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PROPOSED REMEDIAL ACTION PLAN UNEXPLODED ORDNANCE 1 (UXO 1) EASTERN CONSERVATION AREA ATLANTIC FLEET WEAPONS TRAINING AREA FORMER VIEQUES NAVAL TRAINING RANGE (ENGLISH VERSION) VIEQUES ISLAND PUERTO RICO

08/01/2014

DEPARTMENT OF THE NAVY

Proposed Remedial Action Plan

UXO 1, Eastern Conservation Area
Atlantic Fleet Weapons Training Area —Vieques
Former Vieques Naval Training Range
Vieques, Puerto Rico
August 2014

1. Introduction

This Proposed Plan identifies the rationale and preferred remedial alternative for UXO 1, the Eastern Conservation Area (ECA), located at the Former Vieques Naval Training Range (VNTR) in Vieques, Puerto Rico. UXO 1 is also known as Operable Unit (OU) 18 in the Comprehensive Environmental Response, Compensation, and Liability Act Information System (CERCLIS), which is a database maintained by the U.S. Environmental Protection Agency (EPA) to track the progress at hazardous waste sites. The Proposed Plan summarizes this OU's history, the results of previous environmental investigations, and the preferred remedial alternative, and it solicits and facilitates public review of and comment on the preferred alternative.

UXO 1 was established as a conservation area in 1983 and not used as an operational area for munitions; however, the site is located adjacent to the Live Impact Area (LIA) where former artillery and air-to-ground bombing targets and open burning/open detonation (OB/OD) activities were located. Munitions and explosives of concern (MEC) identified in UXO 1 were most likely a result of missing intended targets and from OB/OD activities in the adjacent LIA.

This document is issued by the U.S. Department of the Navy (Navy), Naval Facilities Engineering Command (NAVFAC) Atlantic Division, the EPA Region 2, and the Department of Interior (DOI), in consultation with the Puerto Rico Environmental Quality Board (PREQB), which has consulted with the Puerto Rico Department of Natural and Environmental Resources (PRDNER). The Proposed Plan fulfills the public participation requirements in Section 117(a) of the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) and in Section 300.430(f)(2) of the National Oil and Hazardous Substances Pollution Contingency Plan (NCP). Previous removal actions within UXO 1 resulted in the removal of MEC from the ground surface throughout the majority of the site and from within the subsurface along the beaches and roads. Based on this information, the current and future anticipated land use as part of the Vieques National Wildlife Refuge, and the results of the Remedial Investigation at the site, the preferred alternative for UXO 1 is Focused Additional MEC Removal and Land Use Controls (LUCs).

Mark Your Calendar for the Public Comment Period

August 4 – September 17, 2014

Submit Written Comments

The Navy and EPA will accept written comments on the Proposed Plan during the public comment period. To submit comments or obtain further information, please refer to the insert page.

Attend the Public Meeting

August 21, 2014 at 7:00 p.m.

Vieques Multiple Use Center

Antonio Mellado – (across from Plaza)

Isabel Segunda, Vieques, PR

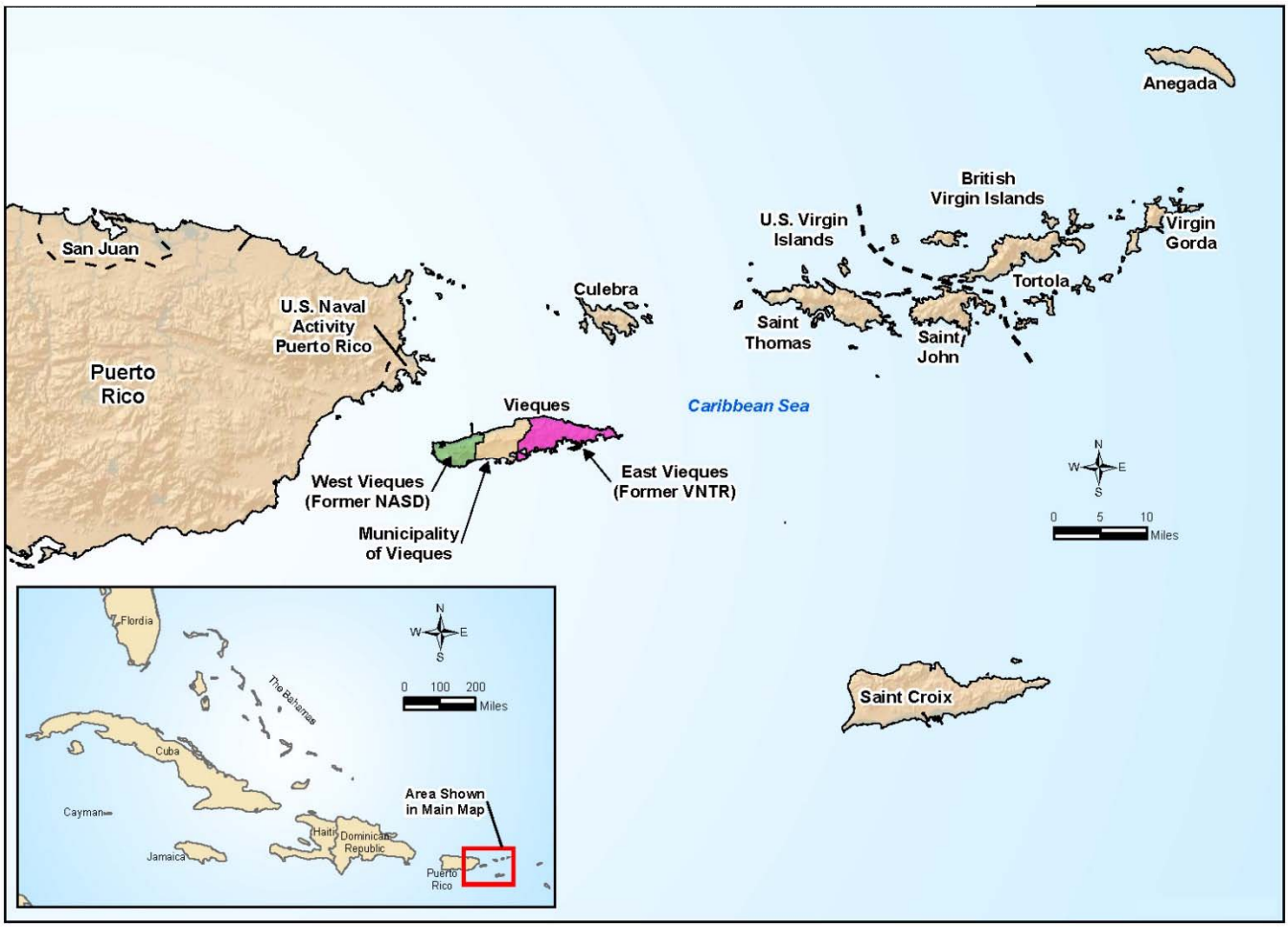
The Navy will hold a public meeting to present and discuss the preferred remedial alternative. Verbal and written comments will also be accepted at this meeting.

Location of Administrative Record File

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

ES072814163220TPA

Figure 1 – Regional Location Map



The Navy, EPA, and DOI, in consultation with PREQB, will make the final decision on the remedial approach for UXO 1 after reviewing and considering all information submitted during the 45-day **public comment period**. If warranted based on public comments and/or new information, the preferred alternative set forth in this document may be modified or an alternate remedy may be considered. Therefore, it is important to the remedy selection process that the public provide input on not only the proposed remedy but also the other alternatives considered.

This Proposed Plan summarizes information that can be found in greater detail in the **Remedial Investigation** Report (CH2M HILL, 2012) and the **Feasibility Study** Report (CH2M HILL, 2012), and other documents contained in the **Administrative Record** for UXO 1. A glossary of key terms used in this document is attached; these key terms are identified in bold print the first time they appear.

2. Site Background

2.1 Facility Description and History

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

The Navy purchased portions of Vieques in the early 1940s to conduct activities related to military training. Operations within the Former Naval Ammunition Support Detachment (NASD; western one-third of Vieques) consisted mainly of ammunition loading and storage, vehicle and facility maintenance, and some training. Operations within the Former VNTR (eastern one-half of Vieques) comprised various aspects of naval gunfire training, including air-to-ground ordnance delivery and amphibious landings, as well as housing the main base of operations for these activities at Camp García. The VNTR is

approximately 14,600 acres and comprises the Eastern Maneuver Area (EMA), Surface Impact Area (SIA), LIA, and 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 Department of Interior (DOI), to be managed by the U.S. Fish and Wildlife Service (USFWS) as a National Wildlife Refuge. On February 11, 2005, the Atlantic Fleet Weapons Training Area – Vieques (also known as AFWTA-Vieques) was added to the National Priorities List (NPL), which required all subsequent environmental restoration activities for Navy Installation Restoration (IR) sites on Vieques to be conducted under CERCLA. On September 7, 2007, the Navy, DOI, EPA, and PREQB finalized a Federal Facility Agreement (FFA) that establishes the procedural framework and schedule for implementing the CERCLA activities for Vieques. The DOI is directed to protect and conserve the transferred land as a wildlife refuge, and the Navy retains the primary responsibility under the FFA for conducting the environmental investigations and clean-up of the property, as warranted.

2.2 Site Description

UXO 1 is approximately 133 acres in size and located along the easternmost portion of Vieques within the Former VNTR (Figure 2). UXO 1 was established as a conservation area in 1983 and was not used for munitions operations; however, the site is located adjacent to the LIA (UXOs 2, 3, and 4) where naval gunfire and air-to-ground training activities occurred from the 1970s through 2003 and where OB/OD activities were conducted (Figure 2). The LIA generated an explosive safety arc that extended into UXO 1. Therefore, MEC and other munitions-related items identified within UXO 1 were most likely from munitions directed toward the LIA that missed their intended target or debris from OB/OD operations.

UXO 1 is located on U.S. property managed by the DOI that has been designated part of the Vieques National Wildlife Refuge. USFWS will perform refuge management activities at the ECA, such as monitoring the turtle nesting area along Playa Blanca and planting of native plant species, and the U.S. Coast Guard (USCG) will maintain its navigation "light post" at the eastern end of UXO 1 (Figure 2). There is currently no planned public access or groundwater use within UXO 1. Because of the presence of high cliffs and shallow coral reefs surrounding UXO 1, the potential route of access to UXO 1 is through the LIA, as shown in Figure 2. However, Public Law 106-398, also referred to as the Floyd D. Spence National Defense Authorization Act for Fiscal Year 2001, required the LIA to be managed as a wilderness area and to prohibit public access. Therefore, the potential for trespassing at UXO 1 is low.

2.3 Summary of Previous Investigations

Environmental investigations have been conducted at UXO 1, beginning in 2000. The following subsections briefly summarize the purpose, scope, and results of environmental investigations and interim actions completed to date.

2.4 Environmental Baseline Survey (2000)

An Environmental Baseline Survey (Program Management Company, 2000) was conducted in 2000 to disclose available and relevant information regarding the environmental condition of the Navy property. The information was used as a basis for determining the environmental suitability of the property for transfer.

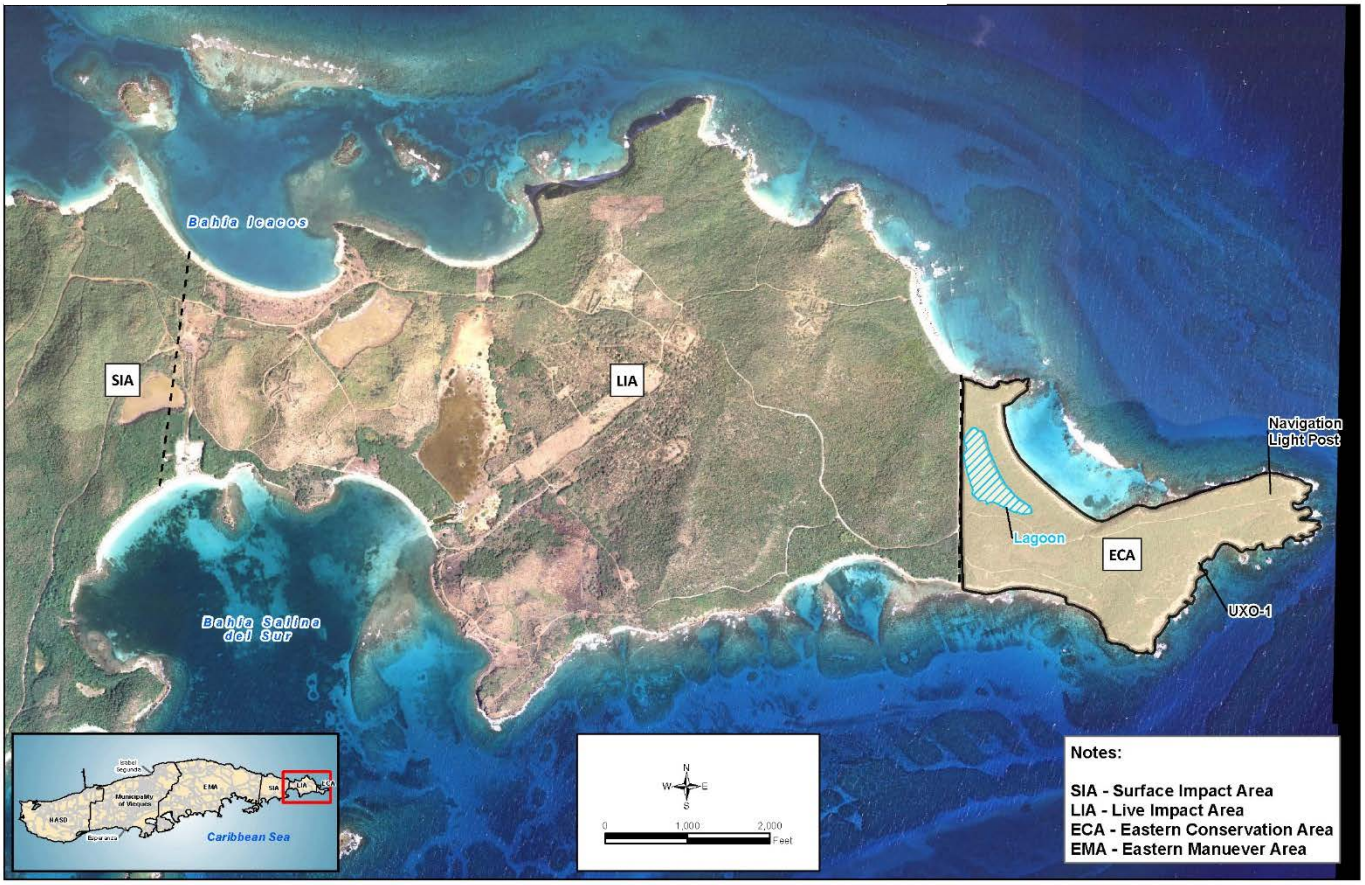
2.5 Preliminary Range Assessment (2002)

The Preliminary Range Assessment (CH2M HILL, 2003) was conducted in 2002 to provide information about the types, quantities, and other factors related to the military munitions used, and to identify the types and locations of any targets that may have been used at the MEC areas at the VNTR. The information was used to help identify areas for further consideration.

2.6 Expanded Range Assessment/ Site Inspection (2005-2008)

The Expanded Range Assessment/Site Inspection (ERA/SI) was conducted from 2005 through 2008 to determine the presence and estimate the quantity of munitions at 17 UXO sites within the former VNTR (CH2M HILL, 2010). Activities within UXO 1 included a handheld magnetometer survey along beaches that identified subsurface anomalies, light detection and radar survey that identified craters, and an aerial magnetometer survey to identify elevated anomaly density areas. The ERA/SI resulted in the identification of munitions within UXO 1.

Figure 2 – Former VNTR and UXO 1 Location Map



2.7 Time-Critical Removal Action (2005-2009)

A Time-Critical Removal Action (TCRA) was conducted from 2005 through 2009 to remove MEC present or exposed on the ground surface in accessible areas within both the LIA and ECA (CH2M HILL, 2010). MEC was removed from the surface within 125 acres of UXO 1 including the lagoon, leaving only several acres of steep slopes and cliff edges not cleared, primarily because of inaccessibility and instability. In total, 1,308 MEC and 784 munitions debris (MD) items, along with numerous other debris, were removed from the surface at a cost of approximately $5,800,000.

2.8 Non-Time Critical Removal Action (2011)

A Non-Time Critical Removal Action (NTCRA) was conducted in 2011 to remove MEC within the subsurface at the beaches (to a maximum depth of 4 feet) and along roads (to a maximum depth of 2 feet) within the UXO 1 (CH2M HILL, 2012). In total, 97 MEC and 792 MD items, along with numerous other debris, were removed from the subsurface at a cost of approximately $1,400,000.

2.9 Remedial Investigation (2011)

A Remedial Investigation (RI) (CH2M HILL, 2011) was conducted to assess the nature and extent of MEC and environmental media contamination and to assess potential risks to human health and the environment at UXO 1. There were no unacceptable risks to human health or the environment posed by environmental contaminant levels identified at the site, so no action is required for environmental media. However, a feasibility study was warranted to address potential explosive hazards associated with the possible presence of MEC in the subsurface, with surface MEC in inaccessible and unstable areas, and from MEC that may become exposed in the surface due to erosion.

2.10 Feasibility Study (2012)

The Feasibility Study (FS) analyzed remedial alternatives to address the potential presence of subsurface MEC at UXO 1, in accordance with EPA guidance. A more detailed description of the FS is presented in Section 7.

3. Site Characteristics

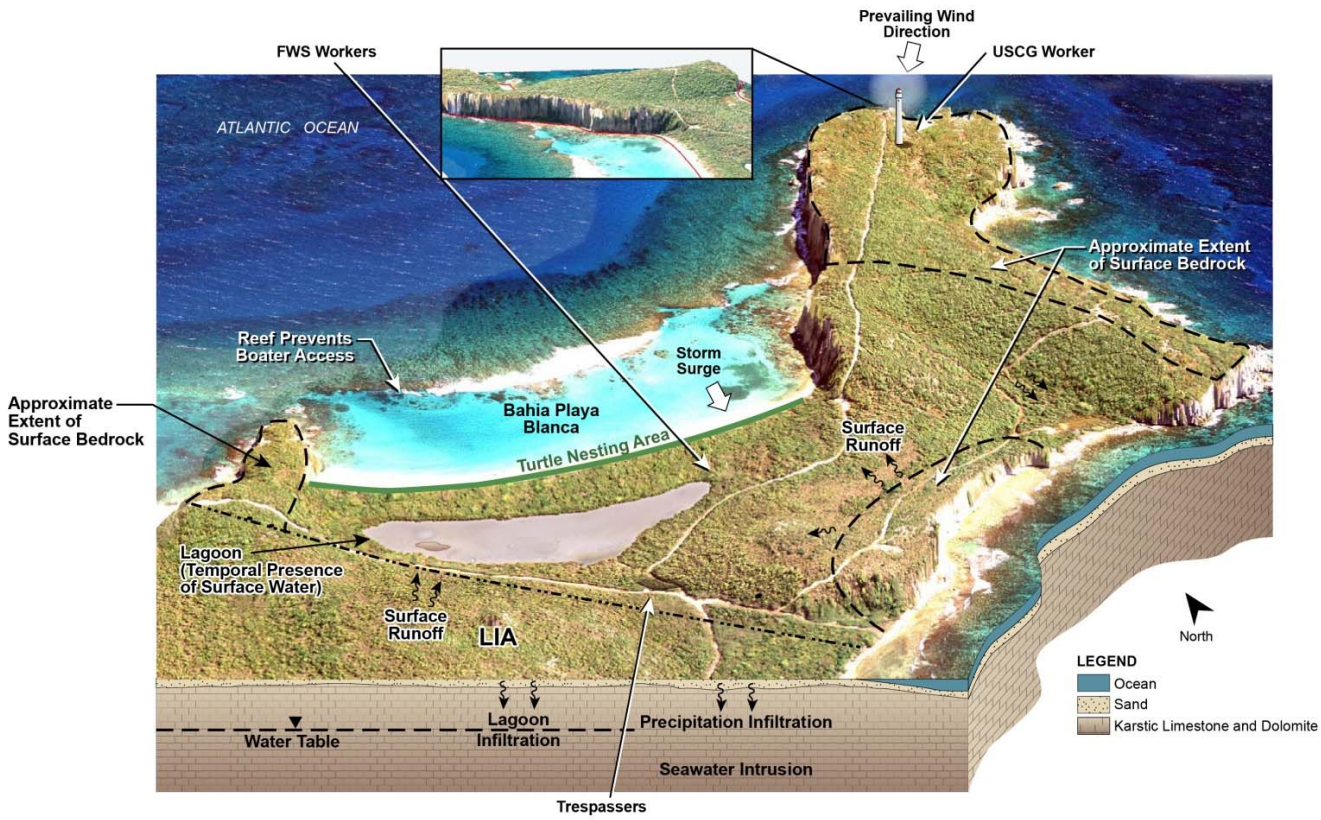
3.1 Physical Characteristics

The northern, eastern, and southwestern portions of UXO 1 are topographically high areas (up to 60 feet above mean sea level [ft msl]) that gently slope toward an inland lagoon and the ocean (down to 0 ft msl), as shown in Figure 3. Large cliff faces separate the ocean from the land, except at Bahia Playa Blanca. A 9-acre inland lagoon is located within the western portion of the site; the lagoon is not tidally influenced and observations of the temporal presences of surface water suggest it is wholly or mostly the result of precipitation. No streams occur within UXO 1.

The dominant vegetation type is low-growing, mostly native evergreen scrub along the eastern, southern, and northwestern portions of UXO 1. A forested scrub community with a greater abundance of invasive species and narrow fringe of mangroves surrounds the inland lagoon.

The geology of UXO 1 is characterized as limestone, either near or exposed at the ground surface, and beach sand at Bahia Playa Blanca. The upland areas generally contain bedrock exposed at the surface, with a very thin layer of soil between exposed bedrock. Within the lowland areas, beach sands intermixed with limestone are encountered at the surface. Groundwater within UXO 1 primarily occurs within the bedrock and is likely influenced by seawater.

Figure 3 – UXO 1 Site Conceptual Model



3.2 Nature and Extent of Contamination

As noted previously, surface removal of MEC, MD, and other debris was conducted across UXO 1 and MEC, MD, and other debris were removed from the subsurface along the beaches and roads. The majority of the munitions-related items were identified in the western portion of the site. MEC was primarily projectiles/mortars (mostly 20 millimeter rounds), but bombs, flares, rockets, and sub-munitions were also identified and removed.

Soil, surface water, and sediment samples were collected and analyzed for explosives and inorganic constituents during the RI to determine if munitions-related contamination had impacted the environmental media. No explosives were detected in subsurface soil, surface water, or sediment. Nitrobenzene was the only explosive detected in surface soil (0 – 2 inches) above a screening criterion (soil screening level [SSL]), but in only one sample and between two and three orders of magnitude

below risk-based screening criteria for direct exposure. The SSL is a conservative screening criterion designed to evaluate the potential for chemicals to leach from soil to groundwater above safe drinking water levels. This sample was collected along the boundary between the ECA and LIA. Common inorganic constituents, such as aluminum, copper, iron, and manganese, were detected in soil, surface water, and sediment; however, the concentrations of all inorganics detected were primarily attributed to background based on the background investigation conducted during the RI (CH2M HILL, 2011).

4. Summary of Site Risks

A summary of the Human Health Risk Assessment (HHRA) and Ecological Risk Assessment (ERA) conducted for UXO 1 during the RI is included in the following subsections and in Table 1. The complete HHRA and ERA are provided in the RI Report, which is available in the Administrative Record File.

Table 1 – UXO 1 Risk Assessment Results

Media	Human Health Risk Current/Future USFWS Workers
Soil	ELCR = 1 x 10-6 and HI = 0.03 **Acceptable**
Sediment	ELCR = 7 x 10-8 and HI = 0.0007 Acceptable
Surface Water	ELCR = 2 x 10-8 and HI = 0.002 Acceptable
ELCR – excess lifetime cancer risk HI – hazard index Unacceptable ELCR = >1 x 10^{-4} Unacceptable HI = >1	
Media	**Ecological Risk** **All Receptors**
Soil	Acceptable
Sediment	Acceptable
Surface Water	Acceptable

4.1 Human Health Risk Assessment

The HHRA was conducted to evaluate potential human health risks associated with exposure to contaminants detected in soil, sediment, and surface water at UXO 1. Maximum detected concentrations of chemicals were compared to risk-based screening levels, and chemicals of potential concern (COPCs) were identified based on exceedances of these screening levels. Arsenic was the only COPC identified in surface soil and lagoon sediment, and three inorganics (arsenic, cobalt, and thallium) were identified as COPCs in lagoon surface water.

Health risks are based on an estimate of the potential carcinogenic risk and the potential non-cancer hazard, which is expressed as a hazard index (HI). Exposure scenarios evaluated for site media included potential USFWS workers, since these workers are likely to have the highest potential exposures based on their anticipated work activities and exposure areas during refuge management activities. The health risks estimated for the USFWS personnel were then used to conservatively estimate potential risks for trespassers and USCG workers, since both of these populations are assumed to have less exposure based on their limited activities and time in the UXO 1 area. Potential exposure pathways comprised ingestion, dermal contact, and/or inhalation of chemicals in soil, surface water, and sediment.

No unacceptable risks were identified for potential human receptors based on the exposure scenarios listed above; in other words, risk estimates were below threshold values. Table 1 provides the highest risk and hazard for USFWS workers engaged in: 1) site-wide wildlife surveillance and monitoring, 2) sea turtle monitoring and conservation activities at Playa Blanca, 3) upland dry forest restoration, 4) lowland forest restoration, and 5) lagoon wildlife surveillance and monitoring. For the two types of USFWS workers exposed to more than one environmental medium (those engaging in site-wide wildlife surveillance and monitoring and those engaging in lagoon wildlife surveillance and monitoring), the cumulative risk estimates for exposure to all three media (soil, sediment, and surface water) were also below threshold values.

What is Human Health Risk and How is it Calculated?

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

Step 1: Data Collection and Evaluation

Step 2: Exposure Assessment

Step 3: Toxicity Assessment

Step 4: Risk Characterization

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

- Identifying and evaluating area(s) where site-related chemicals may be found (source areas) and at what concentrations.
- Evaluating potential movement (transport) of chemicals in the environment.
- Comparing site concentrations to risk-based screening levels to determine which chemicals may pose the greatest threat to human health (called "chemicals of potential concern" [COPCs]). Constituents are not excluded from the risk assessment process if they are within the range of background.

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

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

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

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

- Two types of risk are considered: cancer risk and non-cancer hazard.
- The likelihood of developing cancer as a result of site exposure is expressed as an upper-bound probability; for example, a "1 in 10,000 chance. "In other words, for every 10,000 people that might be exposed under the conditions identified in Step 2, one additional case of cancer may occur as a result of site exposure. Unacceptable risk exists when the ELCR of 1×10^{-4} is exceeded.
- For non-cancer health effects, a "hazard index" (HI) is calculated. The HI represents the ratio between the "reference dose," which is the dose at which no adverse health effects are expected to occur, and the RME dose for a person contacting COPCs at the site. The key concept here is that a "threshold level" (measured as a HI of 1) exists below which no non-cancer health effects are expected to occur.
- The potential risks from the individual COPCs and exposure pathways are summed and a total site risk is calculated for each receptor.

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

4.2 Ecological Risk Assessment

The RI ERA was conducted to evaluate potential risks to terrestrial and aquatic ecological receptors exposed to contaminants detected in soil, sediment, and surface water. The site is relatively undisturbed and provides suitable terrestrial habitat for a variety of plant, invertebrate, reptile, bird, and mammal communities. The beach along Bahia Playa Blanca serves as a sea turtle nesting area. At the time of the survey, few species were identified at the lagoon due to its periodically dry nature.

No unacceptable risks to plants and animals and other wildlife potentially feeding on those plants and animals were identified. Detailed information is provided in the UXO 1 RI Report.

What is Ecological Risk and How is it Calculated?

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

An ERA has three principal components:

1. Problem Formulation establishes the goals, scope, and focus of the ERA and includes:
   - Compiling and reviewing existing information on the habitats, plants, and animals that are present on or near the site
   - Identifying and evaluating area(s) where site-related chemicals may be found (source areas) and at what concentrations
   - Evaluating potential movement (transport) of chemicals in the environment
   - Identifying possible exposure media (soil, air, water, sediment)
   - Evaluating if/how the plants and animals may be exposed (exposure pathways)
   - Evaluating routes of exposure (for example, ingestion)
   - Identifying specific receptors (plants and animals) that could be exposed
   - Specifying how the risk will be measured (assessment and measurement endpoints) for all complete exposure pathways
2. Risk Analysis which includes:
   - Exposure Estimate - An estimate of potential exposures (concentrations of chemicals in applicable media) to plants and animals (receptors). This includes direct exposures of chemicals in site media (such as soil) to lower trophic level receptors (organisms low on the food chain such as plants and insects) and upper trophic level receptors (organisms higher on the food chain such as birds and mammals. This also includes the estimated chemicals dose to upper trophic level receptors via consumption of chemicals accumulated in lower food chain organisms.
   - Effects Assessment - The concentrations of chemicals at which an adverse effect may occur are determined.
3. Risk Calculation or Characterization:
   - The information developed in the first two steps is used to estimate the potential risk to plants and/or animals by comparing the exposure estimates with the effects threshold.
   - Also included is an evaluation of the uncertainties (that is, potential degree of error) associated with the predicted risk estimate and their effects on ERA conclusions.

The three principal components of an ERA are implemented as an 8-step, 3-tier process as follows:

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

5. Scope and Role of Response Action

In cooperation with EPA, PREQB, and USFWS, and in accordance with the FFA and applicable guidance, the Navy performed investigations at UXO 1 to evaluate the nature and extent of MEC and associated contamination and to assess the potential risks to human health and the environment. No unacceptable human health or ecological risks were identified from potential exposure to contaminants. Although surface MEC has been removed across the vast majority of the site, the Navy evaluated remedial alternatives to address remaining MEC at UXO 1 since there is the potential for MEC to be present in areas where it was not previously removed or where it may have become exposed from erosion. The preferred alternative presented in this Proposed Plan is intended to address explosive hazards and ensure that land use within the site boundaries remains the same. The response action is intended to be the final remedy of UXO 1, and it does not include or affect any other sites under the CERCLA process.

6. Remedial Action Objectives

Remedial action objectives (RAOs) are statements that define the extent to which sites require cleanup to protect human health and the environment. The

following RAOs were developed to be protective of current and potential future receptors, in accordance with the current and intended future land use (i.e., wildlife refuge):

- Lessen the explosive hazards associated with MEC by reducing the potential for uncontrolled human contact with MEC potentially present in site soil and the lagoon
- Maintain land use that is consistent with the Memorandum of Agreement between the U.S. Department of the Navy and U.S. Department of Interior concerning the transfer of Department of Defense properties on the Eastern End of Vieques (Navy and DOI, 2003)

7. Summary of Remedial Alternatives

The remedial alternatives developed and evaluated to address MEC explosive hazards at UXO 1 are detailed in the FS Report. Following the screening of various technologies, the following remedial alternatives, as summarized in Table 2 and shown in Figure 4 (Alternative 2) and Figure 5 (Alternative 3), were selected for detailed evaluation and comparative analysis.

The following three remedial alternatives were developed to address MEC explosive hazards:

- Alternative 1 – No Action
- Alternative 2 – Focused Additional MEC Removal and Land Use Controls (LUCs)
- Alternative 3 – Subsurface MEC Removal and LUCs

Inclusion of the No Action Alternative is required by the NCP as a basis of comparison for the other alternatives. Each remedial alternative for UXO 1 was evaluated with respect to the nine evaluation criteria provided in the NCP. The alternatives were then compared to one another with respect to each NCP criterion.

The NCP outlines the approach for comparing remedial alternatives. Evaluation of the alternatives uses nine evaluation criteria, which consist of "threshold," "primary balancing," and "modifying" criteria (Table 3). To be considered for selection as the preferred alternative, a remedial alternative must meet the two threshold criteria. The five primary balancing criteria, which are technical criteria based on environmental protection, cost, and engineering feasibility, are then considered to determine which alternative provides the best combination of attributes. Finally, upon receipt of public comments on this Proposed Plan, the preferred alternative is evaluated further against the two modifying criteria.

The three remedial alternatives were evaluated against the first seven of the nine criteria identified in the NCP. The two remaining criteria will be considered after the public comment period for this Proposed Plan.

Table 2 – Remedial Alternatives

Alternative	Components	Details	Cost*
1. No Action No action and no restriction on activities.	- N/A	- No action.	Total Present-Worth Cost: $0**
2. Focused Additional MEC Removal and LUCs Manages MEC explosive hazards by ensuring land use remains part of the wildlife refuge and provides protection against direct contact with MEC to USFWS workers performing maintenance activities through focused additional MEC removal.	- MEC removal - Physical demarcation and institutional controls (ICs) - Long Term Monitoring (LTM) and Operations and Maintenance (O&M)	- Limited MEC removal (e.g., removal of MEC identified during monitoring, subsurface removal of MEC along additional trails (if identified by USFWS prior to remedy implementation) to allow access to turtle nesting habitats for monitoring and other management activities). - Vegetation restoration at Playa Blanca and the upland dry forest. - Implementing physical demarcation and ICs (restrictive covenants) to maintain land use as wildlife refuge and deter future access by trespassers. This includes installing signage and other boundary demarcation to deter unauthorized access to both the LIA and the ECA. The IC boundary would be surveyed by a professional land surveyor. The LUCs will provide the ability for planned land use and management. - Perform LTM to identify any MEC that becomes exposed at the surface from erosion, observe any indications of trespassing, and repair any damage to boundary demarcation. If MEC is identified, it will be properly disposed.	Capital Cost: $511,000 Present Value of Future, Annual Operations and Maintenance (O&M) Costs: $1,567,000 Total Present-Worth Cost: $2,078,000 Assumed timeframe: 30 years

Table 2 – Remedial Alternatives

Alternative	Components	Details	Cost*
3. Subsurface MEC Removal and LUCs Manages MEC explosive hazards by ensuring land use remains part of the wildlife refuge and provides additional protection against direct contact with MEC through subsurface removal.	- Subsurface MEC removal - Physical demarcation and ICs - LTM and O&M	- Subsurface MEC removal to a maximum depth of 2 feet bgs over the entire area of UXO 1, including the lagoon, with the exception of the steep slopes, cliff edges, and subsurface areas cleared during the NTCRA (i.e., roads and beaches). - Removing 100% of MEC is not technically practical because several acres of UXO 1 would not be cleared of MEC due to the presence of steep slopes and cliff edges. - Complete vegetation clearance of the entire accessible area of the site and lagoon dewatering (if not dry at the time of remedy implementation) to allow for safe working conditions for subsurface MEC removal. - Vegetation restoration at Playa Blanca and the upland dry forest. - Implementing physical demarcation and ICs (restrictive covenants) to maintain land use as wildlife refuge and deter future access by trespassers. This includes installing signage and other boundary demarcation to deter unauthorized access to both the LIA and the ECA. The IC boundary would be surveyed by a professional land surveyor. The LUCs will provide the ability for planned land use and management. - Perform LTM to identify any MEC that becomes exposed at the surface from erosion, observe any indications of trespassing, and repair any damage to boundary demarcation. If MEC is identified, it will be properly disposed.	Capital Cost: $8,979,000 Present Value of Future, Annual O&M Costs: $1,567,000 Total Present-Worth Cost: $10,546,000 Assumed timeframe: 30 years

*The TCRA and NTCRA removed a total of 1,405 MEC and 1,576 MD items from UXO 1 for a combined cost of approximately $7,200,000.
** The No Action alternative in the FS Report included an assumed 30 years of 5-year reviews at a present worth cost of $184,000.

Table 3 – Evaluation Criteria for Comparative Analysis of Alternatives

CERCLA Criteria	Definition
Threshold Criteria	
Protection of human health and the environment	Addresses whether a remedy provides adequate protection and describes how risks posed through each pathway are eliminated, reduced, or controlled through mitigation, engineering controls, or institutional controls.
Compliance with Applicable Relevant and Appropriate Requirements (ARARs) and "To-Be-Considered" criteria	Addresses whether a remedy will meet all of the ARARs of other Federal and Commonwealth/State environmental laws and/or justifies a waiver of the requirements.
Primary Balancing Criteria	
Long-term effectiveness and permanence	Addresses the expected residual risk and the ability of a remedy to maintain reliable protection of human health and the environment over time, once clean-up goals have been met.
Reduction in toxicity, mobility, or volume through treatment	Discusses the anticipated performance of the treatment technologies a remedy may employ.
Short-term effectiveness	Considers the period of time needed to achieve protection and any adverse impacts on human health and the environment that may be posed during the construction and implementation period, until clean-up goals are achieved.
Implementability	Evaluates the technical and administrative feasibility of a remedy, including the availability of materials and services needed to implement an option.
Present-worth cost	Compares the estimated initial, operations and maintenance, and present-worth costs.
Modifying Criteria	
Commonwealth/State acceptance	Considers the Commonwealth/State support agency comments on the Proposed Plan.
Community acceptance	Provides the public's general response to the alternatives described in the Proposed Plan, and RI/FS report. The specific responses to the public comments are addressed in the "Responsiveness Summary" section of the ROD.

7.1 Relative Evaluation of Alternatives

The comparative analysis of alternatives with respect to the first seven evaluation criteria is summarized below. The UXO 1 FS Report provides a more-detailed discussion of the evaluation. Table 4 provides a relative ranking of the alternatives.

7.2 Threshold Criteria

Overall Protection of Human Health and the Environment. Alternative 1 (no action) does not

achieve the RAOs. Both of the other alternatives are protective of human health and the environment and reduce the exposure to MEC by controlling land use and access and limiting intrusive activities.

Compliance with ARARs. All alternatives can comply with the ARARs. A complete list of the ARARs is included in the UXO 1 FS Report.

7.3 Primary Balancing Criteria

Long-Term Effectiveness and Permanence. Each of the alternatives, with the exception of Alternative 1, is expected to achieve long-term effectiveness and permanence. A significant reduction in explosive hazards has already resulted from the interim removal actions. Further hazard reduction would be achieved by minimizing uncontrolled exposure to MEC by the LUCs, and implementing LTM to confirm the remedy effectiveness and identify changes in site conditions. Alternative 3 would not significantly alter the explosive hazard relative to Alternative 2 since areas with the highest likelihood of access (roads and beaches) have already been cleared. Neither Alternative 2 nor Alternative 3 would significantly increase the long-term effectiveness since MEC associated with the most accessible areas has already been removed.

Reduction in Toxicity, Mobility, or Volume through Treatment. Alternative 1 does not result in any reduction of toxicity, mobility, or volume (TMV) by treatment. Alternative 2 would result in additional reduction of TMV by MEC removal, if MEC is identified during site inspections or if clearance of additional pathways for USFWS workers is necessary. Alternative 3 would reduce TMV through removal and detonation of subsurface MEC (down to a maximum of 2 feet bgs) from the entire accessible area of the site not previously addressed through the interim removal actions and where bedrock is not exposed at the surface.

Short-Term Effectiveness. Alternatives 2 and 3 achieve the RAOs within approximately 6 months by controlling potential explosive hazards with implementation of LUCs and LTM.

Figure 4 – Conceptual Layout of Alternative 2 –Focused Additional MEC Removal and LUCs

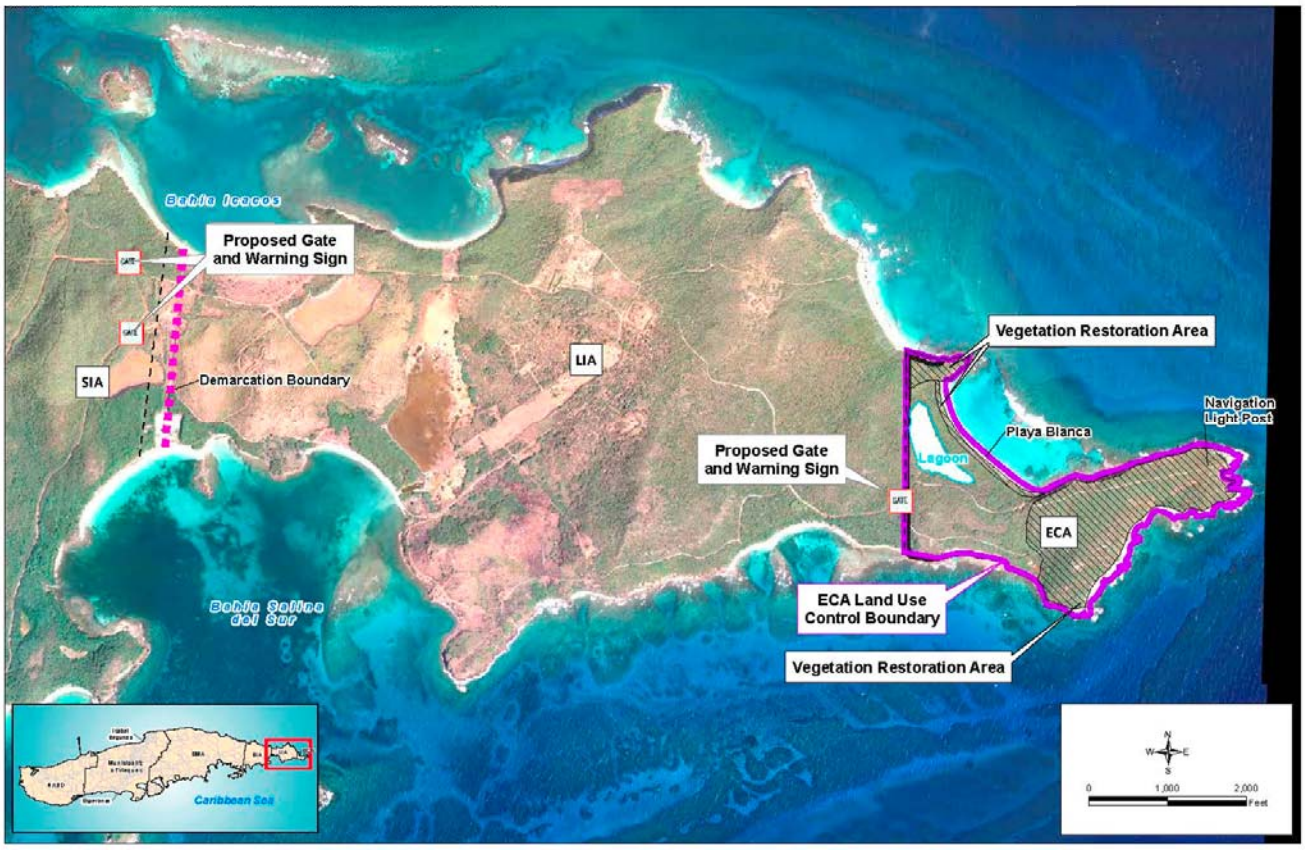


Figure 5 – Conceptual Layout of Alternative 3 – Subsurface MEC Removal and LUCs

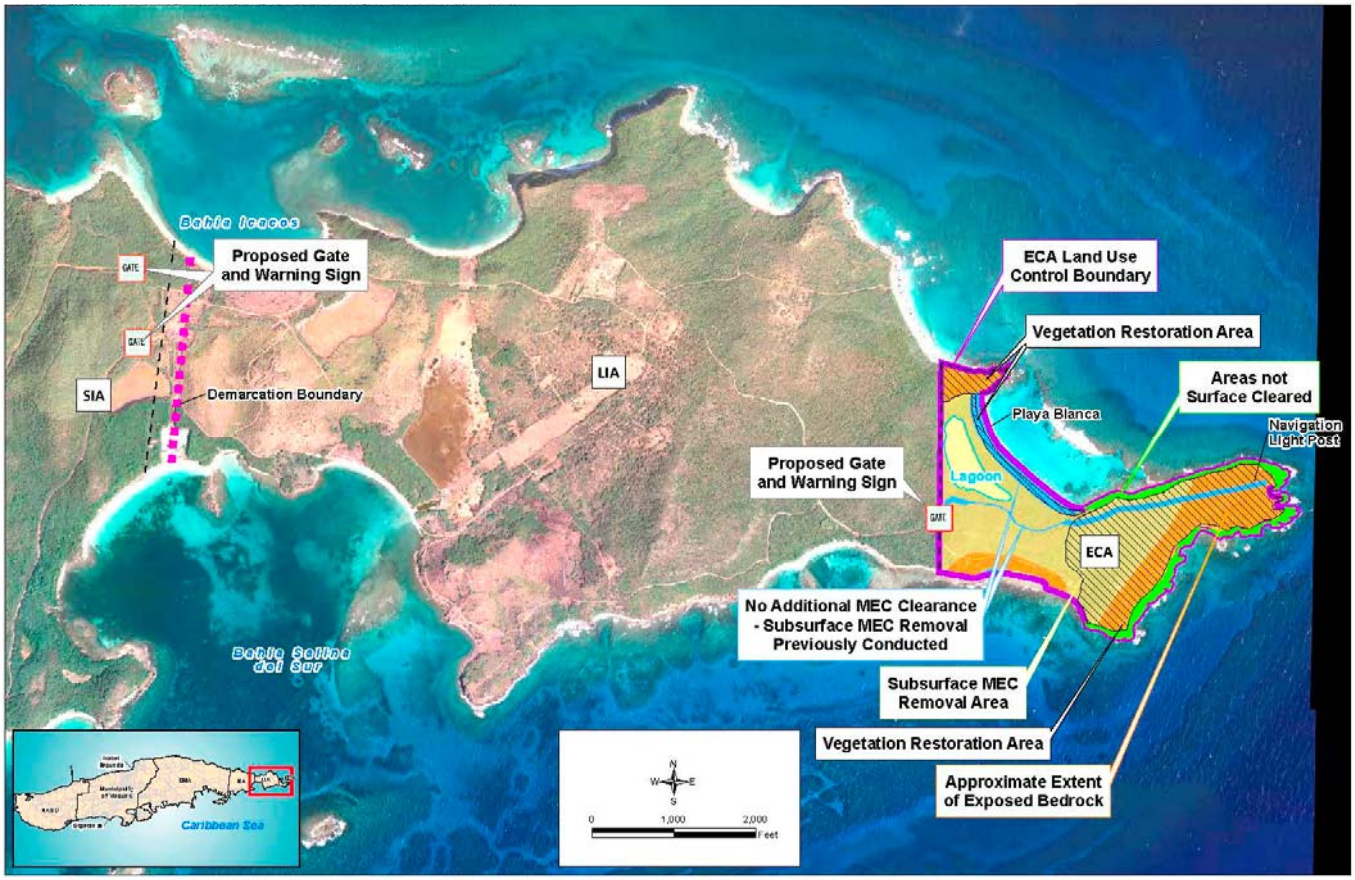


Table 4 – Comparative Analysis of Remedial Alternatives

Criterion	Alternative 1 No Action	Alternative 2 Focused Additional MEC Removal and LUCs	Alternative 3 Subsurface MEC Removal and LUCs
Threshold Criterion			
Overall protection of human health and the environment	○	●	●
Compliance with ARARs	●	●	●
Compliance with Chemical-Specific ARARs	●	●	●
Compliance with Action-Specific ARARs	●	●	●
Compliance with Location-Specific ARARs	●	●	●
Balancing Criterion			
Long-term effectiveness and permanence	◔	◕	●
Magnitude of Residual Risk	◒	◕	●
Adequacy and Reliability of Controls	○	●	●
Reduction of toxicity, mobility, or volume through treatment	○	◕	●
Treatment Process Used and Materials Treated	○	●	●
Amount of Hazardous Materials Destroyed or Treated	Not Applicable	◕	●
Degree of Expected Reductions in Toxicity, Mobility, and Volume	Not Applicable	◕	●
Degree to Which Treatment is Irreversible	Not Applicable	●	●
Type and Quantity of Residual Remaining After Treatment	Not Applicable	◕	●

Table 4 – Comparative Analysis of Remedial Alternatives

Criterion	Alternative 1 No Action	Alternative 2 Focused Additional MEC Removal and LUCs	Alternative 3 Subsurface MEC Removal and LUCs
Threshold Criterion			
Short-term effectiveness	◔	◔	◒
Protection of Community During Remedial Actions	●	●	●
Protection of Workers During Remedial Actions	●	◔	◔
Environmental Impacts	●	◔	◔
Time Until Remedial Action Objectives are Achieved	○	●	●
Implementability	◔	●	◒
Technical Feasibility	●	●	◒
Administrative Feasibility	○	●	●
Availability of Services, Equipment, and Materials	●	●	◒
Cost (Total Present Value)	**$0**	**$2,078,000**	**$10,546,000**

Individual criterion scores: ○ not met ◔ poor ◒ satisfactory ◔ good ● excellent

As part of the short-term effectiveness evaluation, a sustainability analysis was conducted for each of the three remedial alternatives. Sustainability is focused on energy conservation, reduction of greenhouse gases, waste minimization, and re-use and recycling of materials. Alternative 1 has no short-term construction impacts and the lowest environmental footprint since there would be no remedial construction activities. The other alternatives would include construction activities with varying levels of potential impacts to construction workers, the community, and the environment. The amount of impact is proportional to the amount of vegetation clearance, number of detonations and removal, and truck traffic through the community. Alternative 2 has limited impacts to the landscape due to vegetation clearing for boundary demarcation. Alternative 3 has significant temporary disturbance of land during construction activities (i.e., significant vegetation clearance, MEC clearance, lagoon dewatering, erosion control, and re-vegetation). Alternative 3 has the highest greenhouse gas emissions. In addition, Alternative 3 has the highest safety hazard for construction workers due to the significantly higher potential to be in contact with MEC.

Implementability. Alternative 1 would not obtain administrative approval since it does not meet the RAOs. Alternative 3 would be the most complex alternative to implement because of much larger scale of vegetation removal and subsurface MEC clearance, compared to Alternative 2. Alternative 3 would not be implementable without vegetation clearance.

Cost. Alternative 1 is the most cost effective, but does not meet the RAOs. Alternative 2 meets the RAOs and has a present-worth cost of $2,078,000, which is substantially lower than Alternative 3. Alternative 3 is the least-cost effective alternative, with an estimated present-worth cost of $10,546,000.

7.4 Modifying Criteria

Commonwealth Acceptance. Commonwealth involvement has been continual throughout the CERCLA process for UXO 1 and PREQB supports the preferred alternative. However, PREQB's final concurrence will be provided following the review of all comments received during the public comment period.

Community Acceptance. Community acceptance will be evaluated after the public comment period for the Proposed Plan, and substantive public comments will be addressed and documented in the forthcoming Record of Decision (ROD) for UXO 1.

8. Preferred Alternative

The Navy, EPA, and DOI, in consultation with PREQB, agree that the preferred alternative for UXO 1 is Alternative 2, Focused Additional MEC Removal and LUCs. Based on the evaluation of the data, information currently available, 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. A TCRA and NTCRA previously removed MEC from the surface throughout the majority of UXO 1 and from the subsurface along the roads and beaches.

Key elements that make Alternative 2 the preferred alternative are:

- Limited MEC removal (e.g., removal of MEC identified during monitoring, subsurface removal of MEC along additional trails (if identified by USFWS prior to remedy implementation) to allow access to turtle nesting habitats for monitoring and other management activities).
- Vegetation restoration at Playa Blanca and dry upland forest
- LUCs, and associated monitoring, will reduce potential exposure to MEC and ensure the land remains part of the Vieques National Wildlife Refuge.

9. Community Participation

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

Public input is a key element in the decision-making process. Nearby residents and other interested parties are strongly encouraged to use the comment period to relay any questions and comments about the preferred alternative for UXO 1. Following the public comment period, the Navy will summarize and respond to substantive comments in a Responsiveness Summary, which will become part of the official ROD for UXO 1.

This Proposed Plan fulfills the public participation requirements of CERCLA Section 117(a), which specifies that the lead agency (the Navy) must publish a plan outlining any remedial alternatives evaluated for a site and identify the preferred alternative. All documentation pertaining to the investigation of UXO 1 and the development of the preferred alternative presented in this Proposed Plan is available for public review in the Administrative Record at the Information Repository.

The public comment period for the Proposed Plan provides an opportunity for input regarding the remedy selection process for UXO 1. The public comment period will be from August 4 to September 17, 2014, and a public meeting will be held on August 21, 2014 at 7:00 PM at the Multiple Use Center in Vieques, Puerto Rico. All interested parties are encouraged to attend the public meeting to learn more about the preferred alternative for UXO 1. The meeting will provide an additional opportunity to submit comments on the Proposed Plan to the Navy.

Comments on the preferred alternative, or this Proposed Plan, must be postmarked no later than September 17, 2014. On the basis of comments or new information, the Navy, EPA, and DOI, in consultation with PREQB, may modify the preferred alternative or choose another alternative. The comment page included as part of this Proposed Plan may be used to provide comments to the Navy.

The Community Involvement Plan and technical reports supporting the preferred alternative for UXO 1 are available for public review online at: http://www.navfac.navy.mil/vieques and paper copies of the UXO 1 Proposed Plan are available at the EPA office in Vieques and the Navy office at Camp Garcia.

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

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

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

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10. Glossary

Acceptable Risk: EPA's acceptable risk range for Superfund hazardous waste sites is 1×10^{-4} to 1×10^{-6}, meaning there is 1 additional chance in 10,000 (1×10^{-4}) to 1 additional chance in 1 million (1×10^{-6}) that a person will develop cancer if exposed to contaminants at a site that is not remediated.

Accessible Areas: Areas of the site people could easily reach once at the site (i.e., does not include steep slopes or cliffs).

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

Applicable or Relevant and Appropriate Requirements (ARARs): CERCLA Section 121 (d)(2)(A) requires that remedial actions meet any federal standards, requirements, criteria, or limitations that are determined to be legally applicable or relevant and appropriate.

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

Cancer Risk: Cancer risks are expressed as a number reflecting the increased chance that a person will develop cancer if exposed to chemicals or substances, as described in the Human Health Risk Assessment.

Chemical of Potential Concern (COPC): A chemical at the site that may be hazardous to human health or the environment due to its detected concentrations.

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

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

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

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

Excess Lifetime Cancer Risk (ELCR): Potential carcinogenic effects that are characterized by estimating the probability of cancer incidence in a population of individuals for a specific lifetime from projected intakes (and exposures) and chemical-specific dose-response data.

Feasibility Study: A study undertaken by the lead agency to develop and evaluate options for remedial action. The FS emphasizes data analysis and is generally performed concurrently with the RI. The

generally performed concurrently with the RI. The data from the RI is used to define the objectives of the response action, to develop remedial action alternatives, and to undertake an initial screening and detailed analysis of the alternatives.

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

Hazard Index (HI): The HI represents a measure of the potential for non-carcinogenic effects from exposure to COPCs. A "threshold level" (measured as an HI of 1) exists below which no non-cancer health effects are expected to occur.

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

Land Use Control (LUC): Physical, legal, or administrative methods that restrict the use of or limits access to property to reduce risks to human health and the environment.

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

Munitions and Explosives of Concern (MEC): Distinguishes specific categories of military munitions that may pose unique explosive risks.

Munitions Debris (MD): Non-explosive remnants of munitions remaining after munitions use, demilitarization, or disposal.

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

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

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

Non-Time Critical Removal Action (NTCRA): A removal action conducted to address priority risks when a planning period of at least six months is available.

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

Present-Worth Cost: Total present day cost to complete the proposed remedy.

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

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

Puerto Rico Department of Natural and Environmental Resources (PRDNER): The agency responsible for protecting natural resources, Commonwealth-owned conservation areas, submerged lands, and the coastal zone in the Commonwealth of Puerto Rico.

Puerto Rico Environmental Quality Board (PREQB): The agency responsible for protecting the quality of the environment of Puerto Rico through prevention and contamination control of: air, water, soil and noise pollution.

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

Record of Decision (ROD): A legal document that describes the cleanup action or remedy selected for a site, the basis for choosing that remedy, and reflects

the public comments that were considered regarding the selected remedy.

Remedial Action Objectives (RAOs): Statements that define the extent to which sites require cleanup to protect human health and the environment.

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

Soil Screening Level (SSL): A screening criterion designed to evaluate the potential for chemicals to leach from soil to groundwater and to be protective of exposures in a residential setting.

Time Critical Removal Action (TCRA): Those removal actions where, based on a site evaluation, on-site activities must be initiated within six months of the determination.

To-be-considered (TBC) Criteria: Non-promulgated regulatory criteria, advisories, guidance, and proposed standards that have been issued by the Federal or State government that are not legally binding and do not have the legal status of ARARs. However, TBC criteria may be useful for developing remedial alternatives and for determining the necessary level of cleanup for the protection of human health and the environment.

Unacceptable Risk: Excess lifetime cancer risk that exceeds EPA's acceptable risk range for Superfund hazardous waste sites of 1×10^{-4} to 1×10^{-6} or a non-cancer hazard in excess of EPA's target level of 1.

United States Fish and Wildlife Service (USFWS): The Federal agency responsible for the management of the Department of Interior-owned land and the protection of trust species (e.g., threatened and endangered species and migratory birds) on Vieques.

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Place
stamp
here

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