EPA/ROD/R04-97/211
1997

EPA Superfund
Record of Decision:

CAMP LEJEUNE MILITARY RES. (USNAVY)
EPA ID: NC6170022580
OU 12
ONSLOW COUNTY, NC
05/15/1997

<IMG SRC 972110>
<IMG SRC 97211A>

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 4
ATLANTA FEDERAL CENTER
100 ALABAMA STREET, S.W.
ATLANTA, GEORGIA 30303-3104

MAY 15 1997

CERTIFIED MAIL
RETURN RECEIPT REQUESTED

4WD-FFB

Commanding General
Building 1
Marine Corps Base
Camp Lejeune, North Carolina 28542

SUBJ: Record of Decision
Operable Unit 12, Site 3
MCB Camp Lejeune NPL Site
Jacksonville, North Carolina

Dear Sir:

The U.S. Environmental Protection Agency (EPA) Region 4 has reviewed the above subject decision document and concurs with the selected remedy for the Remedial Action at Site 3. This remedy is supported by the previously completed Remedial Investigation, Feasibility Study and Baseline Risk Assessment Reports.

The selected remedy consists of excavation and biological treatment of PAH-contaminated subsurface soils and institutional controls designed to prevent future potential exposure. The controls include restricting potable well installation, restrictions for future land use and a groundwater monitoring plan. This remedial action is protective of human health and the environment, complies with Federal and State requirements that are legally applicable or relevant and appropriate to the remedial action and is cost effective.

<IMG SRC 97211B>

cc: Elsie Munsell, Deputy Assistant Secretary of the Navy
Neal Paul, Camp Lejeune
Kate Landman, LANTDIV
Dave Lown, NODEHNR

<IMG SRC 97211C>

Baker Environmental, Inc.
Airport Office Park, Building 3
420 Rouser Road Coraopolis, Pennsylvania 15108
(412) 269-6000
FAX (412) 269-2002

November 25, 1997

Commander
Atlantic Division
Naval Facilities Engineering Command
1510 Gilbert Street (Building N-26)
Norfolk, Virginia 23511-2699

Attn: Ms. Katherine Landman
Navy Technical Representative
Code 18232

Re: Contract N62470-89-D-4814
Navy CLEAN, District III
Contract Task Order (CTO)-0274
Final ROD
Operable Unit No. 12 (Site 3)
MCB Camp Lejeune, North Carolina

Dear Ms. Landman:

This letter serves as notification of a misprint in the final Record of Decision (ROD) for Operable Unit No. 12 (Site 3) dated January 6, 1997. In the Declaration, under the third subject heading the Description of Selected Remedy reads "No Action". This heading should have read "Source Removal with Biological Treatment". This ROD was signed by MCB, Camp Lejeune on April 3, 1997.

This notification has been submitted to MCB, Camp Lejeune, the United States Environmental Protection Agency (USEPA) Region IV, and North Carolina Department of Environmental and Natural Resources (NC DENR). This notification should be filed with the original ROD submittal to indicate that misprint has been rectified. USEPA and NC DENR representatives have indicated that resubmittal of this document is not required. Should you have any questions regarding this correspondence, please contact me at (412) 269-2053.

Sincerely,

<IMG SRC 97211D>

MDB/rw

cc: Ms. Lee Anne Rapp, P.E. Code 18312
Ms. Beth Collier, Code 02115
Mr. Neal Paul, MCB Camp Lejeune
Ms. Gena Townsend, USEPA Region IV
Mr. David Lown, NC DENR

FINAL

RECORD OF DECISION
OPERABLE UNIT NO. 12 (SITE 3)

MARINE CORPS BASE
CAMP LEJEUNE, NORTH CAROLINA

CONTRACT TASK ORDER 0274

JANUARY 6, 1997

Prepared For:

DEPARTMENT OF THE NAVY
ATLANTIC DIVISION
NAVAL FACILITIES
ENGINEERING COMMAND
Norfolk, Virginia

Under:

LANTDIV CLEAN Program
Contract N62470-89-D-4814

Prepared by:

BAKER ENVIRONMENTAL, INC.
Coraopolis, Pennsylvania

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF APPENDICES

LIST OF ACRONYMS AND ABBREVIATIONS

ARAR	applicable or relevant and appropriate requirement
Baker	Baker Environmental, Inc.
bgs	below ground surface
CERCLA	Comprehensive Environmental Response, Compensation and Liability Act COPC contaminant of potential concern
CP	Concrete Pad Area
DoN	Department of the Navy
DW	deep well
ELISA	enzyme linked immunosorbent assay
FS	Feasibility Study
HI	hazard index
ICR	incremental lifetime cancer risk
IW	intermediate well
Ig/L	microgram per liter
Ig/kg	microgram per kilogram
MCB	Marine Corps Base
MCL	Maximum Contaminant Level
MW	monitoring well
NA	Northern Area
NC DEHNR	North Carolina Department of Environment, Health, and Natural Resources NCP National Oil and Hazardous Substances Pollution Contingency Plan NCWQS North Carolina Water Quality Standards
ND	non detect
NPW	net present worth
O&M	operation and maintenance
OU	Operable Unit
PAH	polynuclear aromatic hydrocarbon
ppb	parts per billion
ppm	parts per million
PRAP	Proposed Remedial Action Plan
psi	pounds per square inch
QI	quotient index
RA	risk assessment
RAA	remedial action alternative
RCRA	Resource Conservation and Recovery Act
RI	Remedial Investigation
ROD	Record of Decision
RS	Rail Spur Area
SARA	Superfund Amendments and Reauthorization Act
SB	soil boring
SD	sediment
SSSV	surface soil screening value
SVOC	semivolatile organic compound

TA	Treatment Area
TAL	target analyte list
TBC	to be considered criteria
TCL	target compound list
USEPA	United States Environmental Protection Agency
VOC	volatile organic compound

DECLARATION

Site Name and Location

Operable Unit No. 12 (Site 3 - the Old Creosote Plant)
Marine Corps Base
Camp Lejeune, North Carolina

Statement of Basis and Purpose

This decision document presents the selected remedy for Operable Unit (OU) No. 12 (Site 3) at Marine Corps Base (MCB), Camp Lejeune, North Carolina. The remedy was chosen in accordance with the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA), as amended by the Superfund Amendments and Reauthorization Act (SARA), and, to the extent practicable, the National Oil and Hazardous Substances Pollution Contingency Plan (NCP). This decision is based on the administrative record file for OU No. 12 (Site 3).

The Department of the Navy (DoN) and the Marine Corps have obtained concurrence from the State of North Carolina Department of Environment, Health, and Natural Resources (NC DEHNR) and the United States Environmental Protection Agency (USEPA) Region IV on the selected remedy.
Description of the Selected Remedy: No Action

The selected remedy for OU No. 12 (Site 3) includes excavation of contaminated soil; treatment of the contaminated soil using aerobic, solid-phase biological treatment at a biocell; land use restrictions; aquifer use restrictions; and groundwater monitoring. More specifically, the selected remedy includes:

- Excavating the subsurface soil area of concern to a depth of nine feet below ground surface(bgs) or to just above the water table.

- Confirmatory soil sampling in the excavation area to ensure that contaminated soil has been removed to acceptable levels.

- Treating the excavated soil (approximately 2,000 cubic yards) using aerobic, solid-phase biological treatment in a biocell.

- Backfilling the excavation area with "clean" soil.
- Implementing land use restrictions that will limit future land development/use at the site until the soil remediation has been completed.

- Quarterly sampling of groundwater from monitoring wells 03-MW02, 03-MW02IW, 03-MW02DW, 03-MW06, 03-MW07, 03-MW08, and 03-MW11IW; analyzing the samples for target compound list (TCL) volatile organic compounds (VOCs) and semivolatile organic compounds (SVOCs). If the groundwater quality improves, the sampling frequency may be reduced from quarterly to semiannual.

- Implementing aquifer use restrictions via the Base Master Plan to prohibit future use of the shallow and Castle Hayne aquifers, within a 100 foot radius of Site 3, as potable water sources.

The selected remedy addresses the principal threat - PAH contaminants in subsurface soil and the shallow groundwater aquifer - at OU No. 12 (Site 3).

Statutory Determinations

The selected remedy is protective of human health and the environment and is cost-effective. Although no chemical-specific applicable or relevant and appropriate requirements (ARARs) apply to the soil at Site 3, the remedy does comply with the to-be-considered criteria (TBCs) established for soil (i.e., federal soil screening levels established for the protection of groundwater). The remedy, however, does not comply with the chemical-specific ARARs identified for groundwater (i.e., federal and state groundwater criteria). Because contaminant concentrations exceeding the ARARs will remain untreated in the groundwater, a waiver of the ARARs may be required before the remedy can be implemented. The remedy will satisfy the statutory preference for treatment of soil but not for treatment of groundwater. The remedy will require five-year reviews by the lead agency.

<IMG SRC 97211E>

DECISION SUMMARY

1.0 INTRODUCTION

This Record of Decision (ROD) document presents the final remedial action plan selected for Operable Unit (OU) No. 12 (Site 3) at Marine Corps Base (MCB), Camp Lejeune, North Carolina. The environmental media at this site were investigated as part of a Remedial Investigation (RI), and remedial action alternatives were developed and evaluated as part of a Feasibility Study (FS), conducted for OU No. 12 (Site 3). Based on the results of the RI and FS, preferred remedial action alternatives were identified in a Proposed Remedial Action Plan (PRAP) document. Then, the public was given the opportunity to comment on the RI, FS, and PRAP. Based on comments received during the public comment period, and any new information that became available in the interim, a final remedial action plan was selected for OU No. 12 (Site 3). This ROD document presents the final selected remedy along with a summary of the remedy selection process.
The ROD is organized into 12 main sections. Section 1.0 presents an introduction, and Section 2.0 presents the site name and location, and a brief description of the site layout. Section 3.0 presents a history of the site and previous investigations/enforcement activities conducted there. Section 4.0 highlights community participation events that have occurred during the development of this ROD. Section 5.0 describes the scope and role of the response action developed to address the site contamination, and Section 6.0 summarizes the nature and extent of this site contamination (i.e., the site characteristics). Section 7.0 summarizes the site risks as determined by human health and ecological risk assessments. Section 8.0 describes the remedial action alternatives developed for soil and groundwater, while Section 9.0 summarizes the comparative analysis of these alternatives. Finally, Section 10.0 presents the final remedy selected for OU No. 12 (Site 3), Section 11.0 evaluates the selected remedy with respect to the statutory determinations, and Section 12.0 presents a responsiveness summary.

2.0 SITE NAME, LOCATION, AND DESCRIPTION

Located in Onslow County, North Carolina, MCB, Camp Lejeune is a training base for the United States Marine Corps. The Base covers approximately 236 square miles and includes 14 miles of coastline. MCB, Camp Lejeune is bounded to the southeast by the Atlantic Ocean, to the northeast by State Route 24, and to the west by U.S. Route 17. The town of Jacksonville, North Carolina is located north of the Base.

OU No. 12 is one of 18 OUs located within MCB, Camp Lejeune. Operable units were developed at the Base to combine one or more individual sites that share a common element OU No. 12 contains only one site, Site 3, which is otherwise known as the Old Creosote Plant. Figure 1 depicts the location of OU No. 12 (Site 3) within MCB, Camp Lejeune. Figure 2 presents a map of OU No. 12 (Site 3). Located within the Mainside Supply and Storage areas at MCB, Camp Lejeune, Site 3 encompasses an area of approximately five acres and is generally flat and unpaved. Open Storage Lots 201 and 203 (i.e., Site 6) are located nearby along Holcomb Boulevard approximately 1-1/2 miles from Site 3. However, Site 3 itself is not currently used for open storage.

As shown in Figure 2, the site is intersected by two roadways: a dirt path that runs north-south and forms a loop in the southern portion of the site, and a gravel road that runs east-west and leads directly to Holcomb Boulevard. Access to the site via these roadways is currently unrestricted. In addition, the Camp Lejeune Railroad line runs parallel to the site's western edge and intersects an old railroad spur line at the site's southern extreme. The intersection of these two lines creates a spike formation that points south. Wooded areas lie north and east of the site.

3.0 SITE HISTORY AND PREVIOUS INVESTIGATIONS/ENFORCEMENT ACTIVITIES

3.1 Site History

The old creosote plant reportedly operated from 1951 to 1952 to supply treated lumber during construction of the Base railroad. Reportedly, an on site sawmill, located in the northern portion of the site, was used to trim logs into railroad ties. The ties were then treated with hot creosote in pressure cylinder chambers. Although the exact treatment procedures that were used are not known, records show that preservatives (i.e., creosote) were stored for reuse in a railroad tank car. In typical pressure treatment processes, wood ties are placed inside cylindrical chambers which are filled with wood-treating preservatives. Then, hydrostatic or pneumatic pressures, ranging from 50 to 200 pounds per square inch (psi), are applied within the treatment chamber until the wood absorbs the desired amount of preservatives. When the treatment process is complete, a pump removes the excess preservative from the chamber and sends it to a storage vessel for reuse. Excess preservative is then removed from the wood by applying a vacuum, or by allowing the wood to drip dry. In the past, treated wood lay in open areas for several days, allowing preservative to drip. Today, treated wood is typically placed on lined and covered drip pads to collect excess preservative. The main treatment area at Site 3 was most likely located within and immediately surrounding the dirt path loop in the southern portion of the site. This area contains an abandoned chimney that was probably associated with creosote heating/thinning activities. (Creosote is heated and mixed with fuel oil to create a less viscous consistency.) The 240 foot long concrete pad encircled by the dirt path loop was probably used as a drip track for pressure cylinder chambers or treated wood ties. However, the concrete pad does not contain visual evidence of contamination. South of the pad, evidence of rail lines was observed indicating that a railroad connection may have been located in this area. The railroad connection may have transported creosote or ties to and from the treatment area.

3.2 Previous Investigations/Enforcement Activities

Previous investigations conducted at Site 3 include a Site Inspection (1991) and a Remedial Investigation (1994-95). More detailed information is located in the Site Inspection Report (Halliburton/NUS, 1991) and the Remedial Investigation Report (Baker, 1996).

3.2.1 Site Inspection, 1991

In June 1991, Halliburton/NUS conducted a Site Inspection that included soil, groundwater, and sediment investigations. Figure 3 identifies the sampling locations associated with these investigations.

Table 1 presents the analytical results for soil. The surficial soil samples collected from 0 to 2 feet below ground surface (bgs) contained semivolatile organic compounds (SVOCs), particularly polynuclear aromatic hydrocarbons (PAHs), which were detected at concentrations ranging from 260 microgram per kilogram (Ig/kg) for benzo(g,h,i)perylene to 2,200 Ig/kg for benzo(b)fluoranthene. Several PAHs, including chrysene, benzo(k)fluoranthene, benzo(a)pyrene, and indeno(1,2,3-cd)pyrene, were detected in the surficial soil at concentrations exceeding 1,000 Ig/kg. PAHs were not detected in the shallow subsurface soil samples collected from three to five feet bgs. However, a deep subsurface soil sample from boring 03-MW02 (15 to 17 feet bgs) contained elevated PAH concentrations. In this sample, several PAHs, including acenaphthene, fluoranthene, fluorene, naphthalene, and phenanthrene, were detected at concentrations exceeding 35,000 Ig/kg; dibenzofuran was detected at 35,000 Ig/kg. Based on the sample depth and sampling logs, this deep subsurface soil sample may have been collected from the saturated zone. Table 2 presents the analytical results for groundwater. Of the three groundwater samples collected, only the sample from well 03-MW02 contained SVOCs. Several PAHs, including acenaphthene, 2-methylnaphthalene, naphthalene, and phenanthrene, were detected at concentrations exceeding 1,000 microgram per liter (Ig/L). Other detected PAHs included anthracene (260 Ig/L), chrysene (96 Ig/L), fluoranthene (640 Ig/L), fluorene (890 Ig/L), and pyrene (460 Ig/L). In addition, dibenzofuran was detected at a concentration of 1,100 Ig/L. In sediment, the SVOC bis(2-ethylhexyl)phthalate was detected at a concentration of 750 Ig/kg. However, this constituent is a common laboratory contaminant so its presence is most likely not site- related. No other SVOCs were detected in the sediment during the Site Inspection.

3.2.2 Remedial Investigation, 1994-95

From 1994 through 1995, Baker Environmental, Inc. (Baker) conducted field activities for an RI at Site 3. These field activities, which included soil and groundwater investigations, were conducted in three phases. Phase 1, conducted in September 1994, consisted of a surface soil investigation using enzyme linked immunosorbent assay (ELISA) field screening (i.e., surface soil samples were collected and immediately analyzed for PAHS in the field using an ELISA field test kit). A total of 84 surface soil samples were collected and analyzed in the field. Thirty-seven of the 84 samples were sent to a laboratory for confirmatory analyses. The results of the Phase 1 surface soil investigation assisted in locating soil borings and monitoring wells at Site 3 during Phases 2 and 3 of the RI. Phase 2, conducted from October through December 1994, included surface soil, subsurface soil, and groundwater investigations. During this second phase, five shallow monitoring wells and one intermediate monitoring well (i.e., a well screened at the top of the Castle Hayne aquifer) were installed. Phase 3, conducted in June

1995, included surface soil, subsurface soil, and groundwater investigations. During this third phase, five additional shallow monitoring wells, one additional intermediate monitoring, and one deep monitoring well (i.e., a well screened in the middle of the Castle Hayne aquifer) were installed. In addition to these three RI phases, monitoring well 03-MW02DW was resampled a third time in January 1996.

Figures 4, 5, and 6 identify the soil sampling locations associated with the RI. Figure 4 identifies the sampling locations in the site's northern area (NA), Figure 5 identifies the sampling locations in the treatment area (TA)/concrete pad area (CP), and Figure 6 identifies the sampling locations in the railroad spur area (RS). Figure 7 identifies the groundwater sampling locations associated with the RI. In addition, Tables 3 and 4 present soil and groundwater sampling summaries, respectively. Tables 5, 6, and 7 summarize the analytical results from the surface soil, subsurface soil, and groundwater investigations associated with the RI. Table 5 summarizes the surface soil results, Table 6 summarizes the subsurface soil results, and Table 7 summarizes the groundwater results. These tables present concentration ranges for positively detected chemical constituents, and a comparison of constituent concentrations to relevant comparison criteria (i.e., federal, state, and/or local standards; background concentrations; or risk-based concentrations). As the analytical results indicate, the most frequently detected organic contaminants were PAHs, which exhibited the highest concentrations in both soil and groundwater. Because creosote is made up of PAH compounds, the PAHs detected at Site 3 are believed to be associated with operations at the former creosote plant. The highest PAH concentrations in soil occurred in the treatment area of the site (i.e., the area encircled by the dirt path loop). Fuel constituents, such as ethylbenzene and xylene, were also detected in surface and subsurface soil at the former treatment area. In the shallow aquifer, benzene was detected above federal and/or state standards in the central portion of the treatment area during the first and third groundwater sampling rounds, but not during the second round. Several PAHs, including naphthalene, phenanthrene, benzo(a)anthracene, chrysene, and benzo(a)pyrene, were detected above federal and/or state standards during the first sampling round. However, naphthalene was the only PAH that was detected above standards during the subsequent sampling rounds. Naphthalene was detected in the treatment area and in the rail spur area, but the locations and concentrations of detections were not consistent between the three groundwater sampling rounds.

In the Castle Hayne aquifer, volatile organic compounds (VOCs) (in particular, fuel constituents) and SVOCs (in particular, PAHs and phenols) were detected during all three sampling rounds. Benzene, chloroform, naphthalene, and phenol were the only organic contaminants detected above federal and/or state standards. Benzene was detected above standards in intermediate well 03-MW02IW during the first sampling round. During the second sampling round, benzene, phenol, and naphthalene were detected above standards in deep well 03-MW02DW (located in the treatment area). During the third sampling round, no contaminants were detected above federal and state standards in the Castle Hayne aquifer. When 03-MW02DW was resampled a third time (in January 1996) no contaminants were detected above federal and state standards.

4.0 HIGHLIGHTS OF COMMUNITY PARTICIPATION

The RI, FS, and PRAP documents for OU No. 12 (Site 3) were released to the public on November 6, 1996. These documents are available in an administrative record file at information repositories maintained at the Onslow County Public Library and at the Installation Restoration Division Office (Room 238, MCB, Camp Lejeune). Also, all addresses on the OU No. 12 (Site 3) mailing list will be sent a copy of the Final PRAP and Fact Sheet. The notice of availability of the PRAP, RI, and FS documents was published in the "Jacksonville Daily News" on November 3, 1996. A public comment period was held from November 6, 1996 to December 6, 1996. In addition, a public meeting was held on November 6, 1996 to respond to questions and to accept public comments on the PRAP for OU No. 12 (Site 3). The public meeting minutes were transcribed and a copy of the transcript is presented in Appendix A of this ROD document. A copy of the transcript is also made available to the public at the aforementioned locations. A Responsiveness Summary, included as part of this ROD, has been prepared to respond to the significant comments, criticisms, and new relevant information received during the comment period. Upon signing this ROD, MCB, Camp Lejeune and the Department of the Navy (DoN) will publish a notice of availability for the ROD in the local newspaper, and place this ROD in the information repositories.

5.0 SCOPE AND ROLE OF THE RESPONSE ACTION

The scope of the response action for Site 3 includes two environmental media of concern: 1) subsurface soil, and 2) groundwater in the shallow aquifer. Based on the results of human health and ecological risk assessments, groundwater was the only environmental medium that generated unacceptable risk values (unacceptable human health risk values were generated under the future residential land use scenario - see Section 7.0 of this ROD). To address these unacceptable risk values, it was necessary to develop a response action for groundwater. Although subsurface soil did not generate unacceptable risk values, the subsurface soil was suspected to be contributing to the groundwater contamination by leaching PAHs. To address the potential for leaching contaminants, it was necessary to develop a response action for subsurface soil. Thus, two sets of remedial action alternatives were developed - one set for subsurface soil and one set for groundwater. A complete response action for Site 3 will combine one subsurface soil alternative and one groundwater alternative.

The response action for Site 3 focuses on specific areas of concern located within the subsurface soil and groundwater. Figure 8 depicts these areas of concern. The subsurface soil area of concern was defined based on SVOC concentrations that exceeded federal soil screening levels established to protect groundwater, and the depth of the water table. This area of concern extends from approximately three feet bgs to nine feet bgs (just above the water table). The total volume of soil within this area of concern is approximately 1,340 cubic yards. [Note: The soil area of concern does not include PAH contamination detected below the water table. This is because it is impractical to remediate this saturated soil. Continued groundwater monitoring, however, may be proposed to address this contamination.] The groundwater areas of concern were defined based on SVOC concentrations in the shallow aquifer that exceeded federal and/or state standards, or risk-based criteria. As shown in Figure 8, one groundwater area of concern is centered around well 03-MW02, and one groundwater area of concern is centered around well 03-MW06. In the vicinity of 03-MW02, the subsurface soil area of concern is suspected to be the main source of groundwater contamination. Leaching PAHs from the subsurface soil most likely contaminated the groundwater in this area. Thus, the subsurface soil area of concern is considered a "source area" of contamination. The groundwater area of concern centered around 03-MW06 contains PAH concentrations, but at lower levels than the groundwater area of concern centered around 03-MW02. In the vicinity of 03-MW06, there does not appear to be a source area of contaminated soil.

6.0 SUMMARY OF SITE CHARACTERISTICS

Based on the results of a previous investigation and the RI, the most frequently detected organic contaminants at Site 3 were PAHs. Because creosote is made up of PAH compounds, the PAHs detected at Site 3 are believed to be associated with operations at the former creosote plant. Soil and groundwater (both shallow and deep) contained the highest levels of PAH compounds. In soil, the maximum PAH concentrations occurred in the treatment area of the site. In groundwater, the maximum PAH concentrations occurred in the treatment area and in the southern rail spike area. In addition to PAHs, fuel constituents, including benzene, were detected in soil and groundwater (both shallow and deep) at Site 3. The maximum concentrations of these fuel constituents, however, were scattered sporadically across the site.

7.0 SUMMARY OF SITE RISKS

As part of the RI, a human health risk assessment (RA) and an ecological RA were conducted to determine the potential risks associated with the chemical constituents detected at Site 3. The following subsections briefly summarize the findings of the human health and ecological RAs.

7.1 Human Health Risk Assessment

During the human health RA, contaminants of potential concern (COPCs) were selected for surface soil, subsurface soil, and groundwater, as shown in Table 8. The selection of COPCs was based on criteria provided in the U.S. Environmental Protection Agency (USEPA) Risk Assessment Guidance for Superfund.

For each COPC, incremental lifetime cancer risk (ICR) values and hazard index (HI) values were calculated to quantify potential carcinogenic and noncarcinogenic risks, respectively. Table 9 presents the ICR and HI values for each environmental medium and receptor evaluated. (Receptors included current military personnel, future child and adult residents, and future construction workers.) Table 9 also presents total ICR and HI values which represent risks to all environmental media combined, for each receptor. A shaded block in Table 9 indicates an ICR value that exceeds the USEPA acceptable limit of 1E-04 for carcinogens, or an HI value that exceeds the USEPA acceptable limit of 1.0 for noncarcinogens. As shown in Table 9, unacceptable risk values were generated for future child and adult residents upon exposure to groundwater. As shown in Tables 8 and 9, the COPCs and risk values for groundwater were generated under two approaches: 1) the evaluation of Round 2 groundwater data, and 2) the evaluation of Rounds 1, 2, and 3 groundwater data combined (referred to as the "Worst Case" approach). The latter approach is more conservative.

7.2 Ecological Risk Assessment

During the ecological RA, COPCs were selected for surface soil as shown in Table 10. Then, the potential ecological impacts to terrestrial receptors were evaluated for each COPC. Several COPCs, including some SVOCs and the inorganic chromium, exceeded surface soil screening values (SSSVs) in open grass areas or along tree lines. However, most of the studies used to develop SSSVs do not take into account the soil type, which may have a large influence on the toxicity of contaminants. In addition, most of the SSSVs are based on one or two studies which limits their reliability for a wide range of site-specific circumstances. Overall, the SSSVs have a high degree of uncertainty associated with them and are not well-established. Consequently, potential ecological risks based on these SSSVs may not be completely accurate and most likely err on the conservative side. In addition, none of the quotient indices (QIs) generated for terrestrial receptors exceeded the acceptable limit of 1.0, so potential impacts to terrestrial mammals or birds are not expected. No threatened or endangered species are known to inhabit Site 3, and no wetlands were identified.

8.0 DESCRIPTION OF ALTERNATIVES

Based on the response action developed for Site 3, remedial action alternatives (RAAs) were developed and evaluated. Five alternatives were developed for subsurface soil:

- Soil RAA No. 1: No Action
- Soil RAA No. 2: Land Use Restrictions
- Soil RAA No. 3: Source Removal and Off Site Landfill Disposal
- Soil RAA No. 4: Source Removal and Off Site Incineration
- Soil RAA No. 5: Source Removal and Biological Treatment

Three alternatives were developed for groundwater:

- Groundwater RAA No. 1: No Action
- Groundwater RAA No. 2: Aquifer Use Restrictions and Monitoring
- Groundwater RAA No. 3: Extraction and On Site Carbon Adsorption Treatment

The following paragraphs describe these soil and groundwater alternatives.

8.1 Description of Soil Alternatives

8.1.1 Soil RAA No. 1: No Action

Capital Cost:	$0
Annual Operation and Maintenance (O&M) Cost:	$0
Net Present Worth (NPW):	$0
Years to Implement:	None

Under Soil RAA No. 1, no remedial actions will be implemented to address the subsurface soil area of concern. The no action alternative is required by the National Oil and Hazardous Substances Pollution Contingency Plan (NCP) as a baseline for comparison with other remedial action alternatives that provide a greater level of response. Under this alternative, contaminants will remain untreated in the subsurface soil. As a result, the lead agency will be required to review the effects of this alternative at least once every five years.

8.1.2 Soil RAA No. 2: Land Use Restrictions

Capital Cost: $0
Annual O&M Cost: $0
NPW: $0
Years to Implement: Less Than One Month

Under Soil RAA No. 2, land use restrictions will be implemented to limit future development and use of the site, and to avoid future exposure to the subsurface soil contaminants. Because the subsurface soil area of concern will not receive active treatment, the lead agency will be required to review the effects of the alternative at least once every five years.

8.1.3 Soil RAA No. 3: Source Removal and Off Site Landfill Disposal

Capital Cost: $920,000
Annual O&M Cost: $0
NPW: $920,000
Years to Implement: Less Than One Month

Under Soil RAA No. 3, the subsurface soil area of concern, which is considered a source of groundwater contamination at Site 3, will be excavated to a depth of nine feet bgs. Confirmatory soil samples will be collected from the excavation area to ensure that contaminated soil above the water table has been removed to acceptable limits. The excavated soil located from 0 to 9 feet bgs (approximately 2,000 cubic yards) will be sent off site to a Resource Conservation and Recovery Act (RCRA) permitted Subtitle C facility for disposal. Finally, the excavation area will be backfilled with clean fill from an on Base borrow pit. In addition to source removal and landfill disposal, Soil RAA No. 3 includes land use restrictions until the soil remediation is complete. Although the subsurface soil area of concern will be removed, a 5-year review by the lead agency may still be required for contaminated groundwater remaining at the site.

8.1.4 Soil RAA No. 4: Source Removal and Off Site Incineration

Capital Cost: $3,150,000
Annual O&M Cost: $0
NPW: $3,150,000
Years to Implement: Less Than One Month

Under Soil RAA No. 4, the subsurface soil area of concern will be excavated to a depth of nine feet bgs. Confirmatory soil samples will be collected from the excavation area to ensure that contaminated soil above the water table has been removed to acceptable limits. The excavated soil located from 0 to 9 feet bgs (approximately 2,000 cubic yards) will be sent off site for thermal treatment at a permitted incineration facility. Finally, the excavation area will be backfilled with clean fill from an on Base borrow pit. In addition to source removal and incineration, Soil RAA No. 4 includes land use restrictions until the soil remediation is complete. Although the subsurface soil area of concern will be removed, a 5-year review by the lead agency may be required for contaminated groundwater remaining at the site.

8.1.5 Soil RAA No. 5: Source Removal and Biological Treatment

Capital Cost: $362,000
Annual O&M Cost: $35,000
NPW: $514,000
Years to Implement: Assumed to be 5 years

Under Soil RAA No. 5, the subsurface soil area of concern will be excavated to a depth of nine feet bgs. Confirmatory soil samples will be collected from the excavation area to ensure that contaminated soil above the water table has been removed to acceptable limits. The excavated soil located from 0 to 9 feet bgs (approximately 2,000 cubic yards) will undergo aerobic, solid-phase biological treatment at one of two locations: 1) the existing Lot 203 biocell at MCB, Camp Lejeune, or 2) a biocell constructed at Site 3. The treatment location will depend on the availability of the Lot 203 biocell which is currently being used to treat petroleum, oil, and lubricant (POL)- contaminated soil from other sites at MCB, Camp Lejeune. In addition, the treatment location will depend on the ability to modify the permit for the Lot 203 biocell so that is can accept PAH- contaminated soil. Prior to implementation, a pilot-scale treatability study will be conducted at Site 3 to further determine the effectiveness of this alternative. The treatability study is currently scheduled to begin in the Spring of 1997. The biological treatment will be conducted using landfarming technology within a controlled unit (the "biocell"). The contaminated soil will be placed in a 12 inch lift underlain by a 24 inch lift of coarse sand, a high density polyethylene geomembrane liner, and a non-woven geotextile fabric. Leachate will be collected by a leachate collection line and sump, and periodically resprayed back onto the contaminated soil. Maintenance of the biocell will consist of periodic leachate collection and respraying, soil tilling, nutrient and fertilizer addition, and soil sampling. Soil RAA No. 5 also includes land use restrictions until the soil rernediation is complete. Although the subsurface soil area of concern will be removed and treated, a 5-year review by the lead agency will be required until the remediation levels for soil are achieved.

8.2 Description of Groundwater Alternatives

8.2.1 Groundwater RAA No. 1: No Action

Capital Cost:	$0
Annual O&M Cost:	$0
NPW:	$0
Years to Implement:	None

Under Groundwater RAA No. 1, no remedial actions will be implemented to address the groundwater areas of concern. The no action alternative is required by the NCP as a baseline for comparison with other remedial action alternatives that provide a greater level of response. Under this alternative, contaminants will remain untreated in the groundwater. As a result, the NCP requires the lead agency to review the effects of this alternative at least once every five years.

8.2.2 Groundwater RAA No. 2: Aquifer Use Restrictions, and Monitoring

Capital Cost:	$0
Annual O&M Cost (Years 1-5):	$64,000
Annual O&M Cost (Years 6-30:	$33,000
NPW:	$643,000
Years to Implement:	30 Years of Groundwater Monitoring

Under Groundwater RAA No. 2, aquifer use restrictions and a groundwater monitoring program will be implemented. The aquifer use restrictions will prohibit future use of the shallow and Castle Hayne aquifers, within a 1000 foot radius of Site 3, as potable water sources. The monitoring program will include quarterly groundwater sampling and analysis at four shallow monitoring wells (03-MW02, 03-MW06, 03-MW07, and 03-MW08), two intermediate monitoring wells (03-MW02IW and 03-MW11IW), and one deep monitoring well (03-MW02DW). If the groundwater quality improves, the sampling frequency may be reduced from quarterly to semiannual. The samples will be analyzed for TCL VOCs and SVOCs to monitor contaminant concentrations in the shallow and Caste Hayne aquifers over time. For cost estimating purposes, quarterly sampling was assumed for years 1-5, and semiannual sampling was assumed for years 6- 30. Additional wells may be added to the monitoring program if necessary. Under Groundwater RAA No. 2, the groundwater areas of concern will not receive active treatment so the lead agency will be required to review the effects of this alternative at least once every five years.

8.2.3 Groundwater RAA No. 3: Extraction and On Site Carbon Adsorption Treatment

Capital Cost:	$422,000
Annual O&M Cost (Years 1-5):	$64,000
Annual O&M Cost (Years 6-30):	$33,000
Annual O&M Cost (Treatment System Years 1-3):	$85,000
NPW:	$2,370,000
Years to Implement:	30 Years of Treatment Plant O&M; 30 Years of Groundwater Monitoring

Under Groundwater RAA No. 3, a groundwater extraction and treatment system (i.e., a pump and treat system) will be installed at Site 3. Two extraction wells will be installed within the shallow aquifer at depths of approximately 20 feet bgs. One extraction well will be located near existing well 03-MW02, and one extraction well will be located near existing well 03-MW06. The wells pumping rates will allow their cones of influence to intercept the groundwater areas of concern. (For cost estimating purposes, it is assumed that each well will pump at 5 gallons per minute and generate a 220 foot radius of influence). Once extracted, the contaminated groundwater will be transported via pipeline to an on site treatment plant located between existing wells 03-MW02 and 03-MW06. At the treatment plant, the groundwater will undergo pretreatment via oil/water separation, neutralization, precipitation, filtration, flocculation, and sedimentation. Then the groundwater will undergo liquid-phase carbon adsorption treatment. The treated groundwater will be discharged by pipeline to the nearest sanitary sewer line for subsequent discharge to a Base sewage treatment plant. In addition to groundwater extraction and treatment, Groundwater RAA No. 3 includes land use and aquifer use restrictions and a groundwater monitoring program. (See Groundwater RAA No. 2 for a description of the restrictions and monitoring program included under Groundwater RAA No. 3.) Because the contaminated groundwater will remain on site indefinitely, 5-year reviews by the lead agency will be required.

9.0 SUMMARY OF THE COMPARATIVE ANALYSIS OF ALTERNATIVES

This section summarizes the comparative analysis of alternatives that was conducted for the soil and groundwater RAAs. During the analysis, the RAAs were comparatively evaluated using seven USEPA evaluation criteria: overall protection of human health and the environment; compliance with applicable and relevant or appropriate requirements (ARARs)/ to-be-considered criteria (TBCs); long-term effectiveness and permanence; reduction of toxicity, mobility, or volume through treatment; short-term effectiveness; implementability; and cost. Table 11 presents definitions of these evaluation criteria.

9.1 Analysis of Soil Alternatives

9.1.1 Overall Protection of Human Health and the Environment

Under Soil RAA No. 1 (No Action) and Soil RAA No. 2 (Land Use Restrictions), no remediation actions will be implemented to remove or treat the area of concern containing contaminated subsurface soil. Because the contaminated soil will be left as is, it will continue to be a potential source of groundwater contamination (via contaminant leaching). As such, the contaminated soil will be contributing to the unacceptable human health risks associated with groundwater. (These risks were generated under the future residential land use scenario.) Soil RAA No. 1 provides no means for reducing these potential risks. Soil RAA No. 2, on the other hand, includes land use restrictions that will reduce some of the potential risks. Regardless, under both Soil RAA Nos. 1 and 2, contaminants may continue to leach from the subsurface soil to the groundwater. Compared to Soil RAA Nos. 1 and 2, Soil RAA No. 3 (Source Removal and Off Site Landfill Disposal), Soil RAA No. 4 (Source Removal and Off Site Incineration), and Soil RAA No. 5 (Source Removal and Biological Treatment) will significantly reduce the human health risks associated with groundwater by completely removing a major source of the groundwater contamination - the subsurface soil area of concern above the water table. Because Soil RAA Nos. 3, 4, and 5 are source removal alternatives, they will prevent the further leaching of PAH contaminants from the subsurface soil (at 3 to 9 feet bgs) to the groundwater. Thus, Soil RAA No. 1 provides no additional protection of human health, Soil RAA No. 2 provides some additional protection, and Soil RAA Nos. 3, 4, and 5 provide significant protection.

Because ecological risks were determined to be insignificant, conditions at Site 3 are already considered to be protective of the environment. As a result, all five soil RAAs will provide overall protection of the environment. The biocell included under Soil RAA No. 5 could potentially present risks to terrestrial receptors. However, if the biocell is properly controlled (with a cover and a surrounding earthen berm), these ecological risks will be insignificant.

9.1.2 Compliance with ARARs/TBCs

Under Soil RAA Nos. 1 and 2, contaminants will remain in the subsurface soil at concentrations that exceed chemical-specific TBCs (i.e., the federal soil screening levels developed for USEPA Region III; no chemical-specific ARARs were identified for soil). Thus, soil conditions at the site will not meet chemical-specific TBCs. Under Soil RAA Nos. 3, 4, and 5, soil contaminants that exceed the federal soil screening levels will be removed from the subsurface. Thus, soil conditions at the site will meet chemical-specific TBCs.

Soil RAA Nos. 3, 4, and 5 can be designed to meet all of the location- and action-specific ARARs/TBCs that apply to them. No location- or action-specific ARARs/TBCs apply to Soil RAA Nos. 1 and 2.

9.1.3 Long-Term Effectiveness and Permanence

Soil RAA No. 1 does not provide long-term effectiveness and permanence. This is because Soil RAA No. 1 allows a source of groundwater contamination, the subsurface soil area of concern, to remain in place and untreated. In addition, Soil RAA No. 1 does not provide controls to manage the remaining soil contaminants. Like Soil RAA No. 1, Soil RAA No. 2 allows the subsurface soil area of concern to remain in place and untreated. However, Soil RAA No. 2 includes land use restrictions to manage the remaining soil contaminants. Therefore, Soil RAA No. 2 provides a greater level of long-term effectiveness and permanence than Soil RAA No. 1. The restrictions will effectively prevent human exposure to the PAH contaminants. However, under Soil RAA No. 2, the contaminants will continue to leach from the subsurface soil to the groundwater. Compared to Soil RAA Nos. 1 and 2, Soil RAA Nos. 3, 4, and 5 provide high levels of long-term effectiveness and permanence. Under Soil RAA Nos. 3, 4, and 5, the subsurface soil area of concern will be completely removed, preventing contaminants from leaching into the groundwater. Soil RAA Nos. 3, 4, and 5 also include land use restrictions which provide additional long-term effectiveness and permanence.

9.1.4 Reduction of Toxicity, Mobility, or Volume Through Treatment

Soil RAA Nos. 1 and 2 do not involve source removal or treatment processes, so these alternatives will not reduce toxicity, mobility, or volume of the soil contaminants. Soil RAA Nos. 3, 4, and 5, however, involve soil removal and treatment and/or disposal so these alternatives will result in toxicity, mobility, and volume reduction. Most importantly, Soil RAA Nos. 3, 4, and 5 will eliminate the mobility of PAH contaminants by preventing them from leaching into the groundwater. Soil RAA Nos. 1, 2, and 3 do not satisfy the statutory preference for treatment. Soil RAA Nos. 4 and 5 do satisfy the statutory preference.

9.1.5 Short-Term Effectiveness

Implementation of Soil RAA Nos. 1 and 2 does not increase risks to the community or to workers because these alternatives include no actions other than administrative efforts. Soil RAA Nos. 3, 4, and 5, however, will present risks during soil excavation and backfilling activities. In addition, Soil RAA Nos. 3 and 4 will present risks during transportation of the contaminated soil to the treatment/disposal facility associated with each alternative. Soil RAA No. 4 will present additional risks by creating incinerator off-gas that may escape to the atmosphere. Soil RAA No. 5 will present risks during the initial placement of the contaminated soil, and during the treatment O&M. Under RAAs Nos. 3 through 5, the following measures will be taken to provide adequate community and worker protection: proper materials handling procedures, personal protective equipment, and construction safety fencing. Air pollution control equipment at the incineration facility will also reduce the risks associated with off-gases under Soil RAA No. 4. In addition, a cover/liner system and periodic maintenance checks will provide additional protection for the treatment cell associated with Soil RAA No. 5. None of the RAAs will present significant environmental impacts.

9.1.6 Implementability

Soil RAA No. 1 is the most implementable, if not the most effective, alternative. Soil RAA No. 2 is the next most implementable alternative because the only activity it involves is ordinance procurement. The remaining RAAs (Soil RAA Nos. 3, 4, and 5) are similar in that they include the excavation of subsurface soil. Soil RAA Nos. 3 and 4 both include transportation of contaminated soil to a treatment/disposal facility. This transportation will require appropriate materials handling procedures. Compared to Soil RAA Nos. 3 and 4, however, Soil RAA No. 5 will be less easy to implement because it involves mixing of the excavated soil with bulking agents and additives, and long-term O&M of the biocell. In addition, Soil RAA No. 5 requires a treatability study.

9.1.7 Cost

In terms of NPW, the no action alternative (Soil RAA No. 1) and the land use restrictions alternative (Soil RAA No. 2) will be the least expensive to implement, followed by Soil RAA No. 5, Soil RAA No. 3, and Soil RAA No. 4. The estimated NPW values, in increasing order, are

- $0 (Soil RAA No. 1 - No Action)
- $0 (Soil RAA No. 2 - Land Use Restrictions)
- $514,000 (Soil RAA No. 5 - Source Removal and Biological Treatment)
- $917,000 (Soil RAA No. 3 - Source Removal and Off Site Landfill Disposal)
- $3,150,000 (Soil RAA No. 4 - Source Removal and Off Site Incineration)

9.2 Analysis of Groundwater Alternatives

9.2.1 Overall Protection of Human Health and the Environment

Groundwater RAA No. 1 (No Action) will not reduce the human health risks associated with groundwater. On the other hand, Groundwater RAA No. 2 (Aquifer Use Restrictions and Monitoring) and Groundwater RAA No. 3 (Extraction and On Site Carbon Adsorption Treatment) will reduce human health risks because both alternatives include restrictions and monitoring programs. The restrictions will prevent human receptors from ingesting, dermally contacting, or inhaling groundwater contaminants. Monitoring will provide a warning system against contaminants that have migrated to unsafe locations, and contaminant concentrations that have increased to unsafe levels, so that human exposure can be avoided. Thus, Groundwater RAA Nos. 2 and 3 will prevent the potential for direct exposure to contaminated groundwater, but Groundwater RAA No. 1 will not. In addition, Groundwater RAA Nos. 2 and 3 will provide overall protection of human health and the environment, but Groundwater RAA No. 1 will not.

Compared to Groundwater RAA Nos. 1 and 2, Groundwater RAA No. 3 provides some additional protection of human health and the environment by collecting the groundwater contaminants and actively treating them at an on site treatment plant. However, this additional protection is not necessary to prevent future human exposure to the groundwater contaminants. PAHs exhibit low volatility and low aqueous solubility. Due to their hydrophobic nature, PAHS tend to adsorb onto soils and sediment. As a result, the PAH contaminants at Site 3 will have a low migration potential so it is unlikely that they will horizontally or vertically migrate to the nearest current receptors.

9.2.2 Compliance with ARARs/TBCs

Groundwater RAA Nos. 1 and 2 will allow contaminant levels exceeding chemical-specific ARARs (i.e., federal and state standards, and risk-based criteria) to remain in groundwater at the site. Because of this, Groundwater RAA Nos. 1 and 2 may require a waiver of the chemical-specific ARARs before these alternatives can be implemented. Groundwater RAA No. 3 could potentially remediate the groundwater to chemical-specific ARARs, but most likely the pump and treat system will not be capable of achieving such stringent cleanup standards. Groundwater contaminants, especially PAHs, may sorb to solid particles or escape into subsurface pore spaces or fissures where they become difficult to extract. Most likely, extraction wells will only collect a portion of the PAH contamination; the remaining PAH contamination will remain in the aquifer. Therefore, a pump and treat system may not be able to achieve chemical-specific ARARs. No location- or action-specific ARARs/TBCs apply to Groundwater RAA Nos. 1 and 2. Groundwater RAA No. 3 can be designed to meet all of the location- and action-specific ARARs/TBCs that apply to it.

9.2.3 Long-Term Effectiveness and Permanence

Groundwater RAA No. 3 will provide long-term effectiveness and permanence because it involves collection and treatment of the contaminated groundwater. Although Groundwater RAA No. 2 will allow contaminants to remain untreated at the site, this alternative will also provide long-term effectiveness and permanence. Based on the hydrophobic nature of PAH contaminants, and the results of a two-dimensional flow model conducted for the FS, leaving PAH contaminants untreated at the site will not affect the nearest, current receptor (a potable water supply well located approximately 700 feet west of Site 3). It may affect future receptors occurring in the vicinity of Site 3, but Groundwater RAA No. 2 includes aquifer use restrictions and monitoring that will effectively prevent future human exposure. Groundwater RAA No. 1, on the other hand, provides no means for preventing future human exposure so this alternative will not provide long-term effectiveness and permanence.

The pump and treat system included under Groundwater RAA No. 3 will only be adequate and reliable to a certain extent. Technologies for completely extracting contaminants from groundwater are not proven. Contaminants, especially PAHs, may adsorb to solid particles or escape into subsurface pore spaces or fissures where they become difficult to extract. Also, contaminants may continue to leach from solid particles into the groundwater. As a result, extraction wells may not be completely reliable for removing PAH contaminants from the shallow aquifer. All three groundwater alternatives will require 5-year reviews by the lead agency to ensure that adequate protection of human health and the environment is maintained.

9.2.4 Reduction of Toxicity, Mobility, or Volume Through Treatment

Groundwater RAA No. 3 will reduce the toxicity, mobility, and volume of contaminated groundwater that is collected by the extraction wells. However, some of the contaminated groundwater will not be collected so it will not receive treatment. This is because PAH contaminants may adsorb to soils and sediments and escape in pore spaces and fissures. Unlike Groundwater RAA No. 3, Groundwater RAA Nos. 1 and 2 do not involve groundwater extraction or active treatment processes. Therefore, Groundwater RAA Nos. 1 and 2 will not reduce the toxicity, mobility, or volume of groundwater contamination. Unlike Groundwater RAA Nos. 1 and 2, Groundwater RAA No. 3 will create treatment residuals. The residuals associated with Groundwater RAA No. 3 (sludge, separated oil, exhausted carbon, and treated groundwater) will be voluminous and will require proper treatment and/or disposal. Groundwater RAA No. 3 satisfies the statutory preference for treatment; Groundwater RAA Nos. 1 and 2 do not.

9.2.5 Short-Term Effectiveness

Implementation of Groundwater RAA Nos. 1 and 2 does not pose substantial risks to the community or to workers. Implementation of Groundwater RAA No. 3 does pose risks because it involves construction of extraction wells, underground pipelines, and a treatment facility. During pipeline construction, special care must be taken to avoid underground utilities. In addition, construction safety fencing and dust minimization procedures should provide adequate protection to the community and to workers. Groundwater RAA No. 3 also involves long-term operation and maintenance of an extraction well system and an on site treatment facility. The treatment facility will generate residual waste streams that must be properly treated and/or disposed. The use of personal protective equipment and proper materials handling procedures should provide adequate protection during operation and maintenance. Because it creates aquifer drawdown, Groundwater RAA No. 3 is the only alternative that could potentially create environmental impacts. Under all three groundwater alternatives, the time for the action to be complete is unknown. Thirty years of groundwater monitoring was assumed for Groundwater RAA No. 2, and 30 years of groundwater monitoring and treatment system O&M was assumed for Groundwater RAA No. 3.

9.2.6 Implementability

Groundwater RAA No. 1 is the easiest alternative to implement, if not the most effective. Groundwater RAA No. 2 is the next most implementable alternative followed by Groundwater RAA No. 3. Groundwater RAA No. 1 requires no operation or maintenance. Groundwater RAA No. 2 requires minimal operation and maintenance (groundwater samples will be collected and wells will be replaced periodically). Groundwater RAA No. 3, however, requires extensive operation and maintenance. Under all three alternatives, additional remedial actions could easily be implemented. Groundwater RAA Nos. 2 and 3 involve conventional equipment and services that should be readily available. Compared to Groundwater RAA No. 2, Groundwater RAA No. 3 will require more extensive coordination with the Base Public Works/Planning department. Unlike Groundwater RAA No. 1, Groundwater RAA Nos. 2 and 3 will require semiannual submission of reports that document sampling results. Unlike Groundwater RAA No. 3, Groundwater RAA Nos. 1 and 2 may require a waiver of ARARs since groundwater contaminants will be left untreated at the site.

9.2.7 Cost

In terms of NPW, the no action alternative (Groundwater RAA No. 1) will be the least expensive alternative to implement, followed by Groundwater RAA No. 2, then Groundwater RAA No. 3. The estimated NPW values in increasing order are

- $0 (Groundwater RAA No. 1 - No Action)
- $643,000 (Groundwater RAA No. 2 - Aquifer Use Restrictions and Monitoring)
- $2,370,000 (Groundwater RAA No. 3 - Extraction and On Site Carbon Adsorption Treatment)

10.0 THE SELECTED REMEDY

This section of the ROD presents the selected remedy for OU No. 12 (Site 3) which is a combination of the separate remedies selected for soil and groundwater. The following information is presented: a remedy description, which includes the rationale behind the remedy selection; the costs estimated to implement the remedy; and the remediation levels to be attained at the conclusion of the remedy.

10.1 Remedy Description

The selected remedy for OU No. 12 (Site 3) is a combination of Soil RAA No. 5 - Source Removal and Biological Treatment, and Groundwater RAA No. 2 - Aquifer Use Restrictions, and Monitoring. Thus, the selected remedy includes the following:

- Excavating the subsurface soil area of concern to a depth of nine feet bgs or to just above the water table.

- Confirmatory soil sampling in the excavation area to ensure that contaminated soil has been removed to acceptable levels.

- Treating the excavated soil (approximately 2,000 cubic yards) with aerobic, solid-phase biological treatment in a biocell.

- Backfilling the excavation area with "clean" soil.

- Implementing land use restrictions that will limit future land development use at the site until the soil remediation has been completed.

- Quarterly sampling of groundwater from monitoring wells 03-MW02, 03-MW02IW, 03-MW02DW, 03-MW06, 03-MW07, 03-MW08, and 03-MW11IW; analyzing the samples for TCL VOCs and SVOCs. If groundwater quality improves, the sampling frequency may be reduced from quarterly to semiannual.

- Implementing aquifer use restrictions via the Base Master Plan to prohibit future use of the shallow and Castle Hayne aquifers, within a 1000 foot radius of Site 3, as potable water sources.

10.1.1 The Selection of Soil RAA No. 5 - Source Removal and Biological Treatment

At Site 3, the subsurface soil area of concern appears to be the main source of groundwater contamination (via contaminant leaching). As a result, source removal alternatives (i.e., Soil RAA Nos. 3, 4, and 5) were considered to be more appropriate than alternatives that leave the soil in situ and untreated (i.e., Soil RAA Nos. 1 and 2). This is because source removal alternatives eliminate the potential for soil contaminants to leach into the groundwater. Under the source removal alternatives, contaminants that could potentially leach will be removed from the subsurface and treated and/or disposed. Because Soil RAA Nos. 1 and 2 allow a source area of contamination to remain in situ and untreated, these alternatives do not provide adequate protection of human health.

Compared to Soil RAA Nos. 3 and 4, Soil RAA No. 5 is the most cost effective source removal alternative. Although the NPW of Soil RAA No. 5 ($514,000) is similar to the NPW of Soil RAA No. 3 ($920,000), Soil RAA No. 5 includes an extra advantage. Under Soil RAA No. 5, the contaminated soil will be treated then reused at the Base as general backfill material. Under Soil RAA No. 3, the contaminated soil will be landfilled. Thus, Soil RAA No. 5 allows for the beneficial reuse of the contaminated soil.

10.1.2 The Selection of Groundwater RAA No. 2 - Aquifer Use Restrictions and Monitoring

The groundwater contamination at Site 3 mainly consists of PAH compounds. Because PAHs exhibit low water solubility, they tend to adsorb to soil and sediment making them relatively immobile contaminants. As a result, the PAH-contaminated groundwater, if left untreated, is not likely to migrate beyond the limits identified in Figure 8. To reinforce this theory, a two-dimensional horizontal flow model was conducted during the FS. The results of the model indicated that untreated PAH-contaminated groundwater will not pose unacceptable risks to the nearest receptor (a potable water supply well) that is currently located on Base. However, future potential receptors located in the vicinity of Site 3 could be affected by the PAH-contaminated groundwater. Thus, a no action plan (i.e., Groundwater RAA No. 1) will not maintain adequate protection of human health. Groundwater RAA No. 2, on the other hand, will maintain adequate protection. Groundwater RAA No. 2 provides aquifer use restrictions that will prohibit the future use of the aquifer, thus protecting any future receptors. In addition, Groundwater RAA No. 2 includes a groundwater monitoring program that will provide a warning system in case contaminant concentrations increase to unsafe levels. This monitoring program provides additional protection of human health.

Compared to Groundwater RAA No. 2, Groundwater RAA No. 3 is not a cost effective alternative. The NPW of Groundwater RAA No. 2 is $643,000 and the NPW of Groundwater RAA No. 3 is $2,370,000. Although Groundwater No. 3 includes extraction and treatment of the contaminated groundwater, the ability of a pump and treat system to effectively extract groundwater contamination is not proven. Contaminants, especially PAHs, will sorb to soil particles and become trapped in subsurface fissures and pores where they are difficult, if not impossible, to extract. Thus, Groundwater RAA No. 3 may only have limited effectiveness. Groundwater RAA No. 2, on the other hand, will have proven effectiveness (aquifer use restrictions and groundwater monitoring are conventional and well-demonstrated). As long as the source of the contamination is removed (i.e., the subsurface soil area of concern), the PAHs in groundwater are expected to remain in the same general vicinity and naturally attenuate over time.

10.2 Estimated Costs

The following costs were estimated for the remedies selected for soil and groundwater remedies:

- Source Removal and Biological Treatment
  Capital Cost: $362,000
  Annual O&M: $35,000
  NPW: $514,000

- Aquifer Use Restrictions, and Monitoring
  Capital Cost: $0
  Annual O&M (Years 1-5): $64,000
  Annual O&M (Years 6-30): $33,000
  NPW: $643,000

The following total cost was estimated for the complete OU No. 12 (Site 3) remedy (addressing both soil and groundwater):

- Total Costs
  Capital Cost: $362,000
  Annual O&M (Years 1-5): $99,000
  Annual O&M (Years 6-30): $68,000
  NPW: $1,157,000

10.3 Remediation Levels

Tables 12 and 13 present the remediation levels developed for soil and groundwater, respectively. The soil remediation levels are based on federal soil screening levels that were established to estimate the concentration at which soil contaminants may leach and create unsafe groundwater conditions. The groundwater remediation levels are either state standards, federal standards, or risk- based concentrations calculated specifically for Site 3.

11.0 STATUTORY DETERMINATIONS

A selected remedy should satisfy the statutory requirements of CERCLA Section 121 which include: (1) protect human health and the environment; (2) comply with ARARs; (3) achieve cost-effectiveness; (4) utilize permanent solutions and alternative treatment technologies or resource recovery technologies to the maximum extent practicable; and (5) satisfy the preference for treatment that reduces toxicity, mobility, or volume as a principal element, or provide an explanation as to why this preference is not satisfied. The following paragraphs evaluate the selected remedy for OU No. 12 (Site 3) with respect to these requirements.

11.1 Protection of Human Health

Source Removal and Biological Treatment will protect human health by removing the source area of contamination (i.e., the subsurface soil area of concern) from the site. When this source area is removed, PAH contaminants will no longer leach from the soil to the groundwater. As a result, subsurface soil will no longer be contributing to unacceptable human health risks associated with groundwater.

Aquifer Use Restrictions and Monitoring will protect human health by preventing future human exposure to potential contaminants in the groundwater. Aquifer use restrictions will prevent future human exposure by prohibiting the use of the shallow and Castle Hayne aquifers, within a 100 foot radius of Site 3, as potable water sources. The groundwater monitoring program will prevent future human exposure by providing a warning system against contaminant concentrations that have increased to unsafe levels.

Because ecological risks were determined to be insignificant, conditions at Site 3 are already considered to be protective of the environment, regardless of any remedy that is implemented. The selected remedy will not provide any additional protection of the environment.

11.2 Compliance with Applicable or Relevant and Appropriate Requirements

Although there were no chemical-specific ARARs identified for soil at Site 3, the federal soil screening levels were identified as chemical-specific TBCs. Because soil with contaminant levels exceeding these screening levels will be excavated and treated, the selected remedy will achieve the soil TBCs.

Federal standards, state standards, and risk-based concentrations were identified as chemical-specific ARARs for groundwater. Because groundwater will be left untreated, the selected remedy will not achieve these ARARs. Before implementing the selected remedy, a waiver of the chemical-specific ARARs may be required. Regardless, the remedy provides adequate controls, in the form of land use restrictions, aquifer use restrictions, and monitoring, to effectively manage the untreated groundwater that will remain on site.

The selected remedy can be designed to meet all of the location- and action-specific ARARs that apply to it.

11.3 Cost-Effectiveness

Compared to the other soil alternatives that were considered, Source Removal and Biological Treatment was the most cost effective remedy capable of providing adequate protection to human health and the environment. Land use and aquifer use restrictions provide a cost-effective remedy since there are no significant costs, other than administrative-type efforts, associated with their implementation. Compared to the groundwater extraction/treatment alternative, Aquifer Use Restrictions and Monitoring is the most cost effective remedy for groundwater because it provides adequate protection of human health and the environment at a reasonable cost.

11.4 Utilization of Permanent Solutions and Alternative Treatment Technologies

The selected remedy will provide a permanent, long-term solution since the source area of contaminated soil will be removed and treated. In addition, the provision and enforcement of aquifer use restrictions will provide a permanent, long-term solution. The selected remedy also employs an innovative alternative treatment technology - a biocell.

11.5 Preference for Treatment as a Principal Element

For soil, the selected remedy satisfies the statutory preference for treatment. However, this statutory preference is not satisfied for groundwater. Regardless, the selected remedy is capable of providing adequate protection to human health and the environment.

12.0 RESPONSIVENESS SUMMARY

12.1 Overview

The selected remedy for OU No. 12 (Site 3) is Source Removal and Biological Treatment, Aquifer Use Restrictions, and Monitoring.

Based on the comments received during the public comment period, the public appears to support the selected remedy. In addition, the USEPA Region IV and the NC DEHNR are in support of the selected remedy outlined herein.

12.2 Background on Community Involvement

A record review of the MCB, Camp Lejeune files indicates that the community involvement centers mainly on a social nature, including the community outreach programs and Base/community clubs. The file search did not locate written Installation Restoration Program concerns of the community. A review of historic newspaper articles indicated that the community is interested in the local drinking and groundwater quality, as well as that of the New River, but that there are no expressed interests or concerns specific to the environmental sites (including Site 3). Two local environmental groups, the Stump Sound Environmental Advocates and the Southeastern Watermen's Association, have posed questions to the Base and local officials in the past regarding other environmental issues. These groups were sought as interview participants prior to the development of the Camp Lejeune, IRP, Community Relations Plan. Neither group was available for the interviews.

Community relations activities to date are summarized below:

- Conducted additional community relations interviews, February through March 1990. A total of 41 interviews were conducted with a wide range of persons including Base personnel, residents, local officials, and off-Base residents.
- Prepared a Community Relations Plan, September 1990.
- Conducted additional community relations interviews, August 1993. Nineteen persons were interviewed, representing local business, civic groups, on- and off-Base residents, military and civilian interests.
- Prepared a revised Final Draft Community Relations Plan, February 1994.
- Established two information repositories.
- Established the Administrative Record for all of the sites at the Base.
- Formed Restoration Advisory Board (RAB) in May 1996.
- Released PRAP for public review in repositories, November 6, 1996.
- Released public notice announcing public comment and document availability of the PRAP, November 3, 1996.
- Held Restoration Advisory Board (RAB) meeting, November 6, 1996, to review PRAP and solicit comments.
- Held public meeting on November 6, 1996, to solicit comments and provide information. Approximately 16 people attended. The public meeting transcript is available in Appendix A of this ROD document, and in the information repositories.

12.3 Summary of Comments Received During the Public Comment Period and Agency Responses

A public meeting was held on November 6, 1996 in the Onslow County Library in Jacksonville, North Carolina. Representatives from LANTDIV, MCB, Camp Lejeune, USEPA Region IV, NC DEHNR, and

OHM Corporation attended the meeting. The transcript for the public meeting is provided in Appendix A. The USEPA Region IV offered no comments. The NC DEHNR requested a more detailed explanation of the reason for not addressing contaminated soil below the water table. The State also requested that the groundwater sampling frequency be adjusted to a quarterly basis.

TABLE 1

SUMMARY OF THE ANALYTICAL RESULTS FOR SOIL
SITE INSPECTION, 1991
OPERABLE UNIT NO. 12 (SITE 3)
MCB CAMP LEJEUNE, NORTH CAROLINA

Constituent	Surface Soil (0-2 feet bgs) No. of Detections/ Total No. of Samples	Surface Soil (0-2 feet bgs) Range of Detected Concentrations	Subsurface Soil (3-12 feet bgs) No. of Detections/ Total No. of Samples	Subsurface Soil (3-12 feet bgs) Range of Detected Concentrations	Subsurface Soil (> 12 feet bgs) No. of Detections/ Total No. of Samples	Subsurface Soil (> 12 feet bgs) Range of Detected Concentrations
Acenaphthene	0/7	ND	0/5	ND	1/2	37,000
Antracene	1/7	1,900	0/5	ND	1/2	8,600
Benzo(a)anthracene	2/7	460-660	0/5	ND	1/2	5,600
Benzo(b)fluoranthene	2/7	520-2,200	0/5	ND	1/2	2,300
Benzo(k)fluoranthene	2/7	420-1,200	0/5	ND	1/2	2,100
Benzo(g,h,i)perylene	2/7	260-720	0/5	ND	0/2	ND
Benzo(a)pyrene	2/7	320-1,300	0/5	ND	0/2	ND
Chrysene	2/7	750-1,400	0/5	ND	1/2	5,900
Flouranthene	2/7	1,000-1,600	0/5	ND	1/2	35,000
Fluorene	0/7	ND	0/5	ND	1/2	35,000
Indeno(1,2,3-cd)pyrene	2/7	340-1,000	0/5	ND	0/2	ND
2-Methylnaphthalene	0/7	ND	0/5	ND	1/2	26,000
Naphthalene	1/7	550	0/5	ND	1/2	52,000
Phenanthrene	1/7	310	0/5	ND	1/2	81,000
Pyrene	2/7	920-1,400	0/5	ND	1/2	27,000
Dibenzofuran	0/7	ND	0/5	ND	1/2	35,000

Notes:

Concentrations expressed in µg/kg (microgram per kilogram)
bgs = Below ground surface
ND = Not detected

Reference: Halliburton/NUS, 1991: Site Inspection Report for Site 3 Old Creosote Plant, Marine Corps Base, Camp Lejeune, North Carolina.

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TABLE 3

SOIL SAMPLING SUMMARY
REMEDIAL INVESTIGATION, 1994-95
OPERABLE UNIT NO. 12 (SITE 3)
MCB CAMP LEJEUNE, NORTH CAROLINA

Sample Location	Depth Interval Identification	Depth of Borehole (feet, bgs)	Sampling Interval (feet, bgs)	Sample Analyses: EnSys Sample (PAH RISC (R)) (1)	Sample Analyses: TCL Volatiles	Sample Analyses: TCL Semivolatiles	Sample Analyses: TCL Pesticides/ PCBs	Sample Analyses: TAL Metals	Sample Analyses: Engineering Parameters (3)	Sample Analyses: Duplicate Samples	Sample Analyses: Matrix Spike/Matrix Spike Duplicate
Rail Spur Area											
3-RS-SB01	00	1.0	0.0-1.0	X		X (2)					
	03	7.0	5.0-7.0			X (4)					
3-RS-SB02	00	1.0	0.0-1.0	X		X (2)				X	
	04	9.0	0.0-9.0			X (4)					
3-RS-SB03	00	1.0	0.0-1.0	X		X (2)					
3-RS-SB04	00	1.0	0.0-1.0	X							
3-RS-SB05	00	1.0	0.0-1.0	X		X (2)					
	03	7.0	5.0-7.0			X (4)					
	04	9.0	7.0-9.0			X (4)					
3-RS-SB06	00	1.0	0.0-1.0	X		X (2)					
	04	9.0	7.0-9.0			X (4)					
3-RS-SB07	00	1.0	0.0-1.0	X		X (2)					
	04	9.0	7.0-9.0			X (4)					
3-RS-SB08	00	1.0	0.0-1.0	X							
3-RS-SB09	00	1.0	0.0-1.0	X							
3-RS-SB10	00	1.0	0.0-1.0	X						X	

TABLE 3 (Continued)
SOIL SAMPLING SUMMARY
OPERABLE UNIT NO. 12 (SITE 3)

Sample Analyses

Duplicate	Spike	Location	Spike/Matrix Identification	Sample (feet, bgs)	Matrix Interval (feet, bgs)	Borehole (1)	Depth Interval Volatiles	Depth of (PAH RISC (R)) Semivolatiles	Sampling TCL PCBS	EnSys Sample TCL Metals	Pesticides/ Parameters (3)	TAL Samples	TCL Engineering Duplicate
Concrete Pad Area													
3-CP-SB01		00	1.0	0.0-1.0	X								
3-CP-SB02		00	1.0	0.0-1.0	X		X (2)			X (6)			
3-CP-SB03		00	1.0	0.0-1.0	X								
3-CP-SB04		00	1.0	0.0-1.0	X		X (2)						
3-CP-SB05		00	1.0	0.0-1.0	X		X (2)						
3-CP-SB06		00	1.0	0.0-1.0	X								
3-CP-SB07		00	1.0	0.0-1.0	X								
3-CP-SB08		00	1.0	0.0-1.0	X								
3-CP-SB09		00	1.0	0.0-1.0	X		X (2)						
3-CP-SB10		00	1.0	0.0-1.0	X								
Treatment Area													
3-TA-SB01		00	1.0	0.0-1.0	X					X			
3-TA-SB02		00	1.0	0.0-1.0	X								
3-TA-SB03		00	1.0	0.0-1.0	X					X			
3-TA-SB04		00	1.0	0.0-1.0	X								
3-TA-SB05		00	1.0	0.0-1.0	X								
3-TA-SB06		00	1.0	0.0-1.0	X								

TABLE 3 (Continued)

SOIL SAMPLING SUMMARY
REMEDIAL INVESTIGATION, 1994-95
OPERABLE UNIT NO. 12 (SITE 3)
MCB CAMP LEJEUNE, NORTH CAROLINA

Sample Location	Depth Interval Identification	Depth of Borehole (feet, bgs)	Sampling Interval (feet, bgs)	Sample Analyses: EnSys Sample (PAH RISC (R)) (1)	TCL Volatiles	TCL Semivolatiles	TCL Pesticides/ PCBS	TAL Metals	Engineering Parameters (3)	Duplicate Samples	Matrix Spike/Matrix Spike Duplicate
3-TA-SB30	00	1.0	0.0-1.0	X							
3-TA-SB31	00	1.0	0.0-1.0	X							
3-TA-SB32	00	1.0	0.0-1.0	X							
3-TA-SB33	00	1.0	0.0-1.0	X							
3-TA-SB34	00	1.0	0.0-1.0	X		X (2)					
	03	7.0	5.0-7.0			X (4)					
3-TA-SB35	00	1.0	0.0-1.0	X							
3-TA-SB36	00	1.0	0.0-1.0	X		X (2)					
	03	7.0	5.0-7.0			X (4)					
3-TA-SB37	00	1.0	0.0-1.0	X		X (2)					
	02	5.0	3.0-5.0			X (4)					
3-TA-SB38	00	1.0	0.0-1.0	X							
3-TA-SB39	00	1.0	0.0-1.0	X		X (2)					
	04	9.0	7.0-9.0			X (4)					
3-TA-SB40	00	1.0	0.0-1.0	X		X (2)					
3-TA-SB41	00	1.0	0.0-1.0	X		X (2)					
	02	5.0	3.0-5.0			X (4)					

TABLE 3 (Continued)

SOIL SAMPLING SUMMARY
REMEDIAL INVESTIGATION, 1994-95
OPERABLE UNIT NO. 12 (SITE 3)
MCB CAMP LEJEUNE, NORTH CAROLINA

Sample Location	Depth Interval Identification	Depth of Borehole (feet, bgs)	Sampling Interval (feet, bgs)	EnSys Sample (PAH RISC (R)) (1)	Sample Analyses: TCL Volatiles	TCL Semivolatiles	TCL Pesticides/ PCBS	TAL Metals	Engineering Parameters (3)	Duplicate Samples	Matrix Spike/Matrix Spike Duplicate
3-TA-SB42	00	1.0	0.0-1.0	X							
3-TA-SB43	00	1.0	0.0-1.0	X		X (2)					
	03	7.0	5.0-7.0			X (4)					
3-TA-SB44	00	1.0	0.0-1.0	X		X (2)					
3-TA-SB45 (5)	00	1.0	0.0-1.0		X	X					
	02	5.0	3.0-5.0		X	X					
3-TA-SB46 (5)	00	1.0	0.0-1.0		X	X					
	02	5.0	3.0-5.0		X	X					
3-TA-SB47 (5)	00	1.0	0.0-1.0		X	X					
	02	5.0	3.0-5.0		X	X					
3-TA-SB48 (5)	00	1.0	0.0-1.0		X	X					
	04	9.0	7.0-9.0		X	X					
3-TA-SB49 (5)	00	1.0	0.0-1.0		X	X					
	04	9.0	7.0-9.0		X	X					
3-TA-SB50 (5)	00	1.0	0.0-1.0		X	X					
	04	9.0	7.0-9.0		X	X					

TABLE 3 (Continued)

SOIL SAMPLING SUMMARY
REMEDIAL INVESTIGATION, 1994-95
OPERABLE UNIT NO. 12 (SITE 3)
MCB CAMP LEJEUNE, NORTH CAROLINA

				Sample Analyses							
Sample Location	Depth Interval Identification	Depth of Borehole (feet, bgs)	Sampling Interval (feet, bgs)	EnSys Sample (PAH RISC (R)) (1)	TCL Volatiles	TCL Semivolatiles	TCL Pesticides/ PCBS	TAL Metals	Engineering Parameters (3)	Duplicate Samples	Matrix Spike/Matrix Spike Duplicate
North Area											
3-NA-SB01	00	1.0	0.0-1.0	X		X (2)				X (6)	
3-NA-SB02	00	1.0	0.0-1.0	X							
3-NA-SB03	00	1.0	0.0-1.0	X		X (2)					
	03	7.0	5.0-7.0			X (4)					
3-NA-SB04	00	1.0	0.0-1.0	X						X	
3-NA-SB05	00	1.0	0.0-1.0	X		X (2)					
	03	7.0	5.0-7.0			X (4)					
3-NA-SB06	00	1.0	0.0-1.0	X							
3-NA-SB07	00	1.0	0.0-1.0	X		X (2)					
3-NA-SB08	00	1.0	0.0-1.0	X		X (2)					
	03	7.0	5.0-7.0			X (4)					
3-NA-SB09	00	1.0	0.0-1.0	X							
3-NA-SB10	00	1.0	0.0-1.0	X		X (2)					
3-NA-SB11	00	1.0	0.0-1.0	X							
3-NA-SB12	00	1.0	0.0-1.0	X							

TABLE 3 (Continued)

SOIL SAMPLING SUMMARY
REMEDIAL INVESTIGATION, 1994-95
OPERABLE UNIT NO. 12 (SITE 3)
MCB CAMP LEJEUNE, NORTH CAROLINA

				Sample Analyses							
Sample Location	Depth Interval Identification	Depth of Borehole (feet, bgs)	Sampling Interval (feet, bgs)	EnSys Sample (PAH RISC (R)) (1)	TCL Volatiles	TCL Semivolatiles	TCL Pesticides/ PCBS	TAL Metals	Engineering Parameters (3)	Duplicate Samples	Matrix Spike/Matrix Spike Duplicate
3-NA-SB13	00	1.0	0.0-1.0	X						X	
3-NA-SB14	00	1.0	0.0-1.0	X							
3-NA-SB15	00	1.0	0.0-1.0	X							
3-NA-SB16	00	1.0	0.0-1.0	X							
3-NA-SB17	00	1.0	0.0-1.0	X		X (2)					
3-NA-SB17A (5)	00	1.0	0.0-1.0		X	X					
	02	5.0	3.0-5.0		X	X					
3-NA-SB18 (5)	00	1.0	0.0-1.0		X	X					
	02	5.0	3.0-5.0		X	X					
3-NA-SB19 (5)	00	1.0	0.0-1.0		X	X					
	02	5.0	3.0-5.0		X	X					
EnSys Background											
3-BB-SB01	00	1.0	0.0-1.0	X							
3-BB-SB02	00	1.0	0.0-1.0	X							
3-BB-SB03	00	1.0	0.0-1.0	X		X(2)				X	

TABLE 3 (Continued)

SOIL SAMPLING SUMMARY
REMEDIAL INVESTIGATION, 1994-95
OPERABLE UNIT NO. 12 (SITE 3)
MCB CAMP LEJEUNE, NORTH CAROLINA

Sample Location	Depth Interval Identification	Depth of Borehole (feet, bgs)	Sampling Interval (feet, bgs)	Sample Analyses: EnSys Sample (PAH RISC (R)) (1)	TCL Volatiles	TCL Semivolatiles	TCL Pesticides/ PCBS	TAL Metals	Engineering Parameters (3)	Duplicate Samples	Matrix Spike/Matrix Spike Duplicate
Soil Investigation											
Background											
3-BB-SB01 (4)	00	1.0	0.0-1.0			X					
	03	7.0	5.0-7.0			X					
3-BB-SB02 (4)	00	1.0	0.0-1.0			X					
	02	5.0	3.0-5.0			X					
3-BB-SB03 (4)	00	1.0	0.0-1.0			X					
	03	7.0	5.0-7.0			X					
Monitoring Wells											
3-MW02IW (4)	00	1.0	0.0-1.0		X	X	X	X		X	X
	03	7.0	5.0-7.0		X	X	X	X		X	X
	09	19.0	17.0-19.0			X					
3-MW02DW (5)	00	1.0	0.0-1.0		X	X					
	02	5.0	3.0-5.0		X	X					
3-MW04 (4)	00	1.0	0.0-1.0			X					
	04	9.0	7.0-9.0			X					

TABLE 3 (Continued)

SOIL SAMPLING SUMMARY
REMEDIAL INVESTIGATION, 1994-95
OPERABLE UNIT NO. 12 (SITE 3)
MCB CAMP LEJEUNE, NORTH CAROLINA

				Sample Analyses							
Sample Location	Depth Interval Identification	Depth of Borehole (feet, bgs)	Sampling Interval (feet, bgs)	EnSys Sample (PAH RISC (R)) (1)	TCL Volatiles	TCL Semivolatiles	TCL Pesticides/ PCBS	TAL Metals	Engineering Parameters (3)	Duplicate Samples	Matrix Spike/Matrix Spike Duplicate
3-MW05 (4)	00	1.0	0.0-1.0		X	X	X	X	X		
	10	21.0	19.0-21.0		X	X	X	X	X		
3-MW06 (4)	00	1.0	0.0-1.0			X					
	04	9.0	7.0-9.0			X					
3-MW07 (4)	00	1.0	0.0-1.0			X					
	02	5.0	3.0-5.0			X					
3-MW08 (4)	00	1.0	0.0-1.0			X					
	02	5.0	3.0-5.0			X					
3-MW09 (5)	00	1.0	0.0-1.0		X	X					
	02	5.0	3.0-5.0		X	X					
3-MW10 (5)	00	1.0	0.0-1.0		X	X					
	02	5.0	3.0-5.0		X	X					
3-MW11 (5)	00	1.0	0.0-1.0		X	X					
	08	19.0	17.0-19.0		X	X					
3-MW11IW (5)	00	1.0	0.0-1.0		X	X					
	08	19.0	17.0-19.0		X	X					

TABLE 3 (Continued)

SOIL SAMPLING SUMMARY
REMEDIAL INVESTIGATION, 1994-95
OPERABLE UNIT NO. 12 (SITE 3)
MCB CAMP LEJEUNE, NORTH CAROLINA

Sample Location	Depth Interval Identification	Depth of Borehole (feet, bgs)	Sampling Interval (feet, bgs)	EnSys Sample (PAH RISC (R)) (1)	Sample Analyses: TCL Volatiles	TCL Semivolatiles	TCL Pesticides/ PCBS	TAL Metals	Engineering Parameters (3)	Duplicate Samples	Matrix Spike/Matrix Spike Duplicate
3-MW12 (5)	00	1.0	0.0-1.0		X	X					
	02	5.0	3.0-5.0		X	X					
3-MW13 (5)	00	1.0	0.0-1.0		X	X					
	04	9.0	7.0-9.0		X	X					

Notes:

(1) Sample was collected during the first phase of the soil investigation (September 19 through September 22, 1994)
(2) EnSys confirmation sample
(3) Engineering Parameters includes Particle Size, Atterberg limits, and TOC
(4) Sample was collected during the second phase of the soil investigation (November 15 through November 22, 1994)
(5) Sample was collected during the third phase of the soil investigation (June 13 through June 20, 1995)
(6) Duplicate samples were collected for both PAH RISC (R) and TCL Semivolatiles

Reference: Baker Environmental, Inc., 1996. Remedial Investigation Report Operable Unit No. 12 (Site 3). Marine Corps Base, Camp Lejeune, North Carolina.

TABLE 4

GROUNDWATER SAMPLING SUMMARY

REMEDIAL INVESTIGATION, 1994-95

OPERABLE UNIT NO. 12 (SITE 3)

MCB CAMP LEJEUNE, NORTH CAROLINA

Sample Analyses

Location	TAL Sampling	Volatiles	Semivolatiles	Spike/Matrix PCBS	Sample Inorganics	Date of Metals	TCL Parameters (1)	TCL Samples	Matrix Pesticides/ Duplicate	TAL	Dissolved	Engineering	Duplicate	TCL Spike
Shallow Monitoring Wells, Round 1														
3-MW02-01	12/1/94		X											
3-MW03-01	12/1/94		X											
3-MW04-01	12/1/94		X											
3-MW05-01	12/2/94		X											
3-MW06-01	12/1/94		X											
3-MW07-01	12/1/94	X	X	X	X	X								
3-MW08-01	12/1/94	X	X	X	X	X								
Intermediate Monitoring Well, Round 1														
3-MW02IW-01	12/3/94	X	X	X	X	X		X	X					
Shallow Monitoring Wells, Round 2														
3-MW01-01	7/13/95	X	X											
3-MW02-02	7/11/95	X	X				X							
3-MW03-02	7/13/95	X	X											
3-MW04-02	7/11/95	X	X											

Sample Analyses

Location	TAL Sampling	Volatiles	Semivolatiles	Spike/Matrix PCBS	Sample Inorganics	Date of Metals	TCL Parameters (1)	TCL Samples	Matrix Pesticides/ Duplicate	TAL	Dissolved	Engineering	Duplicate	TCL Spike
3-MW05-02	7/11/95	X	X											
3-MW06-02	7/12/95	X	X											
3-MW07-02	7/12/95	X	X											
3-MW08-02	7/11/95	X	X				X							
3-MW09-01	7/13/95	X	X											
3-MW10-01	7/12/95	X	X											
3-MW11-01	7/12/95	X	X											
3-MW12-01	7/12/95	X	X											
3-MW13-01	7/13/95	X	X											
Intermediate and Deep Monitoring Wells, Round 2														
3-MW02IW-02	6/12/95	X	X											
3-MW02DW-01	7/13/95	X	X				X							
3-MW11IW-01	7/12/95	X	X											

TABLE 4 (Continued)
GROUNDWATER SAMPLING SUMMARY

REMEDIAL INVESTIGATION, 1994-95

OPERABLE UNIT NO. 12 (SITE 3)

MCB CAMP LEJEUNE, NORTH CAROLINA

Sample Analyses

Location	TAL Sampling	Volatiles	Semivolatiles	Spike/Matrix PCBS	Sample Inorganics	Date of Metals	TCL Parameters (1)	TCL Samples	Matrix Pesticides/ Duplicate	TAL	Dissolved	Engineering	Duplicate	TCL Spike
Shallow Monitoring Wells, Round 3														
3-MW01-02	9/28/95	X	X											
3-MW02-03	9/28/95	X	X											
3-MW03-03	9/28/95	X	X											
3-MW04-03	9/28/95	X	X											
3-MW05-03	9/28/95	X	X											
3-MW06-03	9/28/95	X	X											
3-MW07-03	9/29/95	X	X											
3-MW08-03	9/29/95	X	X											
3-MW09-02	9/29/95	X	X											
3-MW10-02	9/29/95	X	X											
3-MW11-02	9/29/95	X	X											
3-MW12-02	9/29/95	X	X											
3-MW13-02	9/29/95	X	X											

TABLE 4 (Continued)
GROUNDWATER SAMPLING SUMMARY

Sample Analyses

Location	TAL Sampling	Volatiles	Semivolatiles	Spike/Matrix PCBS	Sample Inorganics	Date of Metals	TCL Parameters (1)	TCL Samples	Matrix Pesticides/ Duplicate	TAL	Dissolved	Engineering	Duplicate	TCL Spike
Intermediate and Deep Monitoring Wells, Round 3														
3-MW02IW-03	9/29/95	X	X											
3-MW02DW-02	9/28/95	X	X											
3-MW11IW-02	9/29/95	X	X											
Deep Monitoring Well, Round 4														
3-MW02DW-03	1/29/96	X	X											

Note:

(1) Engineering Parameters include (BOD, COD, TDS, TSS, and TOC)
Reference: Baker Environmental, Inc., 1996. Remedial Investigation Report Operable Unit No. 12 (Site 3). Marine Corps Base, Camp Lejeune, North Carolina.

<IMG SRC 97211G>
<IMG SRC 97211H>
<IMG SRC 97211I>
<IMG SRC 97211J>
<IMG SRC 97211K>
<IMG SRC 97211L>
<IMG SRC 97211M>
<IMG SRC 97211N>
<IMG SRC 97211O>
<IMG SRC 97211P>
<IMG SRC 97211Q>

TABLE 8

CONTAMINANTS OF POTENTIAL CONCERN (COPCs) EVALUATED DURING THE HUMAN HEALTH RISK ASSESSMENT OPERABLE UNIT NO. 12 (SITE 3)
MCB CAMP LEJEUNE, NORTH CAROLINA

Combined Surface Subsurface Round 2 Rounds Contaminant
Soil Soil Groundwater Groundwater
Volatiles:
1,1-Dichloroethene X X Chloroform X X Trichloroethene
Benzene X X Toluene
Ethylbenzene
Xylenes (total)

Semivolatiles:
Phenol
2-Methylphenol X X 4-Methylphenol X X 2,4-Dimethylphenol
X X Naphthalene X X 2-Methynaphthalene X X
Acenaphthene X X Acenaphthylene
Dibenzofuran X X X Fluorene X X Phenanthrene
X X Anthracene
Carbazole X X Fluoranthene
Pyrene
Bis(2-ethylhexyl)phthalate
Benzo(a)anthracene X X X Benzo(b)fluoranthene X X X Chrysene X
X X Benzo(k)fluoranthene X X X Benzo(a)pyrene X X X
Indeno(1,2,3-cd)pyrene X X
Dibenz(a,h)anthracene X
2-Nitrophenol X
Inorganics:
Aluminum X Chromium X
X = Selected as a COPC for human health risk assessment.

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TABLE 10

CONTAMINANTS OF POTENTIAL CONCERN (COPCs) EVALUATED DURING THE ECOLOGICAL RISK ASSESSMENT OPERABLE UNIT NO. 12 (SITE 3)
MCB CAMP LEJEUNE, NORTH CAROLINA

Contaminant of Potential Concern in Surface Soil
Inorganics
Chromium
Zinc
Semivolatiles
Acenaphthylene
Anthracene
Benzo(a)anthracene
Benzo(b)fluoranthene
Benzo(k)fluoranthene
Benzo(g,h,i)perylene
Benzo(a)pyrene
Bis(2-ethylhexyl)phthalate
Carbazole
Chrysene
Dibenz(a,h)anthracene
Di-n-butylphthalate
Fluoranthene
Fluorene
Indeno(1,2,3-cd)pyrene
Phenanthrene
Pyrene
Volatiles
Ethylbenzene
Toluene
Xylenes

TABLE 11

GLOSSARY OF EVALUATION CRITERIA

OPERABLE UNIT NO. 12 (SITE 3) MCB CAMP LEJEUNE, NORTH CAROLINA

- Overall Protection of Human Health and the Environment - addresses whether or not an alternative provides adequate protection and describes how risks posed through each pathway are eliminated, reduced, or controlled through treatment engineering or institutional controls.

- Compliance with ARARs/TBCs - addresses whether or not an alternative will meet the applicable or relevant and appropriate requirements (ARARs), criteria to-be-considered (TBCs), and other federal and state environmental statutes, and/or provide grounds for invoking a waiver.

- Long-Term Effectiveness and Permanence - refers to the magnitude of residual risk and the ability of an alternative to maintain reliable protection of human health and the environment over time once cleanup goals have been met.

- Reduction of Toxicity, Mobility, or Volume Through Treatment - refers to the anticipated performance of the treatment options that may be employed within an alternative.

- Short-Term Effectiveness - refers to the speed with which the alternative achieves protection, as well as the remedy's potential to create adverse impacts on human health and the environment that may occur during the construction and implementation period.

- Implementability - refers to the technical and administrative feasibility of an alternative, including the availability of materials and services required to implement the chosen solution.

- Cost - includes capital and operation and maintenance costs. For comparative purposes, present worth values are provided.

TABLE 12

SOIL REMEDIATION LEVELS
OPERABLE UNIT NO. 12 (SITE 3)
MCB CAMP LEJEUNE, NORTH CAROLINA

Contaminant of Concern	RL	Basis of Goal
Naphthalene	30,000	SSL
2-Methylnaphthalene	30,000	SSL
Carbazole	500	SSL
Benzo(a)anthracene	700	SSL
Chrysene	1,000	SSL

Notes:

RL = Remediation Level in microgram per kilogram (Ig/kg)
SSL = USEPA Region III Soil Screening Level (USEPA, 1995)

TABLE 13

GROUNDWATER REMEDIATION LEVELS
OPERABLE UNIT NO. 12 (SITE 3)
MCB CAMP LEJEUNE, NORTH CAROLINA

Contaminant of Concern	RL	Basis of Goal	Corresponding Risk
Benzene	1	NCWQS	
Phenol	300	NCWQS	
2-Methylphenol	78	Groundwater Ingestion	HI = 0.1
2,4-Dimethylphenol	31	Groundwater Ingestion	HI = 0.1
Naphthalene	21	NCWQS	
2-Methylnaphthalene	63	Groundwater Ingestion	HI = 0.1
Dibenzofuran	6	Groundwater Ingestion	HI = 0.1
Phenanthrene	210	NCWQS	
Benzo(a)anthracene	0.05	NCWQS	
Chrysene	5	NCWQS	
Chloroform	0.19	Groundwater Ingestion	ICR - 1 x 10-6
Carbazole	4	Groundwater Ingestion	ICR = 1 x 10-6
Benzo(b)fluoranthene	0.12	Groundwater Ingestion	ICR - 1 x 10-6
Benzo(k)fluoranthene	1	MCL	
Benzo(a)pyrene	2	MCL	
Iron	300	NCWQS	
Aluminum	50	SMCL	

Notes:

RL = Remediation Level in microgram per liter (ppb)
NCWQS = North Carolina Water Quality Standard
MCL = Maximum Contaminant Level
SMCL = Secondary Maximum Contaminant Level
HI = Hazard Index
ICR = Incremental Cancer Risk

FIGURES

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APPENDIX A
PUBLIC MEETING TRANSCRIPT

RESTORATION ADVISORY BOARD MEETING

Proposed Remedial Action Plan

Operable Unit No. 12 (Site 3)
Operable Unit No. 13 (Site 63)

November 6, 1996.
Onslow Public Library,
Jacksonville, North Carolina

Reported by:

EDNA POLLOCK, CVR
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* Copy *

WEDNESDAY EVENING SESSION

November 6, 1996

The Slide Presentation of the Proposed Remedial Action Plan for Operable Units 12 and 13 by Baker Environmental, Inc. during the Restoration Advisory Board Meeting, convened at 8:00 o'clock p.m. in the Conference Room of Onslow Public Library, 58 Doris Avenue East, Jacksonville, North Carolina.

MR. THOMAS TREBILCOCK: We'll go ahead with the slide presentation.

Some of these figures that are going to be in here are in the Proposed Remedial Action Plan that we have there.

We apologize for getting that out so late, but I guess this has been on sort of a particular track.

But, anyway, my name is Tom Trebilcock with Baker Environmental to speak to you tonight about Operable Unit No. 13, Site 63.

During the presentation, I would welcome any questions that you have and if you don't mind, if you don't object, just state your name before your question so our Court Reporter can just get a record of where the questions are from and that will help us when we go to address these questions with a response summary that will be provided later.

As Matt talked about earlier, as he went through each of the operable units, there are 18 operable units. Some of those operable units are comprised of more than one site.

It just so happens that Operable Unit 13 is comprised of only one site and that's Site 63, the Verona Loop Dump.

A sense of where the site is located, it's in the western part of the facility over here, about two miles south of the Marine Corps Air Station.

The next slide has a little bit better regional location of it.

It's about a mile east of Highway 17 for Verona and it's about a mile-and-a-half west of the New River.

MR. CARRAWAY: That's the one we did not see on our field trip.

MR. MORRIS: We went there, but there were trees down across the entrance.

MR. TREBILCOCK: Yes.

Yeah, it got some storm damage in both hurricanes.

Site 63 is approximately a five acre site which is comprised of mixed hardwood and pine forest. It's located on sort of a topographic high or saddle between two drainages.

So it's sort of on top of a hill.

It's reported to have received what's called "bivouac" waste and I have a picture following this that shows some of what that might include, although the "bivouac" was never really described or defined in any historical documents.

There were no known hazardous waste disposed of at Site 63 also.

Same picture.

Okay, this is a photograph of Site 63 showing the site from an access road that comes off of Verona Loop Road which is what the site is named for.

Looking into the site looking north right here, you can see it's sort of a fairly wooded area. Actually, it's pretty thickly wooded.

Okay, the area is primarily used now as a training area.

This is one that the personnel trenched out, a sort of foxhole that they've dug out there.

This area and the site are also used for hunting and recreational hunting, but primarily for exercises, training exercises, things like that.

Let me get this in a little better focus.

But, this shows some of the things that were observed out at the site and this is what--there are a few mounds of the same type of - it looks like construction material, but it's concrete, some metal, scrap metal and in some of the other piles, there have been derelict vehicles, vehicle parts, tires, wheel covers and things like that.

So, you know, although we don't have a definition of "bivouac" waste, from these piles out there we could see the concrete and other - looks like construction material.

There's a small tributary to Mill Run on this side of the Base and it runs right--abuts sort of the site itself.

This creek tends to dry up in the summer but it's about two to three feet across right here.

And, that's the way most of it is all along beside Site 63.

This is - in case you're wondering - is a statement, just shows where a sample was taken, in this case the surface water and sediment sample.

The investigation at that particular site, the site was originally identified in an initial assessment study in 1983 as a potential dump area.

In 1991, the first samples were collected at Site 63 and that's part of the site investigation.

The findings from that site investigation prompted the next step, the remedial investigation.

Part of the site investigation was recommending further study of the site because only a limited amount of soil samples and groundwater samples were collected.

As part of the remedial investigation that we conducted in 1995, a total of 96 soil samples were collected and 11 shallow groundwater samples were collected from eight temporary wells and three existing shallow wells.

And, also, five surface water and five sediment samples were collected.

The findings from the soil investigation indicated that among the 96 soil samples that were collected, 20 of those samples had - let me get this in focus - 20 of those samples had detectable levels of pesticides.

Now it's sliding away. This slide projector is living up to its name - sliding.

Twenty of those samples had pesticides, detectable levels of pesticides in them.

Nineteen of the samples had detectable levels of semi-volatile organic compounds in them.

And, then two of the ninety some samples had polychlorinated biphenyls or what's commonly referred to as PCBS.

And, then, finally, one sample had detectable levels of volatile organic compounds.

Now, the concentrations of these compounds with the exception of the semi-volatile organic compounds were below one hundred parts per billion.

Now, only a few, actually one semi-volatile organic compound was detected above that and it was detected more than once.

This slide shows exactly where these soil samples were collected throughout the site.

This shows what was thought to be, or still remains to be what we think is the approximate site boundary and this is the gravel road that we saw the picture before.

Now, a lot of the sampling would basically extend out beyond the boundary of the site just in case, you know, this area wasn't well, and it hasn't been well defined in the records.

Okay, the findings from the groundwater investigation indicated that no organic compound was detected among the 11 groundwater samples that were collected.

Iron, manganese and zinc were however detected at concentrations which exceeded the North Carolina Groundwater Quality Standard.

But, those concentrations were detected at concentrations that are typical of natural site conditions in the Coastal Plain in North Carolina.

Next slide.

If there are any questions--[laughter]--I'm kind of rolling through this.

MS. ELEANOR WOOD: I have one in looking at this chart and it talks about chlordane and it compares some criteria of stream sediment and there is no chlordane and I was curious about that.

MR. TREBILCOCK: That's right, for soil.

MS. WOOD: For soil.

MR. TREBILCOCK: Yes, that's right.

For some of the pesticides there are standards and they're related to how and what concentration in soil would a contaminant potentially impact groundwater.

And, for chlordane, for example, does not--

MS. WOOD: You don't have to deal with soil.

MR. TREBILCOCK: Well, it doesn't have a standard.

I'm sure there probably is a concentration of it that would impact groundwater, but I guess it hasn't been established.

I don't know.

Are there any other questions?

[No response]

This figure here shows the location of each of the samples, the groundwater sample locations. There are five within the known site boundary, or six within the known site boundary and five that extend outward from there.

There were, as I mentioned before, five surface water and five sediment samples collected.

There were also no organic compounds detected in the surface water samples and there were only two of the five samples that had detectable levels of pesticides in them.

MR. JAMES SWARTZENBERG: Excuse me, Jim Swartzenberg.

Is there a pattern to where these particular samples were taken from?

MR. TREBILCOCK: Where they were taken?

MR. SWARTZENBERG: Yes.

MR. TREBILCOCK: Yeah, actually--

MR. SWARTZENBERG: Found.

MR. TREBILCOCK: Oh, found.

MR. SWARTZENBERG: Where you found some pesticide and stuff.

MR. TREBILCOCK: It pretty much follows what we've seen in other sites, you know. It gets back I think not too long ago, actually '57 or sixties or fifties, pesticides were fairly commonly used around the Base.

And, when we do find them, they're pretty scattered throughout the Base.

MR. SWARTZENBERG: The same is true for the heavy metals and PCB's and all that.

MR. TREBILCOCK: Yeah, there were no particular--

MR. SWARTZENBERG: Next to where the concrete was?

MR. TREBILCOCK: Well, yeah, there were higher metals detected where we had--where we did observe some in the main part of the site there.

Visually, you could see metals in the sample like rusted iron so in those samples we have a higher concentration of iron.

But, that's where we had buried material mostly. There were only a few places.

But, it usually did correlate.

Pesticides in sediment at least, they tend to adhere to particles so where the surface water flows across soil, it may pick up the particles in the sediment.

So, we see a lot of water pollution in sediments because they sort of adhere to particles and they collect in these drainage basins.

Yes!

MR. CARAWAY: Eric Caraway!

I was noticing on the map itself of the samples, was there any particular reasoning why they were going more towards 17 and none of then were taken across the creek, or the little small branch?

MR. TREBILCOCK: Well, because it's in a sort of a topographic high, the thinking was that if there were sites and we weren't so sure where that site was, if the only thing we had to indicate where the site was, was that gravel road and also some of these debris piles, but the thinking was that if there were a disposal area, it would be on that kind of flat area at the top.

The site actually slopes pretty steeply down to that creek that's to the east.

Maybe if I can flash that, flip forward and show you the surface water sample locations--

MR. CARAWAY: My experience with landfills, you fill in a low area.

MR. TREBILCOCK: Well, it's not a landfill.

MR. CARAWAY: Well, I know, but it was a dump site.

MR. TREBILCOCK: A dump site.

MR. CARAWAY: Yeah, okay, dump site, landfill, there's a definition now. Back then there wasn't.

If you have a low area you want to fill it in, you start in the lowest part of the area and work your way up.

So my question is not being able to see the area--

MR. TREBILCOCK: Right.

MR. CARAWAY: --Was the ridge part of the waste area, or was there a ridge and it was put on top and the things filtered down?

MR. TREBILCOCK: It looks like that just this area within the site boundary had the evidence of, you know, that construction debris.

And, I think those are what originally indicated where the site might be, the location of those debris piles.

Now, you know, we dug down in the ground over 46 spots and only two of those spots did we find any evidence of something buried and that was within this area here, within this same--

MR. CARAWAY: Well, that was part of my question was--

MR. TREBILCOCK: Yeah.

MR. CARAWAY: --That if we start by the creek and work our way towards and the further we got towards and then we worked towards 17 we're getting more samples, we're getting our information toward the 17 side versus the creek side.

MR. TREBILCOCK: Yeah.

MR. CARAWAY: Okay.

MR. TREBILCOCK: Yeah, I follow you.

And, actually, this out here had no evidence of much of anything. In fact, it looks like they're following the scenario that you described.

They were beginning to fill in or dump things down towards the creek from the top, you know, down.

MR. CARAWAY: Yeah.

MR. TREBILCOCK: You know, like pull up a truck and dump it down towards in the direction of the creek.

But, it's sort of like that, but I don't think they buried much and if they did, it was just in--because we had the place pretty well peppered--

MR. CARAWAY: Right.

MR. TREBILCOCK: --With the soil locations.

MR. CARAWAY: Thank you.

MR. TREBILCOCK: Sure.

Okay, which brings us to I guess the goal of the Remedial Investigation is to provide some indication of these sites, do they pose a human health hazard?

A human health risk assessment was performed and for these different potential receptors:

Current military personnel.

A current trespasser.

An adult trespasser.

A child trespasser.

A future construction worker.

A future adult resident.

A future child resident.

Now, the Environmental Protection Agency has established guidelines to determine at what level do carcinogenic or cancer risks, at what level and at what number do they pose a threat.

And, that number is below this number up here.

And, for non-carcinogenic or non-cancerous risk, the number is less than one.

Well, after going through exposure scenarios for the various potential receptors we had, we came up with a potential non-carcinogenic risk to future adult residents and future child residents.

And, those numbers are based on the ingestion of groundwater from the site.

Now, if you remember, we didn't see any indication of organic contaminants in groundwater, but we saw indications of metals, high metal concentrations in the groundwater samples.

So, these two scenarios assume that for the future adult resident and future child resident that groundwater that we collected would be their primary source of potable water, or drinking water.

So, that's how those are and so it's a very conservative number that represents based on what we are doing.

Based on the next slide, which we can come back to this one, but based on the no further remedial action which is the proposed remedy for Site 63, based on this criteria the site will remain in its current state, with no further environmental investigation.

And, also, there will be an aquifer for use restriction placed on the site.

The potential for residents to ingest the groundwater will be eliminated because that will be prohibited from future development.

Are there any other questions about any of the slides or about anything?

MR. SWARTZENBERG: Jim Swartzenberg!

So, you're not proposing that they even go in and clean up--

MR. TREBILCOCK: The surface debris?

MR. SWARTZENBERG: --The surface debris and stuff like that?

MR. TREBILCOCK: No, that's right.

Just leave it there.

MR. SWARTZENBERG: Is it your opinion that that wouldn't do any good?

MR. TREBILCOCK: Well, I think maybe Neal might have a better handle on that.

I think in the past we've sort of just said instead of suggesting, you know, if you say, well, we're going to clean up the site from the aesthetic point of view, you might indicate that, well, you think there might be something there that could cause future contamination.

Right now, we don't think that, you know, concrete or the scrap metal or whatever else is going to cause anything.

But, that's pretty much just a housecleaning thing that I don't know whether Camp Lejeune--

MR. SWARTZENBERG: That's not the problem in other words.

MR. TREBILCOCK: No.

MR. NEAL PAUL: No, that's not the problem.

MS. KATHERINE IANDMAN: It's not a problem of contaminated site.

You might consider it an eyesore--

MR. TREBILCOCK: Yeah.

MS. LANDMAN: --But, you know, at such time as the Marine Corps wants to do that is something else. They might decide not to remove it.

MR. PAUL: It's a pretty remote area which we don't have any plans to use, or any planned use or any way to go in there.

On the other hand, you take lot 2 or 3, you know, I think you guys got to see that site and all the debris that was at that site. That's a site where we have a lot of debris that's not contributing to contamination of the site, but we are going to remove it because we want to turn it over to a future industrial land use.

So, if there's a land use plan, then yeah we would go in to remove the debris.

But, here, we don't have any planned land use.

MR. MORRIS: This site can be used or can be pointed out to the Marine Corps for their Operation Clean Sweep, which eve ry spring they go through and pick up debris.

We can identify this as one of the sites that they could go ahead and clean up.

MR. PAUL: That's a good point, Tom.

MR. TREBILCOCK: Were there any other questions about the site itself?

MR. SWARTZENBERG: If they did do the Clean Sweep thing - I don't want to run his over--

MR. TREBILCOCK: Oh, no, no.

MR. SWARTZENBERG: If you did do the Clean Sweep though, from what you said it wouldn't change your figures at all?

MR. TREBILCOCK: No, no.

MR. SWARTZENBERG: It would just make it look a little better.

MR. PAUL: It would make it look a little better.

MR. CARAWAY: Wouldn't it change the figures ten years down the road if that metal continues to deteriorate?

Is the metal above the ground?

MR. TREBILCOCK: Well, it could, but, you know, once again, it would be iron and things that really wouldn't be hazardous to people or to the environment.

I mean, it could become more unsightly, you know, if you have iron oxidizing and you're going to have a stain or whatever on your ground, but not from a hazard standpoint.

MS. TRACEY DeBOW: So, actually what we have at this site was a couple of examples which had semi-volatile organics so that somewhere between 43 and 80 micrograms per millimeter of water or per liter.

And, that would really be, what, parts per million or parts per billion?

MR. TREBILCOCK: Parts per billion.

MS. DeBOW: Parts per billion ratio, so it's more than likely by the time we did anything to remove those organics, they of themselves would dissociate--

MR. TREBILCOCK: Right.

MS. DeBOW: --And, not be worth the price--

MR. TREBILCOCK: Well, it would be very difficult to remediate or to remove it.

MS. DeBOW: Since it's such a small amount.

MR. TREBILCOCK: Yeah.

MS. DeBOW: And, we don't have any real risk of it getting in the creek?

MR. TREBILCOCK: No.

MS. DeBOW: Because I don't see any--

MR. TREBILCOCK: There is a chance for the pesticide, for example. In my opinion, the pesticides are probably migrating from the site into the sediment in the form of particulates or, you know, tiny pieces absorbed have washed into the creek and are now at the bottom of the creek so when you collect a sediment sample, well, you're going to see pesticides on that particle absorbed.

MS. DeBOW: Yes.

MR. TREBILCOCK: Now it has become a piece of sediment, but it had been just a piece of regular surface water.

MS. DeBOW: But, from what I saw, the pesticides were below State minimum acceptable limits.

MR. TREBILCOCK: Yes.

MS. DeBOW: Yeah, okay.

MR. TREBILCOCK: In fact, this is one of the-- this site is probably at lower levels of pesticides than what we typically see.

And, fewer in number too.

MS. WOOD: And, the same would apply to the naphtha?

MR. TREBILCOCK: Yeah, it had two detections in the soil and they were both under one hundred parts per billion, so, yeah, the same thing would apply to those also.

MR. PAUL: And, Tom, correct me if I'm wrong, but as a general rule, pesticides are pretty much in the soil, they're not going to be a mobile contaminant.

MR. TREBILCOCK: No, no. They're going to adhere to the soil.

The bottom line really at this site it's going to be controlled through time by the Marine Corps, but right now there's no further remedial action indicated.

MR. BARTMAN: If you look at the regulations, the regulations that are involved here, you know, federal and state governments set of qualitative regulations and then you go through them and we do qualitative assessment and we determine we may have levels in the media that are above our regulatory levels, but we determine that the concentration and the specifics of the contaminant were not posing a human health risk, it won't go anywhere.

MS. DeBOW: We won't go anywhere.

MR. BARTMAN: We won't go in there, exactly.

No exposures, no receptors.

MR. TREBILCOCK: Well, if there aren't any more questions, of if you'd like I'll be around after the meeting if you want to talk to me about any specifics about the site, but I'll turn it over to Matt.

We're sort of going in backwards order. I talked about Operable Unit 13 and Matt Bartman's going to talk about Operable Unit 12.

MR. BARTMAN: The discussion that I'll be dealing with is Operable Unit 12, Site 3, which is also referred to as the old Creosote Plant.

I know these pictures are difficult to see.

But, the old creosote plant, I'm going to pass around this photo.

This is an aerial photo from 1949.

The old creosote plant is also referred to, like I said, to Operable Unit 12, Site 3, and it's located on Holcomb Boulevard, about a half-mile off of Holcomb Boulevard, the main side of the Base.

It's also referred to as Lot 204 and that's the big chimney, if anyone's going to the site you'll be able to see this site.

This is from the entrance coming from Holcomb Boulevard to the site.

And, this is what we refer to as the northern area during our investigation.

This area will be referred to as the treatment area, but then there's also the southern portion of the site.

This is the side of the chimney for those of you who were on the site may be familiar with the area.

Just to get everyone in here - see the reason I passed around the aerial photo from 1949, this plant was in operation from 1951 to 1952 and basically the operation of the plant was to treat lumber for the construction of the Base railroad.

And, as you can see in that aerial photo, the Base railroad has not been constructed yet.

There's no indication of subsurface creosote disposal however until we did our investigation.

However, like Site 63, there was a site inspection completed here where subsurface contamination in the form of creosote or PAH, polyaromatic hydrocarbon contamination was indicated, therefore turning it into the remedial investigation site.

Currently, the area is currently used to construct a staging area for the removal of downed trees.

That's all taken place in the northern area of the site from the hurricane that's taken place.

Now you can see the north area is the staging area for all the downed trees.

This is a very quick slide of the layout of the site.

Again we have the northern area where the downed trees are now staged.

This is what we refer to as the treatment area and then the railroad spike or the southern portion of the site.

Mainly all the creosote treating operations were conducted in this area. Again, the reason the chimney is located here.

A dirt track and the railroad spike area which not only comes to about here, but you can see remnants of it where they used the pumps where they appeared to derive water.

Field Investigation Summary.

What Baker Environmental did here, we had a multi-phase field program which was conducted from September 1994 to September 1996.

And, I say multi-phase because unlike Tom's investigation, we found contamination and had to keep delineating our contamination both in groundwater and in soil.

In September of 1994, we came out here and collected approximately 84 surface soil samples and those surface soil samples were analyzed in the field using a kit that's a immunoassay kit, bacterial testing kit, to determine where PAHs - again polyaromatic hydrocarbons which we knew are our known contaminants given our source which was the creosote.

So, we came out here and we had to delineate the site using surface soil samples.

We had to kind of focus our investigation in the area where we think creosote contamination was going to be a problem.

We came out in November of 1994 using the information that we collected in September and were able to focus our surface and subsurface soil investigation in a specific area where we knew we had contamination.

As a follow-up, we had to come back out in June of '95 to take additional samples because we were able to locate through subsurface soil contamination in '94 that we had additional problems.

This is again the treatment area and this is just to give you an indication of how many samples we collected out here.

The pink being the ENSYS investigation.

The green being the different phases of the investigation we did in November of '94 and June of '95.

And, this does not even show the northern area where we had several soil samples taken and also the railroad spike area.

The multi-phase investigation also included groundwater investigation.

In December of 1994 we put in seven shallow and one intermediate monitoring well.

And, then due to the contamination we found there, we came back out and had to put in eight. We sampled the eight existing shallow monitoring wells.

We installed five new shallow monitoring wells.

One intermediate well and one deep well.

The shallow wells being roughly 25 to 30 feet.

Intermediate depth, 40 to 60 feet below ground surface.

And, the deep well 140 feet below ground surface.

MS. WOOD: How many deep wells?

I'm sorry, I got confused reading this.

The deep wells were going in to Castle Hayne?

MR. BARTMAN: Yeah.

MS. WOOD: But not the intermediate?

MR. BARTMAN: No. The intermediate would be upper portion of Castle Hayne.

MS. WOOD: Right, okay.

MR. BARTMAN: And, the reason we had to do this intermediate and deep wells in multi-phase so we could go out there, we investigate the shallow for particle contamination.

We go down vertically to see if the intermediates are contaminated. If the intermediates are contaminated, we focus in and keep going deeper until we can find the particle extent of the contamination.

In order to confirm our findings from the June of 1995 investigation, we came back out in September and did another full round of sampling to confirm the presence or absence of contamination.

That was again by September of 1995.

Through the findings of September of 1995, we kind of have suspected misleading information between July of '95 and September of '95 and wanted to confirm that and that was in the deep well.

We only put in one deep well.

So, we had contamination in '95. We did see the contamination in September of '95 and we came back out in January of '96 and sampled that water and confirmed that there was an absence of contamination deep.

Had we found contamination, we would've had to go deeper.

But, given the nature of the contaminants which again the majority of them are PAHs, again the contaminants don't travel or migrate very readily in soil.

Usually you don't see them in the groundwater because they don't have a high mobility, or high leachability into the groundwater.

But, unfortunately, given the levels of creosote in our soil, we saw them in groundwater.

This figure indicates the areas where our groundwater monitoring wells were placed.

I apologize for the figures.

Again, the pink indicates the shallow monitoring wells.

The blue are the intermediate wells.

And, the purple is the deep well.

You see we have wells on the north area, the treatment area and the southern portions of the site.

Due to contamination we had here in this intermediate well, in the second phase, we decided to put in this intermediate well.

And, then go back and due to the contamination put in this deep well.

What we found in all these phases of investigations was that a majority of our contamination both in soil and in groundwater, as we suspected but had to confirm, was all of our contamination was in what we were thinking would be the treatment area.

The chimney area used to heat the creosote.

If you don't know what creosote is, I could explain it, but I think everybody knows what it is.

But, at first, it's a very tarry material that needs to be cut using fuel related materials.

They heat it and then they treat the lumber.

So, we could tell that this was all where the treatment took place.

And, we found in the northern area and in the southern portion of the area we found isolated detections of creosote contamination, apart from the drippings but no known disposal.

So, we did have contamination in other portions of the site, but concentrated mainly again in this treatment area.

Like Tom's site, we had to go through the human health risks.

Fortunately, for us we had limited receptors.

We only had the future residential child, future residential adult.

The third, military personnel that could be exposed.

We think at that site in the future construction workers.

As you can see, the risks obviously to the future residential child and would be the residential adult, both carcinogenic and non-carcinogenic risks.

And, this is from the ingestion of groundwater.

However, shallow groundwater in this area is no even used as a potable water supply.

However, we still have to consider it as a potential exposure to future adult, to future residents.

Given that we don't have a risk to subsurface soils, which the construction worker is the only exposed receptor to subsurface soil.

However, we knew that that was part of our readings and our findings or detections, we knew that subsurface soil was where our contamination was. However, there's no risk.

That puts us in a Catch-22 because we have contamination but it's not causing risk, so what do you do with it?

So, we knew that our sources was the soil. Our groundwater was causing our contamination and causing our risks.

So, we had to remove the source and that's what we plan on doing as part of our proposed remedial action.

We went through five different alternatives.

The alternatives have been selected for treatability studies at this phase, Number 5, which was the source removal and biological treatment.

For those of you who did visit Lot 203, saw two water treatment plants, for the pump and treat plant, there's a biocell constructed there, we'll be doing a similar biological treatment.

This biological treatment will be for PAH contamination where that one at Lot 203 is for POL waste.

We'll be doing a treatability study hopefully beginning in March to test out whether this technology will be feasible to remediate this contamination.

We'll be excavating for subsurface soil contamination down to roughly nine feet, where we know we have known contamination.

Placing it into the biocell, mixing it with several different types of bugs, nutrients, having it aerated, water applied to it to see if the bugs, the nutrients are able to degrade or decompose this contamination.

As for groundwater, we know we have contamination in our groundwater.

We know it exceeds regulatory levels.

We know that it poses a potential risk.

However, we feel that the source is really the soil, so therefore we remove the soil.

All we want to do here is monitor the groundwater.

Apparently, it's not posing a risk.

So, what we want to do is, again, monitor the groundwater, see if once we remove the source what happens to the concentrations in the groundwater?

Do they remain the same?

Do they increase?

Is there another source out there?

So, this monitoring will be conducted over a 30 year period, probably on a semi-annual basis and will be up for a five year review by the regulators.

So, that's roughly what's going to be happening at Site 3.

MS. WOOD: It says here the clinical phase, this is because it is impractical to remediate the saturated soil, which earlier it states is detectable for PAH contamination because of water--[inaudible].

So, it is saturated soil below the water table.

MR. BARTMAN: Uh-huh.

MS. GOOD: Okay, and it is the PAHs are not going to migrate.

MR. BARTMAN: No, they don't migrate readily into the water.

Think of it this way, a piece of tar, take a beaker and put some sand in it, drop the piece of tar into that and that's what you have.

MS. GOOD: Okay.

And, they aren't going to break down into any other--

MR. BARTMAN: They don't biodegrade. They're not like chlorinated solvents.

MS. GOOD: All right.

MR. BARTMAN: No biodegradability. They don't migrate readily even in presoils or groundwater.

That's why we don't see--we had this known source inside this, I guess when I said take a beaker of sand or a fish tank. Throw a piece of asphalt in there and you have the water flowing back and forth, you don't see the migration.

And, that's exactly what's happened in this case.

MS. GOOD: Thank you.

MR. JOE BARNETT: You said the risk looks like is higher for children, or I didn't understand that statistic.

It looked like it was less for children.

MR. BARTMAN: Can't remember.

MS. DeBOW: It was ten to the minus three.

MR. BARTMAN: Ten to the minus three.

It's actually less for children, higher for an adult.

MR. BARNETT: Does that mean for the adult, because it started as a child and there's--

MR. BARTMAN: Basically--

MR. BARNETT: --A cumulative effect over your lifetime for carcinogenic effect?

MR. BARTMAN: Exactly.

MR. BARNETT: Okay.

MR. BARTMAN: Also, exposure, the amount ingested is higher for an adult. Exposure period's longer, so you're at a higher risk.

There's usually a flip-flop or non-carcinogenic. Usually the child is at higher risk, the adult is at lower risk.

MR. SWARTZENBERG: What's the land use plan for that area? Is there any?

MR. BARTMAN: Neal!

MR. PAUL: I don't think so. Tom!

MR. MORRIS: As a matter of fact, I was contacted this afternoon about that treatment site.

They want to build a storage area into that particular area.

MR. BARTMAN: Into the southern portion, or into the treatment area?

MR. MORRIS: Into the southern portion of the southern portion.

MR. BARTMAN: Okay.

MR. MORRIS: In other words, it's going to start down the road a bit and extend up into the southern portion of--

MS. WOOD: The railroad spur.

MR. MORRIS: --The railroad spur, right..

MR. BARTMAN: All right.

MR. PAUL: This is high performance storage facility is POLs?

MR. MORRIS: Yes, PLOs.

MR. BARTMAN: It probably wouldn't be a problem from our standpoint if it's that treatment area.

The southern portion, there's a monitoring well on W06 which I believe is the most downgraded shallow well.

It's going to be one of the wells that we're going to need to monitor because, for some reason, we found contamination of subsurface soil and in that groundwater as well.

So, as far as, I mean, as long as they don't disturb any of the wells that we'll be using for longterm monitoring, we're probably in good shape.

MR. PAUL: Is that an old site or new site?

MR. MORRIS: For?

MR. PAUL: What you talked about.

MR. BARTMAN: That is not the existing site that we've been planning on--

MR. MORRIS: This is the one that NEPA is still doing documentation on.

MR. PAUL: The only problem I see with it, this facility is going to be only a hazardous waste storage facility to the south?

MR. MORRIS: Uh-huh.

MR. PAUL: And, if we have contamination already in the area, I don't know.

MS. LANDMAN: My response to that would be they would need to stay around the area and need to monitor.

MR. PAUL: Yeah, right.

I don't want it to get that the current use facility is contributing to the contamination and then builds into--[inaudible].

MR. MORRIS: I only brought that up because they are still looking in that area as far as doing additional development.

MR. BARTMAN: One of the things during the investigation, I talked about PAHs in the creosote contamination, this is not like water. We kind of knew going in what contaminants we were looking for.

Now, the regulators still require that we did full scan - I say full scan, that means we looked at all the organics, semi-volatile organics, pesticide PCBS and metals, as well as on select samples of soil and groundwater, we ran full scan.

And, we did find trace levels of detections in fish which was the volatile contaminants and in groundwater and in soil.

So, that's when we go back to this multi-phase groundwater samples to find out where that contamination was coming from.

So, I just want to let everybody know that we didn't just blow off certain chemical parameters. We did examine other things.

The PAHs are driving our risks and our contamination problems, so that's what our remedial effort goes out to.

MR. PAUL: What units will be discussed after our meeting will be more than likely--

MR. BARTMAN: Will be eleven which is Site 7, Tarawa Terrace and also Site 80 which is the Paradise Point Golf Course.

If there's any questions on that now, what's going on with those sites, what's happened at those sites, I can answer those also.

MS. WOOD: I did have a question on 80.

When did the dumping and cleaning of the pesticides stop?

MR. BARTMAN: The time critical for--

MS. GOOD: No, no, when did they start cleaning up. I wasn't sure on that.

MR. BARTMAN: Okay.

MR. DUNN: There was no dumping.

MS. GOOD: Just washing it out, but--

MR. BARTMAN: It's a discharging unit.

MS. GOOD: Right, well, whin did they start doing that?

When you all came in, were they doing it, or had it stopped fifteen years ago, or what was the length of time?

MR. BARTMAN: Well, it's still a pesticide mixing area.

MS. GOOD: Oh, they're still, but they're not washing it?

MR. BARTMAN: It's registered pesticides.

MS. GOOD: Okay.

MR. BARTMAN: It's not the DDDs, the DDEs.

Unregulated pesticides are not being used.

MS. GOOD: Yeah, okay.

MR. DUNN: The area is still a maintenance area for the golf course.

They still apply pesticides to the golf course, but they're not the hazardous pesticides that we used in the past.

MS. WOOD: Okay, so the hazardous pesticides were stopped around '78?

MR. DUNN: I believe that's right.

MS. GOOD: DDT?

MR. DUNN: The DDT earlier, but the chlordane I think was in '78.

MR. BARTMAN: Yeah, the Chlordane

MS. LANDMAN: The highest concentration area in that particular site was probably due to a single event spill rather than--I mean, there were other trace areas that may have been due to washout or overspill to poor mixing practices.

But, the one main area was most likely due to one single incident spill in time which, you know, we wouldn't know.

That's what the results appear to be.

MR. BARTMAN: If there's any questions regarding these sites as you read through the documents, the fact sheets of the Proposed Remedial Action Plan, feel free to give Peter or Neal a call, or Tom or I at Baker Environmental and we'll be able to answer questions relating to the site.

[Whereupon the proceedings concluded at 8:50 o'clock p.m.]