Final Proposed Remedial Action Plan

Groundwater at MRS 001 – Hypervelocity Low Pressure Gun
Groundwater at MRS 002 – Randle Cliffs, Zuni Launch Site
Groundwater at MRS 003 – Small Arms Range
Naval Research Laboratory – Chesapeake Bay Detachment
Chesapeake Beach, Maryland
March 2018

1. Introduction

The purpose of this **Proposed Remedial Action Plan (PRAP)** is to present the preferred alternative for remedial action of **groundwater** at munitions response sites (MRS) 001 – Hypervelocity Low Pressure Gun (HVG), MRS 002 – Randle Cliffs, Zuni Launch Site (RCZ), and MRS 003 – Small Arms Range (SAR) at Naval Research Laboratory (NRL) – Chesapeake Bay Detachment (CBD) in Chesapeake Beach, Maryland **(Figure 1)**. This PRAP only addresses the groundwater remedies for these three sites. The proposed plan for soil at MRS 003 was issued in August 2017 and the proposed plan for soil at MRS 01 and 002 will be issued separately.

This PRAP recommends Land Use Controls (LUCs) as the preferred alternative to address the unacceptable human health risks from hypothetical future exposure to site-related contaminants in shallow groundwater at MRS 001, MRS 002, and MRS 003 under the **Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA)** and the **National Oil and Hazardous Substances Pollution Contingency Plan (NCP)**. This document provides the rationale for this recommendation based on the groundwater investigation activities performed at these three sites to date, and explains how the public can participate in the decision-making process.

The Department of the Navy (Navy), the lead agency for CERCLA site activities, issues this PRAP as part of its public participation requirements under Section 117(a) of CERCLA and Section 300.430(f)(2) of Title 40 of the NCP. The **Maryland Department of the Environment (MDE)** has reviewed this PRAP and is in agreement with this PRAP.

The Navy, in consultation with MDE, will make a final decision on the **remedial action** for groundwater at MRS 001, 002, and 003 after reviewing and considering all information submitted during the 30-day **public comment period**. The Navy may modify the preferred **response action** or select another action based on public comments and/or new information. Community involvement is critical, and the public is encouraged to review and comment on this PRAP. Information on how to participate in this decision-making process is presented in Section 13, Community Participation.

After the public comment period has ended and the comments submitted have been reviewed and considered, the Navy, in consultation with MDE, will

Mark Your Calendar for the Public Comment Period

April 6, 2018 to May 6, 2018

Submit Written Comments

The Navy and MDE will accept written comments on the PRAP during the public comment period. To submit comments or obtain more information, please refer to the comment insert in this PRAP.

Based on public interest, the public comment period may include a public meeting during which the Navy and MDE will provide an overview of the site, investigation findings, remedial alternatives evaluated, and the Preferred Alternative; will answer questions; and will receive public comments. If anyone from the public desires a meeting, they should contact the Naval Facilities Engineering Command (NAVFAC) Washington representative listed on page 11.

Information Repository Location

This PRAP is based on site-related documents contained in the **Administrative Record**, which provides important background and **site investigation** (SI) information about MRS 001, MRS 002, and MRS 003. The Administrative Record can be found at the following **Information Repository** location:

Calvert Library – Twin Beaches Branch
3819 Harbor Road
Chesapeake Beach, MD 20732
Phone: (410) 257-2411

NG0906171224WDC

Note: A glossary of the terms used in this PRAP begins on page 11. Words included in this glossary are indicated in bold print the first time they appear in this document

document the remedial action selected for the MRS 001, MRS 002, and MRS 003 groundwater in a **Decision Document (DD)**. The DD will explain the remedy selection process and will be developed based on the information and technical analysis generated during the **Remedial Investigation (RI)** and the **Focused Feasibility Study (FFS)** and will consider substantial public comments and community concerns received. Any comments or questions received during the comment period will be documented in the **Responsiveness Summary** section of the DD.

2. NRL-CBD Location and History

NRL-CBD is located approximately 40 miles southeast of Washington, D.C., in Chesapeake Beach, Maryland **(Figure 1)**. NRL-CBD, a field station for NRL Washington, D.C. encompasses 161 acres along the western shore of the Chesapeake Bay and includes a 157.4-acre main facility at Randle Cliffs, a small craft berthing in the town of Chesapeake Beach, and a 2-acre site at Tilghman Island (located 10 nautical miles east of the main facility).

The NRL-CBD provides facilities and support services to NRL for research in radar, electronic warfare, optical devices, materials, communications, and fire suppression research. The main facility, located on a cliff approximately 100 feet above the Chesapeake Bay, is the site of many unique experiments, performed in conjunction with the Tilghman Island site across the bay. The experiments conducted at NRL-CBD include low-clutter and lowbackground radar measurements. Basic research is also conducted in radar antenna properties, radar remote sensing concepts, use of radar monitoring of ocean waves, and laser propagation. NRL-CBD hosts facilities for the Navy Technology Center for Safety and Survivability, which conducts fire suppression research on simulated carrier, surface, and submarine platforms. While most of the munitions-related research once conducted at this location is no longer conducted at the field station, the main facility does maintain a test control center for air and sea operations that is available to researchers using NRL-CBD's over-water test range. The test range is a restricted zone located directly east of the main facility that extends across the Chesapeake Bay toward Tilghman Island. In the past, the NRL-CBD also maintained ranges used for munitions-related research and testing, as well as a small arms range; these were used for periodic qualification and training.

3. Site Location, History, and Background

The following subsections present the location, history, and background information for MRS 001, MRS 002, and MRS 003.

3.1 MRS 001 – Hypervelocity Low Pressure Gun

The HVG, designated as MRS 001, also has been identified as unexploded ordnance (UXO) 001 in historical documents. The HVG is located on approximately 2.7 acres near the western property boundary of NRL-CBD **(Figure 1)**. Construction of the light-gas HVG test facility began in 1962 to support the ballistic missile defense program, and the lightgas HVG was used between 1967 and 1995, to study the impact of high-velocity projectiles on various target materials. Targets were placed in a spherical chamber, and a test projectile was fired through the gun into the chamber. The HVG was a totally-enclosed testing environment. The piston would lodge in the gun after each firing, and the gun would be backfired to forcibly expel the piston.

The SI and RI did not address the physical gun structure or other building structures at this site; only the external portions of land behind the gun breach were included in the investigation. The hillside directly behind the gun breach served as a backstop (impact) berm for the piston, which would be forcibly expelled into the backstop berm when the gun was backfired. Because the piston was lead filled, lead may have impacted soils on the range floor behind the gun breach and within the berm. The test projectiles, targets, and the HVG itself have been removed, and there is no evidence of **munitions and explosives of concern (MEC)** at the site.

Both 3- and 8-inch light gas HVGs were used at this site. The HVG used nonstandard munitions specially developed for testing purposes. Detonators, primers, and/or fuses were not used at the site. The propellant, a nitrocellulose powder charge, was contained in cloth bags that were made from a special raw silk known as cartridge cloth. This cloth would burn without leaving any smoldering residue in the barrel, which would have presented a hazard when loading the subsequent round. The desired velocity of the projectile would define the size and composition of the powder charge. During operation of the gun, the specially configured propellant charges were used to propel a combination nylon and lead piston into a tapered compression chamber, explosively compressing a light gas (hydrogen) to extremely high pressures. The pressurized gas was then used, via a rupture valve, to propel test projectiles at hypervelocity into various target materials. The projectile would pass through various testing and measurement apparatus located in the flight tube, orthogonal chamber, and shadowgraph tubes. The projectile would then enter the spherical target chamber through a rapid and quick-closing nonreturn valve (used to limit blow-back contamination) impacting the target material at hypervelocity. At the completion of each test evolution, it was necessary to backfire (explosively project) the compression piston into the backstop berm behind the breach mechanism. In 1998, the hill that served as the backstop berm was stabilized, and currently, a gabion retaining wall supports the undeveloped hillside behind it. Information regarding the disposition of soil removed during stabilization activities is not available.

3.2 MRS 002 – Randle Cliffs, Zuni Launch Site

MRS 002, also identified as UXO 002 in historical documents, is composed of two separate subsites: the RCZ; and the Randle Cliffs, Gun Mounts (RCG). The difference between these sites is that the Gun Mounts are located at the top of the Randle Cliffs and the Zuni Launch Site is located at the bottom of the Randle Cliffs. The RCZ is addressed in this PRAP because the RCG does not have measurable groundwater.

The RCZ is located along the installation's eastern boundary, between the toe of Randle Cliffs and the bulkhead shoreline of the Chesapeake Bay **(Figure 1)**. The RCZ varies from 20 to 75 feet in width and is approximately 500 feet in length (approximately 0.5 acre) It is the land portion of the former over-water quality control (QC)/research test range. The RI focused only on the land portion of the former over-water QC/research test range, which includes the area around the former launcher, associated building and structures, and the tidal zone extending eastward to the mean low-water mark. Activities at the RCZ, which was first used in the 1960s, were limited to production lot QC testing and research associated with chaff rounds. The chaff round ejected chaff-filled dispensers and cassettes which were used as chaff decoys by creating a false radar target. The chaff rounds were attached to Zuni rocket motors, and the assemblies were referred to as CHAFFROC. It is estimated that only 150 CHAFFROC were fired over the 30-year period the site was active (Malcolm Pirnie, 2006). The launch azimuth of the firing stand was fixed at 98 degrees, and the launch elevation angle was fixed at 15 degrees. The chaff round fuze setting was 10 seconds, placing the chaff burst at approximately 5,800 to 6,100 yards over the water (Malcolm Pirnie, 2010). Based on historical information obtained during the PA (Malcolm Pirnie, 2006), all chaff rounds fired at the range detonated over the water, and all equipment and materials were removed from the site following each testing event. Based on this information, no MEC are expected at the site.

The RCZ was last used in 1992, before construction of a pier located directly east/northeast of the site. The pier is currently used in conjunction with research conducted at the active water range. Before 2011, a small building (Building 267, Control Blockhouse), launcher pad, and stand and blast plate remained at the RCZ. The launcher stand was embedded in a concrete foundation located just east of the blast plate. The site is also used occasionally for vehicle parking when personnel access the area along the bulkhead shoreline. The road leading to the site was repaved in summer 2012, after RI field activities were completed.

3.3 MRS 003 – Small Arms Range

The SAR, designated as MRS 003, was also identified as UXO 003 in historical documents. This SAR **(Figure 1)** is not expected to contain UXO, although unexpended small arms rounds may be present. The site is approximately 0.6 acre and is located near the southeastern corner of the portion of NRL-CBD lying west of Maryland Route 261. It is designated as Building C112 on maps obtained from the National Archives dating from 1966; however, no structures or visible foundations are currently present at the site. The range was oriented in an east to west direction and was approximately 30 to 35 yards wide by 50 to 55 yards long. The firing line(s) was located on the easternmost portion of the range. A hill served as the backstop berm. Target stands were placed approximately 5 feet in front of the toe of the hill. The site boundary for the SAR encompasses the historic locations of the firing line and target area, and the former backstop berm (hill). Although the typical surface danger zone associated with a pistol range includes 224 acres, the area where the majority of the bullets and bullet fragments associated with the SAR would be found is greatly reduced because of the presence of the hill that served as the backstop berm. Because a pistol range was designed for short-range firing at specific targets, the majority of weapons fired would have been aimed at the targets. Given the configuration, the backstop berm would have been effective at containing the majority of bullets and bullet fragments, and acted as designed in limiting the surface danger zone. As such, application of a typical pistol range surface danger zone is inappropriate for this SAR.

The range was first used in the 1960s for recreational purposes by Navy personnel and civilians. Navy personnel and Department of Defense contract guard forces also used the range for small arms qualification. Weapons used at the range included .38caliber, .45-caliber, and 9-millimeter pistols. Additionally, .22caliber rifles may have been fired. The SAR was closed early in the 1990s, after failing to maintain military range specifications (that is, adequate separation distances and buffers). Range features remaining at the SAR include the backstop berm, two target stands, and the base of the former range warning flagpole. The backstop berm is a completely vegetated earthen berm. The two target stands are located in front of the berm, and each contains several bullet penetration holes, as observed during the SI. Information obtained during the Preliminary Assessment (PA), including observations made during the visual survey, confirmed that the site was used for small arms training only and that there was no evidence of MEC. Lead bullets and bullet fragments were observed near the toe of the hill that served as the backstop berm during PA and SI site visits.

4. Site Characteristics

The following subsections describe the site characteristics of MRS 001, MRS 002, and MRS 003.

4.1 MRS 001 – Hypervelocity Low Pressure Gun

The HVG area is characterized by sloping hills separated by small streams. The elevation at the site varies from approximately 110 to 145 feet above mean sea level (amsl). The developed portion of the site is generally flat and slopes slightly to the southeast. The site terrain appears to have been altered from a generally sloping eastward land surface to a flat area developed for the gun track by excavating into the hill side resulting in hills surrounding the gun. The hills, which rise 20 to 30 feet above the developed portion of the site, are located along the northern, southern, and western site perimeter. Drainage swales have been constructed southwest of the HVG buildings. The drainage swales direct water southeast across the center of the site toward a pond located adjacent to the site. The Navy is considering redeveloping the site for future use consistent with an industrial land use.

The subsurface material primarily consisted of yellow brown sand encountered just below the top soil and extends down to depths of 22 to 24 feet. Surface water runoff at the HVG flows from northwest to southeast toward the pond (freshwater) adjacent to the site. The groundwater flow direction was not determined during the SI or RI; however, the unconfined groundwater potentiometric surface typically mimics land surface topography and based on the land surface topography at the HVG, the shallow groundwater likely flows to the east by southeast discharging to the pond and eventually to the Chesapeake Bay.

4.2 MRS 002 – Randle Cliffs, Zuni Launch Site

The RCZ is located at the base of Randle Cliffs along a section of bulkhead shoreline. The elevation of the site varies from less than 2 feet to up to 10 feet amsl. The cliffs rise sharply above the Chesapeake Bay to approximately 100 feet amsl. The majority of the RCZ is flat and gently slopes east from the toe of the cliffs to the Chesapeake Bay shoreline. According to installation personnel, there are no plans for future development or use of the site.

Fill material was encountered from the ground surface to depths of about 5 feet in all of the RI well borings. The fill material was not differentiated in the SI borings. The fill material consisted primarily of variegated gravel, silty sand mixtures. Surface water runoff at the RCZ flows west to east from the toe of Randle Cliffs towards the Chesapeake Bay.

The surficial groundwater was encountered at about 4 to 6 feet below ground surface (bgs) during RI well installation. After the wells were installed and developed, the stable water levels were measured in the wells at about 4 to 6 feet bgs indicative of an unconfined surficial aquifer. The surficial groundwater was encountered within the grey green, very fine grain sandy silt unit and the overlying fill material. This material has low permeability based on the purge data collected during sampling and is characteristic of an aquitard. The groundwater flow pattern and direction were not determined for the site. The surficial groundwater at the site is most likely tidally influenced because of the proximity to the Chesapeake Bay; it is not known how much influence the Chesapeake Bay has on the groundwater flow pattern at this site.

4.3 MRS 003 – Small Arms Range

The SAR is a closed range characterized by sloping hills separated by a small stream. The elevation of the range is approximately 60 to 80 feet amsl. The majority of the former range is flat, with the exception of the backstop berm, with a slight slope to the south. The land in the immediate vicinity of the range is undeveloped. According to installation personnel, there are no plans for future development or use of the site.

The subsurface material encountered beneath the loamy top soil consists of yellow brown silty sand interbedded with sandy clay and extends down to various depths ranging from 8.5 to 19.5 feet bgs. Stormwater runoff near the SAR flows generally from north to south. The groundwater flow direction was not determined during the SI or RI; however, groundwater typically mimics land surface topography and the shallow groundwater likely flows south by southeast.

5. Investigation History

This section summarizes previous environmental investigations associated with MRS 001, MRS 002 and MRS 003. The investigations consist of soil and groundwater at MRS 001, MRS 002, and MRS 003 (and also surface water and sediment at MRS 001); however, the soil (and surface water and sediment) information are further discussed in separate PRAPs.

2010 Site Investigation

The SI was conducted in 2010 to identify, assess, confirm, and characterize the extent of **contamination** at MRS 001, MRS 002, and MRS 003. The SI included **surface soil** and **subsurface soil** sampling, installation of temporary monitoring wells, and collection of groundwater samples in all locations except for the RCG, which only included surface soil samples. No MEC were observed at any of the sites. Groundwater samples were analyzed for total and dissolved inorganics at MRS 001, MRS 002, and MRS 003. In addition, explosives and perchlorate were analyzed in groundwater at MRS 002. Groundwater results indicated that RIs were warranted for MRS 001, MRS 002, and MRS 003.

Figure 1 – Installation and Site Locations

2016 Remedial Investigation

The objective of the RI was to collect and evaluate sufficient data to characterize the MRS sites at NRL-CBD, including characterization of the nature and extent of contamination, and to quantify the potential risks posed to human health and the environment as a result of exposure to site-related contaminants. Similar to the SI, groundwater samples collected during the RI were analyzed for explosive and perchlorate (at MRS 002 only) and total and dissolved inorganics (at MRS 001, MRS 002, and MRS 003). Detected groundwater concentrations exceeding the EPA r**egional screening levels (RSLs)** and/or **maximum contaminant levels (MCLs) for drinking water** were retained as **constituents of potential concern (COPCs)**. The **human health risk assessment (HHRA)** did not indicate a **current exposure** risk with groundwater for the hypothetical construction worker as no COCs were retained for direct contact but groundwater results were used to evaluate direct contact of groundwater to the hypothetical future child resident, hypothetical future adult resident, and hypothetical future lifelong resident. The **Ecological Risk Assessment (ERA)** did not evaluate groundwater at MRS 001, MRS 002, and MRS 003 because groundwater does not have an exposure pathway to ecological receptors. However, at MRS 001 the groundwater to surface water pathway was evaluated and no unacceptable risks were identified. Groundwater **constituents of concern (COCs)** were determined based on the HHRA. These **risk assessment** results were further evaluated in the groundwater FFS for MRS 001, MRS 002, and MRS 003.

2016 Focused Feasibility Study

The FFS report documents the development and evaluation of **remedial actions** for addressing unacceptable **human health risks** from exposure to contaminated groundwater at MRS 001, MRS 002, and MRS 003 (Tetra Tech, 2016). The **remedial alternatives** evaluated as part of the FFS are presented for public comment in this PRAP.

2017 Groundwater Background Study

A groundwater background study was conducted to develop a list of **background threshold values (BTVs)** for total and dissolved inorganics at NRL-CBD. Groundwater data obtained during the RI were compared against the BTVs to determine whether metals identified as COCs could be attributable to background conditions rather than a site-related release. The maximum detected concentration of the majority of the inorganic COCs identified for groundwater during the HHRA in the Final RI exceed the BTVs; however, the maximum detected concentrations of cobalt and manganese in groundwater at MRS 002 and cadmium and manganese in groundwater at MRS 003 do not exceed the BTVs. No changes to groundwater COCs were warranted for MRS 001. Therefore, these inorganic constituents were no longer retained as site-related COCs for the aforementioned MRS sites. Section 8 of this PRAP presents the reevaluation of groundwater COCs.

6. Principal Threat Wastes

"Principal threat wastes," defined by the NCP in 40 Code of Federal Regulations Section 300.430(a)(1)(iii)(A), are source materials that are considered to be highly toxic, or highly mobile, and that generally cannot be reliably contained or would present a significant risk to human health or the environment should they be exposed. There are no principal threat wastes present in the groundwater at MRS 001, MRS 002, and MRS 003.

7. Scope and Role of the Action

This PRAP addresses the evaluation of the preferred alternative for groundwater at MRS 001, 002, and 003. The purpose of this PRAP is to summarize investigative activities performed to date and to provide a rationale for the Preferred Alternative for these sites. Any action proposed to address potential risks posed by other environmental **media** are presented in separate PRAPs.

8. Summary of Site Risks

This section presents an overview of how the risks to people associated with exposure to groundwater under anticipated future land uses at MRS 001, 002, and 003 were evaluated.

What is a Human Health Risk Assessment and How is it Calculated?

An HHRA estimates "baseline risk" posed to receptors exposed to site related contamination. An HHRA is an estimate of the likelihood of health problems occurring if no cleanup action were taken at a site. The Navy undertakes a four-step process to estimate baseline risk at a site, and are as follows.

Step 1: Identify Site-related Contamination

In Step 1, the Navy looks at the concentrations of chemicals found at a site as well as past scientific studies on the effects these chemicals have had on people (or animals, when human studies are unavailable). Comparisons between site-specific concentrations and concentrations established by the United States Environmental Protection Agency (USEPA) as generic screening levels that are protective of residential exposure, help the Navy to determine which chemicals detected at the site are most likely to pose a potential impact to human health. These chemicals are identified as COPCs and are evaluated in the next steps of the HHRA.

Step 2: Estimate Exposure

In Step 2, the Navy considers the different ways that people might be exposed to the COPCs identified in Step 1, the concentrations that people might be exposed to, and the potential frequency and duration of exposure. Using this information, a **reasonable maximum exposure (RME)** scenario is calculated that portrays the highest level of human exposure reasonably expected to occur. A **central tendency exposure (CTE)** scenario may also be considered to describe median, rather than the upper limit, exposures.

Step 3: Assess Toxicity

In Step 3, the Navy compiles information on the toxicity of the COPCs. The toxicity assessment defines the relationship between the magnitude of exposure and possible severity of adverse effects, and weighs the quality of available toxicological evidence. Two types of adverse effects are evaluated: carcinogenic and noncarcinogenic. For noncarcinogenic effects, information evaluated includes the type of noncarcinogenic effect that is associated with exposure (for example, exposure that could result in liver damage).

Step 4: Characterize Site Risk

In Step 4, the Navy combines the information gathered in the previous steps to evaluate whether exposure to site contaminants is sufficient to cause health effects in people exposed to the site contamination. The results of the three previous steps are combined, evaluated, and summarized. The likelihood of any kind of cancer resulting from exposure to chemicals at a site is generally expressed as an upper-bound probability, for example, a "1 in 10,000 chance." In other words, for every 10,000 people that could be exposed, one extra individual may develop cancer as a result of exposure to site contaminants. For noncarcinogenic health effects, a **hazard index (HI)** is calculated. The key concept here is that a "threshold level" exists below which noncarcinogenic health effects are not expected to occur, even in sensitive receptors. For noncarcinogenic health effects, the HI can be added based on the particular affect or target organ (for example, if exposure to two or more COPCs at a site would all affect the liver in some way, these are summed for a liver-specific HI).

Human Health Risks from Exposure to Groundwater

A quantitative HHRA was conducted for groundwater at MRS 001, MRS 002, and MRS 003 as part of the Final RI Report and are summarized below. Please refer to the Final RI Report for detailed information regarding the baseline HHRA (available in the Administrative Record Information Repository).

Chemical constituents detected in groundwater were evaluated by the HHRA following the process outlined in the text box titled "What is a Human Health Risk Assessment and How is it Calculated?" For this PRAP, **carcinogenic (cancer) risks** and noncarcinogenic hazards from exposure to only groundwater are presented. The HHRA evaluated for hypothetical future child and adult residents who may potentially come in contact with groundwater. These receptors has the maximum potential exposure and risk because these receptors would experience longer periods of exposure and might have more and longer contact with site groundwater. The inclusion of future residents as potential receptors provides a conservative assessment of the risk because MRS 001, MRS 002, and MRS 003 are not currently used for residential purposes, and there are no plans to convert these areas to residential use in the future.

The HHRA assumes that all receptors could potentially be exposed to site-related contaminants in groundwater via the following exposure pathways:

- Ingestion – incidental drinking of groundwater
- Dermal Contact – incidental skin contact with groundwater

The first step in the HHRA process consisted of screening chemical constituents detected in groundwater to identify a list of COPCs. The COPCs for groundwater for MRS 001, MRS 002, and MRS 003 were determined based on groundwater concentrations exceeding direct contact risk-based screening levels during the SI and RI. The COPCs identified were as follows:

- MRS 001: Aluminum, Arsenic, Beryllium, Cadmium, Cobalt, Copper, Iron, Lead, Manganese, Nickel, Selenium, Thallium, Vanadium, and Zinc
- MRS 002: Aluminum, Arsenic, Beryllium, Cadmium, Chromium, Cobalt, Iron, Lead, Manganese, Nickel, Selenium, Thallium, Vanadium, 2,4-Dinitrotoluene, 2,6Dinitrotoluene, 3-Nitrotoluene, and Pentaerythritol Tetranitrate (PETN)
- MRS 003: Aluminum, Antimony, Arsenic, Barium, Beryllium, Cadmium, Chromium, Cobalt, Iron, Manganese, Nickel, Selenium, Thallium, and Vanadium

The Navy then developed quantitative risk estimates for these COPCs for each potential receptor, to determine if the COPCs are present at concentrations that would result in unacceptable

health risks (carcinogenic and noncarcinogenic). For Step 2 in the HHRA process, RME risks were calculated for each potential receptor.

Human health risk levels were calculated during Step 3 of the HHRA process. Quantitative estimates of noncarcinogenic and carcinogenic risks (HIs and Incremental Lifetime Cancer Risks [ILCRs], respectively) were developed for potential human receptors. Media with risk estimates exceeding MDE's cumulative cancer risk benchmark of 1×10-5 and the upper bound of the USEPA's target risk range of 1×10-4 to 1×10-6 or an HI of 1 are identified. The hypothetical child, adult, and lifelong resident have risk estimates exceeding risk management benchmarks.

Step 4 of the HHRA process characterized site risk and the following groundwater COCs were identified (based on the **future conservative exposure scenario** of potential future residential use. An initial list of groundwater COCs were identified based on results of the HHRA; however, groundwater background values were developed during the background study and the COCs were re-evaluated by comparing the maximum detection concentrations against BTVs). The following groundwater COCs are updated based on the re-evaluation against background values:

- MRS 001: Aluminum, Arsenic, Beryllium, Cadmium, Cobalt, Iron, Manganese, and Nickel
- MRS 002: Aluminum, Arsenic, Beryllium, Iron, 2,4-Dinitrotoluene, and 2,6-Dinitrotoluene
- MRS 003: Aluminum, Arsenic, Barium, Beryllium, Iron, and Vanadium

Ecological Risks from Exposure to Groundwater

No ecological risks are present in groundwater at MRS 001, MRS 002, and MRS 003 because groundwater does not have an exposure pathway to ecological receptors. However, at MRS 001 the groundwater to surface water pathway was evaluated and no unacceptable risks were identified.

9. Remedial Action Objectives

The Navy, with the support of MDE, has concluded that a remedial action is necessary to protect public health and the environment from actual or threatened releases of hazardous substances in groundwater at MRS 001, MRS 002, and MRS 003. Based on the results of groundwater sampling data and human health risk evaluation, the **remedial action objective (RAO)** for MRS 001, 002, and 003 groundwater is:

- Prevent human exposure to groundwater containing concentrations of COCs greater than Preliminary Remediation Goals (PRGs) or that cause unacceptable risk (ILCR greater than 1 x 10-5 or HI greater than 1) under a residential exposure scenario.

The groundwater PRGs are provided in Table 1.

Table 1. Groundwater Preliminary Remediation Goals Focused Feasibility Study for Groundwater at UXO Sites

COC	MRS Sites			Selected PRG (µg/L)	Basis
	HVG	RCZ	SAR		
Aluminum	●	●	●	20,000	RSL, HI = 1
Arsenic	●	●	●	10	MCL
Barium			●	2,000	MCL
Beryllium	●	●	●	4	MCL
Cadmium	●			5	MCL
Cobalt	●			6	RSL, HI = 1
Iron	●	●	●	14,000	RSL, HI = 1
Manganese	●			430	RSL, HI = 1
Nickel	●			390	RSL, HI = 1
Vanadium			●	86	RSL, HI = 1
2,4-Dinitrotoluene		●		2.4	RSL, 10-5
2,6-Dinitrotoluene		●		0.49	RSL, 10-5

● = Indicates that the contaminant is a COC for that site.
µg/L = micrograms per liter
RSL = Regional Screening Level (November 2015, USEPA RSL Table)

10. Summary of Remedial Alternatives

Remedial alternatives are process options that achieve the RAOs described in Section 9 of this PRAP. The following remedial alternatives were identified for groundwater at MRS 001, MRS 002, and MRS 003:

- Alternative 1 – No Action. This alternative is required by NCP as a baseline. Alternative 1 involves no planned actions for groundwater.
- Alternative 2 – LUCs. This alternative uses administrative controls such as deed and land use restrictions to prevent current and hypothetical future use of groundwater.

11. Evaluation of Remedial Alternatives

The NCP identifies the **nine evaluation criteria** for use in a comparative analysis of alternatives (Table 2). Each remedial alternative was evaluated against the threshold and primary balancing criteria during the FFS, as shown in Table 3.

Protection of Human Health and the Environment

- Alternative 1 is not protective of human health and the environment. No actions would be conducted to ensure that exposure to shallow groundwater does not occur.
- Alternative 2 is protective of human health and the environment because LUCs would prevent exposure to contaminants in groundwater.

Compliance with Applicable or Relevant and Appropriate Requirements

- Alternative 1 is not compliant with any federal and state chemical-, location-, and action-specific ARARs because no substantive, promulgated, and enforceable requirements address the No Action alternative
- Alternative 2 would comply with chemical-specific ARARs by eliminating the exposure route to the COCs. There are no location- and action-specific ARARs and To Be Considered.

Long-term Effectiveness and Permanence

- Alternative 1 would not provide long-term effectiveness or permanence because groundwater with elevated COCs concentrations would remain onsite.
- Alternative 2 would be effective and permanent because exposure to groundwater COCs would be prevented and inspections would confirm compliance with the LUCs. Long-term maintenance of the LUCs and inspections would be required.

Table 2. Evaluation Criteria for the 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 or Relevant and Appropriate Requirements (ARARs)**	Addresses whether a remedy will meet all of the ARARs of other federal and state environmental laws and/or justifies a waiver of the requirements.
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 cleanup 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 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 cleanup 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	
State acceptance	Considers the state support agency comments on the Proposed Plan.
Community acceptance	Considers the public's general response to the alternatives described in the Proposed Plan. The specific responses to the public comments are addressed in the "Responsiveness Summary" section of the DD.

Reduction in Toxicity, Mobility, and Volume through Treatment

- Alternatives 1 and 2 would not reduce toxicity, mobility, or volume of the groundwater COCs through treatment because no treatment would occur.

Short-term Effectiveness

- Alternative 1 would not result in risks to site workers or adversely impact the surrounding community or environment because no remedial activities would be performed.
- Alternative 2 would not result in any risks to site workers or adversely impact the surrounding community or environment because no activities would be performed that could cause exposure to groundwater. Groundwater exposure would not occur during LUC inspections. Alternative 2 would be expected to be completed in approximately 3 months.

Implementability

- Alternative 1 would have no remedial activities to implement.
- Alternative 2 would be easy to implement. LUC remedial designs are simple to prepare, LUCs are easy to implement, and routine inspections do not require special expertise.

Cost

- Alternative 1 would have no cost.
- Alternative 2 would cost $22,000 dollars (in net present worth) per MRS site.

State Acceptance

MDE has been involved throughout the CERCLA process and proposed remedy selection. Final concurrence with the selected remedy will be solicited from MDE following the review of comments received through the public comment period.

Community Acceptance

Community acceptance will be evaluated after the close of the public comment period for the PRAP.

Table 3. Comparison of Alternatives

Criteria	Alternative 1	Alternative 2
Overall Protectiveness of Human Health and the Environment	○	●
Compliance with ARAR's	N/A	●
Long-term Effectiveness and Permanence	○	●
Reduction of Toxicity, Mobility, or Volume Through Treatment	○	N/A
Short-term Effectiveness	○	●
Implementability	●	●
Cost[1]	$0	$22,000 for MRS 001 $22,000 for MRS 002 $22,000 for MRS 003

Ranking:
● Satisfies criterion ○ Poorly satisfies criterion
Alternative 1 – No Action
Alternative 2 – Land Use Controls
N/A – not applicable (no applicable ARARs identified)
[1] Cost is the total present-worth value; cost accuracy ranges from -30 percent to +50 percent.

12. Preferred Alternative

The Navy, with the support of MDE, proposes to implement Alternative 2 – Land Use Controls, as the Preferred Alternative to prevent unacceptable human health risks from hypothetical future exposure to site-related contaminants in shallow groundwater at MRS 001, MRS 002, and MRS 003. Under Alternative 2, LUCs remain in place indefinitely to protect human health and the environment.

The Navy may modify the preferred alternative or select another if public comments or additional data indicate that another alternative will yield more appropriate results.

Ms. Regina Adams
NAVFAC Washington
1314 Harwood Street SE
Washington, DC 20374
Email: regina.adams@navy.mil
Phone: (202) 685-0384

For further information, you may also contact:

Ms. Peggy Williams
Land and Materials Administration
Maryland Department of the Environment
1800 Washington Blvd., Suite 625
Baltimore, MD 21230-1710
Email: peggy.williams@maryland.gov
Phone: (410) 537-3493

13. Community Participation

The Navy and MDE will provide information regarding MRS 001, MRS 002, and MRS 003 groundwater cleanup process to the public through **public notice**, site documents (made available in the public Information Repository), NRLCBD Administrative Record File, and announcements published in a local newspaper (Calvert Recorder).

The 30-day public comment period for this PRAP is April 6, 2018 through May 6, 2018. The location of the public Information Repository is provided on page 1. The public meeting notification will be published in the local newspaper *(Calvert Recorder)*.

Should a public meeting be held, a transcript of the public meeting minutes will be included in the DD and the Administrative Record File. All comments received during the comment period will be summarized, and responses will be provided in the Responsiveness Summary section of the DD, which is the document that will present the selected remedy and be included in the Administrative Record file.

Written comments can be submitted via mail or e-mail, and should be sent to the following addresses.

14. References

The Administrative Record contains all the information used to select the preferred remedy for MRS 001, MRS 002, and MRS 003. It also provides important background and site investigation information in more detail than is presented in this PRAP. The following is a list of the primary documents in the Administrative Record where pertinent site-related information can be obtained:

CH2M HILL, Inc. (CH2M). 2018. Technical Memorandum for Comparison of Groundwater Background Threshold Values to Remedial Investigation Data for Metals – Naval Research Laboratory – Chesapeake Bay Detachment. Final. March.

Malcolm Pirnie. 2006. Preliminary Assessment Report Naval Research Laboratory, Naval Research Laboratory Chesapeake Bay Detachment, Chesapeake Beach, Maryland. September.

Malcolm Pirnie. 2010. Site Inspection Report Naval Research Laboratory, Naval Research Laboratory Chesapeake Bay Detachment, Chesapeake Beach, Maryland. May.

Tetra Tech. 2016a. Remedial Investigation Report for MRS 001 – Hypervelocity Low Pressure Gun, MRS 002 – Randle Cliffs, Zuni Launch Site, MRS 002 – Randle Cliffs, Gun Mounts, and MRS 003 – Small Arms Range for Naval Research Laboratory – Chesapeake Bay Detachment. Revision 1. June.

Tetra Tech. 2016b. Focused Feasibility Study Report for Groundwater at UXO Sites – Naval Research Laboratory – Chesapeake Bay Detachment. Revision 0. June.

15. Glossary of Terms

Administrative Record: A record made available to the public that includes all information considered and relied on in the selection of a remedy for a site.

Applicable or Relevant and Appropriate Requirements (ARARs): Federal and state environmental laws that a selected remedy is required to meet under CERCLA. These requirements vary among sites and selected remedies. There are three general classifications of ARARs: chemical, location, and action-specific. Chemical-specific ARARs govern the release to the environment of hazardous substances containing specified chemical compounds. They are used to establish action levels or cleanup goals for soil and groundwater and would be used to evaluate impacts from any remedial action. Location-specific ARARs relate to the geographical setting of the remedial action. For example, remedial actions taken at sites within a 100-year floodplain or within any wetlands may need to address additional regulatory criteria. Action-specific ARARs define acceptable treatment and disposal procedures for any remedial action proposed to address hazardous substances at a site.

Background Threshold Values (BTVs): Background level contaminant concentrations statistically derived from concentrations collected from media samples (i.e., soil, groundwater) at non-contaminated portions of the site or installation.

Carcinogenic (Cancer) Risk: The risk that a person will develop cancer, expressed as a number reflecting the increased chance that a person will develop cancer if exposed to a contaminant.

Central Tendency Exposure (CTE): Portrays the median, rather than upper limit, exposure that could reasonably be expected to occur.

Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA): Also known as the Superfund Law, as amended by the Superfund Amendments and Reauthorization Act of 1986. CERCLA provides the authority and procedures for responding to releases of hazardous substances, pollutants, and contaminants from inactive hazardous waste disposal sites.

Constituents of Concern (COC): Chemicals that are site-related and pose a potential risk to human health, the environment, or leaching to groundwater.

Constituent of Potential Concern (COPC): Compound or analyte identified early in the risk assessment process needed for more detailed evaluation to determine the potential for risk to exposed organisms.

Contamination: Any physical, biological, or radiological substance or matter that at a great enough concentration could have an adverse effect on human health or the environment.

Current Exposure Risk: The HHRA scenario that evaluates the effects of changes in site conditions and/or land use at and around the site at the present time for human receptors.

Decision Document (DD): An official public document that explains which cleanup alternative(s) will be used at an environmentally contaminated site. The DD is based on information and technical analysis generated during the RI/FFS and consideration of public comments and community concerns. The DD explains the remedy selection process and is issued by the Navy in consultation with MDE following the public comment period.

Ecological Risks: The chance of harmful effects posed to ecological receptors such as plants and animals from exposure to existing concentrations of chemicals detected at a site.

Ecological Risk Assessment (ERA): An evaluation of the potential health risks posed to plants and animals from exposure to existing levels of contamination.

Focused Feasibility Study (FFS): The study that develops and analyzes the potential cleanup alternatives for a site. The FFS usually recommends selection of a cost-effective alternative for one particular media.

Future Conservative Exposure Scenario: The most stringent HHRA scenario that evaluates the effects of changes in site conditions and/or land use at and around the site in the future for human receptors.

Groundwater: Water beneath the ground surface that fills pore spaces between materials such as sand, soil, or gravel to the point of saturation. Groundwater may transport substances that have percolated downward from the ground surface as it flows towards its point of discharge.

Hazard Index (HI): Indicates the noncarcinogenic health risk to an individual from the presence of multiple substances at one site, or exposures to the same chemicals through multiple media and pathways. The HI may be summed by each specific target organ or critical effect.

Human Health Risk: The chance of harmful effects posed to people from exposure to existing concentrations of chemicals detected at a site.

Human Health Risk Assessment (HHRA): An evaluation of the potential health risks posed to people from exposure to existing concentrations of chemicals and metals detected at a site.

Information Repository: A file containing information, technical reports, and reference documents regarding a National Priority List (NPL) site. This file is usually maintained in a place with easy public access, such as a public library.

Maryland Department of the Environment (MDE): The regulatory agency that preserves the state's air, water, and land resources and safeguards the environmental health of Maryland's citizens. MDE's duties include enforcement of environmental laws and regulations, long-term planning and research, and providing technical assistance to state industry and communities for pollution, growth issues, and environmental emergencies.

Maximum Contaminant Levels (MCLs) for drinking water: Standards set by the USEPA for drinking water quality. An MCL is the legal threshold limit on the amount of a substance or chemical that is allowed in public water systems under the Safe Drinking Water Act.

Media: Air, surface soil, subsurface soil, groundwater, surface water, or sediments that are the subject of regulatory concern, investigation, and cleanup.

Munitions and Explosives of Concern (MEC): A term that distinguishes specific categories of military munitions that may pose unique explosives safety risks. The categories include unexploded ordnance, discarded military munitions, or munitions constituents.

National Oil and Hazardous Substances Pollution Contingency Plan (NCP): The NCP provides the organizational structure and procedures for preparing for and responding to discharges of oil and releases of hazardous substances, pollutants, and contaminants.

Nine evaluation criteria: Criteria used by USEPA to evaluate remediation alternatives and select a Preferred Alternative.

Proposed Remedial Action Plan (PRAP): A public participation requirement of the CERCLA Amendments and Reauthorization Act, in which the lead agency summarizes for the public the preferred cleanup strategy. The PRAP may be prepared either as a fact sheet or as a more detailed document.

Public Comment Period: A time for the public to review and comment on various documents and actions taken, either by the Navy or MDE. A minimum 30-day comment period is held to allow community members to review the Administrative Record file and review and comment on the PRAP.

Public Meeting: Meeting where the lead agency presents and discusses the PRAP, and accepts written and oral comments and questions from the community members.

Public Notice: A publication to inform the affected public regarding certain rulemaking proceedings. Public notices are usually published in newspapers.

Reasonable Maximum Exposure (RME): The highest exposure that is reasonable expected to occur at a site, and it is intended to estimate a conservative exposure case (that is, well above the average case) that is still within the range of possible exposures.

Regional Screening Levels (RSLs): Derived values by the Environmental Protection Agency (EPA) to determine if potentially significant levels of contamination are present to warrant further investigation.

Remedial Actions: The execution of a selected remedy to accomplish proposed site cleanup.

Remedial Action Objectives (RAOs): The goals that the proposed site cleanup is expected to accomplish. These objectives serve as the basis for the selection of the remedial alternatives.

Remedial Alternatives: A proposed remedy to accomplish site cleanup.

Remedial Investigation (RI): An in-depth study designed to gather data needed to determine the nature and extent of contamination at a site and to evaluate the potential risks posed by exposure of people, plants, and animals to the contamination.

Response Action: As defined by CERCLA, a removal or remedial action, including related enforcement activities.

Responsiveness Summary: A summary of oral and written public comments received by the lead agency during a comment period and the responses to the comments prepared by the lead agency. The Responsiveness Summary is an important part of the DD, highlighting community concerns for decision makers.

Risk Assessment: A study on the chance of harmful effects posed to people, plants, and animals from exposure to existing levels of contamination.

Site Investigation (SI): A preliminary study designed to gather data to determine the types of contamination that may be at a site.

Superfund: The program operated under CERCLA legislative authority that carries out solid waste, emergency, and long-term removal and remedial activities. These activities include investigating sites for inclusion on the NPL, determining site priority, and conducting and/or supervising the cleanup and other remedial actions.

Surface Soil: The top 6 inches of soil.

Subsurface Soil: Any soil below the top 6 inches.

Please print or type your comments here

Please print or type your comments here

Mark Your Calendar for the Public Comment Period

Public Comment Period

April 6, 2018 – May 6, 2018

Submit Written Comments

Written comments must be postmarked no later than the last day of the public comment period, which is May 6, 2018. Based on the public comments or on any new information obtained, the Navy may modify the preferred alternative. The back page of this Proposed Remedial Action Plan may be used to provide comments, although use of the form is not required. If the form is used to submit comments, please fold page, seal, add postage where indicated, and mail.

FOLD HERE

Place stamp here

NAVFAC Washington
Public Affairs Office
Attention: Ms. Regina Adams
1314 Harwood Street SE
Washington, D.C. 20374