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PROPOSED PLAN SITE 1 OPERABLE UNIT 4 (OU 4) SOIL ALLEGANY BALLISTICS LABORATORY ROCKET CENTER WV
3/1/2014
NAVFAC MIDLANT

Mark Your Calendar for the Public Comment Period

Public Comment Period

March 25, 2014 to
May 9, 2014

Submit Written Comments

The Navy will accept written comments on this Proposed Plan during the public comment period. To submit comments or obtain further information, please refer to the names and contact information included at the end of Section 10. A blank sheet has been added at the end of this document to be used for writing comments

Attend the Public Meeting

March 25, 2014 at 6:30 p.m.
South Cumberland Library
100 Seymour Street
Cumberland, Maryland 21502

The Navy will hold a public meeting to explain the Proposed Plan. Verbal and written comments will be accepted at this meeting.

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NAVFAC Naval Facilities Engineering Command

Proposed Plan – Site 1 (Operable Unit 4) Soil
Allegany Ballistics Laboratory
Rocket Center, West Virginia
March 2014

1. Introduction

This **Proposed Plan**[1] identifies the Preferred Alternative for addressing human health and ecological risks at **Operable Unit (OU)** 4, Site 1 Soil, located at Allegany Ballistics Laboratory (ABL), Rocket Center, West Virginia (**Figure 1**). As a result of historical activities at the site, OU-4 has been divided into two areas, identified as the Active Burning Ground (ABG) and the Outside Active Burning Ground (OABG) (**Figure 2**).This plan summarizes the remedial alternatives evaluated for each of these areas and provides the rationale for proposed selection of the following alternatives as the final remedial action for Site 1 soil (OU-4):

- ABG: Excavation of **areas of concern (AOCs)**, offsite disposal, **land use controls (LUCs)**, and long-term management (LTMgt)
- OABG: Removal of surface debris, excavation of AOCs, offsite disposal, LUCs, and LTMgt

This Proposed Plan is issued jointly by the Department of the Navy (Navy) (the lead agency for site activities) and the **U.S. Environmental Protection Agency (EPA)** Region III (the lead regulatory agency) in consultation with the **West Virginia Department of Environmental Protection (WVDEP)**. The Proposed Plan fulfills the public participation responsibilities as required under Section 117(a) of the **Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA)** and Section 300.430(f)(2) of the **National Oil and Hazardous Substances Pollution Contingency Plan (NCP)**.

The previous investigations identified unacceptable potential risk to human health and the environment from the exposure to Site 1 surface and subsurface soil. Detailed information documenting environmental investigations at Site 1 can be found in the **Remedial Investigation (RI)** reports, **Feasibility Studies (FSs)** and other documents contained in the **Administrative Record** file and **Information Repository** for ABL (see the "Mark Your Calendar for the Public Comment Period" text box). A glossary of key terms used in this Proposed Plan is attached.The Navy and EPA, in consultation with WVDEP, will make a final decision on the remedy for Site 1 soil after reviewing and considering information submitted during the 45-day public **comment period** and may modify the Preferred Alternative, or select another remedial action, based on new information and/or public comments. Therefore, community involvement is critical in the decision making process, and the public is invited and encouraged to review and comment on this Proposed Plan. After the public comment period has ended and the comments and information submitted during that time have

[1] Words listed in the glossary are indicated in **bold print** the first time they appear in this plan.

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Public Comment Period
March 25, 2014 to May 9, 2014

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March 25, 2014 at 6:30 p.m.
South Cumberland Library
100 Seymour Street
Cumberland, Maryland 21502

The Navy will hold a **public meeting** to explain the Proposed Plan. Verbal and written comments will be accepted at this meeting.

Location of Administrative Record File:

Fort Ashby Public Library
1 Presidents Street
P.O. Box 74
Fort Ashby, West Virginia 26719
(304) 298-4493

South Cumberland Library
100 Seymour Street
Cumberland, MD 21502
301-724-1504

Figure 1: Site Location Map

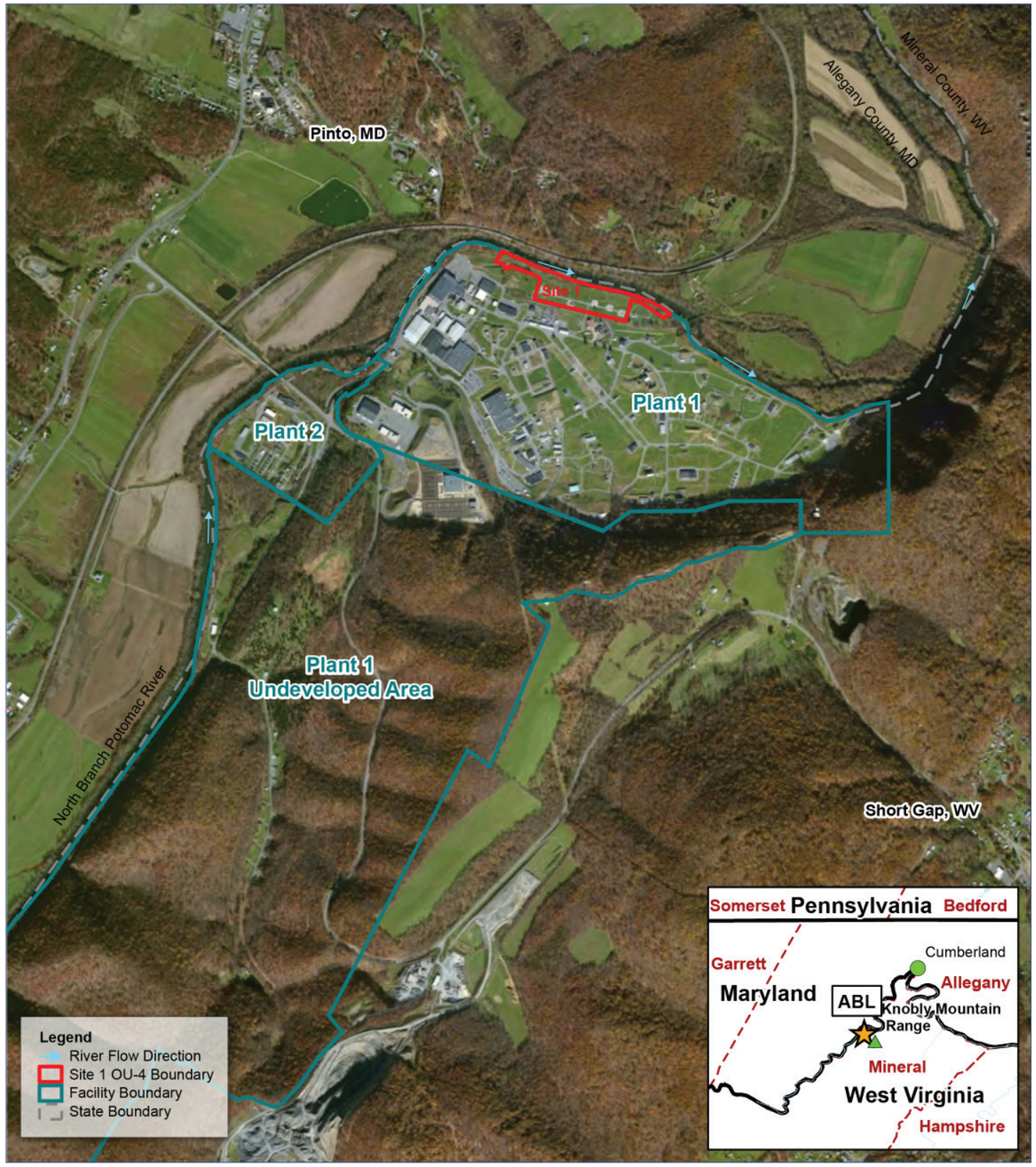

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Figure 2: Site Layout

been reviewed and considered, the Navy and EPA, in consultation with WVDEP, will document the final remedy selection for Site 1 soil in a **Record of Decision (ROD)**.

2. Site Background

ABL covers approximately 1,634 acres in Rocket Center, West Virginia, and is situated along the North Branch Potomac River, which separates West Virginia and Maryland (**Figure 1**). Operations at the facility are divided into two distinct operating plants, Plant 1 and Plant 2. Plant 1 (owned by the Navy and operated by ATK Tactical Systems Company LLC [ATK]) occupies approximately 1,577 acres and includes a large undeveloped area northwest of Knobly Mountain. Plant 2, which occupies the remaining 57 acres, is both owned and operated by ATK. In May 1994, Plant 1 at ABL was listed on the **National Priorities List (NPL)**. Plant 2 is not on the NPL.

Plant 1 is a research, development, testing, and production facility, producing solid propellants and motors for ammunition, rockets, and armaments. Plant 1 was initially constructed in 1942 as a loading plant for 0.50-caliber machine gun ammunition for the United States Army. The Navy took ownership of Plant 1 in 1945. The facility currently operates as a highly automated production facility for tactical propulsion systems and composite and metal structures.

2.1 Site Description and Background

Site 1 is situated adjacent to the North Branch Potomac River, along the northern border of the developed portion of Plant 1 at ABL (**Figure 1**). Although historical documents indicate that Site 1 is an 11-acre area (ABG = 8 acres; OABG = 3 acres), the site boundary encompasses 13.9 acres (ABG = 8.5 acres; OABG = 5.4 acres). Since the early 1940s, Site 1 has been used for various types of waste-burning and disposal activities. Because of its complexity, Site 1 has been investigated under two OUs: OU-3 for **groundwater**, surface water, and sediment, and OU-4 for soil. A ROD was signed in May 1997 for OU-3 (Navy, 1997). The selected remedy for OU-3 is composed of an extraction system for the sitewide **alluvia**l and **bedrock** groundwater to prevent contaminant migration to the river, treatment of the extracted groundwater, as well as a long-term monitoring plan, and LUCs.

OU-4, Site 1 Soil, is composed of surface and subsurface soil and is the focus of this Proposed Plan. Based on current and historical site activities, the site has been divided in two geographical divisions, the ABG and the OABG (**Figure 2**).

Active Burning Ground

The ABG is currently used for burning reactive wastes and is regulated under a **Resource Conservation and Recovery Act (RCRA)** permit (WV0170023691). An 8-foot-tall locked fence surrounds the 8.5-acre area, which is mostly covered by mowed grass. An asphalt road spans the east-west length of the fenced area. Although the ABG is operating under a RCRA permit, it includes several historical disposal units and it was agreed by the Navy and regulatory agencies in April 2009 that this area potentially includes contamination attributed to historical waste burning; therefore, the ABG is being considered for remedial action under CERCLA.

The burning of reactive material at the ABG began in 1959 and continues today. Eight earthen burn pads, operated from 1959 until the mid-1990s, were used to burn solvents and explosive waste generated at ABL (**Figure 2**). The former earthen burn pads are not currently used and have been overgrown by vegetation. Six steel burn pans, which were located on earthen or asphalt burning pads, replaced the eight former earthen burn pads in the mid-1990s (**Figure 2**). These have since been replaced by six large concrete burn pads, labeled in **Figure 2** as Pad A through Pad F, going from east to west.

Historical disposal of spent acids and solvents generated by plant operations occurred in three former disposal pits (FDP 1, FDP 2, and FDP 3) constructed as unlined, crushed-limestone-filled earthen pits (**Figure 2**). After the materials percolated into the ground, it was reported that the pits were ignited to burn off remaining filtrate. The pits were operated during the 1970s and 1980s and have since been backfilled. Reportedly, trichloroethene (TCE) was the primary spent solvent that was disposed in the pits, which are known to be a source of contamination to groundwater (CH2M HILL, 1996). TCE has been detected at elevated concentrations in the unsaturated soil beneath FDPs 1 and 3. FDP 2 does not contain detectable chlorinated solvents and is not considered a source of contamination to groundwater. The size and location of the FDPs are based on historical boundaries using visual observation of ground scarring, as well as the results of a geophysical investigation (Roy F. Weston, 1989). The former pits are located in the southwestern portion of the ABG and are described as having been approximately 10 feet wide and ranging in length from approximately 15 to 40 feet (**Figure 2**). The depths of the pits were estimated at 3 to 5 feet below ground surface (bgs). A **non-time-critical removal action (NTCRA)** was completed in January 2014 (AGVIQ-CH2M HILL, 2013a) to address potential sources of groundwater contamination in the unsaturated soil at FDPs 1 and 3 in accordance with the **Engineering Evaluation and Cost Analysis (EE/CA)** and **Action Memorandum (AM)** (CH2M HILL, 2012a and CH2M HILL, 2012b).

Outside Active Burning Ground

The OABG consists of a 5.4-acre parcel outside of the fenced area that was historically used for the disposal

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potential hazards of waste disposal, energy conservation and natural resources, reducing the amount of waste generated, and managing waste in an environmentally sound manner.

Responsiveness Summary: A summary of public comments received during a comment period and the responses to these comments. The responsiveness summary is an important part of the ROD, highlighting community concerns for decision makers.

Risk Driver: A COC present at a concentration that drives the need for remedial action at the site.

Semivolatile organic compound (SVOC): A compound that has a boiling point higher than water and that may vaporize when exposed to temperatures above room temperatures.

Site remediation goals (SRGs): The concentration levels of constituents that when met are protective of human health and the environment.

Soil screening levels (SSLs): Are not cleanup levels; instead, they are intended to be used to streamline the evaluation and cleanup of site soils by helping site managers eliminate areas, pathways, and/or COCs at NPL sites.

Source materials: Material that includes or contains hazardous substances, pollutants, or contaminants that act as a reservoir for migration of contamination to groundwater, surface water, and/or air, or acts as a source for direct exposure.

Superfund Amendments and Reauthorization Act of 1986 (SARA): Amended CERCLA on October 17, 1986. SARA reflected EPA's experience in administering the complex Superfund program during its first 6 years and provided several important changes and additions to the program. Federal facilities were required by SARA to comply with CERCLA requirements.

Test pit: An excavation made to examine and identify subsurface debris; investigation into the pit may include the collection of environmental samples.

Unexploded ordnance (UXO): Explosive weapons that did not explode when they were employed and still pose a risk of detonation, potentially many decades after they were used or discarded.

U.S. Environmental Protection Agency (EPA): The federal agency responsible for administration and enforcement of CERCLA (and other environmental statutes and regulations), and with final approval authority for the selected remedy.

Vadose zone: The unsaturated zone above the water table.

Volatile organic compounds (VOCs): Naturally occurring or manmade chemicals containing carbon that can evaporate more quickly than SVOCs.

West Virginia Department of Environmental Protection (WVDEP): The state agency responsible for administration and enforcement of environmental regulations.

of various wastes (demolition debris, drums, and rocket casings), as well as for burning waste and spreading ash, from the early 1960s until approximately 1981. The OABG is no longer in use and the area is not included within the boundaries of the active RCRA permit. Based on historical activities, the OABG has been divided into the following areas, as shown on **Figure 2**:

- West OABG - The West OABG, also known as the Former Open Burn Area and Associated Disposal Area, is along the river in the northwest part of Site 1. It consists of the former open burn area, former drum storage pad, and western drainage ditch. The former open burn area, reportedly operated during the 1960s, was enclosed behind a chain-link fence where the solid wastes were burned. The resulting ash was spread along the lower **floodplain** area in a portion of the West OABG. The drum storage pad, reportedly operated from 1979 to 1981, stored 55-gallon drums containing spent solvents and bottom sludge from solvent recovery stills. The asphalt drum storage pad did not have berms or sumps for containment. The asphalt pad is still present, although it is not currently used to store drums. The western drainage ditch is an earthen drainage culvert that cuts through the disposal area and drains surface water and stormwater from Plant 1. Debris materials, including ash buried during successive disposal events, are exposed in the walls of this culvert. Surface and subsurface debris is present throughout the West OABG. The area is currently covered by vegetation.
- East OABG – The East OABG, also known as the Former Inert Burn Area and associated disposal area, is along the river in the northeastern portion of the site. Ash from burning in this area was spread and buried during successive disposal events. Surface and subsurface debris is present throughout the East OABG. The area is currently covered by vegetation.
- Central OABG – The Central OABG lies along the river between the West OABG and East OABG. Visual observation and subsurface soil sampling in this area showed no evidence of debris or disposal activities.

Environmental Investigation History

Site 1 has been characterized through several investigations and studies since 1983. In the early to mid-1990s, the Navy decided to manage the **remediation** of Site 1 as two separate OUs given the size and complexity of total site cleanup. The Site 1 soil **medium** was investigated separately from the groundwater, surface water, and sediment **media**. A ROD was signed in May 1997 for Site 1 groundwater, surface water, and sediment (OU-3) (Navy, 1997). Soil investigations continued separately as OU-4.

Detailed information from previous investigations conducted at Site 1 is available in the Administrative Record for ABL. A complete list of the documents included in the Administrative Record files for ABL can be obtained from the ABL **Installation Restoration Program (IRP)** website (http://go.usa.gov/DyRh), from the Information Repository, or by contacting the **Naval Facilities Engineering Command (NAVFAC)** Public Affairs Office.

The site-specific investigations and studies are summarized in **Table 1**. Soil sample locations for the ABG and OABG are shown on **Figure 3a** and **Figure 3b**, respectively.

Table 1: Previous Studies and Investigations Summary

Previous Study/Investigation*	Date	Investigation Activities
Initial Assessment Study (Environmental Science and Engineering, Inc., 1983)	1983	An Initial Assessment Study (IAS) was performed at ABL under the Navy Assessment and Control of Installation Pollutants Program (NACIP). The purpose of the IAS was to identify and assess sites that might pose a threat to human health or the environment as a result of former hazardous materials handling and operations. Nine potentially contaminated sites, including Site 1, were identified based on information obtained from historical records, photographs, site inspections, and personnel interviews. The IAS concluded that these sites did not pose an immediate threat. However, the results indicated the need for a confirmation study (CS) at seven of the nine sites, including Site 1, to assess the potential impacts on human health and the environment by suspected **contaminants**.
Confirmation Study (Roy F. Weston, 1989)	1984-1987	Based on the IAS recommendations and in accordance with the NACIP, a CS was initiated in June 1984 and completed in August 1987. The CS focused on identifying the existence, concentration, and extent of contamination at the seven sites recommended for further investigation in the IAS. Field activities conducted under the CS included monitoring well installation; groundwater, surface water, sediment, and soil gas sample collection and analysis; and a geophysical survey inside the ABG area at Site 1.
Interim Remedial Investigation (Roy F. Weston, 1989)	1989	As a result of the **Superfund Amendments and Reauthorization Act of 1986 (SARA)**, the Navy changed its NACIP terminology and scope under the IRP to follow the rules, regulations, guidelines, and criteria established by EPA for the Superfund program. Accordingly, the results of the CS were documented in the Interim RI report, which recommended further RI activities for six of the seven sites identified in the IAS, including Site 1.
Remedial Investigation (CH2M HILL, 1996)	1992	Based on the recommendations of the Interim RI report and in accordance with the Navy's modified IRP policy, Hercules (former ABL operator) contracted CH2M HILL to conduct an RI. Field work was completed in 1992; however, the RI report was not finalized until 1996. **Volatile organic compounds (VOCs)**, particularly TCE, were the primary constituents detected in soil, groundwater (in both alluvial and bedrock **aquifers**), surface water, and sediment samples collected at and adjacent to Site 1. The three FDPs were found to be the primary source of VOC contamination at Site 1. **Semivolatile organic compounds (SVOCs)**, explosives, metals, and **dioxins** were also detected in soil and ash samples. The RI report recommended additional investigation at Site 1 to further evaluate the nature and extent of contamination in soil, groundwater, surface water, and sediment.
Focused Remedial Investigation (CH2M HILL, 1995a)	1994	A focused RI was conducted to supplement the Site 1 data collected for the 1992 RI and to re-evaluate potential risks to human health and the environment from contaminants in Site 1 media. The results of the focused RI confirmed that VOCs were the primary contaminants detected in Site 1 media, with TCE detected most often and at the greatest concentrations in soil and groundwater. The focused RI identified specific areas and media at Site 1 where remedial action alternatives should be evaluated in a focused FS. These were the areas of contaminated soil around the FDPs, north of the east and west ends of the ABG area along the river, and in the open and former inert burn disposal areas; contaminated groundwater in both alluvial and bedrock aquifers; and contaminated surface water and sediment in the North Branch Potomac River adjacent to Site 1.

Hazard quotient: The ratio of the daily intake of chemicals from onsite exposure divided by the reference dose for those chemicals. The reference dose is the daily intake of a chemical not expected to cause adverse health effects.

Human health risk assessment (HHRA): An evaluation of the potential health risks posed to people from exposure to existing levels of contamination.

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

Installation Restoration Program (IRP): The Navy established the IRP, which combines aggressive cleanup policies with modern technology to restore and preserve property under Navy and Marine Corps stewardship. The IRP, one of two site cleanup programs, is for sites with past releases of hazardous substances.

Land use controls (LUCs): Also known as "institutional controls," LUCs are defined broadly as legal measures that limit human exposure by restricting activity, use, and access to properties with residual contamination.

Leaching: The natural extraction and movement of contaminants from soil into groundwater.

Lithology: The study of rocks; the character of a rock formation.

Medium: One of the major categories of material found in the environment—surface water, groundwater, soil, or air.

Media: Plural of medium.

Membrane interface probe (MIP): A screening tool with semi-quantitative capabilities acting as an interface between contaminants in the subsurface and gas phase detectors at the surface.

National Priorities List (NPL): EPA's list of the most serious hazardous waste sites, identified for possible long-term remedial response.

National Oil and Hazardous Substances Pollution Contingency Plan (NCP): The procedures for preparing for and responding to discharges of hazardous substances, pollutants, or contaminants.

Naval Facilities Engineering Command (NAVFAC): Global organization that provides planning, design and construction of shore facilities for Navy activities around the world.

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

Non-cancer hazard: Expressed as a quotient that compares the existing level of exposure 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 hazard at Superfund sites is 1, meaning that if the exposure exceeds the threshold, there may be a concern for potential non-cancer effects.

Non-time-critical Removal Action (NTCRA): A removal action conducted at Superfund sites when the lead agency concludes, based on the site evaluation, that a removal action is appropriate, and a planning period of at least 6 months is available before onsite activities must begin.

Operable Unit (OU): A discrete action that is an incremental step toward comprehensively mitigating larger site problems.

Pathway: Describes how a constituent moves through the environment (migration pathway) or comes into contact with a person, plant, or animal (exposure pathway).

Preliminary remediation goals (PRGs): In accordance with EPA guidance for the cleanup of CERCLA sites, PRGs are calculated as part of the risk-based evaluation in the FS process. For Site 1, PRGs were calculated for human health risk, ecological risk, and soil-to-groundwater leaching risk.

Proposed Plan: A public participation document that summarizes the preferred cleanup strategy at a site for the public's information.

Public meetings: Meetings where the lead agency presents and discusses the Proposed Plan and accepts questions from the community members.

Reasonable maximum exposure (RME): The highest concentration of a site contaminant a human could reasonably be exposed to under various exposure scenarios.

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

Record of Decision (ROD): The document that explains which cleanup alternative(s) will be used at an NPL site. The ROD explains the remedy selection process and is issued by the lead agency following the public comment period.

Remedial Investigation (RI): An in-depth study to gather data needed to evaluate the nature and extent of contamination at a site.

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.

Remediation: The action of remedying something, in particular reversing or stopping environmental damage.

Resource Conservation and Recovery Act (RCRA): A federal law passed in 1976 governing the disposal of solid waste and hazardous waste. RCRA set national goals for protecting human health and the natural environment from the

with a hazardous substance, pollutant, or contaminant or a remedial action to address such contaminant. "Relevant and appropriate requirements" are standards and environmental protection criteria of federal or state law that, although not "applicable" to a hazardous substance or remedial action, address situations sufficiently similar to those at the CERCLA site that their use is suitable.

Areas of Concern (AOCs): A geographic area that has experienced environmental degradation. AOCs within Site 1 are associated with areas of soil contamination that contain the highest concentrations of contaminants.

Aquifer: A fully saturated, underground soil or rock formation that is capable of transmitting a usable quantity of water.

Background: Area not affected by facility or site activities.

Bedrock: The common term for consolidated rock underlying the surface.

Calcareous: Mostly or partly composed of calcium carbonate.

Central tendency exposure (CTE): The mean concentration of site data, used as an exposure concentration in the risk assessment.

Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA): A federal law (the "Superfund law"), originally passed in 1980, that provides the authority and procedures for responding to releases of hazardous substances, pollutants, and contaminants from inactive hazardous waste disposal sites.

Comment period: A time for the public to review and comment on various documents and actions proposed or taken, either by the lead agency, lead regulatory agency, or supporting agency.

Conceptual site model (CSM): A brief explanation or three-dimensional "picture" of site conditions that illustrates contaminant distributions, release mechanisms, exposure pathways and migration routes, and potential receptors.

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

Contaminants: Any substances or matter that, at a high enough concentration, could have an adverse effect on human health or the environment.

Contaminant migration pathways: The route that site contaminants may take to get from the source of contamination to a human being, animal, or plant.

Dense non-aqueous phase liquid (DNAPL): Liquid that is denser than water and does not dissolve or mix easily in water.

Dioxins: A class of chemical contaminants that are formed during combustion processes such as waste incineration, forest fires, and backyard trash burning, as well as during some industrial processes, such as paper pulp bleaching and herbicide manufacturing.

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

Engineering Evaluation and Cost Analysis (EE/CA): The investigation summary and feasibility analysis for a proposed NTCRA (see below).

Explosives Safety Submission (ESS): Documentation for a munitions response site that allows the Naval Ordnance Safety and Security Activity to evaluate the site and munitions response actions being proposed.

***Ex situ*:** Meaning "off site." *Ex situ* remediation methods refer to the removal of contaminated media and subsequent treatment offsite or out of place.

Feasibility Study (FS): An analysis of the appropriateness and cost of cleanup alternatives for a site.

Federal Facility Agreement (FFA): The interagency agreement between EPA and the federal facility to govern the cleanup of the facility.

Floodplain: Flat or nearly flat land adjacent to a stream or river that experiences flooding during periods of high water discharge.

Flexible Liner Underground Technologies, LLC (FLUTe), liner: A color-reactive liner that changes color dramatically in the presence of a variety of DNAPL substances.

Geophysical survey: Collection of geophysical data for subsurface mapping. Geophysical surveys may use a great variety of sensing instruments, and data may be collected from above or below the earth's surface or from aerial or marine platforms.

Global positioning system survey: A space-based global navigation satellite system that provides reliable location and time information on or near the earth when and where there is an unobstructed line of sight to four or more global positioning system satellites.

Groundwater: Water beneath the ground surface that fills pore spaces between materials such as sand, soil, or gravel.

Hazard index (HI): The sum of the hazard quotients for compounds that affect a receptor through a specific pathway. An HI of 1 means that the amount to which a receptor is exposed is equivalent to the amount not expected to cause adverse health effects.

Table 1: Previous Studies and Investigations Summary (cont'd)

Previous Study/Investigation*	Date	Investigation Activities
Focused Feasibility Study (CH2M HILL, 1995b)	1995	A focused FS was conducted in 1995 to evaluate remedial alternatives to address risks associated with contamination detected at Site 1. The draft report summarized the focused RI and that information was used as a basis for developing and evaluating cost-effective remedial alternatives to address contamination at Site 1. The study developed seven remedial alternatives to address both soil and groundwater contamination across the site. The document was never finalized.
Soil Level Delineation (CH2M HILL, 1998)	1998	Based on soil data gathered during the focused RI and previous investigations, supplemental soil sampling was conducted to further delineate potentially contaminated areas at Site 1. A formal report of the supplemental soil sampling was not generated; however, these and other historical data were evaluated to assess whether sufficient information existed to establish **preliminary remediation goals (PRGs)** for Site 1 soil. This evaluation resulted in the identification of additional data requirements and the need to refine the **human health risk assessment (HHRA)** and **ecological risk assessment (ERA)** in accordance with current regulatory guidance.
Soils Supplemental Investigations (CH2M HILL, 2002 and CH2M HILL, 2004)	2001 and 2004	The results of the 1992 RI, focused RI, focused FS, and soil level delineation indicated that additional data needed to be collected to adequately delineate the nature and extent of soil contamination at Site 1 and to assess the associated potential risks. In February and October 2001, a soil investigation was conducted to assess current conditions of soil within the ABG to support its continuing operation. The objectives of collecting the data were to assess potential risk to human health and the environment resulting from operation of the ABG, develop the ABG RCRA closure plan, assist in defining operational-related monitoring, provide input to pan and pad redesign activities, and to provide the baseline for an assessment of compliance with permits. In addition, based on a review of existing soil data, including the proximity of areas of potential soil contamination to the North Branch Potomac River, collection of additional data was deemed necessary, primarily to assess whether soil constituents in areas of suspected contamination were affecting the surface water and sediment quality of the river via runoff. In July 2004, soil and tissue sampling (earthworms) were conducted to support Step 4 of the baseline ERA. In September 2004, a supplemental investigation of the soil at Site 1 in support of both the HHRAs and ERAs was conducted to obtain additional nature and extent data and adequately assess potential human and ecological risks for Site 1 soil.
Soils Focused Remedial Investigation (CH2M HILL, 2006a)	2006	A second focused RI was completed for Site 1 to evaluate the nature and extent of the soil contamination at the site and the potential risks that soil contamination may pose to human **receptors** under residential and industrial scenarios and to ecological receptors. The discussions and assessment were based on data collected as part of the 2001 and 2004 supplemental investigations, as well as data from previous investigations. The 2006 focused RI identified potential unacceptable risks to human health and the environment based on exposure to OABG soil and debris. Based on the results of the risk assessments, it was recommended that an FS be prepared to evaluate the remedial alternatives proposed to address the potential risks identified for soil within the FDPs and the OABG areas at Site 1.
Wetland Assessment (CH2M HILL, 2006b)	2006	A field review of Site 1 was conducted to identify any wetlands or water bodies within the area. No wetlands were identified within the Site 1 study area, which consists of the ABG and OABG. The North Branch Potomac River, which borders Site 1 to the north, was mapped as a permanent, lower perennial, unconsolidated bottom, slow-moving river. Another area was identified as a wetland to the east of Site 1, but was outside of the study area. This small wetland was mapped as a seasonally flooded, broad-leaved deciduous, forested wetland.

Table 1: Previous Studies and Investigations Summary (cont'd)

Previous Study/Investigation*	Date	Investigation Activities
OABG Geophysical and Global Positioning System Survey (CH2M HILL, 2008a)	2007	A geophysical survey and **global positioning system survey** were performed in support of the debris characterization to assist in the selection of the **test pit** locations. Survey results showed that the western and eastern regions of the OABG demonstrated the highest response to the geophysical instrumentation, indicating the location of metallic debris on the surface or in the subsurface within those areas. In contrast, the central region of the site showed little to no response.
OABG Limited Surface Debris Removal (Shaw Environmental, Inc., 2008)	2008	Shaw Environmental, Inc., conducted a limited surface debris removal in preparation for the debris characterization. Work was conducted under an approved **Explosives Safety Submission (ESS)** waiver and included **unexploded ordnance (UXO)** avoidance. Small shrubs and trees were cleared, and surface piles of construction and manufacturing debris were removed from the OABG areas where test pitting was to take place. Surface debris removed from the site was contained in portable roll-off boxes and sent offsite for proper disposal, with the exception of rocket casings containing asbestos material, which were removed and disposed by a licensed asbestos abatement contractor. Currently, surface debris (surficial and partially buried) remains throughout the OABG, western drainage ditch, and bank of the North Branch Potomac River. This debris includes piles of construction and manufacturing debris, some of which is intertwined with vegetation along the river bank. Furthermore, asbestos-containing ballistic rocket casings are present at the surface within the OABG.
OABG Debris Characterization (CH2M HILL, 2008b)	2008	Following the limited surface debris removal, debris characterization was conducted. Work was conducted under an approved ESS waiver and included UXO avoidance. Debris characterization was conducted to further define the nature and extent of subsurface debris within the West OABG, Central OABG, and East OABG. The objectives of the debris characterization were to further define the vertical and horizontal extent of debris within the OABG, identify the general composition of debris and foreign material present on the surface and in the subsurface soil, and determine if the debris and foreign material in the subsurface had contaminated the underlying soil. Forty-nine exploratory test pits were excavated to a depth of 10 feet or until groundwater was encountered and then backfilled. The bulk of the surface and subsurface debris was shown to be buried in the West and East areas of the OABG; the Central area showed no surface or subsurface debris based on visual observations and test pits completed in this area. Based on observations of surface and subsurface debris, subsurface material was categorized as burn debris/ash, construction debris, manufacturing debris, or native soil. In addition to the debris characterization, samples were collected from 38 test pit locations. Each was analyzed for VOCs, SVOCs, and metals. A portion was analyzed for dioxins and explosives. The results indicated that the detected constituents in the subsurface soil matched the **constituents of concern (COCs)** presented in the 2006 focused RI.
Membrane Interface Probe and FLUTe Liner Investigation (CH2M HILL, 2010)	2009-2010	A **membrane interface probe (MIP)** and **Flexible Liner Underground Technologies, LLC (FLUTe) liner** study was completed at the location of the FDPs at Site 1. The objective of the investigation was to determine if **dense non-aqueous phase liquid (DNAPL)** constituting principal threat waste was present in the unsaturated zone (ground surface to approximately 15 feet bgs). The MIP was conducted at 55 locations. Twenty-one of the 55 locations had an MIP response, indicating that further investigation with the FLUTe liners was warranted to confirm the presence or absence of DNAPL. The FLUTe liner investigation was conducted during a second mobilization to the site. Twenty-one FLUTe liners were emplaced in the **vadose zone** and shallow aquifer to a maximum depth of 13.5 feet bgs. None of the FLUTe liners indicated the presence of DNAPLs in the vadose zone. Therefore, the team agreed principal threat waste was not present in the unsaturated zone at the Site 1 FDPs.

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Glossary of Terms

This glossary defines, in non-technical language, the bolded terms appearing in this Proposed Plan. The definitions do not constitute the Navy's, EPA's, or WVDEP's official use of terms and phrases for regulatory purposes, and nothing in this glossary should be construed to alter or supplant any other federal or state document. Official terminology may be found in the laws and related regulations as published in such sources as the Congressional Record, Federal Register, and elsewhere.

Action Memorandum (AM): A written record of the selection and approval of a removal action.

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

Alluvial: Related to, composed of, or found in alluvium.

Alluvium: Sand, silt, clay, gravel, or other matter deposited by flowing water, such as in a riverbed, floodplain, delta, or alluvial fan. Alluvium is generally considered to be a young deposit in terms of geologic time.

Applicable or Relevant and Appropriate Requirements (ARARs): State and federal laws and regulations that are relevant to guiding the selection of, and the implementation of, remediation at a CERCLA (see below) site. "Applicable requirements" are standards and other environmental protection requirements of federal or state law that deal

cost-effectiveness, and (4) use of permanent solutions. The Preferred Alternative will be reevaluated as appropriate in response to public comment or new information.

10. Community Participation

The Navy and EPA provide information regarding the cleanup of ABL to the public through public meetings, the Administrative Record file for the site, the Information Repository, and announcements published in local newspapers. The Navy and EPA encourage the public to gain a more-comprehensive understanding of the sites and the CERCLA activities that have been conducted at ABL. The Administrative Record for the site can be accessed at the following internet address: http://go.usa.gov/DyRh.

The public comment period provides the public time to review and comment on the information provided in this Proposed Plan. The 45-day public comment period for this Proposed Plan is from March 25, 2014, through May 9, 2014. The public meeting will be held on March 25, 2014, from 6:30 p.m. to 7:30 p.m. at the South Cumberland Library, 100 Seymour Street, Cumberland, Maryland. The location of the Administrative Record and Information Repository are provided on page 1 of this Proposed Plan.

A transcript of the public meeting will be included in the Administrative Record file. All comments received during the public meeting and comment period will be summarized, and responses will be provided in the Responsiveness Summary section of the ROD. The ROD is the document that will present the selected remedy, and it will also be included in the Administrative Record file.

Written comments can be submitted via mail, e-mail, or fax and should be sent to the following address:

Mr. Thomas Kreidel
NAVFAC Mid-Atlantic
9742 Maryland Avenue
Norfolk, VA 23511
Phone: 757-341-1410
Email: Thomas.kreidel@navy.mil

Table 10A: Preliminary Remediation Cost Summary for the ABG

Remedial Alternative	Description	Construction Time (weeks)	Operation Time (years)	Capital Cost	Present-worth O&M Costs	Total Present-worth
1	No Action	0	0	$0	$0	$0
2	Excavation of AOCs, Offsite Disposal, LUCs, and LTMgt	5	0	$718,695	$0	$718,695

Table 10B: Preliminary Remediation Cost Summary for the OABG

Remedial Alternative	Description	Construction Time (weeks)	Operation Time (years)	Capital Cost	Present-worth O&M Costs	Total Present-worth
1	No Action	0	0	$0	$0	$0
2	Excavation of AOCs, Offsite Disposal, LUCs, and LTMgt	24	30	$10,194,241	$210,862	$10,405,103
3	Removal of Surface Debris, Excavation or AOCs, *Ex Situ* Treatment, Offsite Disposal, LUCs, and LTMgt	33	30[a]	$8,334,872	$210,862	$8,545,734

Notes:

[a] Costs beyond 30 years have minimal impact to the overall evaluation as a result of the present worth adjustment.

Table 1: Previous Studies and Investigations Summary (cont'd)

Previous Study/Investigation*	Date	Investigation Activities
Investigation of Former Disposal Pit 1 (AGVIQ-CH2M HILL, 2013b)	2011-2012	An investigation was completed at FDP 1 to supplement the ongoing post-ROD optimization efforts associated with the existing groundwater extraction and treatment system. The investigation was divided into two phases: Phase I was completed in January 2011 and Phase II was completed in April 2012. Phase I (Focused Extraction Optimization at FDP 1) consisted of employing the existing groundwater model for ABL to estimate the additional groundwater extraction flow rate required to enhance hydraulic capture of TCE contamination within the alluvial aquifer at the FDP 1 area. Phase II consisted of the collection of soil and groundwater data from the FDP 1 alluvial aquifer to refine the **conceptual site model (CSM)** and perform *in situ* chemical oxidation bench-scale testing. Investigation activities consisted of a subsurface soil investigation, hydraulic investigation, groundwater sampling, and *in situ* chemical oxidation bench-scale testing.
Engineering Evaluation and Cost Analysis and Action Memorandum (CH2M HILL, 2012a and CH2M HILL, 2012b)	2012	An EE/CA was prepared to evaluate removal action alternatives to conduct an NTCRA of the unsaturated soil beneath FDPs 1 and 3 within the ABG, which are believed to be primary sources of contamination to groundwater. The objective of the NTCRA (completed in January 2014) was to reduce the source present in the unsaturated soil beneath FDPs 1 and 3, in order to enhance the ability of the groundwater remedy to restore the aquifers to beneficial use. An AM was prepared to document the selection and approval of the NTCRA to address source area soil beneath FDPs 1 and 3 at Site 1. The Preferred Alternative consisted of the excavation, removal, and disposal of the VOC source area in the unsaturated soils beneath FDPs 1 and 3. The excavation would then be backfilled with clean fill and seeded to restore current site conditions.
Site Remediation Goal Selection Process and Evaluation of Target Remediation Areas in Soil (CH2M HILL, 2013a)	2012	Presents the **site remediation goals (SRGs)** and statistical method to select the AOCs that will be targeted for remediation at Site 1. The SRGs for both the ABG and OABG were selected based on a restricted land-use scenario for human health (industrial scenario) and an unrestricted land-use scenario for ecological receptors and groundwater protection. The OABG evaluation considered the entire area as a whole, with no separation between the West, Central, and East areas. Considerations for ecological receptors were incorporated into each scenario.
Soils Feasibility Study (CH2M HILL, 2013b)	2013	An FS was completed to address soil contamination at Site 1 and to evaluate remedial alternatives to mitigate potential hazards associated with the soil. These remedial alternatives are presented for public comment in this document. VOCs, explosives, and metals were identified as risk drivers in the ABG. VOCs, SVOCs, explosives, and metals were identified as **risk drivers** in the OABG.
Non-time-critical Removal Action (AGVIQ-CH2M HILL, 2013a)	2013-2014	The NTCRA (initiated in October 2013 and completed in January 2014) was intended to supplement the final remedy for Site 1 soil and augment the existing groundwater treatment system by reducing potential contaminant source mass to prevent future **leaching** to groundwater.

Notes:

*The documents listed are available in the Administrative Record and provide detailed information used to support remedy selection at Site 1, OU-4.

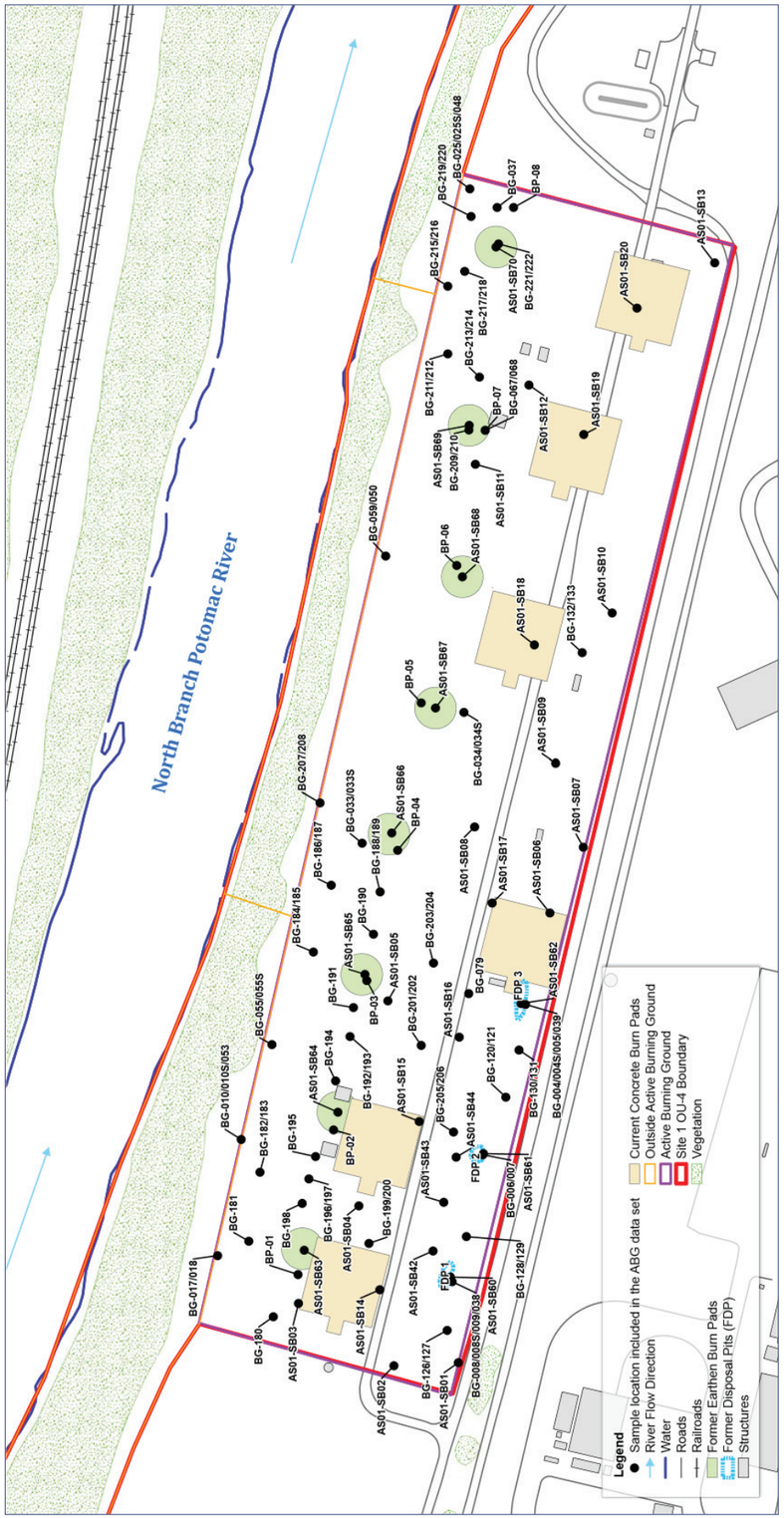

Figure 3A: Active Burning Ground Soil Sample Locations

and potential limitations associated with the *ex situ* treatment, making it a more reliable alternative. Alternative 3 would be slightly more difficult to implement due to the additional *ex situ* treatment component.

6) Cost

The costs associated with each OABG alternative are presented in **Table 10B**, including the capital cost, O&M present worth, and total present worth. Except for the no action alternative, the least expensive alternative would be Alternative 3, with a total present-worth cost of approximately $8.55 million. The total present-worth cost of Alternative 2 would be approximately $10.41 million. Alternative 3 also would have the lowest total capital cost, estimated at $8.33 million. The capital cost for Alternative 2 would be an estimated $10.19 million.

It is recognized that the total present-worth value of OABG Alternative 2 is 22 percent higher than that of OABG Alternative 3. However, the Navy considers the benefit of reducing the uncertainty associated with the effectiveness of the *ex situ* treatment to be worth the additional cost. The *ex situ* treatment may have limitations that could lead to significant cost growth if multiple rounds of treatment are required and/or if treatment goals cannot be achieved.

Modifying Criteria

7) State Acceptance

State involvement has been solicited throughout the CERCLA process and proposed remedy selection. Final concurrence on the selected remedy will be solicited from the State of West Virginia following the review of all comments received during the public comment period.

8) Community Acceptance

Community acceptance will be evaluated after the public comment period for this Proposed Plan ends.

9. Preferred Remedial Alternative

The Navy and EPA, with the support of WVDEP, are proposing to implement Alternative 2 (Excavation of AOCs, Offsite Disposal, LUCs, and LTMgt) as the final remedy at the ABG, and Alternative 2 (Removal of Surface Debris, Excavation of AOCs, Offsite Disposal, LUCs, and LTMgt) as the final remedy at the OABG. Because ABL is an active industrial facility and the ABG is an active RCRA unit, appropriate personnel would be involved during the design and planning phases to ensure the selected remedy would not interfere with the active use of the ABG during and after remedy construction.

These alternatives are recommended because they could be effectively implemented using readily available engineering and construction practices, would be effective both in the short term and in the long term, and would ultimately reduce contaminant mobility by removing the source material that contributes to the soil-to-groundwater leaching risk at moderate cost.

By comparison, all alternatives except for the no action alternatives would comply with ARARs and provide overall protection of human health and the environment. ABG Alternative 2, OABG Alternative 2, and OABG Alternative 3 would all reduce the toxicity, mobility, and volume of risk of exposure of receptors to COCs through removal of high-contaminant-concentration soils. OABG Alternative 3 rates lower than OABG Alternative 2 in long-term effectiveness and permanence, short-term effectiveness, and implementability because of the longer estimated timeframe required to achieve RAOs, as well as the additional technological requirements and uncertainties associated with the *ex situ* thermal treatment. In addition, OABG Alternative 3 presents a slightly higher risk to construction workers during implementation from the handling of equipment and waste streams generated by the treatment. It is recognized that the total present-worth value of OABG Alternative 2 is 22 percent higher than that of OABG Alternative 3. However, the Navy considers the benefit of reducing the uncertainty associated with the effectiveness of the *ex situ* treatment and its associated effectiveness to be worth the additional cost. The *ex situ* treatment may have limitations that could lead to significant cost growth if multiple rounds of treatment are required and/or if treatment goals cannot be achieved.

LTMgt will be implemented to monitor the effectiveness of the selected alternative, including inspections to assess vegetation and erosion and make any necessary repairs in the OABG. Additionally, LUCs will be implemented and maintained to (1) prohibit the development and use of the property for residential housing, elementary and secondary schools, child care facilities and playgrounds, and (2) restrict intrusive activities to minimize the potential for human exposure to contamination Details and requirements of the LUCs will be developed and documented in the LUC Remedial Design. As required by CERCLA, Five year Reviews will be conducted to assess the effectiveness of the remedy.

Based on information currently available, the Navy believes the Preferred Alternative (ABG Alternative 2 and OABG Alternative 2) meets the threshold criteria and provides the best balance of tradeoffs with respect to the balancing and modifying criteria. The Navy expects the Preferred Alternative to satisfy the statutory requirements of CERCLA Section 121 (b): (1) protection of human health and the environment, (2) compliance with ARARs, (3)

result in subsurface debris remaining in place; however, both alternatives would include performance monitoring to confirm that the remedy is functioning and protective, and LUCs would be implemented and maintained to (1) prohibit the development and use of the property for residential housing, elementary and secondary schools, child care facilities and playgrounds; and (2) restrict intrusive activities to minimize the potential for human exposure to contamination.

2) Compliance with ARARs

Both Alternatives 2 and 3 would be expected to comply with ARARs Draft ARARs were identified in Appendix B of the FS. The ARARs will be finalized in the ROD.

The West Virginia ARARs associated with Alternative 2 and 3 are chemical-specific (soils being a source of contamination to other media), location-specific (areas within the 100-year floodplain), and action-specific (erosion and sediment controls during land disturbance, hazardous waste accumulation and storage onsite, generation of fugitive dust, discharge to waters of the State, site closure with waste in place, soil boring and well construction and abandonment, and outdoor material storage or disposal activities). Furthermore, additional West Virginia ARARs associated only with Alternative 3 are chemical-specific (treatment standards for hazardous waste) and action-specific (accumulation or treatment of hazardous waste onsite, and treatment of hazardous waste). The federal ARARs associated with Alternative 2 and 3 are location-specific (areas subject to the Migratory Bird Treaty Act) and action-specific (discharge of dredge or fill to waters of the United States, and storage of fuels and oils onsite). No federal chemical-specific ARARs apply to Alternatives 2 or 3.

Primary Balancing Criteria

3) Long-term Effectiveness and Permanence

Both Alternative 2 and Alternative 3 would be expected to achieve long-term effectiveness and permanence once RAOs are met. The residual risks for Alternatives 2 and 3 are anticipated to be of relatively the same magnitude given the excavation and offsite disposal of the area with the highest contaminant concentrations. With proper engineering, planning, and implementation, controls could be put in place to monitor all the alternatives effectively to verify continued compliance with RAOs. Because the RAOs do not result in unlimited use and unrestricted exposure, LUCs would need to be continually enforced. Alternative 3 would have a lower level of confidence due to the reliance on treatment before offsite disposal. This is due to the uncertainties associated with the treatment of various COCs (VOCs, SVOCs, explosives, and metals) to non-hazardous levels using a single technology as proposed here. Given these uncertainties, which could give rise to the potential need for multiple rounds of treatment to reach SRGs, costs could increase significantly.

4) Reduction of Toxicity, Mobility and Volume through Treatment

Alternative 2 does not involve treatment and, therefore, does not satisfy this criterion. However, Alternative 2 would ultimately reduce contaminant mobility by removing the source material that contributes to the soil-to-groundwater leaching risk. Alternative 3 would reduce toxicity, mobility, and volume through treatment. Alternative 3 would provide active *ex situ* treatment by implementing thermal treatment before offsite disposal and is, therefore, rated the highest.

5) Short-term Effectiveness

Alternatives 2 and 3 would be effective in the short-term to a similar degree because they each would have relatively minimal impacts on the community and present similar risks to the workers during implementation. However, Alternative 3 would present a slightly higher risk to construction workers during implementation from handling equipment and materials used for the *ex situ* thermal treatment, and additional waste streams generated from the treatment. Alternative 2 would have the highest short-term effectiveness as a result of having the shortest timeframe, estimated at 24 weeks, for achieving RAOs through excavation of the AOCs. Alternative 3 is rated slightly lower because it would require a longer timeframe, estimated at 33 weeks, to achieve the RAOs due to addition of the *ex situ* treatment component. There would be short-term risks to the community and workers from exposure to site contaminants associated with the construction activities under both alternatives. However, the short-term risks would be minimized by implementing appropriate health and safety procedures and through proper engineering. Short-term disruptions to daily ABL operations and the local community might be caused by heavy equipment operation, such as increased traffic of construction trucks in and out of the site, dust generation during re-grading, excavation, or backfill operations, and transportation of clean fill from an offsite source. These disruptions would be minimized, to the extent practical, through proper planning for traffic diversion and periodic dust suppression.

Implementability

Alternatives 2 and 3 could both be easily implemented because their technologies are readily available, reliable, able to be monitored for effectiveness, and have been used successfully at many other sites. Alternative 2 could be implemented more easily than Alternative 3 because it does not involve the space requirements, uncertainties,

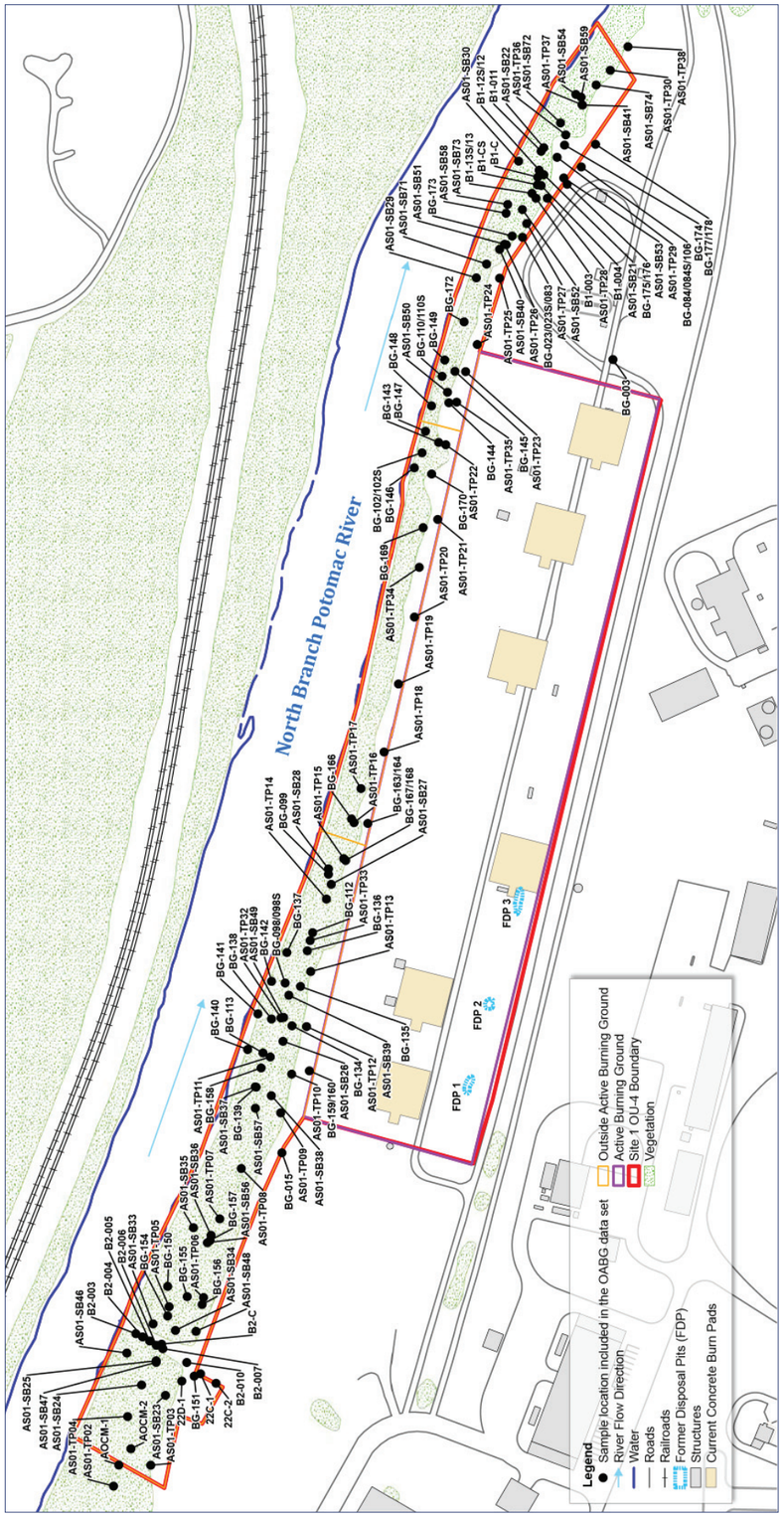

Figure 3B: Outside Active Burning Ground Soil Sample Locations

3. Site Characteristics

ABL is located on the floodplain of the North Branch Potomac River and is flanked by Knobly Mountain to the south and east. The facility is immediately underlain by sediments that generally comprise an upper silt and clay layer underlain by coarser deposits of sand and gravel. Shale is the dominant **lithology** beneath the western third of the facility, where Site 1 is located. A CSM depicts the Site 1 characteristics (**Figure 4**).

Generally, Site 1 is underlain by two distinct lithologies: (1) unconsolidated alluvial deposits of clay, silt, sand, and gravel and (2) predominantly shale bedrock. Drilling at Site 1 indicated that the unconsolidated alluvial deposits overlying bedrock generally consist of two distinct layers of material. The upper, or surficial, layer of **alluvium** consists of silty clay and is considered floodplain deposits of the North Branch Potomac River. At Site 1, this upper alluvial layer extends from the ground surface to an average depth of approximately 12 feet bgs. Groundwater is encountered at approximately 10 to 13 feet bgs. The lower layer of the alluvium consists of a sand and gravel layer containing pebbles and cobbles with variable but typically significant amounts of clay and silt, and is considered to be alluvial deposits of the North Branch Potomac River. At Site 1, this lower alluvial layer has an average thickness of approximately 14.5 feet. Below the alluvium lies bedrock consisting of mainly **calcareous** shale and limestone. The average depth to bedrock at Site 1 is approximately 26.5 feet bgs.

Nature and Extent of Contamination

Historical activities associated with the use of the FDPs and former burn pads in the ABG and the waste disposal and drum storage areas of the OABG have resulted in VOCs, SVOCs, explosives, dioxin, and metals in surface and subsurface soil at Site 1(See **Tables 3, 4, 5A**, and **5B**). The distribution of soil contamination within the ABG and OABG was further refined using a statistical approach to identify the risk drivers that would be the constituents targeted for remediation (CH2M HILL, 2013a and CH2M HILL, 2013b). **Table 2** presents the COCs identified as risk drivers, which are the COCs that require remedial action, for the ABG and OABG, respectively. Estimated target remediation areas for Site 1 soil, identified as AOCs, were delineated (CH2M HILL, 2013b) as discussed in Section 6.

Eight AOCs, delineated with respect to their specific risk drivers, have been identified in the ABG (**Figure 4, Table 2**). The AOC-specific risk drivers for the ABG are as follow:

- AOC 1: lead
- AOC 2: TCE, octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine (HMX), nitroglycerin (NG), and perchlorate
- AOC 3: copper
- AOC 4: TCE and lead
- AOC 5: Tetrachloroethene (PCE) and TCE
- AOC 6: TCE and lead
- FDP 1: PCE and TCE
- FDP 3: PCE and TCE

An NTCRA was completed in January 2014 to address the unsaturated soil beneath the historical aerial extent of FDPs 1 and 3, which are two AOCs in the ABG. Any residual contamination left in place after the NTCRA of FDP 1 and FDP 3 will be managed in the same manner as the AOCs. It is estimated that the contaminated soil associated with the ABG AOCs (excluding FDPs 1 and 3) is equivalent to approximately 1,300 cubic yards.

Eleven AOCs, delineated with respect to their risk drivers, have been identified in the OABG (**Figure 4**, **Table 2**). The AOC-specific risk drivers for the OABG are as follows:

- AOC 1: methyl acetate and TCE
- AOC 2: TCE
- AOC 3: 1,2-dichlorothene (DCE), methyl acetate, TCE, benzo(a)pyrene, total polycyclic aromatic hydrocarbons (PAHs) (high molecular weight), chromium, copper, lead, and vanadium
- AOC 4: TCE
- AOC 5: TCE
- AOC 6: 1,2-DCE, TCE, and cobalt
- AOC 7: methyl acetate, PCE, TCE, HMX, NG, hexahydro-1,2,5-trinitro-1,3,5-triazine (RDX), cadmium, chromium, copper, lead, and mercury
- AOC 8: chromium, cobalt, copper, and lead
- AOC 9: copper and mercury
- AOC 10: cobalt and copper
- AOC 11: benzo(a)anthrancene, benzo(a)pyrene, total PAHs (low molecular weight), total PAHs (high molecular weight), and cobalt

It is estimated that the contaminated soil and debris associated with the OABG AOCs is equivalent to approximately 20,100 cubic yards.

Fate and Transport of Contamination

As depicted in the CSM (**Figure 4**), the primary fate and **contaminant migration pathways** of contaminants in Site 1 soil are leaching from soil to groundwater, ultimately discharging to the river and surface runoff of contaminants in soil media, primarily in the OABG, to the drainage ditch and river. Currently, the groundwater remedy minimizes groundwater flow to the river from the ABG and OABG through groundwater extraction and treatment.

Table 9A : Comparative Analysis of Remedial Alternatives for the ABG

Criteria	Alternative 1	Alternative 2
Overall Protectiveness of Human Health and the Environment	○	●
Compliance with ARARs	N/A	●
Long-term Effectiveness and Permanence	○	●
Reduction of Toxicity, Mobility, or Volume Through Treatment	○	○
Short-term Effectiveness	○	●
Implementability	●	●
Cost[1]	$0	$718,695

Ranking: ● Satisfies criterion ◉ Moderately satisfies criterion ○ Poorly satisfies criterion N/A – not applicable

Alternative 1 – No Action

Alternative 2—Excavation of AOCs, Offsite Disposal, LUCs, and LTMgt

[1] Cost is the total present-worth value; cost accuracy ranges from -30 percent to +50 percent.

Table 9B: Comparative Analysis of Remedial Alternatives for the OABG

Criteria	Alternative 1	Alternative 2	Alternative 3
Overall Protectiveness of Human Health and the Environment	○	●	●
Compliance with ARARs	N/A	●	●
Long-term Effectiveness and Permanence	○	●	●
Reduction of Toxicity, Mobility, or Volume Through Treatment	○	○	●
Short-term Effectiveness	○	●	○
Implementability	●	●	○
Cost[1]	$0	$10.41	$8.55

Ranking: ● Satisfies criterion ◉ Moderately satisfies criterion ○ Poorly satisfies criterion N/A – not applicable

Alternative 1 – No Action

Alternative 2 – Removal of Surface Debris, Excavation of AOCs, Offsite Disposal, LUCs, and LTMgt

Alternative 3 – Removal of Surface Debris, Excavation of AOCs, *Ex Situ* Treatment, Offsite Disposal, LUCs, and LTMgt

[1] Cost is the total present-worth value ($Million); cost accuracy ranges from -30 percent to +50 percent.

Table 7: Details of Remedial Alternative Components

Remedial Alternative Component	Details
Excavation of AOCs (ABG and OABG)	Remove contaminated soil from within the AOCs to prevent or minimize direct exposure to COCs that pose unacceptable risk to human and ecological receptors, overland migration of COCs to the North Branch Potomac River, and migration of COCs from soil to groundwater to restore the aquifers to beneficial use to achieve RAOs. For the ABG, it was assumed that AOC 1 through 6 would be excavated to a vertical depth of 5 feet bgs and include over-excavation at a 2H:1V slope for worker safety. Each AOC would then be backfilled to grade with imported soil. Land survey and compaction would be required because the ABG AOCs are within the actively used portion of Site 1. The ABG would be restored to pre-excavation conditions with topsoil, seeding, and mulching. For the OABG, it was assumed that AOCs 1 through 11 would be excavated to the water table (estimated to range between 10-12 feet bgs) and include a 2H:1V slope for worker safety. All excavated material generated from the OABG would be mechanically screened prior to offsite disposal to remove material potentially presenting an explosive hazard and asbestos-containing material. The segregation of the waste would also support the efforts to reuse and recycle material. Unlike the ABG, compaction testing would not be required because the AOBG AOCs are not within the actively used portion of Site 1; however, a survey would be conducted to ensure that the AOCs are backfilled to sufficient compaction to support the bank and site restoration. The restoration, including bank stabilization, would occur across the OABG and span the West, Central, and East OABG portions to achieve RAOs. Activities would include limited backfilling with imported soil as part of a sustainable restoration approach, with native plants installed throughout. This also includes the restoration of the western drainage ditch.
Offsite Disposal (ABG and OABG)	Transportation and disposal of excavated soil (ABG and OABG) and debris (OABG) to approved disposal facilities.
LUCs (ABG and OABG)	Implement and maintain LUCs to (1) prohibit the development and use of the property for residential housing, elementary and secondary schools, child care facilities and playgrounds, and (2) to restrict intrusive activities to minimize the potential for human exposure to contamination.
LTMgt (ABG and OABG)	Manage the soils to ensure the remedial design components, primarily for erosion control repairs and removal/handling of any debris that surfaces (OABG only), continue to meet the site-specific RAOs. This also includes the inspections, and any necessary vegetation or erosion repairs.
Removal of Surface Debris (OABG)	Remove surface debris (including partially exposed debris) from within the boundaries of the OABG to prevent or minimize the safety hazards and achieve the RAOs.
Ex Situ Treatment (OABG)	Implement thermal desorption of waste soil deemed hazardous to levels deemed non-hazardous before offsite disposal.

Table 8: National Oil and Hazardous Substances Pollution Contingency Plan Criteria

Remedial Alternative Component	Details
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 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.
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 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 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 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 (O&M), 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 ROD.

Principal Threats

"Principal threat wastes" 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. Previous investigations in the ABG did not indicate the presence of DNAPL in FDP soils. Therefore, the Navy, with concurrence from EPA and WVDEP, concluded the FDPs did not contain principal threat waste. However, it was recognized that VOCs in soil, primarily TCE, are a continuing source to groundwater contamination and, therefore, an NTCRA was completed to remove the FDP vadose zone soil. In the OABG, the waste at Site 1 consists of debris from burning, and such waste and is not considered a principal threat waste. Based on the absence of identified DNAPL and a lack of exposure, principal threat wastes are not present at Site 1 Soil.

4. Scope and Role of the Proposed Remedial Action

ABL was placed on EPA's NPL in May 1994. Eight IRP sites are referenced in the **Federal Facility Agreement (FFA)** Findings of Fact Section for further investigation under CERCLA (Sites 1, 2, 3, 4B, 5, 7, Production Well "A" [Site 10], and 11). Six additional sites have been identified following signature of the FFA (Sites 4A, 6, 8, 9, 12, and 13). The Site Management Plan, which is available in the Administrative Record and Information Repository, is updated annually and provides a comprehensive summary of active sites, solid waste management units (SWMUs), and AOCs at Plant 1.

The sites, SWMUs, and AOCs currently under investigation are Site 1 soil and Site 13 groundwater, sediment, and surface water. The remedies for these sites will be documented in separate RODs. Site 1 groundwater, surface water, and sediment (OU-3), Site 5, Site 10, and Sites 11/12 each have a ROD and remedy in place. Responses are complete for Sites 2, 3, 4A, 4B, 6, 7, and 9, which are individually documented for No Further Action. Site 8 comprises the former wastewater sumps that are also identified as the SWMU 37 series, which were addressed as specific SWMUs. To date, 88 of the 92 SWMUs and AOCs identified at ABL during the 1993 RCRA Facility Assessment have been evaluated.

These 88 SWMUs were investigated and/or remediated as necessary, and closed out with No Further Action. In addition to OU-3, Site 1 Soil, which is the subject of this Proposed Plan, SWMU 37E (part of Site 8) and 37W groundwater are currently under investigation as part of Building 8 Lab Row. AOC M will be evaluated in future investigations.

The Preferred Alternative presented in this Proposed Plan is intended to address all potential risks to human health and the environment at Site 1, OU-4, and is intended to be the final remedy for the site. Potential human health and ecological risks in soil have affected OU-3, Site 1, groundwater, surface water, and sediment. Therefore, mitigation of risks in soil will likely affect the groundwater, surface water, and sediment COCs, which are being addressed under the OU-3 ROD (Navy, 1997).

5. Summary of Site Risks

This section summarizes the quantitative HHRA and ERA conducted during the 2006 focused RI for soil within the ABG and OABG (CH2M HILL, 2006a). The human health and ecological risks were re-evaluated based on the most current toxicity criteria, dated November 2012. The update included the addition of perchlorate, an emerging contaminant that is in the process of being regulated under the Safe Drinking Water Act (EPA, 2012). In addition, the potential for constituents to leach from soil to groundwater at levels posing a potentially unacceptable risk was evaluated for Site 1 soils (CH2M HILL, 2013b). These assessments evaluated the potential for chemicals at the site to have an adverse effect on human and ecological receptors and groundwater if no action is taken to clean the site.

Human Health Risk Assessment Summary

The HHRA was conducted to evaluate the potential human health risks associated with dermal contact, inhalation, and ingestion of surface soil and combined soil (surface and subsurface soil) at the ABG, FDPs (addressed separately from the ABG in the 2006 focused RI), and OABG (see the "What is Human Health Risk and How is it Calculated?" text box). The current receptor scenarios associated with Site 1 soil were evaluated for the industrial worker and adolescent trespasser/visitor. Hypothetical future scenarios associated with Site 1 soil were evaluated for the industrial worker, adolescent trespasser/visitor, future adult resident, child resident, lifetime resident, and construction worker.

The results of the HHRA indicated there are no unacceptable **reasonable maximum exposure (RME)** cancer risks or **non-cancer hazards** associated with exposure to site soils for current **receptors**. The RME exposure scenario portrays the highest level of human exposure that could reasonably be expected to occur. In addition, there are no RME non-cancer hazards above EPA's acceptable levels for hypothetical future scenarios with the exception of future residents. The exposure scenarios for which cancer risks or non-cancer hazards exist above EPA's acceptable levels are summarized in **Table 3**. The COCs are identified in **Table 3** for each scenario with RME cancer risks or non-cancer hazards above EPA's acceptable levels. There are no unacceptable

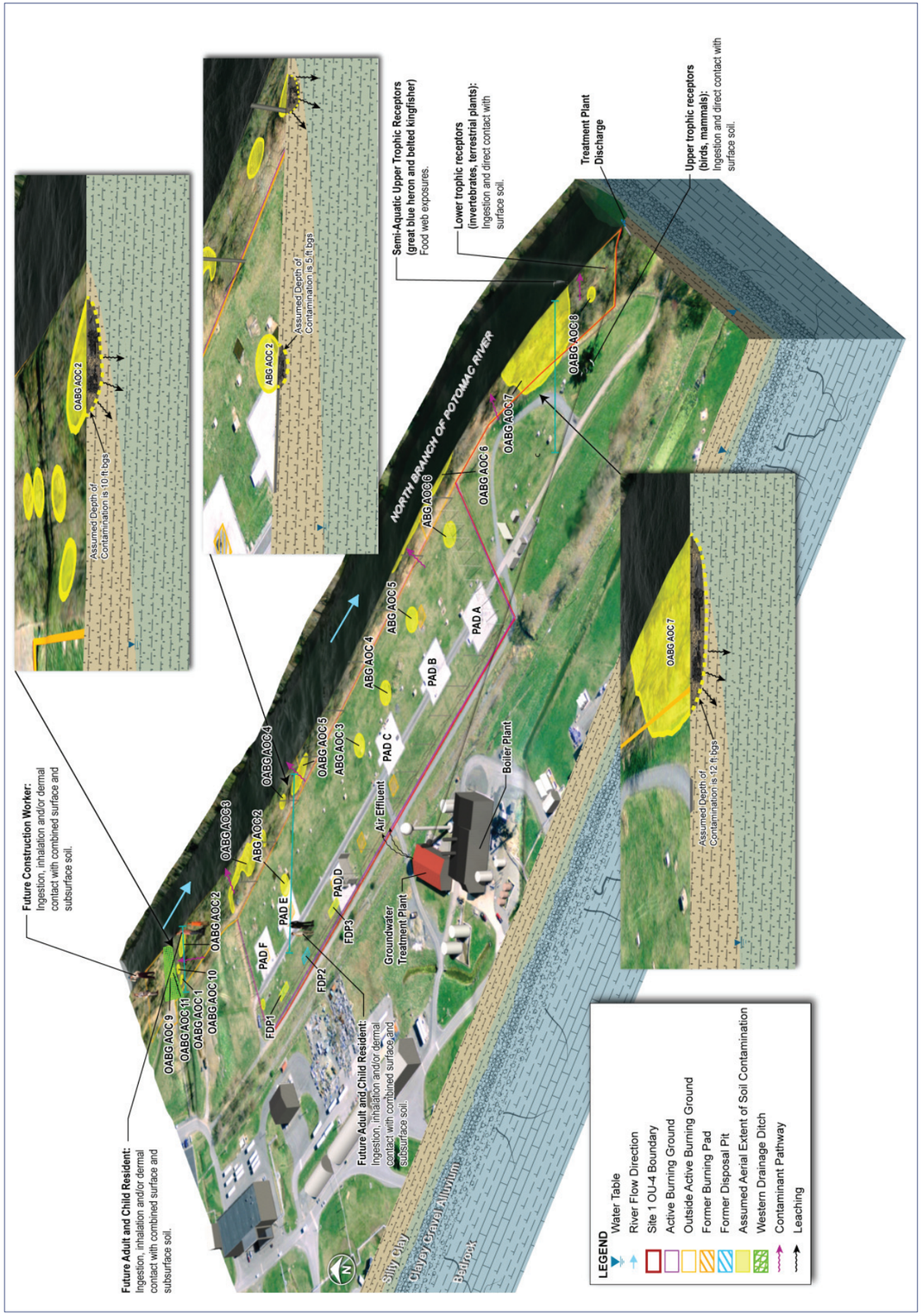

Figure 4: Conceptual Site Model

prohibit the development and use of the property for residential housing, elementary and secondary schools, child care facilities and playgrounds; and (2) restrict intrusive activities to minimize the potential for human exposure to contamination.

2) Compliance with Applicable or Relevant and Appropriate Requirements

Alternative 2 would be expected to comply with **Applicable or Relevant and Appropriate Requirements (ARARs)**. Draft ARARs were identified in Appendix B of the FS. The ARARs will be finalized in the ROD.

The West Virginia ARARs associated with Alternative 2 are chemical-specific (soils being a source of contamination to other media), location-specific (areas within the 100-year floodplain), and action-specific (erosion and sediment controls during land disturbance, hazardous waste accumulation and storage onsite, generation of fugitive dust, discharge to waters of the State, site closure with waste in place, soil boring and well construction and abandonment, and outdoor material storage or disposal activities). The federal ARARs associated with Alternative 2 are location-specific (areas subject to the Migratory Bird Treaty Act) and action-specific (storage of fuels and oils onsite). No federal chemical-specific ARARs apply to Alternative 2.

Primary Balancing Criteria

3) Long-term Effectiveness and Permanence

Alternative 2 would be expected to achieve long-term effectiveness and permanence once RAOs are met. The residual risks associated with Alternative 2 are anticipated to be low given the excavation and offsite disposal of the area with the highest contaminant concentrations. With proper engineering, planning, and implementation, controls could be put in place to monitor the alternative's effectiveness and to verify continued compliance with RAOs. Because the RAOs do not result in unlimited use and unrestricted exposure, LUCs would need to be continually enforced.

4) Reduction of Toxicity, Mobility and Volume through Treatment

Alternative 2 does not involve treatment and, therefore, would not satisfy this criterion.

5) Short-term Effectiveness

Alternative 2 would be highly effective in the short term as a result of the estimated 5-week timeframe for achieving RAOs through excavation of the AOCs. There would be short-term risks to the community and workers from exposure to site contaminants associated with the construction activities; however, these risks would be minimized by implementing the appropriate health and safety procedures and through proper engineering. Short-term disruptions to daily ABL operations and the local community might be experienced as a result of heavy equipment operation, such as increased traffic of construction trucks in and out of the site; dust generation during re-grading, excavation, or backfill operations; and transportation of clean fill from an offsite source. These disruptions would be minimized, to the extent practical, through proper planning for traffic diversion and periodic dust suppression.

6) Implementability

Alternative 2 could be easily implemented because its technology (excavation and offsite disposal) is readily available, reliable, able to be monitored for effectiveness, and has been used successfully at many other sites.

7) Cost

The costs associated with each ABG alternative are presented in **Table 10A**, including the capital cost, O&M present worth, and total present worth. The capital cost for Alternative 2 would be approximately $719,000. There would be no O&M associated with Alternative 2. Therefore, the total present-worth costs for Alternative 2 would also be approximately $719,000.

Modifying Criteria

8) State Acceptance

State involvement has been solicited throughout the CERCLA process and proposed remedy selection. Final concurrence on the selected remedy will be solicited from the State of West Virginia following the review of all comments received during the public comment period.

9) Community Acceptance

Community acceptance will be evaluated after the public comment period for the Proposed Plan.

8.2 Outside Active Burning Ground

Threshold Criteria

1) Overall Protection of Human Health and the Environment

Alternative 1 (no action) would not achieve RAOs and, therefore, because it failed a threshold criterion, was not evaluated further. Alternatives 2 and 3 would be protective of human health and the environment by removing surface debris and excavating contaminated soil in the AOCs and disposing it offsite. Both Alternatives 2 and 3 would

Table 5B: Summary of Soil-to-Groundwater Leaching for the Outside Active Burning Ground

Costituent of Concern	Upland (Active Burning Ground/ Former Disposal Pit)		Central Outside Active Burning Ground	Floodplain (Outside Active Burning Ground)	
	Surface Soil	Food Web	Subsurface Soil	Surface Soil	Food Web
Volatile Organic Compounds					
1,2,4-Trichlorobenzene[1]					X
Bromodichloromethane[1]				X	
trans-1,2-DCE				X	
PCE				X	
TCE	X	X		X	X
Semivolatile Organic Compounds					
1,1-Biphenyl		X			
benzo(b)fluoranthene		X			
Naphthalene1		X			
Dioxin/furans					
NG				X	X
RDX				X	X
Explosives					
1,3,5-Trinitrobenzene	X				
HMX	X			X	
NG	X			X	
Perchlorate	X				
RDX	X			X	
Metals					
Cadmium				X	X
Cobalt	X	X	X	X	X
Copper				X	
Iron	X	X		X	X
Lead	X			X	X
Mercury					X

Notes:
Information summarized from the 2013 SRG Technical Memorandum (CH2M HILL, 2013b)
[1] COC based on leaching concern documented in the Proposed RAOs and Remediation Goals for Site 1 Soil (CH2M HILL, 2009)
X – potential soil-to-groundwater leaching risk is present

Table 6: Summary of Remedial Alternatives

Alternative	Active Burning Ground	Outside Active Burning Ground
1	No Action	No Action
2	Excavation of AOCs, Offsite Disposal, LUCs, and LTMgt	Removal of Surface Debris, Excavation of AOCs, Offsite Disposal, LUCs, and LTMgt
3	N/A	Removal of Surface Debris, Excavation of AOCs, *Ex Situ* Treatment, Offsite Disposal, LUCs, and LTMgt

Table 2: Constituents of Concern Requiring Remedial Action

Risk Driver[1]	Maximum Detected Concentration in Soil (mg/kg)	Soil Remediation Goal for Soils (mg/kg)	Basis
Active Burning Ground			
Volatile Organic Compounds			
PCE	5.80	0.22	SSL
TCE	160	0.16	SSL
Explosives			
HMX	51	10 (SS)	Ecological PRG
NG	98	65 (SS)	Ecological PRG
Perchlorate	31.3	0.85	SSL
Metals			
Copper	1,820	253 (SS)	Ecological PRG
Lead	1,760	160	SSL
Outside Active Burning Ground			
Volatile Organic Compounds			
1,2-DCE	27	0.45 (SS)	SSL
8.4 (SB)	Ecological PRG	0.16	SSL
SSL	5.80	0.22	SSL
Methyl Acetate	2.8	0.30 (SS)	Ecological PRG
Semivolatile Organic Compounds			
Benzo(a)anthracene	58	8.8	SSL
Benzo(a)pyrene	55	2.1	Industrial PRG
Total PAHs (low molecular weight)	240	29 (SS)	Ecological PRG
Total PAHs (high molecular weight)	492	18 (SS)	Ecological PRG
Explosives			
HMX	530	10 (SS)	Ecological PRG
NG	30	0.37	SSL
RDX	7.3	0.12	SSL
Metals			
Cadmium	373	17.4 (SS) 130 (SB)	Ecological PRG SSL
Chromium	319	42.7	SSL
Cobalt	60	52.3 (SS) 20.9 (SB)	Ecological PRG SSL
Copper	13,600	253 (SS) 11,000 (SB)	Ecological PRG SSL
Lead	12,100	785 (SS) 830 (SB)	Ecological PRG SSL
Mercury	56.3	1.61 (SS) 39 (SB)	Ecological PRG SSL
Vanadium	994	173 (SS)	Ecological PRG

Notes:
[1] Risk drivers are COCs present at a concentration that drives the need for remedial action at the site and will be targeted for remediation at Site 1
mg/kg – milligrams per kilogram
SS – surface soil
SB - sediment
SSL – soil screening level

central tendency exposure (CTE) cancer risks and no CTE non-cancer hazards above EPA's acceptable levels for current and future receptors, with the exception of future residents.

Exposure to lead is regulated by EPA based on the concentration of lead in blood. Blood-lead concentrations were estimated through the use of a model and indicated a potential risk associated with exposure to lead in soil (CH2M HILL, 2006a).

Ecological Risk Assessment Summary

The baseline ERA was conducted to identify potential risks to ecological receptors because of exposure to Site 1 soil. A potentially unacceptable risk to plants and/or animals at the site requires a source of contamination and a **pathway** for exposure to the contaminants (see the "What is Ecological Risk and How is it Calculated?" text box). Because of their proximity and similarity in habitat, the ABG and FDP areas were addressed together and referred to as "upland habitat." Because most of the OABG area is within the floodplain of the river, this area was referred to as "floodplain habitat." The ERA was quantitatively conducted using surface soil samples collected from within the top 12 inches of soil because this depth range represented the most realistic potential exposures for most of the ecological receptors evaluated in terrestrial habitats; however, because some ecological receptors may be exposed, at least periodically, to deeper soils, available subsurface soil data from the 12- to 24-inch depth interval (including data from a few samples that extended to 3 feet bgs) were also used.

For upland areas, potential unacceptable risks were identified that are associated with direct exposure to several metals and explosive compounds in surface soil. The upland portion of Site 1 is covered with periodically mowed grasses and other herbaceous plants, providing habitat of limited diversity and quality. Given the limited habitat quality of the ABG area, particularly in the vicinity of the active burn pads where most of the significant exceedances were found, concentrations of the metal and explosive COCs are not likely to result in adverse impacts to populations of ecological receptors. For floodplain areas, potential unacceptable risks were associated with direct exposures to several metals, explosives, VOCs, and PAHs in surface soil.

Surface soil COCs were selected based on a comparison of site surface soil concentrations to literature-based soil screening values and site-specific **background** concentrations (CH2M HILL, 2006a), the results of soil toxicity testing, and the results of food web modeling. A summary of site risks associated with ecological receptor exposure is provided in **Table 4**.

Soil-to-Groundwater Leaching

Site-specific **soil screening levels (SSLs)** were developed to evaluate COC concentrations in soil that are protective of the uppermost groundwater-bearing unit. The basis of the approach is that infiltrating precipitation leaches the contaminants from the soil and transports them into the aquifer, and the contaminants are then diluted by the lateral flow within the aquifer. The approach assumes that a hypothetical future groundwater user is present on the immediate downgradient boundary of the site. Potable groundwater use was assumed for the hypothetical future scenario for the Site 1 SSL evaluation. A qualitative summary of the continued potential site risks associated with the soil-to-groundwater leaching scenario for the ABG and OABG is provided in **Table 5A** and **Table 5B**, respectively.

Table 5A: Summary of Soil-to-Groundwater Leaching for the Active Burning Ground

Costituent of Concern	Upland (Active Burning Ground/ Former Disposal Pit)		Floodplain (Outside Active Burning Ground)	
	Surface Soil	Food Web	Surface Soil	Food Web
Volatile Organic Compounds				
1,1-DCE				X
PCE	X	X		X
TCE	X	X	X	X
Semivolatile Organic Compounds				
2-Nitroaniline	X			
Dioxin/furans				
2-Nitroaniline	X			
Explosives				
1,3,5-Trinitrobenzene	X			
NG	X	X		
RDX	X	X	X	X
Metals				
Antimony		X		
Cobalt	X	X	X	X
Iron	X	X	X	X
Lead	X	X		
Manganese	X	X	X	X
Nickel			X	

Notes:
Information summarized from the 2013 SRG Technical Memorandum (CH2M HILL, 2013b)
X – potential soil-to-groundwater leaching risk is present

Table 4: Ecological Risk Assessment Summary

Costituent of Concern	Upland (Active Burning Ground/ Former Disposal Pit)		Floodplain (Outside Active Burning Ground)	
	Surface Soil	Food Web	Surface Soil	Food Web
Volatile Organic Compounds				
1,2-DCE			X	
Methyl acetate			X	
TCE			X	
Semivolatile Organic Compounds				
2-Nitroaniline	X			
PAHs			X	
Dioxin/furans				
Total dioxin/furans (TEQ)				X
Explosives				
1,3,5-Trinitrobenzene	X			
HMX	X		X	
NG	X		X	
Perchlorate	X			
RDX	X		X	
Metals				
Cadmium			X	X
Chromium			X	
Copper	X		X	
Lead	X		X	X
Mercury	X		X	X
Nickel			X	
Silver			X	
Vanadium			X	
Zinc			X	X

Notes:
Information summarized from the 2006 focused RI
TEQ – toxic equivalency quotient
X – potential ecological risk is present

Table 3: Human Health Risk Assessment Summary

Receptor	Exposure Route		Reasonable Maximum Exposure				Central Tendancy Exposure			
	Cancer	Non-Cancer	Cancer Risk	Constituents of Concern**	Hazard Index	Constituents of Concern**	Cancer Risk	Constituents of Concern**	Hazard Index	Constituents of Concern**
Soil* – Former Disposal Pits										
Future Resident Child	N/A	Ingestion Dermal	N/A	N/A	**3.3**	TCE, iron and thallium	N/A	N/A	1.3	None (no target organ HIs exceed 1)
Future Resident Child/Adult	Ingestion Dermal Inhalation	N/A	**1.7E-04**	Dioxin, TCE, arsenic	N/A	N/A		Dioxin, TCE, arsenic		N/A
Future Construction Worker	Ingestion Dermal		6.6E-06	None	1.1	None (no target organ HIs exceed 1)	1.7E-06	None	0.25	None
Soil* – Outside Active Burning Ground										
Future Resident Adult	N/A	Ingestion Dermal	N/A	N/A	1.1	None (no target organ HIs exceed 1)	N/A	N/A	0.46	None
Future Resident Child	N/A	Ingestion Dermal	N/A	N/A	**8.9**	TCE, antimony, cadmium, copper, iron, lead (based on IEUBK model), thallium, and vanadium	N/A	N/A	3.7	Cadmium and vanadium
Future Resident Child/Adult	Ingestion Dermal Inhalation	N/A	**2.6E-04**	PCE, TCE, benzo(a) anthracene, benzo(a) pyrene, benzo(b) fluoranthene, dibenz(a,h)anthracene, indeno(1,2,3-cd)pyrene, dioxin, arsenic	N/A	N/A	8.2E-05	None	N/A	N/A
Future Construction Worker	Ingestion Dermal		9.6E-06	None	1.2	None (no target organ HIs exceed 1)	2.5E-06	None	0.63	N/A
Soil* – Active Burning Ground										
Future Resident Child	N/A	Ingestion Dermal Inhalation	N/A	N/A	**3.3**	Iron and thallium	N/A	N/A	1.1	None (no target organ HIs exceed 1)

Notes:
*Combined surface and subsurface soil
**COCs are the constituents of potential concern (COPCs) that contribute a cancer risk above $1x10^{-6}$ to a cumulative cancer risk above 10^{-4}, or a non-cancer hazard index (HI) above 0.1 to a cumulative target organ HI above 1.
Bold indicates a risk or hazard that exceeds the EPA's target level.
N/A – not applicable

What is Human Health Risk and How is it Calculated?

An 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 stepped 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 identify which chemicals may pose the greatest threat to human health (constituents 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** (for example, soil, air, groundwater, surface water, and/or 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 an 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.

In Step 4, is Risk Characterization, where the information developed in Steps 1 through 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 excess lifetime cancer risk of 1×10^{-4} is exceeded.
- For non-cancer health effects, a "hazard index" (HI) is calculated. The HI represents the sum of the ratios between the RME doses for a person contacting COPCs at the site and the "reference doses" for those COPCs, which is the dose at which no adverse health effects are expected to occur. The key concept here is that a "threshold level" (measured as an HI of 1) exists, below which no non-cancer health effects are expected to occur. The potential risks from the individual COPCs that affect the same target organ and exposure pathways are summed and a total target organ/effect site risk is calculated for each receptor. Potential unacceptable non-cancer health effects exist when a target organ HI exceeds 1.

What is Ecological Risk and How is it Calculated?

An ERA is conceptually similar to an HHRA 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 (that is, remedial action if unacceptable risks are identified, or no further action if risks are acceptable). The process can also be iterative if data needs are identified at any step; the needed data are collected and the process starts again at the point appropriate to the type of data collected.

An ERA has three principal components:

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

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

2. Risk Analysis that 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.

6. Remedial Action Objectives

The Navy, EPA, and WVDEP have concluded that remedial action is necessary to protect public health, welfare, and the environment from actual or threatened releases of hazardous substances in soil at Site 1. The COCs requiring remedial action are the risk drivers identified on **Table 2**. Site-specific **Remedial Action Objectives (RAOs)** are as follow:

- Prevent or minimize direct contact with soil COCs at concentrations above background that pose unacceptable risks to potential industrial workers, trespasser/visitor adolescents, construction workers, residents, and ecological receptors
- Prevent or minimize overland migration of COCs at concentrations above background to the North Branch Potomac River
- Prevent or minimize migration of COCs at concentrations above background from soil to groundwater, in order to enhance the ability of the groundwater remedy to restore the aquifers to beneficial use and prevent unacceptable risk from COCs discharging to the river
- Render area free of surficial debris (including partially exposed debris) from within the boundaries of the OABG
- Control erosion and riverbank scour to prevent subsurface debris from becoming exposed

To achieve the RAOs, SRGs were developed for constituents in soil (**Table 2**). The SRGs are based on potential risk to human and ecological receptors, and leaching potential into the groundwater. The SRGs for Site 1 soil were derived based on the lower of the human health and ecological risk-based PRGs, site-specific SSLs (as applicable), or facility-wide background concentration (as applicable). Through a statistical evaluation of site-wide soil concentrations in comparison to the SRGs, the COCs were refined to risk drivers and AOCs were identified for targeted remediation to mitigate unacceptable risk.

7. Summary of Remedial Alternatives

Remedial alternatives developed to address soil contamination in the ABG and the OABG were detailed in the FS report. The potential future scenarios for hypothetical residential receptors were evaluated in the 2006 focused RI but are not included in the remedial alternatives because the ABG is an active RCRA unit and land use is to remain industrial. Therefore, land use restrictions are a common element of each remedial alternative evaluated. Screening of remedial technologies identified two remedial alternatives in the ABG and three remedial alternatives in the OABG for detailed evaluation and comparative analysis, as shown in **Table 6**.

Details for each of the remedial alternative components are provided in **Table 7**.

In addition to the remedial alternatives for each component, a bank restoration component has been developed for the OABG, incorporating sustainable practices such as incorporating a natural floodplain and reducing resource consumption. The restoration will control erosion and riverbank scour to prevent subsurface debris from becoming exposed and help achieve the RAOs.

8. Evaluation of Remedial Alternatives

The NCP identifies the **nine evaluation criteria** for use in a comparative analysis of alternatives (**Table 8**). Each remedial alternative for Site 1 soil was evaluated against the threshold and primary balancing criteria during the FS, as illustrated in **Table 9A** and **Table 9B** for the ABG and OABG, respectively. Alternative 1 (no action) is required by the NCP and serves as the baseline against for both the ABG and OABG which the other alternatives were compared.

8.1 Active Burning Ground

Threshold Criteria

1) Overall Protection of Human Health and the Environment

Alternative 1 (no action) would not achieve RAOs and, therefore, because it failed a threshold criterion, was not evaluated further. Alternative 2 would be protective of human health and the environment by excavating contaminated soil from the AOCs and disposing it offsite. Alternative 2 also includes performance monitoring to confirm that the remedy is functioning and protective, and LUCs would be implemented and maintained to (1)