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FINAL

REMEDIAL INVESTIGATION REPORT
FOR
OPERABLE UNIT NO. 2 (Sites 6, 9 and 82)

MARINE CORPS BASE, CAMP LEJEUNE
NORTH CAROLINA

CONTRACT TASK ORDER 0133

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LIST OF ACRONYMS AND ABBREVIATIONS

AOC	Area of Concern
ARARs	Applicable or Relevant and Appropriate Requirements
AWQC	Federal Ambient Water Quality Criteria
Baker	Baker Environmental, Inc.
bgs	below ground surface
BOD	biological oxygen demand
CDI	Chronic Daily Intake
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CH	high plasticity clay
CL	low plasticity clay
CLEAN	Comprehensive Long-Term Environmental Action Navy
CLP	Contract Laboratory Program
COC	Contaminant of Concern
COD	chemical oxygen demand
CSF	Cancer Slope Factor
DoN	Department of the Navy
Eh	Oxidation Reduction Potential
EPIC	Environmental Photographic Interpretation Center
ERA	Ecological Risk Assessment
ER-M	Effects Range-Median
ESE	Environmental Science and Engineering, Inc.
ETC	Electromagnetic terrain conductivity
FFA	Federal Facilities Agreement
FID	flame ionization detector
FWSV	Freshwater Water Quality Screening Values
gpm	gallons per minute
GPR	ground penetrating radar
HA	Health Advisory
HEAST	Health Effects Assessment Summary Tables
HHI	Hardin and Huber, Inc.
HI	hazard index
Hoggard-Eure	Hoggard-Eure Associates
HQ	hazard quotient
IAS	Initial Assessment Study
ICR	Incremental Cancer Risk
ID	inside diameter
IDW	Investigative Derived Wastes
IRIS	Integrated Risk Information System
IRP	Installation Restoration Program

k	hydraulic conductivity
K_{oc}	Organic Carbon Partition Coefficient
K_{ow}	Octanol-Water Partition Coefficient
LANTDIV	Atlantic Division, Naval Facilities Engineering Command
LANTNAVFAC-ENGCOM	Atlantic Division, Naval Facilities Engineering Command
LEL	lower explosive limit
LOAEL	Lowest Observed Adverse Effect Level
MCAS	Marine Corps Air Station
MCB	Marine Corps Base
MCL	Maximum Contaminant Level
mg/kg	milligram per kilogram
MF	Modifying Factor
MH	plastic silt
MI	Mobility Index
ML	low plasticity silt
msl	mean sea level
NACIP	Navy Assessment and Control of Installation Pollutants Program
NBC	nuclear, biological, and chemical
N.C. DEHNR	North Carolina Department of Environment, Health and Natural Resources
NCSPCS	North Carolina State Plane Coordinate System
NCWQS	North Carolina Water Quality Standards
NEESA	Naval Energy and Environmental Support Activity
NOAA	National Oceanic and Atmospheric Administration
NOAEL	No Observed Adverse Effect Level
NPL	National Priorities List
PAH	polynuclear aromatic hydrocarbon
PCBs	polychlorinated biphenyls
PHA	Public Health Assessment
PID	photoionization detector
ppb	parts per billion
ppm	parts per million
PVC	polyvinyl chloride
QA/QC	Quality Assurance/Quality Control
RA	Risk Assessment
RCRA	Resource Conservation and Recovery Act
RfD	Reference Dose
RI/FS	Remedial Investigation/Feasibility Study
S, S	storativity, solubility
SA	Site Assessment
SARA	Superfund Amendments and Reauthorization Act
SCS	Soil Conservation Service
SM	silty sand
SMCL	Secondary Drinking Water Regulations
SQC	Sediment Quality Criteria
SOPs	Standard Operating Procedures

SSV	Sediment Screening Values
SVOCs	semivolatile organic compounds
SWQSVs	Surface Water Quality Screening Values
T	transmissivity
TAL	Target Analyte List
TBC	to be considered
TCL	Target Compound List
TCLP	toxicity characteristic leaching procedure
TDS	total dissolved solids
TEF	Toxicity Equivalency Factor
TSS	total suspended solids
TVS	total volatile solids
TOC	total organic carbon
TRC	Technical Review Committee
UCL	Upper Confidence Limit
UF	Uncertainty Factor
µg/l	micrograms per liter
USEPA	United States Environmental Protection Agency
USGS	United States Geological Survey
VOCs	volatile organic compounds
VP	Vapor Pressure
WAR	Water and Air Research, Inc.
Weston	Weston Geophysical Corporation
WOE	Weight of Evidence

EXECUTIVE SUMMARY

INTRODUCTION

Marine Corps Base (MCB), Camp Lejeune, North Carolina was placed on the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) National Priorities List (NPL) that became effective on October 4, 1989 (54 Federal Register 41015, October 4, 1989). The United States Environmental Protection Agency (USEPA) Region IV, the North Carolina Department of Environment, Health and Natural Resources (NC DEHNR) and the United States Department of the Navy (DoN) then entered into a Federal Facilities Agreement (FFA) for MCB Camp Lejeune. The primary purpose of the FFA was to ensure that environmental impacts associated with past and present activities at the MCB were thoroughly investigated and appropriate CERCLA response/Resource Conservation and Recovery Act (RCRA) corrective action alternatives were developed and implemented as necessary to protect public health and the environment.

This report describes the RI conducted at Operable Unit (OU) No. 2, which is comprised of Sites 6, 9, and 82.

SITE DESCRIPTION

Operable Unit No. 2 is located approximately 1.75 miles east of the New River and 2 miles south of State Route 24 on the mainside portion of MCB Camp Lejeune. The unit is bordered by Holcomb Boulevard to the west, Sneads Ferry Road to the south, Piney Green Road to the east, and by Wallace Creek, which makes up the north boundary. Camp Lejeune Railroad operates rail lines parallel to Holcomb Boulevard bordering Operable Unit No. 2. OU No. 2 covers an area of approximately 210 acres. OU No. 2 consists of three sites: Sites 6, 9, and 82.

There are distinctive areas of concern within each site of OU No. 2. The following section describes the background of each site.

Site 9

Site 9 is referred to in this report as the "Fire Training Area" (the formal name, as provided in the FFA, is "Fire Fighting Training Pit at Piney Green Road"). The site covers an area of approximately 2.6 acres. Site 9 is bounded by Holcomb Boulevard to the west, Bear Head

Creek approximately 500 feet to the north, Piney Green Road to the east and Sneads Ferry Road to the south. Site 6 also borders Site 9 to the north. Locally, the site is bounded by unnamed streets leading to various storage buildings in the vicinity.

Site 9 consists of an asphalt-lined fire training pit, an oil/water separator, four aboveground storage tanks (ASTs), and a fire tower (smoke house). The fire training pit, located in the southern area of the site, is used to conduct training exercises for extinguishing fires. The oil/water separator is located next to the fire training pit to collect water used in the training exercises and storm water that falls into the pit. The recovered product collected in the oil/water separator is disposed of off site. Two of the ASTs at Site 9 are 2500-gallon steel tanks labeled "DO NOT USE". These tanks are currently not in use. Two additional storage tanks are located in a bermed area. These tanks are constructed of steel and contain approximately 500 gallons each of jet fuel.

<u>Site 6</u>

Site 6 is located north of and adjacent to Site 9. Site 6 is bounded on the north by Site 82, by Piney Green Road to the east, by Site 9 to the south, and by Holcomb Boulevard to the west. Site 6 covers an area of approximately 177 acres that incorporates Storage Lots 201 and 203, the wooded area between the storage lots, and a ravine, which begins at Site 6 and bisects Site 82. Three surface water bodies are associated with Site 6 for the purpose of this RI: Wallace Creek, Bear Head Creek, and a ravine located in the wooded area north of Lot 203 that drains to Wallace Creek. The ravine is intermittent and it receives surface runoff and groundwater discharge during various periods.

Open Storage Lot 201 (Lot 201) is a fenced lot located in the south-central portion of Site 6. It is a flat area with sparse vegetation around the fence lines. The lot is approximately 25 acres in size. It is currently being used for the storage of military vehicles and equipment, lumber, hydraulic oils and lubricants, non-PCB transformers, and other supplies (ESE, 1991).

Open Storage Lot 203 (Lot 203) is a fenced lot located in the northern portion of Site 6 covering approximately 46 acres. Lot 203 is a relatively flat area with elevation differences of approximately five feet. The ground surface is comprised of both naturally existing soil and fill material. Lot 203 is bordered by Site 82 to the north, Piney Green Road to the east, woods to the south, and by Holcomb Boulevard to the west. Lot 203 is currently inactive.

Approximately 40 55-gallon drums are present at Lot 203. The majority of the drums, if labeled, were identified as containing lubricants, petroleum products, or corrosives. Empty storage tanks were also found on Lot 203. They were labeled as containing diesel fuel, gasoline, and kerosene (Baker, 1992).

A ravine is located in the northwest section of Site 6. The steepest area of the ravine is located "inside" of Storage Lot 203. The banks of the ravine gradually decline as the ravine bisects Site 82. The elevation ranges from 25 feet above msl at the north boundary of Lot 203 to 5 feet above msl where the ravine meets Wallace Creek. The surface of the ravine area is littered with various debris including batteries, fencing, tires, empty unlabeled drums, wire cables, commercial ovens, commodes, and respirator cartridges. An empty drum labeled "DDT" was also found in the ravine area, as were small canisters labeled to contain "DDT". The canisters were dated "1958."

Woods and open fields surround both Storage Lots 201 and 203 and make up the remaining area of Site 6. The topography of the wooded areas is relatively flat, but localized trenching and mounding is visible just north of Lot 203 and west of Piney Green Road. The wooded areas are randomly littered with debris including spent ammunition casings, and empty or rusted drums. Markings were observed on a few drums located north of Lot 203 (most drums did not contain markings due to their condition and age). These drums were marked as "lubrication oils". Many of the drums observed were only rusted shells or fragments of drums. (Baker, 1992)

Site 82

Site 82 is situated at the northern end of OU No. 2. It is bordered to the north by Wallace Creek, to the east by Piney Green Road, to the west by Holcomb Boulevard, and to the south by Site 6. Site 82 encompasses approximately 30 acres and is predominantly covered by woodlands. The site is randomly littered with debris including communication wire, spent ammunition casings, and empty or rusted drums. Markings were observed on a few drums, however, most of the drums did not contain markings due to their condition and age. Some of the drums were marked as "lubrication oil" and "anti-freeze".

The topography within Site 82 is relatively flat near the southern portion of the site, but becomes very steep near the bank of Wallace Creek. Localized trenching and mounding is visible near the southern portion of the site. The ravine bisects the site, as shown on Figure 1-3.

SITE HISTORY

Site 9

Site 9 has been used as a fire fighting training area from the early 1960s to the present. Fire extinguishing activities took place in an unlined pit. In 1981 the pit was lined with asphalt. The training fires in the pit were started with used oil, solvents, and contaminated fuels (unleaded). Approximately 30,000 to 40,000 gallons of JP-4 and JP-5 fuel were also burned in the fire training pit (Baker, 1992).

Site 6

Site 6 has a long history of various uses including the disposal and storage of wastes and supplies. This discussion on the history of Site 6 has been broken down into Storage Lot 201, Storage Lot 203, and the wooded areas and ravine to simplify the historical descriptions of these areas.

Currently, Lot 201 is used to store military equipment, vehicles, hydraulic oils, and other "non-hazardous" supplies. Pesticides were reportedly stored in the northeast and southeast corners of the lot. Transformers containing PCBs were reportedly stored in the southwest corner of the lot (Water and Air Research, 1983).

Lot 203 has been used as a disposal area since the 1940s. There is little documentation on the disposal activities at this lot. Lot 203 in not currently active as a storage or disposal area, but the ground surface is littered with various debris. Lot 203 was also used for the storage and disposal of radio and communication parts, shredded tires, lubricants, petroleum products, corrosives, expended demolition kit training materials, ordnance, sheet metal debris, wire cables, and wooded pallets. Empty and full 55-gallon drums were found at various locations throughout Lot 203.

Lot 203 is currently fenced. From historical photographs, it appears that the fenced boundaries have changed since the lot was in operation. Former employees at Lot 203 have reported disposal of various chemicals including PCBs, cleaning solvents, electrolytes from used batteries, and waste oils.

The wooded areas around Lots 201 and 203 are randomly littered with debris including drums, metal storage containers, and spent ammunition cartridges. No organized disposal operations are documented for the wooded areas. A ravine is located on the northern boundary of Lot 203. As previously stated, this area is currently littered with various debris. From the deposition of the debris in the ravine, it appears that trucks may have dumped their contents into the ravine from above.

Site 82

Site 82 was identified as a result of the 1986 site assessment conducted at Site 6, and from the 1992 Site Inspection. Surface water samples collected from Wallace Creek exhibited levels of volatile organic compounds (VOCs) at several locations. The source of the VOC contamination in Wallace Creek at that time was unknown. It appeared unlikely that the source of the contamination originated from Site 6 (Lot 203), and, therefore, was attributed to another source near the creek. The area located north of Lot 203 and west of Piney Green Road was established as Site 82 - The Piney Green Road VOC Site.

No previous records indicated that Site 82 was used for disposal or waste handling activities. The area is, however, littered with debris such as trash, communication wire, and drums of various sizes (e.g., 55- gallon and 5- gallon containers).

PREVIOUS INVESTIGATIONS

During the period 1983 through 1991, various studies were conducted at Sites 6, 9, and 82 by the Department of the Navy. These studies included an Initial Assessment Study and a Confirmation Study under the DoN's Installation Restoration Program. The studies included soil investigations at Site 6 (Lots 201 and 203), groundwater investigations at Sites 6, 9, and 82 and surface water/sediment investigations at Wallace Creek and Bear Head Creek.

Soil samples collected from shallow borings at Lot 201 and 203 were analyzed for pesticides. Low levels of pesticides ranging in concentration from 1.3 µg/kg to 770 µg/kg were detected in almost all of the soil samples. Groundwater samples collected from eight shallow monitoring wells at Site 6 revealed low levels of volatile organic compounds such as carbon disulfide and chloromethane in well 6GW6, which is located to the east of Lot 201. In addition, low levels of benzene and 1,1,2,2-tetrachloroethane were detected in well 6GW1, which is located just north of Lot 203. Further investigation of nearby water supply wells revealed elevated levels of trichloroethene (TCE), vinyl chloride, 1,2-dichloroethene, and tetrachloroethene (PCE) in supply wells HP-651 and HP-653. These wells are located east of Piney Green Road near Lot 203. The supply wells are screened to a depth of approximately 200 feet. The wells are no longer in operation due to elevated levels of volatile organic compounds (VOCs).

Three shallow monitoring wells were installed at Site 9. Groundwater samples were collected in 1984, 1986, and 1987. In addition, one sample was collected in 1984 from a nearby supply well. No contamination was detected in the supply well. Low levels of phenol were detected in all three shallow monitoring wells. In addition, low levels of lead and chromium were detected in all three wells.

Upstream and downstream surface water samples were collected from Wallace Creek and Bear Head Creek. Surface water samples collected from Wallace Creek revealed elevated levels of VOCs such as TCE, vinyl chloride, and 1,2-dichloroethene. No organic contamination was detected in Bear Head Creek. Sediment samples collected from Bear Head Creek revealed low levels of pesticides (13 to 75 µg/kg) both upstream and downstream from Site 6. No pesticides were detected in either sample collected from Wallace Creek. However, PAHs (1,990 µg/kg total) were detected in the downstream sediment sample collected near Holcomb Boulevard.

<u>Site 82</u>

A Site Inspection (SI) was conducted at Site 82 in June, 1991 by Halliburton NUS Environmental Corporation (NUS). The investigation was initiated based on results from an Environmental Science and Engineering (ES&E) field investigation in 1986 (the investigation was conducted as part of a study for Site 6). During this investigation, surface water samples collected from Wallace Creek contained VOCs. It was determined that the source of the VOCs in Wallace Creek most likely did not originate from Site 6 (Lot 203). Subsequently a new site, Site 82, was created to investigate the source of the VOCs (NUS, 1992).

The investigation conducted by NUS consisted of installing six shallow soil borings and three shallow monitoring wells, soil and groundwater sampling, and surface water and sediment sampling (Wallace Creek). Results from the investigation indicated positive detections of organic contamination in all of the media sampled. Pesticides (4,4'-DDD, 4,4'-DDE, 4,4'-DDT, endosulfan II, and dieldrin) were detected in soil (33 to 110 µg/kg) and sediment (12 to 69 µg/kg) samples with lower levels in surface water and groundwater. PCB (PCB-1260 and PCB-1242) contamination was also present in soil (150 to 1,900 µg/kg), groundwater (15 µg/l), surface water (80 µg/l), and sediments (220 to 700 µg/kg). Further, levels of TCE (3 to 74 µg/l), 1,2-dichloroethene (6 to 64 µg/l), and vinyl chloride (11 µg/l) were detected in surface water samples. No VOCs were detected in any of the wells sampled.

REMEDIAL INVESTIGATION ACTIVITIES

A Remedial Investigation (RI) was conducted at Operable Unit No. 2 beginning in August 1992 (Final Project Plans were submitted in May 1992). The RI focused on various areas of concern within Operable Unit No. 2 including: Lot 201, Lot 203, the wooded areas surrounding both storage lots, the ravine north of Lot 203, Site 9, Site 82, Wallace Creek, and Bear Head Creek. Moreover, the investigation was conducted in two phases of work: Phase I (August through November 1992) and Phase II (February through May 1993). The Phase II study primarily focused on Site 82, where deep groundwater contamination was identified during the Phase I Study.

The soil investigation focused the reported disposal areas within Lot 201 and Lot 203. Sampling grids were established at the following areas:

- Two reported pesticide storage areas within Lot 201
- A reported PCB storage area within Lot 201
- A reported pesticide disposal area within Lot 203
- A reported PCB disposal area within Lot 203

In addition, the soil investigation focused on other portions of Operable Unit No. 2 that were determined to be environmental concerns based on site reconnaissances and review of historical photographs. Sampling grids were established at the following areas:

- The wooded areas to the north, east, and south of Lot 201
- Site 82
- The fenced-in portion of Lot 203
- The ravine north of Lot 203

Two sampling grids were also established at Site 9 to evaluate potential soil contamination. The grids were established at:

- The fire training pit and oil/water separator
- Aboveground storage tanks

The grid points were surveyed by a licensed surveyor prior to initiating the soil investigation. Shallow borings were augered at each grid point and soil samples were collected at 2-foot continuous intervals until the water table was encountered. The majority of the samples were analyzed for full Target Compound List (TCL) organics and Target Analyte List (TAL) inorganics. In areas where a certain contaminant was expected based on existing information (e.g., pesticide disposal area at Lot 203), the majority of samples were analyzed for that particular contaminant of concern (e.g.,TCL pesticides); however, at least ten percent of samples collected from these areas were analyzed for full TCL organics and TAL inorganics.

The groundwater investigation focused on evaluating surficial and deep groundwater quality at Operable Unit No. 2. Shallow wells were installed in the wooded areas, Site 82 Lot 201, Lot 203, and Site 9. Deep groundwater wells were installed at Site 9, Lot 201, Lot 203, and Site 82. Groundwater samples were analyzed for full TCL organics and TAL inorganics (total and dissolved metals analysis). Furthermore, two rounds of samples were collected from the Phase I and existing wells, and one round of samples were collected from the Phase II wells. The groundwater investigation also included three to four rounds of water level measurements. These measurements included staff gauges that were installed in Bear Head Creek and Wallace Creek.

Placement of monitoring wells was based on reported storage/disposal areas, results of a geophysical investigation conducted at Lot 203, and review of historical aerial photographs produced by the U.S. Environmental Protection Agency (EPA) Environmental Photographic Interpretation Center (EPIC). Additionally, the placement of the Phase II shallow wells were based on the results of a soil gas survey and placement of the Phase II deep wells were based on the results of the Phase I analytical results.

Surface water and sediment investigations were conducted in Bear Head Creek, Wallace Creek, and the ravine. Surface and subsurface sediment samples were collected from the middle portion of the stream as well as from the stream bank. Deep surface water samples were collected when the depth of water exceeded five feet. All samples were analyzed for full TCL organics and TAL inorganics.

An aquatic survey was also conducted at Wallace Creek and Bear Head Creek. Fish population studies, fish tissue analysis, and benthic population studies were conducted in both streams. Representative fish tissue samples were submitted for full TCL organics and TAL inorganics analysis.

In addition to these studies, an ordnance survey was required at Lot 203 and the wooded areas surrounding Lot 203 due to the presence of surface and subsurface unexploded ordnance (UXO). On two occasions, the MCB Camp Lejeune ordnance specialists were contacted to examine UXO. In both cases, the devices were not determined to present a hazard.

PHYSICAL CHARACTERISTICS OF OPERABLE UNIT NO. 2

Surface Water Hydrology

OU No. 2 is located approximately 1.75 miles east of the New River and 12.5 miles north of the New River's outlet into the Atlantic Ocean. Two drainages exist within and adjacent to Sites 6 and 82. Wallace Creek forms the northern border of Site 82 and flows in a southwesterly direction toward the New River. An estimated flow rate of 14.4 cubic feet per second (CFS) or 6,463 gallons per minute (gpm) was calculated based on Manning's equation. Wallace Creek is surrounded by marsh that exhibits extensive surface ponding. Based on staff gauge measurements, it was determined that Wallace Creek is a gaining stream (i.e., receives groundwater discharge). Moreover, the portion of Wallace Creek adjacent to OU No. 2 appears to be slightly effected by tidal changes on the New River based on visual observations. Bear Head Creek lies within the southern portion of Site 6 and empties into Wallace Creek approximately 0.75 miles downstream from the site.

The NC DEHNR classifies bodies of water within the state according to their designated use. Wallace Creek from its source to the New River and Bear Head Creek from its source to Wallace Creek are designated as Class SB NSW (Nutrient Sensitive Waters) surface waters. The Class SB NSW designation denotes tidal saltwaters protected for primary recreation, fishing and for the propagation and survival of aquatic life.

Geology

MCB Camp Lejeune is located in the Atlantic Coastal Plain physiographic province. The sediments of the Atlantic Coastal Plain consist of interbedded sands, clays, calcareous clays, shell beds, sandstone, and limestone. These sediments are layered in interfingering beds and lenses that gently dip and thicken to the southeast. Regionally, they comprise 10 aquifers and nine confining units which overlie igneous and metamorphic basement rocks of pre-Cretaceous age. These sediments were deposited in marine or near-marine (i.e., coastal plain) environments and range in age from early Cretaceous to Quaternary time.

Surficial soil conditions are generally uniform throughout OU No. 2. In general, surficial soils consist of unconsolidated deposits of silty and clayey sand, silt, and clay. These soils represent the Quaternary "undifferentiated" formation which characterizes the surficial aquifer.

Several areas investigated within OU No. 2 contain large amounts of fill or reworked material. These materials were encountered throughout Lot 201, Lot 203, and portions of Site 9. Historical aerial photographs revealed that soils within and adjacent to the Lot 203 have been excavated and reworked extensively over the years. Soil boring data indicates that fill material exists in these areas to depths greater than five feet bgs in some cases.

Soils were classified during the drilling program to a maximum depth of 236 feet bgs. Additional information on deep subsurface soil conditions to 310 feet bgs was also obtained from boring logs of supply wells in the area. Deeper subsurface soils (below 35 feet) are also generally consistent throughout the site. In general, the deeper subsurface soils consist of fine to medium-grained silty sand, silt, silty-sandy clay, and sandy-marly limestone fragments (gravel size). The appearance and classification of the deeper sands are similar to that described for the surficial sands. Below a depth of 50 to 60 feet, however, the sands become very dense to hard (blow counts above 50). Large amounts of shell fragments were noted frequently in the sands. Thin lenses of clay are interbedded within the sands.

The upper silty sand unit, which is encountered from the ground surface, ranges in thickness from approximately 40 to 140 feet. This silty sand unit is thickest in the northern portion of the site and decreases toward the southern portion of the site. Within the upper silty sand unit, thin discontinuous layers of clay (borings HP-653 and 6GW2D) and limestone (boring HP-635) are present. The clay varies in thickness from approximately 2 to 10 feet while the limestone varies in thickness from approximately 3 to 5 feet.

Underlying the upper silty sand is a limestone unit. The limestone unit varies in thickness from approximately 5 feet near the southern portion of the site to 80 feet near the northern portion of the site. Silty sands (lower unit) underlie the limestone unit to a depth of 310 feet bgs (estimated depth). At boring location HP-651, discontinuous layers of clay (approximately 10 feet thick) and limestone (approximately 10 feet) are present at 230 feet and 250 feet deep, respectively. This clay layer also encountered as soil boring/well 6GW1DA at approximately 230 feet.

Hydrogeology

The surficial aquifer is a series of sediments, primarily sand and clay, which commonly extend to depths of 50 to 100 feet. This unit is not used for water supply at MCB Camp Lejeune.

The principal water supply aquifer for the Base is the series of sand and limestone beds that occur between 50 and 300 feet below land surface. This series of sediments generally is known as the Castle Hayne aquifer. The Castle Hayne aquifer is about 150 to 350 feet thick in the area and is the most productive aquifer in North Carolina.

Onslow County and Camp Lejeune lie in an area where the Castle Hayne aquifer contains freshwater, although the proximity of saltwater in deeper layers just below the aquifer and in the New River estuary is of concern in managing water withdrawals from the aquifer.

Surficial groundwater flow patterns in the vicinity of OU No. 2 were evaluated by a network of existing and newly installed shallow monitoring wells (less than 33 feet), and staff gauges installed in Bear Head Creek and Wallace Creek. Groundwater was encountered during the drilling program at varying depths throughout OU No. 2. This variation in groundwater depths is attributed to topographic (i.e., land surface elevations) changes. A high water table (i.e., less than 2 feet bgs) was typically encountered near the banks of Wallace Creek and Bear Head Creek while a lower water table (i.e., greater than 15 feet bgs) was encountered in the vicinity of Site 82 (e.g., vicinities of well clusters 6GW1S/D and 6GW28S/D). An average depth of groundwater across OU No. 2 is approximately 8 feet. A groundwater divide occurs near the north central portion of OU No. 2. Groundwater on the north side of the divide is flowing northwest toward Wallace Creek while groundwater on the south side of the divide is flowing southwest toward Bear Head Creek.

Groundwater elevations (measured from top of PVC casing reference points) ranged from 1.03 feet [well 82MW2 (10/26/92) located near Wallace Creek] to 29.39 [well 6GW2S (4/1/93) located east of Lot 203 across Piney Green Road] feet above msl. Water levels fluctuated between 0.7 and 5.59 feet over a seven month period. In general, the highest water levels were noted on April 1, 1993 and the lowest water levels were noted on November 7, 1993.

The data suggest that the groundwater in the area is most likely not affected by tidal changes on Wallace Creek which were observed to be minimal adjacent to OU No. 2. Water level data was collected over a 24-hour period from monitoring well 6GW28S. Water levels were fairly constant over a 24-hour period as a change of only 0.06-feet was observed. This very small change in water level is most likely the result of normal daily fluctuations, which can be attributed to barometric effects (i.e., atmospheric pressure).

Site-specific surficial and deep aquifer hydraulic characteristics [i.e., hydraulic conductivity (K), transmissivity (T), and storativity (S)] were not evaluated during this investigation. A recent hydrogeologic investigation conducted by Baker (February, 1993) at Hadnot Point (less than 1/2 miles from OU No. 2) provided estimates of T, S, and K within the surficial water-bearing zones. Aquifer pump and recovery test results indicate an average T of 561 gallons/day/feet (75 feet^2/day), an average K of 21 gallons/day/feet (2.8 feet/day or 8.0×10^{-4} cm/sec), and an average S of 0.015 for the surficial silty-sands (10 to 25 feet bgs). A very low flow rate of less than 2 gpm was maintained during this test. Slightly higher flow rates of 2 to 4 gpm were observed from shallow well development during the field investigation at OU No. 2.

Deeper groundwater flow patterns in the vicinity of OU No. 2 were evaluated by a network of deep monitoring wells (maximum depth of 230 feet bgs). The deep monitoring well network extends from north of Wallace Creek to Site 9, and east of Piney Green Road to Holcomb Boulevard. Additionally, aquifer hydraulic characteristic data from the deeper water-bearing zones were obtained from well production tests (i.e., also commonly referred to as "well acceptance tests") performed on water supply wells HP-651 and HP-636, which are located along Piney Green Road.

Three rounds of groundwater level measurements were obtained from the deep monitoring wells. Groundwater elevations (measured from top of casing reference points) ranged from 9.06 feet [well 6GW37D (4/1/93) located near the western boundary of Site 82] to 19.13 [well

6GW2D (4/1/93)] located east of Piney Green Road) feet above msl. Water levels fluctuated between 2.20 and 5.17 feet over a six month period.

Water level data was also collected over a 24-hour period from deep monitoring well 6GW28D. The water level was also fairly constant over a 24-hour period as a change of only 0.05-feet was observed. This very small change in water level is most likely the result of normal daily fluctuations. Further, the data suggests that groundwater in the vicinity of OU No. 2 is most likely not affected by tidal changes on Wallace Creek which were observed to be minimal.

Deep groundwater is flowing toward the west with local penetrations toward the general directions of Wallace Creek and Bear Head Creek. The estimated groundwater gradients calculated are within the same magnitude across OU No. 2. The average groundwater gradients in the vicinity of Wallace Creek and the north-central portion of the site are 0.003 and 0.0042, respectively.

Overall, the deep and surficial groundwater flow patterns at OU No. 2 exhibit a similar trend. Subsequently, this trend may suggest that the surficial and deeper water-bearing zones are at a minimum partly hydraulically interconnected. Although some clay layers underlie the site (i.e., boring 6GW2D from 25 to 27 feet bgs) which may impede vertical groundwater movement, these clay layers are discontinuous and are characterized as leaky semi-confining. Accordingly groundwater recharging the surficial water-bearing zones will, over time, migrate vertically into the deeper soils.

NATURE AND EXTENT OF CONTAMINATION

Site 6, Lot 201

Pesticides (4,4'-DDD, 4,4'-DDE, and 4,4'-DDT) were detected in more than half of the surface soil samples collected at the three sampling grids and in approximately one-third of the subsurface soil samples. The majority of the pesticide concentrations were below 100 μg/kg. Some of the pesticides were detected in areas where pesticides were not reportedly stored or handled (i.e., the PCB storage area at grid C).

At only two sampling locations, soil boring SB16 and SB17, did the pesticide levels exceed one part per million (1,000 μg/kg). Soil borings SB16 and SB17 are located in the northeast corner of sampling grid A, which was reported to be one of two former pesticide storage areas within Lot 201 (the other area is where grid B was established).

Pesticide contamination at soil borings SB16 and SB17 is significant, indicating that this area may have been used to dispose of unused pesticides. It is also possible that this area was impacted via incidental spills from the containers/drums which contained the pesticides. Pesticide levels in surface soils were as high as 1,200,000 µg/kg for 4,4-DDT (soil boring SB17). Pesticides have migrated to subsurface soils as evidenced by elevated levels of pesticides (460,000 µg/kg of 4,4'-DDT) in subsurface soil samples collected from soil boring SB17. However, no pesticides were detected in groundwater at Lot 201.

Subsurface soil samples collected from SB17 also exhibited elevated levels of total xylene (54,000 µg/kg), ethylbenzene (2,800 µg/kg), naphthalene (38,000 µg/kg), and 2-methylnaphthalene (97,000 µg/kg). These constituents were only detected at one location within Lot 201 (i.e., soil boring SB17). Because these constituents are petroleum based, they may be associated with the pesticides since petroleum-based pesticides were used at MCB Camp Lejeune. None of these constituents were detected in nearby monitoring wells.

Polychlorinated biphenyls (PCBs) were detected in only 3 of 87 samples analyzed at Lot 201. The soil sample collected from soil borings SB13 and SB24 within grid A, and from soil boring SB24 within grid B, exhibited PCB contamination. The only elevated PCB level was detected at a concentration of 1,800 µg/kg in the surface soil at boring SB24 within grid A. No PCBs were detected at grid C, which was established over the area where transformers were reportedly stored. The extent of PCB contamination is limited to a few random areas within Lot 201. In addition, no PCBs were detected in groundwater.

With respect to inorganic contaminants in soil, contaminant levels were comparable to other areas within OU No. 2 (i.e., the wooded area, Lot 203, Site 9). Samples (located west of Lot 201) collected from Lot 201 background borings SB38 and SB39 indicated inorganic concentrations within the range of background levels at Camp Lejeune. Therefore, it does not appear that inorganic concentrations in soil are elevated as a result of former waste handling activities at Lot 201.

Groundwater at Lot 201 does not appear to be impacted via former pesticide or transformer storage practices. However, monitoring well 6GW22, which is located within grid A of Lot 201 (i.e., the former pesticide storage area), exhibited TCE at 1.2 µg/l. The source of TCE is unknown. Soil samples collected from borings within grid A as well as from the monitoring well borehole did not detect TCE or PCE. The extent of TCE in groundwater is believed to be local since no other well downgradient of this area exhibited TCE contamination.

Site 6, Lot 203

The pesticides 4,4'-DDD, 4,4'-DDE, and 4,4'-DDT were detected throughout Lot 203. Only one out of approximately 58 surface soil sampling locations within Lot 203 did the level of pesticides exceed 1,000 µg/kg (soil boring SB30 exhibited 4,4'-DDE and 4,4'-DDT at 2,100 µg/kg and 1,500 µg/kg, respectively). Samples collected from the "DDT" grid, which was established over an area where pesticides were reportedly disposed of, only revealed maximum concentrations of 540 µg/kg, 180 µg/kg, and 770 µg/kg for 4,4'-DDE, 4,4'-DDD, and 4,4'-DDT, respectively. All three maximum values were detected at soil boring SB18 within the "DDT" grid.

As with Lot 201 and the wooded areas surrounding these lots, the majority of the pesticide levels were below 100 µg/kg. The widespread distribution and low levels present on Lot 203 are indicative of former pesticide control practices rather than pesticide disposal. Only at soil boring SB30 (and possibly at SB18 within the "DDT" grid) did the results indicate that pesticides may have been disposed of in that area of Lot 203. Subsurface soil samples collected from this boring, however, exhibited pesticide levels below 500 µg/kg. Pesticides were not present in any groundwater samples (throughout Lot 203 and OU No. 2), indicating that pesticides are relatively immobile in the environment.

Polychlorinated biphenyls (PCBs) were detected at 12 out of 40 sampling locations within Lot 203. The most frequently detected PCB was PCB-1260, which was detected at all 12 locations ranging in concentration from 17 to 42,000 µg/kg. However, only at soil borings SB24, SB26, and SB38 did the PCB levels exceed 1,000 µg/kg. The most elevated concentration, 42,000 µg/kg of PCB-1260, was detected in the surface soil at soil boring SB24. Soil boring SB24 is located along the former railroad spur where historical photographs revealed significant anomalies that may be associated with waste handling and disposal. Subsurface soil samples at this location revealed 72 µg/kg of PCB-1260. Monitoring well 6GW11, which is located within 10 feet of soil boring SB24, did not exhibit organic contamination. Soil samples collected from monitoring well borehole 6GW11 did not exhibit PCB contamination.

Subsurface soil samples collected throughout Lot 203 exhibited PCBs in only three samples. The most elevated concentration of PCB-1260 was detected at soil boring SB22 at a level of 29,000 µg/kg. The surface soil sample collected from this boring did not exhibit any organic contamination. This boring is located in the north central portion of Lot 203 near monitoring well 6GW15S. Soil samples collected from monitoring well borehole 6GW15S did not exhibit PCB contamination. Additionally, groundwater samples collected from this well did not exhibit any PCB constituents; however, low levels of TCE (1.9J µg/l) were present in this well.

Soil samples collected from the northeast corner of Lot 203, which was reported to be an area where PCBs were disposed of, did not exhibit elevated levels of PCBs. Only 4 surface soil samples and one subsurface soil sample exhibited PCB-1260 (19J µg/kg to 53 µg/kg). The sampling locations which exhibited PCBs included soil borings SB3, SB6, SB10, and SB13.

The majority of semivolatile organic compounds (SVOCs) detected at Lot 203 were PAHs. PAHs were primarily detected at nine surface soil sampling locations throughout Lot 203 (i.e., these sampling stations exhibited several PAH constituents as opposed to only one or two PAH constituents). Only one of these locations, soil boring SB38, exhibited contaminant levels above 1,000 µg/kg (at this location, approximately 16,000 µg/kg total PAHs were detected in surface soil). This location also exhibited elevated levels of PCB-1254 (2,100 µg/kg) in surface soil as discussed previously. Subsurface soil samples collected from soil boring SB38 did not exhibit PAH contamination.

Elevated levels of PAH constituents in the subsurface soil at Lot 203 were detected only at soil boring SB22 and soil boring SB41. Approximately 36,000 µg/kg total PAHs were detected at SB22 and approximately 11,000 total PAHs were detected at SB41. Soil boring SB22 also exhibited elevated levels of PCB-1260 (29,000 µg/kg) in the subsurface soil. Soil boring SB22 is located in the north central portion of Lot 203 (near well 6GW15) and soil boring SB41 is located just south of the former railroad spur. Based on the analytical results, it appears that these areas may be associated with waste disposal activities at Lot 203.

The more mobile SVOCs including 1,2-dichlorobenzene, and naphthalene were detected in elevated levels at surface soil samples collected from soil boring SB39, which is located along the former railroad spur. In addition, the PAH constituent acenaphthene was detected at this location at a concentration of 9,500 µg/kg. These SVOCs were detected at a total concentration of approximately 16,000 µg/kg (total SVOC). Subsurface soil samples collected from this boring did not reveal any organic contamination.

Inorganic constituents in soil at Lot 203 were comparable to inorganic levels detected throughout OU No. 2. However, most of the inorganic constituents were detected above background levels.

Groundwater quality at Lot 203 has not been significantly impacted from previous disposal and storage practices. As mentioned above, well 6GW15S, which is located in the north central portion of Lot 203 exhibited low levels of TCE (1.9J µg/l) and total chromium (103 µg/l). Dissolved chromium levels were not detected. Well 6GW11, located near the former railroad spur, was not contaminated. Well 6GW3, located near the ravine, and well 6GW23, located in the southern portion of Lot 203, exhibited levels (i.e., less than 1 µg/l) of PCE and TCE, and total chromium (201 µg/l). The source of the elevated levels of total chromium (above the NCWQS of 50 µg/l) detected in wells 6GW15S and 6GW3 is unknown based on the absence of elevated chromium levels in soil analyses.

Wooded Areas, the Ravine, and Site 82

The wooded areas of Lot 203 can be described as those areas which surround Lot 201 to the north, east, and south, and the area between Lot 203 and Wallace Creek. The area between Lot 203 and Wallace Creek is Site 82. The ravine begins in the northern portion of Lot 203 bisects Site 82 and extends to Wallace Creek. These areas will be discussed separately below.

Wooded Area East of Lot 201

The wooded area east of Lot 201 is primarily contaminated with low levels of pesticides in surface soil (11 locations with a maximum detection of 240 µg/kg of 4,4'-DDT at soil boring SB12), low levels of PAHs in surface soil [5 locations with a maximum detection of approximately 2,000 µg/kg total PAHs (principal constituent was pyrene at 410 µg/kg) at soil boring SB16], and elevated levels of PCB-1260 (26,000 µg/kg) at soil boring SB15. Two other sampling locations, soil borings SB18 and SB21, exhibited low levels of PCB-1260 (less than 300 µg/kg). A subsurface soil sample collected from soil boring SB18 also exhibited low levels of PCB-1260 (83J µg/kg). The three sampling locations where PCB-1260 was detected are all located adjacent to each other along Piney Green Road. According to the EPIC report, this area once served as a training area as noted by the presence of tents and roadways in one of the historical photographs. There is no known or documented waste storage or disposal areas in this section of OU No. 2.

Three other locations in the woods east of Lot 201 exhibited PCB contamination in subsurface soils (no PCBs were detected in surface soil samples from these locations). Low levels of PCB-1260 (46J µg/kg to 100 µg/kg) were detected in subsurface soil samples collected from soil borings SB1, SB17, and SB5. Soil boring SB17 is located approximately 200 feet west of SB18. Soil borings SB1 and SB5 are located over a thousand feet north of the area where PCBs were detected in surface soil near Piney Green Road.

Inorganic levels in soil are comparable to other portions of OU No. 2. No elevated levels were detected at this section of OU No. 2.

Four monitoring wells are located in this section of OU No. 2 (wells 6GW6, 6GW14, 6GW17, and 6GW18). Groundwater quality in the wooded area east of Lot 201 does not appear to have been impacted by either organic or inorganic contamination. No organic or inorganic constituents above Federal or State standards were detected in these four wells.

Wooded Area North of Lot 201

The wooded area north of Lot 201 is bordered to the south by Lot 201, to the north by Lot 203, to the east by Piney Green Road, and to the west by the railroad tracks. Site reconnaissances conducted in this area, as well as test pit excavations, have revealed empty drums on the surface, buried ordnance (only casings and not unexploded ordnance), numerous 5-gallon canisters possibly containing liquid wastes, and debris (e.g., communication wire, bivouac wastes, etc.).

Low levels of pesticides (2.2J µg/kg to 500 µg/kg) were detected in eight of the ten surface soil samples collected during the drilling of test borings. With the exception of the one occurrence of 4,4'-DDE at soil boring SB1, no pesticide contaminant level exceeded 100 µg/kg. Subsurface soil samples collected from this area revealed low levels (i.e., less than 10 µg/kg) of 4,4'-DDT and 4,4'-DDE at two soil borings (SB4 and SB12).

In addition to the low levels of pesticides in a few subsurface soil samples, low levels of benzene (1.0 J µg/kg) and toluene (1.0 J µg/kg) were detected at soil boring SB10.

PCB-1260 was detected at low levels (800 µg/kg) in surface soil at boring SB1. Subsurface soil samples collected from this area did not exhibit PCB contamination.

Low levels of PAHs [approximately 1,700 µg/kg total PAH (principal constituent was butyl benzyl phthalate at 390J µg/kg)] were detected in only one surface soil sample collected at soil boring SB1. PAHs were not detected in any subsurface samples from this area.

Soil boring SB1 exhibited the most contamination in the wooded area north of Lot 201. This boring is located in the northwest section of the woods near Lot 203.

Inorganic concentrations in soil were comparable to other portions of OU No. 2. There were no occurrences of inorganic levels that were an order of magnitude higher than either background levels of other areas (e.g., Lot 201, Lot 203, etc.).

Groundwater quality in this portion of OU No. 2 has been impacted. Two of the six wells in this area (wells 6GW16 and 6GW25) exhibited low levels of organic contamination. Chlorobenzene (maximum of 8,500 µg/l), chloroform (maximum of 20 µg/l), 1,1,2,2-tetrachloroethane (maximum of 60 µg/l), phenol (1.0 µg/l), and 2-chlorophenol (5.0 J µg/l) were detected in well 6GW16. This well was installed near a test pit which revealed numerous 5-gallon canisters containing liquids. Well 6GW25, which is located approximately 1,000 feet upgradient of well 6GW16, exhibited levels of phenol (2.0 J µg/l), chlorobenzene (110 µg/l), and chloroform (1.6 µg/l).

Wooded Area to the South of Lot 201

The wooded area to the south of Lot 201 encompasses the area on both sides of Bear Head Creek and separates Lot 201 from Site 9. Various dirt roads are present throughout these woods. General debris including empty 55-gallon drums, construction debris, and garbage were noted throughout this area.

Pesticides were detected in all surface soil samples collected from this area. Only one location, soil boring SB8, exhibited elevated levels of 4,4'-DDE (4,200 µg/kg), 4,4'-DDT (6,400 µg/kg), and 4,4'-DDD (12,000 µg/kg). The other surface soil samples exhibited pesticides levels well below 200 µg/kg. Soil boring SB8 is located near Piney Green Road approximately 100 feet south of Bear Head Creek. The pesticide 4,4'-DDE was detected in subsurface soil at soil borings SB1 (5.0 µg/kg) and SB6 (3.9J µg/kg).

The only other contamination detected in surface soils were low levels of PAHs (less than 240 µg/kg total PAH) in three samples (soil borings SB11, SB5, and SB8). No PAHs were detected in subsurface soils.

Inorganic compounds were detected in soil at levels that were comparable to other portions of OU No. 2.

Groundwater quality in the wooded area south of Lot 201 does not appear to have been impacted by either organic or inorganic contamination. Five shallow monitoring wells were constructed to monitor groundwater quality in this area. No organics or inorganics were detected above Federal or State standards.

Site 82

Site 82 encompasses the area south of Wallace Creek, west of Piney Green Road, and east of Holcomb Boulevard. The ravine area bisects this portion of OU No. 2. The ravine will be discussed separately.

Low levels of pesticides were detected in the majority of surface soil samples collected from this area. With the exception of surface soil samples collected from soil boring SB1 (1,150 µg/kg total pesticides) and soil boring SB7 (350 µg/kg total pesticides), pesticide levels were below 100 µg/kg for total pesticide concentrations. Subsurface soil samples collected from this area revealed low levels of pesticides (53 µg/kg maximum) in only four samples.

PAHs were detected in only three surface soil samples from this area of OU No. 2. Surface soil samples collected from soil borings SB1 (710 µg/kg total PAH), SB16 (2,420 µg/kg total PAH), and SB7 (380 µg/kg total PAH) revealed low to moderate levels of PAHs. Subsurface soil samples collected from this area revealed PAHs in only one sample collected from soil boring SB7 (587 µg/kg total PAH). Soil boring SB7, which exhibited PAHs at the surface and subsurface, is located near the bottom section of the ravine area. The contamination in this area may be due to surface runoff from the ravine. The ravine exhibited elevated levels of PAHs throughout.

PCB-1260 was detected in only one sample in this portion of OU No. 2. The surface soil sample collected from boring SB17 revealed a concentration of only 3.9 µg/kg. This boring is located just north of Lot 203 near Piney Green Road. The section of Lot 203 to the south of soil boring

SB17 is reportedly where PCBs were disposed of. As discussed previously in Section 4.3.2, no significant levels of PCBs were detected in this portion of Lot 203.

Elevated levels of volatile organic compounds (VOCs) were detected in surface soil samples collected from soil borings SB12 and SB6. Total VOC concentrations in these surface soil samples were approximately 78,000 µg/kg at SB6 and approximately 8,400 µg/kg at SB12. Subsurface soil was contaminated with VOCs at SB12 (approximately 17,000 µg/kg total VOC). Both of these borings are located approximately 300 feet west of Piney Green Road. The borings are approximately 300 feet apart. Based on these results, solvents may have been disposed of within this portion of OU No. 2.

Inorganic levels in soil did not appear to be significantly higher than other portions of OU No. 2.

Surficial groundwater quality has been adversely impacted with volatile organic contamination, primarily TCE, PCE, 1,2-dichloroethene, and 1,1,2,2-tetrachloroethane. Surficial groundwater contamination was evidenced in wells 6GW1S, 82MW1, 82MW2, 6GW28S, 6GW32, and 6GW34. The most significant levels of VOCs were detected in wells 6GW32 (2,200 µg/l of total 1,2-dichloroethene, 74 µg/l of PCE, and 1,500 µg/l of TCE) and 6GW34 (410 µg/l of total 1,2-dichloroethene, 9,600 µg/l of PCE, and 610 µg/l of TCE). Well 6GW34 is located approximately 100 feet west of soil borings SB6 and SB12, which exhibited elevated levels of VOCs in soil samples. Lower levels of VOCs were detected upgradient of well 6GW34 in samples collected from wells 6GW1S and 6GW15 (well 6GW15S is located in the northeast section of Lot 203). Additionally, two of the three temporary wells, which were located downgradient of well 6GW32, exhibited elevated concentrations of volatiles. Several surface water samples, collected from Wallace Creek also exhibited VOCs indicating that the source of VOC contamination in Wallace Creek is most likely groundwater discharge. Monitoring wells 82MW1 and 82MW2, which are located west and northeast of well 6GW32, only exhibited low levels of 1,1,1-trichloroethane (0.5J µg/l) and vinyl chloride (1.6 µg/l), respectively.

Deep groundwater quality is severely impacted with VOC contamination. Monitoring wells 6GW1D, 6GW1DA, 6GW28D, 6GW27D, and 6GW37D exhibited elevated levels of TCE (60 to 58,000 µg/l), PCE (60 to 58,000 µg/l), and total 1,2-dichloroethane (120 to 2,600 µg/l). The highest levels were detected in well 6GW1D.

Surficial groundwater contamination at 6GW1S, which is located next to 6GW1D, did not exhibit levels that would correlate with the significant VOC contamination in the deep groundwater. Supply well HP-651, which is located just east of Piney Green Road approximately 500 feet east of well 6GW1D, also exhibited VOC contamination. This well is approximately 199 feet deep (screened from varying depths between 125 and 194 feet) and is no longer in operation.

The horizontal and vertical extent of deep groundwater contamination has been evaluated. The horizontal extent of off-site contamination west of Site 82 (beyond well 6GW37D), however, has not been fully defined. Moreover, the vertical extent has been evaluated to a depth of 230 feet at only one location. It is unknown at this time whether contamination extends below 230 feet. A clay layer is present as approximately 230 feet deep which may impede the vertical migration of contamination.

Ravine Area

The ravine area begins at the northern fenceline of Lot 203. In the upper portion of the ravine, the banks are steep and covered with debris including empty and partially full 55-gallon drums and other smaller containers. Some of these containers indicated that they contained "DDT" and were dated back to the 1950s. Going northward towards Wallace Creek, the ravine gradually becomes less steep.

Samples collected from the banks of the ravine were identified as soil samples. Samples collected from the middle of the ravine were identified as sediment samples. Specific groundwater quality was not evaluated in the ravine area, however, several surface water samples were collected. The ravine is intermittent in nature. During the wet season, groundwater discharges into the ravine (along with surface runoff). During the dryer seasons, the ravine only receives runoff during rain showers.

The majority of surface soil samples collected from the ravine exhibited low levels of 4,4-DDE (7.5 to 220 μg/kg), 4,4'-DDD (14 to 19 μg/kg), and 4,4'-DDT (25 to 510 μg/kg). These levels are comparable to many of the other pesticide levels in surface soil throughout Operable Unit No. 2. Subsurface soil samples collected from the ravine exhibited lower levels than in the surface soil.

PCB-1260 was detected in one surface soil sample at a concentration of 180 µg/kg (soil boring SB10). None of the subsurface soil samples exhibited PCB contamination.

PAHs were detected at elevated levels in several surface soil samples. Elevated levels of PAHs were detected in surface soil samples collected from soil borings SB11 (15,931 µg/kg), SB14 (9,301 µg/kg), and SB6 (6,020 µg/kg). These soil borings are located in an area where a substantial amount of debris has been disposed of into the ravine. Based on these results, wastes disposed of into the ravine have impacted soil quality. PAHs were also detected in two subsurface soil samples collected from soil boring SB13 (271 µg/kg) and SB14 (344 µg/kg). Soil boring SB13 also exhibited elevated levels of the semi-volatiles isophorone (7,700 µg/kg), naphthalene (9,600 µg/kg), 2-methylnaphthalene (11,000 µg/kg), and VOCs including 4-methyl-2-pentanone (2,000J µg/kg) and total xylenes (950 µg/kg). Soil borings SB13 and SB14 are also located in the southern portion of the ravine (near Lot 203) where debris is present along the banks of the ravine.

Inorganic constituents exhibited similar levels in both surface and subsurface soil and were comparable to other portions of OU No. 2.

Sediment samples were collected at eight sampling stations from the ravine along with surface water samples. As mentioned previously, the ravine is intermittent in nature. Two of the proposed eight sampling stations did not contain water and therefore, no surface water sample could be collected. With the exception of sampling station RV8, all of the surface and subsurface sediment samples exhibited low levels of 4,4'-DDD (4.1 to 45 µg/kg), 4,4'-DDE (23 to 120 µg/kg), and 4,4'-DDT (14 to 210 µg/kg). These levels are comparable to pesticide levels detected in soil throughout OU No. 2. Elevated levels of PAHs were detected at sampling station RV2 (12,573 µg/kg total PAHs), which is located in the southern portion of the ravine where debris is present. Lower levels of PAHs were detected in sediment samples collected from sampling stations RV1, RV3, and RV8.

Six of the eight sediment sampling stations exhibited low levels of PCBs. PCB-1260 was detected in the range of 19 µg/kg to 360 µg/kg.

None of the surface water samples collected from the ravine exhibited organic contamination.

Site 9

Surface and subsurface samples collected from Site 9 revealed low levels of pesticides, VOCs, and SVOCs. Inorganic levels were comparable to other portions of OU No. 2 and therefore do not appear to be present due to fire-fighting training at Site 9.

Pesticides (4,4'-DDE and 4,4'-DDT) were detected in five surface soil samples and eight subsurface soil samples. The most contaminated sample was collected from soil boring SB1, which exhibited 650 µg/kg of 4,4'-DDE and 570 µg/kg of 4,4'-DDT. The remaining samples (surface and subsurface soil) exhibited levels of pesticides in the range of 4 µg/kg to 62 µg/kg. Overall, pesticide levels in surface and subsurface soils were comparable to other areas of OU No. 2.

Soil boring SB1 was the only location where PAH constituents were detected in surface soil. Pyrene and benzo(b)fluoranthene were detected at 59 µg/kg and 46 µg/kg, respectively. Elevated levels of PAHs [8,013 µg/kg total PAHs (principal constituents were pyrene and fluoranthene at 1,800 and 1,700 µg/kg, respectively)] were detected in a subsurface soil sample collected from monitoring well borehole 9GW4. This boring/monitoring well is located approximately 800 feet southeast of Site 9 for purposes of monitoring upgradient groundwater quality. The source of the PAHs in this boring is unknown. Groundwater quality in well 9GW4 is good (no organic constituents were detected).

Low levels of PCE (21 µg/kg) and 1,1,1-trichloroethane (1 µg/kg) were present in the surface soil sample collected from soil boring SB3, which is located approximately 100 feet north of the aboveground storage tanks. Toluene was detected at a level of 2 µg/kg in a surface soil sample collected from soil boring SB35 (SB35 is located adjacent to the oil/water separator).

Groundwater quality at Site 9 does not appear to be significantly impacted by the fire-fighting training activities. Shallow monitoring wells 9GW6 and 9GW8 exhibited low levels of total xylenes (0.9 µg/l) and 2-chloroethylvinyl ether (1 µg/l), respectively. These wells are located approximately 100 feet to the west and east of the training pit, respectively. Total lead and chromium were detected above Federal and State drinking water standards in monitoring wells 9GW1, 9GW2, and 9GW3. Dissolved lead and chromium were not detected above any Federal or State standard.

Wallace Creek

Wallace Creek exhibited elevated levels of VOCs at nine of the eleven sampling stations. The source of contamination is believed to be groundwater discharge from Site 82.

Sampling stations WC7, WC8, and WC9 exhibited TCE (16 to 98 µg/l), 1,2-dichloroethene (9 µg/l to 85 µg/l), PCE (1 µg/l to 4 µg/l), and vinyl chloride (6 µg/l). The sample collected at Station WC7 exhibited a TCE concentration (98µg/l) which exceeds the North Carolina Surface Water Standard of 92.4 µg/l. These sampling stations are located just above that portion of Wallace Creek where the ravine discharges into Wallace Creek (i.e., Station WC7) downstream past the Holcomb Boulevard bridge. Station WC7 exhibited the highest level of contamination. Up gradient sample stations (WC1, WC2, and WC3) only exhibited low levels of 1,2-dichloroethene (4J µg/l) at station WC4, which is approximately 100 feet upstream from the Piney Green Road bridge.

Inorganic constituents including cadmium, copper, mercury, nickel, and zinc were detected above State or Federal standards for surface water. Stations WC3 and WC5 exhibited the highest levels of inorganics. Station WC3 is located approximately one-half mile upstream of the site. The presence of inorganic constituents in Wallace Creek may not be associated with surface water runoff from the ravine.

Pesticides were detected in approximately one-half of the sediment samples collected from Wallace Creek. The concentrations exceeded the EPA Region IV sediment quality screening values (SQSV) for both the lower 10 percentile (ER-L) and median percentile (ER-M). The highest levels of pesticides were detected at stations WC7 and WC8, which are located downstream from the area where the ravine discharges into Wallace Creek. Pesticides were also present, however, in upstream sample station WC1 above the ER-L. It should be noted that the tides may transport contaminants upstream from the point of entry into tidally influenced areas of Wallace Creek. The source of pesticides is likely a combination of historical pest control spraying along with runoff from the ravine.

PCB-1260 was detected at all of the sampling stations with the exception of upstream stations WC1 through WC3. The concentrations ranged from 31 µg/kg to 2,100 µg/kg with the highest levels detected at stations WC6, WC7, and WC8. These stations are located adjacent to Site 82. The source of the PCBs may be due to runoff from the ravine. However, soil samples collected approximately 300 feet south of Wallace Creek at Site 82 did not exhibit PCB contamination.

PAH constituents were detected at several sampling stations including station WC1, which is located approximately one-mile upstream of the site. Elevated total PAH concentrations were present in samples collected from stations WC5 (1,600 µg/kg), WC6 (1,220 µg/kg), WC8 (2,720 µg/kg), and WC9 (1,149 µg/kg). These stations are located adjacent and downstream of Site 82.

Inorganic constituents in sediment that exceeded SQSVs include copper, lead, silver, and zinc. Station WC3, which is located approximately one-half mile upstream of the site, exhibited the most elevated levels of these constituents.

Tissue analysis of fish and crab specimens collected from Wallace Creek indicated the presence of pesticides, TCE, and PCB that may be attributable to surface water and sediment quality within Wallace Creek. 4,4'-DDE (15 µg/kg to 180 µg/kg) and 4,4'-DDD (8.1 µg/kg to 8.8 µg/kg) were detected in all six tissue samples from Wallace Creek. PCBs were detected in tissue samples ranging in concentration from 51 µg/kg to 1000 µg/kg. Five of the six samples exhibited the presence of PCB-1260. Trichloroethene was detected in two samples at a concentration of 5.0 µg/kg.

<u>Bear Head Creek</u>

Surface water samples collected from Bear Head Creek exhibited aluminum, copper, iron, lead, mercury, nickel, and silver above surface water quality standards. Samples collected both upstream and downstream of the Operable Unit exhibited these inorganics.

Low levels of pesticides (maximum value of 311 µg/kg total pesticides) were detected in sediment samples collected throughout Bear Head Creek. Sample stations BH4, BH5, and BH6 exhibited the highest levels. These stations are located adjacent to Site 6.

VOCs (TCE, PCE, and total xylenes) were detected in sediment samples collected from station BH3 and BH7. Station BH7 is located about one-half mile downstream of OU No. 2. The presence of VOCs in sediment at Bear Head Creek is unusual and unexplainable from the standpoint that neither soil or groundwater in that area of OU No. 2 exhibited VOC contamination. In addition, surface water did not exhibit VOC contamination.

PCB (PCB-1260) was detected at sampling stations BH3, BH4, BH5, and BH6 ranging in concentration from 51 μg/kg to 370 μg/kg.

Lead was the only inorganic constituent which was detected at a level which exceeded the ER-L EPA Region IV SQSV. Elevated levels of lead were detected at stations BH3, BH6, and BH7. These stations are upstream and downstream of the site. Sampling stations adjacent to Site 6 did not exhibit elevated levels of lead.

CONCLUSIONS

Based on the results of the various environmental investigations conducted at Operable Unit No. 2, conclusions for each area of concern and media were developed and are presented below.

Site 6, Lot 201

- The northeast corner of Lot 201 (i.e., grid area A) at the former pesticide storage area is contaminated with elevated levels of pesticides and volatiles that may be associated with former waste storage/handling activities. The extent of soil contamination is limited in area since only two sampling locations (SB16 and SB17) exhibited elevated contaminant levels.

- Former waste storage/handling activities at Lot 201 have not adversely impacted groundwater quality in this portion of Operable Unit No. 2.

- The presence of low levels of pesticides throughout Lot 201 is indicative of former pest control practices and is probably not associated with the former storage of pesticides. Low levels of pesticides were detected at similar concentrations throughout the 210-acre Operable Unit.

- Reported storage of PCB transformers at Lot 201 has not resulted in significant impacts to soil or groundwater, based on the limited number of occurrences and low contaminant levels.

- Low levels of TCE are present in groundwater but at concentrations below the NCWQS.

- Overall, the current health risk to base personnel working at Lot 201 is within the target range of $1x10^{-4}$ and $1x10^{-6}$.

Site 6, Lot 203

- Pesticide levels detected in soil at Lot 203 are not indicative of pesticide disposal. Pesticide levels at Lot 203 are comparable to other portions of Operable Unit No. 2. The southeast corner of Lot 203 did not reveal elevated pesticide levels given that pesticides were reported to be disposed of in this area.

- The area of Lot 203 near the former railroad spur may be associated with previous disposal activities. A limited number of surface and subsurface soil samples collected near the former railroad spur have revealed elevated levels of PCB-1260 and PAHs. Historical aerial photographs indicate significant activity (i.e., surficial anomalies) in this area of Lot 203.

- Disposal activities may have occurred in the north central portion of Lot 203 (near wells 6GW15S/D) where elevated levels of PCBs were detected in subsurface soil samples. In addition to PCBs, elevated levels of PAHs were also detected in this area.

- The reported PCB disposal area in the northeast corner of Lot 203 did not reveal elevated levels of PCBs. The reported area may have been inaccurately identified in Marine Corps memorandums.

- Military training operations at Lot 203 resulted in a substantial amount of buried debris including communication wire, shell casings, battery packs, small 5-gallon containers, and bivouac wastes. No 55-gallon drums were uncovered in any of the test pit excavations within Lot 203. Trenches identified in historical photographs were probably excavated as a means to dispose of military-type wastes and not for purposes of disposing hazardous wastes.

- Numerous drums on the surface of Lot 203 present a potential impact to human health and the environment. Samples collected from these drums indicate that some of the drum contents are characteristically hazardous. None of the drums were noted to be leaking.

- Groundwater quality at Lot 203 has not been significantly impacted by former disposal and storage practices. Trace levels of TCE were detected in well 6GW15, which is located in the north central portion of Lot 203 where disposal activities may have occurred. Trace levels of TCE and PCE were detected in well 6GW23 at concentrations below the NCWQS. Well 6GW23 is located in the south central portion of Lot 203. The source of VOC contamination in well 6GW23 is unknown. Soil samples collected from this borehole as well as other nearby soil borings did not indicated a source. The source of contamination may have been from a previous spill, which has since migrated from the soil to groundwater.

- Total chromium levels detected in wells 6GW3 and 6GW15S were above the NCWQS of 50 µg/l.

- Currently, Lot 203 is inactive and access is restricted. If the storage lot resumed operations, the potential human health risk (i.e., incremental carcinogenic risk) would be within the target range of $1x10^{-4}$ to $1x10^{-6}$.

Site 6 - Wooded Areas

- PCBs were detected in surface and subsurface soil near Piney Green Road east of Lot 201. Disposal activities may have occurred in this area, which once served as a training area.

- Disposal activities may have occurred in the wooded area between Lot 201 and 203. One location (soil boring SB1) exhibited moderate levels of PCBs, PAHs, and pesticides in surface soil. The extent of this contamination is limited in area.

- A former disposal area was identified during the test pit investigation in the wooded area between Lot 201 and Lot 203. Numerous 5-gallon containers, bivouac wastes, and battery packs were encountered. All of the containers were rusted and destroyed to the point where their contents could not be identified; however, solvent-like odors were observed by the sampling team. A sample of the sludge material near the containers revealed that the material is characteristically hazardous due to elevated levels of lead. Chloroform was also detected, but was below TCLP regulatory levels.

- Groundwater quality in the wooded area south of Lot 203 (near the above-mentioned disposal area) has been impacted by former disposal practices. Elevated levels of VOCs (chloroform, chlorobenzene, phenol) were encountered in wells 6GW16 and 6GW25. The concentration of chloroform detected exceeds the NCWQS.

- Potential human exposure to soil within the wooded portions of Operable Unit No. 2 would not result in significant health risks. Incremental carcinogenic risk values are within the acceptable risk range of $1x10^{-4}$ and $1x10^{-6}$. The area is frequented by hunters and military personnel.

<u>Site 82</u>

- The wooded area north of Lot 203 (Site 82) exhibited elevated VOC contaminant levels in soil at two locations near the eastern portion of the site. This area is a potential source of VOC contamination in groundwater.

- A large quantity of drums and debris were observed on the surface and subsurface just north of Lot 203 in the wooded area (Site 82) near monitoring wells 6GW1S and 6GW1D. Samples collected of the waste material analyzed the waste as No. 6 fuel oil, which is typically used for heating. Other drums uncovered could not be identified. This area may also be a source of groundwater contamination at Site 82.

- Shallow and deep groundwater north of Lot 203 (Site 82) exhibited elevated levels of VOC contaminants which exceed both the Federal MCLs and NCWQS. Deep groundwater quality was found to be significantly more contaminated than shallow groundwater quality.

- The horizontal extent of shallow groundwater contamination is defined. The plume apparently originates just north of Lot 203 (in the southern portion of Site 82) and discharges into Wallace Creek. Contaminants have migrated into the deeper portion of the aquifer as evidenced by elevated VOC levels in deep groundwater monitoring wells.

- The horizontal and vertical extent of the deep groundwater contamination has been evaluated. The horizontal extent of offsite contamination west of Site 82 (beyond well 6GW37D), however, has not been fully defined. Moreover, the vertical extent has been evaluated to a depth of 230 feet. It is unknown at this time whether contamination extends below 230 feet. As mentioned previously, a clay layer is present at approximately 230 feet which may impede the vertical migration of contamination. For purposes of conducting the baseline human health and ecological risk assessment, the deep groundwater database is adequate. For purposes of performing a feasibility study on the deep aquifer, the current database is also adequate to select feasible remedial alternatives. However, additional data points west of Holcomb Boulevard are required to support the design of an alternative which may employ containment/extraction wells. In addition, further studies are required to better assess the presence or absence of contamination on top and below the clay formation.

Ravine

- None of the TCL organics detected in the ravine exceeded applicable water quality criteria values. Surface water concentrations of aluminum, cadmium, copper, iron, lead, silver, and zinc exceed the WQS and/or WQSV in some of the samples. The exceedance of those TAL inorganics occurred in upstream and/or downstream samples or were infrequent in occurrence.

- The presence of elevated levels of PAHs in soil and low levels of PCBs in sediment in the upper portion of the ravine (i.e., near Lot 203) is most likely due to former disposal practices. This portion of the ravine is filled with debris, including empty and partially-filled 55-gallon drums and other containers. In addition, canisters with "DDT" markings were found in the middle section of the ravine (between Lot 203 and Wallace Creek). However, no elevated levels of pesticides were detected in the ravine sediments.

- Soil contamination detected in the ravine has likely migrated to Wallace Creek via surface runoff. Wallace Creek sediments revealed the same constituents detected in ravine soils and sediments.

- Because of the amount of debris and difficulty in accessing the ravine, it is unlikely that human exposure would occur. Incremental carcinogenic risk estimates for the wooded areas and ravine area have indicated that potential human health risks are within the target range of $1x10^{-4}$ and $1x10^{-6}$.

Site 9

- Ongoing fire training exercises at Site 9 have not significantly impacted groundwater quality. Surface soil revealed TPH contamination in a few areas.

- Low levels of pesticides present at Site 9 are likely the result of former pest control practices and not associated with waste disposal.

- Total lead and chromium concentrations were detected in well 9GW3 at concentrations which exceed both the Federal MCLs and NCWQS.

- Potential human health risks to military personnel training at Site 9 are within the incremental carcinogenic risk range of $1x10^{-4}$ and $1x10^{-6}$.

Wallace Creek

- The presence of TCE, PCE, and other VOC contaminants in Wallace Creek is due to shallow and possibly deep groundwater discharge.

- Surface runoff from the ravine and portions of Site 82 (the wooded area north of Lot 203) have impacted sediment quality. Levels of PAHs, PCBs, and pesticides are present in Wallace Creek. These contaminants were also detected in the ravine.

- Pesticides detected in sediment samples have exceeded EPA Region IV sediment screening values. The source of contamination may be due to either runoff from the ravine and/or historical pest control spraying practices. The highest levels of pesticides were detected in two sampling stations that were located just downstream of where the ravine discharges into Wallace Creek. One upstream sampling location exhibited pesticide levels above the sediment screening values. It should be noted that the tides may transport contaminants upstream from the point of entry into tidally influenced areas of Wallace Creek.

- A surface water sample collected from Station WC7 exhibited a TCE concentration which exceeded the North Carolina Surface Water Standard.

- Inorganic levels for aluminum, cadmium, copper, iron, lead, mercury, nickel, silver, and zinc exceeded North Carolina Water Quality Standards (NCWQS) and/or EPA Region IV acute or chronic Water Quality Screening Values (WQSVs). Upstream sampling locations also exhibited inorganic levels which exceeded these standards. The presence of inorganic constituents in Wallace Creek may not be associated with Operable Unit No. 2 since no source of inorganic contamination is apparent.

- The fish community in Wallace Creek appears to be healthy, based on population statistics. No anomalies were observed on any of the fish collected during the aquatic survey.

- The fish population and diversity in Wallace Creek exhibited tissue concentrations of PCBs, pesticides, and TCE, which may be attributable to Site 6 and the ravine area. Ingestion of fish taken from Wallace Creek could result in human health risks (incremental carcinogenic risks) above the target point of $1x10^{-4}$.

<u>Bear Head Creek</u>

- Sediment quality in Bear Head Creek may be impacted via surface runoff from the wooded areas. Low levels PAHs, pesticides, and PCBs were detected in sampling stations which border Site 6. VOC contaminants were also detected in sediment samples; however, the source of the VOC contamination is unknown given that adjacent soil and groundwater did not exhibit VOC contamination. Pesticides in sediment are not likely associated with disposal practices.

- Inorganic constituents detected in sediment are not likely the result of disposal practices at Sites 6 and 9. Upstream sampling locations also exhibited inorganic constituents above EPA Region IV sediment screening values.

- The fish community at Bear Head Creek appears to be healthy, based on population statistics and observations. None of the fish collected at Bear Head Creek exhibited lesions or other anomalies that would represent adverse conditions.

- The fish community in Bear Head Creek had elevated levels of pesticides, PCBs, and zinc in tissue. The presence of these contaminants in fish tissue may be the result of contaminated sediment. Ingestion of fish taken from Bear Head Creek could result in incremental carcinogenic risks above the $1x10^{-4}$ departure point.

- None of the TCL organic detected in Bear Head Creek exceeded applicable water quality criteria values. Dissolved oxygen concentrations and pH values were below WQS and WQSV at some of the stations, but probably were associated with natural conditions.

- Surface water concentrations of aluminum, copper, iron, lead, mercury, nickel, and silver exceeded the WQS and/or WQSV in some of the samples. The exceedances of these TAL inorganics occurred in upstream and/or downstream samples or were infrequent in occurrence.

RECOMMENDATIONS

1. Further groundwater investigations are required to better define the extent of deep groundwater contamination detected west of Holcomb Boulevard, and on top of and below the clay formation. These studies would be required to support the remedial design of alternatives employing containment/extraction wells.

2. Operating supply wells in the vicinity of Lot 203 should be monitored for VOC contamination. If elevated levels of VOCs are detected, the wells should be closed.

3. As a time critical removal action, a fence should be constructed around the wooded area north of Lot 203 (i.e., Site 82), including the ravine to prevent access. Surficial VOC contamination was encountered in this area.

4. Surficial drums at Lot 203 and in the wooded areas and ravine should be removed, overpacked, and properly disposed of as non-time critical removal action. The drums present a potential source of groundwater contamination and human/ecological health hazard.

5. Additional studies should be conducted in Wallace Creek to determine whether the presence of contaminants such as PCBs and pesticides in fish are due to the site. The limited database is not sufficient to conclude whether bioaccumulation is occurring due to site-related contamination.

6. Based on the results of the Human Health Risk Assessment and on a comparison of groundwater contaminant levels to standards, remedial action of the surficial and deep aquifers under Site 82 is recommended in order to restore the aquifers for future use.

7. Based on the soil data results, remedial action is recommended for "hot spot" areas of soil with elevated levels of VOCs, PCBs, PAHs, and pesticides. These areas may be potential sources of groundwater contamination.

1.0 INTRODUCTION

Marine Corps Base (MCB) Camp Lejeune was placed on the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) National Priorities List (NPL) that became effective on October 4, 1989 (54 Federal Register 41015, October 4, 1989). The United States Environmental Protection Agency (USEPA) Region IV, the North Carolina Department of Environment, Health and Natural Resources (NC DEHNR) and the United States Department of the Navy (DoN) then entered into a Federal Facilities Agreement (FFA) for MCB Camp Lejeune. The primary purpose of the FFA was to ensure that environmental impacts associated with past and present activities at the MCB were thoroughly investigated and appropriate CERCLA response/Resource Conservation and Recovery Act (RCRA) corrective action alternatives were developed and implemented as necessary to protect public health and the environment.

The Fiscal Year 1994 Site Management Plan for MCB Camp Lejeune, a primary document identified in the FFA, identifies 27 sites requiring Remedial Investigation/Feasibility Study (RI/FS) activities. These 27 sites have been divided into 13 operable units to simplify proceeding with RI/FS activities. This report describes the RI conducted at Operable Unit (OU) No. 2, which is comprised of Sites 6, 9, and 82.

The purpose of this RI is to fully determine the nature and extent of the threat to public health and the environment caused by the release or threatened release of hazardous substances, pollutants, or contaminants. The RI serves as the basis for the risk assessment (RA) and provides information in support of the FS and record of decision for final remedial action.

This was accomplished by sampling all media (soil, groundwater, sediment, and surface water) at Sites 6, 9 and 82, evaluating the analytical data, and performing a human health and ecological RA. This RI report contains the results of all field investigations and the human health RA. An ecological RA has been prepared under separate cover.

Site 6 is commonly referred to as "Open Storage Lots 201 and 203". Site 9 is entitled the "Fire Training Pit at Piney Green Road". Moreover, Site 82 is known as the "Piney Green Road VOC Site". These sites are located in the north eastern section of MCB Camp Lejeune, north of the Hadnot Point Industrial Area. The sites are bordered by Holcomb Boulevard on the west, Piney Green Road to the east, Wallace Creek to the north, and Sneads Ferry Road to the south. Bear Head Creek separates Site 6 from Site 9. A location map is shown on Figure 1-1 [note that all figures are presented in separate volumes from this RI Report (Volumes I and II).]

This RI Report is to be submitted to the USEPA Region IV, the NC DEHNR, and to members of the Technical Review Committee (TRC) for their review by the DoN, Naval Facilities Engineering Command, Atlantic Division (LANTDIV).

1.1 Operable Unit Description

Operable units (OU) are formed as an incremental step toward addressing individual site problems. There are currently 23 Installation Restoration Program (IRP) sites on MCB Camp Lejeune which have been grouped into twelve operable units to simplify the specific problems associated with a site or a group of sites. Figure 1-2 shows the breakdown of operable units on MCB Camp Lejeune. OU No. 2 includes Sites 6, 9, and 82. Because the three sites border each other, they have been grouped into one operable unit.

OU No. 2 is located approximately two miles east of the New River and two miles south of State Route 24 on the main section of MCB Camp Lejeune. The unit is bordered by Holcomb Boulevard on the west, Sneads Ferry Road on the south, Piney Green Road on the east, and by Wallace Creek on the north boundary. Camp Lejeune Railroad operates rail lines parallel to Holcomb Boulevard bordering OU No. 2. OU No. 2 covers an area of approximately 210 acres. OU No. 2 consists of three sites: Site 6, Site 9, and Site 82. Note that Site 82 was originally referred to as "the wooded area north of Lot 203" in the Final RI/FS Work Plan. This area was renamed during the RI investigation because a previous investigation was conducted at this site which referred to the area as "Site 82."

Site 9, the fire training area, has two aboveground storage tank areas, a fire training pit where flammable liquids are burned as part of training exercises, and an oil/water separator. Site 6 is comprised of Lots 201 and 203, the wooded areas around both storage lots and the ravine area. Site 82 encompasses the wooded area between Lot 203 and Wallace Creek. Lot 201 is active and is used to store military vehicles and supplies. Lot 203 is inactive but was used for storage of military equipment, pesticides, and transformers containing PCBs. Disposal of hazardous substances such as pesticides, paints, and solvents has been reported at Lot 203. In addition, cleaning solvents were reportedly disposed of at Site 82, which is just north of Lot 203. The wooded areas to the south, east and west of the storage lots have no documented disposal activities, but site investigations revealed random disposal of debris including batteries and 55-gallon drums. Large quantities of debris were also noted in the ravine. Detailed site background and site history descriptions follow in Section 1.2 of this RI report.

1.2 Site Description and History

This section provides a description of the physical setting of the areas of concern within OU No. 2. A detailed history of these areas is also included in this section.

1.2.1 Site Description

There are distinctive areas of concern, as shown on Figure 1-3, within each site of OU No. 2. The following section describes the background of each site.

1.2.1.1 Site 9 Description

Site 9 is referred to in this report as the "Fire Training Area" (the formal name, as provided in the FFA, is "Fire Fighting Training Pit at Piney Green Road"). The site covers an area of approximately 2.6 acres. Site 9 is bounded by Holcomb Boulevard on the west, Site 6 to the north, Piney Green Road on the east, and Sneads Ferry Road on the south. Locally, the site is bounded by unnamed streets leading to various storage buildings in the vicinity. Site 9 consists of an asphalt-lined fire training pit, an oil/water separator, four aboveground storage tanks (ASTs), and a fire tower (smoke house). The fire training pit, located in the southern area of the site, is used to conduct training exercises for extinguishing fires caused by flammable liquids. The oil/water separator is located next to the fire training pit to collect water used in the training exercises and storm water that falls into the pit. The recovered product collected in the oil/water separator is disposed of offsite. Two of the ASTs at Site 9 are 2500-gallon steel tanks labeled "DO NOT USE". These tanks are not currently in use. Two additional storage tanks are located in a bermed area. These tanks are constructed of steel and contain approximately 500 gallons each. Two pressurized containment tanks were also located at Site 9. Their contents are unknown. The smoke house, located in the northern part of Site 9, is also used for training exercises. No fuel products are used in this area.

1.2.1.2 Site 6 Description

Site 6 is located north of and adjacent to Site 9. Site 6 is bounded on the north by Site 82, by Piney Green Road on the east, by Site 9 on the south, and by Holcomb Boulevard on the west. Site 6 covers an area of approximately 177 acres that incorporates Storage Lots 201 and 203, the wooded area behind the storage lots, and a ravine, which begins at Site 6 and bisects Site 82. Three surface water bodies are associated with Site 6 for the purpose of this RI: Wallace Creek, Bear Head Creek, and a ravine (intermittent surface water body) located in the wooded area north of Lot 203 that drains to Wallace Creek. Specific details of the individual areas that make up Site 6 are described below.

Open Storage Lot 201

Open Storage Lot 201 (Lot 201) is a fenced lot located in the south-central portion of Site 6. It is a flat area with sparse vegetation around the fence lines. The ground surface is densely compacted soil. Lot 201 is bordered by woods with Bear Head Creek to the south, Holcomb Boulevard to the west, and Piney Green Road to the east. The lot is approximately 25 acres in size. It is currently being used for the storage of military vehicles and equipment, lumber, hydraulic oils and lubricants, non-PCB transformers, and other supplies (ESE, 1991).

Open Storage Lot 203

Open Storage Lot 203 (Lot 203) is a fenced lot located in the northern portion of Site 6. The fenced area of the lot encompasses approximately 46 acres. Lot 203 is a relatively flat area with elevation differences of approximately five feet. The ground surface is comprised of both naturally existing soil and fill material. Lot 203 varies in vegetation from a hard compact surface with no vegetation to areas with loose sandy soil and dense vegetation. Lot 203 is bordered by woods to the north (Site 82) and south, Piney Green Road to the east, and by Holcomb Boulevard to the west. Lot 203 is currently inactive, but it still contains randomly stored scrap materials from former activities such as rubber rafts, shredded tires, radio/communications parts, empty ammunition boxes, spent ammunition casings, fiberglass-like material, barbed wire fencing, used demolition kit training materials, a non-PCB transformer, wooden pallets, shredded tires, metal debris, and 55-gallon drums. Figure 1-4 shows the location of the debris in Lot 203.

The 55-gallon drums found on Lot 203 were observed in small groupings throughout the lot. The majority of the drums, if labeled, were identified as containing lubricants, petroleum products, or corrosives. Drum sampling was conducted as part of this RI. The results of the drum sampling are provided in Section 4.0 of this report. The drums will be removed as part of a non-time critical removal action.

Empty storage tanks were also found on Lot 203. They were labeled as containing diesel fuel, gasoline, and kerosene (Baker, 1992). These tanks will also be removed during the non-time critical removal action.

Ravine Area

A ravine is located in the northwest section of Site 6. The ravine begins "inside" of Storage Lot 203 and bisects Site 82. The elevation ranges from 25 feet above msl at the north boundary of Lot 203 to 5 feet above msl where the ravine drains into Wallace Creek. The surface of the ravine area is littered with various debris including batteries, fencing, tires, empty unlabeled drums, wire cables, commercial ovens, commodes, and respirator cartridges. An empty drum labeled "DDT" was also found in the ravine area, as were small canisters labeled to contain "DDT". The date on the canisters was marked November, 1957.

Wooded Areas

Woods and open fields surround both Storage Lots 201 and 203 and make up the remaining area of Site 6. The topography of the wooded areas is relatively flat, but localized trenching and mounding is visible west of Piney Green Road. The wooded areas are randomly littered with debris including spent ammunition casings, and empty or rusted drums. Many of the drums observed were only shells or fragments of drums. (Baker, 1992)

1.2.1.3 Site 82 Description

Site 82 is situated at the northern end of OU No. 2. It is bordered to the north by Wallace Creek, to the east by Piney Green Road, to the west by Holcomb Boulevard, and to the south by Site 6. Site 82 encompasses approximately 30 acres and is predominantly covered by woodlands. The site is randomly littered with debris including communication wire, spent ammunition casings, and empty or rusted drums. Markings were observed on a few drums, however, most of the drums did not contain markings due to their condition and age. Some of the drums were marked as "lubrication oil" and "anti-freeze".

The topography within Site 82 is relatively flat near the southern portion of the site, but becomes very steep near the bank of Wallace Creek. Localized trenching and mounding is visible near the southern portion of the site. The ravine bisects the site, as shown on Figure 1-3.

1.2.2 Site History

The following paragraphs describe the documented history of OU No. 2. Waste storage and disposal activities at the individual sites are described below.

1.2.2.1 Site 9

Site 9 has been used as a fire fighting training area from the early 1960s to the present. Fire extinguishing activities took place in an unlined pit. In 1981 the pit was lined with asphalt. The training fires in the pit were started with used oil, solvents, and contaminated fuels (unleaded). Approximately 30,000 to 40,000 gallons of JP-4 and JP-5 fuel were also burned in the fire training pit. Chemical retardants containing Diethylene Glycol Monobutyl Ether, proprietary mixtures of hydrocarbons, fluorosurfactants and inorganic salts were occasionally used to extinguish the training fires. (Baker, 1992).

1.2.2.2 Site 6

Site 6 has a long history of various uses including the disposal and storage of wastes and supplies. This section on the history of Site 6 has been broken down into Storage Lot 201, Storage Lot 203, and the wooded and the ravine areas to simplify the historical descriptions of these areas.

Storage Lot 201

Currently, Lot 201 is used to store military equipment, vehicles, hydraulic oils, and other "non-hazardous" supplies. Pesticides were reportedly stored at one time in the northeast and southeast corners of the lot. Transformers containing PCBs were reportedly stored in the southwest corner of the lot (Water and Air Research, 1983). No storage or disposal activities have supporting documentation other than what is reported in the Initial Assessment Study, prepared in 1983 by Water and air Research.

Storage Lot 203

Storage Lot 203 has been used as a disposal area since the 1940s. There is little documentation on the disposal activities at this lot. Lot 203 in not currently active as a storage or disposal area, but the ground surface is littered with various debris. Pesticides were reported to have been stored in a trailer on Lot 203 as well as in the southeast portion of the lot (Memo: Past Disposal Practices at DRMO Lot 203, 17 January 1989). Drums of DDT were found in the southwestern portion of the lot in 1989 (Memo: Unearthed 55-gallon drums of DDT and 55-gallon drums of unknown substance at Camp Lejeune DRMO Lot 203. 12 January 1989). Five 55-gallon drums and surrounding soil were containerized and disposed of (Memo: 12 January 1989).

Lot 203 was also used for the storage and disposal of radio and communication parts, shredded tires, lubricants, petroleum products, corrosives, expended demolition kit training materials, ordnance, sheet metal debris, wire cables, and wooded pallets. Empty and full 55-gallon drums were found at various locations on Lot 203. A drum survey was conducted as part of this RI and the results are located in Section 4.0 of this report.

Lot 203 is currently fenced. From historical photographs, it appears that the fenced boundaries have changed since the lot was in operation. Former employees at Lot 203 have reported disposal of various chemicals including PCBs, cleaning solvents, electrolytes from used batteries, and waste oils.

Wooded and Ravine Areas

The surface of the wooded areas around Lots 201 and 203 is randomly littered with debris including drums, metal storage containers, and rocket cartridges. No organized disposal operations are documented for the wooded areas. The ravine begins at the northern boundary of Lot 203. As previously stated, the ravine is also currently littered with various debris. From the deposition of the debris in the ravine, it appears that trucks may have dumped their contents into the ravine from Lot 203.

1.2.2.3 Site 82

As described in Section 1.2.1.3, Site 82 is also randomly littered with debris. No organized disposal operations are documented for the site. From the deposition of the debris at Site 82, it appears that the area was used for disposal of miscellaneous debris from Lot 203. Although the name of the site refers to VOCs (the site is named "Piney Green Road VOC Area), there are no documents or memorandums which indicate any disposal of VOCs or solvents.

1.3 Previous Investigations

In response to the passage of the Comprehensive Environmental Response Compensation and Liability Act of 1980 (CERCLA), the DoN initiated the Navy Assessment and Control of Installation Pollutants (NACIP) program to identify, investigate, and clean up past hazardous waste disposal sites at Navy installations. The NACIP investigations conducted by the DoN consisted of Initial Assessment Studies (IAS), similar to the EPA's Preliminary Assessments/Site Investigations (PA/SI) and Confirmation Studies, similar to the EPA's RI/FS. When the Superfund Amendment and Reauthorization Act (SARA) was passed in 1986, the DoN aborted the NACIP program in favor of the Installation Restoration Program (IRP), which adopted the EPA Superfund procedures.

The following sections summarize the previous investigations performed at OU No. 2.

1.3.1 Initial Assessment Study

An IAS was conducted Water and Air Research, Inc., in 1983. The IAS identified a number of sites at MCB Camp Lejeune as potential sources of contamination, including the sites discussed in this RI. The IAS reviewed historical records and aerial photographs, as well as performing field inspections and personnel interviews to evaluate potential hazards at various sites on MCB Camp Lejeune. The IAS recommended performing confirmation studies at Sites 6 and 9 to evaluate the necessity of conducting mitigating actions or clean-up operations.

1.3.2 Confirmation Study

A confirmation study was conducted by Environmental Science and Engineering, Inc. (ESE) in 1984 through 1987. The purpose of this investigation was to investigate the potential source areas identified in the IAS. Sites 6 and 9 were identified in the IAS. The Confirmation Study was divided into two separate reports: a Verification Step done in 1984 and a Confirmation Step done in 1986 through 1987. The work that was performed at OU No. 2 is summarized by site and media below.

1.3.2.1 Site 6

Soil Investigations

In August 1984, as part of the Verification Step, ESE drilled and sampled ten soil borings at Lot 201. The sampling locations are unknown. Each of the 10 samples was composited from the 0-to-3 foot depth range. The samples were only analyzed for the o,p- and p,p-isomers of DDD, DDE, and DDT (ESE, 1991). It is not known why only these pesticides were analyzed except that pesticides were reportedly stored at Lot 201. The analytical results indicate that DDT,pp was detected in all ten samples. DDD,op; DDT,op; DDD,pp; and DDE,pp were detected in 8 of the 10 samples. DDE,op was detected in 6 of the 10 samples. The maximum detected concentrations for each of the isomers were: DDD,op (0.03640 µg/g); DDE,op (0.0320 µg/g); DDT,op (0.3240 µg/g); DDD,pp (0.1600 µg/g); DDE,pp (0.7700 µg/g); and DDT,pp (0.1400 µg/g). No information is available to assess the analytical methods employed or the Quality Assurance /Quality Control (QA/QC) protocols used in the field or laboratory.

In August, 1984, as part of the Verification Step, ESE drilled and sampled 10 soil borings at Lot 203. The sampling locations are unknown. Each of the 10 samples was composited from the 0-to-3 foot depth range. Two duplicate samples were also collected. The samples were only analyzed for the o,p- and p,p-isomers of DDD, DDE, and DDT (ESE, 1991). The p,p-isomer of DDD,DDE, and DDT were predominant in these samples. DDE,pp was detected in 10 of the 12 samples; DDD,pp was detected in 7 of the 12 samples; and DDT,pp was detected in 6 of the 12 samples. DDE,op was not detected in any of the samples. The maximum detected concentrations for each of the other five isomers were: DDD,op (0.00137 µg/g); DDT,op (0.01580 µg/g); DDD,pp (0.0048 µg/g); DDE,pp (0.0016 µg/g); and DDT,pp (0.0490 µg/g).

Groundwater Sampling

In November 1986, as part of the Characterization Step, four shallow monitoring wells (wells 6GW4, 6GW5, 6GW6, and 6GW7) were installed and sampled in the vicinity of Lot 201 (see Figure 2-8). Table 1-1 provides a summary of well construction details for existing site wells.

TABLE 1-1

SUMMARY OF EXISTING WELL CONSTRUCTION DETAILS
SITES 6 AND 82
REMEDIAL INVESTIGATION CTO-0133
MCB CAMP LEJEUNE, NORTH CAROLINA

Well No.	Date Installed	Top of PVC Casing Elevation (1) (feet, above msl)	Boring Depth (feet, below ground surface)	Well Depth (feet, below ground surface)	Screen Interval Depth (feet, below ground surface)	Depth to Sand Pack (feet, below ground surface)	Depth to Bentonite (feet, below ground surface)	Stick-Up (feet, above ground surface)
6GW1S(2)	10/21/86	35.18	25.5	25.0	5.0 - 25.0	3.0 - 25.0	2.0 - 3.0	2.4
6GW2S(2)	10/21/86	38.37	25.5	25.0	5.0 - 25.0	3.0 - 25.0	2.0 - 3.0	2.1
6GW3(2)	10/24/86	31.32	25.5	25.0	5.0 - 25.0	3.0 - 25.0	2.0 - 3.0	2.2
6GW4(2)	10/22/86	27.99	25.5	25.0	5.0 - 25.0	3.0 - 25.0	2.0 - 3.0	2.4
6GW5(2)	10/22/86	25.67	25.5	25.0	5.0 - 25.0	3.0 - 25.0	2.0 - 3.0	2.3
6GW6(2)	10/23/86	26.74	25.5	25.0	5.0 - 25.0	3.0 - 25.0	2.0 - 3.0	2.3
6GW7(2)	10/24/86	17.83	25.5	25.0	5.0 - 25.0	3.0 - 25.0	2.0 - 3.0	2.2
6GW8(2)	10/23/88	22.35	25.5	25.0	5.0 - 25.0	3.0 - 25.0	2.0 - 3.0	1.1
82MW1(3)	06/17/91	8.58	14.02	14.0	4.0 - 14.0	3.0 - 14.0	1.0 - 2.0	2.7
82MW2(3)	06/17/91	6.03	13.02	13.0	3.0 - 13.2	2.0 - 13.0	1.0 - 2.0	3.6
82MW3(3)	06/18/91	24.31	21.05	21.0	11.0 - 21.0	9.0 - 21.0	7.0 - 9.0	3.3
82MW30(3)	--(5)	32.19	--	--	--	--	--	--
MW-2(4)	--	29.68	--	--	--	--	--	--
MW-3S(4)	04/22/92	30.73	50.0	25.0	15.0 - 25.0	12.3 - 25.0	9.4 - 12.3	2.1
MW-8(4)	04/21/92	30.62	50.0	25.0	15.0 - 25.0	13.0 - 25.0	11.2 - 13.0	2.1
MW-9(4)	04/22/92	39.98	50.0	25.0	15.0 - 25.0	11.9 - 25.0	9.9 - 11.9	2.1
BP-6(4)	04/21/92	37.41	25.0	25.0	15.0 - 25.0	13.0 - 25.0	11.0 - 13.0	2.1

Notes:
(1) msl - mean sea level
(2) Monitoring well installed by ES&E - Site 6
(3) Monitoring well installed by NUS - Site 82
(4) Monitoring well installed by SM&E - East of Site 6
(5) -- Information unavailable

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A second sampling round was conducted in January 1987. Both rounds of samples were analyzed for volatile organic compounds (VOCs) and the o,p- and p,p-isomers of DDD, DDE, and DDT. DDD, DDE, and DDT were not detected in any groundwater sample in either round. One VOC was detected in the first round of sampling: chloromethane (6.5 µg/l) was detected in well 6GW6 (ESE, 1990a).

In January 1991, the four existing monitoring wells were sampled and analyzed for full TCL parameters. This sampling was conducted by ESE as part of the Supplemental Characterization Investigation (ESE, 1991). Carbon disulfide was detected at a concentration of 10 µg/l in well 6GW6. No semivolatile compounds (SVOCs) or pesticides were detected in any of the groundwater samples. The following inorganic parameters were detected in concentrations exceeding the North Carolina Water Quality Standards (NCWQS): iron, manganese, chromium, lead, and barium. One or more of these inorganic constituents were observed in all four shallow wells.

In November 1986, as part of the Characterization Step, four shallow monitoring wells (wells 6GW1, 6GW2, 6GW3, and 6GW4) were installed and sampled to monitor groundwater quality near Lot 203. A second sampling round was conducted in January 1987. Both rounds of samples were analyzed for VOCs and the o,p- and p,p-isomers of DDD, DDE, DDT. DDD, DDE, and DDT were not detected in any groundwater sample in either round. Only two VOCs were detected in the first round of sampling in well 6GW1: benzene (3.1 µg/l) and 1,1,2,2-tetrachloroethane (63 µg/l) (ESE, 1990a).

In January 1991, three of the four existing monitoring wells and two water supply wells were sampled to assess groundwater quality at Lot 203. The fourth monitoring well was dry and therefore could not be sampled (ESE, 1991). The sampling was conducted by ESE as part of the Supplemental Characterization Investigation. The samples were analyzed for full Target Compound List (TCL) parameters. Detectable concentrations of VOCs were identified only in the water supply wells: acetone (12 µg/l); vinyl chloride (70 µg/l); 1,2-dichloroethene (75 µg/l); trichloroethene (TCE) (13 µg/l); and tetrachloroethene (PCE) (53 µg/l). The water supply wells (HP-651 and HP-653) are located across Piney Green Road, east of Lot 203 and north of Site 6. No SVOCs or pesticides were detected in any of the groundwater samples, including those samples collected from the potable water supply wells. Several inorganic parameters were detected in concentrations exceeding the NCWQS. These compounds included: iron, manganese, chromium, lead, cadmium, and zinc. Every monitoring well had at least one or more elevated inorganic compound.

Surface Water Sampling

As part of the Characterization Step in November 1986, one upstream and one downstream (from OU No. 2) surface water sample were collected in Bear Head Creek. These samples were analyzed for VOCs, and the o,p- and p,p-isomers of DDD, DDE, and DDT (ESE, 1991). No analyzed compounds were detected in the surface water samples collected in Bear Head Creek.

As part of the Characterization Step in November 1986, one upstream and one downstream (from OU No. 2) surface water sample were collected in Wallace Creek. These samples were analyzed for VOCs, and the o,p- and p,p-isomers of DDD,DDE, and DDT (ESE, 1991). The following VOCs were detected: trans-1,2-dichloroethene (6.4-35 μg/l), TCE (<3-26 μg/l), and vinyl chloride (1.9-3.6 μg/l). The downstream concentrations of each of these VOCs were higher than the upstream concentrations. DDD, DDE, and DDT were not detected in any sample.

As part of the Supplemental Characterization Investigation in January 1991, two surface water samples were collected from Wallace Creek. The upstream location was at Piney Green Road, and the downstream location was at Holcomb Boulevard. The samples were analyzed for full TCL parameters. In addition, field measurements of pH, specific conductance, and temperature were made (ESE, 1991). One VOC was detected in the downstream sample: TCE (5 μg/l). SVOCs and pesticides were not detected in any sample. Most of the detected inorganics (aluminum, calcium, magnesium, potassium, sodium, and zinc) all increased in concentration from upstream to downstream. Iron was the only detected inorganic which decreased in concentration upstream to downstream.

Sediment Sampling

As part of the Characterization Step in November 1986, one upstream and one downstream sediment sample were collected in Bear Head Creek. These samples were analyzed for VOCs, and the o,p- and p,p-isomers of DDD, DDE, and DDT (ESE, 1991). VOCs were not detected in any sample. The p,p-isomers of DDE, and DDT were detected in the sediments collected from Bear Head Creek at levels of 0.0758 μg/g (or ppm) and 0.0131 μg/g, respectively. The upstream concentrations of these two isomers were higher than the downstream concentrations. The source of upstream sediment contamination was not reported and is presently unknown.

Historical mosquito control practices may have resulted in the presence of these pesticides in Bear Head Creek sediments.

As part of the Characterization Step in November 1986, one upstream and one downstream sediment sample were collected in Wallace Creek. These samples were analyzed for VOCs, and the o,p- and p,p-isomers of DDD, DDE, and DDT (ESE, 1991). No compounds were detected in either of the samples.

As part of the Supplemental Characterization Investigation in January 1991, two sediment samples were collected from Wallace Creek. The upstream location was at Piney Green Road, and the downstream location was at Holcomb Boulevard. The samples were analyzed for full TCL parameters. In addition, field measurements of pH, specific conductance, and temperature were made (ESE, 1991). Two common laboratory solvents (acetone and methylene chloride) were the only VOCs detected in the samples. SVOCs were not detected in the upstream sediment sample. In the downstream sample, four semivolatiles were detected: chrysene (420 µg/kg), benzo(b)fluoranthene (600 µg/kg), benzo(k)fluoranthene (510 µg/kg), and benzo(a)pyrene (460 µg/kg). Pesticides were not detected in either sample. With respect to inorganic compounds, aluminum, calcium, chromium, iron, manganese, and zinc were detected in the upstream sediments. Of these, calcium and manganese were not detected downstream. In general, the upstream concentrations were higher than the downstream concentrations.

1.3.2.2 Site 9

Previous investigations at Site 9 only focused on groundwater. No soil investigations or supplemental investigations of Bear Head Creek (i.e., over and above the studies conducted on Bear Head Creek that were associated with Site 6) have been conducted.

Two monitoring wells (9GW1 and 9GW2) were installed in 1984 to characterize groundwater quality (see Figure 2-16). Well construction details (e.g., screen lengths and intervals) for these wells are unknown but are believed to be installed at 25 feet below ground surface and screen between 15 and 25 feet. A water supply well (HP-635) located just east of Piney Green Road was also included in the investigation. The two shallow wells and the water supply wells were sampled on July 5, 1984 and analyzed for cadmium, chromium, lead, oil and grease, volatile organics, and total phenols.

In November 1986, a third shallow well was installed at the northeastern corner of the site downgradient of the pit. Samples were collected from all three shallow wells between November 18 and 19, 1986 and analyzed for total xylenes, methyl ethyl ketone, methyl isobutyl ketone, ethylene dibromide, and hexavalent chromium.

Chromium, lead, and phenols were detected in wells 9GW1 and 9GW2 during the 1984 sampling round. As shown on Figure 2-16, these wells are located in the southeastern and northeastern corner of the site, respectively. No target analytes were detected in the water supply well. The water supply well was only sampled in 1984.

The sampling round of 1986 also exhibited the presence of these contaminants in well 9GW1. Well 9GW2 did not exhibit lead above 22 µg/l (it is not known whether this is the instrument or the method detection level); however, both chromium and phenols were detected again in this well. Well 9GW3 exhibited phenols and 1,2-dibromoethane (ethylene dibromide). Well 9GW3 was again sampled in January 1987 (the other two wells were not sampled) and exhibited low levels of chromium and lead (below Federal or State water quality standards) (ESE, 1990).

The analytical methods or quality of data were not reported in the reference documents and therefore are currently unknown.

1.3.2.3 Site 82

A site investigation was conducted at Site 82 in June, 1991 by Halliburton NUS Environmental Corporation (NUS). The investigation was initiated based on results from an Environmental Science and Engineering (ES&E) field investigation in 1986 (the investigation was conducted as part of a study for Site 6). During this investigation, surface water samples collected from Wallace Creek contained VOCs. It was determined that the source of the VOCs in Wallace Creek most likely did not originate from Site 6 (Lot 203). Subsequently a new site, Site 82, was created to investigate the source of the VOCs (NUS, 1992).

The investigation conducted by NUS consisted of installing six shallow soil borings and three shallow monitoring wells, soil and groundwater sampling, and surface water and sediment sampling (Wallace Creek). Results from the investigation indicated positive detections of organic contamination in all of the media sampled. Pesticides (4,4'-DDD, 4,4'-DDE, 4,4'-DDT, endosulfan II, and dieldrin) were detected in soil (33 to 110 µg/kg) and sediment (12 to 69 µg/kg) samples with lower levels in surface water and groundwater. PCB (PCB-1260 and PCB-1242) contamination was also present in soil (150-1,900 µg/kg), groundwater (15 µg/l), surface water (80 µg/l), and sediments (220-700 µg/kg). Further, levels of TCE (3 to 74 µg/l), 1,2-dichloroethene (6 to 64 µg/l), and vinyl chloride (11 µg/l) were detected in surface water samples. Note that concentrations of VOCs were not detected in any of the wells sampled.

1.3.3 Site Assessment Report

A Site Assessment Report was prepared by Environmental Science and Engineering, Inc. (ESE) in March 1992. This report contained a summary of the Confirmation Study done by ESE at an earlier date and a preliminary risk evaluation for Site 6. The Site Assessment Report recommended that a full human health and ecological risk assessment be performed at Site 6.

1.3.4 Additional Studies at OU No. 2

Site Survey Report - February 1989

The purpose of this investigation was to identify the presence of volatile organic compounds using soil gas analysis that may potentially affect personnel working at Storage Lot 203.

The results of the testing found that "no imminent hazards were observed" and that all of the tests were negative except for a localized soil stain from a former spill.

The area of stained soil is located near the north central portion of Lot 203 along the fenceline.

1.4 Report Organization

The following sections are presented in this RI report.

- Section 2.0 Study Area Investigation
- Section 3.0 Physical Characteristics of the Study Area
- Section 4.0 Nature and Extent of Contamination
- Section 5.0 Contaminant Fate and Transport
- Section 6.0 Baseline Human Health Risk Assessment
- Section 7.0 Summary and Conclusions

- Section 8.0 References

Section 2.0 describes the Phase I and II field sampling activities conducted during the RI at OU No. 2. This section describes the purpose of the sampling procedures, sampling grids, and sampling locations for all media. Figures are included to show sampling locations, drilling logs and well installation information. These figures, along with all other figures presented in this report, are provided in two separate volumes (figures for Sections 1.0, 2.0 and 3.0 are presented in Volume I; figures for Sections 4.0 and 6.0 are presented in Volume II). This section also discusses quality control conducted during the sampling events.

Section 3.0 addresses the physical features of OU No. 2. This section discusses the surface features, meteorology, surface water hydrology, geology, soils, hydrogeology, demography and land use, the ecology in and around OU No. 2, and water supply wells identified within the vicinity of OU No. 2.

Section 4.0 presents the nature and the extent of the contamination found at OU No. 2. This section presents the results of the Phase I and II field sampling activities conducted as part of this RI. The results of the sampling activities are presented in the first part of this section. Also included in this section is a discussion of the extent of contamination, a summary of the contaminants detected and a discussion of the potential sources.

Section 5.0 characterizes the contaminants found at OU No. 2. This characterization includes: potential routes of contaminant migration, contaminant persistence, and contaminant migration.

Section 6.0 contains the Baseline Risk Assessment (RA) conducted for the site. The RA contains a human health evaluation and an environmental evaluation. An ecological risk assessment has bee provided under separate cover.

Section 7.0 includes the Summary and Conclusions. This section summarizes the nature and extent of contamination, contaminant fate and transport, and the RA. In addition, the conclusions address any data limitations and recommended remedial action objectives.

Section 8.0 includes references cited in this report.

This RI report is being submitted in eight volumes: the RI report is presented in two volumes; the figures are presented in two volumes; and the appendices are presented in four volumes.

2.0 STUDY AREA INVESTIGATION

2.1 Introduction

The field programs at Sites 6, 9, and 82 [Operable Unit No. 2 (OU No. 2)] were initiated to characterize potential environmental impacts and threats to human health resulting from previous storage, operation, and disposal activities. The following are brief descriptions of each area investigated, site-specific objectives, criteria for meeting the objectives, and general investigative methods for OU No. 2. Specific field investigative methods are discussed in Sections 2.3 through 2.7.

The wooded area between Wallace Creek and the northern boundary of Lot 203 was originally described in the Final RI/FS Work Plan as the "wooded area north of Lot 203". This area is known as "Site 82" (also referred to as "The Piney Green Road VOC Site"), which is a site previously investigated at MCB Camp Lejeune (described in Section 1.0). Accordingly, this area is referred to as Site 82 for this RI investigation. Note that the discussion of the field investigative methods is combined for Sites 6 and 82 because these two sites are essentially continuous.

2.1.1 Site Descriptions and Objectives - Sites 6 and 82

2.1.1.1 Site 6

Sites 6 is located approximately 1.75 miles east of the New River and 2 miles south of Route 24 on the Mainside portion of Camp Lejeune (refer to Figure 1-3). Site 6 is bordered to the west by Holcomb Boulevard, to the north by Site 82, to the east by Piney Green Road, and to the south by Site 9 (Fire Training Area). Site 6 comprises two storage lots, Lot 201 and 203, which are surrounded by woodlands. The combined area of Site 6 encompasses approximately 177 acres.

Open Storage Lot 201

Open Storage Lot 201 (Lot 201) is located in the south-central portion of OU No. 2. This lot, which is actively used to store military equipment (e.g., vehicles, lumber, hydraulic oils and lubricants, non-PCB transformers and other supplies), is bordered by woods on all directions with Holcomb Boulevard further to the west, Piney Green Road further to the east, and Bear Head Creek further to the south (refer to Figure 1-3). This lot is approximately 25 acres in size

(ESE, 1991) as shown on Figure 2-1 (note that all figures are provided in separate volumes from text). The former pesticide storage areas are located near the northeastern and southeastern portions of Lot 201. Further, the former PCB storage area is located near the southwestern portion of the lot.

The objectives, criteria for meeting these objectives, and general investigative methods for the RI performed at Lot 201 are presented on Table 2-1.

Open Storage Lot 203

Open Storage Lot 203 (Lot 203) is situated in the northern portion of Site 6, just north of Lot 201. Lot 203 is bordered to the west by Holcomb Boulevard, the north (at Site 82) and south by woodlands, and to the east by Piney Green Road (refer to Figure 1-3). As shown on Figure 2-2, a fence is present around the lot; however, the actual area of the storage lot may slightly exceed the fenceline. This lot is approximately 46 acres in size (ESE, 1990).

The project objectives, criteria for meeting these objectives, and general investigative methods for the RI performed at Lot 203 are presented on Table 2-2.

Wooded Area and the Ravine

Woodlands and open fields which surround both lots, and the ravine area make up the remaining areas of Site 6 (Figure 2-3). The fields and woodlands are littered throughout (randomly) with debris including spent ammunition casings, and empty and rusted drums (1-, 5-, and 55-gallon in size). Markings were noted on some of the drums such as "lubrication oil" and "decontamination agents". Most of the drums, however, could not be identified due to their condition and age. Many of the drums were only fragments as opposed to "whole" drums. Discarded material was also noted in the ravine, such as drums, pails, battery packs, and miscellaneous garbage (e.g., foot lockers). Some 5-gallon rusted pails were noted along the northwestern bank of the ravine which were marked as "DDT."

The project objectives, criteria for meeting these objectives, and general investigative methods for the RI performed in the wooded areas and the ravine are presented on Table 2-2.

TABLE 2-1

SUMMARY OF REMEDIAL INVESTIGATION OBJECTIVES FOR STORAGE LOT 201
SITE 6
REMEDIAL INVESTIGATION CTO-0133
MCB CAMP LEJEUNE, NORTH CAROLINA

Medium or Area of Concern	RI Objectives	Criteria for Meeting Objectives	Proposed Investigation/Study
1. Soil	1a. Assess the extent of soil contamination at former pesticide storage areas (Grids A and B).	Determine pesticide levels in surface and subsurface soils at former storage areas.	Soil Investigation
	1b. Assess the extent of soil contamination at the former PCB storage area (Grid C).	Determine PCB levels in surface and subsurface soils at the former storage area.	Soil Investigation
	1c. Assess human health and ecological risks associated with exposure to surface soils.	Determine contaminant levels in surface and subsurface soils.	Soil Investigation Risk Assessment
	1d. Assess areas of surface soil contamination due to site runoff.	Characterize contaminant levels in surface soils at downslope drainage areas.	Soil Investigation
2. Groundwater	2a. Assess health risks posed by future usage of the shallow groundwater near Lot 201.	Evaluate groundwater quality and compare to ARARs and health-based action levels.	Groundwater Investigation Risk Assessment
	2b. Assess potential impact to groundwater from pesticide-contaminated soil or unknown releases.	Characterize on-site groundwater quality and groundwater quality downgradient from Lot 201.	Groundwater Investigation
	2c. Evaluate hydrogeologic characteristics.	Estimate hydrogeologic characteristics of the surficial water-bearing zone (flow direction, groundwater gradient, etc.).	Groundwater Investigation Surface water level measurements in Bear Head Creek

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TABLE 2-1 (Continued)

SUMMARY OF REMEDIAL INVESTIGATION OBJECTIVES FOR STORAGE LOT 201
SITE 6
REMEDIAL INVESTIGATION CTO-0133
MCB CAMP LEJEUNE, NORTH CAROLINA

Medium or Area of Concern	RI Objectives	Criteria for Meeting Objectives	Proposed Investigation/Study
3. Sediment	3a. Assess human health and ecological risks associated with exposure to contaminated sediments.	Evaluate the nature and extent of contamination in sediment.	Sediment Investigation in Bear Head Creek Risk Assessment
	3b. Assess potential ecological impacts posed by contaminated sediments.	Evaluate stress to benthic and fish communities.	Aquatic Study in Bear Head Creek
		Identify the presence or absence of contaminants in fish tissue.	Fish Collection and Tissue Analysis Risk Assessment
	3c. Determine the extent of sediment contamination for purposes of identifying areas of remediation.	Identify extent of sediment contamination where contaminant levels exceed risk-based action levels or EPA Region IV TBCs for sediment.	Sediment Investigation (Bear Head Creek) Risk Assessment
4. Surface Water	4a. Assess the presence or absence of surface water contamination in Bear Head Creek.	Determine surface water quality along Bear Head Creek.	Surface Water Investigation
	4b. Assess impacts to Bear Head Creek from groundwater discharge from Site 6, Lot 201 and wooded areas.	Determine surface water quality in Bear Head Creek.	Surface Water Investigation
		Assess groundwater quality from Site 6 or EPA Region IV TBCs for sediment.	Groundwater Investigation

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TABLE 2-2

SUMMARY OF REMEDIAL INVESTIGATION OBJECTIVES FOR STORAGE LOT 203, THE WOODED AREAS, THE RAVINE AND SITE 82
SITES 6 and 82
REMEDIAL INVESTIGATION CTO-0133
MCB CAMP LEJEUNE, NORTH CAROLINA

Medium or Area of Concern	RI Objectives	Criteria for Meeting Objectives	Proposed Investigation/Study
1. Surface Drums	1a. Determine appropriate treatment/disposal methods of all surface drums.	Identify waste type, contents, and hazardous waste characteristics.	Drum Investigation
	1b. Assess potential impact to soils in drum storage areas.	Characterize surface and subsurface soil contaminant levels in the storage area.	Soil Investigation (Test Pits)
	1c. Assess potential impact to shallow groundwater in drum storage areas.	Characterize on-site surficial groundwater quality.	Groundwater Investigation
2. Buried Waste and/or Drums	2a. Determine and confirm the locations where drums or wastes may be buried.	Identify subsurface anomalies associated with drums or bulk wastes.	Review of Historical Photographs Geophysical Investigation Test Pit Investigation
	2b. Pending the identification of potential buried drums or bulk wastes, determine appropriate treatment/ disposal methods.	Identify waste types, contents, and hazardous waste characteristics.	Drum/Waste Sampling Program
3. Soil	3a. Assess human health and ecological risks associated with exposure to surface soil.	Characterize the nature of soil contamination at Lot 203.	Soil Investigation Risk Assessment
	3b. Assess the potential extent of surface soil contamination due to potential surface runoff.	Determine the presence or absence of soil contamination in downslope or drainage areas.	Soil Investigation Sediment Investigation
	3c. Pending the presence of buried drums/waste, assess the impact to subsurface soil.	Characterize the nature and extent of subsurface contaminant levels at drum/waste disposal areas.	Test Pit Investigation Soil Investigation
	3d. Assess potential impacts to soil from past disposal/ storage activities.	Characterize the nature and extent of soil contamination at Lot 203.	Soil Investigation

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TABLE 2-_ (Continued)

SUMMARY OF REMEDIAL INVESTIGATION OBJECTIVES FOR STORAGE LOT 203, THE WOODED AREAS, THE RAVINE AND SITE 82
SITES 6 and 82
REMEDIAL INVESTIGATION CTO-0133
MCB CAMP LEJEUNE, NORTH CAROLINA

Medium or Area of Concern	RI Objectives	Criteria for Meeting Objectives	Proposed Investigation/Study
4. Groundwater	4a. Assess human health and ecological risks posed by potential usage or migration of shallow groundwater near Lot 203.	Evaluate on-site and off-site groundwater quality.	Groundwater Investigation Risk Assessment
	4b. Determine the presence or absence of off-site ground-water contamination.	Characterize off-site groundwater quality between Lot 203 and Wallace Creek.	Groundwater Investigation
	4c. Assess on-site groundwater quality at both known and unsuspected disposal areas.	Characterize on-site groundwater quality where disposal practices are known to have occurred.	Geophysical Investigation Groundwater Investigation
	4d. Assess the extent of vertical contaminated groundwater quality in areas where the shallow aquifer has been impacted.	Determine the quality of groundwater in the deeper aquifer.	Groundwater Investigation
5. Sediment	5a. Assess human health and ecological risks posed by sediment contamination in Wallace Creek.	Characterize areas of sediment contamination in Wallace Creek.	Sediment Investigation Risk Assessment
	5b. Assess potential ecological impacts posed by contaminated sediment.	Evaluate stress to benthic and fish communities.	Aquatic Survey (Wallace Creek)
	5c. Identify possible source of semivolatile contamination in Wallace Creek sediments and delineate areas of remediation, if necessary.	Identify extent of sediment contamination in Wallace Creek.	Sediment Investigation (Wallace Creek and the Ravine Area)

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TABLE 2-_ (Continued)

SUMMARY OF REMEDIAL INVESTIGATION OBJECTIVES FOR STORAGE LOT 203, THE WOODED AREAS, THE RAVINE AND SITE 82
SITES 6 and 82
REMEDIAL INVESTIGATION CTO-0133
MCB CAMP LEJEUNE, NORTH CAROLINA

Medium or Area of Concern	RI Objectives	Criteria for Meeting Objectives	Proposed Investigation/Study
6. Surface Water (Wallace Creek)	6a. Assess human health and ecological risks associated with exposure to surface water.	Evaluate surface water quality throughout Wallace Creek.	Surface Water Investigation Risk Assessment
	6b. Assess ecological impacts from contaminated surface water.	Determine stress to fish or benthic communities.	Aquatic Survey
7. Surface or Subsurface Ordnance Debris	7a. Define areas where ordnance is located and notify DoN for subsequent removal by CLEJ personnel.	Visual inspection by qualified ordnance specialist.	Review of Historical Photographs Site Reconnaissance Geophysical Investigation

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2.1.1.2 Site 82

Site 82 [referred to as "The Piney Green Road VOC Site," (NUS, 1991-1992)] is situated in the wooded area between Lot 203 and Wallace Creek. It is estimated to be 30 acres in size. This site was identified by results from a field investigation (conducted in 1986 by ESE). Portions of the site may have been disturbed by excavation activities (based on the topography and vegetative cover of this area. The debris (which included spent ammunition casings and drums/drum fragments) were noted to be protruding from the ground surface in some of the areas.

The project objectives, criteria for meeting these objectives, and general investigative methods for the RI performed at Site 82 are presented on Table 2-2. Note that the project objectives, criteria for meeting these objectives, etc., for Site 82 are presented together with Site 6 (e.g., Lot 203) because these two sites are essentially continuous (i.e., both sites share a common boundary).

2.2 Aerial Photographic Investigation

In August of 1992, an interim aerial photographic investigation report was completed by the USEPA's Environmental Photographic Interpretation Center (EPIC) in Warrenton, Virginia, of the Advanced Monitoring Systems Division in Las Vegas, Nevada. The investigation was performed at the request of the Superfund Support Section of EPA Region IV. The aerial photographs detail operations at OU No. 2 during the period from 1938 to 1990. Investigation results were employed to locate and assess potential sources of contamination, and to document past waste disposal and storage activities within the study area.

Information supplied by EPA Region IV identified areas of concern within each site and verified the occurrence of waste handling, disposal, and storage activities. Where possible, such activities were noted in the EPIC report and annotated on the photographs.

Black-and-white aerial photographs from 1938, 1944, 1949, 1952, 1956, 1960, 1964, 1970, 1980, 1988, and 1990 were used for the analysis of OU No. 2. The 1938 round of photographs established a basis of comparison, prior to development of the Camp Lejeune Military Reservation.

The analysis was performed by viewing backlit transparencies of aerial photographs through a stereoscope. Stereoscopic viewing of aerial photographs creates a perceived three-dimensional effect which enables the analyst to identify visible characteristics (e.g., color, tone, shadow, texture, size, shape, and pattern). These visible characteristics permit a specific object or condition to be recognized on aerial photographs (EPIC, 1992).

The following subsections describe selected aerial photographs from the photographic investigation. Appendix V contains reproductions of those annotated photographs that best illustrate conditions and delineate areas of concern within the study area.

2.2.1 Aerial Photograph - October 1949

The cleared area of Lot 203 is visible in the northern portion of Site 6 (see Appendix V.1). Probable refuse, material, and debris line the railroad spur that extends into the northwest corner of the cleared area. A building and possible dark-toned stain are noted within the cleared area at the terminus of the railroad spur.

The open storage area of Lot 201 is fenced and noted in the 1949 photograph. A graded area east of Lot 201 is also indicated. This portion of the study area may have been used for temporary housing prior to 1949. Numerous rectangular objects (not further/andannotated) probable housing units are uniformly arranged along the four parallel roads east of Lot 201.

2.2.2 Aerial Photograph - February 1956

The 1956 aerial photograph, see Appendix V.2, shows a marked increase in activity since the 1949 photograph. A large portion of the cleared area is now fenced and used to store military vehicles and equipment. The cleared areas that surround Lot 203 extend south toward Lot 201. Probable stacked containers and dark-toned material have been noted to the north of Lot 203. Trenches, containers, probable refuse, and debris are located throughout the open storage area. An excavated pit is also noted immediately to the south of Lot 203.

2.2.3 Aerial Photograph - November 1960

A dark-toned material, probably topsoil, has been noted to the north and southwest of Lot 203, see Appendix V.3. Trenches and linear ground scars have also been noted to the south and southwest. Probable refuse and dark-toned objects are located in the vicinity of the railroad spur that extends into the clear area.

Probable staining has been indicated within the open storage area of Lot 201. Grading and the same dark-toned material found in the northern portion of the study area is evident to the east of Lot 201.

2.2.4 Aerial Photograph - December 1988

Numerous piles of refuse and raw materials are visible in the northwestern section of Lot 203, see Appendix V.4. Trenches, grading, and other ground scars are no longer evident in the study area. The disturbed areas are almost entirely revegetated. Rows of dark-toned objects, similar to those seen in earlier years, are visible in the northeastern section of the open storage area. Most of this area is now fenced, and vehicles, equipment, and other materials are stored in the open storage area of Lot 203.

Approximately 40 cylindrical objects and a debris pile are visible in the northern portion of Lot 201. Roads and buildings (not further/and annotated) are now seen in the formerly graded area east of Lot 201.

2.3 Preliminary Site Survey

Prior to initiating the drilling and sampling program at OU No. 2, a preliminary survey of each site was conducted, and the locations of the proposed soil borings and monitoring wells were surveyed. The proposed locations were established by using horizontal and vertical control points near the site which are tied into the North Carolina State Plane Coordinate System (NCSPCS). Hoggard-Eure Associates (Hoggard-Eure), a registered surveyor in the State of North Carolina, was retained to perform the survey. The preliminary survey was completed on September 10, 1992.

Sampling grids of boring locations for the soil investigation were established within each of the areas within OU No. 2. The sampling points within each grid area were spaced at varying distances depending on such factors as size of the area, contaminant of concern, and drilling accessibility. Table 2-3 summarizes sampling grid locations, sample spacings for each area investigated, the number of borings per grid, and the contaminants of concern.

TABLE 2-3

SOIL INVESTIGATION SAMPLING GRID SUMMARY
OPERABLE UNIT NO. 2
REMEDIAL INVESTIGATION CTO-0133
MCB CAMP LEJEUNE, NORTH CAROLINA

Site/Area	Sample Grid Designation	Grid Spacing (feet)	Number of Borings in Grid	Primary Contaminant of Concern
Site 6/Lot 201	201A	50/100	39	Pesticides
Site 6/Lot 201	201B	50/100	39	Pesticides
Site 6/Lot 201	201C	50/100	41	PCBs
Site 6/Lot 203	DDT	100	34	Pesticides
Site 6/Lot 203	PCB	100	15	PCBs
Site 6/Lot 203	OSA(1)	300	44	Organics/Inorganics
Site 6/Ravine	RAV	Random	16	Organics/Inorganics
Site 6/Wooded Area	201N	300	12	Organics/Inorganics
Site 6/Wooded Area	201E	300	21	Organics/Inorganics
Site 6/ Wooded Area	201S	300	12	Organics/Inorganics
Site 82	OSA(2)	300	20	Organics/Inorganics
Site 9	Entire Site	25	57	Petroleum Hydrocarbons/ Organics/Inorganics

Notes: (1) Lot 203 grid OSA soil borings SB21 through SB44
(2) Site 82 grid OSA soil borings SB1 through SB20

Samples collected at soil borings SB11 and SB12 (both located at grid "201N") are considered as background samples.

Refer to Figures 2-5, 2-6, and 2-7 for soil sample locations.

Refer to Appendix C for summary of sample depths and analytical parameters tested.

Note that soil borings for monitoring well installation are not represented on this table.

Selection of the proposed soil boring and monitoring well locations for OU No. 2 was based upon review of several sources of information. These sources included results of previous investigations (NUS, 1992; ESE, 1990; and ESE, 1991) performed at OU No. 2, and records obtained from Camp Lejeune Activity personnel and the Navy which describe previous waste handling and disposal at the sites. Additionally, historical aerial photographs supplied from the EPIC were reviewed and interpreted to identify areas which may have been used in the past for disposal activities (i.e., Lot 203 within Site 6) as described in Section 2.2.

2.4 Phase I RI Field Investigations Performed at Sites 6 and 82

The Phase I field investigations performed at Sites 6 and 82 commenced on August 21 and continued through November 10, 1992. The field program implemented during the Phase I investigation consisted of a preliminary site survey; an unexploded ordnance (UXO) survey; a geophysical survey; a soil investigation including drilling and sampling; a groundwater investigation including monitoring well installation (shallow and deep wells) and sampling; drum waste sampling; test pit excavations and soil sampling; surface water and sediment investigations; and an aquatic and ecological survey. The following sections discuss these investigative activities.

2.4.1 Unexploded Ordnance Survey

During the pre-investigation site visit (August, 1991), numerous large caliper expended cartridges and small arms expended cartridges were noted exposed on the surface throughout sections of Sites 6 and 82. Accordingly, an unexploded ordnance (UXO) survey was conducted by the firm of Geo-Centers, Inc., (Geo-Centers) at several areas within Sites 6 and 82 prior to initiating the drilling and sampling programs. The UXO survey was conducted within Lot 203, areas south of Lot 203 (wooded areas), areas east of Lot 201 (wooded areas), and portions of Site 82. The survey was performed in two phases. Phase I included a UXO reconnaissance, a UXO geophysical survey, and a soil borehole/monitoring well UXO. Phase I tasks commenced on August 21, 1992 and were completed in two weeks.

Phase II was initiated on September 27, 1992, and continued for one week. Phase II tasks consisted of test pit excavations. A copy of Geo-Centers' UXO Surface and Subsurface Investigation and Removal Report, which includes the investigative methods and results, is presented in Appendix A.

2.4.2 Geophysical Investigations

A geophysical survey was conducted within Lot 203 and portions of the wooded area north of Lot 203 on August 29 and 30, 1992. Originally in the RI/FS Study Work Plan (submitted in May 1992), the survey was planned to extend into the southern portion of Site 82. Because of extensive overgrowth throughout Site 82, however, most of the area was not investigated. The survey was conducted to investigate areas within Lot 203 that appeared to have been excavated and backfilled as depicted on historical aerial photographs supplied by EPIC. It was believed that the trenches observed in the photographs may have been utilized for disposal of miscellaneous wastes (possibly drums of pesticides) while the storage area was active. The firm of Weston Geophysical Corporation (Weston) was retained to perform the survey.

Prior to the survey, a geophysical survey grid was established within Lot 203 by the surveying firm of Hoggard-Eure that consisted of parallel traverses spaced approximately 100-feet. Figure 2-4 shows the location of the survey grid.

Several geophysical techniques were employed during the investigation including electromagnetic terrain conductivity (ETC), magnetometry, and ground penetrating radar (GPR). ETC profiling was performed to map the lateral extent of buried material and to identify buried metal objects and other debris. The magnetometry survey was performed to complement the ETC interpretation of subsurface objects and debris. Lastly, GPR techniques were initiated to reveal a graphic cross-sectional view of subsurface stratigraphy and buried objects such as drums, pipelines, and tanks.

Results of the survey indicate a widespread area containing buried metal exists in the southern portion of the site, inside the perimeter fence and approximately parallel to the southern perimeter road as shown on Figure 2-4.

Buried metal was also detected in the wooded area on the eastern portion of the site, as shown on Figure 2-4. Additional geophysical lines of coverage were added to better define potential areas of disposal within the woods. One area is centered near grid coordinates 15+00E/6+00N, and its shape is characteristic of a trench.

Magnetic measurements were generally erratic across the entire site, due in part to the presence of surface metal objects and scattered scrap metal and debris. Areas of buried metal delineated on Figure 2-4 were coincident with anomalously high magnetic intensities, indicating the presence of buried ferrous metallic objects.

Several geophysical lines were extended to the north beyond the perimeter fence. As shown on Figure 2-4, conductivity measurements indicate that fill materials or buried debris may extend beyond the perimeter fence in the northeast corner of the lot.

Appendix B contains the report prepared by Weston (a subsidiary of Baker Environmental, Inc.) for the geophysical survey at Site 6.

2.4.3 Soil Investigation

The soil investigation implemented at Sites 6 and 82 was intended to identify contaminants of concern [i.e., pesticides, polychlorinated biophenyls (PCBs), etc.] and evaluate their distribution at the site (refer to Tables 2-1 and 2-2 for specific objectives). Moreover, the investigation was performed to evaluate potential human health risks and ecological impacts associated with the contaminants of concern. As shown on Table 2-3, several sample grids were established within Sites 6 and 82 to assist in sample collection.

2.4.3.1 Analytical Sequences and Quality Control

Field procedures and sampling methods employed for this study were implemented in accordance with EPA Region IV standard operating procedures (USEPA, 1991). These procedures also include sample handling and preservation, documentation, and chain-of-custody procedures. Specific sampling procedures are outlined in the Final RI/FS Work Plan for Site 6 (Baker, 1992).

Validation of analytical data, performed under DQO Level IV, (i.e., CLP organics, CLP inorganics and EPA Methods 601 and 602) was performed by an independent subcontractor. The data validation process involved reviewing the data for completeness of submission, a technical evaluation, and a site-specific evaluation to determine the usability of the data.

The technical data validation is a systematic procedure of reviewing analytical data against a set of established criteria set froth in the USEPAs Laboratory Data Validation National Functional Guidelines for Evaluating Inorganic and Organic Analyses.

As a result of validation there were no analytical values rejected "R". Several values, are considered to be estimated and have been assigned J qualifiers. The J qualifier is the most commonly encountered data qualifier in CLP packages. Consistent with USEPA guidance, J-qualified data are to be used as positive data that are unqualified.

Blank inorganic or organic contaminants detected in a sample are considered as positive only if the concentration of the containment in the site sample is five times the maximum amount detected in any blank. For common lab contaminants (i.e., acetone, 2-butanone, methylene chloride, toluene and phthalate esters), the sample concentration must be ten times the maximum amount detected in any blank. Organic contaminants with a B-qualifier are attributable to blank contamination and have not been incorporated as data points. The soil investigation conducted at Sites 6 and 82 included shallow soil borings, soil sampling, field screening and air monitoring. These activities and analytical sequences are discussed in the following sections.

2.4.3.2 Drilling Procedures

The Phase I drilling activities at Sites 6 and 82 commenced on August 24 and continued through November 7, 1992. Hardin and Huber, Inc., (HHI) was retained to perform the drilling services. The drilling and sampling programs implemented at Sites 6 and 82 were intended to investigate shallow and deep physical (i.e., geologic and hydrogeologic) and chemical (i.e., contaminant distribution) conditions.

Site 6 was subdivided into three areas (grid locations) for the drilling program, including: Lot 201; Lot 203; and the wooded areas (north, east, and south of Lot 201) along with the ravine (north of Lot 203). Site 82 was considered as one entire grid area and consisted of 20 sample locations (soil borings OSA-SB1 through OSA-SB20). These areas were subdivided into grid areas based on the suspected contaminants of concern (from past disposal activities and previous military operations) and their geographical locations. Figures 2-5, 2-6, and 2-7 depict drilling locations for Lot 201; Lot 203; and the wooded areas, (the ravine, and Site 82, respectively.

The following sections describe the drilling procedures employed for advancing the shallow (i.e., less than 35 feet) and deep (greater than 100 feet) boreholes.

Shallow Drilling Procedures

Shallow boreholes were advanced using a truck-mounted drill rig using hollow-stem auger (HSA). During drilling, 3-1/4 inch inside diameter (ID) augers were used to advance the boreholes. Split-spoon samples were collected from inside the augers according to ASTM Method D 1586-84 (ASTM, 1984). Soil cuttings obtained during the drilling program were contained and handled according to the procedures outlined in Section 2.8. Drilling and sampling activities were performed using Level D personal protection. [Note that upgraded levels of protection (e.g., Level D to Level C personal protection) were not required during the drilling program.]

Two different schemes were employed for samples collected from exploratory soil borings and borings advanced for monitoring well installation. Soil samples obtained exploratory from soil borings were collected from the surface (ground surface to six-inches) and then at continuous two-foot intervals (starting at one-foot) until the borings were terminated at the approximate depth of the water table; in some cases where potential wetting fronts were suspected (i.e., perched water table), an additional split-spoon was collected below the water table to confirm groundwater depth. Two-foot samples were obtained to ensure a sufficient quantity of sample was retained for laboratory analysis and classification.

Samples collected from borings advanced for monitoring well installation were obtained at continuous two-foot intervals (from the ground surface) to just below the water table, then at approximate 5-foot intervals thereafter until the borings were terminated [approximately 20 to 35 feet below ground surface (bgs)]. A summary of the sample numbers, boring depths, and sampling intervals is provided in Appendix C (C.1 through C.11).

Each split-spoon sample was classified visually by the site geologist. Soils were classified in the field using a general Unified Soil Classification System (USCS) lithologic description. Lithologic descriptions were recorded in a field logbook and later transferred onto boring log records. Soil classifications included characterization of soil type, grain size, color, moisture content, relative density, plasticity, and other pertinent information such as indications of contamination. Lithologic descriptions of site soils are provided on the Test Boring Records in Appendix D (D.1 through D.10) and the Test Boring and Well Construction Records in Appendix E (E.1 and E.2).

Additionally, some samples (e.g., ravine area) were obtained utilizing a hand auger where access with a drill rig was not possible. The auger bucket was advanced to the desired sampling depth and a new, decontaminated bucket was installed to collect the grab sample. The auger buckets were also decontaminated prior to sample collection according to the procedures outlined in Section 2.7.

Deep Drilling Procedures

Five deep soil borings (6GW1D, 6GW2D, 6GW7D, 6GW27D, and 6GW28D) were advanced from 107 feet (6GW7D) to 122 feet (6GW2D) bgs and converted into deep monitoring wells. The borings were initially advanced with 3-1/4 inch ID HSA to just below the water table, then further advanced using mud rotary drilling until the borehole was terminated. Mud rotary drilling was employed because of the unconsolidated soil conditions and the drilling depth limitations of augers. Continuous two-foot split-spoon samples were collected to just below the water table (for laboratory analysis), then at approximate 5-foot intervals. Soils were visually classified by the site geologist as described in the previous paragraph.

The drilling fluid (i.e., mud) used for the deep borings consisted of a mixture of sodium bentonite. Potable water from a nearby fire hydrant at Site 9 was used to mix the materials. Field blanks of the potable water source, drilling fluid, and mixing tube (collected after the tube was decontaminated) were collected for quality control/quality assurance (QA/QC) purposes. Drilling fluids (along with the soil cuttings) were temporarily stored in 55-gallon drums and later emptied into rolloff boxes staged on site at a secure area (see Section 2.8 for details on Investigative Derived Wastes).

2.4.3.2 Soil Sampling

The following sections summarize soil sampling locations, procedures, and analytical methods employed for the soil investigation.

Sampling Locations

Soil samples were collected throughout Sites 6 and 82 for soil classification purposes and analytical testing. Figures 2-5, 2-6, and 2-7 depict soil sample locations for Lot 201; Lot 203; and the wooded areas, the ravine, and Site 82, respectively. Table 2-3 summarizes the sample locations, grid designations, grid spacings, the number of borings per grid, and primary contaminant of concern for each area.

Sampling Procedures

Surface (0 to 6 inches bgs) and subsurface (deeper than one foot) soil samples were collected for laboratory analysis. Surface samples were collected for risk assessment evaluation while subsurface samples were collected to evaluate the horizontal and vertical extent of potentially impacted soils. Appendix C (C.1 through C.11) summarize the sample depths, sample numbers, and parameters analyzed.

Soil samples were obtained via a drill rig (i.e., split-spoon samples) or hand auger as described in Section 2.4.3.1. Surface samples were obtained by advancing the HSA to approximately six inches bgs so that the soil cuttings could be retained for the grab sample. The first few inches of top soil or matted roots were removed prior to advancing the augers (some areas were covered with grass or humus material). Deeper subsurface grab soil samples were collected with a split-spoon sampler in accordance with ASTM Method D 1586-84 as detailed in Section 2.4.3.1. Both the HSA and split-spoon samplers were decontaminated prior to sample collection according to the procedures outlined in Section 2.7.

In general, samples retained for laboratory analysis were collected from the surface and just above the water table (i.e., typically two samples per borehole were submitted for analysis). In some cases, a third sample from a borehole was also submitted for analysis if evidence of contamination (i.e., elevated PID readings) was noted or if the boring was deeper than 10 feet. Samples retained from borings advanced for monitoring well installation were collected from just above and just below the water table. This sampling methodology was implemented so that groundwater results could be correlated with soil conditions.

Soil samples retained for analysis were prepared according to EPA Region IV SOPs. Samples collected for volatile organic analysis were extracted with a stainless-steel spoon from different sections of the split-spoon or auger bucket, representing the entire sampling interval. Precautions were taken not to aerate the sample, to minimize volatilization. Samples retained for other analytical parameters [i.e., semivolatiles, PCBs, pesticides, toxicity characteristic leaching procedure (TCLP) compounds, and engineering parameters] were first thoroughly mixed and then placed in the appropriate laboratory containers. Samples on which grain-size analysis were performed were collected by advancing the hollow-stem augers and retaining the soil cuttings.

Following sample collection, each sample retained for laboratory analysis was stored with ice in a cooler. Sample preparation also included documentation of sample number, depth, location, date, time, and analytical parameters in a field log book. Chain-of-custody documentation, which included information such as sample number, date, time of sampling, and sampling personnel, accompanied the samples to the laboratory. Samples were shipped via Federal Express to Ceimic Corporation (Ceimic) in Narragansatt, RI.

Analytical Requirements

Analytical methods are summarized on Tables 2-4 and 2-5 for organic and inorganic analyses, respectively. Samples were analyzed for contaminants of concern within each grid area (refer to Table 2-3). For example, in grid 201A, the contaminants of concern are pesticides. Accordingly, most of the samples from this grid were analyzed for TCL pesticides; other random samples from this grid (i.e., generally at sample points located on the perimeter and center of grid) were analyzed for full TCL organics (volatiles, semivolatiles, pesticides, and PCBs) and Target Analyte List (TAL) inorganics (total metals). Selected samples (from grids located within Lot 201) were also analyzed for residual chloride, total fluoride, organic nitrogen, and total alkalinity (engineering parameters); total TCLP; and RCRA hazardous waste characteristics (i.e., flashpoint, ignitability, etc.) to evaluate general soil conditions for potential treatment and disposal options. These samples were collected near the center of each grid or in areas where indications of contamination (i.e., PID readings or analytical results) were noted. Samples were also collected at selected locations (generally near center of grid) for grain-size analysis to evaluate subsurface physical conditions. Appendix C (C.1 through C.11) provides a summary of the analytical program for the various grid areas.

Quality Assurance and Quality Control Samples

Field quality assurance and quality control (QA/QC) samples were also collected during the sampling program. These samples were obtained to: 1) ensure that decontamination procedures were properly implemented (i.e., equipment rinsate samples); 2) evaluate field methodology (i.e., duplicate samples); 3) establish field background conditions (i.e., field blanks); and 4) evaluate whether cross-contamination occurred during sampling and/or shipping (i.e., trip blanks). Data Quality Objectives (DQOs) for the QA/QC samples were

TABLE 2-4

SUMMARY OF METHOD PERFORMANCE LIMITS - ORGANICS
OPERABLE UNIT NO. 2
REMEDIAL INVESTIGATION CTO-0133
MCB CAMP LEJEUNE, NORTH CAROLINA

Volatiles by CLP Protocol	Quantitation Limits*		
	Water µg/L	Low Soil µg//Kg	Med. Soil µg/Kg
1. Chloromethane	10	10	1200
2. Bromomethane	10	10	1200
3. Vinyl Chloride	10	10	1200
4. Chloroethane	10	10	1200
5. Methylene Chloride	10	10	1200
6. Acetone	10	10	1200
7. Carbon Disulfide	10	10	1200
8. 1,1,-Dichloroethene	10	10	1200
9. 1,1-Dichloroethane	10	10	1200
10. 1,2-Dichloroethene (total)	10	10	1200
11. Chloroform	10	10	1200
12. 1,2-Dichloroethane	10	10	1200
13. 2-Butanone	10	10	1200
14. 1,1,1-Trichloroethane	10	10	1200
15. Carbon Tetrachloride	10	10	1200
16. Bromodichloromethane	10	10	1200
17. 1,2-Dichloropropane	10	10	1200
18. cis-1,3-Dichloropropene	10	10	1200
19. Trichloroethene	10	10	1200
20. Dibromochloromethane	10	10	1200
21. 1,1,2-Trichloroethane	10	10	1200
22. Benzene	10	10	1200
23. trans-1,3-Dichloropropene	10	10	1200
24. Bromoform	10	10	1200
25. 4-Methyl-2-pentanone	10	10	1200
26. 2-Hexanone	10	10	1200
27. Tetrachloroethene	10	10	1200
28. Toluene	10	10	1200
29. 1,1,2,2-Tetrachloroethane	10	10	1200
30. Chlorobenzene	10	10	1200
31. Ethyl Benzene	10	10	1200
32. Styrene	10	10	1200
33. Xylenes (Total)	10	10	1200

Note: * Quantitation limits listed for soil/sediment are based on wet weight. The quantitation limits calculated by the laboratory for soil/sediment, calculated on dry weight basis, will be higher.

TABLE 2-4 (Continued)

SUMMARY OF METHOD PERFORMANCE LIMITS - ORGANICS
OPERABLE UNIT NO. 2
REMEDIAL INVESTIGATION CTO-0133
MCB CAMP LEJEUNE, NORTH CAROLINA

Semivolatiles by CLP Protocol	Quantitation Limits*		
	Water µg/L	Low Soil µg//Kg	Med. Soil µg/Kg
34. Phenol	10	330	10000
35. bis (2-Chloroethyl) ether	10	330	10000
36. 2-Chlorophenol	10	330	10000
37. 1,3-Dichlorobenzene	10	330	10000
38. 1,4-Dichlorobenzene	10	330	10000
39. 1,2-Dichlorobenzene	10	330	10000
40. 2-Methylphenol	10	330	10000
41. 2,2′-oxybis (1-Chloropropane)#	10	330	10000
42. 4-Methylphenol	10	330	10000
43. N-Nitroso-di-n-propylamine	10	330	10000
44. Hexachloroethane	10	330	10000
45. Nitrobenzene	10	330	10000
46. Isophorone	10	330	10000
47. 2-Nitrophenol	10	330	10000
48. 2,4-Dimethyphenol	10	330	10000
49. bix (2-Chloroethoxy) methane	10	330	10000
50. 2,4-Dichlorophenol	10	330	10000
51. 1,2,4-Trichlorobenzene	10	330	10000
52. Naphthalene	10	330	10000
53. 4-Chloroaniline	10	330	10000
54. Hexachlorobutadiene	10	330	10000
55. 4-Chloro-3-methylphenol	10	330	10000
56. 2-Methylnaphthalene	10	330	10000
57. Hexachlorocyclopentadiene	10	330	10000
58. 2,4,6-Trichlorophenol	10	330	10000
59. 2,4,5-Trichlorophenol	25	800	25000
60. 2-Chloronaphthalene	10	330	10000
61. 2-Nitroaniline	25	800	25000
62. Dimethylphthalate	10	330	10000
63. Acenaphthylene	10	330	10000
64. 2,6-Dinitrotoluene	10	330	10000
65. 3-Nitroaniline	25	800	25000
66. Acenaphthene	10	330	10000

Notes: * Quantitation limits listed for soil/sediment are based on wet weight. The quantitation limits calculated by the laboratory for soil/sediment, calculated on dry weight basis, will be higher.

\# Previously known by the name bis (2-Chloroisopropyl) ether

TABLE 2-4 (Continued)

SUMMARY OF METHOD PERFORMANCE LIMITS - ORGANICS
OPERABLE UNIT NO. 2
REMEDIAL INVESTIGATION CTO-0133
MCB CAMP LEJEUNE, NORTH CAROLINA

Semivolatiles by CLP Protocol	Quantitation Limits*		
	Water µg/L	Low Soil µg//Kg	Med. Soil µg/Kg
67. 2,4-Dinitrophenol	25	800	25000
68. 4-Nitrophenol	25	800	25000
69. Dibenzofuran	10	330	10000
70. 2,4-Dinitrotoluene	10	330	10000
71. Diethylphthalate	10	330	10000
72. 4-Chlorophenyl-phenyl ether	10	330	10000
73. Fluorene	10	330	10000
74. 4-Nitroaniline	25	800	25000
75. 4,6-Dinitro-2-methylphenol	25	800	25000
76. N-nitrosodiphenylamine	10	330	10000
77. 4-Bromophenyl-phenylether	10	330	10000
78. Hexachlorobenzene	10	330	10000
79. Pentachlorophenol	25	800	25000
80. Phenanthrene	10	330	10000
81. Anthracene	10	330	10000
82. Carbazole	10	330	10000
83. Di-n-butylphthalate	10	330	10000
84. Fluoranthene	10	330	10000
85. Pyrene	10	330	10000
86. Butylbenzylphthalate	10	330	10000
87. 3,3′-Dichlorobenzidine	10	330	10000
88. Benzo(a)anthracene	10	330	10000
89. Chrysene	10	330	10000
90. bis (2-Ethylhexyl) phthalate	10	330	10000
91. Di-n-octylphthalate	10	330	10000
92. Benzo (b) fluoranthene	10	330	10000
93. Benzo (k) fluoranthene	10	330	10000
94. Benzo (a) pyrene	10	330	10000
95. Indeno (1,2,3-cd) pyrene	10	330	10000
96. Dibenz (a,h) anthracene	10	330	10000
97. Benzo (g,h,i) perylene	10	330	10000

Notes: * Quantitation limits listed for soil/sediment are based on wet weight. The quantitation limits calculated by the laboratory for soil/sediment, calculated on dry weight basis, will be higher.

Previously known by the name bis (2-Chloroisopropyl) ether

TABLE 2-4 (Continued)

SUMMARY OF METHOD PERFORMANCE LIMITS - ORGANICS
OPERABLE UNIT NO. 2
REMEDIAL INVESTIGATION CTO-0133
MCB CAMP LEJEUNE, NORTH CAROLINA

Pesticides/PCBs by CLP Protocol	Quantitation Limits*	
	Water µg/L	Soil µg//Kg
98. alpha-BHC	0.05	1.7
99. beta-BHC	0.05	1.7
100. delta-BHC	0.05	1.7
101. gamma-BHC (lindane)	0.05	1.7
102. Heptachlor	0.05	1.7
103. Aldrin	0.05	1.7
104. Heptachlor epoxide	0.05	1.7
105. Eudosulfan I	0.05	1.7
106. Dieldrin	0.10	3.3
107. 4,4'-DDE	0.10	3.3
108. Endrin	0.10	3.3
109. Endosulfan II	0.10	3.3
110. 4,4'-DDD	0.10	3.3
111. Endosulfan sulfate	0.10	3.3
112. 4,4'-DDT	0.10	3.3
113. Methoxychlor	0.50	17.0
114. Endrin ketone	0.10	3.3
115. Endrin aldehyde	0.10	3.3
116. alpha-Chlordane	0.05	1.7
117. gamma-Chlordane	0.05	1.7
118. Toxaphene	5.0	170.0
119. PCB-1016	1.0	33.0
120. PCB-1221	2.0	67.0
121. PCB-1232	1.0	33.0
122. PCB-1242	1.0	33.0
123. PCB-1248	1.0	33.0
124. PCB-1254	1.0	33.0
125. PCB-1260	1.0	33.0

Notes: * Quantitation limits listed for soil/sediment are based on wet weight. The quantitation limits calculated by the laboratory for soil/sediment, calculated on dry weight basis, will be higher.

There is no differentiation between the preparation of low and medium soil samples in this method for the analysis of Pesticides/Aroclors.

TABLE 2-5

SUMMARY OF METHOD PERFORMANCE
LIMITS - INORGANICS
OPERABLE UNIT NO. 2
REMEDIAL INVESTIGATION CTO-0133
MCB CAMP LEJEUNE, NORTH CAROLINA

Analyte	Contract Required Detection Limit
Aluminum	200
Antimony	60
Arsenic	10
Barium	200
Beryllium	5
Cadmium	5
Calcium	5000
Chromium	10
Cobalt	50
Copper	25
Iron	100
Lead	3
Magnesium	5000
Manganese	15
Mercury	0.2
Nickel	40
Potassium	5000
Selenium	5
Silver	10
Sodium	5000
Thallium	10
Vanadium	50
Zinc	20

Notes: * Quantitation limits listed for soil/sediment are based on wet weight. The quantitation limits calculated by the laboratory for soil/sediment, calculated on dry weight basis, will be higher.

Previously known by the name bis (2-Chloroisopropyl) ether

implemented in accordance with DQO Level IV as defined in the Environmental Compliance Branch Standard Operating Procedures (SOPs) and Quality Assurance Manual, EPA Region IV (1991). This DQO Level is equivalent to Naval Energy and Environmental Support Agency DQO Level D, as specified in the "Sampling and Chemical Analysis Quality Assurance Requirements for the Navy Installation Restoration Programs" document (1988).

Several types of field QA/QC samples were collected and analyzed including duplicate samples, equipment rinsates, field blanks, and trip blanks. These sampling definitions are listed below (USEPA, 1991):

- Duplicate Sample: Two or more samples collected simultaneously into separate containers from the same source under identical conditions.

- Equipment Blanks: Equipment field blanks are defined as samples which are obtained by running organic-free water over/through sample collection equipment after it has been cleaned. These samples will be used to determine if cleaning procedures were adequate. (The equipment could have been cleaned in the field or prior to the field operation.) Equipment blanks are collected daily but only samples collected on every other day are analyzed.

- Field Blanks: Organic-free water is taken to the field in sealed containers and poured into the appropriate sample containers at designated locations. This is done to determine if contaminants present in the area may have an affect on the sample integrity. Field blanks should be collected in dusty environments and/or from areas where volatile organic contamination is present in the atmosphere and originating from a source other than the source being sampled.

- Trip Blanks: Trip blanks are prepared prior to the sampling event in the actual sample container and are kept with the investigative samples throughout the sampling event. They are then packaged for shipment with the other samples and sent for analysis. At no time after their preparation are the sample containers to be opened before they return to the laboratory. Field sampling teams utilize volatile organic trip blanks to determine if samples were contaminated during storage and transportation back to the laboratory. If samples are to be shipped, trip blanks are to be provided for each shipment but not necessarily for each cooler.

TABLE 2-6

SUMMARY OF FIELD QUALITY ASSURANCE/QUALITY CONTROL SAMPLING PROGRAM FOR THE PHASE I SOIL INVESTIGATION
SITES 6 and 82
REMEDIAL INVESTIGATION CTO-0133
MCB CAMP LEJEUNE, NORTH CAROLINA

QA/QC Sample (1)	Frequency of Collection	Number of Samples	Analytical Parameters (3)
Trip Blanks (2)	One per Cooler	48	TCL Volatiles
Field Blanks	One per Event (4)	3	TCL Organics/TAL Inorganics
Equipment Rinsates (5)	One per Day	33	TCL Organics/TAL Inorganics
Field Duplicates (6)	10% of Sample Frequency	(6)	TCL Organics/TAL Inorganics

Notes:
(1) QA/QC sample types defined on pages 2-12 and 2-13 in text.
(2) Trip blanks submitted with coolers which contained samples for volatile analysis. Samples analyzed for TCL Volatiles only.
(3) Parameters analyzed according to procedures outlined on Tables 2-5 and 2-6.
(4) An event is defined as one 14 day period. Field blank includes a sample of drilling mud (6-GW1D-FB-03).
(5) Equipment rinsates collected from various sampling equipment (e.g., split spoons, stainless steel spoons, hollow stem augers, etc.). Note that samples were collected daily but were analyzed every other day of the sampling event. Accordingly, the number of samples presented represents the number of samples analyzed.
(6) Field duplicate samples collected from soil borings presented in Appendix N.

Table 2-6 summarizes field QA/QC sample types, sample frequencies, the number of QA/QC samples, and analytical methods. Equipment rinsate samples were collected by pouring laboratory-prepared deionized water over the sampling device (e.g., split-spoon sampler) and collecting the sample in laboratory containers. [Note that equipment rinsate samples were collected daily (from each field team), but the samples were analyzed every other day (USEPA, 1991).] Field blanks were collected during the soil investigation by filling sample containers with laboratory-prepared deionized water. The field blanks were collected in the vicinity of "DDT" and "PCB" sampling grids.

2.4.3.3 Field Screening and Air Monitoring

Several air monitoring and field screening procedures were implemented during drilling and sampling activities for health and safety and initial contaminant monitoring. During drilling, ambient air monitoring in the vicinity of the borehole was performed with a lower explosive limit (LEL) meter, a flame ionization detector (FID) or photoionization detector (PID), and a radiation meter to monitor for airborne contaminants. Samples (i.e., split-spoon samples) were screened with a PID or FID, and the radiation meter to measure for volatile organic vapor and radioactive particles, (note that radioactive particles were not suspected at site) respectively. Measurements obtained in the field was recorded in a field log book. Prior to daily monitoring, the instruments were calibrated and documentation was recorded in field log books and on calibration forms (retained by Baker). PID/FID measurements are provided on the Test Boring Records, and Test Boring and Well Construction Records in Appendices D (D.1 through D.10) and E (E.1 and E.2).

2.4.4 Groundwater Investigation

The groundwater investigation implemented at Sites 6 and 82 was intended to identify contaminants of concern and evaluate their distribution at the site. The primary objectives of this investigation are summarized on Tables 2-1 through 2-2.

In general, the field procedures and sampling methods employed for this study were implemented in accordance with EPA Region IV SOPs. These procedures also included sample handling and preservation, documentation, and chain-of-custody procedures. Specific sampling procedures are outlined in the Final RI/FS Work Plan for Site 6.

The following sections describe monitoring well installation for both shallow and deep wells, well development, groundwater sampling, and water level measurement procedures.

2.4.4.1 Monitoring Well Installation

The following sections describe monitoring well installation procedures for both the shallow and deep monitoring wells.

Shallow Well Installation

Nineteen shallow Type II (i.e., monitoring well was installed without outer casing to seal off a confining layer) monitoring wells (denoted as 6GW9 through 6GW23, 6GW25, 6GW26, 6GW28S, and 6GW30S) were installed at Sites 6 and 82 at the locations shown on Figure 2-8. The monitoring wells were installed to collect surficial groundwater samples for characterizing the nature and horizontal extent of potentially impacted groundwater and to evaluate groundwater flow patterns at the site. As stated previously, the locations of the wells were based on review of previous investigation data, past disposal practices, and historical aerial photographs. Table 2-7 provides a summary for the rationale of the well locations.

Initially in the Final RI/FS Work Plan two other monitoring wells, 6GW24 and 6GW29, were proposed east of Piney Green Road to serve as site-specific background monitoring wells. During a reconnaissance of the area (during the RI investigation) five existing shallow wells (denoted as 6MW2, 6MW3, 6MW8, 6MW9, and 6BP6 installed by SM&E in April 1992), were noted east of Piney Green Road. The SM&E wells (25 feet in depth) were installed as part of a preliminary investigation for a proposed landfill in the area (report submitted by Dewberry and Davis, September 1992). Accordingly, wells 6GW29 and 6GW24 were not installed and the five existing wells were substituted in their place to serve as site-specific background wells.

Additionally, several other monitoring wells including 6GW11, 6GW15, 6GW16 and 6GW23 were proposed in the wooded areas south and east of Lot 201, and east of Piney Green Road. Monitoring wells 6GW11, 6GW15, and 6GW23 were relocated within Lot 203 while 6GW16 was relocated to the wooded area between Lots 201 and 203. These wells were moved to new locations during the investigation because aerial photographs (acquired in September 1992) revealed past activities (e.g., ground scars) in some of these areas. Additionally, well 6GW16

TABLE 2-7

PHASE I MONITORING WELL SUMMARY AND RATIONALE
SITES 6 AND 82
REMEDIAL INVESTIGATION CTO-0133
MCB CAMP LEJEUNE, NORTH CAROLINA

Site No.	Well Designation	General Location	Purpose
82	6GW1S*, 82MW1*, 82MW2*, 82MW3*, 6GW26, 6GW27S, and 6GW28S	Site 82	Monitor shallow groundwater quality downgradient from Lot 203.
82	6GW1D, 6GW27D, and 6GW28D	Site 82	Monitor deep groundwater quality downgradient from Lot 203.
6	6GW3*	Lot 203 near the Ravine Area	Monitor shallow groundwater quality on both sides of the ravine Area.
	6GW30	North of Site 82	Monitor groundwater quality across Wallace Creek to assess other potential contaminant plumes from other unknown sources or to assess the extent of horizontal migration from Lot 203.
	6GW2S*, 6MW3*, 82MW30*, 6MW9*, 6MW2*, 6MW8*, and 6BP6*	East of Lot 203/Piney Green Road	Monitor upgradient shallow groundwater quality.
	6GW2D	East of Lot 203/Piney Green Road	Monitor upgradient deep groundwater quality.
	6GW4*, 6GW20, 6GW21, 6GW25, 6GW19, and 6GW16	South of Lot 203 and North of Lot 201 in a wooded portion of Site 6	Monitor groundwater quality in this portion of site where random disposal of wastes may have occurred. These wells also will assess upgradient conditions with respect to Lot 201.
	6GW5* and 6GW22	Area A, Lot 201	Monitor upgradient and downgradient groundwater quality in the surficial aquifer.
	6GW14, 6GW18, 6GW6*, and 6GW17	East of Lot 201 in a wooded portion of Site 6	Monitor groundwater quality in the surficial aquifer upgradient of Lot 201 and monitor groundwater quality in this portion of the site where random dumping has occurred.
	6GW8*, 6GW7S*, 6GW12, and 6GW13	Downgradient from Area B and Area C, Lot 201	Monitor shallow groundwater quality downgradient of the former pesticide and PCB storage areas.
	6GW7D	Downgradient of Lot 201 and Area C	Monitor deep groundwater quality downgradient of Lot 201.
	6GW9, and 6GW10	South of Bear Head Creek	Monitor shallow groundwater quality in this wooded portion of Site 6 where random disposal has occurred. These wells will also serve to assess groundwater quality downgradient from Site 9.
	6GW11, 6GW1S, and 6GW23	Lot 203	Monitor shallow groundwater quality within Lot 203 where random disposal of wastes may have occurred.

Note: * - Denotes existing monitoring well.

was repositioned because indications of shallow soil contamination (i.e., 5-gallon pails of suspected solvent material) were uncovered during test pit activities.

Prior to well installation, a permit for the Construction of a Well or Well System was obtained from the North Carolina Environmental Commission, Department of Environmental, Health and Natural Resources (NC DEHNR) of Raleigh, North Carolina. A copy of the permit is provided in Appendix F.

The shallow monitoring wells were installed upon completion of advancing the boreholes (refer to Section 2.4.3.1 for drilling procedures). Each borehole was over-drilled with 8-1/4 inch ID HSA prior to well installation. Well depths ranged from 17.6 feet bgs (6GW17) to 32 feet bgs (6GW28S). In general, the wells were installed approximately 15 feet below the water table encountered during initial drilling. Further, the wells were installed at depths and with interception intervals sufficient to compensate for seasonal variations in the water table (known to range from 2 to 4 feet).

Well construction details for the Phase I shallow wells are summarized on Table 2-8, and well construction diagrams are shown on the Test Boring and Well Construction Records provided in Appendix E. Note that well construction details for existing site wells are summarized on Table 1-1 in Section 1.0.

The wells are constructed of 4-inch nominal diameter Schedule 40, flush-joint and threaded PVC casing with 15-foot long No. 10 slotted screen sections (note that a 5- and 10-foot section of screen were screwed together to make up the 15-foot long screen). Four-inch diameter wells were selected so that the wells could also be used to extract groundwater for treatment, if necessary. A 15-foot long screen was used to compensate for seasonal variations (ranges from 2 to 4 feet) in the water table. A medium-grained sand pack (Number 2 silica sand), extending approximately 2-feet (where conditions permitted) above the top of the screen, was placed in the annulus between the screen and the borehole wall (12-inch borehole diameter) from inside the HSA. A 1-to 2-foot sodium bentonite pellet seal was then placed (by dropping the material down the borehole) above the sand pack and hydrated with potable water (from the same water source as described in Section 2.4.3.1). The seal was installed to prevent cement or surface water run-off from intruding onto the sand pack. The remaining annular space (approximately one to two feet in most cases) was backfilled with a mixture of Portland cement and 5 percent bentonite for construction of the pad. An above ground steel protective casing and PVC locking cap were fitted at the top of each well. Well 6GW22 was completed with a

TABLE 2-8

SUMMARY OF PHASE I SHALLOW WELL CONSTRUCTION DETAILS
SITES 6 and 82
REMEDIAL INVESTIGATION CTO-0133
MCB CAMP LEJEUNE, NORTH CAROLINA

Well No.	Date Installed	Top of PVC Casing Elevation (1) (feet, above msl)	Ground Surface Elevation (feet, above msl)	Boring Depth (feet, below ground surface)	Well Depth (feet, below ground surface)	Screen Interval Depth (feet, below ground surface)	Depth to Sand Pack (feet, below ground surface)	Depth to Bentonite (feet, below ground surface)	Stick-Up (feet, above ground surface)
6GW9	9/24/92	21.11	18.6	20.0	19.1	5.3-18.7	3.0	1.0	2.5
6GW10	9/23/92	19.88	17.2	18.5	18.0	3.8-17.5	2.0	1.0	2.6
6GW11	10/10/92	35.05	32.4	19.5	18.7	4.0-18.4	2.5	1.0	2.6
6GW12	9/24/92	18.29	17.0	18.5	18.0	3.8-17.6	2.4	1.0	1.3
6GW13	9/24/92	20.10	18.1	18.5	18.0	3.8-17.6	2.0	1.0	2.0
6GW14	10/6/92	28.49	25.5	23.0	22.0	7.5-21.7	5.0	3.2	3.0
6GW15S	10/11/92	29.07	26.1	20.5	20.0	5.4-19.7	3.0	1.5	2.9
6GW16	10/11/92	27.63	24.9	20.0	20.0	5.4-19.8	3.0	1.6	2.7
6GW17	9/25/92	28.10	25.7	18.5	17.6	2.3-17.1	1.5	0.5	2.4
6GW18	9/25/92	29.70	26.5	19.5	18.5	3.9-18.1	2.0	1.0	3.2
6GW19	10/6/92	27.95	25.2	20.5	20.0	5.2-19.3	3.0	1.6	2.75
6GW20	10/8/92	25.08	22.5	24.0	19.7	4.8-19.4	2.1	1.1	2.58
6GW21	9/24/92	30.30	27.9	24.0	22.5	8.0-22.0	6.0	4.5	2.4
6GW22	9/24/92	24.13	24.5	20.0	19.5	4.5-19.0	3.0	2.0	NA (2)
6GW23	10/12/92	26.96	24.5	22.0	21.0	8.4-22.7	5.0	3.0	2.56
6GW25	10/8/92	34.30	32.1	24.0	23.5	8.9-23.2	6.0	4.2	2.2
6GW26	10/9/92	23.66	20.9	20.0	20.0	5.0-19.7	3.0	1.4	2.7
6GW28S	10/10/92	30.20	27.6	32.5	32.0	17.5-31.7	15.0	13.3	2.6
6GW30S	10/10/92	12.60	9.9	21.0	20.0	5.3-19.7	3.0	1.0	2.7

Notes: (1) msl - mean sea level
(2) NA = Not Applicable; flush-mounted well
Horizontal positions are referenced to N.C. State Plane Coordinate System (NAD 27) CF = 0.9999216 from USMC Monument Toney. Vertical datum NGVD 29.

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flush-mounted cover because of the high traffic conditions in Lot 201. The wells were tagged with the North Carolina well permit information and marked "Caution -- Not Potable Water". Typical well construction details are shown on Figure 2-9.

Deep Well Installation

Five deep monitoring wells (6GW1D, 6GW2D, 6GW7D, 6GW27D, and 6GW28D) were installed to investigate deep hydrogeologic and geologic conditions, and to evaluate contaminant impact on the deeper water-bearing zones underlying the site [i.e., to evaluate whether contaminants have migrated downward from the shallow water-bearing zones to the main water supply aquifer for Camp Lejeune (Castle Hayne aquifer)]. The wells were installed at depths ranging from 100.5 feet bgs (6GW7D) to 119 feet bgs (6GW2D). The selection of well depth was based on geologic conditions encountered in the field. These wells were screened within the upper portion of a sandy-gravelly limestone which is considered to contain the upper portion of the main water supply aquifer (Castle Hayne Aquifer) for Camp Lejeune (Harned, et al., 1989).

The locations of the deep wells were selected based on the results of previous investigations (ESE, 1986; and NUS, 1992) and on information relating to past disposal or storage activities. In general, the deep wells were installed adjacent to shallow well locations (i.e., well clusters) where contamination was noted in the past, or in areas where previous disposal (or storage of hazardous materials) activities were reported. Table 2-7 provides a summary for the rationale of deep well locations. The locations of these wells are shown on Figure 2-8.

The deep monitoring wells are constructed of 4-inch nominal diameter Schedule 40, flush-joint and threaded PVC casing with a 10-foot long No. 10 slotted screen section. A medium-grained sand pack (Number 2 silica sand) extending at a minimum of 2-feet above the top of the screen, was placed in the annulus between the screen the borehole wall (12-inch borehole diameter) by pouring the sand down the borehole (sand pack was not tremmied in place because of the possibility of bridging off the borehole wall). A sodium bentonite pellet seal was then placed (by dropping the material down the borehole) above the sand pack and hydrated with potable water (same source as described in Section 2.4.3.1. The remaining annular space was backfilled (via a tremmie pipe) with a mixture of Portland cement and 5 percent sodium bentonite. An above ground steel protective casing and PVC locking cap were fitted at the top of each well (refer to Figure 2-9). Table 2-9 provides a summary of the Phase I deep monitoring well construction details.

TABLE 2-9

SUMMARY OF PHASE I DEEP WELL CONSTRUCTION DETAILS
SITES 6 AND 82
REMEDIAL INVESTIGATION CTO-0133
MCB CAMP LEJEUNE, NORTH CAROLINA

Well No.	Date Installed	Top of PVC Casing Elevation (1) (feet, above msl)	Ground Surface Elevation (feet, above msl)	Boring Depth (feet, below ground surface)	Depth of Outer Casing (feet, below ground surface)	Well Depth (feet, below ground surface)	Screen Interval Depth (feet, below ground surface)	Depth to Sand Pack (feet, below ground surface)	Depth to Bentonite (feet, below ground surface)	Stick-Up (feet, above ground surface)
6GW1D	10/7-8/92	35.31	32.8	117.0	NA (2)	112.5	102.7-111.7	99.5	96.0	2.5
6GW2D	10/10/92 10/13-14/92	37.61	35.1	122.0	26.0	119.0	108.1-118.1	105.0	101.0	2.5
6GW7D	10/6-7/92	20.08	17.4	107.0	NA	100.5	90.5-99.5	86.5	83.0	2.6
6GW27D	10/11-12/92	24.47	22.5	112.0	NA	110.0	100.1-109.1	97.0	94.5	1.[illegible]
6GW28D	10/20-21/92	31.74	28.7	115.0	NA	114.5	104.0-113.6	99.0	95.0	3.[illegible]

Notes: (1) msl - mean sea level.
(2) NA = Not Applicable; outer casing not installed
Horizontal positions are referenced to N.C. State Plane Coordinate System (NAD 27) CF = 0.9999216 from U.S.M.C. Monument Toney. Vertical datu[illegible] NGVD 29.

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One of the deep wells, 6GW2D, was constructed in a different manner as described above (i.e., a Type III well). As illustrated on Figure 2-10, an 8-inch steel (steel was used because it is more durable than PVC) outer casing was installed and grouted in place (at 26 feet bgs). This casing was installed because a clay layer (i.e., layer of lower hydraulic conductivity material) approximately two-feet in thickness was encountered from 25 feet to 27 feet bgs. This layer was cased-off to minimize the possibility of cross-contaminating the deeper drinking water aquifer.

2.4.4.2 Well Development Procedures

Following well construction and curing of the bentonite seal, each newly installed shallow and deep well was developed to remove fine-grained sediment from the screen and to establish interconnection between the well and the formation. Shallow wells were developed by a combination of surging and pumping (centrifugal pump). Typically, 50 gallons of water were evacuated from the wells, followed by 10 minutes of surging, then continued pumping. Deep wells were developed by forcing air into the well using an air compressor and allowing the water to flow to the surface. [Note that an air filter was installed on the compressor to prevent oil and grease from entering the well.] Groundwater recovered during well development was temporarily stored in drums then transferred into an on-site tanker. Pumping hoses (constructed of flexible PVC) were dedicated for each well to minimize the potential for cross contamination.

Three to five well volumes were removed from each well (where conditions permitted) until the water was essentially sediment-free. Measurements of pH, specific conductance, and temperature were recorded to assist in determining well stabilization. Periodic flow and volume measurements were also recorded during development to evaluate flow rates of the shallow and deep water-bearing zones. Well Development Forms summarizing this information are provided in Appendix G (G.1 and G.2).

2.4.4.3 Water Level Measurements

Static water level measurements were collected from top-of-PVC casing (TOC) reference points (marked on PVC casing) at each existing and newly installed well (refer to Tables 3-5 and 3-10 in Section 3.7.2 for results). Phase I groundwater data was collected from the shallow wells on September 30, October 26, and November 7, 1992; data was collected from the deep wells on October 26 and November 7, 1992.

Groundwater measurements were recorded using an electric measuring tape. Measurements were recorded to the nearest 0.01-foot from TOC. Water level data were collected within a two hour period. Additionally, the water level was monitored at wells 6GW28S and 6GW28D over a 24-hour period with a data logger to evaluate daily changes in the shallow and deep groundwater, respectively.

All newly installed and existing monitoring wells were surveyed to establish vertical elevation in relationship to mean sea level (msl) and horizontal control. Hoggard-Eure was retained for the survey. Vertical accuracy of each well (established to TOC at each well or top of staff gauge) was measured to 0.01 feet and horizontal accuracy within 0.1 foot. Control was established by using horizontal and vertical control points near the site which are tied into the North Carolina State Plane Coordinate System (NCSPCS). In cases where the points could not be established, temporary benchmarks were established from the closest United States Geological Survey (USGS) benchmark.

2.4.4.4 Staff Gauge Installation

Three staff gauges (BHSG1, BHSG2, and BHSG3) were installed in Bear Head Creek to evaluate surface water fluctuations and to assist in determining surficial groundwater flow patterns in the area. The locations of the gauges are shown on Figure 2-8. The staff gauges were surveyed (both horizontal and vertical from top of staff gauge) in place following installation. Measurements were recorded by reading the stream levels on the calibrated (0.1-feet) gauges (refer to Table 3-7 in Section 3.7.2).

2.4.4.5 Groundwater Sampling

This section describes the sampling procedures and analytical methods employed for the groundwater sampling program.

Sampling Locations

Groundwater samples (Phase I - Round One) were collected from existing shallow (17), and newly installed shallow (19) and deep (5) wells at Sites 6 and 82. Monitoring well 82MW30 (background well for the Site 82 investigation) could not be sampled because an obstruction was encountered inside the well. Figure 2-8 shows the locations of the monitoring wells sampled. Rationale for the well locations are summarized on Table 2-7.

Sampling Procedures

Samples were collected to confirm the presence or absence of contaminants of concern and evaluate overall groundwater chemistry in the shallow and deep groundwater. Groundwater sampling procedures were performed in accordance with EPA Region IV SOPs and as outlined in the Final RI/FS Work Plan.

Prior to groundwater purging, water levels from each well were measured according to procedures outlined in Section 2.4.4.3. The total well depth was also recorded from each well to the nearest 0.1-foot using decontaminated a steel tape. Water level and well depth measurements were used to calculate the volume of water in each well and the minimum volume of water necessary to purge the well.

Following well volume calculations, a minimum of three to five well volumes were purged from each well prior to sampling. Water was purged from each well using a decontaminated submersible pump and teflon hoses. A flow rate of 1 to 2 gallons per minute (GPM) was maintained during purging. Measurements of pH, specific conductance, and temperature were made prior to purging and after each well volume was removed to ensure that the groundwater was stabilized before sampling. These measurements were recorded in a field log book (refer to Tables 4-25 and 26 in Section 4.1.2.2 for results). Purge water was containerized and handled as described in the Section 2.7.

Groundwater samples were collected using decontaminated teflon bailers (i.e., bottom loading bailer) equipped with a teflon-coated leader. The samples were introduced directly from the bailer into laboratory-prepared, preserved sample containers (where appropriate) and stored on ice. Samples bottles for the volatile organic analysis were filled first, followed by semivolatiles, PCBs, pesticides, TAL metals (total and dissolved), and cyanides. Samples analyzed for volatiles were collected by slowly pouring water from the bailer into 40 ml vials (acidified with HCl) to minimize volatilization. Samples analyzed for dissolved metals were collected in laboratory-prepared bottles and filtered prior to placement in preserved bottles (acidified to pH <2 with HNO_3). The samples were filtered in the field through a disposable

0.45 micron membrane which was attached to teflon tubing. A peristaltic pump was used for the filtering procedure.

Preparation of groundwater samples incorporated similar procedures as to those described for soil samples. Sample collection information including well number, sample identification, time, date, samplers, analytical parameters, and required laboratory turnaround time were recorded in a field log book and on the sample labels. Chain-of-custody documentation (provided in Appendix S) accompanied the samples to Ceimic.

Analytical Requirements

Groundwater samples were analyzed for TCL organics and TAL inorganic (total and dissolved metals, and cyanide). EPA Methods 601 and 602 were implemented for analysis of volatiles. Additionally, a groundwater sample was collected from monitoring well 6GW1D for analysis of biological oxygen demand (BOD), chemical oxygen demand (COD), total suspended solids (TSS), total dissolved solids (TDS), total solids (TS), and total volatile solids (TVS) to evaluate the general groundwater chemistry for potential treatment options.

Several types of field QA/QC samples were collected and analyzed during the groundwater investigation, including duplicate samples, equipment rinsates, field blanks, and trip blanks. These sample types were defined in Section 2.4.3.2. Equipment rinsate samples were collected from a bailer following decontamination procedures. Laboratory prepared deionized water was poured into the bailer and the water was collected in sample bottles. A field blank was collected in the vicinity of monitoring well 6GW1S during the groundwater investigation. Table 2-10 summarizes field QA/QC sample types, frequencies, and analytical parameters.

2.4.5 Drum Waste Sampling

In September 1992, Baker personnel performed a preliminary investigation of containerized waste at Site 6 (including Lot 203, the ravine area, the wooded areas, and Site 82). Upon completing the investigation, a majority of drums and miscellaneous containers at Site 6 were identified as potentially containing materials which would require sampling for disposal. It should be noted that above-ground storage tanks in Lot 203 were not addressed as part of this study. In addition, containers in the ravine area were only preliminarily classified due to the limitations imposed by the terrain and thick vegetation.

TABLE 2-10

SUMMARY OF FIELD QUALITY ASSURANCE/QUALITY CONTROL SAMPLING PROGRAM FOR THE GROUNDWATER INVESTIGATION
SITES 6 and 82
REMEDIAL INVESTIGATION CTO-0133
MCB CAMP LEJEUNE, NORTH CAROLINA

QA/QC Sample (1)	Frequency of Collection	Number of Samples	Analytical Parameters (3)
Trip Blanks (2)	One per Cooler	3	TCL Volatiles
Field Blanks	One per Event (4)	1	TCL Organics/TAL Inorganics
Equipment Rinsates (5)	One per Day	1	TCL Organics/TAL Inorganics
Field Duplicates (6)	10% of Sample Frequency	(6)	TCL Organics/TAL Inorganics

Notes:
(1) QA/QC sample types defined on pages 2-12 and 2-13 in text.
(2) Trip blanks submitted with coolers which contained samples for volatile analysis. Samples analyzed for TCL Volatiles only.
(3) Parameters analyzed according to procedures outlined on Tables 2-5 and 2-6.
(4) An event is defined as one 14 day period.
(5) Equipment rinsates collected from various sampling equipment (e.g., bailer). Note that samples were collected daily but were analyzed every other day of sampling event. Accordingly, the number of samples presented represents the number of samples analyzed.
(6) Field duplicate sample locations are summarized in Appendix N.

Drums classified as "RCRA empty" were deemed to contain less than one inch of material or residual material in the bottom. All other drums were classified as having known or unknown material and were sampled accordingly. Many of the drums/containers had been subject to the elements and were in very poor condition (i.e., corroded, rusty, over-pressurized, missing bungs and lids etc.).

2.4.5.1 Sampling Locations

Drums/containers were scattered throughout Lot 203, the ravine area, and Site 82. Additionally drums were located in the wooded area south of Lot 203. Figure 2-11 presents approximate locations of drum/container storage areas. Many of the drums were located in clusters within Lot 203; however, some were also found in isolated areas.

2.4.5.2 Sampling Procedures

Prior to opening any containers, monitoring was performed with a radiation meter, a combustible gas indicator (CGI) and OVA or PID. Drum documentation was performed via Baker drum logs concurrently with drum sampling activities. See Appendix H for a complete list of drum logs. The drums were sampled in the following manner (in compliance with Baker's Standard Operating Procedure for Drum Sampling):

1. The container was opened utilizing a bung wrench or drum deheader, and a sample extracted from the container in level B personal protection.

2. Liquid sample collection

    a. A clean glass tube (drum thief) was inserted into the opening of the container;

    b. The liquid in the drum represents a core of the drum contents, and was extracted utilizing the glass tube. Phase separation/differentiation was described where applicable.

    c. The liquid in the tube was transferred repeatedly into an 8-ounce jar until it was approximately three-quarters full.

    d. The mouth of the jar was then sealed with a teflon lid and securely tightened.

e. The outside of the jar was then wiped clean of any gross contamination.

3. The container was then resealed (i.e., bung replaced) or covered with polyethylene wrap if the bung was missing or lid damaged.

4. Each sample was noted on a chain-of-custody form and reported in the appropriate drum log sheet and/or field log book.

5. The samples were then sent to the laboratory for analysis. QA/QC samples (e.g., trip blanks, equipment rinsates, field blanks, and duplicates) were not submitted for this part of the study as they were not applicable.

It should be noted that solid samples were collected in a similar manner utilizing a stainless steel trowel to extract the sample.

In order to properly classify and composite containerized waste, field compatibility analyses were performed on all samples obtained from drums/containers. Compatibility testing was conducted to separate and classify the drum/container materials into compatible groups. The tests were performed using a HAZCAT® kit. The materials were separated into the following general classifications:

Flammable Liquid

Combustible Liquid

Base Neutral Liquid

Base Neutral Liquid with Solids

Flammable Solid

Corrosive Solid

Base Neutral Solid

Compatibility testing was performed on each drum, separating and classifying various unknown containerized waste materials into compatible groups based on their physical and chemical characteristics. RCRA hazardous waste characteristics (ignitability, corrosivity, and reactivity) were identified at a minimum during these tests. Appendix I provides a complete list of parameters tested and the corresponding qualitative result.

Following the physical/chemical testing (via the HAZCAT KIT) aliquots from samples of the same/similar waste stream were combined in a documented sequence. For purposes of compositing, a controlled amount from each sample within a compatible grouping was combined in a separate container, one at a time, and observed closely for a reaction. Visual observations, (i.e., color, precipitation, or phase separation) and temperature measurements (to test for chemical reactions) were performed.

Forty-eight drums/containers were sampled and composited into 11 samples for shipment to the laboratory. Per laboratory requirements, two quarts of liquid/solid material (64 oz. of composite sample) were required. One quart was utilized for sample analysis and one quart was archived (for 1 year) for future analysis, if required. This methodology will eliminate resampling for disposal analyses, provided disposal occurs within the one year statute of limitation.

2.4.5.3 Analytical Requirements

Many of the 48 drums were determined to be 1/4 to 3/4 full. Therefore, field analyses were performed for compositing samples to limit the amount of laboratory analytical cost.

Samples collected during the field program were shipped for laboratory analysis to Wadsworth Alert Laboratories located in Canton, Ohio. Wadsworth Alert Laboratories is a member of the USEPA Contract Laboratory Program (CLP) and is also certified by the Naval Energy and Environmental Support Activity (NEESA). Sample analysis performed by Wadsworth Alert included RCRA characteristics (ignitability, corrosivity, reactivity and full TCLP analysis) to evaluate the nature of the wastes and to evaluate possible disposal options if required.

2.4.6 Test Pit Activities

Based on studies by EPIC, aerial photographs indicate potential disposal and fill areas. These areas were surveyed by Hoggard-Eure. Excavations were then performed perpendicular to the transect (surveyed trench and fill locations) to ensure trenches were properly identified and to allow for error in surveyed points.

In general, test pit operations were performed as an exploratory excavation to assess the contents of past disposal/burial operations.

Test pits varied in length and depth, and were primarily dependent on:

- Space limitations imposed by the site (i.e., wooded areas limited movement of backhoe).

- The capabilities and limitations of the excavation equipment (i.e., depth of excavation was limited to the length of the boom on the backhoe).

- The amount and type of debris excavated (i.e., large amount of communication wire).

- The depth of the water table.

Air monitoring was performed with a radiation meter, CGI, and FID or PID. Test pitting operations were modified due to the potential of unexploded ordnance or the potential rupture of containerized waste.

2.4.6.1 <u>Sampling Locations</u>

As stated previously, studies by EPIC and aerial photographs were analyzed, and transects surveyed at suspected trench and fill areas.

A surface geophysical survey was also conducted from August 24 through September 3, 1992, to delineate areas of suspected disposal and to identify locations of buried debris. Anomalies detected as part of the geophysical investigation which did not correlate to trench and fill operations from the aerial photographs were also examined during the test pit investigation.

A total of 29 primary excavations were performed as part of this study. In addition, six extra excavations were also performed along transects from primary excavations where samples were obtained for laboratory analysis (total of 35 excavations).

Sampling locations were determined in the field based on visual observation and air monitoring results. Samples were collected at areas suspected to be contaminated and at the bottom of the trench. Trench locations are depicted on Figure 2-12.

2.4.6.2 Sampling Procedures

Exploratory trenching operations were performed from September 27 through October 1, 1992, throughout Site 6. Exploratory trenching operations focussed primarily on Lot 203 (the Open Storage Area).

Before any excavation began, a specialized, two-person crew performed a survey of the area with a magnetometer and provided guidance with respect to potentially buried unexploded ordnance (UXO). The magnetometer survey correlated the interpretations of the aerial photographs by confirming the presence of buried debris.

Upon delineation of work zones, activities commenced with a Case 580 backhoe (excavator) equipped with a three-foot bucket. Test pits were excavated approximately 20 feet in length and 9 feet in depth. After visual inspection and sample collection, a sample number was affixed to each sample container.

Grab and composite sampling methods were implemented. Test pit soil samples were chosen based on visual observation or readings obtained from real time air monitoring instrumentation. In addition, test pits which had samples obtained based on visual observations or air monitoring also had soil samples obtained from the bottom of the pit. Two samples were obtained from each test pit suspected of containing contaminants. All information regarding sample depth and findings were recorded in a field log book and transcribed to test pit logs. Appendix D (D.12) provides test pit logs with descriptions of material encountered and approximate depth. No geological characterization was performed on test pits, as several soil borings and well installation boreholes in the area provided a detailed subsurface description. However, soil samples were collected every two feet for future geologic classification purposes.

Excavated soil was stockpiled on the side and the trench backfilled upon completion.

2.4.6.3 Analytical Requirements

Samples collected during the field program were shipped for laboratory analysis to Ceimic Laboratory. Sample analysis included RCRA characteristics (ignitability, corrosivity, and reactivity) and full TCLP analysis.

2.4.7 Surface Water and Sediment Investigations

This section discusses the surface water and sediment investigations conducted at OU No. 2. Included in this section are the sampling methodologies, procedures, locations, and results of the surface water and sediment sampling.

2.4.7.1 Surface Water and Sediment Sampling Methodology

Surface water and sediment sampling was conducted to determine if contamination attributable to OU No. 2 exists in Wallace Creek, Bear Head Creek, or the ravine which had an intermittent tributary to Wallace Creek. Surface water samples were collected at twenty-four stations at OU No. 2, while sediment samples were collected at twenty-six stations (see Figure 2-13). The majority of the samples were collected from August 22 to August 30, 1992, with one sample collected on October 23, 1992 due to site access problems.

The following information from each station was recorded in the field logbook:

- Project location, date and time
- Weather
- Sample location number and identification number
- Flow conditions (i.e., high, low, in flood, etc.)
- On-site water quality measurements
- Visual description of water (i.e., clear, cloudy, muddy, etc.)
- Description of biotic community (i.e., flora, fauna, etc.)
- Sketch of sampling location including boundaries of the water body, sample location (and depth), relative position with respect to the site, location of wood identifier stake
- Names of sampling personnel
- Sampling technique, procedure, and equipment used

The on-site water quality measurements consisted of temperature, pH, specific conductance, salinity, and dissolved oxygen. These measurements were collected immediately following sample collection.

Field QA/QC samples were also collected during the surface water and sediment investigations. The QA/QC sample types and sample collection frequencies are the same as those described in Section 2.4.3. Table 2-11 summarizes the QA/QC sampling program for the surface water and sediment samples.

Surface Water

The following sections describe the stations where surface water samples were collected and the procedures used for collecting the samples.

Station Locations

Forty-eight surface water samples were collected from twenty-four stations at OU No. 2 (see Figure 2-13 for station locations). Twenty-eight samples (eleven stations) were collected from Wallace Creek, fourteen samples (seven stations) were collected from Bear Head Creek, and six samples (six stations) were collected from the ravine (two other ravine sampling stations were dry at the time samples were collected). Tables 2-12, 2-13, and 2-14 contain a summary of the station numbers and locations, and sample numbers for surface and sediment collected at those stations.

The surface water sample numbers were designated as 6-WC"X"-SW-06B; the 6 indicates that the samples were collected at OU No. 2, WC stands for Wallace Creek (BH stands for Bear Head Creek and RV stands for the ravine), "X" stands for the station number, SW stands for surface water, 06 stands for a sample collected at the surface (312 for a sample collected at the surface water/sediment interface), and B stands for a sample collected at the creek bank (M stands for a sample collected in the middle of the creek).

Sampling Procedures

At stations where the water was more than three feet deep, samples were collected at the surface by dipping the sample bottles directly into the water and at one foot above the sediment by using a kemmerer sampler. To determine the designated depth, a marked

TABLE 2-11

SUMMARY OF FIELD QUALITY ASSURANCE/QUALITY CONTROL SAMPLING PROGRAM FOR THE SURFACE WATER AND SEDIMENT INVESTIGATIONS
SITE 6
REMEDIAL INVESTIGATION CTO-0133
MCB CAMP LEJEUNE, NORTH CAROLINA

QA/QC Sample (1)	Frequency of Collection	Number of Samples	Analytical Parameters (3)
Trip Blanks (2)	One per Cooler	6	TCL Volatiles
Field Blanks	One per Event (4)	2	TCL Organics/TAL Inorganics
Equipment Rinsates (5)	One per Day	6	TCL Organics/TAL Inorganics
Field Duplicates (6)	10% of Sample Frequency	(6)	TCL Organics/TAL Inorganics

Notes:
(1) QA/QC sample types defined on pages 2-12 and 2-13 in text.
(2) Trip blanks submitted with coolers which contained samples for volatile analysis. Samples analyzed for TCL Volatiles only.
(3) Parameters analyzed according to procedures outlined on Tables 2-5 and 2-6.
(4) An event is defined as one 14 day period. Field blanks collected during surface water and sediment investigations in the vicinity of sample stations BH06 (Bear Head Creek) and WC04 (Wallace Creek).
(5) Equipment rinsates collected from various sampling equipment (e.g., stainless steel spoons, sediment cores, etc.).
(6) Field duplicate samples presented in Appendix N.

TABLE 2-12

BEAR HEAD CREEK SURFACE WATER AND SEDIMENT
STATION AND SAMPLE NUMBERS AND LOCATIONS
SITE 6
REMEDIAL INVESTIGATION CTO-0133
MCB CAMP LEJEUNE, NORTH CAROLINA

Station Number	Station Location	Surface Water Sample Number	Sediment Sample Number
6-BH01-SW/SD	Headwaters of Bear Head Creek	6-BH01-SW-06B 6-BH01-SW-06M	6-BH01-SD-06B 6-BH01-SD-612B 6-BH01-SD-06M 6-BH01-SD-612M
6-BH02-SW/SD	Upstream of Sites 6 and 9	6-BH02-SW-06M (A)	6-BH02-SD-06M 6-BH02-SD-612M (A)
6-BH03-SW/SD	Approx. 100 feet upstream of Piney Creek Road	6-BH03-SW-06B 6-BH03-SW-06M	6-BH03-SD-06B 6-BH03-SD-612B 6-BH03-SD-06M 6-BH03-SD-612M
6-BH04-SW/SD	Adjacent to Sites 6 and 9	6-BH04-SW-06B 6-BH04-SW-06M	6-BH04-SD-06B 6-BH04-SD-612B 6-BH04-SD-06M 6-BH04-SD-612M
6-BH05-SW/SD	Between Lejeune Railroad and Holcomb Boulevard	6-BH05-SW-06B 6-BH05-SW-06M	6-BH05-SD-06B (B) 6-BH05-SD-06M (B)
6-BH06-SW/SD	Approx. 1000 feet Downstream of Holcomb Boulevard	6-BH06-SW-06B 6-BH06-SW-06M	6-BH06-SD-06B (B) 6-BH06-SD-06M (B)
6-BH07-SW/SD	Downstream of Sites 6 and 9	6-BH07-SW-06B 6-BH07-SW-06M 6-BH07-SW-312M	6-BH07-SD-06B (B) 6-BH07-SD-06M (B)

Notes: B - Sample was collected from the north bank
M - Sample was collected from the middle of the creek
SW-06 - Sample was collected from the water surface (or mid-vertical point if a deeper water sample was not collected at this station).
SW-312 - Sample was collected from the water/sediment interface
SD-06 - Sample was collected from the top six inches of the sediment
SD-612 - Sample was collected from six to twelve inches of the sediment
(A) - Creek was narrow and shallow; only middle sample was collected
(B) - Sediments were flocculant; 6-12 inch sample could not be collected

TABLE 2-13

WALLACE CREEK SURFACE WATER AND SEDIMENT
STATION AND SAMPLE NUMBERS AND LOCATIONS
SITE 6
REMEDIAL INVESTIGATION CTO-0133
MCB CAMP LEJEUNE, NORTH CAROLINA

Station Number	Station Location	Surface Water Sample Number	Sediment Sample Number
6-WC01-SW/SD	North Branch of Wallace Creek	6-WC01-SW-06B 6-WC01-SW-06M (A)	6-WC01-SD-06B 6-WC01-SD-612B (B)
6-WC02-SW/SD	South Branch of Wallace Creek	6-WC02-SW-06B (B)	6-WC02-SD-06B 6-WC02-SD-612B (B)
6-WC03-SW/SD	Approx. 2000 feet downstream of north and south branch	6-WC03-SW-06B 6-WC03-SW-06M 6-WC03-SW-312M	6-WC03-SD-06B 6-WC03-SD-612B 6-WC03-SD-06M (C)
6-WC04-SW/SD	Approx. 250 feet upstream of Piney Creek Road	6-WC04-SW-06B 6-WC04-SW-06M	6-WC04-SD-06B 6-WC04-SD-612B 6-WC04-SD-06M (D)
6-WC05-SW/SD	Approx. 250 feet downstream of Piney Creek Road	6-WC05-SW-06B 6-WC05-SW-06M 6-WC05-SW-312M	6-WC05-SD-06B 6-WC05-SD-612B 6-WC05-SD-06M (D)
6-WC06-SW/SD	Adjacent to Sites 6 and 9	6-WC06-SW-06B 6-WC06-SW-06M	6-WC06-SD-06B 6-WC06-SD-612B 6-WC06-SD-06M 6-WC06-SD-612M
6-WC07-SW/SD	Adjacent to Sites 6 and 9	6-WC07-SW-06B 6-WC07-SW-06M 6-WC07-SW-312M	6-WC07-SD-06B (D) 6-WC07-SD-06M 6-WC07-SD-612M
6-WC08-SW/SD	Between Lejeune Railroad and Holcomb Boulevard	6-WC08-SW-06B 6-WC08-SW-06M 6-WC08-SW-312M	6-WC08-SD-06B 6-WC08-SD-612B 6-WC08-SD-06M
6-WC09-SW/SD	Approx. 1000 feet Downstream of Holcomb Boulevard	6-WC09-SW-06B 6-WC09-SW-06M 6-WC09-SW-312M	6-WC09-SD-06B 6-WC09-SD-612B 6-WC09-SD-06M 6-WC09-SD-612M
6-WC10-SW/SD	Downstream of Sites 6 and 9	6-WC10-SW-06B 6-WC10-SW-06M 6-WC10-SW-312M	6-WC10-SD-06B (D) 6-WC10-SD-06M 6-WC10-SD-612M
6-WC11-SW/SD	Approx. 500 feet Downstream of Confluence with Bear Head Creek	6-WC11-SW-06B 6-WC11-SW-06M 6-WC11-SW-312M	6-WC11-SD-06B (D) 6-WC11-SD-06M (D)

Notes: B - Sample was collected from the south bank
M - Sample was collected from the middle of the creek
SW-06 - Sample was collected from the water surface (or mid-vertical point if a deeper water sample was not collected at this station).
SW-312 - Sample was collected from the water/sediment interface
SD-06 - Sample was collected from the top six inches of the sediment
SD-612 - Sample was collected from six to twelve inches of the sediment
(A) - Samples were collected from shore; depth sample could not be collected
(B) - Samples were collected from shore; middle samples could not be collected
(C) - Sampler refusal at 3-4 inches; 6-12 inch sample could not be collected
(D) - Sediments were flocculant; 6-12 inch sample could not be collected

TABLE 2-14

RAVINE AREA SURFACE WATER AND SEDIMENT STATION AND SAMPLE NUMBERS AND LOCATIONS SITE 6 REMEDIAL INVESTIGATION CTO-0133 MCB CAMP LEJEUNE, NORTH CAROLINA

Station Number	Station location	Surface Water Sample Number	Sediment Sample Number
6-RV1-SD	Ravine	(A)	6-RV1-SD-06 (B)
6-RV2-SW/SD	Ravine	6-RV2-SW-06	6-RV2-SD-06 (B)
6-RV3-SW/SD	Ravine	6-RV3-SW-06	6-RV3-SD-06 6-RV3-SD-612
6-RV4-SD	Ravine	(A)	6-RV4-SD-06 6-RV4-SD-612
6-RV5-SW/SD	Ravine	6-RV5-SW-06	6-RV5-SD-06 (B)
6-RV6-SW/SD	Ravine	6-RV6-SW-06	6-RV6-SD-06 (B)
6-RV7-SW/SD	Ravine	6-RV7-SW-06	6-RV7-SD-06 6-RV7-SD-612
6-RV8-SW/SD	Ravine	6-RV8-SW-06	6-RV8-SD-06 (B)

Notes: SW-06 - Sample was collected from the water surface
SD-06 - Sample was collected from the top six inches of the sediment
SD-612 - Sample was collected from six to twelve inches of the sediment
(A) - No water was present at this station; water sample was not collected
(B) - Sampler refusal at 6 inches; 6-12 inch sample was not collected

weighted line was lowered into the water with the depth to the sediments recorded. At stations where the water was less than three feet deep, samples were collected at the approximate vertical mid-point by dipping the sample bottles directly into the water.

Care was taken when collecting samples for analysis of VOCs to avoid excessive agitation that could result in loss of VOCs. Samples for the VOC analysis were collected prior to the collection of the samples for analysis of the other parameters.

The samples were collected in clean containers provided by the analytical laboratory. Sampling personnel wore clean PVC gloves at each sampling station. For those sample bottles already containing preservative (e.g., sulfuric acid), the water was collected in a clean container and then slowly poured into the sample bottle. All sample containers not containing preservative were rinsed at least once with the sample water prior to sample collection.

The downstream water samples were collected first, with subsequent samples taken while moving upstream. Any sediment or biological samples were collected after the water samples were taken to minimize sediment resuspension that might contaminate the water samples.

The sampling locations were marked by placing a wooden stake and bright colored flagging at the nearest bank or shore. The sample number was marked on the stake with indelible ink. Photographs were taken to document the physical and biological characteristics of the sampling location.

Sediment

The following sections describe the stations where sediment samples were collected and the procedures used for collecting the samples.

<u>Station Locations</u>

Sixty-three sediment samples were collected from twenty-six stations at OU No. 2 (see Figure 2-13 for station locations); thirty-two samples (eleven stations) were located in Wallace Creek, twenty samples (seven stations) were located in Bear Head Creek, and eleven samples (eight stations) were located in the ravine. Tables 2-12, 2-13, and 2-14 contain a summary of the station numbers and locations, and sample numbers collected at those stations.

The sediment sample numbers were designated as 6-WC"X"-SD-06B; the 6 indicates that the for to designate samples were collected at OU No. 2, WC stands for Wallace Creek (BH stands for Bear Head Creek and RV stands for the ravine), "X" stands for the station number, SD stands for sediment, 06 stands for a sample collected from the top six inches of the sediment (612 stands for a sample collected from six to twelve inches of the sediment), and B stands for a sample collected at the creek bank (M stands for a sample collected in the middle of the creek).

Sampling Procedures

At each station, sediment samples were collected at the surface (0-6 inches) and at depth (6-12 inches) using a stainless steel hand-held coring instrument. A new disposable clear plastic liner tube, fitted with a disposable eggshell catcher to prevent sample loss, was used at each station.

The coring device was pushed into the sediments to a maximum depth of fifteen to twenty inches, or until refusal. The liner was removed from the sampler and the sediments were extruded into the appropriate sample jars using a decontaminated extruder. The liners were not cut in half as stated in the work plan because the plastic shavings may have contaminated the sediments.

2.4.8 Ecological and Aquatic Survey

Biological samples collected at OU No. 2 consisted of fish, crabs and benthic macroinvertebrates. Prior to initiating the sampling event at each station, the following information describing the site was recorded in the field log book:

- Average width, depth and velocity of the water body
- Description of substrate
- Description of "abiotic" characteristics of the reach such as pools, riffles, runs, channel shape, degree of bank erosion, and shade/sun exposure
- Description of "biotic" characteristics of the reach including aquatic and riparian vegetation and wetlands

Water quality measurements were collected during the benthic macroinvertebrate sampling, at a minimum, and during collection of some of the fish samples. On-site water quality measurements at these stations consisted of temperature, pH, specific conductance, salinity and dissolved oxygen. These measurements were conducted prior to sample collection.

The Remedial Investigation/Feasibility Study, Sampling and Analysis Plan (SAP) for Sites 6,9,48, and 69 limited the sampling references sites to two stations in the White Oak River Basin (Baker, 1992). One of the stations was to be used as the reference for the marine stations, and the other was to be used as the reference for the freshwater station. The reference stations were selected to be as ecologically similar to the sampling stations for Sites 6, 9, 48, and 69. The reference fish and benthic macroinvertebrate station for OU No. 2 was established in Pettiford Creek (freshwater) which is located in the White Oak River Basin (see Figure 4-1 in the Ecological Risk Assessment).

The White Oak River watershed is smaller than the New River watershed (see Figure 4-1 in the Ecological Risk Assessment). It begins in the Hoffman Forest and flows approximately 48 miles and empties into the Atlantic Ocean. Approximately 77 percent of the watershed is within the Hoffman Forest and the Croatan National Forest. This watershed has very little development, with Swansboro being the largest town. Therefore, because there is not much development in this watershed, it was chosen as a good reference station.

Pettiford Creek was chosen as the location for the reference station. This station is similar to the stations in Wallace Creek in that it has a salinity gradient from fresh to mesohaline at its mouth.

2.4.8.1 Fish and Crabs

This section discusses collection of the fish and crab samples in Wallace Creek, Bear Head Creek, and Pettiford Creek.

A literature review was conducted to determine the fish species that may potentially be exposed to contaminants in the surface water/sediment exposure pathway. This review included compiling information from State and Federal natural resources agencies. In addition, Baker's experience in sampling similar areas formed a basis for a database of expected species for the area.

Originally, three species of fish were to be sampled, with each species being a representative of one of three trophic (feeding) groups, which included a first order predator, a second order predator, and a third order predator. In addition, a minimum of ten individuals per specie, if available, of adult fish of preferably uniform size were to be composited and analyzed for whole body burden and fillet burden of chemicals, with the same species of fish being sampled from each station. A fish species was successfully collected if the above requirements were satisfied. These requirements were identified to Baker by the U.S. Fish and Wildlife Service as part of the Work Plan review.

Sampling variability can prevent the same species of fish from being sampled at each station because either the preferred species was not captured, or adequate numbers of uniform-size individuals were not captured. Therefore, if the preferred species was not successfully collected to satisfy the above requirements, a substitute species was collected that, if possible, exhibiting a similar trophic position in the estuarine ecosystem.

Wallace Creek

This section discusses collection of the fish and crab samples in Wallace Creek including the station locations and sampling procedures.

Station Locations

Fish and crabs were collected from four stations in Wallace Creek. One station was located upstream of OU No. 2 (6-WC4A), one station was located adjacent to OU No. 2 (6-WC6A), and two stations were located downstream of OU No. 2 (6-WC9A and 6-WC11A) (see Figure 2-13).

Station 6-WC4A was located on Wallace Creek approximately 100 feet upstream of Piney Green Road. This station was relocated downstream from the proposed station location (see the Sampling and Analysis Plan [SAP] [Baker, 1992]) because debris obstructed upstream boat access during the time of sampling. Station 6-WC6A was located on Wallace Creek between Piney Green Road and Holcomb Boulevard. Station 6-WC9A was located on Wallace Creek approximately 1000-1500 feet downstream of Holcomb Boulevard, while Station 6-WC11A was located on Wallace Creek approximately 500 feet downstream of it's confluence with Bear Head Creek.

Sampling Procedures

Fish were collected in Wallace Creek using gill nets and a boat-mounted electrofisher. The electrofisher was used when the salinity was in the appropriate salinity range. See Table 4-1 in the Ecological Risk Assessment for a listing of the sampling procedure used at each station.

The fish sampling via electroshocking was conducted using a Smith-Root, Inc. electrofisher powered by a 5,000-watt portable generator. A DC current was applied utilizing the boat as a cathode and a hand-held electrode as the anode. The length of shocking time per subsection was recorded as seconds of applied current. Stunned fish were collected with one-inch mesh or smaller dip nets handled by members of the field sampling team.

The gill nets were six feet deep by 50 feet long with two-inch square mesh and an approximate twine break strength of 29 pounds. The nets were deployed approximately at the locations shown on Figure 2-13. Weights were attached to the nets to secure them on the bottom of the stream and yellow bouys marked with "Baker Environmental" were attached to the tops of the nets. The nets were deployed in the morning or evening, and they were checked for fish within twelve hours after deployment.

The collected fish species were identified, measured, and counted. The small fish (less than 20 mm) were weighed in groups of 10 or 20 because of their low individual weight; the larger fish were weighed individually. In addition, blue crabs that were captured in the gill nets were collected, measured, and weighed. The proportion of individuals as hybrids and the proportion of individuals with disease, tumors, fin damage, and skeletal anomalies was recorded at each station.

Most of the fish species were processed in the field and returned alive to the creeks. Some specimens that presented taxonomic difficulties were preserved in 10% formalin and transported to the Baker Ecological Services Laboratory for taxonomic work. At a minimum, one representative fish from each species was preserved in 10% formalin as a voucher specimen.

An attempt was made to collect ten individuals from three different species with each species being a representative of one of the three trophic groups for the tissue analysis. However this success rate was not achieved at any of the stations. The fish were placed individually into clean ziploc or plastic garbage bags and stored on ice for whole body or fillet tissue analysis.

The blue crabs were placed individually into clean ziploc bags and stored on ice for whole-body analysis. The bags were labeled with the date and station location. The fish and crabs were frozen prior to being shipped to Ceimic, Inc. for chemical analysis. Table 4-2 in the Ecological Risk Assessment shows the number and total weight of the fish and blue crab samples sent to Ceimic.

Bear Head Creek

This section discusses collection of the fish and crab samples in Bear Head Creek including the station locations and sampling procedures.

Station Locations

Fish and crabs were collected from three stations in Bear Head Creek. One station was located upstream of OU No. 2 (6-BH2A), one station was located adjacent to site OU No. 2 (6-BH4A), and one station was located downstream of OU No. 2 (6-BH6A) (see Figure 2-13).

Station 6-BH2A was located on Bear Head Creek approximately 1,000 feet upstream of Piney Green Road. This station was located further downstream than proposed in the sampling and analysis plan (Baker, 1992) because the proposed sampling location could not be accessed due to vegetation overgrowth. Station 6-BH4A was located on Bear Head Creek between Piney Green Road and Holcomb Boulevard. Finally, Station 6-BH6A was located on the Bear Head Creek approximately 1,500 to 2,000 feet downstream of Holcomb Boulevard.

Sampling Procedures

Fish were collected in Bear Head Creek using gill nets and a backpack electrofisher. The electrofisher was used when the salinity was in the appropriate salinity range for use of the electrofisher.

The fish sampling via electroshocking was conducted using a Smith-Root, Inc. electrofisher powered by a 300-watt portable generator. A DC current was applied utilizing a "rattail" as the cathode and a hand-held electrode as the anode. Blocking seines were placed downstream and upstream of the shocking areas to aid in the collection of the fish. The length of shocking time per subsection was recorded as seconds of applied current. Stunned fish were collected with one-inch mesh or smaller dip nets handled by members of the field sampling team.

Gill nets, similar to those used in Wallace Creek, were used to collect fish in Bear Head Creek. The same sample collection and sample processing procedures used in Wallace Creek were conducted in Bear Head Creek. Fish that were collected were processed for population statistics and tissue analysis.

Ravine

The ravine receives only runoff from Sites 6 and 82 and therefore, it is only intermittent in nature. No fish collection was proposed for this area in the SAP (Baker, 1992).

Pettiford Creek

This section discusses collection of the fish and crab samples in Pettiford Creek including the station locations and sampling procedures.

Station Location

The fish station was located upstream on Pettiford Creek where the salinity was close to zero. Several locations with good electrofishing potential (based on salinity) were shocked, however, the yield was very low. Gill nets were not proposed for this station in the SAP (Baker, 1992).

Sampling Procedures

Fish were collected in Pettiford Creek using a boat-mounted electrofisher. The same sample collection and sample processing procedures used in Wallace Creek were conducted at the Pettiford Creek station. All fish that were collected were processed for population statistics; no fish at this station were collected for tissue analysis.

2.4.8.2 Benthic Macroinvertebrate

This section discusses collection of benthic macroinvertebrate samples in Wallace Creek, Bear Head Creek, and Pettiford Creek.

Wallace Creek

This section discusses collection of the benthic macroinvertebrate samples in Wallace Creek including the station locations and sampling procedures.

Station Locations

Benthic macroinvertebrates were collected from four stations in Wallace Creek. One station was located upstream of OU No. 2 (6-WC3A), one station was located adjacent to OU No. 2 (6-WC6A), and two stations were located downstream of OU No. 2 (6-WC9A and 6-WC11A) (see Figure 2-13).

Station 6-WC3A was located on Wallace Creek approximately 3,000 to 4,000 feet upstream of Piney Green Road. At the time this sample was collected, the path in the water was not being obstructed as it was when the fish sample was collected. Station 6-WC6A was located on Wallace Creek, between Piney Green Road and Holcomb Boulevard. Station 6-WC9A was located on Wallace Creek approximately 1,000-1,500 feet downstream of Holcomb Boulevard, and Station 6-WC11A was located on Wallace Creek approximately 500 feet downstream of its confluence with Bear Head Creek.

Sampling Procedures

Benthic macroinvertebrates were collected from a boat using a standard ponar grab. The dimensions of the ponar are 23 x 23 cm (9 x 9 in.) for a sampling area of 529 cm^2 or 0.0529 m^2 (81 in^2).

The ponar was deployed from the boat, which was positioned in slightly different locations for each replicate to prevent the ponar from re-sampling the same area. After retrieving the ponar with a sediment sample, it was opened into a clean tub and the sediments were removed with a teflon spatula. The sediments were transferred to a 0.5 mm sieve that was agitated (by hand) in a tub half-full of water to remove the small particles. The remaining contents in the sieve were transferred into 16-ounce plastic sample jars. The jars were filled up to one-half full with sediments and buffered formalin solution (10% by weight) was added to the remainder of the jar to preserve the benthic macroinvertebrates contained in the sediments. A 100% cotton paper label, marked in pencil with the sample number, was placed inside the jar.

The outside of the jar was labeled with the sample number using a black permanent marker to identify the sample containers.

After all the benthic sampling at OU No. 2 was completed, the sample jars were transported to the Baker Ecological Laboratory for sample processing. Sample processing included washing each sample through a 0.5 mm sieve, transferring the washed sample back into the jar, and adding 70% isopropyl alcohol, as a preservative, to the washed sample in the jar. A small amount of rose bengal was added to each jar to stain the benthic macroinvertebrates a pink-red color to aid in the sorting process. The rose bengal stains the tissue cells of the organisms and helped to distinguish them from plant and other materials in the sediments.

The benthic macroinvertebrates were stained for at least 24 hours prior to sorting under a dissecting microscope. The benthic macroinvertebrates were removed from the sediments using a pair of forceps, and placed into glass vials containing 70% isopropyl alcohol and a 100% cotton paper label marked in pencil with the sample number. A one-fourth aliquot of sample 6-WC3A was sorted because of its large sample volume. The number of individuals from that aliquot was multiplied by four to obtain the total number of individuals in the sample. The vials were sealed with cotton and placed into a jar containing 70% isopropyl alcohol. The date, sorting time, approximate number of benthic macroinvertebrates collected, and the name of the person who sorted the sample were recorded on a sample processing log sheet.

The same sorting procedures outlined above were repeated as a QA/QC measure, with any additional species identified being placed into their respective vials. A senior environmental scientist was employed to perform this QA/QC measure. Fifty-percent of a sample was resorted. If more than five percent of the individuals were missed during the initial sorting, than the rest of the sample was resorted. If less than five percent of the individuals were missed during the initial sorting, than the rest of the sample was not resorted.

The date, sorting time, number and type of additional organisms found and percent of sample that was QA/QCed were recorded on the sample processing log sheet. The vials containing the benthic macroinvertebrates were sent to RMC Environmental Services for taxonomic identification.

Bear Head Creek

This section discusses collection of the benthic macroinvertebrate samples in Bear Head Creek including the station locations and sampling procedures.

Station Locations

Benthic macroinvertebrates were collected from three stations in Bear Head Creek. One station was located upstream of OU No. 2 (6-BH2A), one station was located adjacent to OU No. 2 (6-BH4A), and two stations were located downstream of OU No. 2 (6-BH6A) (see Figure 2-13).

Station 6-BH2A was located on Bear Head Creek approximately 1,000 feet upstream of Piney Green Road. This station was located further downstream than proposed in the SAP (Baker, 1992) because the proposed location could not be accessed due to vegetation overgrowth. Station 6-BH4A was located on Bear Head Creek between Piney Green Road and Holcomb Boulevard. Finally, Station 6-BH6A was located on Bear Head Creek, approximately 1,500-2,000 feet downstream of Holcomb Boulevard.

Sampling Procedures

Benthic macroinvertebrates were collected using the same procedures used in Wallace Creek. The only deviation from the procedures occurred at Stations 6-BH2A and 6-BH4A. The ponar samples collected at these stations were collected by standing in the creek and releasing the ponar, as opposed to deploying the ponar from the boat. The sample processing procedures remained the same for these samples.

A one-fourth aliquot of sample 6-BH6A was sorted because of its large sample volume. The number of individuals from that aliquot was multiplied by four to obtain the total number of individuals in the sample.

Pettiford Creek

This section discusses collection of the benthic macroinvertebrate samples in Pettiford Creek including the station location and sampling procedures.

Station Locations

Pettiford Creek, located within the White Oak Watershed was chosen as the location for the reference station.

Sampling Procedures

Benthic macroinvertebrates were collected in Pettiford Creek using the ponar grab deployed from the boat. The same sample collection and sample processing procedures used in Wallace Creek were conducted at the Pettiford Creek station.

2.5 RI Field Investigations Performed at Site 9

The field investigations performed at Site 9 commenced on September 10, 1992 and continued through November 10, 1992. The field program implemented at Site 9 consisted of a Preliminary Site Survey (discussed in Section 2.3); a soil investigation including drilling and sampling; and a groundwater investigation including monitoring well installation (shallow and deep wells) and groundwater sampling. Table 2-15 summarizes the project objectives, criteria for meeting the objectives, and general investigative methods for the RI performed at Site 9. The following sections discuss these investigative activities.

Site 9 is located between Piney Green Road and Holcomb Boulevard along the southern border of OU No. 2 (refer to Figure 1-3). Bear Head Creek is located approximately 500 feet to the north of the site. The site is bordered by unnamed streets (unpaved roads) to the east and west and encompasses an area of approximately 2.6 acres. An asphalt-lined pit is present at this site. This pit is currently used to conduct training exercises for extinguishing fires. An oil/water separator is located just south of the pit as shown on Figure 2-14. The oil/water separator is used to collect water from fire pit training exercises and storm water that falls into the pit. The recovered product collected in the oil/water separator is disposed of off site. Two groups of above ground storage tanks (two tanks in each group) are located just west-northwest of the training pit.

2.5.1 Soil Investigation

The soil investigation performed at Site 9 was intended to identify contaminants of concern (i.e., petroleum hydrocarbons, solvents, etc.) and evaluate their distribution at the site. The

TABLE 2-15

SUMMARY OF REMEDIAL INVESTIGATION OBJECTIVES FOR FIRE FIGHTING PIT
SITE 9
REMEDIAL INVESTIGATION CTO-0133
MCB CAMP LEJEUNE, NORTH CAROLINA

Medium or Area of Concern	RI Objective	Criteria for Meeting Objective	Proposed Investigation/Study
1. Soil	1a. Assess the extent of soil contamination at the training pit and surrounding area.	Determine contaminant levels in surface and subsurface soils at former storage areas.	Soil Investigation
	1b. Assess human health and ecological risks associated with exposure to surface soils.	Determine contaminant levels in surface and subsurface soils.	Soil Investigation Risk Assessment
	1c. Assess areas of surface soil contamination due to site runoff.	Determine contaminant levels in surface soils at downslope drainage areas.	Soil Investigation
2. Groundwater	2a. Assess health risks posed by future usage of the shallow groundwater near Site 6.	Evaluate groundwater quality and compare to ARARs and health-based action levels.	Groundwater Investigation Risk Assessment
	2b. Assess potential impact to groundwater from fuel-contaminated soil.	Characterize on-site groundwater quality and groundwater quality downgradient from Site 6.	Groundwater Investigation
	2c. Evaluate hydrogeologic characteristics.	Estimate hydrogeologic characteristics of the shallow aquifer (flow direction, groundwter gradient, etc.).	Surface water level measurements in Bear Head Creek

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investigation performed was also to evaluate potential human health risks and ecological impacts associated with previous and ongoing fire training activities. Table 2-15 summarizes the specific RI objectives for the soil investigation.

2.5.1.1 Drilling Procedures

Drilling activities at Site 9 commenced on September 16, 1992 and continued through September 26, 1992. The drilling program implemented at Site 9 was intended to investigate shallow and deep physical (i.e., geologic and hydrogeologic) and chemical (i.e., contaminant distribution) conditions. Figure 2-15 depicts the drilling locations at Site 9. Appendix C (C.12 and C.13) summarizes the number of soil borings and depths.

Drilling procedures (including sampling intervals, air monitoring, level of personal protection, decontamination procedures, handling of investigative derived wastes, etc.) implemented at Site 9 were the similar as those discussed for Sites 6 and 82 in Section 2.4.3.1 for both shallow and deep drilling. As described in Section 2.4.3.1, shallow drilling was accomplished using the HSA technique while deep drilling was accomplished using the mud-rotary technique. Test Boring Log Records and Test Boring and Well Construction Records, describing soil conditions at Site 9 are presented in Appendices D (D.11) and E (E.3).

2.5.1.2 Soil Sampling

Soil samples were collected throughout Site 9 for soil classification purposes and analytical testing. This sections provides a summary of sampling locations, procedures, and analytical methods for Site 9 sampling activities.

Sampling Locations

Figure 2-15 depicts the sampling locations at Site 9. As shown on Figure 2-15, sampling grids were established within Site 9 at approximate 25-foot centers (refer to Table 2-3). The grids encompass the AST areas, the fire training pit, and the oil/water separator. These areas were selected since those structures serve as potential sources of contamination. Note that samples collected at 9GW4 (soil boring advanced for monitoring well installation) served as site-specific background samples. Appendix C (C.12 and C.13) provides a summary of the number of samples collected, their depths, and analytical parameters tested.

Originally in the Final RI/FS Work Plan, 39 soil borings (SB1 through SB39) were proposed at Site 9. Samples collected from soil borings SB18, SB19, SB23, SB26, SB29, SB33, SB37, SB38, and SB39, which were obtained in September 1992, exhibited elevated total petroleum hydrocarbon (TPH) concentrations (i.e., above 100 mg/kg). Accordingly, 16 additional surface soil samples collected and analyzed for TPH (selected samples were also analyzed for full TCL organics and TAL inorganics) in order to further evaluate the extent of TPH contaminated soils. These additional borings are located south of the oil/water separator and east of the fire training pit. Note that only surface soils were collected because the TPH were predominantly detected in surface soils from the borings mentioned above.

Sampling Procedures

Soil samples obtained at Site 9 were collected by employing the same techniques as described in Section 2.4.3.2. As mentioned in Section 2.4.3.2, samples were collected via a drill rig (i.e., inside augers and split-spoons) or a hand auger. Samples retained for laboratory analyses from soil borings were collected from the surface and just above the water table (a third sample was also submitted if evidence of contamination was noted); samples retained for laboratory analysis from soil borings advanced for monitoring well installation were obtained from just above and just below the water table. Sampling depths are summarized in Appendix C (C.12 and C.13). Note that the sample preparation procedures implemented at Site 9 were the same as those described for Sites 6 and 82.

Analytical Requirements

As shown in Appendix C (C.12 and C.13), 78 of the samples collected at Site 9 were analyzed for TPH and 30 samples were analyzed for full TCL organics and TAL inorganic (refer to Tables 2-5 and 2-6 for analytical methods). Soil samples collected from soil borings were analyzed for TPH or TCL organics/TAL inorganics, while samples collected from soil borings advanced for monitoring well installation were analyzed for TCL organics/TAL inorganics only. TPH analyses were performed using EPA Method 418.1. Two samples were also collected (AST-SB18) for grain size analysis to evaluate subsurface physical conditions.

Quality Assurance and Quality Control Samples

Field quality assurance and quality control (QA/QC) samples were also collected during the sampling program at Site 9. The frequencies and types of QA/QC samples obtained were the same as those described for Sites 6 and 82 in Section 2.4.3.2 (refer to Table 2-4). Table 2-16 summarizes the QA/QC sampling program implemented for the soil investigation.

2.5.1.3 Field Screening and Air Monitoring

Air monitoring and field screening procedures were implemented during drilling and sampling activities for health and safety and initial contaminant monitoring. The procedures implemented were the same as those described in Section 2.4.3.3.

2.5.2 Groundwater Investigation

The groundwater investigation performed at Site 9 was intended to identify contaminants of concern and evaluate their distribution at the site, and evaluate groundwater flow patterns. Specific objectives of the groundwater investigation are summarized on Table 2-15. The following discusses monitoring well installation, well development, and water level measurement procedures, as well as groundwater sampling activities.

2.5.2.1 Monitoring Well Installation

Six shallow (denoted as 9GW4 through 9GW8) and one deep (6GW7D) monitoring well were installed at Site 9 [three existing wells (9GW1, 9GW2, and 9GW3) are present at the site]. The locations of the existing and newly installed wells are shown on Figure 2-16. The monitoring wells were installed to collect shallow and deep groundwater samples for characterizing the nature and horizontal extent of potentially impacted groundwater and to evaluate groundwater flow patterns at the site. Location selection of the newly installed wells was based on the results of a previous investigations (ESE, 1991) and groundwater flow patterns at the site. Table 2-17 provides a summary of the rationale for the monitoring well locations at Site 9.

Monitoring well installation procedures (i.e., drilling procedures, well construction and materials, screen lengths, well diameter, etc.) implemented at Site 9 for both the shallow and deep wells were the same as those described in Sections 2.4.4.1 for Sites 6 and 82 (refer to Figure 2-9 for typical well completion details). The shallow wells were installed at depths ranging from 18.4 (9GW8) to 21.5 feet bgs (9GW7S) while deep well 9GW7D was installed at 110 feet bgs. Well construction details for the newly installed shallow and deep wells are summarized on Table 2-18 and well construction diagrams are shown on the Test Boring and

TABLE 2-16

SUMMARY OF FIELD QUALITY ASSURANCE/QUALITY CONTROL
SAMPLING PROGRAM FOR THE SOIL INVESTIGATION
SITE 9
REMEDIAL INVESTIGATION CTO-0133
MCB CAMP LEJEUNE, NORTH CAROLINA

QA/QC Sample (1)	Frequency of Collection	Number of Samples	Analytical Parameters (3)
Trip Blanks (2)	One per Cooler	7	TCL Volatiles
Field Blanks	One per Event (4)	1	TCL Organics/TAL Inorganics
Equipment Rinsates (5)	One per Day	4	TCL Organics/TAL Inorganics
Field Duplicates (6)	10% of Sample Frequency	(6)	TCL Organics/TAL Inorganics/ TPH

Notes:
(1) QA/QC sample types defined on pages 2-12 and 2-13 in text.
(2) Trip blanks submitted with coolers which contained samples for volatile analysis. Samples analyzed for TCL Volatiles only.
(3) Parameters analyzed according to procedures outlined on Tables 2-5 and 2-6.
(4) An event is defined as one 14 day period. Field blank collected from a potable water source used for decontamination of heavy equipment. Source was a fire hydrant located at Site 9.
(5) Equipment rinsates collected from various sampling equipment (e.g., split spoons, stainless steel spoons, hollow stem augers, etc.). Note that samples were collected daily but were analyzed every other day of sampling event. Accordingly, the number of samples presented represents the number of samples analyzed.
(6) Field duplicate samples collected from soil borings presented in Appendix N.

TABLE 2-17

PHASE I MONITORING WELL SUMMARY AND RATIONALE
SITES 9
REMEDIAL INVESTIGATION CTO-0133
MCB CAMP LEJEUNE, NORTH CAROLINA

Site No.	Well Designation	General Location	Purpose
9	9GW1*, 9GW6, 9GW7S, and 9GW8	Near the fire training pit and oil water separator	Monitor on-site groundwater quality in the surficial/aquifer where ongoing fire training exercises occur.
	9GW2*, 9GW3*, and 9GW7	North of the fire training area	Monitor downgradient groundwater quality in the surficial aquifer.
	9GW7D	North of the training area	Monitor downgradient groundwater quality in the deep aquifer.
	9GW4	Southeast of Site 9	Monitor upgradient (site-specific background well) groundwater quality.

Note: * - Denotes existing monitoring well.

TABLE 2-18

SUMMARY OF NEWLY INSTALLED WELL CONSTRUCTION DETAILS
SITE 9
REMEDIAL INVESTIGATION CTO-0133
MCB CAMP LEJEUNE, NORTH CAROLINA

Well No.	Date Installed	Top of PVC Casing Elevation (1) (feet, above msl)	Ground Surface Elevation (feet, above msl)	Boring Depth (feet, below ground surface)	Well Depth (feet, below ground surface)	Screen Interval Depth (feet, below ground surface)	Depth to Sand Pack (feet, below ground surface)	Depth to Bentonite (feet, below ground surface)	Stick-Up (feet, above ground surface)
9GW4	9/23/92	30.70	28.3	21.3	21.0	6.3-20.3	4.0	2.3	2.4
9GW5	9/22/92	30.81	28.0	19.5	18.9	4.2-18.5	2.2	1.0	2.8
9GW6	9/23/92	31.31	28.7	20.2	19.7	4.9-19.3	2.9	1.9	2.6
9GW7S	9/23/92	28.76	26.2	22.0	21.5	7.1-21.0	5.0	3.0	2.56
9GW7D(2)	9/29/92	29.10	26.6	110.0	110.0	100-109	98.5	93.0	2.5
9GW8	9/23/92	28.39	26.0	19.0	18.4	3.5-18.0	2.0	1.0	2.4

Notes: (1) msl - mean sea level
(2) Deep Monitoring Well

Horizontal positions are referenced to N.C. State Plane Coordinate System (NAD27) CF = 0.9999216 from U.S.M.C. Monument Toney. Vertical datum NGVD 29.

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Well Construction Records provided in Appendix E (E.3).

2.5.2.2 Well Development Procedures

Following well construction and curing of the bentonite seal, each newly installed shallow and deep well were developed to remove fine-grained sediment from the screen and to establish interconnection between the well and the formation. Well development procedures employed at Site 9 were the same as those described in Section 2.4.4.2.

Well Development Forms summarizing this information are provided in Appendix G (G.3).

2.5.2.3 Water Level Measurements

Static water level measurements were collected from top-of-PVC casing (TOC) reference points at each existing and newly installed well at Site 9. Phase I groundwater data were collected from all site wells on September 15 and 30, and October 26, 1992. Water level measurements were obtained using the same methods as described in Section 2.4.4.3.

All newly installed monitoring wells were surveyed to establish vertical elevation in relationship to mean sea level (msl) and horizontal control as described in Section 2.4.4.3.

2.5.2.4 Groundwater Sampling

The following section discusses sampling locations, sampling procedures, analytical requirements, QA/QC samples for the groundwater sampling program. Note that the sampling procedures employed at Site 9 were the same as those employed at Sites 6 and 82.

Sampling Locations

Groundwater samples were collected from all existing (3 wells total) and newly installed monitoring wells (6 wells total) at Site 9. Figure 2-16 shows the locations of monitoring wells. Note that monitoring well 9GW4, located south of Site 9, served as a site-specific background well (refer to Table 2-17 for sample location rationale).

Sampling Procedures

Groundwater sampling procedures (i.e., including bailing procedures, field measurements, sampling, handling, etc.) implemented at Site 9 were the same as those described in Section 2.4.4.5.

Analytical Requirements

Groundwater samples were analyzed for TCL organics and TAL inorganic (total and dissolved metals, cyanide). EPA Methods 601 and 602 were implemented for analysis of volatiles. Additionally, a groundwater sample was collected from monitoring well 9GW8 for analysis of BOD, COD, TSS, TDS, TS, and TVS to evaluate the general groundwater chemistry for potential treatment options.

Quality Assurance and Quality Control Samples

Field QA/QC samples were also collected during the groundwater sampling program. The sample types are defined in Section 2.4.3. Table 2-19 summarizes the field QA/QC sampling program for the groundwater investigation.

2.6 Phase II Field Investigations Performed at Sites 6 and 82

A second phase of field investigations (Phase II) was initiated at Sites 6 and 82 in February, 1993. The Phase II field investigation was initiated based on the results of the Phase I field investigation. In general, the Phase I investigation indicated that deep groundwater in the vicinity of Sites 6 and 82 is impacted by chlorinated hydrocarbons (note that the results of the Phase I investigation are presented in Section 4.0). Concentrations of chlorinated hydrocarbons are also present in the vicinity of Site 82 in the surficial groundwater, but less significant in magnitude than the deeper groundwater. Accordingly, the Phase II investigation focused on the surficial and deep groundwater quality in the vicinities of Sites 6 and 82. Phase II also further investigated potential source areas associated with the contamination identified during Phase I.

The Phase II field investigation consisted of a soil gas survey, test pit sampling, soil borings, shallow and deep monitoring well installation, and soil and groundwater sampling. The Phase II field investigation commenced on February 18, 1993 and continued through

TABLE 2-19

SUMMARY OF FIELD QUALITY ASSURANCE/QUALITY CONTROL
SAMPLING PROGRAM FOR THE GROUNDWATER INVESTIGATION
SITE 9
REMEDIAL INVESTIGATION CTO-0133
MCB CAMP LEJEUNE, NORTH CAROLINA

QA/QC Sample (1)	Frequency of Collection	Number of Samples	Analytical Parameters (3)
Trip Blanks (2)	One per Cooler	1	TCL Volatiles
Field Blanks	One per Event (4)	0	TCL Organics/TAL Inorganics
Equipment Rinsates (5)	One per Day	1	TCL Organics/TAL Inorganics
Field Duplicates (6)	10% of Sample Frequency	(6)	TCL Organics/TAL Inorganics

Notes: (1) QA/QC sample types defined on pages 2-12 and 2-13 in text.
(2) Trip blanks submitted with coolers which contained samples for volatile analysis. Samples analyzed for TCL Volatiles only.
(3) Parameters analyzed according to procedures outlined on Tables 2-5 and 2-6.
(4) An event is defined as one 14 day period. Field blank was collected during groundwater sampling activities at Site 6 (same 14 day period).
(5) Equipment rinsates collected from various sampling equipment (e.g., bailers, etc.). Note that samples were collected daily but were analyzed every other day of sampling event. Accordingly, the number of samples presented represents the number of samples analyzed.
(6) Field duplicate samples collected from monitoring wells presented in Appendix N.

May 3, 1993. The following sections provide a detailed description of the field methods employed. Note that many of the field methods employed during Phase II are the same as those employed during Phase I. Therefore, abbreviated descriptions may be used to summarize the Phase II field procedures in some cases.

2.6.1 Soil Gas Survey

A soil gas survey was conducted in portions of Sites 6 and 82 from February 18 through February 23, 1993. The purposes of performing the survey in these areas were to: 1) identify potential source areas which may have contributed to the surficial contamination; 2) evaluate the horizontal extent and distribution of contaminants in the surficial soil and groundwater; and 3) provide real-time data which were used to position the additional shallow monitoring wells installed during Phase II. The survey was performed by TARGET Environmental Services, Inc. (TARGET) and was supervised by Baker personnel. A copy of TARGET's report is provided in Appendix U. The following provides a detailed description of the soil gas field procedures and results.

2.6.1.1 Sampling Locations

Soil gas samples and groundwater headspace samples were collected at the locations shown on Figure 2-17. Three grids were established (referred at grids A, B, and C) to assist in the sample collection. Grid A is located north of Site 82 and Wallace Creek and was established to evaluate potential contaminant migration into Wallace Creek from off-site. Grid B is located in portions of Sites 6 and 82 and was established to: 1) evaluate the extent and distribution of known contamination in the area; 2) identify the source or sources of this contamination; and 3) determine if contaminants are migrating downgradient into Wallace Creek from the south direction. Lastly, grid C is located east of Lot 203 across Piney Green Road and was established to evaluate potential contamination upgradient from Sites 6 and 82. A total of 144 soil gas samples and six groundwater headspace samples were collected during the survey.

2.6.1.2 Sampling Procedures

Prior to sample collection, the three sampling grids were laid out. Sampling points within each grid were established at approximately 100-foot spacings. The groundwater sampling points, however, were placed at random locations within grid B based on the groundwater analytical results from Phase I and from the preliminary soil gas results.

Soil gas samples were collected by employing several steps. A 1/2-inch hole was produced to a depth of approximately six feet by using a drive rod and slide hammer (also commonly referred to as a "slam bar"). The entire sampling system was purged with ambient air drawn through an organic vapor filter cartridge, and a stainless-steel probe was inserted to the full length of the hole and sealed off from the atmosphere. A sample of in-situ soil gas was then withdrawn through the probe and used to purge atmospheric air from the sampling system. A second sample of soil gas was withdrawn through the probe and encapsulated in a pre-evacuated glass vial at two atmospheres of pressure [15 pounds per square (psi)]. The self-sealing vial was detached from the sampling system, packaged, labeled, and stored for laboratory analysis. Sampling depths varied from two to six feet due to the presence of shallow groundwater. Excess soil was used to backfill the sampling holes.

Groundwater samples were collected in slightly different manner than the soil gas samples. A stainless-steel rod was driven into the water table and a sample of groundwater was extracted through dedicated teflon tubing. The samples were collected in clean vials. Fifteen ml of the sample was then placed into a 30 ml vial and sealed with a teflon-faced butyl rubber septum for headspace analysis.

Prior to the day's field activities, all sampling equipment including the side hammer rods and probes were decontaminated by washing with an Alconox soap solution and rinsing thoroughly with distilled water. Internal surfaces were flushed dry using prepurified nitrogen or filtered ambient air, and external surfaces were wiped clean using clean paper towels.

Field control samples were collected at the beginning and end of each day's field activities, and after every twentieth soil gas sample. These QA/QC samples were obtained by inserting the probe tip into a tube flushed by a 20 psi flow of pre-purified nitrogen and encapsulated as described above. The laboratory results of the analysis of these samples are reported on Table 1 in Appendix U. Concentrations of all analytes were below the reporting limit in all field control samples, indicating that the QA/QC measures employed were sufficient to prevent cross-contamination of the samples during collection.

2.6.1.3 <u>Analytical Requirements</u>

All of the soil gas samples and the headspace groundwater samples collected during the field phase of the survey were analyzed according to EPA Method 601 on a gas chromatograph equipped with an electron capture detector (ECD), and using direct injection of the soil gas or prepared headspace. As described in the previous section, groundwater samples were prepared for analysis by pouring 15 ml of the sample into a 30 ml vial. The vial was heated for 10 minutes to volatilize hydrocarbons from the water. Specific analytes standardized for the ECD analysis were:

- 1,1 dichloroethene (1,1 DCE)
- methylene chloride (CH2 Cl2)
- trans-1,2-dichloroethene (t1,2-DCE)
- chloroform (CHCl3)
- 1,1-dichloroethane (11-DCE)
- carbon tetrachloride (CCl4)
- cis-1,2-dichloroethene (c1,2-DCE)
- 1,1,1-trichloroethane (1,1,1 TCA)
- trichloroethane (TCE)
- 1,1,2-trichloroethane (1,1,2-TCE)
- tetrachloroethene (PCE)

The chlorinated hyrdocarbons in this suite were chosen based on the analytical results from Phase I.

In addition, selected samples (I2, H2D, G3, H3, and I5) were submitted to Maryland Spectral Services, Inc. (MSS) in Baltimore, Maryland for analysis by gas chromatography/mass spectroscopy (GC/MS). These samples were selected for laboratory analysis because elevated contaminant levels were detected in them using the ECD in the field.

2.6.1.4 Results

Results of the soil gas sampling (and samples submitted for laboratory analysis) are summarized on Table 1 in Appendix U. Positive detections of volatile organic compounds (VOCs) were detected at 17 soil gas sample points within grid B. VOC concentrations ranged from 1.1 to 1,360 micrograms per liter (ug/l). Tetrachloroethane (PCE) was the most commonly detected VOC. Note that concentrations of VOC were not detected in either grids A or C.

The distribution of PCE detected during the survey gas survey is presented on Figure 2-18. A major occurrence of PCE is centered at sample point I5 (1,360 ug/l) which is located near the southern portion of Site 82 in the vicinity of well cluster 6GW1S/1D. Overall, the TCE concentrations generally decreased (to 1.1 ug/l) north (or downgradient) of I5 with the exception of sample point G6 (81 ug/l). South (or upgradient) of I5, the TCE concentrations also decreased but remained somewhat elevated (1.6 to 221 ug/l).

Overall, TCE contamination (based on the soil gas results) appears to be limited to grid B. The full extent of the contamination south of grid B toward Lot 203, however, was not defined. Based on TCE levels detected in samples K1 and L1, it appears that contaminants may be impacting Wallace Creek.

Groundwater headspace screening results are also provided on Table 1 in Appendix U. Concentrations of 1,1-DCE, t-1,2-DCE, c-1,2-DCE, TCE, 1,1,2-TCA, and PCE were detected in groundwater samples W2, W3, and W5 (not all compounds were detected in all samples). Of the detected VOCs, t-1,2-DCE and c-1,2-DCE were the most commonly detected. Total VOC concentrations (sum of all positively detected volatile organic compounds) ranged from not detected to 792.8 ug/l (W5).

The distribution of total VOCs in headspace groundwater samples is shown on Figure 2-19. The highest concentration of VOCs were detected in sample W5 which is located near the northern portion of grid B, just south of Wallace Creek. Note that the soil gas samples and groundwater sample W4, which is located nearby W5, did not contain any VOC levels. A second major occurrence of VOCs is also present at sample W3 (324.8 ug/l of total VOCs). This sample is located in the vicinity of sample I5 where elevated levels of TCE were detected from soil gas.

2.6.2 Test Pit Activities

Under Phase II field investigation, an area near the southern boundary of Site 82 was investigated. This investigation was conducted after review of following: historical aerial photographs, information collected during a reconnaissance of a suspected source area, and magnetometer survey data conducted by Geo-Centers (Baker's UXO subcontractor). From the aerial photography it was observed that activity once occurred in the general vicinity of the area to be investigated (just north of Lot 203). Reconnaissance of this area conducted in January of 1993, revealed numerous 5-gallon containers of unknown material (believed to be lubrication oil). In January of 1993, Geo-Centers (under the supervision of Baker personnel) performed a magnetometer survey of this area and discovered at least seven distinct magnetic anomalies present at this area. Accordingly, test pits were recommended in this area to identify the source of the magnetic anomalies and a potential organic contamination source.

On March 2, 1993, Geo-Centers (under the supervision of Baker personnel) identified seven northern and southern poles of the magnetic anomalies in this area. These seven locations were then marked, and perpendicular transects were staked out at each location. Test pit operations for these seven locations were conducted on March 3, 1993 and were primarily conducted as exploratory excavations to assess the contents of past disposal/burial operations. Test pits varied in length and depth, and were dependent upon the following conditions:

- Space limitations imposed by the site (i.e., wooded areas limited movement of backhoe)
- The capabilities and limitations of the excavation equipment (i.e., depth of excavation was limited to the length of the boom on the backhoe)
- The amount and type of debris excavated (i.e., large amounts of communication wire were encountered during the excavations)
- The depth of the water table

Air monitoring was performed during the teat pit operations with a radiation meter, and a PID meter. On site personnel performing the test pit excavations were required to maintain a Health and Safety Level of Protection, requiring at a minimum chemical resistant Saranex overalls, and Self Contained Breathing Apparatus's (SCBAs). Geo-Center personnel, if the conditions warranted, were to identify unexploded ordnance unearthed during the excavations.

2.6.2.1 Sampling Locations

As stated previously, the review of aerial photographs, a site reconnaissance, and the magnetometer survey were the basis for both the investigation and the corresponding sample locations.

A total of seven trenches (6-TB1 through 6-TB7) were identified in the investigation area. Trenches 6-TB5 and 6-TB6 when excavated, however, were joined into one long trench due to their proximity to each other.

Soil sampling locations, within each trench, were determined in the field based on visual observations and PID air monitoring results. Samples were collected at areas were elevated PID readings occurred. The investigation area and the corresponding trench locations are depicted in Figure 2-15.

2.6.2.2 Sampling Procedures

Upon delineation of the buried material, and the staking of perpendicular trench transects, trench excavation activities were initiated. Excavation was conducted with a Case 580 backhoe, equipped with a three-foot long bucket. Due to the heavily wooded area, which restricted back hoe access, trenches were no more than 10 feet in length and 10 feet in depth.

Samples were collected utilizing both grab and compositing methods. One sample was collected from each of the following test pits: 6TP2, 6-TP3, 6-TP4, 6-TP5, and 6-TP7. A duplicate sample was collected from test pit 6-TP5, and was given the sample designation of 6-TP5D. A sample was not collected from 6-TP1 because no PID readings or no visible soil staining and/or contamination. Test pit 6-TP5 had several, 1 and 5-gallon containers buried within it and an additional sample was taken of the waste material present in the container. Information regarding sample depth and findings were recorded in a field log book and transcribed onto Test Pit Logs. Appendix D (D.12) provides Test Pit Logs with descriptions of material encountered and approximate depth. No geological characterization was performed on test pits because several soil borings and well installation boreholes in the area provided a detailed subsurface description.

Excavated soil was stockpiled on the side and the trench backfilled upon completion. Also, the backhoe bucket was decontaminated with high-pressure steam before excavation activities were initiated and upon completion of each trench.

2.6.2.3 Analytical Requirements

Samples collected from the trenches were shipped for laboratory analysis to Ceimic. Sample were analyzed for full TCL (i.e., volatiles, semi-volatiles, pesticides, and PCBs) and full TAL (i.e., total metals) parameters. Both the TCL and TAL parameters were performed under Contract Laboratory Protocol and Level IV data quality. The second sample from test pit 6-TP5-02 was also sent to Ceimic, but had an Infrared Spectroscopy scan performed on it. All analytical results are presented in Appendix L.

2.6.3 Soil Investigation

The Phase II soil investigation was initiated to further evaluate areas of concern which were identified during the Phase I investigation and soil gas survey. The investigation consisted of drilling/installing five shallow soil borings (less than 10 feet bgs), and four shallow and seven deep soil borings which were completed as monitoring wells. The five soil borings were installed near the northern boundary of Site 82 to evaluate potentially impacted soils downgradient from a suspected source area (area identified from soil gas survey and Phase I analytical results). Moreover, the monitoring wells were installed within and adjacent to Sites 6 and 82. The following sections describe the field methods employed for the investigation.

2.6.3.1 Drilling Procedures

Drilling activities for the Phase II investigation commenced on March 3, 1993 and continued through April 13, 1993. The shallow soil borings were advanced by using a hand auger according to the procedures outlined in section Section 2.4.3.1. A hand auger was used to install these borings because access with a drill rig was not possible due to the marshy conditions near the borings. Soil borings advanced for shallow and deep monitoring well installation were completed using the same methods (i.e., shallow borings advanced using hollow stem augers and deep borings advanced using a combination of augers and mud rotary drilling) as those described in Section 2.4.3.1. Phase II drilling locations are shown on Figure 2-8 and the borings depths are provided in Appendix C (C.6 and C.11).

Two of the deep soil borings advanced for monitoring well installation, (referred to as "6GW15D Boring" in Appendix E, 6GW15D, and 6GW1DA, experienced difficulties drilling and well installation. The initial boring for deep well 6GW15D was advanced to 52 feet on March 290 and 31, 1993. The boring, however, could not be advanced below this depth because the drilling mud could not be circulated in the borehole (i.e., loss of circulation). Several attempts were made to advance this boring but were unsuccessful. Accordingly, a second boring (referred to as "6GW15D well" in Appendix E) was advanced to a depth of 160 feet in the vicinity of the initial boring for the installation of well 6GW15D. Note that the abandoned boring was backfilled to ground surface with a bentonite/grout slurry.

A similar situation also occurred at boring 6GW1DA (referred to as "6GW1DA Boring" in Appendix E). On April 3, 1993, the initial soil boring for deep well 6GW1DA was advanced to 127 feet but also experienced a loss of circulation. Accordingly, this boring was abandoned (i.e., backfilled with a bentonite/grout slurry) and a second boring (referred to as "6GW1DA well" in Appendix E) was advanced to a depth of 236.5 feet for the installation of well 6GW1DA.

2.6.3.2 Soil Sampling

Soil samples were collected from the shallow soil borings and the shallow and deep soil borings advanced for monitoring well installation. The locations of the soil samples are shown on Figure 2-8. The sampling procedures implemented during the Phase II investigation were the same as those described in Section 2.4.3.2. Samples collected from the hand auger borings were obtained from the surface and from just above the water table. Moreover, samples collected from the shallow and deep soil borings advanced for monitoring well installation were obtained from just above and just below the water table. Sample depths are summarized in Appendix C (C.6 and C.11). All samples were analyzed for TCL volatiles only because these compounds were the contaminants of concern identified during the Phase I investigation. Additionally, field QA/QC samples (i.e., trip blanks, field blanks, equipment rinsates, and duplicate samples) were collected at the same frequencies as those described on Table 2-6.

2.6.4 Groundwater Investigation

The Phase II groundwater investigation was initiated based on the analytical results from the Phase I investigation. The investigation consisted of monitoring well installation, staff gauge installation, water level measurements, and groundwater sampling. The following sections describe the methods employed during the investigation.

2.6.4.1 Monitoring Well Installation

Additional shallow (6GW31, 6GW32, 6GW33, and 6GW34) and deep (6GW1DA, 6GW30D, 6MW3D, 6GW15D, 6GW35D, 6GW36D, and 6GW37D) monitoring wells were installed at Sites 6 and 82 to further evaluate the horizontal extent of surficial VOC impacted groundwater, and the horizontal and vertical extent of deep VOC impacted groundwater. Three temporary shallow wells (TW-1, TW-2, and TW-3) were also installed to evaluate potential contaminant migration into Wallace Creek. As stated previously, the location of the Phase II monitoring wells was based on Phase I analytical data, and the soil gas survey. Table 2-20 provides a summary of well location rational for the Phase II wells.

Shallow Wells

Shallow monitoring wells 6GW32, 6GW33, and 6GW34 are located within Site 82 while 6GW31 is located within Lot 203 as shown on Figure 2-8. Wells 6GW32, 6GW33, and 6GW34 were installed to evaluate surficial groundwater quality downgradient from a suspected source area (believed to be located just north of Lot 203). Well 6GW31 was installed due to a surface spill (approximately 500 gallons was released) from a steel tank which contained well purge and development water from the Phase I groundwater investigation. Groundwater samples were collected from this well to confirm the presence or absence of contamination from the release.

The four shallow monitoring wells were installed by employing the same procedures (i.e., 3-1/4 and 8-1/4 inch HSA) as those described in Section 2.4.4.1. Further, the wells are constructed of the same materials (i.e., Schedule 40 PVC, 15-foot No. 10 slotted screen) as the Phase I wells, with the exception that 2-inch monitoring wells were installed. Two-inch wells were installed in lieu of 4-inch wells because the purpose of these wells was to collect representative groundwater samples, and were not intended to serve as recovery wells. The wells range in depth from 22 feet (6GW33) to 35 feet (6GW34). Well construction details are summarized on Table 2-21 and Test Boring and Well Construction Records are provided in Appendix E.

Three temporary wells were also installed during the Phase II investigation to evaluate surficial groundwater quality prior to discharging into Wallace Creek. The temporary wells located just south of Wallace Creek, and north of well 6GW32 as shown on Figure 2-8. The location of these temporary wells were based on information obtained from the soil gas survey, and from analytical data obtained from 6GW32 (Phase II monitoring well).

The temporary wells were installed at approximately 4-feet bgs with a hand auger. The wells were constructed of 2-inch, screened PVC. The space between the well screen and borehole was backfilled with a sand pack (Number 2 silica sand) to the ground surface. Following groundwater sample collection, the wells were removed and backfilled with sand.

TABLE 2-20

PHASE II MONITORING WELL SUMMARY AND RATIONALE
SITES 6 and 82
REMEDIAL INVESTIGATION CTO-0133
MCB CAMP LEJEUNE, NORTH CAROLINA

Site No.	Well Designation	General Location	Purpose
6	6GW31	Western portion of Lot 203	Evaluate potentially impacted surficial groundwater from surface release
82	6GW32, 6GW33, and 6GW34	Northern, central and eastern portions of Site 82	Surficial groundwater quality downgradient from a potential source area
6	6GW15D and 6MW3D	Northwestern portion of Lot 203; east of Piney Green Road	Deep groundwater quality upgradient - horizontal extent
82	6GW30D, 6GW35D, 6GW36D, and 6GW37D	North, northwest, and west of Site 82	Deep groundwater quality downgradient - horizontal extent
6	6GW1DA	Southeastern portion of Site 82	Deep groundwater quality - vertical extent

TABLE 2-21

SUMMARY OF PHASE II SHALLOW AND DEEP WELL CONSTRUCTION DETAILS
SITES 6 and 82
REMEDIAL INVESTIGATION CTO-0133
MCB CAMP LEJEUNE, NORTH CAROLINA

Well No.	Date Installed	Top of PVC Casing Elevation (1) (feet, above msl)	Ground Surface Elevation (feet, above msl)	Boring Depth (feet, below ground surface)	Well Depth (feet, below ground surface)	Screen Interval Depth (feet, below ground surface)	Depth to Sand Pack (feet, below ground surface)	Depth to Bentonite (feet, below ground surface)	Stick-Up (feet, above ground surface)
6GW31 (2)	03/02/93	30.26	27.8	27.0	25.5	11.4 - 24.6	9.4	7.4	2.4
6GW32 (2)	03/06/93	21.79	19.6	27.0	27.0	11.3 - 26.6	10.0	7.0	2.2
6GW33 (2)	03/03/93	22.42	20.0	22.0	22.0	6.2 - 21.6	4.5	3.0	2.4
6GW34 (2)	03/03 - 03/05/93	32.01	29.0	35.0	35.0	19.3 - 34.6	17.5	15.0	3.0
6GW1DA (3)	04/13/93	35.23	32.7	236.5	230.0	220.1 - 229.6	215.0	190.0	2.5
6GW15D (3)	04/06/93	28.20	25.2	160.0	155.0	145.0 - 154.6	141.0	139.0	3.0
6GW30D (2)	03/03 - 03/04/93	11.90	9.9	161.9	100.0	90 - 99.6	83.0	76.5	1.4
6GW35D (3)	03/05 - 03/07/93	14.29	12.0	201.0	105.0	95.0 - 104.6	90.0	87.0	2.9
6GW36D (3)	03/18 - 03/19/93	17.61	15.6	201.5	95.0	73.3 - 94.6	66.0	62.0	2.0
6GW37D (3)	03/09/93	15.96	14.0	111.5	95.0	76.1 - 94.6	73.0	70.0	1.9
6MW3D (3)	03/20; 03/31/93	35.18	34.2	201.5	118.0	97.5 - 117.6	94.0	88.0	1.6

Notes: (1) msl - mean sea level. Note that top of casing for well 6GW1DA was stainless-steel, not PVC.
(2) Shallow Well
(3) Deep Well
Horizontal positions are referenced to N.C. State Plane Coordinate System (NAD27) CF = 0.9999216 from USMC Monument Toney. Vertical datum NGVD 29.

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Deep Wells

Seven deep wells were installed during the Phase II investigation. Monitoring wells 6GW15D (upgradient well), 6MW3D (upgradient well), 6GW30D (downgradient well), 6GW35D (downgradient well), 6GW36D (downgradient well), and 6GW37D (downgradient well) were installed to evaluate the horizontal extent of contamination while 6GW1DA (installed in an area believed to be near the contamination source) was installed to evaluate the vertical extent of contamination. The locations of these wells were selected based on analytical data from the Phase I groundwater investigation. The locations of these wells are shown on Figure 2-8.

The Phase II deep monitoring wells were installed by employing the same drilling techniques (i.e., combination of hollow-stem augers and mud rotary) as implemented for the Phase I deep wells. Several items, however, were changed or modified regarding the well construction. All Phase II deep wells are constructed of 2-inch PVC with the exception of 6GW1DA which is constructed of 2-inch stainless-steel. Stainless steel was utilized because of the greater depth of this well (stainless-steel is more durable than PVC) and because the well was installed in a potentially highly contaminated area (which may cause vinyl chloride to leach from the PVC) based on the analytical results of 6GW1D. Note that 10- to 20-foot length screens (No. 10 slotted) were used to allow for monitoring of the varying thicknesses of the higher water-producing zones. Table 2-21 provides a summary of the well construction details and Test Boring and Well Construction Records are provided in Appendix E.

Determination of the final well depth for the Phase II deep wells was based on several factors which were evaluated in the field during the drilling program. These factors included: (1) the depth (bottom elevation) of known contamination; and (2) volatile organic levels in soil samples (split-spoon samples collected during drilling) based on PID measurements. The following provides an explanation of the procedures employed for determining the final well depth.

The borings advanced for the Phase II deep wells (i.e., wells installed to evaluate the horizontal extent) were first advanced from approximately 110 to 200 feet bgs. Split-spoon soil samples were collected at approximate 5 to 15-ft intervals during drilling. Samples were collected to these depths because contamination was known to exist at these depths based on contaminant levels exhibited in former supply well HP-651 [which is located just east of

Lot 203 (refer to Section 3.10 for additional information on this supply well)] and from the results of the Phase I Investigation. The soil samples upon collection were placed in eight ounce jars, sealed with aluminum foil and the jar lid, and heated in a crock pot for approximately 10 minutes. The headspace of the sample was then screened with a PID or OVA meter to measure for the presence or absence of volatile organic vapor. Subsequently, these measurements were used to determine the final well depth.

The following scenarios were encountered with the final determination of well depth as explained below:

- In cases where volatiles were not detected by PID or OVA screening to a depth of 200 feet, the borings were backfilled (with a grout/bentonite slurry) to an approximate bottom elevation of Phase I deep well 6GW1D (since contamination is known to exist at this elevation). The wells were then screened at the approximate elevation as 6GW1D.

- In cases where volatiles were detected below 200 feet by PID or OVA screening, the wells were installed approximately 10 to 15 feet below where the level of volatiles decreased to background concentrations.

Selection of the final well depth for monitoring well 6GW1DA, which was installed to evaluate the vertical extent of contamination, was based on a combination of field screening measurements and the lithology of the soils encountered. This well was installed just above a clay unit which was encountered at 230 feet bgs. As described above, this well is constructed of 2-inch stainless-steel.

2.6.4.2 Staff Gauge Installation

Two staff gauges (SGWC1 and SGWC2) were installed in Wallace Creek to evaluate surface water fluctuations and to assist in determining surficial groundwater flow patterns in the area. The gauges are located near the intersections of Wallace Creek and Piney Green Road (SCWC1) and Wallace Creek and Holcomb Boulevard (SGWC2) as shown on Figure 2-8. Further, the gauges were surveyed in place (both vertical and horizontal) according to the procedures outlined in Section 2.4.4.3.

2.6.4.3 Well Development Procedures

The newly installed shallow and deep monitoring wells were developed following well construction and curing of the bentonite/grout seal. The wells were developed by employing the same procedures as those mentioned in Section 2.4.4.2 for both shallow and deep wells. Well Development Forms summarizing well development information in provided in Appendix G.

2.6.4.4 Water Level Measurements

Static water level measurements were collected from the Phase I and II (with the exception of wells 6GW1DA and 6GW15D because these wells were not completed) shallow and deep wells, and existing shallow wells on April 1, 1993. Additionally, staff gauge measurements were also obtained on April 1, 1993 from Wallace Creek and Bear Head Creek. The measurements were collected using the same procedures as those described in Section 2.4.4.3.

2.6.4.5 Groundwater Sampling

Groundwater samples were obtained from all Phase II monitoring wells (round one for Phase II wells) from March 18 to May 3, 1993. Additionally, a second round of groundwater samples were also obtained from all Phase I (Sites 6, 9, and 82 shallow and deep wells) and existing wells from March 18 through March 23, 1993.

The Phase II wells (along the Phase I and existing wells) were sampled by employing the same procedures as those described in Section 2.4.4.5. The groundwater samples were analyzed for parameters based on the Phase I groundwater results. The following summarizes the analytical program:

- Site 9 (round 2) - volatiles (601 and 602):
  - semivolatiles
  - pesticides/PCBs
  - TAL total metals
  - TAL dissolved metals

- Sites 6 and 82 (round 2) - volatiles (601 and 602)

- Sites 6 and 82 (Phase II wells):

- Shallow wells - volatiles (601 and 602):
  - semivolatiles
  - pesticides/PCBs
  - TAL total metals
  - TAL dissolved metals

- Deep wells - volatiles (601 and 602):

  - Field QA/QC samples (i.e., trip blanks, field blanks, equipment rinsates, and duplicate samples) were also collected during the Phase II groundwater field program at the same frequencies as described in Section 2.4.4.5.

Note that the groundwater samples from the Phase II deep wells were only analyzed for volatiles because these compounds are the contaminants of concern in the deep groundwater based on the based on the Phase I results. Additionally note that two samples, one from the top of the water column and one from the bottom of the well, were collected from well 6GW1DA to evaluate the vertical distribution of contaminants. A teflon constructed point source bailer was used to obtain these samples which allowed for discrete interval sampling from within the well. It should be noted that although discrete depths were sampled from this well, the samples may not accurately depict contaminant levels at those depths because of the vertical intermixing of groundwater within the aquifer.

2.7 Decontamination Procedures

Decontamination procedures performed in the field were initiated in accordance with EPA Region IV guidelines. In general, sampling and drilling equipment were divided into two decontamination groups: heavy equipment and routine sample collection equipment. Heavy equipment included: the drill rig, hollow-stem augers, and drill rods; routine sample collection equipment included: split-spoons, stainless-steel spoons and bowls, bailers, bailer wire, hand auger bucket, and sediment corer, etc..

For heavy equipment, the following procedures were implemented:

- Removal of caked-on soil with brush;
- Steam clean with high-pressure steam; and
- Air dry

Note that the well screens for each well were also steam cleaned with high-pressure steam prior to installation.

For routine sample collection equipment, the following procedures were implemented:

- Clean with potable water and laboratory phosphate-free detergent (Alconox soap solution);
- Rinse thoroughly with potable water;
- Rinse thoroughly with deionized water;
- Rinse twice with 10 percent nitric acid;
- Rinse thoroughly with deionized water;
- Rinse twice with pesticide-grade isopropanol alcohol;
- Air dry; and
- Wrap in aluminum foil, if appropriate

Temporary decontamination pads, constructed of wood and plastic, were constructed to minimize spillage onto the ground surface. Decontamination fluids generated during the field program were containerized and handled according to the procedures outlined in Section 2.7.

2.8 Investigative Derived Waste (IDW) Handling

A large volume of solids (approximately 20 cubic yards) and liquids (approximately 6,000 gallons) were generated during the field program at OU No. 2. Solid IDW included soil cuttings, excess split-spoon samples and drilling mud; liquid IDW included well development and purge water, and decontamination fluids (i.e., water, Alconox soap solution, isopropanol alcohol, and 10 percent nitric acid).

Containerization and handling of solids were performed in two phases. At the completion of drilling activities, soils were temporarily stockpiled on plastic sheeting and covered or placed in 55-gallon drums. Afterwards, the soils and drilling mud were transported and emptied into

3.0 PHYSICAL CHARACTERISTICS OF THE STUDY AREA

This section contains a discussion of the physical characteristics of Sites 6 and 9 (refer to as Operable Unit No. 2 or OU No. 2) including: surface features, meteorology, hydrology, geology, soils, hydrogeology, land use, ecology, and water supply well inventories. This information was obtained from the RI field activities and available literature pertaining to MCB Camp Lejeune.

3.1 Surface Features

The topography of MCB Camp Lejeune is relatively flat with ground surface elevations ranging from mean sea level (msl) to 72 feet above msl. Most of MCB Camp Lejeune lies between 20 and 40 feet msl. The terrain of Camp Lejeune is typical of the North Carolina Coastal Plain. Drainage is generally to the New River and the Atlantic Ocean via the Intracoastal Waterway.

OU No. 2 is dominantly a flat area with some elevation variations occurring near the northern portion of Site 82. Overall, the surface elevation at OU No. 2 ranges between 5 to 30 feet above msl (Figure 3-1). The highest elevations of OU No. 2 are encountered in the vicinity of Site 82 where the elevation increases to approximately 30 feet above msl. Elevations drop off sharply at the banks of Wallace Creek located along the northern portion of Site 82 and Bear Head Creek located in the wooded area south of Lot 201. The terrain near the northern portion of Site 82 indicates that drainage would be toward Wallace Creek while the terrain near the southern portion of Site 6 (or northern portion of Site 9) indicates that drainage would be toward Bear Head Creek.

Several major land surface features are present at OU No. 2. These features include a large ravine area, a smaller ravine area, surface depressions, and mounds as shown on Figure 3-1. The large ravine area, which has been discussed throughout this report (refer to Section 2.1.1.3), is located north of Lot 203. This larger ravine is approximately 40 feet in width at its widest point (southern end) and extends from just north of Lot 203 to Wallace Creek (approximately 1,250 feet in length). A smaller ravine area is also located near the eastern boundary of Site 82, northeast of monitoring well 6GW1S. This smaller ravine is approximately 20 feet in width at its widest point and extends approximately 600 feet in the north to south directions. Surface water was noted in the larger ravine periodically while surface water was not noted in the smaller ravine.

A series of depressions and mounded areas are also present near the southern portion of Site 82. Some of these features do not appear to be naturally occurring land features. The depressions appear to be former excavation areas while the mounded areas appear to be associated with excavations. Within some of these mounds, a large number of 5-gallon pails were noted. These pails contain suspected solvents or lubrication oils.

3.2 Meteorology

MCB Camp Lejeune is located within the Coastal Plain physiographic division of North Carolina. Coastal Plain elevations range from 200 feet above msl at the western boundary to generally 30 feet or less in areas of tidal influence to the east. The tidal portion of the Coastal Plain, where Camp Lejeune is situated, is generally flat and swampy.

Although coastal North Carolina lacks distinct wet and dry seasons, there is some seasonal variation in average precipitation. July tends to receive the most precipitation and rainfall amounts during summer are generally the greatest. Daily showers during the summer are not uncommon, nor are periods of one or two weeks without rain. Convective showers and thunderstorms contribute to the variability of precipitation during the summer months. October tends to receive the least amount of precipitation, on average. Throughout the winter and spring months precipitation occurs primarily in the form of migratory low pressure storms. Camp Lejeune's average yearly rainfall is approximately 52 inches. Table 3-1 presents a climatic summary of data collected during 27 years (January 1955 to December 1982) of observations at Marine Corps Air Station (MCAS) New River.

Coastal Plain temperatures are moderated by the proximity of the Atlantic Ocean. The ocean effectively reduces the average daily fluctuation of temperature. Lying 50 miles offshore at its nearest point, the Gulf Stream tends to have little direct effect on coastal temperatures. The southern reaches of the cold Labrador Current offsets any warming effect the Gulf Stream might otherwise provide.

Camp Lejeune experiences hot and humid summers; however, ocean breezes frequently produce a cooling effect. The winter months tend to be mild, with occasional brief cold spells. Average daily temperatures range from 38° F to 58° F in January and 72° F to 86° F in July. The average relative humidity, between 75 and 85 percent, does not vary greatly from season to season.

TABLE 3-1

CLIMATIC DATA SUMMARY FOR MCAS NEW RIVER
REMEDIAL INVESTIGATION CTO-0133
MCB CAMP LEJEUNE, NORTH CAROLINA

	Precipitation (Inches)			Relative Humidity (Percent)	Temperature (Fahrenheit)			Mean Number of Days With				
								Precipitation		Temperature		
	Maximum	Minimum	Average		Maximum	Minimum	Average	>=0.01"	>=0.5"	>=90 F	>=75 F	<=32 F
January	7.5	1.4	4.2	76	54	34	44	11	2	0	1	14
February	7.0	1.5	3.8	74	57	36	46	9	3	0	1	11
March	8.0	0.8	3.5	78	64	42	53	10	2	0	5	7
April	6.5	0.5	3.0	79	73	51	62	8	2	--	14	--
May	8.4	1.7	4.3	86	80	60	70	10	3	2	25	0
June	11.8	2.4	5.8	85	85	67	76	11	4	6	29	0
July	14.3	4.5	8.0	85	88	72	80	14	5	12	31	0
August	12.6	1.7	6.1	87	87	71	80	12	4	11	31	0
September	12.2	1.4	4.7	87	83	66	75	9	3	3	27	0
October	6.5	0.7	2.8	82	74	54	64	7	2	--	16	--
November	5.7	0.6	2.6	80	66	44	55	7	1	0	6	4
December	6.1	0.4	4.0	77	58	37	48	9	2	0	2	11
Annual	14.3	0.4	52.8	81	72	53	63	117	33	34	188	47

-- Less than 0.5 days
Source: Naval Oceanography Command Detachment, Asheville, North Carolina. Measurements obtained from January 1955 to December 1982.

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Observations of sky conditions indicate yearly averages of approximately 112 days clear, 105 partly cloudy, and 148 cloudy. Measurable amounts of rainfall occur 120 days per year, on the average. Prevailing winds are generally from the south-southwest 10 months of the year, and from the north-northwest during September and October. The average wind speed for MCAS New River is 6.9 m.p.h.

3.3 Surface Water Hydrology

The majority of MCB Camp Lejeune is nearly level with wide, undissected interstream areas in which drainage is poor and water movement is slow. The New River is the dominant surface water feature and receives drainage from most of the base. It flows in a southerly direction and empties into the Atlantic Ocean through the New River Inlet.

OU No. 2 is located approximately 1.75 miles east of the New River and 12.5 miles north of the New River's outlet into the Atlantic Ocean. Two drainages exist within and adjacent to OU No. 2. Wallace Creek forms the northern border of Site 82 and flows in a southwesterly direction toward the New River. Wallace Creek is surrounded by marsh that exhibits extensive surface ponding. Bear Head Creek lies within the southern portion of Site 6 and empties into Wallace Creek approximately 0.75 miles downstream from the site.

The NC DEHNR classifies bodies of water within the state according to their designated use. Wallace Creek from its source to the New River and Bear Head Creek from its source to Wallace Creek are designated as Class SB NSW surface waters. The Class SB NSW designation denotes tidal saltwaters protected for primary recreation, fishing and for the propagation and survival of aquatic life.

Tide data was obtained from the National Oceanic and Atmospheric Administration's (NOAA) Hampton Roads, Virginia station in order to quantify tidal effects on the New River and associated tributaries. A correction factor for the New River was applied to tidal data collected from August 1, 1992 to September 18, 1992. High and Low tide data are summarized on Table 3-2.

TABLE 3-2

**TIDE DATA FOR THE NEW RIVER IN JACKSONVILLE, NORTH CAROLINA
REMEDIAL INVESTIGATION CTO-0133
MCB CAMP LEJEUNE, NORTH CAROLINA**

Date	High Tide		Low Tide	
	Time	Height (feet)	Time	Height (feet)
08/01/92	13.1	1.74	7.9	0.88
	NA	NA	20.3	0.92
08/02/92	1.5	1.62	NA	NA
	14.1	1.62	8.8	0.84
	NA	NA	21.2	0.90
08/03/92	2.5	1.55	9.5	0.93
	15.0	1.64	22.2	0.92
08/04/92	3.3	1.52	10.1	0.95
	16.5	1.67	22.6	1.05
08/05/92	4.5	1.54	11.4	1.05
	16.9	1.62	NA	NA
08/06/92	NA	NA	0.4	1.02
	5.4	1.47	12.4	1.03
	18.1	1.59	NA	NA
/07/92	NA	NA	1.3	1.04
	6.3	1.49	13.3	1.04
	19.0	1.59	NA	NA
08/08/92	NA	NA	2.0	1.08
	7.3	1.47	14.4	1.02
	20.1	1.58	NA	NA
08/09/92	8.6	1.44	3.4	1.02
	20.8	1.55	15.4	1.03
08/10/92	9.6	1.50	4.1	1.02
	21.8	1.59	16.2	1.01
08/11/92	10.2	1.52	4.9	1.03
	NA	NA	16.9	1.02
08/12/92	0.3	1.72	NA	NA
	11.1	1.57	5.7	0.99
	22.8	1.59	17.6	0.96
08/13/92	11.4	1.59	6.1	1.02
	NA	NA	18.0	1.06
08/14/92	.04	1.81	NA	NA
	11.9	1.76	6.4	1.19
	NA	NA	19.0	1.21
08/15/92	0.4	1.84	NA	NA
	12.6	1.79	8.0	1.27
	NA	NA	19.7	1.20
08/16/92	1.0	1.76	NA	NA
	13.0	1.73	7.7	1.22
	NA	NA	19.9	1.16

Date	High Tide		Low Tide	
	Time	Height (feet)	Time	Height (feet)
08/17/92	1.4	1.67	NA	NA
	13.7	1.66	8.2	1.11
	NA	NA	20.4	1.14
08/18/92	1.9	1.62	NA	NA
	14.5	1.65	8.6	1.09
	NA	NA	21.4	1.12
08/19/92	2.7	1.55	9.3	1.05
	15.2	1.64	22.2	1.13
08/20/92	3.7	1.54	10.0	1.12
	15.4	1.66	23.3	1.17
08/21/92	4.2	1.55	11.2	1.13
	16.6	1.64	NA	NA
08/22/92	NA	NA	0.2	1.14
	5.0	1.51	12.0	1.06
	17.6	1.58	NA	NA
08/23/92	NA	NA	0.9	1.07
	6.1	1.48	13.1	1.02
	18.7	1.60	NA	NA
08/24/92	NA	NA	2.0	1.05
	7.3	1.52	14.2	1.01
	20.0	1.64	NA	NA
08/25/92	NA	NA	3.1	1.02
	8.4	1.56	15.1	0.95
	21.0	1.65	NA	NA
08/26/92	9.2	1.59	4.0	0.95
	21.8	1.71	16.2	0.90
08/27/92	10.3	1.71	5.0	0.97
	22.5	1.74	17.3	0.95
08/28/92	11.2	1.73	6.0	0.95
	NA	NA	18.5	0.89
08/29/92	0.5	1.64	NA	NA
	12.5	1.81	6.9	0.97
	NA	NA	19.5	0.96
08/30/92	0.9	1.74	NA	NA
	12.9	1.75	7.7	0.96
	NA	NA	20.2	0.93
08/31/92	1.4	1.57	NA	NA
	14.1	1.61	8.5	0.84
	NA	NA	21.0	0.91
09/01/92	2.5	1.56	NA	NA
		NA	9.2	0.96
	14.8	1.65	21.9	1.00

Date	High Tide		Low Tide	
	Time	Height (feet)	Time	Height (feet)
09/02/92	3.1	1.52	10.4	0.94
	15.6	1.59	22.8	0.98
09/03/92	4.1	1.45	11.0	0.95
	16.7	1.55	NA	NA
09/04/92	NA	NA	0.2	1.02
	4.8	1.39	12.0	0.99
	17.7	1.53	NA	NA
09/05/92	NA	NA	0.7	1.02
	6.2	1.44	13.2	1.04
	18.8	1.58	NA	NA
09/06/92	NA	NA	1.7	1.15
	7.2	1.60	14.1	1.15
	19.9	1.68	NA	NA
09/07/92	NA	NA	2.7	1.23
	8.1	1.62	14.9	1.17
	20.4	1.66	NA	NA
09/08/92	8.8	1.55	3.4	1.12
	21.1	1.59	15.7	1.08
09/09/92	9.6	1.55	4.0	1.04
	21.9	1.57	16.5	1.04
09/10/92	10.4	1.54	4.8	0.99
	22.5	1.55	17.2	1.02
09/11/92	10.8	1.66	4.8	1.05
	23.3	1.66	18.1	1.12
09/12/92	11.4	1.71	6.1	1.14
	23.7	1.64	18.5	1.12
09/13/92	12.1	1.69	6.7	1.09
	NA	NA	18.9	1.10
09/14/92	0.3	1.64	NA	NA
	12.7	1.70	7.0	1.08
	NA	NA	19.8	1.11
09/15/92	0.9	1.61	NA	NA
	13.1	1.69	7.6	1.07
	NA	NA	20.2	1.11
09/16/92	1.4	1.58	NA	NA
	13.9	1.62	8.1	1.05
	NA	NA	21.0	1.04
09/17/92	2.2	1.50	9.1	1.00
	14.6	1.57	21.8	1.02
09/18/92	2.9	1.43	9.8	0.96
	15.4	1.56	22.8	1.03

Source: NOAA Tide Station in Hampton Roads, Virginia
NA - Not Available

3.4 Geology

The following sections contain the regional geology of MCB Camp Lejeune and the site-specific geology of OU No. 2.

3.4.1 Regional Geology

MCB Camp Lejeune is located in the Atlantic Coastal Plain physiographic province. The sediments of the Atlantic Coastal Plain consist of interbedded sands, clays, calcareous clays, shell beds, sandstone, and limestone. These sediments are layered in interfingering beds and lenses that gently dip and thicken to the southeast. Regionally, they comprise 10 aquifers and nine confining units which overlie igneous and metamorphic basement rocks of pre-Cretaceous age. These sediments were deposited in marine or near-marine environments and range in age from early Cretaceous to Quaternary time. Table 3-3 presents a generalized stratigraphic column for Jones and Onslow Counties, North Carolina (Harned et al., 1989).

United State Geological Survey (USGS) studies at MCB Camp Lejeune indicate that the area is underlain by sand and limestone aquifers separated by confining units of silt and clay. These include the water table (surficial), Castle Hayne, Beaufort, Peedee, Black Creek, and upper and lower Cape Fear aquifers. The combined thickness of these sediments is approximately 1,500 feet. Less permeable clay and silt beds function as confining units or semi-confining units which separate the aquifers and impede the flow of groundwater between aquifers. A generalized hydrogeologic cross-section of this area is presented in Figure 3-2. This cross-section illustrates the relationship between the aquifers in this area (Harned et al., 1989).

3.4.2 Site Geology

Numerous soil borings were advanced in the surficial (depth less than 25 feet bgs) and deep (depth greater than 100 feet) soils within the vicinity of OU No. 2. The following provides a detailed description of the surficial and deeper subsurface soils.

3.4.2.1 Surficial Soil Conditions

Surficial soil conditions are generally uniform throughout OU No. 2. In general, surficial soils consist of unconsolidated deposits of silty and clayey sand, silt, and clay. These soils represent

TABLE 3-3

GEOLOGIC AND HYDROGEOLOGIC UNITS IN
THE COASTAL PLAIN OF NORTH CAROLINA
REMEDIAL INVESTIGATION CTO-0133
MCB CAMP LEJEUNE, NORTH CAROLINA

GEOLOGIC UNITS			HYDROGEOLOGIC UNITS
System	Series	Formation	Aquifer and Confining Unit
Quaternary	Holocene/ Pleistocene	Undifferentiated	Surficial aquifer
Tertiary	Pliocene	Yorktown Formation[1]	Yorktown confining unit
			Yorktown aquifer
	Miocene	Eastover Formation[1]	
		Pungo River Formation[1]	Pungo River confining unit
			Pungo River aquifer
			Castle Hayne confining unit
	Oligocene	Belgrade Formation[2]	Castle Hayne aquifer
		River Bend Formation	
	Eocene	Castle Hayne Formation	Beaufort confining unit[3]
			Beaufort aquifer
	Paleocene	Beaufort Formation	
Cretaceous	Upper Cretaceous	Peedee Formation	Peedee confining unit
			Peedee aquifer
		Black Creek and Middendorf Formations	Black Creek confining unit
			Black Creek aquifer
		Cape Fear Formation	Upper Cape Fear confining unit
			Upper Cape Fear aquifer
			Lower Cape Fear confining unit
			Lower Cape Fear aquifer
	Lower Cretaceous[1]	Unnamed deposits[1]	Lower Cretaceous confining unit
			Lower Cretaceous aquifer[1]
Pre-Cretaceous basement rocks		--	--

Notes:
(1) Geologic and hydrologic units probably not present beneath Camp Lejeune.
(2) Constitutes part of the surficial aquifer and Castle Hayne confining unit in the study area.
(3) Estimated to be confined to deposits of Paleocene age in the study area.

Source: Harned et al., 1989

the Quaternary "undifferentiated" formation which characterize the surficial aquifer. Sands are fine to coarse-grained and contain varied amounts of silt (5% to 50%) and clay (5% to 20%). Results of standard penetration tests (commonly referred to as "blow counts," ASTM 1586), indicate that the sands have a relative density of loose to dense. Further, the sands classify as SM and/or SC according to the Unified Soil Classification System (USCS). Silts are generally inorganic (ML) with the exception of organic silts encountered near Wallace Creek, Bear Head Creek, and the ravine (saturated conditions). Clays are plastic to nonplastic, contain varied amounts of silt and sand (5% to 25 %), and classify as CL (inorganic clays). Standard penetration results for cohesive soils (clays and silts) indicate a relative density of medium stiff to stiff.

Several areas investigated within OU No. 2 contain large amounts of fill or reworked material. These materials were encountered throughout Lot 201, Lot 203, and portions of Site 9. Historical aerial photographs revealed that soils within and adjacent to the Lot 203 have been excavated and reworked extensively over the years. Soil boring data indicates that fill material exists in these areas to depths greater than five feet bgs in some cases.

Geologic cross-sections depicting surficial soil conditions underlying OU No. 2 were developed based on information obtained during the Phase I and Phase II drilling programs. As shown on Figure 3-3, two cross-sections within OU No. 2 were traversed for the surficial soils. In general, cross-section A to A' traverses north to south (soil borings 6GW30 to 9GW4) while cross-section B to B' traverses west to east (soil borings 6GW21 to 6GW25).

Geologic cross-section A-A' is presented on Figure 3-4. Surficial soils encountered traversing north to south across OU No. 2 are generally uniform. This area is predominantly underlain by silty sand (SM) with thin interbedded layers of silt (ML or MH) and clay (CL). The sand was typically encountered from just below the ground surface to approximately 25 feet bgs where the shallow borings were terminated. Thin laterally discontinuous layers of silt (1 to 3 feet thick) are present near the northern and southern boundaries of OU No. 2. Additionally, a thin laterally discontinuous layer of clay is present in the vicinity of soils boring 9GW6.

Surficial soils encountered along the general northwest to southeast direction across the site are illustrated on Figure 3-5. Soils encountered along the B-B' traverse are similar to those described for the A-A' traverse. Silty sands underlie the area with thin interbedded layers of silt. The silty sands were encountered to a depth of approximately 25 feet bgs where the borings were terminated. Thin laterally discontinuous layers of silt (approximately 1 to 2.5

feet thick) were encountered in soil borings 6GW21 (located west of Lot 203) and 6GW18 (located in the wooded area east of Lot 201).

Overall, the surficial soils encountered at OU No. 2 were generally consistent throughout. The dominant soil type encountered was a silty sand. Within the area investigated, a laterally continuous confining layer (i.e., one which displays a low enough permeability to impede the migration of contaminants to any stratigraphically lower water-bearing zones) was not encountered.

3.4.2.2 Deep Soil Conditions

Soils were classified during the Phase I and Phase II drilling programs to a maximum depth of 236 feet bgs. Additional information on deep subsurface soil conditions to 310 feet bgs was also obtained from boring logs of supply wells (Hadnot Point supply wells) in the area. The following summarizes deep subsurface soil conditions underlying OU No. 2.

Deeper subsurface soils (below 25 feet) are also generally consistent throughout the site. In general, the deeper subsurface soils consist of fine to medium-grained silty sand, silt, silty-sandy clay, and sandy-marly limestone fragments (gravel size). The appearance and classification (SM) of the deeper sands are similar to that described for the surficial sands. Below a depth of 50 to 60 feet, however, the sands become very dense to hard (blow counts above 50). Large amounts of shell fragments were noted frequently in the sands. Thin lenses of clay are interbedded within the sands. The clays contain trace (up to 10 percent) to little (10 percent to 20 percent) amounts of silt and sand, and are non-plastic to slightly plastic. Limestone is interbedded within the sands or occurs as separate units. The limestone contains mixtures of sand and limey mud (marl). This sandy-marly limestone is reported in the literature as representing the Castle Hayne aquifer (Harned, et al, 1989).

Geologic cross-sections depicting deeper subsurface soil conditions underlying OU No. 2 were also developed (refer to Figure 3-3). In general, cross section C to C' traverses north to south (supply well borings HP-653 to HP-635) while cross-section D to D' traverses west to east (supply well borings HP-633 to deep monitoring well boring 6MW3D).

Geologic cross-section C-C' is shown on Figure 3-6. In general, deeper subsurface soils along this traverse consist of silty sand, clay, and limestone fragments (referred to as limestone, sandy limestone, and marly limestone because of its varied nature).

The upper silty sand unit, which is encountered from the ground surface, ranges in thickness from approximately 40 to 140 feet. This silty sand unit is thickest in the southern portion of the site and decreases toward the northern portion of the site. Within the upper silty sand unit, thin laterally discontinuous layers of clay (borings HP-653 and 6GW2D) and limestone (boring HP-635) are present. The clay varies in thickness from approximately 2 to 10 feet while the limestone varies in thickness from approximately 3 to 5 feet.

Underlying the upper silty sand is a limestone unit. The limestone unit varies in thickness from approximately 5 feet near the southern portion of the site to 80 feet near the northern portion of the site.

Silty sands (lower unit) underlie the limestone unit to a depth of 310 feet bgs (estimated depth). At boring location HP-651, laterally discontinuous layers of clay (approximately 10 feet thick) and limestone (approximately 10 feet) are present at 230 feet and 250 feet deep, respectively.

Geologic cross-section D to D' is shown on Figure 3-7. In general, deeper subsurface soils along this traverse also consist of silty sand, silt, clay, and limestone. Silty sands (upper silty sand unit), which are also encountered from ground surface, range in thickness from 40 feet near the eastern portion of the site (HP-651) to 120 feet just west of Holcomb Boulevard (HP-633). Within the upper silty sand unit, discontinuous to partly continuous interbedded layers of clay (boring 6GW1D and HP-653 ranging in thickness from approximately 1 to 20 feet), silt (boring 6GW28D approximately 5 feet thick), and limestone (boring 6GW1D approximately 10 feet thick) are present. The clay layer within the upper silty sand unit is partly continuous across the site since it is present from borings HP-653 to 6GW2D and at boring 6GW1D (very thin).

A limestone unit (upper limestone unit) is present underlying the upper silty sand unit. This unit varies in thickness from approximately 20 feet just west of Holcomb Boulevard to approximately 140 feet just east of Piney Green Road. Subsequently, the limestone unit appears to decrease in thickness westward across the site.

Underlying the upper limestone unit are alternating sequences of silty sand (approximately 30 feet thick), limestone (approximately 3 to 35 feet thick), and silty sand (approximately 20 to 80 feet thick) to a depth of approximately 310 feet bgs. In general, the limestone unit which separates the silty sands is thinner compared to the silty sands. Moreover, this limestone unit generally becomes thinner eastward across the site.

3.5 Test Pits

3.5.1 Phase I Test Pits

The Phase I exploratory excavations (test pits) completed in September 1992, revealed the presence of buried debris. The material unearthed has been classified as "Military/Construction Debris" for purposes of this study. Buried debris was encountered at several locations and consisted primarily of the following:

- Communication wire
- Spent casings (95 to 105 mm cartridges)
- Scrap metal
- Rebar and wire
- Battery packs
- 5-gallon Buckets

In addition, isolated areas contained burned material/residue within the test pit. Some anomalies identified in the geophysical survey, which did not correlate with trench and fill locations depicted on aerial photographs, were also investigated. The test pits associated with the anomalies revealed buried wood and trace amounts of scrap metal in some cases. It should be noted that these areas were not surveyed in and may have deviated from the actual anomaly detected in the geophysical survey. A detailed description of contents encountered and the approximate depth is illustrated on the test pit logs presented in Appendix D.12.

3.5.2 Phase II Test Pits

The Phase II test pits completed in April 1993, also revealed the presence of buried debris. Communication wire was noted in four (6-TP1, 6-TP2, 6-TP3, and 6-TP4) of the six excavations. In test pits 6-TP5 and 6-TP7, numerous 1- and 5-gallon containers were noted in the excavations. The materials present in the containers appeared to be grease or a lubrication oil, which was greenish-blue in color. Samples of the material were retained for laboratory analysis. Appendix D.12 contains the Test Pit Records which describe the materials encountered during the excavations.

3.6 Soils

Information regarding site soil conditions was obtained from the Soil Survey publication prepared by the U.S. Department of Agriculture - Soil Conservation Service (SCS) for Camp Lejeune, North Carolina (SCS, 1984). As part of the RI, a limited number of soil samples were evaluated for geotechnical properties and classified according to the Universal Soil Classification System (USCS). The findings of that evaluation were used to confirm SCS survey results. Due to past burial and excavation activities at OU No. 2, however, the soils described in the SCS publication may differ from current site conditions.

According to the SCS Soil Survey, OU No. 2 is underlain by a number of distinct soil units. The Baymeade (BaB) urban land complex, which underlies Site 9 and Lot 201, is typically found in areas where the original soil has been cut, filled, or graded. Soil properties of this unit have been altered through slope modification and smoothing. Due to its rapid infiltration rate and well drained nature, Baymeade soil tends to be used for parking lots and light-duty urban areas. The soil series found within Lot 203 and extending southward is characteristic of excavated areas. Excavated soils (Pt) commonly range from 5 to 15 feet in depth and are subject to surface ponding.

The wooded areas that surround both Lots 201 and 203 are underlain by either Kureb (KuB) or Leon (Ln) fine sands. Kureb and Leon fine sands are typically found on uplands near large drainages and on convex divides. Kureb soils are well drained and range from 1 to 6 percent slopes. The Leon fine sand unit, unlike the Kureb, is poorly drained and tends to be nearly level.

Wallace and Bear Head Creeks are bordered by Muckalee (Mk) loam soils that tend to be poorly drained and found on flood plains. The Muckalee unit is frequently flooded for brief periods and is subject to ponding. Marvyn (MaC) loamy fine sands are found upland of the Muckalee unit on side slopes near large drainages. Marvyn soil areas are long and narrow, ranging from 6 to 15 percent in slope.

Generally soils identified by the SCS at OU No. 2 are moderately to strongly acidic in nature (see Table 3-4). With the exception of the Muckalee unit, soils at the site are generally classified under USCS as SM or SP-SM (fine sand or loamy fine sand). Muckalee soils are classified as being ML (loam). Sieve analysis results from the limited number of samples collected during the field investigation are consistent with the SCS Soil Survey (see Appendix P).

3.7 Hydrogeology

The following sections discuss the regional and site-specific hydrogeologic conditions. The information presented on the regional hydrogeology is from literature; site-specific hydrogeologic information presented is from data collected during the field investigation.

3.7.1 Regional Hydrogeology

The surficial aquifer lies in a series of sediments, primarily sand and clay, which commonly extend to depths of 50 to 100 feet. This unit is not used for water supply at MCB Camp Lejeune.

The principal water supply aquifer for the Base lies in a series of sand and limestone beds between 50 and 300 feet below land surface. This series of sediments generally is known as the Castle Hayne formation. The Castle Hayne formation is about 150 to 350 feet thick in the area and contains the most productive aquifer in North Carolina. Estimated transmissivity (T) and hydraulic conductivity (K) values for the Castle Hayne Aquifer range from 4,300 to 24,500 feet^2/day (32,200 to 183,300 gallons/day/feet) and 14 to 82 feet/day, respectively (Harned et al., 1989).

Onslow County and Camp Lejeune lie in an area where the Castle Hayne aquifer contains freshwater, although the proximity of saltwater in deeper layers just below the aquifer and in the New River estuary is of concern in managing water withdrawals from the aquifer. Overpumping of the deeper parts of the aquifer could cause intrusion saltwater. The aquifer contains water having less than 250 milligrams per liter (mg/l) chloride throughout the area of the Base (Harned et al., 1989).

TABLE 3-4

SUMMARY OF SOIL PHYSICAL PROPERTIES
OPERABLE UNIT NO. 2
REMEDIAL INVESTIGATION CTO-0133
MCB CAMP LEJEUNE, NORTH CAROLINA

Soil Name	Soil Symbol	USCS Classification	Depth (inches)	Moist Bulk Density (g/cc)	Permeability (cm/s)	Soil Reaction (pH)	Shrink-Swell Potential	Organic Matter (percent)
Baymeade	BaB	SM, SP-SM	0-30	1.60 - 1.75	4.2×10^{-3} - 1.37×10^{-2}	4.5 - 6.5	Low	0.5 - 1.0
Kureb	KuB	SP, SP-SM	0-80	1.60 - 1.80	4.2×10^{-3} - 1.37×10^{-2}	4.5 - 7.3	Low	<2.0
Leon	Ln	SP, SP-SM	0-17	1.40 - 1.65	4.2×10^{-3} - 1.37×10^{-2}	3.6 - 5.5	Low	0.5 - 4.0
Marvyn	MaC	SM	0-12	--	1.37×10^{-3} - 4.2×10^{-3}	4.5 - 6.0	Low	<2.0
Muckalee	Mk	ML	0-28	--	4.2×10^{-4} - 1.37×10^{-3}	5.1 - 7.3	Low	0.5 - 2.0

Source: Soil Survey: Camp Lejeune, North Carolina, U.S. Department of Agriculture - Soil Conservation Service

Notes:
- ML - Loam
- SM - Loamy Fine Sand
- SP - Fine Sand
- -- - Not Estimated

CLEJ-01272-3.13-08/20/93

years 1989 and 1990 over 2.7 million pounds of fish and shellfish were caught commercially in the New River.

Land use within Camp Lejeune is influenced by the topography of the land itself, by established environmental policy, and by base operational requirements. Soil drainage is the most critical factor which determines the suitability of a site for development. Much of the land area found within the facility consists of freshwater swamps that are wooded and largely unsuitable for development. In addition, approximately 3,000 acres of sensitive estuary and other areas set aside for the protection of threatened and endangered species are to remain undeveloped. Operational restrictions and regulations, such as explosive quantity safety distances, impact-weighted noise thresholds, and aircraft landing and clearance zones, may also greatly constrain and influence development (Master Plan, Camp Lejeune Complex, North Carolina, 1988).

The vast majority of Camp Lejeune is used as training ranges and maneuver areas. Although interspersed throughout the installation, these areas are generally concentrated between Sneads Ferry Road and the eastern border of the base.

The combined military and civilian population of the Camp Lejeune/Jacksonville area is approximately 60,000. At the present time nearly 90 percent of the surrounding population resides within urbanized areas. As evidenced by the rapid population growth of Jacksonville and adjacent communities, particularly during the period from 1940 to 1960, Camp Lejeune continues to have a direct effect on regional population growth and development.

3.9 Regional Ecology

MCB Camp Lejeune, North Carolina, is approximately 108,800 acres, with 84 percent of the area covered by forests (USMC, 1987). The base drains primarily to the New River or its tributaries including Northeast Creek, Southwest Creek, Wallace Creek, French Creek, Bear Head Creek, Freeman Creek, and Duck Creek. The soil types range from sandy loams to fine sand and muck, with the dominant series being sandy loam (USMC, 1987).

Vegetation at MCB Camp Lejeune, North Carolina, includes pure pine stands of loblolly and longleaf pine in the drier upland soils, pure pond pine stands in high organic wet soils, pine-hardwood and pure hardwood stands in streamside zones and in more productive soils, and bottomland hardwoods in the floodplains of the major creeks (USMC, 1987). Wildlife on the base includes white-tailed deer, wild turkey, and black bear along with numerous small game species (e.g., bobwhite quail, morning dove, rabbit) (USMC, 1987).

Wallace Creek and Bear Head Creek are designated as Class SB by the North Carolina Department of Environment, Health, and Natural Resources (NC DEHNR), which are saltwaters protected for primary recreation (swimming on a frequent basis), fishing, and aquatic life including propagation and survival (NC DEHNR, 1992a, 1992b). These creeks are classified as Nutrient Sensitive Waters which are waters subject to growths of microscopic or macroscopic vegetation requiring limitations on nutrient inputs (NC DEHNR, 1992a, 1992b). Wallace Creek is classified as Inland Waters above, and Coastal Waters below the first bridge upstream from its mouth (NCMFC, 1992). Wallace Creek and Bear Head Creek are classified as Inland Waters at all the sample stations.

The New River, downstream of OU No. 2, is designated as Class SC: which are saltwaters protected for secondary recreation, fishing, and aquatic life including propagation and survival (NC DEHNR, 1992a, 1992b). All saltwaters in North Carolina are classified to protect these uses at a minimum (NC DEHNR, 1992a, 1992b). This section of the New River also is classified as a Nutrient Sensitive Water (NC DEHNR, 1992a, 1992b).

3.9.1 Sensitive Environments

This section describes the sensitive environments that were evaluated at OU No. 2. These sensitive environments include wetlands, protected species, and other potentially sensitive environments.

3.9.1.1 Wetlands

The NC DEHNR's, Division of Environmental Management (DEM) has developed guidance pertaining to activities that may impact wetlands (NC DEHNR, 1992c). In addition, certain activities impacting wetlands also are regulated by the U.S. Corps of Engineers.

The U.S. Fish and Wildlife Service (FWS) prepared a National Wetlands Inventory (NWI) map for the Camp Lejeune, North Carolina quadrangle by stereoscopic analysis of high altitude aerial photographs (USDI, 1982). OU No. 2 is included in this map (see Appendix A in the Ecological Risk Assessment for a copy of the NWI map). The wetlands were identified on the photographs based on vegetation, visible hydrology, and geography in accordance with

Classification of Wetland and Deep-Water Habitats of the United States (Cowardin, et al, 1979). NWI maps are intended for a initial identification of wetland areas. They cannot be substituted for an actual wetland delineation that may be required by Federal, state and/or local regulatory agencies.

Several types of wetlands have been identified adjacent to Wallace Creek and Bear Head Creek from the NWI map. The wetlands along the creeks primarily are palustine forested wetlands consisting of pond, longleaf or loblolly pines, along with oaks, black gum and baldcypress (NC DNRCD, 1988). [See the NWI map in Appendix A in the Ecological Risk Assessment for the wetland classifications and their locations].

3.9.1.2 Threatened and Endangered Species

Certain species have been granted protection by the FWS under the Federal Endangered Species Act (16 U.S.C. 1531-1543), and/or the North Carolina Wildlife Resources Commission, under the North Carolina Endangered Species Act (G.S. 113-331 to 113-337). The protected species fall into one of the following status classifications: Federal or State endangered, threatened or candidate species, State special concern, State significantly rare, or State watch list. While only the Federal or State threatened or endangered and State special concern species are protected from certain actions, the other classified species have the potential for protection in the future.

Table 3-12 lists the protected faunal species (either endangered, threatened, or special concern) and the only federally endangered or threatened floral species that have been identified in previous studies within the boundaries of MCB Camp Lejeune (USMC, 1991; LeBlond, 1991; Fussell, 1991; and Walters, 1991). The following paragraphs discuss the protected species observed at MCB Camp Lejeune during previous studies.

A Peregrine falcon was spotted approximately five miles southeast of OU No. 2 (Fussell, 1991). These birds potentially may inhabit or feed in areas surrounding OU No. 2 because of their large foraging range. Black skimmers and piping plovers were observed near the New River Inlet (Fussell, 1991). However, these birds primarily inhabit shore line areas and, therefore, are not expected to be found at OU No. 2. Bachmans sparrows and Red-cockaded woodpeckers were observed at numerous locations throughout southern MCB Camp Lejeune. None of these species were observed at OU No. 2 during intensive investigations previously conducted for

TABLE 3-12

OPERABLE UNIT NO. 2
PROTECTED SPECIES WITHIN MCB CAMP LEJEUNE
REMEDIAL INVESTIGATION CTO-0133
MCB CAMP LEJEUNE, NORTH CAROLINA

Species	Protected Classification
American alligator (Alligator mississippienis)	T(f), T(s)
Bachmans sparrow (Aimophilia aestivalis)	SC
Black skimmer (Rhynochops niger)	SC
Green (Atlantic) turtle (Chelonia m. mydas)	T(f), T(s)
Loggerhead turtle (Caretta caretta)	T(f), T(s)
Peregrine Falcon (*)	(*)
Piping plover (Charadrius melodus)	T(f), T(s)
Red-cockaded woodpecker (Picoides borealis)	E(f), E(s)
Rough-leaf loosestrife (Lysimachia asperulifolia)	E(f), E(s)

Legend: SC = State Special Concern
E(f) = Federal Endangered
E(s) = State Endangered
T(f) = Federal Threatened
T(s) = State Threatened

* The observer did not differentiate between the American eastern peregrine Falcon [E (f), E (s)] or the Artic peregrine Falcon [T(f), T(s)].

MCB Camp Lejeune, therefore, there is a low potential for them to exist at OU No. 2 (Fussell, 1991; Walters, 1991).

Sea turtles and sea turtle nests have been observed downstream of OU No. 2 in the New River on Onslow Beach. Sea turtles do not swim very far up the New River because of the low salinity, therefore, they are not expected to inhabit areas of OU No. 2 (USMC, 1991). During the ecological investigation conducted in August and September 1992, an alligator was observed in Wallace Creek. In addition, signs were posted at the boat launching ramp in Wallace Creek warning of the American alligators presence in the creek.

A protected floral species and special-interest community survey previously was conducted at Camp Lejeune (LeBlond, 1991). From this list, the Rough-leaf loosestrife was the only Federally threatened or endangered plant species found on the Marine Corp Base. Several State endangered or threatened and Federal and State candidate species were found on the MCB. A road meadow, inhabited by the state watch species Lugwigia microcarpa, was located upstream of OU No. 2 on Wallace Creek (see Appendix B in the Ecological Risk Assessment).

Also upstream of OU No. 2 on Wallace Creek, a state registered natural resource area has been identified (see Appendix B in the Ecological Risk Assessment). The general landscape consists of a broad floodplain and former mill pond on Wallace Creek which is dominated by a Cypress-Gum Swamp Community which grades upstream into a Coastal Plain Small Stream Swamp Community. The Cypress-Gum Swamp Community is dominated by Taxodium distichum, Nyssa biflora, Acer rubrum, Ulmus alata, and Fraxinus pennsylvanica. The Plain Small Stream Swamp Community is dominated by Taxodium distichum, Nyssa biflora, Fraxinus pennsylvanica, Ulmus americana, Acer rubrum, and Liquidambar styraciflua.

3.9.1.3 Other Sensitive Environments

In addition to wetlands and protected species, the presence of other sensitive environments, including those listed in 40 CFR Part 300, were evaluated. These sensitive environments are evaluated when assessing potential hazardous waste sites using the Hazard Ranking System. These sensitive environments and their presence or absence at OU No. 2 are discussed below.

- Marine Sanctuary - OU No. 2 is not located within a Marine Sanctuary (NCMFC, 1992).

- National Park - OU No. 2 is not located within a National Park (NPS, 1991).

- Designated Federal Wilderness Area - OU No. 2 is not located within a Designated Federal Wilderness Area (WS, 1989).

- Areas Identified under the Coastal Zone Management Act - The North Carolina Coastal Area Management Act (CAMA) regulates various types of Areas of Environmental Concern including estuarine waters, coastal wetlands, public trust areas, and estuarine shoreline through the establishment of unified policies, criteria, standards, methods, and processes (CAMA, 1974). Bear Head Creek, the inland portion of Wallace Creek, and any coastal wetlands associated with these waters are regulated under CAMA. The tidal portion of Wallace Creek along with 75 feet adjacent to the mean water line also are regulated under CAMA (NC DEHNR, 1993a).

- Sensitive Areas Identified under the National Estuary Program (NEP) or Near Coastal Waters Program (NCWP) - OU No. 2 is not located within a Sensitive Area identified under the NEP or NCWP (USEPA, 1993).

- Critical Areas Identified under the Clean Lakes Program - OU No. 2 is not located within a Critical Area identified under the Clean Lakes Program (NPS, 1991).

- National Monument - OU No. 2 is not located within a National Monument (NPS, 1991).

- National Seashore Recreational Area - OU No. 2 is not located within a National Seashore Recreational Area (NPS, 1991).

- National Lakeshore Recreational Area - OU No. 2 is not located within a National Lakeshore Recreational Area (NPS, 1991).

- National Preserve - OU No. 2 is not located within a National Preserve (NPS, 1991).

- National or State Wildlife Refuge - OU No. 2 is not located within a National or State Wildlife Refuge (NC WRC, 1992).

- Unit of the Coastal Barrier Resource Program - OU No. 2 is not located within a unit of the Coastal Barrier Resource Program (USDI, 1993).

- Administratively Proposed Federal Wilderness Area - OU No. 2 is not located within an Administratively Proposed Federal Wilderness Area (WS, 1989, 1993).

- Spawning Areas Critical for the maintenance of fish/shellfish species within river, lake, or coastal tidal waters - OU No. 2 is not located within a spawning area critical for the maintenance of fish/shellfish species (Sholar, 1975).

- Migratory pathways and feeding areas critical for maintenance of anadromous fish species within river reaches or areas in lakes or coastal tidal waters in which fish spend extended periods of time - OU No. 2 is not a migratory pathway or feeding area critical for maintenance of anadromous fish species (NC DEHNR, 1993b). There is not a significant population of anadromous fish in Wallace Creek, Bear Head Creek, or the New River downstream of Wallace Creek.

- Terrestrial areas utilized for breeding by large or dense aggregations of animals - A study of the terrestrial species was not conducted at OU No. 2. However, OU No. 2 probably is not utilized for breeding by large or dense aggregations of animals because the land is open and there is frequent military activity on the land.

- National river reach designated as Recreational - Wallace Creek, Bear Head Creek, or the New River downstream of Wallace Creek are not designated as National Recreational Rivers (NPS, 1990, 1993).

- Federal designated Scenic or Wild River - Wallace Creek, Bear Head Creek, or the New River downstream of Wallace Creek are not Federally designated Scenic or Wild Rivers (NPS, 1990, 1993).

- State land designated for wildlife or game management - OU No. 2 is not located within a State game land (NC WRC, 1992).

- State designated Scenic or Wild River - Wallace Creek, Bear Head Creek, or the New River downstream of Wallace Creek are not State designated Scenic or Wild Rivers (NC MFC, 1992).

- State designated Natural Area - OU No. 2 is not located within a State designated Natural Area or Area of Significant Value (LeBlond, 1991).

- State designated areas for protection or maintenance of aquatic life - No areas within the boundaries of OU No. 2 are designated as primary nursery areas or are unique or special waters of exceptional state or national recreational or ecological significance which require special protection to maintain existing uses (NC DEHNR, 1992b).

- Areas of Significant Value - OU No. 2 is not located within a State Area of Significant Value (LeBlond, 1991).

- State Registered Natural Resource Area - The Wallace Creek Natural Resource Area is located upstream of OU No.2.

3.10 Identification of Water Supply Wells

Potable water supply wells within a one-mile radius of Sites 6 and 82, and Site 9 were identified as shown on Figures 3-15 and 3-16, respectively. Information on well depths, screen intervals, aquifer characteristics (specific capacity and T), well distances and directions is provided on Tables 3-13 and 3-14 for Sites 6 and 82, and Site 9, respectively. Supply well information was obtained in the report entitled, "U.S.G.S. Water Resources Investigation Report 89-4096" (Harned, et al., 1989).

As shown on Table 3-13, eight wells were identified within a one-mile radius of Sites 6 and 82. Wells HP-635 and HP-636 are the closest active supply wells to Sites 6 and 82. These wells are located approximately 80 feet east-southeast across Piney Green Road. These wells are screened between 65 and 227 feet bgs. Based on groundwater flow patterns in the area, these wells are generally upgradient from Sites 6 and 82. Well HP-633 is the closest operating water supply well situated down gradient from Sites 6 and 82. This well is located approximately 1,590 feet northwest and is screened between 55 and 205 feet bgs.

Three supply wells in the area, HP-651 (located approximately 80 feet east) and HP-653 (located approximately 1,950 north), and HP-637 (located approximately 450 feet southwest) are currently out of service due to organic contamination. According to Camp Lejeune Water and Sewer Department personnel, HP-651 was shut down in February 1985. It is unknown when HP-653 and HP-637 were shut down. Groundwater quality data from well HP-651 (prior

TABLE 3-13

SUMMARY OF WATER SUPPLY WELLS WITHIN A ONE-MILE RADIUS OF SITES 6 AND 82[1]
REMEDIAL INVESTIGATION CTO-0133
MCB CAMP LEJEUNE, NORTH CAROLINA

Well No.	USGS Identification Number	Total Depth (feet)	Screen Interval (feet)	Specific Capacity (gal/min/foot)	Estimated Transmissivities ($feet^2$/day)	Approximate Distance/Direction from Site[4] (feet)
HP-633	3441580772006.1	205	55-65 75-80 95-105 123-133 138-143 158-168 178-183 195-205	-- [2]	-- [2]	1,390/northwest
HP-635	3440550771933.1	215	65-75 93-108 122-127 136-146 150-155 170-175 185-190 210-215	-- [2]	-- [2]	80/southeast
HP-636	3441190771933.1	227	90-100 115-125 130-135 140-150 158-163 170-175 185-190 200-210 222-227	6.8	6,900	80/east

Notes: (1) Information obtained from "Assessment of Hydrogeologic and Hydraulic Data at Camp Lejeune Marine Corps Base, North Carolina," 1989.
(2) Information not available.
(3) Supply well currently not in service.
(4) [illegible]

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TABLE 3-13 (CONTINUED)

SUMMARY OF WATER SUPPLY WELLS WITHIN A ONE-MILE RADIUS OF SITES 6 AND 82[1]
REMEDIAL INVESTIGATION CTO-0133
MCB CAMP LEJEUNE, NORTH CAROLINA

Well No.	USGS Identification Number	Total Depth (feet)	Screen Interval (feet)	Specific Capacity (gal/min/foot)	Estimated Transmissivities ($feet^2$/day)	Approximate Distance/Direction from Site[4] (feet)
HP-637[3]	3440390771954.1	172	90-98 102-114 120-128 140-148 156-172	-- [2]	-- [2]	450/southwest
HP-641	3440390771954.1	178	108-118 128-150 158-168	-- [2]	-- [2]	4,100/north
HP-651[3]	3442290771922.1	199	125-135 140-155 189-194	3.8	7,300	80/east
HP-653[3]	3442100771925.1	270	-- [2]	-- [2]	-- [2]	1,950/north
HP-709	3442130771854.1	140	70-90 110-140	4.4	8,500	2,380/northeast

Notes: (1) Information obtained from "Assessment of Hydrogeologic and Hydraulic Data at Camp Lejeune Marine Corps Base, North Carolina," 1989.
(2) Information not available.
(3) Supply well currently not in service.
(4) Distance measured from closest boundary point at Site 6.

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TABLE 3-14

SUMMARY OF WATER SUPPLY WELLS WITHIN A ONE-MILE RADIUS OF SITE 9[1]
REMEDIAL INVESTIGATION CTO-0133
MCB CAMP LEJEUNE, NORTH CAROLINA

Well No.	USGS Identification Number	Total Depth (feet)	Screen Interval (feet)	Specific Capacity (gal/min/foot)	Estimated Transmissivities ($feet^2$/day)	Approximate Distance/Direction from Site[4] (feet)
HP-601[3]	3440180772020.1	195	45-60 95-100 115-130 175-195	--[2]	--[2]	3,960/southwest
HP-602[3]	3440180772007.1	160	70-80 100-105 120-125 145-150 155-160	--[2]	--[2]	3,300/southwest
HP-634[3]	3440300771935.1	225	63-70 73-78 83-88 107-117 124-129 135-140 153-163 170-175 195-200 215-225	4.5	4,300	2,310/south
HP-642	3443040772100.1	210	112-124 136-144 153-163 174-178 188-196	--[2]	--[2]	5,200/south

Notes: (1) Information obtained from "Assessment of Hydrogeologic and Hydraulic Data at Camp Lejeune Marine Corps Base, North Carolina," 1989.
(2) Information not available.
(3) Supply well currently not in service.
(4) Distance measured from closest boundary point at Site 9.

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TABLE 3-14 (Continued)

SUMMARY OF WATER SUPPLY WELLS WITHIN A ONE-MILE RADIUS OF SITE 9[1]
REMEDIAL INVESTIGATION CTO-0133
MCB CAMP LEJEUNE, NORTH CAROLINA

Well No.	USGS Identification Number	Total Depth (feet)	Screen Interval (feet)	Specific Capacity (gal/min/foot)	Estimated Transmissivities ($feet^2$/day)	Approximate Distance/Direction from Site[4] (feet)
HP-635	3440550771933.1	215	65-75 93-108 122-127 136-146 150-155 170-175 185-190 210-215	-- [2]	-- [2]	800/east
HP-636	3441190771933.1	227	90-100 115-125 130-135 140-150 158-163 170-175 185-190 200-210 222-227	6.8	6,900	2,000/northeast
HP-637 [3]	3440390771954.1	172	90-98 102-114 120-128 140-148 156-172	-- [2]	-- [2]	1,000/southwest
HP-651 [3]	3442290771922.1	199	125-135 140-155 189-194	3.8	7,300	5,000/northeast

Notes: (1) Information obtained from "Assessment of Hydrogeologic and Hydraulic Data at Camp Lejeune Marine Corps Base, North Carolina," 1989.
(2) Information not available.
(3) Supply well currently not in service.
(4) Distance measured from closest boundary point at Site 9.

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to being shut down) indicated 18,000 micrograms per liter (µg/l) of trichloroethane (TCE), 1,580 µg/l of 1,2-dichloroethene (DCE), and 400 µg/l of tetrachloroethene (PCE). Recent data from HP-651 (ESE, 1991) indicated positive detections of vinyl chloride (70 µg/l), DCE (75 µg/l), TCE (13 µg/l), and PCE (53 µg/l). Groundwater quality data from January 1985 indicated TCE levels of 9.0 µg/l in well HP-652. The source of the contamination impacting these wells was not identified by Camp Lejeune personnel.

Eight wells were identified within a one-mile radius of Site 9 (wells HP-635, HP-636, HP-637, and HP-651 were also within a one-mile radius of Sites 6 and 82), as shown on Figure 3-16. Three of these supply wells including HP-601, HP-602, and HP-634 have been shut down since 1984 due to organic contamination. The source of the contamination impacting these wells was also not identified by Camp Lejeune personnel, but it is believed that the source may be related to waste handling, disposal activities at the Hadnot Point Industrial Area (HPIA). The following contaminant levels were detected:

- HP-601 - DCE (8.8 to 99 µg/l)
  - TCE (26 to 230 µg/l)
  - PCE (1.5 to 5.0 µg/l)

- HP-602 - DCE (110 to 630 µg/l)
  - TCE (300 to 1,600 µg/l)
  - PCE (24 µg/l)
  - toluene (5.4 to 12 µg/l)
  - vinyl chloride (18 µg/l)

- HP-634 - DCE (2.3 to 700 µg/l)
  - TCE (10 µg/l)
  - vinyl chloride (6.8 µg/l)

Well HP-635 is the closest active supply well to Site 9. This well is located approximately 400 feet up gradient (east)

4.0 NATURE AND EXTENT OF CONTAMINATION

This section presents the Phase I and II results of the environmental investigations performed at Site 9 (Section 4.1.1) and Sites 6 and 82 (Section 4.1.2), and the nature and extent of contamination (Section 4.2) for the various media. Results of the ecologic and aquatic survey are presented in a separate document (Ecological Risk Assessment) from this RI. Soil investigation results and extent of soil contamination are addressed for each area of concern (e.g., Lot 203) within the operable unit and site. Site 82 results are presented in the same section as Site 6 because these two sites are essentially continuous. Groundwater investigation results are presented for each site (Sites 6 and 82 results are also discussed in the same section), but the extent of contamination is addressed as one operable unit (i.e., all three sites). Appendices L through T provide a summary of laboratory results, statistical summaries of analytical data, QA/QC laboratory results (i.e., data and frequency summary), TCLP results (i.e., field duplicates), engineering parameter results field QA/QC samples (e.g., field blanks), chain-of-custodies, and sampling summaries of OU No. 2 for the various media.

4.1 Analytical Results

The results of environmental investigations conducted at Site 9, Sites 6 and 82 are presented in Sections 4.1.1 and 4.1.2, respectively.

4.1.1 Site 9

This section presents the results of the soil and groundwater investigations performed at Site 9. Note that no additional soil samples were collected during the Phase II investigation.

4.1.1.1 Soil Investigation

Positive detection summaries of surface soils for organics and inorganics are presented on Tables 4-1 and 4-2, respectively (note that all tables for Section 4.0 are presented in the back of this section.) Positive detection summaries of subsurface soils for organics and inorganics are presented on Tables 4-3 and 4-4, respectively. Total petroleum hydrocarbon (TPH) results are presented in Appendix Q.

Several notations were used to identify sample locations and sample depths at Site 9 (refer to positive detection summary tables). Samples designated with the prefix "AST" or "TPO" were collected from soil borings located near the above ground storage tanks ("AST") or the fire training pits/oil and water separator ("TPO"). Samples designated with the prefix "GW" were collected from soil borings advanced for monitoring well installation.

Surface soil (i.e., samples collected from ground surface to 6 inches) analytical results indicated the presence of organics (including pesticides, volatiles, and semivolatiles), inorganics (excluding cyanide), and TPH (refer to Figure 2-15 for sample locations). The following summarizes the results :

- Pesticides (4,4'-DDE and 4,4'-DDT) were detected at five soil boring locations including soil borings SB1, SB3, SB35, SB43, and SB54. The concentrations ranged from 3.3J (note that the letter "J" refers to an estimated value) to 650 µg/kg with the highest concentrations detected in a sample collected from SB1 (650 µg/kg of 4,4'-DDE and 570 µg/kg of 4,4'-DDT).

- Low levels of volatile organic compounds (VOCs) including acetone, 1,1,1-trichloroethane, tetrachloroethene (PCE), and toluene were detected in soils collected from soil borings SB3 and SB43. The highest concentration was detected in soil boring SB3 with 21 µg/kg of PCE.

- The semivolatile organic compounds (SVOCs) including pyrene, bis(2-ethylhexyl) phthalate and benzo(b)fluoranthene were detected at low levels in soil samples collected from soil borings SB1 and SB3. The sample collected from SB1 exhibited concentrations of both pyrene (59J µg/kg) and benzo(b)fluoranthene (46J µg/kg).

- Fifteen of 23 TAL metals (cyanide was not analyzed in soils) were detected in surface soils (antimony, arsenic, beryllium, cadmium, nickel, selenium, silver, and thallium were not detected).

- TPH levels ranged from Not Detected (ND) to 1,120 mg/kg. The highest concentration was detected in soil boring SB18. Note that no TCL organic constituents were detected in SB18.

Subsurface soil (soils collected below one-foot in depth) analytical results also indicated the presence of organic and inorganic contamination. The following summarizes the results:

- Pesticides (4,4'-DDE, 4,4'-DDT, 4,4'-DDD, and alpha chlordane) were detected at six soil boring locations including SB13 (3 to 5 feet), 9GW8 (1 to 2 feet), SB24 (1 to 3 and 5 to 7 feet), SB25 (1 to 3 feet), SB31 (1 to 3 and 5 to 7 feet), and SB35 (5 to 7 feet). The highest pesticide concentrations were detected in samples obtained from soil borings SB31 [4,4'-DDE (39 µg/kg) and 4,4'-DDD (50 µg/kg)] and SB2 [4,4'-DDT (62 µg/kg) and alpha chlordane (2.9J µg/kg)]. These compounds were detected in soils from approximately 1 to 7 feet below ground surface (bgs).

- Low levels of VOCs (acetone and PCE) were detected at soil borings SB21 (two samples), SB31 (two samples), and SB35. The highest PCE concentration was 7.0 J µg/kg at soil boring SB21 (7 to 9 feet).

- Eighteen of 23 TAL metals were detected in subsurface soils (antimony, selenium, silver, sodium, and thallium were not detected). Inorganic levels were similar across the site.

- TPH levels ranged from ND to 1,200 mg/kg. The highest concentration was detected in soil boring SB27 (1 to 3-foot sample).

Pesticides were exhibited in both surface and subsurface soil samples but are not believed to be associated with the fire-fighting training operations (i.e., pesticides were not used to ignite fires). Historical usage of pesticides at Camp Lejeune for pest control has been well documented (Water and Research, 1983). Moreover, Site 9 was not reportedly associated with any storage or disposal of pesticides in the past.

The presence of acetone in the samples is most likely due to the use of pesticide-grade isopropanol during decontamination procedures. The pesticide-grade isopropanol was analyzed and found to contain approximately 1.3 percent acetone. Although the final step in the decontamination procedures states that the sampling equipment will be air-dried to allow for the excess isopropanol to evaporate, it is possible that in some cases, the sampling equipment was not completely dry before it was used.

Low levels of chlorinated hydrocarbons (TCE and PCE) were exhibited in several soil samples. These concentrations may have resulted from localized surface spills of solvents since they were only detected at isolated areas within Site 9. These compounds, like pesticides, historically have not been reported to be stored or disposed of at Site 9.

The presence of bis(2-ethylhexyl) phthalate is most likely the result of laboratory contamination (during sample preparation) since historically this compound has not been reported to be stored or disposed of on site. Section 6.0 of this report provides the rationale for justifying why this compound is considered a laboratory contaminant and not related to the site.

Pyrene and benzo(b)fluoranthene detected in site soils may have resulted from localized surface spills of fuel from the ASTs or the fire training pits. The ASTs reportedly contained diesel fuel while they were active. These two compounds are commonly associated with heavier fuels such as diesel.

The concentration ranges of most of the inorganics detected were similar to the background ranges of soils (both surface and subsurface) at Camp Lejeune. Typical inorganic background concentrations for surface and subsurface soils at Camp Lejeune are presented on Table 6-8 in Section 6.2.2.1. Several of the inorganics, however, exhibited concentrations above background levels for surface soils including aluminum, calcium, chromium, iron, lead, magnesium, manganese, potassium, sodium, and vanadium. Inorganics in the subsurface soils were also detected above background levels, including aluminum, arsenic, barium, calcium, chromium, copper, iron, lead, magnesium, manganese, and potassium. In general, inorganic concentrations above background for both surface and subsurface soils were within an order of magnitude of background levels.

4.1.1.2 Groundwater Investigation

Site 9 Phase I - Round One groundwater analytical results are provided on Table 4-5 for organics, and Tables 4-6 and 4-7 for inorganics (total and dissolved, respectively). Phase II - Round Two analytical results are provided in Appendix L. Note that Site 9 monitoring wells displayed on these tables are designated with the number "9" (e.g., 9-GW03-01 is the sample designation for monitoring well 9GW3).

Summary of Phase I - Round One Results

Trace levels of VOCs and SVOCs were detected in both surficial (less than 25 feet bgs) and deep groundwater (greater than 100 feet bgs) at Site 9. Detected VOCs include 2-chloroethylvinyl ether and total xylenes, which were detected in shallow wells 9GW8 (1.0J µg/l of 2-chloroethylvinyl ether) and 9GW6 (0.9J µg/l of total xylenes). SVOCs detected include phenol (7.0J µg/l), dimethyl phthalate (1.0J µg/l), and bis(2ethylhexyl) phthalate (2.0J µg/l), which were detected in deep well 9GW7D only. None of the VOCs or SVOCs detected exhibited concentrations above the Federal Maximum Contaminant Levels (MCLs) or the North Carolina Water Quality Standards (NCWQS) established for groundwater.

The low levels of 2-chloroethylvinyl ether, dimethyl phthalate, and bis(2-ethylhexyl) phthalate detected are believed to be the result of laboratory contamination since these compounds historically have not been used, stored, or disposed at the site. Moreover, the low level of total xylenes (typically associated with petroleum fuels) detected at well 9GW6 may have resulted from releases of fuels which were stored in the ASTs or fuels burned in the fire training pit.

PCBs and pesticides were not detected above method detection limits in any of the shallow or the deep wells.

TAL inorganics (i.e., total and dissolved) were detected in all ten monitoring wells. As shown on Tables 4-6 and 4-7, 18 of 24 total (cyanide, thallium, selenium, silver, antimony, and cobalt were not detected) and 14 of 24 dissolved (antimony, arsenic, beryllium, cadmium, cobalt, copper, lead, silver, thallium, and selenium were not detected) TAL inorganics were detected. Chromium, lead, manganese, and mercury are present above Federal and/or NCWQS. The following wells exhibited concentrations of total chromium (MCL and NCWQS of 50 µg/l), total lead (MCL and NCWQS of 50 µg/l), total manganese (NCWQS of 50 µg/l), and total mercury (MCL of 2.0 µg/l and NCWQS of 1.1 µg/l) above the Federal MCLs and/or the NCWQS:

- chromium - 9GW1 (99.3 µg/l)
  - 9GW3 (214 µg/l)

- lead - 9GW1 (66.4 µg/l)
  - 9GW3 (127 µg/l)

• manganese	-	9GW1	(174 µg/l)
	-	9GW3	(91.3 µg/l)
• mercury	-	9GW2	(1.4 µg/l)

For the dissolved metals, however, none of these wells exhibited contaminant levels above the Federal MCLs or the NCWQS for these inorganics.

Groundwater field parameter results for pH, temperature, and specific conductance are presented on Table 4-8. Specific conductance values ranged from 126 to 459 micromhos/cm, pH values ranged from 5.03 to 9.19 s.u. (slightly acidic to slightly basic), and temperature values ranged from 18° to 24°C. These values represent all field measurements obtained during groundwater sampling activities (i.e., from each well volume purged) which may account for the wide ranges. Specific conductance values appear to be within the range of natural waters which is 50 to 500 micromhos/cm (Pagenkopf, 1978). pH values are within the range of Federal Secondary Drinking Water MCLs (6.5 to 8.5 s.u.) with the exception of one reading at well 9GW7D (9.19 s.u.). This elevated pH value may be related to trace amounts of residule grout in the groundwater which was used during well installation. Note that the pH in this well decreased and stabilized as the well was purged.

Summary of Phase II - Round Two Results

Groundwater samples collected during the Phase II - Round Two investigation at Site 9 were analyzed for full TCL volatile organics and full TAL inorganics. Samples were collected from all existing and newly installed wells. Analytical results of this sampling event are provided in Appendix L.

Pesticides including 4,4-DDE (1.0J µg/l), 4,4-DDD (0.94J µg/l), and 4,4-DDT (0.13J µg/l) were detected in well 9GW1. No other Site 9 wells exhibited pesticide concentrations. Additionally, note that concentrations of PCBs were not detected in any of the wells sampled.

Concentrations of SVOCs were detected at seven wells. Bis(2ethylhexyl)phthalate was the most frequently occurring SVOC. Well 9GW4 exhibited the highest levels. The most detected SVOCs in groundwater samples include naphthalene (17 µg/l), 2-methylnaphthalene (1.0J µg/l), acenaphthene (11J µg/l), dibenzofuran (1.0J µg/l), fluorene (3.0 µg/l), phenanthrene

(3.0J µg/l), fluoranthene (6.0J µg/l), pyrene (3.0J µg/l), and bis(2-ethylhexyl)phthalate (4.0J µg/l). Further, deep well 9GW7D indicated a detection of phenol (5.0J µg/l).

Trace levels of VOCs were also detected from the Round Two groundwater samples. Well 9GW8 exhibited the highest levels of VOCs which include 1,3-dichlorobenzene (3.4 µg/l), ethylbenzene (3.4 µg/l), toluene (2.2 µg/l), and total xylenes (14 µg/l). Additionally, low levels of TCE (1.2 µg/l) were detected in deep well 9GW7D.

Results of the inorganic analysis indicated detections of 17 of the 23 total TAL inorganics (antimony, cadmium, cobalt, copper, silver, and thallium were not detected). Concentrations of cadmium, lead, and manganese were detected in some of the wells above the Federal MCLs and/or the NCWCS. The following wells exhibited elevated concentrations of inorganics:

- 9GW1 - total chromium (351 µg/l)
  - total lead (406J µg/l)
  - total manganese (278J µg/l)

- 9GW2 - total chromium (170J µg/l)

- 9GW3 - total chromium (60 5J µg/l)

Note that none of these wells exhibited concentrations of dissolved inorganics above the Federal MCLs or the NCWCS.

Groundwater field parameter results are presented on Table 4-9. Specific conductance values ranged from 115 to 4,968 micromhos/cm, pH values ranged from 5.23 (acidic to basic) to 12.46 s.u., and temperature values ranged from 13° to 20° C. As discussed in the previous section, these values represent all field measurements collected (i.e., from each well volume purged) which may account for the wide ranges. Note that many of the pH values were below the Federal Secondary MCL (drinking water standards) of 6.5 s.u., but none of these values were below 2.5 s.u. (RCRA hazardous).

Comparison of Phase I - Round One and Phase II - Round Two Results

Groundwater analytical comparisons of Site 9 wells for Phase I and Phase II investigations are summarized on Tables 4-10 (organics only). The data indicates that the overall contaminant levels for organics slightly increased for the Phase II samples. Wells 9GW1, 9GW4, and 9GW8 exhibited the most significant increases in contaminant levels. The following summarizes these contaminant increases:

- Low levels of pesticides were detected in the Phase II sample from 9GW1. Pesticides were not detected in the Phase I sample.

- Low levels of SVOCs were detected in the Phase II sample from 9GW4. SVOCs were not detected in the Phase I sample.

- Low levels of 1,3-dichlorobenzene, ethylbenzene, toluene, and total xylenes were detected in the Phase II sample from well 9GW8. None of these contaminants were not detected in the Phase I sample.

Note that the increases in contaminant levels for these wells were not significant.

The overall increase in contaminant levels may be attributed to seasonal fluctuations in the water table. The fluctuation of the water table (observed to be as high as five feet) may be effecting contaminant movement within the aquifer where concentrations would be increased while the water table is at its highest point following groundwater recharging periods. This concentration trend was observed in many of the wells at all three sites. As discussed in Section 3.0, groundwater levels were at their lowest point in October and November (which coincided with Phase I sampling event) and at their highest point in April (which coincided with the Phase II sampling event). Concurrently, the contaminant levels were generally higher in March and April compared to October and November.

4.1.1.3 Engineering Parameter Results

Engineering parameters were analyzed from groundwater samples collected at shallow well 9GW8. Groundwater engineering parameters included BOD, COD, total solids (TS), TDS, TSS, and total volatile solids (TVS). Engineering parameter results are summarized in Appendix P. Results indicated the following concentration levels in shallow groundwater:

- BOD - ND
- COD - 21 mg/l
- TS - 199 mg/l
- TDS - 160 mg/l
- TSS - 48 mg/l
- TVS - 34 mg/l

The TDS concentration was below the Federal Secondary MCL of 500 mg/l. None of the other parameters have a corresponding water quality criteria.

4.1.1.4 Quality Control/Quality Assurance Results

QA/QC samples were collected during the soil and groundwater investigations. These samples included trip blanks, field blanks, equipment rinsates, and duplicate samples. Analytical results of the field duplicates are provided in Appendix N and other field QA/QC (e.g., rinsate blanks, trip blanks, etc.) results are provided in Appendix R.

Organics and inorganics were detected in several QA/QC samples. Detected organics include methylene chloride, acetone, and bis (2-ethylhexyl) phthalate (methylene chloride and acetone were detected in rinsate blanks, field blanks, and trip blanks; all three compounds were detected in rinsate blanks and field blanks). As stated previously, methylene chloride, acetone, and bis (2-ethylhexyl) phthalate are most likely the result of laboratory contamination. The presence of acetone may also be the result of decontamination procedures with isopropanol alcohol. All 24 TAL inorganics were detected in the QA/QC samples but were quantified B, JB, UJ, or J qualifiers.

A field blank (9-FB-02) collected from the potable water source used for decontamination of heavy equipment did not contain organic concentrations (other than methylene chloride and acetone), but did exhibit levels of inorganics (all with B, JB, UJ, or J qualifiers).

4.1.2 Sites 6 and 82

The results of the soil, groundwater, surface water and sediment investigations, along with the drum waste sampling and test pit sampling performed at Sites 6 and 82 are presented in the following sections.

4.1.2.1 Soil Investigation

Soil results are presented for each area of concern including Lot 201, Lot 203, the wooded areas and the ravine (areas within Site 6), and Site 82. Sample locations for these areas are shown on Figures 2-5, 2-6, and 2-7, respectively.

Site 6, Lot 201

Soil analytical results are representative of samples collected from sample grids A, B, and C. Surface soil analytical results are presented on Tables 4-11 (organics) and 4-12 (inorganics). Subsurface soil analytical results are presented on Tables 4-13 (organics) and 4-14 (inorganics).

Analytical results of the surface soils indicated the presence of organic and inorganic contaminants. The following summarizes the results:

- Pesticides including dieldrin, 4,4'-DDE, 4,4'-DDD, 4,4'-DDT, alpha chlordane, and gamma chlordane were detected throughout the three sample grids. The ranges and maximum (sample location shown in parentheses) concentrations of the detected pesticides are as follows:

• 4,4'-DDT	3.0J to 1,200,000 µg/kg	(201A-SB17)
• 4,4'-DDD	0.98J to 180,000J µg/kg	(2013A-SB17)
• 4,4'-DDE	4.0J to 17,000 µg/kg	(201A-SB17)
• dieldrin	5.6J to 46 µg/kg	(201A-SB20)
• alpha chlordane	8.9 µg/kg	(201A-SB26 only)
• gamma chlordane	8.0J µg/kg	(201A-SB26 only)

- PCBs (PCB-1248 and PCB-1260) were detected in three samples collected within sample grids A and C. PCB-1248 was detected in one sample (201A-SB24 at 1,800 µg/kg) and PCB-1260 was detected in two samples ranging from 31J to 360 µg/kg (201C-SB8).

- VOCs including acetone, methylene chloride, and 1,1,1 -trichloroethane were detected in a few samples. Concentrations of 1,1,1-trichloroethane were found in three samples ranging from 2.0J to 42 µg/kg (201C-SB38).

- Twelve different SVOCs were detected with seven of the positive detections at soil boring 201C-SB33.

- Nineteen of 23 TAL inorganics were detected in surface soils (antimony, mercury, silver, and thallium were not detected).

Subsurface soil analytical results also indicated organic and inorganic contamination. The following summarizes the results:

- Pesticides including 4,4'-DDE, 4,4'-DDT, and 4,4'-DDD were detected at sample grids A, B, and C. The ranges and maximum (sample locations shown in parentheses) concentrations of the detected pesticides are as follows:

• 4,4'-DDE	4.5 to 5,200J µg/kg	(201A-SB17 - 1 to 3 feet)
• 4,4'-DDT	0.58J to 250,000J µg/kg	(201A-SB17 - 1 to 3 feet)
• 4,4'-DDD	3.4J to 460,000 µg/kg	(201A-SB17 - 1 to 3 feet)

- VOCs including acetone, methylene chloride, PCE, 1,1,1-trichloroethane, ethylbenzene, and total xylenes were detected in a few samples. Concentrations of ethylbenzene and total xylenes were detected in soil boring 201A-SB17 (1 to 3-foot sample) at 2,800J and 54,000 µg/kg, respectively.

- Concentrations of five different SVOCs were detected in soil boring 201A-SB17 (1 to 3 feet). The SVOCs exhibiting the highest concentrations were naphthalene (97,000 µg/kg) and 1,4-dichlorobenzene (38,000 µg/kg).

- Fifteen of 23 TAL inorganics were detected in subsurface soils (antimony, beryllium, cobalt, mercury, nickel, selenium, silver, and thallium were not detected).

- PCBs were not detected in any of the subsurface soils.

Overall, elevated levels of pesticides were detected within sample grid A, especially in the vicinity of soil boring 201A-SB17. As stated previously, the area in the vicinity of sample grid A was reportedly used for pesticide storage in the past (ESE, 1990).

Elevated levels of PCBs (above 1,000 µg/kg) were detected only in surface sample 201A-SB24 (1,800 µg/kg). Sample grid C, which is in the immediate vicinity of where PCB transformers were reportedly stored, did not exhibit PCB contamination.

Ethylbenzene and total xylenes were detected from samples collected at soil boring 201A-SB17. The source of these contaminants may be related to surface spills of fuel since the area is currently used for the storage of military vehicles. The presence of these contaminants may also be associated with the application (petroleum-based) of pesticides.

Inorganics were detected above the background ranges of surface soils at Camp Lejeune. Inorganics which exhibited concentrations above background levels include aluminum, cadmium, calcium, chromium, copper, iron, lead, magnesium, manganese, potassium, nickel, selenium, sodium, thallium, vanadium, and zinc. Although these contaminant levels exceed background levels, the concentrations were generally within the same magnitude as surface soil background levels.

Inorganics in subsurface soils were also above the background ranges for Camp Lejeune. Inorganics detected above background levels include aluminum, arsenic, barium, calcium, chromium, copper, iron, lead, magnesium, manganese, and sodium and vanadium. In general, the concentrations were also within the same magnitude of subsurface soil background levels.

Site 6, Lot 203

Analytical results from Lot 203 soils represent samples collected from sample grids "OSA" (samples 203-SB21 through 203-SB42), "DDT," "PCB," and from soil borings advanced for monitoring wells ("GW"). Positive detection summaries for surface soils at Lot 203 are presented on Table 4-15 for the organics and on Table 4-16 for the inorganics. Positive detection summaries of subsurface soils for organics and inorganics are presented on Table 4-17 and Table 4-18, respectively.

Surface soil analytical results indicated the presence of organic and inorganic contaminants. The following summarizes the results:

- Pesticides including dieldrin, 4,4'-DDE, 4,4'-DDD, 4,4'-DDT, alpha chlordane, gamma chlordane, endosulfan II, and endrin were detected throughout Lot 203. The ranges and maximum (sample locations shown in parentheses) concentrations of the detected pesticides are as follows:

• 4,4'-DDE	3.8J to 2,100 µg/kg	(203OSA-SB30)
• 4,4'-DDT	3.4J to 1,500 µg/kg	(203OSA-SB30)
• dieldrin	3.6J to 270J µg/kg	(203OSA-SB24)
• 4,4'-DDD	4.5J to 180J µg/kg	(203DDT-SB18)
• gamma chlordane	160 µg/kg	(203OSA-SB24 only)
• endrin	21 to 130J µg/kg	(203OSA-SB38)
• alpha chlordane	2.3J to 72J µg/kg	(203OSA-SB38)
• endosulfan II	4.4J µg/kg	(203DDT-SB10 only)

- PCBs (PCB-1248, PCB-1254, and PCB-1260) were detected in 12 samples. PCB-1260 was detected in 12 samples ranging from 17J to 42,000 µg/kg (203OSA-SB24); PCB-1254 was detected in two samples ranging from 170J to 2,100J µg/kg (203OSA-SB38); and PCB-1248 was detected in one sample at 580J µg/kg (2030SA-SB38).

- VOCs including acetone, toluene, and 1,1,1-trichloroethane were detected in a few samples. Concentrations of 1,1,1-trichloroethane were found in two samples ranging from 2.0J to 15 µg/kg (203PCB-SB14). Toluene was only detected in sample 203 OSA-SB23 (7.0J µg/kg).

- Twenty-four different SVOCs were detected with 10 positive detections at soil boring 203OSA-SB26 and 18 of the detections at soil boring 203OSA-SB38. The concentration ranges and maximum values (sample locations shown in parentheses) of three of the more frequently occurring SVOCs are as follows:

• acenaphthene	250J to 9,500 µg/kg	(203OSA-SB39)
• pyrene	42J to 2,800 µg/kg	(203OSA-SB38)
• naphthalene	1,400J µg/kg	(203OSA-SB39 only)

- Twenty of 23 TAL inorganics were detected in surface soils (selenium, silver, and thallium were not detected).

Subsurface soil analytical results also indicated the presence of organic and inorganic contamination. The following summarizes the results:

- Pesticides including 4,4'-DDE, 4,4'-DDT, 4,4'-DDD, aldrin, heptachlor epoxide, dieldrin, methoxychlor, delta-BHC, and gamma chlordane were detected. The ranges and maximum (sample locations shown in parentheses) concentrations of detected pesticides are as follows:

• methoxychlor	1,100J µg/kg	(203OSA-SB22 only - 3 to 5 feet)
• 4,4'-DDE	4.9J to 470 µg/kg	(203OSA-SB30 - 1 to 3 feet)
• 4,4'-DDD	21J to 430 µg/kg	(203OSA-SB28 - 5 to 7 feet)
• 4,4'-DDT	3.6J to 300J µg/kg	(203OSA-SB22 - 3 to 5 feet)
• dieldrin	4.4J to 220J µg/kg	(203OSA-SB22 - 3 to 5 feet)
• gamma chlordane	140J µg/kg	(203OSA-SB22 only - 3 to 5 feet)
• heptachlor epoxide	6.4J µg/kg	(203DDT-SB2 only - 1 to 3 feet)
• delta-BHC	4.9J µg/kg	(203OSA-SB41 only - 1 to 3 feet)
• aldrin	4.6J µg/kg	(203DDT-SB2 only - 1 to 3 feet)

- PCB-1260 was detected in three samples ranging from 20J to 29,000J µg/kg. The highest concentration was detected in sample 203OSA-SB22 (3 to 5-foot sample).

- Acetone was the only VOC detected in the subsurface soils.

- Eighteen different SVOCs were detected with 14 of the detections at soil boring 203OSA-SB22 (3 to 5-foot sample). The ranges and maximum (sample location shown in parentheses) concentrations of three of the more frequently occurring SVOCs are as follows:

• acenaphthene	3,200J to 7,700 µg/kg	(203OSA-SB41 - 1 to 3 feet)
• pyrene	3,600 µg/kg	(203OSA-SB22 only - 3 to 5 feet)
• naphthalene	78J to 1,500J µg/kg	(203OSA-SB41 - 1 to 3 feet)

- Twenty-two of 23 TAL inorganics were detected in subsurface soils (silver was not detected).

Sample grid "OSA" within Lot 203 exhibited the highest levels of organic contamination. This grid (samples 203OSA-SB21 through 203OSA-SB42) encompasses most of the area within Lot 203 (note that grids "PCB" and "DDT" comprise the remaining grid areas in Lot 203). Results indicate that low levels of pesticides are present throughout Lot 203 in both the surface and subsurface soils (1 to 5-feet). Samples collected from soil borings 203OSA-SB22 and 203OSA-SB30 (central and northeastern sections of lot) exhibited the highest concentrations and frequencies of pesticides.

PCB concentrations above 1,000 µg/kg were detected in nine surface and two subsurface samples. The highest PCB concentrations within grid "OSA" were found in samples collected from soil borings SB22, SB24, and SB26. Within grid "DDT," the highest PCB concentrations were detected in soil borings SB8 and SB10. Note that PCB concentrations above 1,000 µg/kg were only detected in one surface sample (203PCB-SB3) from the "PCB" grid. PCB transformers were reportedly stored within this grid area while Lot 203 was an active storage area.

Concentrations of VOCs were detected in a few soil samples at low levels (less than 10 µg/kg) within Lot 203.

Inorganic contaminants were detected above background levels in surface soils. Inorganics which exhibited concentrations above background levels include antimony, arsenic, barium, cadmium, calcium, chromium, cobalt, copper, iron, lead, magnesium, manganese, potassium, nickel, sodium, vanadium, and zinc. Moreover, calcium, lead, magnesium, and manganese exhibited the highest values above surface background levels.

Inorganic concentrations in subsurface soils were also above background levels. Nineteen inorganics (excluding antinomy, calcium, cobalt, and silver) exhibited concentrations above background levels. Lead, barium, and manganese exhibited the highest inorganic values.

Wooded Areas, the Ravine, and Site 82

Soil analytical results from the wooded areas are represented by sample grids "201N," "201S," and "201E." The ravine soil results are represented by grid "RAV." Site 82 soil results consist of 24 samples from sample grid "OSA" (samples 203OAS-SB1 through 203OSA-SB20; and 203-SB21 through 203-SB25). Samples collected from monitoring well borings are identified with a "GW" designation. Positive detection summaries for surface soils are presented on

Table 4-19 for organics and on Table 4-20 for inorganics. Subsurface soil positive detection summaries for the organics are presented on Table 4-21 and inorganics are presented on Table 4-22.

Surface soils samples exhibited the following contaminants:

- Pesticides including dieldrin, 4,4'-DDE, 4,4'-DDD, 4,4'-DDT, alpha chlordane, and endrin were detected in samples collected from grids "RAV," "201E," "201S," and "OSA." The ranges and maximum (sample locations shown in parentheses) concentrations of the detected pesticides are as follows:

• 4,4'-DDD	10J to 12,000 µg/kg	(201S-SB8)
• 4,4'-DDT	3.4J to 6,400 µg/kg	(201S-SB8)
• 4,4'-DDE	2.2J to 4,200 µg/kg	(201S-SB8)
• endrin	5.6J to 240J µg/kg	(201E-SB15)
• dieldrin	4.6 to 87J µg/kg	(RAV-SB11)
• alpha chlordane	3.6J µg/kg	(203OSA-SB17 only)

- PCB-1260 was detected in seven samples. Concentrations ranged from 28J to 26,000J (201E-SB15).

- VOCs including toluene, chloromethane, bromomethane, TCE, benzene, 1,1,2,2-tetrachloroethane, 1,2-dichloroethene, and PCE were detected in four samples collected from grid "OSA." The ranges and maximum (sample locations shown in parentheses) concentrations of detected VOCs are as follows:

• 1,1,2,2-tetrachloroethane	55,000 µg/kg	(203OSA-SB6 only)
• chloromethane	620J to 9,800 µg/kg	(203OSA-SB6)
• PCE	2,600J to 7,000J µg/kg	(203OSA-SB12)
• TCE	4,600 µg/kg	(203OSA-SB6 only)
• bromomethane	5J to 3,700J µg/kg	(203OSA-SB6)
• 1,2-dichloroethene	1,500J µg/kg	(203OSA-SB6 only)
• benzene	850J µg/kg	(203OSA-SB6 only)
• toluene	120J µg/kg	(203OSA-SB12 only)

Note that VOCs were not detected in any of the Phase II surface samples.

- Twenty-five different SVOCs were detected with 20 of the detections at soil boring RAV-SB6 and 16 of the detections at soil boring RAV-SB14. The ranges and maximum concentrations (sample locations shown in parentheses) of three of the more frequently occurring SVOCs are as follows:

• pyrene	72J to 2,700 µg/kg	(RAV-SB11)
• benzo(a)anthracene	39J to 2,200 µg/kg	(RAV-SB11)
• benzo(b)fluoranthene	54J to 2,200 µg/kg	(RAV-SB11)

- All 23 TAL inorganics were detected in surface soils.

Subsurface soil analytical results also indicated organic and inorganic contamination. The following summarizes the results:

- Pesticides including dieldrin, 4,4'-DDE, 4,4'-DDD, and 4,4'-DDT were detected at low levels in samples collected from grids "RAV," "201S," and "OSA." The ranges and maximum (sample locations shown in parentheses) concentrations of detected pesticides are as follows:

• 4,4'-DDD	16 µg/kg	(RAV-SB4A only - 1.5 to 2 feet)
• 4,4'-DDT	4.0J to 77J µg/kg	(RAV-SB14 - 0.5 to 1 foot)
• 4,4'-DDE	3.5J to 67 µg/kg	(RAV-SB14 - 0.5 to 1 foot)
• dieldrin	3.4J to 280J µg/kg	(RAV-SB13 3 to 4 feet)

- PCB-1260 was detected in four samples. Concentrations ranged from 46J to 100 µg/kg (201E-SB5).

- Toluene, total xylenes, TCE, benzene, 1,1,1-trichloroethane, 1,2-dichloroethene, PCE, chloromethane, and bromomethane along with several other VOCs were detected. The ranges and maximum (sample locations shown in parentheses) of some of the more frequently occurring VOCs are as follows:

• PCE	9.0J to 11,000 µg/kg	(203OSA-SB-12 - 1 to 3 feet)
• total xylenes	950J µg/kg	(RAV-SB13 only - 3 to 4 feet)
• bromomethane	4.0J to 1,300 µg/kg	(OSA-SB19 - 1 to 3 feet)

• chloromethane	490J µg/kg	(OSA-SB19 only - 1 to 3 feet)
• toluene	1.0J to 34 µg/kg	(203OSA-SB19 - 1 to 3 feet)
• 1,1,1-trichloroethane	1.0J µg/kg	(201E-SB10 only - 3 to 5 feet)
• TCE	1.0J µg/kg	(RAV-SB16 only - 3 to 4 feet)
• 1,2-dichloroethene	5.0J µg/kg	(well boring GW-10 only - 2 to 4 feet)
• benzene	1.0J µg/kg	(201N-2SB10 only - 3 to 5 feet)
• 1,1,2,2-tetrachloroethane	1,100 µg/kg	[6GW34 only - 22 to 24 feet (sampled below the water table)]

- Fifteen different SVOCs were detected with nine of the detections at soil boring 203OSA-SB7 (1 to 3-foot sample). The ranges and maximum concentrations (sample locations shown in parentheses) of four of the more frequently occurring SVOCs are as follows:

• 2-methylnaphthalene	37J to 11,000J	(RAV-SB13 - 3 to 4 feet)
• naphthalene	9,600J µg/kg	(RAV-SB13 only - 3 to 4 feet)
• pyrene	63J to 110J µg/kg	(203OSA-SB7 - 1 to 2 feet)
• benzo(a)anthracene	45J to 96J µg/kg	(203OSA-SB7 - 1 to 2 feet)

- All 23 TAL inorganics were detected in subsurface soils.

Results indicate that organics are present throughout the wooded areas, the ravine and Site 82. The presence of pesticides appears to be most significant in the ravine and at random areas throughout grid "201S." During the investigation, numerous deteriorated 5-gallon containers, which were labeled "DDT," were noted on the surface at the northern end of the ravine. The levels of pesticides detected in the wooded areas appear to be the result of random spraying and not related to disposal activities. Further, the presence of PCBs occurs mainly within the ravine and along the eastern boundary of grid "201E."

VOCs and SVOCs were detected throughout the four grids. The most significant levels of VOCs (both halogenated and aromatic hydrocarbons) were found in samples collected from Site 82. Samples collected from soil borings OSA-SB6 (surface), OSA-SB12 (both surface and subsurface), and OSA-SB19 (subsurface) exhibited the highest levels of VOCs. In general, samples collected from the ravine exhibited the highest concentrations of SVOCs.

Soil samples collected from several monitoring well soil borings at Site 82 exhibited contamination. Samples collected from 6GW10 [1,2-dichloroethene (5.0 µg/kg)], 6GW32[1,2-dichloroethene (12 µg/kg)], 6GW15D [TCE (4.0 J µg/kg)], 6GW31 [ethylbenzene (35 J µg/kg)], and 6GW34 [TCE (49 µg/kg)] and 1,1,2,2-tetrachloroethane (1,100 µg/kg)] contained the highest levels of subsurface soil organic contamination among the monitoring well soil borings.

Concentrations of 20 inorganics (excluding selenium, silver, and thallium) were detected above the background ranges of surface soils at Camp Lejeune. Arsenic, calcium, barium, iron, lead, magnesium, and manganese exhibited the highest values above surface background levels.

Inorganic concentrations detected in subsurface soils were also above the background ranges of soils at Camp Lejeune. Twenty-one inorganics (excluding antinomy and silver) exhibited concentrations above background levels. Lead, iron, barium, and manganese exhibited the highest values above subsurface background levels.

4.1.2.2 Groundwater Investigation

Groundwater results are presented for the Phase I (samples collected from existing and Phase I wells) and Phase II (samples collected from existing, Phase I, and Phase II wells) sampling events. Table 4-5 presents a summary (Phase I - Round One) of positive detections for organics, and Tables 4-6 and 4-7 (refer to Section 4.1.1.2) present a summary (Phase I - Round One) of positive detections for inorganics (total and dissolved metals, respectively). Phase II - Round Two groundwater results are summarized in Appendix L and Phase II - Round One groundwater results are summarized on Tables 4-23 (organics) and Table 4-24 (total and dissolved inorganics). Site 6 and Site 82 groundwater samples are designated on the tables with the number "6" or "82" [deep wells are presented with the letters "DW" (e.g., "GW01-DW-01")]. Monitoring well locations are shown on Figure 2-8.

Summary of Phase I - Round One Results

Surficial Groundwater

As shown on Table 4-5, 12 VOCs and three SVOCs were detected from the 35 shallow monitoring wells sampled at Sites 6 and 82. Detected VOCs, their ranges, and well numbers exhibiting the highest contaminant levels include:

• TCE	0.5J to 120 µg/l	(6GW28S)
• chlorobenzene	110 µg/l	(6GW16 only)
• PCE	0.9J to 26 µg/l	(6GW28S)
• trans-1,2-dichloroethene	16 µg/l	(6GW28S only)
• 1,1,2,2-tetrachloroethane	1.0 to 6.9 µg/l	(6GW1S)
• chloroform	2.7 µg/l	(6GW16 only)
• vinyl chloride	1.6 µg/l	(82MW2 only)
• total xylenes	1.4 µg/l	(6GW1S only)
• bromodichloromethane	1.6J µg/l	(6GW26 only)
• 1,2-dichloroethane	0.6J µg/l	(6GW15 only)
• 1,1,2-trichloroethane	0.5J µg/l	(6GW28S only)
• 1,1,1,-trichloroethane	0.5J µg/l	(82MW1 only)

Moreover, the following wells exhibited VOC contaminant levels above the Federal MCLs or the NCWQS:

- 6GW28S - TCE (120 µg/l; NCWQS of 2.8 µg/l and Federal MCL of 5.0 µg/l)
  - PCE (26 µg/l; NCWQS of 0.7 µg/l and Federal MCL of 5.0 µg/l)
- 6GW1S - PCE (6.9 µg/l)
- 82MW2 - vinyl chloride (1.6 µg/l; NCWQS of 0.015 µg/l)
- 6GW16 - PCE (1.0 µg/l)
  - chloroform (2.7 µg/l; NCWQS of 0.19 µg/l)
- 6GW3 - PCE (0.9J µg/l)
- 6GW15 - 1,2-dichloroethane (0.6J µg/l; NCWQS of 0.38 µg/l)

Detected SVOCs and their ranges include phenol (1.0J to 2.0J µg/l), 2-chlorophenol (5.0J µg/l in one sample), and bis(2ethylhexyl) phthalate (1.0J to 2.0J µg/l). The low concentrations of

2-chlorophenol and bis(2-ethylhexyl) phthalate are believed to be the result of laboratory contamination and not the result of contamination from the site.

Pesticides and PCBs were not detected above method detection limits for any of the samples collected from shallow wells.

Results of the inorganic analyses indicated detections for 19 of the 23 total (silver, thallium, selenium, cyanide not detected) and 18 of 24 dissolved (beryllium, copper, thallium, selenium, and mercury not detected) TAL inorganics. Sixteen of the wells exhibited concentrations of inorganics above the Federal MCLs or NCWQS. These contaminants include arsenic, chromium, lead, and manganese. Moreover, the wells (from most contaminated to least contaminated) where elevated inorganics were detected include 6GW3, 6BP6 (background well), 82MW3, 6GW9, 82MW1, 6GW7S, 6GW2 (background well), 6GW5, 6GW1S, 6GW15, 6GW6, 6GW19, 6GW16, 6GW26, 6GW4, and 82MW2. The ranges and maximum (well number is shown in parentheses) concentrations are as follows:

• chromium (total)	51.4 to 201 μg/l	(6GW3)
• lead (total)	64.4 to 200J μg/l	(6GW3)
• manganese (total)	55 to 362 μg/l	(6GW3)
• manganese (dissolved)	57 to 127 μg/l	(82MW1)
• arsenic (total)	67.8 μg/l	(82MW1 only)

Manganese was the only dissolved inorganic detected above the secondary MCL or the NCWQS.

Groundwater field parameter results for pH, temperature, and specific conductance are presented on Table 4-25. Specific conductance values ranged from 34 to 660 micromhos/cm, pH values ranged from 4.47 to 6.91 s.u. (slightly acidic to slightly basic), and temperature values ranged from 13.1° to 24.5°C. These values represent all field measurements collected (i.e., from each well volume purged) which may account for the wide ranges. Generally the specific conductance values appear to be within the range or slightly above the range of natural waters (Pagenkopf, 1978). Many of the pH values were below the Federal Secondary MCL, but none of these values were below 2.5 (RCRA hazardous).

Deep Groundwater

Organic compounds were detected at all five Phase I deep monitoring wells. Detected VOCs, their ranges, and well number include:

• TCE	1.2 to 58,000 µg/l	(6GW1D)
• trans-1,2-dichloroethene	500 to 5,800 µg/l	(6GW27D)
• methylene chloride	790J µg/l	(6GW1D only)
• PCE	630 µg/l	(6GW1D)
• ethylbenzene	48 µg/l	(6GW1D only)

Three of the deep wells exhibited VOC contaminant levels above the Federal MCLs or the NCWQS, including:

• 6GW1D	TCE	(58,000J µg/l)
	trans-1,2-dichloroethene	(5,600J µg/l)
	methylene chloride	(790 J µg/l)
	PCE	(630 µg/l)
• 6GW27D	TCE	(18,000 µg/l)
	trans-1,2-dichloroethene	(5,800 µg/l)
• 6W28D	TCE	(3600 µg/l)
	trans-1,2-dichloroethene	(500 µg/l)

Detected SVOCs and their ranges include phenol (2.0J to 22 µg/l) and bis(2-ethylhexyl) phthalate (5.0J to 22 µg/l). As mentioned in Section 4.1.1.2, bis(2-ethylhexyl) phthalate is most likely the result of laboratory contamination and may not be associated with the site.

Concentrations of pesticides and PCBs were not detected above method detection limits in any of the deep wells.

Results of the inorganic analyses indicated detections for 11 of the 24 total (beryllium, chromium, cobalt, copper, mercury, nickel, vanadium, zinc, silver, thallium, selenium, cyanide not detected) and 8 of 24 dissolved (arsenic, aluminum, beryllium, chromium, cobalt, copper, lead, mercury, nickel, vanadium, zinc, silver, thallium, selenium, cyanide were not detected) TAL inorganics. As shown on Tables 4-6 and 4-7, none of the deep wells exhibited concentrations of total or dissolved inorganics above the Federal MCLs or NCWQS in groundwater.

Groundwater field parameter results for pH, temperature, and specific conductance (deep wells 6GW1D, 6GW2D, 6GW7D, 6GW27D, and 6GW28D) are presented on Table 4-25. Specific conductance values ranged from 297 to 770 micromhos/cm, pH values ranged from 7.36 to 8.75 s.u. (slightly basic), and temperature values ranged from 18.5° to 19.5°C. The slightly elevated pH readings may be the result of grout, which was used during drilling and well construction, interacting with the groundwater. Note that the pH readings decreased and stabilized over time during the purging activities.

The Phase I groundwater results indicated that the predominant VOCs detected in both the shallow and deep groundwater are chlorinated hydrocarbons (e.g., TCE). These compounds are typically associated with industrial solvents or degreasing agents (i.e., trichloroethene), and/or their degradation product (i.e., vinyl chloride). According to Activity records from Camp Lejeune, solvents and degreasing agents were commonly used and stored at Lot 203 while the storage lot was active. In addition to the chlorinated hydrocarbons, low levels of aromatic hydrocarbons (e.g., total xylenes) are also present. These compounds are typically associated with petroleum fuels or waste oils.

Concentrations of phenol were also detected at several well locations. The source of the phenol is unknown at this time since past records do not indicate this compound was stored or disposed of at the site.

Summary of Phase II - Round Two Results

This section summarizes the results of the Phase II - Round Two groundwater sampling investigation. These results include all Phase I and existing site monitoring wells. Note that only volatile organics were analyzed for the Round Two sampling event because these compounds were the contaminants of concern identified during the Phase I - Round One investigation.

<u>Surficial Groundwater</u>

Analytical results are provided in Appendix L. Detected VOCs, their ranges, and maximum concentrations (well number shown in parentheses) are as follows:

• chlorobenzene	1.8 to 8,500 µg/l	(6GW16)
• 1,1,2,2-tetrachloroethane	1.8J to 60	(6GW16)
• total-1,2-dichloroethene	1.8J to 6.4 µg/l	(6GW15)
• 1,4-dichlorobenzene	4.5 µg/l	(6GW16 only)
• TCE	1.2 to 4.0	(6GW28S)
• chloroform	1.6 to 20 µg/l	(6GW16)
• PCE	1.0 to 2.6 µg/l	(6GW17)
• trichlorofluoromethane	1.9 µg/l	(6GW13 only)
• 1,1,2-trichloroethane	1.6 µg/l	(6GW16 only)

Moreover, the following wells exhibited VOC contaminant levels above the Federal MCLs and/or the NCWQS:

• 6GW16	- chlorobenzene	(8,500 µg/l; NCWQS of 300 µg/l)
	- PCE	(1.2 µg/l; NCWQS of 0.7 µg/l)
• 6GW28S	- TCE	(4.0 µg/l; NCWQS of 2.8 µg/l)
	- PCE	(1.0 µg/l; NCWQS only)
• 6GW17	- PCE	(2.6 µg/l; NCWQS only)
• 6GW22	- PCE	(1.4 µg/l; NCWQS only)

Groundwater field parameter results are presented on Table 4-26. Specific conductance values ranged from 13 to 1,103 micromhos/cm, pH values ranged from 3.50 (acidic to slightly basic) to 8.54 s.u., and temperature values ranged from 11° to 18°C. As discussed in previous sections, these values represent all field measurements collected (i.e., from each well volume purged) which may account for the wide ranges. Note that many of the pH values were below the Federal Secondary MCL (drinking water standards) of 6.5 s.u., but none of these values were below 2.5 s.u. (RCRA hazardous).

Deep Groundwater

Analytical results for the deep wells are provided in Appendix L. Detected VOCs, their ranges, and maximum concentrations (well number shown in parentheses) are as follows:

• TCE	2.1 to 50,000 µg/l	(6GW1D)
• total-1,2-dichloroethene	5,800 to 30,000 µg/l	(6GW27D)
• PCE	2.1 to 920 µg/l	(6GW1D)
• vinyl chloride	100J to 800J µg/l	(6GW1D)
• 1,1-dichloroethene	12 to 55 µg/l	(6GW27D)
• ethylbenzene	2.0 to 52 µg/l	(6GW1D)
• 1,2-dichloroethane	7.5 to 30 µg/l	(6GW1D)
• chlorobenzene	3.6 to 18 µg/l	(6GW28D)
• 1,4-dichlorobenzene	17 µg/l	(6GW1D only)
• benzene	6.7 µg/l	(6GW1D only)
• total xylenes	2.1 µg/l	(6GW1D only)
• chloroform	1.4J µg/l	(6GW1D only)
• toluene	1.4 µg/l	(6GW1D only)

Moreover, the following wells exhibited VOC contaminant levels above the Federal MCLs and/or the NCWQS:

• 6GW1D	- TCE	(50,000 µg/l; both MCLs and NCWQS)
	- PCE	(920 µg/l; both MCLs and NCWQS)
	- vinyl chloride	(800J µg/l; both MCLs and NCWQS)
	- 1,1-dichloroethene	(51 µg/l; both MCLs and NCWQS)
	- ethylbenzene	(52 µg/l; NCWQS only)
	- 1,4-dichlorobenzene	(17 µg/l; NCWQS only)
	- benzene	(6.7 µg/l; both MCLs and NCWQS)
• 6GW27D	- TCE	(22,000 µg/l; both MCLs and NCWQS)
	- PCE	(18 µg/l; NCWQS only)
	- vinyl chloride	(250J µg/l; both MCLs and NCWQS)
	- 1,1-dichloroethene	(55 µg/l; both MCLs and NCWQS)
• 6GW28D	- TCE	(9,100 µg/l; both MCLs and NCWQS)
	- PCE	(42 µg/l; both MCLs and NCWQS)
	- vinyl chloride	(100J µg/l; both MCLs and NCWQS)
	- 1,1-dichloroethene	(12 µg/l; both MCLs and NCWQS)

Groundwater field parameter results are presented on Table 4-25. Specific conductance values ranged from 290 to 820 micromhos/cm, pH values ranged from 6.80 (acidic to slightly basic) to 10.60 s.u., and temperature values ranged from 15° to 19°C. As discussed in previous sections, these values represent all field measurements collected (i.e., from each well volume purged) which may account for the wide ranges. The slightly elevated pH readings may be the result of grout, which was used during drilling and well construction, interacting with the groundwater. Note that the pH values decreased and stabilized over time during the purging activities.

Summary of Phase II - Round One Results

The following section summarizes the results of the Phase II - Round One groundwater sampling investigation. These results include all Phase II monitoring wells (i.e, wells installed during the Phase II investigation) and existing well 82MW30. Note that well 82MW30 was not sampled during the Phase I investigation because an obstruction (removed during the Phase II investigation) was encountered in this well. Groundwater samples from these wells were analyzed for full TCL organics and TAL inorganics because this sampling event was the first round (Round One) of data collected from these wells. Additionally, note that two groundwater samples were collected from well 6GW1DA; sample 6GW1DA-top was collected from the top of the water column while sample 6GW1DA-bottom was collected from the bottom of the well.

<u>Shallow Wells</u>

Seven surficial groundwater water samples (five from monitoring wells and three from temporary wells) were collected during the Phase II - Round One investigation. Analytical results are presented on Tables 4-23 (organics) and 4-24 (inorganics).

Detected VOCs, their ranges, and maximum concentrations (well number shown in parentheses) are as follows:

• 1,1,2,2 tetrachloroethane	9,600 µg/l	(6GW34 only)
• total-1,2-dichloroethene	3.7 to 2,200 µg/l	(6GW32)
• TCE	63 to 1,500 µg/l	(6GW32)
• PCE	3.6 to 1,200 µg/l	(6GW34)
• 1,1,2-trichloroethane	58 µg/l	(6GW34 only)

• vinyl chloride	8.6J to 14 µg/l	(TW-3)
• 1,2-dichlorobenze	4.4 µg/l	(6GW34 only)
• 1,1-dichloroethene	1.3 to 1.4 µg/l	(TW-3)
• benzene	1.4 µg/l	(6GW32 only)
• toluene	1.0 to 4.4 µg/l	(6GW34)

Moreover, the following wells exhibited VOC contaminant levels above the Federal MCLs and/or the NCWQS:

• 6GW32	- TCE	(1,500 µg/l; both MCLs and NCWQS)
	- PCE	(74 µg/l; both MCLs and NCWQS)
	- vinyl chloride	(8.6J µg/l; both MCLs and NCWQS)
	- benzene	(4.4 µg/l; NCWQS only)
• 6GW34	- PCE	(1,200 µg/l; both MCLs and NCWQS)
	- TCE	(610 µg/l; both MCLs and NCWQS)
• TW-3	- TCE	(63 µg/l; both MCLs and NCWQS)
	- PCE	(3.6 µg/l; NCWQS only)
	- vinyl chloride	(14 µg/l; both MCLs and NCWQS)
• TW-2	- PCE	(6.6 µg/l; both MCLs and NCWQS)
	- TCE	(360 µg/l; both MCLs and NCWQS)

Results of the inorganic analysis indicated detections of 20 of the 23 total TAL inorganics (antimony, silver, and thallium were not detected). Several of the constituents including cadmium, chromium, lead, and manganese were detected at concentrations above the Federal MCLs and/or the NCWCS. The following wells exhibited elevated concentrations of inorganics:

• 6GW31 - total manganese	(126 µg/l)
• 6GW32 - total cadmium	(8.4J)
- total chromium	(385 µg/l
- total manganese	(1,170 µg/l)

- 6GW33 - total chromium (139 µg/l)
  - total lead (57.2 µg/l)

- 6GW34 - total cadmium (5.2J µg/l)
  - total chromium (259 µg/l)
  - total manganese (171 µg/l)

None these wells exhibited concentrations of dissolved inorganics which were above the Federal MCLs or NCWCS.

Groundwater field parameter results are presented on Table 4-26. Note that field parameters were not obtained from temporary wells TW-1, TW-2, and TW-3. Specific conductance values ranged from 62 to 283 micromhos/cm, pH values ranged from 4.52 (acidic to slightly basic) to 8.19 s.u., and temperature values ranged from 13° to 16°C. As discussed in previous sections, these values represent all field measurements collected (i.e., from each well volume purged) which may account for the wide ranges. Note that several of the pH values were below the Federal Secondary MCL (drinking water standards) of 6.5 s.u., but none of these values were below 2.5 s.u. (RCRA hazardous).

Deep Wells

Seven deep groundwater water samples were collected during the Phase II - Round One investigation. Analytical results are presented on Table 4-23. Detected VOCs, their ranges, and maximum concentrations (well number shown in parentheses) are as follows:

• TCE	6.4 to 160 µg/l	(6GW1DA-top)
• total-1,2-dichloroethene	6.4 to 100 µg/l	(6GW1DA-top)
• PCE	1.0 to 2.9 µg/l	(6GW1DA-top)
• 1,2-dichlorobenzene	2.6 µg/l	(6GW37D only)

Moreover, the following wells exhibited VOC contaminant levels above the Federal MCLs and/or the NCWQS:

- 6GW1DA - TCE [160 (bottom) and 83 (top) µg/l; both MCLs and NCWQS)
  - PCE [2.9 (bottom) and 1.3 (top) µg/l; NCWQS only)

- 6MW3D - TCE (6.4 µg/l; both MCLs and NCWQS)

- 6GW15D - TCE (34 µg/l; both MCLs and NCWQS)
  - PCE (1.0 µg/l; NCWQS only)

Groundwater field parameter results are presented on Table 4-26. Specific conductance values ranged from 290 to 820 micromhos/cm, pH values ranged from 6.80 (acidic to slightly basic) to 10.60 s.u., and temperature values ranged from 15° to 19°C. As discussed in previous sections, these values represent all field measurements collected (i.e., from each well volume purged) which may account for the wide ranges. The slightly elevated pH readings may be the result of grout, which was used during drilling and well construction, interacting with the groundwater. Note that the pH values decreased and stabilized over time during the purging activities.

Comparison of Phase I - Round One and Phase II - Round Two Results

Groundwater analytical data comparing the Phase I - Round One (i.e., samples collected in October and November 1992) and the Phase II - Round Two (i.e., samples collected in March 1993) results from Sites 6 and 82 are summarized on Table 4-10. Note that Table 4-10 only compares organics because inorganics were not analyzed from the Round Two samples. Furthermore, data collected from the Phase II - Round One (i.e., wells installed during the Phase II investigation) sampling event were not used for comparative purposes because only one round of samples were collected from these wells.

In general, higher VOC concentrations were noted in the Round Two samples for both shallow and deep wells. Twelve of the 19 shallow wells sampled and four of the five deep wells sampled exhibited increases in contaminant levels. Wells 6GW16 and 6GW28S exhibited the most significant changes in contaminant levels of the shallow wells which include the following:

- The concentration of chlorobenzene increased from 110 µg/l (Round One) to 8,500 µg/l (Round Two). Increased levels of chloromethane (2.7 to 60 µg/l) and TCE (1.0 to 60 µg/l) were also noted. As mentioned previously, this well is situated adjacent to one of the test pits where small containers of possibly paint and solvents were discovered.

- TCE and PCE levels significantly decreased in Round Two samples collected from 6GW28S. Concentrations of TCE decreased from 120 to 4.0 µg/l and concentrations of PCE decreased from 26 to 1.0 µg/l.

Moreover, wells 6GW1D, 6GW27D, and 6GW28D exhibited the most significant changes in contaminant levels of the deep wells which include the following:

- Total VOC concentrations increased from 66,068 to 77,910.4 µg/l in well 6GW1D, from 23,800 to 52,342.6 µg/l in well 6GW27D, and from 4,100 to 15,081.5 µg/l in well 6GW28D.

As mentioned previously, the overall increase in contaminant levels observed in the Round Two samples may be attributed to seasonal fluctuations in the water table.

4.1.2.3 Surface Water and Sediment Investigations

The following section discusses the results of the surface water and sediment investigations performed at Site 6. The three surface water bodies sampled at Site 6 include Wallace Creek, Bear Head Creek, and the ravine. Note that even though Wallace Creek and the ravine are situated within the boundary of Site 82, they were identified as part of Site 6 for this RI investigation. (The addition of Site 82 was made after the sampling of Wallace Creek was conducted.). Complete statistical summaries, frequencies, etc. are provided in Appendices L through T for the surface water and sediment investigations.

Surface Water

The following sections present the results of surface water investigation. Note that only one round of surface water and sediment samples were collected as part of this RI investigation.

Bear Head Creek

Organics (Table 4-27) were detected in several surface water samples. Detected organics included two SVOCs, diethyl phthalate (2.0 J µg/l) and bis (2)-ethylhexyl phthalate (1.0 J to 2.0 J µg/l), which were detected in five samples. These two compounds are most likely the result of laboratory contamination because historically these compounds have not been stored or disposed of in the vicinity of the creek. Concentrations of VOCs, pesticides, and PCBs were not detected in any of the samples.

All fourteen surface water samples exhibited some concentrations of TAL inorganics (Table 4-28). Sixteen of the 24 TAL inorganics were detected (antimony, arsenic, beryllium, cadmium, cyanide, cobalt, selenium, and thallium were not detected). Concentration ranges and maximums (sample locations shown in parentheses) of several of the more frequently occurring inorganics are as follows:

- barium 14JB to 31.3B µg/l (BH03-SW-06M)
- chromium 4.4B to 8.0B µg/l (BH05-SW-06M)
- manganese 6.3B to 65 µg/l (BH05-SW-06M)
- nickel 8.0JB to 244 µg/l (BH07-SW-312M)
- zinc 6.2B to 30.7 µg/l (BH07-SW-312M)

Field chemistry parameter results for Bear Head Creek are presented on Table 4-28. These parameters were measured prior to biological sample collection (i.e., fish sampling). Salinity values were ND; specific conductance ranged from 6.0 to 140 micromhos/cm; dissolved oxygen ranged from 4.95 to 6.45 mg/l; pH ranged from 5.5 to 6.4 s.u.; and temperatures ranged from 22.8° to 24°C.

Wallace Creek

Organic compounds were detected in surface water samples collected from Wallace Creek as shown on Table 4-30. Detected organics include six VOCs (vinyl chloride, acetone, 1,2,-dichloroethene, TCE, PCE, and toluene), and two SVOCs [(2,4,6,-trichlorophenol and bis (2)ethylhexylphthalate)]. Concentration ranges and maximums (sample locations shown in parentheses) of some of the more frequently occurring VOCs are as follows:

- vinyl chloride 6.0J µg/l (WC07-SW-06B only)
- 1,2,-dichloroethene 2.0J to 85 µg/l (WC07-SW-06B)
- TCE 3J to 98 µg/l (WC07-SW-06M)
- PCE 1.0J to 4.0J µg/l (WC07-SW-06M)
- toluene 1.0J to 3.0J µg/l (WC07-SW-06M)

Pesticides and PCBs were not detected in any of the samples.

All 28 surface water samples exhibited some TAL inorganics (Table 4-31). A total of 19 of the 24 TAL inorganics were detected (antimony, beryllium, cyanide, selenium, and thallium were not detected). Concentration ranges and maximums (sample locations shown in parentheses) of some of the more frequently occurring inorganics are as follows:

• arsenic	3.7B µg/l	(WC09-SW-06B)
• barium	16JB to 22.6B µg/l	(WC05-SW-06M)
• cadmium	3.2JB to 17.4J µg/l	(WC07-SW-312M)
• chromium	4.9B µg/l	(WC05-SW-312M only)
• manganese	8.2JB to 17.8 µg/l	(WC07-SW-06B)
• nickel	102 to 1,380 µg/l	(WC03-SW-312M)
• zinc	7.3B to 111 µg/l	(WC03-SW-312M)

Field parameter results for Wallace Creek are summarized on Table 4-29. These parameters were measured prior to biological sample collection. Salinity ranged from 0.0 to 7.5 ppt; specific conductance ranged from 20 to 11,500 micromhos/cm; dissolved oxygen ranged from 0.13 to 5.85 mg/l; pH was 6.3 s.u.; and temperatures ranged from 22.8° to 28°C.

Ravine

Acetone was the only organic compound detected in water samples collected from the ravine (Table 4-32). As mentioned throughout Section 4.0, the acetone is most likely the result of decontamination procedures (elevated concentrations of acetone were also detected in equipment rinsate samples) with isopropanol alcohol and not associated with the site.

Inorganics were detected in all six surface water samples from the ravine area as shown on Table 4-33. Seventeen of the 24 TAL inorganics were detected (antimony, beryllium, cyanide, selenium, nickel, mercury, and thallium were not detected). Concentration ranges and maximums (sample locations shown in parentheses) of some of the more frequently occurring inorganics are as follows:

• arsenic	2.2B to 10.5 µg/l	(RV8-SW-06)
• barium	37.1JB to 91B µg/l	(RV2-SW-06)
• cadmium	3.7JB to 4.3JB µg/l	(RV5-SW-06)
• chromium	4.2B to 6.5B µg/l	(RV7-SW-06)

• manganese	38.6J to 597 µg/l	(RV5-SW-06)
• zinc	72.7 to 495 µg/l	(RV6-SW-06)

Field chemistry parameters were not obtained because biological samples were not collected from the ravine.

Sediments

The following sections present the results of sediment samples collected from the three areas.

Bear Head Creek

Results from sediment samples collected in Bear Head Creek indicated positive detections of organics and inorganics (Tables 4-34 and 4-35, respectively). The following summarizes the results:

- Pesticides (4,4'-DDE, 4,4'-DDT, 4,4'-DDD, and alpha chlordane) were detected at five sample stations including BH02, BH03 (two samples), BH04 (four samples), BH05 (two samples), and BH06 (two samples). The highest concentrations of the four pesticides were detected in samples BH03-SD-06M [4,4'-DDE (68 µg/kg)], BH04-SD-612M [4,4'-DDD (220J µg/kg) and 4,4'-DDT (38J µg/kg)], and BH06-SD-06B [alpha chlordane (14J µg/kg)]. Samples BH03-SD-06M and BH06-SD-06M were collected from the top six inches of sediment and sample BH04-SD-612M was collected from six to twelve inches deep in the sediment. Note that all three of these samples were collected from the middle portion of the creek.

- Low levels of PCBs (PCB-1260) were detected at four sample stations including BH03 (two samples), BH04 (four samples), BH05 (two samples), and BH06 (two samples). The highest concentration was detected in sample BH04-SD-612M (370J µg/kg) from six to twelve inches deep.

- VOCs (methylene chloride, acetone, PCE, 2-butanone, TCE, benzene, ethylbenzene, and total xylenes) were detected at all seven sample stations (BH01 through BH07). Sample BH07-SD-06M exhibited the highest detections of TCE (150 µg/kg), ethylbenzene (57J µg/kg), and total xylenes (380 µg/kg).

- SVOCs including 1,4-dichlorobenzene, pyrene, benzo(b)fluoranthene, benzo(a)pyrene, and indeno(1,2,3-cd)pyrene were detected in 10 samples. Pyrene and benzo(a)pyrene concentrations were highest in samples BH06-SD-06B (76J µg/kg) and BH03-SD-612B (640J µg/kg), respectively.

- Eighteen of 24 TAL inorganics were detected (antimony, cyanide, mercury, nickel, silver, and thallium were not detected) in sediment samples. The ranges and maximum (sample locations shown in parentheses) concentrations of some of the more frequently occurring inorganics are as follows:

• arsenic	0.54B to 6.1JB mg/kg	(BH07-SD-06B)
• barium	7.7JB to 40.4B mg/kg	(BH03-SD-612M
• beryllium	0.13B to 0.97B mg/ kg	(BH03-SD-612B)
• cadmium	0.7JB to 4.7JB mg/kg	(BH07-SD-06M)
• chromium	2.3B to 16.4B mg/kg	(BH07-SD-06M)
• manganese	3.8J to 48.6 mg/kg	(BH07-SD-06M)
• zinc	6.7 to 82.4 mg/kg	(BH07-SD-06M)

Wallace Creek

Results from sediment samples collected in Wallace Creek indicated detections of organics (Table 4-36) and inorganics (Table 4-37). The following summarizes the results:

- Pesticides (4,4'-DDE, 4,4'-DDT, 4,4'-DDD, and dieldrin) were detected in seven samples. The highest concentrations of the four pesticides were detected in samples WC09-SD-612M [4,4'-DDE (83 µg/kg)], WC08-SD-06M [4,4'-DDD (200J µg/kg), and 4,4'-DDT (1,200J µg/kg)], and WC01-SD-612D [dieldrin (4.8J µg/kg)].

- PCB-1260 was detected at seven sample stations. The highest concentration was detected in sample WC08-SD-06M (2,100J µg/kg).

- VOCs (methylene chloride, acetone, carbon disulfide, 2-butanone, 1,2,-dichloroethene, TCE, toluene, and total xylenes) were detected at all eleven of the sample stations (WC01 through WC11). A total xylenes concentration of 120J µg/kg was exhibited in sample WC03-SD-06M.

- SVOCs including phenol, diethyl phthalate, phenanthrene, fluoranthene, butyl benzyl phthalate, benzo(a)anthracene, chrysene, bis(2-ethylhexyl) phthalate, pyrene, benzo(b)fluoranthene, benzo(a)pyrene, and benzo(k)fluoranthene were detected. Pyrene and benzo(a)pyrene concentrations were highest in sample WC08-SD-06B (810J µg/kg and 150J µg/kg, respectively). This sample also contained concentrations of fluoranthene (760 µg/kg), benzo(a)anthracene (210J µg/kg), chrysene (230J µg/kg), benzo(b)fluoranthene (420J µg/kg), and benzo(k)fluoranthene (140J µg/kg).

- Eighteen of 24 TAL inorganics were detected in sediment samples (antimony, cadmium, cyanide, mercury, selenium, thallium were not detected). The ranges and maximum concentrations (sample locations shown in parentheses) of some of the more frequently occurring inorganics are as follows:

• arsenic	1.0B to 10.2 mg/kg	(WC08-SD-612M)
• barium	2.5JB to 110 mg/kg	(WC08-SD-612M)
• beryllium	0.07B to 0.78B mg/kg	(WC07-SD-06B)
• chromium	1.2B to 28.5 mg/kg	(WC10-SD-06M)
• manganese	3.2B to 50.2 mg/kg	(WC09-SD-06M)
• nickel	2.7JB to 10.7JB mg/kg	(WC10-SD-06M)
• zinc	6.2 to 388 mg/kg	(WC09-SD-06B)

Ravine

Results from sediment samples collected in the ravine area indicated positive detections of organics (Table 4-38) and inorganics (Table 4-39). The following summarizes the results:

- Pesticides (4,4'-DDE, 4,4'-DDT, 4,4'-DDD, endrin, endrin aldehyde, and dieldrin) were detected at all eight of the sample stations. The highest concentrations of pesticides were detected in samples RV1-SD-06 [dieldrin (43J µg/kg), endrin (5.1J µg/kg), and endrin aldehyde (7.8 µg/kg)], RV2-SD-06 [4,4'-DDE (120J µg/kg) and 4,4'-DDD (45J µg/kg)], and RV3-SD-06 [4,4'-DDD (210J µg/kg)].

- PCB-1260 was detected at five of the sample stations. The highest concentration was detected in sample RV1-SD-06 (360J µg/kg).

- VOCs including acetone and 2-butanone were detected in a few samples. These contaminants are most likely from decontamination fluids (isopropanol alcohol) or from laboratory contamination.

- Twenty different SVOCs were detected in sediment samples. Sample RV2-SD-06 exhibited the most positive detections (18) and contained the highest levels. Pyrene and benzo(a)pyrene concentrations in this sample were 2,100 µg/kg and 1,000 µg/kg, respectively.

- Nineteen of 24 TAL inorganics were detected (antimony, cyanide, selenium, sodium, thallium were not detected) in sediments samples. Concentration ranges and maximums (sample locations shown in parentheses) of some of the more frequently occurring inorganics are as follows:

• arsenic	0.61B to 4.3 mg/kg	(RV1-SD-06)
• barium	2.9JB to 61.5 mg/kg	(RV1-SD-06)
• beryllium	0.06B to 0.25B mg/kg	(RV8-SD-06)
• cadmium	0.53JB to 5.9J mg/kg	(RV1-SD-06)
• chromium	0.64B to 17.7 mg/kg	(RV1-SD-06)
• manganese	3.4J to 288 mg/kg	(RV1-SD-06)
• nickel	2.1B to 7.7JB mg/kg	(RV1-SD-06)
• zinc	20.3 to 408 mg/kg	(RV1-SD-06)

4.1.2.4 Engineering Parameter Results

Engineering parameters were also analyzed for selected soil and groundwater samples at Sites 6 and 82. Soil samples were analyzed for full TCLP, and RCRA hazardous waste characteristics while groundwater samples were analyzed for the same parameters as discussed in Section 4.1.1.3. A total of five soil samples from Lot 201 were analyzed. TCLP results are summarized on Table 4-40 and in Appendix O. Groundwater engineering parameters which were analyzed from samples collected at deep well 6GW1D are summarized in Appendix P.

TCLP results indicate that all organic and inorganic levels from the five samples were below the Federal TCLP regulatory levels. Additionally, none of the samples classify as RCRA hazardous as defined in 40 CFR Part 260.

Engineering parameters analyzed from 6GW1D indicate the following concentration levels in the deep groundwater:

- BOD - ND
- COD - 26 mg/l
- TS - 403 mg/l
- TDS - 377 mg/l
- TSS - 6 mg/l
- TVS - 216 mg/l

The TDS concentration was below the Federal Secondary MCL of 500 mg/l. COD, TS, TDS, and TVS levels detected in this well were higher than those detected in shallow well 9GW8. Well 9GW8, however, contained a higher level of TSS (48 mg/l).

4.1.2.5 Drum Waste Sampling

As stated in Section 2.4.5, contents from 48 drums/containers were sampled and composited into 11 samples based on physical and chemical characteristics. Composite samples were numbered sequentially 6-B01 through 6-B11. All composite samples were analyzed for RCRA characteristics (ignitability, corrosivity and reactivity) and full TCLP analyses. The results of constituents detected are summarized below. Appendix O provides all sample analyses associated with the drum sampling. In addition, Appendix I contains a summary of composite samples and the drums corresponding to each sample.

VOCs

Two samples (6-B08 and 6-B10) contained methyl ethyl ketone (MEK) at a concentration of 59 mg/l and chloroform at a concentration of 15 mg/l, respectively. No other volatile organic compounds were detected. In evaluating the aforementioned detections, only one constituent, chloroform exceeded the Federal regulatory level (6.0 mg/l) in one sample (6-B10). No other compounds exceeded Federal TCLP regulatory levels.

SVOCs

Total creosols were detected in two samples (6-B07 and 6-B10) at concentrations of 0.06 mg/l and 0.04 mg/l, respectively. In addition, pentachlorophenol was detected in one sample (6-B04) at a concentration of 0.01J mg/l. No other semivolatile organic compounds were detected.

In evaluating the aforementioned detections, no SVOC constituents exceeded Federal TCLP regulatory levels for the compounds detected.

Inorganics

Barium was detected in one sample (6-B07) at a concentration of 1.5 mg/l. Chromium was also detected in one sample (6-B10) at a concentration of 0.2 mg/l. Two samples (6-B04 and 6-B07) contained lead at concentrations of 1.3 mg/l and 0.2 mg/l, respectively. No other metals were detected.

In evaluating the aforementioned detections, no metals exceeded Federal TCLP regulatory levels.

RCRA Characteristics

Two samples (6-B09 and 6-B10) contained elevated pH readings of 13.0 s.u., thus exhibiting corrosive characteristics. One sample (6-B08) exhibited flammability characteristics with a flashpoint of 140°F. No other RCRA characteristics were exhibited.

In evaluating the aforementioned detections and considering the information collected during the field compatibility analyses, it is apparent that some of the materials present contain hazardous constituents. Two samples have been classified as corrosive with a pH of 13.0 s.u. In addition, one sample had a flashpoint of 140°F, classifying the material as flammable.

In summary, some of the containerized material has been classified as a hazardous waste under 40 CFR Part 260 and will require proper treatment and disposal in order to alleviate potential multimedia contamination (i.e., soil and groundwater) from an uncontrolled release.

4.1.2.6 Test Pits Sampling

Phase I Results

Seven test pits were sampled at depths where subsurface soil contamination was suspected to be present. Although 28 test pits were excavated, samples were only collected from seven of them where suspected wastes or stained soil were visually identified. Areas were targeted for sampling where discoloration of soil was apparent or deflections occurred on air monitoring instrumentation. In addition, each test pit (sampled at the area of suspected contamination) was also sampled at the bottom of the excavation, as it was usually at or near the soil and water table interface. All samples collected were analyzed for RCRA characteristics (ignitability, corrosivity and reactivity) and full TCLP analyses. Test pit analytical results are presented in Table 4-41.

Test pit analytical results from subsurface soil samples collected at Site 6 indicate that 6 of 13 samples contained volatile organic compounds ranging from 1J µg/l to 200 µg/l. Chloroform was detected in three samples (6-GS1960A01, 6-GS1960B01, and 6GS1960D02) at concentrations ranging from 8 µg/l to 200 µg/l. PCE was detected in three samples (6-TR1970D01, 6TR1952C01, and 6-TR1952C05) at concentrations ranging from 1.0J µg/l to 40 µg/l. Accordingly, none of the samples exhibited PCE or chloroform concentrations which exceed Federal TCLP regulatory levels.

Semivolatile organic compounds and pesticides were not detected in any of the test pit samples collected.

Metals (TCLP) were detected in all thirteen samples. Arsenic was detected in one sample (6-TR1952C05) at a concentration of 76.3B µg/l. Barium was detected in all thirteen samples at concentrations ranging from 81.5B µg/l to 3360 µg/l. Cadmium was detected in seven samples (6-TR1964A02, 6-TR1964A04, 6-TR1970C02, 6-TR1970D01, 6-TR1970D05, 6-GS1960B01, and 6-GS1960D02) at concentrations ranging from 2.10B µg/l to 31.30 µg/l.. Chromium was detected in four samples (6-TR1964A02, 6-TR1970D01, 6-GS1960B01, and 6-GS1960D02) at concentrations ranging from 3.70B µg/l to 17.80B µg/l. Lead was detected in all but three samples (6TR1952C01, 6-TR1952C05 and 6-GS1960A02) at concentrations ranging from 31.20B µg/l to 10,000 µg/l. The lead concentration detected in sample 6-GS1960D02 (10,000 µg/l) exceeded the regulatory level of 5,000 µg/l. Mercury was detected in one sample (6-GS1960A01) at a concentration of 0.27 µg/l. Selenium was detected in two samples (6-TR1964A02 and 6-GS1960D02) at concentrations of 136B µg/l and 52.20B µg/l, respectively. Silver was detected in one sample (6-TR1970D05) at a concentration of 47 µg/l.

Phase II Results

Analytical results from the Phase II test pit sampling are provided on Tables 4-42 (organics) and 4-43 (inorganics). Samples collected from the Phase II test pits were analyzed for full TCL organics and TAL inorganics.

As shown on Table 4-42, four of the six samples analyzed exhibited concentrations of PCE. Tetrachloroethene was detected in test pits 6-TP2 (130 µg/kg), 6-TP3 (210 µg/kg), 6-TP4 (3.0J µg/kg), and 6-TP5 (1.0J µg/kg). Pesticides including alpha-BHC, 4,4'-DDE, and 4,4'DDT were detected in test pit samples 6-TP2 [4,4'-DDE (7.3J µg/kg), and 4,4'-DDT (33J µg/kg)] and 6-TP7 [alpha-BHC (3.1J µg/kg) and 4,4'-DDE (7.4J µg/kg). Lastly, concentrations of SVOCs including benzo(a)pyrene (97 µg/kg), indeno(1,2,3-cd)pyrene (53J µg/kg), and benzo(g,h,i) perylene (210J µg/kg) were detected in test pit 6-TP2. Note that PCBs were not detected in any of the samples collected.

Sixteen of the 23 TAL inorganics were detected as shown on Table 4-43. The concentrations of these inorganics were highest in test pits 6-TP2 and 6-TP5. Overall, the concentrations of the inorganics were within a magnitude of background subsurface soil at Camp Lejeune.

4.1.2.7 Quality Control/Quality Assurance Results

QA/QC samples were also collected during the Site 6 and Site 82 investigation for the various media sampled. Analytical results of the field duplicates are provided in Appendix N and other QA/QC results (i.e., trip blanks, field blanks, and equipment rinsates) are provided in Appendix R.

Various organics and inorganics were detected in QA/QC samples. The most commonly. detected organics included methylene chloride, acetone, carbon disulfide, diethyl phthalate, and bis (2ethylhexyl) phthalate. Methylene chloride, bis (2-ethylhexyl) phthalate, carbon disulfide, and diethyl phthalate levels are most likely the result of laboratory contamination while acetone is most likely the result of decontamination procedures with isopropanol alcohol. Additionally, low concentrations of TCE [detected in equipment rinsate sample (split-spoon) 201A-ER-03 at 2.0J µg/l] and benzene (detected in trip blank samples TB-19, TB-20, and TB-21 ranging from 2.0J to 4.0J µg/l) were also detected in a few QA/QC samples.

All 24 TAL inorganics were detected in QA/QC samples but most were quantified B, JB, UJ, or J qualifiers. A few field blanks and equipment rinsates exhibited concentrations of iron, lead, calcium. One equipment rinsate sample (201E-ER-13) collected from a split-spoon contained low levels of chromium (12 µg/l).

A sample (6GW1D-FB-03) of drilling mud was collected while advancing the borehole for deep well 6GW1D to evaluate contaminant levels while the mud was in contact with potentially contaminated soil/groundwater. Concentrations of bromodichloromethane (64J µg/kg) and TCE (28J µg/kg) were detected in this sample. The contaminants detected in the drilling mud most likely resulted from the mud mixing with contaminated groundwater while the borehole was being advanced.

4.2 Extent of Contamination

This section addresses the extent of contamination for the various media sampled. Note that the extent of groundwater contamination is discussed for both the Phase I - Round One, and Phase II - Rounds One (Round One for Phase II Wells) and Two investigations.

4.2.1 Soil

4.2.1.1 Site 9

Results indicate that pesticides are present in soils throughout Site 9. Other contaminants such as VOCs, SVOCs, PCBs, and inorganics were either: (1) not detected (PCBs); (2) detected but at only a few isolated sample locations (VOCs and SVOCs); or (3) detected but within same order of magnitude as background levels (inorganics). Total petroleum hydrocarbons (TPH) were also detected in soils.

The extent of pesticide contamination in surface and subsurface soils at Site 9 is depicted on Figures 4-1 and 4-2. As shown on Figure 4-1, pesticides were detected throughout the site with most of the contamination occurring in the vicinity of the fire training pit or oil/water separator. Five surface soil samples exhibited pesticide concentrations. These areas are located south and east of the fire training pit, and north of the ASTs. The highest concentrations were detected in samples collected at SB1 [4,4'-DDE (650 µg/kg) and 4,4'-DDT (570 µg/kg)]. In the vicinity of soil borings SB24, SB31, and SB35, pesticides are present in the subsurface soil (1 to 7-feet deep) as shown on Figure 4-2. The highest concentrations in subsurface soils were detected in samples collected at SB31 [4,4'-DDE (17 to 39 µg/kg); 4,4'-DDD (16 to 50 µg/kg); 4,4'DDT (23 to 72 µg/kg]. This boring is located on the south side of the fire training pit. Note that soil boring SB-35 (also located on the south side of the fire training pit) was the only soil boring which exhibited pesticide concentrations in both the surface and subsurface samples.

As discussed in Section 4.1.1.1, VOCs and SVOCs were detected in a few samples at low levels (under 60 µg/kg). PCE was the most frequently detected VOC (three samples) while pyrene (two samples) and fluorene (two samples) were the most frequently detected SVOCs. The extent of these contaminants at Site 9 is not wide spread and is limited to isolated areas. The highest frequencies of SVOCs were detected in subsurface samples collected at monitoring well soil boring 9GW4 (background well) which is located approximately 800 feet southeast of Site 9. The source of this SVOC contamination is unknown but is unlikely related to Site 9 activities, since the sample location is 800 feet away from Site 9 and because no SVOCs (or VOCs) were detected in groundwater samples collected from well 9GW4.

The highest TPH levels were detected primarily in samples collected east and south of the oil/water separator and fire fighting training pit. The source of the TPH contamination, therefore, may be related to fire training activities. These TPH levels may not indicate the soils are impacted by organic contamination since concentrations of VOCs and SVOCs were generally low and present in only a few samples.

The concentrations of inorganics in soils at Site 9 for the most part are within background levels for Camp Lejeune. Chromium and manganese, however, were detected above background levels in soils. These two constituents were also detected in groundwater above Federal MCLs and the NCWQS. Manganese, as reported in previous sections, is a common inorganic found throughout Camp Lejeune (Greenhorne & O'Mara, 1992). In addition to soil and groundwater, chromium was detected in surface water and sediments. The source of the chromium is unknown but it is widely used in industrial processes (in the form of chromium salts) and reportedly has a mean river water concentration of 3.2 µg/l in the U.S. (Pagenkopf, 1978). Because of the random distribution of both chromium and manganese in groundwater, it does not appear that the source is related to Site 9 activities. It is possible that chromium levels are elevated due to suspended solids in water samples. None of the dissolved analyses indicated elevated levels of chromium.

4.2.1.2 Sites 6 and 82

The extent of soil contamination at Sites 6 (which is comprised of Lot 201, Lot 203, the wooded areas, and the ravine) and 82 is addressed separately for each area of concern (e.g., Lot 203). The discussion of soil contamination for the wooded areas, the ravine, and Site 82 is presented in the same section. Additionally, the results of the Phase II sampling (i.e., Phase II soil borings) were also used for assessing the extent of contamination.

Lot 201

Based on the analytical results, the contaminants of concern at Lot 201 include pesticides, VOCs, and SVOCs. Accordingly, the extent of contamination for these contaminants is discussed.

As shown on Figure 4-3, pesticides are present throughout surface soil in all three grid areas (A, B, and C). Grid area A, which is reported to be a former pesticide storage area, exhibited the highest concentrations of pesticides (e.g., soil boring SB17 exhibited 1,200,000 μg/kg of 4,4'-DDT) and also exhibited the widest distribution of pesticide contamination that encompasses most of the grid. In general, areas along the fence lines or the outer portions of Lot 201 in all three grids exhibited the highest levels of pesticide contamination. Pesticide contamination (i.e., elevated levels) does not appear to extend much further beyond (primarily grids A and B) Lot 201 since pesticides were only detected in a few samples in the wooded areas outside (east, north, and south) of Lot 201 (refer to Figures 4-13 and 4-14).

Pesticide contamination in subsurface soils at Lot 201 is depicted on Figure 4-4. Overall, pesticide contamination in subsurface soil is considerably less than the surface soil. Pesticides in subsurface soil are most significant along the eastern boundary of sample grid A (1 to 3-feet in depth) in the vicinity of soil boring SB17 (concentrations range from 5,200 J to 460,000 μg/kg). Levels of pesticides are also present, mostly along the outer portion of the grid, within sample grid B. Note that sample grid C, which is reported to be a former pesticide storage area, only exhibited pesticide concentrations in two samples (SB33 and SB35).

VOC concentrations in the surface and subsurface soils are depicted on Figures 4-5 and 4-6, respectively. Total VOCs, as presented on these figures, are equal to the sum of all detected volatile organic compounds excluding acetone and methylene chloride. These compounds were excluded since they are believed to be laboratory contaminants or the result of decontamination procedures and, therefore, are not associated with the site (refer to Section 6.0 for justification of why these compounds are considered laboratory contaminants and not associated with the site). Total SVOCs are equal to the sum of all positive detected semivolatile organic compounds excluding all phthalates which are considered laboratory contaminants.

As shown on Figures 4-5 and 4-6, isolated areas within Lot 201 are impacted by VOCs in soil. Lot 201 background samples SB38 and SB39 (located west of Lot 201) exhibited low detections of VOCs in surface samples, but only SB38 exhibited VOCs in subsurface samples. The highest levels of VOCs were detected in subsurface soils collected at soil borings SB17 (total VOCs of 56,800 J µg/kg) and SB25 (total VOCs of 4.0 J µg/kg) which are located near the northeast corner of grid A. The extent of the soil VOC contamination, within this area, appears to be limited to this corner of Lot 201 since surrounding soil samples (both inside this grid and the wooded areas) did not exhibited VOC contamination.

The SVOC contaminant distribution pattern for both surface and subsurface soils (Figures 4-5 and 4-6) indicates that the contaminants are relatively isolated (grids B and C) except near the northeastern corner of grid A. Soils impacted by SVOCs in this area appear to be limited to this portion of the grid. The data indicates that the center of the SVOC contamination, similar to the VOC contamination, is situated in the vicinity of soil boring SB17 (48,000 µg/kg total SVOCs).

Overall, the frequency of detected VOCs and SVOCs generally decreased in subsurface soil compared to surface soil. Several of the soil borings (SB17 and SB25 in grid A; SB17 in grid B; and SB33 in grid C), however, exhibited increased concentration levels in the subsurface soils. Soil boring SB17 in grid A exhibited the highest increase in concentrations. Total VOCs and SVOCs were detected (1 to 3-foot sample just above the water table) at 56,000J and 48,400J µg/kg, respectively. The increase in subsurface soil contaminant levels indicates that the contaminants have migrated downward into the vadose zone, and could potentially impact groundwater quality.

Inorganics in soil within Lot 201 for the most part are within background levels for Camp Lejeune. Chromium and manganese, as with Site 9 soils, were detected above background levels. Their presence in site soils was addressed in Section 4.2.1.1.

Overall, contaminant distribution patterns at Lot 201 suggest that soil in the vicinity of the northeastern portion of grid A is significantly impacted by VOCs, SVOCs, and pesticides. The extent of this contamination appears to be limited to the corner of Lot 201; however, the contaminants (VOCs) may potentially impact groundwater quality locally. The source of the contamination, given the isolated nature, appears to have resulted from localized surface spills of hazardous materials, such as solvents or petroleum-based pesticides.

Lot 203

Results indicate that pesticides, PCBs, VOCs, and SVOCs are the contaminants of concern in both surface and subsurface soils at Lot 203, based on frequency of detection and concentration level. The extent and impact of each of these constituents, in both the surface and subsurface soils, is addressed in this section.

Pesticides were detected in surface samples from two of the three grids sampled (grids "OSA" and "DDT"). As depicted on Figure 4-7, pesticides (4,4'-DDE, 4,4'-DDD, and 4,4'-DDT) were detected throughout the western, central, and eastern portions of Lot 203. The highest levels of pesticides were detected at soil boring OSA-SB30 which is located near the central portion of Lot 203. Note that other samples collected in the vicinity of OSA-SB30 did not exhibit pesticide concentrations. Pesticides were not detected in the northeastern portion of Lot 203 (grid "PCB"). Sample grid "DDT," located within the former pesticide storage area, had detections of pesticides throughout.

The extent of pesticide contamination in the subsurface soil is presented on Figure 4-8. The figure shows that the frequency and extent of pesticides in the subsurface soil decreased in comparison to the surface soil. Pesticides in the subsurface soil were mostly found in samples located near the eastern and central portion of Lot 203. The highest concentrations are present in OSA-SB30 which also exhibited high levels of pesticides in the surface soil. Pesticides were not present in subsurface soil samples collected from within the DDT grid.

Figure 4-9 shows the locations of detected PCBs in the surface soils. In general, elevated levels of PCBs were detected at random locations throughout Lot 203. The most prevalent detections are found within the "PCB" grid the western portion of Lot 203.

As shown on Figure 4-10, the frequency and extent of PCBs in the subsurface generally decreased. Sample OSA-SB22 collected near the "PCB" grid, however, exhibited elevated concentrations of PCB (29,000 µg/kg). Overall, the data suggests that the surface soils are impacted more frequently and at a higher concentration by PCBs then subsurface soils.

The extent of VOC and SVOC contamination in surface and subsurface soils is shown on Figures 4-11 and 4-12, respectively. Concentrations of SVOCs are present throughout Lot 203 with the highest levels observed near the western and central portions of lot within the "OSA" grid area. Samples collected at OSA-SB30 and OSA-SB38 exhibited total SVOC concentrations of 1,436J and 19,200J µg/kg, respectively. Some detections were also present within the "PCB" and "DDT" grids. Concentrations within these grids ranged from 34J to 690J µg/kg.

Low levels of VOCs were detected primarily within the "PCB" grid area (soil borings PCB-SB12 and PCB-SB14) with one minor detection near the northwestern corner of the "OSA" grid (soil boring OSA-SB23). The concentration levels within the "PCB" grid ranged from 2.0 J to 15 µg/kg while the concentration at OSA-SB23 was 7.0 J µg/kg.

Overall, the frequency and concentration levels VOCs and SVOCs in the subsurface soils generally decreased but in some cases, however, an increase was observed. In soil borings OSA-SB22 and OSA-SB41, the concentrations of total SVOCs were higher in subsurface soil than in surface soil. At soil boring OSA-SB22, total SVOC concentrations increased from 37J to 41,980J µg/kg, while at OSA-SB41 total SVOC concentrations increased from ND (not detected) to 11,820 µg/kg. Moreover, SVOCs were detected in two samples (1 to 3 and 7 to 9-foot samples) collected from OSA-SB41 (concentrations decreased with depth). Concentrations of SVOCs were also detected in a sample collected from the soil boring for monitoring well. 6GW11 (total SVOCs at 261J µg/kg).

Inorganics in soil within Lot 203 for the most part are within background levels for Camp Lejeune. Chromium and manganese, as stated throughout this section, were detected above background levels. Their presence in site soils was addressed in Section 4.2.1.1.

Overall, soil contamination (mostly organic) at Lot 203 is widespread. The two areas which appear to have the highest amounts of organic contamination (pesticides, PCBs, and SVOCs) are situated near the northwestern (OSA-SB38, OSA-SB39, and OSA-SB24) and northeastern (OSA-SB22 and PCB-SB12) portions of Lot 203. Contaminants identified in the northeastern portion of Lot 203 may be impacting the surficial groundwater locally since several of the wells in the area (6GW15 and 6GW1S) exhibited organic contamination.

Wooded Areas, the Ravine, and Site 82

Organics and inorganics were detected throughout the wooded areas and ravine. Based on the analytical results, pesticides, PCBs, VOCs and SVOCs are the most significant contaminants of concern within these areas. Accordingly, the extent of contamination for these contaminants is addressed. Note that samples collected from soil borings 203-SB21 through 203-SB25, and soil borings advanced for monitoring wells 6GW32, 6GW33, 6GW34, 6GW15D, 6GW30D, 6GW35D, 6GW36D, 6GW37D, 6MW3D, and 6GW1DA were obtained during the Phase II investigation.

The extent of pesticides in the surface soil is depicted on Figure 4-13. As shown on Figure 4-13, pesticides are most significant within the ravine area and at random locations within grids "201E" and "201S." Pesticides in the ravine are generally present throughout the entire length of the ravine and into grid "OSA" (Site 82 samples OSA-SB1 and OSA-SB7). Several sample locations east and west of the ravine also exhibited positive detections of pesticides. Pesticides within grid "201S" were present throughout the area with the highest levels found near the outer portion of the grid.

As shown on Figure 4-14, the extent of pesticides in the subsurface soil is considerably less than the surface soil. The highest pesticide concentrations were detected in the ravine (RAV-SB4A, RAV-SB12, and RAV-SB14). These concentrations were detected to a depth of 3 feet bgs from these samples.

PCB contamination was detected in the surface soil at several locations within grid "201E" and the ravine (Figure 4-15). The most impacted area appears to be located along the eastern boundary of grid "201E." The extent of PCB contamination east of this area (off site across Piney Green Road) has not been evaluated since this area was not included as part of the site. PCBs were not detected in soils west of this area within grid "201E."

The extent of PCB contamination in subsurface soil is depicted on Figure 4-16. PCBs were detected in several subsurface soils collected within the ravine area and grid 201E. As illustrated on Figure 4-16, several of the samples exhibited concentrations of PCBs in the subsurface soils but not the surface soils. This predominantly occurred at soil borings located in the ravine area. Further, PCBs were detected to a depth of three feet within the ravine.

VOCs are present predominantly in soils at Site 82 and at random locations throughout the other grid areas. The highest concentrations of VOCs exist in soils collected from borings OSA-SB6 and OSA-SB12, and the soil boring advanced for shallow well 6GW34. These borings are located near the eastern portion of Site 82, as depicted on Figures 4-17 and 4-18. VOC contamination in this area appears to extend northward toward Wallace Creek.

The most significant occurrences of SVOCs are found within the ravine and in grid "201S." SVOCs are present in surface soil along the entire length of the ravine which extends northward toward Wallace Creek. Other significant occurrences of SVOCs were detected within grid "201E" but their presence appears to be limited to an area just east of Lot 201.

The extent and concentration levels VOCs and SVOCs in subsurface soil are significantly less than surface soil. A few of the samples, however, exhibited elevated concentration levels at depth. VOCs were detected to depths of 17 feet and three feet at soil borings OSA-SB12 and OSA-SB19 (Site 82), respectively. Further, SVOCs were detected in several ravine samples to depths of five feet.

Inorganics in soil within the wooded areas and the ravine for the most part are also within background levels for Camp Lejeune. Chromium and manganese, as stated throughout this section, were detected above background levels. Their presence in site soils was addressed in Section 4.2.1.1.

In general, the areas north of Lot 203 and the ravine exhibited the most significant amounts of organic contamination. Several isolated areas within grids "201E" and "201S" also exhibited. levels of organic contamination, mostly pesticides and PCBs.

4.2.2 Groundwater

Sites 6, 9, and 82 are considered as one Operable Unit (OU No. 2) for the discussion concerning the nature and extent of groundwater contamination. However, because shallow and deep groundwater samples were obtained as part of the investigation, the extent of contamination for the shallow and deep groundwater will be addressed separately. Surficial groundwater is considered less than 35 feet bgs (maximum depth of shallow monitoring wells) while deep groundwater is considered greater than 90 feet bgs [(deep monitoring wells screened from 90 feet (6GW7D) to 118 feet (6GW2D) bgs].

The extent of groundwater contamination is addressed separately for the Phase I investigation (Round One groundwater data) and the Phase II Investigation. The Phase II investigation includes data collected from the existing, Phase I (Round Two), and Phase II (Round One) wells.

4.2.2.1 Phase I Extent of Contamination

The groundwater data presented in this section addresses the extent of contamination for samples collected in October and November, 1992 as part of the Phase I - Round One Investigation. The following discusses the extent of contamination for surficial and deep groundwater.

Surficial Groundwater

Groundwater contamination (both organic and inorganic) was identified in the surficial groundwater at several locations. As discussed in Section 4.1, groundwater quality has been impacted by VOCs, predominantly chlorinated hydrocarbons. Analytical results indicated that TCE, PCE, 1,2-dichloroethane, and 1,1,2,2-tetrachloroethane (1,1,2,2-PCE) were the most frequently detected contaminants present in the surficial groundwater. Further, several other VOCs were also detected in the surficial groundwater including trans-1,2dichloroethene (trans-1,2-DCE), vinyl chloride, and total xylenes (aromatic hydrocarbon), but their occurrences are limited. The most significant inorganic contaminants, based on frequencies of detection and contaminant levels (i.e., above MCLs and/or NCWQS), are total chromium, total lead, total and dissolved manganese, and arsenic.

Isoconcentration maps depicting the estimated extent of total VOCs and TCE in the surficial groundwater (Phase I - Round One data collected from October 20 to October 25, 1993) are presented on Figures 4-19 and 4-20, respectively. Note these maps are intended to illustrate the estimated extent of contamination and may not depict actual site contaminant distributions. Total VOCs presented on Figure 4-19 are considered the sum of all volatile organic compounds detected in a well (including chlorinated and aromatic hydrocarbons), but excluding acetone and methylene chloride.

As depicted on Figure 4-19, two significant and several smaller VOC contaminant plumes were identified. The most predominant, widespread contaminant plume is located near the north-central portion of Site 82 in the vicinity of well 6GW28S. The distribution of the plume is shown extending away from well 6GW28S northward toward Wallace Creek, westward toward well 82MW1, and southward toward wells 6GW1S and 6GW15S. The full extent of the VOC contamination eastward across Piney Green Road was not completely evaluated from this sampling event since a groundwater sample could not be obtained from well 82MW30 [previous results from 1991 (NUS) did not indicate contamination in this well]. Note that well 6MW3S, located approximately 750 feet east of Piney Green Road, did not exhibit VOCs.

The occurrence of the VOC plume in the vicinity of 6GW28S may be the result of a localized contaminant source or possibly the result of contaminant movement within the deeper groundwater. Evidence of a surficial contaminant source, however, was not revealed through review of historical aerial photographs [i.e., no evidence of ground scars were noted with the exception of logging areas (refer to Appendix V)]. The potential source of the surficial groundwater contamination near 6GW28S may be related to the contaminated deeper groundwater. Groundwater movement from the deeper to the surficial water-bearing zone in this area was discussed in Section 3.7.2 (refer to Figure 3-14). Because of the upward head of groundwater in this area, contaminants may be migrating from the deeper (deep well 6GW28D exhibited a total VOC concentration of 4,800 µg/l) to the surficial groundwater (note that VOCs were not detected in soil samples collected from 6GW28S.)

A second VOC contaminant plume is centered in the vicinity of well 6GW16; which is located in the wooded area between Lots 201 and 203. The area encompassed by this plume appears to be limited to the immediate area of 6GW16. The predominant VOC contaminant identified in this area was chlorobenzene with minor amounts of PCE, and chloroform. It is believed that the source of the chlorobenzene is from discarded cans of possibly paint and miscellaneous solvents which were found in a test pit excavated adjacent to well 6GW16 (refer to Table 4-41, samples GS1960D-01 and 02).

Several smaller isolated VOC contaminant plumes are also depicted on Figure 4-19. These isolated plumes are centered in the vicinity of wells 6GW3, 6GW26, 6GW21, 6GW22, 6GW23, 9GW6, and 9GW8. The magnitude and extent of these plumes suggests localized and not widespread contamination in these areas since the contaminant levels are low.

The extent of TCE contamination is shown on Figure 4-20. The TCE contaminant plume depicts a similar pattern as the VOC plume but not as widespread. The primary TCE plume is also centered in the vicinity of well 6GW28S and extends to the east and south. Two smaller isolated TCE plumes are also present which are centered in the vicinity of wells 6GW21 and 6GW23.

Total chromium and total lead contamination in the surficial groundwater occurs in isolated areas at OU No. 2. The locations of the areas impacted by these contaminants are depicted on Figure 4-21. The most impacted total chromium areas are located in the vicinity of Lot 203 (well 6GW3), Site 82 (wells 82MW3 and 6GW1S), and north and south of Lot 201 (wells 6GW5 and 6GW7S, respectively). Further, the most impacted total lead areas are located in the vicinity of Lot 203 (well 6GW3), and Site 9 (9GW3).

4.2.2.2 Deep Groundwater

VOCs were detected predominantly in deep monitoring wells located within Site 82. As shown on Figure 4-22, a highly contaminated VOC plume is centered in the vicinity of well 6GW1D, which is located near the southeastern boundary of Site 82 (just north of Lot 203). Well 6GW1D exhibited a total VOC concentration of 64,278 µg/l. This occurrence extends northwest toward wells 6GW27D and 6GW28D, and to a limited extent southeastward toward 6GW2D (east of Piney Green Road). According to Activity records from Camp Lejeune, supply well HP-651 (located northeast of Lot 203 across Piney Green Road) exhibited a TCE concentration of 18,000 µg/l prior to being put out of service in 1985 (refer to Section 3.10).

The extent of TCE contamination is illustrated on Figure 4-23. As shown on Figure 4-23, the TCE contaminant distribution in the deep groundwater exhibited a similar trend as the VOCs. The center of the most significant TCE plume is situated at well 6GW1D (58,000 J µg/l) and extends primarily toward the northwest; partially toward the southeast (6GW2D). A second isolated TCE plume is also present in the vicinity of well 6GW7D.

Inorganic concentrations in the deep groundwater are insignificant. As stated in Section 4.1, none of the inorganics in the deep groundwater were detected above the Federal MCLs or the

NCWQS. Therefore, the extent of inorganic contamination in the deep groundwater is not addressed.

4.2.2.1 Phase II Extent of Contamination

The groundwater data presented in this section addresses the extent of contamination for samples collected in March through May 1993 which includes the Round One (i.e., samples collected from the Phase II wells) and Round Two (i.e., samples collected from the existing and Phase I wells) results. Note that the extent of contamination discussed in this section only addresses volatile organic compounds because inorganics were not analyzed as part of the Phase II sampling event (Sites 6 and 82).

Surficial Groundwater

Isoconcentration maps were developed which depict the estimated extents of total VOC and TCE contamination for the surficial groundwater at OU No. 2. The extent of total VOC contamination is shown on Figure 4-24 and the extent of TCE contamination is shown on Figure 4-25. As described above, these maps depict contaminant distribution patterns for samples collected from March through May 1993.

Two significant and several minor VOC contaminant plumes are depicted on Figure 4-24. The two significant VOC plumes are situated within Site 82 (which is the most widespread) and in the wooded area between Lots 201 and 203. The other VOC plumes, which are less significant in magnitude, are situated just north of Wallace Creek along Piney Green Road; within, west, and south of Lot 203; and east and south of Lot 201.

The primary VOC plume, which is situated within Site 82, is centered in the vicinity of well 6GW34 (total VOC concentration of 11,833.7 µg/l). This plume extends primarily northwestward and westward away from well 6GW34 toward the general direction of Wallace Creek. As shown on Figure 4-19, data collected from the Phase I investigation also indicated that the surficial groundwater was impacted in this area. The data suggests that the extent of this plume, in all directions from the center of the plume, has been fully evaluated. Although groundwater quality has not been evaluated north of Wallace Creek, soil gas data (refer to Section 2.6.1.4 and Figure 2-18) from samples collected just north of Wallace Creek did not reveal any VOC contamination [Note that low levels of VOCs were detected in Wallace Creek].

The other significant VOC contaminant plume is centered in the vicinity of well 6GW16 (total VOC concentration of 8,591.2 µg/l). The extent of this plume appears to be limited to the immediate vicinity of this well. This isolated plume was also identified from the Phase I groundwater data. As discussed in previous sections, this well is situated adjacent to one of the Phase I test pits where small containers of paints and solvents were present. The primary contaminant identified (in both sampling events) in this well was chlorobenzene with minor amounts of 1,1,2,2-tetrachloroethane.

The extent and distribution of TCE contamination is shown on Figure 4-25. As depicted on Figure 4-25, one significant TCE plume is present within Site 82. This plume is centered in the vicinity of well 6GW32 (TCE concentration of 1,500 µg/l) and it extends southeastward toward well 6GW34 and northwestward toward Wallace Creek. The distribution pattern of this contaminant plume is similar to the VOC plume, but less in concentration magnitude.

Contaminant movement of the primary VOC and TCE plumes appears to be in the same general direction as the surficial groundwater flow (and gradient) in the vicinity of Site 82. As discussed in Section 3.7.2, surficial groundwater in the vicinity of Site 82 is flowing toward the northwest to west in the general direction of Wallace Creek (very low groundwater gradient toward Wallace Creek of 10^{-3}). As depicted on Figures 4-24 and 4-25, the contaminant distribution in this area indicates that VOCs are migrating in this direction and are impacting Wallace Creek. Data collected from the Phase I investigation also suggests that the contaminants are migrating toward Wallace Creek.

Deep Groundwater

Isoconcentration maps were also developed which depict the estimated extents of total VOC and TCE contamination for the deep groundwater at OU No. 2. The extent of total VOC contamination is shown on Figure 4-26 and the extent of TCE contamination is shown on Figure 4-27. As described above, these maps depict contaminant distribution patterns for samples collected from March through May 1993.

The distribution pattern for total VOCs in the deep groundwater indicates a significant contaminant plume is present near the southern boundary of Site 82 and the northern boundary of Site 6. This plume was also identified from analytical data obtained from the Phase I investigation. In general, the plume is centered in the vicinity of well 6GW1D (total

VOC concentration of 77,910.4 µg/l) and it extends outward in all directions with the main portion of the plume extending west and northwest. The plume appears to have migrated east across Piney Green Road, south into Lot 203, west to Holcomb Boulevard, and north across Wallace Creek. Although the plume has migrated a significant distance as indicated by several of the perimeter wells (i.e., 6MW3D, 6GW36D, 6GW37D, and 6GW15D), the extent of contamination east, south, and north is essentially defined since contaminant levels in wells 6GW3D, 6GW15D, 6GW30D, 6GW36D, and 6GW35D are somewhat low (less than 50 µg/l total VOCs). The full extent of contamination to the west of Site 82, however, has not been completely evaluated since elevated levels of VOCs (182.6 µg/l total VOCs) are present in well 6GW37D.

In addition to the VOC contaminant plume described above, two smaller isolated VOC plumes are also present within OU No. 2. Low levels of VOC contamination (less than 3.0 µg/l total VOCs) are also present in deep wells 6GW7D (located southwest of Lot 201) and 9GW7D (located at Site 9).

The extent and distribution of TCE contamination is depicted on Figure 4-27. As shown on Figure 4-27, the TCE contaminant distribution pattern is similar to the total VOC pattern. In general, the largest TCE contaminant plume is centered in the vicinity of well 6GW1D (50,000 µg/l) and it extends primarily to the northwest and west. The overall extent of the TCE plume, similar to the VOC plume, is essentially defined with the exception contamination west of Site 82 (i.e., beyond well 6GW37D).

The vertical extent of the VOC contamination was evaluated by installing a second deep well (6GW1DA) adjacent to exiting deep well 6GW1D (deep well 6GW1DA was installed during the Phase II investigation) as described in Section 2.0. Well 6GW1DA was installed (to a depth of 230 feet) adjacent to this well because elevated levels of VOCs (greater than 60,000 total VOCs) were detected in the Round One 6GW1D sample. Contamination was detected in well 6GW1D to a depth of 112 feet.

Two samples were collected from well 6GW1DA (i.e., top of water column and bottom of well) to evaluate the vertical distribution of contaminations. The sample collected from the top of the water column exhibited a total VOC concentration of approximately 263 µg/l while the sample collected from the bottom of the well exhibited a total VOC concentration of approximately 122 µg/l. Accordingly, the data suggests that VOC contamination is present, at a minimum, to a depth of 230 feet. As described in Section 2.0, this well was installed just above a clay layer (believed to be 10 feet thick) which may impede the vertical migration of the contamination below 230 feet. It should be noted, however, that this clay layer is laterally discontinuous based on information obtained from the drilling of nearby water supply wells.

Overall, the VOC contaminant distribution pattern for the deep groundwater exhibited a similar trend as the surficial groundwater. The magnitude of the contamination, however, is much more significant in the deep groundwater. As stated in Section 3.0, the surficial and deep groundwater at OU No. 2 are partially hydraulically interconnected. Accordingly, this interconnection between the surficial and deep groundwater may account for the similar contaminant distribution patterns.

4.2.3 Surface Water and Sediments

This section addresses the extent of contamination in surface water and sediments from Bear Head Creek, Wallace Creek, and the Ravine.

4.2.3.1 Surface Water

Results indicate that VOCs, SVOCs, and inorganic constituents (i.e., metals) are the most significant contaminants present in the surface water. The following discusses the extent of these contaminants in surface water samples at OU No. 2.

VOCs and SVOCs were detected in Wallace Creek at several of the sample stations. As shown on Figure 4-28, VOCs were the predominant contaminants identified in Wallace Creek. The highest concentrations were found just north of the wooded area of Site 82 (sample station WC8). Concentrations of VOCs or SVOCs were not detected in the upgradient samples collected east of sample station WC4. Moreover, neither VOCs nor SVOCs were detected in samples collected from Bear Head Creek or the ravine.

Positive detections of several TAL inorganics (arsenic, barium, cadmium, chromium, and zinc). were found throughout the three sample locations as depicted on Figure 4-29. The highest frequency of detections and concentrations were found in the ravine, followed by Wallace Creek and Bear Head Creek. A brief description of the extent of the inorganics detected in these three areas follows.

Concentrations of arsenic, barium, cadmium, chromium, and zinc were identified throughout the ravine. The concentrations levels of several of the inorganics indicated a slight trend. In general, barium and chromium levels decreased from the southern end (RV2) to the northern end of the ravine (RV8) while cadmium and arsenic levels showed the reverse trend. Further, zinc concentrations did not reveal any particular trend. As discussed in previous sections, numerous discarded battery packs were noted on the surface in the ravine.

Inorganics were identified throughout Wallace Creek in both upstream and downstream sample stations. Zinc and barium are the predominant inorganics detected as shown on Figure 4-29. Barium was identified mostly in upstream sample stations (WC1 through WC5) while zinc was identified mostly in downstream samples (WC10 and WC11). In general, the highest frequency of positive detects in Wallace Creek were found north of the wooded area in the vicinity of sample station WC5.

In Bear Head Creek, the predominant inorganics identified were barium with minor amounts of chromium and zinc. Barium levels throughout the creek did not reveal a particular trend as concentrations were generally within the same magnitude in both the upstream (BH1) and downstream (BH7) stations. Zinc, however, was only identified in downstream samples collected at station BH7.

4.2.3.2 Sediments

Sediment results indicate that significant concentrations of organics and inorganics are present throughout the three sample areas. Accordingly, the extent of contamination for both organics and inorganics will be addressed. Further, positive detections of the pesticides are shown on Figure 4-30.

Bear Head Creek

In Bear Head Creek sediments, pesticides are most significant in the wooded area (201S grid area) within Site 6. The extent of the pesticides within Bear Head Creek appear to be limited to this area and just upstream to the east. Pesticides were not detected in the downstream samples collected west of Holcomb Boulevard.

PCBs (PCB-1260) were detected in several samples collected from Bear Head Creek. As depicted on Figure 4-31, the highest concentrations were detected in samples obtained within the wooded area (grid 201S) south of Lot 201. The extent of the PCB contamination within Bear Head Creek appears to be limited to this area. Furthermore, PCBs were not detected at upstream or downstream sample stations from Site 6.

VOCs and SVOCs are present throughout Bear Head Creek as shown on Figure 4-32. Concentrations of VOCs and/or SVOCs were found at upstream and downstream sample stations from Site 6. In general, the highest levels of SVOCs in Bear Head Creek are present within the wooded area south of Lot 201 while the highest levels of VOCs are present downstream of Site 6.

Ravine

Pesticides are present throughout the ravine as shown on Figure 4-30. In general, the pesticide levels were highest in the upper (southern portion) and lower (northern portion) ends of the ravine. As discussed in previous sections, empty corroded containers of pesticides were noted on the surface near the northern end of the ravine. Accordingly, the pesticides detected in the ravine may have resulted from previous disposal practices.

Concentrations of PCBs (PCB-1260) were also detected throughout the ravine as shown on Figure 4-31. In general, PCBs levels were highest in samples collected from the southern end (sample station RV1) of the ravine and decreased toward the northern end.

Elevated levels of SVOCs were detected (VOCs were not found) within the ravine as shown on Figure 4-32. The highest levels of SVOC contamination were noted near the southern end of the ravine. Generally, the levels of SVOCs decreased toward the northern end.

Wallace Creek

Wallace Creek exhibited levels of pesticides mostly in samples collected just north of the wooded area (adjacent to Site 82) and ravine. As shown on Figure 4-30, sediments from sample stations WC6 through WC9 contained significant amounts of pesticides. Further, some levels were also detected downstream from Site 6 at sample stations WC10 and WC11.

In Wallace Creek, significant amounts of PCBs (PCB-1260) are present just north of the wooded area and ravine and at locations downstream from Site 82, west of Holcomb Boulevard. As shown on Figure 4-31, the highest PCB concentrations are found at sample stations WC6, WC7, and WC9 north of Site 82 and the ravine. Moreover, PCBs were not detected at sample stations upstream from Site 82.

Concentrations of VOCs and /or SVOCs are present throughout Wallace Creek as depicted on Figure 4-32. The contaminants are presents in both upstream and downstream samples from Site 6. In general, VOCs are most significant at sample stations upstream of Site 82 (WC2, WC3, and WC5) while SVOCs are most significant in sample stations north of the wooded area and ravine, and downstream of Site 82.

4.3 Summary

This section summarizes the nature and extent of contamination at OU No. 2 (Sites 6, 9, and 82). The nature and extent of contamination is summarized by area of concern.

4.3.1 Site 6, Lot 201

Pesticides (4,4'-DDD, 4,4'-DDE, and 4,4'-DDT) were detected in more than half of the surface soil samples collected at the three sampling grids and in approximately one-third of the subsurface soil samples. The majority of the pesticide concentrations were below 100 µg/kg. Some of the pesticides were detected in areas where pesticides were not reportedly stored or handled (i.e., the PCB storage area at grid C).

At only two sampling locations, soil boring SB16 and SB17, did the pesticide levels exceed one part per million (1,000 µg/kg). Soil borings SB16 and SB17 are located in the northeast corner of sampling grid A, which was reported to be one of two former pesticide storage areas within Lot 201 (the other area is where grid B was established).

Pesticide contamination at soil borings SB-16 and SB-17 is significant, indicating that this area may have been used to dispose of unused pesticides. It is also possible that this area was impacted via incidental spills from the containers/drums which contained the pesticides. Pesticide levels in surface soils were as high as 1,200,000 µg/kg for 4,4-DDT (soil boring SB17). Pesticides have migrated to subsurface soils as evidenced by elevated levels of pesticides (460,000 µg/kg of 4,4'-DDT) in subsurface soil samples collected from soil boring SB17. However, no pesticides were detected in groundwater at Lot 201.

Subsurface soil samples collected from SB17 also exhibited elevated levels of total xylene (54,000 µg/kg), ethylbenzene (2,800 µg/kg), naphthalene (38,000 µg/kg), and 2-methylnaphthalene (97,000 µg/kg). These constituents were only detected at one location within Lot 201 (i.e., soil boring SB17). Because these constituents are petroleum based, they may be associated with the application of pesticides used a petroleum-based medium. None of these constituents were detected in nearby monitoring wells.

Polychlorinated biphenyls (PCBs) were detected in only 3 of 87 samples analyzed at Lot 201. The soil sample collected from soil borings SB13 and SB24 within grid A, and from soil boring SB24 within grid B, exhibited PCB contamination. The only elevated PCB level was detected at a concentration of 1,800 µg/kg in the surface soil at boring SB24 within grid A. No PCBs were detected at grid C, which was established over the area where transformers were reportedly stored. The extent of PCB contamination is limited to a few random areas within Lot 201. In addition, no PCBs were detected in groundwater.

With respect to inorganic contaminants in soil, contaminant levels were comparable to other areas within OU No. 2 (i.e., the wooded area, Lot 203, Site 9). Therefore, it does not appear that inorganic concentrations in soil are elevated as a result of former waste handling activities at Lot 201.

Groundwater at Lot 201 does not appear to be impacted via former pesticide or transformer storage practices. However, monitoring well 6GW22, which is located within grid A of Lot 201 (i.e., the former pesticide storage area), exhibited TCE at 1.2 µg/l. The source of TCE is unknown. Soil samples collected from borings within grid A as well as from the monitoring well borehole did not detect TCE or PCE. The extent of TCE in groundwater is believed to be local since no other well downgradient of this area exhibited TCE contamination.

4.3.2 Site 6, Lot 203

The pesticides 4,4'-DDD, 4,4'-DDE, and 4,4'-DDT were detected throughout Lot 203. Only one out of approximately 58 surface soil sampling locations within Lot 203 did the level of pesticides exceed 1,000 µg/kg (soil boring SB30 exhibited 4,4'-DDE and 4,4'-DDT at 2,100 µg/kg and 1,500 µg/kg, respectively). Samples collected from the "DDT" grid, which was established over an area where pesticides were reportedly disposed of, only revealed maximum concentrations of 540 µg/kg, 180 µg/kg, and 770 µg/kg for 4,4'-DDE, 4,4'-DDD, and 4,4'-DDT, respectively. All three maximum values were detected at soil boring SB18 within the "DDT" grid.

As with Lot 201 and the wooded areas surrounding these lots, the majority of the pesticide levels were below 100 µg/kg. The widespread distribution and low levels present on Lot 203 are indicative of former pesticide control practices rather than pesticide disposal. Only at soil boring SB30 (and possibly at SB18 within the "DDT" grid) did the results indicate that pesticides may have been disposed of in that area of Lot 203. Subsurface soil samples collected from this boring, however, exhibited pesticide levels below 500 µg/kg. Pesticides were not present in any groundwater samples (throughout Lot 203 and OU No. 2), indicating that pesticides are relatively immobile in the environment.

Polychlorinated biphenyls (PCBs) were detected at 12 out of 40 sampling locations within Lot 203. The most frequently detected PCB was PCB-1260, which was detected at all 12 locations ranging in concentration from 17 to 42,000 µg/kg. However, only at soil borings SB24, SB26, and SB38 did the PCB levels exceed 1,000 µg/kg. The most elevated concentration, 42,000 µg/kg of PCB-1260, was detected in the surface soil at soil boring SB24. Soil boring SB24 is located along the former railroad spur where historical photographs revealed significant anomalies that may be associated with waste handling and disposal. Subsurface soil samples at this location revealed 72 µg/kg of PCB-1260. Monitoring well 6GW11, which is located within 10 feet of soil boring SB24, did not exhibit organic contamination. Soil samples collected from monitoring well borehole 6GW11 did not exhibit PCB contamination.

Subsurface soil samples collected throughout Lot 203 exhibited PCBs in only three samples. The most elevated concentration of PCB-1260 was detected at soil boring SB22 at a level of 29,000 µg/kg. The surface soil sample collected from this boring did not exhibit any organic contamination. This boring is located in the north central portion of Lot 203 near monitoring well 6GW15. Soil samples collected from monitoring well borehole 6GW15 did not exhibit PCB contamination. Additionally, groundwater samples collected from this well did not exhibit any PCB constituents; however, low levels of TCE (1.9J µg/l) were present in this well.

Soil samples collected from the northeast corner of Lot 203, which was reported to be an area where PCBs were disposed of, did not exhibit elevated levels of PCBs. Only 4 surface soil samples and one subsurface soil sample exhibited PCB-1260 (19J µg/kg to 53 µg/kg). The sampling locations which exhibited PCBs included soil borings SB3, SB6, SB10, and SB13.

The majority of semivolatile organic compounds (SVOCs) detected at Lot 203 were PAHs. PAHs were primarily detected at nine surface soil sampling locations throughout Lot 203 (i.e., these sampling stations exhibited several PAH constituents as opposed to only one or two PAH constituents). Only one of these locations, soil boring SB38, exhibited contaminant levels above 1,000 µg/kg (at this location, approximately 16,000 µg/kg total PAHs were detected in surface soil). This location also exhibited elevated levels of PCB-1254 (2,100 µg/kg) in surface soil as discussed previously. Subsurface soil samples collected from soil boring SB38 did not exhibit PAH contamination. It appears that wastes were disposed of at this area of Lot 203.

Elevated levels of PAH constituents in the subsurface soil at Lot 203 were detected only at soil boring SB22 and soil boring SB41. Approximately 36,000 µg/kg total PAHs were detected at SB22 and approximately 11,000 total PAHs were detected at SB41. Soil boring SB22 also exhibited elevated levels of PCB-1260 (29,000 µg/kg) in the subsurface soil. Soil boring SB22 is located in the north central portion of Lot 203 (near well 6GW15) and soil boring SB41 is located just south of the former railroad spur. Based on the analytical results, it appears that these areas may be associated with waste disposal activities at Lot 203.

The more mobile SVOCs including 1,4-dichlorobenzene, 1,2-dichlorobenzene, and naphthalene were detected in elevated levels at surface soil samples collected from soil boring SB39, which is located along the former railroad spur. In addition, the PAH constituent acenaphthene was detected at this location at a concentration of 9,500 µg/kg. These SVOCs were detected at a total concentration of approximately 16,000 µg/kg (total SVOC). Subsurface soil samples collected from this boring did not reveal any organic contamination.

Inorganic constituents in soil at Lot 203 were comparable to inorganic levels detected throughout OU No. 2. However, most of the inorganic constituents were detected above background levels.

Groundwater quality at Lot 203 has not been significantly impacted from previous disposal and storage practices. As mentioned above, well 6GW15, which is located in the north central portion of Lot 203 exhibited low levels of TCE (1.9J µg/l) and total chromium (103 µg/l). Dissolved chromium levels were not detected. Well 6GW11, located near the former railroad spur, was not contaminated. Wells 6GW3, located near the ravine, and well 6GW23, located in the southern portion of Lot 203, only exhibited trace levels (i.e., less than 1 µg/l) of PCE and TCE, respectively.

4.3.3 Wooded Areas, the Ravine, and Site 82

The wooded areas of Lot 203 can be described as those areas which surround Lot 201 to the north, east, and south, and the area between Lot 203 and Wallace Creek. The area between Lot 203 and Wallace Creek is Site 82. The ravine begins in the northern portion of Lot 203, bisects Site 82, and extends to Wallace Creek. These areas will be discussed separately below.

4.3.3.1 Wooded Area East of Lot 201

The wooded area east of Lot 201 is primarily contaminated with low levels of pesticides in surface soil (11 locations with a maximum detection of 240 µg/kg of 4,4'-DDT at soil boring SB12), low levels of PAHs in surface soil (five locations with a maximum detection of approximately 2,000 µg/kg total PAHs at soil boring SB16), and elevated levels of PCB-1260 (26,000 µg/kg) at soil boring SB15. Two other sampling locations, soil borings SB18 and SB21, exhibited low levels of PCB-1260 (less than 300 µg/kg). A subsurface soil sample collected from soil boring SB18 also exhibited low levels of PCB-1260 (83J µg/kg). The three sampling locations where PCB-1260 was detected are all located adjacent to each other along Piney Green Road. According to the EPIC report, this area once served as a training area as noted by the presence of tents and roadways in one of the historical photographs. There is no known or documented waste storage or disposal areas in this section of OU No. 2.

Three other locations in the woods east of Lot 201 exhibited PCB contamination in subsurface soils (no PCBs were detected in surface soil samples from these locations). Low levels of PCB-1260 (46J µg/kg to 100 µg/kg) were detected in subsurface soil samples collected from soil borings SB1, SB17, and SB5. Soil boring SB17 is located approximately 200 feet west of SB18. Soil borings SB1 and SB5 are located over a thousand feet north of the area where PCBs were detected in surface soil near Piney Green Road.

Inorganic levels in soil are comparable to other portions of OU No. 2. No elevated levels were detected at this section of OU No. 2.

Four monitoring wells are located in this section of OU No. 2 (wells 6GW6, 6GW14, 6GW17, and 6GW18). No organic or inorganic constituents above Federal or State standards were detected in these four wells.

4.3.3.2 Wooded Area North of Lot 201

The wooded area north of Lot 201 is bordered to the south by Lot 201, to the north by Lot 203, to the east by Piney Green Road, and to the west by the railroad tracks. Site reconnaissances conducted in this area, as well as test pit excavations, have revealed empty drums on the surface, buried ordnance (only casings and not unexploded ordnance), numerous 5-gallon canisters possibly containing liquid wastes, and debris (e.g., communication wire, bivouac wastes, etc.).

Low levels of pesticides (2.2J µg/kg to 500 µg/kg) were detected in eight of the ten surface soil samples collected during the drilling of test borings. With the exception of the one occurrence of 4,4'-DDE at soil boring SB1, no pesticide contaminant level exceeded 100 µg/kg. Subsurface soil samples collected from this area revealed low levels (i.e., less than 10 µg/kg) of 4,4'-DDT and 4,4'-DDE at two soil borings (SB4 and SB12).

In addition to the low levels of pesticides in a few subsurface soil samples, low levels of benzene (1.0 J µg/kg) and toluene (1.0 J µg/kg) were detected at soil boring SB10.

PCB-1260 was detected at low levels (800 µg/kg) in surface soil at boring SB1. Subsurface soil samples collected from this area did not exhibit PCB contamination.

Low levels of PAHs (approximately 1,700 µg/kg total PAH) were detected in only one surface soil sample collected at soil boring SB1. PAHs were not detected in any subsurface samples from this area.

Soil boring SB1 exhibited the most contamination in the wooded area north of Lot 201. This boring is located in the northwest section of the woods near Lot 203. This area may have been impacted by previous waste handling/disposal activities.

Inorganic concentrations in soil were comparable to other portions of OU No. 2. There were no occurrences of inorganic levels that were an order of magnitude higher than either background levels of other areas of the operable unit (e.g., Lot 201, Lot 203, etc.).

Groundwater quality in this portion of OU No. 2 has been impacted. Two of the six wells in this area (wells 6GW16 and 6GW25) exhibited levels of organic contamination. Chlorobenzene (maximum of 8,500 µg/l), chloroform (maximum of 20 µg/l), 1,1,2,2-tetrachloroethane (maximum of 60 µg/l), phenol (1.0 µg/l), and 2-chlorophenol (5.0 J µg/l) were detected in well 6GW16. This well was installed near a test pit which revealed numerous 5-gallon canisters containing liquids, possibly paint or solvents. Well 6GW25, which is located approximately 1,000 feet upgradient of well 6GW16, exhibited levels of phenol (2.0 J µg/l), chlorobenzene (110 µg/l), and chloroform (1.6 µg/l).

4.3.3.3 Wooded Area to the South of Lot 201

The wooded area to the south of Lot 201 encompasses the area on both sides of Bear Head Creek and separates Lot 201 from Site 9. Various dirt roads are present throughout these woods. General debris including empty 55-gallon drums, construction debris, and garbage were noted throughout this area.

Pesticides were detected in all surface soil samples collected from this area. Only one location, soil boring SB8, exhibited elevated levels of 4,4'-DDE (4,200 µg/kg), 4,4'-DDT (6,400 µg/kg), and 4,4'-DDD (12,000 µg/kg). The other surface soil samples exhibited pesticides levels well below 200 µg/kg. Soil boring SB8 is located near Piney Green Road approximately 100 feet south of Bear Head Creek. The pesticide 4,4'-DDE was detected in subsurface soil at soil borings SB1 (5.0 µg/kg) and SB6 (3.9J µg/kg).

The only other contamination detected in surface soils were low levels of PAHs (less than 240 µg/kg total PAH) in three samples (soil borings SB11, SB5, and SB8). No PAHs were detected in subsurface soils.

Inorganic compounds were detected in soil at levels that were comparable to other portions of OU No. 2.

Five shallow monitoring wells were constructed to monitor groundwater quality in this area. Low levels of TCE (1.2 µg/l) and trichlorofluoromethane (1.9 µg/l) were detected in well 6GW13. No inorganic contamination was detected above Federal or State Standards.

4.3.3.4 Site 82

Site 82 encompasses the area south of Wallace Creek, west of Piney Green Road, and east of Holcomb Boulevard. The ravine area bisects this portion of OU No. 2. The ravine will be discussed separately in the following section (i.e., Section 4.3.3.5).

Low levels of pesticides were detected in the majority of surface soil samples collected from this area. With the exception of surface soil samples collected from soil boring SB1 (1,150 µg/kg total pesticides) and soil boring SB7 (350 µg/kg total pesticides), pesticide levels were below 100 µg/kg for total pesticide concentrations. Subsurface soil samples collected from this area revealed low levels of pesticides (53 µg/kg maximum) in only four samples.

PAHs were detected in only three surface soil samples from this area of OU No. 2. Surface soil samples collected from soil borings SB1 (710 µg/kg total PAH), SB16 (2,420 µg/kg total PAH), and SB7 (380 µg/kg total PAH) revealed low to moderate levels of PAHs. Subsurface soil samples collected from this area revealed PAHs in only one sample collected from soil boring SB7 (587 µg/kg total PAH). Soil boring SB7, which exhibited PAHs at the surface and subsurface, is located near the bottom section of the ravine area. The contamination in this area may be due to surface runoff from the ravine. The ravine exhibited elevated levels of PAHs throughout, as will be discussed in Section 4.3.3.5.

PCB-1260 was detected in only one sample in this portion of OU No. 2. The surface soil sample collected from boring SB17 revealed a concentration of only 3.9 µg/kg. This boring is located just north of Lot 203 near Piney Green Road. The section of Lot 203 to the south of soil boring SB17 is reportedly where PCBs were disposed of. As discussed previously in Section 4.3.2, no significant levels of PCBs were detected in this portion of Lot 203.

Elevated levels of volatile organic compounds (VOCs) were detected in surface soil samples collected from soil borings SB12 and SB6 and from the soil boring advanced for monitoring well 6GW34. Total VOC concentrations in these surface soil samples were approximately 78,000 µg/kg at SB6 and approximately 8,400 µg/kg at SB12. Subsurface soil was contaminated with VOCs at SB12 (approximately 17,000 µg/kg total VOC) and 6GW34 (approximately 1,149 µg/kg total VOC). These borings are located approximately 300 feet west of Piney Green Road. The borings are approximately 300 feet apart. Based on these results, it is likely that solvents were disposed of within this portion of OU No. 2.

Inorganic levels in soil did not appear to be significantly higher than other portions of OU No. 2.

Surficial groundwater quality has been adversely impacted with volatile organic contamination, primarily TCE, PCE, 1,2-dichloroethene, and 1,1,2,2-tetrachloroethane. Surficial groundwater contamination was evidenced in wells 6GW1S, 82MW1, 82MW2, 6GW28S, 6GW32, 6GW34, and two of the temporary wells (TW-2 and TW-3). The most significant levels of VOCs were detected in wells 6GW32 (2,200 µg/l of total 1,2-dichloroethene, 74 µg/l of PCE, and 1,500 µg/l of TCE) and 6GW34 (410 µg/l of total 1,2-dichloroethene, 9,600 µg/l of PCE, and 610 µg/l of TCE). Well 6GW34 is located approximately 100 feet east of soil borings SB6 and SB12, which exhibited elevated levels of VOCs in soil samples. Lower levels of VOCs were detected upgradient of well 6GW34 in samples collected from wells 6GW1S and 6GW15 (well 6GW15 is located in the northeast section of Lot 203). Two of the three temporary wells, which were located downgradient of well 6GW32, exhibited elevated concentrations of volatiles. Several Wallace Creek samples (located west of Piney Green Road and north of Site 82) also exhibited levels of volatiles suggesting that the source of VOC contamination in Wallace Creek is most likely surficial groundwater discharge. Monitoring wells 82MW1 and 82MW2, which are located west and northeast of well 6GW32, only exhibited low levels of 1,1,1-trichloroethane (0.5 J µg/l) and vinyl chloride (1.6 µg/l), respectively.

Deep groundwater quality is severely impacted with VOC contamination. Monitoring wells 6GW1D, 6GW1DA, 6GW28D, 6GW27D, and 6GW37D, exhibited elevated levels of TCE (60 to 58,000 µg/l), PCE (18 to 920 µg/l), total 1,2-dichloroethane (120 to 2,600 µg/l). The highest overall levels were detected in well 6GW1D.

Surficial groundwater contamination at 6GW1S, which is located next to 6GW1D, did not exhibit levels that would correlate with the significant VOC contamination in the deep groundwater. Supply well HP-651, which is located just east of Piney Green Road approximately 500 feet east of well 6GW1D, also exhibited VOC contamination. This well is approximately 199 feet deep (screened from varying depths between 125 and 194 feet) and is no longer in operation.

The horizontal and vertical extent of the deep groundwater contamination has been essentially defined. The horizontal extent of off-site contamination west of Site 82 (beyond well 6GW37D), however, has not been fully evaluated. Moreover, the vertical extent has been evaluated to a depth of 230 feet. It is unknown at this time whether contamination extends below 230 feet. As mentioned previously, a clay layer is present at approximately 230 feet which may impede the vertical migration of contamination.

The source of groundwater contamination may be associated with the volatiles that were detected in soil borings OSA-SB6 and OSA-SB12, or spills/leaks from surficial and subsurface drums that are present in the area of monitoring well 6GW1S. The drums on the surface are empty and the contents cannot be identified. However, test pits in this area revealed numerous full containers of lubrication oils, No. 6 fuel oil (heating fuel), and unknown substances. Many of the containers were leaking and surrounding soils were visibly stained. These drums will be removed as part of a non-time critical removal action.

4.3.3.5 Ravine Area

The ravine area begins at the northern fenceline of Lot 203. In the upper portion of the ravine, the banks are steep and covered with debris including empty and partially full 55-gallon drums and other smaller containers. Some of these containers indicated that they contained "DDT" and were dated back to the 1950s. Going northward towards Wallace Creek, the ravine gradually becomes less steep.

Samples collected from the banks of the ravine were identified as soil samples. Samples collected from the middle of the ravine were identified as sediment samples. The ravine is intermittent in nature. During the wet season, groundwater discharges into the ravine (along with surface runoff). During the dryer seasons, the ravine only receives runoff during heavy rain showers.

The majority of surface soil samples collected from banks of the ravine exhibited low levels of 4,4-DDE (7.5 to 220 µg/kg), 4,4'-DDD (14 to 19 µg/kg), and 4,4'-DDT (25 to 510 µg/kg). These levels are comparable to many of the other pesticide levels in surface soil throughout OU No. 2. Subsurface soil samples collected from the ravine exhibited lower levels than in the surface soil.

PCB-1260 was detected in one surface soil sample at a concentration of 180 µg/kg (soil boring SB10). None of the subsurface soil samples exhibited PCB contamination.

PAHs were detected at elevated levels in several surface soil samples. Elevated levels of PAHs were detected in surface soil samples collected from soil borings SB11 (15,931 µg/kg), SB14 (9,301 µg/kg), and SB6 (6,020 µg/kg). These soil borings are located in an area where a substantial amount of debris has been disposed of into the ravine. Based on these results, wastes disposed of into the ravine have impacted soil quality. PAHs were also detected in two subsurface soil samples collected from soil boring SB13 (271 µg/kg) and SB14 (344 µg/kg). Soil boring SB13 also exhibited elevated levels of the semivolatiles isophorone (7,700 µg/kg), naphthalene (9,600 µg/kg), 2-methylnaphthalene (11,000 µg/kg), and VOCs including 4-methyl-2-pentanone (2,000J µg/kg) and total xylenes (950 µg/kg). Soil borings SB13 and SB14 are also located in the southern portion of the ravine (near Lot 203) where debris is present along the banks of the ravine.

Inorganic constituents exhibited similar levels in both surface and subsurface soil and were comparable to other portions of OU No. 2.

Sediment samples were collected at eight sampling stations from the ravine along with surface water samples. As mentioned previously, the ravine is intermittent in nature. Two of the proposed eight sampling stations did not contain water and therefore, no surface water sample could be collected. With the exception of sampling station RV8, all of the surface and subsurface sediment samples exhibited low levels of 4,4'-DDD (4.1 to 45 µg/kg), 4,4'-DDE (23 to 120 µg/kg), and 4,4'-DDT (14 to 210 µg/kg). These levels are comparable to pesticide levels detected in soil throughout OU No. 2. Elevated levels of PAHs were detected at sampling station RV2 (12,573 µg/kg total PAHs), which is located in the southern portion of the ravine where debris is present. Lower levels of PAHs were detected in sediment samples collected from sampling stations RV1, RV3, and RV8.

Six of the eight sediment sampling stations exhibited low levels of PCBs. PCB-1260 was detected in the range of 19 µg/kg to 360 µg/kg.

None of the surface water samples collected from the ravine exhibited organic contamination.

4.3.4 Site 9

Surface and subsurface samples collected from Site 9 revealed low levels of pesticides, VOCs, and SVOCs. Inorganic levels were comparable to other portions of OU No. 2 and therefore do not appear to be present due to fire-fighting activities at Site 9.

Pesticides (4,4'-DDE and 4,4'-DDT) were detected in five surface soil samples and eight subsurface soil samples. The most contaminated sample was collected from soil boring SB1, which exhibited 650 µg/kg of 4,4'-DDE and 570 µg/kg of 4,4'-DDT. The remaining samples (surface and subsurface soil) exhibited levels of pesticides in the range of 4 µg/kg to 62 µg/kg. Overall, pesticide levels in surface and subsurface soils were comparable to other areas of OU No. 2.

Soil boring SB1 was the only location where PAH constituents were detected in surface soil. Pyrene and benzo(b)fluoranthene were detected at 59 µg/kg and 46 µg/kg, respectively. Elevated levels of PAHs (8,013 µg/kg total PAHs) were detected in a subsurface soil sample collected from monitoring well borehole 9GW4. This boring/monitoring well is located approximately 1000 feet southeast of Site 9 for purposes of monitoring upgradient groundwater quality. The source of the PAHs in this boring is unknown. Groundwater quality in well 9GW4 is good (no organic constituents were detected).

Low levels of PCE (21 µg/kg) and 1,1,1-trichloroethane (1 µg/kg) were present in the surface soil sample collected from soil boring SB3, which is located approximately 100 feet north of the aboveground storage tanks. Toluene was detected at a level of 2 µg/kg in a surface soil sample collected from soil boring SB35 (SB35 is located adjacent to the oil/water separator).

Groundwater quality at Site 9 does not appear to be significantly impacted by the fire-fighting training activities. Shallow monitoring wells 9GW6 and 9GW8 exhibited low levels of total xylenes (0.9 µg/l) and 2-chloroethylvinyl ether (1 µg/l), respectively. These wells are located approximately 100 feet to the west and east of the training pit, respectively. Total lead and chromium were detected above Federal and State drinking water standards in monitoring wells 9GW1, 9GW2, and 9GW3. Dissolved lead and chromium were not detected above any Federal or State standard.

4.3.5 Wallace Creek

Wallace Creek exhibited elevated levels of VOCs at nine of the eleven sampling stations. The source of contamination is believed to be groundwater discharge.

Sampling stations WC7, WC8, and WC9 exhibited TCE (16 to 98 µg/l), 1,2-dichloroethene (9 µg/l to 85 µg/l), PCE (1 µg/l to 4 µg/l), and vinyl chloride (6 µg/l). These sampling stations are located just above that portion of Wallace Creek where the ravine discharges into Wallace Creek (i.e., Station WC7) downstream past the Holcomb Boulevard bridge. Station WC7 exhibited the highest level of contamination. Up gradient sample stations (WC1, WC2, and WC3) only exhibited low levels of 1,2-dichloroethene (4J µg/l) at station WC4, which is approximately 100 feet upstream from the Piney Green Road bridge. None of these levels were above Federal or State standards for surface water.

Inorganic constituents including cadmium, copper, mercury, nickel, and zinc were detected above State or Federal standards for surface water. Stations WC3 and WC5 exhibited the highest levels of inorganics. Station WC3 is located approximately one-half mile upstream of the site. The elevated levels of inorganics at this location do not appear to be the result of waste disposal/handling operations at Site 6.

Pesticides were detected in approximately one-half of the sediment samples collected from Wallace Creek. The concentrations exceeded the EPA Region IV sediment quality screening values (SQSV) for both the lower 10 percentile (ER-L) and median percentile (ER-M). The highest levels of pesticides were detected at stations WC7 and WC8, which are located downstream from the area where the ravine discharges into Wallace Creek. Pesticides were also present, however, in upstream sample station WC1 above the ER-L. The source of pesticides is likely a combination of historical pest control spraying along with runoff from the ravine.

PCB-1260 was detected at all of the sampling stations with the exception of upstream stations WC1 through WC3. The concentrations ranged from 31 µg/kg to 2,100 µg/kg with the highest levels detected at stations WC6, WC7, and WC8. These stations are located adjacent to Site 82. The source of the PCBs is likely due to runoff from Site 82. However, soil samples collected approximately 300 feet south of Wallace Creek at Site 82 did not exhibit PCB contamination.

PAH constituents were detected at several sampling stations including station WC1, which is located approximately one-mile upstream of the site. Elevated total PAH concentrations were present in samples collected from stations WC5 (1,600 µg/kg), WC6 (1,220 µg/kg), WC8 (2,720 µg/kg), and WC9 (1,149 µg/kg). These stations are located adjacent and downstream of Site 82.

Inorganic constituents in sediment that exceeded SQSVs include copper, lead, silver, and zinc. Station WC3, which is located approximately one-half mile upstream of the site, exhibited the most elevated levels of these constituents.

Tissue analysis of fish and crab specimens collected from Wallace Creek indicated the presence of pesticides, TCE, and PCB that may be attributable to surface water and sediment quality within Wallace Creek. 4,4'-DDE (15 µg/kg to 180 µg/kg) and 4,4'-DDD (8.1 µg/kg to 8.8 µg/kg) were detected in all six tissue samples from Wallace Creek. PCBs were detected in tissue samples ranging in concentration from 51 µg/kg to 1000 µg/kg. Five of the six samples exhibited the presence of PCB-1260. Trichloroethene was detected in two samples at a concentration of 5 µg/kg.

4.3.6 Bear Head Creek

Surface water samples collected from Bear Head Creek exhibited aluminum, copper, iron, lead, mercury, nickel, and silver above surface water quality standards. Samples collected both upstream and downstream of the Operable Unit exhibited these inorganics.

Low levels of pesticides (maximum value of 311 µg/kg total pesticides) were detected in sediment samples collected throughout Bear Head Creek. Sample stations BH4, BH5, and BH6 exhibited the highest levels. These stations are located adjacent to Site 6.

VOCs (TCE, PCE, and total xylenes) were detected in sediment samples collected from station BH3 and BH7. Station BH7 is located about one-half mile downstream of OU No. 2. The presence of VOCs in sediment at Bear Head Creek is unusual and unexplainable from the standpoint that neither soil or groundwater in that area of OU No. 2 exhibited VOC contamination. In addition, surface water did not exhibit VOC contamination.

PCB (PCB-1260) was detected at sampling stations BH3, BH4, BH5, and BH6 ranging in concentration from 51 µg/kg to 370 µg/kg.

Lead was the only inorganic constituent which was detected at a level which exceeded the ER-L EPA Region IV SQSV. Elevated levels of lead were detected at stations BH3, BH6, and BH7. These stations are upstream and downstream of the site. Sampling stations adjacent to Site 6 did not exhibit elevated levels of lead.

Only one fish tissue analysis was submitted for Bear Head Creek. Pesticides and PCBs detected in this analysis may be attributable to the sediment contamination in Bear Head Creek.

TABLES

TABLE 4-1
SITE 9 SURFACE SOIL
POSITIVE DETECTION SUMMARY
REMEDIAL INVESTIGATION CTO-0133
MCB CAMP LEJEUNE, NORTH CAROLINA
ORGANICS

Sample No:		9-AST-SB1-00	9-AST-SB3-00	9-TPO-SB35-00	9-TPO-SB43-00	9-TPO-SB54-00
Depth:		0 - 6"	0 - 6"	0 - 6"	0 - 6"	0 - 6"
Date Sampled:		9/15/92	9/15/92	9/22/92	10/26/92	10/26/92
Lab Id:		00517-05	00517-07	00536-20	00593-44	00593-45
Parameter	Units					
PESTICIDE/PCBS						
4,4'-DDE	UG/KG	650		13	44	41
4,4'-DDT	UG/KG	570	3.3 J	15	39	21
VOLATILES						
ACETONE	UG/KG				16	
1,1,1-TRICHLOROETHANE	UG/KG		1 J			
TETRACHLOROETHENE	UG/KG		21			
TOLUENE	UG/KG				2 J	
SEMIVOLATILES						
PYRENE	UG/KG	59 J				
BIS(2-ETHYLHEXYL)PHTH	UG/KG		71 J			
BENZO(B)FLUORANTHEN	UG/KG	46 J				

UG/KG - microgram per kilogram
J - value is estimated

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TABLE 4-2
SITE 9 SURFACE SOIL
POSITIVE DETECTION SUMMARY
REMEDIAL INVESTIGATION CTO-0133
MCB CAMP LEJEUNE, NORTH CAROLINA
TOTAL METALS

Sample No:		9-AST-SB1-00		9-AST-SB13-00		9-AST-SB15-00		9-AST-SB3-00		9-TPO-SB35-00		9-TPO-SB43-00	
Depth:		0 - 6"		0 - 6"		0 - 6"		0 - 6"		0 - 6"		0 - 6"	
Date Sampled:		9/15/92		9/16/92		9/16/92		9/15/92		9/22/92		10/26/92	
Lab Id:		00517-05		00517-09		00517-11		00517-07		00536-20		00593-44	
Parameter	Units												
ALUMINUM	MG/KG	1510		2180		1890		2400		1660		4510	
BARIUM	MG/KG	5.9	JB	4.9	JB	5.2	JB	6.4	JB	8.9	B	7.3	B
CALCIUM	MG/KG	47100		3960		369	B			1820		1570	
CHROMIUM	MG/KG	5.1		3.4		1.7	B	1.8		2.5		4	
COBALT	MG/KG	0.5	JB	0.76	JB			0.85	JB				
COPPER	MG/KG									2.8	JB	2.3	JB
IRON	MG/KG	1260		1090		861		1020		813		1200	
LEAD	MG/KG	25.7		4.1		11.2		11.3		21		6.5	
MAGNESIUM	MG/KG	811	B							70.3	B	159	B
MANGANESE	MG/KG	14.7		4.1		4.5		6.4		6.1		9.9	
MERCURY	MG/KG			0.03	B	0.02	B	0.02	B	0.02	B		
POTASSIUM	MG/KG	122	B	61.3	JB	51.9	JB	20.6	JB	59.5	JB	152	B
SODIUM	MG/KG	106	JB										
VANADIUM	MG/KG	3.7	JB	3.4	JB	2.7	JB	3.3	JB	2.9	JB	4.8	B
ZINC	MG/KG							18.1		17.5		10.7	

MG/KG - milligram per kilogram
B - reported value is less than Contract Required Detection Limit (CRDL), but greater than Instrument Detection Limit (IDL)
J - value is estimated
JB - value is estimated below the CRDL, but greater than the IDL

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TABLE 4-2
SITE 9 SURFACE SOIL
POSITIVE DETECTION SUMMARY
REMEDIAL INVESTIGATION CTO-0133
MCB CAMP LEJEUNE, NORTH CAROLINA
TOTAL METALS

	Sample No:	9-AST-SB1-00	9-AST-SB13-00	9-AST-SB15-00	9-AST-SB3-00	9-TPO-SB35-00	9-TPO-SB43-00
	Depth:	0 - 6"	0 - 6"	0 - 6"	0 - 6"	0 - 6"	0 - 6"
	Date Sampled:	9/15/92	9/16/92	9/16/92	9/15/92	9/22/92	10/26/92
	Lab Id:	00517-05	00517-09	00517-11	00517-07	00536-20	00593-44
Parameter	Units						
ALUMINUM	MG/KG	1510	2180	1890	2400	1660	4510
BARIUM	MG/KG	5.9 JB	4.9 JB	5.2 JB	6.4 JB	8.9 B	7.3 B
CALCIUM	MG/KG	47100	3960	369 B		1820	1570
CHROMIUM	MG/KG	5.1	3.4	1.7 B	1.8	2.5	4
COBALT	MG/KG	0.5 JB	0.76 JB		0.85 JB		
COPPER	MG/KG					2.8 JB	2.3 JB
IRON	MG/KG	1260	1090	861	1020	813	1200
LEAD	MG/KG	25.7	4.1	11.2	11.3	21	6.5
MAGNESIUM	MG/KG	811 B				70.3 B	159 B
MANGANESE	MG/KG	14.7	4.1	4.5	6.4	6.1	9.9
MERCURY	MG/KG		0.03 B	0.02 B	0.02 B	0.02 B	
POTASSIUM	MG/KG	122 B	61.3 JB	51.9 JB	20.6 JB	59.5 JB	152 B
SODIUM	MG/KG	106 JB					
VANADIUM	MG/KG	3.7 JB	3.4 JB	2.7 JB	3.3 JB	2.9 JB	4.8 B
ZINC	MG/KG				18.1	17.5	10.7

MG/KG - milligram per kilogram
B - reported value is less than Contract Required Detection Limit (CRDL), but greater than Instrument Detection Limit (IDL)
J - value is estimated
JB - value is estimated below the CRDL, but greater than the IDL

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TABLE 4-2
SITE 9 SURFACE SOIL
POSITIVE DETECTION SUMMARY
REMEDIAL INVESTIGATION CTO-0133
MCB CAMP LEJEUNE, NORTH CAROLINA
TOTAL METALS

	Sample No:	9-TPO-SB54-00	
	Depth:	0 - 6"	
	Date Sampled:	10/26/92	
	Lab Id:	00593-45	
Parameter	Units		
ALUMINUM	MG/KG	2800	
BARIUM	MG/KG		
CALCIUM	MG/KG	179	B
CHROMIUM	MG/KG	2.4	
COBALT	MG/KG		
COPPER	MG/KG	0.93	JB
IRON	MG/KG	1070	
LEAD	MG/KG	4.8	
MAGNESIUM	MG/KG	64	B
MANGANESE	MG/KG	9.1	
MERCURY	MG/KG		
POTASSIUM	MG/KG	51.7	B
SODIUM	MG/KG		
VANADIUM	MG/KG	3.6	B
ZINC	MG/KG	6.8	

MG/KG - milligram per kilogram
B - reported value is less than Contract Required Detection Limit (CRDL), but greater than Instrument Detection Limit (IDL)
J - value is estimated
JB - value is estimated below the CRDL, but greater than the IDL

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TABLE 4-3
SITE 9 SUBSURFACE SOIL
POSITIVE DETECTION SUMMARY
REMEDIAL INVESTIGATION CTO-0133
MCB CAMP LEJEUNE, NORTH CAROLINA
ORGANICS

Sample No:		9-AST-SB13-02	9-AST-SB3-02	9-GW4-04	9-GW4-05	9-TPO-GW8-01	9-TPO-SB21-01
Depth:		3 - 5'	3 - 5'	6 - 8'	8 - 10'	1 - 2'	0 - 0.5'
Date Sampled:		9/16/92	9/15/92	9/23/92	9/23/92	9/23/92	9/16/92
Lab Id:		00517-10	00517-08	00536-07	00536-08	00536-16	00527-01
Parameter	Units						
PESTICIDE/PCBS							
4,4'-DDE	UG/KG						
4,4'-DDD	UG/KG						
4,4'-DDT	UG/KG	4.4 J				7.7 J	
ALPHA CHLORDANE	UG/KG						
VOLATILES							
ACETONE	UG/KG						7 J
TETRACHLOROETHENE	UG/KG						
SEMIVOLATILES							
ACENAPHTHENE	UG/KG				280 J		
DIBENZOFURAN	UG/KG				73 J		
FLUORENE	UG/KG				140 J		
PHENANTHRENE	UG/KG			41 J	1200		
ANTHRACENE	UG/KG				140 J		
FLUORANTHENE	UG/KG				1700		
PYRENE	UG/KG				1800		
BENZO(A)ANTHRACENE	UG/KG				540		
CHRYSENE	UG/KG				400 J		
BIS(2-ETHYLHEXYL)PHTHALATE	UG/KG		66 J				84 J
DI-N-OCTYL PHTHALATE	UG/KG						
BENZO(B)FLUORANTHENE	UG/KG				640		
BENZO(K)FLUORANTHENE	UG/KG				340 J		
BENZO(A)PYRENE	UG/KG				370 J		
INDENO(1,2,3-CD) PYRENE	UG/KG				190 J		
BENZO(G,H,I)PERYLENE	UG/KG				200 J		

UG/KG - microgram per kilogram
J - value is estimated

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TABLE 4-3
SITE 9 SUBSURFACE SOIL
POSITIVE DETECTION SUMMARY
REMEDIAL INVESTIGATION CTO-0133
MCB CAMP LEJEUNE, NORTH CAROLINA
ORGANICS

Sample No:		9-TPO-SB21-04	9-TPO-SB24-01	9-TPO-SB24-03	9-TPO-SB25-01	9-TPO-SB25-03	9-TPO-SB31-01
Depth:		7 - 9'	1 - 3'	5 - 7'	1 - 3'	5 - 7'	1 - 3'
Date Sampled:		9/16/92	9/16/92	9/16/92	9/22/92	9/22/92	9/22/92
Lab Id:		00527-02	00527-03	00527-04	00536-03	00536-04	00536-18
Parameter	Units						
PESTICIDE/PCBS							
4,4'-DDE	UG/KG		21	28			17
4,4'-DDD	UG/KG		32	11 J	9.4		50
4,4'-DDT	UG/KG		4	62			7.2
ALPHA CHLORDANE	UG/KG		2.9 J				
VOLATILES							
ACETONE	UG/KG	7 J					
TETRACHLOROETHENE	UG/KG						3 J
SEMIVOLATILES							
ACENAPHTHENE	UG/KG						
DIBENZOFURAN	UG/KG						
FLUORENE	UG/KG						
PHENANTHRENE	UG/KG						
ANTHRACENE	UG/KG						
FLUORANTHENE	UG/KG						
PYRENE	UG/KG						
BENZO(A)ANTHRACENE	UG/KG						
CHRYSENE	UG/KG						
BIS(2-ETHYLHEXYL)PHTHALATE	UG/KG	80 J	43 J	59 J			
DI-N-OCTYL PHTHALATE	UG/KG					41 J	
BENZO(B)FLUORANTHENE	UG/KG						
BENZO(K)FLUORANTHENE	UG/KG						
BENZO(A)PYRENE	UG/KG						
INDENO(1,2,3-CD) PYRENE	UG/KG						
BENZO(G,H,I)PERYLENE	UG/KG						

UG/KG - microgram per kilogram
J - value is estimated

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TABLE 4-3
SITE 9 SUBSURFACE SOIL
POSITIVE DETECTION SUMMARY
REMEDIAL INVESTIGATION CTO-0133
MCB CAMP LEJEUNE, NORTH CAROLINA
ORGANICS

	Sample No:	9-TPO-SB31-03	9-TPO-SB35-03
	Depth:	5 - 7'	5 - 7'
	Date Sampled:	9/22/92	9/22/92
	Lab Id:	00536-19	00536-22
Parameter	Units		
PESTICIDE/PCBS			
4,4'-DDE	UG/KG	39	21
4,4'-DDD	UG/KG	16	4.6 J
4,4'-DDT	UG/KG	23	37
ALPHA CHLORDANE	UG/KG		
VOLATILES			
ACETONE	UG/KG		53 J
TETRACHLOROETHENE	UG/KG	2 J	
SEMIVOLATILES			
ACENAPHTHENE	UG/KG		
DIBENZOFURAN	UG/KG		
FLUORENE	UG/KG		
PHENANTHRENE	UG/KG		
ANTHRACENE	UG/KG		
FLUORANTHENE	UG/KG		
PYRENE	UG/KG		
BENZO(A)ANTHRACENE	UG/KG		
CHRYSENE	UG/KG		
BIS(2-ETHYLHEXYL)PHTHALATE	UG/KG		
DI-N-OCTYL PHTHALATE	UG/KG		
BENZO(B)FLUORANTHENE	UG/KG		
BENZO(K)FLUORANTHENE	UG/KG		
BENZO(A)PYRENE	UG/KG		
INDENO(1,2,3-CD) PYRENE	UG/KG		
BENZO(G,H,I)PERYLENE	UG/KG		

UG/KG - microgram per kilogram
J - value is estimated

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TABLE 4-4
SITE 9 SUBSURFACE SOIL
POSITIVE DETECTION SUMMARY
REMEDIAL INVESTIGATION CTO-0133
MCB CAMP LEJEUNE, NORTH CAROLINA
TOTAL METALS

	Sample No:	9-AST-GW7-03	9-AST-GW7-04	9-AST-SB1-03	9-AST-SB13-02	9-AST-SB15-02	9-AST-SB3-02
	Depth:	4 - 6'	6 - 8'	5 - 7'	3 - 5'	3 - 5'	3 - 5'
	Date Sampled:	9/23/92	9/23/92	9/15/92	9/16/92	9/16/92	9/15/92
	Lab Id:	00536-33	00536-34	00517-06	00517-10	00517-12	00517-08
Parameter	Units						
ALUMINUM	MG/KG	6020 J	8630 J	1270	2350	1780 J	955
ARSENIC	MG/KG	0.75 B					
BARIUM	MG/KG	11.5 B	12.7 B	2.5 JB	8.5 B	2.9 JB	2.1 JB
BERYLLIUM	MG/KG	0.06 B	0.06 B				
CADMIUM	MG/KG						
CALCIUM	MG/KG	600 B	590 B		3530		
CHROMIUM	MG/KG	6.8	8.8	2.2	3.3	2	1.8
COBALT	MG/KG			0.66 JB			
COPPER	MG/KG	1.4 JB	1.5 JB				
IRON	MG/KG	3500 J	2160 J	572	1030	714	656
LEAD	MG/KG	3	4.9	1.5	17.7	1.6	1.3
MAGNESIUM	MG/KG	125 B	205 B				
MANGANESE	MG/KG	4.2 J	4.1 J	3.1	7.1	3.9	3.3
MERCURY	MG/KG			0.02 B	0.03 B	0.02 B	
NICKEL	MG/KG	2.6 JB	1.9 JB				
POTASSIUM	MG/KG	113 B	164 B	35.9 JB	72.4 JB	39.4 JB	18.6 JB
VANADIUM	MG/KG	9.6 J	8.5 J	1.8 JB	3.5 JB	2.3 JB	2.1 JB
ZINC	MG/KG		2.7 JB		18.4		

MG/KG - milligram per kilogram
B - reported value is less than Contract Required Detection Limit (CRDL), but greater than Instrument Detection Limit (IDL)
J - value is estimated
JB - value is estimated below the CRDL, but greater than the IDL

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TABLE 4-4
SITE 9 SUBSURFACE SOIL
POSITIVE DETECTION SUMMARY
REMEDIAL INVESTIGATION CTO-0133
MCB CAMP LEJEUNE, NORTH CAROLINA
TOTAL METALS

Sample No:		9-GW4-04	9-GW4-05	9-GW5-02	9-GW5-03	9-GW7D-04A	9-GW7D-04B
Depth:		6 - 8'	8 - 10'	2 - 4'	4 - 6'	4 - 6'	6 - 8'
Date Sampled:		9/23/92	9/23/92	9/22/92	9/22/92	9/25/92	9/25/92
Lab Id:		00536-07	00536-08	00536-09	00536-10	00544-14	00544-15
Parameter	Units						
ALUMINUM	MG/KG	4600	6060	2700	773	4560	6760
ARSENIC	MG/KG			2.3		0.62 B	0.79 B
BARIUM	MG/KG	39.2 B	7.1 JB	3.9 JB		7.1 JB	10.6 JB
BERYLLIUM	MG/KG						
CADMIUM	MG/KG		0.56 JB				
CALCIUM	MG/KG					389 B	443 B
CHROMIUM	MG/KG	3.7	5.7	3.5	1.9 B		8.6 J
COBALT	MG/KG			0.41 B			
COPPER	MG/KG		1.3 JB	1.4 JB	0.57 JB		
IRON	MG/KG	464	793	2280	222	596	749
LEAD	MG/KG	3.4	2.3	4.5	1.6	3.6 J	4.9 J
MAGNESIUM	MG/KG		91 B			66.6 B	194 B
MANGANESE	MG/KG						3.2 J
MERCURY	MG/KG	0.04 B	0.03 B	0.03 B			0.04 B
NICKEL	MG/KG				2 JB		
POTASSIUM	MG/KG	96.9 JB	168 JB	87.8 JB	46.5 JB		
VANADIUM	MG/KG	2.9 JB	3.7 JB	5.2 JB	1.4 JB		
ZINC	MG/KG						

MG/KG - milligram per kilogram
B - reported value is less than Contract Required Detection Limit (CRDL), but greater than Instrument Detection Limit (IDL)
J - value is estimated
JB - value is estimated below the CRDL, but greater than the IDL

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TABLE 4-4
SITE 9 SUBSURFACE SOIL
POSITIVE DETECTION SUMMARY
REMEDIAL INVESTIGATION CTO-0133
MCB CAMP LEJEUNE, NORTH CAROLINA
TOTAL METALS

	Sample No:	9-TPO-GW6-02	9-TPO-GW6-04	9-TPO-GW8-01	9-TPO-GW8-03	9-TPO-SB21-01	9-TPO-SB21-04
	Depth:	2 - 4'	6 - 8'	4 - 6'	6 - 10'	3 - 5'	7 - 9'
	Date Sampled:	9/23/92	9/23/92	9/23/92	9/23/92	9/16/92	9/16/92
	Lab Id:	00536-14	00536-15	00536-16	00536-17	00527-01	00527-02
Parameter	Units						
ALUMINUM	MG/KG	2460	2010	2890	7610	1670	2360
ARSENIC	MG/KG						1.2 B
BARIUM	MG/KG	5.9 JB	3.4 JB		10.4 JB	7 B	2.6 JB
BERYLLIUM	MG/KG						
CADMIUM	MG/KG	0.34 JB				0.71 JB	0.57 JB
CALCIUM	MG/KG	777 B				1400	217 B
CHROMIUM	MG/KG	3.6	3	2.2	6.4	2.8	3.3
COBALT	MG/KG						
COPPER	MG/KG	0.77 JB	0.44 JB	0.66 JB	1.5 JB	2.4 JB	0.55 JB
IRON	MG/KG	354	409	480	858	951	1800
LEAD	MG/KG	2.3	2.2	4.6	3.5	44.9	1.5
MAGNESIUM	MG/KG				206 B	51.7 B	35 B
MANGANESE	MG/KG				4.1	4.9	
MERCURY	MG/KG	0.03 B	0.03 B	0.03 B	0.04 B		
NICKEL	MG/KG		1.6 JB		2 JB		
POTASSIUM	MG/KG	54.1 JB	56.7 JB	37.7 JB	223 JB	112 B	126 B
VANADIUM	MG/KG	1.9 JB	2.3 JB	2.6 JB	6.8 JB	2.7 JB	6 B
ZINC	MG/KG					12.4	

MG/KG - milligram per kilogram
B - reported value is less than Contract Required Detection Limit (CRDL), but greater than Instrument Detection Limit (IDL)
J - value is estimated
JB - value is estimated below the CRDL, but greater than the IDL

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TABLE 4-4
SITE 9 SUBSURFACE SOIL
POSITIVE DETECTION SUMMARY
REMEDIAL INVESTIGATION CTO-0133
MCB CAMP LEJEUNE, NORTH CAROLINA
TOTAL METALS

Sample No:		9-TPO-SB24-01	9-TPO-SB24-03	9-TPO-SB25-01	9-TPO-SB25-03	9-TPO-SB31-01	9-TPO-SB31-03
Depth:		1 - 3'	5 - 7'	1 - 3'	5 - 7'	1 - 3'	5 - 7'
Date Sampled:		9/16/92	9/16/92	9/22/92	9/22/92	9/22/92	9/22/92
Lab Id:		00527-03	00527-04	00536-03	00536-04	00536-18	00536-19
Parameter	Units						
ALUMINUM	MG/KG	1980	1980	1370	1950	2350	2360
ARSENIC	MG/KG						
BARIUM	MG/KG	8.1 B	1.9 JB	11.3 B	3.1 JB	6.3 JB	5.9 JB
BERYLLIUM	MG/KG						
CADMIUM	MG/KG	0.45 JB					
CALCIUM	MG/KG	840	229 B	8230	340 B	1060	952 B
CHROMIUM	MG/KG	3.1	2.2	2.2	3.7	2.9	3.1
COBALT	MG/KG	0.44 B	0.41 B				
COPPER	MG/KG	2.4 JB	0.81 JB	2.1 JB	0.72 JB	1.9 JB	3.6 JB
IRON	MG/KG	1160	775	613	1200	924	900
LEAD	MG/KG	35.8	1.9	13.2	3.7	9.4	9.9
MAGNESIUM	MG/KG	52.2 B	27.8 B	143 B	51 B	70.5 B	66 B
MANGANESE	MG/KG	9.5		8.9	2.7 B	5.2	5
MERCURY	MG/KG				0.02 B	0.03 B	0.03 B
NICKEL	MG/KG						
POTASSIUM	MG/KG	141 B	67.1 B	59.4 JB	63.3 JB	246 B	159 B
VANADIUM	MG/KG	3.5 JB	2.6 JB	2.1 JB	4.2 JB	3.4 JB	3.7 JB
ZINC	MG/KG	9.8		17.9	1.9 B	14.1	7.6

MG/KG - milligram per kilogram
B - reported value is less than Contract Required Detection Limit (CRDL), but greater than Instrument Detection Limit (IDL)
J - value is estimated
JB - value is estimated below the CRDL, but greater than the IDL

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TABLE 4-4
SITE 9 SUBSURFACE SOIL
POSITIVE DETECTION SUMMARY
REMEDIAL INVESTIGATION CTO-0133
MCB CAMP LEJEUNE, NORTH CAROLINA
TOTAL METALS

	Sample No:	9-TPO-SB35-03	
	Depth:	5 - 7'	
	Date Sampled:	9/22/92	
	Lab Id:	00536-22	
Parameter	Units		
ALUMINUM	MG/KG	2170	J
ARSENIC	MG/KG		
BARIUM	MG/KG	6	JB
BERYLLIUM	MG/KG		
CADMIUM	MG/KG		
CALCIUM	MG/KG	598	B
CHROMIUM	MG/KG	2.6	J
COBALT	MG/KG		
COPPER	MG/KG	1.7	JB
IRON	MG/KG	1010	J
LEAD	MG/KG	8.3	
MAGNESIUM	MG/KG	49.4	B
MANGANESE	MG/KG	3.7	J
MERCURY	MG/KG		
NICKEL	MG/KG		
POTASSIUM	MG/KG	66.6	JB
VANADIUM	MG/KG	3.8	JB
ZINC	MG/KG	6.1	J

MG/KG - milligram per kilogram
B - reported value is less than Contract Required Detection Limit (CRDL), but greater than Instrument Detection Limit (IDL)
J - value is estimated
JB - value is estimated below the CRDL, but greater than the IDL

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TABLE 4-5
OPERABLE UNIT NO. 2 PHASE I - ROUND ONE GROUNDWATER
POSITIVE DETECTION SUMMARY
REMEDIAL INVESTIGATION CTO-0133
MCB CAMP LEJEUNE, NORTH CAROLINA
ORGANICS

	Sample No:	6-82MW1-01	6-82MW2-01	6-GW01-DW-01	6-GW02-DW-01	6-GW03-01	6-GW07-DW-01
	Depth:	N/A	N/A	N/A	N/A	N/A	N/A
	Date Sampled:	10/23/92	10/24/92	11/4/92	11/3/92	10/22/92	11/4/92
	Lab Id:	00591-20	00593-21	00603-07	00603-11	00589-01	00603-13
Parameter	Units						
VOLATILES							
BROMODICHLOROMETHANE	UG/L						
CHLOROBENZENE	UG/L						
2-CHLOROETHYLVINYL ETHER	UG/L						
CHLOROFORM	UG/L						
1,2-DICHLOROETHANE	UG/L						
1,1-DICHLOROETHENE	UG/L						0.6 J
TRANS-1,2-DICHLORETHENE	UG/L			5600.0 J			
METHYLENE CHLORIDE	UG/L			790.0 J			
1,1,2,2-TETRACHLOROETHANE	UG/L						
TETRACHLOROETHENE	UG/L			630.0		0.9 J	
1,1,1-TRICHLOROETHANE	UG/L	0.5 J					
1,1,2-TRICHLOROETHANE	UG/L						
TRICHLOROETHENE	UG/L			58000.0 J	1.4		1.2
VINYL CHLORIDE	UG/L		1.6				
ETHYLBENZENE	UG/L			48.0			
XYLENES (TOTAL)	UG/L						
SEMIVOLATILES							
PHENOL	UG/L			3 J	3 J		3 J
2-CHLOROPHENOL	UG/L						
DIMETHYL PHTHALATE	UG/L						
BIS(2-ETHYLHEXYL)PHTHALATE	UG/L						

N/A - Not applicable
UG/L - microgram per liter
J - value is estimated

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TABLE 4-5
OPERABLE UNIT NO. 2 PHASE I - ROUND ONE GROUNDWATER
POSITIVE DETECTION SUMMARY
REMEDIAL INVESTIGATION CTO-0133
MCB CAMP LEJEUNE, NORTH CAROLINA
ORGANICS

Sample No:		6-GW13-1	6-GW15-01	6-GW16-01	6-GW1S-01	6-GW21-01	6-GW22-01
Depth:		N/A	N/A	N/A	N/A	N/A	N/A
Date Sampled:		10/20/92	10/23/92	10/21/92	10/24/92	10/22/92	10/22/92
Lab Id:		00582-07	00591-10	00582-30	00593-07	00589-13	00582-36
Parameter	Units						
VOLATILES							
BROMODICHLOROMETHANE	UG/L						
CHLOROBENZENE	UG/L			110.0			
2-CHLOROETHYLVINYL ETHER	UG/L						
CHLOROFORM	UG/L			2.7			
1,2-DICHLOROETHANE	UG/L		0.6 J				
1,1-DICHLOROETHENE	UG/L						
TRANS-1,2-DICHLORETHENE	UG/L						
METHYLENE CHLORIDE	UG/L						
1,1,2,2-TETRACHLOROETHANE	UG/L			1.0	6.9		
TETRACHLOROETHENE	UG/L				2.9	1.1	1.2
1,1,1-TRICHLOROETHANE	UG/L						
1,1,2-TRICHLOROETHANE	UG/L						
TRICHLOROETHENE	UG/L		1.9		1.0	0.5 J	
VINYL CHLORIDE	UG/L						
ETHYLBENZENE	UG/L						
XYLENES (TOTAL)	UG/L				1.4		
SEMIVOLATILES							
PHENOL	UG/L			1 J			
2-CHLOROPHENOL	UG/L			5 J			
DIMETHYL PHTHALATE	UG/L						
BIS(2-ETHYLHEXYL)PHTHALATE	UG/L	2 J					

N/A - Not applicable
UG/L - microgram per liter
J - value is estimated

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TABLE 4-5
OPERABLE UNIT NO. 2 PHASE I - ROUND ONE GROUNDWATER
POSITIVE DETECTION SUMMARY
REMEDIAL INVESTIGATION CTO-0133
MCB CAMP LEJEUNE, NORTH CAROLINA
ORGANICS

	Sample No:	6-GW23-01	6-GW25-01	6-GW26-01	6-GW27-DW-01	6-GW28-01	6-GW28-DW-01
	Depth:	N/A	N/A	N/A	N/A	N/A	N/A
	Date Sampled:	10/22/92	10/23/92	10/23/92	11/3/92	10/23/92	11/3/92
	Lab Id:	00589-15	00591-12	00591-14	00603-15	00591-16	00603-17
Parameter	Units						
VOLATILES							
BROMODICHLOROMETHANE	UG/L			0.6 J			
CHLOROBENZENE	UG/L						
2-CHLOROETHYLVINYL ETHER	UG/L						
CHLOROFORM	UG/L						
1,2-DICHLOROETHANE	UG/L						
1,1-DICHLOROETHENE	UG/L						
TRANS-1,2-DICHLORETHENE	UG/L				5800.0	16.0	500.0
METHYLENE CHLORIDE	UG/L						
1,1,2,2-TETRACHLOROETHANE	UG/L						
TETRACHLOROETHENE	UG/L					26.0	
1,1,1-TRICHLOROETHANE	UG/L						
1,1,2-TRICHLOROETHANE	UG/L					0.5 J	
TRICHLOROETHENE	UG/L	0.6 J			18000.0	120.0	3600.0
VINYL CHLORIDE	UG/L						
ETHYLBENZENE	UG/L						
XYLENES (TOTAL)	UG/L						
SEMIVOLATILES							
PHENOL	UG/L		2 J		22		2 J
2-CHLOROPHENOL	UG/L						
DIMETHYL PHTHALATE	UG/L						
BIS(2-ETHYLHEXYL)PHTHALATE	UG/L		1 J		5 J		22

N/A - Not applicable
UG/L - microgram per liter
J - value is estimated

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TABLE 4-5
OPERABLE UNIT NO. 2 PHASE I - ROUND ONE GROUNDWATER
POSITIVE DETECTION SUMMARY
REMEDIAL INVESTIGATION CTO-0133
MCB CAMP LEJEUNE, NORTH CAROLINA
ORGANICS

	Sample No:	6-GW9-1	6-MW2-01	9-GW6-01	9-GW07-DW-01	9-GW8-01
	Depth:	N/A	N/A	N/A	N/A	N/A
	Date Sampled:	10/20/92	10/24/92	10/25/92	11/3/92	10/25/92
	Lab Id:	00582-01	00593-13	00593-35	00603-19	00593-41
Parameter	Units					
VOLATILES						
BROMODICHLOROMETHANE	UG/L					
CHLOROBENZENE	UG/L					
2-CHLOROETHYLVINYL ETHER	UG/L					1.0 J
CHLOROFORM	UG/L					
1,2-DICHLOROETHANE	UG/L					
1,1-DICHLOROETHENE	UG/L					
TRANS-1,2-DICHLORETHENE	UG/L					
METHYLENE CHLORIDE	UG/L					
1,1,2,2-TETRACHLOROETHANE	UG/L					
TETRACHLOROETHENE	UG/L					
1,1,1-TRICHLOROETHANE	UG/L					
1,1,2-TRICHLOROETHANE	UG/L					
TRICHLOROETHENE	UG/L					
VINYL CHLORIDE	UG/L					
ETHYLBENZENE	UG/L					
XYLENES (TOTAL)	UG/L			0.9 J		
SEMIVOLATILES						
PHENOL	UG/L				7 J	
2-CHLOROPHENOL	UG/L					
DIMETHYL PHTHALATE	UG/L				1 J	
BIS(2-ETHYLHEXYL)PHTHALATE	UG/L	2 J	2 J		2 J	

N/A - Not applicable
UG/L - microgram per liter
J - value is estimated

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TABLE 4-6
OPERABLE UNIT NO. 2 PHASE I - ROUND ONE GROUNDWATER
POSITIVE DETECTION SUMMARY
REMEDIAL INVESTIGATION CTO-0133
MCB CAMP LEJEUNE, NORTH CAROLINA
TOTAL METALS

	Sample No:	6-82MW1-01	6-82MW2-01	6-82-MW3-01	6-BP6-01	6-GW01-DW-01	6-GW02-DW-01
	Depth:	N/A	N/A	N/A	N/A	N/A	N/A
	Date Sampled:	10/23/92	10/24/92	10/23/92	10/24/92	11/4/92	11/3/92
	Lab Id:	00591-20	00593-21	00591-26	00593-01	00603-07	00603-11
Parameter	Units						
ALUMINUM	UG/L	57600	6230	93800	229000		
ANTIMONY	UG/L						
ARSENIC	UG/L	67.8	3 B	24.4	7.2 JB		3.8 JB
BARIUM	UG/L	476	49.3 B	540	257	71.5 B	
BERYLLIUM	UG/L	4.1 B		2.6 B			
CALCIUM	UG/L	6580	60800	4360 B	2070 B	103000	8110
CHROMIUM	UG/L	105	5.9 B	174	198		
COBALT	UG/L	6.4 B		8.6 B			
COPPER	UG/L	24.8 JB		29.3 J	35.6		
IRON	UG/L	84800	10800 J	40500	47000 J		
LEAD	UG/L	34.6		88.9	64.4		
MAGNESIUM	UG/L	6000	4370 B	7470	6970	3160 B	812 B
MANGANESE	UG/L	283	55	160	84.5	21.6	
MERCURY	UG/L		0.66	0.27	0.11 B		
NICKEL	UG/L	34.6 B		16.2 JB	27.4 B		
POTASSIUM	UG/L	4060 B	678 B	6600	9040	7640	67600
SODIUM	UG/L	6360	36500 J	5670	3600 JB	13100	26000
VANADIUM	UG/L	256		215	209		
ZINC	UG/L	166		186	56.6		

N/A - Not applicable
UG/L - microgram per liter
B - reported value is less than Contract Required Detection Limit (CRDL), but greater than Instrument Detection Limit (IDL)
J - value is estimated
JB - value is estimated below the CRDL, but greater than the IDL

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TABLE 4-6
OPERABLE UNIT NO. 2 PHASE I - ROUND ONE GROUNDWATER
POSITIVE DETECTION SUMMARY
REMEDIAL INVESTIGATION CTO-0133
MCB CAMP LEJEUNE, NORTH CAROLINA
TOTAL METALS

Sample No:		6-GW03-01	6-GW07-DW-01	6-GW07S-01	6-GW10-1	6-GW11-01	6-GW12-1
Depth:		N/A	N/A	N/A	N/A	N/A	N/A
Date Sampled:		10/22/92	11/4/92	10/22/92	10/20/92	10/22/92	10/20/92
Lab Id:		00589-01	00603-13	00589-03	00582-03	00589-05	00582-05
Parameter	Units						
ALUMINUM	UG/L	171000 J	336	123000 J	6350	30400 J	6180
ANTIMONY	UG/L						
ARSENIC	UG/L	6.9 JB		5.8 JB		4.4 JB	
BARIUM	UG/L	1020		375	47.4 B	76.8 B	21.4 JB
BERYLLIUM	UG/L	7.5					
CALCIUM	UG/L	52500	51900	46200	9170	35900	20400
CHROMIUM	UG/L	201		176	6.7 B	36.9	10 B
COBALT	UG/L	10.9 B		8.2 B		2.6 JB	
COPPER	UG/L	175		25.6 J			
IRON	UG/L	27700 J		21800 J	4340	12800 J	3090
LEAD	UG/L	200 J		31.2 J		12 J	
MAGNESIUM	UG/L	5950 J	1480 B	5570 J	844 B	1740 JB	700 B
MANGANESE	UG/L	362	33.5	79.1	15.7	25.5	13.4 B
MERCURY	UG/L	0.46		0.13 B		0.16 B	
NICKEL	UG/L	41.9					15.9 JB
POTASSIUM	UG/L	10300 J	1310 B	7350 J	2390 B	3360 JB	652 B
SODIUM	UG/L	2850 JB	10900	1500 JB	7430	2020 JB	1620 JB
VANADIUM	UG/L	192		143	10.3 B	108	8.8 B
ZINC	UG/L	1620		61.7		15.5 B	

N/A - Not applicable
UG/L - microgram per liter
B - reported value is less than Contract Required Detection Limit (CRDL), but greater than Instrument Detection Limit (IDL)
J - value is estimated
JB - value is estimated below the CRDL, but greater than the IDL

CLEJ-01272-3.13-08/20/93

TABLE 4-6
OPERABLE UNIT NO. 2 PHASE I - ROUND ONE GROUNDWATER
POSITIVE DETECTION SUMMARY
REMEDIAL INVESTIGATION CTO-0133
MCB CAMP LEJEUNE, NORTH CAROLINA
TOTAL METALS

	Sample No:	6-GW13-1	6-GW14-01	6-GW15-01	6-GW16-01	6-GW17-01	6-GW18-01
	Depth:	N/A	N/A	N/A	N/A	N/A	N/A
	Date Sampled:	10/20/92	10/21/92	10/23/92	10/21/92	10/21/92	10/21/92
	Lab Id:	00582-07	00582-28	00591-10	00582-30	00582-32	00582-34
Parameter	Units						
ALUMINUM	UG/L	8000	7560	96400	19000	3210	714
ANTIMONY	UG/L						
ARSENIC	UG/L			23.3			
BARIUM	UG/L	43.5 B		98 B	84.2 B	115 B	31.7 B
BERYLLIUM	UG/L			1.3 B			
CALCIUM	UG/L	58600	9340	64900	8740	9430	3010 B
CHROMIUM	UG/L	17	6.4 JB	103	15.6 J		
COBALT	UG/L			7.2 B			
COPPER	UG/L			30.6 J			
IRON	UG/L	2160	1310	15300	3520	824	135
LEAD	UG/L			33.8			
MAGNESIUM	UG/L	1170 B	647 B	5430	1510 B	719 B	331 B
MANGANESE	UG/L	8.6 B		29.9	67.9	9.4 B	7.3 B
MERCURY	UG/L						
NICKEL	UG/L			24.4 JB			
POTASSIUM	UG/L	919 B	618 B	5040	1740 B	1340 B	501 B
SODIUM	UG/L	1110 JB	3170 B	68700	4520 B	6670	2280 B
VANADIUM	UG/L	12.2 B	8 B	187	13.7 B	5.7 B	
ZINC	UG/L			54.3	711		

N/A - Not applicable
UG/L - microgram per liter
B - reported value is less than Contract Required Detection Limit (CRDL), but greater than Instrument Detection Limit (IDL)
J - value is estimated
JB - value is estimated below the CRDL, but greater than the IDL

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TABLE 4-6
OPERABLE UNIT NO. 2 PHASE I - ROUND ONE GROUNDWATER
POSITIVE DETECTION SUMMARY
REMEDIAL INVESTIGATION CTO-0133
MCB CAMP LEJEUNE, NORTH CAROLINA
TOTAL METALS

Sample No:		6-GW19-01		6-GW1S-01		6-GW2-01		6-GW20-01		6-GW21-01		6-GW22-01	
Depth:		N/A		N/A		N/A		N/A		N/A		N/A	
Date Sampled:		10/22/92		10/24/92		10/24/92		10/22/92		10/22/92		10/21/92	
Lab Id:		00589-07		00593-07		00593-09		00589-11		00589-13		00582-36	
Parameter	Units												
ALUMINUM	UG/L	60900	J	101000		160000		2480	J	4360	J	8010	
ANTIMONY	UG/L												
ARSENIC	UG/L			11.2		10.6	B						
BARIUM	UG/L	135	B	161	B	192	B	75.7	B	20.4	JB	61.1	B
BERYLLIUM	UG/L												
CALCIUM	UG/L	2560	B	24300		2210	B	4480	B	4860	B	30300	
CHROMIUM	UG/L	51.4		175		169		6	B			7.7	JB
COBALT	UG/L	2.8	JB							2.3	JB		
COPPER	UG/L	14	JB	23.9	JB	37.6							
IRON	UG/L	8650	J	54300	J	36900	J	840	J	932	J	1280	
LEAD	UG/L	21.2	J	37.8		44.5		1.2	JB	2.6	JB		
MAGNESIUM	UG/L	1640	JB	5440		5170		946	JB	704	JB	974	B
MANGANESE	UG/L	25.5		49.9		57.3		11.5	B	6.6	B	11.4	B
MERCURY	UG/L	0.16	B	0.17	B	0.11	B						
NICKEL	UG/L			15.9	B	11.1	B						
POTASSIUM	UG/L	4290	JB	6620		8490		727	JB	616	JB	1320	B
SODIUM	UG/L	2520	JB	1990	JB	2140	JB	5340		2710	JB	4280	B
VANADIUM	UG/L	41.2	B	330		198						8.3	B
ZINC	UG/L	20.3		58.5		50.6							

N/A - Not applicable
UG/L - microgram per liter
B - reported value is less than Contract Required Detection Limit (CRDL), but greater than Instrument Detection Limit (IDL)
J - value is estimated
JB - value is estimated below the CRDL, but greater than the IDL

CLEJ-01272-3.13-08/20/93

TABLE 4-6
OPERABLE UNIT NO. 2 PHASE I - ROUND ONE GROUNDWATER
POSITIVE DETECTION SUMMARY
REMEDIAL INVESTIGATION CTO-0133
MCB CAMP LEJEUNE, NORTH CAROLINA
TOTAL METALS

	Sample No:	6-GW23-01	6-GW25-01	6-GW26-01	6-GW27-DW-01	6-GW28-01	6-GW28-DW-01
	Depth:	N/A	N/A	N/A	N/A	N/A	N/A
	Date Sampled:	10/22/92	10/23/92	10/23/92	11/3/92	10/23/92	11/3/92
	Lab Id:	00589-15	00591-12	00591-14	00603-15	00591-16	00603-17
Parameter	Units						
ALUMINUM	UG/L	2240 J	3970	3150		1740	
ANTIMONY	UG/L				15.3 B		
ARSENIC	UG/L			4.2 B			
BARIUM	UG/L	54.8 B	44 B	50.3 B		26.2 JB	
BERYLLIUM	UG/L						
CALCIUM	UG/L	6370	3370 B	37200	65100	16400	52800
CHROMIUM	UG/L	5.4 B					
COBALT	UG/L						
COPPER	UG/L						
IRON	UG/L	708 J	1090	1890		517	
LEAD	UG/L	1.4 JB	2.2 B	6		1.8 B	
MAGNESIUM	UG/L	1640 JB	1570 B	3650 B	1720 B	1550 B	1540 B
MANGANESE	UG/L	27	12.5 B	62.4	14.2 B	26.9	14.2 B
MERCURY	UG/L						
NICKEL	UG/L						
POTASSIUM	UG/L	3100 JB	963 B	2040 B	1350 B	941 B	1260 B
SODIUM	UG/L	4800 B	3250 JB	3230 JB	6240	7260	7960
VANADIUM	UG/L		2.6 B	2.8 B			
ZINC	UG/L	13.9 B		156			

N/A - Not applicable
UG/L - microgram per liter
B - reported value is less than Contract Required Detection Limit (CRDL), but greater than Instrument Detection Limit (IDL)
J - value is estimated
JB - value is estimated below the CRDL, but greater than the IDL

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TABLE 4-6
OPERABLE UNIT NO. 2 PHASE I - ROUND ONE GROUNDWATER
POSITIVE DETECTION SUMMARY
REMEDIAL INVESTIGATION CTO-0133
MCB CAMP LEJEUNE, NORTH CAROLINA
TOTAL METALS

	Sample No:	6-GW30-01	6-GW4-1	6-GW5-1	6-GW6-1	6-GW8-1	6-GW9-1
	Depth:	N/A	N/A	N/A	N/A	N/A	N/A
	Date Sampled:	10/23/92	10/21/92	10/21/92	10/21/92	10/21/92	10/20/92
	Lab Id:	00591-18	00582-18	00582-20	00582-24	00582-26	00582-01
Parameter	Units						
ALUMINUM	UG/L	6750	27600	144000	56600	24500	6450
ANTIMONY	UG/L				15.6 JB		
ARSENIC	UG/L	5.6 B		8.9 B			
BARIUM	UG/L	48.6 B	209	372	227	62 B	48.8 B
BERYLLIUM	UG/L	2.2 B	0.58 B	2.2 B	0.55 JB		
CALCIUM	UG/L	19200	5430	47900	6600	31500	9680
CHROMIUM	UG/L		26.4	146	93.5	29.4	6.5 B
COBALT	UG/L	10.7 B		5.4 B			
COPPER	UG/L						
IRON	UG/L	8550	3380	19700	12900	3880	2820
LEAD	UG/L	4.1	9.6	85	18.8		
MAGNESIUM	UG/L	2330 B	1010 B	4790 B	2920 B	1530 B	1550 B
MANGANESE	UG/L	44	57.3	50	23.2	17.1	12.3 B
MERCURY	UG/L						
NICKEL	UG/L	21.2 JB	16.5 JB	33.7 JB			14.2 JB
POTASSIUM	UG/L	2140 B	1140 B	6060	4040 B	1540 B	811 B
SODIUM	UG/L	5930	4080 B	3780 B	9010	3350 B	5780
VANADIUM	UG/L	14.6 B	26.7 B	111	165	23.1 B	6.6 B
ZINC	UG/L	204	217	60.3			

N/A - Not applicable
UG/L - microgram per liter
B - reported value is less than Contract Required Detection Limit (CRDL), but greater than Instrument Detection Limit (IDL)
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JB - value is estimated below the CRDL, but greater than the IDL

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TABLE 4-6
OPERABLE UNIT NO. 2 PHASE I - ROUND ONE GROUNDWATER
POSITIVE DETECTION SUMMARY
REMEDIAL INVESTIGATION CTO-0133
MCB CAMP LEJEUNE, NORTH CAROLINA
TOTAL METALS

	Sample No:	6-MW2-01	6-MW3-01	6-MW8-01	6-MW9-01	9-GW07-DW-01	9-GW1-01
	Depth:	N/A	N/A	N/A	N/A	N/A	N/A
	Date Sampled:	10/24/92	10/23/92	10/24/92	10/24/92	11/3/92	10/25/92
	Lab Id:	00593-13	00591-22	00593-17	00593-19	00603-19	00593-27
Parameter	Units						
ALUMINUM	UG/L	23000 J	991	46500	164000	207	88700
ANTIMONY	UG/L						
ARSENIC	UG/L			6.2 B	6.2 JB		20.2 B
BARIUM	UG/L	74.6 B	25.4 JB	84.5 B	185 B	34.9 B	205
BERYLLIUM	UG/L						
CALCIUM	UG/L		466 B	1490 B	1880 B	28500	90700
CHROMIUM	UG/L	15.4		42.2	160		99.3
COBALT	UG/L						
COPPER	UG/L				30.8		23.1 JB
IRON	UG/L	2890 J	888	10600 J	37000 J	281	99200 J
LEAD	UG/L	10.4	1 B	10.7	94.6		66.4
MAGNESIUM	UG/L	763 B	444 B	2080 B	5610	1370 B	4230 B
MANGANESE	UG/L	6.8 B		20.8	64	14.8 B	174
MERCURY	UG/L			0.07 B	0.14 B		0.11 B
NICKEL	UG/L				21.7 B		
POTASSIUM	UG/L	1480 B	839 B	4220 B	6050	65200	8620
SODIUM	UG/L	2560 JB	3250 JB	3970 JB	3810 JB	53800	1390 JB
VANADIUM	UG/L	19.6 B	2.7 B	52.8	157		134
ZINC	UG/L				47.8		77.2

N/A - Not applicable
UG/L - microgram per liter
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JB - value is estimated below the CRDL, but greater than the IDL

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TABLE 4-6
OPERABLE UNIT NO. 2 PHASE I - ROUND ONE GROUNDWATER
POSITIVE DETECTION SUMMARY
REMEDIAL INVESTIGATION CTO-0133
MCB CAMP LEJEUNE, NORTH CAROLINA
TOTAL METALS

Sample No:		9-GW2-01	9-GW3-01	9-GW4-01	9-GW5-01	9-GW6-01	9-GW7-01
Depth:		N/A	N/A	N/A	N/A	N/A	N/A
Date Sampled:		10/25/92	10/25/92	10/25/92	10/25/92	10/25/92	10/25/92
Lab Id:		00593-29	00593-11	00593-31	00593-33	00593-35	00593-39
Parameter	Units						
ALUMINUM	UG/L	35800	167000	2840	754	8830	6360
ANTIMONY	UG/L						
ARSENIC	UG/L	3.7 B	4.5 JB			3.2 B	
BARIUM	UG/L	71.4 B	1060	71.3 B	66.6 B	28.7 JB	
BERYLLIUM	UG/L		3.6 B				
CALCIUM	UG/L	50200	36100	16100	60000	48900	20500
CHROMIUM	UG/L	45.4	214			10.6	8.3 B
COBALT	UG/L						
COPPER	UG/L	15.5 JB	39.7				
IRON	UG/L	11500 J	30700 J	882 J	280 J	3340 J	1320
LEAD	UG/L	18.6	127				1.2 B
MAGNESIUM	UG/L	2370 B	6520	1130 B	1820 B	1250 B	1020 B
MANGANESE	UG/L	20.6	91.3	2.1 B	2.2 B	5 B	
MERCURY	UG/L	1.4	0.33				
NICKEL	UG/L	11.1 B	39.3 B				
POTASSIUM	UG/L	3130 B	8110	326 B	9740	1230 B	1090 B
SODIUM	UG/L	2310 JB	2190 JB	4170 JB	3910 JB	1740 JB	2450 JB
VANADIUM	UG/L	45.8 B	175			20 B	
ZINC	UG/L	24.8	118				

N/A - Not applicable
UG/L - microgram per liter
B - reported value is less than Contract Required Detection Limit (CRDL), but greater than Instrument Detection Limit (IDL)
J - value is estimated
JB - value is estimated below the CRDL, but greater than the IDL

CLEJ-01272-3.13-08/20/93

TABLE 4-6
OPERABLE UNIT NO. 2 PHASE I - ROUND ONE GROUNDWATER
POSITIVE DETECTION SUMMARY
REMEDIAL INVESTIGATION CTO-0133
MCB CAMP LEJEUNE, NORTH CAROLINA
TOTAL METALS

	Sample No:	9-GW8-01	
	Depth:	N/A	
	Date Sampled:	10/25/92	
	Lab Id:	00593-41	
Parameter	Units		
ALUMINUM	UG/L	4270	
ANTIMONY	UG/L		
ARSENIC	UG/L		
BARIUM	UG/L		
BERYLLIUM	UG/L		
CALCIUM	UG/L	16400	
CHROMIUM	UG/L	5.2	B
COBALT	UG/L		
COPPER	UG/L		
IRON	UG/L	1200	
LEAD	UG/L	5.2	
MAGNESIUM	UG/L	1220	B
MANGANESE	UG/L		
MERCURY	UG/L		
NICKEL	UG/L		
POTASSIUM	UG/L	5380	
SODIUM	UG/L	2130	JB
VANADIUM	UG/L		
ZINC	UG/L		

N/A - Not applicable
UG/L - microgram per liter
B - reported value is less than Contract Required Detection Limit (CRDL), but greater than Instrument Detection Limit (IDL)
J - value is estimated
JB - value is estimated below the CRDL, but greater than the IDL

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TABLE 4-7
OPERABLE UNIT NO. 2 PHASE I - ROUND ONE GROUNDWATER
POSITIVE DETECTION SUMMARY
REMEDIAL INVESTIGATION CTO-0133
MCB CAMP LEJEUNE, NORTH CAROLINA
DISSOLVED METALS

	Sample No:	6-82-MW1D-01	6-82-MW2D-01	6-82-MW3D-01	6-BP6D-01	6-GW01-DWD-01	6-GW02-DWD-01
	Depth:	N/A	N/A	N/A	N/A	N/A	N/A
	Date Sampled:	10/23/92	10/24/92	10/23/92	10/24/92	11/4/92	11/3/92
	Lab Id:	00591-21	00593-22	00591-27	00593-02	00603-08	00603-12
Parameter	Units						
ALUMINUM	UG/L			1200			
ANTIMONY	UG/L					19.8 B	
ARSENIC	UG/L						
BARIUM	UG/L			31.4 B		67.1 B	
CADMIUM	UG/L						
CALCIUM	UG/L	3580 B	58500	3870 B		97600	1690 B
CHROMIUM	UG/L						
COBALT	UG/L			4.6 B			
IRON	UG/L		2800	3280			
LEAD	UG/L						
MAGNESIUM	UG/L	3340 B	4200 JB	4240 B	557 JB	3110 B	332 B
MANGANESE	UG/L	127	49.9	98.9		18.5	
NICKEL	UG/L	13.9 JB		10.4 JB			
POTASSIUM	UG/L	1570 B		1440 B		7640	70200
SILVER	UG/L		27.6				
SODIUM	UG/L	6240	36000 J	5980	3410 JB	13100	27300
VANADIUM	UG/L						
ZINC	UG/L	66.8		119			

N/A - Not applicable
UG/L - microgram per liter
B - reported value is less than Contract Required Detection Limit (CRDL), but greater than Instrument Detection Limit (IDL)
J - value is estimated
JB - value is estimated below the CRDL, but greater than the IDL

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TABLE 4-7
OPERABLE UNIT NO. 2 PHASE I - ROUND ONE GROUNDWATER
POSITIVE DETECTION SUMMARY
REMEDIAL INVESTIGATION CTO-0133
MCB CAMP LEJEUNE, NORTH CAROLINA
DISSOLVED METALS

	Sample No:	6-GW03D-01	6-GW07-DWD-01	6-GW07SD-01	6-GW10D-1	6-GW11D-01	6-GW12D-1
	Depth:	N/A	N/A	N/A	N/A	N/A	N/A
	Date Sampled:	10/22/92	11/4/92	10/22/92	10/20/92	10/22/92	10/20/92
	Lab Id:	00589-02	00603-14	00589-04	00582-04	00589-06	00582-06
Parameter	Units						
ALUMINUM	UG/L						271
ANTIMONY	UG/L						
ARSENIC	UG/L						
BARIUM	UG/L	23.4 JB			28.4 B	24 JB	
CADMIUM	UG/L						
CALCIUM	UG/L	40700	51400	40700	8680	37000	19600
CHROMIUM	UG/L		3.8 B				
COBALT	UG/L						
IRON	UG/L				1680	78.9 B	
LEAD	UG/L					1.2 B	1 B
MAGNESIUM	UG/L	1910 B	1510 B	671 B	531 B	1220 B	378 B
MANGANESE	UG/L	5.1 B	31.8			11.5 B	
NICKEL	UG/L						
POTASSIUM	UG/L	3480 B	1410 B	1140 B	2050 B	2440 B	
SILVER	UG/L						
SODIUM	UG/L	2880 JB	11300	1420 JB	6980	2260 JB	
VANADIUM	UG/L						2.7 B
ZINC	UG/L	230					

N/A - Not applicable
UG/L - microgram per liter
B - reported value is less than Contract Required Detection Limit (CRDL), but greater than Instrument Detection Limit (IDL)
J - value is estimated
JB - value is estimated below the CRDL, but greater than the IDL

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TABLE 4-7
OPERABLE UNIT NO. 2 PHASE I - ROUND ONE GROUNDWATER
POSITIVE DETECTION SUMMARY
REMEDIAL INVESTIGATION CTO-0133
MCB CAMP LEJEUNE, NORTH CAROLINA
DISSOLVED METALS

Sample No:		6-GW13D-1	6-GW14D-01	6-GW15D-01	6-GW16D-01	6-GW17D-01	6-GW18D-01
Depth:		N/A	N/A	N/A	N/A	N/A	N/A
Date Sampled:		10/20/92	10/21/92	10/23/92	10/21/92	10/21/92	10/21/92
Lab Id:		00582-08	00582-29	00591-11	00582-31	00582-33	00582-35
Parameter	Units						
ALUMINUM	UG/L		216	402	83.4 B	623	123 B
ANTIMONY	UG/L	19 JB					
ARSENIC	UG/L			6.6 B			
BARIUM	UG/L				43 B	108 B	
CADMIUM	UG/L						
CALCIUM	UG/L	57400	8040	46600	8110	9970	2700 B
CHROMIUM	UG/L						
COBALT	UG/L						
IRON	UG/L				470	287	
LEAD	UG/L			2 B			
MAGNESIUM	UG/L	707 B	379 B	2550 B	1020 B	737 B	315 B
MANGANESE	UG/L			3 B	58.2	10.7 B	9.2 B
NICKEL	UG/L						
POTASSIUM	UG/L		259 B	2570 B	752 B	1200 B	510 B
SILVER	UG/L						
SODIUM	UG/L		2860 B	70500	4410 B	7210	2180 B
VANADIUM	UG/L			41.8 B		1.9 B	
ZINC	UG/L				619		

N/A - Not applicable
UG/L - microgram per liter
B - reported value is less than Contract Required Detection Limit (CRDL), but greater than Instrument Detection Limit (IDL)
J - value is estimated
JB - value is estimated below the CRDL, but greater than the IDL

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TABLE 4-7
OPERABLE UNIT NO. 2 PHASE I - ROUND ONE GROUNDWATER
POSITIVE DETECTION SUMMARY
REMEDIAL INVESTIGATION CTO-0133
MCB CAMP LEJEUNE, NORTH CAROLINA
DISSOLVED METALS

Sample No:		6-GW19D-01	6-GW1SD-01	6-GW20D-01	6-GW21D-01	6-GW22D-01	6-GW23D-01
Depth:		N/A	N/A	N/A	N/A	N/A	N/A
Date Sampled:		10/22/92	10/24/92	10/22/92	10/22/92	10/21/92	10/22/92
Lab Id:		00589-08	00593-08	00589-12	00589-14	00582-37	00589-16
Parameter	Units						
ALUMINUM	UG/L	554		793		291	
ANTIMONY	UG/L						
ARSENIC	UG/L						
BARIUM	UG/L	38.4 B		60.5 B		43.4 B	33.2 B
CADMIUM	UG/L						
CALCIUM	UG/L	2320 B	18400	4700 B	4460 B	29800	6460
CHROMIUM	UG/L						
COBALT	UG/L						
IRON	UG/L	447		605			
LEAD	UG/L						
MAGNESIUM	UG/L	368 B	1770 JB	980 B	682 B	791 B	1640 B
MANGANESE	UG/L	7.6 B		12.4 B	4.9 B	9.9 B	25.4
NICKEL	UG/L						
POTASSIUM	UG/L	2270 B	1180 B	807 B	616 B	1050 B	3240 B
SILVER	UG/L						
SODIUM	UG/L	2620 JB	2240 JB	5690	3020 JB	4360 B	5060
VANADIUM	UG/L					1.8 B	
ZINC	UG/L						14.9 B

N/A - Not applicable
UG/L - microgram per liter
B - reported value is less than Contract Required Detection Limit (CRDL), but greater than Instrument Detection Limit (IDL)
J - value is estimated
JB - value is estimated below the CRDL, but greater than the IDL

CLEJ-01272-3.13-08/20/93

TABLE 4-7
OPERABLE UNIT NO. 2 PHASE I - ROUND ONE GROUNDWATER
POSITIVE DETECTION SUMMARY
REMEDIAL INVESTIGATION CTO-0133
MCB CAMP LEJEUNE, NORTH CAROLINA
DISSOLVED METALS

Sample No:		6-GW25D-01	6-GW26D-01	6-GW27-DWD-01	6-GW28-DWD-01	6-GW28D-01	6-GW2D-01
Depth:		N/A	N/A	N/A	N/A	N/A	N/A
Date Sampled:		10/23/92	10/23/92	11/3/92	11/3/92	10/23/92	10/24/92
Lab Id:		00591-13	00591-15	00603-16	00603-18	00591-17	00593-10
Parameter	Units						
ALUMINUM	UG/L						
ANTIMONY	UG/L						
ARSENIC	UG/L						
BARIUM	UG/L	24.7 JB	19.2 JB				
CADMIUM	UG/L						3000
CALCIUM	UG/L	3550 B	35400	64800	49400	15200	
CHROMIUM	UG/L						
COBALT	UG/L						
IRON	UG/L						
LEAD	UG/L					1 B	
MAGNESIUM	UG/L	1510 B	3450 B	1800 B	1470 B	1420 B	1240 JB
MANGANESE	UG/L	10.8 B	57	14.7 B	11.8 B	21	6.4 B
NICKEL	UG/L						
POTASSIUM	UG/L	934 B	2060 B	1470 B	1230 B	976 B	
SILVER	UG/L						
SODIUM	UG/L	3560 JB	3280 JB	6580	7640	6840	2290 JB
VANADIUM	UG/L						
ZINC	UG/L		147				

N/A - Not applicable
UG/L - microgram per liter
B - reported value is less than Contract Required Detection Limit (CRDL), but greater than Instrument Detection Limit (IDL)
J - value is estimated
JB - value is estimated below the CRDL, but greater than the IDL

CLEJ-01272-3.13-08/20/93

TABLE 4-7
OPERABLE UNIT NO. 2 PHASE I - ROUND ONE GROUNDWATER
POSITIVE DETECTION SUMMARY
REMEDIAL INVESTIGATION CTO-0133
MCB CAMP LEJEUNE, NORTH CAROLINA
DISSOLVED METALS

	Sample No:	6-GW30D-01	6-GW4D-1	6-GW5D-01	6-GW6D-1	6-GW8D-1	6-GW9D-1
	Depth:	N/A	N/A	N/A	N/A	N/A	N/A
	Date Sampled:	10/23/92	10/21/92	10/21/92	10/21/92	10/21/92	10/20/92
	Lab Id:	00591-19	00582-19	00582-21	00582-25	00582-27	00582-02
Parameter	Units						
ALUMINUM	UG/L		782	293	1020	123 B	
ANTIMONY	UG/L						
ARSENIC	UG/L						
BARIUM	UG/L	12 JB	41.5 B		68 B		29.5 B
CADMIUM	UG/L						
CALCIUM	UG/L	15600	4560 B	35100	6230	25900	9240
CHROMIUM	UG/L						
COBALT	UG/L	4.9 B					
IRON	UG/L				354		768
LEAD	UG/L		1 B				
MAGNESIUM	UG/L	1350 B	647 B	756 B	763 B	609 B	1340 B
MANGANESE	UG/L	22.2	92.7				
NICKEL	UG/L	19.6 JB					
POTASSIUM	UG/L	1270 B		568 B	518 B	267 B	
SILVER	UG/L						
SODIUM	UG/L	5730	4300 B	7000	9330	4710 B	5550
VANADIUM	UG/L			3 B	5.8 B	1.8 B	
ZINC	UG/L	35.9	350				

N/A - Not applicable
UG/L - microgram per liter
B - reported value is less than Contract Required Detection Limit (CRDL), but greater than Instrument Detection Limit (IDL)
J - value is estimated
JB - value is estimated below the CRDL, but greater than the IDL

CLEJ-01272-3.13-08/20/93

TABLE 4-7
OPERABLE UNIT NO. 2 PHASE I - ROUND ONE GROUNDWATER
POSITIVE DETECTION SUMMARY
REMEDIAL INVESTIGATION CTO-0133
MCB CAMP LEJEUNE, NORTH CAROLINA
DISSOLVED METALS

Sample No:		6-MW2D-01	6-MW3D-01	6-MW8D-01	6-MW9D-01	9-GW07-DWD-01	9-GW1D-01
Depth:		N/A	N/A	N/A	N/A	N/A	N/A
Date Sampled:		10/24/92	10/23/92	10/24/92	10/24/92	11/3/92	10/25/92
Lab Id:		00593-15	00591-23	00593-18	00593-20	00603-20	00593-28
Parameter	Units						
ALUMINUM	UG/L	652					
ANTIMONY	UG/L						
ARSENIC	UG/L						
BARIUM	UG/L	43.7 JB					
CADMIUM	UG/L						
CALCIUM	UG/L		437 B			1090 B	82400
CHROMIUM	UG/L						
COBALT	UG/L						
IRON	UG/L		536				
LEAD	UG/L						
MAGNESIUM	UG/L	297 JB	424 B	371 J	981 JB	348 B	1580 JB
MANGANESE	UG/L						12.5 B
NICKEL	UG/L					7.9	
POTASSIUM	UG/L		976 B	1720 B		69700	3730 B
SILVER	UG/L						
SODIUM	UG/L	2730 JB	3540 JB	4160 JB	3530 JB	57400	1280 JB
VANADIUM	UG/L		2.4 B				
ZINC	UG/L						

N/A - Not applicable
UG/L - microgram per liter
B - reported value is less than Contract Required Detection Limit (CRDL), but greater than Instrument Detection Limit (IDL)
J - value is estimated
JB - value is estimated below the CRDL, but greater than the IDL

CLEJ-01272-3.13-08/20/93

TABLE 4-7
OPERABLE UNIT NO. 2 PHASE I - ROUND ONE GROUNDWATER
POSITIVE DETECTION SUMMARY
REMEDIAL INVESTIGATION CTO-0133
MCB CAMP LEJEUNE, NORTH CAROLINA
DISSOLVED METALS

Sample No:		9-GW2D-01	9-GW3D-01	9-GW4D-01	9-GW5D-01	9-GW6D-01	9-GW7D-01
Depth:		N/A	N/A	N/A	N/A	N/A	N/A
Date Sampled:		10/25/92	10/25/92	10/25/92	10/25/92	10/25/92	10/25/92
Lab Id:		00593-30	00593-12	00593-32	00593-34	00593-37	00593-40
Parameter	Units						
ALUMINUM	UG/L			1820			
ANTIMONY	UG/L						
ARSENIC	UG/L						
BARIUM	UG/L			67.8 JB	59.1 JB		
CADMIUM	UG/L						
CALCIUM	UG/L	44700	27300	15800	53800	46800	20800
CHROMIUM	UG/L			4.7 B		4.2 B	3.9 B
COBALT	UG/L						
IRON	UG/L			201			
LEAD	UG/L						
MAGNESIUM	UG/L	1190 JB	620 JB	1050 JB	1600 JB	933 JB	837 JB
MANGANESE	UG/L						
NICKEL	UG/L						
POTASSIUM	UG/L	1080 B			8610		
SILVER	UG/L						
SODIUM	UG/L	2210 JB	2130 JB	3860 JB	3400 JB	1740 JB	2480 JB
VANADIUM	UG/L						
ZINC	UG/L						

N/A - Not applicable
UG/L - microgram per liter
B - reported value is less than Contract Required Detection Limit (CRDL), but greater than Instrument Detection Limit (IDL)
J - value is estimated
JB - value is estimated below the CRDL, but greater than the IDL

CLEJ-01272-3.13-08/20/93

TABLE 4-7
OPERABLE UNIT NO. 2 PHASE I - ROUND ONE GROUNDWATER
POSITIVE DETECTION SUMMARY
REMEDIAL INVESTIGATION CTO-0133
MCB CAMP LEJEUNE, NORTH CAROLINA
DISSOLVED METALS

Sample No:		9-GW8D-01
Depth:		N/A
Date Sampled:		10/25/92
Lab Id:		00593-42
Parameter	Units	
ALUMINUM	UG/L	
ANTIMONY	UG/L	
ARSENIC	UG/L	
BARIUM	UG/L	
CADMIUM	UG/L	
CALCIUM	UG/L	16000
CHROMIUM	UG/L	
COBALT	UG/L	
IRON	UG/L	
LEAD	UG/L	
MAGNESIUM	UG/L	1080 JB
MANGANESE	UG/L	
NICKEL	UG/L	
POTASSIUM	UG/L	4920 B
SILVER	UG/L	
SODIUM	UG/L	2200 JB
VANADIUM	UG/L	
ZINC	UG/L	

N/A - Not applicable
UG/L - microgram per liter
B - reported value is less than Contract Required Detection Limit (CRDL), but greater than Instrument Detection Limit (IDL)
J - value is estimated
JB - value is estimated below the CRDL, but greater than the IDL

TABLE 4-8

SUMMARY OF THE PHASE I - ROUND ONE GROUNDWATER FIELD PARAMETERS
SITE 9
REMEDIAL INVESTIGATION CTO-0133
MCB CAMP LEJEUNE, NORTH CAROLINA

Well No. / Date of Measurement	Depth of Well (ft.) (1)	Purge Volume (gals.)	Field Parameters			
			Well Volume	Specific Conductance at 25 deg. C (micromhos/cm)	Temperature (deg. C)	pH (S.U.)
9GW1 / 10/24/92	24.5	15	1	434	23.4	7.00
			2	457	24.0	7.09
			3	457	23.9	7.17
			4	453	23.9	7.18
			5	459	23.9	7.24
9GW2 / 10/25/92	20.7	9	1	293	18.9	6.84
			2	281	20.0	6.79
			3	274	20.0	6.73
			4	267	20.1	6.73
			5	264	20.1	6.71
9GW3 / 10/25/93	27.8	14	1	143	19.8	6.27
			2	135	20.8	6.27
			3	129	20.8	6.26
			4	128	21.4	6.25
			5	127	21.1	6.25
			6	126	21.3	6.24
9GW4 / 10/24/92	21.0	45	1	189	18	5.25
			2	178	18.8	5.03
			3	177	18.8	5.17
			4	172	18.1	5.16
			5	170	18.7	5.12
9GW5 / 10/24/92	19.5	35	1	306	22.5	5.89
			2	351	22	6.49
			3	372	23	6.56
			4	394	23	6.58
			5	400	22.8	6.61
9GW6 / 10/25/92	19.7	99	1	267	22.5	6.67
			2	270	22.6	6.83
			3	270	22.9	6.69
			4	270	23.2	6.69
			5	269	23.2	6.71

Well depth taken from below ground surface (bgs)
(2) pH not recorded due to equipment malfunction
(3) Deep well

TABLE 4-8 (Continued)

SUMMARY OF THE PHASE I - ROUND ONE GROUNDWATER FIELD PARAMETERS
SITE 9
REMEDIAL INVESTIGATION CTO-0133
MCB CAMP LEJEUNE, NORTH CAROLINA

Well No. / Date of Measurement	Depth of Well (ft.) (1)	Purge Volume (gals.)	Field Parameters: Well Volume	Specific Conductance at 25 deg. C (micromhos/cm)	Temperature (deg. C)	pH (S.U.)
9GW7S / 10/25/92	21.5	40	1	139	20.5	5.945
			2	145	20.5	5.920
			3	135	20.3	5.927
			4	141	20.8	5.887
			5	139	20.5	2.872
9GW7D(3) / 11/03/92	110	180	1	391	19.7	9.19
			2	407	19.7	7.72
			3	407	19.7	7.69
9GW8 / 10/24/92	18.4	40	1	128	20.4	--(2)
			2	132	19.8	--
			3	133	19.9	--
			4	130	20.9	--
			5	130	20.8	--

(1) Well depth taken from below ground surface (bgs)
(2) pH not recorded due to equipment malfunction
(3) Deep well

TABLE 4-9

SUMMARY OF THE PHASE II - ROUND TWO GROUNDWATER FIELD PARAMETERS
SITE 9
REMEDIAL INVESTIGATION CTO-0133
MCB CAMP LEJEUNE, NORTH CAROLINA

Well No. / Date of Measurement	Depth of Well (ft.) (1)	Purge Volume (gals.)	Field Parameters			
			Well Volume	Specific Conductance at 25 deg. C (micromhos/cm)	Temperature (deg. C)	pH (S.U.)
9GW1 03/09/93	24.5	8	1	440	16.0	6.83
			2	431	16.0	6.94
			3	428	16.0	6.87
			4	428	16.0	7.00
9GW2 03/09/93	20.7	7	1	173	13.0	6.49
			2	180	13.0	6.56
			3	175	14.0	6.57
			4	175	14.0	6.57
9GW3 03/09/93	27.8	9.5	1	144	14.0	6.00
			2	122	15.0	6.00
			3	122	15.0	6.10
			4	122	15.0	6.10
9GW4 03/08/93	21.0	40	1	250	13.0	5.48
			2	241	13.5	5.45
			3	219	14.0	5.32
			4	200	14.0	5.23
9GW5 03/08/93	19.5	39	1	415	16.5	6.07
			2	351	17.0	6.17
			3	375	17.0	6.16
			4	391	17.2	6.15
9GW6 03/08/93	19.7	25	1	281	17.0	6.46
			2	294	17.0	6.45
			3	234	17.0	6.44
			4	220	17.5	6.43
			5	222	17.0	6.40
9GW7S 03/08/93	21.5	27	1	120	18.0	5.84
			2	115	18.5	5.81
			3	118	19.0	5.75
			4	118	19.0	5.71

(1) Well depth taken from below ground surface (bgs)
Deep well

TABLE 4-9 (Continued)

SUMMARY OF THE PHASE II - ROUND TWO GROUNDWATER FIELD PARAMETERS
SITE 9
REMEDIAL INVESTIGATION CTO-0133
MCB CAMP LEJEUNE, NORTH CAROLINA

Well No. / Date of Measurement	Depth of Well (ft.) (1)	Purge Volume (gals.)	Field Parameters			
			Well Volume	Specific Conductance at 25 deg. C (micromhos/cm)	Temperature (deg. C)	pH (S.U.)
9GW7D(2) 03/08/93	110	192	1	4968	19.8	12.46
			2	3960	20.0	12.28
			3	440	20.0	10.05
			4	413	20.0	9.00
			5	407	20.0	8.10
9GW8 03/09/93	18.4	6	1	128	13.0	5.95
			2	127	15.0	5.98
			3	128	14.9	5.96
			4	127	15.0	5.98

Well depth taken from below ground surface (bgs)
Deep well

TAB[illegible]
OPERABLE [illegible] NO. 2
PHASE I AND II GROUNDWATER
POSITIVE RESULT COMPARISON
REMEDIAL INVESTIGATION CTO-0133
MCB CAMP LEJEUNE, NORTH CAROLINA
ORGANICS

Sample No:		6-BP6-01	6-BP6-02		6-GW01-DW-01	6-GW1DW-02	
Depth:		N/A	N/A		N/A	N/A	
Date sampled:		10/24/92	3/22/93	RPD	11/4/92	3//23/93	RPD
Lab Id:		00593-01	930141-28	%	00603-07	930150-04	%
	Units						
VOLATILES							
BROMODICHLOROMETHANE	UG/L	ND	ND	-	ND	ND	-
CHLOROBENZENE	UG/L	ND	ND	-	ND	13	NC
2-CHLOROETHYLVINYL ETHER	UG/L	ND	ND	-	ND	ND	-
CHLOROFORM	UG/L	ND	3.7	NC	ND	ND	-
CHLOROMETHANE	UG/L	ND	ND	-	ND	1.4 J	NC
1,4-DICHLOROBENZENE	UG/L	ND	ND	-	ND	17	NC
1,2-DICHLOROETHANE	UG/L	ND	ND	-	ND	30	NC
1,1-DICHLOROETHENE	UG/L	ND	ND	-	ND	51	NC
TOTAL-1,2-DICHLORETHENE	UG/L	ND	ND	-	5600.0 J	26000	129.1
METHYLENE CHLORIDE	UG/L	ND	ND	-	790.0 J	ND	NC
1,1,2,2-TETRACHLOROETHANE	UG/L	ND	ND	-	ND	ND	-
TETRACHLOROETHENE	UG/L	ND	ND	-	630.0	920	37.4
1,1,1-TRICHLOROETHANE	UG/L	ND	ND	-	ND	ND	-
1,1,2-TRICHLOROETHANE	UG/L	ND	ND	-	ND	5.8	NC
TRICHLOROETHENE	UG/L	ND	ND	-	58000.0 J	50000	14.8
TRICHLOROFLUOROMETHANE	UG/L	ND	ND	-	ND	ND	-
VINYL CHLORIDE	UG/L	ND	ND	-	ND	800 J	NC
BENZENE	UG/L	ND	ND	-	ND	6.7 J	NC
1,3-DICHLOROBENZENE	UG/L	ND	ND	-	ND	ND	-
1,4-DICHLOROBENZENE	UG/L	ND	ND	-	ND	10	NC
ETHYLBENZENE	UG/L	ND	ND	-	48.0	52	8.0
TOLUENE	UG/L	ND	ND	-	ND	1.4	NC
XYLENES (TOTAL)	UG/L	ND	ND	-	ND	2.1	NC

NOTES:
NC - Not Calculable
"-" - No Positives Detected
ND - Not Detected
RPD - Relative Percent Difference = (absolute value[x1-x2])/([x1+x2]/2)

CLEJ-01272-3.13-08/20/93

TABL[illegible]
OPERABLE [illegible] NO. 2
PHASE I AND II GROUNDWATER
POSITIVE RESULT COMPARISON
REMEDIAL INVESTIGATION CTO-0133
MCB CAMP LEJEUNE, NORTH CAROLINA
ORGANICS

Sample No:		6-GW1S-01	6-GW1S-02		6-GW02-DW-01	6-GW2DW-02	
Depth:		N/A	N/A		N/A	N/A	
Date sampled:		10/24/92	3/23/93	RPD	11/3/92	3/21/93	RPD
Lab Id:		00593-07	930150-03	%	00603-11	930141-03	%
	Units						
VOLATILES							
BROMODICHLOROMETHANE	UG/L	ND	ND	-	ND	ND	-
CHLOROBENZENE	UG/L	ND	ND	-	ND	ND	-
2-CHLOROETHYLVINYL ETHER	UG/L	ND	ND	-	ND	ND	-
CHLOROFORM	UG/L	ND	ND	-	ND	ND	-
CHLOROMETHANE	UG/L	ND	ND	-	ND	ND	-
1,4-DICHLOROBENZENE	UG/L	ND	ND	-	ND	ND	-
1,2-DICHLOROETHANE	UG/L	ND	ND	-	ND	ND	-
1,1-DICHLOROETHENE	UG/L	ND	ND	-	ND	ND	-
TOTAL-1,2-DICHLORETHENE	UG/L	ND	ND	-	ND	ND	-
METHYLENE CHLORIDE	UG/L	ND	ND	-	ND	ND	-
1,1,2,2-TETRACHLOROETHANE	UG/L	6.9	ND	NC	ND	ND	-
TETRACHLOROETHENE	UG/L	2.9	ND	NC	ND	ND	-
1,1,1-TRICHLOROETHANE	UG/L	ND	ND	-	ND	ND	-
1,1,2-TRICHLOROETHANE	UG/L	ND	ND	-	ND	ND	-
TRICHLOROETHENE	UG/L	1.0	ND	NC	1.4	ND	NC
TRICHLOROFLUOROMETHANE	UG/L	ND	ND	-	ND	ND	-
VINYL CHLORIDE	UG/L	ND	ND	-	ND	ND	-
BENZENE	UG/L	ND	ND	-	ND	ND	-
1,3-DICHLOROBENZENE	UG/L	ND	ND	-	ND	ND	-
1,4-DICHLOROBENZENE	UG/L	ND	ND	-	ND	ND	-
ETHYLBENZENE	UG/L	ND	ND	-	ND	ND	-
TOLUENE	UG/L	ND	ND	-	ND	ND	-
XYLENES (TOTAL)	UG/L	1.4	ND	NC	ND	ND	-

NOTES:
NC - Not Calculable
"-" - No Positives Detected
ND - Not Detected
RPD - Relative Percent Difference = (absolute value[x1-x2])/([x1+x2]/2)

CLEJ-01272-3.13-08/20/93

TABL
OPERABLE UNIT NO. 2
PHASE I AND II GROUNDWATER
POSITIVE RESULT COMPARISON
REMEDIAL INVESTIGATION CTO-0133
MCB CAMP LEJEUNE, NORTH CAROLINA
ORGANICS

Sample No:		6-GW03-01	6-GW3-02		6-GW4-01	6-GW4-02	
Depth:		N/A	N/A		N/A	N/A	
Date sampled:		10/22/92	3/22/93	RPD	10/21/92	3/21/93	RPD
Lab Id:		00589-01	930141-30	%	00582-18	930141-04	%
	Units						
VOLATILES							
BROMODICHLOROMETHANE	UG/L	ND	ND	-	ND	ND	-
CHLOROBENZENE	UG/L	ND	ND	-	ND	ND	-
2-CHLOROETHYLVINYL ETHER	UG/L	ND	ND	-	ND	ND	-
CHLOROFORM	UG/L	ND	ND	-	ND	ND	-
CHLOROMETHANE	UG/L	ND	ND	-	ND	ND	-
1,4-DICHLOROBENZENE	UG/L	ND	ND	-	ND	ND	-
1,2-DICHLOROETHANE	UG/L	ND	ND	-	ND	ND	-
1,1-DICHLOROETHENE	UG/L	ND	ND	-	ND	ND	-
TOTAL-1,2-DICHLORETHENE	UG/L	ND	ND	-	ND	ND	-
METHYLENE CHLORIDE	UG/L	ND	ND	-	ND	ND	-
1,1,2,2-TETRACHLOROETHANE	UG/L	ND	ND	-	ND	2.5 J	NC
TETRACHLOROETHENE	UG/L	0.9 J	ND	NC	ND	ND	-
1,1,1-TRICHLOROETHANE	UG/L	ND	ND	-	ND	ND	-
1,1,2-TRICHLOROETHANE	UG/L	ND	ND	-	ND	ND	-
TRICHLOROETHENE	UG/L	ND	ND	-	ND	ND	-
TRICHLOROFLUOROMETHANE	UG/L	ND	ND	-	ND	ND	-
VINYL CHLORIDE	UG/L	ND	ND	-	ND	ND	-
BENZENE	UG/L	ND	ND	-	ND	ND	-
1,3-DICHLOROBENZENE	UG/L	ND	ND	-	ND	ND	-
1,4-DICHLOROBENZENE	UG/L	ND	ND	-	ND	ND	-
ETHYLBENZENE	UG/L	ND	ND	-	ND	ND	-
TOLUENE	UG/L	ND	ND	-	ND	ND	-
XYLENES (TOTAL)	UG/L	ND	ND	-	ND	ND	-

NOTES:
NC - Not Calculable
"-" - No Positives Detected
ND - Not Detected
RPD - Relative Percent Difference = (absolute value[x1-x2])/([x1+x2]/2)

CLEJ-01272-3.13-08/20/93

TAB. [illegible]0
OPERABL[illegible]T NO. 2
PHASE I AND II GROUNDWATER
POSITIVE RESULT COMPARISON
REMEDIAL INVESTIGATION CTO-0133
MCB CAMP LEJEUNE, NORTH CAROLINA
ORGANICS

Sample No:		6-GW07-DW-01	6-GW7DW-02		6-GW13-1	6-GW13-02	
Depth:		N/A	N/A		N/A	N/A	
Date sampled:		11/4/92	3/19/93	RPD	10/20/92	3/20/93	RPD
Lab Id:		00603-13	930136-20	%	00582-07	930136-25	%
	Units						
VOLATILES							
BROMODICHLOROMETHANE	UG/L	ND	ND	-	ND	ND	-
CHLOROBENZENE	UG/L	ND	ND	-	ND	ND	-
2-CHLOROETHYLVINYL ETHER	UG/L	ND	ND	-	ND	ND	-
CHLOROFORM	UG/L	ND	ND	-	ND	ND	-
CHLOROMETHANE	UG/L	ND	ND	-	ND	ND	-
1,4-DICHLOROBENZENE	UG/L	ND	ND	-	ND	ND	-
1,2-DICHLOROETHANE	UG/L	ND	ND	-	ND	ND	-
1,1-DICHLOROETHENE	UG/L	0.6 J	ND	NC	ND	ND	-
TOTAL-1,2-DICHLORETHENE	UG/L	ND	ND	-	ND	ND	-
METHYLENE CHLORIDE	UG/L	ND	ND	-	ND	ND	-
1,1,2,2-TETRACHLOROETHANE	UG/L	ND	ND	-	ND	ND	-
TETRACHLOROETHENE	UG/L	ND	ND	-	ND	ND	-
1,1,1-TRICHLOROETHANE	UG/L	ND	ND	-	ND	ND	-
1,1,2-TRICHLOROETHANE	UG/L	ND	ND	-	ND	ND	-
TRICHLOROETHENE	UG/L	1.2	2.1	54.5	ND	1.2	NC
TRICHLOROFLUOROMETHANE	UG/L	ND	ND	-	ND	1.9	NC
VINYL CHLORIDE	UG/L	ND	ND	-	ND	ND	-
BENZENE	UG/L	ND	ND	-	ND	ND	-
1,3-DICHLOROBENZENE	UG/L	ND	ND	-	ND	ND	-
1,4-DICHLOROBENZENE	UG/L	ND	ND	-	ND	ND	-
ETHYLBENZENE	UG/L	ND	ND	-	ND	ND	-
TOLUENE	UG/L	ND	ND	-	ND	ND	-
XYLENES (TOTAL)	UG/L	ND	ND	-	ND	ND	-

NOTES:
NC - Not Calculable
"-" - No Positives Detected
ND - Not Detected
RPD - Relative Percent Difference = (absolute value[x1-x2])/([x1+x2]/2)

CLEJ-01272-3.13-08/20/93

TAL[illegible] [illegible]0
OPERABL[illegible] [illegible]T NO. 2
PHASE I AND II GROUNDWATER
POSITIVE RESULT COMPARISON
REMEDIAL INVESTIGATION CTO-0133
MCB CAMP LEJEUNE, NORTH CAROLINA
ORGANICS

Sample No:		6-GW14-01	6-GW14-02		6-GW15-01	6-GW15-02	
Depth:		N/A	N/A		N/A	N/A	
Date sampled:		10/22/92	3/20/93	RPD	10/23/92	3/21/93	RPD
Lab Id:		00582-28	930141-09	%	00591-10	930141-10	%
	Units						
VOLATILES							
BROMODICHLOROMETHANE	UG/L	ND	ND	-	ND	ND	-
CHLOROBENZENE	UG/L	ND	ND	-	ND	ND	-
2-CHLOROETHYLVINYL ETHER	UG/L	ND	ND	-	ND	ND	-
CHLOROFORM	UG/L	ND	ND	-	ND	ND	-
CHLOROMETHANE	UG/L	ND	ND	-	ND	ND	-
1,4-DICHLOROBENZENE	UG/L	ND	ND	-	ND	ND	-
1,2-DICHLOROETHANE	UG/L	ND	ND	-	0.6 J	ND	NC
1,1-DICHLOROETHENE	UG/L	ND	ND	-	ND	ND	-
TOTAL-1,2-DICHLORETHENE	UG/L	ND	ND	-	ND	6.4	NC
METHYLENE CHLORIDE	UG/L	ND	ND	-	ND	ND	-
1,1,2,2-TETRACHLOROETHANE	UG/L	ND	1.8 J	NC	ND	ND	-
TETRACHLOROETHENE	UG/L	ND	ND	-	ND	ND	-
1,1,1-TRICHLOROETHANE	UG/L	ND	ND	-	ND	ND	-
1,1,2-TRICHLOROETHANE	UG/L	ND	ND	-	ND	ND	-
TRICHLOROETHENE	UG/L	ND	ND	-	1.9	ND	NC
TRICHLOROFLUOROMETHANE	UG/L	ND	ND	-	ND	ND	-
VINYL CHLORIDE	UG/L	ND	ND	-	ND	ND	-
BENZENE	UG/L	ND	ND	-	ND	ND	-
1,3-DICHLOROBENZENE	UG/L	ND	ND	-	ND	ND	-
1,4-DICHLOROBENZENE	UG/L	ND	ND	-	ND	ND	-
ETHYLBENZENE	UG/L	ND	ND	-	ND	ND	-
TOLUENE	UG/L	ND	ND	-	ND	ND	-
XYLENES (TOTAL)	UG/L	ND	ND	-	ND	ND	-

NOTES:
NC - Not Calculable
"-" - No Positives Detected
ND - Not Detected
RPD - Relative Percent Difference = (absolute value[x1-x2])/([x1+x2]/2)

CLEJ-01272-3.13-08/20/93

TAL. 0
OPERABLE T NO. 2
PHASE I AND II GROUNDWATER
POSITIVE RESULT COMPARISON
REMEDIAL INVESTIGATION CTO-0133
MCB CAMP LEJEUNE, NORTH CAROLINA
ORGANICS

Sample No:		6-GW16-01	6-GW16-02		6-GW17-01	6-GW17-02	
Depth:		N/A	N/A		N/A	N/A	
Date sampled:		10/21/92	3/21/93	RPD	10/22/92	3/20/93	RPD
Lab Id:		00582-30	930141-11	%	00582-32	930141-12	%
	Units						
VOLATILES							
BROMODICHLOROMETHANE	UG/L	ND	ND	-	ND	ND	-
CHLOROBENZENE	UG/L	110.0	8500	194.9	ND	ND	-
2-CHLOROETHYLVINYL ETHER	UG/L	ND	ND	-	ND	ND	-
CHLOROFORM	UG/L	2.7	20	152.4	ND	ND	-
CHLOROMETHANE	UG/L	ND	ND	-	ND	ND	-
1,4-DICHLOROBENZENE	UG/L	ND	4.5	NC	ND	ND	-
1,2-DICHLOROETHANE	UG/L	ND	ND	-	ND	ND	-
1,1-DICHLOROETHENE	UG/L	ND	ND	-	ND	ND	-
TOTAL-1,2-DICHLORETHENE	UG/L	ND	ND	-	ND	ND	-
METHYLENE CHLORIDE	UG/L	ND	ND	-	ND	ND	-
1,1,2,2-TETRACHLOROETHANE	UG/L	1.0	60	193.4	ND	ND	-
TETRACHLOROETHENE	UG/L	ND	1.2	NC	ND	2.6	NC
1,1,1-TRICHLOROETHANE	UG/L	ND	ND	-	ND	ND	-
1,1,2-TRICHLOROETHANE	UG/L	ND	1.6	NC	ND	ND	-
TRICHLOROETHENE	UG/L	ND	ND	-	ND	ND	-
TRICHLOROFLUOROMETHANE	UG/L	ND	ND	-	ND	ND	-
VINYL CHLORIDE	UG/L	ND	ND	-	ND	ND	-
BENZENE	UG/L	ND	ND	-	ND	ND	-
1,3-DICHLOROBENZENE	UG/L	ND	ND	-	ND	ND	-
1,4-DICHLOROBENZENE	UG/L	ND	3.9	NC	ND	ND	-
ETHYLBENZENE	UG/L	ND	ND	-	ND	ND	-
TOLUENE	UG/L	ND	ND	-	ND	ND	-
XYLENES (TOTAL)	UG/L	ND	ND	-	ND	ND	-

NOTES:
NC - Not Calculable
"-" - No Positives Detected
ND - Not Detected
RPD - Relative Percent Difference = (absolute value[x1-x2])/([x1+x2]/2)

CLEJ-01272-3.13-08/20/93

TAB[illegible]0
OPERABLE UNIT NO. 2
PHASE I AND II GROUNDWATER
POSITIVE RESULT COMPARISON
REMEDIAL INVESTIGATION CTO-0133
MCB CAMP LEJEUNE, NORTH CAROLINA
ORGANICS

Sample No:		6-GW21-01	6-GW21-02		6-GW22-01	6-GW22-02	
Depth:		N/A	N/A		N/A	N/A	
Date sampled:		10/22/92	3/21/93	RPD	10/22/92	3/22/93	RPD
Lab Id:		00589-13	930141-17	%	00582-36	930141-31	%
	Units						
VOLATILES							
BROMODICHLOROMETHANE	UG/L	ND	ND	-	ND	ND	-
CHLOROBENZENE	UG/L	ND	ND	-	ND	1.8	NC
2-CHLOROETHYLVINYL ETHER	UG/L	ND	ND	-	ND	ND	-
CHLOROFORM	UG/L	ND	ND	-	ND	ND	-
CHLOROMETHANE	UG/L	ND	ND	-	ND	ND	-
1,4-DICHLOROBENZENE	UG/L	ND	ND	-	ND	ND	-
1,2-DICHLOROETHANE	UG/L	ND	ND	-	ND	ND	-
1,1-DICHLOROETHENE	UG/L	ND	ND	-	ND	ND	-
TOTAL-1,2-DICHLORETHENE	UG/L	ND	ND	-	ND	ND	-
METHYLENE CHLORIDE	UG/L	ND	ND	-	ND	ND	-
1,1,2,2-TETRACHLOROETHANE	UG/L	ND	ND	-	ND	ND	-
TETRACHLOROETHENE	UG/L	1.1	ND	NC	1.2	1.4	15.4
1,1,1-TRICHLOROETHANE	UG/L	ND	ND	-	ND	ND	-
1,1,2-TRICHLOROETHANE	UG/L	ND	ND	-	ND	ND	-
TRICHLOROETHENE	UG/L	0.5 J	ND	NC	ND	ND	-
TRICHLOROFLUOROMETHANE	UG/L	ND	ND	-	ND	ND	-
VINYL CHLORIDE	UG/L	ND	ND	-	ND	ND	-
BENZENE	UG/L	ND	ND	-	ND	ND	-
1,3-DICHLOROBENZENE	UG/L	ND	ND	-	ND	ND	-
1,4-DICHLOROBENZENE	UG/L	ND	ND	-	ND	ND	-
ETHYLBENZENE	UG/L	ND	ND	-	ND	ND	-
TOLUENE	UG/L	ND	ND	-	ND	ND	-
XYLENES (TOTAL)	UG/L	ND	ND	-	ND	ND	-

NOTES:
NC - Not Calculable
"-" - No Positives Detected
ND - Not Detected
RPD - Relative Percent Difference = (absolute value[x1-x2])/([x1+x2]/2)

CLEJ-01272-3.13-08/20/93

TAB[illegible]0
OPERABL[illegible]T NO. 2
PHASE I AND II GROUNDWATER
POSITIVE RESULT COMPARISON
REMEDIAL INVESTIGATION CTO-0133
MCB CAMP LEJEUNE, NORTH CAROLINA
ORGANICS

Sample No:		6-GW23-01	6-GW23-02		6-GW25-01	6-GW25-02	
Depth:		N/A	N/A		N/A	N/A	
Date sampled:		10/22/92	3/21/93	RPD	10/23/92	3/21/93	RPD
Lab Id:		00589-15	930141-18	%	00591-12	930141-19	%
	Units						
VOLATILES							
BROMODICHLOROMETHANE	UG/L	ND	ND	-	ND	ND	-
CHLOROBENZENE	UG/L	ND	ND	-	ND	110	NC
2-CHLOROETHYLVINYL ETHER	UG/L	ND	ND	-	ND	ND	-
CHLOROFORM	UG/L	ND	ND	-	ND	1.6	NC
CHLOROMETHANE	UG/L	ND	ND	-	ND	ND	-
1,4-DICHLOROBENZENE	UG/L	ND	ND	-	ND	ND	-
1,2-DICHLOROETHANE	UG/L	ND	ND	-	ND	ND	-
1,1-DICHLOROETHENE	UG/L	ND	ND	-	ND	ND	-
TOTAL-1,2-DICHLORETHENE	UG/L	ND	ND	-	ND	ND	-
METHYLENE CHLORIDE	UG/L	ND	ND	-	ND	ND	-
1,1,2,2-TETRACHLOROETHANE	UG/L	ND	ND	-	ND	ND	-
TETRACHLOROETHENE	UG/L	ND	ND	-	ND	ND	-
1,1,1-TRICHLOROETHANE	UG/L	ND	ND	-	ND	ND	-
1,1,2-TRICHLOROETHANE	UG/L	ND	ND	-	ND	ND	-
TRICHLOROETHENE	UG/L	0.6 J	ND	NC	ND	ND	-
TRICHLOROFLUOROMETHANE	UG/L	ND	ND	-	ND	ND	-
VINYL CHLORIDE	UG/L	ND	ND	-	ND	ND	-
BENZENE	UG/L	ND	ND	-	ND	ND	-
1,3-DICHLOROBENZENE	UG/L	ND	ND	-	ND	ND	-
1,4-DICHLOROBENZENE	UG/L	ND	ND	-	ND	ND	-
ETHYLBENZENE	UG/L	ND	ND	-	ND	ND	-
TOLUENE	UG/L	ND	ND	-	ND	ND	-
XYLENES (TOTAL)	UG/L	ND	ND	-	ND	ND	-

NOTES: NC - Not Calculable
"-" - No Positives Detected
ND - Not Detected
RPD - Relative Percent Difference = (absolute value[x1-x2])/([x1+x2]/2)

CLEJ-01272-3.13-08/20/93

TABL[illegible]
OPERABLE [illegible] NO. 2
PHASE I AND II GROUNDWATER
POSITIVE RESULT COMPARISON
REMEDIAL INVESTIGATION CTO-0133
MCB CAMP LEJEUNE, NORTH CAROLINA
ORGANICS

Sample No:		6-GW26-01	6-GW26-02		6-GW27-DW-01	6-GW27DW-02	
Depth:		N/A	N/A		N/A	N/A	
Date sampled:		10/23/92	3/22/93	RPD	11/3/92	3/23/93	RPD
Lab Id:		00591-14	930141-32	%	00603-15	930150-06	%
	Units						
VOLATILES							
BROMODICHLOROMETHANE	UG/L	0.6 J	ND	NC	ND	ND	-
CHLOROBENZENE	UG/L	ND	7.7	NC	ND	3.6	NC
2-CHLOROETHYLVINYL ETHER	UG/L	ND	ND	-	ND	ND	-
CHLOROFORM	UG/L	ND	3.5	NC	ND	ND	-
CHLOROMETHANE	UG/L	ND	ND	-	ND	ND	-
1,4-DICHLOROBENZENE	UG/L	ND	ND	-	ND	ND	-
1,2-DICHLOROETHANE	UG/L	ND	ND	-	ND	16	NC
1,1-DICHLOROETHENE	UG/L	ND	ND	-	ND	55	NC
TOTAL-1,2-DICHLORETHENE	UG/L	ND	ND	-	5800.0	30000	135.2
METHYLENE CHLORIDE	UG/L	ND	ND	-	ND	ND	-
1,1,2,2-TETRACHLOROETHANE	UG/L	ND	ND	-	ND	ND	-
TETRACHLOROETHENE	UG/L	ND	ND	-	ND	18	NC
1,1,1-TRICHLOROETHANE	UG/L	ND	ND	-	ND	ND	-
1,1,2-TRICHLOROETHANE	UG/L	ND	ND	-	ND	ND	-
TRICHLOROETHENE	UG/L	ND	ND	-	18000.0	22000	20.0
TRICHLOROFLUOROMETHANE	UG/L	ND	ND	-	ND	ND	-
VINYL CHLORIDE	UG/L	ND	ND	-	ND	250 J	NC
BENZENE	UG/L	ND	ND	-	ND	ND	-
1,3-DICHLOROBENZENE	UG/L	ND	ND	-	ND	ND	-
1,4-DICHLOROBENZENE	UG/L	ND	ND	-	ND	ND	-
ETHYLBENZENE	UG/L	ND	ND	-	ND	ND	-
TOLUENE	UG/L	ND	ND	-	ND	ND	-
XYLENES (TOTAL)	UG/L	ND	ND	-	ND	ND	-

NOTES:
NC - Not Calculable
"-" - No Positives Detected
ND - Not Detected
RPD - Relative Percent Difference = (absolute value[x1-x2])/([x1+x2]/2)

CLEJ-01272-3.13-08/20/93

TAL [illegible]10
OPERABLE [illegible]IT NO. 2
PHASE I AND II GROUNDWATER
POSITIVE RESULT COMPARISON
REMEDIAL INVESTIGATION CTO-0133
MCB CAMP LEJEUNE, NORTH CAROLINA
ORGANICS

Sample No:		6-GW28-DW-01	6-GW28DW-02		6-GW28S-01	6-GW28S-02	
Depth:		N/A	N/A		N/A	N/A	
Date sampled:		11/3/92	3/23/93	RPD	10/23/92	3/18/93	RPD
Lab Id:		00603-17	930150-07	%	00591-16	00135-02	%
	Units						
VOLATILES							
BROMODICHLOROMETHANE	UG/L	ND	ND	-	ND	ND	-
CHLOROBENZENE	UG/L	ND	18	NC	ND	ND	-
2-CHLOROETHYLVINYL ETHER	UG/L	ND	ND	-	ND	ND	-
CHLOROFORM	UG/L	ND	ND	-	ND	ND	-
CHLOROMETHANE	UG/L	ND	ND	-	ND	ND	-
1,4-DICHLOROBENZENE	UG/L	ND	ND	-	ND	ND	-
1,2-DICHLOROETHANE	UG/L	ND	7.5	NC	ND	ND	-
1,1-DICHLOROETHENE	UG/L	ND	12	NC	ND	ND	-
TOTAL-1,2-DICHLORETHENE	UG/L	500.0	5800	168.3	16.0	1.8 J	159.6
METHYLENE CHLORIDE	UG/L	ND	ND	-	ND	ND	-
1,1,2,2-TETRACHLOROETHANE	UG/L	ND	ND	-	ND	ND	-
TETRACHLOROETHENE	UG/L	ND	42	NC	26.0	1.0	185.2
1,1,1-TRICHLOROETHANE	UG/L	ND	ND	-	ND	ND	-
1,1,2-TRICHLOROETHANE	UG/L	ND	ND	-	0.5 J	ND	NC
TRICHLOROETHENE	UG/L	3600.0	9100	86.6	120.0	4.0	187.1
TRICHLOROFLUOROMETHANE	UG/L	ND	ND	-	ND	ND	-
VINYL CHLORIDE	UG/L	ND	100 J	NC	ND	ND	-
BENZENE	UG/L	ND	ND	-	ND	ND	-
1,3-DICHLOROBENZENE	UG/L	ND	ND	-	ND	ND	-
1,4-DICHLOROBENZENE	UG/L	ND	ND	-	ND	ND	-
ETHYLBENZENE	UG/L	ND	2.0	NC	ND	ND	-
TOLUENE	UG/L	ND	ND	-	ND	ND	-
XYLENES (TOTAL)	UG/L	ND	ND	-	ND	ND	-

NOTES:
NC - Not Calculable
"-" - No Positives Detected
ND - Not Detected
RPD - Relative Percent Difference = (absolute value[x1-x2])/([x1+x2]/2)

CLEJ-01272-3.13-08/20/93

TAB. [illegible]0
OPERABLE [illegible]T NO. 2
PHASE I AND II GROUNDWATER
POSITIVE RESULT COMPARISON
REMEDIAL INVESTIGATION CTO-0133
MCB CAMP LEJEUNE, NORTH CAROLINA
ORGANICS

Sample No:		6-GW30-01	6-GW30-02		6-82MW1-01	6-82-MW1-02	
Depth:		N/A	N/A		N/A	N/A	
Date sampled:		10/23/92	3/22/93	RPD	10/23/92	3/23/93	RPD
Lab Id:		00591-18	930141-33	%	00591-20	930150-08	%
	Units						
VOLATILES							
BROMODICHLOROMETHANE	UG/L	ND	ND	-	ND	ND	-
CHLOROBENZENE	UG/L	ND	13	NC	ND	ND	-
2-CHLOROETHYLVINYL ETHER	UG/L	ND	ND	-	ND	ND	-
CHLOROFORM	UG/L	ND	ND	-	ND	ND	-
CHLOROMETHANE	UG/L	ND	ND	-	ND	ND	-
1,4-DICHLOROBENZENE	UG/L	ND	ND	-	ND	ND	-
1,2-DICHLOROETHANE	UG/L	ND	ND	-	ND	ND	-
1,1-DICHLOROETHENE	UG/L	ND	ND	-	ND	ND	-
TOTAL-1,2-DICHLORETHENE	UG/L	ND	ND	-	ND	ND	-
METHYLENE CHLORIDE	UG/L	ND	ND	-	ND	ND	-
1,1,2,2-TETRACHLOROETHANE	UG/L	ND	ND	-	ND	ND	-
TETRACHLOROETHENE	UG/L	ND	1.1	NC	ND	ND	-
1,1,1-TRICHLOROETHANE	UG/L	ND	ND	-	0.5 J	ND	NC
1,1,2-TRICHLOROETHANE	UG/L	ND	ND	-	ND	ND	-
TRICHLOROETHENE	UG/L	ND	ND	-	ND	ND	-
TRICHLOROFLUOROMETHANE	UG/L	ND	ND	-	ND	ND	-
VINYL CHLORIDE	UG/L	ND	ND	-	ND	ND	-
BENZENE	UG/L	ND	ND	-	ND	ND	-
1,3-DICHLOROBENZENE	UG/L	ND	ND	-	ND	ND	-
1,4-DICHLOROBENZENE	UG/L	ND	ND	-	ND	ND	-
ETHYLBENZENE	UG/L	ND	ND	-	ND	ND	-
TOLUENE	UG/L	ND	ND	-	ND	ND	-
XYLENES (TOTAL)	UG/L	ND	ND	-	ND	ND	-

NOTES:
NC - Not Calculable
"-" - No Positives Detected
ND - Not Detected
RPD - Relative Percent Difference = (absolute value[x1-x2])/([x1+x2]/2)

CLEJ-01272-3.13-08/20/93

TAB. 0
OPERABLE UNIT NO. 2
PHASE I AND II GROUNDWATER
POSITIVE RESULT COMPARISON
REMEDIAL INVESTIGATION CTO-0133
MCB CAMP LEJEUNE, NORTH CAROLINA
ORGANICS

Sample No:		6-82MW2-01	6-82-MW2-02		6-MW9-01	6-MW9-02	
Depth:		N/A	N/A		N/A	N/A	
Date sampled:		10/24/92	3/23/93	RPD	10/24/92	3/21/93	RPD
Lab Id:		00593-21	930150-09	%	00593-19	930141-24	%
	Units						
VOLATILES							
BROMODICHLOROMETHANE	UG/L	ND	ND	-	ND	ND	-
CHLOROBENZENE	UG/L	ND	ND	-	ND	ND	-
2-CHLOROETHYLVINYL ETHER	UG/L	ND	ND	-	ND	ND	-
CHLOROFORM	UG/L	ND	ND	-	ND	2.4	NC
CHLOROMETHANE	UG/L	ND	ND	-	ND	ND	-
1,4-DICHLOROBENZENE	UG/L	ND	ND	-	ND	ND	-
1,2-DICHLOROETHANE	UG/L	ND	ND	-	ND	ND	-
1,1-DICHLOROETHENE	UG/L	ND	ND	-	ND	ND	-
TOTAL-1,2-DICHLORETHENE	UG/L	ND	ND	-	ND	ND	-
METHYLENE CHLORIDE	UG/L	ND	ND	-	ND	ND	-
1,1,2,2-TETRACHLOROETHANE	UG/L	ND	ND	-	ND	ND	-
TETRACHLOROETHENE	UG/L	ND	ND	-	ND	ND	-
1,1,1-TRICHLOROETHANE	UG/L	ND	ND	-	ND	ND	-
1,1,2-TRICHLOROETHANE	UG/L	ND	ND	-	ND	ND	-
TRICHLOROETHENE	UG/L	ND	ND	-	ND	ND	-
TRICHLOROFLUOROMETHANE	UG/L	ND	ND	-	ND	ND	-
VINYL CHLORIDE	UG/L	1.6	ND	NC	ND	ND	-
BENZENE	UG/L	ND	ND	-	ND	ND	-
1,3-DICHLOROBENZENE	UG/L	ND	ND	-	ND	ND	-
1,4-DICHLOROBENZENE	UG/L	ND	ND	-	ND	ND	-
ETHYLBENZENE	UG/L	ND	ND	-	ND	ND	-
TOLUENE	UG/L	ND	ND	-	ND	ND	-
XYLENES (TOTAL)	UG/L	ND	ND	-	ND	ND	-

NOTES:
NC - Not Calculable
"-" - No Positives Detected
ND - Not Detected
RPD - Relative Percent Difference = (absolute value[x1-x2])/([x1+x2]/2)

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TAB[illegible] [illegible]0
OPERABLE UNIT NO. 2
PHASE I AND II GROUNDWATER
POSITIVE RESULT COMPARISON
REMEDIAL INVESTIGATION CTO-0133
MCB CAMP LEJEUNE, NORTH CAROLINA
ORGANICS

Sample No:		9-GW6-01	9-GW6-02		9-GW07-DW-01	9-GW7DW-02	
Depth:		N/A	N/A		N/A	N/A	
Date sampled:		10/25/92	3/8/93	RPD	11/3/92	3/8/93	RPD
Lab Id:		00593-35	930115-18	%	00603-19	930115-20	%
	Units						
VOLATILES							
BROMODICHLOROMETHANE	UG/L	ND	ND	-	ND	ND	-
CHLOROBENZENE	UG/L	ND	ND	-	ND	ND	-
2-CHLOROETHYLVINYL ETHER	UG/L	ND	ND	-	ND	ND	-
CHLOROFORM	UG/L	ND	ND	-	ND	ND	-
CHLOROMETHANE	UG/L	ND	ND	-	ND	ND	-
1,4-DICHLOROBENZENE	UG/L	ND	ND	-	ND	ND	-
1,2-DICHLOROETHANE	UG/L	ND	ND	-	ND	ND	-
1,1-DICHLOROETHENE	UG/L	ND	ND	-	ND	ND	-
TOTAL-1,2-DICHLORETHENE	UG/L	ND	ND	-	ND	ND	-
METHYLENE CHLORIDE	UG/L	ND	ND	-	ND	ND	-
1,1,2,2-TETRACHLOROETHANE	UG/L	ND	ND	-	ND	ND	-
TETRACHLOROETHENE	UG/L	ND	ND	-	ND	ND	-
1,1,1-TRICHLOROETHANE	UG/L	ND	ND	-	ND	ND	-
1,1,2-TRICHLOROETHANE	UG/L	ND	ND	-	ND	ND	-
TRICHLOROETHENE	UG/L	ND	ND	-	ND	1.2	NC
TRICHLOROFLUOROMETHANE	UG/L	ND	ND	-	ND	ND	-
VINYL CHLORIDE	UG/L	ND	ND	-	ND	ND	-
BENZENE	UG/L	ND	ND	-	ND	ND	-
1,3-DICHLOROBENZENE	UG/L	ND	ND	-	ND	ND	-
1,4-DICHLOROBENZENE	UG/L	ND	ND	-	ND	ND	-
ETHYLBENZENE	UG/L	ND	ND	-	ND	ND	-
TOLUENE	UG/L	ND	ND	-	ND	ND	-
XYLENES (TOTAL)	UG/L	0.9 J	ND	NC	ND	ND	-

NOTES:
NC - Not Calculable
"-" - No Positives Detected
ND - Not Detected
RPD - Relative Percent Difference = (absolute value[x1-x2])/([x1+x2]/2)

CLEJ-01272-3.13-08/20/93

TAB [illegible]10
OPERABLE UNIT NO. 2
PHASE I AND II GROUNDWATER
POSITIVE RESULT COMPARISON
REMEDIAL INVESTIGATION CTO-0133
MCB CAMP LEJEUNE, NORTH CAROLINA
ORGANICS

Sample No:		9-GW8-01	9-GW8-02	
Depth:		N/A	N/A	
Date sampled:		10/25/92	3/9/93	RPD
Lab Id:		00593-41	930115-24	%
	Units			
VOLATILES				
BROMODICHLOROMETHANE	UG/L	ND	ND	-
CHLOROBENZENE	UG/L	ND	ND	-
2-CHLOROETHYLVINYL ETHER	UG/L	1.0 J	ND	NC
CHLOROFORM	UG/L	ND	ND	-
CHLOROMETHANE	UG/L	ND	ND	-
1,4-DICHLOROBENZENE	UG/L	ND	ND	-
1,2-DICHLOROETHANE	UG/L	ND	ND	-
1,1-DICHLOROETHENE	UG/L	ND	ND	-
TOTAL-1,2-DICHLORETHENE	UG/L	ND	ND	-
METHYLENE CHLORIDE	UG/L	ND	ND	-
1,1,2,2-TETRACHLOROETHANE	UG/L	ND	ND	-
TETRACHLOROETHENE	UG/L	ND	ND	-
1,1,1-TRICHLOROETHANE	UG/L	ND	ND	-
1,1,2-TRICHLOROETHANE	UG/L	ND	ND	-
TRICHLOROETHENE	UG/L	ND	ND	-
TRICHLOROFLUOROMETHANE	UG/L	ND	ND	-
VINYL CHLORIDE	UG/L	ND	ND	-
BENZENE	UG/L	ND	ND	-
1,3-DICHLOROBENZENE	UG/L	ND	3.4	NC
1,4-DICHLOROBENZENE	UG/L	ND	ND	-
ETHYLBENZENE	UG/L	ND	3.4	NC
TOLUENE	UG/L	ND	2.2	NC
XYLENES (TOTAL)	UG/L	ND	14	NC

NOTES:
NC - Not Calculable
"-" - No Positives Detected
ND - Not Detected
RPD - Relative Percent Difference = (absolute value[x1-x2])/([x1+x2]/2)

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TABLE 4-10
OPERABLE UNIT NO. 2
PHASE I AND 2 GROUNDWATER
POSITIVE RESULT COMPARISON
REMEDIAL INVESTIGATION CTO-0133
MCB CAMP LEJEUNE, NORTH CAROLINA
ORGANICS

Sample No:		9-GW1-01	9-GW1-02		9-GW4-01	9-GW4-02	
Depth:		N/A	N/A		N/A	N/A	
Date Sampled:		10/25/92	3/9/93	RPD	10/25/92	3/8/93	RPD
Lab Id:		00593-27	930115-06	%	00593-31	930115-14	%
Parameter	Units						
PESTICIDE/PCBS							
4,4'-DDE	UG/L	ND	1 J	NC	ND	ND	-
4,4'-DDD	UG/L	ND	0.94 J	NC	ND	ND	-
4,4'-DDT	UG/L	ND	0.13 J	NC	ND	ND	-
SEMIVOLATILES							
PHENOL	UG/L	ND	ND	-	ND	ND	-
NAPHTHALENE	UG/L	ND	ND	-	ND	17	NC
2-METHYLNAPHTHALENE	UG/L	ND	ND	-	ND	1 J	NC
ACENAPHTHENE	UG/L	ND	ND	-	ND	11 J	NC
DIBENZOFURAN	UG/L	ND	ND	-	ND	1 J	NC
FLUORENE	UG/L	ND	ND	-	ND	3 J	NC
PHENANTHRENE	UG/L	ND	ND	-	ND	3 J	NC
FLUORANTHENE	UG/L	ND	ND	-	ND	6 J	NC
PYRENE	UG/L	ND	ND	-	ND	3 J	NC
DIMETHYL PHTHALATE	UG/L	ND	ND	-	ND	ND	-
BIS(2-ETHYLHEXYL)PHTHALATE	UG/L	ND	1 J	NC	ND	4 J	NC
DI-N-OCTYL PHTHALATE	UG/L	ND	ND	-	ND	ND	-

NOTES: NC - Not Calculated
"-" - No Positives Detected
ND - Not Detected
RPD - Relative Percent Difference = (absolute value[x1-x2])/([x1+x2]/2)

TABLE . 10
OPERABLE UNIT NO. 2
PHASE I AND 2 GROUNDWATER
POSITIVE RESULT COMPARISON
REMEDIAL INVESTIGATION CTO-0133
MCB CAMP LEJEUNE, NORTH CAROLINA
ORGANICS

	Sample No:	9-GW5-01	9-GW5-02		9-GW6-01	9-GW6-02	
	Depth:	N/A	N/A		N/A	N/A	
	Date Sampled:	10/25/92	3/8/93	RPD	10/25/92	3/8/93	RPD
	Lab Id:	00593-33	930115-16	%	00593-35	930115-18	%
Parameter	Units						
PESTICIDE/PCBS							
4,4'-DDE	UG/L	ND	ND	-	ND	ND	-
4,4'-DDD	UG/L	ND	ND	-	ND	ND	-
4,4'-DDT	UG/L	ND	ND	-	ND	ND	-
SEMIVOLATILES							
PHENOL	UG/L	ND	ND	-	ND	ND	-
NAPHTHALENE	UG/L	ND	ND	-	ND	ND	-
2-METHYLNAPHTHALENE	UG/L	ND	ND	-	ND	ND	-
ACENAPHTHENE	UG/L	ND	ND	-	ND	ND	-
DIBENZOFURAN	UG/L	ND	ND	-	ND	ND	-
FLUORENE	UG/L	ND	ND	-	ND	ND	-
PHENANTHRENE	UG/L	ND	ND	-	ND	ND	-
FLUORANTHENE	UG/L	ND	ND	-	ND	ND	-
PYRENE	UG/L	ND	ND	-	ND	ND	-
DIMETHYL PHTHALATE	UG/L	ND	ND	-	ND	ND	-
BIS(2-ETHYLHEXYL)PHTHALATE	UG/L	ND	39	NC	ND	4 J	NC
DI-N-OCTYL PHTHALATE	UG/L	ND	ND	-	ND	ND	-

NOTES: NC - Not Calculated
"-" - No Positives Detected
ND - Not Detected
RPD - Relative Percent Difference = (absolute value[x1-x2])/([x1+x2]/2)

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TABLE [illegible]10
OPERABLE UNIT NO. 2
PHASE I AND 2 GROUNDWATER
POSITIVE RESULT COMPARISON
REMEDIAL INVESTIGATION CTO-0133
MCB CAMP LEJEUNE, NORTH CAROLINA
ORGANICS

Sample No:		9-GW07-DW-01	9-GW7DW-02		9-GW7S-01	9-GW7S-02	
Depth:		N/A	N/A		N/A	N/A	
Date Sampled:		11/3/92	3/8/93	RPD	10/25/92	3/8/93	RPD
Lab Id:		00603-19	930115-20	%	00593-39	930115-22	%
Parameter	Units						
PESTICIDE/PCBS							
4,4'-DDE	UG/L	ND	ND	-	ND	ND	-
4,4'-DDD	UG/L	ND	ND	-	ND	ND	-
4,4'-DDT	UG/L	ND	ND	-	ND	ND	-
SEMIVOLATILES							
PHENOL	UG/L	7 J	5 J	33.3	ND	ND	-
NAPHTHALENE	UG/L	ND	ND	-	ND	ND	-
2-METHYLNAPHTHALENE	UG/L	ND	ND	-	ND	ND	-
ACENAPHTHENE	UG/L	ND	ND	-	ND	ND	-
DIBENZOFURAN	UG/L	ND	ND	-	ND	ND	-
FLUORENE	UG/L	ND	ND	-	ND	ND	-
PHENANTHRENE	UG/L	ND	ND	-	ND	ND	-
FLUORANTHENE	UG/L	ND	ND	-	ND	ND	-
PYRENE	UG/L	ND	ND	-	ND	ND	-
DIMETHYL PHTHALATE	UG/L	1 J	ND	NC	ND	ND	-
BIS(2-ETHYLHEXYL)PHTHALATE	UG/L	2 J	62	187.5	ND	4 J	NC
DI-N-OCTYL PHTHALATE	UG/L	ND	ND	-	ND	ND	-

NOTES: NC - Not Calculated
"-" - No Positives Detected
ND - Not Detected
RPD - Relative Percent Difference = (absolute value[x1-x2])/([x1+x2]/2)

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TABL_ .-10
OPERABLE UNIT NO. 2
PHASE I AND 2 GROUNDWATER
POSITIVE RESULT COMPARISON
REMEDIAL INVESTIGATION CTO-0133
MCB CAMP LEJEUNE, NORTH CAROLINA
ORGANICS

	Sample No:	9-GW8-01	9-GW8-02	
	Depth:	N/A	N/A	
	Date Sampled:	10/25/92	3/9/93	RPD
	Lab Id:	00593-41	930115-24	%
Parameter	Units			
PESTICIDE/PCBS				
4,4'-DDE	UG/L	ND	ND	-
4,4'-DDD	UG/L	ND	ND	-
4,4'-DDT	UG/L	ND	ND	-
SEMIVOLATILES				
PHENOL	UG/L	ND	ND	-
NAPHTHALENE	UG/L	ND	ND	-
2-METHYLNAPHTHALENE	UG/L	ND	ND	-
ACENAPHTHENE	UG/L	ND	ND	-
DIBENZOFURAN	UG/L	ND	ND	-
FLUORENE	UG/L	ND	ND	-
PHENANTHRENE	UG/L	ND	ND	-
FLUORANTHENE	UG/L	ND	ND	-
PYRENE	UG/L	ND	ND	-
DIMETHYL PHTHALATE	UG/L	ND	ND	-
BIS(2-ETHYLHEXYL)PHTHALATE	UG/L	ND	7 J	NC
DI-N-OCTYL PHTHALATE	UG/L	ND	6 J	NC

NOTES: NC - Not Calculated
"-" - No Positives Detected
ND - Not Detected
RPD - Relative Percent Difference = (absolute value[x1-x2])/([x1+x2]/2)

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TABLE 4-11
SITE 6 LOT 201 SURFACE SOIL
POSITIVE DETECTION SUMMARY
REMEDIAL INVESTIGATION CTO-0133
MCB CAMP LEJEUNE, NORTH CAROLINA
ORGANICS

Sample No:		6-201A-SB1-00	6-201A-SB11-00	6-201A-SB12-00	6-201A-SB13-00	6-201A-SB14-00	6-201A-SB15-00
Depth:		0 - 6"	0 - 6"	0 - 6"	0 - 6"	0 - 6"	0 - 6"
Date Sampled:		8/28/92	8/28/92	8/28/92	8/26/92	8/26/92	8/26/92
Lab Id:		00452-01	00452-12	00452-14	00446-01	00447-01	00447-03
Parameter	Units						
PESTICIDE/PCBS							
DIELDRIN	UG/KG			6.4 J			
4,4'-DDE	UG/KG	420 J	19	7.7	110 J	61	210
4,4'-DDD	UG/KG				31		
4,4'-DDT	UG/KG	330 J	25 J	22 J	240 J	62	280
ALPHA CHLORDANE	UG/KG						
GAMMA CHLORDANE	UG/KG						
PCB-1248	UG/KG						
PCB-1260	UG/KG				36 J		
VOLATILES							
METHYLENE CHLORIDE	UG/KG						
ACETONE	UG/KG						
1,1,1-TRICHLOROETHANE	UG/KG						
SEMIVOLATILES							
1,4-DICHLOROBENZENE	UG/KG				38 J		
PHENANTHRENE	UG/KG						
DI-N-BUTYL PHTHALATE	UG/KG						
FLUORANTHENE	UG/KG						
PYRENE	UG/KG						
BENZO(A)ANTHRACENE	UG/KG						
CHRYSENE	UG/KG						
BIS(2-ETHYLHEXYL)PHTHALATE	UG/KG						
DI-N-OCTYL PHTHALATE	UG/KG						
BENZO(B)FLUORANTHENE	UG/KG						
BENZO(K)FLUORANTHENE	UG/KG						
BENZO(A)PYRENE	UG/KG						

UG/KG - microgram per kilogram
J - value is estimated

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TABLE 4-11
SITE 6 LOT 201 SURFACE SOIL
POSITIVE DETECTION SUMMARY
REMEDIAL INVESTIGATION CTO-0133
MCB CAMP LEJEUNE, NORTH CAROLINA
ORGANICS

Sample No:		6-201A-SB16-00	6-201A-SB17-00	6-201A-SB18-00	6-201A-SB19-00	6-201A-SB2-00	6-201A-SB20-00
Depth:		0 - 6"	0 - 6"	0 - 6"	0 - 6"	0 - 6"	0 - 6"
Date Sampled:		8/26/92	8/26/92	8/26/92	8/27/92	8/28/92	8/27/92
Lab Id:		00447-05	00446-03	00447-07	00447-09	00452-03	00447-12
Parameter	Units						
PESTICIDE/PCBS							
DIELDRIN	UG/KG						46
4,4'-DDE	UG/KG	1400 J	17000 J	50		210	450
4,4'-DDD	UG/KG	2500 J	180000 J				96 J
4,4'-DDT	UG/KG	8100 J	1200000	180	120	99	770
ALPHA CHLORDANE	UG/KG						
GAMMA CHLORDANE	UG/KG						
PCB-1248	UG/KG						
PCB-1260	UG/KG						
VOLATILES							
METHYLENE CHLORIDE	UG/KG						
ACETONE	UG/KG						
1,1,1-TRICHLOROETHANE	UG/KG						
SEMIVOLATILES							
1,4-DICHLOROBENZENE	UG/KG		38 J				
PHENANTHRENE	UG/KG						
DI-N-BUTYL PHTHALATE	UG/KG		89 J				
FLUORANTHENE	UG/KG						
PYRENE	UG/KG						
BENZO(A)ANTHRACENE	UG/KG						
CHRYSENE	UG/KG						
BIS(2-ETHYLHEXYL)PHTHALATE	UG/KG						
DI-N-OCTYL PHTHALATE	UG/KG						
BENZO(B)FLUORANTHENE	UG/KG						
BENZO(K)FLUORANTHENE	UG/KG						
BENZO(A)PYRENE	UG/KG						

UG/KG - microgram per kilogram
J - value is estimated

CLEJ-01272-3.13-08/20/93

TABLE 4-11
SITE 6 LOT 201 SURFACE SOIL
POSITIVE DETECTION SUMMARY
REMEDIAL INVESTIGATION CTO-0133
MCB CAMP LEJEUNE, NORTH CAROLINA
ORGANICS

	Sample No:	6-201A-SB21-00	6-201A-SB22-00	6-201A-SB23-00	6-201A-SB24-00	6-201A-SB25-00	6-201A-SB26-00
	Depth:	0 - 6"	0 - 6"	0 - 6"	0 - 6"	0 - 6"	0 - 6"
	Date Sampled:	8/27/92	8/27/92	8/27/92	8/27/92	8/27/92	8/27/92
	Lab Id:	00447-14	00447-16	00447-18	00447-20	00446-05	00447-23
Parameter	Units						
PESTICIDE/PCBS							
DIELDRIN	UG/KG						11 J
4,4'-DDE	UG/KG	79	54		81 J	41	53
4,4'-DDD	UG/KG				33 J	89 J	31 J
4,4'-DDT	UG/KG	94	66	34 J	350	300 J	340
ALPHA CHLORDANE	UG/KG						8.9
GAMMA CHLORDANE	UG/KG						8 J
PCB-1248	UG/KG				1800		
PCB-1260	UG/KG						
VOLATILES							
METHYLENE CHLORIDE	UG/KG						
ACETONE	UG/KG						
1,1,1-TRICHLOROETHANE	UG/KG						
SEMIVOLATILES							
1,4-DICHLOROBENZENE	UG/KG					38 J	
PHENANTHRENE	UG/KG						
DI-N-BUTYL PHTHALATE	UG/KG						
FLUORANTHENE	UG/KG						
PYRENE	UG/KG						
BENZO(A)ANTHRACENE	UG/KG						
CHRYSENE	UG/KG						
BIS(2-ETHYLHEXYL)PHTHALATE	UG/KG						
DI-N-OCTYL PHTHALATE	UG/KG						
BENZO(B)FLUORANTHENE	UG/KG						
BENZO(K)FLUORANTHENE	UG/KG						
BENZO(A)PYRENE	UG/KG						

UG/KG - microgram per kilogram
J - value is estimated

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TABLE 4-11
SITE 6 LOT 201 SURFACE SOIL
POSITIVE DETECTION SUMMARY
REMEDIAL INVESTIGATION CTO-0133
MCB CAMP LEJEUNE, NORTH CAROLINA
ORGANICS

Sample No:		6-201A-SB27-00	6-201A-SB28-00	6-201A-SB29-00	6-201A-SB3-00	6-201A-SB30-00	6-201A-SB31-00
Depth:		0 - 6"	0 - 6"	0 - 6"	0 - 6"	0 - 6"	0 - 6"
Date Sampled:		8/27/92	8/27/92	8/27/92	8/28/92	8/27/92	8/27/92
Lab Id:		00447-25	00447-27	00447-29	00452-05	00447-32	00453-01
Parameter	Units						
PESTICIDE/PCBS							
DIELDRIN	UG/KG						
4,4'-DDE	UG/KG		4 J		500 J		8.4
4,4'-DDD	UG/KG				48 J		3.5 J
4,4'-DDT	UG/KG	17	11 J	4	350	64	34
ALPHA CHLORDANE	UG/KG						
GAMMA CHLORDANE	UG/KG						
PCB-1248	UG/KG						
PCB-1260	UG/KG						
VOLATILES							
METHYLENE CHLORIDE	UG/KG						
ACETONE	UG/KG						
1,1,1-TRICHLOROETHANE	UG/KG						
SEMIVOLATILES							
1,4-DICHLOROBENZENE	UG/KG						
PHENANTHRENE	UG/KG						
DI-N-BUTYL PHTHALATE	UG/KG						
FLUORANTHENE	UG/KG						
PYRENE	UG/KG						
BENZO(A)ANTHRACENE	UG/KG						
CHRYSENE	UG/KG						
BIS(2-ETHYLHEXYL)PHTHALATE	UG/KG						
DI-N-OCTYL PHTHALATE	UG/KG						
BENZO(B)FLUORANTHENE	UG/KG						
BENZO(K)FLUORANTHENE	UG/KG						
BENZO(A)PYRENE	UG/KG						

UG/KG - microgram per kilogram
J - value is estimated

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TABLE 4-11
SITE 6 LOT 201 SURFACE SOIL
POSITIVE DETECTION SUMMARY
REMEDIAL INVESTIGATION CTO-0133
MCB CAMP LEJEUNE, NORTH CAROLINA
ORGANICS

	Sample No:	6-201A-SB32-00	6-201A-SB34-00	6-201A-SB35-00	6-201A-SB36-00	6-201A-SB37-00	6-201A-SB4-00
	Depth:	0 - 6"	0 - 6"	0 - 6"	0 - 6"	0 - 6"	0 - 6"
	Date Sampled:	8/27/92	8/27/92	8/27/92	8/27/92	8/27/92	8/28/92
	Lab Id:	00453-03	00453-05	00453-07	00453-10	00452-19	00452-08
Parameter	Units						
PESTICIDE/PCBS							
DIELDRIN	UG/KG						
4,4'-DDE	UG/KG	7.4	160	8.1 J			
4,4'-DDD	UG/KG		20 J			4.4 J	8.9 J
4,4'-DDT	UG/KG	14	320	32 J	4.6 J	16	44 J
ALPHA CHLORDANE	UG/KG						
GAMMA CHLORDANE	UG/KG						
PCB-1248	UG/KG						
PCB-1260	UG/KG						
VOLATILES							
METHYLENE CHLORIDE	UG/KG						
ACETONE	UG/KG					26 J	
1,1,1-TRICHLOROETHANE	UG/KG						
SEMIVOLATILES							
1,4-DICHLOROBENZENE	UG/KG						
PHENANTHRENE	UG/KG						
DI-N-BUTYL PHTHALATE	UG/KG						
FLUORANTHENE	UG/KG						
PYRENE	UG/KG						
BENZO(A)ANTHRACENE	UG/KG						
CHRYSENE	UG/KG						
BIS(2-ETHYLHEXYL)PHTHALATE	UG/KG					88 J	
DI-N-OCTYL PHTHALATE	UG/KG						
BENZO(B)FLUORANTHENE	UG/KG						
BENZO(K)FLUORANTHENE	UG/KG						
BENZO(A)PYRENE	UG/KG						

UG/KG - microgram per kilogram
J - value is estimated

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TABLE 4-11
SITE 6 LOT 201 SURFACE SOIL
POSITIVE DETECTION SUMMARY
REMEDIAL INVESTIGATION CTO-0133
MCB CAMP LEJEUNE, NORTH CAROLINA
ORGANICS

Sample No:		6-201A-SB5-00	6-201A-SB7-00	6-201A-SB8-00	6-201A-SB9-00	6-201B-SB10-00	6-201B-SB11-00
Depth:		0 - 6"	0 - 6"	0 - 6"	0 - 6"	0 - 6"	0 - 6"
Date Sampled:		8/26/92	8/26/92	8/26/92	8/26/92	8/28/92	8/31/92
Lab Id:		00438-01	00438-05	00438-08	00438-10	00452-29	00463-04
Parameter	Units						
PESTICIDE/PCBS							
DIELDRIN	UG/KG	5.8 J		5.6 J			
4,4'-DDE	UG/KG	380	5.7 J	25 J	18		
4,4'-DDD	UG/KG	11 J					
4,4'-DDT	UG/KG	570	14 J	27 J	55 J	4 J	4.8 J
ALPHA CHLORDANE	UG/KG						
GAMMA CHLORDANE	UG/KG						
PCB-1248	UG/KG						
PCB-1260	UG/KG						
VOLATILES							
METHYLENE CHLORIDE	UG/KG						
ACETONE	UG/KG						
1,1,1-TRICHLOROETHANE	UG/KG						
SEMIVOLATILES							
1,4-DICHLOROBENZENE	UG/KG						
PHENANTHRENE	UG/KG						
DI-N-BUTYL PHTHALATE	UG/KG						
FLUORANTHENE	UG/KG						
PYRENE	UG/KG						
BENZO(A)ANTHRACENE	UG/KG						
CHRYSENE	UG/KG						
BIS(2-ETHYLHEXYL)PHTHALATE	UG/KG						
DI-N-OCTYL PHTHALATE	UG/KG						
BENZO(B)FLUORANTHENE	UG/KG						
BENZO(K)FLUORANTHENE	UG/KG						
BENZO(A)PYRENE	UG/KG						

UG/KG - microgram per kilogram
J - value is estimated

CLEJ-01272-3.13-08/20/93

TABLE 4-11
SITE 6 LOT 201 SURFACE SOIL
POSITIVE DETECTION SUMMARY
REMEDIAL INVESTIGATION CTO-0133
MCB CAMP LEJEUNE, NORTH CAROLINA
ORGANICS

	Sample No:	6-201B-SB13-00	6-201B-SB15-00	6-201B-SB16-00	6-201B-SB17-00	6-201B-SB20-00	6-201B-SB21-00
	Depth:	0 - 6"	0 - 6"	0 - 6"	0 - 6"	0 - 6"	0 - 6"
	Date Sampled:	8/26/92	8/26/92	8/26/92	8/26/92	8/27/92	8/27/92
	Lab Id:	00438-16	00448-03	00448-06	00446-15	00448-13	00448-15
Parameter	Units						
PESTICIDE/PCBS							
DIELDRIN	UG/KG						
4,4'-DDE	UG/KG				20 J	4.3	
4,4'-DDD	UG/KG	7.5 J	42 J	9.5	16 J		
4,4'-DDT	UG/KG	94	310 J	34	200 J	3.9	4.2
ALPHA CHLORDANE	UG/KG						
GAMMA CHLORDANE	UG/KG						
PCB-1248	UG/KG						
PCB-1260	UG/KG						
VOLATILES							
METHYLENE CHLORIDE	UG/KG						
ACETONE	UG/KG						
1,1,1-TRICHLOROETHANE	UG/KG						
SEMIVOLATILES							
1,4-DICHLOROBENZENE	UG/KG				37 J		
PHENANTHRENE	UG/KG						
DI-N-BUTYL PHTHALATE	UG/KG						
FLUORANTHENE	UG/KG						
PYRENE	UG/KG						
BENZO(A)ANTHRACENE	UG/KG						
CHRYSENE	UG/KG						
BIS(2-ETHYLHEXYL)PHTHALATE	UG/KG	68 J					
DI-N-OCTYL PHTHALATE	UG/KG						
BENZO(B)FLUORANTHENE	UG/KG						
BENZO(K)FLUORANTHENE	UG/KG						
BENZO(A)PYRENE	UG/KG						

UG/KG - microgram per kilogram
J - value is estimated

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TABLE 4-11
SITE 6 LOT 201 SURFACE SOIL
POSITIVE DETECTION SUMMARY
REMEDIAL INVESTIGATION CTO-0133
MCB CAMP LEJEUNE, NORTH CAROLINA
ORGANICS

Parameter	Units	6-201B-SB22-00	6-201B-SB24-00	6-201B-SB25-00	6-201B-SB27-00	6-201B-SB3-00	6-201B-SB31-00
Depth:		0 - 6"	0 - 6"	0 - 6"	0 - 6"	0 - 6"	0 - 6"
Date Sampled:		8/27/92	8/27/92	8/27/92	8/27/92	8/26/92	8/27/92
Lab Id:		00448-18	00453-14	00452-31	00453-18	00446-07	00453-27
PESTICIDE/PCBS							
DIELDRIN	UG/KG						
4,4'-DDE	UG/KG	150 J		120	230		5.2
4,4'-DDD	UG/KG				17 J	9 J	
4,4'-DDT	UG/KG	330 J		130 J	210	19 J	5
ALPHA CHLORDANE	UG/KG						
GAMMA CHLORDANE	UG/KG						
PCB-1248	UG/KG						
PCB-1260	UG/KG		31 J				
VOLATILES							
METHYLENE CHLORIDE	UG/KG						
ACETONE	UG/KG						
1,1,1-TRICHLOROETHANE	UG/KG						
SEMIVOLATILES							
1,4-DICHLOROBENZENE	UG/KG						
PHENANTHRENE	UG/KG						
DI-N-BUTYL PHTHALATE	UG/KG						
FLUORANTHENE	UG/KG						
PYRENE	UG/KG						
BENZO(A)ANTHRACENE	UG/KG						
CHRYSENE	UG/KG						
BIS(2-ETHYLHEXYL)PHTHALATE	UG/KG			310 J			
DI-N-OCTYL PHTHALATE	UG/KG						
BENZO(B)FLUORANTHENE	UG/KG						
BENZO(K)FLUORANTHENE	UG/KG						
BENZO(A)PYRENE	UG/KG						

UG/KG - microgram per kilogram
J - value is estimated

TABLE 4-11
SITE 6 LOT 201 SURFACE SOIL
POSITIVE DETECTION SUMMARY
REMEDIAL INVESTIGATION CTO-0133
MCB CAMP LEJEUNE, NORTH CAROLINA
ORGANICS

Sample No:		6-201B-SB32-00	6-201B-SB33-00	6-201B-SB34-00	6-201B-SB35-00	6-201B-SB36-00	6-201B-SB37-00
Depth:		0 - 6"	0 - 6"	0 - 6"	0 - 6"	0 - 6"	0 - 6"
Date Sampled:		8/27/92	8/28/92	8/27/92	8/27/92	8/27/92	8/27/92
Lab Id:		00453-29	00452-33	00453-32	00453-34	00453-36	00452-36
Parameter	Units						
PESTICIDE/PCBS							
DIELDRIN	UG/KG						
4,4'-DDE	UG/KG	4.9 J	110 J	170	370	200	
4,4'-DDD	UG/KG				21 J	18 J	
4,4'-DDT	UG/KG	6.6 J	130 J	230	800	190	
ALPHA CHLORDANE	UG/KG						
GAMMA CHLORDANE	UG/KG						
PCB-1248	UG/KG						
PCB-1260	UG/KG						
VOLATILES							
METHYLENE CHLORIDE	UG/KG						
ACETONE	UG/KG		37 J				26 J
1,1,1-TRICHLOROETHANE	UG/KG						
SEMIVOLATILES							
1,4-DICHLOROBENZENE	UG/KG						
PHENANTHRENE	UG/KG						
DI-N-BUTYL PHTHALATE	UG/KG						
FLUORANTHENE	UG/KG		43 J				
PYRENE	UG/KG		38 J				
BENZO(A)ANTHRACENE	UG/KG						
CHRYSENE	UG/KG		39 J				
BIS(2-ETHYLHEXYL)PHTHALATE	UG/KG		100 J				180 J
DI-N-OCTYL PHTHALATE	UG/KG						
BENZO(B)FLUORANTHENE	UG/KG		61 J				
BENZO(K)FLUORANTHENE	UG/KG						
BENZO(A)PYRENE	UG/KG						

UG/KG - microgram per kilogram
J - value is estimated

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TABLE 4-11
SITE 6 LOT 201 SURFACE SOIL
POSITIVE DETECTION SUMMARY
REMEDIAL INVESTIGATION CTO-0133
MCB CAMP LEJEUNE, NORTH CAROLINA
ORGANICS

Sample No:		6-201B-SB5-00	6-201B-SB6-00	6-201B-SB7-00	6-201B-SB7A-00	6-201B-SB8-00	6-201C-SB14-00
Depth:		0 - 6"	0 - 6"	0 - 6"	0 - 6"	0 - 6"	0 - 6"
Date Sampled:		8/27/92	8/27/92	8/28/92	8/26/92	8/28/92	8/28/92
Lab Id:		00446-10	00446-12	00452-22	00547-01	00452-24	00456-05
Parameter	Units						
PESTICIDE/PCBS							
DIELDRIN	UG/KG						
4,4'-DDE	UG/KG				140		
4,4'-DDD	UG/KG	20 J	0.98 J				4.8
4,4'-DDT	UG/KG	98 J	3 J		62 J		12 J
ALPHA CHLORDANE	UG/KG						
GAMMA CHLORDANE	UG/KG						
PCB-1248	UG/KG						
PCB-1260	UG/KG						
VOLATILES							
METHYLENE CHLORIDE	UG/KG					4 J	
ACETONE	UG/KG			7 J			
1,1,1-TRICHLOROETHANE	UG/KG						
SEMIVOLATILES							
1,4-DICHLOROBENZENE	UG/KG						
PHENANTHRENE	UG/KG						
DI-N-BUTYL PHTHALATE	UG/KG						
FLUORANTHENE	UG/KG						
PYRENE	UG/KG						
BENZO(A)ANTHRACENE	UG/KG						
CHRYSENE	UG/KG						
BIS(2-ETHYLHEXYL)PHTHALATE	UG/KG						
DI-N-OCTYL PHTHALATE	UG/KG						
BENZO(B)FLUORANTHENE	UG/KG						
BENZO(K)FLUORANTHENE	UG/KG						
BENZO(A)PYRENE	UG/KG						

UG/KG - microgram per kilogram
J - value is estimated

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TABLE 4-11
SITE 6 LOT 201 SURFACE SOIL
POSITIVE DETECTION SUMMARY
REMEDIAL INVESTIGATION CTO-0133
MCB CAMP LEJEUNE, NORTH CAROLINA
ORGANICS

	Sample No:	6-201C-SB21-00	6-201C-SB33-00	6-201C-SB34-00	6-201C-SB35-00	6-201C-SB36-00	6-201C-SB37-00
	Depth:	0 - 6"	0 - 6"	0 - 6"	0 - 6"	0 - 6"	0 - 6"
	Date Sampled:	8/28/92	8/31/92	8/29/92	8/29/92	8/29/92	8/29/92
	Lab Id:	00456-16	00474-03	00456-36	00456-39	00456-41	00457-14
Parameter	Units						
PESTICIDE/PCBS							
DIELDRIN	UG/KG						
4,4'-DDE	UG/KG	15		40 J	270 J	25	60
4,4'-DDD	UG/KG			6.1 J	20 J	3.9	67 J
4,4'-DDT	UG/KG	31		42 J	520 J	24 J	190
ALPHA CHLORDANE	UG/KG						
GAMMA CHLORDANE	UG/KG						
PCB-1248	UG/KG						
PCB-1260	UG/KG						
VOLATILES							
METHYLENE CHLORIDE	UG/KG						
ACETONE	UG/KG						
1,1,1-TRICHLOROETHANE	UG/KG		2 J				
SEMIVOLATILES							
1,4-DICHLOROBENZENE	UG/KG						
PHENANTHRENE	UG/KG						36 J
DI-N-BUTYL PHTHALATE	UG/KG						
FLUORANTHENE	UG/KG		77 J				94 J
PYRENE	UG/KG		99 J				75 J
BENZO(A)ANTHRACENE	UG/KG		47 J				
CHRYSENE	UG/KG		88 J				63 J
BIS(2-ETHYLHEXYL)PHTHALATE	UG/KG						
DI-N-OCTYL PHTHALATE	UG/KG						44 J
BENZO(B)FLUORANTHENE	UG/KG		160 J				67 J
BENZO(K)FLUORANTHENE	UG/KG		46 J				
BENZO(A)PYRENE	UG/KG		78 J				

UG/KG - microgram per kilogram
J - value is estimated

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TABLE 4-11
SITE 6 LOT 201 SURFACE SOIL
POSITIVE DETECTION SUMMARY
REMEDIAL INVESTIGATION CTO-0133
MCB CAMP LEJEUNE, NORTH CAROLINA
ORGANICS

Parameter	Units	6-201C-SB38-00	6-201C-SB39-00
Sample No:		6-201C-SB38-00	6-201C-SB39-00
Depth:		0 - 6"	0 - 6"
Date Sampled:		8/31/92	8/31/92
Lab Id:		00474-05	00474-07
PESTICIDE/PCBS			
DIELDRIN	UG/KG		
4,4'-DDE	UG/KG		
4,4'-DDD	UG/KG		
4,4'-DDT	UG/KG		5.1
ALPHA CHLORDANE	UG/KG		
GAMMA CHLORDANE	UG/KG		
PCB-1248	UG/KG		
PCB-1260	UG/KG		
VOLATILES			
METHYLENE CHLORIDE	UG/KG		
ACETONE	UG/KG		
1,1,1-TRICHLOROETHANE	UG/KG	42	19
SEMIVOLATILES			
1,4-DICHLOROBENZENE	UG/KG		
PHENANTHRENE	UG/KG		
DI-N-BUTYL PHTHALATE	UG/KG		
FLUORANTHENE	UG/KG		
PYRENE	UG/KG		
BENZO(A)ANTHRACENE	UG/KG		
CHRYSENE	UG/KG		
BIS(2-ETHYLHEXYL)PHTHALATE	UG/KG		
DI-N-OCTYL PHTHALATE	UG/KG		
BENZO(B)FLUORANTHENE	UG/KG		
BENZO(K)FLUORANTHENE	UG/KG		
BENZO(A)PYRENE	UG/KG		

UG/KG - microgram per kilogram
J - value is estimated

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TABLE 4-12
SITE 6 LOT 201 SURFACE SOIL
POSITIVE DETECTION SUMMARY
REMEDIAL INVESTIGATION CTO-0133
MCB CAMP LEJEUNE, NORTH CAROLINA
TOTAL METALS

Sample No:		6-201A-SB13-00		6-201A-SB17-00		6-201A-SB25-00		6-201A-SB33-00		6-201A-SB37-00		6-201B-SB13-00	
Depth:		0 - 6"		0 - 6"		0 - 6"		0 - 6"		0 - 6"		0 - 6"	
Date Sampled:		8/26/92		8/26/92		8/27/92		8/27/92		8/27/92		8/26/92	
Lab Id:		00446-01		00446-03		00446-05		00452-17		00452-19		00438-16	
Parameter	Units												
ALUMINUM	MG/KG	1670		1420		952		2170		3320		1020	
ARSENIC	MG/KG	1.8	JB	1.8	JB	1	JB					1.4	B
BARIUM	MG/KG	10.3	B	7.6	B			5	B	6.7	B	5.9	B
BERYLLIUM	MG/KG												
CADMIUM	MG/KG	0.87	JB										
CALCIUM	MG/KG	122000		165000		47800		91400		80200		129000	
CHROMIUM	MG/KG	8.5		7.8		3.5		6.1	J	7.2	J	8	
COBALT	MG/KG												
COPPER	MG/KG	4.2	JB	3.9	JB	0.78	JB	1.2	JB	1.8	JB	0.85	B
IRON	MG/KG	2290		2330		969		1580		2040		2670	
LEAD	MG/KG	78		36.1		26.2		8	J	24		6.1	
MAGNESIUM	MG/KG	1740		2010		726	B	1250		1200		1680	
MANGANESE	MG/KG	21.6		25.7		8.8	J	11.7	J	13.3	J	26.9	
NICKEL	MG/KG												
POTASSIUM	MG/KG	139	B	144	B			123	B	182	B	156	B
SELENIUM	MG/KG												
SODIUM	MG/KG	213	JB	282	JB	104	JB	155	JB	165	JB	203	JB
VANADIUM	MG/KG	4.8	B	4	B	2.1	B	3.9	B	6.2	B	3.9	B
ZINC	MG/KG	26.1		20.1		6				11		9.8	

MG/KG - milligram per kilogram
B - reported value is less than Contract Required Detection Limit (CRDL), but greater than Instrument Detection Limit (IDL)
J - value is estimated
JB - value is estimated below the CRDL, but greater than the IDL

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TABLE 4-12
SITE 6 LOT 201 SURFACE SOIL
POSITIVE DETECTION SUMMARY
REMEDIAL INVESTIGATION CTO-0133
MCB CAMP LEJEUNE, NORTH CAROLINA
TOTAL METALS

Sample No:		6-201B-SB17-00	6-201B-SB25-00	6-201B-SB33-00	6-201B-SB37-00	6-201C-SB13-00	6-201C-SB17-00
Depth:		0 - 6"	0 - 6"	0 - 6"	0 - 6"	0 - 6"	0 - 6"
Date Sampled:		8/26/92	8/27/92	8/28/92	8/27/92	8/31/92	8/29/92
Lab Id:		00446-15	00452-31	00452-33	00452-36	00474-01	00457-09
Parameter	Units						
ALUMINUM	MG/KG	3510	1120	1530	2480	5520	2120
ARSENIC	MG/KG			7.5		0.92 B	2.7
BARIUM	MG/KG	7 B	8.2 B	9.4 B	8 B	7 B	5.7 B
BERYLLIUM	MG/KG						
CADMIUM	MG/KG		1.4 J	1.5 J	0.71 JB	0.51 JB	
CALCIUM	MG/KG	111000	205000	286000	182000	10800	149000 J
CHROMIUM	MG/KG	8.2	14.3 J	21.6	10.2 J	6.2	7.9
COBALT	MG/KG			1.3 JB			
COPPER	MG/KG	1.4 JB	15.9	27.8	8.4 J	1 JB	1.9 JB
IRON	MG/KG	2200	3210	4260	2840	2700	2010
LEAD	MG/KG	6.4	25.9	47 J	9.8	3.6 R	2.7
MAGNESIUM	MG/KG	1550	3090	3980	2390	367 B	1970
MANGANESE	MG/KG	21.1	35.7	204 J	31.3	4.2 J	51.4
NICKEL	MG/KG			3.7 B			
POTASSIUM	MG/KG	254 B	321 B	539 B	275 B	179 B	277 B
SELENIUM	MG/KG						
SODIUM	MG/KG	238 JB	312 JB	270 JB	280 JB		202 JB
VANADIUM	MG/KG	6.1 B	5.7 B	13.7	5.9 B	6.5 B	8 B
ZINC	MG/KG	14.7	59.3	135 J	19.9		

MG/KG - milligram per kilogram
B - reported value is less than Contract Required Detection Limit (CRDL), but greater than Instrument Detection Limit (IDL)
J - value is estimated
JB - value is estimated below the CRDL, but greater than the IDL

TABLE 4-12
SITE 6 LOT 201 SURFACE SOIL
POSITIVE DETECTION SUMMARY
REMEDIAL INVESTIGATION CTO-0133
MCB CAMP LEJEUNE, NORTH CAROLINA
TOTAL METALS

Sample No:		6-201C-SB25-00		6-201C-SB33-00		6-201C-SB37-00		6-201C-SB38-00		6-201C-SB39-00	
Depth:		0 - 6"		0 - 6"		0 - 6"		0 - 6"		0 - 6"	
Date Sampled:		8/28/92		8/31/92		8/29/92		8/31/92		8/31/92	
Lab Id:		00457-12		00474-03		00457-14		00474-05		00474-07	
Parameter	Units										
ALUMINUM	MG/KG	1290		2960		1660		748		245	
ARSENIC	MG/KG	5.7	J	2	J	9.7	J	0.91	B		
BARIUM	MG/KG	5.5	B	9	B	8.2	B	16.5	B	3.5	JB
BERYLLIUM	MG/KG	0.22	B								
CADMIUM	MG/KG	0.92	J	0.58	JB	1.4	J	0.58	JB		
CALCIUM	MG/KG	261000	J	25800		113000	J	10700		402	B
CHROMIUM	MG/KG	10.1		5.4		12.9					
COBALT	MG/KG	1.3	JB								
COPPER	MG/KG	1.7	JB	5.9	J	11.4		3.1	JB	0.75	JB
IRON	MG/KG	2590		2380		2580		684		238	
LEAD	MG/KG	1	J	33.2	R	31.8		62.9	R	25.1	R
MAGNESIUM	MG/KG	3100		495	B	1890		200	B	26	B
MANGANESE	MG/KG	145		14	J	31.4		16	J	4.5	J
NICKEL	MG/KG	6.4	JB								
POTASSIUM	MG/KG	567	B	149	B	197	B	54.5	B	30.6	JB
SELENIUM	MG/KG	2.2	J								
SODIUM	MG/KG	269	JB	41.6	JB	212	JB				
VANADIUM	MG/KG	18.3		6.3	B	5.6	JB	2.8	B	1.6	B
ZINC	MG/KG	13.8		46.8		95.4		23.1		4.6	

MG/KG - milligram per kilogram
B - reported value is less than Contract Required Detection Limit (CRDL), but greater than Instrument Detection Limit (IDL)
J - value is estimated
JB - value is estimated below the CRDL, but greater than the IDL

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TABLE 4-13
SITE 6 LOT 201 SUBSURFACE SOIL
POSITIVE DETECTION SUMMARY
REMEDIAL INVESTIGATION CTO-0133
MCB CAMP LEJEUNE, NORTH CAROLINA
ORGANICS

	Sample No:	6-201A-SB10-01	6-201A-SB12-01	6-201A-SB13-01	6-201A-SB15-01	6-201A-SB17-01	6-201A-SB18-01
	Depth:	1 - 3'	1 - 3'	1 - 3'	1 - 3'	1 - 3'	1 - 3'
	Date Sampled:	8/27/92	8/28/92	8/26/92	8/26/92	8/26/92	8/26/92
	Lab Id:	00452-11	00452-16	00446-02	00447-04	00446-04	00447-08
Parameter	Units						
PESTICIDE/PCBS							
4,4'-DDE	UG/KG	90			8.1	5200 J	
4,4'-DDD	UG/KG		6.8			250000 J	
4,4'-DDT	UG/KG	125	12 J	3.5 J	19	460000	5.8 J
VOLATILES							
METHYLENE CHLORIDE	UG/KG						
ACETONE	UG/KG						
1,1,1-TRICHLOROETHANE	UG/KG						
TETRACHLOROETHENE	UG/KG						
ETHYLBENZENE	UG/KG					2800 J	
TOTAL XYLENES	UG/KG					54000	
SEMIVOLATILES							
1,4-DICHLOROBENZENE	UG/KG						
NAPHTHALENE	UG/KG					38000	
2-METHYLNAPHTHALENE	UG/KG					97000	
DIBENZOFURAN	UG/KG					2800 J	
FLUORENE	UG/KG					4100 J	
N-NITRISODIPHENYLAMINE	UG/KG					3500 J	
BIS(2-ETHYLHEXYL)PHTHALATE	UG/KG						

UG/KG - microgram per kilogram
J - value is estimated

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TABLE 4-13
SITE 6 LOT 201 SUBSURFACE SOIL
POSITIVE DETECTION SUMMARY
REMEDIAL INVESTIGATION CTO-0133
MCB CAMP LEJEUNE, NORTH CAROLINA
ORGANICS

Sample No:		6-201A-SB20-01	6-201A-SB21-01	6-201A-SB22-01	6-201A-SB23-01	6-201A-SB24-01	6-201A-SB25-01
Depth:		1 - 3'	1 - 3'	1 - 3'	1 - 3'	1 - 3'	1 - 3'
Date Sampled:		8/27/92	8/27/92	8/27/92	8/27/92	8/27/92	8/27/92
Lab Id:		00447-13	00447-15	00447-17	00447-19	00447-21	00446-06
Parameter	Units						
PESTICIDE/PCBS							
4,4'-DDE	UG/KG	15					
4,4'-DDD	UG/KG	3.5 J		9.7 J			6.4 J
4,4'-DDT	UG/KG	39	7.1	33	8.2	17	23
VOLATILES							
METHYLENE CHLORIDE	UG/KG						
ACETONE	UG/KG						
1,1,1-TRICHLOROETHANE	UG/KG						
TETRACHLOROETHENE	UG/KG						4 J
ETHYLBENZENE	UG/KG						
TOTAL XYLENES	UG/KG						
SEMIVOLATILES							
1,4-DICHLOROBENZENE	UG/KG						36 J
NAPHTHALENE	UG/KG						
2-METHYLNAPHTHALENE	UG/KG						
DIBENZOFURAN	UG/KG						
FLUORENE	UG/KG						
N-NITRISODIPHENYLAMINE	UG/KG						
BIS(2-ETHYLHEXYL)PHTHALATE	UG/KG						

UG/KG - microgram per kilogram
J - value is estimated

CLEJ-01272-3.13-08/20/93

TABLE 4-13
SITE 6 LOT 201 SUBSURFACE SOIL
POSITIVE DETECTION SUMMARY
REMEDIAL INVESTIGATION CTO-0133
MCB CAMP LEJEUNE, NORTH CAROLINA
ORGANICS

Sample No:		6-201A-SB26-01	6-201A-SB27-01	6-201A-SB28-02	6-201A-SB33-02	6-201A-SB37-02	6-201A-SB4-01
Depth:		1 - 3'	1 - 3'	3 - 5'	3 - 5'	3 - 5'	1 - 3'
Date Sampled:		8/27/92	8/27/92	8/27/92	8/27/92	8/27/92	8/28/92
Lab Id:		00447-24	00447-26	00447-28	00452-18	00452-20	00452-09
Parameter	Units						
PESTICIDE/PCBS							
4,4'-DDE	UG/KG				36		
4,4'-DDD	UG/KG	3.9 J	11 J	7.1 J	7.1 J		
4,4'-DDT	UG/KG	10	35 J	24	36 J	3.5 J	12 J
VOLATILES							
METHYLENE CHLORIDE	UG/KG						
ACETONE	UG/KG				12 J		
1,1,1-TRICHLOROETHANE	UG/KG						
TETRACHLOROETHENE	UG/KG						
ETHYLBENZENE	UG/KG						
TOTAL XYLENES	UG/KG						
SEMIVOLATILES							
1,4-DICHLOROBENZENE	UG/KG					51 J	
NAPHTHALENE	UG/KG						
2-METHYLNAPHTHALENE	UG/KG						
DIBENZOFURAN	UG/KG						
FLUORENE	UG/KG						
N-NITRISODIPHENYLAMINE	UG/KG						
BIS(2-ETHYLHEXYL)PHTHALATE	UG/KG						

UG/KG - microgram per kilogram
J - value is estimated

CLEJ-01272-3.13-08/20/93

TABLE 4-13
SITE 6 LOT 201 SUBSURFACE SOIL
POSITIVE DETECTION SUMMARY
REMEDIAL INVESTIGATION CTO-0133
MCB CAMP LEJEUNE, NORTH CAROLINA
ORGANICS

Sample No:		6-201A-SB9-02	6-201B-SB10-01	6-201B-SB13-02	6-201B-SB15-01	6-201B-SB15-02	6-201B-SB16-02
Depth:		3 - 5'	1 - 3'	3 - 5'	1 - 3'	1 - 3'	3 - 5'
Date Sampled:		8/26/92	8/28/92	8/26/92	8/26/92	8/26/92	8/26/92
Lab Id:		00438-11	00452-30	00438-17	00448-04	00448-05	00448-07
Parameter	Units						
PESTICIDE/PCBS							
4,4'-DDE	UG/KG						
4,4'-DDD	UG/KG		5.5		46 J	3.6	53 J
4,4'-DDT	UG/KG	13 J	10 J		88 J	7.5 J	340 J
VOLATILES							
METHYLENE CHLORIDE	UG/KG						
ACETONE	UG/KG						
1,1,1-TRICHLOROETHANE	UG/KG						
TETRACHLOROETHENE	UG/KG						
ETHYLBENZENE	UG/KG						
TOTAL XYLENES	UG/KG						
SEMIVOLATILES							
1,4-DICHLOROBENZENE	UG/KG						
NAPHTHALENE	UG/KG						
2-METHYLNAPHTHALENE	UG/KG						
DIBENZOFURAN	UG/KG						
FLUORENE	UG/KG						
N-NITRISODIPHENYLAMINE	UG/KG						
BIS(2-ETHYLHEXYL)PHTHALATE	UG/KG			160 J			

UG/KG - microgram per kilogram
J - value is estimated

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TABLE 4-13
SITE 6 LOT 201 SUBSURFACE SOIL
POSITIVE DETECTION SUMMARY
REMEDIAL INVESTIGATION CTO-0133
MCB CAMP LEJEUNE, NORTH CAROLINA
ORGANICS

	Sample No:	6-201B-SB17-02	6-201B-SB19-02	6-201B-SB2-03	6-201B-SB25-01	6-201B-SB3-02	6-201B-SB33-01
	Depth:	3 - 5'	3 - 5'	5 - 7'	1 - 3'	3 - 5'	1 - 3'
	Date Sampled:	8/26/92	8/27/92	8/26/92	8/27/92	8/26/92	8/28/92
	Lab Id:	00446-16	00448-12	00438-15	00452-32	00446-08	00452-35
Parameter	Units						
PESTICIDE/PCBS							
4,4'-DDE	UG/KG						66
4,4'-DDD	UG/KG	6.8 J		36 J		63 J	
4,4'-DDT	UG/KG	43 J	5.1	86 J		91 J	88 J
VOLATILES							
METHYLENE CHLORIDE	UG/KG						
ACETONE	UG/KG	130 J					25 J
1,1,1-TRICHLOROETHANE	UG/KG						
TETRACHLOROETHENE	UG/KG						
ETHYLBENZENE	UG/KG						
TOTAL XYLENES	UG/KG						
SEMIVOLATILES							
1,4-DICHLOROBENZENE	UG/KG	46 J					
NAPHTHALENE	UG/KG						
2-METHYLNAPHTHALENE	UG/KG						
DIBENZOFURAN	UG/KG						
FLUORENE	UG/KG						
N-NITRISODIPHENYLAMINE	UG/KG						
BIS(2-ETHYLHEXYL)PHTHALATE	UG/KG				79 J		68 J

UG/KG - microgram per kilogram
J - value is estimated

TABLE 4-13
SITE 6 LOT 201 SUBSURFACE SOIL
POSITIVE DETECTION SUMMARY
REMEDIAL INVESTIGATION CTO-0133
MCB CAMP LEJEUNE, NORTH CAROLINA
ORGANICS

	Sample No:	6-201B-SB36-02	6-201B-SB37-01	6-201B-SB5-02	6-201B-SB6-01	6-201B-SB6-02	6-201B-SB7-01
	Depth:	3 - 5'	1 - 3'	3 - 5'	1 - 3'	3 - 5'	1 - 3'
	Date Sampled:	8/27/92	8/27/92	8/27/92	8/27/92	8/27/92	8/28/92
	Lab Id:	00453-37	00452-37	00446-11	00446-13	00446-14	00452-23
Parameter	Units						
PESTICIDE/PCBS							
4,4'-DDE	UG/KG	4.5				1.4 J	
4,4'-DDD	UG/KG			6 J	2.4 J	0.58 J	
4,4'-DDT	UG/KG	4.5		39 J	3.6 J	3.4 J	
VOLATILES							
METHYLENE CHLORIDE	UG/KG						4 J
ACETONE	UG/KG		96 J				
1,1,1-TRICHLOROETHANE	UG/KG						
TETRACHLOROETHENE	UG/KG						
ETHYLBENZENE	UG/KG						
TOTAL XYLENES	UG/KG						
SEMIVOLATILES							
1,4-DICHLOROBENZENE	UG/KG						
NAPHTHALENE	UG/KG						
2-METHYLNAPHTHALENE	UG/KG						
DIBENZOFURAN	UG/KG						
FLUORENE	UG/KG						
N-NITRISODIPHENYLAMINE	UG/KG						
BIS(2-ETHYLHEXYL)PHTHALATE	UG/KG		94 J				

UG/KG - microgram per kilogram
J - value is estimated

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TABLE 4-13
SITE 6 LOT 201 SUBSURFACE SOIL
POSITIVE DETECTION SUMMARY
REMEDIAL INVESTIGATION CTO-0133
MCB CAMP LEJEUNE, NORTH CAROLINA
ORGANICS

Sample No:		6-201B-SB9-01	6-201C-SB33-01	6-201C-SB35-02	6-201C-SB37-02	6-201C-SB38-01
Depth:		1 - 3'	1 - 3'	1 - 3'	1 - 3'	0 - 3'
Date Sampled:		8/28/92	8/31/92	8/29/92	8/29/92	8/31/92
Lab Id:		00452-28	00474-04	00456-40	00457-15	00474-06
Parameter	Units					
PESTICIDE/PCBS						
4,4'-DDE	UG/KG	70	24			
4,4'-DDD	UG/KG		5 J			
4,4'-DDT	UG/KG	170	22	4.8 J		
VOLATILES						
METHYLENE CHLORIDE	UG/KG					
ACETONE	UG/KG				110	
1,1,1-TRICHLOROETHANE	UG/KG					4 J
TETRACHLOROETHENE	UG/KG					
ETHYLBENZENE	UG/KG					
TOTAL XYLENES	UG/KG					
SEMIVOLATILES						
1,4-DICHLOROBENZENE	UG/KG					
NAPHTHALENE	UG/KG					
2-METHYLNAPHTHALENE	UG/KG					
DIBENZOFURAN	UG/KG					
FLUORENE	UG/KG					
N-NITRISODIPHENYLAMINE	UG/KG					
BIS(2-ETHYLHEXYL)PHTHALATE	UG/KG		810			

UG/KG - microgram per kilogram
J - value is estimated

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TABLE 4-14
SITE 6 LOT 201 SUBSURFACE SOIL
POSITIVE DETECTION SUMMARY
REMEDIAL INVESTIGATION CTO-0133
MCB CAMP LEJEUNE, NORTH CAROLINA
TOTAL METALS

	Sample No:	6-201A-GW22-02	6-201A-GW22-04	6-201A-SB17-01	6-201A-SB25-01	6-201A-SB33-02	6-201A-SB37-02
	Depth:	4 - 6'	8 - 10'	1 - 3'	1 - 3'	3 - 5'	3 - 5'
	Date Sampled:	9/24/92	9/24/92	8/26/92	8/27/92	8/27/92	8/27/92
	Lab Id:	00536-28	00536-29	00446-04	00446-06	00452-18	00452-20
Parameter	Units						
ALUMINUM	MG/KG	2840 J	904 J	4540	2020	1410	1290
ARSENIC	MG/KG			0.95 JB	0.79 JB		
BARIUM	MG/KG	2.8 JB	1.3 JB	5.1 B	5.2 B		
CADMIUM	MG/KG						
CALCIUM	MG/KG	86.6 B		3390	1370	68 B	84 B
CHROMIUM	MG/KG	2.7 J	1.6 JB	5.1	1.9	1.6 JB	6.7 J
COPPER	MG/KG				0.77 JB		
IRON	MG/KG	446 J	232 J	3610	223	137	157
LEAD	MG/KG	2	0.99	4.2	2.1	2.5	1.9
MAGNESIUM	MG/KG	57.3 B	21.1 B	66.5 B	43.2 B	20.3 B	22.5 B
MANGANESE	MG/KG	1.8 JB	1.7 JB	2.3 JB	1.4 JB	0.53 JB	1.6 JB
POTASSIUM	MG/KG	76.7 B	37 JB				
SODIUM	MG/KG					10.6 JB	31.7 JB
VANADIUM	MG/KG	2.6 JB	0.83 JB	18.1	1.5 B		
ZINC	MG/KG			2.3 B	2.6 B		

MG/KG - milligram per kilogram
B - reported value is less than Contract Required Detection Limit (CRDL), but greater than Instrument Detection Limit (IDL)
J - value is estimated
JB - value is estimated below the CRDL, but greater than the IDL

CLEJ-01272-3.13-08/20/93

TABLE 4-14
SITE 6 LOT 201 SUBSURFACE SOIL
POSITIVE DETECTION SUMMARY
REMEDIAL INVESTIGATION CTO-0133
MCB CAMP LEJEUNE, NORTH CAROLINA
TOTAL METALS

	Sample No:	6-201B-SB13-02	6-201B-SB17-02	6-201B-SB25-01	6-201B-SB33-01	6-201B-SB37-01	6-201C-SB13-01
	Depth:	3 - 5'	3 - 5'	1 - 3'	1 - 3'	1 - 3'	1 - 3'
	Date Sampled:	8/26/92	8/26/92	8/27/92	8/27/92	8/27/92	8/31/92
	Lab Id:	00438-17	00446-16	00452-32	00452-35	00452-37	00474-02
Parameter	Units						
ALUMINUM	MG/KG	2670	1580	1290	1850	365	3390
ARSENIC	MG/KG	0.79 B	1.8 JB				0.66 B
BARIUM	MG/KG			8.2 B	5.8 B		4.2 JB
CADMIUM	MG/KG						0.63 JB
CALCIUM	MG/KG	653 B	85.1 B	943	832 B	243 B	508 B
CHROMIUM	MG/KG	3.8		1.3 JB	2.3 J		
COPPER	MG/KG			0.85 JB	0.71 JB		0.44 JB
IRON	MG/KG	2000	221	243	699	173	2470
LEAD	MG/KG	3.4	1.6	2	2	0.87	2 R
MAGNESIUM	MG/KG	42.6 B	24.3 B	21.2 B	43.6 B	13.7 B	81.3 B
MANGANESE	MG/KG	2.2 B	0.77 JB	1.1 JB	1.6 JB	0.8 JB	1.8 JB
POTASSIUM	MG/KG						87.1 B
SODIUM	MG/KG	10.6 JB		11.4 JB	14.2 JB	11.7 JB	
VANADIUM	MG/KG	4.1 B		0.96 B	2.6 B		4.3 B
ZINC	MG/KG		1.8 B				

MG/KG - milligram per kilogram
B - reported value is less than Contract Required Detection Limit (CRDL), but greater than Instrument Detection Limit (IDL)
J - value is estimated
JB - value is estimated below the CRDL, but greater than the IDL

CLEJ-01272-3.13-08/20/93

TABLE 4-14
SITE 6 LOT 201 SUBSURFACE SOIL
POSITIVE DETECTION SUMMARY
REMEDIAL INVESTIGATION CTO-0133
MCB CAMP LEJEUNE, NORTH CAROLINA
TOTAL METALS

Sample No:		6-201C-SB17-03		6-201C-SB25-02		6-201C-SB33-01		6-201C-SB37-02		6-201C-SB38-01		6-201C-SB39-04	
Depth:		5 - 7'		3 - 5'		1 - 3'		3 - 5'		1 - 3'		5 - 7'	
Date Sampled:		8/29/92		8/28/92		8/31/92		8/29/92		8/31/92		8/31/92	
Lab Id:		00457-10		00457-13		00474-04		00457-15		00474-06		00474-08	
Parameter	Units												
ALUMINUM	MG/KG	841		1940		3150		3590		3620		2970	
ARSENIC	MG/KG					0.65	B						
BARIUM	MG/KG					7.6	B			7.6	B	6.5	B
CADMIUM	MG/KG									0.57	JB		
CALCIUM	MG/KG	123	JB	17100	J	2750		907	JB	4410			
CHROMIUM	MG/KG	0.84	B	1.7	B			2.5		6			
COPPER	MG/KG					0.73	JB			1.7	JB	0.65	JB
IRON	MG/KG	372		626		1040		252		456		833	
LEAD	MG/KG	1		1.2		2.5	R	1.9		11.5	R	2.7	R
MAGNESIUM	MG/KG	33.5	B	259	B	105	B	35.6	B	133	B	86.8	B
MANGANESE	MG/KG	1.6	JB	12.6	J	10.7	J	1.7	JB	7.5	J	2.6	JB
POTASSIUM	MG/KG					67.1	B			84.7	B	187	B
SODIUM	MG/KG												
VANADIUM	MG/KG	1.3	JB	2.4	JB	2.6	B	1.5	JB	3	B	4.7	B
ZINC	MG/KG					5.6				11.6			

MG/KG - milligram per kilogram
B - reported value is less than Contract Required Detection Limit (CRDL), but greater than Instrument Detection Limit (IDL)
J - value is estimated
JB - value is estimated below the CRDL, but greater than the IDL

CLEJ-01272-3.13-08/20/93

TABLE 4-15
SITE 6 LOT 203 SURFACE SOIL
POSITIVE DETECTION SUMMARY
REMEDIAL INVESTIGATION CTO-0133
MCB CAMP LEJEUNE, NORTH CAROLINA
ORGANICS

Sample No:		6-203DDT-SB1-00	6-203DDT-SB10-00	6-203DDT-SB13-00	6-203DDT-SB16-00
Depth:		0-6"	0-6"	0-6"	0-6"
Date Sampled:		9/9/92	9/9/92	9/9/92	9/9/92
Lab Id:		00496-01	00496-14	00497-15	00497-19
Parameter Name	Units				
PESTICIDE/PCBS					
DIELDRIN	UG/KG				
4,4'-DDE	UG/KG		5.7 J	3.8 J	6.4 J
ENDRIN	UG/KG	21			
ENDOSULFAN II	UG/KG		4.4 J		
4,4'-DDD	UG/KG				5.2 J
4,4'-DDT	UG/KG			15 J	18 J
ALPHA CHLORDANE	UG/KG	6.9			
GAMMA CHLORDANE	UG/KG				
PCB-1248	UG/KG				
PCB-1254	UG/KG				
PCB-1260	UG/KG		230 J		
VOLATILES					
:ETONE	UG/KG				
ι,1,1-TRICHLOROETHANE	UG/KG				
TOLUENE	UG/KG				
SEMIVOLATILES					
1,4-DICHLOROBENZENE	UG/KG				
1,2-DICHLOROBENZENE	UG/KG				
NAPHTHALENE	UG/KG				
2-METHYLNAPHTHALENE	UG/KG				
ACENAPHTHENE	UG/KG				
DIBENZOFURAN	UG/KG				
FLUORENE	UG/KG				
PENTACHLOROPHENOL	UG/KG				
PHENANTHRENE	UG/KG		66 J		
ANTHRACENE	UG/KG				
DI-N-BUTYL PHTHALATE	UG/KG				
FLUORANTHENE	UG/KG		130 J		
CARBAZOLE	UG/KG				
PYRENE	UG/KG		140 J		
BUTYL BENZYL PHTHALATE	UG/KG				
3,3-DICHLOROBENZIDINE	UG/KG				
BENZO(A)ANTHRACENE	UG/KG		64 J		
CHRYSENE	UG/KG		58 J		
BIS(2-ETHYLHEXYL)PHTHALATE	UG/KG				
BENZO(B)FLUORANTHENE	UG/KG		91 J		
BENZO(K)FLUORANTHENE	UG/KG		42 J		
BENZO(A)PYRENE	UG/KG		57 J		
NDENO(1,2,3-CD) PYRENE	UG/KG		42 J		
ENZO(G,H,I)PERYLENE	UG/KG				

UG/KG - microgram per kilogram
J - value is estimated

TABLE 4-15
SITE 6 LOT 203 SURFACE SOIL
POSITIVE DETECTION SUMMARY
REMEDIAL INVESTIGATION CTO-0133
MCB CAMP LEJEUNE, NORTH CAROLINA
ORGANICS

	Sample No:	6-203DDT-SB18-00	6-203DDT-SB2-00	6-203DDT-SB21-00	6-203DDT-SB23-00
	Depth:	0-6"	0-6"	0-6"	0-6"
	Date Sampled:	9/2/92	9/9/92	9/2/92	9/2/92
	Lab Id:	00485-06	00496-11	00485-13	00485-18
Parameter Name	Units				
PESTICIDE/PCBS					
DIELDRIN	UG/KG				
4,4'-DDE	UG/KG	540 J	3.8 J		7
ENDRIN	UG/KG	36 J			
ENDOSULFAN II	UG/KG				
4,4'-DDD	UG/KG	180 J			
4,4'-DDT	UG/KG	770 J	3.4 J	51 J	60
ALPHA CHLORDANE	UG/KG		2.3 J		
GAMMA CHLORDANE	UG/KG				
PCB-1248	UG/KG				
PCB-1254	UG/KG				
PCB-1260	UG/KG				
VOLATILES					
TONE	UG/KG				
,1-TRICHLOROETHANE	UG/KG				
TOLUENE	UG/KG				
SEMIVOLATILES					
1,4-DICHLOROBENZENE	UG/KG				
1,2-DICHLOROBENZENE	UG/KG				
NAPHTHALENE	UG/KG				
2-METHYLNAPHTHALENE	UG/KG				
ACENAPHTHENE	UG/KG				
DIBENZOFURAN	UG/KG				
FLUORENE	UG/KG				
PENTACHLOROPHENOL	UG/KG				
PHENANTHRENE	UG/KG				
ANTHRACENE	UG/KG				
DI-N-BUTYL PHTHALATE	UG/KG				
FLUORANTHENE	UG/KG				
CARBAZOLE	UG/KG				
PYRENE	UG/KG				
BUTYL BENZYL PHTHALATE	UG/KG				
3,3-DICHLOROBENZIDINE	UG/KG				
BENZO(A)ANTHRACENE	UG/KG				
CHRYSENE	UG/KG				
BIS(2-ETHYLHEXYL)PHTHALATE	UG/KG				
BENZO(B)FLUORANTHENE	UG/KG				
BENZO(K)FLUORANTHENE	UG/KG				
BENZO(A)PYRENE	UG/KG				
DENO(1,2,3-CD) PYRENE	UG/KG				
NZO(G,H,I)PERYLENE	UG/KG				

UG/KG - microgram per kilogram
J - value is estimated

TABLE 4-15
SITE 6 LOT 203 SURFACE SOIL
POSITIVE DETECTION SUMMARY
REMEDIAL INVESTIGATION CTO-0133
MCB CAMP LEJEUNE, NORTH CAROLINA
ORGANICS

Sample No:		6-203DDT-SB24-00	6-203DDT-SB25-00	6-203DDT-SB26-00	6-203DDT-SB26-00D
Depth:		0-6"	0-6"	0-6"	0-6"
Date Sampled:		9/10/92	9/2/92	9/10/92	9/10/92
Lab Id:		00502-20	00485-20	00502-23	00502-24
Parameter Name	Units				
PESTICIDE/PCBS					
DIELDRIN	UG/KG				
4,4'-DDE	UG/KG	25	4.8 J	9.2	11
ENDRIN	UG/KG				
ENDOSULFAN II	UG/KG				
4,4'-DDD	UG/KG	4.5 J			
4,4'-DDT	UG/KG	6.6 J	12	20	19
ALPHA CHLORDANE	UG/KG				
GAMMA CHLORDANE	UG/KG				
PCB-1248	UG/KG				
PCB-1254	UG/KG				
PCB-1260	UG/KG				
VOLATILES					
CETONE	UG/KG	4 J			
1,1,1-TRICHLOROETHANE	UG/KG				
TOLUENE	UG/KG				
SEMIVOLATILES					
1,4-DICHLOROBENZENE	UG/KG				
1,2-DICHLOROBENZENE	UG/KG				
NAPHTHALENE	UG/KG				
2-METHYLNAPHTHALENE	UG/KG				
ACENAPHTHENE	UG/KG				
DIBENZOFURAN	UG/KG				
FLUORENE	UG/KG				
PENTACHLOROPHENOL	UG/KG				
PHENANTHRENE	UG/KG				
ANTHRACENE	UG/KG				
DI-N-BUTYL PHTHALATE	UG/KG				
FLUORANTHENE	UG/KG				
CARBAZOLE	UG/KG				
PYRENE	UG/KG				
BUTYL BENZYL PHTHALATE	UG/KG				
3,3-DICHLOROBENZIDINE	UG/KG				
BENZO(A)ANTHRACENE	UG/KG				
CHRYSENE	UG/KG				
BIS(2-ETHYLHEXYL)PHTHALATE	UG/KG			67 J	89 J
BENZO(B)FLUORANTHENE	UG/KG				
BENZO(K)FLUORANTHENE	UG/KG				
BENZO(A)PYRENE	UG/KG				
INDENO(1,2,3-CD) PYRENE	UG/KG				
BENZO(G,H,I)PERYLENE	UG/KG				

UG/KG - microgram per kilogram
J - value is estimated

TABLE 4-15
SITE 6 LOT 203 SURFACE SOIL
POSITIVE DETECTION SUMMARY
REMEDIAL INVESTIGATION CTO-0133
MCB CAMP LEJEUNE, NORTH CAROLINA
ORGANICS

	Sample No:	6-203DDT-SB28-00	6-203DDT-SB3-00	6-203DDT-SB8-00	6-203OSA-SB21-00
	Depth:	0-6"	0-6"	0-6"	0-6"
	Date Sampled:	9/1/92	9/01/92	9/9/92	8/30/92
	Lab Id:	00485-22	00474-09	00496-03	00467-01
Parameter Name	Units				
PESTICIDE/PCBS					
DIELDRIN	UG/KG	3.6 J			
4,4'-DDE	UG/KG	22 J		14 J	43
ENDRIN	UG/KG				
ENDOSULFAN II	UG/KG				
4,4'-DDD	UG/KG	8.3	9.5 J	7.1 J	
4,4'-DDT	UG/KG	43	19	31 J	91
ALPHA CHLORDANE	UG/KG				
GAMMA CHLORDANE	UG/KG				
PCB-1248	UG/KG				
PCB-1254	UG/KG				
PCB-1260	UG/KG			270 J	
VOLATILES					
ACETONE	UG/KG				
1,1,1-TRICHLOROETHANE	UG/KG				
TOLUENE	UG/KG				
SEMIVOLATILES					
1,4-DICHLOROBENZENE	UG/KG				
1,2-DICHLOROBENZENE	UG/KG				
NAPHTHALENE	UG/KG				
2-METHYLNAPHTHALENE	UG/KG				
ACENAPHTHENE	UG/KG				
DIBENZOFURAN	UG/KG				
FLUORENE	UG/KG				
PENTACHLOROPHENOL	UG/KG				
PHENANTHRENE	UG/KG				
ANTHRACENE	UG/KG				
DI-N-BUTYL PHTHALATE	UG/KG				
FLUORANTHENE	UG/KG			100 J	
CARBAZOLE	UG/KG				
PYRENE	UG/KG			100 J	
BUTYL BENZYL PHTHALATE	UG/KG				
3,3-DICHLOROBENZIDINE	UG/KG				
BENZO(A)ANTHRACENE	UG/KG			59 J	
CHRYSENE	UG/KG			66 J	
BIS(2-ETHYLHEXYL)PHTHALATE	UG/KG				160 J
BENZO(B)FLUORANTHENE	UG/KG			140 J	
BENZO(K)FLUORANTHENE	UG/KG				
BENZO(A)PYRENE	UG/KG			72 J	
INDENO(1,2,3-CD) PYRENE	UG/KG			62 J	
BENZO(G,H,I)PERYLENE	UG/KG			65 J	

UG/KG - microgram per kilogram
J - value is estimated

TABLE 4-15
SITE 6 LOT 203 SURFACE SOIL
POSITIVE DETECTION SUMMARY
REMEDIAL INVESTIGATION CTO-0133
MCB CAMP LEJEUNE, NORTH CAROLINA
ORGANICS

Sample No:		6-203OSA-SB22-00	6-203OSA-SB23-00	6-203OSA-SB24-00	6-203OSA-SB26-00
Depth:		0-6"	0-6"	0-6"	0-6"
Date Sampled:		8/31/92	8/30/92	8/30/92	8/30/92
Lab Id:		00467-03	00467-05	00467-07	00467-11
Parameter Name	Units				
PESTICIDE/PCBS					
DIELDRIN	UG/KG	35		270 J	
4,4'-DDE	UG/KG		700 J		45
ENDRIN	UG/KG				
ENDOSULFAN II	UG/KG				
4,4'-DDD	UG/KG				27 J
4,4'-DDT	UG/KG		850 J	350 J	
ALPHA CHLORDANE	UG/KG				
GAMMA CHLORDANE	UG/KG			160 J	
PCB-1248	UG/KG				
PCB-1254	UG/KG				
PCB-1260	UG/KG			42000 J	2300 J
VOLATILES					
ACETONE	UG/KG				
1,1,1-TRICHLOROETHANE	UG/KG				
TOLUENE	UG/KG		7 J		
SEMIVOLATILES					
1,4-DICHLOROBENZENE	UG/KG	37 J			
1,2-DICHLOROBENZENE	UG/KG				
NAPHTHALENE	UG/KG				
2-METHYLNAPHTHALENE	UG/KG				
ACENAPHTHENE	UG/KG				
DIBENZOFURAN	UG/KG				
FLUORENE	UG/KG				
PENTACHLOROPHENOL	UG/KG				
PHENANTHRENE	UG/KG		68 J		270 J
ANTHRACENE	UG/KG				55 J
DI-N-BUTYL PHTHALATE	UG/KG				
FLUORANTHENE	UG/KG		130 J	61 J	350
CARBAZOLE	UG/KG				
PYRENE	UG/KG		110 J	58 J	260 J
BUTYL BENZYL PHTHALATE	UG/KG				
3,3-DICHLOROBENZIDINE	UG/KG			540	
BENZO(A)ANTHRACENE	UG/KG		62 J		140 J
CHRYSENE	UG/KG		63 J		120 J
BIS(2-ETHYLHEXYL)PHTHALATE	UG/KG	53 J	52 J	55 J	
BENZO(B)FLUORANTHENE	UG/KG		88 J		170 J
BENZO(K)FLUORANTHENE	UG/KG				51 J
BENZO(A)PYRENE	UG/KG				100 J
INDENO(1,2,3-CD) PYRENE	UG/KG				55 J
BENZO(G,H,I)PERYLENE	UG/KG				

UG/KG - microgram per kilogram
J - value is estimated

TABLE 4-15
SITE 6 LOT 203 SURFACE SOIL
POSITIVE DETECTION SUMMARY
REMEDIAL INVESTIGATION CTO-0133
MCB CAMP LEJEUNE, NORTH CAROLINA
ORGANICS

	Sample No:	6-203OSA-SB28-00	6-203OSA-SB29-00	6-203OSA-SB30-00	6-203OSA-SB31-00
	Depth:	0-6"	0-6"	0-6"	0-6"
	Date Sampled:	8/30/92	8/30/92	8/30/92	8/30/92
	Lab Id:	00467-15	00467-17	00467-20	00467-22
Parameter Name	Units				
PESTICIDE/PCBS					
DIELDRIN	UG/KG				
4,4'-DDE	UG/KG	6.8	4.7	2100	
ENDRIN	UG/KG				
ENDOSULFAN II	UG/KG				
4,4'-DDD	UG/KG				
4,4'-DDT	UG/KG	7.2 J	19	1500 J	
ALPHA CHLORDANE	UG/KG				
GAMMA CHLORDANE	UG/KG				
PCB-1248	UG/KG				
PCB-1254	UG/KG				
PCB-1260	UG/KG				150
VOLATILES					
CETONE	UG/KG				
,1-TRICHLOROETHANE	UG/KG				
TOLUENE	UG/KG				
SEMIVOLATILES					
1,4-DICHLOROBENZENE	UG/KG				
1,2-DICHLOROBENZENE	UG/KG				
NAPHTHALENE	UG/KG				
2-METHYLNAPHTHALENE	UG/KG				
ACENAPHTHENE	UG/KG				
DIBENZOFURAN	UG/KG				
FLUORENE	UG/KG				
PENTACHLOROPHENOL	UG/KG				
PHENANTHRENE	UG/KG				90 J
ANTHRACENE	UG/KG				
DI-N-BUTYL PHTHALATE	UG/KG				
FLUORANTHENE	UG/KG			160 J	120 J
CARBAZOLE	UG/KG				
PYRENE	UG/KG			260 J	100 J
BUTYL BENZYL PHTHALATE	UG/KG				
3,3-DICHLOROBENZIDINE	UG/KG				
BENZO(A)ANTHRACENE	UG/KG			240 J	47 J
CHRYSENE	UG/KG			230 J	50 J
BIS(2-ETHYLHEXYL)PHTHALATE	UG/KG	110 J	54 J	76 J	1300
BENZO(B)FLUORANTHENE	UG/KG			350 J	
BENZO(K)FLUORANTHENE	UG/KG			76 J	
BENZO(A)PYRENE	UG/KG			120 J	
INDENO(1,2,3-CD) PYRENE	UG/KG				
NZO(G,H,I)PERYLENE	UG/KG				

UG/KG - microgram per kilogram
J - value is estimated

TABLE 4-15
SITE 6 LOT 203 SURFACE SOIL
POSITIVE DETECTION SUMMARY
REMEDIAL INVESTIGATION CTO-0133
MCB CAMP LEJEUNE, NORTH CAROLINA
ORGANICS

	Sample No:	6-203OSA-SB32-00	6-203OSA-SB33-00	6-203OSA-SB34-00	6-203OSA-SB35-00
	Depth:	0-6"	0-6"	0-6"	0-6"
	Date Sampled:	8/31/92	8/30/92	8/30/92	8/30/92
	Lab Id:	00467-24	00467-27	00467-29	00467-31
Parameter Name	Units				
PESTICIDE/PCBS					
DIELDRIN	UG/KG	14			
4,4'-DDE	UG/KG		65	71	44 J
ENDRIN	UG/KG				
ENDOSULFAN II	UG/KG				
4,4'-DDD	UG/KG			33	
4,4'-DDT	UG/KG	10 J	25 J	31 J	99
ALPHA CHLORDANE	UG/KG				
GAMMA CHLORDANE	UG/KG				
PCB-1248	UG/KG				
PCB-1254	UG/KG				
PCB-1260	UG/KG			70	
VOLATILES					
ETONE	UG/KG				
1-TRICHLOROETHANE	UG/KG				
TOLUENE	UG/KG				
SEMIVOLATILES					
1,4-DICHLOROBENZENE	UG/KG				
1,2-DICHLOROBENZENE	UG/KG				
NAPHTHALENE	UG/KG				
2-METHYLNAPHTHALENE	UG/KG				
ACENAPHTHENE	UG/KG				
DIBENZOFURAN	UG/KG				
FLUORENE	UG/KG				
PENTACHLOROPHENOL	UG/KG	520			
PHENANTHRENE	UG/KG			60 J	
ANTHRACENE	UG/KG				
DI-N-BUTYL PHTHALATE	UG/KG				
FLUORANTHENE	UG/KG			99 J	
CARBAZOLE	UG/KG				
PYRENE	UG/KG			79 J	
BUTYL BENZYL PHTHALATE	UG/KG				
3,3-DICHLOROBENZIDINE	UG/KG				
BENZO(A)ANTHRACENE	UG/KG				
CHRYSENE	UG/KG				
BIS(2-ETHYLHEXYL)PHTHALATE	UG/KG				
BENZO(B)FLUORANTHENE	UG/KG				
BENZO(K)FLUORANTHENE	UG/KG				
BENZO(A)PYRENE	UG/KG				
INDENO(1,2,3-CD) PYRENE	UG/KG				
NZO(G,H,I)PERYLENE	UG/KG				

UG/KG - microgram per kilogram
J - value is estimated

TABLE 4-15
SITE 6 LOT 203 SURFACE SOIL
POSITIVE DETECTION SUMMARY
REMEDIAL INVESTIGATION CTO-0133
MCB CAMP LEJEUNE, NORTH CAROLINA
ORGANICS

Sample No:		6-203OSA-SB36-00	6-203OSA-SB37-00	6-203OSA-SB38-00	6-203OSA-SB39-00
Depth:		0-6"	0-6"	0-6"	0-6"
Date Sampled:		8/30/92	8/31/92	10/12/92	10/12/92
Lab Id:		00467-33	00467-36	00573-01	00573-03
Parameter Name	Units				
PESTICIDE/PCBS					
DIELDRIN	UG/KG				
4,4'-DDE	UG/KG	9.8	83	290 J	62 J
ENDRIN	UG/KG			130 J	
ENDOSULFAN II	UG/KG				
4,4'-DDD	UG/KG				
4,4'-DDT	UG/KG	13	85	700 J	150 J
ALPHA CHLORDANE	UG/KG			72 J	
GAMMA CHLORDANE	UG/KG				
PCB-1248	UG/KG			580 J	
PCB-1254	UG/KG			2100 J	170 J
PCB-1260	UG/KG			550 J	700 J
VOLATILES					
TONE	UG/KG				
,1-TRICHLOROETHANE	UG/KG				
TOLUENE	UG/KG				
SEMIVOLATILES					
1,4-DICHLOROBENZENE	UG/KG				160 J
1,2-DICHLOROBENZENE	UG/KG				160 J
NAPHTHALENE	UG/KG				1400 J
2-METHYLNAPHTHALENE	UG/KG				3100 J
ACENAPHTHENE	UG/KG			250 J	9500 J
DIBENZOFURAN	UG/KG			140 J	890 J
FLUORENE	UG/KG			220 J	940 J
PENTACHLOROPHENOL	UG/KG				
PHENANTHRENE	UG/KG			2000	
ANTHRACENE	UG/KG			440 J	
DI-N-BUTYL PHTHALATE	UG/KG			160 J	
FLUORANTHENE	UG/KG	110 J		2300	
CARBAZOLE	UG/KG			390 J	910 J
PYRENE	UG/KG	87 J		2800	
BUTYL BENZYL PHTHALATE	UG/KG			83 J	
3,3-DICHLOROBENZIDINE	UG/KG				
BENZO(A)ANTHRACENE	UG/KG	52 J		1600	
CHRYSENE	UG/KG	54 J		1300	
BIS(2-ETHYLHEXYL)PHTHALATE	UG/KG			400 J	
BENZO(B)FLUORANTHENE	UG/KG	95 J		2700	
BENZO(K)FLUORANTHENE	UG/KG	30 J		1100	
BENZO(A)PYRENE	UG/KG	49 J		1800	
INDENO(1,2,3-CD) PYRENE	UG/KG	53 J		1000	
IZO(G,H,I)PERYLENE	UG/KG	41 J		1000	

UG/KG - microgram per kilogram
J - value is estimated

TABLE 4-15
SITE 6 LOT 203 SURFACE SOIL
POSITIVE DETECTION SUMMARY
REMEDIAL INVESTIGATION CTO-0133
MCB CAMP LEJEUNE, NORTH CAROLINA
ORGANICS

	Sample No:	6-203OSA-SB41-00	6-203OSA-SB42-00	6-203PCB-SB10-00	6-203PCB-SB12-00
	Depth:	0-6"	0-6"	0-6"	0-6"
	Date Sampled:	10/12/92	10/12/92	8/31/92	9/1/92
	Lab Id:	00573-06	00573-09	00473-07	00472-05
Parameter Name	Units				
PESTICIDE/PCBS					
DIELDRIN	UG/KG				
4,4'-DDE	UG/KG	13 J	120 J		
ENDRIN	UG/KG				
ENDOSULFAN II	UG/KG				
4,4'-DDD	UG/KG				
4,4'-DDT	UG/KG	26 J	180 J		
ALPHA CHLORDANE	UG/KG				
GAMMA CHLORDANE	UG/KG				
PCB-1248	UG/KG				
PCB-1254	UG/KG				
PCB-1260	UG/KG			41 J	
VOLATILES					
ETONE	UG/KG	15			
,1,1-TRICHLOROETHANE	UG/KG				2 J
TOLUENE	UG/KG				
SEMIVOLATILES					
1,4-DICHLOROBENZENE	UG/KG				34 J
1,2-DICHLOROBENZENE	UG/KG				
NAPHTHALENE	UG/KG				
2-METHYLNAPHTHALENE	UG/KG				
ACENAPHTHENE	UG/KG				
DIBENZOFURAN	UG/KG				
FLUORENE	UG/KG				
PENTACHLOROPHENOL	UG/KG				
PHENANTHRENE	UG/KG				
ANTHRACENE	UG/KG				
DI-N-BUTYL PHTHALATE	UG/KG				
FLUORANTHENE	UG/KG				
CARBAZOLE	UG/KG				
PYRENE	UG/KG				
BUTYL BENZYL PHTHALATE	UG/KG				
3,3-DICHLOROBENZIDINE	UG/KG				
BENZO(A)ANTHRACENE	UG/KG				
CHRYSENE	UG/KG				
BIS(2-ETHYLHEXYL)PHTHALATE	UG/KG				
BENZO(B)FLUORANTHENE	UG/KG				
BENZO(K)FLUORANTHENE	UG/KG				
BENZO(A)PYRENE	UG/KG				
INDENO(1,2,3-CD) PYRENE	UG/KG				
NZO(G,H,I)PERYLENE	UG/KG				

UG/KG - microgram per kilogram
J - value is estimated

TABLE 4-15
SITE 6 LOT 203 SURFACE SOIL
POSITIVE DETECTION SUMMARY
REMEDIAL INVESTIGATION CTO-0133
MCB CAMP LEJEUNE, NORTH CAROLINA
ORGANICS

Sample No:		6-203PCB-SB13-00	6-203PCB-SB14-00	6-203PCB-SB3-00	6-203PCB-SB6-00
Depth:		0-6"	0-6"	0-6"	0-6"
Date Sampled:		9/01/92	8/31/92	9/2/92	9/01/92
Lab Id:		00473-09	00472-08	00484-06	00473-02
Parameter Name	Units				
PESTICIDE/PCBS					
DIELDRIN	UG/KG				
4,4'-DDE	UG/KG				
ENDRIN	UG/KG				
ENDOSULFAN II	UG/KG				
4,4'-DDD	UG/KG				
4,4'-DDT	UG/KG				
ALPHA CHLORDANE	UG/KG				
GAMMA CHLORDANE	UG/KG				
PCB-1248	UG/KG				
PCB-1254	UG/KG				
PCB-1260	UG/KG	19 J		53 J	17 J
VOLATILES					
ETONE	UG/KG				
,1-TRICHLOROETHANE	UG/KG		15		
TOLUENE	UG/KG				
SEMIVOLATILES					
1,4-DICHLOROBENZENE	UG/KG				
1,2-DICHLOROBENZENE	UG/KG				
NAPHTHALENE	UG/KG				
2-METHYLNAPHTHALENE	UG/KG				
ACENAPHTHENE	UG/KG				
DIBENZOFURAN	UG/KG				
FLUORENE	UG/KG				
PENTACHLOROPHENOL	UG/KG				
PHENANTHRENE	UG/KG				
ANTHRACENE	UG/KG				
DI-N-BUTYL PHTHALATE	UG/KG				
FLUORANTHENE	UG/KG		39 J		
CARBAZOLE	UG/KG				
PYRENE	UG/KG		42 J		
BUTYL BENZYL PHTHALATE	UG/KG				
3,3-DICHLOROBENZIDINE	UG/KG				
BENZO(A)ANTHRACENE	UG/KG				
CHRYSENE	UG/KG				
BIS(2-ETHYLHEXYL)PHTHALATE	UG/KG				
BENZO(B)FLUORANTHENE	UG/KG				
BENZO(K)FLUORANTHENE	UG/KG				
BENZO(A)PYRENE	UG/KG				
INDENO(1,2,3-CD) PYRENE	UG/KG				
NZO(G,H,I)PERYLENE	UG/KG				

UG/KG - microgram per kilogram
J - value is estimated

TABLE 4-16
SITE 6 LOT 203 SURFACE SOIL
POSITIVE DETECTION SUMMARY
REMEDIAL INVESTIGATION CTO-0133
MCB CAMP LEJEUNE, NORTH CAROLINA
TOTAL METALS

Sample No:		6-203DDT-SB10-00	6-203DDT-SB24-00	6-203DDT-SB26-00	6-203DDT-SB8-00	6-203OSA-SB21-00	6-203OSA-SB22-00
Depth:		0 - 6"	0 - 6"	0 - 6"	0 - 6"	0 - 6"	0 - 6"
Date Sampled:		9/9/92	9/10/92	9/10/92	9/9/92	8/30/92	8/31/92
Lab Id:		00496-14	00502-20	00502-23	00496-03	00467-01	00467-03
Parameter	Units						
ALUMINUM	MG/KG	2140	1470	1560	1700	2010	1030
ANTIMONY	MG/KG						
ARSENIC	MG/KG	0.86 JB				1.1 B	0.39 B
BARIUM	MG/KG	6.8 B		2.7 JB	7.7 B	8.6 B	4.7 B
BERYLLIUM	MG/KG						
CADMIUM	MG/KG	0.48 JB			0.55 JB		
CALCIUM	MG/KG	728 B	560 JB	204 JB	539 B	6430	207 B
CHROMIUM	MG/KG	2.4	1.1 B	2.1	3.6	3.6 J	1.5 JB
COBALT	MG/KG				0.39 JB		
COPPER	MG/KG	4 JB			3.1 JB	3.4 B	
IRON	MG/KG	1510	740	793	2490	1070	844
LEAD	MG/KG	37.1	4.7	4.1	16.4	19.4	11.2
MAGNESIUM	MG/KG	50 B	68.9 B	27 B	73.9 B	129 B	35.2 B
MANGANESE	MG/KG	11.2	5.4	3.1 J	9.7	12	2.6 B
MERCURY	MG/KG						
NICKEL	MG/KG				1.8 JB		
POTASSIUM	MG/KG	39.9 B		27.7 JB	68.4 B		
SODIUM	MG/KG		26.2 JB			30.6 B	
VANADIUM	MG/KG	4.1 JB	3.1 JB	2 JB	3.8 JB	3.6 B	2.9 B
ZINC	MG/KG	25.6	9.1			22.1	1.1 B

MG/KG - microgram per kilogram
B - reported value is less than Contract Required Detection Limit (CRDL), but greater than Instrument Detection Limit (IDL)
J - value is estimated
JB - value is estimated below the CRDL, but greater than the IDL

CLEJ-01272-3.13-08/20/93

TABLE 4-16
SITE 6 LOT 203 SURFACE SOIL
POSITIVE DETECTION SUMMARY
REMEDIAL INVESTIGATION CTO-0133
MCB CAMP LEJEUNE, NORTH CAROLINA
TOTAL METALS

Sample No:		6-203OSA-SB23-00	6-203OSA-SB24-00	6-203OSA-SB25-00	6-203OSA-SB26-00	6-203OSA-SB27-00	6-203OSA-SB28-00
Depth:		0 - 6"	0 - 6"	0 - 6"	0 - 6"	0 - 6"	0 - 6"
Date Sampled:		8/30/92	8/30/92	8/30/92	8/30/92	8/31/92	8/30/92
Lab Id:		00467-05	00467-07	00467-09	00467-11	00467-13	00467-15
Parameter	Units						
ALUMINUM	MG/KG	3540	3800	1410	2260	1350	1850
ANTIMONY	MG/KG	20.7 J					
ARSENIC	MG/KG	1.4 B	4.9		0.79 JB	0.79 JB	1.6 B
BARIUM	MG/KG	12.3 B	11.5 B	5.4 B	6.6 B	4.6 B	5.3 B
BERYLLIUM	MG/KG						
CADMIUM	MG/KG	2.8	1.3	0.77 B	0.51 B		0.69 B
CALCIUM	MG/KG	36900	28600	2240	487 B	1750	2420
CHROMIUM	MG/KG	10 J	8.1 J	3.4 J	3.7 J	1.7 JB	3.7 J
COBALT	MG/KG	2.2 B					
COPPER	MG/KG	25.3	17.5	4.4 B	6.9		14
IRON	MG/KG	11300	2760	1700	764	696	1070
LEAD	MG/KG	1310	61.2	17.6	19.8	6.2	20.8
MAGNESIUM	MG/KG	584 B	550 B	191 B	66.9 B	49.2 B	80.1 B
MANGANESE	MG/KG	37.8	62.8	32.5	8	6	105
MERCURY	MG/KG						
NICKEL	MG/KG	13.2					
POTASSIUM	MG/KG	114 B	157 B		73.7 B		100 B
SODIUM	MG/KG	68.9 B	55.3 B	19.7 B	13.7 B		16.6 B
VANADIUM	MG/KG	7.3 B	6.7 B	2.3 B	3.2 B	2.4 B	3.2 B
ZINC	MG/KG	92.7	116	35.5	12.3	2.2 B	69.8

MG/KG - microgram per kilogram
B - reported value is less than Contract Required Detection Limit (CRDL), but greater than Instrument Detection Limit (IDL)
J - value is estimated
JB - value is estimated below the CRDL, but greater than the IDL

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TABLE 4-16
SITE 6 LOT 203 SURFACE SOIL
POSITIVE DETECTION SUMMARY
REMEDIAL INVESTIGATION CTO-0133
MCB CAMP LEJEUNE, NORTH CAROLINA
TOTAL METALS

	Sample No:	6-203OSA-SB29-00		6-203OSA-SB30-00		6-203OSA-SB31-00		6-203OSA-SB32-00		6-203OSA-SB33-00		6-203OSA-SB34-00	
	Depth:	0 - 6"		0 - 6"		0 - 6"		0 - 6"		0 - 6"		0 - 6"	
	Date Sampled:	8/30/92		8/30/92		8/30/92		8/31/92		8/30/92		8/30/92	
	Lab Id:	00467-17		00467-20		00467-22		00467-24		00467-27		00467-29	
Parameter	Units												
ALUMINUM	MG/KG	898		3140		1740		4170		4170		1210	
ANTIMONY	MG/KG					13.5	J			17.9	J		
ARSENIC	MG/KG			1.8	B			0.6	B	0.77	JB	0.83	B
BARIUM	MG/KG			41.2		15.2	B	7.4	B	8.1	B	5.1	B
BERYLLIUM	MG/KG			0.21	B								
CADMIUM	MG/KG											0.6	B
CALCIUM	MG/KG	11700		1190		341	B	250	B	11000		4220	
CHROMIUM	MG/KG	1.8	JB	6.5	J	9.7	J	10.3	J	6.4	J	2.9	J
COBALT	MG/KG												
COPPER	MG/KG	1.1	B	38.6		44.2		44.2		3.2	B	4.4	B
IRON	MG/KG	1730		2990		2920		2750		2030		1470	
LEAD	MG/KG	5.6		60.7		75.9		64.3		11.7		20.2	
MAGNESIUM	MG/KG	251	B	153	B	91.7	B	131	B	275	B	96.8	B
MANGANESE	MG/KG	12		182		94.1		16.2	J	10.1		13.7	
MERCURY	MG/KG			0.3									
NICKEL	MG/KG					6.1	JB	5.7	JB				
POTASSIUM	MG/KG			176	B			133	B	195	B	79	B
SODIUM	MG/KG	25.2	B							35.9	B	18.3	B
VANADIUM	MG/KG	2.1	B	6.5	B	2.8	JB	4.7	B	6.8	B	2.7	B
ZINC	MG/KG	5.9		271		203		38		16.2		13.7	

MG/KG - microgram per kilogram
B - reported value is less than Contract Required Detection Limit (CRDL), but greater than Instrument Detection Limit (IDL)
J - value is estimated
JB - value is estimated below the CRDL, but greater than the IDL

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TABLE 4-16
SITE 6 LOT 203 SURFACE SOIL
POSITIVE DETECTION SUMMARY
REMEDIAL INVESTIGATION CTO-0133
MCB CAMP LEJEUNE, NORTH CAROLINA
TOTAL METALS

Sample No:		6-203OSA-SB35-00	6-203OSA-SB36-00	6-203OSA-SB37-00	6-203OSA-SB38-00	6-203OSA-SB39-00	6-203OSA-SB41-00
Depth:		0 - 6"	0 - 6"	0 - 6"	0 - 6"	0 - 6"	0 - 6"
Date Sampled:		8/30/92	8/30/92	8/31/92	10/12/92	10/12/92	10/12/92
Lab Id:		00467-31	00467-33	00467-36	00573-01	00573-03	00573-06
Parameter	Units						
ALUMINUM	MG/KG	511	495	2360	2210	1880	2220
ANTIMONY	MG/KG					51.2	
ARSENIC	MG/KG	0.49 JB	0.74 JB		1.9	2.7	0.66 B
BARIUM	MG/KG			6.2 B	47.8	17.1 B	6.7 B
BERYLLIUM	MG/KG						
CADMIUM	MG/KG	0.59 B			9.3		
CALCIUM	MG/KG	3150	44.4 B	352 B	18800	92100	11400
CHROMIUM	MG/KG	2.3 J		4.1 J	25.2	11.2	
COBALT	MG/KG						
COPPER	MG/KG	12.9	1.6 B	10.5	75	37	6.5
IRON	MG/KG	458	241	1400	12900	3920	2010
LEAD	MG/KG	22.7	7.4	10.3	630	4010 J	17.1
MAGNESIUM	MG/KG	71.8 B	12 B	67.3 B	698 B	1680	227 B
MANGANESE	MG/KG	15.3	3.7	14.8 J	154	43.9	34.7
MERCURY	MG/KG				1.1	0.03 B	
NICKEL	MG/KG						
POTASSIUM	MG/KG						
SODIUM	MG/KG	9.2 B			460 JB	284 JB	90.7 JB
VANADIUM	MG/KG	1.1 B		3.7 B		8.2 JB	
ZINC	MG/KG	39.9	6.4	26	604	124	47

MG/KG - microgram per kilogram
B - reported value is less than Contract Required Detection Limit (CRDL), but greater than Instrument Detection Limit (IDL)
J - value is estimated
JB - value is estimated below the CRDL, but greater than the IDL

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TABLE 4-16
SITE 6 LOT 203 SURFACE SOIL
POSITIVE DETECTION SUMMARY
REMEDIAL INVESTIGATION CTO-0133
MCB CAMP LEJEUNE, NORTH CAROLINA
TOTAL METALS

	Sample No:	6-203OSA-SB42-00	6-203PCB-SB12-00	6-203PCB-SB14-00
	Depth:	0 - 6"	0 - 6"	0 - 6"
	Date Sampled:	10/12/92	9/01/92	8/31/92
	Lab Id:	00573-09	00472-05	00472-08
Parameter	Units			
ALUMINUM	MG/KG	2760	2660 J	1520 J
ANTIMONY	MG/KG			
ARSENIC	MG/KG			
BARIUM	MG/KG	7.4 B	5 B	7.9 B
BERYLLIUM	MG/KG			
CADMIUM	MG/KG			
CALCIUM	MG/KG	3520		1260
CHROMIUM	MG/KG		3.5	1.7 B
COBALT	MG/KG			
COPPER	MG/KG		1 JB	1.4 JB
IRON	MG/KG	1270	1040 J	756 J
LEAD	MG/KG	7.2	5.1	18.9 J
MAGNESIUM	MG/KG	105 B	56.1 B	60.1 B
MANGANESE	MG/KG	5.5	1.9 JB	9.3 J
MERCURY	MG/KG			
NICKEL	MG/KG			
POTASSIUM	MG/KG			
SODIUM	MG/KG			
VANADIUM	MG/KG		3.7 B	2.6 JB
ZINC	MG/KG	14.4		10.8

MG/KG - microgram per kilogram
B - reported value is less than Contract Required Detection Limit (CRDL), but greater than Instrument Detection Limit (IDL)
J - value is estimated
JB - value is estimated below the CRDL, but greater than the IDL

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TABLE 4-17
SITE 6 LOT 203 SUBSURFACE SOIL
POSITIVE DETECTION SUMMARY
REMEDIAL INVESTIGATION CTO-0133
MCB CAMP LEJEUNE, NORTH CAROLINA
ORGANICS

	Sample No:	6-203DDT-SB10-01	6-203DDT-SB2-01	6-203DDT-SB26-04	6-203OSA-SB21-02	6-203OSA-SB22-02	6-203OSA-SB23-02
	Depth:	1 - 3'	1 - 3'	5 - 7'	3 - 5'	3 - 5'	3 - 5'
	Date Sampled:	9/9/92	9/9/92	9/10/92	8/30/92	8/31/92	8/30/92
	Lab Id:	00496-15	00496-12	00502-25	00467-02	00467-04	00467-06
Parameter	Units						
PESTICIDE/PCBS							
DELTA-BHC	UG/KG						
ALDRIN	UG/KG		4.6 J				
HEPTACHLOR EPOXIDE	UG/KG		6.4 J				
DIELDRIN	UG/KG					220 J	
4,4'-DDE	UG/KG						8.9 J
4,4'-DDD	UG/KG						
4,4'-DDT	UG/KG					300 J	6.9
METHOXYCHLOR	UG/KG					1100 J	
GAMMA CHLORDANE	UG/KG					140 J	
PCB-1260	UG/KG					29000 J	
VOLATILES							
ACETONE	UG/KG						
SEMIVOLATILES							
1,4-DICHLOROBENZENE	UG/KG						
1,2-DICHLOROBENZENE	UG/KG						
NAPHTHALENE	UG/KG						
2-METHYLNAPHTHALENE	UG/KG					1300	
ACENAPHTHENE	UG/KG					3200	
DIBENZOFURAN	UG/KG					3500	
FLUORENE	UG/KG					5100	
PHENANTHRENE	UG/KG					8700	
ANTHRACENE	UG/KG					5700	
FLUORANTHENE	UG/KG					5000	
CARBAZOLE	UG/KG					4300	
PYRENE	UG/KG					3600	
BENZO(A)ANTHRACENE	UG/KG					1000 J	
CHRYSENE	UG/KG					1000 J	
BIS(2-ETHYLHEXYL)PHTHALATE	UG/KG	240 J		100 J	140 J		77 J
BENZO(B)FLUORANTHENE	UG/KG					500 J	
BENZO(K)FLUORANTHENE	UG/KG					170 J	
BENZO(A)PYRENE	UG/KG					210 J	

UG/KG - microgram per kilogram
J - value is estimated

TABLE 4-17
SITE 6 LOT 203 SUBSURFACE SOIL
POSITIVE DETECTION SUMMARY
REMEDIAL INVESTIGATION CTO-0133
MCB CAMP LEJEUNE, NORTH CAROLINA
ORGANICS

Sample No:		6-203OSA-SB24-01	6-203OSA-SB26-01	6-203OSA-SB28-03	6-203OSA-SB30-01	6-203OSA-SB34-01	6-203OSA-SB35-02
Depth:		1 - 3'	1 - 3'	5 - 7'	1 - 3'	1 - 3'	3 - 5'
Date Sampled:		8/30/92	8/30/92	8/30/92	8/30/92	8/30/92	8/30/92
Lab Id:		00467-08	00467-12	00467-16	00467-21	00467-30	00467-32
Parameter	Units						
PESTICIDE/PCBS							
DELTA-BHC	UG/KG						
ALDRIN	UG/KG						
HEPTACHLOR EPOXIDE	UG/KG						
DIELDRIN	UG/KG				32 J	4.4	
4,4'-DDE	UG/KG				470	4.9 J	24
4,4'-DDD	UG/KG			430 J	37 J		
4,4'-DDT	UG/KG				280		18
METHOXYCHLOR	UG/KG						
GAMMA CHLORDANE	UG/KG						
PCB-1260	UG/KG	72					
VOLATILES							
ACETONE	UG/KG						120 J
SEMIVOLATILES							
1,4-DICHLOROBENZENE	UG/KG						
1,2-DICHLOROBENZENE	UG/KG						
NAPHTHALENE	UG/KG						
2-METHYLNAPHTHALENE	UG/KG						
ACENAPHTHENE	UG/KG						
DIBENZOFURAN	UG/KG						
FLUORENE	UG/KG						
PHENANTHRENE	UG/KG						
ANTHRACENE	UG/KG						
FLUORANTHENE	UG/KG						
CARBAZOLE	UG/KG						
PYRENE	UG/KG						
BENZO(A)ANTHRACENE	UG/KG						
CHRYSENE	UG/KG						
BIS(2-ETHYLHEXYL)PHTHALATE	UG/KG		140 J				
BENZO(B)FLUORANTHENE	UG/KG						
BENZO(K)FLUORANTHENE	UG/KG						
BENZO(A)PYRENE	UG/KG						

UG/KG - microgram per kilogram
J - value is estimated

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TABLE 4-17
SITE 6 LOT 203 SUBSURFACE SOIL
POSITIVE DETECTION SUMMARY
REMEDIAL INVESTIGATION CTO-0133
MCB CAMP LEJEUNE, NORTH CAROLINA
ORGANICS

Sample No:		6-203OSA-SB38-01	6-203OSA-SB41-01	6-203OSA-SB41-04	6-203PCB-SB12-03	6-203PCB-SB3-01	6-GW11-01
Depth:		1 - 3'	1 - 3'	7 - 11'	5 - 7'	1 - 3'	2 - 4'
Date Sampled:		10/12/92	10/12/92	10/12/92	9/1/92	9/2/92	10/10/92
Lab Id:		00573-02	00573-07	00573-08	00472-06	00484-07	00570-15
Parameter	Units						
PESTICIDE/PCBS							
DELTA-BHC	UG/KG		4.9 J				
ALDRIN	UG/KG						
HEPTACHLOR EPOXIDE	UG/KG						
DIELDRIN	UG/KG		17 J				
4,4'-DDE	UG/KG			12			
4,4'-DDD	UG/KG		21 J	31			
4,4'-DDT	UG/KG	6.9 J					3.6 J
METHOXYCHLOR	UG/KG						
GAMMA CHLORDANE	UG/KG						
PCB-1260	UG/KG					20 J	
VOLATILES							
ACETONE	UG/KG	6 J	130	26			
SEMIVOLATILES							
1,4-DICHLOROBENZENE	UG/KG				34 J		
1,2-DICHLOROBENZENE	UG/KG		200 J				
NAPHTHALENE	UG/KG		1500 J	380			78 J
2-METHYLNAPHTHALENE	UG/KG		2400 J	70 J			160 J
ACENAPHTHENE	UG/KG		7700 J				
DIBENZOFURAN	UG/KG		920 J				63 J
FLUORENE	UG/KG		810 J				
PHENANTHRENE	UG/KG						120 J
ANTHRACENE	UG/KG						
FLUORANTHENE	UG/KG						
CARBAZOLE	UG/KG		690 J				
PYRENE	UG/KG						
BENZO(A)ANTHRACENE	UG/KG						
CHRYSENE	UG/KG						
BIS(2-ETHYLHEXYL)PHTHALATE	UG/KG			200 J			
BENZO(B)FLUORANTHENE	UG/KG						
BENZO(K)FLUORANTHENE	UG/KG						
BENZO(A)PYRENE	UG/KG						

UG/KG - microgram per kilogram
J - value is estimated

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TABLE 4-17
SITE 6 LOT 203 SUBSURFACE SOIL
POSITIVE DETECTION SUMMARY
REMEDIAL INVESTIGATION CTO-0133
MCB CAMP LEJEUNE, NORTH CAROLINA
ORGANICS

	Sample No:	6-GW15-02	6-GW23-02	6-GW23-04
	Depth:	4 - 6'	4 - 6'	8 - 10'
	Date Sampled:	10/11/92	10/12/92	10/12/92
	Lab Id:	00570-17	00570-32	00570-33
Parameter	Units			
PESTICIDE/PCBS				
DELTA-BHC	UG/KG			
ALDRIN	UG/KG			
HEPTACHLOR EPOXIDE	UG/KG			
DIELDRIN	UG/KG			
4,4'-DDE	UG/KG			
4,4'-DDD	UG/KG			
4,4'-DDT	UG/KG			
METHOXYCHLOR	UG/KG			
GAMMA CHLORDANE	UG/KG			
PCB-1260	UG/KG			
VOLATILES				
ACETONE	UG/KG	21	29	150 J
SEMIVOLATILES				
1,4-DICHLOROBENZENE	UG/KG			
1,2-DICHLOROBENZENE	UG/KG			
NAPHTHALENE	UG/KG			
2-METHYLNAPHTHALENE	UG/KG			
ACENAPHTHENE	UG/KG			
DIBENZOFURAN	UG/KG			
FLUORENE	UG/KG			
PHENANTHRENE	UG/KG			
ANTHRACENE	UG/KG			
FLUORANTHENE	UG/KG			
CARBAZOLE	UG/KG			
PYRENE	UG/KG			
BENZO(A)ANTHRACENE	UG/KG			
CHRYSENE	UG/KG			
BIS(2-ETHYLHEXYL)PHTHALATE	UG/KG			
BENZO(B)FLUORANTHENE	UG/KG			
BENZO(K)FLUORANTHENE	UG/KG			
BENZO(A)PYRENE	UG/KG			

UG/KG - microgram per kilogram
J - value is estimated

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TABLE 4-18
SITE 6 LOT 203 SUBSURFACE SOILS
POSITIVE DETECTION SUMMARY
REMEDIAL INVESTIGATION CTO-0133
MCB CAMP LEJEUNE, NORTH CAROLINA
TOTAL METALS

Sample No:		6-203DDT-SB10-01	6-203DDT-SB24-02	6-203DDT-SB24-03	6-203DDT-SB26-04	6-203DDT-SB8-01	6-203OSA-SB21-02
Depth:		1 - 3'	3 - 5'	5 - 7'	5 - 7'	1 - 3'	3 - 5'
Date Sampled:		9/9/92	9/10/92	9/10/92	9/10/92	9/9/92	8/30/92
Lab Id:		00496-15	00502-21	00502-22	00502-25	00496-04	00467-02
Parameter	Units						
ALUMINUM	MG/KG	2750	3700	1710	5330	3680	3900
ANTIMONY	MG/KG						
ARSENIC	MG/KG	1.1 JB				0.78 JB	1.4 B
BARIUM	MG/KG	8.9 B	5.8 JB		7.2 JB	5.8 B	5.6 B
BERYLLIUM	MG/KG				0.1 B		
CADMIUM	MG/KG		0.62 JB			0.65 JB	
CALCIUM	MG/KG		63.3 JB		109 JB	330 B	314 B
CHROMIUM	MG/KG	3.4	4.1	1.7 B	4.1	3.7	4.9 J
COBALT	MG/KG					0.53 JB	
COPPER	MG/KG						
IRON	MG/KG	1090	1180	401	1080	665	2170
LEAD	MG/KG	2.4	2.7	2.6	3.7	2.9	3
MAGNESIUM	MG/KG	99.4 B	101 B	54.2 B	144 B	61.3 B	103 B
MANGANESE	MG/KG	2.2 B	1.4 JB	1.2 JB	2.2 JB	1.9 B	
MERCURY	MG/KG						
NICKEL	MG/KG				4.6 JB	1.5 JB	
POTASSIUM	MG/KG	115 B	103 JB	78.2 JB	121 JB	81.6 B	131 B
SELENIUM	MG/KG						
SODIUM	MG/KG		43.7 JB		32.5 JB		
THALLIUM	MG/KG						
VANADIUM	MG/KG	3.7 JB	5.2 JB	1.4 JB	5.1 JB	3.1 JB	7.8 B
ZINC	MG/KG		9.1				1.6 B

MG/KG - milligram per kilogram
B - reported value is less than Contract Required Detection Limit (CRDL), but greater than Instrument Detection Limit (IDL)
J - value is estimated
JB - value is estimated below the CRDL, but greater than the IDL

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TABLE 4-18
SITE 6 LOT 203 SUBSURFACE SOILS
POSITIVE DETECTION SUMMARY
REMEDIAL INVESTIGATION CTO-0133
MCB CAMP LEJEUNE, NORTH CAROLINA
TOTAL METALS

Sample No:		6-203OSA-SB22-02	6-203OSA-SB23-02	6-203OSA-SB24-01	6-203OSA-SB25-03	6-203OSA-SB26-01	6-203OSA-SB27-01
Depth:		3 - 5'	3 - 5'	1 - 3'	5 - 7'	1 - 3'	1 - 3'
Date Sampled:		8/31/92	8/30/92	8/30/92	8/30/92	8/30/92	8/31/92
Lab Id:		00467-04	00467-06	00467-08	00467-10	00467-12	00467-14
Parameter	Units						
ALUMINUM	MG/KG	292	4180	3980	4060	2370	3520
ANTIMONY	MG/KG						
ARSENIC	MG/KG		1.2 B	1 B	1 B	0.86 B	1.6 B
BARIUM	MG/KG		7.3 B	5.1 B		4.9 B	
BERYLLIUM	MG/KG						
CADMIUM	MG/KG						
CALCIUM	MG/KG	67.1 B	565 B	679 B	332 B	579 B	202 B
CHROMIUM	MG/KG	1.2 JB	4.6 J	4.7 J	5.6 J	3.5 J	6 J
COBALT	MG/KG						
COPPER	MG/KG						
IRON	MG/KG	1180	1260	2270	585	1080	548
LEAD	MG/KG	5.1	4.4	3.3	3.4	3.3	2.3
MAGNESIUM	MG/KG	9.1 B	130 B	123 B	76.3 B	79.3 B	63.8 B
MANGANESE	MG/KG		2.9 JB	7.2 J		2.7 JB	
MERCURY	MG/KG						
NICKEL	MG/KG						
POTASSIUM	MG/KG		90.6 B	110 B	105 B	73.3 B	
SELENIUM	MG/KG						
SODIUM	MG/KG						
THALLIUM	MG/KG						
VANADIUM	MG/KG	4.1 B	5.2 B	6.8 B	2.8 JB	4.1 B	3.1 JB
ZINC	MG/KG	1.6 B	3.6 B	7.9	1.4 B	1.8 B	2 B

MG/KG - milligram per kilogram
B - reported value is less than Contract Required Detection Limit (CRDL), but greater than Instrument Detection Limit (IDL)
J - value is estimated
JB - value is estimated below the CRDL, but greater than the IDL

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TABLE 4-18
SITE 6 LOT 203 SUBSURFACE SOILS
POSITIVE DETECTION SUMMARY
REMEDIAL INVESTIGATION CTO-0133
MCB CAMP LEJEUNE, NORTH CAROLINA
TOTAL METALS

	Sample No:	6-203OSA-SB28-03	6-203OSA-SB29-02	6-203OSA-SB30-01	6-203OSA-SB31-01	6-203OSA-SB32-02	6-203OSA-SB33-02
	Depth:	5 - 7'	3 - 5'	1 - 3'	1 - 3'	3 - 5'	3 - 5'
	Date Sampled:	8/30/92	8/30/92	8/30/92	8/30/92	8/31/92	8/30/92
	Lab Id:	00467-16	00467-18	00467-21	00467-23	00467-25	00467-28
Parameter	Units						
ALUMINUM	MG/KG	957	1550	4780	4990	1970 J	3940
ANTIMONY	MG/KG						
ARSENIC	MG/KG			3.9 J	0.91 B		0.95 B
BARIUM	MG/KG			54.4	6.1 B		7.9 B
BERYLLIUM	MG/KG						
CADMIUM	MG/KG			0.92 B			
CALCIUM	MG/KG	840	109 B	1020	65 B		1040
CHROMIUM	MG/KG	1.6 JB	1.4 JB	7.2 J	4.4 J	2.1 J	5.2 J
COBALT	MG/KG						
COPPER	MG/KG			187			
IRON	MG/KG	622	847	2200	632	289 J	1800
LEAD	MG/KG	1.6	1.5	111	4.1	2.5	2.7
MAGNESIUM	MG/KG	46.1 B	35.5 B	112 B	128 B	21.6 B	69.9 B
MANGANESE	MG/KG	3.3 J		113	2 B	0.67 B	
MERCURY	MG/KG			0.97 J			
NICKEL	MG/KG						
POTASSIUM	MG/KG			88.2 B	132 B		
SELENIUM	MG/KG						
SODIUM	MG/KG			18.5 B	13.5 B		
THALLIUM	MG/KG						
VANADIUM	MG/KG	2.1 JB	2.8 JB	8.1 B	4.1 B	0.99 B	7.3 B
ZINC	MG/KG	3.7	1.4 B	321	1.6 B	0.78 B	2 B

MG/KG - milligram per kilogram
B - reported value is less than Contract Required Detection Limit (CRDL), but greater than Instrument Detection Limit (IDL)
J - value is estimated
JB - value is estimated below the CRDL, but greater than the IDL

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TABLE 4-18
SITE 6 LOT 203 SUBSURFACE SOILS
POSITIVE DETECTION SUMMARY
REMEDIAL INVESTIGATION CTO-0133
MCB CAMP LEJEUNE, NORTH CAROLINA
TOTAL METALS

	Sample No:	6-203OSA-SB34-01	6-203OSA-SB35-02	6-203OSA-SB36-02	6-203OSA-SB37-02	6-203OSA-SB38-01	6-203OSA-SB39-04
	Depth:	1 - 3'	3 - 5'	3 - 5'	3 - 5'	1 - 3'	8 - 10'
	Date Sampled:	8/30/92	8/30/92	8/30/92	8/31/92	10/12/92	10/12/92
	Lab Id:	00467-30	00467-32	00467-34	00467-37	00573-02	00573-05
Parameter	Units						
ALUMINUM	MG/KG	4450	2330	3010	1840	879	1570
ANTIMONY	MG/KG						
ARSENIC	MG/KG	1.2 B		1.3 B			
BARIUM	MG/KG	21 B	7.6 B	4.3 B			
BERYLLIUM	MG/KG						
CADMIUM	MG/KG						
CALCIUM	MG/KG	494 B	221 B		196 B	184 B	675 B
CHROMIUM	MG/KG	9.7 J	3.3 J	4.5 J	3.8 J		
COBALT	MG/KG						
COPPER	MG/KG		8.2 J		1.2 B		
IRON	MG/KG	2800	992	647	419	445	536
LEAD	MG/KG	6.7	27.7 J	2.3	2.9	21.9	1.5
MAGNESIUM	MG/KG	117 B	45.1 B	79 B	30.2 B		
MANGANESE	MG/KG	12.5 J	21.9		2.7 B		
MERCURY	MG/KG						
NICKEL	MG/KG						
POTASSIUM	MG/KG	138 B		164 B			
SELENIUM	MG/KG						
SODIUM	MG/KG						
THALLIUM	MG/KG						
VANADIUM	MG/KG	7.9 B	2.8 JB	5.9 B	1.3 B		
ZINC	MG/KG	35	89.8	1.9 B	2.1 B		

MG/KG - milligram per kilogram
B - reported value is less than Contract Required Detection Limit (CRDL), but greater than Instrument Detection Limit (IDL)
J - value is estimated
JB - value is estimated below the CRDL, but greater than the IDL

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TABLE 4-18
SITE 6 LOT 203 SUBSURFACE SOILS
POSITIVE DETECTION SUMMARY
REMEDIAL INVESTIGATION CTO-0133
MCB CAMP LEJEUNE, NORTH CAROLINA
TOTAL METALS

Sample No:		6-203OSA-SB41-01	6-203OSA-SB41-04	6-203PCB-SB12-03	6-203PCB-SB14-02	6-203PCB-SB14-04	6-GW11-01
Depth:		1 - 3'	7 - 11'	5 - 7'	3 - 5'	7 - 9'	2 - 4'
Date Sampled:		10/12/92	10/12/92	9/01/92	8/31/92	8/31/92	10/10/92
Lab Id:		00573-07	00573-08	00472-06	00472-09	00472-10	00570-15
Parameter	Units						
ALUMINUM	MG/KG	3880	1690	3140 J	3800 J	2920 J	2600
ANTIMONY	MG/KG						
ARSENIC	MG/KG	23.9					1.4 JB
BARIUM	MG/KG	103	12.5 B	3.9 B	6 B		
BERYLLIUM	MG/KG	2.7 J					0.06 B
CADMIUM	MG/KG	5.4					
CALCIUM	MG/KG	940 B	2560		389 B	265 B	479 B
CHROMIUM	MG/KG	42.9		6.1	5.8	5.5	3.4
COBALT	MG/KG						
COPPER	MG/KG	339		0.66 JB		4.3 JB	
IRON	MG/KG	26000	1150	794 J	630 J	505 J	4900
LEAD	MG/KG	35.9	9	2.1	2.2		2.6
MAGNESIUM	MG/KG	226 B	317 B	90.9 B	118 B	146 B	39.3 B
MANGANESE	MG/KG	22	19.2	2.2 JB	4.5 J	2.5 JB	4.3
MERCURY	MG/KG	0.13 B	3				
NICKEL	MG/KG	20.5					
POTASSIUM	MG/KG	708 B		112 B	134 B	99.3 B	32.3 B
SELENIUM	MG/KG	5.7					
SODIUM	MG/KG	883 JB					
THALLIUM	MG/KG	0.54 JB					
VANADIUM	MG/KG	15.3 J		4.7 B	3.5 JB	2.3 JB	7.1 B
ZINC	MG/KG	330	367				

MG/KG - milligram per kilogram
B - reported value is less than Contract Required Detection Limit (CRDL), but greater than Instrument Detection Limit (IDL)
J - value is estimated
JB - value is estimated below the CRDL, but greater than the IDL

CLEJ-01272-3.13-08/20/93

TABLE 4-18
SITE 6 LOT 203 SUBSURFACE SOILS
POSITIVE DETECTION SUMMARY
REMEDIAL INVESTIGATION CTO-0133
MCB CAMP LEJEUNE, NORTH CAROLINA
TOTAL METALS

Sample No:		6-GW11-02	6-GW15-02	6-GW15-03	6-GW23-02	6-GW23-04
Depth:		4 - 6'	4 - 6'	6 - 8'	4 - 6'	8 - 10'
Date Sampled:		10/10/92	10/11/92	10/11/92	10/12/92	10/12/92
Lab Id:		00570-16	00570-17	00570-18	00570-32	00570-33
Parameter	Units					
ALUMINUM	MG/KG	5360	338	2740	1690	640
ANTIMONY	MG/KG		2.8 JB			
ARSENIC	MG/KG	0.84 B				
BARIUM	MG/KG	6.2 JB		5.6 JB		
BERYLLIUM	MG/KG	0.08 B				
CADMIUM	MG/KG					
CALCIUM	MG/KG	565 B		351 B		
CHROMIUM	MG/KG	3.5	1.4 B	3.6	2.1 B	
COBALT	MG/KG					
COPPER	MG/KG					0.45 JB
IRON	MG/KG	994	627	906		
LEAD	MG/KG	3	1.2	3.2	2.1	1.5
MAGNESIUM	MG/KG	146 B		85.6 B	23.3 B	
MANGANESE	MG/KG	2.1 B	1.4 B	1.8 B		
MERCURY	MG/KG					
NICKEL	MG/KG	2.5 JB				
POTASSIUM	MG/KG	119 B	17 B	103 B	64.9 B	
SELENIUM	MG/KG					
SODIUM	MG/KG					
THALLIUM	MG/KG					
VANADIUM	MG/KG	4.4 B	1.5 B	2.9 B	1 B	0.41 B
ZINC	MG/KG					

MG/KG - milligram per kilogram
B - reported value is less than Contract Required Detection Limit (CRDL), but greater than Instrument Detection Limit (IDL)
J - value is estimated
JB - value is estimated below the CRDL, but greater than the IDL

CLEJ-01272-3.13-08/20/93

TABLE 4-19
WOODED AREAS, THE RAVINE AND SITE 82 SURFACE SOIL
POSITIVE DETECTION SUMMARY
REMEDIAL INVESTIGATION CTO-0133
MCB CAMP LEJEUNE, NORTH CAROLINA
ORGANICS

Sample No:		6-201E-SB1-00	6-201E-SB10-00	6-201E-SB11-00	6-201E-SB12-00
Depth:		0 - 6"	0 - 6"	0 - 6"	0 - 6"
Date Sampled:		9/11/92	9/12/92	9/12/92	9/13/92
Lab Id:		00507-01	00507-20	00507-23	00510-01
Parameter	Units				
PESTICIDE/PCBS					
DIELDRIN	UG/KG				
4,4'-DDE	UG/KG				130
ENDRIN	UG/KG				
4,4'-DDD	UG/KG				
4,4'-DDT	UG/KG				200
ALPHA CHLORDANE	UG/KG				
PCB-1260	UG/KG				2500
VOLATILES					
CHLOROMETHANE	UG/KG				
BROMOMETHANE	UG/KG				
ACETONE	UG/KG				
1,2-DICHLOROETHENE	UG/KG				
1,1,1-TRICHLOROETHANE	UG/KG				
TRICHLOROETHENE	UG/KG				
BENZENE	UG/KG				
TETRACHLOROETHENE	UG/KG				
1,1,2,2-TETRACHLOROETHANE	UG/KG				
TOLUENE	UG/KG				
STYRENE	UG/KG				
SEMIVOLATILES					
PHENOL	UG/KG				
1,4-DICHLOROBENZENE	UG/KG	54 J	52 J	47 J	
4-METHYLPHENOL	UG/KG				
NAPHTHALENE	UG/KG				
2-METHYLNAPHTHALENE	UG/KG				
ACENAPHTHYLENE	UG/KG				
ACENAPHTHENE	UG/KG				
DIBENZOFURAN	UG/KG				
FLUORENE	UG/KG				
PHENANTHRENE	UG/KG				
ANTHRACENE	UG/KG				
FLUORANTHENE	UG/KG				
CARBAZOLE	UG/KG				
PYRENE	UG/KG				
BUTYL BENZYL PHTHALATE	UG/KG				
BENZO(A)ANTHRACENE	UG/KG				
CHRYSENE	UG/KG				
BIS(2-ETHYLHEXYL)PHTHALATE	UG/KG	35 J			
DI-N-OCTYL PHTHALATE	UG/KG				
BENZO(B)FLUORANTHENE	UG/KG				
BENZO(K)FLUORANTHENE	UG/KG				
BENZO(A)PYRENE	UG/KG				
INDENO(1,2,3-CD) PYRENE	UG/KG				
DIBENZ(A,H)ANTHRACENE	UG/KG				
BENZO(G,H,I)PERYLENE	UG/KG				

UG/KG - microgram per kilogram
J - value is estimated

TABLE 4-19
WOODED AREAS, THE RAVINE AND SITE 82 SURFACE SOIL
POSITIVE DETECTION SUMMARY
REMEDIAL INVESTIGATION CTO-0133
MCB CAMP LEJEUNE, NORTH CAROLINA
ORGANICS

	Sample No:	6-201E-SB13-00	6-201E-SB14-00	6-201E-SB15-00	6-201E-SB16-00
	Depth:	0 - 6"	0 - 6"	0 - 6"	0 - 6"
	Date Sampled:	9/13/92	9/13/92	9/13/92	9/13/92
	Lab Id:	00510-03	00510-06	00510-08	00510-10
Parameter	Units				
PESTICIDE/PCBS					
DIELDRIN	UG/KG			39 J	
4,4'-DDE	UG/KG			81 J	
ENDRIN	UG/KG			240 J	
4,4'-DDD	UG/KG				
4,4'-DDT	UG/KG		4.9 J	120 J	8.6
ALPHA CHLORDANE	UG/KG				
PCB-1260	UG/KG			26000 J	
VOLATILES					
CHLOROMETHANE	UG/KG				
BROMOMETHANE	UG/KG				
ACETONE	UG/KG				
1,2-DICHLOROETHENE	UG/KG				
1,1,1-TRICHLOROETHANE	UG/KG				
TRICHLOROETHENE	UG/KG				
BENZENE	UG/KG				
TETRACHLOROETHENE	UG/KG				
1,1,2,2-TETRACHLOROETHANE	UG/KG				
TOLUENE	UG/KG				
STYRENE	UG/KG				
SEMIVOLATILES					
PHENOL	UG/KG				
1,4-DICHLOROBENZENE	UG/KG	60 J			
4-METHYLPHENOL	UG/KG				
NAPHTHALENE	UG/KG				
2-METHYLNAPHTHALENE	UG/KG				
ACENAPHTHYLENE	UG/KG				
ACENAPHTHENE	UG/KG				36 J
DIBENZOFURAN	UG/KG				
FLUORENE	UG/KG				
PHENANTHRENE	UG/KG	46 J			230 J
ANTHRACENE	UG/KG				41 J
FLUORANTHENE	UG/KG				400
CARBAZOLE	UG/KG				
PYRENE	UG/KG				410
BUTYL BENZYL PHTHALATE	UG/KG				
BENZO(A)ANTHRACENE	UG/KG				210 J
CHRYSENE	UG/KG				140 J
BIS(2-ETHYLHEXYL)PHTHALATE	UG/KG				
DI-N-OCTYL PHTHALATE	UG/KG		40 J		
BENZO(B)FLUORANTHENE	UG/KG	68 J			240 J
BENZO(K)FLUORANTHENE	UG/KG	45 J			65 J
BENZO(A)PYRENE	UG/KG	67 J			150 J
INDENO(1,2,3-CD) PYRENE	UG/KG	45 J			
DIBENZ(A,H)ANTHRACENE	UG/KG				43 J
BENZO(G,H,I)PERYLENE	UG/KG	46 J			92 J

UG/KG - microgram per kilogram
J - value is estimated

TABLE 4-19
WOODED AREAS, THE RAVINE AND SITE 82 SURFACE SOIL
POSITIVE DETECTION SUMMARY
REMEDIAL INVESTIGATION CTO-0133
MCB CAMP LEJEUNE, NORTH CAROLINA
ORGANICS

	Sample No:	6-201E-SB17-00	6-201E-SB18-00	6-201E-SB19-00	6-201E-SB2-00
	Depth:	0 - 6"	0 - 6"	0 - 6"	0 - 6"
	Date Sampled:	9/13/92	9/13/92	9/15/92	9/11/92
	Lab Id:	00510-12	00510-14	00519-01	00507-03
Parameter	Units				
PESTICIDE/PCBS					
DIELDRIN	UG/KG				
4,4'-DDE	UG/KG			12	
ENDRIN	UG/KG				
4,4'-DDD	UG/KG				
4,4'-DDT	UG/KG			86 J	27 J
ALPHA CHLORDANE	UG/KG				
PCB-1260	UG/KG		150 J		
VOLATILES					
CHLOROMETHANE	UG/KG				
BROMOMETHANE	UG/KG				
ACETONE	UG/KG				
1,2-DICHLOROETHENE	UG/KG				
1,1,1-TRICHLOROETHANE	UG/KG				
TRICHLOROETHENE	UG/KG				
BENZENE	UG/KG				
TETRACHLOROETHENE	UG/KG				
1,1,2,2-TETRACHLOROETHANE	UG/KG				
TOLUENE	UG/KG				
STYRENE	UG/KG				
SEMIVOLATILES					
PHENOL	UG/KG				
1,4-DICHLOROBENZENE	UG/KG				
4-METHYLPHENOL	UG/KG				
NAPHTHALENE	UG/KG				
2-METHYLNAPHTHALENE	UG/KG				
ACENAPHTHYLENE	UG/KG			84 J	
ACENAPHTHENE	UG/KG				
DIBENZOFURAN	UG/KG				
FLUORENE	UG/KG				
PHENANTHRENE	UG/KG				
ANTHRACENE	UG/KG				
FLUORANTHENE	UG/KG			43 J	
CARBAZOLE	UG/KG				
PYRENE	UG/KG			110 J	
BUTYL BENZYL PHTHALATE	UG/KG				
BENZO(A)ANTHRACENE	UG/KG			60 J	
CHRYSENE	UG/KG			64 J	
BIS(2-ETHYLHEXYL)PHTHALATE	UG/KG				72 J
DI-N-OCTYL PHTHALATE	UG/KG				
BENZO(B)FLUORANTHENE	UG/KG			130 J	
BENZO(K)FLUORANTHENE	UG/KG			42 J	
BENZO(A)PYRENE	UG/KG			140 J	
INDENO(1,2,3-CD) PYRENE	UG/KG			140 J	
DIBENZ(A,H)ANTHRACENE	UG/KG				
BENZO(G,H,I)PERYLENE	UG/KG	40 J		310 J	

UG/KG - microgram per kilogram
J - value is estimated

TABLE 4-19
WOODED AREAS, THE RAVINE AND SITE 82 SURFACE SOIL
POSITIVE DETECTION SUMMARY
REMEDIAL INVESTIGATION CTO-0133
MCB CAMP LEJEUNE, NORTH CAROLINA
ORGANICS

	Sample No:	6-201E-SB20-00	6-201E-SB21-00	6-201E-SB3-00	6-201E-SB6-00
	Depth:	0 - 6"	0 - 6"	0 - 6"	0 - 6"
	Date Sampled:	9/15/92	9/15/92	9/11/92	9/12/92
	Lab Id:	00519-04	00519-16	00507-05	00507-12
Parameter	Units				
PESTICIDE/PCBS					
DIELDRIN	UG/KG				
4,4'-DDE	UG/KG	24 J			
ENDRIN	UG/KG				
4,4'-DDD	UG/KG				
4,4'-DDT	UG/KG	17 J			7.9 J
ALPHA CHLORDANE	UG/KG				
PCB-1260	UG/KG		290		
VOLATILES					
CHLOROMETHANE	UG/KG				
BROMOMETHANE	UG/KG				
ACETONE	UG/KG				
1,2-DICHLOROETHENE	UG/KG				
1,1,1-TRICHLOROETHANE	UG/KG				
TRICHLOROETHENE	UG/KG				
BENZENE	UG/KG				
TETRACHLOROETHENE	UG/KG				
1,1,2,2-TETRACHLOROETHANE	UG/KG				
TOLUENE	UG/KG				
STYRENE	UG/KG				
SEMIVOLATILES					
PHENOL	UG/KG				
1,4-DICHLOROBENZENE	UG/KG				
4-METHYLPHENOL	UG/KG				
NAPHTHALENE	UG/KG				
2-METHYLNAPHTHALENE	UG/KG				
ACENAPHTHYLENE	UG/KG				
ACENAPHTHENE	UG/KG				
DIBENZOFURAN	UG/KG				
FLUORENE	UG/KG				
PHENANTHRENE	UG/KG				
ANTHRACENE	UG/KG				
FLUORANTHENE	UG/KG				
CARBAZOLE	UG/KG				
PYRENE	UG/KG				
BUTYL BENZYL PHTHALATE	UG/KG				
BENZO(A)ANTHRACENE	UG/KG				
CHRYSENE	UG/KG				
BIS(2-ETHYLHEXYL)PHTHALATE	UG/KG			66 J	52 J
DI-N-OCTYL PHTHALATE	UG/KG				
BENZO(B)FLUORANTHENE	UG/KG				
BENZO(K)FLUORANTHENE	UG/KG				
BENZO(A)PYRENE	UG/KG				
INDENO(1,2,3-CD) PYRENE	UG/KG				
DIBENZ(A,H)ANTHRACENE	UG/KG				
BENZO(G,H,I)PERYLENE	UG/KG				

UG/KG - microgram per kilogram
J - value is estimated

TABLE 4-19
WOODED AREAS, THE RAVINE AND SITE 82 SURFACE SOIL
POSITIVE DETECTION SUMMARY
REMEDIAL INVESTIGATION CTO-0133
MCB CAMP LEJEUNE, NORTH CAROLINA
ORGANICS

	Sample No:	6-201E-SB7-00	6-201E-SB8-00	6-201E-SB9-00	6-201N-SB1-00
	Depth:	0 - 6"	0 - 6"	0 - 6"	0 - 6"
	Date Sampled:	9/12/92	9/12/92	9/12/92	9/11/92
	Lab Id:	00507-14	00507-16	00507-18	00502-01
Parameter	Units				
PESTICIDE/PCBS					
DIELDRIN	UG/KG				
4,4'-DDE	UG/KG	5 J		4.3 J	500
ENDRIN	UG/KG				
4,4'-DDD	UG/KG				
4,4'-DDT	UG/KG	5.6 J			280 J
ALPHA CHLORDANE	UG/KG				
PCB-1260	UG/KG			28 J	800
VOLATILES					
CHLOROMETHANE	UG/KG				
BROMOMETHANE	UG/KG				
ACETONE	UG/KG				
1,2-DICHLOROETHENE	UG/KG				
1,1,1-TRICHLOROETHANE	UG/KG				
TRICHLOROETHENE	UG/KG				
BENZENE	UG/KG				
TETRACHLOROETHENE	UG/KG				
1,1,2,2-TETRACHLOROETHANE	UG/KG				
TOLUENE	UG/KG				
STYRENE	UG/KG				
SEMIVOLATILES					
PHENOL	UG/KG				
1,4-DICHLOROBENZENE	UG/KG		58 J	57 J	
4-METHYLPHENOL	UG/KG				
NAPHTHALENE	UG/KG				
2-METHYLNAPHTHALENE	UG/KG				
ACENAPHTHYLENE	UG/KG				
ACENAPHTHENE	UG/KG				
DIBENZOFURAN	UG/KG				
FLUORENE	UG/KG				
PHENANTHRENE	UG/KG				130 J
ANTHRACENE	UG/KG				
FLUORANTHENE	UG/KG				380 J
CARBAZOLE	UG/KG				
PYRENE	UG/KG				390 J
BUTYL BENZYL PHTHALATE	UG/KG				
BENZO(A)ANTHRACENE	UG/KG				150 J
CHRYSENE	UG/KG				180 J
BIS(2-ETHYLHEXYL)PHTHALATE	UG/KG	150 J	60 J	53 J	
DI-N-OCTYL PHTHALATE	UG/KG				
BENZO(B)FLUORANTHENE	UG/KG				250 J
BENZO(K)FLUORANTHENE	UG/KG				81 J
BENZO(A)PYRENE	UG/KG				110 J
INDENO(1,2,3-CD) PYRENE	UG/KG				
DIBENZ(A,H)ANTHRACENE	UG/KG				
BENZO(G,H,I)PERYLENE	UG/KG				

UG/KG - microgram per kilogram
J - value is estimated

TABLE 4-19
WOODED AREAS, THE RAVINE AND SITE 82 SURFACE SOIL
POSITIVE DETECTION SUMMARY
REMEDIAL INVESTIGATION CTO-0133
MCB CAMP LEJEUNE, NORTH CAROLINA
ORGANICS

	Sample No:	6-201N-SB11-00	6-201N-SB12-00	6-201N-SB2-00	6-201N-SB3-00
	Depth:	0 - 6"	0 - 6"	0 - 6"	0 - 6"
	Date Sampled:	10/13/92	10/13/92	9/10/92	9/10/92
	Lab Id:	00573-11	00573-13	00502-04	00502-06
Parameter	Units				
PESTICIDE/PCBS					
DIELDRIN	UG/KG			14 J	
4,4'-DDE	UG/KG				2.2 J
ENDRIN	UG/KG				
4,4'-DDD	UG/KG				
4,4'-DDT	UG/KG			7.9 J	
ALPHA CHLORDANE	UG/KG				
PCB-1260	UG/KG				
VOLATILES					
CHLOROMETHANE	UG/KG				
BROMOMETHANE	UG/KG				
ACETONE	UG/KG	5 J	5 J		
1,2-DICHLOROETHENE	UG/KG				
1,1,1-TRICHLOROETHANE	UG/KG				
TRICHLOROETHENE	UG/KG				
BENZENE	UG/KG				
TETRACHLOROETHENE	UG/KG				
1,1,2,2-TETRACHLOROETHANE	UG/KG				
TOLUENE	UG/KG				
STYRENE	UG/KG				
SEMIVOLATILES					
PHENOL	UG/KG				
1,4-DICHLOROBENZENE	UG/KG				
4-METHYLPHENOL	UG/KG				
NAPHTHALENE	UG/KG				
2-METHYLNAPHTHALENE	UG/KG				
ACENAPHTHYLENE	UG/KG				
ACENAPHTHENE	UG/KG				
DIBENZOFURAN	UG/KG				
FLUORENE	UG/KG				
PHENANTHRENE	UG/KG				
ANTHRACENE	UG/KG				
FLUORANTHENE	UG/KG				
CARBAZOLE	UG/KG				
PYRENE	UG/KG				
BUTYL BENZYL PHTHALATE	UG/KG				
BENZO(A)ANTHRACENE	UG/KG				
CHRYSENE	UG/KG				
BIS(2-ETHYLHEXYL)PHTHALATE	UG/KG			98 J	82 J
DI-N-OCTYL PHTHALATE	UG/KG				
BENZO(B)FLUORANTHENE	UG/KG				
BENZO(K)FLUORANTHENE	UG/KG				
BENZO(A)PYRENE	UG/KG				
INDENO(1,2,3-CD) PYRENE	UG/KG				
DIBENZ(A,H)ANTHRACENE	UG/KG				
BENZO(G,H,I)PERYLENE	UG/KG				

UG/KG - microgram per kilogram
J - value is estimated

TABLE 4-19
WOODED AREAS, THE RAVINE AND SITE 82 SURFACE SOIL
POSITIVE DETECTION SUMMARY
REMEDIAL INVESTIGATION CTO-0133
MCB CAMP LEJEUNE, NORTH CAROLINA
ORGANICS

	Sample No:	6-201N-SB6-00	6-201N-SB7-00	6-201N-SB8-00	6-201N-SB9-00
	Depth:	0 - 6"	0 - 6"	0 - 6"	0 - 6"
	Date Sampled:	9/11/92	9/11/92	9/11/92	9/11/92
	Lab Id:	00502-12	00502-14	00502-16	00502-18
Parameter	Units				
PESTICIDE/PCBS					
DIELDRIN	UG/KG	82	61	25	8.4 J
4,4'-DDE	UG/KG				
ENDRIN	UG/KG				
4,4'-DDD	UG/KG				
4,4'-DDT	UG/KG			15	4.7 J
ALPHA CHLORDANE	UG/KG				
PCB-1260	UG/KG				
VOLATILES					
CHLOROMETHANE	UG/KG				
BROMOMETHANE	UG/KG				
ACETONE	UG/KG				14 J
1,2-DICHLOROETHENE	UG/KG				
1,1,1-TRICHLOROETHANE	UG/KG				
TRICHLOROETHENE	UG/KG				
BENZENE	UG/KG				
TETRACHLOROETHENE	UG/KG				
1,1,2,2-TETRACHLOROETHANE	UG/KG				
TOLUENE	UG/KG				
STYRENE	UG/KG				
SEMIVOLATILES					
PHENOL	UG/KG				
1,4-DICHLOROBENZENE	UG/KG	42 J			
4-METHYLPHENOL	UG/KG				
NAPHTHALENE	UG/KG				
2-METHYLNAPHTHALENE	UG/KG				
ACENAPHTHYLENE	UG/KG				
ACENAPHTHENE	UG/KG				
DIBENZOFURAN	UG/KG				
FLUORENE	UG/KG				
PHENANTHRENE	UG/KG				
ANTHRACENE	UG/KG				
FLUORANTHENE	UG/KG				
CARBAZOLE	UG/KG				
PYRENE	UG/KG				
BUTYL BENZYL PHTHALATE	UG/KG				
BENZO(A)ANTHRACENE	UG/KG				
CHRYSENE	UG/KG				
BIS(2-ETHYLHEXYL)PHTHALATE	UG/KG	65 J	47 J		200 J
DI-N-OCTYL PHTHALATE	UG/KG				
BENZO(B)FLUORANTHENE	UG/KG				
BENZO(K)FLUORANTHENE	UG/KG				
BENZO(A)PYRENE	UG/KG				
INDENO(1,2,3-CD) PYRENE	UG/KG				
DIBENZ(A,H)ANTHRACENE	UG/KG				
BENZO(G,H,I)PERYLENE	UG/KG				

UG/KG - microgram per kilogram
J - value is estimated

TABLE 4-19
WOODED AREAS, THE RAVINE AND SITE 82 SURFACE SOIL
POSITIVE DETECTION SUMMARY
REMEDIAL INVESTIGATION CTO-0133
MCB CAMP LEJEUNE, NORTH CAROLINA
ORGANICS

Sample No:		6-201S-SB1-00	6-201S-SB11-00	6-201S-SB12-00	6-201S-SB2-00
Depth:		0 - 6"	0 - 6"	0 - 6"	0 - 6"
Date Sampled:		9/15/92	9/13/92	9/13/92	9/15/92
Lab Id:		00519-07	00510-25	00511-01	00519-10
Parameter	Units				
PESTICIDE/PCBS					
DIELDRIN	UG/KG				
4,4'-DDE	UG/KG	170 J	16 J	24 J	4.4
ENDRIN	UG/KG				
4,4'-DDD	UG/KG	10 J			11
4,4'-DDT	UG/KG	150 J	13 J	9.3	5.5
ALPHA CHLORDANE	UG/KG				
PCB-1260	UG/KG				
VOLATILES					
CHLOROMETHANE	UG/KG				
BROMOMETHANE	UG/KG				
ACETONE	UG/KG				
1,2-DICHLOROETHENE	UG/KG				
1,1,1-TRICHLOROETHANE	UG/KG				
TRICHLOROETHENE	UG/KG				
BENZENE	UG/KG				
TETRACHLOROETHENE	UG/KG				
1,1,2,2-TETRACHLOROETHANE	UG/KG				
TOLUENE	UG/KG				
STYRENE	UG/KG				
SEMIVOLATILES					
PHENOL	UG/KG				
1,4-DICHLOROBENZENE	UG/KG				
4-METHYLPHENOL	UG/KG				
NAPHTHALENE	UG/KG				
2-METHYLNAPHTHALENE	UG/KG				
ACENAPHTHYLENE	UG/KG				
ACENAPHTHENE	UG/KG				
DIBENZOFURAN	UG/KG				
FLUORENE	UG/KG				
PHENANTHRENE	UG/KG				
ANTHRACENE	UG/KG				
FLUORANTHENE	UG/KG		59 J		
CARBAZOLE	UG/KG				
PYRENE	UG/KG		72 J		
BUTYL BENZYL PHTHALATE	UG/KG				
BENZO(A)ANTHRACENE	UG/KG				
CHRYSENE	UG/KG		47 J		
BIS(2-ETHYLHEXYL)PHTHALATE	UG/KG	59 J	85 J	70 J	
DI-N-OCTYL PHTHALATE	UG/KG				
BENZO(B)FLUORANTHENE	UG/KG		60 J		
BENZO(K)FLUORANTHENE	UG/KG				
BENZO(A)PYRENE	UG/KG				
INDENO(1,2,3-CD) PYRENE	UG/KG				
DIBENZ(A,H)ANTHRACENE	UG/KG				
BENZO(G,H,I)PERYLENE	UG/KG				

UG/KG - microgram per kilogram
J - value is estimated

TABLE 4-19
WOODED AREAS, THE RAVINE AND SITE 82 SURFACE SOIL
POSITIVE DETECTION SUMMARY
REMEDIAL INVESTIGATION CTO-0133
MCB CAMP LEJEUNE, NORTH CAROLINA
ORGANICS

	Sample No:	6-201S-SB3-00	6-201S-SB4-00	6-201S-SB5-00	6-201S-SB6-00
	Depth:	0 - 6"	0 - 6"	0 - 6"	0 - 6"
	Date Sampled:	9/15/92	9/15/92	9/14/92	9/14/92
	Lab Id:	00519-11	00519-13	00510-16	00510-18
Parameter	Units				
PESTICIDE/PCBS					
DIELDRIN	UG/KG				
4,4'-DDE	UG/KG	11 J	25 J	20	110 J
ENDRIN	UG/KG				
4,4'-DDD	UG/KG				
4,4'-DDT	UG/KG	9.1 J	16 J	20 J	80 J
ALPHA CHLORDANE	UG/KG				
PCB-1260	UG/KG				
VOLATILES					
CHLOROMETHANE	UG/KG				
BROMOMETHANE	UG/KG				
ACETONE	UG/KG				
1,2-DICHLOROETHENE	UG/KG				
1,1,1-TRICHLOROETHANE	UG/KG				
TRICHLOROETHENE	UG/KG				
BENZENE	UG/KG				
TETRACHLOROETHENE	UG/KG				
1,1,2,2-TETRACHLOROETHANE	UG/KG				
TOLUENE	UG/KG				
STYRENE	UG/KG				
SEMIVOLATILES					
PHENOL	UG/KG				
1,4-DICHLOROBENZENE	UG/KG			47 J	
4-METHYLPHENOL	UG/KG				
NAPHTHALENE	UG/KG				
2-METHYLNAPHTHALENE	UG/KG				
ACENAPHTHYLENE	UG/KG				
ACENAPHTHENE	UG/KG				
DIBENZOFURAN	UG/KG				
FLUORENE	UG/KG				
PHENANTHRENE	UG/KG				
ANTHRACENE	UG/KG				
FLUORANTHENE	UG/KG			41 J	
CARBAZOLE	UG/KG				
PYRENE	UG/KG				
BUTYL BENZYL PHTHALATE	UG/KG				
BENZO(A)ANTHRACENE	UG/KG				
CHRYSENE	UG/KG				
BIS(2-ETHYLHEXYL)PHTHALATE	UG/KG	53 J	78 J		
DI-N-OCTYL PHTHALATE	UG/KG				
BENZO(B)FLUORANTHENE	UG/KG				
BENZO(K)FLUORANTHENE	UG/KG				
BENZO(A)PYRENE	UG/KG				
INDENO(1,2,3-CD) PYRENE	UG/KG				
DIBENZ(A,H)ANTHRACENE	UG/KG				
BENZO(G,H,I)PERYLENE	UG/KG				

UG/KG - microgram per kilogram
J - value is estimated

TABLE 4-19
WOODED AREAS, THE RAVINE AND SITE 82 SURFACE SOIL
POSITIVE DETECTION SUMMARY
REMEDIAL INVESTIGATION CTO-0133
MCB CAMP LEJEUNE, NORTH CAROLINA
ORGANICS

Sample No:		6-201S-SB7-00	6-201S-SB8-00	6-203OSA-SB1-00	6-203OSA-SB12-00
Depth:		0 - 6"	0 - 6"	0 - 6"	0 - 6"
Date Sampled:		9/14/92	9/15/92	9/14/92	9/9/92
Lab Id:		00510-21	00519-15	00511-03	00496-17
Parameter	Units				
PESTICIDE/PCBS					
DIELDRIN	UG/KG				
4,4'-DDE	UG/KG	9.5 J	4200	470 J	15 J
ENDRIN	UG/KG				
4,4'-DDD	UG/KG		12000	150 J	
4,4'-DDT	UG/KG	7.7	6400	530 J	5.9 J
ALPHA CHLORDANE	UG/KG				
PCB-1260	UG/KG				
VOLATILES					
CHLOROMETHANE	UG/KG				620 J
BROMOMETHANE	UG/KG				670 J
ACETONE	UG/KG				
1,2-DICHLOROETHENE	UG/KG				
1,1,1-TRICHLOROETHANE	UG/KG				
TRICHLOROETHENE	UG/KG				
BENZENE	UG/KG				
TETRACHLOROETHENE	UG/KG				7000 J
1,1,2,2-TETRACHLOROETHANE	UG/KG				
TOLUENE	UG/KG				120 J
STYRENE	UG/KG				
SEMIVOLATILES					
PHENOL	UG/KG				
1,4-DICHLOROBENZENE	UG/KG				74 J
4-METHYLPHENOL	UG/KG				
NAPHTHALENE	UG/KG				
2-METHYLNAPHTHALENE	UG/KG				
ACENAPHTHYLENE	UG/KG				
ACENAPHTHENE	UG/KG				
DIBENZOFURAN	UG/KG				
FLUORENE	UG/KG				
PHENANTHRENE	UG/KG				
ANTHRACENE	UG/KG				
FLUORANTHENE	UG/KG			300 J	
CARBAZOLE	UG/KG				
PYRENE	UG/KG			270 J	
BUTYL BENZYL PHTHALATE	UG/KG			140 J	
BENZO(A)ANTHRACENE	UG/KG				
CHRYSENE	UG/KG				
BIS(2-ETHYLHEXYL)PHTHALATE	UG/KG	130 J	120 J	180 J	56 J
DI-N-OCTYL PHTHALATE	UG/KG				
BENZO(B)FLUORANTHENE	UG/KG		54 J	140 J	
BENZO(K)FLUORANTHENE	UG/KG				
BENZO(A)PYRENE	UG/KG				
INDENO(1,2,3-CD) PYRENE	UG/KG				
DIBENZ(A,H)ANTHRACENE	UG/KG				
BENZO(G,H,I)PERYLENE	UG/KG				

UG/KG - microgram per kilogram
J - value is estimated

TABLE 4-19
WOODED AREAS, THE RAVINE AND SITE 82 SURFACE SOIL
POSITIVE DETECTION SUMMARY
REMEDIAL INVESTIGATION CTO-0133
MCB CAMP LEJEUNE, NORTH CAROLINA
ORGANICS

	Sample No:	6-203OSA-SB13-00	6-203OSA-SB14-00	6-203OSA-SB15-00	6-203OSA-SB16-00
	Depth:	0 - 6"	0 - 6"	0 - 6"	0 - 6"
	Date Sampled:	9/13/92	9/13/92	9/11/92	9/11/92
	Lab Id:	00511-16	00511-19	00507-42	00507-45
Parameter	Units				
PESTICIDE/PCBS					
DIELDRIN	UG/KG	9.2 J	38 J	6.4	
4,4'-DDE	UG/KG	3.8 J			22
ENDRIN	UG/KG				
4,4'-DDD	UG/KG				
4,4'-DDT	UG/KG			5.8	18
ALPHA CHLORDANE	UG/KG				
PCB-1260	UG/KG				
VOLATILES					
CHLOROMETHANE	UG/KG				
BROMOMETHANE	UG/KG				
ACETONE	UG/KG				
1,2-DICHLOROETHENE	UG/KG				
1,1,1-TRICHLOROETHANE	UG/KG				
TRICHLOROETHENE	UG/KG				
BENZENE	UG/KG				
TETRACHLOROETHENE	UG/KG				
1,1,2,2-TETRACHLOROETHANE	UG/KG				
TOLUENE	UG/KG				
STYRENE	UG/KG				
SEMIVOLATILES					
PHENOL	UG/KG				
1,4-DICHLOROBENZENE	UG/KG				
4-METHYLPHENOL	UG/KG				
NAPHTHALENE	UG/KG				
2-METHYLNAPHTHALENE	UG/KG				
ACENAPHTHYLENE	UG/KG				
ACENAPHTHENE	UG/KG				
DIBENZOFURAN	UG/KG				
FLUORENE	UG/KG				
PHENANTHRENE	UG/KG				
ANTHRACENE	UG/KG				
FLUORANTHENE	UG/KG				380
CARBAZOLE	UG/KG				
PYRENE	UG/KG				470
BUTYL BENZYL PHTHALATE	UG/KG				
BENZO(A)ANTHRACENE	UG/KG				320 J
CHRYSENE	UG/KG				240 J
BIS(2-ETHYLHEXYL)PHTHALATE	UG/KG		53 J		
DI-N-OCTYL PHTHALATE	UG/KG				
BENZO(B)FLUORANTHENE	UG/KG				440
BENZO(K)FLUORANTHENE	UG/KG				110 J
BENZO(A)PYRENE	UG/KG				250 J
INDENO(1,2,3-CD) PYRENE	UG/KG				210 J
DIBENZ(A,H)ANTHRACENE	UG/KG				
BENZO(G,H,I)PERYLENE	UG/KG				

UG/KG - microgram per kilogram
J - value is estimated

TABLE 4-19
WOODED AREAS, THE RAVINE AND SITE 82 SURFACE SOIL
POSITIVE DETECTION SUMMARY
REMEDIAL INVESTIGATION CTO-0133
MCB CAMP LEJEUNE, NORTH CAROLINA
ORGANICS

	Sample No:	6-203OSA-SB17-00	6-203OSA-SB19-00	6-203OSA-SB2-00	6-203OSA-SB20-00
	Depth:	0 - 6"	0 - 6"	0 - 6"	0 - 6"
	Date Sampled:	9/9/92	9/13/92	9/13/92	9/13/92
	Lab Id:	00496-05	00511-21	00511-05	00511-23
Parameter	Units				
PESTICIDE/PCBS					
DIELDRIN	UG/KG				63 J
4,4'-DDE	UG/KG				41 J
ENDRIN	UG/KG				
4,4'-DDD	UG/KG				
4,4'-DDT	UG/KG	3.4 J			48 J
ALPHA CHLORDANE	UG/KG	3.6 J			
PCB-1260	UG/KG				
VOLATILES					
CHLOROMETHANE	UG/KG				
BROMOMETHANE	UG/KG				
ACETONE	UG/KG				
1,2-DICHLOROETHENE	UG/KG				
1,1,1-TRICHLOROETHANE	UG/KG				
TRICHLOROETHENE	UG/KG				
BENZENE	UG/KG				
TETRACHLOROETHENE	UG/KG				
1,1,2,2-TETRACHLOROETHANE	UG/KG				
TOLUENE	UG/KG				
STYRENE	UG/KG				
SEMIVOLATILES					
PHENOL	UG/KG				
1,4-DICHLOROBENZENE	UG/KG				
4-METHYLPHENOL	UG/KG				
NAPHTHALENE	UG/KG				
2-METHYLNAPHTHALENE	UG/KG				
ACENAPHTHYLENE	UG/KG				
ACENAPHTHENE	UG/KG				
DIBENZOFURAN	UG/KG				
FLUORENE	UG/KG				
PHENANTHRENE	UG/KG				
ANTHRACENE	UG/KG				
FLUORANTHENE	UG/KG				40 J
CARBAZOLE	UG/KG				
PYRENE	UG/KG				
BUTYL BENZYL PHTHALATE	UG/KG				
BENZO(A)ANTHRACENE	UG/KG				
CHRYSENE	UG/KG				
BIS(2-ETHYLHEXYL)PHTHALATE	UG/KG		48 J	87 J	
DI-N-OCTYL PHTHALATE	UG/KG				
BENZO(B)FLUORANTHENE	UG/KG				
BENZO(K)FLUORANTHENE	UG/KG				
BENZO(A)PYRENE	UG/KG				
INDENO(1,2,3-CD) PYRENE	UG/KG				
DIBENZ(A,H)ANTHRACENE	UG/KG				
BENZO(G,H,I)PERYLENE	UG/KG				

UG/KG - microgram per kilogram
J - value is estimated

TABLE 4-19
WOODED AREAS, THE RAVINE AND SITE 82 SURFACE SOIL
POSITIVE DETECTION SUMMARY
REMEDIAL INVESTIGATION CTO-0133
MCB CAMP LEJEUNE, NORTH CAROLINA
ORGANICS

	Sample No:	6-203OSA-SB3-00	6-203OSA-SB4-00	6-203OSA-SB5-00	6-203OSA-SB6-00
	Depth:	0 - 6"	0 - 6"	0 - 6"	0 - 6"
	Date Sampled:	9/12/92	9/12/92	9/11/92	9/10/92
	Lab Id:	00507-28	00507-32	00507-35	00496-16
Parameter	Units				
PESTICIDE/PCBS					
DIELDRIN	UG/KG				
4,4'-DDE	UG/KG	4.1			
ENDRIN	UG/KG				
4,4'-DDD	UG/KG				
4,4'-DDT	UG/KG	11 J			
ALPHA CHLORDANE	UG/KG				
PCB-1260	UG/KG				
VOLATILES					
CHLOROMETHANE	UG/KG				9800
BROMOMETHANE	UG/KG				3700 J
ACETONE	UG/KG				
1,2-DICHLOROETHENE	UG/KG				1500 J
1,1,1-TRICHLOROETHANE	UG/KG		2 J	1 J	
TRICHLOROETHENE	UG/KG				4600
BENZENE	UG/KG				850 J
TETRACHLOROETHENE	UG/KG				2600 J
1,1,2,2-TETRACHLOROETHANE	UG/KG				55000
TOLUENE	UG/KG				
STYRENE	UG/KG				
SEMIVOLATILES					
PHENOL	UG/KG				
1,4-DICHLOROBENZENE	UG/KG	39 J			
4-METHYLPHENOL	UG/KG				120 J
NAPHTHALENE	UG/KG				
2-METHYLNAPHTHALENE	UG/KG				
ACENAPHTHYLENE	UG/KG				
ACENAPHTHENE	UG/KG				
DIBENZOFURAN	UG/KG				
FLUORENE	UG/KG				
PHENANTHRENE	UG/KG				
ANTHRACENE	UG/KG				
FLUORANTHENE	UG/KG				
CARBAZOLE	UG/KG				
PYRENE	UG/KG				
BUTYL BENZYL PHTHALATE	UG/KG				
BENZO(A)ANTHRACENE	UG/KG				
CHRYSENE	UG/KG				
BIS(2-ETHYLHEXYL)PHTHALATE	UG/KG				190 J
DI-N-OCTYL PHTHALATE	UG/KG				
BENZO(B)FLUORANTHENE	UG/KG				
BENZO(K)FLUORANTHENE	UG/KG				
BENZO(A)PYRENE	UG/KG				
INDENO(1,2,3-CD) PYRENE	UG/KG				
DIBENZ(A,H)ANTHRACENE	UG/KG				
BENZO(G,H,I)PERYLENE	UG/KG				

UG/KG - microgram per kilogram
J - value is estimated

TABLE 4-19
WOODED AREAS, THE RAVINE AND SITE 82 SURFACE SOIL
POSITIVE DETECTION SUMMARY
REMEDIAL INVESTIGATION CTO-0133
MCB CAMP LEJEUNE, NORTH CAROLINA
ORGANICS

Sample No:		6-203OSA-SB7-00	6-203OSA-SB9-00	6-RAV-SB10-00	6-RAV-SB11-00
Depth:		0 - 6"	0 - 6"	0 - 6"	0 - 6"
Date Sampled:		9/14/92	9/13/92	9/14/92	9/14/92
Lab Id:		00511-07	00511-13	00512-14	00512-17
Parameter	Units				
PESTICIDE/PCBS					
DIELDRIN	UG/KG			12 J	87 J
4,4'-DDE	UG/KG	170 J		220 J	
ENDRIN	UG/KG				
4,4'-DDD	UG/KG			19 J	
4,4'-DDT	UG/KG	180 J		510 J	
ALPHA CHLORDANE	UG/KG				
PCB-1260	UG/KG			180 J	
VOLATILES					
CHLOROMETHANE	UG/KG				
BROMOMETHANE	UG/KG				
ACETONE	UG/KG				
1,2-DICHLOROETHENE	UG/KG				
1,1,1-TRICHLOROETHANE	UG/KG				
TRICHLOROETHENE	UG/KG				
BENZENE	UG/KG				
TETRACHLOROETHENE	UG/KG				
1,1,2,2-TETRACHLOROETHANE	UG/KG				
TOLUENE	UG/KG				
STYRENE	UG/KG		2 J		
SEMIVOLATILES					
PHENOL	UG/KG				
1,4-DICHLOROBENZENE	UG/KG				
4-METHYLPHENOL	UG/KG				
NAPHTHALENE	UG/KG				
2-METHYLNAPHTHALENE	UG/KG				
ACENAPHTHYLENE	UG/KG				
ACENAPHTHENE	UG/KG				
DIBENZOFURAN	UG/KG				
FLUORENE	UG/KG				
PHENANTHRENE	UG/KG				91 J
ANTHRACENE	UG/KG				170 J
FLUORANTHENE	UG/KG	65 J		83 J	2000 J
CARBAZOLE	UG/KG				
PYRENE	UG/KG	87 J		110 J	2700
BUTYL BENZYL PHTHALATE	UG/KG				
BENZO(A)ANTHRACENE	UG/KG	58 J		59 J	2200
CHRYSENE	UG/KG	50 J		59 J	1600
BIS(2-ETHYLHEXYL)PHTHALATE	UG/KG	110 J		75 J	59 J
DI-N-OCTYL PHTHALATE	UG/KG				
BENZO(B)FLUORANTHENE	UG/KG	80 J		95 J	2200
BENZO(K)FLUORANTHENE	UG/KG			25 J	490
BENZO(A)PYRENE	UG/KG	40 J		50 J	1500
INDENO(1,2,3-CD) PYRENE	UG/KG				1300
DIBENZ(A,H)ANTHRACENE	UG/KG				380 J
BENZO(G,H,I)PERYLENE	UG/KG				1300 J

UG/KG - microgram per kilogram
J - value is estimated

TABLE 4-19
WOODED AREAS, THE RAVINE AND SITE 82 SURFACE SOIL
POSITIVE DETECTION SUMMARY
REMEDIAL INVESTIGATION CTO-0133
MCB CAMP LEJEUNE, NORTH CAROLINA
ORGANICS

Sample No:		6-RAV-SB12-00	6-RAV-SB13-00	6-RAV-SB14-00	6-RAV-SB15-00
Depth:		0 - 6"	0 - 6"	0 - 6"	0 - 6"
Date Sampled:		9/14/92	9/14/92	9/14/92	10/09/92
Lab Id:		00512-19	00512-22	00512-24	00570-05
Parameter	Units				
PESTICIDE/PCBS					
DIELDRIN	UG/KG				14 J
4,4'-DDE	UG/KG	140 J		200	17 J
ENDRIN	UG/KG		5.6 J		
4,4'-DDD	UG/KG				
4,4'-DDT	UG/KG	130 J		240 J	73 J
ALPHA CHLORDANE	UG/KG				
PCB-1260	UG/KG				
VOLATILES					
CHLOROMETHANE	UG/KG				
BROMOMETHANE	UG/KG				
ACETONE	UG/KG				
1,2-DICHLOROETHENE	UG/KG				
1,1,1-TRICHLOROETHANE	UG/KG				
TRICHLOROETHENE	UG/KG				
BENZENE	UG/KG				
TETRACHLOROETHENE	UG/KG				
1,1,2,2-TETRACHLOROETHANE	UG/KG				
TOLUENE	UG/KG				
STYRENE	UG/KG				
SEMIVOLATILES					
PHENOL	UG/KG				
1,4-DICHLOROBENZENE	UG/KG		60 J		
4-METHYLPHENOL	UG/KG				
NAPHTHALENE	UG/KG			71 J	
2-METHYLNAPHTHALENE	UG/KG				
ACENAPHTHYLENE	UG/KG				
ACENAPHTHENE	UG/KG			370	
DIBENZOFURAN	UG/KG			120 J	
FLUORENE	UG/KG			200 J	
PHENANTHRENE	UG/KG			1500	
ANTHRACENE	UG/KG			260 J	
FLUORANTHENE	UG/KG			1400	
CARBAZOLE	UG/KG			190 J	
PYRENE	UG/KG			1600	
BUTYL BENZYL PHTHALATE	UG/KG				
BENZO(A)ANTHRACENE	UG/KG			750	
CHRYSENE	UG/KG			590	
BIS(2-ETHYLHEXYL)PHTHALATE	UG/KG		320 J	71 J	52 J
DI-N-OCTYL PHTHALATE	UG/KG				
BENZO(B)FLUORANTHENE	UG/KG			970	
BENZO(K)FLUORANTHENE	UG/KG			260 J	
BENZO(A)PYRENE	UG/KG			600	
INDENO(1,2,3-CD) PYRENE	UG/KG				
DIBENZ(A,H)ANTHRACENE	UG/KG				
BENZO(G,H,I)PERYLENE	UG/KG			430	

UG/KG - microgram per kilogram
J - value is estimated

TABLE 4-19
WOODED AREAS, THE RAVINE AND SITE 82 SURFACE SOIL
POSITIVE DETECTION SUMMARY
REMEDIAL INVESTIGATION CTO-0133
MCB CAMP LEJEUNE, NORTH CAROLINA
ORGANICS

Sample No:		6-RAV-SB16-00	6-RAV-SB4-00	6-RAV-SB4A-00	6-RAV-SB5-00
Depth:		0 - 6"	0 - 6"	0 - 6"	0 - 6"
Date Sampled:		10/09/92	9/11/92	9/14/92	9/14/92
Lab Id:		00570-07	00502-33	00512-01	00512-03
Parameter	Units				
PESTICIDE/PCBS					
DIELDRIN	UG/KG		4.6		
4,4'-DDE	UG/KG	7.5		49	130
ENDRIN	UG/KG				
4,4'-DDD	UG/KG				
4,4'-DDT	UG/KG	25		71 J	260 J
ALPHA CHLORDANE	UG/KG				
PCB-1260	UG/KG				
VOLATILES					
CHLOROMETHANE	UG/KG				
BROMOMETHANE	UG/KG				
ACETONE	UG/KG				
1,2-DICHLOROETHENE	UG/KG				
1,1,1-TRICHLOROETHANE	UG/KG				
TRICHLOROETHENE	UG/KG				
BENZENE	UG/KG				
TETRACHLOROETHENE	UG/KG				
1,1,2,2-TETRACHLOROETHANE	UG/KG				
TOLUENE	UG/KG				
STYRENE	UG/KG				
SEMIVOLATILES					
PHENOL	UG/KG				37 J
1,4-DICHLOROBENZENE	UG/KG				
4-METHYLPHENOL	UG/KG				
NAPHTHALENE	UG/KG				
2-METHYLNAPHTHALENE	UG/KG				
ACENAPHTHYLENE	UG/KG				
ACENAPHTHENE	UG/KG				
DIBENZOFURAN	UG/KG				
FLUORENE	UG/KG				
PHENANTHRENE	UG/KG				
ANTHRACENE	UG/KG				
FLUORANTHENE	UG/KG				74 J
CARBAZOLE	UG/KG				
PYRENE	UG/KG				120 J
BUTYL BENZYL PHTHALATE	UG/KG				
BENZO(A)ANTHRACENE	UG/KG				39 J
CHRYSENE	UG/KG				44 J
BIS(2-ETHYLHEXYL)PHTHALATE	UG/KG	69 J		67 J	60 J
DI-N-OCTYL PHTHALATE	UG/KG				
BENZO(B)FLUORANTHENE	UG/KG				
BENZO(K)FLUORANTHENE	UG/KG				
BENZO(A)PYRENE	UG/KG				
INDENO(1,2,3-CD) PYRENE	UG/KG				
DIBENZ(A,H)ANTHRACENE	UG/KG				
BENZO(G,H,I)PERYLENE	UG/KG				

UG/KG - microgram per kilogram
J - value is estimated

TABLE 4-19
WOODED AREAS, THE RAVINE AND SITE 82 SURFACE SOIL
POSITIVE DETECTION SUMMARY
REMEDIAL INVESTIGATION CTO-0133
MCB CAMP LEJEUNE, NORTH CAROLINA
ORGANICS

	Sample No:	6-RAV-SB6-00	6-RAV-SB7-00	6-RAV-SB8-00	6-RAV-SB9-00
	Depth:	0 - 6"	0 - 6"	0 - 6"	0 - 6"
	Date Sampled:	9/14/92	9/14/92	9/14/92	9/14/92
	Lab Id:	00512-06	00512-08	00512-10	00512-12
Parameter	Units				
PESTICIDE/PCBS					
DIELDRIN	UG/KG	45 J			
4,4'-DDE	UG/KG	27 J	20 J		
ENDRIN	UG/KG				
4,4'-DDD	UG/KG	14 J			
4,4'-DDT	UG/KG	98 J	25 J		
ALPHA CHLORDANE	UG/KG				
PCB-1260	UG/KG				
VOLATILES					
CHLOROMETHANE	UG/KG				
BROMOMETHANE	UG/KG				
ACETONE	UG/KG				
1,2-DICHLOROETHENE	UG/KG				
1,1,1-TRICHLOROETHANE	UG/KG				2 J
TRICHLOROETHENE	UG/KG				
BENZENE	UG/KG				
TETRACHLOROETHENE	UG/KG				
1,1,2,2-TETRACHLOROETHANE	UG/KG				
TOLUENE	UG/KG				
STYRENE	UG/KG				
SEMIVOLATILES					
PHENOL	UG/KG	160 J		53 J	120 J
1,4-DICHLOROBENZENE	UG/KG				
4-METHYLPHENOL	UG/KG				
NAPHTHALENE	UG/KG	140 J			
2-METHYLNAPHTHALENE	UG/KG	42 J			
ACENAPHTHYLENE	UG/KG				
ACENAPHTHENE	UG/KG	150 J			
DIBENZOFURAN	UG/KG	82 J			
FLUORENE	UG/KG	130 J			
PHENANTHRENE	UG/KG	980	47 J		
ANTHRACENE	UG/KG	190 J			
FLUORANTHENE	UG/KG	580	90 J		
CARBAZOLE	UG/KG	73 J			
PYRENE	UG/KG	1100 J	110 J		
BUTYL BENZYL PHTHALATE	UG/KG				
BENZO(A)ANTHRACENE	UG/KG	490 J	59 J		
CHRYSENE	UG/KG	440 J	56 J		
BIS(2-ETHYLHEXYL)PHTHALATE	UG/KG	87 J			
DI-N-OCTYL PHTHALATE	UG/KG				
BENZO(B)FLUORANTHENE	UG/KG	460	88 J		
BENZO(K)FLUORANTHENE	UG/KG	140 J			
BENZO(A)PYRENE	UG/KG	330 J	48 J		
INDENO(1,2,3-CD) PYRENE	UG/KG	400 J			
DIBENZ(A,H)ANTHRACENE	UG/KG	85 J			
BENZO(G,H,I)PERYLENE	UG/KG	390 J			

UG/KG - microgram per kilogram
J - value is estimated

TABLE 4-20
WOODED AREAS, THE RAVINE, AND SITE 82 SURFACE SOIL
POSITIVE DETECTION SUMMARY
REMEDIAL INVESTIGATION CTO-0133
MCB CAMP LEJEUNE, NORTH CAROLINA
TOTAL METALS

Sample No:		6-201E-SB1-00		6-201E-SB10-00		6-201E-SB11-00		6-201E-SB12-00		6-201E-SB13-00		6-201E-SB14-00	
Depth:		0 - 6"		0 - 6"		0 - 6"		0 - 6"		0 - 6"		0 - 6"	
Date Sampled:		9/11/92		9/12/92		9/12/92		9/13/92		9/13/92		9/13/92	
Lab Id:		00507-01		00507-20		00507-23		00510-01		00510-03		00510-06	
Parameter	Units												
ALUMINUM	MG/KG	1100	J	255	J	1390	J	792		2490		769	
ANTIMONY	MG/KG												
ARSENIC	MG/KG					1.7		1	JB				
BARIUM	MG/KG	4	JB	6.1	JB	14.6	JB	8.3	B	10.3	B	3.9	B
BERYLLIUM	MG/KG					0.18	B						
CADMIUM	MG/KG	0.59	JB										
CALCIUM	MG/KG	296	JB	493	JB	48400	J	58500		884	B	485	B
CHROMIUM	MG/KG					3.8		3.5	J	1.4	JB		
COBALT	MG/KG					0.52	B						
COPPER	MG/KG							2	JB	0.89	JB	0.65	JB
IRON	MG/KG			274	J	1220	J	1110		620		336	
LEAD	MG/KG	7.1						30.1		13.4	J	8	
MAGNESIUM	MG/KG	32.4	B	32.2	B	725	B	908		78.2	JB	30.3	JB
MANGANESE	MG/KG			8.3	J	30.4	J	12.6		7.4	J	3.5	
MERCURY	MG/KG									0.03	B		
NICKEL	MG/KG												
POTASSIUM	MG/KG	23.1	JB	15	JB	175	B	84.3	B	66.7	B	23.1	B
SELENIUM	MG/KG												
SILVER	MG/KG												
SODIUM	MG/KG							128	JB				
THALLIUM	MG/KG												
VANADIUM	MG/KG	1.5	JB	1.7	JB	8.1	JB	2.7	B	3.7	B	1.3	B
ZINC	MG/KG							10.6		5.9			

MG/KG - milligram per kilogram
B - reported value is less than Contract Required Detection Limit (CRDL), but greater than Instrument Detection Limit (IDL)
J - value is estimated
JB - value is estimated below the CRDL, but greater than the IDL

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TABLE 4-20
WOODED AREAS, THE RAVINE, AND SITE 82 SURFACE SOIL
POSITIVE DETECTION SUMMARY
REMEDIAL INVESTIGATION CTO-0133
MCB CAMP LEJEUNE, NORTH CAROLINA
TOTAL METALS

Sample No:		6-201E-SB15-00	6-201E-SB16-00	6-201E-SB17-00	6-201E-SB18-00	6-201E-SB19-00	6-201E-SB2-00
Depth:		0 - 6"	0 - 6"	0 - 6"	0 - 6"	0 - 6"	0 - 6"
Date Sampled:		9/13/92	9/13/92	9/13/92	9/13/92	9/15/92	9/11/92
Lab Id:		00510-08	00510-10	00510-12	00510-14	00519-01	00507-03
Parameter	Units						
ALUMINUM	MG/KG	1570	750	250	709	571 J	241 J
ANTIMONY	MG/KG						
ARSENIC	MG/KG	0.8 JB			0.82 B	0.76 B	
BARIUM	MG/KG	18.1 B	5.5 B	2 JB	3.9 B	2.9 JB	7.9 JB
BERYLLIUM	MG/KG						
CADMIUM	MG/KG	0.53 JB					
CALCIUM	MG/KG	47400	581 B	22300	75100	65500 J	157 JB
CHROMIUM	MG/KG	3.8 J	1.3 JB	0.95 JB	3.1 J		
COBALT	MG/KG		0.96 JB				
COPPER	MG/KG	2.6 JB	1.2 JB	0.39 JB	1.2 JB	0.89 JB	
IRON	MG/KG	1630	407	279	1010	793 J	
LEAD	MG/KG	96.1	8.6	2.1	11.4	2.5 J	
MAGNESIUM	MG/KG	763	31.9 JB	384 B	1100	849 JB	23.5 B
MANGANESE	MG/KG	13.8	4.6	5.6	41.5	12.1 J	
MERCURY	MG/KG						
NICKEL	MG/KG						
POTASSIUM	MG/KG	109 B	31.9 B	32.5 B	135 B	84 B	21.6 JB
SELENIUM	MG/KG						
SILVER	MG/KG						
SODIUM	MG/KG	107 JB			129 JB		
THALLIUM	MG/KG		0.35 B				
VANADIUM	MG/KG	4.7 B	1.7 B	0.74 B	3.6 B	2.1 JB	1.4 JB
ZINC	MG/KG	17.8	4.2 B		6.6		

MG/KG - milligram per kilogram
B - reported value is less than Contract Required Detection Limit (CRDL), but greater than Instrument Detection Limit (IDL)
J - value is estimated
JB - value is estimated below the CRDL, but greater than the IDL

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TABLE 4-20
WOODED AREAS, THE RAVINE, AND SITE 82 SURFACE SOIL
POSITIVE DETECTION SUMMARY
REMEDIAL INVESTIGATION CTO-0133
MCB CAMP LEJEUNE, NORTH CAROLINA
TOTAL METALS

	Sample No:	6-201E-SB20-00	6-201E-SB21-00	6-201E-SB3-00	6-201E-SB4-00	6-201E-SB5-00	6-201E-SB6-00
	Depth:	0 - 6"	0 - 6"	0 - 6"	0 - 6"	0 - 6"	0 - 6"
	Date Sampled:	9/15/92	9/15/92	9/11/92	9/11/92	9/11/92	9/12/92
	Lab Id:	00519-04	00519-16	00507-05	00507-07	00507-09	00507-12
Parameter	Units						
ALUMINUM	MG/KG	540 J	1100 J	1080 J	258 J	177 J	664 J
ANTIMONY	MG/KG						
ARSENIC	MG/KG						
BARIUM	MG/KG	12.2 B	3.9 JB	14.5 JB	1.1 JB	3.1 JB	8.1 JB
BERYLLIUM	MG/KG						
CADMIUM	MG/KG	0.44 JB					
CALCIUM	MG/KG	312 JB	39700 J	434 JB			1010 J
CHROMIUM	MG/KG						
COBALT	MG/KG						
COPPER	MG/KG	3.9 JB					4.3 B
IRON	MG/KG	322 J	844 J	331 J			505 J
LEAD	MG/KG	12.9 J	9 J	5.9			11.1
MAGNESIUM	MG/KG		624 JB	33.8 B			110 B
MANGANESE	MG/KG	5.4 J	26.8 J			7.4 J	7 J
MERCURY	MG/KG			0.14			
NICKEL	MG/KG	1.8 JB					
POTASSIUM	MG/KG	16.9 JB	129 B	28.9 JB			39.4 B
SELENIUM	MG/KG						
SILVER	MG/KG						
SODIUM	MG/KG						
THALLIUM	MG/KG						
VANADIUM	MG/KG		4.3 JB	1.5 JB	0.36 JB	1.3 JB	1.9 JB
ZINC	MG/KG						

MG/KG - milligram per kilogram
B - reported value is less than Contract Required Detection Limit (CRDL), but greater than Instrument Detection Limit (IDL)
J - value is estimated
JB - value is estimated below the CRDL, but greater than the IDL

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TABLE 4-20
WOODED AREAS, THE RAVINE, AND SITE 82 SURFACE SOIL
POSITIVE DETECTION SUMMARY
REMEDIAL INVESTIGATION CTO-0133
MCB CAMP LEJEUNE, NORTH CAROLINA
TOTAL METALS

Sample No:		6-201E-SB7-00	6-201E-SB8-00	6-201E-SB9-00	6-201N-SB1-00	6-201N-SB10-00	6-201N-SB11-00
Depth:		0 - 6"	0 - 6"	0 - 6"	0 - 6"	0 - 6"	0 - 6"
Date Sampled:		9/12/92	9/12/92	9/12/92	9/11/92	9/11/92	10/13/92
Lab Id:		00507-14	00507-16	00507-18	00502-01	00507-25	00573-11
Parameter	Units						
ALUMINUM	MG/KG	711 J	1360 J	3030 J	14700	501 J	1120
ANTIMONY	MG/KG						
ARSENIC	MG/KG		0.49 B	4.6	26.3		
BARIUM	MG/KG	11.9 JB	6.2 JB	51.8 J	737	2.5 JB	
BERYLLIUM	MG/KG			0.59 B	2.2		
CADMIUM	MG/KG			0.57 JB	3.9		
CALCIUM	MG/KG	878 JB	232 JB	1730 J	18000		178 B
CHROMIUM	MG/KG			2.9	19.2	0.72 B	
COBALT	MG/KG		0.41 B	1.3 B	9 B		
COPPER	MG/KG			9	66.4		
IRON	MG/KG	325 J	565 J	2470 J	13500	323 J	525
LEAD	MG/KG	7.1		9.4	90.8		2
MAGNESIUM	MG/KG	67.2 B	36.6 B	140 B	732 B		
MANGANESE	MG/KG			9.5 J	119		3.1
MERCURY	MG/KG				0.44		
NICKEL	MG/KG			2.3 B			
POTASSIUM	MG/KG	74 B	40.3 B	338 B	796 B		
SELENIUM	MG/KG			1.2	3.3 J		
SILVER	MG/KG						
SODIUM	MG/KG				461 JB		
THALLIUM	MG/KG						
VANADIUM	MG/KG	2 JB	2.6 JB	8.8	35.2		
ZINC	MG/KG				194		

MG/KG - milligram per kilogram
B - reported value is less than Contract Required Detection Limit (CRDL), but greater than Instrument Detection Limit (IDL)
J - value is estimated
JB - value is estimated below the CRDL, but greater than the IDL

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TABLE 4-20
WOODED AREAS, THE RAVINE, AND SITE 82 SURFACE SOIL
POSITIVE DETECTION SUMMARY
REMEDIAL INVESTIGATION CTO-0133
MCB CAMP LEJEUNE, NORTH CAROLINA
TOTAL METALS

Sample No:		6-201N-SB12-00	6-201N-SB2-00	6-201N-SB3-00	6-201N-SB4-00	6-201N-SB5-00	6-201N-SB6-00
Depth:		0 - 6"	0 - 6"	0 - 6"	0 - 6"	0 - 6"	0 - 6"
Date Sampled:		10/13/92	9/10/92	9/10/92	9/10/92	9/10/92	9/11/92
Lab Id:		00573-13	00502-04	00502-06	00502-08	00502-10	00502-12
Parameter	Units						
ALUMINUM	MG/KG		408	477	2980	1330	642
ANTIMONY	MG/KG						
ARSENIC	MG/KG						
BARIUM	MG/KG		4.5 JB		6 B	3.6 JB	6.2 B
BERYLLIUM	MG/KG				0.07 B		0.06 B
CADMIUM	MG/KG		0.7 JB	0.53 JB	1.1 J	0.85 J	0.83 JB
CALCIUM	MG/KG	108 B	469 B	306 B	59.6 B	501 B	535 B
CHROMIUM	MG/KG				2.4	1.6 B	1.5 B
COBALT	MG/KG						
COPPER	MG/KG			9.2			
IRON	MG/KG	160	261	387	1510	704	353
LEAD	MG/KG	3	6.8	12.1	7.1	4.9	12.3
MAGNESIUM	MG/KG		31.8 B	23.5 B	60.9 B	35.9 B	46.8 B
MANGANESE	MG/KG		6.5	9.2	12	3.4	6
MERCURY	MG/KG		0.07 B	0.04 B	0.04 B	0.03 B	0.08 B
NICKEL	MG/KG						
POTASSIUM	MG/KG		70.5 JB	78.4 JB			
SELENIUM	MG/KG						
SILVER	MG/KG						
SODIUM	MG/KG		19.4 JB	18.8 JB	36.6 JB	22.5 JB	19.7 JB
THALLIUM	MG/KG						
VANADIUM	MG/KG			1.2 JB	4.9 JB	2.2 JB	1.5 JB
ZINC	MG/KG		8.6	23.7	14		6.2

MG/KG - milligram per kilogram
B - reported value is less than Contract Required Detection Limit (CRDL), but greater than Instrument Detection Limit (IDL)
J - value is estimated
JB - value is estimated below the CRDL, but greater than the IDL

TABLE 4-20
WOODED AREAS, THE RAVINE, AND SITE 82 SURFACE SOIL
POSITIVE DETECTION SUMMARY
REMEDIAL INVESTIGATION CTO-0133
MCB CAMP LEJEUNE, NORTH CAROLINA
TOTAL METALS

	Sample No:	6-201N-SB7-00	6-201N-SB8-00	6-201N-SB9-00	6-201S-SB1-00	6-201S-SB10-00	6-201S-SB11-00
	Depth:	0 - 6"	0 - 6"	0 - 6"	0 - 6"	0 - 6"	0 - 6"
	Date Sampled:	9/11/92	9/11/92	9/11/92	9/15/92	9/13/92	9/13/92
	Lab Id:	00502-14	00502-16	00502-18	00519-07	00510-24	00510-25
Parameter	Units						
ALUMINUM	MG/KG	569	208	976	1350 J	3240	624
ANTIMONY	MG/KG						
ARSENIC	MG/KG				2 B		0.54 JB
BARIUM	MG/KG	5.2 B		26.6 B	6.9 B	5.9 B	3.5 B
BERYLLIUM	MG/KG			0.09 B			
CADMIUM	MG/KG	1.1 J	0.53 JB	1 JB	1.2 J		
CALCIUM	MG/KG	546 B	176 B	668 B	174000 J	128 B	7050
CHROMIUM	MG/KG	0.82 B		0.93 B	10.2	2.7	2.8
COBALT	MG/KG						
COPPER	MG/KG				5.1		
IRON	MG/KG	334	113	651	3940 J	1260	602
LEAD	MG/KG	10.6	4.3	7.9	62.3 J	3	15
MAGNESIUM	MG/KG	23.1 B	12.3 B	130 B	2580 J	70.3 B	180 B
MANGANESE	MG/KG	2.4 B	1.1 JB	5.1	34.8 J	2.3 B	5.1
MERCURY	MG/KG	0.06 B	0.05 B	0.09 B			
NICKEL	MG/KG				2.8 B		
POTASSIUM	MG/KG				250 B	62.9 B	29.8 B
SELENIUM	MG/KG				1.1 J		0.9
SILVER	MG/KG						
SODIUM	MG/KG		9.6 JB	70.7 JB			
THALLIUM	MG/KG						
VANADIUM	MG/KG	1.3 JB		1.8 JB	6.4 B	3.3 B	2 B
ZINC	MG/KG	5.2	5.3	5.6	52.2 J	1.7 B	13.1

MG/KG - milligram per kilogram
B - reported value is less than Contract Required Detection Limit (CRDL), but greater than Instrument Detection Limit (IDL)
J - value is estimated
JB - value is estimated below the CRDL, but greater than the IDL

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TABLE 4-20
WOODED AREAS, THE RAVINE, AND SITE 82 SURFACE SOIL
POSITIVE DETECTION SUMMARY
REMEDIAL INVESTIGATION CTO-0133
MCB CAMP LEJEUNE, NORTH CAROLINA
TOTAL METALS

Sample No:		6-201S-SB12-00	6-201S-SB2-00	6-201S-SB3-00	6-201S-SB4-00	6-201S-SB5-00	6-201S-SB6-00
Depth:		0 - 6"	0 - 6"	0 - 6"	0 - 6"	0 - 6"	0 - 6"
Date Sampled:		9/13/92	9/15/92	9/15/92	9/15/92	9/14/92	9/14/92
Lab Id:		00511-01	00519-10	00519-11	00519-13	00510-16	00510-18
Parameter	Units						
ALUMINUM	MG/KG	547 J	1040 J	3380 J	709 J	1310	947 J
ANTIMONY	MG/KG						
ARSENIC	MG/KG			0.72 B			
BARIUM	MG/KG	9.8 JB	5.4 B	4.9 B	18.8 B	27.4 B	10.1 B
BERYLLIUM	MG/KG						
CADMIUM	MG/KG						
CALCIUM	MG/KG	1950 J	222 JB	236 JB	1340 J	2850	185 B
CHROMIUM	MG/KG	1.3 B				0.78 JB	0.85 JB
COBALT	MG/KG						
COPPER	MG/KG	1.9 JB				1.6 JB	0.52 JB
IRON	MG/KG	382 J	645 J	879 J	926 J	1350	258
LEAD	MG/KG	12.6	6.7 J	5.5 J	48 J	25.5	3.9
MAGNESIUM	MG/KG	72.3 JB	42.7 JB	103 JB	56.8 JB	120 B	34.7 JB
MANGANESE	MG/KG	7.4 J	4 J	3.8 J	6 J	32.9	2.1 B
MERCURY	MG/KG					0.03 B	0.02 B
NICKEL	MG/KG						
POTASSIUM	MG/KG	26.3 JB	46.6 JB	92.8 B	52.8 B	87.2 B	41.7 B
SELENIUM	MG/KG						
SILVER	MG/KG						
SODIUM	MG/KG						
THALLIUM	MG/KG						
VANADIUM	MG/KG	1.2 JB	2.7 JB	6.4 B	2.7 JB	3.9 B	1 B
ZINC	MG/KG	11 J			8.8 J	10.8	4.1 B

MG/KG - milligram per kilogram
B - reported value is less than Contract Required Detection Limit (CRDL), but greater than Instrument Detection Limit (IDL)
J - value is estimated
JB - value is estimated below the CRDL, but greater than the IDL

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TABLE 4-20
WOODED AREAS, THE RAVINE, AND SITE 82 SURFACE SOIL
POSITIVE DETECTION SUMMARY
REMEDIAL INVESTIGATION CTO-0133
MCB CAMP LEJEUNE, NORTH CAROLINA
TOTAL METALS

Sample No:		6-201S-SB7-00	6-201S-SB8-00	6-201S-SB9-00	6-203OSA-SB1-00	6-203OSA-SB10-00	6-203OSA-SB11-00
Depth:		0 - 6"	0 - 6"	0 - 6"	0 - 6"	0 - 6"	0 - 6"
Date Sampled:		9/14/92	9/15/92	9/14/92	9/14/92	9/12/92	9/11/92
Lab Id:		00510-21	00519-15	00510-22	00511-03	00507-37	00507-40
Parameter	Units						
ALUMINUM	MG/KG	846	8910 J	265	19200 J	1110	384
ANTIMONY	MG/KG				13.2 JB		
ARSENIC	MG/KG				7.7	1.1 B	
BARIUM	MG/KG	13.8 B	42.2 B	3.7 B	134 J	5.6 JB	4.9 JB
BERYLLIUM	MG/KG						
CADMIUM	MG/KG		1.4 JB		9.2 J		
CALCIUM	MG/KG	625 B	7090 J	144 B	13300 J	166 JB	
CHROMIUM	MG/KG				29	1.4 B	1.3 B
COBALT	MG/KG				3.1 B		
COPPER	MG/KG		5.6 B		104 J		
IRON	MG/KG	379	4500 J	153	13200 J	802 J	303 J
LEAD	MG/KG	3.7	50.4 J	2.2	218	6.3	
MAGNESIUM	MG/KG	77.6 B	348 JB	15.1 JB	1040 JB	53 B	
MANGANESE	MG/KG	1.6 B	8.7 J	2.5 B	381 J	9.7 J	
MERCURY	MG/KG				0.9		
NICKEL	MG/KG				14 B		
POTASSIUM	MG/KG	63.5 B	231 B	15.5 B	787 B	54.8 B	32.1 JB
SELENIUM	MG/KG						
SILVER	MG/KG						
SODIUM	MG/KG	45.4 JB			809 JB		
THALLIUM	MG/KG						
VANADIUM	MG/KG	2.2 B	15.4 B	0.82 B	35.5	2.8 JB	
ZINC	MG/KG	3.1 B	38.4 J	1.6 B	675 J		

MG/KG - milligram per kilogram
B - reported value is less than Contract Required Detection Limit (CRDL), but greater than Instrument Detection Limit (IDL)
J - value is estimated
JB - value is estimated below the CRDL, but greater than the IDL

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TABLE 4-20
WOODED AREAS, THE RAVINE, AND SITE 82 SURFACE SOIL
POSITIVE DETECTION SUMMARY
REMEDIAL INVESTIGATION CTO-0133
MCB CAMP LEJEUNE, NORTH CAROLINA
TOTAL METALS

Sample No:		6-203OSA-SB12-00	6-203OSA-SB13-00	6-203OSA-SB14-00	6-203OSA-SB15-00	6-203OSA-SB16-00	6-203OSA-SB17-00
Depth:		0 - 6"	0 - 6"	0 - 6"	0 - 6"	0 - 6"	0 - 6"
Date Sampled:		9/9/92	9/13/92	9/13/92	9/11/92	9/11/92	9/9/92
Lab Id:		00496-17	00511-16	00511-19	00507-42	00507-45	00496-05
Parameter	Units						
ALUMINUM	MG/KG	7400	749 J	1880 J	2290	1990	1640
ANTIMONY	MG/KG						
ARSENIC	MG/KG	18.7 J			0.81 B	1.4 B	1.1 JB
BARIUM	MG/KG	892		7.9 JB	5.7 JB	34.1	20.3 B
BERYLLIUM	MG/KG	2					0.09 B
CADMIUM	MG/KG	2.2 J			0.57 JB	0.4 JB	0.44 JB
CALCIUM	MG/KG	1820		120 JB		14800 J	10000
CHROMIUM	MG/KG	9.5	0.77 B	1.6 B	1.8 B	2.5	2.2
COBALT	MG/KG	6.2 B				0.34 B	
COPPER	MG/KG	45.5	0.72 JB	0.97 JB			
IRON	MG/KG	11400	620 J	1050 J	1100	1540	1440
LEAD	MG/KG	12.5	11	8		7.8	5.3
MAGNESIUM	MG/KG	439 B		64 JB	50.8 B	311 B	205 B
MANGANESE	MG/KG	52.5		10.5 J	7.2 J	12.6 J	9.3
MERCURY	MG/KG			0.02 B	0.04 B	0.34	
NICKEL	MG/KG	13.9					
POTASSIUM	MG/KG	661 B	25.4 JB	61.4 JB	38.9 B	88.5 B	76.6 B
SELENIUM	MG/KG	5.8					
SILVER	MG/KG						
SODIUM	MG/KG						
THALLIUM	MG/KG						
VANADIUM	MG/KG	30.1	3 JB	4.3 JB	3.7 JB	4.3 JB	3.6 JB
ZINC	MG/KG					11.9	36.7

MG/KG - milligram per kilogram
B - reported value is less than Contract Required Detection Limit (CRDL), but greater than Instrument Detection Limit (IDL)
J - value is estimated
JB - value is estimated below the CRDL, but greater than the IDL

CLEJ-01272-3.13-08/20/93

TABLE 4-20
WOODED AREAS, THE RAVINE, AND SITE 82 SURFACE SOIL
POSITIVE DETECTION SUMMARY
REMEDIAL INVESTIGATION CTO-0133
MCB CAMP LEJEUNE, NORTH CAROLINA
TOTAL METALS

Sample No:		6-203OSA-SB18-00	6-203OSA-SB19-00	6-203OSA-SB2-00	6-203OSA-SB20-00	6-203OSA-SB3-00	6-203OSA-SB4-00
Depth:		0 - 6"	0 - 6"	0 - 6"	0 - 6"	0 - 6"	0 - 6"
Date Sampled:		9/9/92	9/13/92	9/13/92	9/13/92	9/12/92	9/12/92
Lab Id:		00496-08	00511-21	00511-05	00511-23	00507-28	00507-32
Parameter	Units						
ALUMINUM	MG/KG	1840	4030 J	2610 J	967 J	1320	2990
ANTIMONY	MG/KG						
ARSENIC	MG/KG	0.73 JB	1.2 B	0.76 B	0.69 B	0.73 B	1.3 B
BARIUM	MG/KG	3.7 JB	4.6 JB	15.4 JB	9.6 JB	6.2 B	6.5 B
BERYLLIUM	MG/KG						
CADMIUM	MG/KG	0.43 JB			0.77 JB		
CALCIUM	MG/KG	745 B	193 JB	266 JB	1020 J		
CHROMIUM	MG/KG	2	4.2	2.7	2.6	1 B	1.8 B
COBALT	MG/KG						
COPPER	MG/KG			1.3 JB	10		
IRON	MG/KG	1400	2390 J	1360 J	934 J	654 J	1260 J
LEAD	MG/KG	3.5	4.3	10.1	40.3	6.6	
MAGNESIUM	MG/KG	48.2 B	119 B	97.2 JB	85.2 B	33.7 B	50.6 B
MANGANESE	MG/KG	4.6	2.9 JB	8.7 J	13.2 J	7.8 J	
MERCURY	MG/KG			0.03 B	0.04 B		
NICKEL	MG/KG						
POTASSIUM	MG/KG	34.6 B	97.5 B	82.7 JB	44.6 JB	37.2 JB	30.4 JB
SELENIUM	MG/KG						
SILVER	MG/KG						
SODIUM	MG/KG						
THALLIUM	MG/KG						
VANADIUM	MG/KG	3.5 JB	8.5 B	3.8 JB	2.7 JB	2.1 JB	4 JB
ZINC	MG/KG				61.8 J		

MG/KG - milligram per kilogram
B - reported value is less than Contract Required Detection Limit (CRDL), but greater than Instrument Detection Limit (IDL)
J - value is estimated
JB - value is estimated below the CRDL, but greater than the IDL

CLEJ-01272-3.13-08/20/93

TABLE 4-20
WOODED AREAS, THE RAVINE, AND SITE 82 SURFACE SOIL
POSITIVE DETECTION SUMMARY
REMEDIAL INVESTIGATION CTO-0133
MCB CAMP LEJEUNE, NORTH CAROLINA
TOTAL METALS

Sample No:		6-203OSA-SB5-00	6-203OSA-SB6-00	6-203OSA-SB7-00	6-203OSA-SB8-00	6-203OSA-SB9-00	6-RAV-SB1-00
Depth:		0 - 6"	0 - 6"	0 - 6"	0 - 6"	0 - 6"	0 - 6"
Date Sampled:		9/11/92	9/10/92	9/14/92	9/13/92	9/13/92	9/10/92
Lab Id:		00507-35	00496-16	00511-07	00511-09	00511-13	00502-26
Parameter	Units						
ALUMINUM	MG/KG	1600	2800	3040 J	3800 J	2350 J	1140
ANTIMONY	MG/KG			3.5 JB			
ARSENIC	MG/KG	0.7 B		1.5 B	0.71 B	1.3 B	
BARIUM	MG/KG	6 B	19.4 B	22.7 JB	7 JB	11.6 JB	5.7 JB
BERYLLIUM	MG/KG		0.53 B				
CADMIUM	MG/KG		0.48 JB	1.8 J			
CALCIUM	MG/KG		230 B	1060 J		149 JB	64.6 JB
CHROMIUM	MG/KG		2.1	4.6	2.5	1.5 B	1.9 B
COBALT	MG/KG		0.54 JB				
COPPER	MG/KG			17.6 J	0.69 JB	0.8 JB	
IRON	MG/KG	912 J	601	2580 J	1750 J	960 J	851
LEAD	MG/KG		3.8	45.2	6.1	7	5.4
MAGNESIUM	MG/KG	33.8 B		98.7 JB	95.2 JB	59.7 JB	34.8 B
MANGANESE	MG/KG		1.4 B	72.3 J	8.6 J	20 J	2.6 JB
MERCURY	MG/KG	0.03 B		0.16		0.04 B	
NICKEL	MG/KG		2.8 JB				
POTASSIUM	MG/KG	33.2 JB	22.8 B	86.8 B	65.8 JB	40.5 JB	33.3 JB
SELENIUM	MG/KG						
SILVER	MG/KG						0.47 JB
SODIUM	MG/KG						26.2 JB
THALLIUM	MG/KG						
VANADIUM	MG/KG	2.9 JB	2.9 JB	6.6 B	5.6 B	3.2 JB	1.9 JB
ZINC	MG/KG			139 J			

MG/KG - milligram per kilogram
B - reported value is less than Contract Required Detection Limit (CRDL), but greater than Instrument Detection Limit (IDL)
J - value is estimated
JB - value is estimated below the CRDL, but greater than the IDL

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TABLE 4-20
WOODED AREAS, THE RAVINE, AND SITE 82 SURFACE SOIL
POSITIVE DETECTION SUMMARY
REMEDIAL INVESTIGATION CTO-0133
MCB CAMP LEJEUNE, NORTH CAROLINA
TOTAL METALS

	Sample No:	6-RAV-SB10-00		6-RAV-SB11-00		6-RAV-SB12-00		6-RAV-SB13-00		6-RAV-SB14-00		6-RAV-SB15-00	
	Depth:	0 - 6"		0 - 6"		0 - 6"		0 - 6"		0 - 6"		0 - 6"	
	Date Sampled:	9/14/92		9/14/92		9/14/92		9/14/92		9/14/92		10/09/92	
	Lab Id:	00512-14		00512-17		00512-19		00512-22		00512-24		00570-05	
Parameter	Units												
ALUMINUM	MG/KG	5200		2830		1860		3670		3370		6660	
ANTIMONY	MG/KG												
ARSENIC	MG/KG	1.9	JB			0.97	B	17.4		2.1		8.9	
BARIUM	MG/KG	34.8	B	7.2	B	16.5	B	598		48.6		412	
BERYLLIUM	MG/KG							0.98	B	0.17	B	2	
CADMIUM	MG/KG	2.4	J					51.9		1.6	J		
CALCIUM	MG/KG	2640		137	B	407	B	3900		1990		7410	
CHROMIUM	MG/KG	10.2		4.3		2.7		54.6		6.6		9.7	
COBALT	MG/KG							13.7		1.2	B	6.1	B
COPPER	MG/KG	27.7		1.7	JB	7				21.7		348	
IRON	MG/KG	5040		1890		1650	J	149000		2860		7920	
LEAD	MG/KG	57.6	J	13.1	J	14.7	J	1710		60.8		116	
MAGNESIUM	MG/KG	205	B	95.7	B	65.3	B	1110	B	164	B	1200	B
MANGANESE	MG/KG	128		7.3		25.2		700		93.6		120	
MERCURY	MG/KG	0.45	J	0.04	JB	0.07	JB	3.9		0.14		0.28	
NICKEL	MG/KG	2.8	B			2	B	79.4		3.3	B	7.5	B
POTASSIUM	MG/KG	173	B	91.7	B	94.8	B	342	B	171	B	357	B
SELENIUM	MG/KG							4.5				2.7	
SILVER	MG/KG												
SODIUM	MG/KG							97.5	JB				
THALLIUM	MG/KG							0.57	JB				
VANADIUM	MG/KG	12.2	J	7.7	JB	5	JB	35.7		8.5	JB	32.8	
ZINC	MG/KG	169		5.9		52.7		16600		145		745	

MG/KG - milligram per kilogram
B - reported value is less than Contract Required Detection Limit (CRDL), but greater than Instrument Detection Limit (IDL)
J - value is estimated
JB - value is estimated below the CRDL, but greater than the IDL

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TABLE 4-20
WOODED AREAS, THE RAVINE, AND SITE 82 SURFACE SOIL
POSITIVE DETECTION SUMMARY
REMEDIAL INVESTIGATION CTO-0133
MCB CAMP LEJEUNE, NORTH CAROLINA
TOTAL METALS

	Sample No:	6-RAV-SB16-00	6-RAV-SB2-00	6-RAV-SB3-00	6-RAV-SB4-00	6-RAV-SB4A-00	6-RAV-SB5-00
	Depth:	0 - 6"	0 - 6"	0 - 6"	0 - 6"	0 - 6"	0 - 6"
	Date Sampled:	10/09/92	9/10/92	9/11/92	9/11/92	9/14/92	9/14/92
	Lab Id:	00570-07	00502-28	00502-30	00502-33	00512-01	00512-03
Parameter	Units						
ALUMINUM	MG/KG	8290	1240	2530	601	917	2330
ANTIMONY	MG/KG						
ARSENIC	MG/KG	21.8					0.69 JB
BARIUM	MG/KG	1410	26.3 B	5.2 BJ	2.9 JB	4.7 JB	7.7 B
BERYLLIUM	MG/KG	2.2 B					
CADMIUM	MG/KG			0.58 JB			
CALCIUM	MG/KG	3120	263 JB	61.5 JB		173 B	293 B
CHROMIUM	MG/KG	9	1.6 B	2.9	1.3 B	0.82 B	3.3
COBALT	MG/KG	6.7 B					
COPPER	MG/KG	35				4.4 JB	2.3 JB
IRON	MG/KG	7380	836	1300	471	1150	1530
LEAD	MG/KG	27.3	8.8	3.5	10.7 J	10.5 J	7.8 J
MAGNESIUM	MG/KG	551 B	40.4 B	49.1 B	19.6 B	31.1 B	90.6 B
MANGANESE	MG/KG	69.7	7.9	4.4 J	2.8 JB	23.1	25.3
MERCURY	MG/KG	0.1 B				0.06 JB	0.11 J
NICKEL	MG/KG	15.2 B				1.7 B	
POTASSIUM	MG/KG	2560	65.5 JB	49 JB	31.7 JB	32.6 JB	89.5 B
SELENIUM	MG/KG	5.3					
SILVER	MG/KG			0.49 JB			
SODIUM	MG/KG		30 JB	28 JB	30.8 JB		
THALLIUM	MG/KG						
VANADIUM	MG/KG	28.3	2.9 JB	3.8 JB	1.8 JB		5.3 JB
ZINC	MG/KG	73.6				45.5	26.1

MG/KG - milligram per kilogram
B - reported value is less than Contract Required Detection Limit (CRDL), but greater than Instrument Detection Limit (IDL)
J - value is estimated
JB - value is estimated below the CRDL, but greater than the IDL

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TABLE 4-20
WOODED AREAS, THE RAVINE, AND SITE 82 SURFACE SOIL
POSITIVE DETECTION SUMMARY
REMEDIAL INVESTIGATION CTO-0133
MCB CAMP LEJEUNE, NORTH CAROLINA
TOTAL METALS

	Sample No:	6-RAV-SB6-00	6-RAV-SB7-00	6-RAV-SB8-00	6-RAV-SB9-00
	Depth:	0 - 6"	0 - 6"	0 - 6"	0 - 6"
	Date Sampled:	9/14/92	9/14/92	9/14/92	9/14/92
	Lab Id:	00512-06	00512-08	00512-10	00512-12
Parameter	Units				
ALUMINUM	MG/KG	2060	2080	297	294
ANTIMONY	MG/KG				
ARSENIC	MG/KG	0.82 B	1.3 B		
BARIUM	MG/KG	23.6 B	44.2	2.6 JB	6.8 JB
BERYLLIUM	MG/KG				
CADMIUM	MG/KG	0.46 JB	1.5 J		
CALCIUM	MG/KG	2350	3280		162 B
CHROMIUM	MG/KG	3.2	10.9		
COBALT	MG/KG		0.76 JB		
COPPER	MG/KG	5.7 J	17.1		0.55 JB
IRON	MG/KG	1470	5180	286	192
LEAD	MG/KG	48.1 J	30.4 J	8 J	2.4 J
MAGNESIUM	MG/KG	223 B	250 B		104 B
MANGANESE	MG/KG	12.6	48.9	5.6	5
MERCURY	MG/KG	0.49 J	0.31 J	0.02 JB	0.04 JB
NICKEL	MG/KG	3 B	2.5 B		
POTASSIUM	MG/KG	197 B	217 B	24.5 JB	29.5 JB
SELENIUM	MG/KG				
SILVER	MG/KG				
SODIUM	MG/KG				
THALLIUM	MG/KG				
VANADIUM	MG/KG	8.8 JB	5.6 JB		
ZINC	MG/KG	44.4	109		

MG/KG - milligram per kilogram
B - reported value is less than Contract Required Detection Limit (CRDL), but greater than Instrument Detection Limit (IDL)
J - value is estimated
JB - value is estimated below the CRDL, but greater than the IDL

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TABLE 4-21
WOODED AREAS, THE RAVINE, AND SITE 82 SUBSURFACE SOIL
POSITIVE DETECTION SUMMARY
REMEDIAL INVESTIGATION CTO-0133
MCB CAMP LEJEUNE, NORTH CAROLINA
ORGANICS

	Sample No:	6-201E-SB1-01	6-201E-SB10-01	6-201E-SB17-02	6-201E-SB18-01
	Depth:	1 - 3'	1 - 3'	3 - 5'	1 - 3'
	Date Sampled:	9/11/92	9/12/92	9/13/92	9/13/92
	Lab Id:	00507-02	00507-22	00510-13	00510-15
Parameter	Units				
PESTICIDE/PCBS					
DIELDRIN	UG/KG				
4,4'-DDE	UG/KG				
4,4'-DDD	UG/KG				
4,4'-DDT	UG/KG				
PCB-1260	UG/KG	46 J		71 J	83 J
VOLATILES					
CHLOROMETHANE	UG/KG				
BROMOMETHANE	UG/KG				
METHYLENE CHLORIDE	UG/KG				
ACETONE	UG/KG				
CARBON DISULFIDE	UG/KG				
1,2-DICHLOROETHENE	UG/KG				
2-BUTANONE	UG/KG				
1,1,1-TRICHLOROETHANE	UG/KG		1 J		
TRICHLOROETHENE	UG/KG				
BENZENE	UG/KG				
4-METHYL-2-PENTANONE	UG/KG				
TETRACHLOROETHENE	UG/KG				
TOLUENE	UG/KG		2 J		
TOTAL XYLENES	UG/KG				
SEMIVOLATILES					
1,4-DICHLOROBENZENE	UG/KG		49 J		
ISOPHORONE	UG/KG				
NAPHTHALENE	UG/KG				
2-METHYLNAPHTHALENE	UG/KG				
2-CHLORONAPHTHALENE	UG/KG				
DIETHYL PHTHALATE	UG/KG				
PHENANTHRENE	UG/KG				
FLUORANTHENE	UG/KG				
PYRENE	UG/KG				
BENZO(A)ANTHRACENE	UG/KG				
CHRYSENE	UG/KG				
BIS(2-ETHYLHEXYL)PHTHALATE	UG/KG	1200 J			
DI-N-OCTYL PHTHALATE	UG/KG				
BENZO(B)FLUORANTHENE	UG/KG				
BENZO(A)PYRENE	UG/KG				

UG/KG - microgram per kilogram
J - value is estimated

TABLE 4-21
WOODED AREAS, THE RAVINE, AND SITE 82 SUBSURFACE SOIL
POSITIVE DETECTION SUMMARY
REMEDIAL INVESTIGATION CTO-0133
MCB CAMP LEJEUNE, NORTH CAROLINA
ORGANICS

	Sample No:	6-201E-SB2-01	6-201E-SB5-01	6-201E-SB6-02	6-201E-SB7-01
	Depth:	1 - 3'	1 - 3'	3 - 5'	1 - 3'
	Date Sampled:	9/11/92	9/11/92	9/12/92	9/12/92
	Lab Id:	00507-04	00507-11	00507-13	00507-15
Parameter	Units				
PESTICIDE/PCBS					
DIELDRIN	UG/KG				
4,4'-DDE	UG/KG				
4,4'-DDD	UG/KG				
4,4'-DDT	UG/KG				
PCB-1260	UG/KG		100		
VOLATILES					
CHLOROMETHANE	UG/KG				
BROMOMETHANE	UG/KG				
METHYLENE CHLORIDE	UG/KG				
ACETONE	UG/KG				
CARBON DISULFIDE	UG/KG				
1,2-DICHLOROETHENE	UG/KG				
2-BUTANONE	UG/KG				
1,1,1-TRICHLOROETHANE	UG/KG				
TRICHLOROETHENE	UG/KG				
BENZENE	UG/KG				
4-METHYL-2-PENTANONE	UG/KG				
TETRACHLOROETHENE	UG/KG				
TOLUENE	UG/KG				
TOTAL XYLENES	UG/KG				
SEMIVOLATILES					
1,4-DICHLOROBENZENE	UG/KG				50 J
ISOPHORONE	UG/KG				
NAPHTHALENE	UG/KG				
2-METHYLNAPHTHALENE	UG/KG				
2-CHLORONAPHTHALENE	UG/KG				
DIETHYL PHTHALATE	UG/KG				
PHENANTHRENE	UG/KG				
FLUORANTHENE	UG/KG				
PYRENE	UG/KG				
BENZO(A)ANTHRACENE	UG/KG				
CHRYSENE	UG/KG				
BIS(2-ETHYLHEXYL)PHTHALATE	UG/KG	160 J		65 J	
DI-N-OCTYL PHTHALATE	UG/KG				
BENZO(B)FLUORANTHENE	UG/KG				
BENZO(A)PYRENE	UG/KG				

UG/KG - microgram per kilogram
J - value is estimated

TABLE 4-21
WOODED AREAS, THE RAVINE, AND SITE 82 SUBSURFACE SOIL
POSITIVE DETECTION SUMMARY
REMEDIAL INVESTIGATION CTO-0133
MCB CAMP LEJEUNE, NORTH CAROLINA
ORGANICS

Sample No:		6-201N-SB10-02	6-201N-SB12-02	6-201N-SB4-01	6-201N-SB5-03
Depth:		3 - 5'	5 - 7'	1 - 3'	5 - 7'
Date Sampled:		9/11/92	10/13/92	9/10/92	9/10/92
Lab Id:		00507-27	00573-14	00502-09	00502-11
Parameter	Units				
PESTICIDE/PCBS					
DIELDRIN	UG/KG				
4,4'-DDE	UG/KG			3.5	
4,4'-DDD	UG/KG				
4,4'-DDT	UG/KG		5.9		
PCB-1260	UG/KG				
VOLATILES					
CHLOROMETHANE	UG/KG				
BROMOMETHANE	UG/KG				
METHYLENE CHLORIDE	UG/KG				
ACETONE	UG/KG		27		
CARBON DISULFIDE	UG/KG				
1,2-DICHLOROETHENE	UG/KG				
2-BUTANONE	UG/KG				
1,1,1-TRICHLOROETHANE	UG/KG				
TRICHLOROETHENE	UG/KG				
BENZENE	UG/KG	1 J			
4-METHYL-2-PENTANONE	UG/KG				
TETRACHLOROETHENE	UG/KG				
TOLUENE	UG/KG	1 J			
TOTAL XYLENES	UG/KG				
SEMIVOLATILES					
1,4-DICHLOROBENZENE	UG/KG				
ISOPHORONE	UG/KG				
NAPHTHALENE	UG/KG				
2-METHYLNAPHTHALENE	UG/KG				
2-CHLORONAPHTHALENE	UG/KG				
DIETHYL PHTHALATE	UG/KG				
PHENANTHRENE	UG/KG				
FLUORANTHENE	UG/KG				
PYRENE	UG/KG				
BENZO(A)ANTHRACENE	UG/KG				
CHRYSENE	UG/KG				
BIS(2-ETHYLHEXYL)PHTHALATE	UG/KG				89 J
DI-N-OCTYL PHTHALATE	UG/KG				
BENZO(B)FLUORANTHENE	UG/KG				
BENZO(A)PYRENE	UG/KG				

UG/KG - microgram per kilogram
J - value is estimated

TABLE 4-21
WOODED AREAS, THE RAVINE, AND SITE 82 SUBSURFACE SOIL
POSITIVE DETECTION SUMMARY
REMEDIAL INVESTIGATION CTO-0133
MCB CAMP LEJEUNE, NORTH CAROLINA
ORGANICS

	Sample No:	6-201N-SB7-01	6-201N-SB9-01	6-201S-SB1-01	6-201S-SB11-01
	Depth:	1 - 3'	1 - 3'	1 - 3'	1 - 3'
	Date Sampled:	9/11/92	9/11/92	9/15/92	9/13/92
	Lab Id:	00502-15	00502-19	00519-09	00510-26
Parameter	Units				
PESTICIDE/PCBS					
DIELDRIN	UG/KG				
4,4'-DDE	UG/KG			5.3	
4,4'-DDD	UG/KG				
4,4'-DDT	UG/KG				
PCB-1260	UG/KG				
VOLATILES					
CHLOROMETHANE	UG/KG				
BROMOMETHANE	UG/KG				
METHYLENE CHLORIDE	UG/KG				
ACETONE	UG/KG		9 J		
CARBON DISULFIDE	UG/KG				
1,2-DICHLOROETHENE	UG/KG				
2-BUTANONE	UG/KG				
1,1,1-TRICHLOROETHANE	UG/KG				
TRICHLOROETHENE	UG/KG				
BENZENE	UG/KG				
4-METHYL-2-PENTANONE	UG/KG				
TETRACHLOROETHENE	UG/KG				
TOLUENE	UG/KG				
TOTAL XYLENES	UG/KG				
SEMIVOLATILES					
1,4-DICHLOROBENZENE	UG/KG				
ISOPHORONE	UG/KG				
NAPHTHALENE	UG/KG				
2-METHYLNAPHTHALENE	UG/KG				
2-CHLORONAPHTHALENE	UG/KG				
DIETHYL PHTHALATE	UG/KG				
PHENANTHRENE	UG/KG				
FLUORANTHENE	UG/KG				
PYRENE	UG/KG				
BENZO(A)ANTHRACENE	UG/KG				
CHRYSENE	UG/KG				
BIS(2-ETHYLHEXYL)PHTHALATE	UG/KG	64 J			210 J
DI-N-OCTYL PHTHALATE	UG/KG				
BENZO(B)FLUORANTHENE	UG/KG				
BENZO(A)PYRENE	UG/KG				

UG/KG - microgram per kilogram
J - value is estimated

TABLE 4-21
WOODED AREAS, THE RAVINE, AND SITE 82 SUBSURFACE SOIL
POSITIVE DETECTION SUMMARY
REMEDIAL INVESTIGATION CTO-0133
MCB CAMP LEJEUNE, NORTH CAROLINA
ORGANICS

	Sample No:	6-201S-SB4-01	6-201S-SB6-01	6-201S-SB9-01	6-203OSA-SB12-01
	Depth:	1 - 3'	1 - 3'	1 - 3'	1 - 3'
	Date Sampled:	9/15/92	9/14/92	9/13/92	9/9/92
	Lab Id:	00519-14	00510-20	00510-23	00496-19
Parameter	Units				
PESTICIDE/PCBS					
DIELDRIN	UG/KG				
4,4'-DDE	UG/KG		3.9 J		
4,4'-DDD	UG/KG				
4,4'-DDT	UG/KG				
PCB-1260	UG/KG				
VOLATILES					
CHLOROMETHANE	UG/KG				
BROMOMETHANE	UG/KG				750 J
METHYLENE CHLORIDE	UG/KG				
ACETONE	UG/KG				4800
CARBON DISULFIDE	UG/KG				
1,2-DICHLOROETHENE	UG/KG				
2-BUTANONE	UG/KG				
1,1,1-TRICHLOROETHANE	UG/KG				
TRICHLOROETHENE	UG/KG				
BENZENE	UG/KG				
4-METHYL-2-PENTANONE	UG/KG				
TETRACHLOROETHENE	UG/KG				11000
TOLUENE	UG/KG		2 J		
TOTAL XYLENES	UG/KG				
SEMIVOLATILES					
1,4-DICHLOROBENZENE	UG/KG				300 J
ISOPHORONE	UG/KG				
NAPHTHALENE	UG/KG				
2-METHYLNAPHTHALENE	UG/KG				
2-CHLORONAPHTHALENE	UG/KG				
DIETHYL PHTHALATE	UG/KG				
PHENANTHRENE	UG/KG				
FLUORANTHENE	UG/KG				
PYRENE	UG/KG				
BENZO(A)ANTHRACENE	UG/KG				
CHRYSENE	UG/KG				
BIS(2-ETHYLHEXYL)PHTHALATE	UG/KG	44 J		69 J	510 J
DI-N-OCTYL PHTHALATE	UG/KG				
BENZO(B)FLUORANTHENE	UG/KG				
BENZO(A)PYRENE	UG/KG				

UG/KG - microgram per kilogram
J - value is estimated

TABLE 4-21
WOODED AREAS, THE RAVINE, AND SITE 82 SUBSURFACE SOIL
POSITIVE DETECTION SUMMARY
REMEDIAL INVESTIGATION CTO-0133
MCB CAMP LEJEUNE, NORTH CAROLINA
ORGANICS

	Sample No:	6-203OSA-SB12-08	6-203OSA-SB13-05	6-203OSA-SB13-12	6-203OSA-SB14-03
	Depth:	15 - 17'	9 - 11'	21 - 23'	5 - 7'
	Date Sampled:	9/9/92	9/13/92	9/13/92	9/13/92
	Lab Id:	00496-20	00511-17	00511-18	00511-20
Parameter	Units				
PESTICIDE/PCBS					
DIELDRIN	UG/KG				
4,4'-DDE	UG/KG				
4,4'-DDD	UG/KG				
4,4'-DDT	UG/KG				
PCB-1260	UG/KG				
VOLATILES					
CHLOROMETHANE	UG/KG				
BROMOMETHANE	UG/KG				
METHYLENE CHLORIDE	UG/KG				
ACETONE	UG/KG				48 J
CARBON DISULFIDE	UG/KG				
1,2-DICHLOROETHENE	UG/KG				
2-BUTANONE	UG/KG				
1,1,1-TRICHLOROETHANE	UG/KG				
TRICHLOROETHENE	UG/KG				
BENZENE	UG/KG				
4-METHYL-2-PENTANONE	UG/KG				
TETRACHLOROETHENE	UG/KG	9 J			
TOLUENE	UG/KG				
TOTAL XYLENES	UG/KG				
SEMIVOLATILES					
1,4-DICHLOROBENZENE	UG/KG				
ISOPHORONE	UG/KG				
NAPHTHALENE	UG/KG				
2-METHYLNAPHTHALENE	UG/KG				
2-CHLORONAPHTHALENE	UG/KG				
DIETHYL PHTHALATE	UG/KG				
PHENANTHRENE	UG/KG				
FLUORANTHENE	UG/KG				
PYRENE	UG/KG				
BENZO(A)ANTHRACENE	UG/KG				
CHRYSENE	UG/KG				
BIS(2-ETHYLHEXYL)PHTHALATE	UG/KG	160 J	62 J	74 J	
DI-N-OCTYL PHTHALATE	UG/KG				
BENZO(B)FLUORANTHENE	UG/KG				
BENZO(A)PYRENE	UG/KG				

UG/KG - microgram per kilogram
J - value is estimated

TABLE 4-21
WOODED AREAS, THE RAVINE, AND SITE 82 SUBSURFACE SOIL
POSITIVE DETECTION SUMMARY
REMEDIAL INVESTIGATION CTO-0133
MCB CAMP LEJEUNE, NORTH CAROLINA
ORGANICS

Sample No:		6-203OSA-SB15-02	6-203OSA-SB16-03	6-203OSA-SB17-04	6-203OSA-SB17-06
Depth:		3 - 5'	3 - 5'	7 - 9'	13 - 15'
Date Sampled:		9/11/92	9/11/92	9/9/92	9/9/92
Lab Id:		00507-43	00507-46	00496-06	00496-07
Parameter	Units				
PESTICIDE/PCBS					
DIELDRIN	UG/KG				
4,4'-DDE	UG/KG	8.3 J			
4,4'-DDD	UG/KG				
4,4'-DDT	UG/KG	9.9 J	4 J		
PCB-1260	UG/KG				
VOLATILES					
CHLOROMETHANE	UG/KG				
BROMOMETHANE	UG/KG				
METHYLENE CHLORIDE	UG/KG				
ACETONE	UG/KG	510 J			
CARBON DISULFIDE	UG/KG				
1,2-DICHLOROETHENE	UG/KG				
-BUTANONE	UG/KG				
.,1,1-TRICHLOROETHANE	UG/KG				
TRICHLOROETHENE	UG/KG				
BENZENE	UG/KG				
4-METHYL-2-PENTANONE	UG/KG				
TETRACHLOROETHENE	UG/KG				
TOLUENE	UG/KG				
TOTAL XYLENES	UG/KG				
SEMIVOLATILES					
1,4-DICHLOROBENZENE	UG/KG				
ISOPHORONE	UG/KG				
NAPHTHALENE	UG/KG				
2-METHYLNAPHTHALENE	UG/KG				
2-CHLORONAPHTHALENE	UG/KG				
DIETHYL PHTHALATE	UG/KG				
PHENANTHRENE	UG/KG				
FLUORANTHENE	UG/KG				
PYRENE	UG/KG				
BENZO(A)ANTHRACENE	UG/KG				
CHRYSENE	UG/KG				
BIS(2-ETHYLHEXYL)PHTHALATE	UG/KG			93 J	140 J
DI-N-OCTYL PHTHALATE	UG/KG				
BENZO(B)FLUORANTHENE	UG/KG				
BENZO(A)PYRENE	UG/KG				

UG/KG - microgram per kilogram
J - value is estimated

TABLE 4-21
WOODED AREAS, THE RAVINE, AND SITE 82 SUBSURFACE SOIL
POSITIVE DETECTION SUMMARY
REMEDIAL INVESTIGATION CTO-0133
MCB CAMP LEJEUNE, NORTH CAROLINA
ORGANICS

	Sample No:	6-203OSA-SB18-03	6-203OSA-SB19-01	6-203OSA-SB20-02	6-203OSA-SB3-01
	Depth:	5 - 7'	1 - 3'	3 - 5'	1 - 3'
	Date Sampled:	9/9/92	9/13/92	9/13/92	9/12/92
	Lab Id:	00496-09	00511-22	00511-25	00507-30
Parameter	Units				
PESTICIDE/PCBS					
DIELDRIN	UG/KG			53 J	
4,4'-DDE	UG/KG				
4,4'-DDD	UG/KG				
4,4'-DDT	UG/KG				
PCB-1260	UG/KG				
VOLATILES					
CHLOROMETHANE	UG/KG		490 J		
BROMOMETHANE	UG/KG		1300		
METHYLENE CHLORIDE	UG/KG		340 J		
ACETONE	UG/KG		5000 J		59
CARBON DISULFIDE	UG/KG				
1,2-DICHLOROETHENE	UG/KG				
-BUTANONE	UG/KG		1500 J		
1,1,1-TRICHLOROETHANE	UG/KG				
TRICHLOROETHENE	UG/KG				
BENZENE	UG/KG				
4-METHYL-2-PENTANONE	UG/KG				
TETRACHLOROETHENE	UG/KG				
TOLUENE	UG/KG		34 J		
TOTAL XYLENES	UG/KG				
SEMIVOLATILES					
1,4-DICHLOROBENZENE	UG/KG				
ISOPHORONE	UG/KG				
NAPHTHALENE	UG/KG				
2-METHYLNAPHTHALENE	UG/KG				
2-CHLORONAPHTHALENE	UG/KG				
DIETHYL PHTHALATE	UG/KG				
PHENANTHRENE	UG/KG				
FLUORANTHENE	UG/KG				
PYRENE	UG/KG				
BENZO(A)ANTHRACENE	UG/KG				
CHRYSENE	UG/KG				
BIS(2-ETHYLHEXYL)PHTHALATE	UG/KG	51 J			
DI-N-OCTYL PHTHALATE	UG/KG				
BENZO(B)FLUORANTHENE	UG/KG				
BENZO(A)PYRENE	UG/KG				

UG/KG - microgram per kilogram
J - value is estimated

TABLE 4-21
WOODED AREAS, THE RAVINE, AND SITE 82 SUBSURFACE SOIL
POSITIVE DETECTION SUMMARY
REMEDIAL INVESTIGATION CTO-0133
MCB CAMP LEJEUNE, NORTH CAROLINA
ORGANICS

Sample No:		6-203OSA-SB7-01	6-203OSA-SB8-06	6-203OSA-SB9-05	6-203OSA-SB9-06
Depth:		1 - 2'	13 - 15'	9 - 11'	11 - 13'
Date Sampled:		9/14/92	9/13/92	9/13/92	9/13/92
Lab Id:		00511-08	00511-12	00511-14	00511-15
Parameter	Units				
PESTICIDE/PCBS					
DIELDRIN	UG/KG	3.4 J			
4,4'-DDE	UG/KG	5.5 J			
4,4'-DDD	UG/KG				
4,4'-DDT	UG/KG	9.1 J			
PCB-1260	UG/KG				
VOLATILES					
CHLOROMETHANE	UG/KG				
BROMOMETHANE	UG/KG				
METHYLENE CHLORIDE	UG/KG				
ACETONE	UG/KG		29		28
CARBON DISULFIDE	UG/KG				
1,2-DICHLOROETHENE	UG/KG				
2-BUTANONE	UG/KG				
1,1,1-TRICHLOROETHANE	UG/KG				
TRICHLOROETHENE	UG/KG				
BENZENE	UG/KG				
4-METHYL-2-PENTANONE	UG/KG				
TETRACHLOROETHENE	UG/KG				
TOLUENE	UG/KG				
TOTAL XYLENES	UG/KG				
SEMIVOLATILES					
1,4-DICHLOROBENZENE	UG/KG				
ISOPHORONE	UG/KG				
NAPHTHALENE	UG/KG				
2-METHYLNAPHTHALENE	UG/KG	37 J			
2-CHLORONAPHTHALENE	UG/KG				
DIETHYL PHTHALATE	UG/KG				
PHENANTHRENE	UG/KG	70 J			
FLUORANTHENE	UG/KG	85 J			
PYRENE	UG/KG	110 J			
BENZO(A)ANTHRACENE	UG/KG	96 J			
CHRYSENE	UG/KG	68 J			
BIS(2-ETHYLHEXYL)PHTHALATE	UG/KG	110 J	78 J	46 J	60 J
DI-N-OCTYL PHTHALATE	UG/KG				
BENZO(B)FLUORANTHENE	UG/KG	100 J			
BENZO(A)PYRENE	UG/KG	58 J			

UG/KG - microgram per kilogram
J - value is estimated

TABLE 4-21
WOODED AREAS, THE RAVINE, AND SITE 82 SUBSURFACE SOIL
POSITIVE DETECTION SUMMARY
REMEDIAL INVESTIGATION CTO-0133
MCB CAMP LEJEUNE, NORTH CAROLINA
ORGANICS

Sample No:		6-GW10-02A	6-GW10-02B	6-GW12-02	6-GW13-01
Depth:		2 - 4'	4 - 6'	2 - 4'	1 - 2'
Date Sampled:		9/23/92	9/23/92	9/24/92	9/24/92
Lab Id:		00536-24	00536-25	00536-27	00544-06
Parameter	Units				
PESTICIDE/PCBS					
DIELDRIN	UG/KG				
4,4'-DDE	UG/KG				
4,4'-DDD	UG/KG				
4,4'-DDT	UG/KG				
PCB-1260	UG/KG				
VOLATILES					
CHLOROMETHANE	UG/KG				
BROMOMETHANE	UG/KG				
METHYLENE CHLORIDE	UG/KG				
ACETONE	UG/KG				33 J
CARBON DISULFIDE	UG/KG				
1,2-DICHLOROETHENE	UG/KG	5 J			
2-BUTANONE	UG/KG				
1,1,1-TRICHLOROETHANE	UG/KG				
TRICHLOROETHENE	UG/KG				
BENZENE	UG/KG				
4-METHYL-2-PENTANONE	UG/KG				
TETRACHLOROETHENE	UG/KG				
TOLUENE	UG/KG				
TOTAL XYLENES	UG/KG				
SEMIVOLATILES					
1,4-DICHLOROBENZENE	UG/KG				
ISOPHORONE	UG/KG				
NAPHTHALENE	UG/KG				
2-METHYLNAPHTHALENE	UG/KG				
2-CHLORONAPHTHALENE	UG/KG				
DIETHYL PHTHALATE	UG/KG				
PHENANTHRENE	UG/KG				
FLUORANTHENE	UG/KG		65 J		
PYRENE	UG/KG		63 J		
BENZO(A)ANTHRACENE	UG/KG				
CHRYSENE	UG/KG				
BIS(2-ETHYLHEXYL)PHTHALATE	UG/KG			88 J	
DI-N-OCTYL PHTHALATE	UG/KG				
BENZO(B)FLUORANTHENE	UG/KG				
BENZO(A)PYRENE	UG/KG				

UG/KG - microgram per kilogram
J - value is estimated

TABLE 4-21
WOODED AREAS, THE RAVINE, AND SITE 82 SUBSURFACE SOIL
POSITIVE DETECTION SUMMARY
REMEDIAL INVESTIGATION CTO-0133
MCB CAMP LEJEUNE, NORTH CAROLINA
ORGANICS

	Sample No:	6-GW13-02	6-GW16-02	6-GW17-01	6-GW17-02
	Depth:	2 - 4'	4 - 6'	2 - 4'	4 - 6'
	Date Sampled:	9/24/92	10/11/92	9/25/92	9/25/92
	Lab Id:	00544-07	00570-19	00544-08	00544-09
Parameter	Units				
PESTICIDE/PCBS					
DIELDRIN	UG/KG				
4,4'-DDE	UG/KG				
4,4'-DDD	UG/KG				
4,4'-DDT	UG/KG				
PCB-1260	UG/KG				
VOLATILES					
CHLOROMETHANE	UG/KG				
BROMOMETHANE	UG/KG				
METHYLENE CHLORIDE	UG/KG				
ACETONE	UG/KG	25 J	22 J	4 J	4 J
CARBON DISULFIDE	UG/KG				
1,2-DICHLOROETHENE	UG/KG				
2-BUTANONE	UG/KG				
1,1,1-TRICHLOROETHANE	UG/KG				
TRICHLOROETHENE	UG/KG				
BENZENE	UG/KG				
4-METHYL-2-PENTANONE	UG/KG				
TETRACHLOROETHENE	UG/KG				
TOLUENE	UG/KG				
TOTAL XYLENES	UG/KG				
SEMIVOLATILES					
1,4-DICHLOROBENZENE	UG/KG				
ISOPHORONE	UG/KG				
NAPHTHALENE	UG/KG				
2-METHYLNAPHTHALENE	UG/KG				
2-CHLORONAPHTHALENE	UG/KG				
DIETHYL PHTHALATE	UG/KG				
PHENANTHRENE	UG/KG				
FLUORANTHENE	UG/KG				
PYRENE	UG/KG				
BENZO(A)ANTHRACENE	UG/KG				
CHRYSENE	UG/KG				
BIS(2-ETHYLHEXYL)PHTHALATE	UG/KG				
DI-N-OCTYL PHTHALATE	UG/KG				
BENZO(B)FLUORANTHENE	UG/KG				
BENZO(A)PYRENE	UG/KG				

UG/KG - microgram per kilogram
J - value is estimated

TABLE 4-21
WOODED AREAS, THE RAVINE, AND SITE 82 SUBSURFACE SOIL
POSITIVE DETECTION SUMMARY
REMEDIAL INVESTIGATION CTO-0133
MCB CAMP LEJEUNE, NORTH CAROLINA
ORGANICS

Sample No:		6-GW18-01	6-GW18-03	6-GW21-04	6-GW21-07
Depth:		0 - 2'	4 - 6'	8 - 10'	14 - 16'
Date Sampled:		9/25/92	9/25/92	9/24/92	9/24/92
Lab Id:		00544-18	00544-19	00544-10	00544-11
Parameter	Units				
PESTICIDE/PCBS					
DIELDRIN	UG/KG				
4,4'-DDE	UG/KG				
4,4'-DDD	UG/KG				
4,4'-DDT	UG/KG				
PCB-1260	UG/KG				
VOLATILES					
CHLOROMETHANE	UG/KG				
BROMOMETHANE	UG/KG				
METHYLENE CHLORIDE	UG/KG				
ACETONE	UG/KG	15	26	8 J	34 J
CARBON DISULFIDE	UG/KG				
1,2-DICHLOROETHENE	UG/KG				
2-BUTANONE	UG/KG				
1,1,1-TRICHLOROETHANE	UG/KG				
TRICHLOROETHENE	UG/KG				
BENZENE	UG/KG				
4-METHYL-2-PENTANONE	UG/KG				
TETRACHLOROETHENE	UG/KG				
TOLUENE	UG/KG				
TOTAL XYLENES	UG/KG				
SEMIVOLATILES					
1,4-DICHLOROBENZENE	UG/KG				
ISOPHORONE	UG/KG				
NAPHTHALENE	UG/KG				
2-METHYLNAPHTHALENE	UG/KG				
2-CHLORONAPHTHALENE	UG/KG				
DIETHYL PHTHALATE	UG/KG				
PHENANTHRENE	UG/KG				
FLUORANTHENE	UG/KG				
PYRENE	UG/KG				
BENZO(A)ANTHRACENE	UG/KG				
CHRYSENE	UG/KG				
BIS(2-ETHYLHEXYL)PHTHALATE	UG/KG				
DI-N-OCTYL PHTHALATE	UG/KG				
BENZO(B)FLUORANTHENE	UG/KG				
BENZO(A)PYRENE	UG/KG				

UG/KG - microgram per kilogram
J - value is estimated

TABLE 4-21
WOODED AREAS, THE RAVINE, AND SITE 82 SUBSURFACE SOIL
POSITIVE DETECTION SUMMARY
REMEDIAL INVESTIGATION CTO-0133
MCB CAMP LEJEUNE, NORTH CAROLINA
ORGANICS

	Sample No:	6-GW25-04	6-GW25-05	6-GW26-03	6-GW26-04
	Depth:	8 - 10'	10 - 12'	6 - 8'	8 - 10'
	Date Sampled:	10/7/92	10/7/92	10/09/92	10/09/92
	Lab Id:	00564-14	00564-15	00570-01	00570-02
Parameter	Units				
PESTICIDE/PCBS					
DIELDRIN	UG/KG				
4,4'-DDE	UG/KG				
4,4'-DDD	UG/KG				
4,4'-DDT	UG/KG				
PCB-1260	UG/KG				
VOLATILES					
CHLOROMETHANE	UG/KG				
BROMOMETHANE	UG/KG				
METHYLENE CHLORIDE	UG/KG				
ACETONE	UG/KG			11 J	4 J
CARBON DISULFIDE	UG/KG	2 J	2 J		
1,2-DICHLOROETHENE	UG/KG				
2-BUTANONE	UG/KG				
1,1,1-TRICHLOROETHANE	UG/KG				
TRICHLOROETHENE	UG/KG				
BENZENE	UG/KG				
4-METHYL-2-PENTANONE	UG/KG				
TETRACHLOROETHENE	UG/KG				
TOLUENE	UG/KG				
TOTAL XYLENES	UG/KG				
SEMIVOLATILES					
1,4-DICHLOROBENZENE	UG/KG				
ISOPHORONE	UG/KG				
NAPHTHALENE	UG/KG				
2-METHYLNAPHTHALENE	UG/KG				
2-CHLORONAPHTHALENE	UG/KG				
DIETHYL PHTHALATE	UG/KG				
PHENANTHRENE	UG/KG				
FLUORANTHENE	UG/KG				
PYRENE	UG/KG				
BENZO(A)ANTHRACENE	UG/KG				
CHRYSENE	UG/KG				
BIS(2-ETHYLHEXYL)PHTHALATE	UG/KG			110 J	
DI-N-OCTYL PHTHALATE	UG/KG				
BENZO(B)FLUORANTHENE	UG/KG				
BENZO(A)PYRENE	UG/KG				

UG/KG - microgram per kilogram
J - value is estimated

TABLE 4-21
WOODED AREAS, THE RAVINE, AND SITE 82 SUBSURFACE SOIL
POSITIVE DETECTION SUMMARY
REMEDIAL INVESTIGATION CTO-0133
MCB CAMP LEJEUNE, NORTH CAROLINA
ORGANICS

	Sample No:	6-GW28-08	6-GW28-09	6-GW28D-09	6-GW2D-06
	Depth:	16 - 18'	18 - 20'	18 - 20'	10 - 12'
	Date Sampled:	10/09/92	10/09/92	10/20/92	10/10/92
	Lab Id:	00570-03	00570-04	00582-09	00570-14
Parameter	Units				
PESTICIDE/PCBS					
DIELDRIN	UG/KG				
4,4'-DDE	UG/KG				
4,4'-DDD	UG/KG				
4,4'-DDT	UG/KG				
PCB-1260	UG/KG				
VOLATILES					
CHLOROMETHANE	UG/KG				
BROMOMETHANE	UG/KG				
METHYLENE CHLORIDE	UG/KG				
ACETONE	UG/KG	15	44	8 J	
CARBON DISULFIDE	UG/KG				
1,2-DICHLOROETHENE	UG/KG				
2-BUTANONE	UG/KG				
1,1,1-TRICHLOROETHANE	UG/KG				
TRICHLOROETHENE	UG/KG				
BENZENE	UG/KG				
4-METHYL-2-PENTANONE	UG/KG				
TETRACHLOROETHENE	UG/KG				
TOLUENE	UG/KG				
TOTAL XYLENES	UG/KG				
SEMIVOLATILES					
1,4-DICHLOROBENZENE	UG/KG				
ISOPHORONE	UG/KG				
NAPHTHALENE	UG/KG				
2-METHYLNAPHTHALENE	UG/KG				
2-CHLORONAPHTHALENE	UG/KG				
DIETHYL PHTHALATE	UG/KG				
PHENANTHRENE	UG/KG				
FLUORANTHENE	UG/KG				
PYRENE	UG/KG				
BENZO(A)ANTHRACENE	UG/KG				
CHRYSENE	UG/KG				
BIS(2-ETHYLHEXYL)PHTHALATE	UG/KG				67 J
DI-N-OCTYL PHTHALATE	UG/KG				
BENZO(B)FLUORANTHENE	UG/KG				
BENZO(A)PYRENE	UG/KG				

UG/KG - microgram per kilogram
J - value is estimated

TABLE 4-21
WOODED AREAS, THE RAVINE, AND SITE 82 SUBSURFACE SOIL
POSITIVE DETECTION SUMMARY
REMEDIAL INVESTIGATION CTO-0133
MCB CAMP LEJEUNE, NORTH CAROLINA
ORGANICS

	Sample No:	6-GW30-02	6-GW30-03	6-GW7D-02	6-GW9-02
	Depth:	4 - 6'	6 - 8'	2 - 4'	2 - 4'
	Date Sampled:	10/10/92	10/10/92	10/6/92	9/24/92
	Lab Id:	00570-24	00570-25	00564-01	00544-04
Parameter	Units				
PESTICIDE/PCBS					
DIELDRIN	UG/KG				
4,4'-DDE	UG/KG				
4,4'-DDD	UG/KG				
4,4'-DDT	UG/KG				
PCB-1260	UG/KG				
VOLATILES					
CHLOROMETHANE	UG/KG				
BROMOMETHANE	UG/KG			4 J	
METHYLENE CHLORIDE	UG/KG				
ACETONE	UG/KG	23 J	13 J		11 J
CARBON DISULFIDE	UG/KG				
1,2-DICHLOROETHENE	UG/KG				
2-BUTANONE	UG/KG				
1,1,1-TRICHLOROETHANE	UG/KG				
TRICHLOROETHENE	UG/KG				
BENZENE	UG/KG				
4-METHYL-2-PENTANONE	UG/KG				
TETRACHLOROETHENE	UG/KG				
TOLUENE	UG/KG				
TOTAL XYLENES	UG/KG				
SEMIVOLATILES					
1,4-DICHLOROBENZENE	UG/KG				
ISOPHORONE	UG/KG				
NAPHTHALENE	UG/KG				
2-METHYLNAPHTHALENE	UG/KG				
2-CHLORONAPHTHALENE	UG/KG				
DIETHYL PHTHALATE	UG/KG				
PHENANTHRENE	UG/KG				
FLUORANTHENE	UG/KG				
PYRENE	UG/KG				
BENZO(A)ANTHRACENE	UG/KG				
CHRYSENE	UG/KG				
BIS(2-ETHYLHEXYL)PHTHALATE	UG/KG				
DI-N-OCTYL PHTHALATE	UG/KG				
BENZO(B)FLUORANTHENE	UG/KG				
BENZO(A)PYRENE	UG/KG				

UG/KG - microgram per kilogram
J - value is estimated

TABLE 4-21
WOODED AREAS, THE RAVINE, AND SITE 82 SUBSURFACE SOIL
POSITIVE DETECTION SUMMARY
REMEDIAL INVESTIGATION CTO-0133
MCB CAMP LEJEUNE, NORTH CAROLINA
ORGANICS

Sample No:		6-GW9-03	6-RAV-SB11-01	6-RAV-SB12-01	6-RAV-SB13-02
Depth:		4 - 6'	2 - 3'	1 - 2'	3 - 4'
Date Sampled:		9/24/92	9/14/92	9/14/92	9/14/92
Lab Id:		00544-05	00512-18	00512-21	00512-23
Parameter	Units				
PESTICIDE/PCBS					
DIELDRIN	UG/KG				280 J
4,4'-DDE	UG/KG			37	
4,4'-DDD	UG/KG				
4,4'-DDT	UG/KG			39 J	
PCB-1260	UG/KG				
VOLATILES					
CHLOROMETHANE	UG/KG				
BROMOMETHANE	UG/KG				
METHYLENE CHLORIDE	UG/KG				
ACETONE	UG/KG	11 J			
CARBON DISULFIDE	UG/KG				
1,2-DICHLOROETHENE	UG/KG				
2-BUTANONE	UG/KG				
1,1,1-TRICHLOROETHANE	UG/KG				
TRICHLOROETHENE	UG/KG				
BENZENE	UG/KG				
4-METHYL-2-PENTANONE	UG/KG				2000 J
TETRACHLOROETHENE	UG/KG				
TOLUENE	UG/KG				
TOTAL XYLENES	UG/KG				950 J
SEMIVOLATILES					
1,4-DICHLOROBENZENE	UG/KG				
ISOPHORONE	UG/KG				7700 J
NAPHTHALENE	UG/KG				9600 J
2-METHYLNAPHTHALENE	UG/KG				11000 J
2-CHLORONAPHTHALENE	UG/KG				110 J
DIETHYL PHTHALATE	UG/KG				34 J
PHENANTHRENE	UG/KG				31 J
FLUORANTHENE	UG/KG				
PYRENE	UG/KG				
BENZO(A)ANTHRACENE	UG/KG				
CHRYSENE	UG/KG				
BIS(2-ETHYLHEXYL)PHTHALATE	UG/KG		59 J	96 J	130 J
DI-N-OCTYL PHTHALATE	UG/KG				110 J
BENZO(B)FLUORANTHENE	UG/KG				
BENZO(A)PYRENE	UG/KG				

UG/KG - microgram per kilogram
J - value is estimated

TABLE 4-21
WOODED AREAS, THE RAVINE, AND SITE 82 SUBSURFACE SOIL
POSITIVE DETECTION SUMMARY
REMEDIAL INVESTIGATION CTO-0133
MCB CAMP LEJEUNE, NORTH CAROLINA
ORGANICS

	Sample No:	6-RAV-SB14-01	6-RAV-SB16-02	6-RAV-SB3-02	6-RAV-SB4A-01
	Depth:	0.5 - 1'	3.5 - 4'	1 - 2'	1.5 - 2'
	Date Sampled:	9/14/92	10/09/92	9/11/92	9/14/92
	Lab Id:	00512-25	00570-08	00502-32	00512-02
Parameter	Units				
PESTICIDE/PCBS					
DIELDRIN	UG/KG				
4,4'-DDE	UG/KG	67			16
4,4'-DDD	UG/KG				16
4,4'-DDT	UG/KG	77 J			21 J
PCB-1260	UG/KG				
VOLATILES					
CHLOROMETHANE	UG/KG				
BROMOMETHANE	UG/KG				
METHYLENE CHLORIDE	UG/KG				
ACETONE	UG/KG				
CARBON DISULFIDE	UG/KG				
1,2-DICHLOROETHENE	UG/KG				
2-BUTANONE	UG/KG				
1,1,1-TRICHLOROETHANE	UG/KG				
TRICHLOROETHENE	UG/KG		1 J		
BENZENE	UG/KG				
4-METHYL-2-PENTANONE	UG/KG				
TETRACHLOROETHENE	UG/KG				
TOLUENE	UG/KG				
TOTAL XYLENES	UG/KG				
SEMIVOLATILES					
1,4-DICHLOROBENZENE	UG/KG				
ISOPHORONE	UG/KG				
NAPHTHALENE	UG/KG				
2-METHYLNAPHTHALENE	UG/KG				
2-CHLORONAPHTHALENE	UG/KG				
DIETHYL PHTHALATE	UG/KG				
PHENANTHRENE	UG/KG				
FLUORANTHENE	UG/KG	61 J			
PYRENE	UG/KG	73 J			
BENZO(A)ANTHRACENE	UG/KG	45 J			
CHRYSENE	UG/KG				
BIS(2-ETHYLHEXYL)PHTHALATE	UG/KG	380 J		43 J	100 J
DI-N-OCTYL PHTHALATE	UG/KG				
BENZO(B)FLUORANTHENE	UG/KG	110 J			
BENZO(A)PYRENE	UG/KG	55 J			

UG/KG - microgram per kilogram
J - value is estimated

TABLE 4-21
WOODED AREAS, THE RAVINE, AND SITE 82 SUBSURFACE SOIL
POSITIVE DETECTION SUMMARY
REMEDIAL INVESTIGATION CTO-0133
MCB CAMP LEJEUNE, NORTH CAROLINA
ORGANICS

	Sample No:	6-RAV-SB6-02	6-RAV-SB7-02
	Depth:	2 - 3'	2.5 - 3'
	Date Sampled:	9/14/92	9/14/92
	Lab Id:	00512-07	00512-09
Parameter	Units		
PESTICIDE/PCBS			
DIELDRIN	UG/KG		
4,4'-DDE	UG/KG		16
4,4'-DDD	UG/KG		
4,4'-DDT	UG/KG	6.9 J	24 J
PCB-1260	UG/KG		
VOLATILES			
CHLOROMETHANE	UG/KG		
BROMOMETHANE	UG/KG		
METHYLENE CHLORIDE	UG/KG		
ACETONE	UG/KG		
CARBON DISULFIDE	UG/KG		
1,2-DICHLOROETHENE	UG/KG		
2-BUTANONE	UG/KG		
1,1,1-TRICHLOROETHANE	UG/KG		
TRICHLOROETHENE	UG/KG		
BENZENE	UG/KG		
4-METHYL-2-PENTANONE	UG/KG		
TETRACHLOROETHENE	UG/KG		
TOLUENE	UG/KG		
TOTAL XYLENES	UG/KG		
SEMIVOLATILES			
1,4-DICHLOROBENZENE	UG/KG		
ISOPHORONE	UG/KG		
NAPHTHALENE	UG/KG		
2-METHYLNAPHTHALENE	UG/KG		
2-CHLORONAPHTHALENE	UG/KG		
DIETHYL PHTHALATE	UG/KG		
PHENANTHRENE	UG/KG		
FLUORANTHENE	UG/KG		
PYRENE	UG/KG		
BENZO(A)ANTHRACENE	UG/KG		
CHRYSENE	UG/KG		
BIS(2-ETHYLHEXYL)PHTHALATE	UG/KG	76 J	44 J
DI-N-OCTYL PHTHALATE	UG/KG		
BENZO(B)FLUORANTHENE	UG/KG		
BENZO(A)PYRENE	UG/KG		

UG/KG - microgram per kilogram
J - value is estimated

TABLE 4-21
WOODS AND RAVINE AREA (SITE 82) SUBSURFACE SOILS
POSITIVE DETECTION SUMMARY
REMEDIAL INVESTIGATION CTO-0133
MCB CAMP LEJEUNE, NORTH CAROLINA
ORGANICS

	Sample No:	6-GW15D-02	6-GW30D-02	6-GW30D-03	6-GW31-06
	Depth:	4-6	4-6	6-8	10-12
	Date Sampled:	3/30/93	3/2/93	3/2/93	3/2/93
	Lab Id:	930170-01	930095-01	930095-02	930095-04
Parameter	Units				
VOLATILES					
BROMOMETHANE	UG/KG				22 J
METHYLENE CHLORIDE	UG/KG				12 J
ACETONE	UG/KG		290	180	
1,2-DICHLOROETHENE	UG/KG				
TRICHLOROETHENE	UG/KG	4 J			
1,1,2,2-TETRACHLOROETHANE	UG/KG				
ETHYLBENZENE	UG/KG				35 J

UG/KG - microgram per kilogram
J - value is estimated

TABLE 4-21
WOODS AND RAVINE AREA (SITE 82) SUBSURFACE SOILS
POSITIVE DETECTION SUMMARY
REMEDIAL INVESTIGATION CTO-0133
MCB CAMP LEJEUNE, NORTH CAROLINA
ORGANICS

	Sample No:	6-GW32-09	6-GW34-10	6-GW34-12	6-GW37D-03
	Depth:	12-14	14-16	18-20	4-6
	Date Sampled:	3/6/93	3/3/93	3/4/93	3/9/93
	Lab Id:	930095-33	930095-09	930095-30	930115-01
Parameter	Units				
VOLATILES					
BROMOMETHANE	UG/KG				
METHYLENE CHLORIDE	UG/KG				
ACETONE	UG/KG				10 J
1,2-DICHLOROETHENE	UG/KG	12 J			
TRICHLOROETHENE	UG/KG	13 J			
1,1,2,2-TETRACHLOROETHANE	UG/KG		49	1100	
ETHYLBENZENE	UG/KG				

TABLE 4-21
WOODS AND RAVINE AREA (SITE 82) SUBSURFACE SOILS
POSITIVE DETECTION SUMMARY
REMEDIAL INVESTIGATION CTO-0133
MCB CAMP LEJEUNE, NORTH CAROLINA
ORGANICS

	Sample No:	6-GW37D-04
	Depth:	4-6
	Date Sampled:	3/9/93
	Lab Id:	930115-02
Parameter	Units	
VOLATILES		
BROMOMETHANE	UG/KG	
METHYLENE CHLORIDE	UG/KG	
ACETONE	UG/KG	15
1,2-DICHLOROETHENE	UG/KG	
TRICHLOROETHENE	UG/KG	
1,1,2,2-TETRACHLOROETHANE	UG/KG	
ETHYLBENZENE	UG/KG	

UG/KG - microgram per kilogram
J - value is estimated

TABLE 4-22
WOODED AREAS, THE RAVINE, AND SITE 82 SUBSURFACE SOILS
POSITIVE DETECTION SUMMARY
REMEDIAL INVESTIGATION CTO-0133
MCB CAMP LEJEUNE, NORTH CAROLINA
TOTAL METALS

Sample No:		6-201E-SB1-01	6-201E-SB10-01	6-201E-SB11-01	6-201E-SB12-01	6-201E-SB13-02	6-201E-SB14-02
Depth:		1 - 3'	1 - 3'	1 - 3'	1 - 3'	3 - 5'	3 - 5'
Date Sampled:		9/11/92	9/12/92	9/12/92	9/13/92	9/13/92	9/13/92
Lab Id:		00507-02	00507-22	00507-24	00510-02	00510-05	00510-07
Parameter	Units						
ALUMINUM	MG/KG	3410 J	333 J	325 J	825	4370	1840
ANTIMONY	MG/KG			2.4 JB			
ARSENIC	MG/KG					3.2	
BARIUM	MG/KG	1.7 JB	7.4 JB	1.6 JB	3.4 B	4.1 B	1.8 JB
BERYLLIUM	MG/KG						
CADMIUM	MG/KG	0.33 JB					
CALCIUM	MG/KG		405 JB	153 JB	756 B	17.2 B	10.4 B
CHROMIUM	MG/KG	1.6 B	1.2 B	0.73 B	0.99 JB	3.6 J	1.2 JB
COBALT	MG/KG				0.49 JB		
COPPER	MG/KG				0.57 JB	0.92 JB	
IRON	MG/KG		363 J		58.1	2080	167
LEAD	MG/KG				2.2	4.4	19.5
MAGNESIUM	MG/KG	27.1 B	26.9 B		13.5 JB	49.1 JB	19.1 JB
MANGANESE	MG/KG		9.7 J		0.56 B	1.1 B	0.67 B
MERCURY	MG/KG						
NICKEL	MG/KG						
POTASSIUM	MG/KG	26 JB	18.2 JB	26.3 JB	19.3 B	160 B	30.8 B
SELENIUM	MG/KG						
SILVER	MG/KG						
SODIUM	MG/KG						
THALLIUM	MG/KG						
VANADIUM	MG/KG	1.3 JB			0.53 B	7.5 B	1.7 B
ZINC	MG/KG						

MG/KG - milligram per kilogram
B - reported value is less than Contract Required Detection Limit (CRDL), but greater than Instrument Detection Limit (IDL)
J - value is estimated
JB - value is estimated below the CRDL, but greater than the IDL

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TABLE 4-22
WOODED AREAS, THE RAVINE, AND SITE 82 SUBSURFACE SOILS
POSITIVE DETECTION SUMMARY
REMEDIAL INVESTIGATION CTO-0133
MCB CAMP LEJEUNE, NORTH CAROLINA
TOTAL METALS

Sample No:		6-201E-SB15-01	6-201E-SB16-02	6-201E-SB17-02	6-201E-SB18-01	6-201E-SB19-02	6-201E-SB2-01
Depth:		1 - 3'	3 - 5'	3 - 5'	1 - 3'	3 - 5'	1 - 3'
Date Sampled:		9/13/92	9/13/92	9/13/92	9/13/92	9/15/92	9/11/92
Lab Id:		00510-09	00510-11	00510-13	00510-15	00519-03	00507-04
Parameter	Units						
ALUMINUM	MG/KG	2500	2150	571	2560	1460 J	2530 J
ANTIMONY	MG/KG						
ARSENIC	MG/KG						
BARIUM	MG/KG	3.3 B	3 B	0.91 JB	5.4 B		2.6 JB
BERYLLIUM	MG/KG						
CADMIUM	MG/KG					0.39 JB	
CALCIUM	MG/KG	2150	195 B	83.3 B	398 B	222 JB	
CHROMIUM	MG/KG	2 J	2.8 J		2.3 J		0.88 B
COBALT	MG/KG						
COPPER	MG/KG	0.4 JB	0.75 JB	0.33 JB	0.94 JB		
IRON	MG/KG	106	1060	145	344	218 J	
LEAD	MG/KG	4.9	3.8	2.4	2.9	1.6 J	
MAGNESIUM	MG/KG	36 JB	48.1 JB	10.3 JB	46.8 JB	31.9 JB	33.7 B
MANGANESE	MG/KG	0.39 B	1.5 B	0.48 B	1.1 B		
MERCURY	MG/KG						
NICKEL	MG/KG						
POTASSIUM	MG/KG	21.2 B	88.6 B	17.2 B	59.5 B	38.6 JB	40.8 B
SELENIUM	MG/KG						
SILVER	MG/KG						
SODIUM	MG/KG						
THALLIUM	MG/KG						
VANADIUM	MG/KG	0.77 B	3.5 B	0.73 B	1.6 B	1.6 JB	1.1 JB
ZINC	MG/KG	3.8 B					

MG/KG - milligram per kilogram
B - reported value is less than Contract Required Detection Limit (CRDL), but greater than Instrument Detection Limit (IDL)
J - value is estimated
JB - value is estimated below the CRDL, but greater than the IDL

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TABLE 4-22
WOODED AREAS, THE RAVINE, AND SITE 82 SUBSURFACE SOILS
POSITIVE DETECTION SUMMARY
REMEDIAL INVESTIGATION CTO-0133
MCB CAMP LEJEUNE, NORTH CAROLINA
TOTAL METALS

Sample No:		6-201E-SB20-02	6-201E-SB3-01	6-201E-SB4-01	6-201E-SB5-01	6-201E-SB6-02	6-201E-SB7-01
Depth:		3 - 5'	1 - 3'	1 - 3'	1 - 3'	3 - 5'	1 - 3'
Date Sampled:		9/15/92	9/11/92	9/11/92	9/11/92	9/12/92	9/12/92
Lab Id:		00519-06	00507-06	00507-08	00507-11	00507-13	00507-15
Parameter	Units						
ALUMINUM	MG/KG	6380 J	3340 J	858 J	2970 J	1170 J	5810 J
ANTIMONY	MG/KG						
ARSENIC	MG/KG						1.3 B
BARIUM	MG/KG	6.7 B	2.9 JB	10.6 JB	2.8 JB	2.2 JB	4.6 JB
BERYLLIUM	MG/KG						
CADMIUM	MG/KG	0.64 JB					0.64 JB
CALCIUM	MG/KG			460 JB			
CHROMIUM	MG/KG	6.2	1.7		1.7 B		3.4
COBALT	MG/KG						
COPPER	MG/KG					2.4 JB	
IRON	MG/KG	2160 J		328 J	298 J		855 J
LEAD	MG/KG	1.9 J					
MAGNESIUM	MG/KG	122 JB	49.8 B	29.9 B	40.8 B	50.6 B	114 B
MANGANESE	MG/KG	2.3 JB					
MERCURY	MG/KG						
NICKEL	MG/KG	1.6 B					
POTASSIUM	MG/KG	160 B	35.8 JB	20.7 JB	45.5 B	36.9 JB	155 B
SELENIUM	MG/KG						
SILVER	MG/KG						
SODIUM	MG/KG						
THALLIUM	MG/KG				0.41 JB		
VANADIUM	MG/KG	7.2 B	4.1 JB	1.2 JB	2.3 JB	1.3 JB	5.1 JB
ZINC	MG/KG						

MG/KG - milligram per kilogram
B - reported value is less than Contract Required Detection Limit (CRDL), but greater than Instrument Detection Limit (IDL)
J - value is estimated
JB - value is estimated below the CRDL, but greater than the IDL

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TABLE 4-22
WOODED AREAS, THE RAVINE, AND SITE 82 SUBSURFACE SOILS
POSITIVE DETECTION SUMMARY
REMEDIAL INVESTIGATION CTO-0133
MCB CAMP LEJEUNE, NORTH CAROLINA
TOTAL METALS

Sample No:		6-201E-SB8-01	6-201E-SB9-01	6-201N-SB1-01	6-201N-SB10-02	6-201N-SB11-07	6-201N-SB12-02
Depth:		1 - 3'	1 - 3'	1 - 3'	5 - 7'	13 - 15'	5 - 7'
Date Sampled:		9/12/92	9/12/92	9/11/92	9/11/92	10/13/92	10/13/92
Lab Id:		00507-17	00507-19	00502-02	00507-27	00573-12	00573-14
Parameter	Units						
ALUMINUM	MG/KG	917 J	1510 J	5170 J	4830 J	672	857
ANTIMONY	MG/KG						
ARSENIC	MG/KG				1.6 JB		
BARIUM	MG/KG	1.8 JB	2.3 JB	119 J	7 JB		
BERYLLIUM	MG/KG			0.06 B			
CADMIUM	MG/KG			0.61 JB			
CALCIUM	MG/KG		157 JB	285 B			
CHROMIUM	MG/KG	2 B	0.74 B	6 J	5.2		
COBALT	MG/KG						
COPPER	MG/KG						
IRON	MG/KG	371 J	322 J	1470	2480 J	257	126
LEAD	MG/KG			13		1.2	1.6
MAGNESIUM	MG/KG	31.1 B	32.8 B	148 JB	103 B		
MANGANESE	MG/KG	6.6 J		7.1			
MERCURY	MG/KG			0.02 B			
NICKEL	MG/KG						
POTASSIUM	MG/KG	45.9 B	39.4 B	144 B	73 B		
SELENIUM	MG/KG						
SILVER	MG/KG						
SODIUM	MG/KG			50.6 JB			
THALLIUM	MG/KG						
VANADIUM	MG/KG	2 JB	1.9 JB	4.7 JB	6.9 JB		
ZINC	MG/KG			30.3 J			

MG/KG - milligram per kilogram
B - reported value is less than Contract Required Detection Limit (CRDL), but greater than Instrument Detection Limit (IDL)
J - value is estimated
JB - value is estimated below the CRDL, but greater than the IDL

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TABLE 4-22
WOODED AREAS, THE RAVINE, AND SITE 82 SUBSURFACE SOILS
POSITIVE DETECTION SUMMARY
REMEDIAL INVESTIGATION CTO-0133
MCB CAMP LEJEUNE, NORTH CAROLINA
TOTAL METALS

Sample No:		6-201N-SB2-01	6-201N-SB3-01	6-201N-SB4-01	6-201N-SB5-03	6-201N-SB6-01	6-201N-SB7-01
Depth:		1 - 3'	1 - 3'	1 - 3'	5 - 7'	1 - 3'	1 - 3'
Date Sampled:		9/10/92	9/10/92	9/10/92	9/10/92	9/11/92	9/11/92
Lab Id:		00502-05	00502-07	00502-09	00502-11	00502-13	00502-15
Parameter	Units						
ALUMINUM	MG/KG	1740	2140	1740	1600	2350	5890
ANTIMONY	MG/KG						
ARSENIC	MG/KG						
BARIUM	MG/KG						
BERYLLIUM	MG/KG						0.07 B
CADMIUM	MG/KG					0.6 JB	
CALCIUM	MG/KG		82 B				
CHROMIUM	MG/KG	1 B	1.4 B	1.4 B	1.5 B	0.75 B	4.5
COBALT	MG/KG						
COPPER	MG/KG						
IRON	MG/KG	96.3	76.5	323	535	205	1150
LEAD	MG/KG	2.2	2.1	2.5 J	1.5	1.5 J	2.3
MAGNESIUM	MG/KG	13.1 B	8.2 B	38.9 B	39.5 B	36.2 B	77.4 B
MANGANESE	MG/KG	0.47 JB	0.57 JB	0.94 JB	1.6 JB	0.99 JB	1.5 JB
MERCURY	MG/KG	0.03 B	0.05 B	0.02 B			0.03 B
NICKEL	MG/KG						
POTASSIUM	MG/KG						96.6 JB
SELENIUM	MG/KG						
SILVER	MG/KG						
SODIUM	MG/KG	13.4 JB		12.7 JB	22.7 JB	10.1 JB	36.5 JB
THALLIUM	MG/KG						
VANADIUM	MG/KG	0.94 JB	1.1 JB	1.7 JB	1.6 JB	2.2 JB	5.4 JB
ZINC	MG/KG						

MG/KG - milligram per kilogram
B - reported value is less than Contract Required Detection Limit (CRDL), but greater than Instrument Detection Limit (IDL)
J - value is estimated
JB - value is estimated below the CRDL, but greater than the IDL

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TABLE 4-22
WOODED AREAS, THE RAVINE, AND SITE 82 SUBSURFACE SOILS
POSITIVE DETECTION SUMMARY
REMEDIAL INVESTIGATION CTO-0133
MCB CAMP LEJEUNE, NORTH CAROLINA
TOTAL METALS

Sample No:		6-201N-SB8-01		6-201N-SB9-01		6-201S-SB1-01		6-201S-SB11-01		6-201S-SB12-01		6-201S-SB3-01	
Depth:		1 - 3'		1 - 3'		1 - 3'		1 - 3'		1 - 3'		1 - 3'	
Date Sampled:		9/11/92		9/11/92		9/15/92		9/13/92		9/13/92		9/15/92	
Lab Id:		00502-17		00502-19		00519-09		00510-26		00511-02		00519-12	
Parameter	Units												
ALUMINUM	MG/KG	2840		1160		2790	J	2010		3150	J	6860	J
ANTIMONY	MG/KG												
ARSENIC	MG/KG					0.73	B						
BARIUM	MG/KG					5.9	B	5.5	B			7.7	B
BERYLLIUM	MG/KG												
CADMIUM	MG/KG	0.79	JB	0.52	JB							0.44	JB
CALCIUM	MG/KG					5640	J	713	B				
CHROMIUM	MG/KG	1.4	B	1.4	B			1.2	B	3.6		6.5	
COBALT	MG/KG												
COPPER	MG/KG									1	JB		
IRON	MG/KG	57.4		156		1190	J	1060		335	J	892	J
LEAD	MG/KG	4.7		3.2		13	J	4.1		3.8		3.9	J
MAGNESIUM	MG/KG			24.2	B	166	JB	26.8	B	49.8	JB	177	JB
MANGANESE	MG/KG	0.2	JB	0.7	JB	5.3	J	2.4	B	4.4	J	3.3	J
MERCURY	MG/KG	0.04	B	0.04	B								
NICKEL	MG/KG											1.7	B
POTASSIUM	MG/KG					89.4	B	14.2	B	55.6	JB	210	B
SELENIUM	MG/KG												
SILVER	MG/KG												
SODIUM	MG/KG	15	JB	20.6	JB								
THALLIUM	MG/KG												
VANADIUM	MG/KG	1.4	JB			3.9	JB	2.6	B	3.3	JB	4.7	B
ZINC	MG/KG							0.73	B				

MG/KG - milligram per kilogram
B - reported value is less than Contract Required Detection Limit (CRDL), but greater than Instrument Detection Limit (IDL)
J - value is estimated
JB - value is estimated below the CRDL, but greater than the IDL

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TABLE 4-22
WOODED AREAS, THE RAVINE, AND SITE 82 SUBSURFACE SOILS
POSITIVE DETECTION SUMMARY
REMEDIAL INVESTIGATION CTO-0133
MCB CAMP LEJEUNE, NORTH CAROLINA
TOTAL METALS

Sample No:		6-201S-SB4-01	6-201S-SB5-01	6-201S-SB6-01	6-201S-SB9-01	6-203OSA-SB10-04	6-203OSA-SB10-06
Depth:		1 - 3'	1 - 3'	1 - 3'	1 - 3'	7 - 9'	11 - 13'
Date Sampled:		9/15/92	9/14/92	9/14/92	9/14/92	9/12/92	9/12/92
Lab Id:		00519-14	00510-17	00510-20	00510-23	00507-38	00507-39
Parameter	Units						
ALUMINUM	MG/KG	937 J	2210	2090	3070	6010	2080
ANTIMONY	MG/KG						
ARSENIC	MG/KG					3.4	
BARIUM	MG/KG		2.4 JB	3.4 B	3.7 B	10.9 B	3.9 JB
BERYLLIUM	MG/KG					0.16 B	
CADMIUM	MG/KG						
CALCIUM	MG/KG		30.8 B	43.1 B		147 JB	
CHROMIUM	MG/KG		1.2 JB	1.9 J	2.3	11.2	5.1
COBALT	MG/KG						
COPPER	MG/KG			0.41 JB			
IRON	MG/KG	228 J	168	183	1720	8220 J	3450 J
LEAD	MG/KG		2.1	2.5	3.8		
MAGNESIUM	MG/KG		29.8 JB	33.9 JB	49.8 B	196 B	77.3 B
MANGANESE	MG/KG	3.2 JB	0.97 B	0.73 B	1.6 B		
MERCURY	MG/KG						
NICKEL	MG/KG						
POTASSIUM	MG/KG	32.1 JB	30.5 B	23.1 B	31.3 B	278 B	126 B
SELENIUM	MG/KG						
SILVER	MG/KG						
SODIUM	MG/KG						
THALLIUM	MG/KG						
VANADIUM	MG/KG	1.5 JB	1.6 B	1.7 B	4 B	26.8	10.1
ZINC	MG/KG				1.1 B		

MG/KG - milligram per kilogram
B - reported value is less than Contract Required Detection Limit (CRDL), but greater than Instrument Detection Limit (IDL)
J - value is estimated
JB - value is estimated below the CRDL, but greater than the IDL

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TABLE 4-22
WOODED AREAS, THE RAVINE, AND SITE 82 SUBSURFACE SOILS
POSITIVE DETECTION SUMMARY
REMEDIAL INVESTIGATION CTO-0133
MCB CAMP LEJEUNE, NORTH CAROLINA
TOTAL METALS

Sample No:		6-203OSA-SB11-02		6-203OSA-SB12-01		6-203OSA-SB12-08		6-203OSA-SB13-05		6-203OSA-SB13-12		6-203OSA-SB14-03	
Depth:		3 - 5'		1 - 3'		15 - 17'		9 - 11'		21 - 23'		5 - 7'	
Date Sampled:		9/11/92		9/9/92		9/9/92		9/13/92		9/13/92		9/13/92	
Lab Id:		00507-41		00496-19		00496-20		00511-17		00511-18		00511-20	
Parameter	Units												
ALUMINUM	MG/KG	3750		8660		5720		2300	J	2070	J	2510	J
ANTIMONY	MG/KG												
ARSENIC	MG/KG	1.1	B	25.4	J			0.64	B			1.9	B
BARIUM	MG/KG	9.5	B	1100		8	B	3.9	JB	4.6	JB	3.8	JB
BERYLLIUM	MG/KG			3.1		0.1	B						
CADMIUM	MG/KG	0.63	JB	2.2	J	0.51	JB						
CALCIUM	MG/KG			911	B								
CHROMIUM	MG/KG	4.4		9.8		8.5		2.4		1.9		4.4	
COBALT	MG/KG			6.8	B								
COPPER	MG/KG			39						0.6	JB	0.87	JB
IRON	MG/KG	2010		11200		724		688	J	824	J	2450	J
LEAD	MG/KG			5.4		4.1		3.3		1.5		2.4	
MAGNESIUM	MG/KG	86	B	465	B	170	B	71.2	JB	60.4	JB	110	JB
MANGANESE	MG/KG			46.1		1.5	B			3.8	J		
MERCURY	MG/KG												
NICKEL	MG/KG			11.7	B								
POTASSIUM	MG/KG	71.8	B	1270	B	249	B	65	JB	77.1	B	148	B
SELENIUM	MG/KG			10.5									
SILVER	MG/KG												
SODIUM	MG/KG												
THALLIUM	MG/KG			0.76	JB								
VANADIUM	MG/KG	6.3	JB	35.6		8.1	B	3.5	JB	2.2	JB	8.4	B
ZINC	MG/KG												

MG/KG - milligram per kilogram
B - reported value is less than Contract Required Detection Limit (CRDL), but greater than Instrument Detection Limit (IDL)
J - value is estimated
JB - value is estimated below the CRDL, but greater than the IDL

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TABLE 4-22
WOODED AREAS, THE RAVINE, AND SITE 82 SUBSURFACE SOILS
POSITIVE DETECTION SUMMARY
REMEDIAL INVESTIGATION CTO-0133
MCB CAMP LEJEUNE, NORTH CAROLINA
TOTAL METALS

	Sample No:	6-203OSA-SB15-02	6-203OSA-SB15-06	6-203OSA-SB16-03	6-203OSA-SB16-07	6-203OSA-SB17-04	6-203OSA-SB17-06
	Depth:	3 - 5'	13 - 15'	3 - 5'	15 - 17'	7 - 9'	13 - 15'
	Date Sampled:	9/11/92	9/11/92	9/11/92	9/11/92	9/9/92	9/9/92
	Lab Id:	00507-43	00507-44	00507-46	00507-47	00496-06	00496-07
Parameter	Units						
ALUMINUM	MG/KG	6620	1110	5330	135	3190	819
ANTIMONY	MG/KG						
ARSENIC	MG/KG	1.2 B		1.2 B		0.87 JB	
BARIUM	MG/KG	12.5 B	2.4 JB	10 B		5.1 B	2.4 JB
BERYLLIUM	MG/KG						
CADMIUM	MG/KG	1 J		0.88 JB		0.7 JB	0.36 JB
CALCIUM	MG/KG			185 JB		132	
CHROMIUM	MG/KG	7.4	1.7	5.3	2.3	3.3	1.9
COBALT	MG/KG	0.48 B					
COPPER	MG/KG						
IRON	MG/KG	3040		4120		1490	233
LEAD	MG/KG					2.5	1.8
MAGNESIUM	MG/KG	160 B	28.2 B	113 B		99.8 B	
MANGANESE	MG/KG					2.4 B	0.78 B
MERCURY	MG/KG	0.04 B	0.03 B		0.07 B		
NICKEL	MG/KG						
POTASSIUM	MG/KG	124 B	36.9 B	81.7 B		110 B	32.2 B
SELENIUM	MG/KG						
SILVER	MG/KG						
SODIUM	MG/KG						
THALLIUM	MG/KG						
VANADIUM	MG/KG	10.9	1.3 JB	10.4	0.72 JB	6.3 JB	0.9 JB
ZINC	MG/KG						

MG/KG - milligram per kilogram
B - reported value is less than Contract Required Detection Limit (CRDL), but greater than Instrument Detection Limit (IDL)
J - value is estimated
JB - value is estimated below the CRDL, but greater than the IDL

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TABLE 4-22
WOODED AREAS, THE RAVINE, AND SITE 82 SUBSURFACE SOILS
POSITIVE DETECTION SUMMARY
REMEDIAL INVESTIGATION CTO-0133
MCB CAMP LEJEUNE, NORTH CAROLINA
TOTAL METALS

Sample No:		6-203OSA-SB18-03	6-203OSA-SB18-06	6-203OSA-SB19-01	6-203OSA-SB2-01	6-203OSA-SB20-02	6-203OSA-SB3-01
Depth:		5 - 7'	11 - 13'	1 - 3'	1 - 3'	3 - 5'	1 - 3'
Date Sampled:		9/9/92	9/9/92	9/13/92	9/13/92	9/13/92	9/12/92
Lab Id:		00496-09	00496-10	00511-22	00511-06	00511-25	00507-30
Parameter	Units						
ALUMINUM	MG/KG	5330	7420	4100 J	2180 J	1310 J	1780
ANTIMONY	MG/KG				3.8 JB		
ARSENIC	MG/KG	1.5 JB	4.6 J	0.81 B			0.61 B
BARIUM	MG/KG	9.1 B	8.4 B	5 JB	4.7 JB	5.7 JB	6.8 B
BERYLLIUM	MG/KG	0.07 B	0.08 B				
CADMIUM	MG/KG	0.71 JB	1.1 JB				
CALCIUM	MG/KG	481 B	950 B	101 JB		820 JB	1780 J
CHROMIUM	MG/KG	6.2	9.9	4.7	1.2 B	1.3 B	0.85 B
COBALT	MG/KG	0.69 JB					
COPPER	MG/KG	2.5 JB					
IRON	MG/KG	3430	2830	1700 J	704 J	104 J	628 J
LEAD	MG/KG	4.1	5.1	4.1	2.6	2.3	
MAGNESIUM	MG/KG	146 B	223 B	117 B	53.3 JB		103 B
MANGANESE	MG/KG	3.8	2.2 B	2.8 JB	4.2 J		12.5 J
MERCURY	MG/KG						
NICKEL	MG/KG	2.1 JB					
POTASSIUM	MG/KG	111 B	379 B	113 B	26 JB	23 JB	21.1 JB
SELENIUM	MG/KG						
SILVER	MG/KG						
SODIUM	MG/KG						
THALLIUM	MG/KG						
VANADIUM	MG/KG	9.6 B	12.7	7.7 B	2.6 JB	1 JB	
ZINC	MG/KG						

MG/KG - milligram per kilogram
B - reported value is less than Contract Required Detection Limit (CRDL), but greater than Instrument Detection Limit (IDL)
J - value is estimated
JB - value is estimated below the CRDL, but greater than the IDL

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TABLE 4-22
WOODED AREAS, THE RAVINE, AND SITE 82 SUBSURFACE SOILS
POSITIVE DETECTION SUMMARY
REMEDIAL INVESTIGATION CTO-0133
MCB CAMP LEJEUNE, NORTH CAROLINA
TOTAL METALS

	Sample No:	6-203OSA-SB3-06	6-203OSA-SB4-05	6-203OSA-SB4-07	6-203OSA-SB5-02	6-203OSA-SB7-01	6-203OSA-SB8-04
	Depth:	11 - 13'	9 - 11'	15 - 17'	3 - 5'	1 - 2'	9 - 11'
	Date Sampled:	9/12/92	9/12/92	9/12/92	9/11/92	9/14/92	9/13/92
	Lab Id:	00507-31	00507-33	00507-34	00507-36	00511-08	00511-10
Parameter	Units						
ALUMINUM	MG/KG	2380	1160	2110	1540	1470 J	2540 J
ANTIMONY	MG/KG				4.4 JB		
ARSENIC	MG/KG	1 B	0.63 B			0.56 B	0.61 B
BARIUM	MG/KG	6.7 B	1.9 JB	3.6 JB	5.3 JB	15.5 JB	
BERYLLIUM	MG/KG						
CADMIUM	MG/KG						
CALCIUM	MG/KG	146 JB				500 JB	
CHROMIUM	MG/KG	2.8	1.9	2.4	1.9 B	4	5.4
COBALT	MG/KG						
COPPER	MG/KG					4.2 JB	1 JB
IRON	MG/KG	1390 J	481 J	614 J	893 J	1190 J	953 J
LEAD	MG/KG					10.7	3.3
MAGNESIUM	MG/KG	86.4 B		33.2 B	48.6 B	50.9 JB	
MANGANESE	MG/KG					13.7 J	
MERCURY	MG/KG					0.08 B	
NICKEL	MG/KG						
POTASSIUM	MG/KG	97.5 B	24.3 JB	49.2 B	90.9 B	52.3 JB	33.4 JB
SELENIUM	MG/KG						
SILVER	MG/KG						
SODIUM	MG/KG						
THALLIUM	MG/KG						
VANADIUM	MG/KG	4 JB	2.3 JB		4.2 JB	5 JB	3.2 JB
ZINC	MG/KG					68.5 J	

MG/KG - milligram per kilogram
B - reported value is less than Contract Required Detection Limit (CRDL), but greater than Instrument Detection Limit (IDL)
J - value is estimated
JB - value is estimated below the CRDL, but greater than the IDL

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TABLE 4-22
WOODED AREAS, THE RAVINE, AND SITE 82 SUBSURFACE SOILS
POSITIVE DETECTION SUMMARY
REMEDIAL INVESTIGATION CTO-0133
MCB CAMP LEJEUNE, NORTH CAROLINA
TOTAL METALS

	Sample No:	6-203OSA-SB8-06	6-203OSA-SB9-05	6-203OSA-SB9-06	6-GW10-02A	6-GW10-02B	6-GW12-01
	Depth:	13 - 15'	9 - 11'	11 - 13'	7 - 9'	11 - 13'	1 - 3'
	Date Sampled:	9/13/92	9/13/92	9/13/92	9/23/92	9/23/92	9/24/92
	Lab Id:	00511-12	00511-14	00511-15	00536-24	00536-25	00536-26
Parameter	Units						
ALUMINUM	MG/KG	4350 J	6420 J	10500 J	12500 J	6340 J	910 J
ANTIMONY	MG/KG						
ARSENIC	MG/KG	1.2 B	3.7	8.9			
BARIUM	MG/KG	6.4 JB	7.8 JB	12.5 JB	14.2 B	7.9 B	1.5 JB
BERYLLIUM	MG/KG				0.12 B		
CADMIUM	MG/KG		1.4 J	2.3 J			
CALCIUM	MG/KG			97.3 JB			297 B
CHROMIUM	MG/KG	7.3	12.1	19.2	10.6	5.1	2 J
COBALT	MG/KG			0.51 B			
COPPER	MG/KG	1.7 JB	2.3 JB	4.1 JB	2.4 JB	0.98 JB	
IRON	MG/KG	351 J	12700 J	19200 J	3140 J	938 J	140 J
LEAD	MG/KG	4.1	6.5	10.1	6.1	3.2	1.2
MAGNESIUM	MG/KG		301 JB	491 JB	396 B	173 B	25.3 B
MANGANESE	MG/KG		4.3 J	5.9 J	6.9 J	4.2 J	2.8 J
MERCURY	MG/KG						
NICKEL	MG/KG	1.7 B			5.7 JB		
POTASSIUM	MG/KG	35.4 JB	326 B	626 B	294 B	176 B	28.5 JB
SELENIUM	MG/KG			1.4			
SILVER	MG/KG						
SODIUM	MG/KG						
THALLIUM	MG/KG						
VANADIUM	MG/KG	3.6 JB	23.7	32.4	16.2	5.5 JB	1.3 JB
ZINC	MG/KG				5.4 J		

MG/KG - milligram per kilogram
B - reported value is less than Contract Required Detection Limit (CRDL), but greater than Instrument Detection Limit (IDL)
J - value is estimated
JB - value is estimated below the CRDL, but greater than the IDL

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TABLE 4-22
WOODED AREAS, THE RAVINE, AND SITE 82 SUBSURFACE SOILS
POSITIVE DETECTION SUMMARY
REMEDIAL INVESTIGATION CTO-0133
MCB CAMP LEJEUNE, NORTH CAROLINA
TOTAL METALS

	Sample No:	6-GW12-02	6-GW13-01	6-GW13-02	6-GW14-03	6-GW14-04	6-GW16-02
	Depth:	3 - 5'	1 - 2'	2 - 4'	4 - 6'	6 - 8'	4 - 6'
	Date Sampled:	9/24/92	9/24/92	9/24/92	10/6/92	10/6/92	10/11/92
	Lab Id:	00536-27	00544-06	00544-07	00564-03	00564-04	00570-19
Parameter	Units						
ALUMINUM	MG/KG	599 J	4040	1820	708	850	3860
ANTIMONY	MG/KG						2.8 JB
ARSENIC	MG/KG					0.99 JB	
BARIUM	MG/KG	2 JB					
BERYLLIUM	MG/KG						0.06 B
CADMIUM	MG/KG						
CALCIUM	MG/KG	54.5 B	1520	423 B			
CHROMIUM	MG/KG	1.1 JB			1.7 B	2.7	4
COBALT	MG/KG						
COPPER	MG/KG					0.43 JB	
IRON	MG/KG	248 J	192	506			187
LEAD	MG/KG	0.89	3.9 J	2 J			3.2
MAGNESIUM	MG/KG	27.1 B	88.1 B	65.1 B			45.3 B
MANGANESE	MG/KG	2.7 JB		5.2 J			1.1 B
MERCURY	MG/KG		0.03 B				
NICKEL	MG/KG						
POTASSIUM	MG/KG	28.3 JB					32.2 B
SELENIUM	MG/KG						
SILVER	MG/KG						
SODIUM	MG/KG						
THALLIUM	MG/KG						
VANADIUM	MG/KG	0.87 JB			0.86 B	0.87 B	1.6 B
ZINC	MG/KG						

MG/KG - milligram per kilogram
B - reported value is less than Contract Required Detection Limit (CRDL), but greater than Instrument Detection Limit (IDL)
J - value is estimated
JB - value is estimated below the CRDL, but greater than the IDL

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TABLE 4-22
WOODED AREAS, THE RAVINE, AND SITE 82 SUBSURFACE SOILS
POSITIVE DETECTION SUMMARY
REMEDIAL INVESTIGATION CTO-0133
MCB CAMP LEJEUNE, NORTH CAROLINA
TOTAL METALS

	Sample No:	6-GW16-03	6-GW17-01	6-GW17-02	6-GW18-01	6-GW18-03	6-GW19-02
	Depth:	6 - 8'	2 - 4'	4 - 6'	0 - 2'	4 - 6'	2 - 4'
	Date Sampled:	10/11/92	9/25/92	9/25/92	9/25/92	9/25/92	10/6/92
	Lab Id:	00570-21	00544-08	00544-09	00544-18	00544-19	00564-05
Parameter	Units						
ALUMINUM	MG/KG	7830	3620	3910	1250	963	1190
ANTIMONY	MG/KG						
ARSENIC	MG/KG					0.85 B	
BARIUM	MG/KG	8.2 B					
BERYLLIUM	MG/KG						
CADMIUM	MG/KG						
CALCIUM	MG/KG		523 B	273 B	150 B		
CHROMIUM	MG/KG	7.2					2.3
COBALT	MG/KG	0.83 B					
COPPER	MG/KG	1.4 JB					0.5 JB
IRON	MG/KG	1140	308	475	181	395	
LEAD	MG/KG	4.2	3 J	2.2 J	2.6 J	3.3 J	
MAGNESIUM	MG/KG	192 B	66.5 B	77.9 B	98.5 B		
MANGANESE	MG/KG						
MERCURY	MG/KG		0.02 B		0.04 B		
NICKEL	MG/KG						
POTASSIUM	MG/KG	289 B					
SELENIUM	MG/KG						
SILVER	MG/KG						
SODIUM	MG/KG						
THALLIUM	MG/KG						
VANADIUM	MG/KG	4.6 B					0.42 B
ZINC	MG/KG						

MG/KG - milligram per kilogram
B - reported value is less than Contract Required Detection Limit (CRDL), but greater than Instrument Detection Limit (IDL)
J - value is estimated
JB - value is estimated below the CRDL, but greater than the IDL

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TABLE 4-22
WOODED AREAS, THE RAVINE, AND SITE 82 SUBSURFACE SOILS
POSITIVE DETECTION SUMMARY
REMEDIAL INVESTIGATION CTO-0133
MCB CAMP LEJEUNE, NORTH CAROLINA
TOTAL METALS

Sample No:		6-GW19-03	6-GW1D-07	6-GW1D-08	6-GW20-01	6-GW20-02	6-GW21-04
Depth:		4 - 6'	14 - 16'	16 - 18'	2 - 4'	4 - 6'	8 - 10'
Date Sampled:		10/6/92	10/7/92	10/7/92	10/8/92	10/8/92	9/24/92
Lab Id:		00564-06	00564-12	00564-13	00564-18	00564-20	00544-10
Parameter	Units						
ALUMINUM	MG/KG	1030	381	1550	5240	1950	6080
ANTIMONY	MG/KG						
ARSENIC	MG/KG			0.8 B			1.4 B
BARIUM	MG/KG						8.4 JB
BERYLLIUM	MG/KG						
CADMIUM	MG/KG						
CALCIUM	MG/KG						372 B
CHROMIUM	MG/KG	2.5	3.1	6.6	4.2	3	
COBALT	MG/KG						
COPPER	MG/KG	0.47 JB		0.42 JB	0.67 JB	0.46 JB	
IRON	MG/KG						1220
LEAD	MG/KG						4 J
MAGNESIUM	MG/KG						79.8 B
MANGANESE	MG/KG						
MERCURY	MG/KG		0.02 B	0.03 B	0.03 B		
NICKEL	MG/KG						
POTASSIUM	MG/KG						
SELENIUM	MG/KG						
SILVER	MG/KG						
SODIUM	MG/KG						
THALLIUM	MG/KG						
VANADIUM	MG/KG	0.41 B	4.9 B	14.2	2.6 B	1.2 B	
ZINC	MG/KG						

MG/KG - milligram per kilogram
B - reported value is less than Contract Required Detection Limit (CRDL), but greater than Instrument Detection Limit (IDL)
J - value is estimated
JB - value is estimated below the CRDL, but greater than the IDL

CLEJ-01272-3.13-08/20/93

TABLE 4-22
WOODED AREAS, THE RAVINE, AND SITE 82 SUBSURFACE SOILS
POSITIVE DETECTION SUMMARY
REMEDIAL INVESTIGATION CTO-0133
MCB CAMP LEJEUNE, NORTH CAROLINA
TOTAL METALS

	Sample No:	6-GW21-07	6-GW25-04	6-GW25-05	6-GW26-03	6-GW26-04	6-GW27D-05
	Depth:	14 - 16'	8 - 10'	10 - 12'	6 - 8'	8 - 10'	10 - 12'
	Date Sampled:	9/24/92	10/7/92	10/7/92	10/09/92	10/09/92	10/11/92
	Lab Id:	00544-11	00564-14	00564-15	00570-01	00570-02	00570-22
Parameter	Units						
ALUMINUM	MG/KG	3700	3810	2170	3820	11200	15500
ANTIMONY	MG/KG						
ARSENIC	MG/KG						6.3
BARIUM	MG/KG	5 JB			4.4 JB	8.8 B	16.8 B
BERYLLIUM	MG/KG					0.08 B	0.29 B
CADMIUM	MG/KG						
CALCIUM	MG/KG	160 B			252 B	842 B	
CHROMIUM	MG/KG		4.3	3.2	4.1	7.9	31.6
COBALT	MG/KG						0.94 B
COPPER	MG/KG		0.59 JB	0.35 JB			6.4 J
IRON	MG/KG	468			576	1050	17800
LEAD	MG/KG	2.3 J			2.8	1.4	16.8
MAGNESIUM	MG/KG	85.6 B			86.3 B	195 B	637 B
MANGANESE	MG/KG				2 B	3.4	8.1
MERCURY	MG/KG		0.13				
NICKEL	MG/KG						
POTASSIUM	MG/KG				191 B	336 B	959 B
SELENIUM	MG/KG						
SILVER	MG/KG						
SODIUM	MG/KG						
THALLIUM	MG/KG						
VANADIUM	MG/KG		3.1 B	1.7 B	2.4 B	5.7 B	33.8
ZINC	MG/KG						8.3

MG/KG - milligram per kilogram
B - reported value is less than Contract Required Detection Limit (CRDL), but greater than Instrument Detection Limit (IDL)
J - value is estimated
JB - value is estimated below the CRDL, but greater than the IDL

CLEJ-01272-3.13-08/20/93

TABLE 4-22
WOODED AREAS, THE RAVINE, AND SITE 82 SUBSURFACE SOILS
POSITIVE DETECTION SUMMARY
REMEDIAL INVESTIGATION CTO-0133
MCB CAMP LEJEUNE, NORTH CAROLINA
TOTAL METALS

Sample No:		6-GW27D-06	6-GW28-08	6-GW28-09	6-GW28D-09	6-GW28D-10	6-GW2D-05
Depth:		12 - 14'	16 - 18'	18 - 20'	18 - 20'	20 - 22'	10 - 12'
Date Sampled:		10/11/92	10/09/92	10/09/92	10/20/92	10/20/92	10/10/92
Lab Id:		00570-23	00570-03	00570-04	00582-09	00582-12	00570-13
Parameter	Units						
ALUMINUM	MG/KG	356	1530	534	554 J	2320	2400
ANTIMONY	MG/KG						
ARSENIC	MG/KG	15.9					
BARIUM	MG/KG		3.8 JB				4.3 JB
BERYLLIUM	MG/KG	0.07 B					
CADMIUM	MG/KG						
CALCIUM	MG/KG					146 B	
CHROMIUM	MG/KG	3	2.6	2.1	2.3	5.1	2.6
COBALT	MG/KG	0.41 B					
COPPER	MG/KG	0.6 JB				0.99 JB	
IRON	MG/KG	1570	182	430	364	508	739
LEAD	MG/KG	4.3	2.7	1	1	1	3.1
MAGNESIUM	MG/KG		42.4 B			69.4 B	41.9 B
MANGANESE	MG/KG					1.9 B	1.4 B
MERCURY	MG/KG						
NICKEL	MG/KG						
POTASSIUM	MG/KG	14.3 B	136 B	30.3 B	49.2 B	174 B	48 B
SELENIUM	MG/KG						
SILVER	MG/KG						
SODIUM	MG/KG						
THALLIUM	MG/KG						
VANADIUM	MG/KG	5.4 B	2.7 B	2.8 B	3.1 B	4.8 B	1.4 B
ZINC	MG/KG						

MG/KG - milligram per kilogram
B - reported value is less than Contract Required Detection Limit (CRDL), but greater than Instrument Detection Limit (IDL)
J - value is estimated
JB - value is estimated below the CRDL, but greater than the IDL

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TABLE 4-22
WOODED AREAS, THE RAVINE, AND SITE 82 SUBSURFACE SOILS
POSITIVE DETECTION SUMMARY
REMEDIAL INVESTIGATION CTO-0133
MCB CAMP LEJEUNE, NORTH CAROLINA
TOTAL METALS

Sample No:		6-GW2D-06	6-GW30-02	6-GW30-03	6-GW7D-02	6-GW7D-03	6-GW9-02
Depth:		12 - 14'	4 - 6'	6 - 8'	2 - 4'	4 - 6'	2 - 4'
Date Sampled:		10/10/92	10/10/92	10/10/92	10/6/92	10/6/92	9/24/92
Lab Id:		00570-14	00570-24	00570-25	00564-01	00564-02	00544-04
Parameter	Units						
ALUMINUM	MG/KG	1830	6920	4720	582	3310	1570
ANTIMONY	MG/KG						
ARSENIC	MG/KG		0.66 B				
BARIUM	MG/KG		9.2 B	13.4 B			
BERYLLIUM	MG/KG		0.11 B	0.13 B			
CADMIUM	MG/KG						
CALCIUM	MG/KG		564 B	389 B			
CHROMIUM	MG/KG	3.7	7.5	4.4	1.3 B	3.5	
COBALT	MG/KG		0.45 B				
COPPER	MG/KG		0.52 JB		0.42 JB	0.58 JB	
IRON	MG/KG	725	5390	894			680
LEAD	MG/KG	3.4	4.4	4.6			2.1 J
MAGNESIUM	MG/KG	26.1 B	239 B	128 B			70.4 B
MANGANESE	MG/KG	1.2 B	11.7				3.1 J
MERCURY	MG/KG						
NICKEL	MG/KG	1.6 JB					
POTASSIUM	MG/KG	40.5 B	140 B	120 B			
SELENIUM	MG/KG						
SILVER	MG/KG						
SODIUM	MG/KG						
THALLIUM	MG/KG						
VANADIUM	MG/KG	1.5 B	10.8 B	3 B	0.48 B	2.1 B	
ZINC	MG/KG			45.4			

MG/KG - milligram per kilogram
B - reported value is less than Contract Required Detection Limit (CRDL), but greater than Instrument Detection Limit (IDL)
J - value is estimated
JB - value is estimated below the CRDL, but greater than the IDL

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TABLE 4-22
WOODED AREAS, THE RAVINE, AND SITE 82 SUBSURFACE SOILS
POSITIVE DETECTION SUMMARY
REMEDIAL INVESTIGATION CTO-0133
MCB CAMP LEJEUNE, NORTH CAROLINA
TOTAL METALS

	Sample No:	6-GW9-03	6-RAV-SB1-01	6-RAV-SB10-01	6-RAV-SB11-01	6-RAV-SB12-01	6-RAV-SB13-02
	Depth:	4 - 6'	1 - 2'	1.5 - 2.5'	2 - 3'	1.5 - 2'	3.5 - 4'
	Date Sampled:	9/24/92	9/10/92	9/14/92	9/14/92	9/14/92	9/14/92
	Lab Id:	00544-05	00502-27	00512-16	00512-18	00512-21	00512-23
Parameter	Units						
ALUMINUM	MG/KG	3820	1130	3910	3390	2180	2700
ANTIMONY	MG/KG						
ARSENIC	MG/KG			0.69 B	0.82 B		5.7
BARIUM	MG/KG	5 JB	2.8 JB	6.9 JB	5.1 JB	17.3 B	111
BERYLLIUM	MG/KG						0.17 B
CADMIUM	MG/KG				0.66 JB	0.69 JB	2.5 J
CALCIUM	MG/KG			583 B		552 B	422 B
CHROMIUM	MG/KG		1.9 B	4.2	5.8	3.2	16
COBALT	MG/KG						2.2 B
COPPER	MG/KG			4.5 JB	1.2 JB	8.7	733
IRON	MG/KG	1570	464	735	7180	1370	7030
LEAD	MG/KG	2.4 J	1.6	6.2 J	3.4 J	27.6	1610
MAGNESIUM	MG/KG	102 B	34.1 B	112 B	89.2 B	70.5 B	235 B
MANGANESE	MG/KG	3.6 J	1.6 JB	7.5	2.2 B	31.8	2990
MERCURY	MG/KG			0.04 JB		0.08 B	2
NICKEL	MG/KG					1.8 B	3.4 B
POTASSIUM	MG/KG		29.9 JB	106 B	154 B	79.1 B	142 B
SELENIUM	MG/KG						
SILVER	MG/KG						
SODIUM	MG/KG						
THALLIUM	MG/KG						
VANADIUM	MG/KG		1.7 JB	5.1 JB	9.1 JB	4.4 JB	9.6 JB
ZINC	MG/KG			6.9		74.2	2450

MG/KG - milligram per kilogram
B - reported value is less than Contract Required Detection Limit (CRDL), but greater than Instrument Detection Limit (IDL)
J - value is estimated
JB - value is estimated below the CRDL, but greater than the IDL

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TABLE 4-22
WOODED AREAS, THE RAVINE, AND SITE 82 SUBSURFACE SOILS
POSITIVE DETECTION SUMMARY
REMEDIAL INVESTIGATION CTO-0133
MCB CAMP LEJEUNE, NORTH CAROLINA
TOTAL METALS

Sample No:		6-RAV-SB14-01		6-RAV-SB15-02		6-RAV-SB16-02		6-RAV-SB2-02		6-RAV-SB3-01		6-RAV-SB3-02	
Depth:		0.5 - 1'		1 - 2'		1 - 2'		1 - 2'		1.5 - 3'		4 - 5'	
Date Sampled:		9/14/92		10/09/92		10/09/92		9/10/92		9/11/92		9/11/92	
Lab Id:		00512-25		00570-06		00570-08		00502-29		00502-31		00502-32	
Parameter	Units												
ALUMINUM	MG/KG	6340		462		329		1510		1670		1250	
ANTIMONY	MG/KG												
ARSENIC	MG/KG	1.4	B	0.99	B								
BARIUM	MG/KG	31.4	B	14.5	B			3.5	JB	5.4	JB	5.2	JB
BERYLLIUM	MG/KG	0.14	B	0.06	B								
CADMIUM	MG/KG	2	J										
CALCIUM	MG/KG	1720											
CHROMIUM	MG/KG	10.3		2.4		0.86	B	4.5		2		2.7	
COBALT	MG/KG	2.1	B										
COPPER	MG/KG	25											
IRON	MG/KG	3500		1160		130		722		732		938	
LEAD	MG/KG	68.3		2.7		2.1		2.1		1.8		2.1	
MAGNESIUM	MG/KG	233	B					42.5	B	26	B	37.1	B
MANGANESE	MG/KG	87.9		14.7		4.4		2.2	JB	3.1	J	7.2	
MERCURY	MG/KG	0.17											
NICKEL	MG/KG	3.8	B										
POTASSIUM	MG/KG	227	B	34	B	14.8	B	46	JB	24.5	JB	49.7	JB
SELENIUM	MG/KG												
SILVER	MG/KG											0.39	JB
SODIUM	MG/KG									24.3	JB	27.1	JB
THALLIUM	MG/KG												
VANADIUM	MG/KG	11.1	JB	3.9	B	0.47	B	3.8	JB	2	JB	3.4	JB
ZINC	MG/KG	178		69.4		35							

MG/KG - milligram per kilogram
B - reported value is less than Contract Required Detection Limit (CRDL), but greater than Instrument Detection Limit (IDL)
J - value is estimated
JB - value is estimated below the CRDL, but greater than the IDL

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TABLE 4-22
WOODED AREAS, THE RAVINE, AND SITE 82 SUBSURFACE SOILS
POSITIVE DETECTION SUMMARY
REMEDIAL INVESTIGATION CTO-0133
MCB CAMP LEJEUNE, NORTH CAROLINA
TOTAL METALS

Sample No:		6-RAV-SB4A-01	6-RAV-SB5-02	6-RAV-SB6-02	6-RAV-SB7-02	6-RAV-SB8-02	6-RAV-SB9-01
Depth:		1.5 - 2'	2.5 - 3'	2 - 3'	2.5 - 3'	2.5 - 3'	2 - 2.5'
Date Sampled:		9/14/92	9/14/92	9/14/92	9/14/92	9/14/92	9/14/92
Lab Id:		00512-02	00512-05	00512-07	00512-09	00512-11	00512-13
Parameter	Units						
ALUMINUM	MG/KG	1880	3880	3410	1440	11800	1040
ANTIMONY	MG/KG						
ARSENIC	MG/KG		0.85 JB			2.3	
BARIUM	MG/KG	6.7 JB	5.4 JB	3.4 JB	5.5 JB	14.9 B	
BERYLLIUM	MG/KG						
CADMIUM	MG/KG					0.8 JB	
CALCIUM	MG/KG	243 B	76.2 B	241 B	1180	112 B	
CHROMIUM	MG/KG	2 B	5.8	4.7	1.7 B	14	
COBALT	MG/KG						
COPPER	MG/KG	4.5 JB	1.4 JB	0.59 JB	1.4 JB	1.9 JB	
IRON	MG/KG	1120	2830	1430	870	6940	267
LEAD	MG/KG	14.3 J	2.7 J	3.7 J	5 J	7 J	1.9 J
MAGNESIUM	MG/KG	60.7 B	154 B	70.1 B	63.3 B	478 B	26 B
MANGANESE	MG/KG	9.1	2.6 B	17.9	6	7.9	3 B
MERCURY	MG/KG	0.06 JB		0.05 JB	0.05 JB		0.04 JB
NICKEL	MG/KG	2 B				3.2 B	
POTASSIUM	MG/KG	73.5 JB	209 B	79.9 JB	64.9 JB	311 B	15.2 JB
SELENIUM	MG/KG						
SILVER	MG/KG						
SODIUM	MG/KG						
THALLIUM	MG/KG						
VANADIUM	MG/KG	3.5 JB	10.3 J	6.1 JB	3 JB	22.6	
ZINC	MG/KG	47.6		7	6.5	5.4	

MG/KG - milligram per kilogram
B - reported value is less than Contract Required Detection Limit (CRDL), but greater than Instrument Detection Limit (IDL)
J - value is estimated
JB - value is estimated below the CRDL, but greater than the IDL

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TABI

OPERABLE UNIT NO. 2 PHASE I.. UND ONE GROUNDWATER

POSITIVE DETECTION SUMMARY

REMEDIAL INVESTIGATION CTO-0133

MCB CAMP LEJEUNE, NORTH CAROLINA

VOLATILE ORGANICS

Sample No:		6-GW1DA-01B	6-GW1DA-01T	6-GW3D-01	6-GW15DW-01	6-GW32-01	6-GW34-01
Depth:		N/A	N/A	N/A	N/A	N/A	N/A
Date sampled:		5/3/93	5/3/93	4/6/93	5/3/93	3/18/93	3/18/93
Lab Id:		930259-01	930259-02	930170-15	930259-03	00135-03	00135-05
Parameter	Units						
VOLATILES							
1,1-DICHLOROETHENE	UG/L						1.3
TOTAL-1,2-DICHLORETHENE	UG/L	38	100	3.7	9.1	2200	410
1,1,2,2-TETRACHLOROETHANE	UG/L						9600
TETRACHLOROETHENE	UG/L	1.3	2.9		1.0	74	1200
1,1,2-TRICHLOROETHANE	UG/L						58
TRICHLOROETHENE	UG/L	83	160	6.4	34	1500	610
VINYL CHLORIDE	UG/L					8.6 J	
BENZENE	UG/L					1.4	
1,2-DICHLOROBENZENE	UG/L						4.4
TOLUENE	UG/L						

N/A - Not applicable

UG/L - microgram per liter

J - value is estimated

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TABL

OPERABLE UNIT NO. 2 PHASE II - ROUND ONE GROUNDWATER
POSITIVE DETECTION SUMMARY
REMEDIAL INVESTIGATION CTO-0133
MCB CAMP LEJEUNE, NORTH CAROLINA
VOLATILE ORGANICS

	Sample No:	6-GW36DW-01	6-GW37DW-01	6-TW2-01	6-TW3-01
	Depth:	N/A	N/A	N/A	N/A
	Date sampled:	3/30/93	3/22/93	3/31/93	3/31/93
	Lab Id:	930170-03	930141-36	930170-07	930170-08
Parameter	Units				
VOLATILES					
1,1-DICHLOROETHENE	UG/L				1.4
TOTAL-1,2-DICHLORETHENE	UG/L	3.4	120	280	430
1,1,2,2-TETRACHLOROETHANE	UG/L				
TETRACHLOROETHENE	UG/L			6.6	3.6
1,1,2-TRICHLOROETHANE	UG/L				
TRICHLOROETHENE	UG/L	6.4	60	360	63
VINYL CHLORIDE	UG/L				14
BENZENE	UG/L				
1,2-DICHLOROBENZENE	UG/L		2.6		
TOLUENE	UG/L			1.0	

N/A - Not applicable
UG/L - microgram per liter
J - value is estimated

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TAB 24

OPERABLE UNIT NO. 2

PHASE II - ROUND ONE GROUNDWATER

POSITIVE DETECTION SUMMARY

REMEDIAL INVESTIGATION CTO-0133

MCB CAMP LEJEUNE, NORTH CAROLINA

TOTAL METALS

	Sample No:	6-GW28S-02		9-GW1-02		9-GW2-02		9-GW3-02		9-GW4-02		9-GW5-02	
	Depth:	N/A		N/A		N/A		N/A		N/A		N/A	
	Date Sampled:	N/A		3/9/93		3/9/93		3/9/93		3/8/93		3/8/93	
	Lab Id:	30136-07		30115-06		30115-10		30115-12		30115-14		30115-16	
Parameter'	Units												
ALUMINUM	UG/L	8170		380000	J	154000	J	64500	J	1970	J	1460	J
ARSENIC	UG/L			25.4	J	5.6	JB	2.5	JB	1.1	JB		
BARIUM	UG/L	80.8	B	745		279		413		38.4	B	74.6	B
BERYLLIUM	UG/L			3.5	B	2	B	1	B				
CALCIUM	UG/L	2720	B	142000								62500	
CHROMIUM	UG/L	18.4		351	J	170	J	60.5	J				
IRON	UG/L	4070		135000	J	24800	J	10400	J	1420	J	498	J
LEAD	UG/L	2.3	B	408	J	31	J	18	J				
MAGNESIUM	UG/L	2580	B										
MANGANESE	UG/L	12.9	B	278	J	37	J	29.9	J	3.6	JB	1.5	JB
MERCURY	UG/L					0.19	JB	0.19	JB				
NICKEL	UG/L			61.8		38.5	B						
POTASSIUM	UG/L	1220	B	17300	J							9910	J
SELENIUM	UG/L			7.9	J			3.3	JB			3.3	JB
SODIUM	UG/L	8310											
VANADIUM	UG/L	15.8	B	400	J	149	J	47.4	JB			6.2	JB
ZINC	UG/L	19.6	B	409	J	58.2		35.3					

UG/L - microgram per liter

B - reported value is less than Contract Required Detection Limit (CRDL), but greater than Instrument Detection Limit (IDL)

J - value is estimated

JB - value is estimated below the CRDL, but greater than the IDL

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TABL 4
OPERABLE UNIT NO. 2
PHASE II - ROUND ONE GROUNDWATER
POSITIVE DETECTION SUMMARY
REMEDIAL INVESTIGATION CTO-0133
MCB CAMP LEJEUNE, NORTH CAROLINA
TOTAL METALS

Sample No:		9-GW6-02	9-GW7DW-02	9-GW7S-02	9-GW8-02
Depth:		N/A	N/A	N/A	N/A
Date Sampled:		3/8/93	3/8/93	3/8/93	3/9/93
Lab Id:		30115-18	30115-20	31115-22	31115-24
Parameter'	Units				
ALUMINUM	UG/L	1880 J	1360 J	604 J	5190 J
ARSENIC	UG/L	1.1 JB			
BARIUM	UG/L		356		21.3 B
BERYLLIUM	UG/L				
CALCIUM	UG/L		162000		
CHROMIUM	UG/L				
IRON	UG/L	592 J	1230 J	782 J	1300 J
LEAD	UG/L				
MAGNESIUM	UG/L				
MANGANESE	UG/L		49.3 J	3.9 JB	3.3 JB
MERCURY	UG/L				
NICKEL	UG/L				
POTASSIUM	UG/L		53000 J		
SELENIUM	UG/L	2.2 JB	2.1 JB	3.6 JB	2.4 JB
SODIUM	UG/L				
VANADIUM	UG/L	4.3 JB		4.1 JB	10.3 JB
ZINC	UG/L				

UG/L - microgram per liter
B - reported value is less than Contract Required Detection Limit (CRDL), but greater than Instrument Detection Limit (IDL)
J - value is estimated
JB - value is estimated below the CRDL, but greater than the IDL

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TABLE 4-24
OPERABLE UNIT NO. 2 PHASE II - ROUND ONE GROUNDWATER
POSITIVE DETECTION SUMMARY
REMEDIAL INVESTIGATION CTO-0133
MCB CAMP- LEJEUNE, NORTH CAROLINA
DISSOLVED METALS

	Sample No:	6-GW28SD-02	9-GW1D-02	9-GW2D-02	9-GW3D-02	9-GW4D-02	9-GW5D-02
	Depth:	N/A	N/A	N/A	N/A	N/A	N/A
	Date Sampled:	N/A	3/9/93	3/9/93	3/9/93	3/8/93	3/8/93
	Lab Id:	30136-08	30115-08	30115-11	30115-13	30115-15	30115-17
Parameter	Units						
ALUMINUM	UG/L			796		457	
ARSENIC	UG/L		1 B	6.3 JB	1.4 B		
BARIUM	UG/L	9.1 JB	36.2 B			37.4 B	73.4 B
CALCIUM	UG/L	1930 B	74600	33100	18500	28900	65800
COPPER	UG/L	18.5 B					
IRON	UG/L					801	
MAGNESIUM	UG/L	2080 B					
MANGANESE	UG/L	4.4 B	14.6 B		2.1 B	3.5 B	
POTASSIUM	UG/L		4780 B				10600
SELENIUM	UG/L						
SODIUM	UG/L	8350					
VANADIUM	UG/L						4 B

N/A - Not applicable
UG/L - microgram per liter
B - reported value is less than Contract Required Detection Limit (CRDL), but greater than Instrument Detection Limit (IDL)
J - value is estimated
JB - value is estimated below the CRDL, but greater than the IDL

CLEJ-01272-3.13-08/20/93

TABLE 4-24
OPERABLE UNIT NO. 2 PHASE II - ROUND ONE GROUNDWATER
POSITIVE DETECTION SUMMARY
REMEDIAL INVESTIGATION CTO-0133
MCB CAMP- LEJEUNE, NORTH CAROLINA
DISSOLVED METALS

Sample No:		9-GW6D-02	9-GW7DWD-02	9-GW7SD-02	9-GW8D-02
Depth:		N/A	N/A	N/A	N/A
Date Sampled:		3/8/93	3/8/93	3/8/93	3/9/93
Lab Id:		30115-19	31115-21	31115-23	31115-25
Parameter	Units				
ALUMINUM	UG/L				150 B
ARSENIC	UG/L				
BARIUM	UG/L				
CALCIUM	UG/L	41600		19500	16500
COPPER	UG/L				
IRON	UG/L			116	29.8 B
MAGNESIUM	UG/L				
MANGANESE	UG/L			3 B	1.8 B
POTASSIUM	UG/L		55200		3850 B
SELENIUM	UG/L	2.2 JB		3.7 JB	2.6 B
SODIUM	UG/L				
VANADIUM	UG/L				5 B

N/A - Not applicable
UG/L - microgram per liter
B - reported value is less than Contract Required Detection Limit (CRDL), but greater than Instrument Detection Limit (IDL)
J - value is estimated
JB - value is estimated below the CRDL, but greater than the IDL

CLEJ-01272-3.13-08/20/93

TABLE 4-25

SUMMARY OF THE PHASE I - ROUND ONE GROUNDWATER FIELD PARAMETERS
SITES 6 AND 82
REMEDIAL INVESTIGATION CTO-0133
MCB CAMP LEJEUNE, NORTH CAROLINA

Well No. / Date of Measurement	Depth of Well (ft.)(1)	Purge Volume (gals.)	Field Parameters: Well Volume	Specific Conductance at 25 deg. C (micromhos/cm)	Temperature (deg. C)	pH (S.U.)
6GW9 / 10/20/92	19.1	40	1	114	14.0	5.56
			2	108	16.0	5.56
			3	115	17.0	5.57
			4	114	17.5	5.55
			5	109	18.0	5.58
6GW10 / 10/20/92	18.0	41	1	118	19.0	5.56
			2	114	18.8	5.56
			3	118	18.0	5.57
			4	115	19.0	5.55
			5	115	18.0	5.58
6GW11 / 10/22/92	18.7	9	1	206	22.0	6.42
			2	206	22.0	6.45
			3	206	22.0	6.52
			4	208	22.5	6.52
			5	208	22.5	6.51
6GW12 / 10/20/92	18.0	40	1	110	19.7	6.17
			2	109	20.6	6.12
			3	110	19.9	6.07
			4	109	19.4	6.18
			5	110	19.9	6.15
6GW13 / 10/20/92	18.0	40	1	43	19.2	6.63
			2	264	20.0	6.64
			3	292	20.0	6.68
			4	286	20.0	6.56
6GW14 / 10/21/92	22.0	44	1	67	18.0	5.90
			2	67	19.2	5.81
			3	66	19.2	5.80
			4	66	19.2	5.70
			5	68	19.0	5.72

Notes: (1) Well depth taken from below ground surface (bgs)

TABLE 4-25 (Continued)

SUMMARY OF THE PHASE I - ROUND ONE GROUNDWATER FIELD PARAMETERS
SITES 6 AND 82
REMEDIAL INVESTIGATION CTO-0133
MCB CAMP LEJEUNE, NORTH CAROLINA

Well No.			Field Parameters			
Date of Measurement	Depth of Well (ft.)[1]	Purge Volume (gals.)	Well Volume	Specific Conductance at 25 deg. C (micromhos/cm)	Temperature (deg. C)	pH (S.U.)
6GW15S 10/23/92	20.0	40	1	597	17.3	6.70
			2	626	17.6	6.76
			3	637	17.5	6.76
			4	631	18	6.75
			5	660	18	6.80
6GW16 10/21/92	20.0	40	1	143	20.0	5.83
			2	154	20.1	5.78
			3	164	19.5	5.78
			4	152	19.8	5.75
			5	154	20.0	5.65
6GW17 10/21/92	17.6	41	1	180	16.1	5.18
			2	148	18.5	5.15
			3	135	18.5	5.08
			4	134	18.5	5.04
			5	130	18.5	4.99
6GW18 10/21/92	18.5	42	1	42	21.0	5.27
			2	42	21.0	5.21
			3	42	21.0	5.23
			4	42	21.0	5.18
			5	42	21.0	5.16
6GW19 10/22/92	20.0	48	1	38	20.4	5.15
			2	37	20.0	5.12
			3	39	19.9	5.10
			4	39	19.9	5.14
			5	42	19.9	5.17
6GW20 10/21/92	19.7	50	1	93	19.0	4.97
			2	99	19.0	4.94
			3	94	19.5	4.86
			4	98	19.5	4.87
			5	98	19.5	4.84

Notes: [1] Well depth taken from below ground surface (bgs)

TABLE 4-25 (Continued)

SUMMARY OF THE PHASE I - ROUND ONE GROUNDWATER FIELD PARAMETERS
SITES 6 AND 82
REMEDIAL INVESTIGATION CTO-0133
MCB CAMP LEJEUNE, NORTH CAROLINA

Well No. / Date of Measurement	Depth of Well (ft.)(1)	Purge Volume (gals.)	Field Parameters			
			Well Volume	Specific Conductance at 25 deg. C (micromhos/cm)	Temperature (deg. C)	pH (S.U.)
6GW21 / 10/22/92	22.5	38	1	54	20.3	5.58
			2	57	19.9	5.19
			3	59	19.8	5.10
			4	59	19.9	5.13
			5	58	19.7	5.07
6GW22 / 10/21/92	19.5	42	1	238	21.5	5.31
			2	203	21.5	5.46
			3	192	21.5	5.48
			4	194	21.5	5.52
			5	192	21.5	5.51
6GW23 / 10/22/92	21.0	56	1	114	22.0	5.72
			2	110	22.0	5.75
			3	118	21.0	5.76
			4	116	21.0	5.76
			5	116	21.0	5.76
6GW25 / 10/23/92	23.5	48	1	41	17.2	5.71
			2	70	18.3	5.37
			3	72	17.5	5.54
			4	70	18.4	5.21
			5	73	17.1	5.27
6GW26 / 10/23/92	20.0	40	1	286	19.3	6.06
			2	300	19.7	6.06
			3	297	19.9	6.10
			4	289	20.0	6.13
			5	289	20.0	6.13
6GW27D / 11/03/92	110.0	18.6	1	476	18.5	7.36
			2	460	18.9	7.57
			3	454	18.8	7.52

Notes: (1) Well depth taken from below ground surface (bgs)

TABLE 4-25 (Continued)

SUMMARY OF THE PHASE I - ROUND ONE GROUNDWATER FIELD PARAMETERS
SITES 6 AND 82
REMEDIAL INVESTIGATION CTO-0133
MCB CAMP LEJEUNE, NORTH CAROLINA

Well No. / Date of Measurement	Depth of Well (ft.)(1)	Purge Volume (gals.)	Field Parameters			
			Well Volume	Specific Conductance at 25 deg. C (micromhos/cm)	Temperature (deg. C)	pH (S.U.)
6GW28S / 10/23/92	32.0	34	1	130	17.7	5.86
			2	148	17.5	6.09
			3	153	17.5	6.14
			4	153	17.5	6.14
			5	153	17.5	6.17
6GW28D / 11/03/92	115.0	180	1	366	19.5	7.59
			2	354	19.1	7.57
			3	348	19.1	7.45
82MW2 / 10/24/92	25	45	1	609	17.0	5.82
			2	603	17.4	5.84
			3	596	17.9	5.88
			4	596	17.9	5.83
			5	596	17.9	5.82
6GW30S / 10/23/92	20.5	53	1	149	19.9	6.02
			2	142	19.8	6.07
			3	142	20.0	6.04
			4	142	20.0	6.08
			5	--	--	--
6GW1S / 10/24/92	28.5	51	1	147	14.6	5.78
			2	141	16.8	5.70
			3	126	13.1	5.34
			4	114	15.9	5.40
			5	112	16.7	5.47
6GW1D / 11/04/92	112.5	180	1	770	18.6	7.44
			2	770	18.7	7.40
			3	766	19.4	7.41
6GW2S / 10/24/92	27.4	11	1	46	20.7	4.85
			2	46	20.4	4.85
			3	46	20.4	4.84
			4	46	20.1	4.85
			5	46	20.3	4.85

ɔtes: (1) Well depth taken from below ground surface (bgs)

TABLE 4-25 (Continued)

SUMMARY OF THE PHASE I - ROUND ONE GROUNDWATER FIELD PARAMETERS
SITES 6 AND 82
REMEDIAL INVESTIGATION CTO-0133
MCB CAMP LEJEUNE, NORTH CAROLINA

Well No. / Date of Measurement	Depth of Well (ft.)(1)	Purge Volume (gals.)	Field Parameters: Well Volume	Specific Conductance at 25 deg. C (micromhos/cm)	Temperature (deg. C)	pH (S.U.)
6GW2D 11/03/92	119.0	180	1	300	19.3	8.75
			2	297	19.5	8.44
			3	299	19.5	8.42
6GW3 10/22/92	27.5	10	1	212	22.5	6.60
			2	239	22.5	6.49
			3	239	23.0	6.45
			4	239	23.0	6.39
			5	239	23.0	6.34
6GW4 10/21/92	27.6	16	1	84	20.8	5.20
			2	81	20.8	5.09
			3	83	20.4	4.47
			4	87	20.3	4.90
			5	82	20.3	4.84
6GW5 10/21/92	26.8	17	1	106	24.5	6.35
			2	114	23.2	6.45
			3	132	24.1	6.43
			4	108	23.4	6.49
			5	116	24.5	6.56
6GW6 10/21/92	27.5	16	1	99	19.3	5.32
			2	109	19.6	4.66
			3	105	19.7	4.63
			4	103	18.9	4.64
			5	108	19.9	4.61
6GW7S 10/21/92	27.4	40	1	160	15.5	6.65
			2	219	18.5	6.88
			3	215	19.0	6.90
			4	214	19.0	6.89
			5	216	19.0	6.91
6GW7D 11/03/92	100.5	180	1	345	19.0	7.74
			2	339	18.9	7.67
			3	335	19.4	7.74

.es: (1) Well depth taken from below ground surface (bgs)

TABLE 4-25 (Continued)

SUMMARY OF THE PHASE I - ROUND ONE GROUNDWATER FIELD PARAMETERS
SITES 6 AND 82
REMEDIAL INVESTIGATION CTO-0133
MCB CAMP LEJEUNE, NORTH CAROLINA

Well No. / Date of Measurement	Depth of Well (ft.)(1)	Purge Volume (gals.)	Field Parameters			
			Well Volume	Specific Conductance at 25 deg. C (micromhos/cm)	Temperature (deg. C)	pH (S.U.)
6GW8 10/21/92	25.0	18	1	181	16.2	6.35
			2	159	18.6	6.07
			3	156	19.1	5.95
			4	155	19.3	6.05
82MW3 10/23/92	21.0	8	1	155	17.1	4.51
			2	152	17.1	4.50
			3	149	17.2	4.52
			4	150	17.3	4.51
			5	148	17.4	4.50
82MW1 10/23/92	14.0	9	1	112	18.2	5.19
			2	111	18.5	5.19
			3	111	18.6	5.17
			4	110	18.7	5.18
			5	110	18.7	5.19
6MW2 10/24/92	25.0	18	1	43	20.1	4.84
			2	43	19.9	5.04
			3	43	20.0	4.83
			4	43	20.0	4.83
			5	42	20.6	5.19
6MW3S 10/23/92	25.1	15	1	38	21.2	5.21
			2	37	22.2	5.11
			3	34	22.3	5.05
			4	37	22.1	5.14
			5	37	22.5	5.05
6MW8 10/24/92	25.1	15	1	34	19.3	6.86
			2	34	19.3	6.28
			3	34	19.2	6.28
			4	34	19.3	6.28
			5	34	19.3	6.33

Notes: (1) Well depth taken from below ground surface (bgs)

TABLE 4-25 (Continued)

SUMMARY OF THE PHASE I - ROUND ONE GROUNDWATER FIELD PARAMETERS
SITES 6 AND 82
REMEDIAL INVESTIGATION CTO-0133
MCB CAMP LEJEUNE, NORTH CAROLINA

Well No. / Date of Measurement	Depth of Well (ft.)(1)	Purge Volume (gals.)	Field Parameters			
			Well Volume	Specific Conductance at 25 deg. C (micromhos/cm)	Temperature (deg. C)	pH (S.U.)
6BP6 / 10/24/92	25.0	10	1	38	16.1	5.83
			2	33	17.2	5.50
			3	35	17.5	5.33
			4	35	17.7	5.28
			5	35	17.7	5.30
6MW9 / 10/24/92	25.0	10	1	44	18.6	5.34
			2	44	18.9	5.35
			3	45	18.1	5.25
			4	44	19.0	5.33
			5	44	18.6	5.39

Notes: (1) Well depth taken from below ground surface (bgs)

TABLE 4-26

SUMMARY OF THE PHASE II - ROUND ONE AND ROUND TWO
GROUNDWATER FIELD PARAMETERS
SITES 6 AND 82
REMEDIAL INVESTIGATION CTO-0133
MCB CAMP LEJEUNE, NORTH CAROLINA

Well No. / Date of Measurement	Depth of Well (ft.)(1)	Purge Volume (gals.)	Field Parameters			
			Well Volume	Specific Conductance at 25 deg. C (micromhos/cm)	Temperature (deg. C)	pH (S.U.)
6GW1S 03/20/93	28.5	6.5	1	224	17.5	5.44
			2	226	17.5	5.89
			3	204	17.5	6.07
			4	224	17.8	6.05
6GW10 03/23/93	18.0	182	1	820	19.0	10.46
			2	820	19.0	10.30
			3	820	19.0	10.29
6GW2S 03/21/93	27.4	10	1	44	14.0	5.60
			2	44	13.8	5.32
			3	44	14.0	5.07
			4	45	14.0	4.90
6GW2D 03/21/93	119.0	200	1	391	15.0	10.30
			2	290	17.0	8.40
			3	297	17.8	7.77
			4	300	19.5	7.44
6GW3 03/22/93	27.5	7	1	199	17.0	6.93
			2	193	17.0	7.22
			3	193	17.0	6.82
6MW3D(3) 04/06/93	118.0	50	1	28	15.0	7.61
			2	363	17.0	7.75
			3	316	17.0	8.25
			4	293	17.0	8.47
			5	281	17.0	8.58
6GW4 03/21/93	27.6	11	1	60	16.0	5.38
			2	129	17.0	4.99
			3	86	15.0	5.25
			4	96	16.0	5.15
			5	132	16.0	4.99
			6	86	15.0	5.23

Notes: (1) Well depth taken from below ground surface (bgs)
(2) NA - Not Available
(3) New Well - Installed during Phase II Field Investigation

TABLE 4-26 (Continued)

SUMMARY OF THE PHASE II - ROUND ONE AND ROUND TWO
GROUNDWATER FIELD PARAMETERS
SITES 6 AND 82
REMEDIAL INVESTIGATION CTO-0133
MCB CAMP LEJEUNE, NORTH CAROLINA

Well No. / Date of Measurement	Depth of Well (ft.)(1)	Purge Volume (gals.)	Field Parameters			
			Well Volume	Specific Conductance at 25 deg. C (micromhos/cm)	Temperature (deg. C)	pH (S.U.)
6GW5 03/21/93	26.8	5	1	194	14.0	6.71
			2	182	14.0	6.55
			3	182	14.0	7.02
			4	169	14.0	6.65
6GW6 03/20/93	27.5	15	1	69	14.0	5.03
			2	67	13.5	3.5
			3	65	14.0	3.5
			4	69	14.0	3.76
			5	65	14.0	3.93
6GW7 03/19/93	100.5	190	1	300	16.0	6.8
			2	298	18.0	7.0
			3	304	17.0	7.0
			4	316	17.0	7.0
			5	316	17.0	7.1
6GW8 03/20/93	25.0	11.5	1	125	14.0	5.75
			2	141	13.0	5.94
			3	128	13.0	5.80
			4	132	12.0	5.91
			5	141	13.0	5.91
6GW9 03/19/93	19.1	35	1	74	8.0	7.0
			2	72	12.0	5.9
			3	75	11.0	5.7
			4	77	13.0	5.3
			5	75	14.0	5.0
6GW10 03/20/93	18.0	22	1	91	12.5	5.15
			2	86	12.0	4.84
			3	91	12.5	4.87
			4	90	13.0	4.87
6GW11 03/20/93	18.7	7	1	236	15.0	6.15
			2	188	14.0	6.13
			3	188	14.0	6.10

Notes: (1) Well depth taken from below ground surface (bgs)
(2) NA - Not Available
(3) New Well - Installed during Phase II Field Investigation

TABLE 4-26 (Continued)

SUMMARY OF THE PHASE II - ROUND ONE AND ROUND TWO
GROUNDWATER FIELD PARAMETERS
SITES 6 AND 82
REMEDIAL INVESTIGATION CTO-0133
MCB CAMP LEJEUNE, NORTH CAROLINA

Well No. / Date of Measurement	Depth of Well (ft.)(1)	Purge Volume (gals.)	Field Parameters: Well Volume	Specific Conductance at 25 deg. C (micromhos/cm)	Temperature (deg. C)	pH (S.U.)
6GW12 03/20/93	18.0	27.5	1	110	12.0	7.17
			2	132	12.0	6.91
			3	119	12.0	7.10
			4	119	12.0	7.05
			5	119	12.0	6.90
6GW13 03/20/93	18.0	32	1	258	11.0	6.77
			2	251	11.0	6.52
			3	251	11.0	6.63
			4	241	10.5	6.85
			5	241	11.5	6.55
6GW14 03/20/93	22.0	35	1	101	13.5	6.27
			2	75	14.0	5.96
			3	106	14.0	5.98
			4	100	14.0	5.96
			5	79	14.0	6.00
			6	106	14.0	6.10
6GW15S 03/20/93	20.0	24	1	490	14.9	6.42
			2	516	14.9	6.48
			3	460	14.5	6.43
			4	515	14.9	6.49
6GW16 03/21/93	20.0	30	1	175	14.0	6.05
			2	180	13.0	5.74
			3	175	14.0	5.90
			4	169	14.0	5.82
6GW17 03/20/93	17.6	28	1	207	14.0	6.0
			2	182	14.0	5.1
			3	169	14.0	4.9
			4	157	14.0	5.1

Notes: (1) Well depth taken from below ground surface (bgs)
(2) NA - Not Available
(3) New Well - Installed during Phase II Field Investigation

TABLE 4-26 (Continued)

SUMMARY OF THE PHASE II - ROUND ONE AND ROUND TWO
GROUNDWATER FIELD PARAMETERS
SITES 6 AND 82
REMEDIAL INVESTIGATION CTO-0133
MCB CAMP LEJEUNE, NORTH CAROLINA

Well No. / Date of Measurement	Depth of Well (ft.)(1)	Purge Volume (gals.)	Field Parameters			
			Well Volume	Specific Conductance at 25 deg. C (micromhos/cm)	Temperature (deg. C)	pH (S.U.)
6GW18 03/20/93	18.5	31	1	63	14.0	5.83
			2	50	14.0	5.95
			3	50	14.0	5.79
			4	50	14.0	5.67
			5	50	14.0	5.86
6GW19 03/20/93	20.0	34	1	75	14.0	6.12
			2	25	14.0	5.84
			3	25	14.0	5.75
			4	25	14.0	5.75
			5	25	14.0	5.75
6GW20 03/21/93	19.7	36	1	128	15.0	5.75
			2	NA (2)	NA	5.50
			3	NA	NA	5.34
			4	NA	NA	5.68
			5	NA	NA	5.45
6GW21 03/21/93	22.5	27	1	60	16.0	6.08
			2	60	16.0	6.02
			3	60	16.0	6.04
			4	59	17.0	6.00
6GW22 03/22/93	19.5	32	1	188	14.0	5.79
			2	188	14.0	5.80
			3	183	15.0	5.79
6GW23 03/21/93	21.0	38	1	132	16.0	6.43
			2	144	16.0	6.39
			3	150	16.0	6.39
			4	150	16.0	6.45
6GW25 03/21/93	23.5	32	1	13	14.0	5.10
			2	86	15.0	5.05
			3	73	15.0	5.22
			4	73	15.0	5.19

tes: (1) Well depth taken from below ground surface (bgs)
(2) NA - Not Available
(3) New Well - Installed during Phase II Field Investigation

TABLE 4-26 (Continued)

SUMMARY OF THE PHASE II - ROUND ONE AND ROUND TWO
GROUNDWATER FIELD PARAMETERS
SITES 6 AND 82
REMEDIAL INVESTIGATION CTO-0133
MCB CAMP LEJEUNE, NORTH CAROLINA

Well No. / Date of Measurement	Depth of Well (ft.)(1)	Purge Volume (gals.)	Field Parameters			
			Well Volume	Specific Conductance at 25 deg. C (micromhos/cm)	Temperature (deg. C)	pH (S.U.)
6GW26 03/22/93	20.0	21	1	304	18.0	6.54
			2	275	18.0	6.43
			3	264	18.0	6.37
			4	252	18.0	6.30
6GW27D 03/23/93	110.0	190	1	482	19.0	10.54
			2	470	19.0	10.44
			3	465	19.0	10.51
6GW28S 03/18/93	32.0	40	1	89	13.5	7.0
			2	98	15.0	5.5
			3	89	16.5	4.8
			4	89	16.5	5.2
			5	89	16.5	5.1
6GW28D 03/23/93	115.0	187	1	379	18.0	10.55
			2	356	18.0	10.51
			3	361	18.0	10.60
6GW30S 03/22/93	20.5	32	1	135	17.0	6.04
			2	129	17.0	5.85
			3	129	17.0	5.82
			4	127	17.5	5.79
6GW30D (3) 03/22/93	100.0	32	1	176	17.0	8.37
			2	197	17.5	9.24
			4	184	18.0	10.24
			5	193	18.5	9.96
6GW32 (3) 03/18/93	27.0	10	1	237	16.0	6.47
			2	241	15.3	6.66
			3	283	15.7	6.51
			4	242	15.0	6.70
			5	257	15.0	6.90

Notes: (1) Well depth taken from below ground surface (bgs)
(2) NA - Not Available
(3) New Well - Installed during Phase II Field Investigation

TABLE 4-26 (Continued)

SUMMARY OF THE PHASE II - ROUND ONE AND ROUND TWO
GROUNDWATER FIELD PARAMETERS
SITES 6 AND 82
REMEDIAL INVESTIGATION CTO-0133
MCB CAMP LEJEUNE, NORTH CAROLINA

Well No. / Date of Measurement	Depth of Well (ft.)(1)	Purge Volume (gals.)	Field Parameters			
			Well Volume	Specific Conductance at 25 deg. C (micromhos/cm)	Temperature (deg. C)	pH (S.U.)
6GW33 (3) 03/18/93	22.0	9	1	94	14.0	5.10
			2	84	16.0	4.60
			3	98	15.0	4.55
			4	90	13.0	4.60
6GW34 (3) 03/18/93	35.0	9.5	1	120	16.0	4.80
			2	108	16.0	4.52
			3	120	16.0	4.56
			4	108	16.0	4.60
6GW35D (3) 03/22/93	105.0	30	1	1983	18.5	11.89
			2	1822	19.0	11.65
			3	1665	19.5	12.05
6GW36D (3) 03/30/93	95.0	48	1	172	21.0	8.42
			2	202	19.0	10.48
			3	224	19.0	9.89
			4	224	19.0	9.58
			5	235	19.0	9.47
6GW37D (3) 03/22/93	95.0	45	1	296	21.0	7.20
			2	149	20.0	7.32
			3	222	19.5	7.38
			4	222	19.5	7.42
82MW1 03/23/93	14.0	7	1	106	14.0	4.98
			2	105	15.5	4.98
			3	103	16.0	4.96
			4	104	16.0	4.98
6MW2 03/20/93	25.0	8.5	1	39	17.0	4.56
			2	39	17.0	4.59
			3	39	17.0	4.59
			4	39	17.0	4.49

Notes: (1) Well depth taken from below ground surface (bgs)
(2) NA - Not Available
(3) New Well - Installed during Phase II Field Investigation

TABLE 4-26 (Continued)

SUMMARY OF THE PHASE II - ROUND ONE AND ROUND TWO
GROUNDWATER FIELD PARAMETERS
SITES 6 AND 82
REMEDIAL INVESTIGATION CTO-0133
MCB CAMP LEJEUNE, NORTH CAROLINA

Well No. / Date of Measurement	Depth of Well (ft.)(1)	Purge Volume (gals.)	Field Parameters			
			Well Volume	Specific Conductance at 25 deg. C (micromhos/cm)	Temperature (deg. C)	pH (S.U.)
82MW2 03/23/93	25.0	7	1	1002	14.0	5.78
			2	1103	13.5	5.73
			3	1089	14.0	5.88
			4	1089	14.0	5.87
6MW3S 03/23/93	25.1	10	1	36	14.2	8.22
			2	36	14.7	8.16
			3	36	14.9	8.54
82MW3 03/23/93	21.0	7.5	1	66	14.0	3.87
			2	88	14.0	3.70
			3	100	14.0	3.79
			4	95	14.0	3.64
6MW8 03/22/93	25.1	10.5	1	23	17.0	5.95
			2	29	18.0	6.72
			3	29	18.0	6.65
			4	29	18.0	5.93
6MW9 03/20/93	25.0	9	1	41	17.0	5.11
			2	42	16.5	5.06
			3	41	17.0	5.05
			4	41	17.0	5.08
82MW30 03/22/93	25.0	7	1	62	16.0	6.45
			2	63	14.0	8.04
			3	63	14.0	8.19
6BP6 03/22/93	25.0	7.5	1	35	17.0	5.44
			2	36	16.0	5.39
			3	36	16.0	5.39
6GW1DA (3) 05/03/93	230.0	150	1	790	18.5	8.15
			2	785	18.5	8.05
			3	785	18.8	8.10
6GW15D (3) 05/03/93	155.0	90	1	570	17.5	9.10
			2	570	17.5	9.05
			3	565	17.5	8.75

Notes: (1) Well depth taken from below ground surface (bgs)
(2) NA - Not Available
(3) New Well - Installed during Phase II Field Investigation

TABLE 4-27
SITE 6 BEAR HEAD CREEK SURFACE WATER
POSITIVE DETECTION SUMMARY
REMEDIAL INVESTIGATION CTO-0133
MCB CAMP LEJEUNE, NORTH CAROLINA
ORGANICS

	Sample No:	6-BH01-SW-06M	6-BH04-SW-06B	6-BH04-SW-06M	6-BH05-SW-06B	6-BH07-SW-312M
	Depth:	N/A	N/A	N/A	N/A	N/A
	Date Sampled:	10/23/92	8/28/92	8/28/92	8/28/92	8/25/92
	Lab Id:	00591-06	00454-03	00454-04	00454-05	00437-03
Parameter	Units					
PESTICIDE/PCBS						
DIETHYL PHTHALATE	UG/L					2 J
BIS(2-ETHYLHEXYL)PHTHALATE	UG/L	1 J	1 J	1 J	2 J	

N/A - Not applicable
UG/L - microgram per liter
J - value is estimated

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TABLE 4-28
SITE 6 BEAR HEAD CREEK SURFACE WATER
POSITIVE DETECTION SUMMARY
REMEDIAL INVESTIGATION CTO-0133
MCB CAMP LEJEUNE, NORTH CAROLINA
TOTAL METALS

	Sample No:	6-BH01-SW-06B		6-BH01-SW-06M		6-BH02-SW-06M		6-BH03-SW-06B		6-BH03-SW-06M		6-BH04-SW-06B	
	Depth:	N/A		N/A		N/A		N/A		N/A		N/A	
	Date Sampled:	10/23/92		10/23/92		8/28/92		8/28/92		8/28/92		8/28/92	
	Lab Id:	00591-05		00591-06		00458-04		00458-10		00458-11		00454-03	
Parameter	Units												
ALUMINUM	UG/L	1210		1230		868		494		1560			
BARIUM	UG/L	13.4	JB	14	JB	25.1	JB	25.6	JB	31.3	B	22	B
CALCIUM	UG/L	612	B	600	B	16100		17200		19100		20600	
CHROMIUM	UG/L												
COPPER	UG/L												
IRON	UG/L	958		818		921		989		1790		1180	
LEAD	UG/L									5.9		1.8	JB
MAGNESIUM	UG/L	588	B	612	B	1010	B	1050	B	1120	B	1010	B
MANGANESE	UG/L	6.5	B	6.2	B	14	JB	16	J	23	J	17	
MERCURY	UG/L												
NICKEL	UG/L							8	JB				
POTASSIUM	UG/L					685	B	713	B	721	B		
SILVER	UG/L												
SODIUM	UG/L	4680	B	4850	B	5250		5480		5620		4420	JB
VANADIUM	UG/L					2	JB	2	JB	3	JB		
ZINC	UG/L												

N/A - Not applicable
UG/L - microgram per liter
B - reported value is less than Contract Required Detection Limit (CRDL), but greater than Instrument Detection Limit (IDL)
J - value is estimated
JB - value is estimated below the CRDL, but greater than the IDL

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TABLE 4-28
SITE 6 BEAR HEAD CREEK SURFACE WATER
POSITIVE DETECTION SUMMARY
REMEDIAL INVESTIGATION CTO-0133
MCB CAMP LEJEUNE, NORTH CAROLINA
TOTAL METALS

Sample No:		6-BH04-SW-06M	6-BH05-SW-06B	6-BH05-SW-06M	6-BH06-SW-06B	6-BH06-SW-06M	6-BH07-SW-06B
Depth:		N/A	N/A	N/A	N/A	N/A	N/A
Date Sampled:		8/28/92	8/28/92	8/28/92	8/28/92	8/28/92	8/25/92
Lab Id:		00454-04	00454-05	00454-06	00454-07	00454-09	00437-01
Parameter	Units						
ALUMINUM	UG/L	782		2700			408
BARIUM	UG/L	24 B	22 B	36 B	24 B	27 B	20.6 B
CALCIUM	UG/L	20000	20000	22500	20100	23000	24900
CHROMIUM	UG/L			8 B	5 B		4.4 B
COPPER	UG/L						4 B
IRON	UG/L	1650	1120	6200	1150	1180	679
LEAD	UG/L	1.8 JB	1.5 JB	8.2	2 JB	2.2 JB	2.4 B
MAGNESIUM	UG/L	1060 B	1240 B	1160 B	1010 B	1130 B	37900
MANGANESE	UG/L	17	18	65	20	20	13.5 JB
MERCURY	UG/L			0.05 B			
NICKEL	UG/L						
POTASSIUM	UG/L		10100				13000
SILVER	UG/L						3.6 B
SODIUM	UG/L	4580 JB	4310 JB		5140 J	4510 JB	319000
VANADIUM	UG/L						
ZINC	UG/L						6.4 B

N/A - Not applicable
UG/L - microgram per liter
B - reported value is less than Contract Required Detection Limit (CRDL), but greater than Instrument Detection Limit (IDL)
J - value is estimated
JB - value is estimated below the CRDL, but greater than the IDL

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TABLE 4-28
SITE 6 BEAR HEAD CREEK SURFACE WATER
POSITIVE DETECTION SUMMARY
REMEDIAL INVESTIGATION CTO-0133
MCB CAMP LEJEUNE, NORTH CAROLINA
TOTAL METALS

	Sample No:	6-BH07-SW-06M		6-BH07-SW-312M	
	Depth:	N/A		N/A	
	Date Sampled:	8/25/92		8/25/92	
	Lab Id:	00437-02		00437-03	
Parameter	Units				
ALUMINUM	UG/L	418		334	
BARIUM	UG/L	20.5	B	18.6	B
CALCIUM	UG/L	23900		54900	
CHROMIUM	UG/L				
COPPER	UG/L	5.2	B	55.8	
IRON	UG/L	725		501	
LEAD	UG/L	2	B	2.6	B
MAGNESIUM	UG/L	33600		136000	
MANGANESE	UG/L	13.5	JB	16.2	J
MERCURY	UG/L			0.34	
NICKEL	UG/L			244	
POTASSIUM	UG/L	11600		49000	
SILVER	UG/L	2.1	B		
SODIUM	UG/L	284000		1260000	
VANADIUM	UG/L				
ZINC	UG/L	6.2	B	30.7	

N/A - Not applicable
UG/L - microgram per liter
B - reported value is less than Contract Required Detection Limit (CRDL), but greater than Instrument Detection Limit (IDL)
J - value is estimated
JB - value is estimated below the CRDL, but greater than the IDL

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TABLE 4-29

SUMMARY OF FIELD PARAMETERS FROM BIOLOGICAL SAMPLES
SITE 6
REMEDIAL INVESTIGATION CTO-0133
MCB CAMP LEJEUNE, NORTH CAROLINA

Sample Identification	Sample Location	Salinity (ppt)	Specific Conductance (micromhos/cm)	Dissolved Oxygen (mg/l)	pH (S.U.)	Temperature (deg. C)
Wallace Creek						
6-WC3A-BN	Bottom	NA	NA	NA	NA	NA
6-WC6A-BN	Surface	0.0	125	5.85	6.3	23.5
	Bottom	0.0	145	5.8	6.3	23.5
6-WC9A-BN	Surface	0.5	900	5.1	6.3	22.8
	Bottom	7	11,500	0.13	NA	25.5
6-WC11A-BN	Surface	0.5	1,500	4.45	6.3	23.3
	Bottom	7.5	10,900	0.15	NA	26.0
6-WC03A-FS	Bottom	0.0	20	NA	NA	28.0
6-WC06A-FS	Bottom	NA	NA	NA	NA	NA
6-WC09A-FS	Bottom	NA	NA	NA	NA	NA
6-WC11A-FS	Bottom	NA	NA	NA	NA	NA
Bear Head Creek						
6-BH2A-BN	Bottom	0.0	6.0	6.45	5.5	24.0
6-BH4A-BN	Bottom	0.0	82	6.35	NA	23
6-BH6A-BN	Surface	0.0	135	5.0	6.3	22.9
	Bottom	0.0	140	4.95	NA	22.8
6-BH2A-FS	Bottom	0.0	115	5.0	NA	22.5
6-BH4A-FS	Bottom	0.0	112	5.7	6.4	24.0
6-BH6A-FS	Bottom	NA	NA	NA	NA	NA

Notes:

ppt	- Parts per Thousand
mg/l	- Milligram per Liter
S.U.	- Standard Units
deg. C	- Degrees Celsius
NA	- Not Analyzed
Sample Location	- Water Surface or Water Bottom
BN	- Benthic Macroinvertebrate Sample
FS	- Fish Sample
BH	- Bear Head Creek Station
WC	- Wallace Creek Station

TABLE 4-30
SITE 6 WALLACE CREEK SURFACE WATER
POSITIVE DETECTION SUMMARY
REMEDIAL INVESTIGATION CTO-0133
MCB CAMP LEJEUNE, NORTH CAROLINA
ORGANICS

	Sample No:	6-WC03-SW-312M	6-WC04-SW-06B	6-WC04-SW-06M	6-WC05-SW-312M	6-WC06-SW-06B	6-WC06-SW-06M
	Depth:	N/A	N/A	N/A	N/A	N/A	N/A
	Date Sampled:	8/26/92	8/25/92	8/25/92	8/25/92	8/23/92	8/23/92
	Lab Id:	00439-20	00439-21	00439-22	00437-21	00429-05	00429-06
Parameter	Units						
VOLATILES							
VINYL CHLORIDE	UG/L						
ACETONE	UG/L	46	14				4 J
1,2-DICHLOROETHENE	UG/L		4 J	4 J			
TRICHLOROETHENE	UG/L						
TETRACHLOROETHENE	UG/L						
TOLUENE	UG/L					2 J	
SEMIVOLATILES							
2,4,6-TRICHLOROPHENOL	UG/L						
BIS(2-ETHYLHEXYL)PHTH	UG/L				2 J		

N/A - Not applicable
UG/L - microgram per liter
J - value is estimated

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TABLE 4-30
SITE 6 WALLACE CREEK SURFACE WATER
POSITIVE DETECTION SUMMARY
REMEDIAL INVESTIGATION CTO-0133
MCB CAMP LEJEUNE, NORTH CAROLINA
ORGANICS

Sample No:	6-WC07-SW-06B	6-WC07-SW-312M	6-WC08-SW-06B	6-WC08-SW-06M	6-WC08-SW-312M	6-WC09-SW-06B
Depth:	N/A	N/A	N/A	N/A	N/A	N/A
Date Sampled:	8/23/92	8/23/92	8/23/92	8/23/92	8/23/92	8/23/92
Lab Id:	00429-10	00429-12	00429-18	00429-19	00429-20	00429-26
Parameter						
VOLATILES						
VINYL CHLORIDE	6 J					
ACETONE		5 J		6 J	27 J	
1,2-DICHLOROETHENE	85	9 J	13	23	9 J	17
TRICHLOROETHENE	98	4 J	16	28	10	22
TETRACHLOROETHENE	4 J			1 J		
TOLUENE	3 J					
SEMIVOLATILES						
2,4,6-TRICHLOROPHENOL						
BIS(2-ETHYLHEXYL)PHTH						

N/A - Not applicable
UG/L - microgram per liter
J - value is estimated

CLEJ-01272-3.13-08/20/93

TABLE 4-30
SITE 6 WALLACE CREEK SURFACE WATER
POSITIVE DETECTION SUMMARY
REMEDIAL INVESTIGATION CTO-0133
MCB CAMP LEJEUNE, NORTH CAROLINA
ORGANICS

Sample No:	6-WC09-SW-06M	6-WC09-SW-312M	6-WC10-SW-06B	6-WC10-SW-06M	6-WC10-SW-312M	6-WC11-SW-06B
Depth:	N/A	N/A	N/A	N/A	N/A	N/A
Date Sampled:	8/23/92	8/23/92	8/22/92	8/22/92	8/22/92	8/22/92
Lab Id:	00429-28	00429-29	00426-06	00426-08	00426-09	00426-12
Parameter						
VOLATILES						
VINYL CHLORIDE						
ACETONE		900 J				
1,2-DICHLOROETHENE	21		4 J	6 J		2 J
TRICHLOROETHENE	28		5 J	7 J		3 J
TETRACHLOROETHENE	1 J					
TOLUENE			1 J			1 J
SEMIVOLATILES						
2,4,6-TRICHLOROPHENOL				1 J		
BIS(2-ETHYLHEXYL)PHTH				2 J	1 J	

N/A - Not applicable
UG/L - microgram per liter
J - value is estimated

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TABLE 4-30
SITE 6 WALLACE CREEK SURFACE WATER
POSITIVE DETECTION SUMMARY
REMEDIAL INVESTIGATION CTO-0133
MCB CAMP LEJEUNE, NORTH CAROLINA
ORGANICS

Sample No:	6-WC11-SW-06M	6-WC11-SW-312M
Depth:	N/A	N/A
Date Sampled:	8/22/92	8/22/92
Lab Id:	00426-13	00426-14
Parameter		
VOLATILES		
VINYL CHLORIDE		
ACETONE	9 J	14 J
1,2-DICHLOROETHENE		2 J
TRICHLOROETHENE	3 J	4 J
TETRACHLOROETHENE		
TOLUENE		
SEMIVOLATILES		
2,4,6-TRICHLOROPHENOL		
BIS(2-ETHYLHEXYL)PHTH	2 J	2 J

N/A - Not applicable
UG/L - microgram per liter
J - value is estimated

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TABLE 4-31
SITE 6 WALLACE CREEK SURFACE WATER
POSITIVE DETECTION SUMMARY
REMEDIAL INVESTIGATION CTO-0133
MCB CAMP LEJEUNE, NORTH CAROLINA
TOTAL METALS

	Sample No:	6-WC01-SW-06B	6-WC01-SW-06M	6-WC02-SW-06B	6-WC03-SW-06B	6-WC03-SW-06M	6-WC03-SW-312M
	Depth:	N/A	N/A	N/A	N/A	N/A	N/A
	Date Sampled:	8/30/92	8/30/92	8/26/92	8/26/92	8/26/92	8/26/92
	Lab Id:	00464-25	00464-26	00445-16	00439-18	00439-19	00439-20
Parameter	Units						
ALUMINUM	UG/L	1350	1220	633	747	633	676
ARSENIC	UG/L						
BARIUM	UG/L	16 JB	16.2 JB	19.3 B			
CADMIUM	UG/L						
CALCIUM	UG/L	3640 B	3670 B	9990	9360	8890	9430
CHROMIUM	UG/L						
COBALT	UG/L						
COPPER	UG/L						129
IRON	UG/L	1050	941	844	849	756	830
LEAD	UG/L	2.3 JB	1.9 JB	1.2 B	5	5	10.4
MAGNESIUM	UG/L	632 B	639 B	1110 B	916 B	883 B	936 B
MANGANESE	UG/L			8.8 B	9.8 JB	8.2 JB	9.2 JB
MERCURY	UG/L						0.52
NICKEL	UG/L						1380
POTASSIUM	UG/L	376 B	341 B	604 B	610 B	603 B	640 B
SILVER	UG/L						
SODIUM	UG/L	3930 B	3980 B	7790	6240	6100	6500
VANADIUM	UG/L	3.3 JB	1.9 JB	2.1 JB			
ZINC	UG/L						111

N/A - Not applicable
UG/L - microgram per liter
B - reported value is less than Contract Required Detection Limit (CRDL), but greater than Instrument Detection Limit (IDL)
J - value is estimated
JB - value is estimated below the CRDL, but greater than the IDL

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TABLE 4-31
SITE 6 WALLACE CREEK SURFACE WATER
POSITIVE DETECTION SUMMARY
REMEDIAL INVESTIGATION CTO-0133
MCB CAMP LEJEUNE, NORTH CAROLINA
TOTAL METALS

Sample No:		6-WC04-SW-06B	6-WC04-SW-06M	6-WC05-SW-06B	6-WC05-SW-06M	6-WC05-SW-312M	6-WC06-SW-06B
Depth:		N/A	N/A	N/A	N/A	N/A	N/A
Date Sampled:		8/26/92	8/26/92	8/25/92	8/25/92	8/25/92	8/23/92
Lab Id:		00439-21	00439-22	00437-19	00437-20	00437-21	00429-05
Parameter	Units						
ALUMINUM	UG/L	697	698	799	945	762	751 J
ARSENIC	UG/L						
BARIUM	UG/L			18.9 B	22.6 B	17.6 B	
CADMIUM	UG/L		3.2 JB				
CALCIUM	UG/L	9720	9520	9440	11200	8850	
CHROMIUM	UG/L					4.9 B	
COBALT	UG/L					2.9 B	
COPPER	UG/L			5.5 B	3 B	43.8	
IRON	UG/L	834	812	854	1020	818	701
LEAD	UG/L			1.8 B	2 B	3.1	
MAGNESIUM	UG/L	1080 B	995 B	1060 B	1230 B	985 B	
MANGANESE	UG/L	10 JB	10.5 JB	10.6 JB	12.2 JB	10 JB	12.5 B
MERCURY	UG/L					0.24 B	
NICKEL	UG/L					177	
POTASSIUM	UG/L	636 B	614 B	821 B	821 B	700 B	
SILVER	UG/L					2.6 B	
SODIUM	UG/L	7400 J	6810 J	7400	8430	6710	
VANADIUM	UG/L						
ZINC	UG/L			20.6	9.9 B	26.8	

N/A - Not applicable
UG/L - microgram per liter
B - reported value is less than Contract Required Detection Limit (CRDL), but greater than Instrument Detection Limit (IDL)
J - value is estimated
JB - value is estimated below the CRDL, but greater than the IDL

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TABLE 4-31
SITE 6 WALLACE CREEK SURFACE WATER
POSITIVE DETECTION SUMMARY
REMEDIAL INVESTIGATION CTO-0133
MCB CAMP LEJEUNE, NORTH CAROLINA
TOTAL METALS

Sample No:		6-WC06-SW-06M	6-WC07-SW-06B	6-WC07-SW-06M	6-WC07-SW-312M	6-WC08-SW-06B	6-WC08-SW-06M
Depth:		N/A	N/A	N/A	N/A	N/A	N/A
Date Sampled:		8/23/92	8/23/92	8/23/92	8/23/92	8/23/92	8/23/92
Lab Id:		00429-06	00429-10	00429-11	00429-12	00429-18	00429-19
Parameter	Units						
ALUMINUM	UG/L	798 J	881 J	814 J	696 J	811 J	845 J
ARSENIC	UG/L						
BARIUM	UG/L						
CADMIUM	UG/L				17.4 J		
CALCIUM	UG/L						
CHROMIUM	UG/L						
COBALT	UG/L						
COPPER	UG/L						
IRON	UG/L	775	800	823	724	790	831
LEAD	UG/L						
MAGNESIUM	UG/L		14400				
MANGANESE	UG/L	13.8 B	17.8	17.6	14.7 B	16.2	16.9
MERCURY	UG/L						
NICKEL	UG/L						
POTASSIUM	UG/L						
SILVER	UG/L						
SODIUM	UG/L						
VANADIUM	UG/L		1.9 JB	2 JB		2.1 JB	1.9 JB
ZINC	UG/L						

N/A - Not applicable
UG/L - microgram per liter
B - reported value is less than Contract Required Detection Limit (CRDL), but greater than Instrument Detection Limit (IDL)
J - value is estimated
JB - value is estimated below the CRDL, but greater than the IDL

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TABLE 4-31
SITE 6 WALLACE CREEK SURFACE WATER
POSITIVE DETECTION SUMMARY
REMEDIAL INVESTIGATION CTO-0133
MCB CAMP LEJEUNE, NORTH CAROLINA
TOTAL METALS

Sample No:		6-WC08-SW-312M	6-WC09-SW-06B	6-WC09-SW-06M	6-WC09-SW-312M	6-WC10-SW-06B	6-WC10-SW-06M
Depth:		N/A	N/A	N/A	N/A	N/A	N/A
Date Sampled:		8/23/92	8/23/92	8/23/92	8/23/92	8/22/92	8/22/92
Lab Id:		00429-20	00429-26	00429-28	00429-29	00426-06	00426-08
Parameter	Units						
ALUMINUM	UG/L	719 J	746 J	745 J	480 J	621	
ARSENIC	UG/L		3.7 B				
BARIUM	UG/L						
CADMIUM	UG/L						
CALCIUM	UG/L				56000 J	30900	32500
CHROMIUM	UG/L						
COBALT	UG/L						
COPPER	UG/L						
IRON	UG/L	749	704	740	477	599	498
LEAD	UG/L						
MAGNESIUM	UG/L	12600	18300	12800	146000	76600	83300
MANGANESE	UG/L	16.5	15.5	15.8	17.3	15 J	16 J
MERCURY	UG/L						
NICKEL	UG/L						
POTASSIUM	UG/L				53700	25500	27700
SILVER	UG/L						
SODIUM	UG/L		154000 J		1340000	661000	714000
VANADIUM	UG/L	2.5 JB		2 JB			
ZINC	UG/L					9 B	7.3 B

N/A - Not applicable
UG/L - microgram per liter
B - reported value is less than Contract Required Detection Limit (CRDL), but greater than Instrument Detection Limit (IDL)
J - value is estimated
JB - value is estimated below the CRDL, but greater than the IDL

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TABLE 4-31
SITE 6 WALLACE CREEK SURFACE WATER
POSITIVE DETECTION SUMMARY
REMEDIAL INVESTIGATION CTO-0133
MCB CAMP LEJEUNE, NORTH CAROLINA
TOTAL METALS

	Sample No:	6-WC10-SW-312M		6-WC11-SW-06B		6-WC11-SW-06M		6-WC11-SW-312M	
	Depth:	N/A		N/A		N/A		N/A	
	Date Sampled:	8/22/92		8/22/92		8/22/92		8/22/92	
	Lab Id:	00426-09		00426-12		00426-13		00426-14	
Parameter	Units								
ALUMINUM	UG/L			807				682	
ARSENIC	UG/L								
BARIUM	UG/L								
CADMIUM	UG/L								
CALCIUM	UG/L	53400		40300		36000		64100	
CHROMIUM	UG/L								
COBALT	UG/L								
COPPER	UG/L	66						209	
IRON	UG/L	494		881		546		649	
LEAD	UG/L								
MAGNESIUM	UG/L	143000		98900		88200		174000	
MANGANESE	UG/L	18	J	18	J	14	JB	25	J
MERCURY	UG/L							0.52	
NICKEL	UG/L	102						213	
POTASSIUM	UG/L	48500		32000		28000		55700	
SILVER	UG/L								
SODIUM	UG/L	1620000		726000		700000		1260000	
VANADIUM	UG/L								
ZINC	UG/L	30.7		8.4	B	17.6	B	95.1	

N/A - Not applicable
UG/L - microgram per liter
B - reported value is less than Contract Required Detection Limit (CRDL), but greater than Instrument Detection Limit (IDL)
J - value is estimated
JB - value is estimated below the CRDL, but greater than the IDL

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TABLE 4-32
SITE 6 RAVINE SURFACE WATER
POSITIVE DETECTION SUMMARY
REMEDIAL INVESTIGATION CTO - 0133
MCB CAMP LEJEUNE, NORTH CAROLINA
ORGANICS

Sample No:		6-RV5-SW-06
Depth:		N/A
Date Sampled:		8/25/92
Lab Id:		00439-16
Parameter	Units	
VOLATILES		
ACETONE	UG/L	140

N/A - Not applicable
UG/L - microgram per liter
J - value is estimated

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TABLE 4-33
SITE 6 RAVINE SURFACE WATER
POSITIVE DETECTION SUMMARY
REMEDIAL INVESTIGATION CTO-0133
MCB CAMP LEJEUNE, NORTH CAROLINA
TOTAL METALS

	Sample No:	6-RV2-SW-06	6-RV3-SW-06	6-RV5-SW-06	6-RV6-SW-06	6-RV7-SW-06	6-RV8-SW-06
	Depth:	N/A	N/A	N/A	N/A	N/A	N/A
	Date Sampled:	8/25/92	8/24/92	8/25/92	8/25/92	8/25/92	8/25/92
	Lab Id:	00439-14	00437-06	00439-16	00439-17	00437-15	00437-18
Parameter	Units						
ALUMINUM	UG/L	613	119 B	148 B	612	279	487
ARSENIC	UG/L	2.2 B		3.5 B			10.5
BARIUM	UG/L	91 B	79.1 B	37.1 JB	39.5 JB	49.6 B	56.9 B
CADMIUM	UG/L	3.7 JB		4.3 JB			
CALCIUM	UG/L	102000	79900	23100	19700	12300	15800
CHROMIUM	UG/L					6.5 B	4.2 B
COBALT	UG/L						2.3 B
COPPER	UG/L	9 JB	4.7 B	9 JB	5.7 JB	7.5 B	7.2 B
IRON	UG/L	733	127 J	641	827	1910	9600
LEAD	UG/L	6.1	1.9 B	4.8	8	2.8 B	12.2
MAGNESIUM	UG/L	7100	4650 B	1200 B	1930 B	2980 B	1790 B
MANGANESE	UG/L	319	38.6 J	597	204	267	253
POTASSIUM	UG/L	2910 B	2720 B	1620 B	393 B	607 B	844 B
SILVER	UG/L		3.6 B		67.6		2.9 B
SODIUM	UG/L	6480	4380 JB	2860 JB	5920	8260	8960
VANADIUM	UG/L						6.2 B
ZINC	UG/L	452	113	374	495	248	72.7

N/A - Not applicable
UG/L - microgram per liter
B - reported value is less than Contract Required Detection Limit (CRDL), but greater than Instrument Detection Limit (IDL)
J - value is estimated
JB - value is estimated below the CRDL, but greater than the IDL

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TABLE 4-34
SITE 6 BEAR HEAD CREEK SEDIMENT
POSITIVE DETECTION SUMMARY
REMEDIAL INVESTIGATION CTO-0133
MCB CAMP LEJEUNE, NORTH CAROLINA
ORGANICS

	Sample No:	6-BH01-SD-06B	6-BH02-SD-06M	6-BH02-SD-612M	6-BH03-SD-06B	6-BH03-SD-06M	6-BH03-SD-612B
	Depth:	0 - 6"	0 - 6"	6 - 12"	0 - 6"	0 - 6"	6 - 12"
	Date Sampled:	10/23/92	8/28/92	8/28/92	8/28/92	8/28/92	8/28/92
	Lab Id:	00591-01	00458-02	00458-03	00458-05	00458-07	00458-08
Parameter	Units						
4,4'-DDE	UG/KG		5.7			68	
4,4'-DDD	UG/KG					25	
4,4'-DDT	UG/KG					15	
ALPHA CHLORDANE	UG/KG						
PCB-1260	UG/KG					170	
METHYLENE CHLORIDE	UG/KG			2 J	3 J		4 J
ACETONE	UG/KG		840	140	34	99	210
2-BUTANONE	UG/KG		15 J	3 J	10 J	23 J	30
TRICHLOROETHENE	UG/KG				5 J		
BENZENE	UG/KG	5 J					
TETRACHLOROETHENE	UG/KG				3 J		
ETHYLBENZENE	UG/KG						
TOTAL XYLENES	UG/KG				3 J		
1,4-DICHLOROBENZENE	UG/KG						
PYRENE	UG/KG						
BENZO(B)FLUORANTHENE	UG/KG						
BENZO(A)PYRENE	UG/KG				450 J	190 J	640
INDENO(1,2,3-CD) PYRENE	UG/KG						

UG/KG - microgram per kilogram
J - value is estimated

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TABLE 4-34
SITE 6 BEAR HEAD CREEK SEDIMENT
POSITIVE DETECTION SUMMARY
REMEDIAL INVESTIGATION CTO-0133
MCB CAMP LEJEUNE, NORTH CAROLINA
ORGANICS

Sample No:		6-BH03-SD-612M	6-BH04-SD-06B	6-BH04-SD-06M	6-BH04-SD-612B	6-BH04-SD-612M	6-BH05-SD-06B
Depth:		6 - 12"	0 - 6"	0 - 6"	6 - 12"	6 - 12"	0 - 6"
Date Sampled:		8/28/92	8/26/92	8/26/92	8/26/92	8/26/92	8/26/92
Lab Id:		00458-09	00439-01	00439-02	00439-03	00439-04	00439-05
Parameter	Units						
4,4'-DDE	UG/KG	22	14	41 J	35 J	53 J	30 J
4,4'-DDD	UG/KG	9.2 J	8.4 J	42 J	11 J	220 J	26 J
4,4'-DDT	UG/KG	6.6 J	16 J	9.4 J		38 J	
ALPHA CHLORDANE	UG/KG						
PCB-1260	UG/KG	160	51	110 J	240 J	370 J	64 J
METHYLENE CHLORIDE	UG/KG	7 J					
ACETONE	UG/KG	340	140	9900 J	50 J	91	3700 J
2-BUTANONE	UG/KG	59		2400	5 J		2600
TRICHLOROETHENE	UG/KG						
BENZENE	UG/KG						
TETRACHLOROETHENE	UG/KG						
ETHYLBENZENE	UG/KG						
TOTAL XYLENES	UG/KG						
1,4-DICHLOROBENZENE	UG/KG						
PYRENE	UG/KG					60 J	
BENZO(B)FLUORANTHENE	UG/KG						
BENZO(A)PYRENE	UG/KG	230 J			93 J	100 J	
INDENO(1,2,3-CD) PYRENE	UG/KG		40 J				

UG/KG - microgram per kilogram
J - value is estimated

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TABLE 4-34
SITE 6 BEAR HEAD CREEK SEDIMENT
POSITIVE DETECTION SUMMARY
REMEDIAL INVESTIGATION CTO-0133
MCB CAMP LEJEUNE, NORTH CAROLINA
ORGANICS

Sample No:		6-BH05-SD-06M	6-BH06-SD-06B	6-BH06-SD-06M	6-BH07-SD-06B	6-BH07-SD-06M
Depth:		0 - 6"	0 - 6"	0 - 6"	0 - 6"	0 - 6"
Date Sampled:		8/26/92	8/26/92	8/26/92	8/27/92	8/27/92
Lab Id:		00439-06	00439-07	00439-09	00445-01	00445-02
Parameter	Units					
4,4'-DDE	UG/KG	32	68 J	24 J		
4,4'-DDD	UG/KG	23	37 J	22 J		
4,4'-DDT	UG/KG	21 J	14 J	7 J		
ALPHA CHLORDANE	UG/KG		14 J			
PCB-1260	UG/KG	110 J	180 J	69 J		
METHYLENE CHLORIDE	UG/KG					
ACETONE	UG/KG	470 J	60 J	91 J		
2-BUTANONE	UG/KG	87 J				
TRICHLOROETHENE	UG/KG					150
BENZENE	UG/KG					
TETRACHLOROETHENE	UG/KG					
ETHYLBENZENE	UG/KG					57 J
TOTAL XYLENES	UG/KG					380
1,4-DICHLOROBENZENE	UG/KG				340 J	370 J
PYRENE	UG/KG		76 J			
BENZO(B)FLUORANTHENE	UG/KG		96 J			
BENZO(A)PYRENE	UG/KG					
INDENO(1,2,3-CD) PYRENE	UG/KG					

UG/KG - microgram per kilogram
J - value is estimated

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TABLE 4-35
SITE 6 BEAR HEAD CREEK SEDIMENT
POSITIVE DETECTION SUMMARY
REMEDIAL INVESTIGATION CTO-0133
MCB CAMP LEJEUNE, NORTH CAROLINA
TOTAL METALS

Sample No:		6-BH01-SD-612B	6-BH01-SD-612M	6-BH01-SD-06B	6-BH01-SD-06M	6-BH02-SD-06M	6-BH02-SD-612M
Depth:		6 - 12"	6 - 12"	0 - 6"	0 - 6"	0 - 6"	6 - 12"
Date Sampled:		10/23/92	10/23/92	10/23/92	10/23/92	8/28/92	8/28/92
Lab Id:		00591-03	00591-04	00591-01	00591-02	00458-02	00458-03
Parameter	Units						
ALUMINUM	MG/KG	6760	7790	5610	6360	3010	7780
ARSENIC	MG/KG						1.6 JB
BARIUM	MG/KG	9.7 JB	14.4 B		9.9 JB	12.5 B	30 B
BERYLLIUM	MG/KG	0.13 B	0.17 B	0.14 B			0.33 B
CADMIUM	MG/KG					0.54 JB	1.3 JB
CALCIUM	MG/KG					1410	3890
CHROMIUM	MG/KG	5.1	4.7	4.9	3.6		9.9
COBALT	MG/KG						
COPPER	MG/KG	3.2 JB	10.1 JB	4.2 JB	6.2 JB		
IRON	MG/KG	765	1590	638	956	1240	3150
LEAD	MG/KG	8.9	12.3	11.3	10.2	6.9	8.9
MAGNESIUM	MG/KG	128 B	160 B	103 B	130 B	77.9 B	187 B
MANGANESE	MG/KG	4.9	6 B	4.7	4.9 B	4.4 J	8.6 J
POTASSIUM	MG/KG	125 B	163 B	122 B	140 B		
SELENIUM	MG/KG						2.9
SODIUM	MG/KG						
VANADIUM	MG/KG	5.7 B	6.5 B	4.8 B	4.9 B	3.3 JB	14.1 B
ZINC	MG/KG					12	12.6

MG/KG - milligram per kilogram
B - reported value is less than Contract Required Detection Limit (CRDL), but greater than Instrument Detection Limit (IDL)
J - value is estimated
JB - value is estimated below the CRDL, but greater than the IDL

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TABLE 4-35
SITE 6 BEAR HEAD CREEK SEDIMENT
POSITIVE DETECTION SUMMARY
REMEDIAL INVESTIGATION CTO-0133
MCB CAMP LEJEUNE, NORTH CAROLINA
TOTAL METALS

	Sample No:	6-BH03-SD-06B	6-BH03-SD-06M	6-BH03-SD-612B	6-BH03-SD-612M	6-BH04-SD-06B	6-BH04-SD-06M
	Depth:	0 - 6"	0 - 6"	6 - 12"	6 - 12"	0 - 6"	0 - 6"
	Date Sampled:	8/28/92	8/28/92	8/28/92	8/28/92	8/26/92	8/26/92
	Lab Id:	00458-05	00458-07	00458-08	00458-09	00439-01	00439-02
Parameter	Units						
ALUMINUM	MG/KG	13600 J	9210	15000	10800	465	570
ARSENIC	MG/KG						0.62 B
BARIUM	MG/KG	31.7 B	33.2 B	32.8 B	40.4 B		
BERYLLIUM	MG/KG	0.63 B	0.56 B	0.97 B	0.42 B		
CADMIUM	MG/KG	1.3 JB	1.1 JB	1.3 JB	1.7 JB	0.7 JB	
CALCIUM	MG/KG	3340	4850	3280	5880	45600	8560
CHROMIUM	MG/KG	11.9	8.4	13.6	10	2.4	
COBALT	MG/KG						
COPPER	MG/KG		6.7 JB		7.1 JB		
IRON	MG/KG	3050	4450	3030	4660	516	442
LEAD	MG/KG	19.1 J	45.3	20.8	46.1	2.9	7.7
MAGNESIUM	MG/KG	317 B	219 B	291 B	210 B	653 B	138 B
MANGANESE	MG/KG	11 J	14 J	8.1 J	15 J	28.7	6.3 J
POTASSIUM	MG/KG	225 B		288 B			
SELENIUM	MG/KG						
SODIUM	MG/KG					86.5 JB	
VANADIUM	MG/KG	13.8 B	12.9 B	17.8	12.5 B	1.7 JB	1.5 JB
ZINC	MG/KG	11	30.4	6.4 B	34.5		7.7

MG/KG - milligram per kilogram
B - reported value is less than Contract Required Detection Limit (CRDL), but greater than Instrument Detection Limit (IDL)
J - value is estimated
JB - value is estimated below the CRDL, but greater than the IDL

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TABLE 4-35
SITE 6 BEAR HEAD CREEK SEDIMENT
POSITIVE DETECTION SUMMARY
REMEDIAL INVESTIGATION CTO-0133
MCB CAMP LEJEUNE, NORTH CAROLINA
TOTAL METALS

	Sample No:	6-BH04-SD-612B	6-BH04-SD-612M	6-BH05-SD-06B	6-BH05-SD-06M	6-BH06-SD-06B	6-BH06-SD-06M
	Depth:	6 - 12"	6 - 12"	0 - 6"	0 - 6"	0 - 6"	0 - 6"
	Date Sampled:	8/26/92	8/26/92	8/26/92	8/26/92	8/26/92	8/26/92
	Lab Id:	00439-03	00439-04	00439-05	00439-06	00439-07	00439-09
Parameter	Units						
ALUMINUM	MG/KG	1000	1300	1850	6230	3840	5260 J
ARSENIC	MG/KG		0.54 B		1.1 B	1 B	2.2 JB
BARIUM	MG/KG	8.1 JB		7.7 JB	27 B	17.9 B	25.1 JB
BERYLLIUM	MG/KG				0.3 B		
CADMIUM	MG/KG		0.73 JB		1.8 J	1.1 JB	
CALCIUM	MG/KG	7490	18000	1210	4070	4630	12300 J
CHROMIUM	MG/KG	3.4	2.8	2.3 B	6.6	5.5	9.2 J
COBALT	MG/KG				1.7 JB		
COPPER	MG/KG		1.2 JB	2.2 JB	6.2 JB	5.2 JB	8.8 JB
IRON	MG/KG	1320	995	998	6250	3060	5920 J
LEAD	MG/KG	2.5	17.8	17.6	29	42	27 J
MAGNESIUM	MG/KG	118 B	295 B	57.6 B	180 B	178 B	302 JB
MANGANESE	MG/KG	4.8 J	10.4 J	3.8 J	12.4 J	19 J	27.5 J
POTASSIUM	MG/KG				156 B	121 B	
SELENIUM	MG/KG						
SODIUM	MG/KG						93.7 JB
VANADIUM	MG/KG	1.5 JB	2.2 B	3.2 JB	10.4 B	6.5 B	9 JB
ZINC	MG/KG	6.7	11.4	13.8	36.6	24.9	50.7 J

MG/KG - milligram per kilogram
B - reported value is less than Contract Required Detection Limit (CRDL), but greater than Instrument Detection Limit (IDL)
J - value is estimated
JB - value is estimated below the CRDL, but greater than the IDL

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TABLE 4-35
SITE 6 BEAR HEAD CREEK SEDIMENT
POSITIVE DETECTION SUMMARY
REMEDIAL INVESTIGATION CTO-0133
MCB CAMP LEJEUNE, NORTH CAROLINA
TOTAL METALS

	Sample No:	6-BH07-SD-06B		6-BH07-SD-06M	
	Depth:	0 - 6"		0 - 6"	
	Date Sampled:	8/27/92		8/27/92	
	Lab Id:	00445-01		00445-02	
Parameter	Units				
ALUMINUM	MG/KG	12300	J	22100	J
ARSENIC	MG/KG	6.1	JB	4.7	B
BARIUM	MG/KG	10.5	JB	22.8	JB
BERYLLIUM	MG/KG				
CADMIUM	MG/KG			4.7	JB
CALCIUM	MG/KG	9240	J	14400	J
CHROMIUM	MG/KG	10.8	B	16.4	B
COBALT	MG/KG	3.4	B	4	B
COPPER	MG/KG	28.1	B	23.8	B
IRON	MG/KG	15800	J	17100	J
LEAD	MG/KG	49.2	J	70.4	J
MAGNESIUM	MG/KG	9820	J	10500	J
MANGANESE	MG/KG	46.5		48.6	
POTASSIUM	MG/KG	1930	B	1460	B
SELENIUM	MG/KG				
SODIUM	MG/KG	36200	J	15500	J
VANADIUM	MG/KG	45.9	B	54.1	B
ZINC	MG/KG	77.1		82.4	

MG/KG - milligram per kilogram
B - reported value is less than Contract Required Detection Limit (CRDL), but greater than Instrument Detection Limit (IDL)
J - value is estimated
JB - value is estimated below the CRDL, but greater than the IDL

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TABLE 4-36
SITE 6 WALLACE CREEK SEDIMENT
POSITIVE DETECTION SUMMARY
REMEDIAL INVESTIGATION CTO-0133
MCB CAMP LEJEUNE, NORTH CAROLINA
ORGANICS

	Sample No:	6-WC01-SD-06B	6-WC01-SD-612D	6-WC02-SD-06B	6-WC02-SD-612B	6-WC03-SD-06B	6-WC03-SD-06M
	Depth:	0 - 6"	6 - 12"	0 - 6"	6 - 12"	0 - 6"	0 - 6"
	Date Sampled:	8/30/92	8/30/92	8/26/92	8/26/92	8/26/92	8/26/92
	Lab Id:	00464-22	00464-24	00445-03	00445-04	00445-05	00445-06
Parameter	Units						
DIELDRIN	UG/KG		4.8 J				
4,4'-DDE	UG/KG						
4,4'-DDD	UG/KG		16 J				
4,4'-DDT	UG/KG						
PCB-1260	UG/KG						
METHYLENE CHLORIDE	UG/KG						
ACETONE	UG/KG	26		320 J	95 J	8400 J	
CARBON DISULFIDE	UG/KG						
1,2-DICHLOROETHENE	UG/KG						
2-BUTANONE	UG/KG			21 J		4200	
TRICHLOROETHENE	UG/KG			23	7 J		
TOLUENE	UG/KG						
TOTAL XYLENES	UG/KG			70	26		120 J
PHENOL	UG/KG						
DIETHYL PHTHALATE	UG/KG						
PHENANTHRENE	UG/KG						
FLUORANTHENE	UG/KG						
PYRENE	UG/KG						
BUTYL BENZYL PHTHALATE	UG/KG						
BENZO(A)ANTHRACENE	UG/KG						
CHRYSENE	UG/KG						
BIS(2-ETHYLHEXYL)PHTHALATE	UG/KG						
BENZO(B)FLUORANTHENE	UG/KG						
BENZO(K)FLUORANTHENE	UG/KG						
BENZO(A)PYRENE	UG/KG		63 J				

UG/KG - microgram per kilogram
J - value is estimated

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TABLE 4-36
SITE 6 WALLACE CREEK SEDIMENT
POSITIVE DETECTION SUMMARY
REMEDIAL INVESTIGATION CTO-0133
MCB CAMP LEJEUNE, NORTH CAROLINA
ORGANICS

Sample No:		6-WC03-SD-612B	6-WC04-SD-06B	6-WC04-SD-06M	6-WC04-SD-612B	6-WC05-SD-06B	6-WC05-SD-06M
Depth:		6 - 12"	0 - 6"	0 - 6"	6 - 12"	0 - 6"	0 - 6"
Date Sampled:		8/26/92	8/26/92	8/26/92	8/26/92	8/27/92	8/27/92
Lab Id:		00445-07	00445-08	00445-09	00445-10	00445-11	00445-13
Parameter	Units						
DIELDRIN	UG/KG						
4,4'-DDE	UG/KG						
4,4'-DDD	UG/KG						
4,4'-DDT	UG/KG						
PCB-1260	UG/KG			760			330 J
METHYLENE CHLORIDE	UG/KG	910 J					
ACETONE	UG/KG	15000 J	180 J		160 J		
CARBON DISULFIDE	UG/KG						
1,2-DICHLOROETHENE	UG/KG						
2-BUTANONE	UG/KG						
TRICHLOROETHENE	UG/KG						
TOLUENE	UG/KG						
TOTAL XYLENES	UG/KG						
PHENOL	UG/KG						120 J
DIETHYL PHTHALATE	UG/KG						
PHENANTHRENE	UG/KG						
FLUORANTHENE	UG/KG						
PYRENE	UG/KG						
BUTYL BENZYL PHTHALATE	UG/KG		200 J				
BENZO(A)ANTHRACENE	UG/KG						
CHRYSENE	UG/KG						
BIS(2-ETHYLHEXYL)PHTHALATE	UG/KG						
BENZO(B)FLUORANTHENE	UG/KG						
BENZO(K)FLUORANTHENE	UG/KG						
BENZO(A)PYRENE	UG/KG					850 J	

UG/KG - microgram per kilogram
J - value is estimated

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TABLE 4-36
SITE 6 WALLACE CREEK SEDIMENT
POSITIVE DETECTION SUMMARY
REMEDIAL INVESTIGATION CTO-0133
MCB CAMP LEJEUNE, NORTH CAROLINA
ORGANICS

	Sample No:	6-WC05-SD-612B	6-WC06-SD-06B	6-WC06-SD-06M	6-WC06-SD-612B	6-WC06-SD-612M	6-WC07-SD-06B
	Depth:	6 - 12"	0 - 6"	0 - 6"	6 - 12"	6 - 12"	0 - 6"
	Date Sampled:	8/27/92	8/23/92	8/23/92	8/23/92	8/23/92	8/23/92
	Lab Id:	00445-14	00429-01	00429-02	00429-03	00429-04	00429-07
Parameter	Units						
DIELDRIN	UG/KG						
4,4'-DDE	UG/KG		25 J		16 J	7.9 J	48 J
4,4'-DDD	UG/KG		80 J				
4,4'-DDT	UG/KG		200 J				
PCB-1260	UG/KG		1300 J	400 J			
METHYLENE CHLORIDE	UG/KG						30 J
ACETONE	UG/KG			240	220		
CARBON DISULFIDE	UG/KG						
1,2-DICHLOROETHENE	UG/KG						31 J
2-BUTANONE	UG/KG						
TRICHLOROETHENE	UG/KG						
TOLUENE	UG/KG	4 J		5 J			
TOTAL XYLENES	UG/KG						
PHENOL	UG/KG		190 J				
DIETHYL PHTHALATE	UG/KG		530 J				
PHENANTHRENE	UG/KG						
FLUORANTHENE	UG/KG		290 J	100 J			
PYRENE	UG/KG		210 J	200 J			
BUTYL BENZYL PHTHALATE	UG/KG						920 J
BENZO(A)ANTHRACENE	UG/KG						
CHRYSENE	UG/KG						
BIS(2-ETHYLHEXYL)PHTHALATE	UG/KG						
BENZO(B)FLUORANTHENE	UG/KG						
BENZO(K)FLUORANTHENE	UG/KG						
BENZO(A)PYRENE	UG/KG	1600					

UG/KG - microgram per kilogram
J - value is estimated

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TABLE 4-36
SITE 6 WALLACE CREEK SEDIMENT
POSITIVE DETECTION SUMMARY
REMEDIAL INVESTIGATION CTO-0133
MCB CAMP LEJEUNE, NORTH CAROLINA
ORGANICS

Sample No:		6-WC07-SD-06M	6-WC07-SD-612M	6-WC08-SD-06B	6-WC08-SD-06M	6-WC08-SD-612B	6-WC08-SD-612M
Depth:		0 - 6"	6 - 12"	0 - 6"	0 - 6"	6 - 12"	6 - 12"
Date Sampled:		8/23/92	8/23/92	8/23/92	8/23/92	8/23/92	8/23/92
Lab Id:		00429-08	00429-09	00429-13	00429-15	00429-16	00429-17
Parameter	Units						
DIELDRIN	UG/KG						
4,4'-DDE	UG/KG			47 J	18 J	27.9	7.6 J
4,4'-DDD	UG/KG		67	50 J	200 J	23 J	49
4,4'-DDT	UG/KG		220 J		1200 J		
PCB-1260	UG/KG	2000 J		310 J	2100 J	32 J	
METHYLENE CHLORIDE	UG/KG		6 J				
ACETONE	UG/KG				350	590 J	
CARBON DISULFIDE	UG/KG		2 J			5 J	
1,2-DICHLOROETHENE	UG/KG						
2-BUTANONE	UG/KG						
TRICHLOROETHENE	UG/KG						
TOLUENE	UG/KG						
TOTAL XYLENES	UG/KG						
PHENOL	UG/KG						
DIETHYL PHTHALATE	UG/KG				120 J		
PHENANTHRENE	UG/KG						76 J
FLUORANTHENE	UG/KG			760 J	250 J	180 J	94 J
PYRENE	UG/KG	95 J		810 J	220 J	350 J	130 J
BUTYL BENZYL PHTHALATE	UG/KG						
BENZO(A)ANTHRACENE	UG/KG			210 J		67 J	
CHRYSENE	UG/KG			230 J		74 J	
BIS(2-ETHYLHEXYL)PHTHALATE	UG/KG						
BENZO(B)FLUORANTHENE	UG/KG			420 J	140 J	95 J	
BENZO(K)FLUORANTHENE	UG/KG			140 J		67 J	
BENZO(A)PYRENE	UG/KG			150 J			

UG/KG - microgram per kilogram
J - value is estimated

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TABLE 4-36
SITE 6 WALLACE CREEK SEDIMENT
POSITIVE DETECTION SUMMARY
REMEDIAL INVESTIGATION CTO-0133
MCB CAMP LEJEUNE, NORTH CAROLINA
ORGANICS

Sample No:		6-WC09-SD-06B	6-WC09-SD-06M	6-WC09-SD-612B	6-WC09-SD-612M	6-WC10-SD-06M	6-WC10-SD-612M
Depth:		0 - 6"	0 - 6"	6 - 12"	6 - 12"	0 - 6"	6 - 12"
Date Sampled:		8/23/92	8/23/92	8/23/92	8/23/92	8/22/92	8/22/92
Lab Id:		00429-21	00429-22	00429-23	00429-24	00426-04	00426-05
Parameter	Units						
DIELDRIN	UG/KG						
4,4'-DDE	UG/KG	5.9	69		83	32	34 J
4,4'-DDD	UG/KG	7.4 J	80 J	16 J	49 J	44	43 J
4,4'-DDT	UG/KG						
PCB-1260	UG/KG	31 J	290 J		730 J	420	160 J
METHYLENE CHLORIDE	UG/KG						
ACETONE	UG/KG	240		24000 J		140 J	200 J
CARBON DISULFIDE	UG/KG				5 J		24 J
1,2-DICHLOROETHENE	UG/KG						
2-BUTANONE	UG/KG			9300			22 J
TRICHLOROETHENE	UG/KG						
TOLUENE	UG/KG						
TOTAL XYLENES	UG/KG						
PHENOL	UG/KG						
DIETHYL PHTHALATE	UG/KG						
PHENANTHRENE	UG/KG						
FLUORANTHENE	UG/KG	330 J			250 J	260 J	330 J
PYRENE	UG/KG	410 J			190 J	300 J	230 J
BUTYL BENZYL PHTHALATE	UG/KG						
BENZO(A)ANTHRACENE	UG/KG	120 J					130 J
CHRYSENE	UG/KG	74 J					
BIS(2-ETHYLHEXYL)PHTHALATE	UG/KG						
BENZO(B)FLUORANTHENE	UG/KG	140 J		190 J			94 J
BENZO(K)FLUORANTHENE	UG/KG						
BENZO(A)PYRENE	UG/KG	75 J			480 J		

UG/KG - microgram per kilogram
J - value is estimated

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TABLE 4-36
SITE 6 WALLACE CREEK SEDIMENT
POSITIVE DETECTION SUMMARY
REMEDIAL INVESTIGATION CTO-0133
MCB CAMP LEJEUNE, NORTH CAROLINA
ORGANICS

	Sample No:	6-WC11-SD-06B	6-WC11-SD-06M
	Depth:	0 - 6"	0 - 6"
	Date Sampled:	8/22/92	8/22/92
	Lab Id:	00426-10	00426-11
Parameter	Units		
DIELDRIN	UG/KG		
4,4'-DDE	UG/KG		25 J
4,4'-DDD	UG/KG	35 J	42 J
4,4'-DDT	UG/KG		
PCB-1260	UG/KG		120 J
METHYLENE CHLORIDE	UG/KG		
ACETONE	UG/KG	330 J	72 J
CARBON DISULFIDE	UG/KG		15 J
1,2-DICHLOROETHENE	UG/KG		
2-BUTANONE	UG/KG		
TRICHLOROETHENE	UG/KG		
TOLUENE	UG/KG		
TOTAL XYLENES	UG/KG		
PHENOL	UG/KG		
DIETHYL PHTHALATE	UG/KG		
PHENANTHRENE	UG/KG		
FLUORANTHENE	UG/KG		200 J
PYRENE	UG/KG		120 J
BUTYL BENZYL PHTHALATE	UG/KG		
BENZO(A)ANTHRACENE	UG/KG		
CHRYSENE	UG/KG		
BIS(2-ETHYLHEXYL)PHTHALATE	UG/KG	960 J	
BENZO(B)FLUORANTHENE	UG/KG		
BENZO(K)FLUORANTHENE	UG/KG		
BENZO(A)PYRENE	UG/KG		

UG/KG - microgram per kilogram
J - value is estimated

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TABLE 4-37
SITE 6 WALLACE CREEK SEDIMENT
POSITIVE DETECTION SUMMARY
REMEDIAL INVESTIGATION CTO-0133
MCB CAMP LEJEUNE, NORTH CAROLINA
TOTAL METALS

	Sample No:	6-WC01-SD-06B	6-WC01-SD-612B	6-WC02-SD-06B	6-WC02-SD-612B	6-WC03-SD-06B	6-WC03-SD-06M
	Depth:	0 - 6'	6 - 12'	0 - 6'	6 - 12'	0 - 6'	0 - 6'
	Date Sampled:	8/30/92	8/30/92	8/26/92	8/26/92	8/26/92	8/26/92
	Lab Id:	00464-22	00464-24	00445-03	00445-04	00445-05	00445-06
Parameter	Units						
ALUMINUM	MG/KG	2090 J	2510	6540 J	5390 J	6480 J	4780 J
ARSENIC	MG/KG	1.2 JB					
BARIUM	MG/KG	5.2 JB	15.3 B	19.6 JB	23.7 JB	15.8 JB	37.1 JB
BERYLLIUM	MG/KG						
CALCIUM	MG/KG	329 B	1060 B	1090 JB	1790 J	2850 J	22200 J
CHROMIUM	MG/KG			4.2	3.4	6.2	6.4
COBALT	MG/KG			0.6 JB	0.87 JB		1.3 JB
COPPER	MG/KG			0.43 JB	0.62 JB	5.8 JB	53200
IRON	MG/KG	724 J	1430 J	1200 J	1570 J	6870 J	6940 J
LEAD	MG/KG	9.7 J	2.3 J	4.8 J	4.8 J	9 J	314 J
MAGNESIUM	MG/KG	50.5 B	57 B	372 JB	356 JB	440 JB	852 JB
MANGANESE	MG/KG		4.7 J	8.8	6.5	9.7	23
NICKEL	MG/KG				2.8 B		
POTASSIUM	MG/KG	92.1 B	98.1 B	145 B		220 B	360 B
SILVER	MG/KG						7.3
SODIUM	MG/KG			491 JB	469 JB		489 JB
VANADIUM	MG/KG	5.7 B	4.4 B	5.8 B	7 B	11.6 B	9.1 B
ZINC	MG/KG						926

MG/KG - milligram per kilogram
B - reported value is less than Contract Required Detection Limit (CRDL), but greater than Instrument Detection Limit (IDL)
J - value is estimated
JB - value is estimated below the CRDL, but greater than the IDL

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TABLE 4-37
SITE 6 WALLACE CREEK SEDIMENT
POSITIVE DETECTION SUMMARY
REMEDIAL INVESTIGATION CTO-0133
MCB CAMP LEJEUNE, NORTH CAROLINA
TOTAL METALS

Sample No:		6-WC03-SD-612B	6-WC04-SD-06B	6-WC04-SD-06M	6-WC04-SD-612B	6-WC05-SD-06B	6-WC05-SD-06M
Depth:		6 - 12'	0 - 6'	0 - 6'	6 - 12'	0 - 6'	0 - 6'
Date Sampled:		8/26/92	8/26/92	8/26/92	8/26/92	8/27/92	8/27/92
Lab Id:		00445-07	00445-08	00445-09	00445-10	00445-11	00445-13
Parameter	Units						
ALUMINUM	MG/KG	7040 J	1830 J	569 J	1950 J	8600 J	2040 J
ARSENIC	MG/KG	1.3 JB		1.3 B			
BARIUM	MG/KG	25.2 JB	4.2 JB	4.3 JB	4.8 JB	18.1 JB	4.7 JB
BERYLLIUM	MG/KG						
CALCIUM	MG/KG	4500 J	407 JB	90000 J	1090 JB	1300 JB	2430 J
CHROMIUM	MG/KG	8.3	2.7	3.7	2 B	4.3	2.4
COBALT	MG/KG				0.63 JB	1.1 JB	0.62 JB
COPPER	MG/KG	79.6	8.7 J	2.5 JB	1.8 JB	1.2 JB	1.9 JB
IRON	MG/KG	6050 J	1920 J	1160 J	2050 J	1680 J	1450 J
LEAD	MG/KG	10.3 J	3 J	4.4 J	4.4 J	6.2 J	7.1 J
MAGNESIUM	MG/KG	333 JB	160 JB	1380 J	311 JB	673 JB	209 JB
MANGANESE	MG/KG	8.3	5	18.7	5.1	6.4	7.1
NICKEL	MG/KG						
POTASSIUM	MG/KG	457 B		101 B		180 B	
SILVER	MG/KG						
SODIUM	MG/KG				621 JB	1070 JB	
VANADIUM	MG/KG	15.7 B				4.6 JB	3.5 JB
ZINC	MG/KG				15.9		

MG/KG - milligram per kilogram
B - reported value is less than Contract Required Detection Limit (CRDL), but greater than Instrument Detection Limit (IDL)
J - value is estimated
JB - value is estimated below the CRDL, but greater than the IDL

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TABLE 4-37
SITE 6 WALLACE CREEK SEDIMENT
POSITIVE DETECTION SUMMARY
REMEDIAL INVESTIGATION CTO-0133
MCB CAMP LEJEUNE, NORTH CAROLINA
TOTAL METALS

	Sample No:	6-WC05-SD-612B	6-WC06-SD-06B	6-WC06-SD-06M	6-WC06-SD-612B	6-WC06-SD-612M	6-WC07-SD-06B
	Depth:	6 - 12'	0 - 6'	0 - 6'	6 - 12'	6 - 12'	0 - 6'
	Date Sampled:	8/27/92	8/23/92	8/23/92	8/23/92	8/23/92	8/23/92
	Lab Id:	00445-14	00429-01	00429-02	00429-03	00429-04	00429-07
Parameter	Units						
ALUMINUM	MG/KG	4130 J	9120	1990	6210	1390	8590
ARSENIC	MG/KG		3.6 B	1 B			
BARIUM	MG/KG	23.4 JB	14.8 B	4.2 JB	14.3 B	2.5 JB	12 B
BERYLLIUM	MG/KG		0.35 B	0.12 B	0.41 B	0.1 B	0.78 B
CALCIUM	MG/KG	1530 J	3590	1410 B	3930	1740	8290
CHROMIUM	MG/KG	2.4	5.4 B	1.5 B	3.2 B	1.2 B	
COBALT	MG/KG	0.89 JB			1.6 JB		
COPPER	MG/KG	0.77 JB	13.3 JB	7.3 JB	5.2 JB	1.3 JB	7.2 JB
IRON	MG/KG	1010 J	8080	1480	5410	978	3980
LEAD	MG/KG	3.4 J	70.9	19.9	12.4	5.7	18.8
MAGNESIUM	MG/KG		2250 B	438 B	1110 B	427 B	5650 B
MANGANESE	MG/KG	4.4	25.8	5.8	16.3	5.9	13.1 B
NICKEL	MG/KG						
POTASSIUM	MG/KG		533 B	99.8 JB	318 B	124 B	545 B
SILVER	MG/KG						
SODIUM	MG/KG	468 JB	4220	481 JB	1630 JB	1530 J	6020 B
VANADIUM	MG/KG	4.7 B	14.2 B	3.5 JB	9.6 JB	2.2 JB	16.7 B
ZINC	MG/KG		39.6	11.5	22.6	6.2	

MG/KG - milligram per kilogram
B - reported value is less than Contract Required Detection Limit (CRDL), but greater than Instrument Detection Limit (IDL)
J - value is estimated
JB - value is estimated below the CRDL, but greater than the IDL

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TABLE 4-37
SITE 6 WALLACE CREEK SEDIMENT
POSITIVE DETECTION SUMMARY
REMEDIAL INVESTIGATION CTO-0133
MCB CAMP LEJEUNE, NORTH CAROLINA
TOTAL METALS

	Sample No:	6-WC07-SD-06M		6-WC07-SD-612M		6-WC08-SD-06B		6-WC08-SD-06M		6-WC08-SD-612B		6-WC08-SD-612M	
	Depth:	0 - 6'		6 - 12'		0 - 6'		0 - 6'		6 - 12'		6 - 12'	
	Date Sampled:	8/23/92		8/23/92		8/23/92		8/23/92		8/23/92		8/23/92	
	Lab Id:	00429-08		00429-09		00429-13		00429-15		00429-16		00429-17	
Parameter	Units												
ALUMINUM	MG/KG	975		539		10700		9810		4470		18300	
ARSENIC	MG/KG					4.9	B	3.2	B	9.7		10.2	
BARIUM	MG/KG	3.6	JB	2.8	JB	12.8	B	38.4	B	5.9	JB	110	
BERYLLIUM	MG/KG			0.07	B	0.49	B	0.35	B	0.21	B	0.76	B
CALCIUM	MG/KG	457	B	242	B	4560		3080		2080		5270	
CHROMIUM	MG/KG					8.4		9.2		2.7	B	19.2	
COBALT	MG/KG											2	JB
COPPER	MG/KG			0.89	JB	21.5		13.7	J	16.7	J	27.2	
IRON	MG/KG	695		390		8680		7450		4090		11300	
LEAD	MG/KG	8.7		1.5		97		44.1	J	49.7		156	
MAGNESIUM	MG/KG	140	B	62.7	B	3620		1650	B	701	B	906	B
MANGANESE	MG/KG	3.7	B	3.1		27.8		21.3		12		28.4	
NICKEL	MG/KG											7.4	JB
POTASSIUM	MG/KG	71.4	JB	38.5	JB	862	B	807	B	233	B	834	B
SILVER	MG/KG												
SODIUM	MG/KG	553	JB	224	JB	6740		3730		1140	JB	1150	JB
VANADIUM	MG/KG	1.7	JB	0.82	JB	21.8	B	19.1	B	8.1	JB	33.7	
ZINC	MG/KG					106		67.9		29.2		132	

MG/KG - milligram per kilogram
B - reported value is less than Contract Required Detection Limit (CRDL), but greater than Instrument Detection Limit (IDL)
J - value is estimated
JB - value is estimated below the CRDL, but greater than the IDL

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TABLE 4-37
SITE 6 WALLACE CREEK SEDIMENT
POSITIVE DETECTION SUMMARY
REMEDIAL INVESTIGATION CTO-0133
MCB CAMP LEJEUNE, NORTH CAROLINA
TOTAL METALS

Sample No:		6-WC09-SD-06B	6-WC09-SD-06M	6-WC09-SD-612B	6-WC09-SD-612M	6-WC10-SD-06B	6-WC10-SD-06M
Depth:		0 - 6'	0 - 6'	N/A	N/A	0 - 6'	0 - 6'
Date Sampled:		8/23/92	8/23/92	8/23/92	8/23/92	8/22/92	8/22/92
Lab Id:		00429-21	00429-22	00429-23	00429-24	00426-02	00426-04
Parameter	Units						
ALUMINUM	MG/KG	978	17200	8610	9160	4640	25400
ARSENIC	MG/KG		5.8 B		3.5 B		4.7 B
BARIUM	MG/KG	2.8 JB	19.8 B	15.4 B	10.9 B		23.6 B
BERYLLIUM	MG/KG		0.63 B	0.33 B	0.3 B		
CALCIUM	MG/KG	399 B	6150	10300	3410	6500 B	4180
CHROMIUM	MG/KG	1.7 B	17.7	8.2 B	9.6		28.5
COBALT	MG/KG	2.3 JB	3.3 JB	2.9 JB	1.6 JB		
COPPER	MG/KG	11.9 J	33.5	4.4 JB	10.7 JB		
IRON	MG/KG	789	14600	11600	7000	4610 J	13900
LEAD	MG/KG	4.9	106	8.8	37.4	22.4 J	68.9 J
MAGNESIUM	MG/KG	213 B	4520 B	730 B	1350 B	6630 B	4630
MANGANESE	MG/KG	3.2 B	50.2	42.5	20.9	11.8 JB	40.6
NICKEL	MG/KG	2.7 JB			4.3 JB		10.7 JB
POTASSIUM	MG/KG	65.5 JB	1390 B	419 B	628 B	829 B	2200 B
SILVER	MG/KG						
SODIUM	MG/KG	332 JB	8880	1380 JB	1110 JB	14900	11900
VANADIUM	MG/KG	1.9 JB	41.5 B	12.7 JB	18.5 B		45.5 J
ZINC	MG/KG	388	137	17.1	43.6	33.1 B	69.6

MG/KG - milligram per kilogram
B - reported value is less than Contract Required Detection Limit (CRDL), but greater than Instrument Detection Limit (IDL)
J - value is estimated
JB - value is estimated below the CRDL, but greater than the IDL

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TABLE 4-37
SITE 6 WALLACE CREEK SEDIMENT
POSITIVE DETECTION SUMMARY
REMEDIAL INVESTIGATION CTO-0133
MCB CAMP LEJEUNE, NORTH CAROLINA
TOTAL METALS

	Sample No:	6-WC10-SD-612M		6-WC11-SD-06B		6-WC11-SD-06M	
	Depth:	6 - 12'		0 - 6'		0 - 6'	
	Date Sampled:	8/22/92		8/22/92		8/22/92	
	Lab Id:	00426-05		00426-10		00426-11	
Parameter	Units						
ALUMINUM	MG/KG	8070		3470		12000	
ARSENIC	MG/KG	1.8	B	8.9	B	4.4	JB
BARIUM	MG/KG	10.4	B				
BERYLLIUM	MG/KG						
CALCIUM	MG/KG	2560		9350		4170	
CHROMIUM	MG/KG	10		7.7	B	13.5	
COBALT	MG/KG						
COPPER	MG/KG						
IRON	MG/KG	6810		3940		11600	
LEAD	MG/KG	13.7	J	16.7	J	31.8	J
MAGNESIUM	MG/KG	1620	B	9840		3830	
MANGANESE	MG/KG	26.5		12.3	JB	38.8	
NICKEL	MG/KG						
POTASSIUM	MG/KG	762	B	1040	B	1280	B
SILVER	MG/KG						
SODIUM	MG/KG	2380		18300		10300	
VANADIUM	MG/KG						
ZINC	MG/KG	24.3		22.7	B	42.5	

MG/KG - milligram per kilogram
B - reported value is less than Contract Required Detection Limit (CRDL), but greater than Instrument Detection Limit (IDL)
J - value is estimated
JB - value is estimated below the CRDL, but greater than the IDL

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TABLE 4-38
SITE 6 RAVINE SEDIMENT
POSITIVE DETECTION SUMMARY
REMEDIAL INVESTIGATION CTO-0133
MCB CAMP LEJEUNE, NORTH CAROLINA
ORGANICS

Sample No:		6-RV1-SD-06	6-RV2-SD-06	6-RV3-SD-06	6-RV3-SD-612	6-RV4-SD-06	6-RV4-SD-612
Depth:		0 - 6"	0 - 6"	0 - 6"	6 - 12"	0 - 6"	6 - 12"
Date Sampled:		8/25/92	8/25/92	8/24/92	8/24/92	8/24/92	8/24/92
Lab Id:		00439-11	00439-13	00437-04	00437-05	00437-08	00437-09
Parameter	Units						
DIELDRIN	UG/KG	43 J			8.1 J		
4,4'-DDE	UG/KG		120 J		53 J		
ENDRIN	UG/KG	5.1 J					
4,4'-DDD	UG/KG		45 J			9.4 J	4.1 J
4,4'-DDT	UG/KG		130 J	210 J	51	14 J	
ENDRIN ALDEHYDE	UG/KG	7.8					
PCB-1260	UG/KG	360 J	92 J	190 J			
ACETONE	UG/KG	62				180 J	9100 J
2-BUTANONE	UG/KG						2400 J
NAPHTHALENE	UG/KG		54 J				
2-METHYLNAPHTHALENE	UG/KG		44 J				
ACENAPHTHENE	UG/KG		220 J				
DIBENZOFURAN	UG/KG		110 J				
FLUORENE	UG/KG		250 J				
PHENANTHRENE	UG/KG	50 J	1600		90 J		
ANTHRACENE	UG/KG		480				
DI-N-BUTYL PHTHALATE	UG/KG						
FLUORANTHENE	UG/KG	84 J	1500 J		130 J		
CARBAZOLE	UG/KG		170 J				
PYRENE	UG/KG	130 J	2100		96 J		
BENZO(A)ANTHRACENE	UG/KG	61 J	1100		43 J		
CHRYSENE	UG/KG	85 J	1100		59 J		
BIS(2-ETHYLHEXYL)PHTHALATE	UG/KG			200 J			
BENZO(B)FLUORANTHENE	UG/KG	120 J	1200		54 J		
BENZO(K)FLUORANTHENE	UG/KG		440				
BENZO(A)PYRENE	UG/KG	70 J	1000				
INDENO(1,2,3-CD) PYRENE	UG/KG	57 J	710				
DIBENZ(A,H)ANTHRACENE	UG/KG		83 J				
BENZO(G,H,I)PERYLENE	UG/KG	57 J	680				

UG/KG - microgram per kilogram
J - value is estimated

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TABLE 4-38
SITE 6 RAVINE SEDIMENT
POSITIVE DETECTION SUMMARY
REMEDIAL INVESTIGATION CTO-0133
MCB CAMP LEJEUNE, NORTH CAROLINA
ORGANICS

Sample No:		6-RV5-SD-06	6-RV6-SD-06	6-RV7-SD-06	6-RV7-SD-612	6-RV8-SD-06
Depth:		0 - 6"	0 - 6"	0 - 6"	6 - 12"	0 - 6"
Date Sampled:		8/25/92	8/25/92	8/25/92	8/25/92	8/25/92
Lab Id:		00439-15	00437-11	00437-12	00437-14	00437-17
Parameter	Units					
DIELDRIN	UG/KG					
4,4'-DDE	UG/KG	44 J	58 J	37 J	23 J	
ENDRIN	UG/KG					
4,4'-DDD	UG/KG	9 J		36 J	34 J	
4,4'-DDT	UG/KG	19 J	170 J	60 J	19 J	
ENDRIN ALDEHYDE	UG/KG					
PCB-1260	UG/KG	79 J		29 J	41 J	
ACETONE	UG/KG		3400 J			340 J
2-BUTANONE	UG/KG		2300			
NAPHTHALENE	UG/KG					
2-METHYLNAPHTHALENE	UG/KG					
ACENAPHTHENE	UG/KG					
DIBENZOFURAN	UG/KG					
FLUORENE	UG/KG					
PHENANTHRENE	UG/KG					
ANTHRACENE	UG/KG					
DI-N-BUTYL PHTHALATE	UG/KG				52 J	
FLUORANTHENE	UG/KG					
CARBAZOLE	UG/KG					
PYRENE	UG/KG					120 J
BENZO(A)ANTHRACENE	UG/KG					
CHRYSENE	UG/KG					
BIS(2-ETHYLHEXYL)PHTHALATE	UG/KG					
BENZO(B)FLUORANTHENE	UG/KG					110 J
BENZO(K)FLUORANTHENE	UG/KG					
BENZO(A)PYRENE	UG/KG					89 J
INDENO(1,2,3-CD) PYRENE	UG/KG					
DIBENZ(A,H)ANTHRACENE	UG/KG					
BENZO(G,H,I)PERYLENE	UG/KG					

UG/KG - microgram per kilogram
J - value is estimated

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TABLE 4-39
SITE 6 RAVINE SEDIMENT
POSITIVE DETECTION SUMMARY
REMEDIAL INVESTIGATION CTO-0133
MCB CAMP LEJEUNE, NORTH CAROLINA
TOTAL METALS

	Sample No:	6-RV1-SD-06	6-RV2-SD-06	6-RV3-SD-06	6-RV3-SD-612	6-RV4-SD-06	6-RV4-SD-612
	Depth:	0 - 6"	0 - 6"	0 - 6"	6 - 12"	0 - 6"	6 - 12"
	Date Sampled:	8/25/92	8/25/92	8/24/92	8/24/92	8/24/92	8/24/92
	Lab Id:	00439-11	00439-13	00437-04	00437-05	00437-08	00437-09
Parameter	Units						
ALUMINUM	MG/KG	10300	2540	3820	1090	947	739
ARSENIC	MG/KG	4.3	0.61 B	2.1 JB			
BARIUM	MG/KG	61.5	22.9 B	18.2 JB	5.6 JB	4.2 JB	2.9 JB
BERYLLIUM	MG/KG			0.13 B			
CADMIUM	MG/KG	5.9 J	1.8 J	1.9 J	0.61 J	0.53 JB	
CALCIUM	MG/KG	3450	1490	735 B	315 B	148 B	
CHROMIUM	MG/KG	17.7	3.6	6			
COBALT	MG/KG	2.1 JB		0.72 B			
COPPER	MG/KG	67.5	12.3	18.7 J	6 J	4.2 JB	2.6 JB
IRON	MG/KG	7590	2290	2690	828	1010	420
LEAD	MG/KG	2.1 B	21.2	62.3 J	12.4 J	6.6 J	5.4 J
MAGNESIUM	MG/KG	402 B	139 B	137 B	40 B	34.7 B	24.5 B
MANGANESE	MG/KG	288	24	58.3	5.1 J	6.5 J	3.4 J
MERCURY	MG/KG	0.75	0.25	0.1	0.04 B	0.03 B	
NICKEL	MG/KG	7.7 JB		2.1 B			
POTASSIUM	MG/KG	361 B	108 B	153 B	47.5 B	35.1 B	29.5 B
SILVER	MG/KG			0.85 B		0.56 B	0.6 B
VANADIUM	MG/KG	19	6 B	7 B	2.1 B	2.5 B	1.2 B
ZINC	MG/KG	408	64.8	113	24.8	31.6	20.3

MG/KG - milligram per kilogram
B - reported value is less than Contract Required Detection Limit (CRDL), but greater than Instrument Detection Limit (IDL)
J - value is estimated
JB - value is estimated below the CRDL, but greater than the IDL

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TABLE 4-39
SITE 6 RAVINE SEDIMENT
POSITIVE DETECTION SUMMARY
REMEDIAL INVESTIGATION CTO-0133
MCB CAMP LEJEUNE, NORTH CAROLINA
TOTAL METALS

	Sample No:	6-RV5-SD-06	6-RV6-SD-06	6-RV7-SD-06	6-RV7-SD-612	6-RV8-SD-06
	Depth:	0 - 6"	0 - 6"	0 - 6"	6 - 12"	0 - 6"
	Date Sampled:	8/25/92	8/25/92	8/25/92	8/25/92	8/25/92
	Lab Id:	00439-15	00437-11	00437-12	00437-14	00437-17
Parameter	Units					
ALUMINUM	MG/KG	913	2100	1260	1710	7130
ARSENIC	MG/KG					2.3 B
BARIUM	MG/KG		8.5 JB	6.8 JB	12.2 JB	37.7 JB
BERYLLIUM	MG/KG		0.06 B		0.07 B	0.25 B
CADMIUM	MG/KG		1.7 J	0.64 JB	1.6 J	2.3 J
CALCIUM	MG/KG		10100	284 B	577 B	1390 B
CHROMIUM	MG/KG	2 B	3.1 J			10.5
COBALT	MG/KG					1.1 B
COPPER	MG/KG	6.5 J	8.1 J	6.9 J	45 J	35 J
IRON	MG/KG	875	2950	851	1000	3420
LEAD	MG/KG	25.6	11.2 J	13.3 J	18.5 J	105 J
MAGNESIUM	MG/KG	36.3 B	217 B	53.2 B	91.1 B	289 B
MANGANESE	MG/KG	28.9	104	25.5 J	21.6 J	24.2 J
MERCURY	MG/KG		0.15	0.09 B	0.15	0.27
NICKEL	MG/KG				2.8 B	4 B
POTASSIUM	MG/KG		83.2 B	48.2 B	60.9 B	253 B
SILVER	MG/KG			0.82 B	0.85 B	1.2 B
VANADIUM	MG/KG	1.8 JB	4 B	2.4 JB	3.7 JB	11.4 JB
ZINC	MG/KG	80.8	204	94.2	193	142

MG/KG - milligram per kilogram
B - reported value is less than Contract Required Detection Limit (CRDL), but greater than Instrument Detection Limit (IDL)
J - value is estimated
JB - value is estimated below the CRDL, but greater than the IDL

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TABLE 4-40
SUMMARY OF TCLP RESULTS
SITE 6 - LOT 201 AREAS A B AND C
REMEDIAL INVESTIGATION CTO-0133
MCB CAMP LEJEUNE, NORTH CAROLINA

Baker Sample ID:	6-201A-SB17A		6-201A-SB39		6-201B-SB33A		6-201B-SB39		6-201C-SB41	
Parameter (Units)										
VOLATILES (UG/L)										
Vinyl Chloride	10	U	10	U	10	U	10	U	10	U
1,1-DCE	5	U	10	U	5	U	10	U	5	U
Chloroform	5	U	10	U	5	U	10	U	5	U
1,2-DCA	5	U	10	U	5	U	10	U	5	U
2-Butanone	10	U	10	U	10	U	10	U	10	U
Carbon Tetrachloride	5	U	10	U	5	U	10	U	5	U
Trichloroethene	5	U	10	U	5	U	10	U	5	U
Benzene	5	U	10	U	5	U	1	BJ	5	U
Tetrachloroethene	5	U	10	U	5	U	1	J	5	U
Chlorobenzene	5	U	10	U	5	U	10	U	5	U
SEMIVOLATILES (UG/L)										
Pyridine	10	U	33	U	10	U	33	U	10	U
2,4-Dinitrotoluene	10	U	33	U	10	U	33	U	10	U
Hexachlorobenzene	10	U	33	U	10	U	33	U	10	U
Nitrobenzene	10	U	33	U	10	U	33	U	10	U
1,4-Dichlorobenzene	10	U	33	U	10	U	33	U	10	U
Methylphenols (total)	10	U	33	U	10	U	33	U	10	U
Pentachlorophenol	25	U	83	U	25	U	83	U	25	U
2,4,5-Trichlorophenol	25	U	83	U	25	U	83	U	25	U
2,4,6-Trichlorophenol	10	U	33	U	10	U	33	U	10	U
PESTICIDES (UG/L)										
Gamma-BHC	0.17	U	0.17	U	0.17	U	0.17	U	0.17	U
Heptachlor	0.17	U	0.17	U	0.17	U	0.17	U	0.17	U
Heptachlor Epoxide	0.17	U	0.17	U	0.17	U	0.17	U	0.17	U
Endrin	0.33	U	0.33	U	0.33	U	0.33	U	0.33	U
Methoxychlor	1.7	U	1.7	U	1.7	U	1.7	U	1.7	U
Alpha-Chlordane	0.17	U	0.17	U	0.17	U	0.17	U	0.17	U
Gamma-Chlordane	0.17	U	0.17	U	0.17	U	0.17	U	0.17	U
Toxaphene	17	U	17	U	17	U	17	U	17	U
INORGANICS (UG/L)										
Arsenic	40.00	U	40.00	U	40.00	U	40.00	U	40.00	U
Barium	147.00	B	148.00	B	176.00	B	372.00		299.00	
Cadmium	1.90	U	3.70	B	5.20	B	1.90	U	1.90	U
Chromium	5.10	B	3.60	U	5.80	B	3.60	U	14.40	B
Lead	22.00	U	217.00		22.00	U	53.20	B	22.00	U
Mercury	0.04	U	0.04	U	0.04	U	0.04	U	1.60	
Selenium	146.00	B	50.00	U	280.00	U	50.00	U	202.00	
Silver	2.00	U	2.00	U	2.00	U	2.00	U	3.70	
HERBICIDES (UG/L)										
2,4-D	30	U	30	U	30	U	30	U	30	U
2,4,5-TP (Silvex)	10	U	10	U	10	U	10	U	10	U
RCRA										
Reactive Cyanide (mg/kg)	0.5	U	0.5	U	0.5	U	0.5	U	NA	
Reactive Sulfide (mg/kg)	2	U	2	U	2	U	2	U	NA	
Total Nitrogen (mg/kg)	50	U	50	U	50	U	50	U	NA	
Fluoride (mg/kg)	2	U	2	U	2	U	2	U	NA	
Alkalinity (mg/kg)	452		NA		336		NA		NA	
Chloride (mg/kg)	20	U	20	U	20	U	20	U	NA	
Flashpoint (F)	>200		>200		>200		>200		NA	
pH (S.U.)	7.82		6.59		7.93		6.83		NA	

U - Not detected above the Method Detection Limit
B - Reported concentration is less that the Method Detection Limit for Inorganics
(UG/L) - microgram per liter
(mg/kg) - microgram per kilogram
NA - Not analyzed

TABLE 4-41
SUMMARY OF TCLP RESULTS
PHASE I - TRENCH TEST PITS
REMEDIAL INVESTIGATION CTO-0133
MCB CAMP LEJEUNE, NORTH CAROLINA

Baker Sample ID:	6TR1964A02		6TR1964A04		6TR1970C02		6TR1970C03		6TR1970D01	
Parameter (Units)										
VOLATILES (UG/L)										
Vinyl Chloride	10	U	10	U	10	U	10	U	10	U
1,1-DCE	10	U	10	U	10	U	10	U	10	U
Chloroform	10	U	10	U	10	U	10	U	10	U
1,2-DCA	10	U	10	U	10	U	10	U	10	U
2-Butanone	10	U	10	U	10	U	10	U	10	U
Carbon Tetrachloride	10	U	10	U	10	U	10	U	10	U
Trichloroethene	10	U	10	U	10	U	10	U	10	U
Benzene	10	U	10	U	10	U	1	BJ	1	B
Tetrachloroethene	10	U	10	U	10	U	1	J	10	U
Chlorobenzene	10	U	10	U	10	U	10	U	10	U
SEMIVOLATILES (UG/L)										
Pyridine	33	U	33	U	33	U	33	U	33	U
2,4-Dinitrotoluene	33	U	33	U	33	U	33	U	33	U
Hexachlorobenzene	33	U	33	U	33	U	33	U	33	U
Nitrobenzene	33	U	33	U	33	U	33	U	33	U
1,4-Dichlorobenzene	33	U	33	U	33	U	33	U	33	U
Methylphenols (total)	33	U	33	U	33	U	33	U	33	U
Pentachlorophenol	83	U	83	U	83	U	83	U	83	U
2,4,5-Trichlorophenol	83	U	83	U	83	U	83	U	83	U
2,4,6-Trichlorophenol	33	U	33	U	33	U	33	U	33	U
PESTICIDES (UG/L)										
Gamma-BHC	0.17	U	0.17	U	0.17	U	0.17	U	0.17	U
Heptachlor	0.17	U	0.17	U	0.17	U	0.17	U	0.17	U
Heptachlor Epoxide	0.17	U	0.17	U	0.17	U	0.17	U	0.17	U
Endrin	0.33	U	0.33	U	0.33	U	0.33	U	0.33	U
Methoxychlor	1.7	U	1.7	U	1.7	U	1.7	U	1.7	U
Alpha-Chlordane	0.17	U	0.17	U	0.17	U	0.17	U	0.17	U
Gamma-Chlordane	0.17	U	0.17	U	0.17	U	0.17	U	0.17	U
Toxaphene	17	U	17	U	17	U	17	U	17	U
INORGANICS (UG/L)										
Arsenic	40.00	U	40.00	U	40.00	U	40.00	U	40.00	U
Barium	3360.00		148.00	B	150.00	B	372.00		563.00	
Cadmium	31.30		3.70	B	3.30	B	1.90	U	23.20	
Chromium	16.60	B	3.60	U	3.60	U	3.60	U	9.00	B
Lead	1530.00		217.00		70.40	B	53.20	B	620.00	
Mercury	0.04	U	0.04	U	0.04	U	0.04	U	0.04	U
Selenium	136.00	B	50.00	U	50.00	U	50.00	U	50.00	U
Silver	2.00	U	2.00	U	2.00	U	2.00	U	2.00	U
HERBICIDES (UG/L)										
2,4-D	30	U	30	U	30	U	30	U	30	U
2,4,5-TP (Silvex)	10	U	10	U	10	U	10	U	10	U
RCRA										
Reactive CN (mg/kg)	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U
Reactive S (mg/kg)	2	U	2	U	2	U	2	U	2	U
Flashpoint (F)	>200		>200		>200		>200		>200	
pH (S.U.)	5.91		6.59		5.03		6.83		6.85	

U - Not detected above the Method Detection Limit
B - Reported concentration is less than the Method Detection Limit for Inorganics
(UG/L) - microgram per liter
(mg/kg) - milligram per kilogram

TABLE 4-41
SUMMARY OF TCLP RESULTS
PHASE I - TRENCH TEST PITS
REMEDIAL INVESTIGATION CTO-0133
MCB CAMP LEJEUNE, NORTH CAROLINA

Baker Sample ID:	6TR1970D05	6TR1952C01	6TR1952C01D	6TR1952C05
Parameter (Units)				
VOLATILES (UG/L)				
Vinyl Chloride	10 U	10 U	10 U	10 U
1,1-DCE	10 U	5 U	5 U	5 U
Chloroform	10 U	5 U	5 U	5 U
1,2-DCA	10 U	5 U	5 U	5 U
2-Butanone	10 U	10 U	10 U	10 U
Carbon Tetrachloride	10 U	5 U	5 U	5 U
Trichloroethene	10 U	5 U	5 U	5 U
Benzene	10 U	5 U	5 U	5 U
Tetrachloroethene	10 U	5	6	40
Chlorobenzene	10 U	5 U	5 U	5 U
SEMIVOLATILES (UG/L)				
Pyridine	33 U	33 U	33 U	33 U
2,4-Dinitrotoluene	33 U	33 U	33 U	33 U
Hexachlorobenzene	33 U	33 U	33 U	33 U
Nitrobenzene	33 U	33 U	33 U	33 U
1,4-Dichlorobenzene	33 U	33 U	33 U	33 U
Methylphenols (total)	33 U	33 U	33 U	33 U
Pentachlorophenol	83 U	83 U	83 U	83 U
2,4,5-Trichlorophenol	83 U	83 U	83 U	83 U
2,4,6-Trichlorophenol	33 U	33 U	33 U	33 U
PESTICIDES (UG/L)				
Gamma-BHC	0.17 U	0.17 U	0.17 U	0.17 U
Heptachlor	0.17 U	0.17 U	0.17 U	0.17 U
Heptachlor Epoxide	0.17 U	0.17 U	0.17 U	0.17 U
Endrin	0.33 U	0.33 U	0.33 U	0.33 U
Methoxychlor	1.7 U	1.7 U	1.7 U	1.7 U
Alpha-Chlordane	0.17 U	0.17 U	0.17 U	0.17 U
Gamma-Chlordane	0.17 U	0.17 U	0.17 U	0.17 U
Toxaphene	17 U	17 U	17 U	17 U
INORGANICS (UG/L)				
Arsenic	40.00 U	40.00 U	40.00 U	76.30 B
Barium	310.00	101.00 B	142.00 B	167.00 B
Cadmium	2.10 B	1.90 U	1.90 U	1.90 U
Chromium	3.60 U	3.60 U	3.60 U	3.60 U
Lead	2780.00	22.00 U	22.00 U	22.00 U
Mercury	0.04 U	0.04 U	0.04 U	0.04 U
Selenium	50.00 U	50.00 U	50.00 U	50.00 U
Silver	47.00	2.00 U	2.00 U	2.00 U
HERBICIDES (UG/L)				
2,4-D	30 U	30 U	30 U	30 U
2,4,5-TP (Silvex)	10 U	10 U	10 U	10 U
RCRA				
Reactive CN (mg/kg)	0.5 U	0.5 U	0.5 U	0.5 U
Reactive S (mg/kg)	2 U	2 U	2 U	2 U
Flashpoint (F)	>200	>200	>200	>200
pH (S.U.)	7.66	6.95	7.19	6.66

U - Not detected above the Method Detection Limit
B - Reported concentration is less than the Method Detection Limit for Inorganics
(UG/L) - microgram per liter
(mg/kg) - milligram per kilogram

TABLE 4 - 41
SUMMARY OF TCLP RESULTS
PHASE I - TRENCH TEST PITS
REMEDIAL INVESTIGATION CTO-0133
MCB CAMP LEJEUNE, NORTH CAROLINA

Baker Sample ID:	6GS1960A01		6GS1960A02		6GS1960B01		6GS1960D02		6GS1960D03	
Parameter (Units)										
VOLATILES (UG/L)										
Vinyl Chloride	10	U	10	U	10	U	10	U	10	U
1,1-DCE	5	U	5	U	5	U	5	U	5	U
Chloroform	200		18		5	U	8		5	U
1,2-DCA	5	U	5	U	5	U	5	U	5	U
2-Butanone	10	U	10	U	10	U	10	U	10	U
Carbon Tetrachloride	5	U	5	U	5	U	5	U	5	U
Trichloroethene	5	U	5	U	5	U	5	U	5	U
Benzene	5	U	5	U	5	U	5	U	5	U
Tetrachloroethane	5	U	5	U	5	U	5	U	5	U
Chlorobenzene	5	U	5	U	5	U	5	U	5	U
SEMIVOLATILES (UG/L)										
Pyridine	33	U	33	U	10	U	33	U	33	U
2,4-Dinitrotoluene	33	U	33	U	10	U	33	U	33	U
Hexachlorobenzene	33	U	33	U	10	U	33	U	33	U
Nitrobenzene	33	U	33	U	10	U	33	U	33	U
1,4-Dichlorobenzene	33	U	33	U	10	U	33	U	33	U
Methylphenols (total)	33	U	33	U	10	U	33	U	33	U
Pentachlorophenol	83	U	83	U	25	U	83	U	83	U
2,4,5-Trichlorophenol	83	U	83	U	25	U	83	U	83	U
2,4,6-Trichlorophenol	33	U	33	U	10	U	33	U	33	U
PESTICIDES (UG/L)										
Gamma-BHC	0.17	U	0.17	U	0.17	U	0.17	U	0.17	U
Heptachlor	0.17	U	0.17	U	0.17	U	0.17	U	0.17	U
Heptachlor Epoxide	0.17	U	0.17	U	0.17	U	0.17	U	0.17	U
Endrin	0.33	U	0.33	U	0.33	U	0.33	U	0.33	U
Methoxychlor	1.7	U	1.7	U	1.7	U	1.7	U	1.7	U
Alpha-Chlordane	0.17	U	0.17	U	0.17	U	0.17	U	0.17	U
Gamma-Chlordane	0.17	U	0.17	U	0.17	U	0.17	U	0.17	U
Toxaphene	17	U	17	U	17	U	17	U	17	U
INORGANICS (UG/L)										
Arsenic	40.00	U	40.00	U	40.00	U	40.00	U	40.00	U
Barium	161.00	B	159.00	B	81.50	B	274.00		220.00	
Cadmium	1.90	U	1.90	U	2.70	B	5.70	B	1.90	U
Chromium	3.60	U	3.60	U	3.70	B	17.80	B	3.60	U
Lead	37.70	B	22.00	U	31.20	B	10000.00		209.00	
Mercury	0.27	B	0.04	U	0.04	U	0.04	U	0.04	U
Selenium	50.00	U	50.00	U	50.00	U	52.20	B	50.00	U
Silver	2.00	U	2.00	U	2.00	U	2.00	U	2.00	U
HERBICIDES (UG/L)										
2,4-D	30	U	30	U	30	U	30	U	30	U
2,4,5-TP (Silvex)	10	U	10	U	10	U	10	U	10	U
RCRA										
Reactive CN (mg/kg)	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U
Reactive S (mg/kg)	2	U	2	U	2	U	5		2	U
Flashpoint (F)	>200		>200		>200		>200		>200	
pH (S.U.)	4.82		4.57		4.39		5.86		6.56	

U - Not detected above the Method Detection Limit
B - Reported concentration is less than the Method Detection Limit
(UG/L) - microgram per liter
(mg/kg) - milligram per kilogram

TAB 2
PHASE II TEST PIT SOILS
POSITIVE DETECTION SUMMARY
REMEDIAL INVESTIGATION CTO-0133
MCB CAMP LEJEUNE, NORTH CAROLINA
ORGANICS

	Sample No:	6-TP2-02	6-TP3-02	6-TP4-02	6-TP5-02	6-TP7-02
	Depth:	2-4	5	8	7	7
	Date Sampled:	3/3/93	3/3/93	3/3/93	3/3/93	3/3/93
	Lab Id:	930095-10	930095-11	930095-12	930095-13	930095-15
Parameter	Units					
PESTICIDE/PCBS						
ALPHA-BHC	UG/KG					3.1 J
4,4'-DDE	UG/KG	7.3 J				7.4 J
4,4'-DDT	UG/KG	33 J				
VOLATILES						
TETRACHLOROETHENE	UG/KG	130	210	3 J	1 J	
SEMIVOLATILES						
BENZO(A)PYRENE	UG/KG	97 J				
INDENO(1,2,3-CD) PYRENE	UG/KG	53 J				
BENZO(G,H,I)PERYLENE	UG/KG	210 J				

UG/KG - microgram per kilogram
J - value is estimated

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PHASE II TEST PIT SOILS
POSITIVE DETECTION SUMMARY
REMEDIAL INVESTIGATION CTO-0133
MCB CAMP LEJEUNE, NORTH CAROLINA
TOTAL METALS

	Sample No:	6-TP2-02	6-TP3-02	6-TP4-02	6-TP5-02	6-TP7-02
	Depth:	2-4	5	8	7	7
	Date Sampled:	3/3/93	3/3/93	3/3/93	3/3/93	3/3/93
	Lab Id:	30095-10	30095-11	30095-12	30095-13	30095-15
Parameter	Units					
ALUMINUM	MG/KG	7910	3490	3540	11300 J	2180
ARSENIC	MG/KG	2.2	0.68 B	0.7 B	2.7	3.5
BARIUM	MG/KG	36.2 B	7.6 B	8 B	18.7 B	59.5
CALCIUM	MG/KG	212 B			508 B	324 B
CHROMIUM	MG/KG	7.4	2.5	3.6	10.9	1.5 B
COBALT	MG/KG	0.74 B			0.79 B	
COPPER	MG/KG	4680	1.1 JB	1.2 JB	2.9 B	3 B
IRON	MG/KG	4970	1610	1950	6740 J	7200
LEAD	MG/KG	9.3 J	3.5 J	4.4 J	4.3 J	133 J
MAGNESIUM	MG/KG	197 B	84 B	83.3 B	321 B	98.2 B
MANGANESE	MG/KG	8	2.6 B	4.9	7.1	12.6
NICKEL	MG/KG				3.8 B	
POTASSIUM	MG/KG	178 B			436 B	173 B
SELENIUM	MG/KG	0.61 B	0.47 JB		0.9 B	3.3
VANADIUM	MG/KG	12.4	4.9 B	5.1 B	17.7	3.6 B
ZINC	MG/KG	87.8				

MG/KG - milligram per kilogram
B - reported value is less than Contract Required Detection Limit (CRDL), but greater than Instrument Detection Limit (IDL)
J - value is estimated
JB - value is estimated below the CRDL, but greater than the IDL

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5.0 CONTAMINANT FATE AND TRANSPORT

This section contains a discussion on the various physical and chemical properties of contaminants detected at Operable Unit No. 2, (Sites 6 and 9) that determine the fate and transport of the contaminants in the environment. The basis for this discussion of contaminant fate and transport is discussed in Section 4.0, Nature and Extent of Contamination.

5.1 Contaminant Mobility and Persistence

The potential for a contaminant to migrate and persist in environmental media are critical characteristics to consider in choosing a contaminant as a contaminant of concern (COC) for the risk assessment. The environmental mobility of a chemical is influenced by its physical and chemical properties, the physical characteristics of the site, and the site chemistry. This section evaluates the properties of the contaminants detected at Operable Unit No. 2 for inclusion as contaminants of concern with emphasis on potential environmental mobility and persistence.

Table 5-1 presents the physical and chemical properties associated with the organic contaminants detected at the site which determine a contaminants inherent environmental mobility and fate. These properties include specific gravity, vapor pressure, water solubility, octanol/water partition coefficient, soil/sediment adsorption coefficient, Henry's Law constant, bioconcentration factor and mobility index. Calculated values, which were obtained using approximation methods, are presented if published literature values are unavailable. A discussion of the environmental significance of each properties follows.

Specific gravity is the ratio of a given volume of pure chemical at a specified temperature to the weight of the same volume of water at a given temperature. Its primary use is to determine whether a contaminant will have a tendency to float or sink (as an immiscible liquid) in water if it exceeds its corresponding water solubility.

Vapor pressure provides an indication of the rate at which a chemical may volatilize. It is of primary significance at environmental interfaces such as surface soil/air and surface water/air. Volatilization is not as important when evaluating groundwater and subsurface soils. Vapor pressure for monocyclic aromatics are generally higher than vapor pressures for

TABLE 5-1

ORGANIC PHYSICAL AND CHEMICAL PROPERTIES
REMEDIAL INVESTIGATION CTO-0133
MCB CAMP LEJEUNE, NORTH CAROLINA

Chemical	Vapor Pressure (mm Hg)	Water Solubility (mg/L)	Octanol/Water Coefficient (log K_{ow})	Sediment Partition (log K_{oc})	Specific Gravity (g/cm^3)	Henry's Law Constant ($atm\text{-}m^3/mole$)	Mobility Index	Comments
Volatiles:								
Benzene	76	1780	2.13	1.92	0.879	5.55E-03	3.2	Very mobile
Bromodichloromethane	50	4500	2.10	1.79	--	2.41E-03	3.6	Very mobile
Chlorobenzene	8.8	500	2.84	2.64	1.1066	3.58E-03	1	Very mobile
1,1-Dichloroethene	500	400	1.48	2.26	1.218	1.90E-01	3.0	Very mobile
1,2-Dichloroethane	61	8700	1.48	1.52	1.25	8.14E-04	4.2	Very mobile
1,2-Dichloroethene	200	600	1.48	2.17	1.26	5.32E-03	2.9	Very mobile
Ethylbenzene	7	152	3.15	2.93	0.867	6.44E-03	0.1	Very mobile
Tetrachloroethene	14	150	2.6	2.6	1.626	2.87E-03	0.75	Very mobile
Toluene	22	515	2.69	2.54	0.867	5.90E-03	1.5	Very mobile
1,1,2-Trichloroethane	19	4500	2.17	1.75	1.44	7.42E-04	3.2	Very mobile
1,1,2,2-Trichloroethane	5	2900	2.56	1.92	1.60	3.83E-04	2.2	Very mobile
Trichloroethene	60	1100	2.29	2.09	1.46	1.17E-03	2.7	Very mobile
Vinyl chloride	2660	1100	0.6	1.91	0.9121	8.14E-02	4.6	Very mobile
Xylenes (total)	6	180	3.02	2.84	0.87	4.64E-03	0.19	Very mobile

Sources:
1. Verscheuren, K. 1983. Handbook of Environmental Data on Organic Chemicals. Van Nostrand Reinhold Co., New York.
2. Lyman, et al. 1982. Handbook of Chemical Property Estimation Methods. Environmental Behavior of Organic Compounds.
3. USEPA. 1982. Aquatic Fate Process Data for Organic Priority Pollutants. Final Report.

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TABLE 5-1 (Continued)

ORGANIC PHYSICAL AND CHEMICAL PROPERTIES
REMEDIAL INVESTIGATION CTO-0133
MCB CAMP LEJEUNE, NORTH CAROLINA

Chemical	Vapor Pressure (mm Hg)	Water Solubility (mg/L)	Octanol/Water Coefficient (log K_{ow})	Sediment Partition (log K_{oc})	Specific Gravity (g/cm3)	Henry's Law Constant (atm-m3/mole)	Mobility Index	Comments
Semivolatiles:								
Benzo(a)anthracene	5.0E-09	0.014	5.61	5.34	NA	1.0E-06	-15.5	Immobile
Benzo(b)fluoranthene	10E-06 to 10E-07	0.009	6.57	6.26	NA	1.22E-05	-14	Immobile
Benzo(k)fluoranthene	9.6E-11	0.0016	6.84	6.22	NA	3.87E-05	-19	Immobile
Benzo(a)pyrene	5.0E-09	0.0038	6.04	5.72	NA	4.9E-07	-16.4	Immobile
Chrysene	10E-06 to 10E-11	0.006	5.61	5.44	1.274	1.1E-06	-13.7	Immobile
1,4-Dichlorobenzene	6.0E-01	49	3.39	3.22	1.458	3.1E-03	-1.8	Slightly mobile
Fluoranthene	10E-06 to 10E-04	0.265	5.33	4.84	NA	6.5E-06	-9.4	Immobile
Ideno(1,2,3-cd)pyrene	2.0E-01	82,000	1.46	0.94/2.17	1.070	4.54E-07	2.04/3.27	Very mobile
Pyrene	6.85	0.14	5.32	4.91	NA	5.1E-06	-11.9	Immobile
Pesticides/PCBs:								
Dieldren	1.87E-04	0.1	5.6	4.31	1.75	4.57E-10	-12	Immobile
4,4'-DDT	1.9E-07	0.0034	6.19	4.89	*NA	1.58E-05	-14	Very immobile
4,4'-DDD	10.2E-07	0.09	5.99	4.47	*NA	2.2E-08	-12	Very immobile
4,4'-DDE	6.5E-06	0.04	4.28	3.66	*NA	6.8E-05	-10	Immobile
Endrin	2.0E10-07	0.26	5.6	4.06	NA	4.0E-07	-11	Immobile
PCB-1254	7.7E-05	0.03	6.03	4.59	1.50	2.80E-03	-10	Immobile

Sources:
1. Verscheuren, K. 1983. Handbook of Environmental Data on Organic Chemicals. Van Nostrand Reinhold Co., New York.
2. Lyman, et al. 1982. Handbook of Chemical Property Estimation Methods. Environmental Behavior of Organic Compounds.
3. USEPA. 1982. Aquatic Fate Process Data for Organic Priority Pollutants. Final Report.

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PAHs. Contaminants with higher vapor pressures will enter the atmosphere at a quicker rate than the contaminants with low vapor pressures.

The rate at which a contaminant is leached from soil by infiltrating precipitation is proportional to its water solubility. More soluble contaminants are usually more readily leached than less soluble contaminants. The water solubilities indicate that the volatile organic contaminants including monocyclic aromatics are usually several orders-of-magnitude more soluble than PAHs.

The octanol/water partition coefficient (Kow) is a measure of the equilibrium partitioning of contaminants between octanol and water. A linear relationship between octanol/water partition coefficient and the uptake of chemicals by fatty tissues of animal and human receptors (the bioconcentration factor - BCF) has been established (Lyman et al., 1982). The coefficient is also useful in characterizing the sorption of compounds by organic soils where experimental values are not available.

The organic carbon adsorption coefficient (Koc) indicates the tendency of a chemical to adhere to soil particles organic carbon. Contaminants with high soil/sediment adsorption coefficients generally have low water solubilities and vice versa. For example, contaminants such as PAHs are relatively immobile in the environment and are preferentially bound to the soil. The compounds are not subject to aqueous transport to the extent of compounds with higher water solubilities. Erosional properties of surface soils may, however, enhance the mobility of these bound soils contaminants.

Both vapor pressure and water solubility are of use in determining volatilization rates from surface water bodies and from groundwater. These two parameters can be used to estimate an equilibrium concentration of a contaminant in the water phase and in the air directly above the water. This can be expressed as Henry's Law Constant.

A quantitative assessment of mobility has been developed that uses water solubility (S), vapor pressure (VP), and organic carbon partition coefficient (Koc) (Laskowski, 1983). This value is referred to as the Mobility Index (MI). It is defined as:

$$MI = \log((S*VP)/Koc)$$

A scale to evaluate MI is presented by Ford and Gurba (1894):

Relative MI	Mobility Description
> 5	extremely mobile
0 to 5	very mobile
-5 to 0	slightly mobile
-10 to -5	immobile
< -10	very immobile

The following paragraphs summarize the site-specific fate and transport data for some potential contaminants of concern at Operable Unit No. 2.

5.1.1 Volatile Organic Compounds (VOCs)

VOCs (i.e., vinyl chloride, trichloroethene, and tetrachloroethane) tend to be mobile in environmental media as indicated by their presence in groundwater and their corresponding MI values. Their environmental mobility is a function of high water solubilities, high vapor pressures, low Kow and Koc values, and high mobility indices.

Without a continuing source, VOCs do not tend to persist in environmental media because photolysis, oxidation, and biodegradation figure significantly in their removal. For example, limited frequencies VOCs were detected in surface soils where volatilization and other removal processes predominate. Physical removal mechanisms such as sorption could contribute to their elimination in surface water bodies.

5.1.2 Polycyclic Aromatic Hydrocarbons (PAHs)

Low water solubilities, high Kow's and Koc's indicate a strong tendency for PAHs to adsorp to soils. Their mobility indices indicate that they are relatively immobile from a physical-chemical standpoint. An exception is naphthalene, which is considered only slightly immobile in solution (groundwater and surface water) because of somewhat higher water solubility.

PAHs generally lack adequate vapor pressures to be transmitted via vaporization and subsequent airborne transport. However, surface and shallow surface soil particles containing

PAHs could potentially be subject to airborne transport and subsequent deposition, especially during mechanical disturbances such as vehicle traffic or digging.

PAHs are not extremely persistent in the environment. Photolysis and oxidation may be important removal mechanisms in surface waters and surficial soils, while biodegradation could be an important fate process in groundwater, surface soils or deeper soils. PAHs are ubiquitous in nature. The presence of PAHs in the soil may be the result of aerially deposited material, and the chemical and biological conditions in the soil which result in selective microbial degradation/breakdown.

5.1.3 Pesticides/Polychlorinated Biphenyls (PCBs)

Pesticides/PCBs are persistent and immobile contaminants in environmental media.

Pesticides travel at varying rates through soil, mainly due to their affinity for soil surfaces. The soil sorption coefficient (Kd) is the distribution of a pesticide between soil and water. In general, the Kd values are higher for high organic carbon soil than for low organic carbon soils. Therefore, soils with high Kd values will retain pesticides (i.e., 4,4'-DDT, 4,4'-DDE, and 4,4'-DDD). As evidenced by the ubiquitous nature of 4,4'-DDT, 4,4'-DDE, and 4,4'-DDD, volatilization is an important transport process from soils and waters.

PCBs have low vapor pressures, low water solubilities, and high Koc and Kow values. Adsorption of these contaminants to soil and sediment is the major fate of these contaminants in the environment. The absorption of these contaminants to soil is indicated by the absence of these contaminants from all aqueous samples collected at the Operable Unit.

5.1.4 Inorganics

Inorganics can be found as solid complexes at ambient temperature and pressure in soils at the site. Inorganic ions exist in pure solutions as hydrated ions. Groundwater, as opposed to a pure solution, is a highly complex chemical system which is heavily influenced by the mineralogy of the substrate. Factors affecting the transport of inorganics in saturated soils are interactive and far more complex and numerous than those affecting the transport of organic contaminants.

The most complicated pathway for inorganic contaminants is migration in subsurface soils and groundwaters, where oxidation reduction potential (Eh) and pH play critical roles. Table 5-2 presents and assessment of relative inorganic environmental mobilities as a function of Eh and pH. Soils at MCB Camp Lejeune are relatively neutral, therefore, inorganics in the subsurface soil should be relatively immobile.

Transport of inorganic species in groundwater is mainly a function of the inorganic's solubility in solution under the chemical conditions of the soil-solution matrix. The inorganic must be dissolved (i.e. in solution) for leaching and transport by advection with the groundwater to occur. Generally, dynamic and reversible processes control solubility and transport of the dissolved metal ions. Such process include precipitation/dissolution, adsorption/desorption, and ion exchange.

Inorganics could be sorbed onto colloidal materials, theoretically increasing their inherent mobility in saturated porous media. It is important to note, however, that colloids themselves are not mobile in most soil/water systems.

Inorganics such as arsenic and chromium depend upon speciation to influence their mobility. Speciation varies with the chemistry of the environmental medium and temporal factors. These variables make the site-specific mobility of an inorganic constituent difficult to assess.

5.2 Potential Sources and Migration Routes

This section discusses potential sources and migration routes for the development of exposure routes. Potential sources and potential migration routes in conjunction with fate and transport information are combined to summarize a site-conceptual model of potential exposure. Once the site-conceptual model is developed, exposure pathways to be retained for quantitative evaluation can be selected.

Potential sources of contaminants in the surface and subsurface soils are discussed in Section 4.0, Nature and Extent of Contamination. The migration of potential contaminants from these sources can potentially occur by the following routes:

Vertical migration of potential contaminants from surficial soils to subsurface soils;

Leaching of potential contaminants from subsurface soils to the water-bearing zones;

TABLE 5-2

**RELATIVE MOBILITIES OF INORGANICS AS A FUNCTION OF ENVIRONMENTAL CONDITIONS (Eh, pH)
REMEDIAL INVESTIGATION CTO-0133
MCB CAMP LEJEUNE, NORTH CAROLINA**

Relative Mobility	Environmental Conditions			
	Oxidizing	Acidic	Neutral/ Alkaline	Reducing
Very high			Se	
High	Se, Zn	Se, Zn, Cu, Ni, Hg, Ag		
Medium	Cu, Ni, Hg, Ag, As, Cd	As, Cd	As, Cd	
Low	Pb, Ba, Se	Pb, Ba, Be	Pb, Ba, Be	
Very Low	Fe, Cr	Cr	Cr, Zn, Cu, Ni, Hg, Ag	Cr, Se, Zn, Cu, Ni, Hg, Pb, Ba, Be, Ag

Notes:

Se	=	Selenium	Cd	=	Cadmium
Zn	=	Zinc	Ba	=	Barium
Cu	=	Copper	Pb	=	Lead
Ni	=	Nickel	Fe	=	Iron
Hg	=	Mercury	Cr	=	Chromium
Ag	=	Silver	Be	=	Beryllium
As	=	Arsenic	Zn	=	Zinc

Source: Swartzbaugh, et al. "Remediating Sites Contaminated with Heavy Metals." Hazardous Materials Control, November/December 1992.

Surface runoff from the Lots 201, Lots 203, and the Wooded and Ravine areas to Wallace Creek and Bear Head Creek;

Vertical migration from shallow water-bearing zones to deeper flow systems;

Horizontal migration in groundwater via groundwater flow;

Groundwater discharge into local streams or rivers; and

On-site atmospheric deposition of windblown dust.

The potential for a contaminant to migrate spatially and persist in environmental media are important in the estimation of potential exposure.

6.0 PUBLIC HEALTH ASSESSMENT

6.1 Introduction

This section presents the Public Health Assessment (PHA) or Risk Assessment for Operable Unit No. 2 (OU No. 2) (Sites 6, 9, and 82). The ecological risk assessment is presented under separate cover.

In order to estimate potential human health effects associated with OU No. 2., the study area has been divided into four areas of concern. These areas are Site 9 (Fire Training Pit at Piney Green Road), Site 6 (Open Storage Lots 201 and 203), and Site 6 (Wooded Areas and Ravine) and Site 82 (Piney Green Road VOC Site). The OU has been divided into the areas based upon the current access to the aforementioned areas. The following is a description of accessibility by potential receptors to these areas of concern:

- Site 9 is currently used for fire-fighting training and is non-restricted.
- Lot 201 is currently active, but is a restricted area because the boundary is defined by a locking fence
- Lot 203 is an inactive site with a bordering secure fence to prevent access
- Site 6 (Wood Areas and Ravine) and Site 82 are unrestricted

Soil data collected from each of these areas will be used in estimating the potential human health risks under future and current exposure scenarios. The human health assessment for future groundwater use considers groundwater data collected from entire OU No. 2 area and not individual areas of concern. Groundwater data is not subdivided because it is continuous beneath OU No. 2.

Future residential human exposure to surface water and sediments will be assessed separately for Wallace Creek and Bear Head Creek.

Current biota exposure will be assessed based on fish samples collected from Wallace Creek.

The PHA process evaluates the analytical data generated during the sampling and analytical phase of the RI, identifying areas of interest and contaminants of concern with respect to geographical, demographic, physical and biological characteristics of the study area. These, combined with the current understanding of physical and chemical properties of the site-associated constituents (with respect to environmental fate and transport processes), are then used to estimate the concentrations of contaminants at the end points of logical exposure pathways. Finally, contaminants intakes by hypothetical receptors are determined and combined with the toxicological properties of the contaminants to estimate (inferentially) the potential public health impacts and environmental effects posed by constituents detected at the sites.

The PHA investigates the potential for contaminants of potential concern to affect human health and/or the environment, both now and in the future, under a "no further remedial action scenario."

The PHA for OU No. 2 is conducted in accordance with current USEPA's Risk Assessment Guidance (USEPA, December 1989 and March 25, 1991).

The components of the PHA include:

- identification of potential contaminants of concern;
- the exposure assessment;
- the toxicity assessment;
- risk characterization and environmental effects;
- uncertainty analysis; and
- conclusions of the PHA and potential site risk.

This PHA is divided into seven sections, including the introduction. Section 6.2 establishes the criteria for the selection of Contaminants of Potential Concern (COPCs). The COPCs are chosen, for each media at each site, from an overall list of contaminants detected at the site. Section 6.3 discusses the site characteristics, identifies potential human exposure pathways, and describes potential current and future exposure scenarios. Section 6.4 presents the estimation of potential exposure, discussing the estimation of daily intakes, incremental cancer risks and hazard indices. In addition, advisory criteria for the evaluation of human health is discussed. Section 6.5 discusses the risk characterization. Section 6.6 discusses the sources of uncertainty in the PHA. Section 6.7 provides a summary of the potential human health impacts in the form of total site risks.

6.2 Contaminants of Potential Concern

COPCs are site-related contaminants used to quantitatively estimate human exposures and associated potential health effects. Six environmental media were investigated during this RI. These are surface soils, subsurface soils, groundwater, surface water, sediments, and biota. This section presents the selection of COPCs for surface soil, subsurface soil, groundwater, surface water, and sediments. The discussion of findings presented in Section 4.0, Nature and Extent of Contamination, were used as the basis for this section.

6.2.1 Criteria for Selecting Contaminants of Potential Concern

The criteria to be used in selecting the COPCs from the constituents detected during the field sampling and analytical phase of the investigation are prevalence, mobility, persistence, and toxicity. The criterion chosen to establish the COPCs is based on the guidance in the USEPA's Risk Assessment Guidance for Superfund (USEPA, 1989). A comparison to contaminant-specific criteria will also be considered in the selection of COPCs. A brief description of the selection criteria used in choosing final COPCs is presented below. A contaminant does not need to fit into all of these categories in order to be retained as a contaminant of concern.

HISTORICAL INFORMATION

The association of contaminants with site activities based on historical information will be used along with the following procedures to determine retention or elimination of contaminants.

PREVALENCE

The frequency of positive detections in sample sets and the level at which a contaminant is detected in a given medium are factors that determine prevalence in a given medium. The judicious use of data is used in setting limits on the inclusion of infrequently detected contaminants. A minimum frequency of detection equal to or greater than five percent (at least 20 samples of a medium are needed) can warrant the inclusion of a contaminant as a

COPC. Prevalence of a contaminant can also be determined by comparison of site concentrations to background concentrations if site background data are available.

MOBILITY

The physical and chemical properties of a contaminant are responsible for its transport in the environment. These properties, in conjunction with site conditions, determine whether a contaminant, will tend to volatilize into the air from, surface soils or surface waters, or be transported via advection or diffusion through soils, groundwaters, and surface waters. Physical and chemical properties also describe a contaminant's tendency to adsorb onto soil/sediment particles. Environmental mobility can correspond to either an increased or decreased potential to affect human health and/or the environment.

PERSISTENCE

The persistence of a contaminant in the environment depends on factors such as the microbial content of soil and water, organic carbon content, the concentration of the contaminant, climate, and the ability of the microbes to degrade the contaminant under site conditions. In addition, chemical degradation (i.e. hydrolysis), photochemical degradation and certain fate processes such as sorption may contribute to the elimination or retention of a particular compound in a given medium.

TOXICITY

The potential toxicity of contaminant is an important consideration when selecting COPCs for further evaluation in the human health assessment. Some effects considered in the selection of COPCs include carcinogenicity, mutagenicity, teratogenicity, systemic effects, and reproductive toxicity. Bioaccumulation and bioconcentration properties may affect the severity of the toxic response in an organism and/or subsequent receptors and are evaluated if relevant data exist.

Despite their inherent toxicity, certain inorganic contaminants are essential nutrients. Essential nutrients need not be considered for further consideration in the quantitative risk assessment if they are present in relatively low concentration (i,e., below base-specific background levels or slightly elevated above naturally occurring levels), or if the contaminant is toxic at doses much higher than those which could be assimilated through exposures at the site.

APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS (ARARS)

In addition to these criteria, contaminant concentrations can be compared to contaminant-specific established state and federal Applicable or Relevant and Appropriate Requirements (ARARs) such as Maximum Contaminant Levels (MCLs) or Ambient Water Quality Criteria (AWQC).

Currently, there are no ARARs established for soil. As for water, the only enforceable regulatory standards are the Federal Maximum Contaminant Levels (MCLs). In addition to the Federal standards, the state of North Carolina has developed the North Carolina Water Quality Standards (NCWQS) for groundwater and surface water. Regulatory guidelines are used for comparative purposes to infer the potential health risks and environmental impacts when necessary. Relevant regulatory guidelines include Ambient Water Quality Criteria and Health Advisories. In addition, Region IV of the USEPA uses sediment screening values.

Because there are no criteria established for soil, base-specific background concentrations were compiled to evaluate background levels of organics and inorganics in the surface and subsurface soil. Organic contaminants were not detected in the base-specific background samples. Therefore, it is likely that all organic contaminants detected in the surface and subsurface soil, within OU No. 2, are attributable to the practices which have or are currently taking place within the areas of concern.

Maximum Contaminant Levels (MCLs) - MCLs are enforceable standards for public water supplies promulgated under the Safe Drinking Water Act and are designed for the protection of human health. MCLs are based on laboratory or epidemiological studies and apply to drinking water supplies consumed by a minimum of 25 persons. They are designed for prevention of human health effects associated with a lifetime exposure (70-year lifetime) of an average adult (70 kg) consuming 2 liters of water per day. MCLs also consider the technical feasibility of removing the contaminant from the public water supply.

North Carolina Water Quality Standards (Groundwater) - NCWQSs are the maximum allowable concentrations resulting from any discharge of contaminants due to the land or waters of the state, which may be tolerated without creating a threat to human health or which otherwise render the groundwater unsuitable for its intended purpose.

Health Advisories - HAs are guidelines developed by the USEPA Office of Drinking Water for nonregulated constituents in drinking water. These guidelines are designed to consider both acute and chronic toxic effects in children (assumed body weight 10 kg) who consume 1 liter of water per day or in adults (assumed body weight 70 kg) who consume 2 liters of water per day. Health Advisories are generally available for acute (1 day), and subchronic (10 days), and chronic (longer-term) exposure scenarios. These guidelines are designed to consider only threshold effects and, as such, are not used to set acceptable levels of potential human carcinogens.

Ambient Water Quality Criteria (AWQC) - AWQC are non-enforceable regulatory guidelines and are of primary utility in assessing acute and chronic toxic effects in aquatic systems. They may also be used for identifying the potential for human health risks. AWQCs consider acute and chronic effects in both freshwater and saltwater aquatic life, and potential carcinogenic and noncarcinogenic health effects in humans from ingestion of both water (2 liters/day) and aquatic organisms (6.5 grams/day), or from ingestion of water alone (2 liters/day). The AWQCs for the protection of human health for potential carcinogenic substances are based on the USEPA's specified incremental cancer risk range of one additional case of cancer in an exposed population of 10,000,000 to 100,000 (i.e. the 10E-7 to 10E-5 range).

North Carolina Water Quality Standards (Surface Water) - The NCWQSs for surface water is the standard concentration, that either alone or in combination with other wastes, in surface waters that will not render waters injurious to aquatic life or wildlife, recreational activities, public health, or impair the waters for any designated use.

Sediment Screening Values - SSVs were developed by the National Oceanic and Atmosphere Administration (NOAA). This screening method for aquatic (marine and freshwater) organisms was developed for each contaminant having sufficient data available. Adverse effects on the biota are considered probable if the contaminant concentrations are above the Effects Range-Median (ER-M). If contaminant concentrations are between the Effects Range-Low (ER-L) and the ER-M adverse effects are considered possible. Concentrations below the ER-L indicate that adverse effects are unlikely.

The remaining sections apply the aforementioned selection criteria beginning with the prevalence of detected analytical results in each medium of interest to establish a preliminary list of COPC for OU No. 2 (Sites 6, 9 and 82). Once this task has been completed, a final list of media-specific COPCs will be selected based on the remaining criteria (persistence, mobility, toxicity, and ARARs).

6.2.2 Selection of Contaminants of Potential Concern

The following paragraphs present an overview of the analytical data obtained for each medium, at each site during the RI and the subsequent selection or elimination of COPCs using prevalence as a criterion.

In accordance with current USEPA Risk Assessment Guidance to prevent the inclusion of non-site-related contaminants in the risk assessment, the concentration of contaminants detected in blanks (i.e., trip, field, or laboratory) must be compared with concentrations of the same contaminant detected in site samples. In this sample set, it is impossible to associate specific blanks and data. Therefore, blank data is compared to the entire sample data set.

For the purposes of selecting COPC, samples containing detectable levels of common laboratory contaminants (i.e., acetone, methylene chloride, and phthalate esters) will be retained only if the concentrations exceed ten times the maximum amounted detected in any blank. If all samples contain levels of common laboratory contaminants that are less than ten times the level of contamination noted in the blank, the contaminant will be completely eliminated from the data set.

When assessing soil concentrations the method detection limit and percent moisture were taken into account in order to correlate aqueous and solid detection limits.

Due to the size of the analytical database, the analytical findings, frequency of detection, and maximum concentration summaries for each media and area of concern are presented in Appendix L.

6.2.2.1 Soils

Site 9

Pesticide contaminants 4,4'-DDE, 4,4'-DDT were detected in 4 of 7, and 5 of 7 samples, respectively across the area with no apparent trend with depth or area. Given that the history of Site 9 is associated with fuels and solvents, the low concentrations of pesticides, and that widespread pesticide use has been practiced across the base, pesticides will not be retained as COPCs.

The volatile contaminants acetone, 1,1,1-trichloroethane, tetrachloroethene, and toluene were detected. 1,1,1-trichloroethane and tetrachloroethene were infrequently detected in 1 of 7 samples. Therefore, these contaminants will not be retained as contaminants of concern. In addition, the presence of acetone and toluene is due to laboratory interference and not an actual indication of site conditions.

The concentration of PAH contaminants pyrene (max. 59 µg/kg) and benzo(b)fluoranthene (max. 46 µg/kg), detected in training pit soil, and the infrequent detection (pyrene 1 of 7 and benzo(b)fluoranthene 1 of 7) does not warrant that these contaminants be included as contaminants of potential concern. In addition, the prevalence of bis(2-ethylhexyl)phthalate is laboratory related and not an indication of site conditions.

The inorganic contaminants barium, chromium, cobalt, copper, lead, manganese, mercury, vanadium, and zinc were detected intermittently across the site with no apparent trends. In addition, the concentrations of positive detects for these inorganics are less than two times the site-specific background concentrations. They will not, therefore, be considered COPCs.

Tables 6-1 and 6-2 present the range of positive detections and frequency of positive detections for the organic and inorganic contaminants detected in Site 9 surface and subsurface soil. In addition, Table 6-2 presents a comparison to base-specific background levels for inorganics.

Site 6 Lot 201

Soil samples in this area were collected from three grid areas (i.e, grid locations 201A, 201B and 201C) in order to define the extent of contamination at the suspected pesticide and PCB storage areas.

Pesticides and PCBs detected with sufficient frequencies great enough for inclusion as COPCs in this area include; dieldrin, 4,4'-DDD, 4,4'-DDT, and PCB-1260. The contaminants alpha and gamma chlordane were detected in only 1 of 96 samples, and PCB-1248 was detected in 1 of 87 samples therefore, these contaminants will not be retained as COPCs for further evaluation.

The volatile contaminants acetone and methylene chloride were not retained as COPCs due to their presence in field or laboratory blanks. The volatile contaminant 1,1,1-trichloroethane was infrequently detected (3 of 19 samples), at low concentrations ranges (2.0 to 42 µg/kg), therefore, this contaminant will not be retained.

PAHs were detected throughout the site. The semivolatile contaminants chrysene, benzo(b)fluoroanthene, 1,4-dichlorobenzene, fluoranthene, and pyrene were detected at frequencies which warrant the inclusion of these PAHs as COPCs. The PAHs benzo(a)anthracene, benzo(k)fluoranthene, benzo(a)pyrene, and phenanthrene were detected in 1 of 17 samples therefore they will not be retained as COPCs for further evaluation. In addition, the presence of bis(2-ethylhexyl)phthalate and di-n-octyl phthalate are the result of blank contamination and therefore will not be retained as COPCs.

The prevalence and/or the level of detection of inorganic constituents arsenic, cadmium, chromium, manganese and zinc warrant that these inorganics be retained as COPCs. Although frequently detected, barium concentrations are within the range of site-specific background concentrations. Therefore, barium will not be retained as a COPC.

Tables 6-3 and 6-4 present the range of positive detections and frequency of positive detections for the organic and inorganic contaminants detected in the surface and subsurface soil at Site 6 Lot 201.

Site 6 Lot 203

These soil samples were collected from the area designated as Lot 203 Open Storage Area. Within this area sampling grids (i.e. 203OSA, 203DDT, and 203PCB) were established to define areas of contamination.

Pesticides 4,4'-DDD, 4,4'-DDT, and 4,4'-DDE were frequently detected in the surface soil therefore, these pesticides will be retained as COPCs. The pesticides dieldrin and endrin were also considered prevalent in this area and are retained as COPCs. Other pesticides, endosulfan II (1 of 58), alpha chlordane (3 of 58) and gamma chlordane (1 of 58) were detected infrequently and consequently will not be retained as COPCs. PCB-1260 was prevalent in soil samples collected from this area and has been retained as a COPC. PCBs 1248 (1 of 12) and 1254 (2 of 12) were infrequently detected in this area and consequently will not be retained as COPCs.

The prevalence of volatile organics, in this area, does not warrant the retention of any of these as COPCs for further evaluation. The infrequent detection and low concentrations of acetone (2 of 28) and toluene (1 of 28) detected in area soil samples indicate that these contaminants are blank related and not truly indicative of area-specific conditions. In addition, 1,1,1-trichloroethane was detected in 2 of 28 samples and does not warrant retention as a COPC.

Semivolatile contaminants benzo(a)anthracene, benzo(b)fluoranthene, benzo(k)fluoranthene, benzo(a)pyrene, chrysene, 1,4-dichlorobenzene, fluoranthene, indeno(1,2,3-cd)pyrene, and pyrene were detected at frequencies that were greater than five percent. Therefore, these contaminants have been retained as COPCs. Other semivolatiles (i.e., naphthalene, carbazole, and butyl benzyl phthalate) do not warrant consideration as COPCs. These contaminants were either detected at frequencies less than five percent (35 samples in sample data set) or are a result of blank contamination.

The inorganic constituents arsenic, barium, cadmium, chromium, manganese, and zinc were detected throughout the area at concentrations above site-specific background levels and, therefore, will be retained as COPCs. Other inorganics (i.e., antimony, beryllium, copper, and nickel) were infrequently detected and/or detected at concentrations which are less than two times site-background and will, therefore, not be retained as COPCs.

The range of positive detects and number of positive detects for surface and subsurface soil organics and inorganics are presented in Tables 6-5 and 6-6, respectively.

Site 6 (Wooded Areas and Ravine) and Site 82

The wooded areas and ravine consist of grid areas 201N (North), 201E (East), 201S (South) which bound Lot 201, and Site 82 which is the wooded area north of Lot 203 bounded by

Wallace Creek to the North, Piney Green Road to the East, and Holcomb Boulevard to the West. In addition, samples from the grid designated as 203OSA and the ravine were included as part of the wooded area and ravine.

The pesticides 4,4'-DDD, 4,4'-DDD, 4,4'-DDT, dieldrin and endrin were prevalent in the wooded and ravine areas. Consequently, these pesticides warrant retention as COPCs. Alpha-chlordane was infrequently detected, 1 of 83 samples, in the surface soil, therefore, it will not be retained as a COPC. PCB-1260 was detected in 7 of 83 soil samples in the area at concentrations ranging from 63 to 26,000 µg/kg. PCB-1260 is therefore retained as a COPC.

The volatile contaminants bromomethane, chloromethane were detected in 2 of 83 soil samples, and 1,2-dichloroethene, trichloroethene, benzene, 1,1,2,2-tetrachloroethane, and toluene were detected in 1 of 83 soil samples. Consequently, these contaminants were not retained as contaminants of concern due to their infrequent occurrence in the soil. Low levels of acetone detected in 3 of 83 soil samples can be attributed to blank contamination. Therefore, acetone will not be retained as a COPC.

Semivolatiles were detected throughout the areas sampled. PAH contaminants anthracene, benzo(a)anthracene, benzo(b)fluoranthene, benzo(k)fluoranthene, benzo(a)pyrene, indeno(1,2,3-cd)pyrene, chrysene, dibenz(a,h)anthracene, fluoranthene, and pyrene were prevalent in these areas and will be retained as COPCs. In addition, 1,4-dichlorobenzene and phenol were retained as COPCs.

Inorganic contaminants arsenic, barium, cadmium, chromium, manganese, vanadium and zinc were retained as contaminants of concern due to their prevalence and/or their concentration above site-specific background.

Tables 6-7 and 6-8 present the organic and inorganic range of positive detects and frequency of positive detects in the surface and subsurface soils in the wooded areas and ravine.

6.2.2.2 Groundwater

Groundwater bearing zones flowing beneath OU No. 2 have not been segregated for this discussion. Groundwater elevation data collected during this investigation indicates that Bear Head Creek, which runs between the two sites on the surface, does not act as a hydrologic boundary between the groundwater at the two sites. Since there is no natural boundary between them, groundwater quality data from the two sites will be combined for the selection of contaminants of concern.

Pesticides and PCBs were not detected in the groundwater, therefore, they do not warrant inclusion as COPCs.

The volatile organic compounds bromodichloromethane, 1,2-dichloroethane, 1,1-dichloroethene, 1,1,2-trichloroethane, vinyl chloride, chlorobenzene, T-1,2-dichloroethene, tetrachloroethene, ethylbenzene, total xylenes, 1,1,2,2-tetrachloroethane, 1,1,1-trichloroethane and trichloroethene were prevalent in the groundwater and will be retained as COPCs. Volatile organic compounds 2-chloroethylvinylether, chloroform, and methylene chloride were not frequently detected compounds and are attributable to field or laboratory blanks and, therefore, do not merit inclusion as COPCs.

The semivolatile organic compounds 2-chlorophenol, dimethyl phthalate were detected at frequencies less than five percent (1 of 49 samples), and bis(2-ethylhexyl)phthalate can be attributed to blank contamination. These contaminants will not be retained as COPC. Phenol was detected at low levels in 8 of 49 samples and will be retained as a COPC.

The inorganic constituents antimony, arsenic, barium, beryllium, chromium, copper, lead, manganese, mercury, nickel, vanadium, and zinc were retained as COPCs due to their prevalence in the total metal fraction of the groundwater.

Table 6-9 presents a comparison between groundwater criteria and the contaminants detected in the groundwater. In addition, the range of positive detects and the number of positive detects are presented.

6.2.2.3 Surface Water

There are two surface water bodies (Wallace Creek and Bear Head Creek) within the boundaries of Operable Unit No.2. COPCs were independently selected for each of the surface water bodies.

Wallace Creek

No pesticides/PCBs were detected in the samples collected from Wallace Creek. Therefore, these contaminants do not warrant inclusion as COPCs.

Volatile organic contaminants tetrachloroethane, toluene, trichloroethene, T-1,2-dichloroethene, and vinyl chloride were prevalent at frequencies that warrant inclusion as COPCs. The presence of acetone in the surface water is believed to be the result of laboratory or field blank contamination and therefore, will not be retained as a COPCs.

The semivolatile organic compounds, bis(2-ethylhexyl)phthalate (5 of 28 samples)and 2,4,6-trichlorophenol (1 of 28 samples) will not be retained as COPCs. The prevalence of these contaminants and/or their presence in laboratory blanks does not warrant there inclusion as contaminants of potential concern.

Inorganic constituents arsenic, barium, cadmium, chromium, copper, lead, manganese, mercury, nickel, and zinc will be retained as COPCs due to their prevalence in the surface water.

Table 6-10 presents a comparison of detected contaminants to surface water criteria. In addition, the number of positive detects and range of detects are presented in this table.

Bear Head Creek

Organic contaminants were not detected in any of the surface water samples collected from Bear Head Creek. The presence of diethyl phthalate and bis(2-ethylhexyl)phthalate are attributable to laboratory blank contamination and not indicative of site-specific conditions. Consequently, no organic contaminants will be retained as COPCs.

Inorganic constituents barium, chromium, copper, lead, manganese, mercury, nickel, vanadium, and zinc will be retained as COPCs due to their prevalence in the surface water. Inorganic constituents antimony, arsenic, beryllium, cadmium, cyanide, cobalt, selenium, and thallium were not detected.

Table 6-11 presents a comparison of the detected contaminants to established surface water criteria. In addition, the frequency of positive detects and the range of positive of detects are presented in this table.

Ravine

Surface water data collected from the Ravine will not be used to evaluate a risk to human health. The flow of surface water in the Ravine has been described as intermittent and, surface water sampling locations used for this investigation may no longer exist which would impact the frequency and duration of exposure required to conduct a human health assessment. Therefore, in order to qualitatively assess the surface water, contaminant concentrations were compared to NCWQSs and Federal AWQCs. Table 6-12 presents the number and range of contaminants detected in the Ravine surface water along with a comparison to NCWQSs and Federal AWQCs.

6.2.2.4 Sediment

Sediment samples were collected from Wallace Creek and Bear Head Creek within the boundaries of OU No. 2, and at upstream and downstream locations. Contaminants of concern were independently selected for each of the sediment areas.

Wallace Creek

Pesticides (dieldrin, 4,4'-DDD, 4,4'-DDT and 4,4'-DDE) were detected at frequencies and concentrations that warrant inclusion as COPCs. No other pesticides were detected in the sediment. PCB-1260 was detected at a frequency that warrants inclusion as a COPC.

The volatile contaminants toluene, 1,2-dichloroethene, and total xylenes were detected in the sediment. These organic contaminants were retained as COPCs based on their toxicity potential. Volatile contaminants acetone, methylene chloride, 2-butanone, and carbon disulfide are believed to be attributable to field or laboratory blank contamination. These contaminants will, therefore, not be included as COPCs.

Semivolatiles were detected throughout Wallace Creek. The frequencies of benzo(a)anthracene, benzo(a)pyrene, chrysene, fluoranthene, and pyrene warrant their inclusion as COPCs. Although detected, the frequency (less than five percent) and concentration level do not warrant the inclusion of benzo(b)fluoranthene, benzo(k)fluoranthene, phenanthrene and phenol as a COPCs. In addition, the presence of bis(2-ethylhexyl)phthalate, butyl benzyl phthalate, and diethyl phthalate are believed to be laboratory blank related. Therefore, these contaminants will not be retained as COPCs.

Inorganic constituents arsenic, beryllium, chromium, copper, lead, manganese, nickel and zinc were detected at frequencies and concentrations that warrant inclusion as COPCs.

Frequency and range of contaminants detected in the sediment samples are presented in Table 6-13 along with a comparison to SSVs.

Bear Head Creek

Pesticide/PCB contaminants 4,4'-DDD, 4,4'-DDT, 4,4'-DDE and PCB-1260 were detected throughout Bear Head Creek. The prevalence of these contaminants warrants that they be retained as COPCs. Alpha-chlordane was detected in 1 of 20 samples, therefore, it will not be retained as a COPC.

Volatile constituents benzene, ethylbenzene, and tetrachloroethane were retained as COPCs. These contaminants were retained based on their toxicity and prevalence in this media. The presence of acetone, 2-butanone, and methylene chloride are believed to be the result of field or laboratory blank contamination. Therefore, these contaminants do not warrant being retained as COPCs.

Semivolatile contaminants (benzo(a)pyrene, benzo(b)fluoranthene, and pyrene were retained as COPCs. These contaminants were prevalent in this media. The contaminants 1,4-dichlorobenzene (1 of 20) and indeno(1,2,3-cd)pyrene (2 of 20) were infrequently detected at low concentrations in this media. Therefore, they will not be retained as COPCs.

Inorganic constituents arsenic, barium, beryllium, cadmium, chromium, manganese, vanadium, and zinc were prevalent in the soil and have been retained as COPCs.

Table 6-14 presents the frequency and range of contaminants detected in the sediment samples compared to SSVs.

Ravine

A human health assessment will not be conducted on sediment contaminants detected in the Ravine. However, in order to qualitative assess conditions in the Ravine, concentrations of contaminants detected in the Ravine are compared to SSVs. The range and frequency of contaminants detected in the Ravine along with a comparison to SSVs are presented in Table 6-15.

Biota

Pesticide/PCB contaminants 4,4'-DDD, 4,4'-DDE, 4,4'-DDT, endrin and PCB-1260 were frequently detected in filet samples. In addition, inorganic contaminants beryllium, cadmium and mercury were detected in the fish, therefore, for evaluation purposes these contaminants will be retained as COPCs.

6.2.2.5 Summary of COPCs

Table 6-16 presents a detailed summary of potential COPCs in each environmental medium sampled at OU No. 2 (Site 6, 9 and 82).

6.3 Exposure Assessment

This section develops the potential human exposure pathways at OU No. 2 and the rationale for their evaluation. Potential source areas and potential migration routes in conjunction with contaminant fate and transport information are combined to produce a conceptual model. Exposure pathways to be retained for quantitative evaluation are subsequently selected, based on the conceptual site model.

6.3.1 Site Conceptual Model of Potential Exposure

A site conceptual model of potential sources, migration pathways and human receptors is developed which encompasses all potential routes of exposure both now and in the future. Figure 6-1 presents the diagram of the conceptual site model for OU No. 2. Future potential exposure to contaminants is also addressed on Figure 6-1 (see Volume 2 of 2 Figures) under a no remedial action scenario. Inputs to the site conceptual site model include qualitative descriptions of current and future land use patterns in the vicinity of OU No. 2. All available analytical data and meteorological data are considered in addition to general understanding demographics of surrounding ecological habitats. For this information, the following list of potential receptors was developed for inclusion in the quantitative health risk analysis:

- Future onsite residents (child and adult);
- Onsite civilian base employees;
- Recreational users (adolescent and adult) of Wallace Creek and Bear Head Creek; and
- Adult fisher persons who recreationally ingest fish

6.3.2 Exposure Pathways

This section describes the potential exposure pathways presented on Figure 6-1 associated with each medium and each potential human receptor group, then qualitatively evaluates each pathway for further consideration in the quantitative risk analysis. Table 6-17 presents a generalized summary of potential human exposure scenarios discussed in this section.

6.3.2.1 Surface Soils

Surface soil samples were collected on-site from each area of concern (Site 9, Site 6 Lot 201, Site 6 Lot 203, and Site 6 Wooded Areas and Ravine, and Site 82). Potential direct contact exposures to these soils may possibly occur through the incidental ingestion and absorption via dermal contact with surface soil containing potential COPCs. Dermal intakes may result following dermal contact with soils containing potential COPCs. Incidental ingestion of soil may also occur by oral contact with hands, arms, or food items which soil particles have adhered.

Receptors most likely to be exposed via dermal contact and incidental ingestion include future residential children and adults, and current and/or civilian base employees.

Therefore, both incidental ingestion and dermal contact for future residential children and adults, current, and future civilian base employees will be retained for quantitative risk evaluation. Inhalation of wind-borne particulates will also be addressed for all receptors.

6.3.2.2 Subsurface Soils

Potential exposure to subsurface soils is limited to on-site construction workers. The Base Master Plan for Camp Lejeune indicates that the OU No. 2 area will continue to be used for open storage with no permanent structures planned. Because it is difficult to predict where construction activities would take place resulting in potential exposure, and it is not justifiable to assume that extensive excavation will be performed at the areas of concern, the exposure pathways associated with this medium will not be retained for quantitative evaluation.

6.3.2.3 Groundwater

Currently the shallow groundwater in this area is not used as a potable supply source for residents or base personnel. However, under a future scenario the major potential exposure pathways for the use of on-site groundwater are ingestion and dermal contact. On-site wells will be retained for the assessment of future potential exposure to residential child and adult, and civilian employee receptors. Ingestion scenarios will be evaluated for all receptor groups. Per USEPA Region IV guidance, potential exposure to receptor via inhalation during showering and cooking does not need estimated at this time.

6.3.2.4 Surface Water/Sediments

The two surface water bodies which flow within the borders of OU No. 2 contain site-related COPCs. Wallace Creek runs in a westerly direction, from Piney Green Road to Holcomb Boulevard, in the northern part of the OU. Bear Head Creek flows in a westerly direction, between Piney Green and Holcomb Boulevard, and is located in the southern portion of the OU in the area of Site 9. Currently, these waters are not used by military and/or base personnel for recreational purposes. The following potential human exposure pathways for both surface water/sediments exist:

- Accidental ingestion of surface water and sediments during recreational use (future residential adolescent and adult).
- Dermal contact of surface water and sediments during recreational usage (future residential adolescent and adult).

Therefore, ingestion and direct dermal contact of surface water/sediments will be retained for further quantitative evaluation.

6.3.2.5 Air

A potential human exposure pathway exists in air through inhalation of fugitive particulates from surface soils containing potential COPCs. Fugitive particulate emissions from the OU may result from the wind erosion of soils. Potential COPCs adhering to these airborne soil particles may be inhaled by potential future on-site residents (i.e., children and adults) and current civilian base employees.

Therefore, inhalation of fugitive particulate emissions by potential future residents and current base employees will be retained for quantitative evaluation. Off-site receptors would be exposed to concentrations much lower than those detected in onsite air samples as a result of the dilution characteristics of ambient air and the wooded areas which separate the facility from the nearby receptors.

6.3.2.6 Biota

Current and future adult residents could catch and consume fish from Wallace Creek, thereby being exposed to COPCs accumulated in the edible portions of fish.

Recreational fishing does occur on Wallace Creek, therefore, ingestion of fish by current and future fisher persons is retained for quantitative evaluation.

6.3.3 Quantification of Exposure

The concentrations used in the estimation of chronic daily intakes must be representative of the type of exposure being considered.

Exposure to groundwaters, sediments and surface waters can occur discretely or at a number of sampling locations. These media are transitory in that concentrations change frequently over time. Averaging transitory data obtained from multiple locations is difficult and requires many more data points at discrete locations than exist within OU No. 2. As a result, the best way to represent groundwater, sediment, and surface water contaminants from an exposure standpoint is to use a representative exposure concentration.

Soils are less transitory than the aforementioned media and in most cases, exposure occurs over a wider area (i.e., residential exposure). Therefore, an upper confidence interval is used to represent a soil exposure concentration.

Since all the data sets originate from a skewed underlying distribution and since lognormal distribution best fits the majority of environmental data sets, the lognormal distribution is used to represent all facility media. This ensures conservatism in the estimation of chronic daily intake associated with potential exposures. Ninety-five percent upper confidence intervals derived for lognormal data sets (95 percent U.C.L.) produce concentrations in excess of the ninety-five percent interval derived assuming normality. For the sake of conservatism, the 95 percent U.C.L. for the lognormal distribution will be used for each contaminant in a given data set for quantifying potential exposure. In cases where the 95 percent U.C.L. for a contaminant exceeds the maximum detected value in a given data set, the maximum result will be used in the estimate of exposure of the 95 percent U.C.L.

Maximum values, arithmetic means, geometric means, standard deviations, and 95 percent U.C.L.s are presented in Appendix L and Appendix M. Determination of the 95 percent U.C.L. is provided in Appendix M.

6.3.4 Calculation of Chronic Daily Intakes

In order to numerically estimate the risks for current and future human receptors at OU No. 2., a chronic daily intake (CDI) must be estimated for each COPC in every retained exposure pathway.

The following paragraphs present the general equations and input parameters used in the calculation of CDIs for each potential exposure pathway. Input parameters are taken from USEPA's default exposure factors guidelines where available and applicable. All inputs not defined by USEPA are derived from USEPA documents concerning exposure or best professional judgement. All exposure assessments incorporate the representative contaminant concentrations in the estimation of intakes. Therefore, only one exposure scenario was developed for each exposure route/receptor combination.

Carcinogenic risks are calculated as an incremental lifetime risk, and therefore incorporate terms describing to represent the exposure duration (years) over the course of a lifetime (70 years, or 25,550 days).

Noncarcinogenic risks, on the other hand, were estimated using the concept of an average annual exposure. The intake incorporates terms describing the exposure time and/or frequency that represent the number of hours per day and the number of days per year that exposure occurs. In general, noncarcinogenic risks for many exposure routes (e.g. soil ingestion) are greater for children than for adults because of the differences in body weights and similar or higher ingestion rates.

Current and future exposure scenarios consider 1 to 6 year old children weighing 15 kg, 7 to 16 year old adolescents weighing 45 kg, and adults weighing 70 kg on average. For base personnel an exposure duration of 25 years was used to estimate a working lifetime.

6.3.4.1 Incidental Ingestion of Surface Soil

The CDI for COPCs detected in surface soil can be estimated for all potential human receptors and was expressed as:

$$CDI = \frac{C \times IR \times CF \times Fi \times EF \times ED}{BW \times AT}$$

Where:

C = Contaminant concentration in surface soil (mg/Kg)
IR = Ingestion rate (mg/day)
CF = Conversion factor (10E-6 Kg/mg)
Fi = Fraction ingested from source (dimensionless)
EF = Exposure frequency (days/year)
ED = Exposure duration (years)
BW = Body weight (kg)
AT = Averaging time (days)

The following paragraphs discuss the exposure assumptions used in the estimation of potential COPCs associated with the potential ingestion of soils.

Base Personnel

During the course of maintenance activities at OU No. 2, base personnel could potentially be exposed to potential COPCs by the incidental ingestion of surface soils.

The IR for base personnel exposed to surficial soils was assumed to be 100 mg/day (USEPA, 1989) and that 100 percent of the exposure was with facility soils containing COPCs. An exposure frequency (EF) of 250 days per year was used in conjunction with an exposure duration of 25 years.

An averaging time (AT) of 70 years or 25,550 days was used for exposure to potentially carcinogenic compounds while an averaging time of 9,125 days was used for noncarcinogenic exposures. An average body weight (BW) of 70 kg is used (USEPA, 1989).

Future On-Site Residents

Future on-site residents could potentially be exposed to COPCs in the surficial soils during recreational activities or landscaping activities around their homes. Children and adults could potentially be exposed to COPCs in soils by accidental ingestion occurring through hand to mouth behavior.

Ingestion rates (IR) for adults and children in this scenario were assumed to be 100 mg/day and 200 mg/day, respectively. Exposure frequency (EF) for both receptor groups was assumed to be 350 days per year. Exposure duration (ED) was 30 years for an adult and 6 years for a child (USEPA, 1991).

The body weight (BW), for a resident child was assumed to be 15 kg, representing younger individuals than those considered to be potential trespassers. The rationale was that the younger child (1 to 6 years), as a resident, will have access to affected on-site soils. The body weight for the future resident adult is assumed to be 70 kg.

Averaging times (AT) of 25,550 days for potential carcinogens and 10,950 days for noncarcinogenic constituents was used for estimating potential CDIs for adults. An AT of 2,190 days was used to estimate potential CDIs for children potentially exposed to noncarcinogens.

A summary of the exposure factors used in the estimation of soil CDIs associated with incidental ingestion is presented on Table 6-18.

6.3.4.2 Dermal Contact with Surface Soil

Chronic daily intakes associated with potential dermal contact of surface soils containing COPCs was expressed using the following equation:

$$CDI = \frac{C \times CF \times SA \times AF \times ABS \times EF \times ED}{BW \times AT}$$

Where:

C = Contaminant concentration in surface soil (mg/Kg)
CF = Conversion factor (Kg/mg)
SA = Skin surface available for contact (cm^2)
AF = Soil to skin adherence factor (mg/cm^2)
ABS = Absorption factor (dimensionless)
EF = Exposure frequency (days/year)
ED = Exposure duration (years)
BW = Body weight (kg)
AT = Averaging time (days)

The following paragraphs discuss the exposure assumptions used in the estimation of potential COPCs with the potential dermal contact with soils.

Base Personnel

During construction activities, there is a potential for base personnel to absorb COPCs by dermal contact.

It was assumed that base personnel have approximately 4,300 cm^2 (USEPA, 1992) of skin surface (SA) available for dermal exposure with COPCs. Exposed body parts are the hands, head, and arms.

Values for exposure duration, exposure frequency, body weight, and averaging time were the same as those used for the incidental ingestion of soil scenario.

Future On-Site Residents

Future on-site residents could also be potentially exposed to COPCs in on-site soil through dermal contact experienced during activities near their home.

Skin surface areas (SA) used in the on-site resident exposure scenario were developed for a reasonable worst case scenario for an individual wearing a short sleeve shirt, shorts, and shoes. The exposed skin surface area is limited to the head, hands, forearms, and lower legs. Thus, applying 25 percent of the total body surface area results in a default of 5,300 cm^2 for adults and 1,800 cm^2 for children. The child SA was calculated using information presented in Dermal Exposure Assessment: Principles and Applications (USEPA, 1992).

Exposure duration, exposure frequencies, body weights and averaging times were the same as those discussed for the accidental ingestion scenario presented previously.

Data on soil adherence (AF) are limited. A value of 1.0 mg/cm^2 (USEPA, 1992) was used in this assessment.

A summary of the soil exposure assessment input parameters for dermal contact is presented in Table 6-19.

6.3.4.3 Inhalation of Fugitive Particulates

Exposure to fugitive particulates are estimated for future residents and civilian base-personnel. These populations may be exposed during daily recreational or work-related activities. The chronic daily intake of contaminants associated with the inhalation of particulates can be estimated using the following equation:

$$CDI = \frac{C \times IR \times ET \times EF \times ED \times 1/PEF}{BW \times AT}$$

Where:

C	=	Contaminant concentration in surface soil (mg/kg)
IR	=	Inhalation rate (m3/hr)
ET	=	Exposure time (hr/day)
EF	=	Exposure frequency (days/year)
ED	=	Exposure duration (years)
1/PEF	=	Particulate emission factor (m3/Kg)
BW	=	Body weight (Kg)
AT	=	Averaging time (days)

The following paragraphs discuss the exposure assumptions used in the estimation of potential COPCs with the potential inhalation of particulates.

The PEF relates the concentration in soil with the concentration of respirable particles in the air due to fugitive dust emissions from surface contamination. This relationship is derived by Cowherd (1985). The particulate emissions from contaminated sites are due to wind erosion, and, therefore, depend on erodibility of the surface material. A site-specific PEF was estimated relating the annual average rate of respirable particulate emissions to surface and climatic factors which accounted for fraction of vegetated cover, observed fastest mile of wind speed, surface area of contamination, and frequency of disturbance.

Base Personnel

During work related activities, there is a potential for base personnel to inhale COPCs emitted as fugitive dust.

It was assumed that the inhalation rate 1.25 m^3/hour would be used for base personnel (USEPA, 1989).

An exposure time of 8 hours/day, a normal working day, was assumed.

Values for exposure duration, exposure frequency, body weight, and averaging time were the same as those used for the accidental ingestion scenario.

Future On-Site Residents

Future on-site residents could also be potentially exposed to COPCs in on-site soil through inhalation of particulates during activities near their home.

Inhalation rates (IR) used in the on-site resident exposure scenario were 0.83 m^3/hour and 0.43 m^3/hour for adults and children, respectively (USEPA, 1989).

It was assumed that future on-site residents were exposed 16 hours/day and 24 hours/day, for adults and children, respectively (USEPA, 1989).

Exposure frequencies, duration, body weight, and averaging time were the same as those used for the accidental ingestion scenario.

Table 6-20 presents the exposure factors used to estimate CDIs associated with the particulate inhalation scenario.

6.3.4.4 Ingestion of Groundwater

Shallow groundwater is not currently being used as a potable supply at OU No. 2. Development of the shallow aquifer for potable use is unlikely because of the general water quality in the shallow zone and poor flow rates. However, there remains the possibility that upon closure of this facility, residential housing could be constructed and deep groundwater used for potable purposes in the future.

The chronic daily intake of contaminants associated with the future potential consumption of groundwater can be estimated using the following general equation:

$$CDI = \frac{C \times IR \times EF \times ED}{BW \times AT}$$

Where:

C = Contaminant concentration is groundwater (mg/L)
IR = Ingestion rate (liters/day)
EF = Exposure frequency (days/year)

ED = Exposure duration (years)
BW = Body weight (kg)
AT = Averaging time (days)

The following paragraphs discuss the exposure assumptions used in the estimation of potential COPCs with the potential ingestion of groundwater.

Base Personnel

Exposure to COPCs via ingestion of groundwater was retained as a future potential pathway for base personnel.

An ingestion rate (IR) of 2.0 liter/day was used for the amount of water consumed. This value assumes that base personnel obtain tap water they drink from same source for 250 days/year [which represents the exposure frequency (EF)].

An averaging time (AT) of 9,125 days (25 years x 365 days/year times the ED was used for the noncarcinogenic compound exposure.

The ED used for the estimation of base personnel CDIs was 25 years (working lifetime).

Future On-Site Residents

Exposure to COPCs via ingestion of groundwater was retained as a potential current and future exposure pathway for both children and adults.

An IR of 1.0 liter/day was used for the amount of water consumed by a 1 to 6 year old child. This ingestion rate provides a health conservative exposure estimate (for systemic, noncarcinogenic toxicants) designed to protect young children who could potentially be more affected than adolescents, or adults. This value assumes that children obtain all the tap water they drink from the same source for 350 days/year [which represents the exposure frequency (EF)].

An averaging time (AT) of 25,550 days (70 years x 365 days/year) was used for potentially carcinogenic compounds and 365 days/year times the ED was used for noncarcinogenic compound exposure.

The ED used for the estimation of adult CDIs was 30 years (USEPA, 1989), which represents the national upper-bound (90th percentile) time at one residence. The ingestion rate (IR) for adults was 2 liters/day (USEPA, 1989). The exposure time for noncarcinogens was 10,950 days.

Table 6-21 presents a summary of the input parameters for the ingestion of groundwater scenarios.

6.3.4.5 Dermal Contact with Groundwater

Groundwater is not currently being used as a potable supply at OU No. 2. However, there remains the possibility (however unlikely) that upon closure of this facility residential housing could be constructed and groundwater used for residential purposes in the future.

The CDI associated with the dermal contact with groundwater was estimated using the following general equation:

$$CDI = \frac{C \times SA \times PC \times ET \times EF \times ED \times CF}{BW \times AT}$$

Where:

C	=	Contaminant concentration is groundwater (mg/L)
SA	=	Surface area available for contact (cm^2)
PC	=	Dermal permeability constant (cm/hr)
ET	=	Exposure time (hour/day)
EF	=	Exposure frequency (days/year)
ED	=	Exposure duration (years)
CF	=	Conversion factor (1L/1000cm3)
BW	=	Body weight (kg)
AT	=	Averaging time (days)

The following paragraphs discuss the exposure assumptions used in the estimation of potential COPCs with potential dermal contact with groundwater.

Base Personnel

Base personnel could potentially be exposed to COPCs via dermal contact with groundwater while bathing or showering.

It was assumed that bathing or showering would take place 250 days/year using site groundwater as the sole source. The whole body skin surface area (SA) available for dermal absorption by base personnel was estimated to be 18,150 cm^2 (USEPA, 1989).

An exposure time (ET) of 0.25 hour/day was day used to conservatively estimate the duration of bathing or showering.

The exposure duration, body weight, and averaging time are the same as those used for the ingestion of groundwater scenario.

Future On-Site Residents

Children could contact COPCs through dermal contact with groundwater while bathing or showering.

It was assumed that bathing would take place 350 days/year using site groundwater as the sole source. The whole body skin surface area (SA) available for dermal absorption by children was estimated to be 7,880 cm^2 and 18,150 cm^2 for adults (USEPA, 1989). The permeability constant (PC) reflects the movement of a chemical across the skin and into the blood stream. The permeability of a chemical is an important property in evaluating actual absorbed dose, yet many compounds do not have literature PC values. For contaminants in which a PC value has not been established, the permeability constant for water (1.0E-03 cm/hr), will be used. This value may in fact be a realistic estimate of the adsorption rate of a chemical when COPC concentrations are in the part-per-billion range.

Table 6-22 presents the exposure factors used to estimate CDIs associated with the future dermal contact with COPCs in groundwater.

6.3.4.6 Incidental Ingestion of Surface Water

The chronic daily intake for contaminants associated with incidental ingestion of affected surface water can be expressed using the following equation:

$$CDI = \frac{C \times IR \times ET \times EF \times ED}{BW \times AT}$$

Where:

C = Contaminant concentration in surface water (mg/l)
IR = Ingestion rate (liters/hour)
ET = Exposure time (hours/day)
EF = Exposure frequency (days/year)
ED = Exposure duration (years)
BW = Body weight (kg)
AT = Averaging time (days)

The following paragraphs discuss the exposure assumptions used in the estimation of potential COPCs with potential accidental ingestion of surface water.

Future On-Site Residents

Adults and adolescents participating in recreational activities in the surface water were assumed to potentially ingest surface water at a rate of 50 ml/hour; (USEPA, 1989). In addition, a recommended exposure time (ET) of 2.6 hours/day, exposure frequency (EF) of 7 days/year (national average for swimming USEPA, 1992) and an exposure duration (ED) of 9 years (age 7-16) for an adolescent, and 30 years for an adult were used (USEPA, 1989).

A summary of the surface water exposure factors associated with incidental ingestion of surface water is presented in Table 6-23.

6.3.4.7 Dermal Contact with Surface Water

The chronic daily intake of contaminants associated with the dermal contact of affected surface water can be expressed using the following general equation:

$$CDI = \frac{C \times CF \times SA \times PC \times ET \times EF \times ED}{BW \times AT}$$

Where:

C	=	Contaminant concentration in the surface water (mg/L)
CF	=	Conversion factor (1 liter/1000cm3)
SA	=	Surface area available for contact (cm^2)
PC	=	Permeability constant (cm/hour)
ET	=	Exposure time (hours/event)
EF	=	Exposure frequency (events/year)
ED	=	Exposure duration (years)
BW	=	Body weight (Kg)
AT	=	Averaging time (days)

The following paragraphs discuss the exposure assumptions used in the estimation of potential COPCs with potential dermal contact with surface water.

Skin surface areas used in the future on-site resident exposure scenario are 17,500 cm^2 and 13,800 cm^2 for adults and children, respectively. The adult surface area is taken directly from USEPA's Dermal Exposure Assessment: Principles and Applications (USEPA, 1992). The adolescent surface area is calculated using information presented in this publication. A total body surface area is derived for an adolescent by averaging the 50th and 95th percentiles of the total body surface reported for adolescents 7 to 8 years, 8 to 9 years, 9 to 10 years, 10 to 11 years, 11 to 12 years, 12 to 13 years, 13 to 14 years, 14 to 15 years, and 15 to 16 years. Exposure time, frequency, and duration are the same as for the ingestion scenario.

The exposure factors for this potential exposure pathway are summarized in Table 6-24.

6.3.4.8 Accidental Ingestion of Sediment

The chronic daily intake of COPCs associated with the accidental ingestion of affected sediment was expressed using the following general equation:

$$CDI = \frac{C \times IR \times Fi \times EF \times ED \times CF}{BW \times AT}$$

Where:

C = Contaminant concentration in sediment (mg/Kg)
IR = Ingestion rate of sediment (mg/day)
Fi = Fraction ingested from source (dimensionless)
EF = Exposure frequency (days/year)
ED = Exposure duration (years)
CF = Conversion factor (Kg/mg)
BW = Body weight (kg)
AT = Averaging time (days)

Future On-Site Residents

Accidental ingestion of COPCs in sediments is also possible during recreational activities occurring in the surface water bodies at OU No. 2.

An ingestion rate (IR) of 50 mg/day was used in calculating the chronic daily intake, for adolescents and adults, of COPCs. The exposure frequency (EF) of 7 days/year (national average for swimming, USEPA, 1992) was assumed (USEPA, January, 1992).

An exposure duration (ED) of 9 years (7 to 16 year old) was used in the estimation of potential COPCs for an adolescent

A summary of exposure factors for this scenario are presented in Table 6-25.

6.3.4.9 Direct Contact with Sediment

The chronic daily intake of contaminants associated with the dermal contact of affected sediments was expressed using the following general equation:

$$CDI = \frac{C \times CF \times SA \times AF \times ABS \times EF \times ED}{BW \times AT}$$

Where:

- C = Contaminant concentration in sediment (mg/Kg)
- CF = Conversion factor (Kg/mg)
- SA = Surface area available for contact (cm^2/event)
- AF = Adherence factor (mg/cm^2)
- ABS = Absorption factor (dimensionless)
- EF = Exposure frequency (events/year)
- ED = Exposure duration (years)
- BW = Body weight (kg)
- AT = Averaging time (days)

Future On-Site Residents

If surface water within the Operable Unit were used for recreational purposes, direct contact with sediments could occur.

Hands, arms, legs, and feet were considered to be available for dermal exposure to sediments, totaling 3,700 cm^2 of skin surface area (USEPA, 1992). A sediment adherence factor (AF) of 1.0 mg/cm^2 was used. Dermal absorption factors (ABS) for COPCs, defined previously for dermal contact of soils, was the same for sediment exposure. The exposure frequency (EF) for contact with sediments was estimated to be 7 days/year. This EF assumes that contact to sediment can occur during swimming and other recreational activities.

An averaging time (AT) of 70 years or 25,550 days was used for exposure to potentially carcinogenic compounds. An averaging time of 365 days/year times the exposure duration was used for exposure to noncarcinogenic COPCs (USEPA, 1989).

Table 6-26 provides a complete summary of the input parameters used in the estimation of CDIs.

6.3.4.10 Biota

The chronic daily intake associated with the potential ingestion of fish taken from Wallace Creek was expressed using the following general equation:

$$CDI = \frac{C \times IR \times Fi \times EF \times ED}{BW \times AT}$$

Where:

C = Contaminant concentration in fish (mg/Kg)
IR = Ingestion rate (kg/day)
Fi = Fraction ingested (dimensionless)
EF = Exposure frequency (events/year)
ED = Exposure duration (years)
BW = Body weight (kg)
AT = Averaging time (days)

Adults

The ingestion rate was 0.284 kg/day which represents the upper 95th percentile consumption rate occurring in conjunction with recreational fishing (USEPA, 1989). The fraction of fish ingested from the source (FI) for adults was estimated to be 1.0 (100 percent) for the 90th percentile consumption rate. The exposure frequency is equal to 48 days/year. The exposure duration (ED) for adults was set at 30 years, and an averaging time (AT) of 70 years or 25,550 days was used for exposure to carcinogenic compounds. An averaging time of 365 days times the exposure duration (ED) was used for exposure to noncarcinogenic COPCs (USEPA, 1989).

Table 6-27 presents a summary of the exposure factors used for the ingestion of biota scenario.

Appendix K contains the specific CDI equations for each exposure scenario of interest. These equations were adopted from USEPA's Risk Assessment Guidance for Superfund, Volume I (December, 1989).

6.4 Toxicity Assessment

Section 6.3 identified potential exposure pathways and potentially affected populations for this PHA. This section will review the available toxicological information for potential COPCs.

6.4.1 Toxicological Evaluation

The purpose of this section is to define the toxicological values used to evaluate the potential exposure to the potential COPCs identified in Section 6.2. A toxicological evaluation characterizes the inherent toxicity of a compound. It consists of the review of scientific data to determine the nature and extent of the potential human health and environmental effects associated with potential exposure to various contaminants.

Human data from occupational exposures are often insufficient for determining quantitative indices of toxicity because of uncertainties in exposure estimates, and inherent difficulties in determining causal relationships established by epidemiological studies. For this reason, animal bioassays are conducted under controlled conditions and their results are extrapolated to humans. There are several stages to this extrapolation. First, to account for species differences, conversion factors are used to extrapolate from test animals to humans. Second, the relatively high doses administered to test animals must be extrapolated to the lower doses more typical of human exposures. For potential noncarcinogens, safety factors and modifying factors are applied to animal results when developing acceptable human doses. For potential carcinogens, mathematical models are used to extrapolate effects at high doses to effects at lower doses. Epidemiological data can be used for inferential purposes to establish the credibility of the experimentally derived indices.

The available toxicological information indicates that many of the potential COPCs have both potential carcinogenic and noncarcinogenic health effects in humans and/or experimental animals. Although the potential COPCs may potentially cause adverse health and environmental impacts, dose-response relationships and the potential for exposure must be evaluated before the risk to receptors can be determined. Dose-response relationships correlate the magnitude of the dose with the probability of toxic effects, as discussed in the following section.

6.4.2 Dose-Response Evaluation

An important component of the risk assessment is the relationship between the dose of a compound (amount to which an individual or population is potentially exposed) and the potential for adverse health effects resulting from the exposure to that dose. Dose-response relationships provide a means by which potential public health impacts may be evaluated. The published information on doses and responses is used in conjunction with information on the nature and magnitude of exposure to develop an estimate of risk.

Standard carcinogenic slope factors and/or reference doses have been developed for many of the COPCs. This section provides a brief description of these parameters.

6.4.2.1 Carcinogenic Slope Factor (CSF)

Carcinogenic slope factors are used to estimate an upper-bound lifetime probability of an individual developing cancer as a result of exposure to a particular level of a potential carcinogen (USEPA, 1989). This factor is generally reported in units of (mg/kg/day)-1 and is derived through an assumed low-dosage linear multistage model and an extrapolation from high to low dose-responses determined from animal studies. The value used in reporting the slope factor is the upper 95th percent confidence limit.

These slope factors are also accompanied by USEPA weight-of-evidence (WOE) classifications which designate the strength of the evidence that the COPC is a potential human carcinogen.

In assessing the carcinogenic potential of a chemical, the Human Health Assessment Group (HHAG) of USEPA classifies the chemical into one of the following groups, according to the weight of evidence from epidemiologic and animal studies:

Group A - Human Carcinogen (sufficient evidence of carcinogenicity in humans)

Group B - Probable Human Carcinogen (B1 - limited evidence of carcinogenicity in humans; B2 - sufficient evidence of carcinogenicity in animals with inadequate or lack of evidence in humans)

Group C - Possible Human Carcinogen (limited evidence of carcinogenicity in animals and inadequate or lack of human data)

Group D - Not Classifiable as to Human Carcinogenicity (inadequate or no evidence)

Group E - Evidence of Noncarcinogenicity for Humans (no evidence of carcinogenicity in adequate studies)

6.4.2.2 Reference Dose (RfD)

The RfD is developed for chronic and/or subchronic human exposure to chemicals and is based solely on the noncarcinogenic effects of chemical substances. It is defined as an estimate of a daily exposure level for the human population, including sensitive populations, that is likely to be without an appreciable risk of adverse effects during a lifetime. The RfD is usually expressed as dose (mg) per unit body weight (kg) per unit time (day). It is generally derived by dividing a no-observed-(adverse)-effect-level (NOAEL or NOEL) or a lowest observed-adverse-effect-level (LOAEL) for the critical toxic effect by an appropriate "uncertainty factor (UF)". Effect levels are determined from laboratory or epidemiological studies. The uncertainty factor is based on the availability of toxicity data.

Uncertainty factors usually consist of multiples of 10, where each factor represents a specific area of uncertainty naturally present in the extrapolation process. These uncertainty factors are presented below and were taken from the "Risk Assessment Guidance Document for Superfund, Volume I, Human Health Evaluation Manual (Part A) (USEPA, 1989):

- A UF of 10 is to account for variation in the general population and is intended to protect sensitive populations (e.g., elderly, children).

- A UF of 10 is used when extrapolating from animals to humans. This factor is intended to account for the interspecies variability between humans and other mammals.

- A UF of 10 is used when a NOAEL derived from a subchronic instead of a chronic study is used as the basis for a chronic RfD.

- A UF of 10 is used when a LOAEL is used instead of a NOAEL. This factor is intended to account for the uncertainty associated with extrapolating from LOAELs to NOAELs.

In addition to UF's, a modifying factor (MF) is applied to each reference dose and is defined as:

- An MF ranging from >0 to 10 is included to reflect a qualitative professional assessment of additional uncertainties in the critical study and in the entire data base for the chemical not explicitly addressed by the preceding uncertainty factors. The default for the MF is 1.

Thus, the RfD incorporates the uncertainty of the evidence for chronic human health effects. Even if applicable human data exist, the RfD still maintains a margin of safety so that chronic human health effects are not underestimated.

Toxicity factors and the USEPA weight-of-evidence classifications are presented in Table 6-28. The hierarchy (USEPA, 1989) for choosing these values is as follows:

- Integrated Risk Information System (IRIS);

- Health Effects Assessment Summary Table (HEAST).

The IRIS data base is updated monthly and contains both verified CSF's and RfD's. The USEPA has formed the Carcinogen Risk Assessment Verification Endeavor (CRAVE) Workgroup to review and validate toxicity values used in developing CSF's. Once the slope factors have been verified via extensive peer review, they appear in the IRIS data base. Like the CSF Workgroup, the EPA has formed a RfD Workgroup to review existing data used to derive RfDs. Once the reference doses has been verified, they also appear in IRIS.

HEAST on the other hand, provides both interim (unverified) and verified CSF's and RFD's. This document is published quarterly and incorporates any applicable changes to its data base.

6.5 Risk Characterization

This section presents and discusses the estimated incremental lifetime cancer risks (ICR) and hazard indices (HI) for identified potential receptor groups which could be exposed to COPCs via the exposure pathways presented in Section 6.3.

These quantitative risk calculations for potentially carcinogenic compounds estimate incremental lifetime cancer risk levels for an individual in a specified population. This unit risk refers to the cancer risk that is over and above the background cancer risk in unexposed individuals. For example, an incremental lifetime cancer risk level (ICR) of 10E-6 indicates that, for a lifetime exposure, one additional case of cancer may occur per one million exposed individuals.

The incremental lifetime potential cancer risk level to individuals is estimated from the following relationship:

$$ICR = \sum_{i=1}^{n} CDI_i \, x \, CSF_i$$

where CSFi is the cancer slope [(mg/kg/day)-1] for contaminant i, and CDIi is the chronic daily intake (mg/kg/day) for compound i. The cancer slope factor is defined in most instances as an upper 95th percentile confidence limit of the probability of a carcinogenic response based on experimental animal data and the CDI is defined as the exposure expressed as a mass of a substance contracted per unit body weight per unit time, averaged over a period of time (i.e., six years to a lifetime). The above equation was derived assuming that cancer is a non-threshold process and that the potential excess risk level is proportional to the cumulative intake over a lifetime.

In contrast to the above approach for potentially carcinogenic effects, quantitative risk calculations for noncarcinogenic compounds assume that a threshold toxicological effect exists. Therefore, the potential for noncarcinogenic effects are calculated by comparing chronic daily intake levels with threshold levels (reference doses).

Noncarcinogenic effects are estimated by calculating the Hazard Index (HI) which is defined as:

$$HI = HQ_1 + HQ_2 + ... HQ_n$$
$$= \sum_{i=1}^{n} HQ_i$$
$$where\ HQ_i = CDI_i/RfD_i$$

HQi is the hazard quotient for contaminant i, CDIi is the chronic daily intake (mg/kg/day) of contaminant i, and RfDi is the reference dose (mg/kg/day) of the contaminant i over a prolonged period of exposure.

Estimated incremental cancer risks will be compared to the target risk range of 10E-4 to 10E-6 which the USEPA considers to be safe and protective of public health (USEPA, 1989). A value of 1.0 is used for examination of the HI. The hazard index calculated by comparing estimated chronic daily intakes with threshold levels below which, noncarcinogenic health effects are not expected to occur. Any HI equal to or exceeding 1.0 suggests that noncarcinogenic health effects are possible.

6.5.1 Human Health Effects

The following paragraphs present the quantitative results of the human health evaluation for each medium and area of concern at OU No. 2.

6.5.1.1 Soils

Site 6 Lot 201

Table 6-29 and 6-30 present the ICR and HQ values derived for the potential ingestion, dermal contact, and inhalation of area surface soils by future residents (i.e., children and adults), and current civilian base employees. Surface soil Total ICRs values for each potential receptor fall within or below USEPA's target risk (10E-4 to 10E-6). Similarly, surface soil HIs results, for each receptor and each exposure pathway, do not exceed unity, suggesting that the occurrence of adverse systemic health effects are unlikely.

Site 6 Lot 203

The ICRs and HQs derived for potential ingestion, dermal contact, and inhalation of the area surface soils are presented in Tables 6-31 and 6-32, respectively. The ICRs estimated for ingestion, dermal contact, and inhalation by future residential receptors and future civilian base employees fell within or below the USEPA's target risk (10E-4 to 10E-6). The HI for each of the exposure pathways and receptors, did not exceed unity. Therefore the occurrence of adverse systemic health effects are unlikely.

Site 6 (Wooded Areas and Ravine) and Site 82

The ICRs estimated for all future potential child and adult residents, and civilian base employees are presented in Table 6-33. ICR values for all potential receptors were below or within the USEPA's target risk range. Associated HI values, presented in Table 6-34, do not exceed unity, suggesting that adverse systemic effects are unlikely to occur upon exposure via ingestion of, dermal contact with, or inhalation of surface soil.

6.5.1.2 Groundwater

ICR values derived for the ingestion of groundwater from OU No. 2 exceeded the USEPA's target risk range for all future potential receptors. ICR values for residential children, residential adults, and civilian base employees are 1.7E-04, 3.6E-04, and 2.0E-04. These values exceed USEPA's target risk level of 10E-4 to 10E-6. The individual risks from vinyl chloride, arsenic, and beryllium contribute approximately 80 percent to the total risk for all receptors. The ICR values for all potential receptors and associated exposure pathways are presented in Table 6-35.

The HI value for future potential base personnel did not exceed unity, suggesting that adverse systemic human health effects are unlikely subsequent to exposure. The HI values for future potential receptors are presented in Table 6-36. The HI value for future potential residential children and adult receptors exceed unity, suggesting that adverse systemic human health effects are likely subsequent to exposure.

6.5.1.3 Surface Water

Wallace Creek

Table 6-37 presents the ICR values for recreational potential exposures to surface waters in Wallace Creek. ICR values for adolescents and adults fall below USEPA's target risk range of 10E-4 to 10E-6.

The HQ values for ingestion and dermal contact by adolescents and adults presented in Table 6-38. The HIs, for adolescents and adults are below 1.0, suggesting that noncarcinogenic effects are unlikely to occur.

Bear Head Creek

Potential carcinogenic contaminants were not detected in the surface water samples collected from Bear Head Creek. Therefore, ICR values cannot be derived for this medium.

Future residents contacting surface waters in Bear Head Creek do not produce HI values in excess of 1.0, suggesting that adverse systemic health effects will not occur subsequently to exposure. Table 6-39 presents the HQ values for future residential adolescents and adults exposed to surface water via ingestion and dermal contact.

6.5.1.4 Sediments

Wallace Creek

Adolescents and adults could be exposed to COPCs detected in Wallace Creek sediment samples. ICR values are presented in Table 6-40. ICRs for ingestion and dermal contact for both receptors were within the USEPA's target risk range of 10E-4 and 10E-6.

HI values for adolescents and adults are presented in Table 6-41. HI values for both adolescent and adult receptors were below 1.0, suggesting that systemic health effects are unlikely to occur subsequent to exposure.

Bear Head Creek

ICR values for both adolescents and adults exposed to COPCs present in Bear Head Creek sediment samples are presented in Table 6-42. Adolescents who may conduct take part in recreational activities in Bear Head Creek produce ICR values within the USEPA's target risk range of 10E-4 to 10E-6.

Table 6-43 presents the HI values adolescents and adults exposed to contaminants in Bear Head Creek sediment samples. Estimated HIs for an adolescent via ingestion (3.13E-04) and dermal contact (2.32E-02) are below 1.0 indicating that systemic health effects are not expected upon exposure.

6.5.1.5 Biota

ICR values for adult residents are presented in Table 6-44. Adults who ingest fish obtained recreationally from Wallace Creek display ICR values of 1.8E-04 which exceeds the USEPA's target risk range of 10E-4 to 10E-6. Approximately 98 percent of the ICR value is due to the presence of PCB-1260 detected in the stripped mullet fillet.

Table 6-45 presents the HI value adults who consume fish obtained on a recreational basis from Wallace Creek. The total HI is not in excess of 1.0 indicating that systemic health effects are not expected subsequent to exposure.

6.6 Sources of Uncertainty

Uncertainties are encountered throughout the process of performing the risk assessment. This section discusses the sources of uncertainty involved with the following:

- Analytical data;
- Exposure Assessment;
- Toxicity Assessment;and
- Compounds Not Qualitatively Evaluated

Uncertainties associated with this risk assessment are discussed in detail below.

6.6.1 Analytical Data

The development of a risk assessment depends on the reliability of and uncertainties with the analytical data available to the risk assessor. Analytical data are limited by the precision and accuracy of the analytical method of analysis. For example, contract laboratory program (CLP) methods have, in general, a precision of about plus or minus 50 percent depending on the sample media and the presence of interfering compounds. A value of 100 µg/kg could be as high as 150 µg/kg or as low as 50 µg/kg. In addition, the statistical methods used to compile and analyze the data (mean concentration, standard deviation, and detection frequencies) are subject to the uncertainty in the ability to acquire data.

Data validation serves to reduce some of the inherent uncertainty associated with the analytical data by establishing the usability of the data to the risk assessor who may or may not choose to include the data point in the estimation of risk.

Data qualified as "J" (estimated) is retained for the estimation of risk at OU No. 2. Data can be qualified as estimated for many reasons including a slight exceedence of holding times, high or low surrogate recovery, or intra sample variability. Organic data qualified "B" (detected in blank) or "R" (unreliable) are not used in the estimation of risk due to the unusable nature of the data. Due to the comprehensive sampling and analytical program at OU No. 2, the loss of some data points qualified "B" or "R" does not significantly increase the uncertainty in the estimation of risk.

6.6.2 Exposure Assessment

In performing exposure assessments, uncertainties arise from two main sources. First, the chemical concentration to which a receptor may be exposed must be estimated for every medium of interest. Second, uncertainties arise in the estimation of contaminant intakes resulting from contact by a receptor with a particular medium.

Estimating the contaminant concentration in a given medium to which a human receptor could potentially be exposed can be as simple as deriving the 95th percent upper confidence limit of the mean for a data set. More complex methods of deriving the contaminant concentration is necessary when exposure to COPCs in a given medium occur subsequent to release from another medium and analytical data are not available to characterize the release. In this case, modeling is usually employed to estimate the potential human exposure.

The potential inhalation of fugitive dusts from affected soils was estimated in the risk assessment using USEPAs Rapid Assessment of Exposure to Particulate Emissions from Surface Contaminated Sites (Cowherd et al. 1985). The Cowherd model employs the use of a site-specific particulate emission factor (PEF) for a wind erosion based on source area and vegetative cover. A conservative estimate of the PEF was derived for OU No. 2 by assuming that the entire area is not covered with vegetation and is unlimited in its erosion potential. Modeling results for fugitive dust emission exposure suggest that the potential risk associated with this pathway are not significant.

Modeling the potential release of volatile organics from groundwater during showering was not attempted because groundwater is not currently used as a potable source at OU No. 2. If groundwater in the study area were to be developed as a future potable supply, volatilization of COPCs during showering, washing clothes, cooking, etc. could be a significant human exposure pathway. Risk estimates associated with the potential future potable use of groundwater presented in this risk assessment may underestimate the potential human exposure for the aforementioned reason. However, risk estimates for potential human exposure via groundwater ingestion estimated a risk of greater than 10E-04.

Groundwater samples were analyzed for total (unfiltered) and dissolved (filtered) inorganic contaminants. These samples were obtained from wells which were constructed using USEPA Region IV monitoring well design specifications. Groundwater taken from monitoring wells cannot be considered representative of potable groundwater or groundwater which is obtained from a domestic well "at the tap". The use of total inorganic analytical results overestimates the potential human health risks associated with potable use scenarios. However, for the sake of conservatism total organic results have been used to estimate the potential intake associated with groundwater use.

To estimate an intake, certain assumptions must be made about exposure events, exposure durations, and the corresponding assimilation of contaminants by the receptor. Exposure factors, have been generated by the scientific community and have undergone review by the USEPA. Regardless of the validity of these exposure factors, they have been derived from a range of values generated by studies of limited number of individuals. In all instances, values used in the risk assessment, scientific judgements, and conservative assumptions agree with those of the USEPA. Conservative assumptions designed not to underestimate daily intakes were employed throughout the risk assessment and should err on conservatively, thus adequately protecting human health and allowing the establishment of reasonable clean-up goals.

6.6.3 Toxicity Assessment

In making quantitative estimates of the toxicity of varying dosage of a compound to human receptors, uncertainties arise from two sources. First, data on human exposure and the subsequent effects are usually insufficient, if they are available at all. Human exposure data usually lack adequate concentration estimations and suffer from inherent temporal variability. Therefore, animal studies are often used and new uncertainties arise from the process of extrapolating animal results to humans. Second, to obtain observable effects with a manageable number of experimental animals, high doses of a compound are used over a relatively short time period. In this situation, a high dose means that experimental animal exposures are much greater than human environmental exposures. Therefore, when applying the results of the animal experiment to the human condition, the effects at the high doses must be extrapolated to approximate effects at lower doses.

In extrapolating effects from animals to humans and high doses to low doses, scientific judgement and conservative assumptions are employed. In selecting animal studies for use in dose response calculations, the following factors are considered:

- studies are preferred where the animal closely mimics human pharmacokinetics,
- studies are preferred where dose intake most closely mimics the intake route and duration for humans, and
- studies are preferred which demonstrate the most sensitive response to the compound in question.

For compounds believed to cause threshold effects (i.e., noncarcinogens) safety factors are employed in the extrapolation of effects from animals to humans, and from high to low doses.

The use of conservative assumptions results in quantitative indices of toxicity that are not expected to underestimate potential toxic effects, but may overestimate these effects by an order of magnitude or more.

6.6.4 Compounds Not Quantitatively Evaluated

The following contaminants were not quantitatively evaluated because of toxicity information has not been promulgated by the USEPA:

1,1,1-Trichloroethane
Phenanthrene
Copper
Lead

The toxicity indices for trichloroethene are under review by the USEPA. Updated values will be available in the future.

6.7 Conclusion

Human receptors at OU No. 2 could potentially be exposed to COPCs in more than one medium and through multiple exposure pathways associated with each medium. For example, future resident children could be exposed to COPCs in surface soil by ingestion, dermal contact and inhalation of fugitive dusts. The same child could also be exposed to COPCs in groundwater by ingestion and dermal contact while bathing. The total site risk to the child receptor can be derived by summing the risks associated with surface soils and groundwater and any other media applicable to the child receptor. The following paragraphs present the ICR values and HIs for each human receptor and each medium investigated for this Operable Unit.

6.7.1 Surface Soil - Site 9

Potential human health risks are not of a concern from exposure to any media at Site 9. COPCs were not present in any of the media collected at Site 9. Therefore, potential exposure is not a concern under current or future action.

6.7.2 Surface Soil - Site 6 Lot 201

Future adult and children residents (if base housing was constructed at Lot 201), and current civilian base employees and military personnel could be exposed to COPCs in Lot 201 surface soils through incidental ingestion, dermal contact, and inhalation of particulates. ICR values for children (9.07E-06), adults (4.02E-05), and civilian base employees (4.38E-06) for these exposure pathways are presented in Table 6-46. Combined ICRs, for all receptor groups, are within the USEPA's acceptable risk range of 10E-4 to 10E-6.

Future potential residential development and current civilian base employee exposure pathways (i.e., incidental ingestion of soil, dermal contact with soil, and inhalation of particulates) produced HI values associated with the aforementioned exposure pathways do not exceed unity. Exposure to soils by future or current receptors will not produce noncarcinogenic health effects. Total HI values are presented on Table 6-47.

Continue use of this area as an open storage facility will not pose a significant risk to base personnel from soil exposure. In addition, the possibility of future residential receptors does not pose a significant risk from exposure to soil contaminants.

6.7.3 Surface Soil - Site 6 Lot 203

Future resident children, resident adults and civilian base employees could be exposed to COPCs present in Lot 203 surface soils. Exposure pathways include incidental ingestion, dermal contact, and inhalation of particulates. The ICR values for children (2.79E-06), adults (2.7E-06) and civilian base employees (1.38E-06) are within the USEPA acceptable risk range of 10E-4 to 10E-6.

ICR values for future residential children, adults, and future civilian base employees are presented in Table 6-48.

HI values for the three receptor groups do not exceed 1.0. Therefore, noncarcinogenic health effects associated with ingestion, dermal contact, or inhalation of soil containing COPCs are expected. HI values resident children, resident adults, and civilian base employees are presented in Table 6-49.

Current use of this area as an open storage facility should not pose an increased human health risk from soil exposure. Future potential residential exposure to soil should not present an exceedence of carcinogenic or noncarcinogenic human health risks.

6.7.4 Surface Soil - Site 6 (Wooded Areas and Ravine) and Site 82

Potential incidental ingestion, dermal contact, and inhalation of particulate exposures for child residents, adult residents and civilian base employees were assessed for the Wooded Areas and Ravine within Sites 6 and 82.

The total ICR values are presented in Table 6-50. ICR values for children (1.99E-05), adults (2.54E-05), and civilian base employees (1.31E-05) are within the USEPA's acceptable risk range of 10E-4 to 10E-6.

HIs values presented on Table 6-51 are below 1.0 indicating that systemic health effects to resident children and adults, and civilian base employees are not expected subsequent to exposure.

6.7.5 Groundwater OU No.2 (Sites 6, 9, and 82)

Exposure to on-site groundwater was considered to be a future potential exposure scenario since there are no operating supply wells extracting water from the contaminated plume. Groundwater ingestion and dermal contact were considered for potential exposure to child residents, adult residents, and civilian base employees. ICR values, presented in Table 6-52, indicate that combined risks to children (1.71E-04), adults (3.87E-04) and civilian base employees (2.17E-04) exceed USEPA's upper end (10E-4) target risk range. Therefore, an unacceptable risk to human health would result if groundwater was used as a potable supply without treatment to remove the COPCs.

HI values exceeded unity for resident children (3.0) and resident adults (1.3). The HI for future potential civilian base employees (0.9) did not exceed unity. HIs greater than 1.0 indicate that the potential for noncarcinogenic health effects is possible subsequent to exposure. The HI values are presented in Table 6-53.

6.7.6 Surface Water/Sediment Wallace Creek

Future potential residential adolescents and adults contacting the surface water/sediment along Wallace Creek do not produce ICR values or HIs in excess of USEPA's target risk range of 10E-4 to 10E-6 or an acceptable hazard index of 1.0, respectively. Tables 6-54 and 6-55 summarize the values for potential future residential adolescents and adults.

6.7.7 Surface Water/Sediment Bear Head Creek

Carcinogenic contaminants of concern were not detected in the surface water collected from Bear Head Creek. Therefore, ICR values were not derived for future potential residential adolescents and adults. Carcinogenic contaminants were detected in Bear Head Creek sediment samples.

ICR values for sediment are presented in Table 6-56. ICR values for future potential residential adolescents and adults are within the USEPA's acceptable risk range of 10E-4 to 10E-6.

HI values, presented in Table 6-57, are below 1.0 suggesting that the systemic health effects will not occur subsequent to exposure.

6.7.8 Biota

Local adults can be exposed to site-associated potential COPCs through the ingestion of fish from Wallace Creek or Bear Head Creek. The incremental lifetime cancer risk associated with the ingestion of affected biota exceed the USEPA's target risk range of 10E-4 to 10E-6. The presence of PCB-1260 produces approximately 90 percent of the total ICR. Table 6-58 present the ICR values for the fish ingestion scenario.

HI values for adult fish ingestion are presented in Table 6-59. A total HI value greater than 1.0 suggests that systemic health effects may occur subsequent to exposure. The presence of PCB-1260 produces approximately 85 percent of the total HI.

6.7.9 Total Operable Unit Risk

Table 6-60 presents the total exposure ICR and HI values for the potential future and current human receptors evaluated in the quantitative risk assessment. The future potable use of groundwater is responsible for as much as 94 percent of the total ICR value and 98 percent of the total HI value because of the presence of vinyl chloride, arsenic, and beryllium. The consumption of recreationally caught fish is responsible for approximately 80 percent of the total ICR value for adult residents. The presence of PCB-1260 in fish fillets produces 100 percent of the biota consumption ICR value.

TABLE 6-1

SOIL DATA SUMMARY - SITE 9
FREQUENCY AND RANGE OF ORGANIC POSITIVE DETECTIONS
REMEDIAL INVESTIGATION CTO-0133
MCB CAMP LEJEUNE, NORTH CAROLINA

Contaminant	Surface Soil (0-6 inches)		Subsurface Soil (Below 6 inches)	
	Range of Positive Detections	No. of Positive Detects/No. of Samples	Range of Positive Detections	No. of Positive Detects/No. of Samples
4,4'-DDD	ND	0/7	4.6-50	6/25
4,4'-DDE	13-650	4/7	17-39	5/25
4,4'-DDT	3.3-570	5/7	4.0-62	7/25
Alpha Chlordane	ND	0/7	2.9	1/25
1,1,1-Trichloroethane	1.0	1/7	ND	0/25
Tetrachloroethene	21	1/7	2-3	2/25
Benzo(b)fluoranthene	46	1/7	640	1/25
Acenapthene	ND	0/7	280	1/25
Pyrene	59	1/7	1800	1/25
Chrysene	ND	0/7	400	1/25
Benzo(a)anthracene	ND	0/7	540	1/25
Fluoranthene	ND	0/7	1700	1/25
Anthracene	ND	0/7	140	1/25
Phenanthrene	ND	0/7	41-1200	2/25
Fluorene	ND	0/7	1700	1/25
Benzo(k)fluoranthene	ND	0/7	340	1/25
Dibenzofuran	ND	0/7	73	1/25
Benzo(a)pyrene	ND	0/7	370	1/25
Ideno(1,2,3-cd)pyrene	ND	0/7	190	1/25
Benzo(g,h,i)perylene	ND	0/7	200	1/25

Notes: 1) Concentrations expressed in microgram per kilogram (µg/kg).
2) Organic contaminants were not detected in base-specific background samples.
3) ND - Not detected

TABLE 6-2

SOIL DATA SUMMARY - SITE 9
FREQUENCY AND RANGE OF INORGANIC POSITIVE DETECTIONS
COMPARED TO BASE-SPECIFIC BACKGROUND CONCENTRATIONS
REMEDIAL INVESTIGATION CTO-0133
MCB CAMP LEJEUNE, NORTH CAROLINA

Contaminant	Surface Soil (0-6 inches)			Subsurface Soil (Below 6 inches)		
	Base-Specific Background Concentration	Range of Positive Detections	No. of Positive Detects/No. of Samples	Base-Specific Background Concentration	Range of Positive Detections	No. of Positive Detects/No. of Samples
Aluminum	<90.5 - 1,120	1,510 - 4,510	7/7	672 - 3,600	773 - 8,630	25/25
Antimony	<2.6 - 9.6	ND	0/7	2.5 - <9.7	ND	0/25
Arsenic	<0.56 - 0.91	ND	0/7	<0.61 - <0.65	0.62 - 2.3	5/25
Barium	3.5 - 16.5	4.9 - 8.9	6/7	<4.0 - 7.6	1.9 - 39.2	23/25
Beryllium	<0.06 - <0.2	ND	0/7	<0.05 - <0.02	0.06 - 0.06	2/25
Cadmium	<0.35 - <0.59	ND	0/7	<0.34 - <0.59	0.34 - 0.71	5/25
Calcium	108 - 10,700	179 - 47,100	6/7	<10.7 - 4.410	217 - 8,230	15/25
Chromium	<0.06 - <3.2	1.7 - 5.1	7/7	<3.2 - 6.0	1.8 - 8.8	24/25
Cobalt	<0.37 - <1.8	0.5 - 0.85	3/7	<0.35 - <1.8	0.41 - 0.66	4/25
Copper	<1.1 - 3.1	0.93 - 2.8	3/7	0.65 - 1.2	0.44 - 3.6	18/25
Iron	160 - 684	813 - 1,260	7/7	126 - 833	222 - 3,500	25/25
Lead	2.0 - 3.0	4.1 - 25.7	7/7	1.2 - 1.6	1.3 - 44.9	25/25
Magnesium	<20.2 - 200	64 - 811	4/7	<25.4 - 133	27.8 - 206	15/25
Manganese	<2.0 - 3.0	4.1 - 14.7	7/7	1.2 - 1.6	2.7 - 9.5	15/25
Mercury	<0.02 - <0.12	0.02 - 0.03	4/7	<0.02 - <0.08	0.02 - 0.04	14/25
Nickel	<1.5 - <3.3	ND	0/7	<1.4 - <3.4	1.6 - 2.6	5/25
Potassium	54.5 - 75	20.6 - 152	7/7	<81.6 - 187	18.6 - 246	29/25
Selenium	<0.93 - <1.0	ND	0/7	<1.0	ND	0/25
Silver	<0.37 - 62.0	ND	0/7	<0.35 - <2.0	ND	0/25
Sodium	<9.4 - <39.13	106	1/7	<14.5 - <26.5	ND	0/25
Thallium	<0.37 - <0.41	ND	0/7	<0.40 - <0.44	ND	0/25
Vanadium	<2.1 - 2.8	2.7 - 4.8	7/7	<1.5 - 4.7	1.4 -9.6	23/26
Zinc	<1.1 - 23.1	6.8 - 18.1	4/7	<0.19 - 11.6	1.9 - 18.4	9/25

Notes: 1) Concentrations expressed in milligram per kilogram (mg/kg).
2) ND - Not detected

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TABLE 6-3

SOIL DATA SUMMARY SITE 6 - LOT 201
FREQUENCY AND RANGE OF ORGANIC POSITIVE DETECTIONS
REMEDIAL INVESTIGATION CTO-0133
MCB CAMP LEJEUNE, NORTH CAROLINA

Contaminant	Surface Soil (0-6 inches)		Subsurface Soil (Below 6 inches)	
	Range of Positive Detections	No. of Positive Detects/No. of Samples	Range of Positive Detections	No. of Positive Detects/No. of Samples
1,1,1-Trichloroethane	2 - 42	3/19	4	1/19
1,4-Dichlorobenzene	37 - 38	4/17	36 -51	3/18
4,4'-DDD	0.98 - 180,000	28/96	0.58 - 250,000	20/103
4,4'-DDE	4 - 17,000	43/96	1.4 - 5,200	10/103
4,4'-DDT	3 - 1,200,000	62/96	3.4 - 460,000	35/103
Alpha Chlordane	8.9	1/96	ND	0/103
Benzo(a)anthracene	47	1/17	ND	0/18
Benzo(a)pyrene	78	1/17	ND	0/18
Benzo(b)fluoranthene	61 - 160	3/17	ND	0/18
Benzo(k)fluoranthene	46	1/17	ND	0/18
Chrysene	39 - 88	3/17	ND	0/18
Dieldrin	5.6 - 46	5/96	ND	0/103
Fluoranthene	43 - 94	3/17	ND	0/18
Gamma Chlordane	8.0	1/96	ND	0/103
PCB-1248	1,800	1/87	ND	0/89
PCB-1260	31 - 36	2/87	ND	0/89
Phenanthrene	36	1/17	ND	0/18
Pyrene	38 - 99	3/17	ND	0/18

Notes: 1) Concentrations expressed in microgram per kilogram (μg/kg).
2) Organic contaminants were not detected in base-specific background samples.
3) ND - Not detected

TABLE 6-4

SOIL DATA SUMMARY SITE 6 - LOT 201
FREQUENCY AND RANGE OF INORGANIC POSITIVE DETECTIONS
COMPARED TO BASE-SPECIFIC BACKGROUND CONCENTRATIONS
REMEDIAL INVESTIGATION CTO-0133
MCB CAMP LEJEUNE, NORTH CAROLINA

Contaminant	Surface Soil (0-6 inches)			Subsurface Soil (Below 6 inches)		
	Base-Specific Background Concentration	Range of Positive Detections	No. of Positive Detects/No. of Samples	Base-Specific Background Concentration	Range of Positive Detections	No. of Positive Detects/No. of Samples
Aluminum	<90.5 - 1,120	245-5,520	17/17	672 - 3,600	365-4,540	18/18
Antimony	<2.6 - 9.6	ND	0/17	2.5 - <9.7	ND	0/18
Arsenic	<0.56 - 0.91	0.91 - 9.7	11/17	<0.61 - <0.65	0.65 - 1.8	6/18
Barium	3.5 - 16.5	3.5 - 16.5	16/17	<4.0 - 7.6	1.3 - 8.2	10/18
Beryllium	<0.06 - <0.2	0.22	1/17	<0.05 - <0.02	ND	0/18
Cadmium	<0.35 - <0.59	0.51 - 1.5	9/17	<0.34 - <0.59	0.57 - 0.63	2/18
Calcium	108 - 10,700	402 - 286,000	17/17	<10.7 - 4.410	68 - 17,100	16/18
Chromium	<0.06 - <3.2	3.5 - 21.6	15/17	<3.2 - 6.0	0.84 - 6.7	13/18
Cobalt	<0.37 - <1.8	1.3 - 1.3	2/17	<0.35 - <1.8	ND	0/18
Copper	<1.1 - 3.1	0.75 - 27.8	17/17	0.65 - 1.2	0.44 - 1.7	7/18
Iron	160 - 684	238 - 4,260	17/17	126 - 833	137 - 3,610	18/18
Lead	2.0 - 3.0	1.0 - 78	17/17	1.2 - 1.6	0.87 - 4.2	18/18
Magnesium	<20.2 - 200	26 - 3,980	17/17	<25.4 - 133	13.7 - 259	18/18
Manganese	<2.0 - 3.0	4.2 - 204	17/17	1.2 - 1.6	0.53 - 12.6	18/18
Mercury	<0.02 - <0.12	ND	0/17	<0.02 - <0.08	ND	0/18
Nickel	<1.5 - <3.3	3.7 - 6.4	2/17	<1.4 - <3.4	ND	0/18
Potassium	54.5 - 75	30.6 - 567	16/17	<81.6 - 187	37 - 187	6/18
Selenium	<0.93 - <1.0	2.2	1/17	<1.0	ND	0/18
Silver	<0.37 - 62.0	ND	0/17	<0.35 - <2.0	ND	0/18
Sodium	<9.4 - <39.13	41.6 - 312	14/17	<14.5 - <26.5	10.6 - 31.7	6/18
Thallium	<0.37 - <0.41	ND	0/17	<0.40 - <0.44	ND	0/18
Vanadium	<2.1 - 2.8	1.6 - 18.3	17/17	<1.5 - 4.7	0.83 - 18.1	14/18
Zinc	<1.1 - 23.1	4.6 - 135	14/17	<0.19 - 11.6	1.8 - 11.6	5/18

Notes: 1) Concentrations expressed in milligram per kilogram (mg/kg).
2) ND - Not Detected

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TABLE 6-5

SOIL DATA SUMMARY SITE 6 - LOT 203
FREQUENCY AND RANGE OF ORGANIC POSITIVE DETECTIONS
REMEDIAL INVESTIGATION CTO-0133
MCB CAMP LEJEUNE, NORTH CAROLINA

Contaminant	Surface Soil (0-6 inches)		Subsurface Soil (Below 6 inches)	
	Range of Positive Detections	No. of Positive Detects/No. of Samples	Range of Positive Detections	No. of Positive Detects/No. of Samples
1,1,1-Trichloroethane	2 - 15	2/28	ND	0/35
1,2-Dichlorobenzene	160	1/28	200	1/35
1,4-Dichlorobenzene	34 - 160	3/28	34	1/35
2-Methylnaphthalene	3,100	1/28	70 - 2,400	4/35
4,4'-DDD	4.5 - 180	8/58	21 - 430	4/66
4,4'-DDE	3.8 - 2,100	27/58	4.9 - 470	5/66
4,4'-DDT	3.4 - 1,500	29/58	3.6 - 300	6/66
Acenaphthene	250 - 9,500	2/28	ND	0/35
Alpha Chlordane	2.3 - 72	3/58	ND	0/66
Anthracene	55 - 440	2/28	5,700	1/35
Benzo(a)anthracene	47 - 1,600	8/28	1,000	1/35
Benzo(a)pyrene	49 - 1,800	6/28	210	1/35
Benzo(b)fluoranthene	88 - 2,700	7/28	500	1/35
Benzo(g,h,i)perylene	41 - 1,000	3/28	ND	0/35
Benzo(k)fluoranthene	30 - 1,100	5/28	170	1/35
Carbazole	390 - 910	2/28	690 - 4,300	2/35
Chrysene	50 - 1,300	8/28	1,000	1/35
Dibenzofuran	140 - 890	2/28	63 - 3,500	3/35
Dieldrin	3.6 - 270	4/58	4.4 - 220	4/66
Endosulfan II	4.4	1/58	ND	0/66
Endrin	21 - 130	3/58	ND	0/66
Fluoranthene	39 - 2,300	11/28	5,000	1/35
Fluorene	220 - 940	2/28	810 - 5,100	2/35
Gamma Chlordane	160	1/58	140	1/66
Indeno(1,2,3-cd)pyrene	42 - 1,000	5/28	ND	0/35
Naphthalene	1,400	1/28	78 - 1,500	3/35
PCB-1248	580	1/40	ND	0/49
PCB-1254	170 - 2,100	2/40	ND	0/49
PCB-1260	17 - 42,000	12/40	20 - 29,000	3/49
Pentachlorophenol	520	1/28	ND	0/35
Phenanthrene	60 - 2,000	6/28	120 - 8,700	2/35
Pyrene	42 - 2,800	11/28	3,600	1/35

Notes: 1) Concentrations expressed in microgram per kilogram (µg/kg).
2) Organic contaminants were not detected in base-specific background samples.
3) ND - Not detected

TABLE 6-6

SOIL DATA SUMMARY - SITE 6 - LOT 203
FREQUENCY AND RANGE OF INORGANIC POSITIVE DETECTIONS
COMPARED TO BASE-SPECIFIC BACKGROUND CONCENTRATIONS
REMEDIAL INVESTIGATION CTO-0133
MCB CAMP LEJEUNE, NORTH CAROLINA

Contaminant	Surface Soil (0-6 inches)			Subsurface Soil (Below 6 inches)		
	Base-Specific Background Concentration	Range of Positive Detections	No. of Positive Detects/No. of Samples	Base-Specific Background Concentration	Range of Positive Detections	No. of Positive Detects/No. of Samples
Aluminum	<90.5 - 1,120	495 - 4,170	27/27	672 - 3,600	292 - 5,360	35/35
Antimony	<2.6 - 9.6	13.5 - 51.2	4/27	2.5 - <9.7	2.8	1/35
Arsenic	<0.56 - 0.91	0.39 - 4.9	17/27	<0.61 - <0.65	0.78 - 23.9	16/35
Barium	3.5 - 16.5	2.7 - 47.8	23/27	<4.0 - 7.6	3.9 - 103	20/35
Beryllium	<0.06 - <0.2	0.21	1/27	<0.05 - <0.02	0.06 - 2.7	4/35
Cadmium	<0.35 - <0.59	0.48 - 9.3	10/27	<0.34 - <0.59	0.62 - 5.4	4/35
Calcium	108 - 10,700	44.4 - 92,100	26/27	<10.7 - 4.410	63.3 - 2,560	27/35
Chromium	<0.06 - <3.2	1.1 - 25.2	24/27	<3.2 - 6.0	1.2 - 42.9	31/35
Cobalt	<0.37 - <1.8	0.39 - 2.2	2/27	<0.35 - <1.8	0.53	1/35
Copper	<1.1 - 3.1	1.0 - 7.5	22/27	0.65 - 1.2	0.45 - 339	7/35
Iron	160 - 684	241 - 12,900	27/27	126 - 833	289 - 26,000	33/35
Lead	2.0 - 3.0	4.1 - 4,010	27/27	1.2 - 1.6	1.2 - 111	34/35
Magnesium	<20.2 - 200	12 - 1,680	27/27	<25.4 - 133	9.1 - 317	31/35
Manganese	<2.0 - 3.0	1.9 - 182	27/27	1.2 - 1.6	0.67 - 113	24/35
Mercury	<0.02 - <0.12	0.03 - 1.1	3/27	<0.02 - <0.08	0.13 - 3	3/35
Nickel	<1.5 - <3.3	1.8 - 13.2	4/27	<1.4 - <3.4	1.5 - 20.5	4/35
Potassium	54.5 - 75	27.7 - 195	11/27	<81.6 - 187	17 - 708	23/35
Selenium	<0.93 - <1.0	ND	0/27	<1.0	5.7	1/35
Silver	<0.37 - 62.0	ND	0/27	<0.35 - <2.0	ND	0/35
Sodium	<9.4 - <39.13	9.2 - 460	14/27	<14.5 - <26.5	13.5 - 883	5/35
Thallium	<0.37 - <0.41	ND	0/27	<0.40 - <0.44	0.54	1/35
Vanadium	<2.1 - 2.8	1.1 - 8.2	23/27	<1.5 - 4.7	0.41 - 15.3	32/35
Zinc	<1.1 - 23.1	1.1 - 604	24/27	<0.19 - 11.6	0.78 - 367	20/35

Notes: 1) Concentrations expressed in milligram per kilogram (mg/kg).
2) ND - Not Detected

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TABLE 6-7

SOIL DATA SUMMARY SITE 6 (WOODED AREAS AND RAVINE) AND SITE 82
FREQUENCY AND RANGE OF ORGANIC POSITIVE DETECTIONS
REMEDIAL INVESTIGATION CTO-0133
MCB CAMP LEJEUNE, NORTH CAROLINA

Contaminant	Surface Soil (0-6 inches)		Subsurface Soil (Below 6 inches)	
	Range of Positive Detections	No. of Positive Detects/No. of Samples	Range of Positive Detections	No. of Positive Detects/No. of Samples
1,1,1-Trichloroethane	1 - 2	3/83	1.0	1/126
1,1,2,2-Tetrachloroethane	55,000	1/83	ND	0/126
1,2-Dichloroethene	1,500	1/83	5.0	1/126
1,4-Dichlorobenzene	39 - 74	11/83	49 - 300	3/126
2-Methylnaphthalene	42	1/83	37 - 11,000	2/126
4,4'-DDD	10 - 12,000	6/83	16	1/126
4,4'-DDE	2.2 - 4,200	34/83	3.5 - 67	9/126
4,4'-DDT	3.4 - 6,400	40/83	4 - 77	9/126
4-Methylphenol	120	1/83	ND	0/126
Acenaphthylene	84	1/83	ND	0/126
Acenapthene	36 - 370	3/83	ND	0/126
Alpha Chlordane	3.6	1/83	ND	0/126
Anthracene	41 - 260	4/83	ND	0/126
Benzene	850	1/83	1.0	1/126
Benzo(a)anthracene	39 - 2,200	11/83	45 - 96	2/126
Benzo(a)pyrene	40 - 1,500	11/83	55 - 58	2/126
Benzo(b)fluoranthene	54 - 2,200	14/83	110	2/126
Benzo(g,h,i)perylene	40 - 1,300	7/83	ND	0/126
Benzo(k)fluoranthene	25 - 490	9/83	ND	0/126
Bromomethane	670 - 3,700	2/83	4 - 1,300	3/126
Chloromethane	620 - 9,800	2/83	490	1/126
Chrysene	44 - 1,600	12/83	68	1/126
Dibenz(a,h)anthracene	43 - 380	3/83	ND	0/126
Dibenzofuran	82 - 120	2/83	ND	0/126
Dieldrin	4.6 - 87	15/83	3.4 - 280	3/126

Notes: 1) Concentrations expressed in microgram per kilogram (µg/kg).
2) Organic contaminants were not detected in site-specific background samples.
3) ND - Not Detected

TABLE 6-7 (Continued)

SOIL DATA SUMMARY SITE 6 (WOODED AREAS AND RAVINE) AND SITE 82
FREQUENCY AND RANGE OF ORGANIC POSITIVE DETECTIONS
REMEDIAL INVESTIGATION CTO-0133
MCB CAMP LEJEUNE, NORTH CAROLINA

Contaminant	Surface Soil (0-6 inches)		Subsurface Soil (Below 6 inches)	
	Range of Positive Detections	No. of Positive Detects/No. of Samples	Range of Positive Detections	No. of Positive Detects/No. of Samples
Endrin	5.6 - 240	2/83	ND	0/126
Fluoranthene	40 - 2,000	15/83	61 - 85	3/126
Fluorene	130 - 200	2/83	ND	0/126
Ideno(1,2,3-cd)pyrene	45 - 1,300	5/83	ND	0/126
Naphthalene	71 - 140	2/83	9,600	1/126
PCB-1260	28 - 26,000	7/83	46 - 100	4/126
Phenanthrene	46 - 1,500	2/83	31 - 70	2/126
Phenol	37 - 160	4/83	ND	0/126
Pyrene	72 - 2,700	13/83	63 - 110	3/126
Tetrachloroethene	2,600 - 7,000	2/83	9 - 11,000	2/126
Toluene	120	1/83	1-34	4/126
Trichloroethene	4,600	1/83	1.0	1/126

Notes: 1) Concentrations expressed in microgram per kilogram (μg/kg).
2) Organic contaminants were not detected in site-specific background samples.
3) ND - Not Detected

TABLE 6-8

SOIL DATA SUMMARY SITE 6 (WOODED AREAS AND RAVINE) AND SITE 82
FREQUENCY AND RANGE OF INORGANIC POSITIVE DETECTIONS
COMPARED TO BASE-SPECIFIC BACKGROUND CONCENTRATIONS
REMEDIAL INVESTIGATION CTO-0133
MCB CAMP LEJEUNE, NORTH CAROLINA

	Surface Soil (0-6 inches)			Subsurface Soil (Below 6 inches)		
Contaminant	Base-Specific Background Concentration	Range of Positive Detections	No. of Positive Detects/No. of Samples	Base-Specific Background Concentration	Range of Positive Detections	No. of Positive Detects/No. of Samples
Aluminum	<90.5 - 1,120	177 - 19,200	81/82	672 - 3,600	135 - 15,500	126/126
Antimony	<2.6 - 9.6	3.5 - 13.2	2/82	2.5 - <9.7	2.4 - 4.4	4/126
Arsenic	<0.56 - 0.91	0.49 - 26.3	36/82	<0.61 - <0.65	0.56 - 25.4	37/126
Barium	3.5 - 16.5	1.1 - 1,410	27/82	<4.0 - 7.6	0.91 - 1,100	84/126
Beryllium	<0.06 - <0.2	0.06 - 2.2	13/82	<0.05 - <0.02	0.06 - 3.1	17/126
Cadmium	<0.35 - <0.59	0.4 - 51.9	30/82	<0.34 - <0.59	0.33 - 2.5	25/126
Calcium	108 - 10,700	59.6 - 174,000	70/82	<10.7 - 4.410	10.4 - 5,640	53/126
Chromium	<0.06 - <3.2	0.72 - 54.6	55/82	<3.2 - 6.0	0.73 - 31.6	107/126
Cobalt	<0.37 - <1.8	0.34 - 13.7	14/82	<0.35 - <1.8	0.41 - 6.8	11/126
Copper	<1.1 - 3.1	0.39 - 348	38/82	0.65 - 1.2	0.33 - 733	45/126
Iron	160 - 684	113 - 149,000	78/82	126 - 833	57.4 - 19,200	107/126
Lead	2.0 - 3.0	2 - 1,710	71/82	1.2 - 1.6	0.89 - 1,610	89/126
Magnesium	<20.2 - 200	12.3 - 2,580	72/82	<25.4 - 133	8.2 - 637	97/126
Manganese	<2.0 - 3.0	1.1 - 700	70/82	1.2 - 1.6	0.2 - 2,990	72/126
Mercury	<0.02 - <0.12	0.02 - 3.9	35/82	<0.02 - <0.08	0.02 - 2	26/126
Nickel	<1.5 - <3.3	1.7 - 79.4	15/82	<1.4 - <3.4	1.6 - 11.7	12/126
Potassium	54.5 - 75	15 - 2,560	71/82	<81.6 - 187	14.2 - 1,270	94/126
Selenium	<0.93 - <1.0	0.9 - 5.8	8/82	<1.0	1.4 - 10.5	2/126
Silver	<0.37 - 62.0	0.47 - 0.49	2/82	<0.35 - <2.0	0.39	1/126
Sodium	<9.4 - <39.13	9.6 - 809	18/82	<14.5 - <26.5	10.1 - 50.6	10/126
Thallium	<0.37 - <0.41	0.35 - 0.57	2/82	<0.40 - <0.44	0.41 - 0.76	2/126
Vanadium	<2.1 - 2.8	0.36 - 35.7	72/82	<1.5 - 4.7	0.41 - 35.6	108/126
Zinc	<1.1 - 23.1	1.6 - 16,600	39/82	<0.19 - 11.6	0.73 - 2,450	18/126

Notes: 1) Concentrations expressed in milligram per kilogram (mg/kg).

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TABLE 6-9

GROUNDWATER DATA SUMMARY
OPERABLE UNIT NO. 2
FREQUENCY AND RANGE OF POSITIVE DETECTIONS
COMPARED TO NORTH CAROLINA AND FEDERAL GROUNDWATER CRITERIA
REMEDIAL INVESTIGATION CTO-0133
MCB CAMP LEJEUNE, NORTH CAROLINA

Contaminant	Groundwater Criteria				Contaminant Frequency/Range		Comparison to Criteria			
	North Carolina NCWQS(1)	Federal MCLs (2)	Federal Health Advisories (3) 10 kg Child	Federal Health Advisories (3) 70 kg Adult	No. of Positive Detects/ No. of Samples	Range of Positive Detects	No. of Positive Detects above NCWQS	No. of Positive Detects above MCLs	No. of Positive Detects above Health Advisories 10 kg Child	No. of Positive Detects above Health Advisories 70 kg Adult
1,1,1-Trichloroethane	200	200	10,000	10,000	1/49	0.5	0	0	0	0
1,1,2,2-Tetrachloroethene	--	--	--	--	2/49	1.0 - 6.9	NA	NA	NA	NA
1,1,2-Trichloroethane	--	5.0	600	1,000	1/49	0.5	NA	0	0	0
1,1-Dichloroethene	7.0	7.0	2,000	4,000	1/49	0.6	0	0	0	0
1,2-Dichloroethane	0.38	5.0	700	2,600	1/49	0.6	1	0	0	0
Antimony	--	6.0	15	15	2/49	15.3 - 15.6	NA	2	2	2
Arsenic	50	50	--	--	20/49	3.0 - 67.8	1	1	NA	NA
Barium	1,000	2,000	--	--	42/49	20.4 - 1,060	2	0	NA	NA
B[illegible]llium	--	4.0	30,000	20,000	9/49	0.55 - 7.5	NA	2	0	0
[illegible]odichloromethane	--	100	7,000	13,000	1/49	0.6	NA	0	0	0
Cadmium	5.0	5.0	40	20	0/49	ND	NA	NA	NA	NA
Chlorobenzene	300	--	--	--	1/49	110 - 110	0	NA	NA	NA
Chromium	50	100	1,000	800	33/49	5.2 - 214	12	11	0	0
Cobalt	--	--	--	--	10/49	2.3 - 10.9	NA	NA	NA	NA
Copper	1,000	1,300	--	--	13/49	14 - 175	0	0	NA	NA
Cyanide	154	200	200	800	0/49	ND	NA	NA	NA	NA
Ethylbenzene	29	700	30,000	3,000	1/49	48	1	0	0	0
Lead	50	15	--	--	29/49	1.0 - 200	8	15	NA	NA
Manganese	50	50 (4)	--	--	44/49	21 - 362	13	13	NA	NA
Mercury	1.1	2.0	--	2.0	14/49	0.07 - 1.4	1	0	NA	0
Nickel	150	100	1,000	1,700	15/49	11.1 - 41.9	0	0	0	0
Phenol	--	--	6,000	20,000	8/49	1.0 - 22	NA	NA	0	0
T-1,2-Dichloroethene	70	100	20,000	6,000	4/49	16 - 5,800	3	3	0	0
Tetrachloroethene	0.7	5.0	2,000	5.000	6/49	0.9 - 630	6	2	0	0
Total Xylenes	400	10,000	40,000	100,000	2/49	0.9 - 1.4	0	0	0	0
Trichloroethene	2.8	5.0	--	--	10/49	0.5 - 58,000	4	4	NA	NA
Vanadium	--	--	--	--	33/49	2.6 - 330	NA	NA	NA	NA
Vinyl Chloride	0.015	2.0	3,000	50	1/49	1.6	1	0	0	0
Zinc	5,000	5,000 (4)	6,000	12,000	20/49	13.9 - 1,620	0	0	0	0

Notes:
(1) NCWQS - North Carolina Water Quality Standards for Groundwater
(2) MCL - Maximum Contaminant Level
(3) Longer Term Health Advisories for 10 kg Child and 70 kg Adult
(4) SMCL - Secondary Maximum Contaminant Level
(5) All concentrations expressed in µg/L
(6) -- No ARAR published
(7) NA - Not applicable
(8) ND - Not detected

TABLE 6-10

SURFACE WATER DATA SUMMARY
SITE 6 - WALLACE CREEK
FREQUENCY AND RANGE OF DETECTIONS
COMPARED TO NORTH CAROLINA AND FEDERAL SURFACE WATER CRITERIA
REMEDIAL INVESTIGATION CTO-0133
MCB CAMP LEJEUNE, NORTH CAROLINA

Contaminant	Surface Water Criteria			Contaminant Frequency/Range		Comparison to Criteria		
	North Carolina NCWQS(1)	Federal AWQCs (2)		No. of Positive Detects/No. of Samples	Range of Positive Detections	No. of Positive Detects Above NCWQS	No. of Positive Detects above AWQCs	
		Acute	Chronic				Acute	Chronic
Arsenic	50	--	--	1/28	3.7	0	NA	NA
Barium	--	--	--	6/28	16 - 22.6	NA	NA	NA
Cadmium	5.0	43	9.3	2/28	3.2 - 17.4	1	0	1
Chromium	20	1,100	50	1/28	4.9	0	0	0
Copper	3	29	--	6/28	3 - 209	5	5	NA
Lead	25	220	8.5	9/28	1.2 - 10.4	0	0	1
Manganese	--	--	--	26/28	8.2 - 25	NA	NA	NA
Mercury	0.025	2.1	0.025	3/28	0.24 - 0.52	3	0	3
Nickel	8.3	75	8.3	4/28	102 - 1,380	4	4	4
T-1,2-Dichloroethene	--	--	--	13/28	2 - 85	NA	NA	NA
Tetrachloroethene	--	10,200	450	3/28	1 - 4	NA	0	0
Toluene	--	6,300	5,000	4/28	1 - 3	NA	0	0
Trichloroethene	--	2,000	--	12/28	3 - 98	NA	0	NA
Vanadium	--	--	--	9/28	1.9 - 3.3	NA	NA	NA
Vinyl Chloride	--	--	--	1/28	6	NA	NA	NA
Zinc	86	95	86	10/28	7.3 - 111	2	1	1

(1) NCWQS - North Carolina Water Quality Standards for Saltwater Aquatic Life
(2) AWQC - Ambient Water Quality Standards for the Protection of Saltwater
(3) -- No ARAR published
(4) All concentrations expressed in microgram per liter (µg/L)
(5) NA - Not Applicable

TABLE 6-11

SURFACE WATER DATA SUMMARY
SITE 6 - BEAR HEAD CREEK
FREQUENCY AND RANGE OF DETECTIONS
COMPARED TO NORTH CAROLINA AND FEDERAL SURFACE WATER CRITERIA
REMEDIAL INVESTIGATION CTO-0133
MCB CAMP LEJEUNE, NORTH CAROLINA

Contaminant	Surface Water Criteria			Contaminant Frequency/Range		Comparison to Criteria		
	North Carolina NCWQS(1)	Federal AWQCs (2)		No. of Positive Detects/No. of Samples	Range of Positive Detections	No. of Positive Detects Above NCWQS	No. of Positive Detects above AWQCs	
		Acute	Chronic				Acute	Chronic
Arsenic	50	--	--	0/14	ND	NA	NA	NA
Barium	--	--	--	14/14	13.4 - 36	NA	NA	NA
Cadmium	5.0	43	9.3	0/14	ND	NA	NA	NA
Chromium	20	1,100	50	3/14	4.4 - 8	0	0	0
Copper	3	2.9	--	3/14	4.0 - 55.8	3	3	NA
Lead	25	220	8.5	10/14	1.5 - 8.2	0	0	0
Manganese	--	--	--	14/14	6.2 - 65	NA	NA	NA
Mercury	0.025	2.1	0.025	2/14	0.05 - 0.34	2	0	2
Nickel	83	75	8.3	2/14	8.0 - 244	1	1	1
Vanadium	--	--	--	3/14	2.0 - 3.0	NA	NA	NA
Zinc	86	95	86	3/14	6.2 - 30.7	0	0	0

(1) NCWQS - North Carolina Water Quality Standards for Saltwater Aquatic Life
(2) AWQC - Ambient Water Quality Standards for the Protection of Saltwater
(3) -- No ARAR published
(4) All concentrations expressed in microgram per liter (µg/L)
(5) NA - Not applicable
(6) ND - Not detected

TABLE 6-12

SURFACE WATER DATA SUMMARY
SITE 6 - RAVINE
FREQUENCY AND RANGE OF DETECTIONS
COMPARED TO NORTH CAROLINA AND FEDERAL SURFACE WATER CRITERIA
REMEDIAL INVESTIGATION CTO-0133
MCB CAMP LEJEUNE, NORTH CAROLINA

Contaminant	Surface Water Criteria			Contaminant Frequency/Range		Comparison to Criteria		
	North Carolina NCWQS(1)	Federal AWQCs (2)		No. of Positive Detects/No. of Samples	Range of Positive Detections	No. of Positive Detects Above NCWQS	No. of Positive Detects above AWQCs	
		Acute	Chronic				Acute	Chronic
Arsenic	50	--	--	3/6	2.2 - 10.5	0	NA	NA
Barium	--	--	--	6/6	37.1 - 91	NA	NA	NA
Cadmium	2.0	3.9	1.1	2/6	3.7 - 4.3	2	1	2
Chromium	50	16	11	2/6	4.2 - 6.5	0	0	0
Copper	7	18	12	6/6	4.7 - 9.0	4	0	0
Lead	25	83	3.2	6/6	1.9 - 12.2	0	0	4
Manganese	--	--	--	6/6	38.6 - 597	NA	NA	NA
Mercury	0.012	2.4	0.012	0/6	ND	NA	NA	NA
Nickel	88	1,400	160	0/6	ND	NA	NA	NA
Vanadium	--	--	--	1/6	6.2	NA	NA	NA
Zinc	50	120	110	6/6	72.7 - 495	6	4	5

(1) NCWQS - North Carolina Water Quality Standards for the Protection of Aquatic Life
(2) AWQC - Ambient Water Quality Standards for the Protection of Fresh Water
(3) -- No ARAR published
(4) All concentrations expressed in microgram per liter (µg/L)
(5) NA - Not applicable
(6) ND - Not detected

TABLE 6-13

SEDIMENT DATA SUMMARY
SITE 6 - WALLACE CREEK
FREQUENCY AND RANGE OF POSITIVE DETECTIONS
COMPARED TO USEPA REGION IV SEDIMENT SCREENING VALUES
REMEDIAL INVESTIGATION CTO-0133
MCB CAMP LEJEUNE, NORTH CAROLINA

	Sediment Screening Value		Contaminant Frequency/Range		Comparison to Screening Values	
Contaminant	ER-L(1)	ER-M (2)	No. of Positive Detects/No. of Samples	Range of Positive Detections	No. of Positive Detects above ER-L	No. of Positive Detects above ER-M
4,4'-DDD	2.0	20	15/33	7.4 - 200	15	12
4,4'-DDT	1.0	7.0	3/33	200 - 2,000	3	3
4,4-DDE	2.0	15	14/33	5.9 - 83	14	11
Arsenic	33	85	15/33	1.0 - 10.2	0	0
Benzo(a)anthracene	230	1,600	4/33	67 - 210	0	0
Benzo(a)pyrene	400	2,500	6/33	63 - 1,600	3	0
Chromium	80	145	27/33	1.2 - 28.5	0	0
Chrysene	400	2,800	3/33	74 - 230	0	0
Copper	70	390	25/33	0.43 -53,200	2	1
Dieldrin	0.02	8.0	1/33	4.8	1	0
Fluoranthene	600	3,600	11/33	94 - 760	1	0
Lead	35	110	33/33	1.5 - 314	6	2
Nickel	30	50	5/33	2.7 - 10.7	0	0
Total PCBs (3)	50	400	14/33	31 - 2,100	12	6
Pyrene	350	2,200	12/33	95 - 810	2	0
Zinc	120	270	19/33	6.2 - 926	4	2

(1) ER-L - Effects Range Low
(2) ER-M - Effects Range Median
(3) Sediment Screening Value established for Total PCBs
(4) Organic concentrations reported in µg/kg, Inorganic concentrations reported in mg/kg
(5) Only contaminants with Screening Values are presented on Table

TABLE 6-14

SEDIMENT DATA SUMMARY
SITE 6 - BEAR HEAD CREEK
FREQUENCY AND RANGE OF POSITIVE DETECTIONS
COMPARED TO USEPA REGION IV SEDIMENT SCREENING VALUES
REMEDIAL INVESTIGATION CTO-0133
MCB CAMP LEJEUNE, NORTH CAROLINA

	Sediment Screening Value		Contaminant Frequency/Range		Comparison to Screening Values	
Contaminant	ER-L(1)	ER-M (2)	No. of Positive Detects/No. of Samples	Range of Positive Detections	No. of Positive Detects above ER-L	No. of Positive Detects above ER-M
4,4'-DDD	2.0	20	10/20	8.4 - 220	10	7
4,4'-DDE	2.0	15	11/20	5.7 - 68	11	10
4,4'-DDT	1.0	7.0	8/20	6.6 - 38	8	6
Arsenic	33	85	8/20	0.54 - 6.1	0	0
Benzo(a)pyrene	400	2,500	6/20	93 - 640	0	0
Cadmium	5.0	9.0	11/20	0.54 - 4.7	0	0
Chromium	80	145	18/20	2.3 - 16.4	0	0
Copper	70	390	13/20	1.2 - 28.1	0	0
Lead	35	110	20/20	2.5 - 70.4	5	0
Total PCBs (3)	50	400	10/20	51 - 370	10	0
Pyrene	350	2,200	2/20	60 - 76	0	0
Zinc	120	270	15/20	6.4 - 82.4	0	0

(1) ER-L - Effects Range Low
(2) ER-M - Effects Range Median
(3) Sediment Screening Value established for Total PCBs
(4) Organic concentrations reported in µg/kg, Inorganic concentrations reported in mg/kg
(5) Only contaminants with Screening Values are presented on Table

TABLE 6-15

SEDIMENT DATA SUMMARY
SITE 6 - RAVINE
FREQUENCY AND RANGE OF POSITIVE DETECTIONS
COMPARED TO USEPA REGION IV SEDIMENT SCREENING VALUES
REMEDIAL INVESTIGATION CTO-0133
MCB CAMP LEJEUNE, NORTH CAROLINA

	Sediment Screening Value		Contaminant Frequency/Range		Comparison to Screening Values	
Contaminant	ER-L(1)	ER-M (2)	No. of Positive Detects/No. of Samples	Range of Positive Detections	No. of Positive Detects above ER-L	No. of Positive Detects above ER-M
4,4'-DDD	2.0	20	6/11	4.1 - 45	6	4
4,4'-DDE	2.0	15	6/11	23 - 120	6	6
4,4'-DDT	1.0	7.0	8/11	14 -210	8	8
Arsenic	33	85	4/11	0.61 - 4.3	0	0
Benzo(a)anthracene	230	1,600	3/11	43 - 1,100	2	0
Benzo(a)pyrene	400	2,500	3/11	70 - 1,000	2	0
Cadmium	5.0	9.0	9/11	0.53 - 5.9	0	0
Chromium	80	145	6/11	2.0 - 17.7	0	0
Chrysene	400	2,800	3/11	59 - 1,100	2	0
Copper	70	390	11/11	2.6 - 67.5	0	0
Dieldrin	0.02	8.0	2/11	8.1 - 43	2	2
Fluoranthene	600	3,600	3/11	84 - 1,500	2	0
Lead	35	110	11/11	2.1 - 105	0	0
Mercury	0.15	1.3	9/11	0.03 - 0.75	4	0
Total PCBs (3)	50	400	6/11	29 - 360	5	0
Phenanthrene	225	1,380	3/11	50 - 1,600	2	2
Pyrene	350	2,200	4/11	96 - 2,100	2	0
Zinc	120	270	11/11	20.3 - 408	4	1

(1) ER-L - Effects Range Low
(2) ER-M - Effects Range Median
(3) Sediment Screening Value established for Total PCBs
(4) Organic concentrations reported in µg/kg, Inorganic concentrations reported in mg/kg
(5) Only contaminants with Screening Values are presented on Table

TABLE 6-16

SUMMARY OF COPCs IN ENVIRONMENTAL MEDIA OF INTEREST
REMEDIAL INVESTIGATION CTO-0133
MCB CAMP LEJEUNE, NORTH CAROLINA

Contaminant	Soil	Groundwater	Surface Water	Sediment	Air	Biota
Bromodichloromethane		X				
1,2-Dichloroethane		X				
1,1-Dichloroethene		X				
1,1,2-Trichloroethane		X				
Chlorobenzene		X				
T-1,2-Dichloroethene		X	X	X		
Tetrachloroethene		X	X			
Ethylbenzene		X				
Total Xylenes		X		X		
1,1,2,2-Tetrachloroethane		X				
1,1,1-Trichloroethane		X				
Trichloroethene		X	X			
Vinyl Chloride		X	X			
Toluene			X	X		
1,4-Dichlorobenzene	X				X	
Chrysene	X			X		
Acenaphthene	X					
Phenanthrene	X					
Anthracene	X					
Fluoranthene	X			X		
Pyrene	X			X		
Benzo(a)anthracene	X			X		
Benzo(b)fluoranthene	X			X		
Benzo(k)fluoranthene	X					
Benzo(a)pyrene	X			X		
Indeno(1,2,3-cd)pyrene	X					
Dibenz(a,h)anthracene	X					
Phenol		X				
4,4'-DDD	X			X		X
4,4'-DDE	X			X		X
4,4'-DDT	X			X	X	X
Dieldrin	X			X	X	
Endrin	X					X
Total PCBs	X			X		X
Antimony		X				
Arsenic	X	X	X	X	X	
Barium	X	X	X	X		
Beryllium		X	X	X		X
Cadmium	X		X	X	X	X
Chromium	X	X	X	X	X	
Copper		X	X	X		
Lead		X	X	X		
Manganese	X	X	X	X	X	
Mercury		X	X			
Nickel		X	X	X		
Vanadium	X	X	X	X		
Zinc	X	X	X	X		X

X - Contaminant Retained a COPC

TABLE 6-17

**SUMMARY OF HUMAN RECEPTORS,
EXPOSURE PATHWAYS AND THE RATIONALE
FOR THEIR SELECTION
REMEDIAL INVESTIGATION CTO-0133
MCB CAMP LEJEUNE, NORTH CAROLINA**

Medium	Receptor Group	Exposure Pathway	Retained/ Not Retained	Rationale
Onsite Surface Soil	Trespassing Sportsmen	Ingestion Dermal Contact Inhalation	Not Retained Not Retained Not Retained	Areas of concern are fenced with limited access hunting not allowed in areas.
	Civilian Personnel	Ingestion Dermal Contact Inhalation	Retained Retained Retained	Exposure to surface soils would predominate as a result of employment activities.
	Onsite Future Residents Child/Adult	Ingestion Dermal Contact Inhalation	Retained Retained Retained	Exposure to surface soils would predominate as a result of daily activities.
Onsite Subsurface Soil	Trespassing Sportsmen	Ingestion Dermal Contact	Not Retained Not Retained	Areas of concern are fenced with limited access hunting not allowed in areas.
	Military Personnel/ Construction Workers	Ingestion Dermal Contact	Not Retained Not Retained	Excavation of soils is not expected as future potential exposure pathway.
Onsite Groundwater	Onsite Future Residents Child/Adult	Ingestion Dermal Contact Inhalation	Retained Retained Not Retained	No current residential receptor of onsite groundwater. However, future potential.
	Civilian Personnel	Ingestion Dermal Contact Inhalation	Retained Retained Not Retained	State groundwater criteria established in the Consent Order provides a basis for qualitative comparisons and subsequent remedial decision making.
Surface Water/ Sediments	Adults/Adolescents	Ingestion Dermal Contact	Retained Retained	Adults may frequent the creeks for recreational fishing.
	Construction/Utility Workers	Ingestion Dermal Contact	Not Retained Not Retained	Not likely to contact waterbodies during working activities.
Biota	Adults	Ingestion of Aquatic Biota	Retained	Fishing could occur on a limited basis in the onsite creeks.

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TABLE 6-18

EXPOSURE ASSESSMENT SUMMARY - SURFACE SOIL
REMEDIAL INVESTIGATION CTO-0133
MCB CAMP LEJEUNE, NORTH CAROLINA

Incidental Ingestion of Surface Soil - Base Personnel, Child, Adult			
Input Parameter	Description	Value	Rationale
C	Exposure Concentration	95% UCL (mg/kg)	USEPA, May 1992
IR	Ingestion Rate	Base Personnel 100 mg/day Child 200 mg/day Adult 100 mg/day	USEPA, December 1989
CF	Conversion Factor	10E-6 kg/mg	USEPA, December 1989
Fi	Fraction Ingested from Contaminated Source	100%	Conservative Professional Judgement
EF	Exposure Frequency	Base Personnel 250 days/yr Child 350 days/yr Adult 350 days/yr	USEPA, December 1989
ED	Exposure Duration	Base Personnel 25 years Child 6 years Adult 30 years	USEPA, March 1991
BW	Body Weight	Base Personnel 70 kg Child 15 kg Adult 70 kg	USEPA, December 1989
AT_c	Averaging Time Carcinogen	All 25,550 days	USEPA, December 1989
AT_{nc}	Averging Time Noncarcinogen	Base Personnel 9,125 days Child 2,190 days Adult 10,950 days	USEPA, December 1989

TABLE 6-19

EXPOSURE ASSESSMENT SUMMARY - SURFACE SOIL
REMEDIAL INVESTIGATION CTO-0133
MCB CAMP LEJEUNE, NORTH CAROLINA

Dermal Contact with Surface Soil - Base Personnel, Child, Adult			
Input Parameter	Description	Value	Rationale
C	Exposure Concentration	95% UCL (mg/kg)	USEPA, May 1992
CF	Conversion Factor	10E-6 kg/mg	USEPA, December 1989
SA	Exposed Surface Area of Skin Available for Contact	Base Personnel 4,300 cm^2 Child 1,800 cm^2 Adult 5,300 cm^2	USEPA, January 1992
AF	Soil-to-Skin Adherence Factor	1.0 mg/cm^2	USEPA, Region IV, 1992
ABS	Absorption Factor (dimensionless)	Volatiles 0.10 Semivolatiles/ Pesticides 0.05 PCBs 0.03 Metals 0.01	Accounts for desorption from soil and percutaneous absorption (Feldman and Maibach, 1970; USEPA, October 1984; Wester and Maibach, 1985)
EF	Exposure Frequency	Base Personnel 250 days/yr Child 350 days/yr Adult 350 days/yr	USEPA, December 1989
ED	Exposure Duration	Base Personnel 25 years Child 6 years Adult 30 years	USEPA, December 1989
BW	Body Weight	Base Personnel 70 kg Child 15 kg Adult 70 kg	USEPA, December 1989
AT_c	Averaging Time Carcinogen	All 25,550 days	USEPA, December 1989
AT_{nc}	Averging Time Noncarcinogen	Base Personnel 9,125 days Child 2,190 days Adult 10,950 days	USEPA, December 1989

TABLE 6-20

EXPOSURE ASSESSMENT SUMMARY - SURFACE SOIL
REMEDIAL INVESTIGATION CTO-0133
MCB CAMP LEJEUNE, NORTH CAROLINA

Inhalation of Particulates - Base Personnel, Child, Adult			
Input Parameter	Description	Value	Rationale
C	Exposure Concentration	95% UCL (mg/kg)	USEPA, May 1992
EF	Exposure Frequency	Base Personnel 250 days/yr Child 350 days/yr Adult 350 days/yr	USEPA, December 1989
ED	Exposure Duration	Base Personnel 25 years Child 6 years Adult 30 years	USEPA, March 1991
ET	Exposure Time	Base Personnel 8 hr/day Child 24 hr/day Adult 16 hr/day	USEPA, December 1989
IR	Inhalation Rate	Base Personnel 1.25 m^3/hr Child 0.43 m^3/hr Adult 0.83 m^3/hr	USEPA, December 1989
BW	Body Weight	Base Personnel 70 kg Child 15 kg Adult 70 kg	USEPA, December 1989
AT_c	Averaging Time Carcinogen	All 25,550 days	USEPA, December 1989
AT_{nc}	Averging Time Noncarcinogen	Base Personnel 9,125 days Child 2,190 days Adult 10,950 days	USEPA, December 1989
PEF	Site-specific Particulate Emission Factor	5.0×10^8 m^3/kg	USEPA, December 1989 Cowherd, 1985

TABLE 6-21

EXPOSURE ASSESSMENT SUMMARY - GROUNDWATER
REMEDIAL INVESTIGATION CTO-0133
MCB CAMP LEJEUNE, NORTH CAROLINA

Ingestion of Groundwater - Base Personnel, Child, Adult			
Input Parameter	Description	Value	Rationale
C	Exposure Concentration	95% UCL (mg/L)	USEPA, May 1992
IR	Ingestion Rate	Base Personnel 2 L/day Child 1 L/day Adult 2 L/day	USEPA, December 1989
EF	Exposure Frequency	Base Personnel 250 days/yr Child 350 days/yr Adult 350 days/yr	USEPA, December 1989
ED	Exposure Duration	Base Personnel 25 years Child 6 years Adult 30 years	USEPA, March 1991
BW	Body Weight	Base Personnel 70 kg Child 15 kg Adult 70 kg	USEPA, December 1989
AT_c	Averaging Time Carcinogen	All 25,550 days	USEPA, December 1989
AT_{nc}	Averging Time Noncarcinogen	Base Personnel 9,125 days Child 2,190 days Adult 10,950 days	USEPA, December 1989

TABLE 6-22

EXPOSURE ASSESSMENT SUMMARY - GROUNDWATER
REMEDIAL INVESTIGATION CTO-0133
MCB CAMP LEJEUNE, NORTH CAROLINA

Dermal Contact with Groundwater - Base Personnel, Child, Adult			
Input Parameter	Description	Value	Rationale
C	Exposure Concentration	95% UCL (mg/L)	USEPA, December 1989
SA	Exposed Surface Area of Skin Available for Contact	Adult 18,150 cm^2 Child 7,880 cm^2	USEPA, December 1989
PC	Permeability Constant	Chemical Specific	USEPA, January 1992
ET	Exposure Time	All 0.25 hr/day	Fifteen minute shower or bath; professional judgment
EF	Exposure Frequency	Base Personnel 250 days/yr Child 350 days/yr Adult 350 days/yr	Shower/bath every day (USEPA, March 25, 1991)
ED	Exposure Duration	Base Personnel 25 years Child 6 years Adult 30 years	USEPA, December 1989
CF	Conversion Factor	1L/1000 cm^3	USEPA, December 1989
BW	Body Weight	Base Personnel 70 kg Child 15 kg Adult 70 kg	USEPA, December 1989
AT_c	Averaging Time Carcinogen	All 25,550 days	USEPA, December 1989
AT_{nc}	Averaging Time Noncarcinogen	Base Personnel 9,125 days Child 2,190 days Adult 10,950 days	USEPA, December 1989

TABLE 6-23

EXPOSURE ASSESSMENT SUMMARY - SURFACE WATER
REMEDIAL INVESTIGATION CTO-0133
MCB CAMP LEJEUNE, NORTH CAROLINA

Incidental Ingestion of Surface Water - Adolescent, Adult				
Input Parameter	Description	Value		Rationale
C	Exposure Concentration	95% UCL (mg/L)		USEPA, December 1989
IR	Ingestion Rate	0.05 L/hr		USEPA, December 1989
ET	Exposure Time	All	2.6 hr/day	USEPA, December 1989
EF	Exposure Frequency	All	7 days/yr	USEPA, January 1992
ED	Exposure Duration	Adolescent Adult	9 yrs 30 yrs	USEPA, December 1989
BW	Body Weight	Adolescent Adult	45 kg 70 kg	USEPA, December 1989
AT_c	Averaging Time Carcinogen	All	25,550 days	USEPA, December 1989
AT_{nc}	Averging Time Noncarcinogen	Adolescent Adult	3,285 days 10,950 days	USEPA, December 1989

TABLE 6-24

EXPOSURE ASSESSMENT SUMMARY - SURFACE WATER
REMEDIAL INVESTIGATION CTO-0133
MCB CAMP LEJEUNE, NORTH CAROLINA

Dermal Contact with Surface Water - Adolescent, Adult			
Input Parameter	Description	Value	Rationale
C	Exposure Concentration	95% UCL (mg/L)	USEPA, May 1992
SA	Exposed Surface Area of Skin Available for Contact	Adolescent 13,800 cm^2 Adult 17,500 cm^2	Whole body immersion 50th percentile. Adult/Adolescent USEPA, January 1992
PC	Permeability Constant	Chemical Specific	USEPA, January 1992
ET	Exposure Time	All 2.6 hr/event	USEPA, December 1989
EF	Exposure Frequency	All 7 events/yr	USEPA, January 1992
ED	Exposure Duration	Adolescent 9 yr Adult 30 yr	USEPA, December 1989
CF	Conversion Factor	1 l/1,000 cm^3	USEPA, December 1989
BW	Body Weight	Adolescent 45 kg Adult 70 kg	USEPA, December 1989
AT_c	Averaging Time Carcinogen	All 25,550 days	USEPA, December 1989
AT_{nc}	Averaging Time Noncarcinogen	Adolescent 3,285 days Adult 10,950 days	USEPA, December 1989

TABLE 6-25

EXPOSURE ASSESSMENT SUMMARY - SEDIMENT
REMEDIAL INVESTIGATION CTO-0133
MCB CAMP LEJEUNE, NORTH CAROLINA

Incidental Ingestion of Sediment - Adolescent, Adult			
Input Parameter	Description	Value	Rationale
C	Exposure Concentration	95% UCL (mg/kg)	USEPA, May 1992
IR	Ingestion Rate	Adolescent 50 mg/day Adult 50 mg/day	USEPA, December 1989
Fi	Fraction Ingestion from Contaminated Source	100%	Conservative Professional Judgement
EF	Exposure Frequency	All 7 days/yr	USEPA, January 1992
ED	Exposure Duration	Adolescent 9 yr Adult 30 yr	USEPA, December 1989
CF	Conversion Factor	1.0E-06 kg/mg	USEPA, December 1989
BW	Body Weight	Adolescent 45 kg Adult 70 kg	USEPA, December 1989
AT_c	Averaging Time Carcinogen	All 25,550 days	USEPA, December 1989
AT_{nc}	Averaging Time Noncarcinogen	Adolescent 3,285 days Adult 10,950 days	USEPA, December 1989

TABLE 6-26

EXPOSURE ASSESSMENT SUMMARY - SEDIMENT
REMEDIAL INVESTIGATION CTO-0133
MCB CAMP LEJEUNE, NORTH CAROLINA

Dermal Contact with Sediment - Adolescent, Adult			
Input Parameter	Description	Value	Rationale
C	Exposure Concentration	95% UCL (mg/kg)	USEPA, May 1992
SA	Exposed Surface Area of Skin Available for Contact	Adolescent 3,700 cm^2/event Adult 3,700 cm^2/event	Feet, lower legs, forearms, and hands exposed (USEPA, January 1992)
AF	Soil-to-Skin Adherence Factor	1.0 mg/cm^2	USEPA, Region IV, 1992
ABS	Absorption Factor (dimensionless)	Volatiles 0.10 Semivolatiles/ Pesticides 0.05 PCBs 0.03 Metals 0.01	Accounts for desorption from soil and percutaneous absorption (Feldman and Maibach, 1970; USEPA, October 1984; Wester and Maibach, 1985)
EF	Exposure Frequency	All 7 events/yr	USEPA, January 1992
ED	Exposure Duration	Adolescent 9 yr Adult 30 yr	USEPA, December 1989
CF	Conversion Factor	1.0 E-6 kg/mg	USEPA, December 1989
BW	Body Weight	Adolescent 45 kg Adult 70 kg	USEPA, December 1989
AT_c	Averaging Time Carcinogen	All 25,550 days	USEPA, December 1989
AT_{nc}	Averaging Time Noncarcinogen	Adolescent 3,285 days Adult 10,950 days	USEPA, December 1989

TABLE 6-27

EXPOSURE ASSESSMENT SUMMARY - FISH INGESTION
REMEDIAL INVESTIGATION CTO-0133
MCB CAMP LEJEUNE, NORTH CAROLINA

Fish Ingestion - Adult			
Input Parameter	Description	Value	Rationale
C	Exposure Concentration	95% UCL (mg/kg)	USEPA, May 1992
IR	Ingestion Rate	0.284 kg/day	95th percentile for finfish (USEPA, December 1989)
Fi	Fraction Ingested from Contaminated Source	1.0	90th Percentile Consumption Rate
EF	Exposure Frequency	48 days/yr	USEPA, December 1989
ED	Exposure Duration	30 years	90th percentile at one residence (USEPA, December 1989)
BW	Body Weight	70 kg	USEPA, December 1989
AT_c	Averaging Time Carcinogen	25,550 days	USEPA, December 1989
AT_{nc}	Averaging Time Noncarcinogen	10,950 days	USEPA, December 1989

TABLE 6-28

TOXICITY FACTORS
REMEDIAL INVESTIGATION CTO-0133
MCB CAMP LEJEUNE, NORTH CAROLINA

	RfD	RfC	CSF	CSFI	WOE	Reference
Volatiles: 1,1-Dichloroethene	9.0E-03	--	6.0E-01	1.75E-01	C	IRIS, 1993
1,1,2-Trichloroethane	4.0E-03	--	5.7E-02	5.6E-02	C	IRIS, 1993
1,1,2,2-Tetrachloroethane	--	--	2.0E-01	2.03E-01	C	IRIS, 1993
1,2-Dichloroethane	ND	ND	9.1E-02	9.1E-02	B2	IRIS, 1993
Bromodichloromethane	2.0E-02	--	6.2E-02	--	B2	IRIS, 1993
Chlorobenzene	2.0E-02	2.0E-02	--	--	D	IRIS, 1993, HEAST 1992
Ethylbenzene	1.0E-01	1.0E+00	--	--	D	IRIS, 1993
T-1,2-Dichloroethene	2.0E-2	--	--	--	--	IRIS, 1993
Tetrachloroethene	1.0E-02	ND	5.2E-02	2.0E-03	--	IRIS, 1993, USEPA, 1992
Toluene	2.0E-01	4.0E-01	--	--	D	IRIS, 1993, USEPA Region III, 1992
Trichloroethene	PDG	PDG	1.1E-02	6.0E-03	--	IRIS, 1993, USEPA 1992
Vinyl Chloride	--	--	1.9E+00	2.9E-01	A	HEAST, 1992
Xylenes (total)	2.0E+00	PDG	--	--	D	IRIS, 1993
Semivolatiles: 1,4-Dichlorobenzene	--	8.0E-01	2.4E-02	--	C	HEAST, 1992
Benzo(a)anthracene	--	--	7.3E+00	--	B2	USEPA - Region IV, 1992
Benzo(b)fluoranehtne	--	--	7.3E+00	--	B2	USEPA - Region IV, 1992
Benzo(k)fluoranthene	--	--	7.3E+00	--	B2	USEPA - Region IV, 1992
Benzo(a)pyrene	--	--	7.3E+00	--	B2	USEPA - Region IV, 1992
Chrysene	--	--	7.3E+00	--	B2	USEPA - Region IV, 1992
Fluoranthene	4.0E-02	--	--	--	D	IRIS, 1993
Indeno(1,2,3-cd)pyrene	--	--	7.3E+00	--	B2	USEPA - Region IV, 1992
Phenol	6.0E-01	--	--	--	D	HEAST, 1992
Pyrene	3.0E-02	--	--	--	D	IRIS, 1993
Pesticides/PCBs: 4,4'-DDD	--	--	2.4E-01	--	B2	IRIS, 1993
4,4'-DDE	--	--	3.4E-01	--	B2	IRIS, 1993
4,4'-DDT	5.0E-04	--	3.4E-01	3.4E-01	B2	IRIS, 1993
Dieldrin	5.0E-05	--	1.6E+01	1.61E+01	B2	IRIS, 1993
Endrin	3.0E-04	--	--	--	D	IRIS, 1993
Total PCB	7.0E-05	ND	7.7E+00	--	B2	IRIS, 1993

TABLE 6-28 (Continued)

TOXICITY FACTORS
REMEDIAL INVESTIGATION CTO-0133
MCB CAMP LEJEUNE, NORTH CAROLINA

	RfD	RfC	CSF	CSFI	WOE	Reference
Inorganics:						
Arsenic	3.0E-04	ND	1.7E+00	5.0E+01	A_I	IRIS, 1993, USEPA, 1992
Barium	7.0E-02	--	--	--	--	IRIS, 1993
Benzene	PDG	PDG	2.9E-02	2.9E-02	A	IRIS, 1993
Beryllium	5.0E-03	ND	4.3E+00	8.4E+00	B2	IRIS, 1993
Cadmium	5.0E-04	PDG	--	6.3E+00	B1	IRIS, 1993
Chromium VI	5.0E-03	PDG	--	4.2E+01	A_I	IRIS, 1993
Manganese	5.0E-03	4.0E-04	--	--	D	IRIS, 1993
Mercury	3.0E-04	3.0E-04	--	--	D	HEAST, 1992
Nickel	2.0E-02	PDG	--	--	--	IRIS, 1993
Vanadium	7.0E-03	--	--	--	--	HEAST, 1992
Zinc	3.0E-01	--	--	--	D	IRIS, 1993

Notes:
RfD - Oral Reference Dose (mg/kg - day)
RfC - Inhalation Reference Concentration (mg/cu m)
CSF - Oral Cancer Slope Factor $(mg/kg\text{-}day)^{-1}$
CSFI - Inhalation Cancer Slope Factor $(mg/kg\text{-}day)^{-1}$
WOE - Weight of Evidence
IRIS - Integrated Risk Information System
HEAST - Health Effects Assessment Summary Tables
USEPA - United States Environmental Protection Agency
ND - Not Determined
PDG - Pending
WOE - Weight of Evidence
A - Human Carcinogen
B1 - Probable Human Carcinogen - Limited Evidence
B2 - Probable Human Carcinogen - Sufficient Evidence
C - Possible Human Carcinogen
D - Not Classifiable as to Human Carcinogenicity

TABLE 6-29

INCREMENTAL LIFETIME CANCER RISK VALUES ASSOCIATED WITH POTENTIAL CURRENT AND FUTURE EXPOSURES TO SURFACE SOIL SITE 6 LOT 201 REMEDIAL INVESTIGATION CTO-0133 MCB CAMP LEJEUNE, NORTH CAROLINA

Contaminant of Concern	Incremental Lifetime Cancer Risks								
	Child Resident (Future Potential Risk Scenario)			Resident Adult (Future Potential Risk Scenario)			Base Personnel (Current Risk Scenario)		
	Ingestion	Dermal	Inhalation	Ingestion	Dermal	Inhalation	Ingestion	Dermal	Inhalation
1,4-Dichlorobenzene	9.99E-10	4.50E-10	--	2.4E-02	1.42E-09	--	3.19E-10	6.85E-11	--
4,4'-DDD	4.10E-09	1.85E-09	--	2.20E-09	5.82E-09	--	1.31E-09	2.81E-09	--
4,4'-DDE	1.68E-08	7.58E-09	--	9.02E-09	2.39E-08	--	5.37E-09	1.15E-08	--
4,4'-DDT	5.07E-08	2.28E-08	5.2E-12	2.71E-08	7.19E-08	7.31E-12	1.62E-08	3.47E-08	9.70E-12
Arsenic	5.37E-06	4.83E-07	1.58E-08	2.88E-06	1.52E-06	2.18E-08	1.71E-06	7.36E-07	2.94E-08
Benzo(b)fluoranthene	1.28E-06	1.66E-07	--	6.86E-07	5.22E-07	--	4.08E-07	2.52E-07	--
Cadmium	--	--	5.70E-10	--	--	7.86E-10	--	--	1.06E-09
Chromium	--	--	5.75E-08	--	--	7.92E-08	--	--	1.07E-07
Chrysene	7.04E-07	3.17E-07	--	3.77E-07	9.99E-07	--	2.24E-07	8.61E-09	--
Dieldrin	1.30E-07	5.84E-08	1.34E-11	6.95E-08	1.84E-07	1.85E-11	4.14E-08	8.90E-08	2.48E-11
Total PCBs	3.04E-07	8.20E-08	--	1.63E-07	2.59E-07	--	9.69E-08	1.25E-07	--
TOTAL	7.86E-06	1.14E-06	7.39E-08	4.21E-06	3.59E-06	1.02E-07	2.51E-06	1.73E-06	1.37E-07

Note: -- Not evaluated as part of this exposure pathway.

TABLE 6-30

HAZARD QUOTIENTS AND INDICES
ASSOCIATED WITH POTENTIAL CURRENT AND FUTURE
EXPOSURES TO SURFACE SOIL
SITE 6 LOT 201
REMEDIAL INVESTIGATION CTO-0133
MCB CAMP LEJEUNE, NORTH CAROLINA

Contaminant of Concern	Hazard Quotients								
	Child Resident (Future Potential Risk Scenario)			Adult Resident (Future Potential Risk Scenario)			Base Personnel (Current Risk Scenario)		
	Ingestion	Dermal	Inhalation	Ingestion	Dermal	Inhalation	Ingestion	Dermal	Inhalation
1,4-Dichlorobenzene	--	--	6.27E-11	---	--	1.73E-11	--	--	2.79E-11
4,4'-DDT	3.48E-03	1.56E-03	--	3.75E-04	9.87E-04	--	2.66E-04	5.72E-04	--
Arsenic	1.19E-01	1.07E-02	--	1.28E-02	6.78E-03	--	9.13E-03	3.93E-03	--
Cadmium	2.05E-02	1.84E-03	--	2.19E-03	1.16E-03	--	1.57E-03	6.73E-04	--
Chromium	3.09E-02	2.78E-08	--	3.32E-03	1.76E-03	--	2.37E-03	1.02E-03	--
Dieldrin	1.89E-03	8.52E-04	--	2.03E-04	5.37E-04	--	1.45E-04	3.11E-04	--
Fluoranthene	3.00E-05	1.35E-05	--	3.22E-06	8.53E-06	--	2.30E-06	4.94E-06	--
Manganese	1.19E-01	1.07E-02	1.53E-04	1.27E-02	6.74E-03	4.22E-05	9.08E-03	3.90E-03	6.81E-05
Pyrene	4.22E-05	1.90E-05	--	4.52E-06	1.20E-05	--	3.23E-06	6.04E-06	--
Zinc	1.66E-05	1.50E-04	--	1.78E-04	9.44E-05	--	1.27E-04	5.47E-05	--
Total PCBs	6.58E-03	1.78E-03	--	7.05E-04	1.12E-03	--	5.03E-04	6.49E-04	--
TOTAL (Hazard Index)	3.03E-01	3.04E-02	1.53E-04	3.25E-02	1.92E-02	4.22E-05	2.32E-02	1.11E-02	6.81E-05

Note: -- Not evaluated as part of this exposure pathway.

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TABLE 6-31

INCREMENTAL LIFETIME CANCER RISK VALUES
ASSOCIATED WITH POTENTIAL FUTURE
EXPOSURES TO SURFACE SOIL
SITE 6 LOT 203
REMEDIAL INVESTIGATION CTO-0133
MCB CAMP LEJEUNE, NORTH CAROLINA

	Incremental Lifetime Cancer Risks								
	Child Resident (Future Potential Risk Scenario)			Adult Resident (Future Potential Risk Scenario)			Base Employee (Future Potential Risk Scenario)		
Contaminant of Concern	Ingestion	Dermal	Inhalation	Ingestion	Dermal	Inhalation	Ingestion	Dermal	Inhalation
1,4-Dichlorobenzene	4.21E-09	4.06E-10	--	2.25E-09	5.97E-09	--	1.34E-09	2.89E-09	--
4,4'-DDD	1.63E-09	1.57E-09	--	8.74E-10	2.31E-08	--	5.20E-10	1.12E-08	--
4,4'-DDE	9.24E-09	8.91E-10	--	4.95E-09	1.31E-08	--	2.95E-09	6.34E-09	--
4,4'-DDT	1.55E-08	1.49E-09	1.60E-12	8.30E-09	2.20E-08	2.21E-12	4.94E-09	1.06E-08	2.97E-12
Arsenic	1.92E-06	3.70E-08	5.65E-09	1.03E-06	7.80E-09	2.34E--09	6.12E-07	2.63E-07	1.05E-08
Benzo(a)anthracene	1.91E-06	1.84E-07	--	1.02E-06	2.71E-06	--	6.10E-07	1.31E-06	--
Benzo(a)pyrene	1.93E-06	1.86E-07	--	1.03E-06	2.74E-06	--	6.15E-07	1.32E-06	--
Benzo(b)fluoranthene	2.16E-06	2.08E-07	--	1.16E-06	3.07E-06	--	6.89E-07	1.48E-06	--
Benzo(k)fluoranthene	1.88E-06	1.81E-07	--	1.01E-06	2.67E-06	--	5.99E-07	1.29E-06	--
Cadmium	--	--	6.41E-10	--	--	8.84E-10	--	--	1.19E-09
Chromium	--	--	2.66E-08	--	--	3.67E-08	--	--	4.93E-08
Chrysene	1.85E-06	1.42E-09	--	9.90E-07	2.08E-08	--	5.89E-07	1.01E-08	--
Dieldrin	9.99E-08	9.69E-09	1.03E-11	5.35E-08	1.42E-07	1.42E-11	3.19E-08	6.85E-08	1.91E-11
Ideno(1,2,3-cd)pyrene	1.44E-07	1.75E-07	--	7.73E-08	2.58E-06	--	5.79E-07	1.25E-06	--
Total PCBs	1.53E-06	8.86E-08	--	8.20E-07	1.38E-06	--	4.88E-07	6.30E-07	--
TOTAL	1.51E-06	1.25E-06	3.29E-08	8.10E-06	1.84E-05	4.54E-08	4.82E-06	8.91E-06	6.10E-08

Note: -- Not evaluated as part of this exposure pathway

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TABLE 6-32

HAZARD QUOTIENTS AND INDICES
ASSOCIATED WITH POTENTIAL FUTURE
EXPOSURES TO SURFACE SOIL
SITE 6 LOT 203
REMEDIAL INVESTIGATION CTO-0133
MCB CAMP LEJEUNE, NORTH CAROLINA

Contaminant of Concern	Hazard Quotients								
	Child Resident (Future Potential Risk Scenario)			Adult Resident (Future Potential Risk Scenario)			Base Personnel (Future Potential Risk Scenario)		
	Ingestion	Dermal	Inhalation	Ingestion	Dermal	Inhalation	Ingestion	Dermal	Inhalation
1,4-Dichlorobenzene	--	--	2.64E-10	--	--	7.28E-11	--	--	1.17E-10
4,4'-DDT	1.06E-03	1.03E-04	--	1.14E-04	3.02E-04	--	8.14E-05	1.75E-04	--
Arsenic	4.26E-02	8.22E-04	--	4.57E-03	2.42E-03	--	3.26E-03	1.40E-03	--
Barium	1.90E-03	3.66E-05	--	2.04E-04	1.08E-04	--	1.45E-04	6.25E-05	--
Cadmium	2.30E-02	4.44E-04	--	2.47E-03	1.31E-03	--	1.76E-03	7.57E-04	--
Chromium	1.43E-02	2.76E-04	--	1.53E-03	8.13E-04	--	1.10E-03	4.71E-04	--
Dieldrin	1.46E-03	1.41E-04	--	1.56E-04	4.14E-04	--	1.12E-04	2.40E-04	--
Endrin	1.28E-05	2.22E-05	--	1.37E-06	6.53E-05	--	9.78E-07	3.79E-05	--
Fluoranthene	7.99E-05	7.71E-06	--	8.56E-06	2.27E-05	--	6.12E-06	1.32E-05	--
Manganese	9.31E-02	1.80E-03	1.20E-04	9.97E-03	5.29E-03	3.31E-05	7.12E-03	3.06E-03	5.34E-05
Pyrene	1.08E-04	1.04E-05	--	1.16E-05	3.07E-05	--	8.28E-06	1.78E-05	--
Zinc	3.33E-03	6.43E-05	--	3.57E-04	1.89E-04	--	2.55E-04	1.10E-04	--
Total PCBs	3.32E-02	1.92E-03	--	3.55E-03	5.65E-03	--	2.54E-03	3.27E-03	--
TOTAL (Hazard Index)	2.14E-01	5.64E-08	1.20E-04	2.29E-02	1.66E-02	3.31E-05	1.64E-02	9.62E-04	5.34E-05

Note: -- Not evaluated as part of this exposure pathway.

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TABLE 6-33

INCREMENTAL LIFETIME CANCER RISK VALUES
ASSOCIATED WITH POTENTIAL FUTURE EXPOSURES TO SURFACE SOIL
SITE 6 (WOODED AREAS AND RAVINE) AND SITE 82
REMEDIAL INVESTIGATION CTO-0133
MCB CAMP LEJEUNE, NORTH CAROLINA

Contaminant of Concern	Incremental Lifetime Cancer Risks								
	Child Resident (Future Potential Risk Scenario)			Adult Resident (Future Potential Risk Scenario)			Base Personnel (Future Potential Risk Scenario)		
	Ingestion	Dermal	Inhalation	Ingestion	Dermal	Inhalation	Ingestion	Dermal	Inhalation
1,4-Dichlorobenzene	1.95E-09	2.20E-09	--	1.04E-09	6.95E-09	--	6.21E-10	3.36E-09	--
4,4'-DDD	1.58E-09	7.10E-10	--	8.45E-10	2.24E-09	--	5.03E-10	1.08E-09	--
4.4'-DDE	7.75E-09	3.49E-09	--	4.15E-09	1.10E-08	--	2.47E-09	5.31E-09	--
4.4'-DDT	1.05E-08	4.75E-09	1.09E-12	5.65E-09	1.50E-08	1.50E-12	3.36E-09	7.23E-09	6.72E-13
Arsenic	1.98E-06	1.78E-07	5.82E-09	1.06E-06	5.61E-07	8.03E-09	6.30E-07	2.71E-07	3.60E-09
Benzo(a)anthracene	1.74E-06	7.85E-07	--	9.35E-07	2.48E-06	--	5.56E-07	1.20E-06	--
Benzo(a)pyrene	1.68E-06	7.56E-06	--	9.00E-07	2.39E-06	--	5.36E-07	1.15E-06	--
Benzo(b)fluoranthene	1.70E-06	7.67E-07	--	9.13E-07	2.42E-06	--	5.44E-07	1.17E-06	--
Benzo(k)fluoranthene	1.58E-06	7.09E-07	--	8.44E-07	2.24E-06	--	5.02E-07	1.08E-06	--
Cadmium	--	--	4.06E-10	--	--	5.60E-10	--	--	2.51E-10
Chromium	--	--	1.28E-08	--	--	1.77E-08	--	--	7.93E-09
Chrysene	1.69E-06	7.59E-07	--	9.04E-07	2.40E-06	--	5.38E-07	1.16E-06	--
Dibenz(a,h)anthracene	1.16E-06	7.23E-07	--	8.61E-07	2.28E-06	--	5.12E-07	1.10E--6	--
Dieldrin	1.21E-07	5.44E-10	1.25E-11	6.48E-08	1.72E-09	1.72E-11	3.86E-08	8.29E-10	7.72E-12
Ideno(1,2,3-cd)pyrene	1.69E-06	7.62E-07	--	9.08E-07	2.41E-06	--	5.40E-07	1.16E-06	--
Total PCBs	5.32E-07	1.44E-07	--	2.85E-07	4.53E-07	--	1.70E-07	2.19E-07	--
TOTAL	1.43E-05	5.60E-06	1.91E-08	7.68E-06	1.77E-05	2.63E-08	4.57E-06	8.52E-06	1.18E-08

Note: -- Not evaluated as part of this exposure pathway.

TABLE 6-34

HAZARD QUOTIENTS AND INDICES
ASSOCIATED WITH POTENTIAL FUTURE
EXPOSURES TO SURFACE SOIL
SITE 6 (WOODED AREAS AND RAVINE) AND SITE 82
REMEDIAL INVESTIGATION CTO-0133
MCB CAMP LEJEUNE, NORTH CAROLINA

Contaminant of Concern	Hazard Quotients								
	Child Resident (Future Potential Risk Scenario)			Adult Resident (Future Potential Risk Scenario)			Base Employee (Future Potential Risk Scenario)		
	Ingestion	Dermal	Inhalation	Ingestion	Dermal	Inhalation	Ingestion	Dermal	Inhalation
1,4-Dichlorobenzene	--	--		--	--	3.37E-11	--	--	1.81E-11
4,4'-DDT	7.27E-04	3.26E-04	--	7.75E-05	2.05E-04	--	5.54E-05	1.19E-04	--
Anthracene	8.52E-06	3.84E-06	--	9.13E-07	2.42E-06	--	6.52E-07	1.40E-06	--
Arsenic	4.39E-02	3.95E-03	--	4.70E-03	2.49E-03	--	3.36E-03	1.44E-03	--
Barium	4.00E-03	8.40E-05	--	4.29E-04	2.27E-04	--	3.06E-04	1.32E-04	--
Cadmium	1.46E-02	1.31E-03	--	1.56E-03	8.28E-04	--	1.12E-03	4.80E-04	--
Chromium	6.90E-03	6.21E-04	--	7.40E-04	3.92E-04	--	5.28E-04	2.27E-04	--
Dieldrin	1.76E-03	7.94E-04	--	1.89E-04	5.01E-04	--	1.35E-04	2.90E-04	--
Endrin	1.75E-04	7.86E-05	--	1.87E-05	4.96E-05	--	1.34E-05	2.88E-05	--
Fluoranthene	7.08E-05	3.19E-05	--	7.59E-06	2.01E-05	--	5.42E-06	1.16E-05	--
Manganese	4.42E-02	3.98E-03	5.71E-05	4.74E-03	2.51E-03	1.57E-05	3.39E-03	1.46E-03	8.46E-06
Phenol	3.41E-06	1.53E-06	--	3.65E-07	9.68E-07	--	2.61E-07	5.61E-07	--
Pyrene	1.00E-04	4.50E-05	--	1.07E-05	2.84E-05	--	7.65E-06	1.65E-05	--
Vanadium	8.58E-03	7.73E-04	--	9.20E-04	4.87E-04	--	6.57E-04	2.82E-04	--
Zinc	8.78E-04	7.90E-05	--	9.41E-05	4.99E-05	--	6.72E-05	2.89E-05	--
Total PCBs	1.15E-02	3.11E-03	--	1.23E-03	1.96E-03	--	8.81E-04	1.14E-03	--
TOTAL (Hazard Index)	1.37E-01	1.52E-02	5.71E-05	1.47E-02	9.76E-03	1.57E-05	1.05E-02	5.63E-03	8.46E-06

Note: -- Not evaluated as part of this exposure pathway.

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TABLE 6-35

**INCREMENTAL LIFETIME CANCER RISK VALUES
ASSOCIATED WITH POTENTIAL FUTURE
EXPOSURES TO GROUNDWATER
OPERABLE UNIT NO. 2
REMEDIAL INVESTIGATION CTO-0133
MCB CAMP LEJEUNE, NORTH CAROLINA**

Contaminant of Concern	Incremental Lifetime Cancer Risk					
	Child Resident (Future Potential Risk Scenario)		Adult Resident (Future Potential Risk Scenario)		Base Personnel (Future Potential Risk Scenario)	
	Ingestion	Dermal Contact	Ingestion	Dermal Contact	Ingestion	Dermal Contact
1,1,2,2-Tetrachloroethane	1.86E-06	3.30E-08	3.99E-06	8.15E-08	2.58E-06	4.85E-08
1,1,2-Trichloroethane	1.56E-07	2.58E-09	3.35E-07	6.38E-09	1.99E-07	3.80E-09
1,1-Dichloroethene	1.97E-07	6.22E-08	4.23E-06	1.53E-07	2.52E-06	9.13E-08
1,2-Dichloroethene	2.99E-07	3.12E-09	6.41E-07	7.71E-09	3.82E-07	4.59E-09
Arsenic	4.48E-05	7.32E-07	9.6E-05	3.27E-07	5.71E-05	1.94E-07
Beryllium	1.01E-04	2.99E-07	2.17E-04	7.39E-07	1.29E-04	4.4E-07
Bromodichloromethane	2.84E-07	2.33E-09	4.37E-07	5.75E-09	2.67E-07	3.42E-09
Vinyl Chloride	1.67E-05	2.40E-07	3.57E-05	5.91E-07	2.12E-05	3.52E-07
Trichloroethene	8.44E-07	3.32E-07	1.81E-06	1.49E-05	1.08E-06	4.88E-07
Tetrachloroethene	5.98E-07	4.72E-07	1.28E-06	8.95E-06	7.63E-07	6.93E-07
Total	1.69E-04	1.58E-06	3.61E-04	2.58E-05	2.15E-04	2.32E-06

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TABLE 6-36

HAZARD QUOTIENTS AND INDICES
ASSOCIATED WITH POTENTIAL
FUTURE EXPOSURES TO GROUNDWATER
OPERABLE UNIT NO. 2
REMEDIAL INVESTIGATION CTO-0133
MCB CAMP LEJEUNE, NORTH CAROLINA

	Hazard Quotients					
	Child Resident (Future Potential Risk Scenario)		Adult Resident (Future Potential Risk Scenario)		Base Personnel (Future Potential Risk Scenario)	
Contaminant of Concern	Ingestion	Dermal Contact	Ingestion	Dermal Contact	Ingestion	Dermal Contact
1,1,2-Trichloroethane	7.99E-03	1.32E-04	3.42E-03	6.53E-05	2.45E-03	4.66E-05
1,1-Dichloroethene	4.26E-03	1.34E-04	1.83E-03	6.63E-05	1.30E-03	4.74E-05
Arsenic	9.95E-01	2.96E-03	4.26E-01	1.46E-03	3.05E-01	1.04E-03
Barium	1.25E-01	3.69E-04	5.35E-02	1.82E-04	3.82E-02	1.30E-04
Beryllium	7.03E-03	2.27E-05	3.01E-03	1.12E-05	2.15E-03	7.99E-06
Bromodichloromethane	1.92E-03	2.19E-05	8.22E-04	1.08E-05	5.87E-04	7.73E-06
Chlorobenzene	6.71E-03	5.42E-04	2.88E-03	2.68E-04	2.05E-03	1.91E-04
Chromium	5.96E-01	2.35E-03	2.56E-01	1.16E-03	1.83E-01	8.29E-04
Ethylbenzene	5.11E-04	7.46E-05	2.19E-04	3.68E-05	1.57E-04	2.63E-05
Manganese	5.79E-01	1.71E-03	2.48E-01	8.45E-04	1.77E-01	6.03E-04
Mercury	1.70E-02	6.30E-05	7.31E-03	3.11E-05	5.22E-03	2.22E-05
Nickel	3.31E-02	9.82E-05	1.42E-02	4.85E-05	1.01E-02	3.46E-05
Phenol	5.75E-04	9.29E-05	2.47E-04	4.59E-05	1.76E-04	3.28E-05
T-1,2-Dichloroethene	1.63E-02	3.21E-04	6.99E-03	1.59E-04	4.99E-03	1.13E-04
Tetrachloroethene	1.34E-02	9.79E--03	5.75E-03	4.83E-03	4.11E-03	3.45E-03
Total Xylenes	2.24E-05	3.53E-06	9.59E-06	1.74E-06	6.85E-06	1.24E-06
Vanadium	5.54E-01	1.64E-03	2.37E-01	8.08E-04	1.70E-01	5.77E-04
Zinc	1.00E-02	2.97E-05	4.3E-03	1.46E-05	3.07E-03	1.05E-05
TOTAL (Hazard Index)	3.0E+00	2.04E-02	1.3E+00	1.00E-02	9.0E-01	7.18E-03

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TABLE 6-37

INCREMENTAL LIFETIME CANCER RISK VALUES
ASSOCIATED WITH POTENTIAL
FUTURE EXPOSURES TO SURFACE WATER
SITE 6 WALLACE CREEK
REMEDIAL INVESTIGATION CTO-0133
MCB CAMP LEJEUNE, NORTH CAROLINA

	Incremental Lifetime Cancer Risk			
	Adolescent Residents (Future Potential Risk Scenario)		Adult Residents (Future Potential Risk Scenario)	
Contaminant of Concern	Ingestion	Dermal Contact	Ingestion	Dermal Contact
Vinyl Chloride	8.12E-08	1.64E-07	1.74E-07	4.45E-07
Arsenic	1.80E-08	7.43E-09	3.85E-08	2.02E-08
TOTAL	9.92E-08	1.71E-07	2.12E-07	4.65E-07

TABLE 6-38

HAZARD QUOTIENT AND INDICES
ASSOCIATED WITH POTENTIAL FUTURE
EXPOSURES TO SURFACE WATER
SITE 6 WALLACE CREEK
REMEDIAL INVESTIGATION CTO-0133
MCB CAMP LEJEUNE, NORTH CAROLINA

	Hazard Quotients			
	Adolescent Resident (Future Potential Risk Scenario)		Adult Resident (Future Potential Risk Scenario)	
Contaminant of Concern	Ingestion	Dermal Contact	Ingestion	Dermal Contact
T-1,2-Dichloroethene	3.07E-05	8.49E-05	1.98E-05	6.92E-05
Tetrachloroethene	2.22E-05	2.26E-03	1.42E-05	1.84E-03
Toluene	8.31E-07	2.29E-04	5.34E-07	1.87E-04
Arsenic	2.66E-04	1.10E-04	1.71E-04	8.98E-05
Barium	9.90E-06	4.10E-06	6.37E-06	3.34E-06
Cadmium	2.02E-04	5.57E-05	1.30E-04	4.54E-05
Chromium	2.65E-05	1.46E-05	1.70E-05	1.19E-05
Manganese	1.66E-04	6.89E-05	1.07E-04	5.61E-05
Mercury	2.59E-05	7.14E-06	1.66E-05	5.82E-06
Nickel	1.25E-04	3.45E-06	8.04E-05	2.81E-06
Vanadium	1.93E-04	8.00E-06	1.24E-05	6.52E-06
Zinc	2.77E-05	4.58E-07	1.78E-06	3.74E-07
TOTAL (Hazard Index)	1.10E-03	2.58E-03	5.77E-04	2.32E-03

TABLE 6-39

HAZARD QUOTIENTS AND INDICES
ASSOCIATED WITH POTENTIAL FUTURE
EXPOSURES TO SURFACE WATER
SITE 6 BEAR HEAD CREEK
REMEDIAL INVESTIGATION CTO-0133
MCB CAMP LEJEUNE, NORTH CAROLINA

	Hazard Quotients			
	Adolescent Resident (Future Potential Risk Scenario)		Adult Resident (Future Potential Risk Scenario)	
Contaminant of Concern	Ingestion	Dermal Contact	Ingestion	Dermal Contact
Barium	2.06E-05	8.55E-06	1.33E-05	6.97E-06
Chromium	4.22E-05	2.33E-05	2.71E-05	1.90E-05
Manganese	2.56E-04	1.06E-04	1.65E-04	8.65E-05
Mercury	9.23E-06	2.55E-06	5.94E-06	2.08E-06
Nickel	5.08E-05	1.40E-06	3.27E-05	1.14E-06
Vanadium	2.02E-05	8.36E-06	1.30E-05	6.81E-06
Zinc	1.77E-06	2.93E-07	1.14E-06	2.39E-07
TOTAL (Hazard Index)	4.01E-04	1.51E-04	2.58E-04	1.23E-04

TABLE 6-40

INCREMENTAL LIFETIME CANCER RISK VALUES
ASSOCIATED WITH POTENTIAL
FUTURE EXPOSURES TO SEDIMENT
SITE 6 WALLACE CREEK
REMEDIAL INVESTIGATION CTO-0133
MCB CAMP LEJEUNE, NORTH CAROLINA

Contaminant of Concern	Incremental Cancer Risk			
	Adolescent Resident (Future Potential Risk Scenario)		Adult Resident (Future Potential Risk Scenario)	
	Ingestion	Dermal Contact	Ingestion	Dermal Contact
4,4'-DDD	2.03E-11	1.50E-09	4.35E-11	3.22E-09
4,4'-DDE	1.82E-11	1.34E-09	3.89E-11	2.88E-09
4,4'-DDT	2.13E-11	1.58E-09	4.57E-11	3.38E-09
Arsenic	1.18E-08	8.73E-07	2.53E-08	1.87E-06
Benzo(a)anthracene	4.20E-09	3.11E-07	9.00E-09	6.66E-07
Benzo(a)pyrene	1.22E-08	9.07E-07	2.61E-08	1.93E-06
Benzo(b)fluoranthene	8.40E-09	6.22E-07	1.80E-08	1.33E-06
Beryllium	3.53E-09	2.63E-07	7.57E-09	5.60E-07
Chrysene	4.60E-09	3.40E-07	9.86E-09	7.29E-07
Dieldrin	2.10E-10	1.56E-08	4.51E-10	3.34E-08
Total PCBs	6.41E-09	4.74E-07	1.37E-08	1.02E-06
TOTAL	5.14E-08	3.80E-06	1.10E-07	8.15E-06

TABLE 6-41

HAZARD QUOTIENTS AND INDICES
ASSOCIATED WITH POTENTIAL FUTURE
EXPOSURES TO SEDIMENT
SITE 6 WALLACE CREEK
REMEDIAL INVESTIGATION CTO-0133
MCB CAMP LEJEUNE, NORTH CAROLINA

	Hazard Quotients			
	Adolescent Resident (Future Potential Risk Scenario)		Adult Resident (Future Potential Risk Scenario)	
Contaminant of Concern	Ingestion	Dermal Contact	Ingestion	Dermal Contact
4,4'-DDT	9.76E-07	7.22E-05	6.27E-07	4.64E-05
Arsenic	1.75E-04	1.29E-02	1.12E-04	8.31E-03
Barium	5.37E-06	3.98E-04	3.45E-06	2.56E-04
Beryllium	1.28E-06	9.46E-05	8.22E-07	6.08E-05
Chromium	2.97E-05	2.20E-03	1.91E-05	1.41E-03
Dieldrin	2.05E-06	1.51E-04	1.32E-06	9.37E-05
Fluoranthane	2.46E-07	1.82E-05	1.58E-07	1.17E-05
Manganese	7.53E-05	5.57E-03	4.84E-05	3.58E-03
Nickel	3.56E-06	2.63E-04	2.29E-06	1.69E-04
Pyrene	3.24E-07	2.40E-05	2.09E-07	1.54E-05
T-1,2-Dichloroethene	3.30E-08	2.44E-06	2.12E-08	1.57E-06
Toluene	5.33E-10	3.94E-08	3.42E-10	2.53E-08
Total Xylenes	8.69E-10	6.43E-08	5.59E-10	4.14E-08
Vanadium	3.90E-05	2.89E-03	2.51E-05	1.86E-03
Zinc	4.19E-06	3.10E-04	2.69E-06	1.99E-04
Total PCBs	9.25E-05	6.84E-03	5.94E-05	4.40E-03
TOTAL (Hazard Index)	4.29E-04	3.18E-02	2.76E-04	2.04E-02

TABLE 6-42

INCREMENTAL LIFETIME CANCER RISK VALUES
ASSOCIATED WITH POTENTIAL FUTURE
EXPOSURE TO SEDIMENT
SITE 6 BEAR HEAD CREEK
REMEDIAL INVESTIGATION CTO-0133
MCB CAMP LEJEUNE, NORTH CAROLINA

Contaminant of Concern	Incremental Lifetime Cancer Risk			
	Adolescent Resident (Future Potential Risk Scenario)		Adult Resident (Future Potential Risk Scenario)	
	Ingestion	Dermal Contact	Ingestion	Dermal Contact
4,4'-DDD	1.93E-11	1.43E-09	4.14E-11	3.07E-09
4,4'-DDE	3.21E-11	2.38E-09	6.89E-11	5.10E-09
4,4'-DDT	1.26E-11	9.31E-10	2.69E-11	1.99E-09
Arsenic	6.23E-09	4.61E-07	1.34E-08	9.88E-07
Benzene	3.97E-13	2.94E-11	8.51E-13	6.30E-11
Benzo(b)fluoranthene	1.92E-09	1.42E-07	4.11E-09	3.04E-07
Benzo(a)pyrene	1.06E-08	7.81E-07	2.27E-08	1.67E-06
Beryllium	4.24E-09	3.14E-07	9.09E-09	6.73E-07
Total PCBs	3.18E-09	2.35E-07	6.81E-09	5.04E-07
TOTAL	2.62E-08	1.94E-06	5.62E-08	4.15E-06

TABLE 6-43

HAZARD QUOTIENTS AND INDICES
ASSOCIATED WITH POTENTIAL FUTURE
EXPOSURES TO SEDIMENT
SITE 6 BEAR HEAD CREEK
REMEDIAL INVESTIGATION CTO-0133
MCB CAMP LEJEUNE, NORTH CAROLINA

	Hazard Quotients			
	Adolescent Resident (Future Potential Risk Scenario)		Adult Resident (Future Potential Risk Scenario)	
Contaminant of Concern	Ingestion	Dermal Contact	Ingestion	Dermal Contact
4,4'-DDT	5.75E-07	4.26E-05	3.70E-07	2.74E-05
Arsenic	9.23E-05	6.83E-03	5.94E-05	4.39E-03
Barium	7.12E-06	5.27E-04	4.58E-06	3.39E-04
Beryllium	1.53E-06	1.14E-04	9.86E-07	7.30E-05
Cadmium	5.58E-05	4.13E-03	3.59E-05	2.66E-03
Chromium	3.69E-05	2.73E-03	2.37E-05	1.76E-03
Ethylbenzene	1.16E-08	8.58E-07	7.45E-09	5.51E-07
Manganese	7.31E-05	5.41E-03	4.70E-05	3.48E-03
Pyrene	5.40E-08	3.99E-06	3.47E-08	2.57E-06
Tetrachloroethene	1.11E-07	4.73E-07	7.15E-08	3.04E-07
Total Xylenes	7.58E-10	5.61E-08	4.87E-10	3.60E-08
Vanadium	4.32E-05	3.20E-03	2.78E-05	2.05E-03
Zinc	2.46E-06	1.82E-04	1.58E-06	1.17E-04
Total PCBs	4.58E-05	3.39E-03	2.95E-05	2.18E-03
TOTAL (Hazard Index)	3.59E-04	2.66E-02	2.31E-04	1.71E-02

TABLE 6-44

INCREMENTAL LIFETIME CANCER RISK VALUES
ASSOCIATED WITH POTENTIAL CURRENT
EXPOSURE TO BIOTA
SITE 6 WALLACE CREEK
REMEDIAL INVESTIGATION CTO-0133
MCB CAMP LEJEUNE, NORTH CAROLINA

Contaminant of Concern	Incremental Lifetime Cancer Risks Adult Ingestion (Current Risk Scenario)
4,4'-DDD	2.37E-06
4,4'-DDE	2.13E-05
4,4'-DDT	7.54E-07
Beryllium	2.95E-06
Total PCBs	1.76E-03
TOTAL	1.79E-03

TABLE 6-45

HAZARD QUOTIENTS AND INDEX
ASSOCIATED WITH POTENTIAL CURRENT EXPOSURE
TO BIOTA
SITE 6 WALLACE CREEK
REMEDIAL INVESTIGATION CTO-0133
MCB CAMP LEJEUNE, NORTH CAROLINA

Contaminant of Concern	Hazard Quotients Adult Ingestion (Current Risk Scenario)
4,4'-DDT	1.04E-02
Beryllium	3.20E-04
Cadmium	2.99E-02
Endrin	2.45E-02
Zinc	4.98E-02
Total PCBs	7.62E+00
TOTAL (Hazard Index)	7.74+00

TABLE 6-46

TOTAL INCREMENTAL LIFETIME CANCER RISK
ASSOCIATED WITH SURFACE SOIL
SITE 6 LOT 201
REMEDIAL INVESTIGATION CTO-0133
MCB CAMP LEJEUNE, NORTH CAROLINA

Scenario	Exposed Population		
	Future Child Resident	Future Adult Resident	Current Base Personnel
Incidental Ingestion of Soil	7.86E-06	4.21E-06	2.51E-06
Dermal Contact with Soil	1.14E-06	3.59E-06	1.73E-06
Inhalation of Particulates	7.39E-08	1.02E-07	1.37E-07
TOTAL	9.07E-06	4.02E-06	4.38E-06

TABLE 6-47

TOTAL HAZARD INDICES
ASSOCIATED WITH SURFACE SOIL
SITE 6 LOT 201
REMEDIAL INVESTIGATION CTO-0133
MCB CAMP LEJEUNE, NORTH CAROLINA

Scenario	Exposed Population		
	Future Child Resident	Future Adult Resident	Current Base Personnel
Incidental Ingestion of Soil	3.03E-01	3.25E-02	2.32E-02
Dermal Contact with Soil	3.04E-02	1.92E-02	1.11E-02
Inhalation of Particulates	1.53E-04	4.22E-05	6.18E-05
TOTAL	3.34E-01	5.17E-02	3.44E-02

TABLE 6-48

TOTAL INCREMENTAL LIFETIME CANCER RISK
ASSOCIATED WITH SURFACE SOIL
SITE 6 LOT 203
REMEDIAL INVESTIGATION CTO-0133
MCB CAMP LEJEUNE, NORTH CAROLINA

Scenario	Exposed Population		
	Future Child Resident	Future Adult Resident	Future Base Personnel
Incidental Ingestion of Soil	1.51E-06	8.10E-06	4.82E-06
Dermal Contact with Soil	1.25E-06	1.84E-06	8.91E-06
Inhalation of Particulates	3.29E-08	4.54E-08	6.10E-08
TOTAL	2.79E-06	9.99E-06	1.38E-05

TABLE 6-49

TOTAL HAZARD INDICES
ASSOCIATED WITH SURFACE SOIL
SITE 6 LOT 203
REMEDIAL INVESTIGATION CTO-0133
MCB CAMP LEJEUNE, NORTH CAROLINA

	Exposed Population		
Scenario	Future Child Resident	Future Adult Resident	Future Base Personnel
Incidental Ingestion of Soil	2.14E-01	2.29E-02	1.64E-02
Dermal Contact with Soil	5.64E-03	1.66E-02	9.62E-03
Inhalation of Particulates	1.20E-04	3.31E-05	5.34E-05
TOTAL	2.20E-01	3.95E-02	2.61E-02

TABLE 6-50

TOTAL INCREMENTAL LIFETIME CANCER RISK
ASSOCIATED WITH SURFACE SOIL
SITE 6 (WOODED AREAS AND RAVINE) AND SITE 82
REMEDIAL INVESTIGATION CTO-0133
MCB CAMP LEJEUNE, NORTH CAROLINA

	Exposed Population		
Scenario	Future Child Resident	Future Adult Resident	Future Base Personnel
Incidental Ingestion of Soil	1.43E-05	7.68E-06	4.57E-06
Dermal Contact with Soil	5.60E-06	1.77E-05	8.52E-06
Inhalation of Particulates	1.91E-08	2.63E-08	1.18E-08
TOTAL	1.99E-05	2.54E-05	1.31E-05

TABLE 6-51

TOTAL HAZARD INDICES
ASSOCIATED WITH SURFACE SOIL
SITE 6 (WOODED AREAS AND RAVINE) AND SITE 82
REMEDIAL INVESTIGATION CTO-0133
MCB CAMP LEJEUNE, NORTH CAROLINA

	Exposed Population		
Scenario	Future Child Resident	Future Adult Resident	Future Base Personnel
Incidental Ingestion of Soil	1.37E-01	1.47E-02	1.05E-02
Dermal Contact with Soil	1.52E-02	9.76E-03	5.63E-03
Inhalation of Particulates	5.71E-05	1.57E-05	8.46E-06
TOTAL	1.52E-01	2.45E-02	1.61E-02

TABLE 6-52

TOTAL INCREMENTAL LIFETIME CANCER RISK
ASSOCIATED WITH GROUNDWATER
OPERABLE UNIT NO. 2
REMEDIAL INVESTIGATION CTO-0133
MCB CAMP LEJEUNE, NORTH CAROLINA

Scenario	Exposed Population		
	Future Child Resident	Future Adult Resident	Future Base Personnel
Groundwater Ingestion	1.69E-04	3.61E-04	2.15E-04
Dermal Contact	1.58E-06	2.58E-05	2.32E-06
TOTAL	1.71E-04	3.87E-04	2.17E-04

TABLE 6-53

TOTAL HAZARD INDICES
ASSOCIATED WITH GROUNDWATER
OPERABLE UNIT NO. 2
REMEDIAL INVESTIGATION CTO-0133
MCB CAMP LEJEUNE, NORTH CAROLINA

Scenario	Exposed Population		
	Future Child Resident	Future Adult Resident	Future Base Personnel
Groundwater Ingestion	3.0E+00	1.3E+00	9.0E-01
Dermal Contact	2.04E-02	1.00E-02	7.18E-03
TOTAL	3.0E+00	1.31E+00	9.10E-01

TABLE 6-54

TOTAL INCREMENTAL LIFETIME CANCER RISK ASSOCIATED WITH SURFACE WATER/SEDIMENT SITE 6 WALLACE CREEK REMEDIAL INVESTIGATION CTO-0133 MCB CAMP LEJEUNE, NORTH CAROLINA

	Exposed Population	
Scenario	Future Adolescent Resident	Future Adult Resident
Incidental Ingestion of Surface Water	9.92E-08	2.12E-07
Dermal Contact with Surface Water	1.71E-07	4.65E-07
Incidental Ingestion of Sediment	5.14E-08	1.10E-07
Dermal Contact with Sediment	3.80E-06	8.15E-06
TOTAL	4.12E-06	8.94E-06

TABLE 6-55

TOTAL HAZARD INDICES
ASSOCIATED WITH SURFACE WATER/SEDIMENT
SITE 6 WALLACE CREEK
REMEDIAL INVESTIGATION CTO-0133
MCB CAMP LEJEUNE, NORTH CAROLINA

Scenario	Exposed Population	
	Future Adolescent Resident	Future Adult Resident
Incidental Ingestion of Surface Water	1.10E-03	5.77E-04
Dermal Contact with Surface Water	2.85E-03	2.32E-03
Incidental Ingestion of Sediment	4.29E-04	2.76E-04
Dermal Contact with Sediment	3.18E-02	2.04E-02
TOTAL	3.60E-02	2.36E-02

TABLE 6-56

TOTAL INCREMENTAL LIFETIME CANCER RISK
ASSOCIATED WITH SEDIMENT
SITE 6 BEAR HEAD CREEK
REMEDIAL INVESTIGATION CTO-0133
MCB CAMP LEJEUNE, NORTH CAROLINA

Scenario	Exposed Population	
	Future Adolescent Resident	Future Adult Resident
Incidental Ingestion of Sediment	2.62E-08	5.62E-08
Dermal Contact with Sediment	1.94E-06	4.15E-06
TOTAL	1.97E-06	4.21E-06

TABLE 6-57

TOTAL HAZARD INDICES
ASSOCIATED WITH SURFACE WATER/SEDIMENT
SITE 6 BEAR HEAD CREEK
REMEDIAL INVESTIGATION CTO-0133
MCB CAMP LEJEUNE, NORTH CAROLINA

Scenario	Exposed Population	
	Future Adolescent Resident	Future Adult Resident
Incidental Ingestion of Surface Water	4.01E-04	2.58E-04
Dermal Contact with Surface Water	1.51E-04	1.23E-04
Incidental Ingestion of Sediment	3.59E-04	2.31E-04
Dermal Contact with Sediment	2.66E-02	1.71E-02
TOTAL	2.75E-02	1.77E-02

TABLE 6-58

TOTAL INCREMENTAL LIFETIME CANCER RISK
ASSOCIATED WITH BIOTA
SITE 6 WALLACE CREEK
REMEDIAL INVESTIGATION CTO-0133
MCB CAMP LEJEUNE, NORTH CAROLINA

	Exposed Population
Scenario	Adult
Fish Ingestion	1.79E-03

TABLE 6-59

TOTAL HAZARD INDICES
ASSOCIATED WITH BIOTA
SITE 6 WALLACE CREEK
REMEDIAL INVESTIGATION CTO-0133
MCB CAMP LEJEUNE, NORTH CAROLINA

Scenario	Exposed Population
	Adult
Fish Ingestion	7.74E+00

TABLE 6-60

TOTAL EXPOSURE INCREMENTAL LIFETIME CANCER RISKS AND HAZARD INDICES
REMEDIAL INVESTIGATION CTO-0133
MCB CAMP LEJEUNE, NORTH CAROLINA

Receptors	Surface Soils (1)		Groundwaters		Surface Waters (2)		Sediments (2)		Biota		Total	
	ICR	HI	ICR	HI	ICR	HI	ICR	HI	ICR	HI	ICR	HI
Base Personnel	1.31E-05 (6)	0.02 (2)	2.17E-04 (94)	0.9 (98)	NA	NA	NA	NA	NA	NA	2.31E-04	0.92
Future Child Resident	1.99E-05 (10)	0.15 (5)	1.71E-04 (90)	3.0 (95)	NA	NA	NA	NA	NA	NA	1.91E-04	3.15
Future Adolescent Resident	NA	NA	NA	NA	2.70E-07 (6)	0.004 (12)	3.95E-06 (94)	0.03 (88)	NA	NA	4.12E-06	0.034
Future Adult Resident	2.54E-05 (1.2)	0.02 (0.22)	3.87E-04 (18)	1.31 (14)	6.77E-07 (0.03)	0.003 (0.03)	8.26E-06 (0.004)	0.02 (0.22)	1.79E-03 (80)	7.74 (85)	2.2E-03	9.09

Notes:
- ICR - Incremental Lifetime Cancer Risk
- HI - Hazard Index
- (1) - Risk results associated with potential exposure to Wooded and Ravine Area Surface Soils
- (2) - Risk results associated with potential exposure to Wallace Creek Surface Water and Sediments
- ( ) - Approximate percent contribution to the total ICR or HI value
- Total - Surface Soils + Groundwaters + Surface Waters + Sediments + Biota

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7.0 CONCLUSIONS AND RECOMMENDATIONS

This section presents the conclusions of the remedial investigation, and the human health and ecological risk assessment. Although the ecological risk assessment is presented under separate cover, the conclusions are provided herein in order to summarize the results of the entire remedial investigation. Recommendations for further action and pre-design studies are also provided in this section.

7.1 Conclusions

Based on the results of the various environmental investigations conducted at Operable Unit No. 2, conclusions for each area of concern and media were developed and are presented below.

7.1.1 Site 6, Lot 201

- The northeast corner of Lot 201 (i.e., grid area A) at the former pesticide storage area is contaminated with elevated levels of pesticides and volatiles that may be associated with former waste storage/handling activities. The extent of soil contamination is limited in area since only two sampling locations (SB16 and SB17) exhibited elevated contaminant levels.

- Former waste storage/handling activities at Lot 201 have not adversely impacted groundwater quality in this portion of Operable Unit No. 2.

- The presence of low levels of pesticides throughout Lot 201 is indicative of former pest control practices and is probably not associated with the former storage of pesticides. Low levels of pesticides were detected at similar concentrations throughout the 210-acre Operable Unit.

- Reported storage of PCB transformers at Lot 201 has not resulted in significant impacts to soil or groundwater, based on the limited number of occurrences and level of contamination.

- Overall, the current health risk to base personnel working at Lot 201 is within the target range of $1x10^{-4}$ and $1x10^{-6}$.

7.1.2 Site 6, Lot 203

- Pesticide levels detected in soil at Lot 203 are not indicative of pesticide disposal. Pesticide levels at Lot 203 are comparable to other portions of Operable Unit No. 2. The southeast corner of Lot 203 did not reveal elevated pesticide levels given that pesticides were reported to be disposed of in this area.

- The area of Lot 203 near the former railroad spur may be associated with previous disposal activities. A limited number of surface and subsurface soil samples collected near the former railroad spur have revealed elevated levels of PCB-1260 and PAHs. Historical aerial photographs indicate significant activity (i.e., surficial anomalies) in this area of Lot 203.

- Disposal activities may have occurred in the north central portion of Lot 203 (near well 6GW15) where elevated levels of PCBs were detected in subsurface soil samples. In addition to PCBs, elevated levels of PAHs were also detected in this area.

- The reported PCB disposal area in the northeast corner of Lot 203 did not reveal elevated levels of PCBs. The reported area may have been inaccurately identified in Marine Corps Memorandum.

- Military training operations at Lot 203 resulted in a substantial amount of buried debris including communication wire, rocket casings, battery packs, small 5-gallon containers, and bivouac wastes. No 55-gallon drums were uncovered in any of the test pit excavations within Lot 203. Trenches identified in historical photographs were probably excavated as a means to dispose of military-type wastes and not for purposes of disposing hazardous wastes.

- Numerous drums on the surface of Lot 203 present a potential impact to human health and the environment. Samples collected from these drums indicate that some of the drum contents are characteristically hazardous. None of the drums were noted to be leaking.

- Groundwater quality at Lot 203 has not been significantly impacted by former disposal and storage practices. Trace levels of TCE were detected in well 6GW15, which is located in the north central portion of Lot 203 where disposal activities may have occurred. Trace levels of TCE and PCE were detected in well 6GW23. Well 6GW23 is located in the south central portion of Lot 203. The source of VOC contamination in well 6GW23 is unknown. Soil samples collected from this borehole as well as other nearby soil borings did not indicated a source. The source of contamination may have been from a previous spill, which has since migrated from the soil to groundwater.

- Currently, Lot 203 is inactive and access is restricted. If the storage lot resumed operations, the potential human health risk (i.e., incremental carcinogenic risk) would be within the target range of $1x10^{-4}$ to $1x10^{-6}$.

7.1.3 Wooded Areas and Site 82

- The wooded area north of Lot 203 (Site 82) exhibited elevated VOC contaminant levels in soil at two locations near the eastern portion of the site. This area is a potential source of VOC contamination in groundwater.

- A large quantity of drums and debris were observed on the surface and subsurface just north of Lot 203 in the wooded area (Site 82) near monitoring wells 6GW1S and 6GW1D. Samples collected of the waste material analyzed the waste as No. 6 fuel oil, which is typically used for heating. Other drums uncovered could not be identified. This area may also be a source of groundwater contamination at Site 82.

- Shallow and deep groundwater north of Lot 203 (Site 82) exhibited elevated levels of VOC contaminants. Deep groundwater quality was found to be significantly more contaminated than shallow groundwater quality.

- The horizontal extent of shallow groundwater contamination is defined. The plume apparently originates just north of Lot 203 (in the southern portion of Site 82) and discharges into Wallace Creek. Contaminants have migrated into the deeper portion of the aquifer as evidenced by elevated VOC levels in deep groundwater monitoring wells.

- The horizontal and vertical extent of deep groundwater contamination has been evaluated. The horizontal extent of off-site contamination west of Site 82 (beyond well 6GW37D), however, has not been fully defined. Moreover, the vertical extent has been evaluated to a depth of 230 feet. It is unknown at this time whether contamination extends below 230 feet. As mentioned previously, a clay layer is present at approximately 230 feet which may impede the vertical migration of contamination. For purposes of conducting the baseline human health and ecological risk assessment, the current deep groundwater database is adequate. For purposes of performing a feasibility study on the deep aquifer, the current database is also adequate to select feasible remedial alternatives. Additional deep wells west of Holcomb Boulevard and at and/or below the clay formation are required to support the design of an alternative which may employ containment/extraction wells. Installation of these additional wells is currently underway as of August 1993.

- PCBs were detected in surface and subsurface soil near Piney Green Road east of Lot 201. Disposal activities may have occurred in this area, which once served as a training area.

- Disposal activities may have occurred in the wooded area between Lot 201 and 203. One location (soil boring SB1) exhibited moderate levels of PCBs, PAHs, and pesticides in surface soil. The extent of this contamination is limited in area.

- A former disposal area was identified during the test pit investigation in the wooded area between Lot 201 and Lot 203. Numerous 5-gallon containers, bivouac wastes, and battery packs were encountered. All of the containers were rusted and destroyed to the point where their contents could not be identified; however, solvent-like odors were observed by the sampling team. A sample of the sludge material near the containers revealed that the material is characteristically hazardous due to elevated levels of lead. Chloroform was also detected, but was below TCLP regulatory levels.

- Groundwater quality in the wooded area south of Lot 203 (near the above-mentioned disposal area) has been impacted by former disposal practices. Elevated levels of VOCs (chloroform, chlorobenzene, phenol) were encountered in wells 6GW16 and 6GW25.

- Potential human exposure to soil within the wooded portions of Operable Unit No. 2 would not result in significant health risks. Incremental carcinogenic risk values are within the acceptable target risk range of $1x10^{-4}$ and $1x10^{-6}$. The area is frequented by hunters and military personnel.

7.1.4 Ravine

None of the TCL organics detected in the ravine exceeded applicable water quality criteria values. Surface water concentrations of aluminum, cadmium, copper, iron, lead, silver, and zinc exceeded the WQS and/or WQSV in some of the samples. The exceedances of these TAL inorganics occurred in upstream and/or downstream samples or were infrequent in occurrence.

- The presence of elevated levels of PAHs in soil and low levels of PCBs in sediment in the upper portion of the ravine (i.e., near Lot 203) is most likely due to former disposal practices. This portion of the ravine is filled with debris, including empty and partially-filled 55-gallon drums and other containers. In addition, canisters with "DDT" markings were found in the middle section of the ravine (between Lot 203 and Wallace Creek). However, no elevated levels of pesticides were detected in the ravine sediments.

- Soil contamination detected in the ravine has likely migrated to Wallace Creek via surface runoff. Wallace Creek sediments revealed the same constituents detected in ravine soils and sediments.

- Because of the amount of debris and difficulty in accessing the ravine, it is unlikely that human exposure would occur. Incremental carcinogenic risk estimates for the wooded areas and ravine area have indicated that potential human health risks are within the target range of $1x10^{-4}$ and $1x10^{-6}$.

7.1.5 Site 9

- Ongoing fire training exercises at Site 9 have not significantly impacted groundwater quality. Surface soil samples revealed TPH contamination in various areas.

- Low levels of pesticides present at Site 9 are likely the result of former pest control practices and not associated with waste disposal.

- Potential human health risks to military personnel training at Site 9 are within the incremental carcinogenic risk range of $1x10^{-4}$ and $1x10^{-6}$.

7.1.6 Ecological

7.1.6.1 Wallace Creek

- The presence of TCE, PCE, and other VOC contaminants in Wallace Creek is due to shallow and possibly deep groundwater discharge.

- Surface runoff from the ravine and portions of Site 82 (the wooded area north of Lot 203) have impacted sediment quality. Elevated levels of PAHs and PCBs are present in Wallace Creek. These contaminants were also detected in the ravine.

- Pesticides detected in sediment samples have exceeded EPA Region IV sediment screening values. The source of contamination may be due to either runoff from the ravine and/or historical pest control spraying practices. The highest levels of pesticides were detected in two sampling stations that were located just downstream of where the ravine discharges into Wallace Creek. One upstream sampling location exhibited pesticide levels above the sediment screening values.

- None of the organic chemicals of concern detected in Wallace Creek exceeded applicable water quality standards.

- Inorganic levels for cadmium, copper, lead, mercury, nickel, silver, and zinc exceeded North Carolina Water Quality Standards (WQS) and/or EPA Region IV acute or chronic WQSVs. Upstream sampling locations also exhibited inorganic levels which exceeded these standards. The presence of inorganic constituents in Wallace Creek may not be associated with surface runoff from the ravine.

- The fish population and diversity in Wallace Creek appears to be healthy, based on population statistics. No anomalies were observed on any of the fish collected during the aquatic survey.

- Some of the fish collected in Wallace Creek exhibited tissue concentrations of PCBs, pesticides, and TCE, which may be attributable to Site 82 and the ravine area. Ingestion of fish taken from Wallace Creek could result in human health risks (incremental carcinogenic risks) above the target point of $1x10^{-4}$.

7.1.6.2 Bear Head Creek

- Sediment quality in Bear Head Creek may be impacted via surface runoff from the wooded areas. Low levels PAHs, pesticides, and PCBs were detected in sampling stations which border Site 6. VOC contaminants were also detected in sediment samples; however, the source of VOC contamination is unknown given that adjacent soil and groundwater did not exhibit VOC contamination. Pesticides in sediment are not likely associated with disposal practices.

- Inorganic constituents detected in sediment are not likely the result of disposal practices at Site 6 or 9. Upstream sampling locations also exhibited inorganic constituents above EPA Region IV sediment screening values.

- The fish community at Bear Head Creek appears to be healthy, based on population statistics and observations. None of the fish collected at Bear Head Creek exhibited lesions or other anomalies that would represent adverse conditions.

- The fish community in Bear Head Creek had elevated levels of pesticides, PCBs, and zinc in tissue. The presence of these contaminants in fish tissue may be the result of contaminated sediment. Ingestion of fish taken from Bear Head Creek could result in incremental carcinogenic risks above the $1x10^{-4}$ departure point.

- None of the TCL organics detected in Bear Head Creek exceeded applicable water quality criteria values. Dissolved oxygen concentrations and pH values were below WQS and WQSV at some of the stations, but probably were associated with natural conditions.

- Surface water concentrations of copper, lead, mercury, nickel, and silver exceeded the WQS and/or WQSV in some of the samples. The exceedances of these TAL inorganics occurred in upstream and/or downstream samples or were infrequent in occurrence.

7.1.6.3 Terrestrial Receptor

Some of the contaminant concentrations in the surface soils of a few TAL inorganics may cause adverse effects to plants and invertebrates. The potential risk for terrestrial vertebrates exposed to on-site soils and surface water is expected to be low based on a comparison of terrestrial reference values to chronic daily intake estimates.

7.2 Recommendations

1. Further groundwater investigations are required to better define the extent of deep groundwater contamination at Site 82. These studies would be required to support the remedial design of alternatives employing containment/extraction wells.

2. Operating supply wells in the vicinity of Lot 203 should be monitored for VOC contamination. If elevated levels of VOCs are detected, the wells should be closed.

3. As a time critical removal action, a fence should be constructed around the wooded area north of Lot 203 (i.e., Site 82), including the ravine to prevent access. Surficial VOC contamination was encountered in this area.

4. Surficial drums at Lot 203 and in the wooded areas and ravine should be removed, overpacked, and properly disposed of as a non-time critical removal action. The drums present a potential source of groundwater contamination and human/ecological health hazard.

5. Additional studies should be conducted in Wallace Creek to determine whether the presence of contaminants such as PCBs and pesticide in fish and shellfish are due to the site. The limited database is not sufficient to conclude whether bioaccumulation is occurring due to the site-related migration pathways.

6. Based on the results of the Human Health Risk Assessment, and on a comparison of contaminant levels to groundwater standards, remedial action of the surficial and deep aquifer under Site 82 is recommended in order to restore the aquifer for future use.

7. Based on the soil data results, remedial action is recommended for "hot spot" areas of soil with elevated levels of VOCs, PCBs, PAHs, and pesticides. These areas may be potential sources of groundwater contamination.

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