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PROPOSED REMEDIAL ACTION PLAN SITE 89 OPERABLE UNIT 16 (OU16) MCBC CAMP LEJEUNE NC
5/1/2012
MCBC CAMP LEJEUNE

Proposed Remedial Action Plan

Site 89: Operable Unit No. 16

Marine Corps Installations East - Marine Corps Base Camp Lejeune
North Carolina

May 2012

1 Introduction

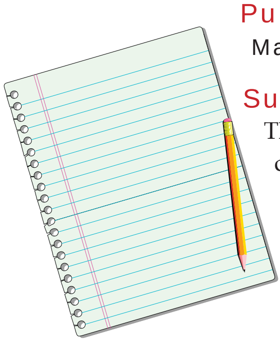
This **Proposed Remedial Action Plan (PRAP)** identifies the Preferred Alternatives for addressing **groundwater** contamination and migration to **surface water** at **Site** 89: **Operable Unit (OU)** No. 16, located at Marine Corps Installations East-Marine Corps Base Camp Lejeune (MCIEAST - MCB CAMLEJ) in Onslow County, North Carolina. OU 16 consists of Site 89 and Site 93 that have been grouped together because of their proximity to one another and suspected waste (solvents). The final ROD for Site 93 was signed in 2006, and the remedy is in-place.

The Preferred Alternative for Site 89 includes **air sparging (AS) using a horizontal well** to treat areas of groundwater with high contaminant concentrations (**source** area), **permeable reactive barrier (PRB)** to treat the **downgradient** groundwater, **aerators** to treat groundwater discharge to surface water, **monitored natural attenuation (MNA)**, and **land use controls (LUCs)**.

This PRAP is issued jointly by the 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)** in order to solicit public comments on the remedial alternatives, and in particular the preferred **remedial action** for Site 89. 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 89. Detailed background information for Site 89 is contained in the Comprehensive **Remedial Investigation (RI)** (CH2M HILL, 2008), the **Feasibility Study (FS)** (CH2M HILL, 2012), and other documents in the **Administrative Record** file and **Information Repository** for MCIEAST - MCB CAMLEJ. Key information from the FS report, including all remedial options considered and the rationale for selection of AS, PRB, aerators, MNA, and LUCs as the preferred remedies for Site 89, 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.

Mark Your Calendar for the Public Comment Period



Public Comment Period

May 22 - June 25, 2012

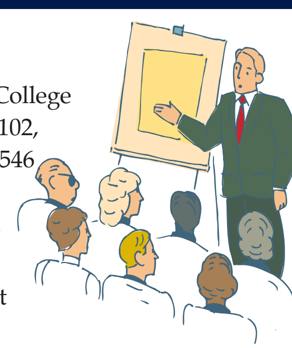
Submit Written Comments

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

Attend the Public Meeting

May 24, 2012 at 6:00 p.m.

Place – 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 File

Available for Review Online: http://go.usa.gov/jZi
Internet access is available at the Onslow County Library:
58 Doris Avenue East
Jacksonville, NC 28540
(910) 455-7350

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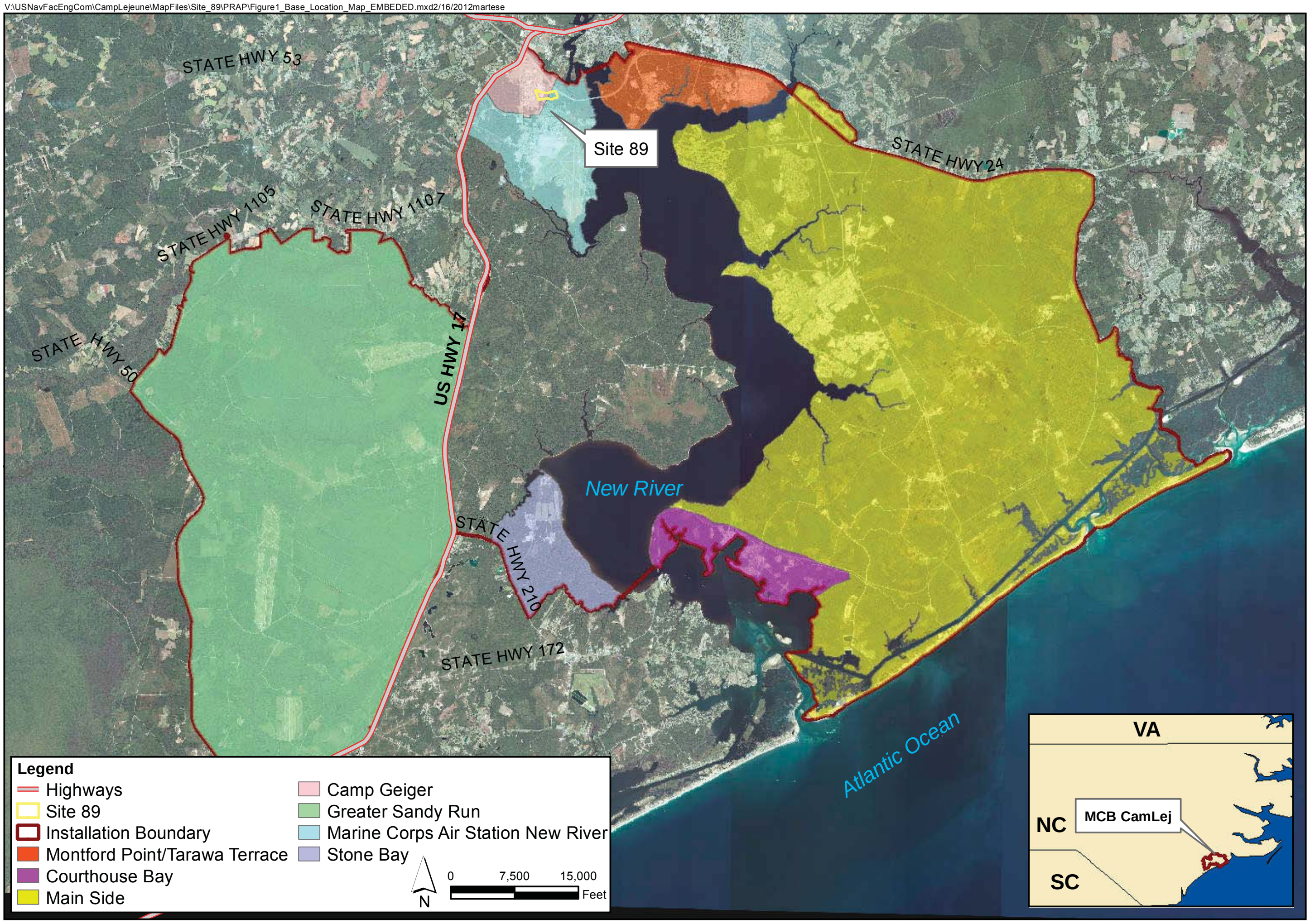


Figure 1 – Base and Site Location Map

The Navy, MCIEAST - MCB CAMLEJ, and EPA, in concurrence with NCDENR, will make the final decision on the remedial approach for Site 89 after reviewing and considering all information submitted during the 30-day **public comment period**. The Navy and MCIEAST - MCB CAMLEJ, along with 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 **Record of Decision (ROD)** will then be prepared to document the Selected Remedy for Site 89.

2 Site Background

Marine Corps Base Camp Lejeune 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 89 is located on Camp Geiger in the northern portion of MCIEAST - MCB CAMLEJ. The Base motor pool operated on the site until 1988 and reportedly used solvents such as acetone, trichloroethene (TCE), and 2-butanone (methyl-ethyl-ketone), for cleaning parts and equipment. A steel 550-gallon underground storage tank (UST) was used to store waste oil from 1983 until its removal in 1993. During removal, visible signs of contamination were observed and the contaminated soil was removed until groundwater was encountered. Other structures historically located in the former UST area include Building STC-867, which was used to store hazardous soil, and a wash rack with an associated drain and oil/water separator. The Defense Reutilization and Marketing Office (DRMO) was operated by the Defense Logistics Agency on the site until 2000, and the area was used as a storage yard for items such as scrap and surplus metal, electronic equipment, vehicles, rubber tires, and fuel bladders. The site has not been used since the DRMO relocated in 2000. The only site activity since that time has been related to environmental investigations.

The highest concentrations of groundwater contamination at Site 89 are located in the southern portion of the former DRMO (the former vehicle maintenance and

Previous Investigation/Action*	Administrative Record Number	Dates	Activities and Findings
RI OU No. 16 (Sites 89 and 93) (Baker, 1998)	002278 and 002279	1996 -1997	Conducted RI to detect the presence or absence of contamination in groundwater, surface water, sediment, and subsurface soil. Chlorinated solvents were detected in soil, groundwater in the surficial and upper Castle Hayne aquifers within the DRMO area, and in the surface water and sediment in Edwards Creek.
Long-Term Monitoring (LTM) and Immediate Response Field Effort (Baker, 1999)	02569	1999	Conducted an immediate response to the 1,1,2,2-tetrachloroethane (1,1,2,2-PCA) concentration of 30,000 micrograms per liter (µg/L) in the sample from surficial aquifer monitoring well IR89-MW02, to re-sample the well and install additional wells to confirm and delineate groundwater and potential soil impacts. Results indicated the potential for dense non-aqueous phase liquid (DNAPL) in the eastern and southern portions of the DRMO area.
Additional Sampling (soil, groundwater, surface water and sediment) (Baker, 2000)	04140	1999-2000	Conducted additional investigations of soil, groundwater, surface water, and sediment. Identified elevated VOC impacts in the soil vadose zone indicative of a source of groundwater and surface water contamination. A time-critical removal action (TCRA) was recommended for shallow soil in the southern DRMO area.
TCRA (OHM, 2000)	003519	2000	Removed 24,000 tons of shallow (0 to 5 feet below ground surface [bgs]) VOC-impacted soil and treated the soil using low temperature thermal desorption. Treatment was considered complete when confirmatory samples of the treated soil indicated that concentrations of 1,1,2,2-PCA were below 1 milligram per kilogram (mg/kg). Additionally, an aeration system was installed in Edwards Creek immediately downstream of Site 89 to remove VOCs from surface water.
Supplemental Investigation (SI) and Evaluation (CH2M HILL, Baker, and CDM, 2001)	003956	2001	Investigated the horizontal and vertical extent of DNAPL through soil, groundwater, surface water, and sediment sampling. The SI identified two DNAPL source zones affecting 25,000 cubic yards of soil in the southern portion of the DRMO area.
Electrical Resistance Heating (ERH) Pilot Test (Shaw, 2005)	003806	2003-2005	Conducted a pilot test of an ERH system in the southern portion of the former DRMO area to remove free-phase DNAPL from below the groundwater surface. The treatment area was approximately 15,900 square feet and treated soil to a depth of 19 to 26 feet bgs. An estimated 48,500 pounds of VOC- contaminated soil were removed, and confirmatory soil sampling indicated that DNAPL was effectively removed.
Comprehensive RI (CH2M HILL, 2008)	004169	2003-2008	Investigated the extent of chlorinated VOCs and semi-volatile organic compounds (SVOCs) in groundwater, surface water, and sediment of Edwards Creek. The RI concluded that the groundwater was still impacted by VOCs. The human health risk assessment (HHRA) concluded that the subsurface soil posed a potential risk to the future adult and child residents and that groundwater posed a potential risk to current industrial receptors. Soil risks were driven by soil in the southern portion of the DRMO area at the suspected source of groundwater contamination. The screening-level ecological risk assessment (ERA) identified concentrations of polycyclic aromatic hydrocarbons (PAHs) and pesticides that posed a potential risk to the benthic invertebrate community in the wetlands.
Treatability Studies (AGVIQ-CH2M HILL Joint Venture, 2008)	004123	2006-2008	Implemented a treatability study to evaluate the performance and design of four remedial technologies in support of the FS: enhanced reductive dechlorination (ERD) by injecting a combination of sodium lactate and emulsified vegetable oil, chemical reduction via zero valent iron injection using pneumatic fracture, AS via a horizontal well, and a PRB using mulch/compost as backfill. While AS and ERD injections reduced contaminant mass for a similar cost per volume treated, AS was determined to be the most practical technology for full scale implementation.
Results of the August 2008 SI (CH2M HILL, 2008)	04210	2008	Collected groundwater samples from four temporary wells and surface water samples from three locations in Edwards Creek, from the eastern portion of Site 89, to further delineate VOC impacts.
Baseline ERA Addendum for the Western Wetland (CH2M HILL, 2008)	004205	2008	Collected confirmatory soil and sediment samples to assess the extent of PAH and pesticide impacts to the wetlands. Removal of the impacted soil and sediment from the western wetland area was recommended.

Notes: *Documents listed are available in the Administrative Record and provide detailed information to support remedy selection at Site 35.

Table 1 – Previous Studies and Investigations

Previous Investigation/Action*	Administrative Record Number	Dates	Activities and Findings
Vapor Intrusion Evaluation Report (CH2M HILL, 2009)	002775	2008	Collected subslab soil gas and indoor air samples from buildings TC860 and TC864, located immediately northwest of the former DRMO area, to assess potential vapor intrusion pathways. No current risks to human health from vapor intrusion of VOCs were identified, but further vapor intrusion evaluation during future groundwater remediation was recommended based on soil vapor data collected during the treatability study while the AS system was running.
Soil Mixing Non-Time-Critical Removal Action (NTCRA) (AGVIQ-CH2M HILL Joint Venture, 2010)	002789	2007-2009	Treated source area DNAPL by mixing zero valent iron and clay into contaminated soil in the southern portion of the former DRMO area. Treated a 32,000 square foot area to a depth of 25 feet resulting in a total treated volume of 30,000 cubic yards. Post-treatment monitoring indicated significant reduction in VOC concentrations in the soil, groundwater, and adjacent creek. Soil samples within the mixing area indicated that subsurface soil impacts and associated risks from exposure were removed. Soil mixing provided enhanced conditions for biological degradation of COCs in the mixing zone and for water that passes through the mixing zone. As a result, this area is considered an active treatment area and will be monitored and evaluated during the Five-year Review process.
Western Wetland NTCRA (CH2M HILL, 2010)	002841	2010	Removed soil and sediment with PAHs and pesticide concentrations that contributed to unacceptable ecological risks. Confirmatory samples verified that the cleanup levels had been achieved, and any remaining ecological risks were considered minimal and acceptable.
FS, Site 89, OU No. 16 (CH2M HILL, 2012)	004745	2008-2012	Conducted comprehensive groundwater and surface water sampling for VOCs and natural attenuation (NA) parameters sampling to assess current site conditions and conducted a fate and transport study in the soil mixing area to monitor the migration of treated groundwater. Groundwater concentrations of parent compounds (TCE, and 1,1,2,2-PCA) were significantly lower (1 to 2 orders of magnitude) than historically detected, and concentrations of degradation daughter products (cis-1,2-dichloroethene [DCE], trans-1,2-DCE, and vinyl chloride [VC]) were higher. This suggests that previous pilot studies and targeted removal actions were successful in reducing the source area contaminant volume. Although detection of COCs in the upgradient wells is decreasing, the water discharging into Edwards Creek is still impacted by VOCs. Assessed the following remedial alternatives for VOC-impacted groundwater and surface water: Source Area Groundwater Alternatives: (1) No action, (2) ERD, (3) in situ chemical oxidation (ISCO), (4) AS Downgradient Groundwater Alternatives: (1) No Action, (2) MNA, (3) PRB with MNA. Surface Water Alternatives: (1) No Action, (2) PRB, (3) Aerators

Notes: *Documents listed are available in the Administrative Record and provide detailed information to support remedy selection at Site 35.

Table 1 – Previous Studies and Investigations (cont.)

storage area) and near the former UST. Based on the high concentrations reported, this area has been identified as the source area. The primary contaminants in the groundwater at Site 89 are chlorinated volatile organic compounds (**VOCs**). Chlorinated VOCs are also present in the surface water, indicating that the contaminated groundwater is discharging into Edwards Creek. Figure 2 shows the approximate location of the groundwater VOC source and downgradient extents of the VOC **plume**.

Chlorinated VOC-impacted soil was identified in the source area during the RI. VOCs in soil were addressed during previous removal actions discussed in Table 1.

2.2 Summary of Previous Investigations and Actions

Site 89 was characterized under numerous investigations between 1996 and the present. Table 1 presents a chronological list of those studies and interim actions taken to address site contamination. Figure 3 shows the extent of contamination based on the previous investigations and identifies the locations where previous actions were taken.

3 Site Characteristics

The former DRMO area is surrounded by a fence with an access gate, and the ground surface is covered with asphalt, gravel, or grass (the areas east of the former UST STC-868 and south of former Building TC952). The areas north of the former DRMO area are generally developed, with buildings, asphalt, and grass. The area surrounding the former DRMO area to the west and south is primarily wetland along Edwards Creek. The eastern portion of Site 89 is generally undeveloped and covered in wetland and forest.

Site 89 is located within an interstream area and has little topographic relief. Edwards Creek is located to the west and south of Site 89 and eventually flows into the New River. Stormwater from Camp Geiger is conveyed via manmade drainage ditches into the source of Edwards Creek near the intersection of 8th and E Streets, as shown in Figure 2. Surface water at Site 89 also drains

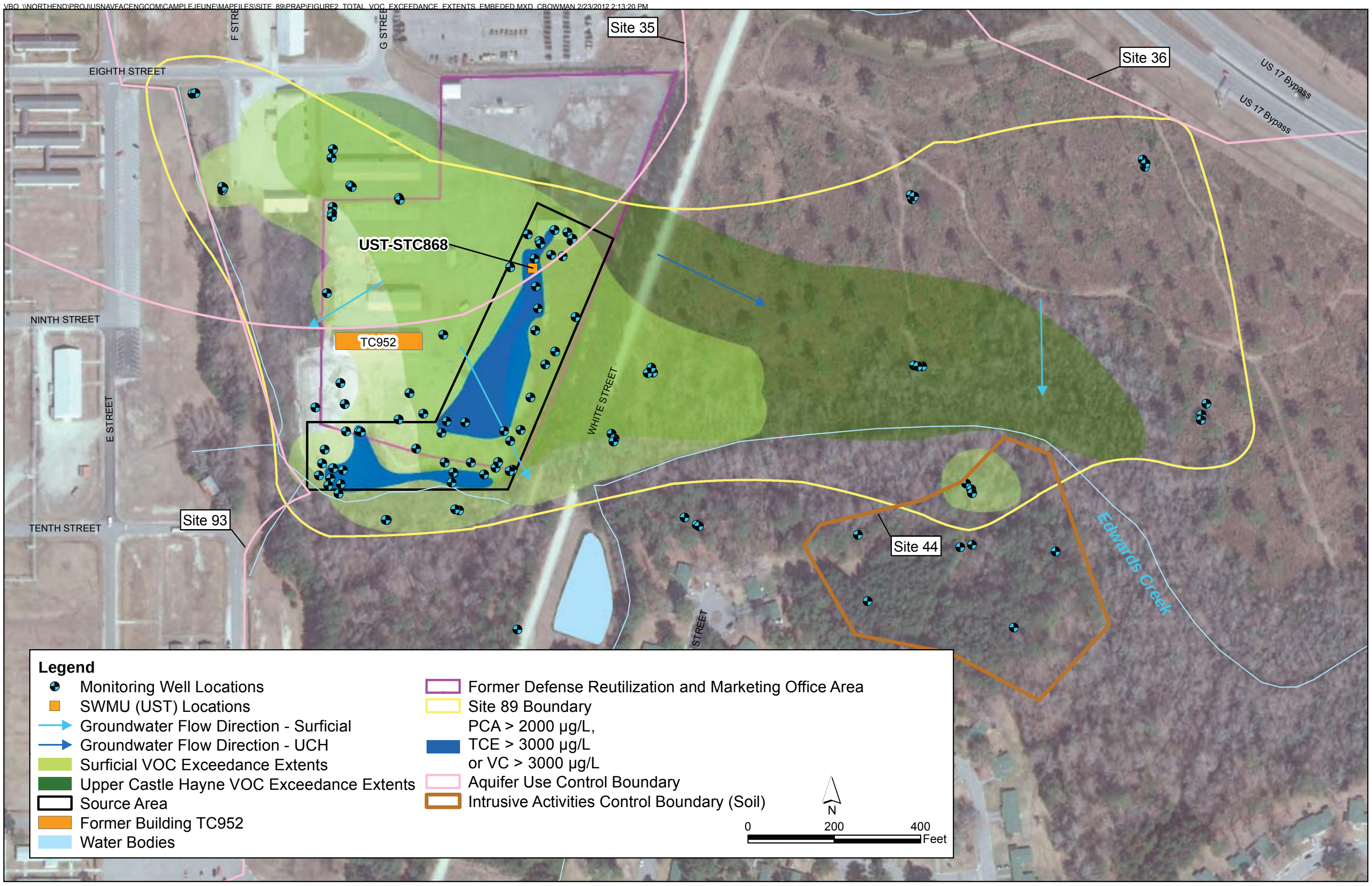


Figure 2 – Site Map

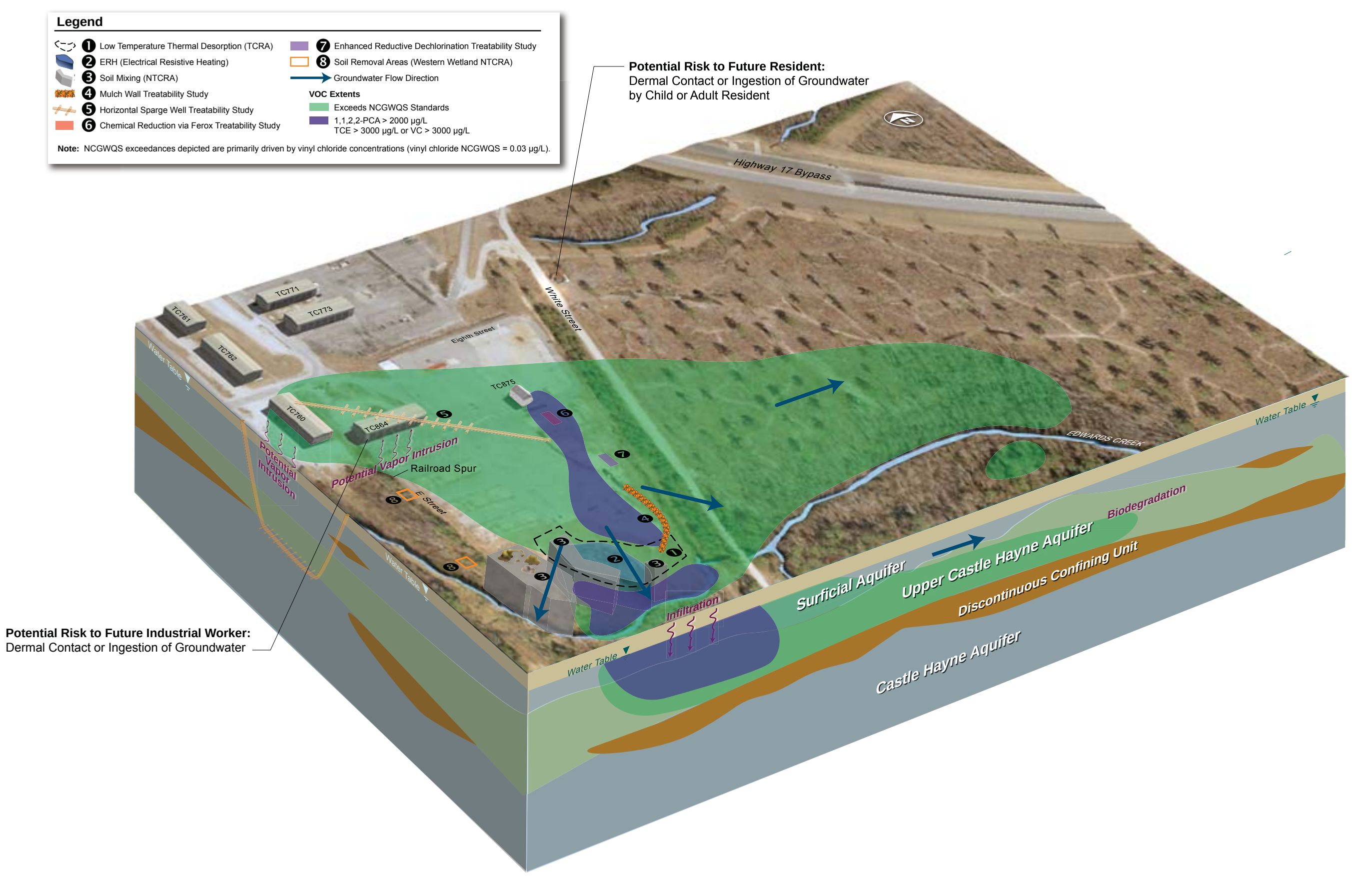


Figure 3 – Conceptual Site Model

into Edwards Creek. The elevation of the DRMO Area is approximately 14 feet above mean sea level (msl), but drops off as the site approaches Edwards Creek.

Groundwater investigations completed at Site 89 have focused on the surficial aquifer and underlying Castle Hayne Aquifer. For the purposes of the PRAP, the aquifers have been designated as three zones corresponding to the following depths: surficial (screened to 10 feet below msl), upper Castle Hayne Aquifer (screened from 20 to 40 feet below msl), and middle Castle Hayne Aquifer (screened greater than 40 feet below msl).

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. There are no water supply wells within 1,500 ft of Site 89.

3.1 Nature and Extent of Contamination

Groundwater

From 2009 to 2011, 109 temporary and permanent monitoring wells were sampled for VOCs. The compounds 1,1,2,2-PCA, 1,1,2,-trichloroethane (1,1,2-TCA), cis-1,2-DCE, tetrachloroethene (PCE), trans-1,2-DCE, TCE, and VC were detected in groundwater samples at concentrations exceeding the **North Carolina Groundwater Quality Standards (NCGWQS)**. Table 2 provides the maximum concentrations detected during the most recent sampling event for each COC in groundwater at Site 89. Figure 2 shows the horizontal extents of the COCs. Concentrations of COCs within the source area were generally one to two orders of magnitude greater than in the downgradient plume area. Generally, COCs were more prevalent and detected at higher concentrations in samples collected from the surficial aquifer monitoring wells than the concentrations detected in the samples collected from the upper Castle Hayne Aquifer monitoring wells.

Surface Water

Historically, 1,1,2,2-PCA, TCE, and VC were detected in surface water samples at concentrations exceeding the **North Carolina Surface Water Quality Standards (NCSWQS)**. Table 3 provides the maximum concentration detected for each COC in surface water at Site 89. The highest concentrations of VOCs were observed in the sample immediately downgradient of the source area and upstream of the current aeration system. Concentrations reported in samples collected downstream of the existing aeration system are approximately 50 percent lower, suggesting that the aeration system is successfully decreasing the levels of VOCs in the surface water.

COCs	Maximum Concentration (µg/L)
1,1,2,2-PCA	9,300
1,1,2-TCA	310
cis-1,2-DCE	33,000
PCE	600
trans-1,2-DCE	6,000
TCE	69,000
VC	14,000

Table 2 – Groundwater – Maximum Concentration of COCs

COCs	Maximum Concentration (µg/L)
1,1,2,2-PCA	83
TCE	5
VC	83

Table 3 – Surface Water – Maximum Concentration of COCs

3.2 Fate and Transport of Contamination

The primary contaminant migration pathway is through groundwater flow in the surficial and upper Castle Hayne aquifers. In general, groundwater flows to the south/southeast towards Edwards Creek in the surficial aquifer and east to southeast towards the New River in the upper Castle Hayne Aquifer. Edwards Creek serves as a hydrologic divide, with runoff and surficial groundwater draining into it from the north and south. The presence of VOCs within the surface water suggests that contaminated groundwater is discharging into Edwards Creek.

Conditions in the surficial aquifer, primarily within the plume areas, are generally favorable for NA processes and exhibit evidence that NA is occurring through the widespread presence of daughter products, including ethene and ethane. Conditions in the upper Castle Hayne Aquifer appear to be limited for NA processes. However, geochemical parameters such as low oxidation reduction potential and neutral pH indicate that conditions can be favorable for NA.

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. 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 one to five percent of a compound's solubility could suggest

the presence of DNAPL in the subsurface. The maximum concentration of TCE (69 milligrams per liter [mg/L] collected from monitoring well IR89-MW53) in the surficial aquifer was detected at approximately five percent of the compounds' solubility (1,280 mg/L in water). Concentrations of TCE detected in samples collected from nearby monitoring wells screened within the surficial and upper Castle Hayne aquifers were one to two orders of magnitude lower. In addition, DNAPL has not been identified in the eastern portion of the DRMO during previous investigations and DNAPL was not observed during the sampling of IR89-MW53. Based on these lines of evidence, DNAPL is not likely present at the site. Site access is restricted by a locked gate, and surficial groundwater is not used as a potable water source. Although this action is addressing the dissolved phase VOC contaminated groundwater, the earlier NTCRAs at this site using soil mixing and LTTD addressed both DNAPL and high-concentration VOC contaminated soils that were considered principal threat wastes.

4 Scope and the Role of the Action

MCIEAST - MCB CAMLEJ was placed on 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. OU No. 16 is one of 25 discrete OUs under investigation in the **Installation Restoration Program (IRP)** and consists of Site 89 and Site 93 that have been grouped together because of their proximity to one another and unique characteristic of suspected waste (solvents). Site 93, located west of Site 89, is currently **Remedy-in-Place (RIP)** status (Figure 2). The final ROD for Site 93 was signed in 2006, and the remedial action (ISCO, MNA, and LUCs) was initiated in October 2006 and MNA and LUCs are ongoing. This is the final remedial action for Site 89 and OU 16.

Site 89 and the associated plume overlap the LUCs in-place for Sites 35 (OU 10), 44 (OU 6), and 93. 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

During previous investigations (Table 1) an HHRA and ERA were conducted to evaluate risks to human health and the environment from the chemicals detected at Site 89. The following subsections and Table 4 summarize the risk assessment results.

Media	Human Health Risk	Ecological Risk
Surface Soil	Acceptable	Acceptable
Subsurface Soil	Acceptable	Not Applicable*
Groundwater	Unacceptable	Not Applicable*
Sediment	Acceptable	Acceptable
Surface Water	Acceptable	Acceptable
Indoor Air	Acceptable	Not Applicable

*Ecological receptors are not exposed to subsurface soil and groundwater

Table 3 – Site 89 Risk Summary

5.1 Human Health Risk Summary

The HHRA was completed during the 2008 Comprehensive RI to evaluate the potential impact of COCs on human health resulting from exposure to soil, sediment, surface water, groundwater, and indoor air at Site 89. Currently, the only activities underway at the site are related to environmental investigation, so the only potential human receptors included in risk estimations are future receptors. The exposure scenarios evaluated included: exposure to surface soil for future maintenance and industrial workers, recreational users, and residents; exposure to subsurface soil for future construction workers and residents; exposure to surface water and sediment for future recreational users; exposure to groundwater for future industrial and construction workers, and residents; and exposure to indoor air for future industrial workers and residents. 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 89 were used to determine if any further actions were required to sufficiently protect human health. Based on the results of the HHRA, it was concluded:

- There is no unacceptable risk from exposure to surface soil.
- There is no unacceptable risk from exposure to surface water. However, since the chemicals detected in surface water indicate that contaminated groundwater is discharging into Edwards Creek, the HHRA recommended establishing clean up levels and continuing to monitor chlorinated VOC concentrations in surface water.
- There was a potential risk identified from exposure to VOCs in subsurface soil. However, the soil-mixing NTCRA was since implemented to treat the high VOC concentrations and DNAPL and the results of follow-up sampling suggest that this removal action was successful in treating subsurface soils and that potential risk from exposure to subsurface soil was removed.

- There is a potential risk to future industrial workers, construction workers, and residents from exposure to chlorinated VOCs (listed in Table 2) in groundwater.
- There is a potential for risk to future industrial workers and residents from exposure to VOCs in indoor air if the vapor intrusion pathway is completed by constructing buildings within 100 feet of the groundwater plume.

The **conceptual site model (CSM)** (Figure 3) depicts the potential unacceptable risk identified at Site 89, including the exposure **media**, exposure routes, and potential human health receptors.

5.2 Ecological Risk Summary

The ERA was conducted as part of the 2008 Comprehensive RI and ERA addendum to evaluate potential risks to ecological receptors. Risk was estimated by calculating **hazard quotients (HQ)** using the concentration of each contaminant in applicable media (soil, surface water, and sediment) 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 contaminants 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 web modeling.

The results indicated that the only ecological risk at Site 89 was to the benthic invertebrate community (animals with no backbones that live in sediments) exposed directly to the surface soil and sediment containing elevated levels of PAHs and pesticides in the western wetland adjacent to Edwards Creek.

In 2010, a Western Wetland NTCRA (CH2M HILL, 2010) was conducted to remove the soil and sediment with PAHs and pesticide contamination exceeding ecological risk screening levels (Figure 3). Confirmatory sampling results verified that the performance standards had been achieved and that any remaining ecological risk was within acceptable levels.

6 Remedial Action Objectives

The role of the Preferred Alternative presented in this PRAP is to address the unacceptable risks posed by Site 89 and to eliminate current exposure pathways that may pose an 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 or the environment from actual or threatened releases of hazardous substances into 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 89 are as follows:

- 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
- Minimize degradation of Edwards Creek from COC-impacted groundwater discharging into surface water
- Control exposure to COCs in groundwater and potential vapor intrusion from COCs in groundwater

Cleanup levels were developed for COCs contributing to unacceptable risks and hazards from exposure to groundwater and surface water at Site 89; see Table 5. Surface water COCs were retained because groundwater is continually discharging into Edwards Creek. The cleanup levels for COCs listed in Table 5 are based upon chemical-specific **Applicable or Relevant, and Appropriate Requirements (ARARs)**. The cleanup levels for groundwater are based on the more stringent of the NCGWQS or Federal Maximum Contaminant Level (MCL). The cleanup levels for surface water are based on the NCSWQS.

Groundwater		Surface Water	
COC	NCGWQS/ MCL (µg/L)	COC	NCSWQS (µg/L)
1,1,2,2-PCA	0.2	1,1,2,2-PCA	4
1,1,2-TCA	5	PCE	3.3
cis-1,2-DCE	70	TCE	30
PCE	0.7	VC	2.4
trans-1,2-DCE	100		
TCE	3		
VC	0.03		
µg/L - micrograms per liter			

Table 5 – Cleanup Levels

7 Summary of Remedial Alternatives

The remedial alternatives that were developed and evaluated to address COCs in groundwater and surface water at Site 89 are detailed in the FS. A summary of remedial alternatives is presented in Tables 6, 7, and 8. Treatment approaches for groundwater were designed to actively treat the source area (Figure 2) and provide passive treatment and/or monitoring in the downgradient groundwater. The treatment approaches for surface water were designed to treat contaminants in Edwards Creek to concentrations below the applicable NCSWQS.

With the exception of the no-action alternatives for groundwater and surface water, all alternatives comply with ARARs, have the same RAOs, expected outcomes, and anticipated future land uses. The No Action Alternative does not protect human health and the environment, but is presented as a baseline for comparison purposes.

Alternative	Components	Details	Cost	
1 - No Action	None	None	**Total Cost**	**$0**
			Timeframe	**Indefinite**
2 – ERD	Enhanced bioremediation	Injection of electron source/substrate to promote anaerobic biodegradation of VOCs by reductive dechlorination.	Capital cost	$1,625,000
			Semi-annual monitoring (yr 1)	$57,000
			Total present value	**$1,682,000**
	Performance monitoring	Semi-annual groundwater monitoring for the first year to evaluate effectiveness of ERD injections.	**Timeframe**	**3 to 5 years**
		Active treatment would be considered complete when 95% reduction of COCs has been achieved.		
	LTM/LUCs	LTM and LUCs included in Downgradient Groundwater alternatives.		
3 – ISCO using Persulfate	Chemical oxidation of VOCs	Injection of chemical oxidant and activation agent to chemically degrade VOCs.	Capital cost	$4,096,500
			Quarterly monitoring (yr 1)	$41,000
			Total present value	**$4,137,000**
	Performance monitoring	Quarterly groundwater monitoring for the first year to evaluate effectiveness of injections.	**Timeframe**	**1 year**
		Active treatment would be considered complete when 95% reduction of COCs has been achieved.		
	LTM/LUCs	LTM and LUCs included in Downgradient Groundwater alternatives.		
4 – Air Sparging	Air Sparging	Injection of air to induce mass transfer (stripping) of VOCs from groundwater and/or aerobic biodegradation.	Capital cost	$919,900
			Annual O&M (yrs 1-3)	$151,000
			Total present value	**$1,360,000**
	Performance monitoring	Semi-annual groundwater monitoring for first 3 years to evaluate effectiveness of sparge well.	**Timeframe**	**3 years**
		Active treatment would be considered complete when 95% reduction of COCs has been achieved.		
		LTM and LUCs included in Downgradient Groundwater alternatives.		

Table 6 – Description of Remedial Alternatives for Site 89 – Source Area Groundwater

Alternative	Components	Details	Cost	
1 - No Action	None	None	**Total Cost**	**$0**
			Timeframe	**Indefinite**
2 – MNA	MNA	Long-term groundwater and surface water monitoring and reporting to evaluate:	Capital cost	$11,000
		-Progress of natural attenuation over time	Annual monitoring	$58,000
		-Potential impacts to surface water	**Total present value**	**$841,000**
		-Plume stability	**Timeframe**	**90 years**
	LUCs	LUCs to prevent exposure to groundwater and vapor intrusion.		
3 – PRB / MNA	PRB	Installation of a permeable reactive barrier to promote biodegradation through physical, chemical, or biological processes. Carbon substrate injections every 3 years to extend the lifespan of the PRB.	Capital Cost	$805,000
			PRB Operation	$24,000
			Annual monitoring	$58,000
			Total Present Value	**$1,836,000**
	MNA	Long-term groundwater and surface water monitoring and reporting to evaluate:	**Timeframe**	**90 years**
		-Effectiveness of the PRB		
		-Progress of natural attenuation over time		
		-Potential impacts to surface water		
		-Plume stability		
	LUCs	LUCs to prevent exposure to groundwater and vapor intrusion.		

Table 7 – Description of Remedial Alternatives for Site 89 – Downgradient Groundwater

Alternative	Components	Details	Cost	
1 - No Action	None	None	**Total Cost**	**$0**
			Timeframe	**Indefinite**
2 – PRB	PRB	Installation of a permeable reactive barrier to promote biodegradation through physical, chemical, or biological processes. Carbon substrate injections every 3 years extend the lifespan of the PRB.	Capital cost	$674,700
			PRB Operations	$75,700
			Total present value	**$1,952,000**
			Timeframe	**30 years**
	LTM	LTM of surface water will be performed as long as groundwater concentrations exceed NCSWQS in the surficial aquifer. LTM is included in downgradient groundwater alternatives.		
	LUCs	LUCs included in Downgradient Groundwater alternatives.		
3 – Aerators	Air Stripping	Aerators utilize air stripping technology to transfer contaminants from aqueous solutions to air.	Capital cost	$47,250
			Annual O&M	$15,000
			Total present value	**$297,000**
	LTM	LTM of surface water will be performed as long as groundwater concentrations exceed NCSWQS in the surficial aquifer. LTM is included in downgradient groundwater alternatives.	**Timeframe**	**30 years**
	LUCs	LUCs included in Downgradient Groundwater alternatives.		

Table 8 – Description of Remedial Alternatives for Site 89 – Surface Water

8 Summary of Remedial Alternatives

The NCP outlines the approach for comparing remedial alternatives using the **nine evaluation criteria** listed below (see the Glossary for a detailed description of each). Each remedial alternative for Site 89 was evaluated against these criteria. A summary of the comparative analysis of the alternatives is presented below and in Tables 9, 10, and 11. The groundwater and surface water 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

All of the alternatives screened, with the exception of the No Action Alternative, are protective of human health and the environment by reducing or controlling risks posed by the site through treatment and/or LUCs.

Source area alternatives 2 (ERD), 3 (ISCO), and 4 (AS) provide active treatment to reduce the concentrations of COCs in groundwater, expediting the NA process. The downgradient groundwater alternatives 2 (MNA) and 3 (PRB and MNA) provide passive treatment and monitoring to ensure that the plume is stable and LUCs remain protective. The surface water alternative 2 (PRB) provides treatment of groundwater immediately before discharging into Edwards Creek and surface water and alternative 3 (aerators) provides direct treatment of surface water. 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 the requirements and standards under federal or more stringent state environmental laws and regulation that are applicable or relevant and appropriate (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).

All alternatives, except the No Action Alternative (alternative 1 for each area or media), are expected to comply with ARARs. The source area alternatives are expected to meet ARARs because they employ active treatment, reducing contaminant concentrations in a shorter time frame.

Downgradient alternative 2 will have a longer time frame to meet ARARs because it relies only on natural degradation, whereas downgradient alternative 3 (PRB and MNA) provides enhanced conditions for biological degradation of COCs in groundwater migrating from the source area, reducing the time frame to meet ARARs.

Surface water alternatives 2 and 3 will meet ARARs. Alternative 3 is less intensive than alternative 2, resulting in fewer action-specific ARARs to comply with.

8.2 Primary Balancing Criteria

Long-term effectiveness and permanence

Source Area Groundwater

All source area groundwater alternatives are expected to be effective in the long term as active treatment is intended to treat most of the remaining contamination and allow NA to reduce groundwater contaminant concentration to below cleanup levels. Although "**rebound**" is a potential issue related to any injection scenario or AS. Subsurface distribution is the key to the treatment effectiveness and timeframe.

Source area alternative 2 (ERD) would take the longest of the active treatment alternatives because it relies on biological degradation rather than chemical or physical processes to remove contaminant mass. Because ISCO rapidly oxidizes COCs to innocuous compounds on contact, source area alternative 3 (ISCO) would likely remove COCs in the shortest amount of time. Source area alternative 4 (AS) would also remove COCs within a relatively short amount of time, and air may be more effective than liquid injection (alternatives 2 and 3) for making contact with the contamination.

Due to the possibility of rebound, multiple injections (or system restart for AS) may be required for source area alternatives 2, 3, and 4; however, it is less labor- and material-intensive to restart the compressor than to re-inject substrate or oxidant.

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

Downgradient Groundwater

Downgradient alternatives 2 (MNA) and 3 (PRB and MNA) would be expected to be effective in the long term. Alternative 2 would take the longest time to achieve RAOs because it relies on NA; whereas alternative 3 provides enhanced conditions for reductive dechlorination. Alternative 3 requires more long-term maintenance in the form of regular injections of a carbon source to replenish the electron donor in the PRB.

Surface Water

Active treatment of groundwater is planned to remove the source of surface water contamination from impacted surficial groundwater discharge. In the interim, surface water alternatives 2 (PRB) and 3 (aerators) would likely be effective in the long term. Both alternatives require long-term operations and maintenance (O&M). Alternative 2 requires more costly material- and labor-intensive monitoring and maintenance (potential future injections of ERD substrate) than Alternative 3.

8.3 Reduction of Toxicity, Mobility, or Volume through Treatment

Source Area Groundwater

Source area alternatives 2 (ERD), 3 (ISCO), and 4 (AS) would reduce toxicity, mobility and volume through treatment. Source area alternatives 3 and 4 would quickly reduce the toxicity and volume of COCs in groundwater through chemical oxidation or air stripping, while alternative 2 would reduce COCs at a relatively slower rate because it is dependent on biological processes.

Downgradient Groundwater

Downgradient alternative 3 (PRB and MNA) would reduce toxicity, mobility, and volume through treatment by providing passive remediation of contaminants migrating from the source area, but it would not treat the source directly. Although downgradient alternative 2 (MNA) would not provide for active treatment, the natural reduction of contaminant concentrations through a variety of physical, chemical, or biological activities is expected over time.

Surface Water

Surface water alternatives 2 (PRB) would reduce toxicity, mobility, and volume through treatment by providing passive remediation of contaminants migrating from the source (groundwater), but it would not treat the surface water directly. Alternative 3 (aerators) would reduce the toxicity and volume of contaminants in Edwards Creek.

Short-term Effectiveness

Source Area Groundwater

Short-term effectiveness, in terms of risks to workers, the community, and the environment, would be minimized for source area alternatives 2 (ERD), 3 (ISCO), and 4 (AS) through the use of appropriate personal protective equipment and air monitoring. Source area alternative 3 has a highest short-term risk to workers because of the use of oxidants and strongly corrosive chemicals and the possibility of re-injection. In general, emissions, water consumption, and energy use are greatest for source area alternative 4 because of the electricity used to power the AS system for 3 years. Source area alternatives 3 and 4 are most likely to achieve RAOs in the shortest period of time because of the enhanced distribution of relatively fast-acting reagents, particularly chemical oxidation. Source area alternative 4 will take less time to install than source area alternatives 2 and 3.

Downgradient Groundwater

Short-term effectiveness, in terms of risks to the environment, workers, and the community during implementation, would be lowest for downgradient alternative 2 (MNA) compared with downgradient alternative 3 (PRB and MNA). Because both alternatives include MNA for 90 years, the only difference between the two alternatives is the PRB installation and maintenance. Alternative 3 is likely to reach RAOs within a shorter timeframe but would have higher environmental impacts because of installation activities and maintenance of the PRB.

Surface Water

The short-term effectiveness of surface water alternatives is similar to the downgradient alternatives. The PRB would be significantly more labor-intensive and require more materials to install and maintain than aerators.

Implementability

Source Area Groundwater

Each alternative is implementable, with materials and services readily available. However, subsurface liquid injections rely heavily on the ability to distribute reagents uniformly at acceptable quantities. In addition, ISCO (alternative 3) would require extra health and safety precautions for the handling of both the oxidant and the activator. Similar to liquid injections, AS (alternative 4) relies on a relatively uniform distribution of air. Air injected beneath the cemented sand layer or any clay lenses would likely follow this layer until it reaches the point where it is discontinuous. Alternatives 2, 3, and 4 would involve significant construction activities during installation of 108 injection wells (5,875 linear feet total) or 2,950 linear feet of horizontal wells. While horizontal directional drilling is more specialized than vertical drilling, the two horizontal wells can be installed from one location so set-up and breakdown costs would be relatively minor compared to 108 different well locations for Source Area Alternatives 2 and 3.

Downgradient Groundwater

Each alternative is implementable, with materials and services readily available. Downgradient alternative 2 is significantly easier to implement because no construction activities are required. The PRB would require significant site preparation and construction activities to implement. Additionally, it would involve significant soil handling (approximately 1,500 cubic yards) during initial implementation and potential future periodic injections during the life span of the PRB. There are also a limited number of one-pass trenching companies for the PRB.

Surface Water

Both surface water alternatives are implementable, with materials and services readily available. Preparation, installation, and maintenance for alternative 3 (aerators) would be significantly easier than alternative 2 (PRB). Site preparation to clear vegetation from the trencher path would be logistically difficult in the wetland. Additionally, it would involve soil handling (approximately 2,000 cubic yards) during initial implementation and potential future periodic injections during the life span of the PRB. There are also a limited number of one-pass trenching companies for the PRB.

Cost

Tables 6, 7, and 8 summarize the capital costs, as well as long-term O&M costs (as applicable) for the alternatives. For comparative purposes, a 90-year time frame was used for downgradient groundwater alternatives and a 30-year time frame was used for surface water alternative comparisons.

Source Area Groundwater

The estimated present-worth cost of source area alternative 3 (ISCO) is $4,137,000, which is more than twice the cost of source area alternatives 2 (ERD) ($1,680,000) or 4 (AS) ($1,360,000).

Downgradient Groundwater

The estimated present-worth cost of downgradient alternative 2 (MNA), $841,000 is less than half of the cost of downgradient alternative 3 (PRB and MNA), estimated at $1,836,000.

Surface Water

The estimated present-worth cost of alternative 2 (PRB) is $1,952,000 is significantly higher than alternative 3 (aerators), estimated at $297,000.

8.4 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.

CERCLA Criteria	No Action (1)	ERD (2)	ISCO (3)	Air Sparging (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	●	◉	◉	●
Present Cost	$0	$1.7 M	$4.1 M	$1.4 M

Relative Ranking: ● High ◉ Moderate ❍ Low

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

Table 9 – Source Area Groundwater

CERCLA Criteria	No Action (1)	MNA (2)	PRB (3)
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	●	●	◉
Present Cost	$0	$0.9 M	$1.9 M

Relative Ranking: ● High ◉ Moderate ❍ Low

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

Table 10 – Downgradient Groundwater

CERCLA Criteria	No Action (1)	PRB (2)	Aerators (3)
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	●	◉	●
Present Cost	$0	$2 M	$0.3 M

Relative Ranking: ● High ◉ Moderate ❍ Low

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

Table 11 – Surface Water

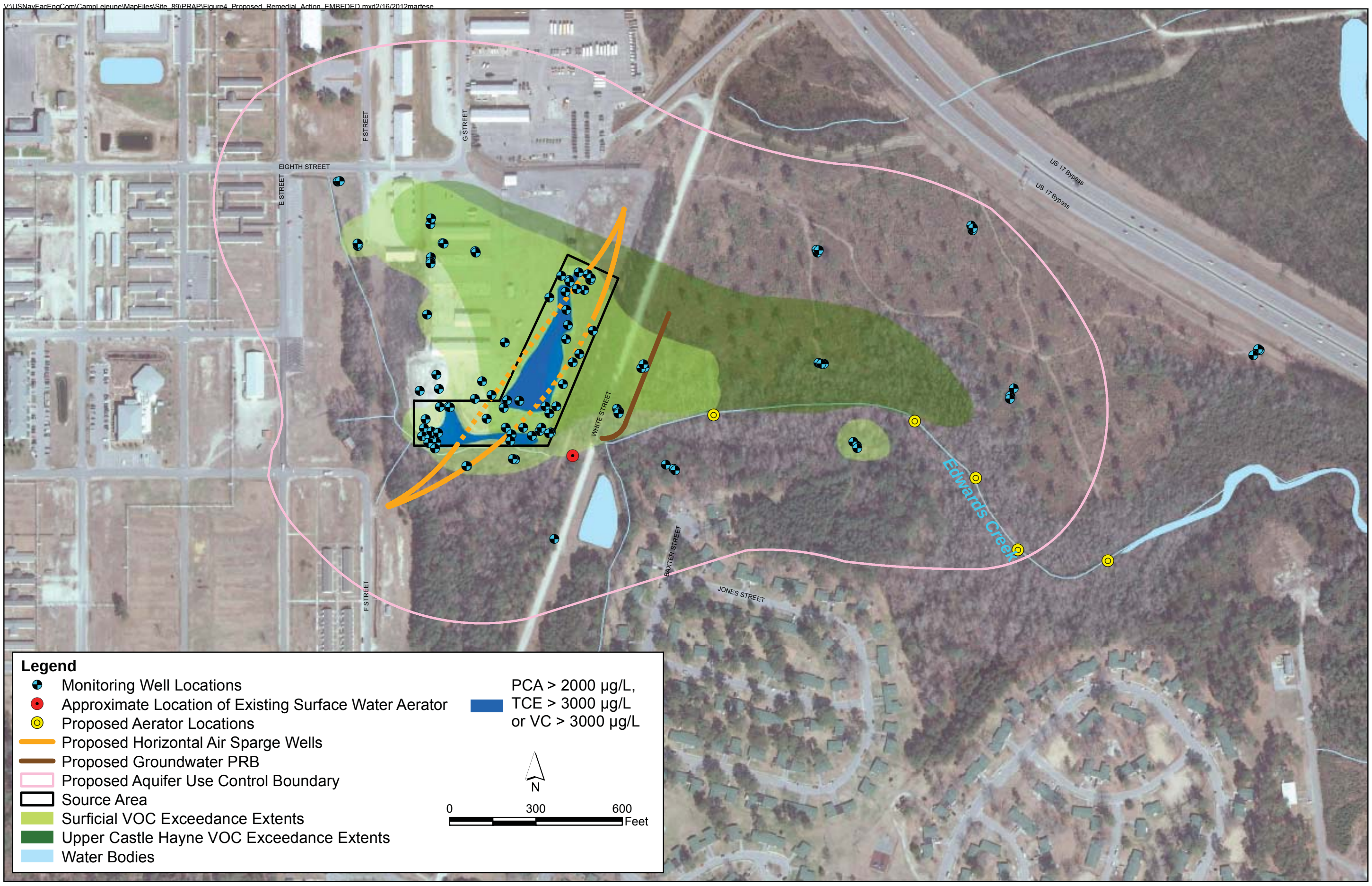


Figure 4 - Preferred Alternative

9 Preferred Alternative

One alternative from each treatment approach was selected to comprise the Preferred Alternative for remediation of groundwater and protection of surface water quality at Site 89. The preferred alternative is shown on Figure 4 and consists of:

- AS via horizontal well to remove contaminants from groundwater in the source area
- PRB and MNA to treat downgradient groundwater and monitor plume stability and NA processes

- Aerators to treat contaminated surface water in Edwards Creek
- LUCs to prevent aquifer use and mitigate vapor intrusion site.

AS is preferred because it has been proven effective at Site 89 during pilot studies, complies with ARARs, will remove COCs to the performance criteria (95 percent removal) in a reasonable timeframe, and is less expensive than source area alternatives 2 and 3. The proposed AS system consists of two horizontal directionally drilled wells, as shown on Figure 4. Operation of the AS system will continue for 3 years and will include monthly O&M. LTM will be conducted to measure the effectiveness of the AS and changes in COC concentrations.

The PRB and MNA is preferred to address downgradient groundwater contamination because it has also been proven effective at Site 89 in pilot studies, it protects human health and the environment, complies with ARARs, will enhance conditions for reductive dechlorination, and it will reduce the toxicity, mobility, and volume of the COCs through treatment. The PRB will consist of an approximately 525-foot-long mulch wall east of White Street, as shown on Figure 4. In order to extend the life span of the PRB, carbon substrate will be injected into the wall every 3 to 5 years for 10 years after the initial 5-year life span of the mulch. LTM will be conducted to monitor the effectiveness or the PRB and changes in COC concentrations for approximately 30 years. The goal of this PRB is to reduce the time required to reach cleanup levels.

Aerators are proposed to address surface water contamination because it complies with ARARs, it reduces the COCs in Edwards Creek immediately following installation, it has the smallest environmental footprint, and it is less expensive than Alternative 2. Five aerators, in addition to the aerator currently located in Edwards Creek, are proposed downstream of the source area as shown on Figure 4. LTM will be conducted to measure the effectiveness of the aerators and changes in COC concentrations.

Although the effectiveness of mitigation of COCs in groundwater will be measured by comparison to the cleanup levels (Table 4), these remedial technologies are not guaranteed to reduce COC concentrations to levels at or below cleanup levels across Site 89. However, NA processes will continue to reduce VOC concentrations over time.

LUCs including, but not limited to, land use restrictions in the Base Master Plan, Notice of Contaminated Site signage, deed and/or lease restrictions, 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 residual contamination on the site that exceeds the remediation goals. Consideration of vapor intrusion is recommended prior to any new construction or changes to existing building use or structure within the LUC boundary. The LUCs will be implemented and maintained by the Navy and MCIEAST - MCB CAMLEJ until the concentration of hazardous substances in the soil and groundwater are at such levels to allow for unlimited use and unrestricted exposure. The LUC performance objectives include:

- To prevent exposure to, and use of, the surficial and Castle Hayne aquifers underlying Site 89
- To mitigate exposure of COCs in indoor air from vapor intrusion pathways
- To maintain the integrity of any existing or future monitoring or remediation system at the site

The estimated LUC boundary is provided in Figure 4, the actual LUC boundaries will be finalized in the remedial design document. The LUC implementation actions, including monitoring and enforcement requirements, will be provided in an LUC Implementation Plan (LUCIP) that will be prepared by the Navy after the ROD has been finalized. The Navy will submit the LUCIP to 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 LUCIP 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 Alternative meets 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 Alternative to satisfy the following requirements of CERCLA: 1) protects human health and the environment, 2) complies with ARARs, 3) is cost-effective, 4) uses permanent solutions and alternative treatment technologies to the maximum extent practicable, and 5) satisfies the preference for treatment as a principal element. The Preferred Alternative can change in response to public comment or new information.

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 CFR300.430(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 would be evaluated by the parties and implemented by the Navy.

10 Community Participation

The Navy and EPA provide information regarding environmental cleanups at Site 89 to the public through the Restoration Advisory Board, public meetings, the Administrative Record file for the site, the Information Repository, and announcements published in Jacksonville Daily News, The Globe and RotoVue. The public is encouraged to gain a more-comprehensive understanding of Site 89 and the IRP. The public comment period for this PRAP is from May 25, 2012 – June 25, 2012, and a public meeting will be held on May 24, 2012 at 6:00 pm (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:

Mr. Dave Cleland
NAVFAC Mid-Atlantic
Code: OPQE
USMC NC IPT, EV Business Line
6506 Hampton Blvd
Norfolk, VA 23508
Phone (757) 322-4851
Fax (757) 322-8280
david.t.cleland@navy.mil

Ms. Charity Rychak
MCIEAST - MCBCAMLEJ
IF&E/EMD/EQB
12 Post Lane
Camp Lejeune, NC 28547
Phone (910) 451-9385
Fax (910) 451-5997
charity.rychak@usmc.mil

Ms. Gena Townsend
EPA Region 4
Atlanta Federal Center
61 Forsyth Street SW
Atlanta, GA 30303
Phone (404) 562-8538
Fax (404) 562-8518
townsend.gena@epa.gov

Mr. Randy McElveen
NCDENR
Green Square Complex, 3rd Floor
1646 Mail Service Center
Raleigh, NC 27699-1646
Phone/Fax (919) 707-8341
Randy.McElveen@ncdenr.gov

Location of Administrative Record and Information Repository Available Online at:

http://go.usa.gov/jZi
Internet access is available at the
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 Proposed Remedial Action Plan. 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.

Aerators: A surface water remedial alternative where air stripping is used to transfer contaminants from aqueous solutions to air.

Air Sparge (AS) using a Horizontal Well: Injection of contaminant-free air into the subsurface saturated zone, enabling a phase transfer of hydrocarbons from a dissolved state to a vapor phase.

Applicable or Relevant and Appropriate Requirements (ARARs):

- Applicable requirements, as defined in 40 C.F.R. § 300.5, are 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 specifically address a hazardous substance, pollutant, contaminant, remedial action, location, or other circumstance found 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, 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, 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.

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 U.S.C. §§ 9601 et seq., and amended again in 2000. CERCLA created a trust fund known as the Superfund, which is available to EPA to investigate and clean up 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.

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

Downgradient: the direction that groundwater flows, the Downgradient Area Groundwater alternatives address the plume area downgradient from the Source Area.

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

Enhanced reductive dechlorination (ERD): 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.

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

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

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.

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

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

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.

Installation Restoration Program (IRP): The Navy, as the lead agency, acts in partnership with 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.

In situ chemical oxidation (ISCO): Use of oxidizing chemicals to break down groundwater contaminants into carbon dioxide and water.

Land use controls (LUCs): Physical, legal, or administrative methods that restrict 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 OSC/RPM to plan and implement response actions under the NCP. EPA, the 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, or 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.

Non-aqueous phase liquids (NAPLs): 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.

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 United States 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.

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 that a remedy may employ in their ability to reduce 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 in the PRAP.
- Community Acceptance - The public's general response to the alternatives described in the PRAP and the RI and FS reports. The specific responses to the public comments are addressed in the Responsiveness Summary section of the ROD.

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 contaminant concentrations resulting from any discharge of contaminants to the land or waters of the state, which may be tolerated without creating a threat to human health or which 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 contaminant concentrations in surface waters in the state, which may be tolerated without creating a threat to human health or which 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.

Polycyclic aromatic hydrocarbon (PAH): Known carcinogenic pollutant found primarily in soils and sediments.

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.

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, permitting, 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.

Receptors: Humans, animals, or plants 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 objectives (RAOs): Objectives of remedial actions that are based on contaminated media, COCs, potential receptors and exposure scenarios, human health and ecological risk assessments, and attainment of regulatory cleanup levels, if any exist.

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

Remedial Investigation (RI): A study to determine the nature and extent of contaminants present at a site and the problems caused by their release.

Remedy-in-Place (RIP): Signifies that the remedy has already been implemented and has been demonstrated to be functioning as designed.

Site: The area of a 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.

Source: The two main source areas located within the DRMO area: one in the southern portion of the former DRMO area (the former vehicle maintenance and storage area) and the other in the area of the former UST.

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.

Vapor intrusion: The migration of volatile chemicals from the subsurface into overlying buildings.

Volatile organic compound (VOC): A compound that easily vaporizes and has low water solubility. Many VOCs are manufactured chemicals, such as those associated with paint, solvents, and petroleum. VOCs are common groundwater contaminants.

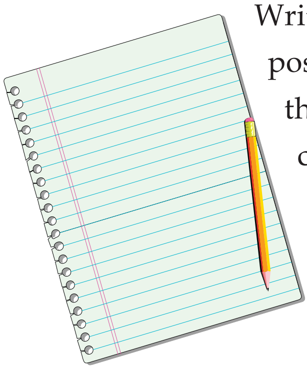
Please print or type your comments for Site 89 here

Mark Your Calendar for the Public Comment Period

Public Comment Period

May 25 – June 25, 2012

Submit Written Comments



Written comments must be postmarked no later than the last day of the public comment period, which is June 25, 2012. Based on the public comments or on any new information obtained, the Navy may modify the Preferred Alternative.

The insert page of this Proposed Plan may be used to provide comments, although the use of the form is not required. If the form is used to submit comments, please fold page, seal, add postage where indicated, and mail to addressee as provided.

Attend the Public Meeting

May 24, 2012 at 6:00pm

Coastal Carolina Community College
Business Technology Building, Room 102
4444 Western Blvd.
Jacksonville, NC 28546

The public comment period will include a public meeting during which the Navy, EPA, and MCB Camp Lejeune will provide an overview of the site, previous investigation findings, remedial alternatives evaluated and the Preferred Alternative; answer questions; and accept public comments on the Proposed Plan.

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Place stamp here

Mr. Dave Cleland
NAVFAC Mid-Atlantic Division
Attn: Matt Louth
5700 Cleveland Street, Suite 101
Virginia Beach, VA 23462