 - UXO 12 Risk Assessment Results

Receptors	Human Health Risk
Current/Future Trespassers	Adult – ELCR = 3×10^{-7} and HI < 1.0 Youth – ELCR = 2×10^{-7} and HI < 1.0 **Acceptable**
Future Recreational Users	Adult – ELCR = 5×10^{-7} and HI < 1.0 Child – ELCR = 1×10^{-6} and HI < 1.0 **Acceptable**
Potential Current/Future Land Crab Consumers	Laguna Monte Largo Fringe Adult – ELCR = 1×10^{-6}, HI < 1.0, the probability of BLLs exceeding 10 µg/dL < 5% Child – ELCR = 1×10^{-6}, HI < 1.0, the probability of BLLs exceeding 10 µg/dL < 5% **Acceptable**
Potential Current/Future Fish and Blue Crab Consumers	Adult – ELCR = 2×10^{-5}, HI > 1.0 (due to arsenic), the probability of BLLs exceeding 10 µg/dL > 5% Child – ELCR = 1×10^{-5}, HI > 1.0 (due to arsenic and selenium), the probability of BLLs exceeding 10 µg/dL > 5% **Although calculations indicate unacceptable non-cancer hazard and blood lead levels, inorganic concentrations responsible for calculated unacceptable HI and BLL values are attributable to natural conditions; therefore, no unacceptable risk associated with past site-related activities.**
Hypothetical Potable Groundwater Users	Adult – HI > 1.0 (due to manganese and cobalt) Child – HI > 1.0 (due to manganese and cobalt) No carcinogenic COPC identified **Although calculations indicate unacceptable non-cancer hazard, inorganic concentrations responsible for calculated unacceptable HI value were concluded to be either attributable to natural conditions or may be associated with historic military activities at UXO 13 and, if so, will be addressed accordingly as part of UXO 13.**
Current/Future USFWS Workers	No COPCs identified for soil **Acceptable**
Potential Current/Future Game Bird Consumers	Adult – ELCR = 2×10^{-7} and HI < 1.0 Child – ELCR = 2×10^{-7} and HI < 1.0 **Acceptable**

For there to be unacceptable cancer risk, the ELCR would need to be higher than 1×10^{-4}

For there to be unacceptable non-cancer hazard, the HI would need to be higher than 1

EPA Regional Screening Levels (RSLs) are not adjusted for carcinogenic constituents; therefore, adjusted and unadjusted RSLs for carcinogenic constituents are the same.

A detailed discussion about the rationale for the conclusion that the inorganics responsible for the unacceptable risk are attributable to natural conditions is provided in Appendix M, Section 5.4, of the RI/FS Report (CH2M, 2018).

µg/dL = micrograms per deciliter
BLL = blood lead level
ELCR = excess lifetime cancer risk
HI = hazard index

Table 3 - UXO 12 Risk Assessment Results

UXO 12 Media	Ecological Risk
	All Receptors
Soil, Surface Water, Sediment, Food Web Exposures	**Acceptable**

Human Health Risk Assessment UXO 12

The HHRA was conducted to evaluate potential human health risks associated with exposure to constituents detected in soil, groundwater, surface water, and sediment at UXO 12. Maximum detected concentrations of constituents were compared to adjusted EPA RSLs, and if there were exceedances, chemicals of potential concern (COPCs) were identified for direct exposure pathways based on those exceedances of screening levels. COPCs for the indirect exposure to constituents in surface water, sediment, and soil through consumption of biota (fish, blue crab, and land crab) were selected using both quantitative (based on screening level comparison) and qualitative (based on constituents' bioaccumulation potential) approaches. **Table 2** in Section 2.1.4 identifies constituents detected above human health adjusted RSLs; these constituents were therefore identified as COPCs for quantitative evaluation.

Human health risks were quantitatively evaluated for current and potential future human receptors exposed to COPCs in site media at UXO 12 under reasonable maximum exposure (RME) scenarios. Exposure scenarios evaluated for site media comprised potential current and future trespassers (adult and youth exposure to surface water and sediment) and likely future recreational users (adult and child exposure to soil, surface water, and sediment), as well as hypothetical groundwater users (adult and child). Additionally, ingestion of fish, blue crab, and land crab by potential current and future consumers (adult and child) was evaluated. Furthermore, the potential risks associated with consumption of game birds by hunters were evaluated. The potential non-cancer hazards, expressed as the hazard index (HI), and cancer risk estimates, expressed as the excess lifetime cancer risk (ELCR), were calculated using RME assumptions.

Contaminants of concern (COCs) were not identified for soil, surface water, sediment, groundwater, or biota (fish, blue crab, and land crab, as well as game birds) because either risk estimates for site-related chemicals were below threshold values (the upper end of EPA's acceptable ELCR range of 10^{-4}, non-cancer HI of 1, and 5% probability of blood lead levels [BLLs] exceeding 10 micrograms per deciliter [µg/dL]) or constituents detected at levels resulting in potentially unacceptable risks are attributable to natural background levels or are not site-related.

Ecological Risk Assessment UXO 12

The ERA was conducted to evaluate potential ecological (plants and animals) risks associated with exposure to constituents detected in surface soil, surface water, and surface sediment at UXO 12. The ERA was conducted in accordance with the Master Ecological Risk Assessment Protocol (CH2M, 2010) and Ecological Risk Assessment Protocol for Vieques Environmental Restoration Program – Revision 1 (CH2M, 2015) and used established ecological effects values to assess risks from direct exposure to organisms as well as via the food chain. UXO 12 is heavily vegetated and provides suitable terrestrial and aquatic habitats for a variety of plant, invertebrate, reptile, bird, and mammalian communities. No unacceptable risks to plants and animals and other wildlife potentially feeding on those plants and animals were identified (**Table 3**).

2.2 UXO 14 – EMA Interior

2.2.1 Site Description and History

UXO 14 (EMA south) is approximately 784 acres and is located in the southern portion of the former EMA; the site is south of UXO 12 (**Figure 2**). One gun position was found within UXO 14 that would have fired toward targets located within the SIA and LIA. A second gun position (G-20) is partially within UXOs 12 and 14 (**Figure 7**). The road separating UXO 12 and UXO 14 is being addressed as UXO 6 - EMA/SIA Planned Public Roads.

2.2.2 Site Characteristics

UXO 14 is adjacent to the southern coastline (near sea level) and is generally low-lying, but has some hills that reach an elevation of over 220 feet msl near its boundary with UXO 12. The terrestrial and aquatic habitats and subsurface lithology are the same as those noted for UXO 12 in Section 2.1.2. Surface runoff follows the sloping topography to the south toward the lagoons and ocean. Four lagoons occur within UXO 14 (Laguna Yanuel, Lagoon 14, Lagoon 15 [consists of two hydraulically connected surface water bodies], and Lagoon 16; **Figure 7**). These lagoons are tidally influenced and surface water is present at all times. Surface water in Laguna Yanuel ranges from brackish to saline. A number of ephemeral streams, originating in UXO 12, flow through UXO 14 and drain to the lagoons and the ocean. The ephemeral streams generally contain water only during sustained precipitation events. Numerous wildlife species exist at UXO 14, including abundant insects, many bird species, various reptiles, and some mammals (**Figure 8**).

Generalized groundwater flow across UXO 14 is consistent with what would be anticipated in that region. Groundwater flows within the bedrock from the topographic high (**Figure 4**) toward the southern coast. Groundwater adjacent to the coastline is expected to be brackish to saline from seawater intrusion and unsuitable for potable use unless treated. There is currently no public access allowed, and there is no current, planned, or likely groundwater use within UXO 14.

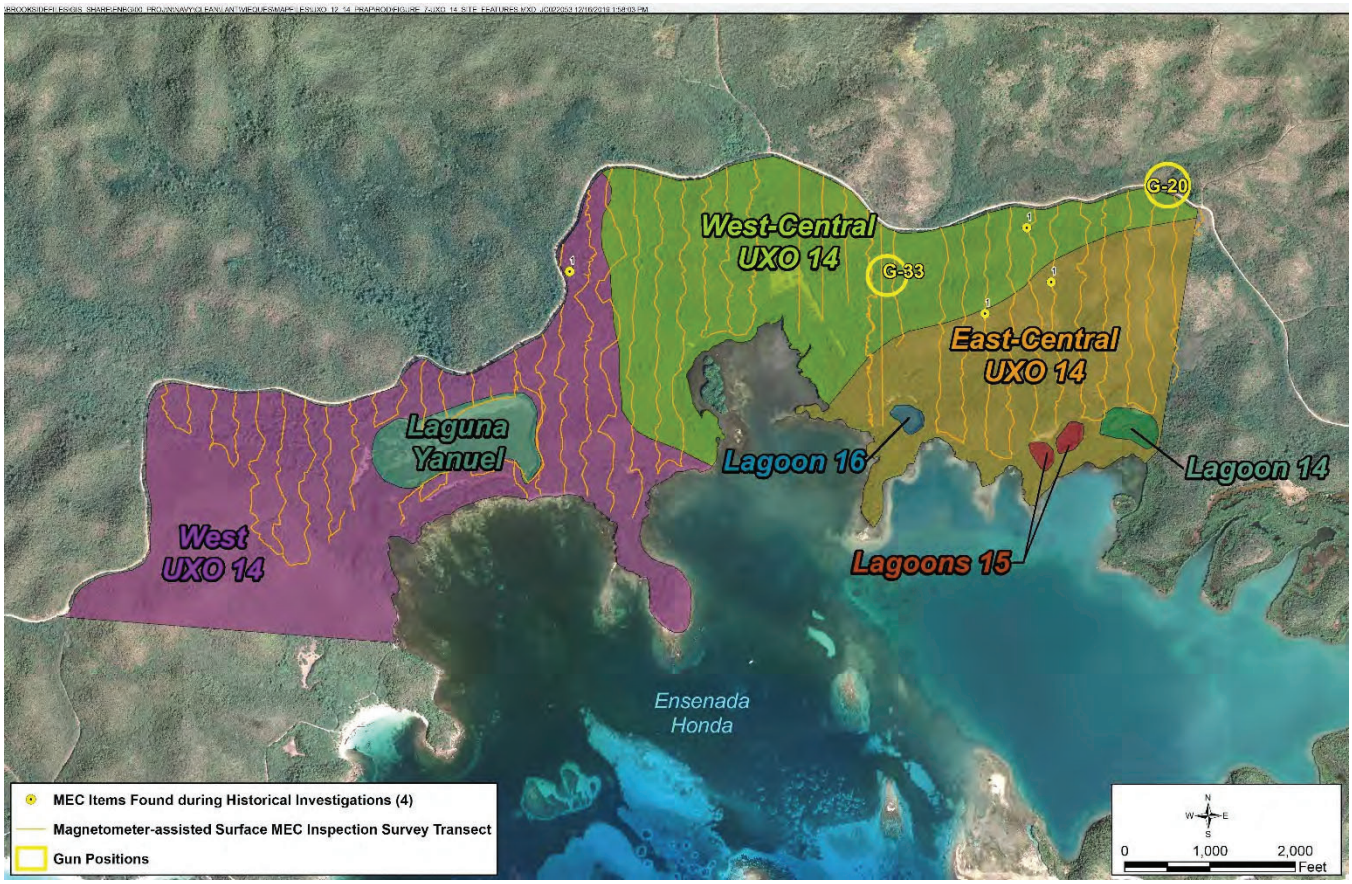
2.2.3 Summary of Previous Investigations for UXO 14

Environmental investigations of the former VNTR that are relevant to UXO 14 were initiated in 2005. **Table 1** summarizes the purpose, scope, and pertinent results of previous investigations and munitions removal activities performed at or relevant to UXO 14. **Figure 7** shows relevant munitions related site features at UXO 14, including historic transect locations and MEC findings.

2.2.4 Nature and Extent of Contamination

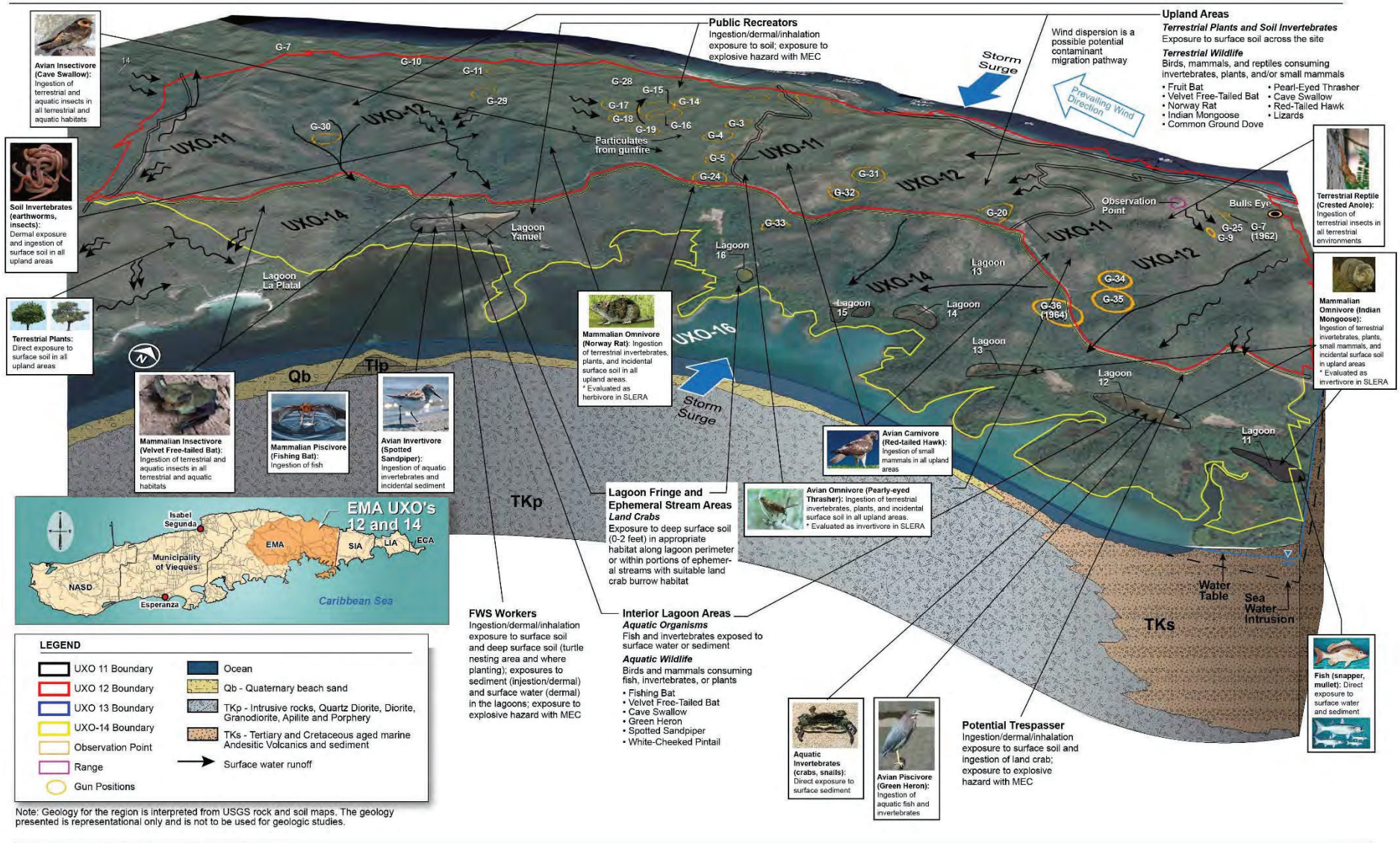
As discussed in Section 2.2.3 and summarized in **Table 1**, a 2005 ERA/SI was conducted to determine the nature and extent of MEC on the surface in UXO 14. Only 4 MEC (105-mm, 106-mm, and 155-mm projectiles) were identified on the surface within UXO 14, primarily within the eastern portion of the site near the SIA. No MEC were found on the surface at the gun positions (G-20 and G-33) associated with UXO 14. Further, while MEC may be present in the subsurface, no MEC were identified within the subsurface of where RI sampling was conducted. All MEC discovered were destroyed through controlled detonation.

Figure 7 - Site Features UXO 14



Similar to the approach at UXO 12, environmental media (soil, surface water, sediment, and groundwater) samples were collected and analyzed for e plosives and inorganics and sampling activities focused on areas with the highest potential for contamination to provide for the most conservative evaluation of releases and nature and e tent of contamination and potential risk. Surface water and sediment samples were collected at three lagoons (aguna anuel, agoon 1 , and agoon 1) within UXO 1 . **Table 4** shows the constituents detected at concentrations above screening criteria at UXO 1 . In that the monitoring wells were positioned to help assess groundwater conditions at both UXO 12 and 1 , the groundwater data are provided in **Table 2** and discussed in Section 2.1. . Other than a single detection of 2 nitrotoluene in soil below the ad usted RS , e plosives were not detected in soil at UXO 1 . o e plosives were detected in surface water and the e plosives 2, , trinitrotoluene (T T) and he ahydro 1, , trinitro 1, , triazine (R X) were detected in sediment of agoon 1 , but at concentrations below ad usted RS s. ike UXO 12, the vast ma ority of inorganic concentrations detected in all media at UXO 1 are attributable to background. This determination is supported by lines of evidence that include relatively low magnitude of background e ceedances, relatively uniform distribution across the site indicative of natural conditions, relatively minor or lack of contribution in munitions, and/or likely association with lithology present at UXO 1 .

Figure 8 - UXO 14 Conceptual Site Model



Note: Geology for the region is interpreted from USGS rock and soil maps. The geology presented is representational only and is not to be used for geologic studies.

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Table 4 - Soil, Surface Water, and Sediment Exceedances for UXO 14

Environmental Media	COPC	Maximum Concentration Detected Above Screening Criteria and Background	West Vieques Background Value (Kv)	Screening Criteria		
				Soil Screening Level (risk-based if no MCL) (June 2017)	Adjusted Regional Screening Level for Industrial Soil (June 2017)	Ecological Screening Value
Surface Soil	***Total Inorganics (mg/kg)***					
	Beryllium	0.35	0.27	3.2	230	40
	Chromium	15.6 J	72	100,000	6.3	64
	Cobalt	10.9 J	26	0.27	35	13
	Iron	30,900 J	43,200	350	82,000	--
	Manganese	687 J	1,630	28	2,600	220
	Selenium	2 J	0.51	0.26	580	0.52

Environmental Media	COPC	Maximum Concentration Detected Above Screening Criteria and Background	West Vieques Background (Kv)	Screening Criteria	
				Soil Screening Level (risk-based if no MCL) (June 2017)	Adjusted Regional Screening Level for Industrial Soil (June 2017)
Subsurface Soil	***Explosives (µg/kg)***				
	2-Nitrotoluene	33.6 J	--	0.3	15,000
	Total Inorganics (mg/kg)				
	Aluminum	33,600	35,000	30,000	100,000
	Arsenic	2	1.6	0.29	3
	Barium	100	212	82	22,000
	Chromium	17.1	72	6.3	100,000
	Cobalt	15.6	26	0.27	35
	Copper	160	94	46	4,700
	Iron	47,800	43,200	350	82,000
	Manganese	641	1,630	28	2,600
	Selenium	0.94	0.51	0.26	580
	Thallium	0.535 J	0.13	0.14	1.2
	Vanadium	94.1	144	86	580

Table 4 - Soil, Surface Water, and Sediment Exceedances for UXO 14

Environmental Media	COPC	Maximum Concentration Detected Above Screening Criteria	Screening Criteria		
			Adjusted Regional Screening Level for Tap Water (June 2017)	Marine Surface Water Ecological Screening Values	Puerto Rico Water Quality Standard Class SB/SC (August 2016)
Surface Water	***Total Inorganics (µg/L)***				
	Aluminum	2,090 J	2000	--	--
	Arsenic	3.6 J	0.052	36	36
	Copper	5.2 J	80	3.73	3.73
	Iron	1,290 J	1,400	50	--
	Dissolved Inorganics (µg/L)				
	Arsenic	3 J	0.052	36	36
	Copper	6.9 J	80	3.73	3.73

Environmental Media	COPC	Maximum Concentration Detected Above Screening Criteria	Screening Criteria	
			Adjusted Regional Screening Level for Industrial Soil (June 2017)	Ecological Screening Level Marine Sediment
Sediment	***Total Inorganics (mg/kg)***			
	Aluminum	23,600	100,000	18,000
	Arsenic	10.5	3	8.2
	Chromium	31.6	6.3	81
	Cobalt	11	35	10
	Copper	34.2 J	4,700	34
	Manganese	498	2,600	260
	Selenium	1.4	580	1
	Vanadium	62.2 J	580	57

Notes:

Adjusted Regional Screening Level (RSL) corresponds to a risk of $1x10^{-6}$ and adjusted hazard quotient (HQ) of 0.1, as applicable. The adjusted HQ is used for initial screening of data from sites where more than one constituent with the same toxic endpoint (e.g., target organ, reproductivity, etc.) might be present. EPA RSLs are not adjusted for carcinogenic constituents; therefore, adjusted and unadjusted RSLs for carcinogenic constituents are the same. The June 2017 RSLs were available during the Remedial Investigation; although several RSLs (as well as other screening levels) have been updated since that time, the updated values do not alter the human health or ecological risk assessment conclusions.

µg/kg = micrograms per kilogram
µg/L = micrograms per liter
J = estimated value
MCL = maximum contaminant level
mg/kg = milligrams per kilogram

2.2.5 Current and Potential Future Land and Resource Uses

Section 2.1.5 discusses the current and potential future land and resource uses at UXOs 12 and 14, in accordance with the CCP/EIS for the Vieques National Wildlife Refuge. As noted previously, USFWS has identified and mapped locations of planned future recreational features and public use areas, including areas/trails for hiking and birdwatching, parking, and picnicking. These planned public use areas are shown in **Figure 6**. There are currently no planned fishing and land crabbing areas. However, USFWS has stated that land crabbing could occur in habitats that are appropriate, such as to the east of Laguna Yanuel. Therefore, the land crab exposure scenarios were included in the risk assessment to account for potential trespasser receptors.

There is currently no public accessed allowed, and although groundwater in Vieques is classified as a potable water supply by the Commonwealth of Puerto Rico, there is no current or planned groundwater use within UXO 14. Potable water supply on Vieques is derived from the Rio Blanco on the main island of Puerto Rico and supplied to Vieques via pipeline by the PRASA.

2.2.6 Summary of Site Risks

The results of the HHRA and ERA conducted for UXO 14 during the RI are discussed in the following subsections and summarized in **Table 5**. The complete HHRA and ERA are provided in the RI/FS Report, which is available in the Administrative Record file.

Table 5 - UXO 14 Risk Assessment Results

Receptors	Human Health Risk
Current/Future Trespassers	Adult – ELCR = 7×10^{-7} and HI < 1.0 Youth – ELCR = 6×10^{-7} and HI < 1.0 **Acceptable**
Future Recreational Users	Adult – ELCR = 9×10^{-7} and HI < 1.0 Child – ELCR = 2×10^{-6} and HI < 1.0 **Acceptable**
Potential Current/Future Land Crab Consumers	East Lagoon Fringe Adult – ELCR = 9×10^{-7}, HI < 1.0, the probability of BLLs exceeding 10 µg/dL < 5% Child – ELCR = 8×10^{-7}, HI < 1.0, the probability of BLLs exceeding 10 µg/dL < 5% West Lagoon Fringe Adult – ELCR = 8×10^{-7}, HI < 1.0, the probability of BLLs exceeding 10 µg/dL < 5% Child – ELCR = 6×10^{-7}, HI ≤ 1.0, the probability of BLLs exceeding 10 µg/dL < 5% **Acceptable**

Table 5 - UXO 14 Risk Assessment Results

Receptors	Human Health Risk
Potential Current/Future Fish and Blue Crab Consumers	Laguna Yanuel Adult – ELCR = 2 x 10^{-5}, HI > 1.0 (due to arsenic and selenium), the probability of BLLs exceeding 10 µg/dL < 5% Child – ELCR = 2 x 10^{-5}, HI > 1.0 (due to arsenic and selenium), the probability of BLLs exceeding 10 µg/dL < 5% Lagoons 14 and 15 Adult – ELCR = 4 x 10^{-5}, HI > 1.0 (due to arsenic and selenium), the probability of BLLs exceeding 10 µg/dL < 5% Child – ELCR = 3 x 10^{-5}, HI > 1.0 (due to arsenic and selenium), the probability of BLLs exceeding 10 µg/dL < 5% **Although calculations indicate unacceptable non-cancer hazard, inorganic concentrations responsible for calculated unacceptable HI values are attributable to natural conditions; therefore, no unacceptable risk associated with past site-related activities**
Hypothetical Potable Groundwater Users	No COPCs identified for groundwater **Acceptable**
Current/Future USFWS Workers	No COPCs identified for soil **Acceptable**
Potential Current/Future Game Bird Consumers	Adult – ELCR = 5 x 10^{-8} and HI < 1.0 Child – ELCR = 5 x 10^{-8} and HI < 1.0 **Acceptable**
For there to be unacceptable cancer risk, the ELCR would need to be higher than 1 x 10^{-4} For there to be unacceptable non-cancer hazard, the HI would need to be higher than 1 EPA Regional Screening Levels (RSLs) are not adjusted for carcinogenic constituents; therefore, adjusted and unadjusted RSLs for carcinogenic constituents are the same. A detailed discussion about the rationale for the conclusion that the inorganics responsible for the unacceptable risk are attributable to natural conditions is provided in Appendix M, Section 5.4, of the RI/FS Report (CH2M, 2018). µg/dL = micrograms per deciliter BLL = blood lead level ELCR = excess lifetime cancer risk HI = hazard index	
UXO 14 Media	**Ecological Risk** **All Receptors**
Soil, Surface Water, Sediment, Food Web Exposures	**Acceptable**

Human Health Risk Assessment for UXO 14

The HHRA was conducted to evaluate potential human health risks associated with exposure to constituents detected in soil, groundwater, surface water, and sediment at UXO 14. Maximum detected concentrations of constituents were compared to adjusted EPA RSLs, and if there were exceedances, COPCs were identified for direct contact exposure pathways based on those exceedances of screening levels. COPCs for the indirect exposure to constituents in surface water, sediment, and soil through consumption of biota (fish, blue crab, and land crab) were selected using both

quantitative (based on screening level comparison) and qualitative (based on constituents' bioaccumulation potential) approaches. **Table 4** in Section 2.2.4 identifies constituents detected above human health adjusted RSLs; these constituents were therefore identified as COPCs for quantitative evaluation.

Human health risks were quantitatively evaluated for current and potential future human receptors exposed to site media at UXO 14 under RME scenarios. Exposure scenarios evaluated for site media comprised potential current and future trespassers (adult and youth exposure to surface water and sediment) and likely future recreational users (adult and child exposure to soil, surface water and sediment). Additionally, ingestion of fish, blue crab, and land crab by potential current and future consumers (adult and child) was evaluated. Furthermore, the potential risks associated with consumption of game birds by hunters were evaluated. The potential non-cancer hazards, expressed as the HI, and cancer risk estimates, expressed as the ELCR, were calculated using RME assumptions.

COCs were not identified for soil, surface water, sediment, groundwater, or biota (fish, blue crab, and land crab, as well as game birds) because either risk estimates for site-related chemicals were below threshold values (the upper end of EPA's acceptable ELCR range of 10^{-4}, non-cancer HI of 1, and 5% probability of BLLs exceeding 10 µg/dL) or constituents detected at levels resulting in potentially unacceptable risks are attributable to natural background levels.

Ecological Risk Assessment for UXO 14

The ERA was conducted to evaluate potential ecological (plants and animals) risks associated with exposure to constituents detected in surface soil, surface water, and surface sediment at UXO 14. The ERA was conducted in accordance with the Master Ecological Risk Assessment Protocol (CH2M, 2010) and Ecological Risk Assessment Protocol for Vieques Environmental Restoration Program – Revision 1 (CH2M, 2015) and used established ecological effects values to assess risks from direct exposure to organisms as well as via the food chain. UXO 14 is heavily vegetated and provides suitable terrestrial and aquatic habitats for a variety of plant, invertebrate, reptile, bird, and mammalian communities. No unacceptable risks to plants and animals and other wildlife potentially feeding on those plants and animals were identified (**Table 3**).

2.3 Explosive Hazard

Relative to other UXO sites within the former VNTR, the anticipated density of MEC within UXOs 12 and 14 is low, based on information gathered during munitions response actions and other munitions removal performed there. However, potential explosive hazard remains at UXOs 12 and 14, associated with the possible presence of MEC in the subsurface, with surface MEC in areas not previously cleared, and from MEC that may become exposed on the surface as a result of erosion.

2.4 Basis for Response Action

In cooperation with EPA, DOI, and the Commonwealth, and in accordance with applicable guidance, the Navy performed investigations and munitions removal at UXOs 12 and 14 to evaluate the nature and extent of MEC and potentially associated contamination, to assess the potential risks to human health and the environment from exposure to UXOs 12 and 14 media, and to evaluate remedial alternatives for their suitability to further reduce possible explosive hazards remaining at the site.

No unacceptable human health or ecological risks from exposure to chemicals in UXOs 12 and 14 media were identified. However, the Navy evaluated remedial alternatives and ultimately selected a response action to address potential explosive hazards remaining because there is the potential for MEC to be present in certain areas, or where it may become exposed over time from erosion.

2.5 Principal Threat Waste

MEC, specifically discarded military munitions (DMM) or unexploded ordnance (UXO), if any, that remains present at UXOs 12 and 14 may constitute a principal threat waste (PTW) due to the potential for it to pose an explosive hazard if the material is moved, handled, or disturbed. The selected remedy includes MEC removal from areas planned for public and refuge management use and LUCs and inspections to limit the potential for people to encounter MEC that may remain. During historical investigations and removal actions, MEC were removed from UXOs 12 and 14. If potential MEC is later found at UXOs 12 or 14, Department of Defense (DoD) explosive ordnance disposal personnel or similarly qualified personnel will evaluate the material to determine if it poses an explosive hazard. Material that is determined to pose an explosive hazard will normally be treated onsite or removed for destruction per applicable DoD explosives safety standards and environmental laws and regulations. In these cases, the Navy, EPA, DOI, and the Commonwealth will consult, in accordance with the terms of the Vieques FFA, to make a determination as to whether the material should, as defined by CERCLA, the NCP, and EPA guidance, be classified as PTW. If the material is deemed to be PTW, the Navy will conduct the actions necessary to ensure protectiveness of human health and the environment to address unacceptable risks posed by the material designated as PTW.

2.6 Remedial Action Objectives

Remedial action objectives (RAOs) are cleanup objectives that specify contaminants to be cleaned up, the cleanup standard, the area of cleanup, and the time required to achieve cleanup, for the purpose of protecting human health and the environment. The following RAOs were developed to be protective of current, potential future, and hypothetical receptors, in accordance with the current and anticipated future land use for UXOs 12 and 14:

- Reduce or prevent the explosive hazard that may be present and associated with potential MEC in order to be compatible with current and anticipated future land use set forth in Public Law 106-398, as amended by Public Law 107-107, which requires the land containing UXOs 12 and 14 to be managed by USFWS as a National Wildlife Refuge.
- Reduce or prevent the potential for unauthorized access to portions of the site, including the unauthorized access and use of groundwater.

An RAO for groundwater restoration is not necessary because there is no groundwater contamination requiring remediation (i.e., no promulgated standard exceedance, no unacceptable risk attributed to the site). However, long-term groundwater monitoring can be conducted to evaluate long-term trends in contaminant concentrations. Including long-term groundwater monitoring as part of the remedial action is a conservative approach because it provides a mechanism for assuring the potential long-term impacts associated with potential source areas across the sites are evaluated and addressed, as appropriate.

2.7 Description and Comparative Analysis of Remedial Alternatives

Remedial alternatives were developed based on site-specific considerations related to the potential explosive hazard, site conditions, and planned recreational site use.

2.7.1 Description of Remedial Alternatives

Table 6 summarizes the alternatives included in the evaluation, including a listing and description of the major components and estimated cost of each alternative. The following three remedial alternatives were developed to address potential MEC explosive hazards:

- Alternative 1 – No Action
- Alternative 2 – Land Use Controls and MEC Inspections
- Alternative 3 – Focused MEC Removal, Land Use Controls, and MEC Inspections

Consistent with the NCP, a no action alternative was evaluated as a baseline for the comparative analysis. Two additional alternatives were evaluated for their potential to meet the RAOs.

2.7.2 Comparative Analysis of Remedial Alternatives

Each remedial alternative for UXOs 12 and 14 was evaluated with respect to the nine evaluation criteria[10] provided in the NCP. The alternatives were then compared to one another with respect to each NCP criterion. The RI/FS Report (CH2M, 2018) provides details and a comparison of the remedial alternatives considered.

The remedial alternatives summarized in **Table 6** and shown in **Figure 9** were selected for detailed evaluation and comparative analysis. To support evaluation of the alternatives, USFWS has identified locations of planned future recreational features and public use areas within and adjacent to UXOs 12 and 14, including areas/trails for hiking and birdwatching, parking, and picnicking. The assumptions regarding each alternative are conceptual, but sufficient for cost-estimating and evaluation purposes. The details of the alternative selected by this ROD will be provided in the associated remedial action work plan, including the actual number and locations of signs installed, which will be based on such factors as site conditions, accessibility by vehicles, dense jungle conditions, and actual needs.

Table 6 - Remedial Alternatives

Alternative	Components	Details	Cost
1. No Action No action and no restriction on activities.			**Capital Cost: $0**

Table 6 - Remedial Alternatives

Alternative	Components	Details	Cost
2. Land Use Controls and MEC Inspections Manages MEC explosive hazards by reducing the potential for unauthorized access to portions of the site, guiding site users to areas intended for access, and performing periodic inspections to identify and remove exposed MEC.	- LUCs, including physical mechanisms (e.g., educational kiosks) and administrative processes (e.g., special use permits) - LTM and removal of any MEC identified	- Implementing LUCs (e.g., educational kiosks and administrative mechanisms) to guide access to approved areas and control unauthorized access. The specific LUC requirements, including the associated checklist, would be included in an LTM plan associated with the remedy that would be submitted for regulatory review. - An MEC LTM program would be established, including periodic inspections for trespassing, erosion, MEC/MD recurrence in public-access areas, and the integrity and effectiveness of physical LUCs. Any MEC/MD discovered during implementation of the LTM program would be removed. - A groundwater LTM program would be established to evaluate long-term trends in contaminant concentrations.	Capital Cost: $246,000 Present Value of Future, Annual LTM Costs: $552,000 **Total Present-Worth Cost: $1,057,000** Assumed timeframe: 30 years
3. Focused MEC Removal, Land Use Controls, and MEC Inspections Manages MEC explosive hazards by performing surface and subsurface MEC removal in planned recreational use areas. Further manages MEC explosive hazards by reducing the potential for unauthorized access to portions of the site, guiding site users to areas intended for access, and performing periodic inspections to identify and remove exposed MEC.	- MEC removal in planned recreational use areas - LUCs, including physical mechanisms (e.g., educational kiosks) and administrative processes (e.g., special use permits) - LTM and removal of any MEC identified	- Vegetation cutting and focused MEC removal (i.e., surface and subsurface MEC clearance within areas identified land management and recreational activities). This includes biological and archaeological surveys and vegetation cutting necessary to facilitate focused MEC removal. - Implementing LUCs (e.g., educational kiosks and administrative mechanisms) to guide access to approved areas and control unauthorized access. The specific LUC requirements, including the associated checklist, would be included in an LTM plan associated with the remedy that would be submitted for regulatory review. - An MEC LTM program would be established, including periodic inspections for trespassing, erosion, MEC/MD recurrence in public-access areas, and the integrity and effectiveness of physical LUCs. Any MEC/MD discovered during implementation of the LTM program would be removed. - A groundwater LTM program would be established to evaluate long-term trends in contaminant concentrations.	Capital Cost: $528,000 Present Value of Future, Annual LTM Costs: $552,000 **Total Present-Worth Cost: $1,339,000** Assumed timeframe: 30 years

Figure 9 - Conceptual Layout of Alternative 2-Land Use Controls and MEC Inspections and Alternative 3-Focused MEC Removal, LUCs, and MEC Inspections

2.7.3 Threshold Criteria

The two threshold criteria listed in this subsection are statutory requirements that the chosen alternative must satisfy. Alternatives that do not meet the threshold criteria are not eligible for selection as the final remedy.

Overall Protection of Human Health and the Environment

Alternative 1 (no action) does not achieve the RAOs. The remaining alternatives are protective of human health and the environment and reduce the e posure to E by controlling land use and access and in the case of Alternative , by performing E removal. E removal would also be performed under Alternative 2 should it be found during T or identified during recreational use or land management.

Compliance with Applicable Relevant and Appropriate Requirements

A complete list of the applicable relevant and appropriate requirements (ARARs[11]), comprising chemical specific ARARs that govern groundwater quality location specific ARARs that address migratory birds, endangered species, and cultural resources and action specific ARARs that address fuel storage, construction noise, and management of waste are included in **Attachment A**. Based on the information gathered during E investigations and removal, Alternatives 2 and would comply with ARARs.

2.7.4 Primary Balancing Criteria

The five primary balancing criteria listed in this subsection are used to identify major benefit trade-offs among the alternatives. These trade-offs are balanced to help identify the preferred alternative.

Long-term Effectiveness and Permanence

Each of the alternatives, with the exception of Alternative 1, is expected to achieve long-term effectiveness and permanence. Alternatives 2 and 3 can provide long-term effectiveness and permanence using LUCs and/or additional MEC removal. Alternative 3 provides the highest amount of long-term effectiveness and permanence due to inclusion of focused MEC removal within the planned recreational areas.

Reduction in Toxicity, Mobility, or Volume through Treatment

Alternative 1 does not result in any additional reduction of toxicity, mobility, or volume (TMV). Alternative 3 has slightly higher degree of reduction in TMV than Alternative 2 because it includes the focused screening for and, if present, removal and controlled detonation of surface and subsurface MEC within planned recreational areas, versus removal of MEC only if discovered during LTM (or reported by the agencies or public) under Alternative 2.

Short-term Effectiveness

Alternative 1 has the least short-term impacts because no remedial construction activities are associated with the alternative; however, Alternative 1 would not meet short-term-effectiveness goals because it would take no action to reduce the threat of exposure to MEC. Alternative 2 can be implemented soon after a ROD and remedial action work plan are finalized because it comprises installation of LUCs, which has the least short-term construction impacts. Alternative 3 will require a longer time to complete compared to Alternative 2 because of focused MEC removal associated with construction activities.

Implementability

Alternative 1 requires no implementation but does not meet the RAOs. Both Alternatives 2 and 3 are technically and administratively feasible, and fully implementable. Alternative 3 would have a somewhat higher degree of challenges to implementation due to the need to plan for and conduct MEC removal from the planned recreational areas.

Cost

Alternative 1 has no cost associated with it, but it does not meet the RAOs. Alternatives 2 and 3 both meet the RAOs and have present-worth costs of $1,037,000 and $1,339,000, respectively.

2.7.5 Modifying Criteria

The modifying criteria represent the level of Commonwealth and community acceptance of the proposed remedial alternative.

Commonwealth Acceptance. Commonwealth involvement has been continual throughout the CERCLA process for UXOs 12 and 14, and PRDNER supports and concurs with the preferred alternative.

Community Acceptance. The Proposed Plan was issued for public review from March 18, 2019 to May 31, 2019 and was discussed at a public meeting held on April 2, 2019. Several clarifying questions were asked and addressed at the

meeting. Substantive public comments were documented and addressed in the Responsiveness Summary (**Attachment B**).

2.8 Selected Remedy

The selected remedy for UXOs 12 and 14 is Alternative 3 – Focused MEC Removal, Land Use Controls, and MEC Inspections. This selected remedy is the preferred alternative that was presented in the Proposed Plan.

2.8.1 Rationale for Selected Remedy

Based on the evaluation of the data, information currently available, including the anticipated land use provided by USFWS, and the comparative analysis, the preferred alternative meets the statutory requirements of CERCLA for protection of human health and the environment under current and projected future land use as a wildlife refuge with focused areas of recreational use.

2.8.2 Description of Selected Remedy

Alternative 3 - Focused MEC Removal, Land Use Controls, and MEC Inspections involves surface and subsurface MEC removal from areas that have been identified for recreational use. Because MEC may still be present at the site following the MEC removal, LUCs and LTM will be employed and maintained to ensure the remedy remains effective in the long-term. The details of Alternative 3 are provided in **Table 6**. The statutorily-required five-year reviews will also be performed every five years to assure that human health and the environment are being protected.

Key elements that make Alternative 3 the preferred alternative are:

- Meets the RAOs and is compatible with the planned USFWS land use
- Performs additional surface and subsurface MEC removal in all areas planned for recreational use and implements an MEC LTM program to monitor for and remove MEC identified in the future
- Implements, monitors, and maintains LUCs to guide access to approved areas and control unauthorized access

2.8.3 Expected Outcomes of the Selected Remedy

The expected outcome of the selected remedy is that the RAOs for UXOs 12 and 14 will be met and that potential explosive hazards will be reduced to levels appropriately supportive of the planned land use.

Within 90 days following selection of the remedy, the Navy will prepare, in accordance with EPA guidance, and submit to EPA, DOI, and PRDNER for review and concurrence, the UXOs 12 and 14 Remedial Action Work Plan that includes an LUC Plan, LTM Plan, and a plan for focused MEC removal from proposed public use areas or areas where MEC may be discovered due to natural or other occurrences, such as soil erosion. Details of the focused MEC removal and LUCs, including performance metrics, will be included in the LUC Plan. While the potential for explosive hazards remains, the Navy is responsible for implementing, maintaining, inspecting, reporting on, and enforcing the LUCs in accordance with the ROD and associated MEC removal, LUC, and LTM plans.

2.8.4 Statutory Determinations

In accordance with the NCP, the selected remedy meets the following statutory determinations.

- **Protection of Human Health and the Environment -** The selected remedy is protective of human health and the environment by controlling land use and access, limiting negative impacts to the environment and site workers (associated with vegetation clearance and land disturbance), and guiding access to areas planned for public use, and by performing focused MEC removal and removal of any MEC identified during LTM or public use.
- **Compliance with ARARs -** The selected remedy will comply with Federal and Commonwealth ARARs presented herein (**Attachment A**, Tables A-1 through A-6).
- **Cost-Effectiveness -** The selected remedy provides the best value relative to the planned land use.
- **Utilization of Permanent Solutions and Alternative Treatment Technologies or Resource Recovery Technologies to the Maximum Extent Practicable -** The selected remedy represents the maximum extent to which permanent solutions and alternative treatment technologies can be used in a practicable manner at UXOs 12 and 14 because any MEC found during remedy implementation and associated LTM will be removed and treated (detonated).
- **Preference for Treatment as a Principal Element -** The selected remedy results in additional reduction in TMV through focused MEC removal (if found) and treatment (detonation).

2.9 Community Participation

The Navy, in consultation with the EPA, Commonwealth, and USFWS, established a community relations program for the Vieques Environmental Restoration Program in 2001. The program promotes communication regarding various OU investigations and response activities between the stakeholder agencies (Navy, EPA, Commonwealth, and USFWS) and the public. The community relations program formed a Restoration Advisory Board (RAB) in 2004 to further encourage community involvement. RAB meetings are held approximately every three months and are open to the public for participation. A summary of the community participation activities associated with this action are discussed in the next section.

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[12] (EPA, 1992) after the public comment period ended on May 31, 2019.

3.1 Overview

The Proposed Plan that was presented to the public identified that *Alternative 3 - Focused MEC Removal, Land Use Controls, and MEC inspections* is warranted at UXOs 12 and 14 to protect human health and the environment.

3.2 Community Involvement Process

In accordance with CERCLA Section 117(a), the Navy issued the Proposed Plan for public comment starting March 18, 2019 and ending May 31, 2019. The Navy and EPA held a public meeting[13] to discuss the Proposed Plan on Wednesday, April 2, 2019, at the Multiple Use Center in Isabel Segunda, Vieques, Puerto Rico.

The Proposed Plan and previous investigation reports for UXOs 12 and 14 were available during the public comment period and are currently available in the Administrative Record for this remedial decision. The Administrative Record is accessible to the public via:

https://go.usa.gov/xRHxY

3.3 Summary of the Public Comment Period

During the UXOs 12 and 14 Proposed Plan public comment period, written comments were received from several commenters. In addition, comments were made during the public meeting. The responses to public comments by the Navy and EPA, in consultation with DOI and PRDNER, are presented in the responsiveness summary, which is included as **Attachment B** of this ROD. No public comments were received during the public comment period that resulted in substantive changes to the selected remedy.

4. Acronyms

µg/dL	microgram(s) per deciliter
µg/kg	microgram(s) per kilogram
µg/L	microgram(s) per liter
AFWTA	Atlantic Fleet Weapons Training Area
ARAR	applicable or relevant and appropriate requirement
BLL	blood lead levels
CCP/EIS	Comprehensive Conservation Plan/Environmental Impact Statement
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act of 1980
COC	contaminant of concern
COPC	chemical of potential concern
DMM	discarded military munitions
DoD	Department of Defense
DOI	Department of the Interior
ECA	Eastern Conservation Area
ELCR	excess lifetime cancer risk
EMA	Eastern Maneuver Area
EPA	Environmental Protection Agency
ERA	Ecological Risk Assessment
ERA/SI	Expanded Range Assessment/Site Inspection
FFA	Federal Facilities Agreement
FS	Feasibility Study
HHRA	Human Health Risk Assessment
HI	hazard index
LIA	Live Impact Area
LTM	long-term monitoring
LUC	land use control

MCL	maximum contaminant level
MD	munitions debris
MEC	munitions and explosives of concern
mg/kg	milligram per kilogram
mm	millimeter
MRP	Munitions Response Program
msl	mean sea level
NAVFAC	Naval Facilities Engineering Command
Navy	Department of the Navy
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
NPL	National Priorities List
NTCRA	Non-Time-Critical Removal Action
OU	Operable Unit
PETN	pentaerythritol tetranite
PI	photo-identified (site)
PRA	Preliminary Range Assessment
PRASA	Puerto Rico Aqueduct and Sewer Authority
PRDNER	Puerto Rico Department of Natural and Environmental Resources
PTW	principal threat waste
RAB	Restoration Advisory Board
RAO	remedial action objective
RDX	hexahydro-1,3,5-trinitro-1,3,5-triazine
RI	Remedial Investigation
RME	reasonable maximum exposure
ROD	Record of Decision
RSL	Regional screening level
SEMS	Superfund Enterprise Management System
SIA	Surface Impact Area
TMV	toxicity, mobility, or volume
TNT	2,4,6-trinitrotoluene
USFWS	United States Fish and Wildlife Service
UXO	unexploded ordnance
VNTR	Vieques Naval Training Range

5. References

Item	Reference Phrase in ROD	Location in ROD	Identification of Referenced Document Available in the Administrative Record and/or Hyperlinked to this ROD
Ref. 1	Guide	Section 1.2	EPA. 1999. *A Guide to Preparing Superfund Proposed Plans, Records of Decision, and Other Remedy Selection Decision Documents*.
Ref. 2	Toolkit	Section 1.2	EPA. 2011. *Toolkit for Preparing CERCLA Records of Decision. September*.
Ref. 3	Preliminary Range Assessment	Section 2.1.3	NAVFAC. 2003. *Preliminary Range Assessment Report, Vieques Naval Training Range, Vieques Island Puerto Rico*. Final Draft. April.
Ref. 4	Expanded Range Assessment/Site Inspection	Section 2.1.3	CH2M. 2010. *Expanded Range Assessment/Site Inspection Report, Former Vieques Naval Training Range (VNTR), Vieques, Puerto Rico*. September.
Ref. 5	Background Investigation	Section 2.1.3	CH2M. 2007. *East Vieques Background Soil Inorganics Investigation Report, Former Vieques Naval Training Range, Vieques, Puerto Rico*. October.
Ref. 6	Non-Time-Critical Removal Action	Section 2.1.3	CH2M. 2009. *Non-Time-Critical Removal Action Work Plan, Surface Munitions and Explosives of Concern at Munitions Response Area – Surface Impact Area, Munitions Response Sites 1 through 7, Former Vieques Naval Training Range, Vieques, Puerto Rico*. January.
Ref.7	RI/FS	Section 2.1.3	CH2M. 2018. *UXOs 12 and 14 Remedial Investigation/Feasibility Study Report, Former Vieques Naval Training Range, Vieques, Puerto Rico*. August.
Ref. 8	no unacceptable risks to human health or the environment	Section 2.1.3	CH2M. 2018. *UXOs 12 and 14 Remedial Investigation/Feasibility Study Report, Former Vieques Naval Training Range, Vieques, Puerto Rico*. August.
Ref. 9	remedial alternatives to address potential explosive hazards	Section 2.1.3	CH2M. 2018. *UXOs 12 and 14 Remedial Investigation/Feasibility Study Report, Former Vieques Naval Training Range, Vieques, Puerto Rico*. August.
Ref. 10	nine evaluation criteria	Section 2.7.2	CH2M. 2018. *UXOs 12 and 14 Remedial Investigation/Feasibility Study Report, Former Vieques Naval Training Range, Vieques, Puerto Rico*. August.
Ref. 11	ARARs	Section 2.7.3	CH2M. 2018. *UXOs 12 and 14 Remedial Investigation/Feasibility Study Report, Former Vieques Naval Training Range, Vieques, Puerto Rico*. August.

Item	Reference Phrase in ROD	Location in ROD	Identification of Referenced Document Available in the Administrative Record and/or Hyperlinked to this ROD
Ref. 12	Community Relations in Superfund: A Handbook	Section 3	EPA. 1992. *Community Relations in Superfund: A Handbook*.
Ref. 13	public meeting	Section 3.2	Proposed Remedial Action Plan for UXOs 12 and 14, Former Vieques Naval Training Range, Vieques, Puerto Rico, Public Meeting Transcript. April.

Attachment A
Applicable Relevant and Appropriate Requirements

Federal Chemical-Specific ARARs
Remedial Investigation/Feasibility Study - UXO 12 and UXO 14
Former Vieques Naval Training Range, Vieques, Puerto Rico

Media	Requirement	Prerequisite	Citation	Alternative	ARAR Determination	Comment
No Federal Chemical-Specific ARARs apply.						

Federal Location-Specific ARARs
Remedial Investigation/Feasibility Study - UXO 12 and UXO 14
Former Vieques Naval Training Range, Vieques, Puerto Rico

Location	Requirement	Prerequisite	Citation	Alternative	ARAR Determination	Comment
Migratory Bird Treaty Act						
Migratory bird area	Protects almost all species of native birds in the United States from unregulated taking.	Presence of migratory birds.	16 USC 703	2 and 3	Applicable	The site is located in the Atlantic Americas Migratory Flyway. If migratory birds, or their nests or eggs, are identified at the site, operations will not destroy the birds, nests, or eggs.
Endangered Species Act 1978						
Endangered species	Actions to protect endangered or threatened species and prevent adversely impacting critical habitat.	Presence of protected species or their critical habitat.	16 USC 1531, et seq	2 and 3	Applicable	Several endangered species and critical habitat have been identified within UXO 12 and UXO 14. If protected species are present at the site during the response action, steps will be taken to prevent adverse impacts. Activities will avoid identified critical habitat areas or, if they cannot be avoided, actions resulting in permanent impact will be avoided.
Archaeological Resources Protection Act of 1979						
Locations of archaeological significance	Provides for the preservation of historically and archaeologically significant artifacts.	Applies to archaeological sites and artifacts.	16 USC 470ee(a)	2 and 3	Applicable	Cultural resources are present in the project area. It is possible that the remedial action may take place where cultural resources exist. Procedures may be necessary to avoid impact to these resources to the maximum extent practical. Activities performed onsite and in compliance with CERCLA are not subject to permits or administrative review; however, the substantive requirements of a permit to disturb these sites will be met if they cannot be avoided.

Puerto Rico Chemical-Specific ARARs
Remedial Investigation/Feasibility Study - UXO 12 and UXO 14
Former Vieques Naval Training Range, Vieques, Puerto Rico

Media	Requirement	Prerequisite	Citation	Alternative	ARAR Determination	Comment
Groundwater (The Puerto Rico Water Quality Standards Regulation classification designation for all groundwaters as defined in this Regulation is "SG")	Specific Standards for Non-Pesticide Organic Substances and Carbon Tetrachloride	These specific substances shall not exceed the maximum allowable concentration, at any time in ground waters (Classified as SG).	Puerto Rico Water Quality Standards Regulation 1303.1(J)(3)	2 and 3	Applicable	The Puerto Rico Water Quality Standards are: Antimony: 5.6 µg/L Arsenic: 10 µg/L Cadmium: 5 µg/L Chromium: 100 µg/L Nickel: 610 µg/L Selenium: 50 µg/L Thallium: 0.2 µg/L

Puerto Rico Location-Specific ARARs
Remedial Investigation/Feasibility Study - UXO 12 and UXO 14
Former Vieques Naval Training Range, Vieques, Puerto Rico

Location	Requirement	Prerequisite	Citation	Alternative	ARAR Determination	Comment
No Puerto Rico Location-Specific ARARs apply.						

Federal Action-Specific ARARs
Remedial Investigation/Feasibility Study - UXO 12 and UXO 14
Former Vieques Naval Training Range, Vieques, Puerto Rico

Action	Requirement	Prerequisite	Citation	Alternative	ARAR Determination	Comment
Spill Pollution, Control, and Countermeasures						
Storage of fuels and oils (petroleum and non-petroleum) onsite	If storage capacity limits are exceeded a Spill, Prevention, Control, and Countermeasures Plan must be prepared and implemented with procedures, methods, equipment, and other requirements to prevent the discharge of into or upon the navigable waters of the United States.	Total onsite storage capacity exceeding 1,320 gallons in containers that are 55 gallons or larger in size. Empty or partially filled containers must still have their entire volume included in the summation.	40 CFR 112.1(b) through (d), 112.3 [excluding paragraph f], 112.5 through 8, and 12	2 and 3	Applicable	It is anticipated that fuels or other oil-based treatment chemicals may be stored onsite. If the storage capacity in containers that are 55 gallons or greater is equal to or exceeds 1,320 gallons, a Spill Prevention, Control, and Countermeasure (SPCC) Plan must be prepared and implemented. Containers include oil (including those oils used for enhanced biodegradation) and fuel reservoirs in equipment.

Puerto Rico Action-Specific ARARs
Remedial Investigation/Feasibility Study - UXO 12 and UXO 14
Former Vieques Naval Training Range, Vieques, Puerto Rico

Action	Requirement	Prerequisite	Citation	Alternative	ARAR Determination	Comment
Noise						
Performing construction activities that generate noise	No construction activity may be performed at night or in such a way that vibrations are produced that can be felt beyond the property boundary. If equipment used in construction is not manufactured in accordance with USEPA standards for newly manufactured equipment then it may not produce noise that exceeds 70 dBA.	Construction activity including earthwork.	Puerto Rico Regulation 3418.3.1.5(A),(C);3.1.10; 3.1.13; and 4.1	2 and 3	Relevant and Appropriate	The site is considered to be in Zone II (Commercial) for noise production. Noise pollution during MEC clearance and demolition activities will be prevented if necessary.
Waste Management						
Management of non-hazardous solid waste onsite in containers and piles	Non-hazardous solid waste staged onsite must not create a hazard or public nuisance.	Generation of non-hazardous solid waste that is managed onsite in containers or in piles.	Puerto Rico Non-Hazardous Solid Waste Regulation 531.H	2 and 3	Applicable	It is possible non-hazardous solid wastes will be generated during the implementation of these alternatives. If necessary, IDW will be sampled to confirm characterization prior to disposal. It will be assumed that MDAS is regulated as scrap metal.
Fugitive Dust						
Production of fugitive dust	Take reasonable precautions to prevent particulate matter from becoming airborne during activities such as land clearing, soil or material hauling. Immediately clean up any soil spilled during transport. Do not cause or permit the discharge of visible emissions of fugitive dust beyond the boundary line of the property on which the emissions originate.	Construction and material hauling activities causing particulate matter to become airborne.	Puerto Rico Regulation 5300.404(A)(1), (4), (7); (B)	3	Applicable	Applicable to activities that produce fugitive dust. If necessary, dust control measures will be implemented.

Attachment B
Responsiveness Summary for UXOs 12 and 14

ATTACHMENT B

Responsiveness Summary

Proposed Plan
UXO 12 (Eastern Maneuver Area Interior) and
UXO 14 (Eastern Maneuver Area South)
Atlantic Fleet Weapons Training Area – Vieques
Former Naval Ammunition Support Detachment
Vieques, Puerto Rico

1. Introduction

This responsiveness summary provides a summary of the substantive comments submitted by the public on the UXO 12 and UXO 14 Proposed Plan issued by the United States Navy, Naval Facilities Engineering Command (NAVFAC) Atlantic, the United States Environmental Protection Agency (EPA), and the United States Department of the Interior (DOI), in consultation with the Puerto Rico Department of Natural and Environmental Resources (PRDNER). The responsiveness summary was prepared in accordance with the National Oil and Hazardous Substances Pollution Contingency Plan (NCP), at 40 CFR 300.430(f)(3)(F), Section 117(b) of CERCLA, and EPA Office of Solid Waste and Emergency Response (OSWER) Directive 9230.0-06 (Superfund Responsiveness Summaries).

The UXO 12 and UXO 14 Proposed Plan was issued for public comment from March 18, 2019, to May 31, 2019, which included a 30-day review extension and a subsequent 15-day review extension based on community member request. The Navy, EPA, and the United States Fish and Wildlife Service (USFWS, a bureau of DOI), the Vieques National Wildlife Refuge administrator, held a public meeting to discuss the Proposed Plan on Wednesday April 2, 2019, at the Multiple Use Center in Isabel Segunda, Vieques, Puerto Rico, during which questions and comments regarding the proposed remedial alternative, as well as other alternatives, were made, for which the Navy and other stakeholder agencies provided feedback. In addition, comments were submitted in writing to NAVFAC Atlantic and EPA. A summary of the comments/questions and the associated responses is provided in Section 3 of this Responsiveness Summary.

UXO 12 and 14, together comprising just over 4,800 acres, make up the majority of the Eastern Maneuver Area (EMA), located within the western portion of the former Vieques Naval Training Range (VNTR). As detailed in the Proposed Plan, the Navy and EPA identified Alternative 3 – Focused Munitions and Explosives of Concern (MEC) Removal, Land Use Controls (LUCs), and MEC Inspections as the preferred alternative for UXO 12 and UXO 14. The alternative was determined to be appropriate because it is protective of human health and the environment based on planned land use, especially considering munitions removal was previously performed and relatively few (with respect to other areas within the former VNTR) MEC were found and the current and anticipated future land use is a wildlife refuge area with localized recreational use.

Key elements of Alternative 3 are:

- MEC removal from areas identified by USFWS for future recreational use (e.g., trails and observations tower)
- No planned groundwater use
- Ecological habitat preservation
- LUCs, inspections/groundwater monitoring, and removal of munitions identified during inspections or future use

2. Community Involvement Activities Associated with UXO 12 and UXO 14

This section summarizes the community involvement activities associated with investigation and munitions cleanup at UXO 12 and UXO 14. The community involvement activities discussed below were designed to ensure the community is informed and has opportunity to provide feedback and input throughout the investigation and cleanup process.

Community Involvement Plan: The Navy, EPA, PRDNER, and DOI/USFWS, collectively referred to as the stakeholder agencies, worked jointly to update the Community Involvement Plan (CIP) in 2015 with input from community members and stakeholders via interviews, surveys, and agency-community meetings. The CIP defines the mechanisms used to facilitate communication between the community and the agencies involved in the cleanup of former Navy lands in Vieques. As such, the CIP is designed to foster two-way communication whereby the community can provide input into the site characterization and cleanup activities and the stakeholder agencies can keep the community informed about the cleanup progress. In recognition of the large number of Spanish-speaking residents, the Navy translated the CIP into Spanish.

Information Repositories: The Navy maintains an information repository where the public can review documents associated with UXO 12 and UXO 14. The repository is located at: https://go.usa.gov/xRHxY. In addition, the Navy submitted the following key documents to the Vieques Restoration Advisory Board (RAB) or public to solicit community comment and input prior to issuing the final versions of the documents and placing them in the Administrative Record:

- Non-Time-Critical Removal Action Work Plan for Surface Munitions and Explosives of Concern (2009) – Describes the approach for removing munitions from the Surface Impact Area (SIA), which was also used to perform the removal actions at UXO 12.
- Expanded Range Assessment/Site Inspection Report (2010) – Describes the results of the surveys conducted to identify the presence of munitions on the ground surface throughout the former VNTR, including the EMA.
- Master Remedial Investigation Sampling and Analysis Plan for Terrestrial UXO Sites (2013) – Describes the approach for evaluating the nature and extent of munitions and munitions constituents in environmental media and assessing potential risks to human health and the environment for multiple UXO sites, including UXOs 12 and 14.
- Remedial Investigation Status Report for UXOs 4, 9, 10, 12, and 14 (2016) – Describes the results of the Remedial Investigation, including preliminary evaluation of potential human health and ecological risks.
- Remedial Investigation/Feasibility Study Report for UXOs 12 and 14 (2018) – Describes the results of the remedial investigation, including quantitative human health and ecological risk assessments, and the remedial alternatives evaluation in the feasibility study to address potential explosive hazards present at UXO 12 and UXO 14.

Informational flyers and newsletters are regularly distributed to keep the Vieques community informed about Vieques cleanup activities. Information specific to UXO 12 and UXO 14 was included in the following flyers/newsletters:

- October 2008 Flyer – Described the aerial magnetometer survey being conducted as part of the Expanded Range Assessment to help identify where munitions may be located on the ground.
- November/December 2008 Flyer – Educational flyer describing why certain areas within the former VNTR are restricted from public access, including the EMA.
- January 2009 Flyer – Described the planned Site Inspection intended to further evaluate the presence of munitions.
- June 2009 Flyer – Update on the monitoring well and groundwater sampling activities performed during the Site Inspection and Expanded Site Inspection.

- June 2013 Flyer – Notification of the planned discussion during the upcoming June 12, 2013, RAB meeting regarding the removal action at UXO 12 as a result of a 282-acre fire suspected to have been set by trespassers.
- May 2016 Newsletter – Described the RAB review process for the Remedial Investigation Status Report for five UXO sites, including UXOs 12 and 14.
- March 2019 Flyer – Described the proposed remedial action plan for UXOs 12 and 14 and announced the opening of public comment period and the scheduled public meeting.
- May/June 2019 Flyer – Described the proposed remedial action plan for UXOs 12 and 14 and announced the closing of public comment period.

Restoration Advisory Board: The Vieques RAB comprises community members and representatives from stakeholder government agencies. The objective of the RAB is to foster communication among the community, regulators, and other stakeholders associated with or interested in the Vieques cleanup. RAB meetings serve as a forum to share information on the environmental restoration process. The community was updated, and input was solicited regarding the investigation and cleanup progress associated with UXOs 12 and 14 during the following RAB meetings:

- February, May 2005 – Discussed the purpose and status of the Munitions and Explosives of Concern (MEC) Expanded Range Assessment/Site Inspection; discussed the planned background soil inorganics investigation and how the information would be used for site-specific investigations, including those in the former EMA.
- August 2005 – Provided the status of contract award for munitions removal work; summarized the background soil inorganics investigation work plan status.
- November 2005 – Discussed background soil inorganics investigation work plan details.
- June 2006 – Discussed RAB comments on background soil inorganics investigation work plan.
- September 2006 – Discussed background soil inorganics investigation results.
- August 2007 – Discussed background soil inorganics investigation report; summarized upcoming documents for RAB review.
- February, May 2008 – Discussed objectives of the Expanded Range Assessment/Site Inspection for munitions sites, including those in the former EMA.
- January 2009 – Provided the status of Site Inspection field work.
- August 2010 – Summarized the Expanded Range Assessment/Site Inspection Report findings.
- June 2013 – Discussed the 282-acre fire that occurred in UXO 12 and the subsequent surface MEC clearance.
- November 2015 – Provided the status of removal actions, including UXO 12.
- February 2019 – Discussion of upcoming Proposed Plan for UXOs 12 and 14.
- May 2019 – Summary of UXOs 12 and 14 Proposed Plan public review, including public comment period extension through May 31.

Presentations made and minutes from the RAB meetings listed here, which summarize discussions regarding UXO 12 and UXO 14, including any comments/questions posed and the associated responses, can be found on the Vieques Public Website at the following link:

https://navfac.navy.mil/products_and_services/ev/products_and_services/env_restoration/installation_map/navfac_atlantic/vieques/outreach/rab_documents.html

In addition, 20 Restoration Advisory Board Status Reports were issued between December 2004 and November 2010 to provide updates on ongoing investigation and cleanup activities across Vieques, including UXO 12 and UXO 14.

On May 12, 2005, members of the RAB and public were escorted to various background soil samples locations to solicit input on their placement. Several were relocated at that time based on RAB/public input.

3. Summary of Commenters' Major Points Regarding the UXO 12 and UXO 14 Proposed Remedial Action

During the UXO 12 and UXO 14 Proposed Plan public comment period (excluding the public meeting), a number of comments were received. In addition, several comments/concerns were expressed during the April 2, 2019, public meeting. Responses to substantive comments received are summarized here. It is noted that several commenters (both during the public comment period and the public meeting) provided comments not specific to the UXOs 12 and 14 remedial action, such as cleanup of Vieques as a whole, prioritization and timing of cleanup of other UXO sites, access to various areas of wildlife refuge, access to information regarding past military practices on Vieques, restoration of refuge areas (e.g., mangrove and lagoon areas) damaged by Hurricane Maria, the health of Viequenses, and other comments not specific to the proposed remedial action at UXO 12 and UXO 14. In accordance with CERCLA guidance, comments not specific to the UXO 12 and UXO 14 proposed remedial action are not addressed in this responsiveness summary. However, the Vieques community involvement program provides the appropriate mechanism for interactive dialogue between the public and stakeholder agencies regarding the Navy's environmental restoration program.

Site-specific substantive comments/input are grouped by category and discussed as follows. Section 4 of the Responsiveness Summary provides responses to specific substantive questions.

3.1 Major Point/Comment – Use of alternative methods to open detonation to dispose of munitions found in UXOs 12 and 14, as well as elsewhere in the former Vieques Naval Training Range: Several commenters stated opposition to open detonation of munitions and suggested it is no longer the most effective or efficient methodology for disposal of munitions and that alternative methods (specifically closed chamber technologies) are available that are safer for the public.

Response: The commenters refer to alternatives to open detonation they consider safer and some have cited a letter[1] and/or report[2] that propose the use of these alternative technologies. However, the project team does not concur that the suggested alternatives are safer for these sites. Specifically, the suggested technologies are stated in the referenced letter/report to be applicable to abandoned or stockpiled munitions, neither of which is present at UXOs 12 and 14 or other munitions sites in Vieques. Abandoned and stockpiled munitions have not been fuzed and fired, meaning they are stable and safe to move and handle. In contrast, the munitions on Vieques are classified as unexploded ordnance (UXO), meaning they have been fuzed and fired, but subsequently malfunctioned and failed to explode as expected. UXO items are especially dangerous because they are set to explode and may do so without warning, posing a

[1] In the Letter to the Vieques Restoration Advisory Board entitled "Vieques Remediation and OB/OD" (Paul F. Walker, August 1, 2017) it is stated, "While it is clear that in situ detonation practices are necessary in certain circumstances in order to reduce risk to workers, most old and abandoned ordnance can be safely destroyed by excavation, defused if necessary, removed, and eliminated in a variety of ways including closed detonation and/or neutralization." The Navy agrees that this is the case for old, abandoned, or stockpiled munitions that have not been fuzed and fired. However, as stated previously, the munitions that the remedy seeks to address are UXO for which the approach suggested in the letter is not appropriate, as discussed previously.

[2] The "Alternatives for the Demilitarization of Conventional Munitions" report (National Academies of Sciences, Engineering, and Medicine, 2019) presents alternatives for the demilitarization of abandoned or stockpiled munitions. The study's statement of task (SOT) states, "The SOT lays out both the nature of and the constraints of the committee's work. While the committee must address each item of the SOT, it is not permitted to exceed the scope of its work as set forth in the SOT. The SOT specifically focuses on the Department of Defense (DoD) conventional munitions demilitarization stockpile being destroyed at seven stockpile depots…It does not include OB/OD at other military bases, ammunition plants, military ranges, or other government-owned locations where OB/OD is conducted." As indicated in report itself, the study did not evaluate current or former military ranges or munitions that had been fuzed and fired. Vieques is not a weapons stockpile depot, it is a former military range containing UXO. Because the weapons that the remedy seeks to address are UXO rather than unfired, stockpiled ordnance, the approaches outlined in this report cannot be safely implemented at UXOs 12 and 14.

significant hazard to anyone who may come in contact with them or move them in any way, including the public, wildlife refuge staff, and munitions cleanup workers. Therefore, it is imperative that these munitions be destroyed in a manner that avoids movement and handling as much as possible, meaning open detonation is the safest manner in which to destroy these munitions.

Open detonation of munitions found in Vieques is also the safest for the public. Without open detonation, the unexploded munitions found on Vieques would need to be left in place and the cleanup could not be completed as required. In contrast, open detonation supports all cleanup requirements, thereby protecting residents, tourists, and wildlife refuge workers from the risks associated with unexploded munitions. Furthermore, nearly a decade of air monitoring during open detonations of munitions in Vieques demonstrated this type of munitions disposal does not adversely impact the Vieques air quality. Between 2005 and 2013, over 1,600 air samples were collected during 177 open detonation events, and samples were analyzed for explosive chemicals, metals, and particulate matter (dust and soot). No explosive chemicals were detected during any of the air monitoring events, concentrations of all metals were at least 99% below health-based standards, and concentrations of particulate matter were within regulatory standards.

Attached to this Responsiveness Summary is an Open Detonation Fact Sheet that provides additional information regarding the use of open detonation for munitions cleanup in Vieques. The Fact Sheet is also available on the Vieques cleanup public website at https://www.navfac.navy.mil/vieques. The Fact Sheet includes references to an Air Quality Fact Sheet that discusses the air quality monitoring conducted during open detonations and a Detonation Chamber Fact Sheet that discusses the circumstances for which detonation chambers are and are not appropriate for use in munitions cleanup. These fact sheets are also available on the Vieques cleanup public website.

3.2 **Major Point/Comment – Statutory and Regulatory Compliance of Proposed Remedy:** One commenter concluded the proposed remedy does not meet statutory or regulatory requirements for a safe cleanup that does not put the local population at risk of health hazards and environmental contamination. The commenter also asserted the necessity to comply with the National Environmental Policy Act (NEPA).

Response: The Navy has the legal obligation to perform its environmental restoration responsibilities (i.e., investigation and remediation) in compliance with CERCLA. The CERCLA process is defined by regulations and EPA has also issued guidance documents that include standard procedures that are practiced throughout the United States. Other statutes, laws, and regulations that apply to each action are defined during this process. One of the responsibilities of the federal (e.g., EPA, DOI, USFWS) and Commonwealth (e.g., PREQB, PRDNER) regulatory/stakeholder agencies is to ensure Navy compliance prior to and as part of concurring with investigation findings (i.e., analytical results, human health and ecological risk assessments) and remedial alternatives evaluation and selection.

Data collected during historical investigation and munitions removal activities at UXOs 12 and 14 were: (1) obtained under work plans developed in accordance with CERCLA and related standard procedures and reviewed/approved by the federal and Commonwealth regulatory/stakeholder agencies, and (2) evaluated in accordance with standard guidance, including *Risk Assessment Guidance for Superfund (RAGS)* for conducting the human health risk assessment (HHRA) and the *Ecological Risk Assessment Guidance for Superfund*, both developed by EPA and required for use at Superfund sites across the United States. The results of the risk assessments, as well as the remedial alternatives evaluated and proposed, were reviewed and endorsed by the federal and Commonwealth regulatory/stakeholder agencies.

The National Contingency Plan (NCP), the plan developed by EPA to provide the framework for cleanup authorized by CERCLA, requires any selected remedy be protective of human health and the environment. By working closely with USFWS to understand its planned land use at UXOs 12 and 14, the Navy implemented investigations throughout UXOs 12 and 14 and developed proposed munitions cleanup specifically to support the planned public access, thus allowing a determination that the area would be safe for this use under the proposed remedial action. This conclusion was based on rigorous evaluation of

past munitions investigation and removal activities and site-specific data, and this conclusion was reviewed and confirmed by the federal and Commonwealth regulatory/stakeholder agencies.

The remedial action, including the planned land use controls, will be implemented under CERCLA. As such, the Navy has the legal responsibility to ensure all elements of the land use controls are monitored and maintained to ensure they remain protective. As part of the process, EPA will retain regulatory authority over the remedial action, and the consulting parties, including the Commonwealth, will provide third party verification of the remedy protectiveness.

With respect to NEPA, it does not apply to actions taken in accordance with CERCLA and the NCP. EPA acknowledged this in the Federal Register Volume 63, Number 209, Page 58046 stating, "EPA is also exempted from the procedural requirements of environmental laws, including NEPA, for Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) response actions." Additionally, the United States Department of Justice (DOJ) has concluded in a letter dated January 23, 1995 that, "…CERCLA's Section 113(h) bar on pre-enforcement review, which is vital to obtaining expeditious cleanups, clearly conflicts with the third component of NEPA which generally permits judicial review prior to the commencement of the agency action…. This irreconcilable conflict supports DOJ's historic position that NEPA, as a matter of law, does not apply to CERCLA cleanups." Nevertheless, as stated previously, the selected remedy will comply with the requirements under CERCLA and the NCP to be protective of human health and the environment in association with the planned land use.

3.3 Major Point/Comment – Development of Appropriate Remedial Alternatives: One commenter stated the remedial alternative development did not comply with CERCLA and the NCP, including assumptions upon which the alternatives were based (i.e., no human health and environmental risks) are inconsistent with CERCLA and the NCP.

Response: The data collection and the data evaluation upon which the remedial alternatives were developed and evaluated were performed accordance with applicable regulations and standard procedures used on Superfund sites throughout the United States, as discussed under Major Point/Comment 3.2. The risk assessment process and conclusions represent quantitative calculations using EPA-defined protocol with data that appropriately represent environmental media conditions at UXOs 12 and 14. While the data demonstrate there are no unacceptable human health or ecological risks associated with constituent concentrations in environmental media, the potential presence of munitions within UXOs 12 and 14 warrant remedial action to ensure the land can be used as intended by USFWS.

Regarding development of remedial alternatives, the expectations for their development and evaluation can be found in 40 CFR 300.430(a)(1)(iii)(A-F) and are listed as follows.

(A) EPA expects to use treatment to address the principal threats posed by a site, wherever practicable. Principal threats for which treatment is most likely to be appropriate include liquids, areas contaminated with high concentrations of toxic compounds, and highly mobile materials.

(B) EPA expects to use engineering controls, such as containment, for waste that poses a relatively low long-term threat or where treatment is impracticable.

(C) EPA expects to use a combination of methods, as appropriate, to achieve protection of human health and the environment. In appropriate site situations, treatment of the principal threats posed by a site, with priority placed on treating waste that is liquid, highly toxic or highly mobile, will be combined with engineering controls (such as containment) and institutional controls, as appropriate, for treatment residuals and untreated waste.

(D) EPA expects to use institutional controls such as water use and deed restrictions to supplement engineering controls as appropriate for short- and long-term management to prevent or limit exposure to hazardous substances, pollutants, or contaminants. Institutional controls may be used during the conduct of the remedial investigation/feasibility study (RI/FS) and implementation of the remedial action and, where necessary, as a component of the completed remedy. The use of

institutional controls shall not substitute for active response measures (e.g., treatment and/or containment of source material, restoration of ground waters to their beneficial uses) as the sole remedy unless such active measures are determined not to be practicable, based on the balancing of trade-offs among alternatives that is conducted during the selection of remedy.

(E) EPA expects to consider using innovative technology when such technology offers the potential for comparable or superior treatment performance or implementability, fewer or lesser adverse impacts than other available approaches, or lower costs for similar levels of performance than demonstrated technologies.

(F) EPA expects to return usable ground waters to their beneficial uses wherever practicable, within a timeframe that is reasonable given the particular circumstances of the site. When restoration of ground water to beneficial uses is not practicable, EPA expects to prevent further migration of the plume, prevent exposure to the contaminated ground water, and evaluate further risk reduction.

In accordance with these requirements, the Navy considered remedial alternatives that treat the principle threat of UXO onsite to facilitate the future land use plan and be appropriately protective of human health and the environment. This balances the use of open detonation, the only practical treatment for UXO, with the desired future land use, ensuring all human health and ecological risk pathways are identified and addressed. Potential UXO exposure is addressed by performing MEC removal in areas where recreational use is planned and implementation of controls to guide access to these areas, discouraging access to areas not intended for use, and providing UXO awareness and safety procedures to be followed by visitors. Although there is no planned groundwater use and no unacceptable contaminant levels have been found that are likely attributable to UXOs 12 and 14, long-term groundwater monitoring will be conducted to verify this conclusion remains true in the long term. Periodic inspections will also be performed to ensure MEC does not become exposed within public areas due to such factors as erosion. Since there is the possibility for MEC to remain at the site, CERCLA requires that the remedy be reviewed every 5 years to assure that it is still protective of human health and the environment, in accordance with 40 CFR 300.430(f)(4)(ii).

Paragraph E and 40 CFR 300.430(e)(5) require the consideration of innovative technologies, "…when such technology offers the potential for comparable or superior treatment performance or implementability, fewer or lesser adverse impacts than other available approaches, or lower costs for similar levels of performance than demonstrated technologies." As discussed under Major Point/Comment 3.1, alternative technologies such as detonation chambers are not appropriate for UXO; open detonation is the most efficient, effective, and safest technology for UXO found at UXOs 12 and 14 and elsewhere at Vieques.

Finally, the NCP requires the consideration of the future land use (Land Use in the CERCLA Remedy Selection Process, OSWER 9355.7-04) in the development of remedial alternatives. Specifically, remedial action objectives must consider and reflect future land use, the future land use must be considered in risk assessments, and the land uses that will be available following the completion of the remedy must be determined as part of the alternative. Alternative 3 considers the planned land use developed by USFWS and includes elements in the remedial action that facilitate that use.

3.4 Major Point/Comment – Level of Detail in the Proposed Plan: One commenter expressed concern that the Proposed Plan provided no meaningful information regarding the alternatives analysis and decision-making process and that it contained no meaningful references to the HHRA and ERA results and how the cleanup will be implemented.

Response: The format and content of the Proposed Plan are those dictated by regulation and EPA guidance. As such, it provides a summary of information and references other documentation where details of the summarized information can be found. Detailed historical information and reports for the sites can be found in the Administrative Record file for UXOs 12 and 14. Section 9 of the Proposed Plan provides information on how to access the Administrative Record file. With respect to the HHRA, ERA, and

alternatives analysis and decision-making process, this information is detailed in the Remedial Investigation/Feasibility Study Report (CH2M, 2018), as stated in the last paragraph of Section 1 of the Proposed Plan.

In accordance with 40 CFR 300.430(f)(2), the proposed plan "…briefly describes the remedial alternatives analyzed by the lead agency, proposes a preferred remedial action alternative, and summarizes the information relied upon to select the preferred alternative…. The purpose of the proposed plan is to supplement the Remedial Investigation/Feasibility Study and provide the public with a reasonable opportunity to comment on the preferred alternative for remedial action, as well as alternative plans under consideration, and to participate in the selection of remedial action at a site."

In accordance with NCP, the remedial design and implementation follows the selection of the remedy. 40 CFR 300.435(a) states, "…The remedial design/remedial action (RD/RA) stage includes the development of the actual design of the selected remedy and implementation of the remedy through construction. A period of operation and maintenance may follow the RA activities." Therefore, the cleanup details the commenter suggests are missing from the Proposed Plan are not intended to be contained in the Proposed Plan, but instead included in a remedial design and/or remedial action work plan.

3.5 Major Point/Comment – Scope and Implementation of Land Use Controls and Long-term Groundwater Monitoring: One commenter suggested the extent and risk of contamination merits a more robust groundwater monitoring program to protect public health and the environment, and objected to long-term monitoring as a legally sufficient remedy. Also stated 30 years is an excessively long time to achieve educational kiosks and land use controls.

Response: As summarized in the Proposed Plan and detailed in the Remedial Investigation/Feasibility Study Report (CH2M, 2018), the quantitative human health risk assessment demonstrated there is no unacceptable risk associated with hypothetical potable use of groundwater containing constituents potentially attributable to UXOs 12 and 14. Further, there is no current or planned use of groundwater at these sites as a potable source. Additionally, long-term monitoring is not being proposed as the remedy; it is being proposed as a component of the remedy (together with MEC removal and land use controls) to verify the conclusions drawn with respect to groundwater remain true in the long term. As a matter of standard convention, the details of the groundwater monitoring will be provided in a long-term monitoring work plan that will be reviewed and approved by the federal and Commonwealth regulatory/stakeholder agencies and provided to the public.

The duration of 30 years is not intended to suggest it will require 30 years to implement all elements of the remedy. Because the remedy includes long-term monitoring, 30 years of the MEC and groundwater monitoring are assumed for cost-estimating purposes, in accordance with EPA Guidance for Conducting Remedial Investigations and Feasibility Studies under CERCLA (EPA, 1988). Conducting MEC removal in planned recreational use areas and implementing land use controls (e.g., educational kiosks) can be conducted as soon as the ROD and associated remedial action, land use control, and long-term monitoring work plan(s) are finalized.

3.6 Major Point/Comment – Relationship to Other Sites at the Vieques Naval Training Range: One commenter asserted that remedy determinations made exclusively for UXOs 12 and 14 do not consider the cumulative impacts associated with the other sites.

Response: While evaluation of data and remedial alternative evaluation did consider information from other sites, addressing impacts on a site by site basis complies with the NCP. CERCLA actions are generally defined in terms of being onsite and offsite. 40 CFR 300.5 states, "On-site means the areal extent of contamination and all suitable areas in very close proximity to the contamination necessary for implementation of the response action." Additionally, 40 CFR 300.430(a)(i)(2) states, "Sites should generally be remediated in operable units when early actions are necessary or appropriate to achieve significant risk reduction quickly, when phased analysis and response is necessary or appropriate given

the size or complexity of the site, or to expedite the completion of total site cleanup." In this context the term Operable Unit is also defined in 40 CFR 300.5. It states, "Operable unit means a discrete action that comprises an incremental step toward comprehensively addressing site problems. This discrete portion of a remedial response manages migration, or eliminates or mitigates a release, threat of a release, or pathway of exposure. The cleanup of a site can be divided into a number of operable units, depending on the complexity of the problems associated with the site. Operable units may address geographical portions of a site, specific site problems, or initial phases of an action, or may consist of any set of actions performed over time or any actions that are concurrent but located in different parts of a site." The size and complexity of the overall Vieques remediation makes the designation of Operable Units appropriate. It should be noted that as additional, related sites are investigated, such as the roads that traverse areas within and adjacent to UXOs 12 and 14 that may be utilized for accessing the recreational areas, cumulative risks will be assessed and reported in documents associated with those sites.

Regarding the potential expansion of public use areas, the NCP requires the consideration of the future land use (Land Use in the CERCLA Remedy Selection Process, OSWER 9355.7-04) in the development of remedial alternatives. Specifically, remedial action objectives must consider and reflect future land use, the future land use must be considered in risk assessments, and the land uses that will be available following the completion of the remedy must be determined as part of the alternative. Alternative 3 considers the future recreational land use that is currently anticipated and includes land use controls to foster that use. The alternative limits any expansion of the public use area to only those locations where the remedy remains effective. Nonetheless, as demonstrated in the Response to Question 4.1 in Section 4, the remedy contains appropriate robustness to adapt to potential changes in planned public use areas.

3.7 Major Point/Comment – Compliance with the Applicable or Relevant and Appropriate Requirements (ARARs): One commenter asserted the necessity of complying with various environmental and species protection laws and that the ecological risk assessment insufficiencies may result in violations of various ecological protection laws.

Response: It is acknowledged that actions taken under the authority of CERCLA are subject to ARARs, which include the substantive requirements of the laws such as those cited by the commenter if they are applicable or relevant and appropriate to the proposed remedy. While it is not the purpose of nor within the scope of an Ecological Risk Assessment to determine or assess compliance with species protection laws, identification of ARARs and compliance with them is part of the remedial alternative evaluation included in the Remedial Investigation/Feasibility Study Report (CH2M, 2018) and the proposed remedy will comply with all ARARs, as stated in Section 7.2 of the Proposed Plan. Laws created specifically to protect endangered species and other ecological resources that are applicable to the remedial action at UXOs 12 and 14 are identified in Attachment A of this ROD.

4. Summary of Specific Questions Regarding the UXO 12 and UXO 14 Proposed Remedial Action

This section provides specific questions regarding the UXO 12 and UXO 14 Proposed Plan that were asked at the public meeting (questions were edited for clarity and as necessary to account for translation from Spanish to English) or submitted during the public comment period.

4.1 Question (from public meeting): In approximately a year, the UXO 12 and UXO 14 area will be available for land use as defined by USFWS, including public access. If in the future (e.g., 10 years down the road) a new trail is desired, would the Navy be available to inspect the trail?

Response: Yes, the Navy would be available to perform that inspection because the Navy's responsibility does not stop with implementation of the remedial action. The Navy retains the long-term obligation to ensure the remedies are working as intended, including safety.

4.2 **Question (from public meeting):** Is the land use plan provided for UXO 12 and UXO 14 the only land use plan, because it shows use only along the roads? What about all the land that is inside the roads?

Response: UXO 12 and UXO 14 are mainly mangroves and other vegetated areas where there is not much of a potential public use area and where public use could harm the environment. While there are no plans to open the central areas of these sites because there is no public attractiveness identified, USFWS may perform a biological evaluation of the area, and decide how to manage it and whether there is reason to open public access to it in the future. If so, the Navy would support USFWS in their future planning efforts, which may include additional public access, as stated in the response to Question 4.1. In the meantime, the remedial action will support the current USFWS land use plan for the area.

4.3 **Question (from public meeting):** Is there a way in which college students could get involved with seeding and planting in areas where cleanup will take place?

Response: That may not be possible in a UXO site due to safety concerns, but EPA has issued a grant solicitation and is seeking proposals to do various types of studies in Vieques. While not part of the Navy's cleanup process, it may provide opportunities for similar kind of work.

4.4 **Question:** What hunting will be allowed?

Response: Hunting will be at the discretion of USFWS, in accordance with its land use plan for UXO 12 and UXO 14, and via a hunting permitting process that will be developed by USFWS and communicated to the public.

4.5 **Question:** What was the criteria used to determine that UXO 12 and UXO 14 are the priority clean-up areas, and what is their proximity to civilian populations versus other areas of the VNTR?

Response: Prioritization of sites for cleanup is multifaceted and includes such considerations as explosive hazard relative to other sites, planned use by USFWS, proximity to public areas, and input from the public. However, there are other factors that contribute to the duration of investigation and timing of remedy determinations and implementation, such as historical use; physical features; types, quantity, and distribution of munitions; levels of contamination found; etc. For example, sites where historical use involved high quantities and distribution of munitions may require longer to study in order to sufficiently characterize and determine appropriate remedial alternatives.

UXOs 12 and 14, together comprising nearly 5,000 acres, represent approximately one third of the Former Vieques Naval Training Range (VNTR) area and are located between about 1 and 6 miles from the eastern edge of the Municipality of Vieques. Relative to other sites within the VNTR, historical military training activities were more limited and quantities of munitions found were significantly lower at UXOs 12 and 14. Further, planned public use areas represent a small percentage of the area, with the remainder planned for wildlife management. These factors allow for a large area of land to be returned to beneficial public use relatively quickly while investigation and/or remediation continue at other locations.

4.6 **Question:** How many actual munitions have been estimated or located at each site?

Response: Forty-nine MEC were found within UXO 12, constituting a density of approximately 0.09 MEC per acre surface cleared, which equates to an estimated 362 surface MEC within the 4,026-acre site. For perspective, over 20,000 MEC have been identified within UXO 9 (the site immediately east of UXO 12 within the Surface Impact Area), constituting a density of over 100 MEC per acre surface cleared at the site. Because of its smaller size, UXO 14 is anticipated to have a similar density, but smaller quantity of MEC than UXO 12.. To date, only 4 MEC were found at UXO 14, constituting a density of approximately 0.09 MEC per acre surface cleared, which equates to an estimated 75 MEC within the 784-acre site.

4.7 **Question:** What are the proposed mechanisms for cleanup under Alternative 3 and what do they each entail?

Response: The general approach for remedy implementation for each alternative is described in the Remedial Investigation/Feasibility Study Report (CH2M, 2018) and summarized in the Proposed Plan. The

details of remedy implementation will be provided in the remedial action work plan, land use control plan, and long-term monitoring plan, which will be made available to the public once approved by the federal and Commonwealth regulatory/stakeholder agencies.

4.8 **Question:** Is open-air detonation of unexploded ordnance and open-air burning of vegetation anticipated under Alternative 3?

Response: No vegetation burning is anticipated for Alternative 3 because any vegetation clearing likely can be done by mechanical means in UXOs 12 and 14. If MEC is found during implementation of Alternative 3 (or any alternative that involves MEC clearance), it will be disposed of in accordance with the regulatory-approved protocol in place at the time of its removal, which currently would use open detonation.

4.9 **Question:** What weight has been given the research of independent scientists, physicians, and health experts on the on-going clean-up mechanisms being currently used by the Navy – including open-air detonations and open-air burning of vegetation – on local flora and fauna, as well as the civilian population?

Response: Published, peer-reviewed research relevant to the Vieques environmental restoration program under CERCLA are considered as they become available. For example, the "Alternatives for the Demilitarization of Conventional Munitions" report (National Academies of Sciences, Engineering, and Medicine, 2019) referenced in Major Point/Comment 3.1 has been considered by the Navy. However, as detailed in that response, detonation chambers are not appropriate for the type of munitions found in Vieques (i.e., UXO). Further, many years of air monitoring conducted during open detonations and vegetation burning have demonstrated these activities do not adversely impact air quality.

4.10 **Question:** Has the Navy attempted to locate and use detonation chambers for unexploded ordnance in Vieques? If so, when and what was the outcome? If not, why not?

Response: Detonation chambers have been evaluated for potential use on Vieques but determined not to be appropriate for the type of munitions found in Vieques (i.e., UXO), as detailed in Major Point/Comment 3.1.

4.11 **Question:** What is the estimated cost per area for clean-up under each proposed Alternative?

Response: The total land area of UXOs 12 and 14 is approximately 4,800 acres, comprising 4,026 acres in UXO 12 and 784 acres in UXO 14. Table 3 of the Proposed Plan provides the capital, present value of annual LTM, and total present-worth cost of each alternative. The cost per acre of each alternative can be determined by selecting the desired cost and dividing by the total acreage. For example, in terms of capital cost, the cost per acre is approximately $51/acre for Alternative 2 and $110/acre for Alternative 3. Therefore, under Alternative 2, the capital cost for UXO 12 would be approximately $206,000, and the capital cost for UXO 14 would be about $40,000 due to the large difference is acreage between the sites. Similarly, under Alternative 3, the capital cost for UXO 12 would be approximately $443,000, and the capital cost for UXO 14 would be about $86,000.

4.12 **Question:** What are the names of the scientists and scientific experts that the EPA, the Navy, and its contractor, CH2M HILL, have used to conduct an assessment concerning environmental contamination and health risks per proposed Alternative and per site?

Response: All agencies utilize scientists and scientific experts, trained and experienced in performing CERCLA investigations, including munitions and munitions constituents, data evaluation, risk assessments, and associated remedial alternatives. Site-related documents produced by or on behalf of the Navy are peer-reviewed by the federal and Commonwealth regulatory/stakeholder agencies and the technical and scientific information relative to UXOs 12 and 14, as well as all other sites on Vieques, is available in the Administrative Record, which is available to the public. The Administrative Record can be accessed online at https://go.usa.gov/xRHxY.

4.13 **Question:** When can the sampling data be made available to the community?

Response: The data for the samples collected at UXOs 12 and 14 are provided in the Remedial Investigation/Feasibility Study Report (CH2M, 2018). That report was made available to the public (i.e., placed in the Administrative Record) in August 2018. The Administrative Record can be accessed online at https://go.usa.gov/xRHxY. Sampling data generated during long-term monitoring at UXOs 12 and 14 will be made available to the public on a periodic basis, the frequency of which will be based on the frequency long-term monitoring is conducted); the associated reports will be placed in the Administrative Record file referenced previously.

4.14 **Question:** Will you be conducting long-term groundwater monitoring, and if so, under which Alternative and when?

Response: As stated in the Proposed Plan, Alternative 3 is the proposed remedy, which includes long-term groundwater monitoring. The remedy will be implemented as soon as the Record of Decision and the remedial action work plan, land use control plan, and long-term monitoring plan are finalized. The details of long-term groundwater monitoring, including the frequency of sampling, will be included in the long-term monitoring plan, which will be made available to the public once approved by the federal and Commonwealth regulatory/stakeholder agencies.

Open Detonation Fact Sheet

Summary

On Vieques, open detonation is used in remote areas to destroy unexploded munitions that are designed to be destructive rather than toxic or poisonous. During open detonation, the explosive chemicals are consumed, releasing a powerful shockwave, metal fragments, and non-toxic gases that are naturally present in the atmosphere. Extensive air monitoring has shown that the open detonations do not affect the health of Vieques residents. Open detonation is the safest method for site workers because it can be performed with little or no handling of dangerous unexploded munitions. Open detonation is also safest for the public because it supports all cleanup requirements and minimizes explosive hazards. Without open detonation, the munitions on Vieques would need to be left in place, and the cleanup could not be completed as required.

What kind of munitions are found on Vieques?

The Vieques cleanup involves high explosive munitions, including bombs, projectiles, mortars, rockets, grenades, and submunitions, which are designed to be destructive, rather than toxic or poisonous. Cleanup workers also encounter white phosphorous, flares, and spotting charges, which are designed to product heat, light, or puffs of smoke. The munitions on Vieques are classified as unexploded ordnance (UXO) because they have been fuzed and fired, but somehow failed to explode as expected. UXO items are especially dangerous because they are set to explode and may do so without warning. The Vieques cleanup does not involve toxic chemical weapons.

What are high explosive munitions made of?

The outer casing and internal parts are made of metal – mainly iron, aluminum, and copper. Internal parts may also include small amounts of asphalt, wax, alcohols, solvents, petroleum, and other substances. The explosive chemicals are mostly made of carbon, oxygen, hydrogen, and nitrogen, but they may also include aluminum or other metals to increase explosive power or produce light. TNT, RDX, and HMX are common high explosive chemicals.

What happens during an open detonation?

The explosive chemicals react and break apart, producing extreme heat, a high pressure blast, large amounts of gas, and a sharp bang. Dirt and metal fragments are blown into the air, and trace amounts of organic chemicals and metal compounds are released at very low concentrations (EPA, 1998 and SEESAC, 2004). The explosive chemicals are changed into non-toxic gases – mostly nitrogen, carbon dioxide, hydrogen, and water vapor, plus small amounts of carbon monoxide, nitrogen oxides, and other gases. These gases are common components of the earth's atmosphere. For example, the atmosphere is 78% nitrogen and 0.04% carbon dioxide.

Why is open detonation used on Vieques?

Open detonation is conducted in a manner that is protective of public health, and it is the safest method for site workers to destroy unexploded munitions. Without open detonation, the cleanup could not be completed as required.

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Vieques
Environmental Restoration
Fact Sheet

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How do open detonations affect public health?

The environmental and health effects of open detonations have been studied by the US Environmental Protection Agency, the US Department of Defense, and governmental agencies overseas. The results show that open detonations can be conducted in a manner that is protective of public health and the environment (EPA, 1998 and SEESAC, 2004). This general conclusion has been confirmed many times on Vieques, as the Navy has conducted extensive air monitoring during open detonations. From 2005 to 2013, over 1,600 air samples were collected during 177 open detonation events, and the samples were analyzed for explosive chemicals, metals, and particulate matter (dust and soot). No explosive chemicals were detected during any of the air monitoring events; concentrations of all metals were at least 99% below health based standards; and concentrations of particulate matter were within regulatory standards.

How do open detonations affect the safety of site workers?

In order to protect the safety of site workers, it is standard practice in the munitions cleanup industry to avoid the movement and handling of unexploded munitions as much as possible. Historical records show that explosive accidents usually occur after someone has picked up or moved an unexploded munition (EPA, 2001). With open detonation, the most sensitive munitions are destroyed in place and never touched, while more stable items can be moved a few feet for consolidated detonation if the UXO Safety Officer determines that the risk of such minimal movement will create a safer, more effective process overall. During the past 14 years, site workers on Vieques have encountered and destroyed over 100,000 unexploded munitions, and tens of thousands remain. Given this large number of chances for an accident, it is essential for workers to use the safest possible approach. Open detonation is the safest method because it can be performed with little or no handling of munitions.

How do open detonations affect public safety?

Open detonation increases public safety because it can be used to destroy all types of munitions found on Vieques. Without open detonation, the UXO on Vieques would need to be left in place, and the cleanup could not be completed as required. In contrast, open detonation supports all cleanup requirements and minimizes the risk that residents and tourists may encounter munitions.

Why not use detonation chambers?

The Vieques cleanup involves tens of thousands of UXO scattered across miles of rugged, hilly terrain. In order to use a detonation chamber on Vieques, site workers would need to carry UXO for hundreds of yards across difficult terrain, load the UXO onto trucks, transport UXO over miles of unimproved roads, move UXO into and out of storage, and set up each UXO item for treatment. Such long-distance transport and repeated handling of tens of thousands of UXO would expose site workers to the very real danger of being injured or killed in an accidental explosion. Overall, detonation chambers would create significant danger for site workers, fail to support cleanup requirements, and provide no public health benefits. For these reasons, detonations chambers are not used on Vieques.

References

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