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PROPOSED REMEDIAL ACTION PLAN SITE 69 OPERABLE UNIT 14 (OU14) MCB CAMP LEJEUNE NC

8/1/2012

NAVFAC MIDLANT

Proposed Remedial Action Plan

Site 69; Operable Unit No. 14

Marine Corps Installations East - Marine Corps Base Camp Lejeune

North Carolina

August 2012

1 Introduction

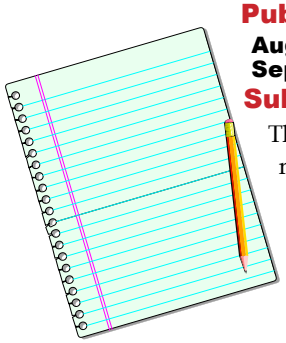
This **Proposed Remedial Action Plan (PRAP)** identifies the Preferred Alternative for addressing the waste disposal area and associated **soil** and **groundwater** contamination at **Site** 69: **Operable Unit (OU)** No. 14, located at Marine Corps Installations East—Marine Corps Base Camp Lejeune (MCIEAST - MCB CAMLEJ) in Onslow County, North Carolina. The site is also encompassed by Unexploded Ordnance Site 2 (UXO-02).

An interim **Record of Decision (ROD)** was issued in 2000, which included **land use controls (LUCs)** and **monitored natural attenuation (MNA)**. The current Preferred Alternative for Site 69 presented in this document includes **capping** with LUCs for the waste disposal area and associated soil and MNA and **long-term monitoring (LTM)** with LUCs for groundwater. This Preferred Alternative and forthcoming ROD will be the final decision document for this OU.

This PRAP is issued jointly by the United States (U.S.) Department of the Navy (Navy), the **lead agency** for site activities, MCIEAST - MCB CAMLEJ, and the **U.S. Environmental Protection Agency (EPA)**, in consultation with the **North Carolina Department of Environment and Natural Resources (NCDENR)**. It is issued in order to solicit public comments on the remedial alternatives, and in particular, the preferred **remedial action** for Site 69. This PRAP fulfills the public participation responsibilities 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).

This PRAP summarizes the remedial alternatives evaluated for Site 69. Detailed background information for Site 69 is contained in the **Supplemental Investigation (SI)** (CH2M HILL, 2011), the **Feasibility Study (FS)** (CH2M HILL, 2012), and other documents in the **Administrative Record** file and **Information Repository** for MCIEAST - MCB CAMLEJ. Draft documents, not included in the Administrative Record, are provided in hard copy at the Onslow County Library. Key information from the FS Report, including all remedial options considered and the rationale for

Mark Your Calendar for the Public Comment Period



Public Comment Period

August 16, 2012 through September 16, 2012

Submit Written Comments

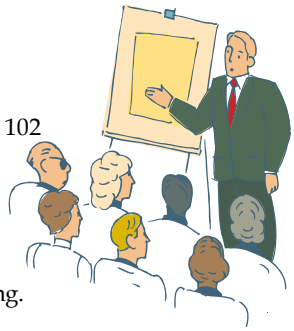
The Navy will accept written comments regarding the PRAP during the public comment period. To submit comments or obtain further information, please refer to the insert page.

Attend the Public Meeting

August 16, 2012, from 6:00 P.M.

Coastal Carolina Community College
Business Technology Building, Room 102
444 Western Blvd
Jacksonville, NC 28546

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



Location of Administrative Record Files

Available Online at: http://go.usa.gov/jZi

Internet access is available at the Onslow County Library:

58 Doris Avenue East
Jacksonville, NC 28540
(910) 455-7350

selection of Capping, MNA, and LUCs as the preferred remedies for Site 69, is summarized in this PRAP. A glossary of key terms used in this PRAP is attached, and the terms are identified in bold print the first time they appear.

The Navy, MCIEAST - MCB CAMLEJ, and the EPA, in concurrence with NCDENR, will make the final decision on the remedial approach for Site 69 after reviewing and considering all information submitted during the 30-day **public comment period**. The Navy and MCIEAST - MCB CAMLEJ, along with the EPA, may modify the Preferred Alternative based on new information or public comment. Therefore, public comment on the Preferred Alternative is invited and encouraged. Information on how to participate in this decision making process is presented in Section 10. A ROD will then be prepared to document the Selected Remedy for Site 69.

2 Site Background

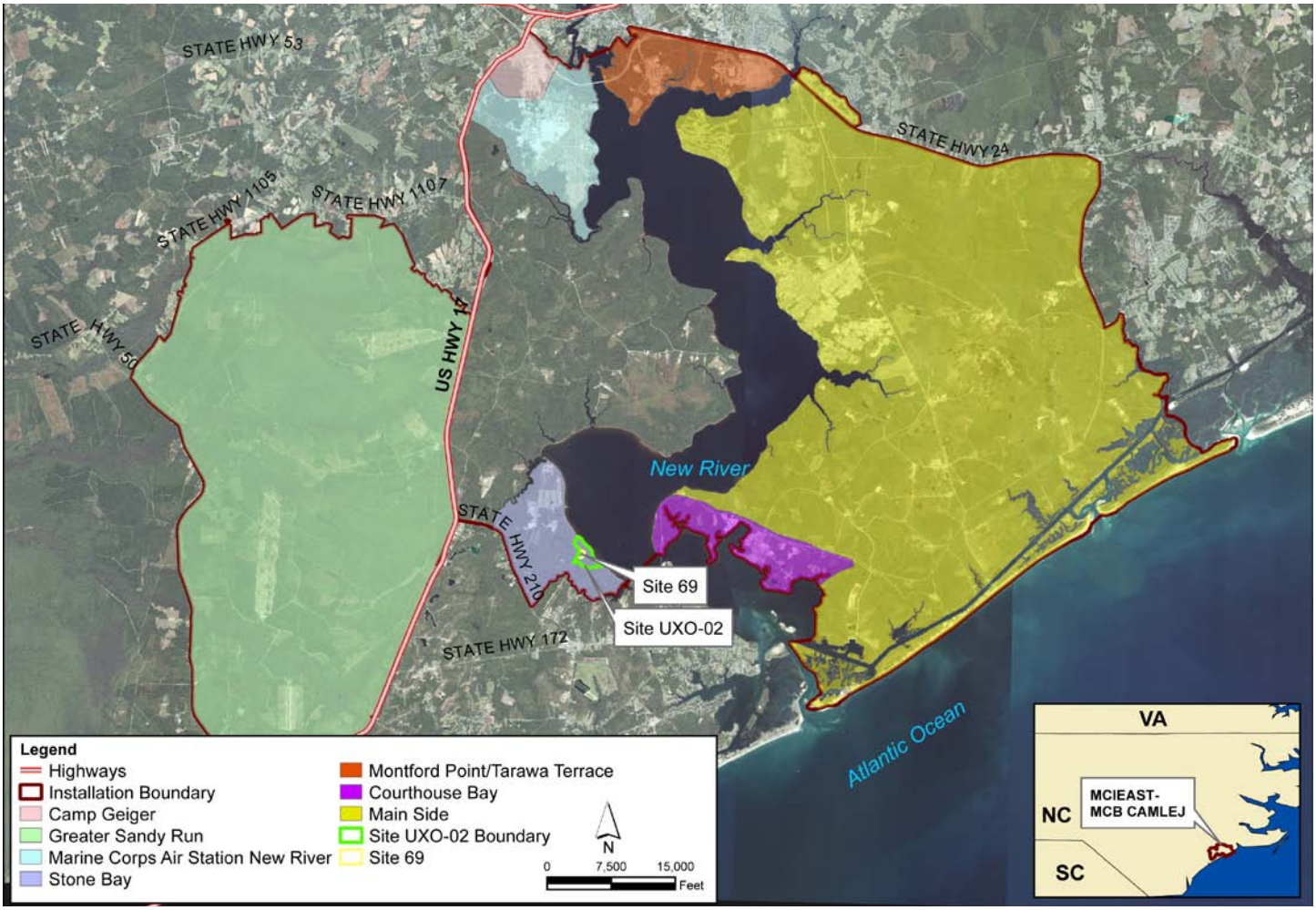
MCIEAST - MCB CAMLEJ is a 156,000-acre facility located in Jacksonville, North Carolina, within Onslow County (Figure 1). The mission of MCIEAST - MCB CAMLEJ is to maintain combat-ready units for expeditionary deployment. The Base provides housing, training facilities, and logistical support for Fleet Marine Force Units and other assigned units.

2.1 Site Description and Background

Site 69, the Rifle Range Chemical Dump, is located within OU No. 14, west of the New River in the Stone Bay area of MCIEAST - MCB CAMLEJ (Figure 2). Site 69 encompasses approximately 14 acres and is covered with vegetation and heavily wooded with primarily pine, dogwood, and oak trees. The site is secluded and unoccupied; however, training exercises are periodically conducted throughout the surrounding area.

From 1950 to 1976, Site 69 was reportedly used to dispose of chemical wastes that included **polychlorinated biphenyls (PCBs)**, solvents, and pesticides. Based on available documentation, Site 69 may also have a history of **chemical agent (CA)** disposal. CA detector kits were observed during a 1982 site visit, but formal documentation of disposal methods, particularly related to CA, is unavailable. In 1982, an interview with a former heavy equipment operator indicated that drums of what was possibly nerve or mustard agent were buried in trenches at Site 69. A disposal incident occurred in 1953 or 1954, when approximately 50 to 60 drums of suspected agent were reportedly delivered to the site on rubber-padded trucks and

Figure 1: Base and Site Location Map



disposed of in two trenches, each approximately 20 feet deep. The unmarked drums were light-blue or blue-green in color and were stacked in the trenches so that the top layer of the drums was approximately 5 or 6 feet below ground surface (bgs). According to historical documentation detailed in the SI, a second disposal incident occurred in 1970 when 5-gallon cans and 55-gallon drums of dichlorodiphenyltrichloroethane (DDT), trichloroethene (TCE), and calcium hypochlorite were placed together in a common pit. As soil was being placed over the containers, an explosion occurred, resulting in a brush fire and the ejection of drums to as far as 120 feet from the pit.

The **source** area at Site 69 appears to be this former waste disposal area. The primary contaminants in groundwater at Site 69 are **chlorinated volatile organic compounds (CVOCs)**. The continued presence of buried waste at the site suggests that soil within the waste disposal area is contaminated as well.

2.2 Summary of Previous Investigations and Actions

Site 69 was characterized under numerous investigations between 1981 and the present. Table 1 presents a chronological list of those studies and actions taken to address site contamination. The **conceptual site model (CSM)**, presented on Figure 3, shows the extent of contamination based on the findings of previous investigations and the location of the waste disposal area.

3 Site Characteristics

Site 69 is located in a wooded area and enclosed by a 6-foot-high chain-link fence to prevent site access. The area is overgrown to the point that the boundary of the former dump is not easily discernable. Within the fence, evidence of trench disposal activities is present in the form of shallow, elongated surface depressions and slumping associated with settlement. The surface and outer perimeter of Site 69 is unpaved, although there is a dirt road leading to the site and around the perimeter fence.

Site 69 consists of wooded land that occupies the crest of a low-lying, west-east trending ridge that gently slopes toward the east and the New River. Ground surface elevations range from 20 to 38 feet above mean sea level, and drainage features to the northeast and southeast of Site 69 convey surface water to the New River. Three surface water bodies lie within a quarter-mile of the site: the New River to the east, an unnamed tributary of the New River to the north, and Everett Creek to the south. Also, the wooded areas east of the site boundary are bisected by numerous small streams and drainage features. Ground-

Figure 2: Site Map

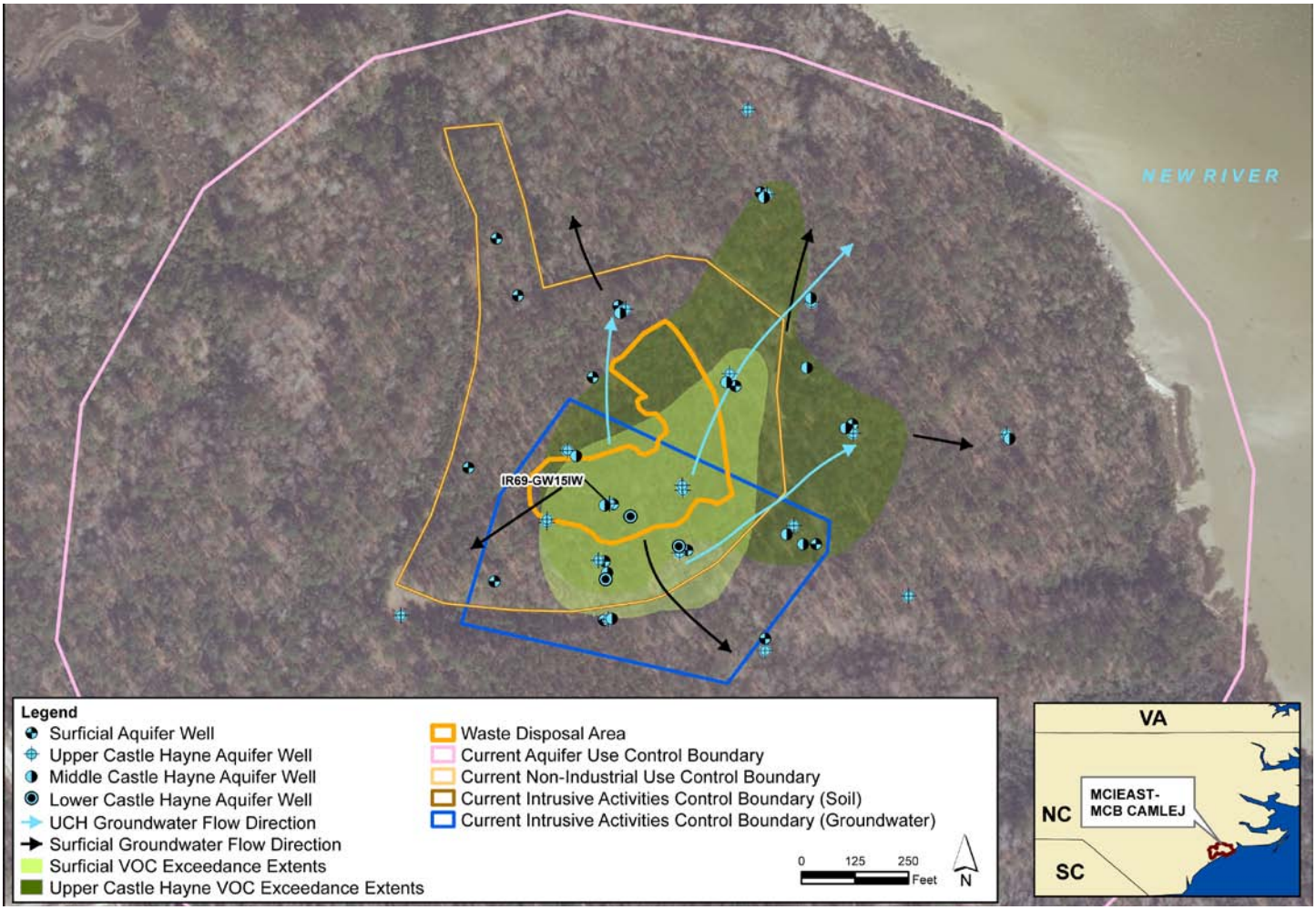
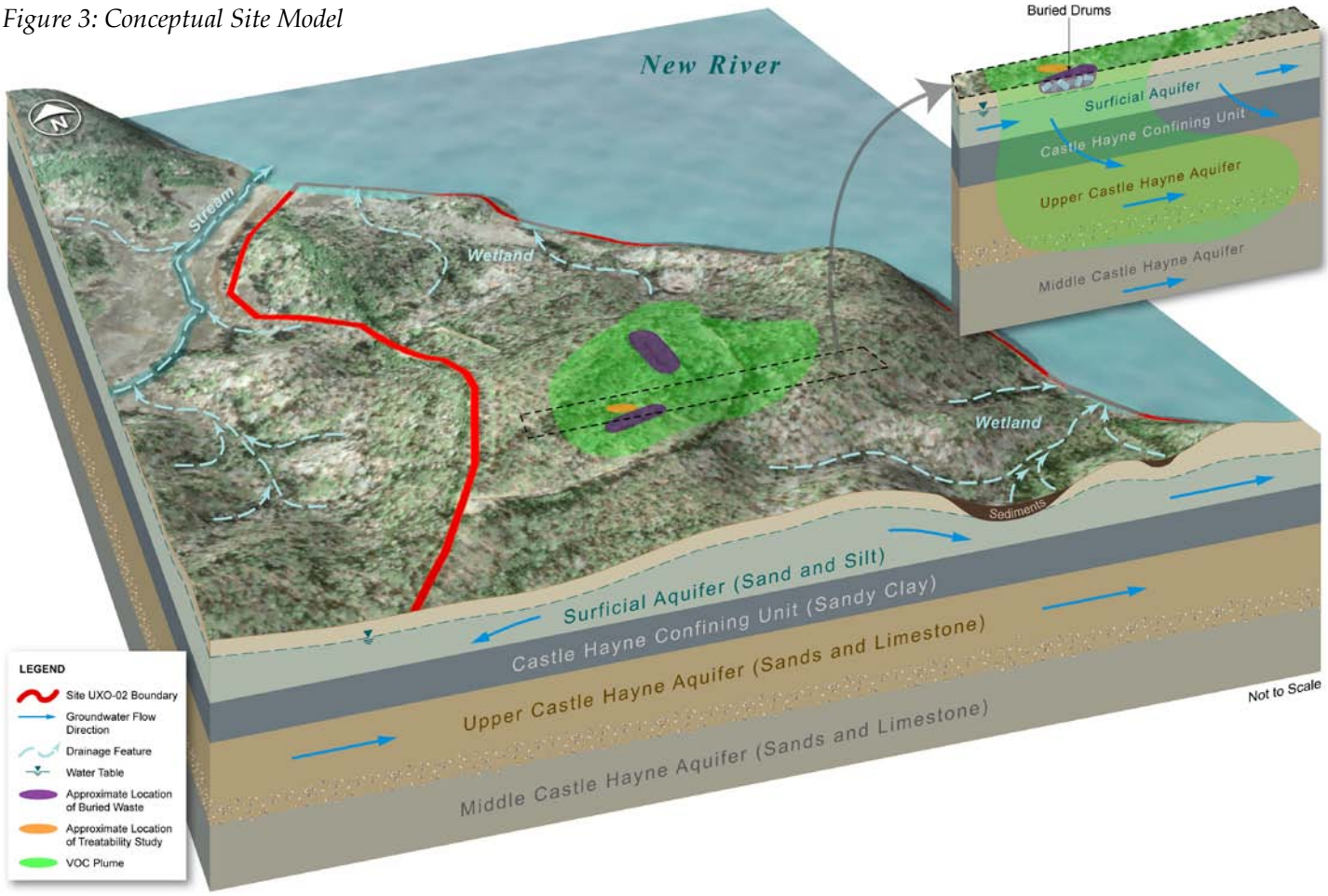


Table 1 - Previous Investigations and Actions

Previous Investigation/Action*	Administrative Record Number	Dates	Activities and Findings
Rifle Range Wastewater Treatment Plant and Chemical Dump Sampling (Navy, 1981;1982)	000376, 000373	1981-1982	Representative samples were collected from surrounding water supply wells, existing monitoring wells, and **surface water**. Analytical results indicated CVOCs and trihalomethanes were present in groundwater.
Initial Assessment Study (WAR, 1983)	000377	1983	Identified the Rifle Range Chemical Dump (Site 69) as a priority site for further investigation because of historical disposal activities at the site.
Confirmation Study (Environmental Science & Engineering, 1992)	000273	1984-1991	Surficial groundwater, surface water, sediment, and shellfish samples were collected. Analytical results indicated that **volatile organic compounds (VOCs)** including TCE, trans-1,2-dichloroethene (DCE), and vinyl chloride (VC) were present in groundwater in the southern portion of the site and in the surface water.
Remedial Investigation (RI) (Baker, 1997)	001761-001763	1992-1996	Conducted a **geophysical investigation** near suspected disposal trenches and monitoring well cluster IR69-GW02, confirming their location. Collected surface soil, subsurface soil, surface water, sediment, and groundwater (surficial, upper Castle Hayne, middle Castle Hayne, and lower Castle Hayne **aquifers**) samples. Analytical results indicated VOCs were present above **North Carolina Groundwater Quality Standards (NCGWQS)** in the surficial, upper, and middle Castle Hayne aquifers in the southern portion of the site, with the highest concentrations in the vicinity of monitoring well IR69-GW15.
Treatability Study (TS) (Baker/SBP, 1998)	001792	1996-1997	Installed vacuum vaporizer well (UVB) and coaxial groundwater ventilation (KGB) treatment systems to evaluate these technologies as potential remedial alternatives. The UVB system was successful in reducing concentrations in the treatment well but not widespread, and the KGB system failed to operate and perform consistently.
FS (Baker, 1998)	002308	1997 1990s	Analyzed remedial alternatives, including no action, institutional LUCs for soil and no action, LUCs and **natural attenuation (NA)**, groundwater extraction and physical treatment, dual-phase vacuum extraction, and in-situ air stripping for groundwater. Soil and waste **removal** was determined not to be a viable option because of cost, safety, and logistical issues associated with the potential CA buried in the disposal trenches. Installed a 6-foot-high chain-link fence around the site to prevent unauthorized access.
Interim Record of Decision (IROD) (Baker, 2000)	003005	2000	Selected interim remedy for soil was institutional LUCs. Selected interim remedy for groundwater was institutional aquifer use controls and MNA. Remedy included 5 years of quarterly sampling for 24 monitoring wells screened in all aquifer zones, followed by 25 years of semi-annual sampling of 12 monitoring wells to be selected based on quarterly sampling results.
LTM (Engineering and Environment, Inc., 2005)	003911	1998-2005	Collected groundwater samples from monitoring wells in the surficial, upper Castle Hayne, and middle Castle Hayne aquifers. Analytical results indicated that vertical migration of VOCs into the upper Castle Hayne aquifer was occurring. In 2005, the LTM Program was optimized and the LTM optimization report (AGVIQ/CH2M HILL, 2005) recommended removal of Site 69 from the program because an SI was planned.
SI (CH2M HILL, 2011)	004729	2010-2011	Collected surface soil, subsurface soil, surface water, sediment, and groundwater samples to complete the delineation of site contamination to support a final ROD. The current and historical investigative activities have consistently avoided characterization of the actual waste disposal areas because of the potential presence of CA. As a result, empirical data are not available for the soil or waste material present in this area. Monitoring and screening for CA was provided by **Edgewood Chemical Biological Center**. Analytical results from soil samples collected outside the waste disposal area indicated concentrations of pesticides and metals in surface soil and metals in subsurface soil exceeding risk screening criteria; metals in surface water exceeding **North Carolina Surface Water Quality Standards (NCSWQS)**; VOCs, **semivolatile organic compounds (SVOCs)**, pesticides, and metals in sediment exceeding risk screening criteria; and VOCs, pesticides, PCBs, and metals in groundwater exceeding NCGWQS. Concentrations of cis-1,2-DCE in the upper Castle Hayne indicated the presence of a continuous source area and potential **dense non-aqueous phase liquid (DNAPL)**. Additional investigation of the potential risks for surface water, sediment, and metals in groundwater was recommended as part of the UXO-02 investigation activities.
UXO-02 Expanded Site Investigation (CH2M HILL, 2012)	Draft	2011-2012	Further investigated select pesticides in surface soil and sediment and metals in groundwater outside of the Site 69 fence. The **Human Health Risk Assessment (HHRA)** and **Ecological Risk Assessment (ERA)** identified no unacceptable human health or ecological risks in soil, surface water, sediment, or metals in surficial groundwater. Unacceptable risks were not identified from exposure to munitions and explosives of concern (MEC) and munitions constituents (MC). **No Further Action (NFA)** is recommended for the portions of UXO-02 located outside of the Site 69 fence, and the Site 69 ROD will document site closure for the UXO-02 area.
FS (CH2M HILL, 2012)	004788	2011-2012	Assessed the following remedial alternatives for buried wastes and associated soil and groundwater: Waste Alternatives: (1) No action, (2) LUCs, (3) Capping with LUCs, (4) Removal Groundwater Alternatives: (1) No action, (2) MNA/ LTM with LUCs, (3) **permeable reactive barrier (PRB)** with MNA/ LTM and LUCs, (4) **enhanced reductive dechlorination (ERD) with bioaugmentation**, MNA/LTM and LUCs, (5) **in situ chemical oxidation (ISCO)** with MNA/LTM and LUCs

***Documents listed are available in the Administrative Record and provide detailed information to support remedy selection at Site 69.**

Figure 3: Conceptual Site Model



water investigations completed at Site 69 have focused on the surficial and underlying Castle Hayne aquifers. For the purposes of this PRAP, the aquifers have been designated as four zones: surficial aquifer, upper Castle Hayne aquifer, middle Castle Hayne aquifer, and the lower Castle Hayne aquifer. LUCs are in place to prevent soil intrusive activities and control exposure to waste and soil that could result in unacceptable risks. Site access is restricted by a locked gate, surficial groundwater is not used as a potable source, and LUCs prevent intrusive activities within the waste disposal area. These measures prevent exposure to the material but do not reduce mobility.

Potable water for MCIEAST - MCB CAMLEJ and the surrounding residential area is provided by public water supply wells that pump groundwater from the Castle Hayne aquifer. Regionally in southeastern North Carolina, the Castle Hayne aquifer may be used as a potable source of domestic water supply, watering lawns, or filling swimming pools. The closest active water supply wells on the Base are located more than 2 miles from Site 69 and across the New River.

3.1 Nature and Extent of Contamination

Soil

The historical investigative activities have consistently avoided characterization of the actual waste disposal areas due to the potential presence of CA. LUCs have been implemented at the site to prevent current and future exposure to contaminated **media** and waste. As a result, empirical data are not available for the soil or waste material present in this area, but the concentrations of **constituents of concern (COCs)** in groundwater samples collected from IR69-GW15IW, installed through the waste material, which are two to three orders of magnitude greater than the groundwater in all surrounding monitoring wells, and the continued presence of buried waste at the site suggests that soil within the waste disposal area is contaminated, as illustrated on Figure 3. Based on historical documentation and groundwater analytical data, the waste disposal area likely contains buried drums of PCBs, chlorinated solvents, pesticides and potentially contains drums of CA. The soil within the waste disposal area is likely contaminated with these constituents as a result of drum leakage.

Depending on the concentrations of hazardous constituents in the waste disposal area and associated soil, such soil and waste could be considered RCRA hazardous waste or Toxic Substance Control Act PCB waste if removed from the landfill.

Groundwater

In 2010 and 2011, 49 permanent monitoring wells were sampled for VOCs, SVOCs, PCBs, pesticides, metals, CA, and **CA degradation products**.

Groundwater in the surficial and upper Castle Hayne aquifers is primarily affected by two types of CVOCs; chlorinated ethanes (1,1,2,2- tetrachloroethane [PCA], 1,1,2-trichloroethane [TCA], and 1,2- dichloroethane [DCA]) and chlorinated ethenes (TCE, cis- and trans-1,2-DCE, and VC).

Exceedances in the surficial aquifer were reported for samples collected from the south-central portion of Site 69. In the upper Castle Hayne aquifer, the greatest concentrations were also detected in samples collected in the south-central portion of Site 69, in the vicinity of the greatest density of **geophysical anomalies**, with concentrations decreasing in samples collected from **downgradient** monitoring wells located northeast and east. CVOCs were more prevalent and detected at higher concentrations in samples collected from upper Castle Hayne aquifer wells than those from surficial aquifer wells. The concentrations of all CVOCs reported in the sample collected from IR69-GW15IW, installed through the buried waste material, were at least 2 to 3 orders of magnitude higher than all other samples collected from the upper Castle Hayne aquifer. Figure 2 shows the horizontal extents of the CVOCs through the surficial aquifer.

The greatest concentrations of pesticides and metals exceeding NCGWQS in the surficial aquifer and upper Castle Hayne aquifer were also reported in samples collected from monitoring wells located in the south-central portion of Site 69. PCBs were detected one surficial aquifer monitoring well, and chromium exceeded the NCGWQS in a sample collected from the upper Castle Hayne aquifer east of the site. Concentrations of metals that exceeded twice the mean Base background concentrations and NCGWQS were detected in all aquifers.

3.2 Fate and Transport of Contamination

The primary contaminant migration pathway is through groundwater flow in the surficial, upper Castle Hayne, and middle Castle Hayne aquifers. Infiltrating water generally reaches the water table at approximately 4 to 10 feet bgs and enters the surficial aquifer. Groundwater migrates horizontally downgradient toward the New River and vertically into the upper Castle Hayne aquifer. The Castle Hayne **confining unit** is only semi-confining in the Site 69 area, allowing some downward migration of groundwater. Contaminants are leached from the buried waste material and transported into the underlying aquifers. Groundwater flow in the surficial aquifer is radially outward from the source area and follows the site topography to surface water features to the north, east, and south of the site. Groundwater flow in the upper and middle Castle Hayne aquifer is east and northeast towards the New River. Vertical migration of COCs is evidenced by detected concentrations in samples from downgradient monitoring wells screened in deeper aquifers. There is also a downward vertical gradient between the surficial and Castle Hayne aquifers. The New River is located downgradient of the eastern boundary of Site 69 and is the ultimate **receptor** for surface water and groundwater discharge from the site. Surface water and sediment at Site 69 were investigated during the Confirmation Study, RI, and SI. The surface water and sediment investigated as part of Site 69 consist of the drainage areas northeast, east, and southeast of the site. Current (2010) analytical data for surface water indicates that lead, selenium, silver, thallium, and zinc are present in surface water at concentrations that exceed applicable screening values. The contaminant concentrations were generally within one order of magnitude of the most conservative screening value or background concentration.

The most prevalent site-related constituents are VOCs in groundwater. SVOCs, pesticides, and PCBs were detected infrequently at low concentrations relative to screening values, and are less mobile in the environment than VOCs. Metals may be more mobile in shallow groundwater; however, analytical results indicate that metals exceedances are generally confined to the source area. **Groundwater modeling** has shown that the New River will not be impacted at the discharge point. The model predicts that each **plume** (defined as groundwater concentrations exceeding NCGWQS) will remain relatively stable over the 100-year predicted period. This 100-year time frame is a factor of a continuing source. VC concentrations were predicted to exceed NCGWQS (0.03 µg/L) throughout the aquifer in all future models (2020 to 2110). However, the dissolved phase (degradation) contaminants are at lower concentrations and will not exceed the NCSWQS at discharge. VC concentrations are predicted to remain below the NCSWQS (2.4 µg/L) at the discharge point to the New River. Concentrations of TCE and cis-1,2-DCE are not predicted to exceed NCSWQS (30 µ/L for TCE; no criterion was available for cis-1,2-DCE).

The potential efficacy of MNA as a remedial alternative was evaluated with a three-tiered approach per EPA guidance *Use of Monitored Natural Attenuation at Superfund, RCRA Corrective Action, and Underground Storage Tank Sites*. Analysis of CVOCs and **natural attenuation indicator parameters (NAIPs)** indicated that NA is currently occurring in the surficial, upper Castle Hayne, and middle Castle Hayne aquifers. Conditions are limited to somewhat favorable for NA processes in the surficial aquifer and the upper Castle Hayne aquifer and limited in the middle Castle Hayne aquifer. The more-favorable indicators were observed within the higher concentration areas of the groundwater plumes. Historical data trends from samples collected from monitoring well IR69-GW02 show an overall decrease in TCE and DCE and an increase in VC, which is strongly supportive of reductive dechlorination. VC may currently be on a decreasing trend in this well. The limited presence of ethane is evidence that full reductive dechlorination can occur. Due to the somewhat aerobic nature of the surficial aquifer, the lack of additional ethene or ethane detections is likely the result of oxidation of VC

to carbon dioxide and other innocuous products. Microbial analysis conducted in the upper Castle Hayne and middle Castle Hayne aquifers provided further evidence of favorable conditions for NA, that the appropriate microorganisms were present in groundwater, and that their population sizes were elevated within the groundwater plumes.

3.3 Principal Threats

"Principal threat wastes" are source materials considered to be highly toxic or highly mobile that generally cannot be reliably contained or would present a significant risk to human health or the environment should they be exposed. As described in the EPA's *Guide to Principal Threat and Low-level Threat Waste* (EPA OSWER Pub.9380.3-06FS, Nov. 1991), liquids (e.g., in buried drums), NAPL, and/or high-concentrations of toxic compounds in soils are considered PTW. Contaminated groundwater generally is not considered to be a source material; however, **Non–Aqueous Phase Liquids (NAPLs)** in groundwater may be viewed as a source material. Dissolved concentrations of COCs in groundwater at approximately 1 to 5 percent of a compound's solubility could suggest the presence of DNAPL in the subsurface. The maximum concentration of cis-1,2-DCE in the upper Castle Hayne aquifer was identified at approximately 1.5 percent of the compounds' solubility, suggesting that DNAPL may be present within or below the waste disposal area.

Other principal threat wastes include buried waste and potentially contaminated subsurface soils that are a source of groundwater contamination. Additionally, the waste is in place and includes the potential presence of CA. CA is considered a principal threat waste because it is highly toxic and potentially fatal should exposure occur. In 1993, the EPA established source containment as the **presumptive remedy** for municipal landfills regulated under CERCLA. EPA guidance developed in 1996 indicated that military landfills regulated under CERCLA should also consider the source containment (including hydraulic isolation) presumptive remedy approach (EPA, 1996). However, as detailed in the NCP at 40 CFR 300.430(a)(1)(iii), EPA expects to use active treatment to address the principal threat wastes posed by a site, wherever practicable.

4 Scope and Role of Response Action

MCIEAST - MCB CAMLEJ was placed on the EPA's National Priorities List (NPL) effective November 4, 1989 (54 Federal Register 41015, October 4, 1989), under the narrative "Camp Lejeune Military Reservation (USNAVY)" and EPA ID# NC6170022580. There are 25 discrete OUs under CERCLA investigation at MCIEAST - MCB CAMLEJ. OU No. 14 consists of Site 69 and is one of several OUs in the **Installation Restoration Program (IRP)**. UXO-02 encompasses Site 69. In the Draft UXO 02 Expanded Site Investigation (CH2M HILL, 2012), NFA was recommended for the portions of UXO-02 located outside of the Site 69 fence.

In June 2000, an IROD was issued to address the human health and ecological risks posed by VOCs in groundwater and safety risks from the potential presence of buried CA. The IROD incorporated a site-specific Land Use Control Implementation Plan (LUCIP) for Site 69 in accordance with the Memorandum of Agreement dated May 24, 1999, known as the LUC Assurance Plan. An IROD, rather than a final ROD, was executed because of the reported presence of CA at the site. Based on discussions with the Design Center for Ordnance and Explosives Team of the U.S. Army Corps of Engineers (USACE), the unearthing of CA would require indefinite storage somewhere on-Base pending final disposition. At the time of the IROD, disposal alternatives for such materials were not readily available.

The final ROD for Site 69 will incorporate and update the LUCs specified in the IROD and document site closure for the UXO-02 area. Information on the status of all the OUs and sites at MCIEAST - MCB CAMLEJ can be found in the current version of the Site Management Plan, in the Administrative Record.

5 Summary of Site Risks

As part of the 2010 SI an HHRA and ERA were conducted to evaluate risks to human health and the environment from chemicals detected at Site 69. Risk assessments were also conducted as part of the UXO-02 Expanded SI to further evaluate potential risk and confirm no changes to the conclusions. The following subsections and Table 4 summarize the risk assessment results.

Table 2 – Site 69 Risk Summary

Media	Human Health Risk	Ecological Risk
Surface/Subsurface Soil Outside of Waste	Acceptable	Acceptable
Waste and Associated Soil	Unacceptable	Unacceptable
Groundwater	Unacceptable	Acceptable*
Sediment	Acceptable	Acceptable
Surface Water	Acceptable	Acceptable
Potential Indoor Air	Unacceptable	Not Applicable

*Groundwater was evaluated assuming it may discharge to surface water. Evaluation of the available groundwater and surface water data indicated that this pathway was insignificant.

5.1 Human Health Risk Summary

The HHRA was completed as part of the 2010 SI for Site 69 and 2012 Expanded SI for UXO-02 to evaluate the potential impact of COCs on human health now and in the future. Human health risks are assumed to be present as the result of waste materials and associated soil present in the waste disposal area at Site 69; however, LUCs currently prevent any current or future exposure to this area. As a result, these areas were not included in the HHRA. The exposure scenarios evaluated included exposure to soil outside the waste disposal area, surface water, and sediment for current receptors; and exposure to soil outside the waste disposal area, groundwater, surface water, and sediment for future receptors.

The preliminary human health risk-based screening indicated the potential for risks associated with exposure to aluminum, antimony, arsenic, chromium, iron, manganese, and vanadium in groundwater. Based on the evaluation of available data, the results of the HHRA and additional considerations indicate that there are no unacceptable risks to human health associated with metals in groundwater, or contact with surface soil, surface water, and sediment. Per the Site 69 SI, unacceptable risks remain associated with potable use of groundwater, primarily due to the concentrations of CVOCs in the surficial and Castle Hayne aquifers associated with the Site 69 waste disposal area.

Health risks are based on a conservative estimate of the potential **cancer risk** or the potential to cause other health effects not related to cancer (non-cancer hazard, or **hazard index [HI]**). EPA identifies an acceptable cancer risk range of 1 in 10,000 (10^{-4}) to 1 in 1,000,000 (10^{-6}) and an acceptable non-cancer hazard as an HI of less than 1. The estimates of risk at Site 69 were used to determine if any further actions were required to sufficiently protect human health. The HHRA concluded:

- Because the site is fenced and access is restricted, there is no unacceptable risk to human health based on current site use.
- Unacceptable risks from exposure to waste and soil are assumed to be present as result of materials present in the disposal trenches and burial pits.
- The future use scenario indicated there would be an unacceptable risk from exposure to groundwater including CVOCs in the surficial aquifer and CVOCs, pesticides/PCBs, and metals in the surficial and upper Castle Hayne aquifers.
- Risks associated with current and future receptor contact with surface water, sediment, and soils outside the waste disposal area were below EPA target levels.
- There is a potential risk to future receptors from exposure to CVOCs in indoor air if the vapor intrusion pathway is completed by constructing buildings within Site 69 or within 100 feet of the groundwater plume.

LUCs are currently in place to prevent the exposure to waste and associated soil and groundwater.

5.2 Ecological Risk Summary

The ERA was conducted as part of the 2010 SI to evaluate potential risks to ecological receptors from exposure to soil outside the waste area, surface water, sediment, and groundwater. Potential ecological risk from pesticides in surface soil and sediment was further evaluated as part of the Step 3b refinement completed during the development of the UXO-02 Expanded SI.

Risk was estimated by calculating **hazard quotients (HQs)** using the concentration of each contaminant in applicable media (soil, sediment, surface water, and groundwater) and dividing by an ecological screening value (ESV). Contaminants were retained for further assessment if the HQ was greater than 1 (the concentration exceeded the ESV), the contaminant was detected but did not have an ESV, or the contaminant was not detected but the reporting limit was greater than the ESV. The list of COCs was further refined using a weight-of-evidence approach that considered spatial and temporal distribution of analytical results, the general ecological setting and health of the ecosystems, and food chain modeling.

Based on the multiple ERA efforts, conclusions are as follows:

- Ecological risks are assumed to be present as a result of waste materials and the associated soil present in the disposal trenches and burial pits at Site 69.
- No unacceptable ecological risks were identified from potential exposure to soil, surface water, sediment, or groundwater in areas outside of the disposal trenches at burial pits at Site 69.

6 Remedial Action Objectives

The role of the Preferred Alternative presented in this PRAP is to address the unacceptable risks posed by Site 69 and to eliminate current exposure pathways that may pose unacceptable human health risk. It is the current judgment of the Navy, MCIEAST - MCB CAMLEJ, and EPA, in concurrence with NCDENR, that the Preferred Alternatives identified in this PRAP, or one of the other active measures considered in the PRAP, is necessary to protect public health or welfare of the environment from actual or threatened releases of hazardous substances in to the environment.

In order to be protective of human health and the environment and address potential future risks identified in the HHRA, the **Remedial Action Objectives (RAOs)** identified for Site 69 are as follows:

1. Restore groundwater quality to meet NCDENR and federal primary drinking water standards based on the classification of the aquifer as a potential source of drinking water [Class GA or Class GSA] under 15A North Carolina Administrative Code (NCAC) 02L.0201.

2. Minimize exposure to potential CA and chemical waste to the maximum extent practicable.

3. Reduce infiltration and leaching of contaminants from waste into groundwater to the maximum extent practicable.

4. Prevent exposure to buried waste and associated soil and groundwater until concentrations meet levels that allow for unlimited use and unrestricted exposure.

5. Minimize potential degradation of the New River by COC affected groundwater.

Cleanup levels were developed for COCs contributing to unacceptable risks and hazards from exposure to groundwater Site 69; see Table 3. The cleanup levels for groundwater are based on the more stringent of the NCGWQS or Federal Maximum Contaminant Level (MCL). The cleanup levels for the COCs listed below in Table 4 are based upon chemical-specific **Applicable or Relevant and Appropriate Requirements (ARARs)**.

Table 3 – Groundwater Cleanup Levels

COCs	NCGWQS/MCL* (µg/L)
VOCs	
1,1,2,2-PCA	0.2
1,1,2-TCA	5
1,2- DCA	0.4
cis-1,2-DCE	70
TCE	3
trans-1,2-DCE	100
VC	0.03
Pesticides/PCBs	
Alpha-BHC	0.02
Aroclor-1260	0.5
Dieldrin	0.002
Heptachlor epoxide	0.004
Metals	
Chromium	10
Thallium	2

*NCGWQS or MCL, whichever is more conservative

7 Summary of Remedial Alternatives

The remedial alternatives that were developed and evaluated to address the waste disposal area and associated soil and groundwater contamination at Site 69 are detailed in the FS. A summary of remedial alternatives is presented in Tables 4 and 5.

With the exception of the No Action alternatives for the waste disposal area and groundwater and Waste Disposal Area Alternative 2 (LUCs), all alternatives comply with ARARs and have the same RAOs, expected outcomes, and anticipated future land uses. However, if Waste Disposal Area Alternative 4 (Removal) were chosen, it would allow for additional future land uses and also meets the EPA's preference for treatment of principal threat wastes. The No Action alternatives do not protect human health and the environment, but are presented as a baseline for comparison purposes.

8 Evaluation of Alternatives

The NCP outlines the approach for comparing remedial alternatives using the **Nine Evaluation Criteria** listed as follows (see the Glossary for a detailed description of each). Each remedial alternative for Site 69 was evaluated against these criteria. A summary of the comparative analysis of the alternatives is presented in the following subsections and in Tables 6 and 7. The waste disposal area and groundwater No Action alternatives do not meet the RAOs and were not considered further.

8.1 Threshold Criteria

Overall Protection of Human Health and the Environment

Waste Disposal Area

Alternative 2 (LUCs) would not be protective of ecological receptors and is not considered further.

Alternatives 3 (Capping) and 4 (Removal) are suitable for addressing buried waste and associated soil for the reduction of risk to human and ecological risk receptors. They also provide an active approach to meet the RAOs. Alternative 3 is the most protective of human health and the environment, as it controls the exposure to the buried waste and minimizes leaching of contaminants to groundwater. Alternative 4 will present significant short-term risk to the human health and the environment from the excavation and offsite transportation and disposal of waste.

Capping is the presumptive remedy for landfill sites, except that when principal threat wastes are present the EPA expects treatment or removal of such source materials to the maximum extent possible.

Alternative 3 (Capping) does not meet EPA's preference for treatment or removal but does provide an impermeable cover which provides hydraulic isolation to reduce further migration of the principal threat waste. Hydraulic isolation, as part of a containment remedy, is also an acceptable alternative to the EPA. While Alternative 4 (Removal) meets EPA's preference for the removal of the principal threat waste, the risk associated with the

Table 4 - Description of Remedial Alternatives - Waste Disposal Area

Alternative	Components	Details	Cost
1 – No Action	None	None	Total Cost: $0 Timeframe: Indefinite
2 – LUCs	LUCs	LUCs to prevent exposure to waste and associated soil within the waste disposal area.	Capital cost: $13,500 Total Operations and Maintenance (O&M) cost: $32,500 Total present value cost: $46,000 Timeframe: 30 years
3 – Capping	Cap LUCs MNA/LTM	Construction of a multilayer cap to contain and immobilize contaminants and provide a barrier to receptors. LUCs to prevent exposure to waste and associated soil within the waste disposal area. Monitor performance of cap by sampling downgradient groundwater. Performance monitoring is included as part of the MNA/LTM groundwater alternative below.	Capital cost: $4,992,000 Total O&M cost: $521,000 Total present value cost: $5,513,000 Timeframe: 30 years
4 – Removal	Excavation and Disposal	Removal of the buried waste and associated soil from the waste disposal area and disposal of the materials at an approved facility.	Capital cost: $24,502,000 Total present value cost: $24,502,000 Timeframe: 1 year

Table 5 - Description of Remedial Alternatives –Groundwater

Alternative	Components	Details	Cost
1 – No Action	None	None	Total Cost: $0 Timeframe: Indefinite
2 – MNA/LTM	MNA/LTM LUCs	MNA/LTM and reporting to evaluate: - Progress of NA over time. - Potential impacts to surface water. - Plume stability. LUCs to prevent exposure to groundwater and aquifer use.	Capital cost: $22,000 Total O&M cost: $935,000 Total present value cost: $957,000 Timeframe: 30 years
3 – PRB	PRB Performance monitoring MNA/LTM/LUCs LUCs	Installation of a PRB constructed with zero valent iron (ZVI) to promote biodegradation through physical, chemical, or biological processes. Semi-annual groundwater monitoring for first 3 years to evaluate effectiveness of barrier. MNA/LTM and reporting to evaluate: -Continued effectiveness of the PRB -Potential impacts to surface water -Progress of NA over time -Potential migration to the deep aquifer LUCs to prevent exposure to groundwater and aquifer use.	Capital cost: $5,100,000 Total O&M cost: $1,104,000 Total present value cost: $6,204,000 Timeframe: 30 years
4 – ERD	Enhanced bioremediation Performance monitoring MNA/LTM/LUCs LUCs	Injection of electron source and substrate and bioaugmentation culture to promote anaerobic biodegradation of VOCs by reductive dechlorination. Semi-annual groundwater monitoring for first 3 years to evaluate effectiveness of injections. MNA/LTM and reporting to evaluate: -Continued effectiveness of the ERD injections -Potential impacts to surface water -Progress of NA over time -Potential migration to the deep aquifer LUCs to prevent exposure to groundwater and aquifer use.	Capital cost: $1,526,000[a] $3,735,000[b] Total O&M cost $1,104,000 Total present value cost $2,630,000[a] $4,839,000[b] Timeframe: 30 years
5 – ISCO	Chemical oxidation of VOCs Performance monitoring MNA/LTM/LUCs LUCs	Injection of chemical oxidant to chemically degrade VOCs. Semi-annual groundwater monitoring for first 3 years to evaluate effectiveness of injections. MNA/LTM and reporting to evaluate: -Continued effectiveness of the ISCO injections -Potential impacts to surface water -Progress of NA over time -Potential migration to the deep aquifer LUCs to prevent exposure to groundwater and aquifer use.	Capital Cost: $6,509,000[a] Total O&M cost: $1,104,000[b] Total present value cost: $7,613,000 Timeframe: 30 years

a Vertical Injection/Extraction Wells
b Horizontal Injection Wells

removal and disposal of CA is high due to the lethal toxicity of these contaminants.

Groundwater

All of the groundwater alternatives screened, with the exception of Alternative 1 (No Action), can achieve the RAOs.

Alternatives 2 through 5 (MNA, PRB, ERD, and ISCO, respectively) are suitable for treatment of groundwater contaminated with chlorinated solvents and for the reduction of risk to human and ecological risk receptors. Alternatives 3, 4, and 5 provide active treatment to meet the RAOs. No alternative will permanently reduce the risks as long as the contaminant source area remains intact. Monitoring and LUCs will provide protection until RAOs are achieved.

Compliance with ARARs

Section 121(d) of CERCLA, as amended, specifies in part, that remedial actions for cleanup of hazardous substances must comply with requirements and standards under federal or more stringent state environmental laws and regulations that are applicable or relevant and appropriate (i.e., ARARs) to the hazardous substances or particular circumstances at a site unless such ARAR(s) are waived under CERCLA Section 121(d) (4). See also 40 C.F.R. § 300.430(f)(1)(ii)(B).

Waste Disposal Area

Alternative 3 (Capping) and Alternative 4 (Removal) are expected to meet ARARs. No Action (Alternative 1) and LUCs (Alternative 2) would not meet the location-specific ARARs related to sensitive ecosystems.

Location- and action-specific ARARs regarding land-disturbing activities and waste disposal during capping (Alternative 3) or removal activities (Alternative 4) would be complied with during implementation of each remedy. Alternative 3 (Capping) would also comply with the action-specific ARARs for RCRA Subtitle C landfill closure and post-closure care requirements for which are required to provide hydraulic isolation of the source materials to address the principal threat wastes in the waste disposal area.

Groundwater

All groundwater alternatives, except the No Action alternative, are expected to meet ARARs. Action-specific ARARs specific to Alternative 3 (PRB), Alternative 4 (ERD), and Alternative 5 (ISCO) regarding land-disturbing activities and waste handling would be complied with during the implementation of the alternative. LTM will be conducted, as part of all alternatives except No Action, to evaluate compliance with the location-specific ARARs regarding discharge of groundwater to wetlands or water bodies. LUCs will be implemented to prevent exposure to groundwater until such time that the chemical-specific ARARs, including NCGWQS and federal Maximum Contaminant Levels (MCLs), can be achieved.

8.2 Primary Balancing Criteria

Long-term Effectiveness and Permanence

Waste Disposal Area

Alternatives 3 (Capping) and 4 (Removal) are expected to be effective at reducing impacts of COCs in the long term. Alternative 3 (Capping) is considered to meet permanence goals by maintaining LUCs over time when paired with a groundwater alternative. Alternative 4 (Removal) would be a permanent remedy by effectively removing the source.

Groundwater

Alternatives 2 through 5 (MNA, PRB, ERD, and ISCO, respectively) are expected to be effective in the long term, although "**rebound**" is a potential issue with the injection scenarios. Active treatment is intended to treat the area of the plume with the highest concentrations of COCs and allow NA to reduce groundwater contaminant concentrations, preventing migration towards the New River. Alternative 2 would take the longest time to achieve RAOs without active treatment. Alternative 3 would take the longest time of the active treatment alternatives because it relies on the plume to flow through the PRB, but it is protective for downgradient receptors. Alternative 4 relies on biological degradation rather than chemical or physical processes to remove contaminant mass, taking longer than Alternative 5, which would likely remove COCs the fastest. Distribution and rebound may hinder the effectiveness of ERD and ISCO.

Reviews at least every 5 years, as required, would be necessary to evaluate the effectiveness of any of the alternatives because hazardous substances would remain onsite at concentrations above levels that allow for unlimited use and unrestricted exposure.

Reduction of Toxicity, Mobility, or Volume through Treatment

CERCLA Section 121(b) (1) and NCP requirement as referenced at 40 CFR 300.430(f)(1)(ii)(E) and 300.430(f)(5)(ii)(F) indicate that principal threat wastes should be treated to the maximum extent practical. Based on the unique nature of the CA potentially present in the waste disposal area, treatment is not feasible and none of the remedial alternatives include treatment. The CA that is reportedly disposed of has not been located because of the limitations on intrusive investigation into the waste disposal area, and it has not been detected in the envi-

ronmental samples (i.e. soil, groundwater, surface water, etc.). For the waste disposal area, leaving the potentially buried CA in the ground may be preferable to excavation and destruction per the Programmatic Environmental Impact Statement: Destruction of Non-Stockpile Chemical Warfare Materiel Containing Chemical Agent (FR. Oct. 18, 1996 [Volume 61, Number 203]). For groundwater, there are unknown safety concerns with adding substrate and/or creating chemical reactions in situ. The ROD will include a detailed explanation of why treatment was not utilized to address the principal threat waste.

Waste Disposal Area

Alternative 3 (Capping) does not include treatment of wastes or associated soil that are considered principal threat waste and does not reduce toxicity or volume. However, Alternative 3 (Capping) would reduce mobility through minimized infiltration. Alternative 4 (Removal) also does not include treatment but would remove the principal threat waste which reduces toxicity and volume as well as the mobility.

Groundwater

Alternatives 3 (PRB), 4 (ERD), and 5 (ISCO) include treatment. Alternative 5 (ISCO) will reduce toxicity and volume of the plume. With Alternative 4, (ERD) toxicity, mobility, and volume will be reduced at a relatively slower rate. Toxicity, mobility, and volume will be reduced outside of the source area with Alternative 3 (PRB) as the plume migrates. Alternative 2 (MNA) would take the longest, as it provides reduction in toxicity, mobility, or volume under natural processes. Previous treatability studies, as detailed in Table 1, were not effective in treating the source are, which may indicate that treatment is not practicable for treating the non-CA principal threat wastes.

Short-term Effectiveness

Waste Disposal Area

Alternatives 3 (Capping) and 4 (Removal) pose an elevated risk to workers through the use of heavy equipment and significant soil movement. Alternative 4 would also pose potential risk of exposure to CA and offsite waste transportation and disposal. These risks would be minimized through the use of safety controls, appropriate personal protective equipment (PPE), and air monitoring. The duration of short-term exposure risk associated with implementing Alternative 3 (Capping) is expected to be approximately 5 months. Alternative 4 (Removal) would present the greatest short-term risk to workers and the community near the disposal transportation route and the environment due to the nature of materials potentially disposed of at the site; however, it also would exhibit the shortest remediation timeline while effectively addressing the source. The duration of short-term exposure risk associated with implementing Alternative 4 (Removal) is expected to be approximately 6 months. Alternative 3 (Capping) has a lower relative environmental footprint compared to Alternative 4 (Removal).

Groundwater

Short-term effectiveness in terms of risks to workers, the community, and the environment is minimized for Alternatives 2 through 5 (MNA, PRB, ERD, and ISCO, respectively) through the use of appropriate PPE and air monitoring. The duration of short-term exposure risk associated with implementing Alternatives 3 through 5 ranges from approximately 100 days for Alternative 3 (PRB), to 3 years for Alternative 4 (ERD). Alternative 5 (ISCO) has a higher short-term risk because of the use of oxidants. Alternatives 4 (ERD) and 5 (ISCO) are most likely to achieve RAOs in the shortest period of time because of enhanced distribution of relatively fast-acting reagents, particularly chemical oxidation. Subsurface distribution is key to the effectiveness and treatment timeframe of alternatives 4 (ERD) and 5 (ISCO) (microbes, ERD substrate, or oxidant). The time frame associated with complete dechlorination via bioremediation can be many years. Alternative 2 (MNA) would likely exhibit the least short-term effectiveness because the remediation timeline would be dictated by the rate of natural biodegradation, and Alternative 3 (PRB)would be limited because it relies on groundwater to flow through the PRB as it migrates towards the New River. Alternative 2 (MNA) has the lowest relative environmental footprint of the groundwater alternatives while the environmental footprint of Alternative 3 (PRB) is highest, primarily due to the equipment use and consumables (ZVI) associated with construction of the PRB. The next highest overall environmental footprint would be from Alternative 5 (ISCO) followed by Alternative 4 (ERD).

Implementability

Waste Disposal Area

Alternative 3 (Capping) is implementable, with materials and services readily available. Alternative 4 (Removal) would be difficult to implement because of the potential presence of CA at the site. If present, management of CA will be difficult, disposal options are limited at this time, additional health and safety precautions would be required, and U.S. Army would become the lead agency for dealing with the CA.

Groundwater

Each alternative is implementable, with materials and services readily available. However, subsurface injections rely heavily on the ability to distribute reagents

uniformly at acceptable quantities. In Alternative 4 (ERD), injection through vertical injection and extraction wells (Alternative 4a) would be more difficult to implement than injection through horizontal wells (Alternative 4b). Furthermore, Alternative 3, implementation of a Trenchless PRB, would be easier than injections through horizontal wells, although ensuring a continuous barrier is technically challenging. Alternative 5 (ISCO) would require extra health and safety precautions for the handling of the oxidant. Alternatives 4 (ERD) and 5 (ISCO) would involve installation of 20 injection and extraction wells or 5,600 linear feet of horizontal wells.

Cost

Tables 4 and 5 summarize the capital costs, as well as long-term O&M costs (as applicable) for the alternatives. For comparative purposes, a 30-year time frame with a 4.5 percent discount rate was used.

Waste Disposal Area

The estimated present-worth cost of Alternative 3 (Capping) is $5,513,000, which is approximately 20 percent of the cost of Alternative 4 (Removal), estimated at $24,502,000.

Groundwater

The estimated present-worth cost of Alternative 2 (MNA) is $957,000. The estimated present-worth cost of Alternative 3 (PRB) is $6,204,000, which is more than two times the cost of Alternative 4a (ERD with vertical wells) at $2,630,000 and approximately 20 percent more than Alternative 4b (ERD with horizontal wells) at $4,840,000. Alternative 5 (ISCO), estimated at $7,613,000, is the most expensive of the groundwater alternatives.

8.3 Modifying Criteria

State Acceptance

State involvement has been solicited throughout the CERCLA and remedy selection process. NCDENR supports the Preferred Alternative, and its final concurrence will be solicited following the review of all comments received during the public comment period.

Community Acceptance

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

9 Preferred Alternative

Preferred Alternative

One technology for each media was selected as part of the Preferred Alternative for addressing the waste disposal area and groundwater contamination at Site 69. The Preferred Alternative is shown on Figure 4 and consists of:

- Capping to prevent potential exposure to buried wastes and contaminated subsurface soil (some of which are considered principal threat wastes) and provide a barrier for potential receptors and infiltration
- MNA and LTM to monitor groundwater and track changes in COC concentrations and NAIPs
- LUCs to protect receptors from potential contact with buried waste and affected soils and prevent aquifer use
- Inspections and maintenance to maintain the integrity of any existing or future monitoring or remediation

Table 6 – Waste Disposal Area

CERCLA Criteria	No Action (1)	LUCs (2)	Capping (3)	Removal (4)
Threshold Criteria				
Protection of human health and the environment	❍	❍	●	●
Compliance with ARARs	❍	❍	●	●
Primary Balancing Criteria				
Long-term effectiveness and permanence	❍	○	○	●
Reduction in toxicity, mobility, or volume through treatment	❍	❍	❍	❍
Short-term effectiveness	❍	○	○	❍
Implementability	●	●	●	❍
Community Acceptance	$0	$46 K	$5.5 M	$24.5 M

Ranking: ● High ○ Moderate ❍ Low

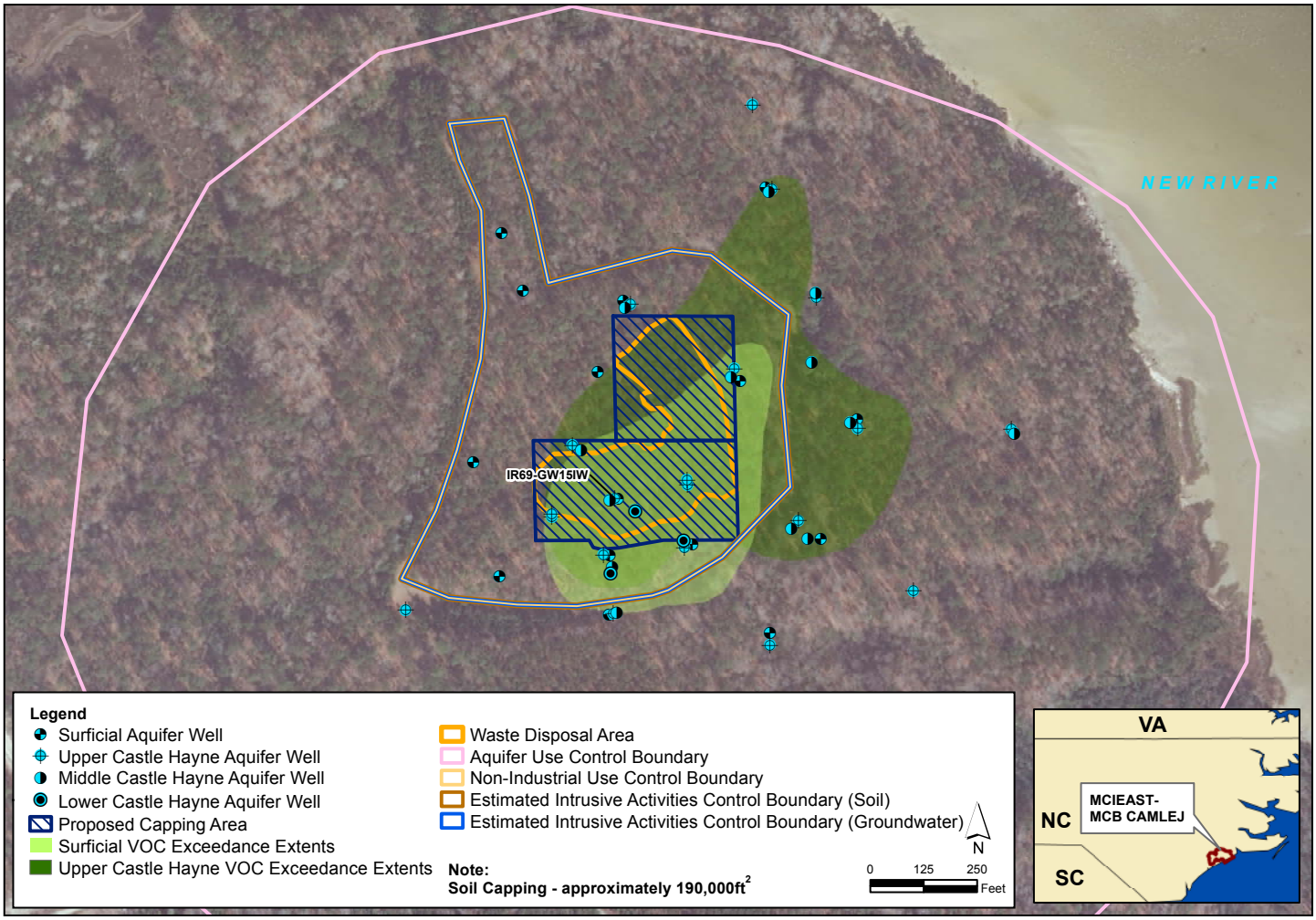
Table 7 - Groundwater

CERCLA Criteria	No Action	MNA/LTM	PRB	ERD Injection & Extrac-tion	ERD Horizontal	ISCO
	(1)	(2)	(3)	(4a)	(4b)	(5)
Threshold Criteria						
Protection of human health and the environment	❍	●	●	●	●	●
Compliance with ARARs	❍	●	●	●	●	●
Primary Balancing Criteria						
Long-term effectiveness and permanence	❍	◉	●	◉	◉	◉
Reduction in toxicity, mobility, or volume through treatment	❍	❍	◉	◉	◉	◉
Short-term effectiveness	❍	◉	◉	❍	◉	❍
Implementability	●	●	◉	❍	◉	◉
Community Acceptance	$0	$1 M	$6.2 M	$2.6 M	$4.8 M	$7.6 M

Ranking: ● High ◉ Moderate ❍ Low

Rankings are provided as qualitative descriptions of the relative compliance of each alternative with the criteria.

Figure 4: Preferred Alternative



system at the site (including but not limited to groundwater monitoring wells, fences, signs, and landfill cover)

Capping is preferred to address buried waste and associated soil because source containment prevents exposure to potential receptors; prevents infiltration that could add to the groundwater contaminant plume; is the presumptive remedy approach for military landfills addressed under CERCLA; protects human health and the environment, complies with ARARs, and would reduce mobility of the COCs.

While capping does not meet the EPA's preference for active treatment of principal threat wastes, it does provide containment, an EPA acceptable alternative to reduce the mobility of the principal threat wastes. The high risk associated with removal and transportation of CA and the limited acceptable disposal facilities for CA waste make the EPA preference for removal of the principal threat waste an impractical alternative at this time.

A multilayer cap with an impermeable layer meeting relevant RCRA Subtitle C landfill cover requirements will be installed to provide hydraulic isolation of the buried wastes and associated soils that are source materials for contaminating groundwater. The cap will be constructed over the southern and eastern burial trenches to cover a total area of approximately 190,000 square feet, as indicated on Figure 4. Cap inspections, mowing, and maintenance would be conducted semi-annually for 30 years.

MNA is preferred to address groundwater contamination because natural degradation is expected to proceed at Site 69, favorable conditions exist at the location of highest concentrations, protects human health and the environment, complies with ARARs, has the smallest environmental footprint, is easily implementable, and is the least expensive alternative.

In addition to the favorable conditions for reductive dechlorination within the plume area, and elevated populations of dehalogenating bacteria; groundwater modeling predicts that each plume will remain relatively stable and will remain below the NCSWQS at the discharge point to the New River.

MNA/LTM will be conducted using the existing monitoring well network to monitor changes in COC concentrations for approximately 30 years. NA processes will continue to reduce COC concentrations over time.

LUCs including, but not limited to, land use restrictions in the Base Master Plan, Notice of Inactive Hazardous Substance or Waste Disposal, file a Notice of Contaminated Site with the Onslow County Register of Deeds, and administrative procedures to prohibit unauthorized intrusive activities (for example, excavation, well installation, or construction) will be implemented as part of the remedy to prevent exposure to the contamination on the site that exceeds the remediation goals. In addition, the existing 6-foot-high chain-link fence will remain in place or be replaced following cap installation. The LUCs will be implemented and maintained indefinitely by the Navy and MCIEAST - MCB CAMLEJ as the buried waste and associated soil will remain intact. The LUC performance objectives include:

- To prevent exposure to, and use of, the surficial and Castle Hayne aquifers underlying Site 69
- Prevent future potential exposure to contaminated subsurface soil (including landfill materials)
- Maintain the integrity of any existing or future monitoring or remediation system at the site

The estimated LUC boundary is provided on Figure 4; the actual LUC boundaries will be finalized in the remedial design (RD) document. The LUC implementation actions, including monitoring and enforcement requirements, will be provided in the RD that will be prepared by the Navy after the ROD has been finalized. The Navy will submit the RD to the EPA and NCDENR for review and approval pursuant to the primary document review procedures stipulated in the Federal Facility Agreement. The Navy will maintain, monitor (including conducting periodic inspections), and enforce the LUCs according to the requirements contained in the RD and the ROD. The need for LUCs to prevent exposure and ensure protection will be periodically reassessed as COC concentrations are reduced over time.

Based on information currently available, the Navy, MCIEAST - MCB CAMLEJ, EPA, and NCDENR believe the Preferred Alternatives for the waste disposal area and associated soil and groundwater meet the threshold criteria and provides the best balance of tradeoffs among the other alternatives with respect to the balancing and modifying criteria.

The Navy expects the Preferred Alternatives to satisfy the following requirements of CERCLA: 1) protection of human health and the environment, 2) compliance with ARARs, 3) cost-effectiveness, 4) use of permanent solutions and alternative treatment technologies

to the maximum extent practicable, and 5) satisfaction of the preference for treatment as a principal element, or provide an explanation in the ROD as to why this preference was not met. The Preferred Alternatives can change in response to public comment or new information.

Five-Year Review

Because COCs will remain at the site above levels that allow for unlimited use and unrestricted exposure, the Navy will review the final remedial action no less than every 5 years after initiation of the remedial action, in accordance with CERCLA Section 121(c) and the NCP at 40 C.F.R. § 300.430(f)(4)(ii). If results of the 5-year reviews reveal that remedy integrity is compromised and protection of human health is insufficient, additional remedial actions will be evaluated by the parties and implemented by the Navy.

10 Community Participation

The Navy has prepared this PRAP in view of the public participation requirements specified in the NCP at 40 CFR 300.430 (f)(3) and 40 CFR 300.515(e)to provide information regarding environmental cleanups at Site 69 to the public through the Restoration Advisory Board, public meetings, the Administrative Record file for the site, the Information Repository, and announcements published in the Jacksonville Daily News, The Globe, and RotoVue. The public is encouraged to gain a more comprehensive understanding of Site 69 and the IRP. The public comment period for this PRAP is from August 16, 2012, through September 16, 2012, and a public meeting will be held on August 16, 2012, at 6:00 p.m. (see Page 1 of this report for details). The Navy will summarize and respond to comments in a Responsiveness Summary, which will become part of the official ROD and will also be included in the Administrative Record file.

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

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Location of Administrative Record and Information Repository

Available Online at: http://go.usa.gov/jZi

Internet access is available at the
Onslow County Library
58 Doris Avenue East
Jacksonville, NC 28540
(910) 455-7350

Glossary of Terms

This glossary defines in non-technical language the more commonly used environmental terms appearing in this PRAP. The definitions do not constitute the Navy's, EPA's, or NCDENR'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.

Administrative Record: A compilation of site-related information for public review.

Applicable or Relevant and Appropriate Requirement (ARAR): Applicable requirements, as defined in 40 C.F.R. § 300.5, means those cleanup standards, standards of control, and other substantive requirements, criteria, or limitations pro-

mulgated under federal environmental or state environmental or facility siting laws that specifically address a hazardous substance, pollutant, or contaminant, remedial action, location, or other circumstance at a CERCLA site. Only those state standards that are identified by the state in a timely manner and that are more stringent than federal requirements may be applicable.

Relevant and appropriate requirements, as defined in 40 C.F.R. § 300.5, means those cleanup standards, standards of control, and other substantive requirements, criteria, or limitations promulgated under federal environmental or state environmental or facility siting laws that, while not "applicable" to a hazardous substance, pollutant, or contaminant, remedial action, location, or other circumstance at a CERCLA site, address problems or situations sufficiently similar to those encountered at a CERCLA site that their use is well suited to the particular site. Only those state standards that are identified by the state in a timely manner and that are more stringent than federal requirements may be relevant and appropriate.

Aquifer: Underground bed of soil or rock from which groundwater can be usefully extracted.

Cancer risk: Cancer risks are expressed as a number reflecting the increased chance that a person will develop cancer if exposed to chemicals or substances. For example, the EPA's acceptable risk range for Superfund sites is 1 × 10-4 to 1 × 10-6, meaning there is 1 additional chance in 10,000 (1 × 10-4) to 1 additional chance in 1 million (1 × 10 6) that a person will develop cancer if exposed to a site that is not remediated.

Capping: Maintaining a multi-layer, low-permeability cover over waste to stabilize surface soil and reduce surface water infiltration.

Chemical agent (CA): A chemical substance that is intended for use in military operations to kill, seriously injure, or incapacitate persons through its physiological effects.

CA degradation product: A chemical that results from processes such as microbial degradation, oxidation, or hydrolysis that breaks down the parent chemical agents.

Constituent of concern (COC): A subset of the chemicals of potential concern that are identified in the SI and FS as needing to be addressed by the proposed response action.

Chlorinated volatile organic compound (CVOC): A subgroup of VOCs that contain chlorine.

Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA): A federal law, commonly referred to as the Superfund Program, passed in 1980 and amended in 1986 by the Superfund Amendments and Reauthorization Act codified at 42 United States Code (U.S.C.) §§ 9601 et seq., and amended again in 2000. CERCLA created a trust fund known as Superfund that is available to the EPA to investigate and cleanup abandoned or uncontrolled hazardous waste sites.

Conceptual site model (CSM): A description of a site and its environment that is based on existing knowledge and that assists in planning, interpreting data, and communicating. It describes sources of contamination (for example, spills) and receptors (for example, humans) and the interactions that link the two.

Confining unit: A body of impermeable or distinctly less permeable material bounding one or more aquifers.

Downgradient: The direction that groundwater flows.

Ecological Risk Assessment (ERA): An evaluation of the risk posed to the environment if remedial activities are not performed at the site.

Edgewood Chemical Biological Center: The center is run by the U.S. Army and is the nation's principal research and development resource for non-medical chemical and biological defense.

Enhanced Reductive Dechlorination (ERD) with bioaugmentation: An anaerobic (without oxygen) process in which an electron donor source is injected into the subsurface to allow chlorine atoms on a parent VOC molecule to be sequentially replaced with hydrogen and break down COCs. Bioaugmentation refers to the introduction of a bacterial culture capable of fully reducing chlorinated solvents to ethane.

Feasibility Study (FS): An investigation of the nature and extent of contamination at a given site, undertaken for the purpose of developing and evaluating remedial alternatives, as appropriate.

Geophysical anomaly: A deviation from an expected geophysical background measurement, possibly indicating the existence and physical characteristics of a subsurface feature that is detected.

Geophysical investigation: The systematic collection of spatial data from both above and below the Earth's surface using noninvasive techniques.

Groundwater: Subsurface water that occurs in soils and in geologic formations that are fully saturated.

Groundwater modeling: Using a computer program to generate models of groundwater flow systems that allow observation, simulation, and prediction of aquifer conditions.

Hazard Index (HI): A number indicative of non-cancer health effects that is the ratio of the existing level of exposure to an acceptable level of exposure. A value equal to or less than 1 indicates that the human population is not likely to experience adverse effects.

Hazard Quotient (HQ): The ratio of the exposure estimate to an effects concentration considered to represent a "safe" environmental concentration or dose.

Human Health Risk Assessment (HHRA): An evaluation of the risk posed to human health should remedial activities not be implemented at a site.

Information Repository: A file containing information, technical reports, and reference documents regarding an NPL site. This file is usually maintained at a location with easy public access, such as a public library.

In situ: In place or position.

In Situ Chemical Oxidation (ISCO): Use of oxidizing chemicals to break down groundwater contaminants into carbon dioxide and water.

Installation Restoration Program (IRP): The Navy, as the lead agency, acts in partnership with the EPA and NCDENR to address environmental investigations at the facility through the IRP. The current IRP is consistent with CERCLA and applicable state environmental laws.

Land use control (LUC): Physical, legal, or administrative

method that restricts the use of or limits access to property to reduce risks to human health and the environment.

Lead agency: means the agency that provides the On-scene Coordinator (OSC)/Remedial Project Manager (RPM) to plan and implement response actions under the NCP. EPA, the U.S. Coast Guard (USCG), another federal agency, or a state (or political subdivision of a state) operating pursuant to a contract or cooperative agreement executed pursuant to section 104(d)(1) of CERCLA, or designated pursuant to a Superfund Memorandum of Agreement (SMOA) entered into pursuant to subpart F of the NCP or other agreements may be the lead agency for a response action. In the case of a release of a hazardous substance, pollutant, or contaminant, where the release is on any facility or vessel under the jurisdiction, custody, or control of Department of Defense (DoD) or Department of Energy (DOE), then DoD or DOE will be the lead agency. Where the release is on, or the sole source of the release is from, any facility or vessel under the jurisdiction, custody, or control of a federal agency other than EPA, the USCG, DoD, or DOE, then that agency will be the lead agency for remedial actions and removal actions other than emergencies. The federal agency maintains its lead agency responsibilities whether the remedy is selected by the federal agency for non-NPL sites or by EPA and the federal agency or by EPA alone under CERCLA section 120. The lead agency will consult with the support agency, if one exists, throughout the response process.

Long-term monitoring (LTM): Monitoring of groundwater or surface water to track changes in COC concentrations for a predetermined amount of time.

Media (singular, medium): Soil, groundwater, surface water, or sediments at the site.

Monitored natural attenuation (MNA): Periodic monitoring of groundwater or surface water to track changes in COC concentrations and NA parameters.

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

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

Natural attenuation (NA): Reduction in mass or concentration of a constituent over time or distance from the source through naturally occurring physical, chemical, and biological processes.

Natural attenuation indicator parameter (NAIP): Measured characteristic of water quality used to provide qualitative evidence of conditions favorable for biodegradation and reductive dechlorination.

Nine Evaluation Criteria: The NCP outlines the approach for comparing remedial alternatives using these evaluation criteria:

- Overall Protection of Human Health and the Environment – Addresses whether a remedy provides adequate protection and how risks posed through each pathway are eliminated, reduced, or controlled through treatment, engineering controls, or institutional controls.
- Compliance with ARARs - A statutory requirement for remedy selection that an alternative will either meet all of the ARARs or that there is a good rationale for waiving an ARAR.
- Long-Term Effectiveness and Permanence - Addresses the expected residual risk that will remain at the site after completion of the remedial action and the ability of a remedy to maintain reliable protection of human health and the environment in the future as well as in the short term.
- Reduction of Toxicity, Mobility, and Volume Through Treatment - The anticipated performance of the treatment technologies a remedy may employ in their ability to reduce the toxicity, mobility, or volume of contamination.
- Short-Term Effectiveness - Considers the short-term impacts of the alternatives on the neighboring community, the plant workers, remedial construction workers, and the surrounding environment, including potential threats to human health and the environment associated with the collection, handling, treatment, and transport of hazardous substances.
- Implementability - The technical and administrative feasibility of a remedy, including the availability of materials and services needed to implement an option.
- Cost - Encompasses all construction, operation and maintenance costs incurred over the life of the project, expressed as the net present value of these costs.
- State Acceptance - Considers substantial and meaningful state involvement on the PRAP.
- Community Acceptance - The public's general response to the alternatives described in the PRAP and the SI and FS reports. The specific responses to the public comments are addressed in the Responsiveness Summary section of the ROD.

No Further Action (NFA): When the regulators have reviewed and approved documentation, confirming that a site is clean, they will issue a notice stating that NFA is required.

Non-Aqueous Phase Liquid (NAPL): Either singular free-product organic compounds or mixtures of organic compounds that are resistant to mixing with water. NAPL zones are the delineated portions of the subsurface (including one or more aquifers) where such liquids (free-phase or residual NAPL) are present. There are two types of NAPLs, Light Non-Aqueous Phase Liquids (LNAPLs) and Dense Non-Aqueous Phase Liquids (DNAPLs):

- LNAPLs are less dense than water and tend to float on the water table.
- DNAPLs have a density greater than water. This property allows them to sink through the water table and penetrate the deeper portions of an aquifer.

North Carolina Department of Environment and Natural Resources (NCDENR): The state agency responsible

for administration and enforcement of state environmental regulations.

North Carolina Groundwater Quality Standards (NCGWQS): Enforceable standards developed by NCDENR. They are the maximum allowable concentrations resulting from any discharge of contaminants to the land or waters of the state that may be tolerated without creating a threat to human health or that would otherwise render the groundwater unsuitable for its intended best usage.

North Carolina Surface Water Quality Standards (NCSWQS): Enforceable standards developed by NCDENR. They are the maximum allowable concentrations in surface waters in the state that may be tolerated without creating a threat to human health or that would otherwise render the groundwater unsuitable for its intended best usage.

Operable Unit (OU): A discrete action that comprises an incremental step toward comprehensively addressing site problems. The cleanup of a site can be divided into a number of OUs, depending on the complexity of the problems associated with the site. OUs can address geographical portions of a site, specific site problems, or different phases of remediation at a site.

Permeable reactive barrier (PRB): A reactive medium within a wall barrier to enhance contaminant degradation through physical, chemical, or biological processes.

Plume: A space in air, water, or soil containing pollutants released from a point source.

Polychlorinated biphenyl (PCB): A known carcinogen, PCBs are man-made organic chemicals used in industrial and commercial applications until 1979 when their domestic manufacture was banned.

Presumptive remedy: Preferred technologies for common categories of sites based on historical patterns of remedy selection and the EPA's scientific and engineering evaluation of performance data on technology implementation.

Proposed Remedial Action Plan (PRAP): A document that presents and requests public input regarding the proposed cleanup alternative.

Public comment period: The time allowed for the members of an affected community to express views and concerns regarding an action proposed to be taken by the Navy and EPA, such as a rulemaking, permit, or Superfund remedy selection.

Rebound: An increase in contaminant concentrations after a treatment system has been turned off. It occurs because not all contamination has been removed and, as the subsurface returns to equilibrium, additional dissolution of residual contamination occurs.

Receptor: A human, animal, or plant that may be exposed to risks from contaminants related to a given site.

Record of Decision (ROD): A public document that explains which cleanup alternative(s) will be used at NPL sites where, under CERCLA, trust funds pay for the cleanup.

Remedial action: A cleanup method proposed or selected to address contaminants at a site.

Remedial Action Objective (RAO): An objective of a remedial action that is based on contaminated media, COCs, potential receptors and exposure scenarios, HHRAs and ERAs, and attainment of regulatory cleanup levels, if any exist.

Removal: The excavation and disposal of waste disposed of in the landfill and impacted soil.

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

Site: The area of the facility where a hazardous substance, hazardous waste, hazardous constituent, pollutant, or contaminant from the facility has been deposited, stored, disposed of, placed, has migrated, or otherwise come to be located.

Soil: The top layer of the Earth's surface, consisting of rock and mineral particles mixed with organic matter.

Source: At Site 69, the source of contamination is the waste disposal area composed of two burial trenches in the southeastern portion of the site.

Supplemental Investigation (SI): A study to refine the nature and extent of contaminants determined to be present at a site and the problems caused by their release.

Surface water: Water collecting on the ground or in a stream, river, lake, wetland, or ocean.

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.

Volatile organic compound (VOC): An organic compound which has a boiling point below that of water which can easily vaporize. Many VOCs are manufactured chemicals, such as those associated with paint, solvents, and petroleum. VOCs are common groundwater contaminants.

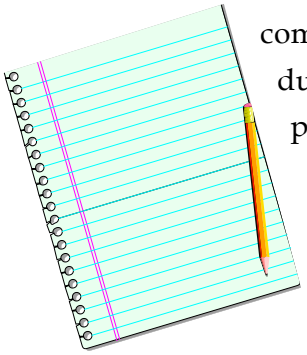
Zero valent iron (ZVI): Correctly elemental iron, which is a strong reducing agent that is capable of breaking down several common chlorinated solvents which are common pollutants at military and industrial sites. The granular ZVI used in permeable barrier applications makes the ZVI barrier more permeable than the surrounding aquifer.

Please print or type your comments for Site 69 here

Mark Your Calendar for the Public Comment Period

Public Comment Period
August 16, 2012 through September 16, 2012

Submit Written Comments



The Navy will accept written comments regarding the PRAP during the public comment period. To submit comments or obtain further information, please refer to the insert page.

Attend the Public Meeting
August 16, 2012, from 6:00 P.M.

Coastal Carolina Community College
Business Technology Building, Room 102
444 Western Blvd
Jacksonville, NC 28546

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

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Place stamp here

Public Affairs Officer
Naval Support Activity Camp Lejeune
444 Western Blvd
Jacksonville, NC 28540
(910) 455-73503