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FINAL

SITE INVESTIGATION REPORT
SITE 10 - ORIGINAL BASE LANDFILL

MARINE CORPS BASE
CAMP LEJEUNE, NORTH CAROLINA

CONTRACT TASK ORDER 0369

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LIST OF ACRONYMS

ABS	Absorbance Factor (dermal)
AOC	Area Of Concern
AF	Adherence Factor
ARAR	Applicable or Relevant and Appropriate Requirements
AT	Averaging Time
AWQC	Ambient Water Quality Criteria
B	contaminant detected in the method blank associated with the sample
BaB	Baymeade fine sand
Baker	Baker Environmental, Incorporated
BCF	Bioconcentration Factor
bgs	Below Ground Surface
BTAG	Biological Technical Assistance Group
BRA	Baseline Risk Assessment
BW	Body Weight
CCME	Canadian Council of Ministers of the Environment
CDI	Chronic Daily Intake
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act of 1980
CLP	Contract Laboratory Program
COC	Contaminant of Concern
COPC	Contaminant Of Potential Concern
CRAVE	Carcinogen Risk Assessment Verification Endeavor
CRDL	Contract Required Detection Limit
CRQL	Contract Required Quantitation Limit
CSF	Cancer Slope Factor
CT	Central Tendency
CTO	Contract Task Order
DCE	1,2-dichloroethene
DEHNR	Department of Environment, Health and Natural Resources
DEM	Division of Environmental Management
DoN	United States Department of the Navy
ECOC	Ecological Contaminants of Concern
ED	Exposure Duration
EF	Exposure Frequency
Eh	oxidation reduction potential
EPA	Environmental Protection Agency
EPA-NCEA	USEPA National Center for Environmental Assessment Office
ESE	Environmental Science and Engineering
ET	Exposure Time
FEMA	Federal Emergency Management Agency
FFA	Federal Facilities Agreement
FIRM	Flood Insurance Rate Maps

LIST OF ACRONYMS
(Continued)

FMFLANT	Fleet Marine Force Atlantic
FSSG, 2nd	2nd Force Service Support Group
ft/d	feet per day
ft^2/day	square feet per day
FWS	U.S. Fish and Wildlife Services
G3CTM	G3 Groundwater Contaminant Transport Model
GA	existing or a potential source of drinking water supply for humans
gpd	Gallons Per Day
GSRA	Greater Sandy Run Area
HA	Health Advisories
HEAST	Health Effects Assessment Summary Table
HHAG	Human Health Assessment Group
HI	Hazard Indices
HQ	Hazard Quotients
HQW	High Quality Water
H and HSSW	Headquarters and Headquarters Squadron Station Weather
IAS	Initial Assessment Study
ICR	Incremental Cancer Risk
IDW	Investigative derived waste
IEUBK	Integrated Exposure Uptake Biokinetic Model for Lead in Children
IR	Ingestion Rate
IRIS	Integrated Risk Information System
IRP	Installation Restoration Program
J	estimated value
K_d	soil sorption coefficient
K_{oc}	organic carbon partition coefficient
K_{ow}	octanol/water partition coefficient
KuB	Kureb fine sand
LOAEL	Lowest Observed Adverse Effect Level
MaC	Marvyn loamy fine sand
MAGTF	Marine Air Ground Task Force
MCAS	Marine Corps Air Station
MCB	Marine Corps Base
MCL	Maximum Contaminant Level
MF	Modifying Factor
MI	Mobility Index
msl	Mean Sea Level
mg/L	milligrams per liter
MOH	Dutch Ministry of Housing

LIST OF ACRONYMS
(Continued)

NACIP	Navy Assessment and Control of Installation Pollutants
NC DENR	North Carolina Department of Environmental and Natural Resources
NC WQS	North Carolina Water Quality Standards
NC WRC	North Carolina Wildlife Resources Commission
NEESA	Navy Energy and Environmental Support Activity
NJ	compound was tentatively identified, but the reported value may not be accurate or precise
NOAEL	No Observed Adverse Effects Level
NOEL	No Observed Effects Level
NPL	National Priorities List
NREA	Natural Resources and Environmental Affairs
NSW	Nutrient Sensitive Water
NTU	Nephelometric Turbidity Units
NWI	National Wetland Inventory
ORNL	Oak Ridge National Laboratory
QA/QC	Quality Assurance / Quality Control
Pa	Pactolus fine sand
PAH	Polynuclear Aromatic Hydrocarbons
Pas/SIs	Preliminary Assessments/Site Investigations
PCB	Polychlorinated Biphenyl
PEF	Particulate Emission Factor
PID	Photoionization Detector
PLE	Plume's Leading Edge
PPE	Personal Protective Equipment
PVC	Polyvinyl Chloride
R	sample result has serious deficiencies with regard to the ability to analyze the sample and meet quality control criteria
RA	Risk Assessment
RAGS	Risk Assessment Guidance for Superfund
RBCs	Region III Risk-Based Concentrations
RCRA	Resource Conservation Recovery Act
RDA	Recommended Daily Allowance
RfD	Reference Dose
RI	Remedial Investigation
RME	Reasonable Maximum Exposure
SA	estuarine water suited for commercial shell fishing and all other tidal saltwater uses
SARA	Superfund Amendment and Reauthorization Act
SB NSW	nutrient sensitive waters capable of sustaining primary and secondary recreation, aquatic life, propagation and survival, fishing, and wildlife

LIST OF ACRONYMS
(Continued)

SC	salt waters protected for secondary recreation, fishing, aquatic life including propagation and survival
SCS	Soil Conservation Service
SI	Site Investigation
SOP	Standard Operating Procedure
SSSV	Surface Soil Screening Value
SVOC	Semivolatile Organics
SW	well graded sand
TBC	To Be Considered
TCL	Target Compound List
TAL	Target Analyte List
UBK	Uptake/Biokinetic
UCL	Upper Confidence Limit
UF	Uncertainty Factor
µg/kg	micrograms per kilogram
µg/L	micrograms per liter
µg/dl	micrograms per deciliter
UJ	compounds that were not detected and had inaccurate or imprecise quantitation limits
USCS	Unified Soil Classification System
USDI	United States Department of the Interior
USEPA	United States Environmental Protection Agency
USGS	United States Geological Society
VOC	Volatile Organic Compounds
WAR	Water and Air Research, Inc.
WOE	Weight of Evidence

EXECUTIVE SUMMARY

This document was prepared by Baker Environmental, Inc. (Baker) to document on the activities and findings of the Phase I and Phase II Investigations conducted at Site 10 - Original Base Landfill, MCB Camp Lejeune, North Carolina. The purpose of the Phase I investigation was to determine whether contamination was present at this site and if additional work was warranted in the form of a Remedial Investigation (RI). The Phase II investigation was conducted in order to delineate inorganic groundwater contamination, which may have been inaccurate in the Phase I investigation due to high Neophelometric Turbidity Units (NTU) readings in collected samples. In addition, data was collected at Site 10 during the two investigations in order to determine groundwater flow direction in the shallow aquifer, which would provide necessary information for a limited quantitative Risk Assessment (RA), and a qualitative assessment of all data against applicable criteria (screening).

The Phase I investigation at Site 10 was initiated March 16 and concluded March 25, 1998. The field program investigated soil, groundwater, surface water, and sediment investigation. All sampled media from the site were analyzed for Target Compound List (TCL) organics and Target Analyte List (TAL) inorganics via Contract Laboratory Program (CLP) protocols.

The Phase II investigation began February 26 and concluded March 1, 2001. The field event consisted of the installation of six permanent monitoring wells and a subsequent groundwater investigation. The groundwater samples were analyzed for TAL total metals in accordance with CLP methods.

Results from the Phase I investigation revealed that two volatile organic compounds (VOCs) (methylene chloride and acetone) were detected in excess of the target concentrations for soils. Both of these compounds are common laboratory contaminants and are not suspected to be site related. Toluene was detected in sediment at concentrations below target concentrations.

Additionally, the investigation revealed a fairly large number of semivolatile organic compounds (SVOCs) detected in soil samples. The majority of the detections appear to be concentrated in the northern-most portion of the site, near soil boring IR10-SB03. The log for this soil boring indicates that charred wood and fill material was observed within the sampling interval. The high concentration

of PAHs may be the result of the combustion of materials buried in the vicinity of soil boring IR10-SB03.

Heptachlor, heptachlor epoxide and endrin were detected at concentrations in excess of target concentrations in a surface soil sample collected from soil boring IR10-SB09 during Phase I. Since pesticides were not detected throughout the site (as would be the case if pesticide application was the source of contamination), an isolated spill is suspected for their detection. One detection of Aroclor-1260 was detected in surface soil sample IR10-SB04, which is the same area as most of the PAHs were detected. The source of this contamination may be the same as the PAHs, material burned at the site.

During the Phase I investigation, inorganics were detected in all sampled media. Inorganics detected at the site are most likely related to the types of materials disposed at the site (construction materials). Metal debris was observed throughout the site during the site visit and Phase I investigation. The distribution of contaminants is not typical of an isolated spill or release. It is suspected that the contaminants may be the result of rusting metal debris and breakdown of various construction materials. Inorganics were retained as contaminants of concern (COCs) in all media except sediment.

Total metals detected in groundwater samples collected during the Phase II investigation were at concentrations more than one order of magnitude below the concentrations detected during the Phase I investigation. Iron was the only contaminant to exceed the North Carolina 2L Groundwater Protection Standards. Previous investigations have shown that elevated iron concentrations are naturally occurring throughout MCB Camp Lejeune, North Carolina.

Human health risk evaluation indicates there are potential non-carcinogenic adverse health effects from ingestion and dermal contact by the construction worker. However, it should be noted that the acceptable risk level is not exceeded for any one organ system/target organ, and iron accounted for approximately 35 percent of the elevated noncarcinogenic effect. Therefore, using this conservation approach in the risk approach may have overestimated the noncarcinogenic effects on the construction worker scenario.

The ecological risk screening indicates that risk to aquatic receptor groups (e.g., aquatic plants, amphibians, etc.) may exist in surface water and groundwater due to inorganics detected during the

SI. However, it was noted that the conservative nature of this screening may have overestimated risks. Upper trophic level aquatic receptors were not evaluated as part of this ecological risk screening, therefore, chemicals detected in surface water/sediment may present unacceptable risk to these receptors.

Based on the findings of the Phase I and Phase II investigations, Baker recommends that no further action be taken at this site.

1.0 INTRODUCTION

Marine Corps Base (MCB) Camp Lejeune was placed on the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) National Priorities List (NPL) effective November 4, 1989 (54 Federal Register 41015, October 4, 1989). Subsequent to this listing, the United States Environmental Protection Agency (USEPA) Region IV, the North Carolina Department of Environment, Health and Natural Resources (DEHNR), the United States Department of the Navy (DoN) and the Marine Corps 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 are thoroughly investigated, and that appropriate CERCLA response and Resource Conservation Recovery Act (RCRA) corrective action alternatives are developed and implemented as necessary to protect the public health and welfare, and the environment (MCB Camp Lejeune FFA, 1989).

Under the scope of the FFA, a Site Investigation (SI) can be implemented to determine whether contamination is present at a site and if additional work is warranted in the form of a remedial investigation (RI). In addition, data was collected at Site 10 determining groundwater flow direction in the shallow aquifer, providing necessary information for a limited quantitative Risk Assessment (RA) using conservative receptors, and to qualitatively assess all data against applicable criteria. It is not the focus of this SI to determine the extent of contamination detected at the site; however, an attempt to establish contaminant patterns is included in Section 4.0.

1.1 Report Organization

This SI Report for Site 10 is comprised of a single volume with text, tables, figures and appendices. The text is subdivided into the following sections:

- Section 1.0 - Introduction
- Section 2.0 - Field Investigation Activities
- 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 - Human Health Risk Assessment
- Section 7.0 - Ecological Risk Screening
- Section 8.0 - Summary and Conclusions

Section 1.0 summarizes relevant background information pertaining to MCB, Camp Lejeune and the site. This includes information such as the location, setting and mission of MCB, Camp Lejeune, description and history of the site, previous investigations conducted at the site, data limitations associated with the previous investigations, and objectives of this Site Investigation. Section 2.0 describes the field sampling activities and analytical program conducted at the site. Section 3.0 describes the topography and surface features of the study area, surface water hydrology, regional and site-specific geology, regional and site specific hydrogeology, land use, demographics, climatology, MCB, Camp Lejeune water supply, and ecological characteristics of MCB, Camp Lejeune and the study area. Section 4.0 discusses data management and tracking, non-site related contamination, state and federal criteria and standards, analytical results, and quality assurance and quality control. Contaminant fate and transport is described in Section 5.0. Section 6.0 discusses human health risk and Section 7.0 discusses ecological risk. Section 8.0 provides a summary and conclusions.

References for each of the sections will be included as the last subsection. All tables and figures will be provided following the text for each section .

1.2 MCB, Camp Lejeune Location, Setting and Mission

This section provides an overview of the location, history and mission associated with MCB Camp Lejeune, North Carolina (which also includes Marine Corps Air Station [MCAS] New River).

1.2.1 Location and Setting

MCB Camp Lejeune is located within the Coastal Plain Physiographic Province. It is located in Onslow County, North Carolina, approximately 45 miles south of New Bern and 47 miles north of Wilmington (Figure 1-1). The facility covers approximately 236 square miles. This includes the recent acquisition of approximately 64 square miles west of the facility within the Greater Sandy Run Area (GSRA) of the county. The military reservation is bisected by the New River, which flows in a southeasterly direction and forms a large estuary before entering the Atlantic Ocean.

The eastern border of MCB Camp Lejeune is the Atlantic shoreline. The western and northwestern boundaries are U.S. Route 17 and State Route 24, respectively. The City of Jacksonville, North Carolina, borders MCB Camp Lejeune to the north. The location of MCB Camp Lejeune is depicted in Figure 1-1.

The GSRA is located in the southeast portion of Onslow County, North Carolina, near the Pender-Onslow County border. The GSRA is approximately 31 miles northeast of Wilmington, North Carolina; 15 miles south of Jacksonville, North Carolina; and 5 miles northwest of the Atlantic Ocean. The GSRA is located south and west of MCB, Camp Lejeune, sharing a common boundary along Route 17 between Dixon and Verona.

The following overview of the Base was taken from the document "Master Plan, Camp Lejeune Complex, North Carolina." The Complex consists of 12 identifiable developed areas. Of the developed areas, Hadnot Point comprises the most concentrated area of development. This area includes the organizational offices for the Host Activity and for the Headquarters, 26th Marine Amphibious Unit, as well as the Headquarters and regimental areas for the 2nd Marine Division, Marine Expeditionary Force, 6th Marine Expeditionary Brigade, 22nd Marine Expeditionary Unit, 24th Marine Amphibious Unit, the Central Exchange & Commissary and the Naval Dental Clinic Headquarters. Directly north of Hadnot Point are the family housing areas concentrated throughout the wooded areas of the central Complex and along the shores of the New River. Also located in this north central area are major personnel support land uses, including the Naval Hospital, school sites, recreational areas, as well as additional family housing areas (quarters developments, Midway Park and Tarawa Terrace I and II).

MCAS New River and Camp Geiger are considered as a single urban area possessing two separate missions and supported by two unrelated groups of personnel. MCAS New River encompasses 2,772 acres and is located in the northwestern section of the Base and lies approximately five miles south of Jacksonville. The MCAS includes air support activities, troop housing and personnel support facilities, all of which immediately surround the aircraft operations and maintenance areas.

Camp Geiger, located directly north of MCAS New River, contains a mixture of troop housing, personnel support and training uses. Currently, the area is utilized by a number of groups which have no direct relationship to one another. The majority of the land surrounding this area is comprised of buffer zones and unbuildable marshland.

MCB Camp Lejeune contains five other areas of concentrated development, all of which are much smaller in size and population than either Hadnot Point, MCAS New River, or the Camp Geiger area. The oldest of these is the Montford Point area, which is bounded by the New River to the south and west and by Route 24 on the north. New development in Montford Point has been limited, with most

of the facilities for troop housing, maintenance, supply and personnel support having been converted from their intended uses. A majority of the MCB training schools requiring classroom instruction are located here and use surrounding undeveloped areas for training operations when required. The French Creek area located directly south of Hadnot Point is occupied by the 2nd Force Service Support Group (2nd FSSG). Its activities are directed toward providing combat service and technical support as required by Headquarters, II Marine Expeditionary Force. Expansion of the French Creek Complex is constrained by the Ordnance Storage Depot explosives safety arc on the south and by the regimental area of Hadnot Point. Onslow Beach, located along the Onslow Bay, east of the New River Inlet, presents assets for amphibious training as well as recreational use. Courthouse Bay is located on one of a series of small bays which are formed by the New River. This area is used for maintenance, storage and training associated with amphibious vehicles and heavy engineering equipment. The Engineering School, also located here, conducts training activities in the large open area located to the southeast of the Courthouse Bay. Another concentrated area of development is the Rifle Range. This area is located on the southwest side of the New River, is singular in purpose and has only a small number of assigned personnel. It was constructed in the early stages of Base development and is used solely for rifle qualification training. The small group of barracks, located at the Rifle Range, are used for two-week periods by troops assigned to range training.

1.2.2 History and Mission of Camp Lejeune

Construction of MCB Camp Lejeune began in 1941 with the objective of developing the "World's Most Complete Amphibious Training Base." Construction of the Base started at Hadnot Point, where the major functions of the base are centered. Development at MCB Camp Lejeune is primarily in five geographical locations under the jurisdiction of the Base Command. These areas include Camp Geiger, Montford Point, Courthouse Bay, Mainside, and the Rifle Range Area.

The MCB organization functions as the host command to the two Fleet Marine Force Atlantic (FMFLANT) tenant activities -- Headquarters of the II Marine Expeditionary Division and the 2nd FSSG. The MCB host organization mission is to provide housing, training facilities, logistical support and certain administrative support for tenant units and for other units assigned to MCB Camp Lejeune and to conduct specialized schools and other training maneuvers, as directed.

The mission of the 6th Marine Expeditionary Brigade is to provide the Command element for a brigade-size Marine Air Ground Task Force (MAGTF).

The mission of the 2nd Marine Division is to execute amphibious assault operations, and other operations as may be directed, which are supported by Marine aviation and force service support units. With the aircraft wing, the Marine division provides combined arms for service with the Fleet in the seizure or defense of advanced naval bases and for the conduct of land operations essential to the prosecution of a naval campaign.

The mission of the 2nd FSSG is to command, administer and train assigned units in order to provide combat service and technical support as required by Headquarters FMFLANT and its subordinate command in accomplishment of the overall FMFLANT mission.

1.3 Site Description and History

Site 10, referred to as the Original Base Landfill, is located on the western side of Holcomb Boulevard, approximately 1,600 feet south of Wallace Creek and 1,750 feet north of Bearhead Creek (Figure 1-2). Open storage lots 201 and 203, as well as RI Sites 6 and 82 are located east of Site 10. The Original Base Landfill was reported to be approximately five to ten acres in size during full operation. The Initial Assessment Study (IAS) (Water and Air Research [WAR], 1983) indicated that the area was used as a disposal site for construction debris and as a burn dump. It is believed the landfill was operated prior to 1950 during construction of the base. Records indicating the type of debris and /or wastes disposed at the site are unavailable.

The study area is populated with trees varying in age from saplings to trees that are 30 to 40 years in age. A thick underbrush is present throughout much of the area. The terrain slopes north, south and west of the site. Much of the area is near groundwater level creating a very marshy environment. Two relatively large ponds exist on the southern-half of the site. Neither pond was deeper than 2.5 feet and did not support aquatic life. Evidence such as terrestrial vegetation indicated that the ponds were most likely seasonal.

The site visit conducted in September 1996, confirmed the presence of construction debris including concrete, bricks, scrap metal, metal piping and asphalt within the boundaries of the site. The area is currently unrestricted with respect to site access. Numerous "foxholes" and ammunition casings indicate that military maneuvers are conducted in the area.

During the IAS, it was decided that the site did not need further investigation and it was removed from the list of sites requiring further investigation. In 1994, two marines were conducting night maneuvers and reported fell into an "open trench" receiving a rash from an "oily substance" that they had contacted at the bottom. They were treated at the base hospital and released. Site 10 was one of two sites that the marines may have been crossing while on maneuvers. The other site has not been located. It is not known if the reference to the other site referred to a potential IR site, or just another base location. Because Site 10 was identified as one of the locations where the marines may have contacted the "oily substance", it was determined that the site should be investigated further to determine if contamination exists.

An expedited site characterization and evaluation of Site 10 was conducted in September 1995 by the DoN in the western portion of the landfill. At the time of the investigation, it was believed that the landfill existed within the boundaries of the study area. Subsequent information such as aerial photographs indicated that the landfill was much larger than originally believed, consequently creating a need to investigate the remaining portion.

1.4 Previous Investigations

Two previous investigations have been conducted at this site to date. The first was an Initial Assessment Study (IAS) by Water and Air Research, Inc. (WAR, 1983). The second was an expedited site characterization and evaluation of Site 10 conducted in September 1995 by Baker at the request of the DoN.

1.4.1 Initial Assessment Study

In response to the passage of 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 were conducted by the Navy Energy and Environmental Support Activity (NEESA) and consisted of IAS and Confirmation Studies. IAS are similar to the USEPA's Preliminary Assessments/Site Investigations (PAs/SIs). Confirmation Studies are similar to USEPA's Remedial Investigation / Feasibility Studies (RI/FS). When the Superfund Amendment and Reauthorization Act (SARA) was passed in 1986, the DoN dissolved the NACIP in favor of the Installation Restoration Program (IRP), which adopted USEPA Superfund terminology and procedures.

The IAS for MCB, Camp Lejeune was conducted by WAR in 1983. The IAS identified a number of sites at MCB, Camp Lejeune as potential sources of contamination. Based on historical records, aerial photographs, field inspections, and personnel interviews, the IAS identified 76 sites at MCB, Camp Lejeune as potential sources of contamination. Of these 76 sites, 27 sites warranted further investigation to assess potential long-term impacts based on contamination characteristics, migration pathways, and pollutant receptors. Site 10 was not one of the 27 sites needing further investigation. As detailed in previous paragraphs, in 1994, two marines conducting night maneuvers fell into an open trench and received a rash from an "oily substance" that they had contacted in the bottom. Site 10 was one of two sites that the marines may have been crossing while on maneuvers. Once the incident was reported, Site 10 was again added to a list of sites at the base that require investigation.

1.4.2 Expedited Site Characterization and Evaluation

An expedited site characterization and evaluation of Site 10 was conducted by Baker in September 1995, along with numerous other sites, to determine each site's hazard ranking. The objective of this study was to determine the order of site investigations based on risk (i.e., highest risk ranking equals first site investigated). At the time of the investigation, it was believed that the landfill was existed within the boundaries of the investigation. Subsequent information such as aerial photographs indicated that the landfill was much larger than originally believed, consequently creating a need to investigate the remaining portion. A summary of the findings of the investigation are presented below.

1.4.2.1 Soil Investigation

Five (5) soil borings (10-SB01 through 10-SB05) were drilled on site and advanced to the water table (Figure 1-3). A single surface and two subsurface soil samples were collected from each of the five locations using a Geoprobe. Surface soil samples were collected from 0 to 6 inches below ground surface (bgs). The subsurface samples were collected from just above the water table and from a depth midway between the surface and the water table. All soil samples were analyzed for full Target Compound List (TCL) organics and Target Analyte List (TAL) metals. Results of the surface and subsurface soils were compared to Region III Risk-Based Concentrations (RBCs) for residential and industrial soil. In addition, the detected inorganics were compared to base background results. Contaminant concentrations exceeding Region III RBCs are summarized in Tables 1-1 through 1-4, and discussed below.

Surface Soil:

- Acetone was detected in surface samples collected at the site. However, not in excess of industrial or residential RBCs.

- Numerous semivolatile organic compounds (SVOCs) were detected in the samples collected during the expedited site characterization. The following SVOCs exceeded residential and/or industrial RBCs: benzo(a)anthracene, benzo(b)fluoranthene, benzo(a)pyrene, indeno(1,2,3-cd)pyrene, and dibenzo(a,h)anthracene.

- Pesticides such as aldrin 4,4'-DDE, Endosulfan II and 4,4'-DDT were detected in samples. The concentrations of these compounds were not in excess of the RBCs. Polychlorinated biphenyls (PCBs) were not detected in any of the samples.

- Arsenic, barium, beryllium, potassium, manganese, lead, and zinc were detected at concentrations exceeding the residential or industrial RBCs, and/or base background concentrations.

Subsurface Soil:

- No volatile organic compounds (VOCs) were detected in subsurface soils collected at the site.

- Benzo(a)pyrene was the only detected SVOC whose concentration exceeded residential RBCs.

- A single pesticide compound was detected in the subsurface soils, however the concentration was below the RBCs. No PCBs were detected.

- Arsenic, barium, calcium, copper, manganese, lead, and zinc were detected at concentrations exceeding the residential and industrial RBCs, and/or base background concentrations.

1.4.2.2 Groundwater Investigation

Three (3) temporary monitoring wells (10-TW01, 10-TW02, and 10-TW03) were installed, and one round of groundwater samples were collected (Figure 1-3). Groundwater samples were analyzed for full TCL organics and TAL Inorganics (total and dissolved fractions). Results of the groundwater samples were compared to Federal Maximum Contaminant Levels (MCLs) and the North Carolina Water Quality Standards (NC WQS). Analytical findings are summarized in Table 1-5 and highlighted below.

- VOCs, SVOCs, and pesticides/PCBs were detected at low levels. However, the detected concentrations were well below the MCLs and NC WQS.

- The following inorganics were detected at levels above the MCLs and/or NC WQS: aluminum, arsenic, chromium, iron (total and dissolved samples), manganese, nickel, lead, and vanadium.

1.4.2.3 Aerial Photograph Review

Aerial photographs from October 21, 1949 and February 1, 1956 were reviewed by Baker. These photos helped to identify the approximate size and shape of the site. The following paragraphs summarize the review of these photos.

The aerial photograph from 1949 (Figure 1-4) clearly depicts the site. Most of the trees are cleared and access roads are visible throughout the area. No evidence of disposal activities were noted; therefore, the actual boundaries of the landfill can not be determined.

The aerial photograph from 1956 (Figure 1-5) does not depict the site as clearly as the 1949 photograph. The land filling operations reportedly ceased in 1950; therefore, evidence of vegetation recovery is expected in this photo. Access roads are still very clear indicating that they were still being used.

1.5 Data Limitations

Upon review of the previous investigations, it was determined that data limitations existed at Site 10. The most significant data gap concerned the lack of site coverage during the expedited site characterization and evaluation. Specific data needs included the following:

- The evaluation of surface and subsurface soils in the portion of the site no investigated during the expedited site characterization and evaluation in order to conduct a human health risk assessment.

- The evaluation of groundwater in the vicinity of the site in order to conduct a human health risk assessment. This includes the establishment of groundwater flow direction.

- The evaluation of the surface water and sediment contained within the two ponds located on the southern-half of the site. An ecological risk assessment will be conducted to determine if a potential risk exists at the site.

From these site-specific data needs, SI objectives were established to meet the data deficiencies for Site 10. SI objectives are presented in the following section.

1.6 Site Investigation Objectives

Table 1-6 presents the SI objectives that were included in the Final SI Work Plan (Baker, 1998).

1.7 References

Baker 1998. Final Site Investigation Project Plans for Site 10 - Original Base Landfill, Marine Corps Base Camp Lejeune, North Carolina. Prepared for Department of the Navy, Atlantic Division, Naval Facilities Engineering Command, Norfolk, Virginia. January 1998.

Baker 1995. Final Site Characterization and Evaluation Report, Sites 10 and 85, MCB, Camp Lejeune, and Sites 11 and 17, Naval Station Roosevelt Roads. Prepared for Department of the Navy, Atlantic Division, Naval Facilities Engineering Command, Norfolk, Virginia. October 1995.

54 Federal Register 41015. 1989. CERCLA National Priorities List. October 4, 1989.

DoN, 1988. Master Plan, Camp Lejeune Complex, North Carolina. COMNAVFACENGCOM, April 8, 1988.

MCB, Camp Lejeune Federal Facility Agreement (FFA). December 6, 1989.

U.S. Environmental Protection Agency (USEPA), 1988. Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA. Office of Emergency and Remedial Response, OSWER Directive 9355.3-01, October 1988.

Water and Air Research, Inc. (WAR). 1983. Initial Assessment Study of Marine Corps Base, Camp Lejeune, North Carolina. Prepared for Naval Energy and Environmental Support Activity.

SECTION 1.0 TABLES

TABLE 1-1

ORGANIC COMPOUNDS EXCEEDING CRITERIA - SURFACE SOIL
EXPEDITED SITE CHARACTERIZATION AND EVALUATION
SITE 10 - ORIGINAL BASE LANDFILL
MCB, CAMP LEJEUNE, NORTH CAROLINA
SITE INVESTIGATION, CTO - 0369

	Risk-Based Concentrations		North Carolina Risk Analysis Framework Method I Target Concentrations	Soil Results				
Constituent	Industrial Soils (µg/kg)	Residential Soils (µg/kg)	S3:G1 (µg/kg)	10-SB01-00 Soil	10-SB02-00 Soil	10-SB03-00 Soil	10-SB04-00 Soil	10-SB05-00 Soil
Semivolatiles (µg/kg):								
Benzo(a)anthracene	7,800	880	343	170J	390U	*4,500E*	440U	450U
Benzo(b)fluoranthene	7,800	880	--	260J	390U	4,600E	440U	450U
Benzo(a)pyrene	780	88	--	190J	390U	**3,500E**	440U	450U
Indeno(1,2,3-cd)pyrene	7,800	880	--	120J	390U	2,800	440U	450U
Dibenzo(a,h)anthracene	780	88	--	410U	390U	630	440U	450U

Notes:

µg/kg = Micrograms per kilogram
U = Analyzed, not detected
J = Present below detection limit
E = Exceeds linear range of calibration

Industrial/Residential - Industrial and Residential Risk Based Concentrations (March 1995)
Shading indicates the compound exceeded Residential Risk Based Concentrations.
Bold indicates the compound exceeded Industrial Risk Based Concentrations.
Italics indicates the compound exceeded the North Carolina Risk Analysis Framework Method I Target Concentrations.

TABLE 1-2

INORGANIC COMPOUNDS EXCEEDING CRITERIA - SURFACE SOIL
EXPEDITED SITE CHARACTERIZATION AND EVALUATION
SITE 10 - ORIGINAL BASE LANDFILL
MCB, CAMP LEJEUNE, NORTH CAROLINA
SITE INVESTIGATION, CTO -0369

	Soil Criteria				Soil Results				
Constituent	(RBCs) Industrial Soils (mg/kg)	(RBCs) Residential Soils (mg/kg)	SS Background 2X (CTO 303)	North Carolina Risk AnalAnalysis Framework Method I Target Concentrations S1:G1 (mg/kg)	10-SB01-00 Soil	10-SB02-00 Soil	10-SB03-00 Soil	10-SB04-00 Soil	10-SB05-00 Soil
Total Analytes (mg/kg):									
Arsenic	3.3	0.37	1.3	26.2	0.36U	*0.59*	0.32U	0.43U	0.42U
Barium	140,000	5,500	17.4	848	4.1	*18.1*	3.7	16.2	3.5
Beryllium	1.3	0.15	0.2	--	0.27U	0.39	0.35U	0.37U	0.34U
Calcium	NC	NC	1,396.8	--	148	803	225	889	39.7
Cadmium	1,000	39	0.7	2.72	0.51U	0.54U	0.65U	0.7U	0.64U
Cobalt	120,000	4,700	1.9	--	0.4U	0.88	0.54	0.55U	0.5U
Chromium	10,000	390	6.7	27.2	1.8	2.6	2.1	0.95	0.97
Copper	76,000	2,900	7.2	704	1.3	3.2	1.4	2.4	1
Iron	NC	NC	3,755.1	151.2	794	1,990	604	384	1,040
Mercury	610	23	0.1	0.0154	0.11U	0.12U	0.1U	0.11U	0.1U
Potassium	NC	NC	199.6	--	144	129	146	*213*	121U
Manganese	10,000	390	18.5	65.2	13.3	*34.6*	3.2	3.9	2.8
Sodium	NC	NC	52.3	--	12.5	29.4	14.1	18.6	14.6
Nickel	41,000	1,600	3.4	56.4	2.1U	2.3U	*2.7U*	2.9U	2.6U
Lead	NC	400	23.7	270.06	28	*48.5*	25.7	12.1	2.1
Vanadium	14,000	550	11.6	--	2.4	5	2.9	3	3.5
Zinc	610,000	23,000	13.9	1100.4	8.6	*29.2*	10.1	7.6	0.75

Notes:
mg/kg = Milligrams per kilogram
NC = No criteria available
U = Analyzed, not detected

Industrial/Residential - Industrial and Residential Risk Based Concentrations (RBCs) (March 1995)
Site Specific (SS) Background - MCB Camp Lejeune Base Background, updated through CTO 303 (August 1995)
Italics indicates the compound exceeded site-specific background levels
Indicates the compound exceeded North Carolina Risk Analysis Framework Method I Target Concentrations, Draft, November, 1996.

TABLE 1-3

ORGANIC COMPOUNDS EXCEEDING CRITERIA - SUBSURFACE SOIL
EXPEDITED SITE CHARACTERIZATION AND EVALUATION
SITE 10 - ORIGINAL BASE LANDFILL
MCB, CAMP LEJEUNE, NORTH CAROLINA
SITE INVESTIGATION, CTO - 0369

	Soil Criteria		Soil Results									
Constituent	(RBCs) Industrial Soils (µg/kg)	(RBCs) Residential Soils (µg/kg)	10-SB01-00 Soil	10-SB01-02 Soil	10-SB02-01 Soil	10-SB02-02 Soil	10-SB03-01 Soil	10-SB03-02 Soil	10-SB04-02 Soil	10-SB04-04 Soil	10-SB05-02 Soil	10-SB05-04 Soil
Semivolatiles (µg/kg):												
Benzo(a)pyrene	780	88	360U	350U	360U	410U	350J	400U	370J	430U	380U	350U

Notes:

µg/kg = Micrograms per kilogram
U = Analyzed, not detected
J = Present below detection limit

Industrial/Residential - Industrial and Residential Risk Based Concentrations (RBS) (March 1995)
Shading indicates the compound exceeded Residential Risk Based Concentrations.

TABLE 1-4

INORGANIC COMPOUNDS EXCEEDING CRITERIA - SUBSURFACE SOIL
EXPEDITED SITE CHARACTERIZATION AND EVALUATION
SITE 10 - ORIGINAL BASE LANDFILL
MCB, CAMP LEJEUNE, NORTH CAROLINA
SITE INVESTIGATION, CTO - 0369

Constituent	Industrial Soils (mg/kg)	Residential Soils (mg/kg)	SS Background 2X (CTO 303)	North Carolina Risk Analysis Framework Method I Target concentrations S3:G1 (mg/kg)	10-SB01-01 Soil	10-SB01-02 Soil	10-SB02-01 Soil	10-SB02-02 Soil
Total Analytes (mg/kg):								
Aluminum	1,000,000	78,000	7,375.0	--	4,680	717	2,290	782
Arsenic	3.3	0.37	2.0	26.2	1.2	0.3U	0.67	0.35U
Barium	140,000	5,500	14.2	848	*15.4*	3.2	11.2	1.8
Calcium	NC	NC	391.5	--	*1,550*	103	*1,250*	79.4
Copper	76,000	2,900	2.4	704	1.8	0.75	*6.2*	0.38
Iron	NC	NC	7,252.1	151.2	2,110	165	2,400	404
Mercury	610	23	0.1	0.0154	0.09U	0.09U	0.088U	0.083U
Manganese	10,000	390	7.9	65.2	*9.1*	1.9	*23.5*	2.5
Nickel	41,000	1,600	3.7	56.4	2.4U	2.4U	2.1U	2.2U
Lead	NC	400	8.3	270.06	*10.7*	1.1	*99.8*	2
Vanadium	14,000	550	13.5	--	6.1	1.4	3.4	1.3
Zinc	610,000	23,000	6.7	1,100.4	*13.3*	0.65U	*148*	*11.1*

TABLE 1-4 (Continued)

INORGANIC COMPOUNDS EXCEEDING CRITERIA - SUBSURFACE SOIL
EXPEDITED SITE CHARACTERIZATION AND EVALUATION
SITE 10 - ORIGINAL BASE LANDFILL
MCB, CAMP LEJEUNE, NORTH CAROLINA
SITE INVESTIGATION, CTO - 0369

Constituent	10-SB03-01 Soil	10-SB03-02 Soil	10-SB04-02 Soil	10-SB04-04 Soil	10-SB05-02 Soil	10-SB05-04 Soil
Total Analytes (mg/kg):						
Aluminum	964	641	3,830	1,040	6,100	616
Arsenic	0.28U	0.29U	0.36	0.34U	0.97	0.29U
Barium	6.4	2	*18.1*	2.5	8.5	1.7
Calcium	247	66.8	76.7	29.3	43.4	18.5
Copper	2.1	0.59	1.5	0.6	1.5	0.41
Iron	950	161	1,730	278	3,590	235
Mercury	0.11U	0.086U	0.1U	0.097U	0.091U	0.071U
Manganese	6.3	1.3	4.1	2	3.8	1.6
Nickel	2.4U	2.7U	2.2U	2.8U	2.5U	2.1U
Lead	*19.2*	4	3.7	0.86	3.6	4.4
Vanadium	2.2	1.6	4.3	2	10.4	1.7
Zinc	*56.7*	*7.7*	0.67	0.74U	2.5	0.57U

Notes:

mg/kg = Milligrams per kilogram
NC = No criteria available
U = Analyzed, not detected
SS = Site Specific

Industrial/Residential - Industrial and Residential Risk Based Concentrations (March 1995)
SS Background - MCB Camp Lejeune Base Background, updated through CTO 303 (August 1995)
Shading indicates the compound exceeded Residential Risk Based Concentrations.
Bold indicates the compound exceeded Industrial Risk Based Concentrations.
Italics indicates the compound exceeded site-specific background levels
Cross-hatch indicates compound exceeded North Carolina Risk Analysis Framework Method I Target Concentrations (S3:G-1).

TABLE 1-5

INORGANIC COMPOUNDS (TOTAL AND DISSOLVED) EXCEEDING CRITERIA - GROUNDWATER
EXPEDITED SITE CHARACTERIZATION AND EVALUATION
SITE 10 - ORIGINAL BASE LANDFILL
MCB, CAMP LEJEUNE, NORTH CAROLINA
SITE INVESTIGATION, CTO - 0369

Constituent	Tap Water (µg/L)	MCL (µg/L)	NCWQS (µg/L)	10-TW01 GW	10-TW01D GS-DIS	10-TW02 GW	10-TW02D GS-DIS	10-TW03 GW	10-TW03D GW-DIS
Total Analytes (µg/L):									
Aluminum	37,000	NC	NC	10,800	16.9U	145,000	117	75,100	85.2
Arsenic	0.038	50	50	1.8U	1.8U	17.6	1.8U	14.1	1.8U
Beryllium	0.016	4	NC	1.5U	1.5U	1.5U	1.5U	1.5U	1.5U
Cadmium	18	5	5	2.8U	2.8U	2.8U	2.8U	2.8U	2.8U
Chromium	180	100	50	15.2	2.4U	***184***	2.4U	*74.6*	2.4U
Iron	NC	NC	300	*2,780*	*1,650*	*57,100*	*1,910*	*26,800*	*1,710*
Mercury	11	2	1.1	0.2U	0.2U	0.2U	0.2U	0.2U	0.2U
Manganese	180	NC	50	32.9	28.7	*127*	27	92.2	38.5
Nickel	730	100	100	***369***	17.8	28	11.6U	***215***	53.5
Lead	NC	15	15	5.1	1.4U	***48.4***	3	***45.9***	1.4U
Vanadium	260	NC	NC	11.6	2.6U	388	2.6U	175	2.6U
Zinc	11,000	NC	2,100	6.5	3.1U	326	10.4	58.2	13.2

Notes:

µg/l = Micrograms per liter
GW = Groundwater
DIS = Dissolved fraction
NC = No criteria available
U = Analyzed, not detected

Tap Water - Risked Based Concentration (March 1995)
MCL - Maximum Contaminant Level, Federal Register (May 1995)
NCWQS - North Carolina Water Quality Standard (November 1993)
Shading indicates the compound exceeded Tap Water Risk-Based Concentrations.
Bold indicates the compound exceeded Federal MCL.
Italics indicates the compound exceeded NCWQS.

TABLE 1-6

SITE INVESTIGATION OBJECTIVES
SITE 10 - ORIGINAL BASE LANDFILL
MCB, CAMP LEJEUNE, NORTH CAROLINA
SITE INVESTIGATION, CTO - 0369

Medium or Area of Concern	SI Objective	Criteria for Meeting Objective	Proposed Investigation/Study
1. Site 10 - Soil	1a. Determine whether soils at the site have been contaminated by wastes disposed at the landfill.	Characterize contaminant levels in surface and subsurface soils in the vicinity of the site.	Soil Investigation
	1b. Assess human health risks associated with exposure to surface soils at the site.	Characterize contaminant levels in surface soils at the study area.	Soil Investigation Risk Assessment
	1c. Determine whether contamination from soils is migrating to groundwater.	Characterize subsurface soil. Characterize shallow groundwater.	Soil Investigation Groundwater Investigation
2. Site 10 - Groundwater	2a. Assess health risks posed by potential future usage of the shallow groundwater.	Evaluate groundwater quality and compare to groundwater criteria and risk-based action levels.	Groundwater Investigation Risk Assessment
	2b. Assess nature of shallow groundwater quality.	Characterize shallow groundwater quality.	Groundwater Investigation
	2c. Define groundwater flow direction.	Collect two sets of groundwater levels and establish groundwater elevation.	Groundwater Investigation Site Survey

SECTION 1.0 FIGURES

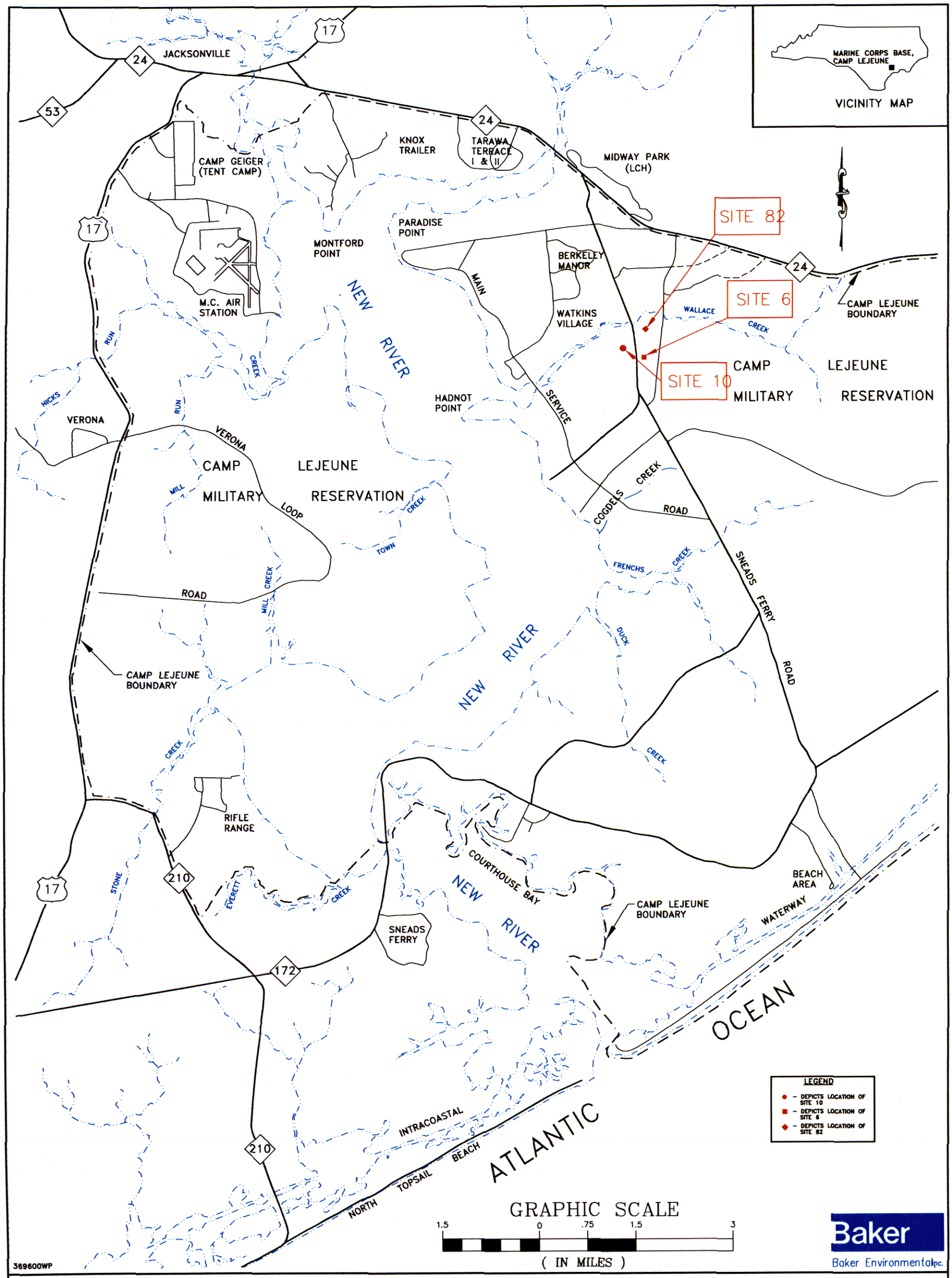
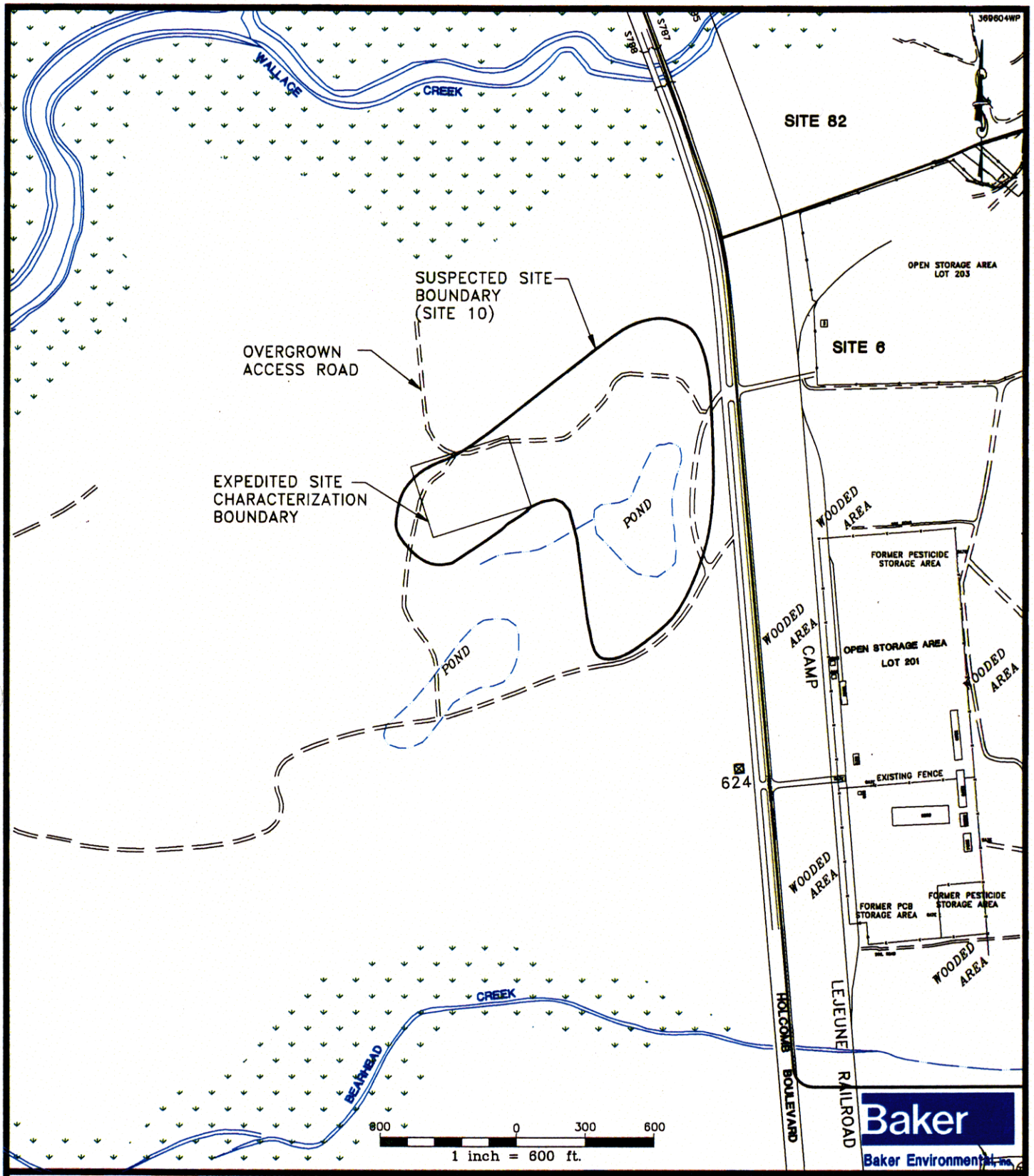


FIGURE 1-1
CAMP LEJEUNE AND SITE
LOCATION MAP
SITE 10 - ORIGINAL BASE LANDFILL
NA DECISION DOCUMENT, CTO - 0369

MARINE CORPS BASE, CAMP LEJEUNE
NORTH CAROLINA

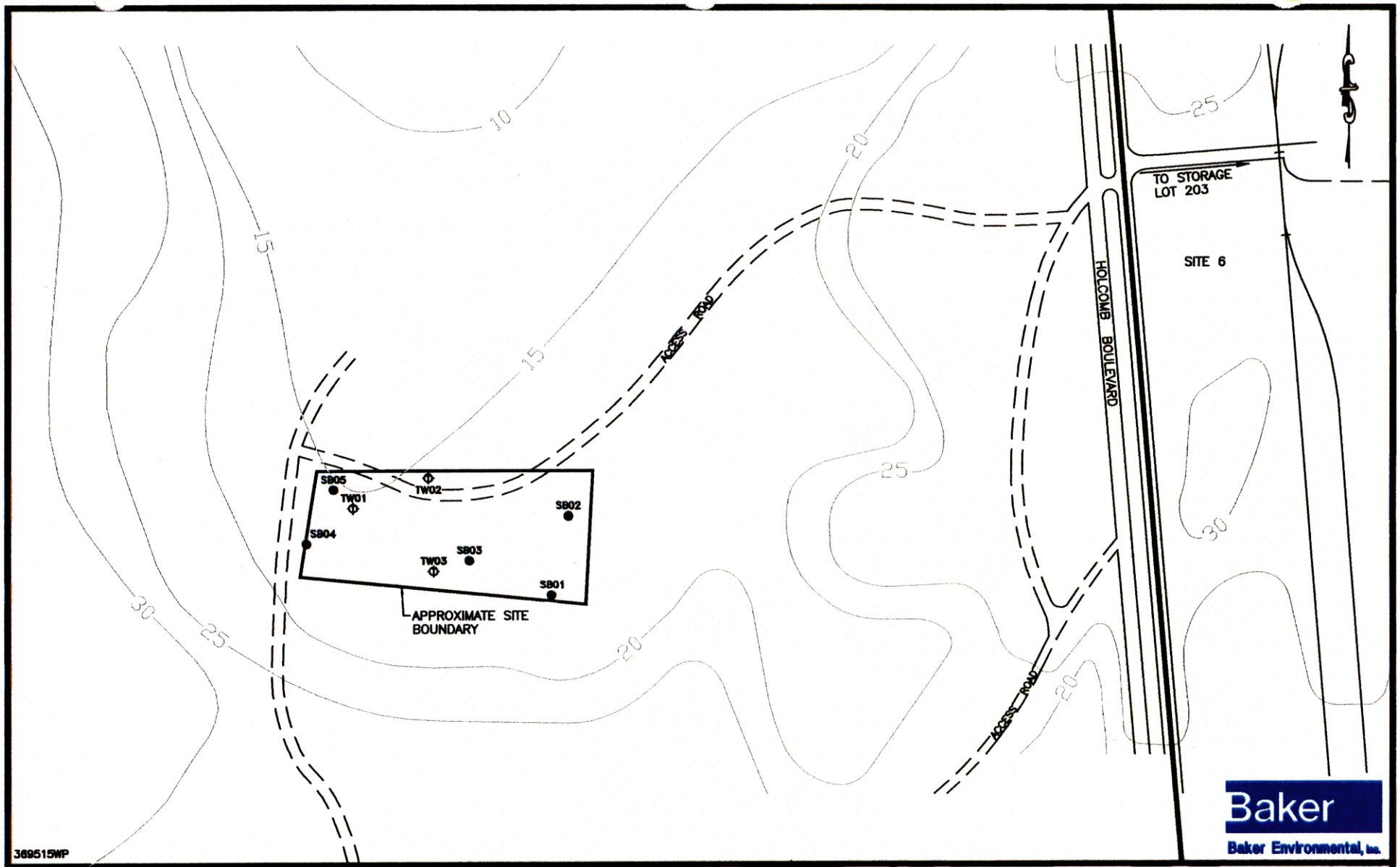


LEGEND

- ACCESS ROAD
- POND
- WETLANDS
- SUPPLY WELL
- FENCE

FIGURE 1-2
SITE MAP
SITE 10, ORIGINAL BASE LANDFILL
SITE INVESTIGATION, CTO - 0369

MARINE CORPS BASE, CAMP LEJEUNE
NORTH CAROLINA



LEGEND

- SB01 — SOIL BORING LOCATION
- TW01 — TEMPORARY GROUNDWATER MONITORING WELL
- ACCESS ROAD
- 25 — TOPOGRAPHIC CONTOUR (MSL)

SOURCE: LANTDIV, FEB. 1992

250 0 175 250

1 inch = 250 ft.

FIGURE 1-3
EXPEDITED SITE CHARACTERIZATION
SOIL AND GROUNDWATER SAMPLING LOCATIONS
SITE 10 – ORIGINAL BASE LANDFILL
SITE INVESTIGATION, CTO – 0369

MARINE CORPS BASE, CAMP LEJEUNE
NORTH CAROLINA

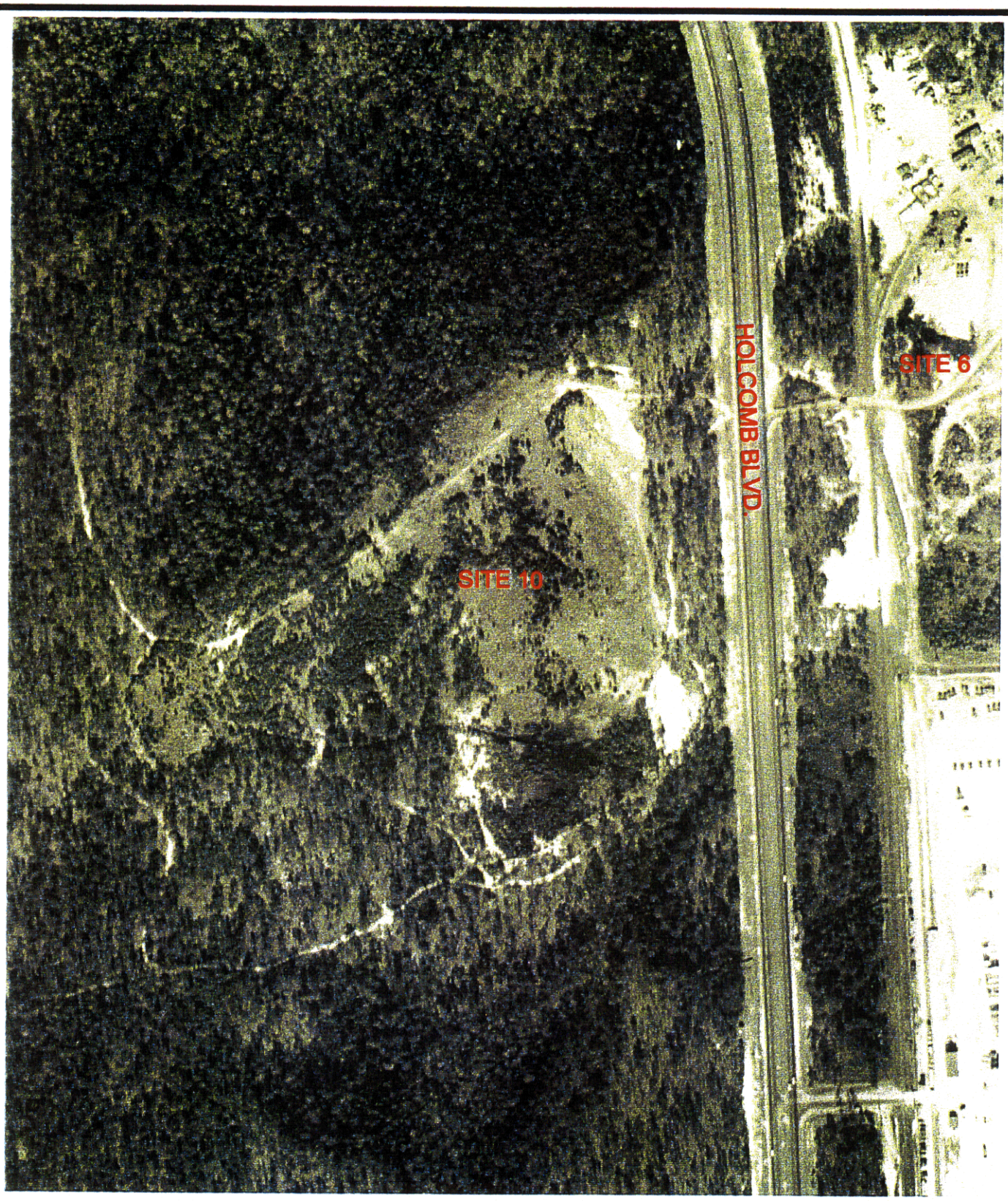
Baker

Baker Environmental, Inc.

FIGURE 1-4
AERIAL PHOTOGRAPH, OCTOBER 21, 1949
SITE 10, ORIGINAL BASE LANDFILL
SITE INVESTIGATION, CTO - 0369

MARINE CORPS BASE, CAMP LEJEUNE
NORTH CAROLINA

389611WP



Baker

Baker Environmental, Inc.

FIGURE 1-5
AERIAL PHOTOGRAPH, FEBRUARY 1, 1956
SITE 10, ORIGINAL BASE LANDFILL
SITE INVESTIGATION, CTO - 0369
MARINE CORPS BASE, CAMP LEJEUNE
NORTH CAROLINA

389612WP

2.0 STUDY AREA INVESTIGATION

The Site Investigation (SI) for Site 10 was conducted in two phases. The first phase (Phase I) was conducted in March 1998 and the second phase (Phase II) was conducted in February/March 2001.

The purpose of the SI at Site 10, was to characterize potential environmental impacts and threats to human health, ecology and the environment resulting from previous activities. Investigations conducted at the site were initiated in an attempt to define potential impacts to surface and subsurface soils, groundwater, sediments and surface waters. Specifically, this study was designed to provide:

- Data regarding the environmental impact on surface water and sediments in the two surface water bodies located within the boundaries of the site.

- Soil and groundwater data to support a streamline human health and ecological risk evaluation which is an evaluation, intermediate in scope, between the limited risk evaluation undertaken for emergency removal actions and the conventional baseline assessment normally conducted for remedial actions.

- Sufficient data to verify the presence or absence of contamination at the site and to determine if additional work is warranted in the form of a remedial investigation (RI).

- Hydrogeologic parameters of the shallow aquifer and determine its direction of flow.

The field work for Phase I was initiated March 16 and concluded March 25, 1998. Investigative derived waste (IDW) management was conducted on May 4, 1998. The field program consisted of soil, groundwater, surface water and sediment investigations; a site survey; and IDW handling. All field activities were performed in accordance with the Project Plans submitted January 1998.

At the conclusion of the Phase I investigation, it was determined that sediment within the groundwater samples (in excess of 200 Nephelometric Turbidity Units) was the cause of high inorganic concentrations in the groundwater samples. It was suspected that the high turbidity (200 NTUs) was the result of temporary well construction and that constructing permanent wells (with sand packs) would minimize or eliminate turbidity. The Phase II investigation was initiated as a result of high inorganic concentrations in groundwater during Phase I. The Phase II investigation

included the installation of six (6) permanent monitoring wells in the same locations as six of the nine temporary wells and collecting inorganic groundwater samples that would be indicative of dissolved inorganics in groundwater.

The Phase II Investigation was initiated February 26, 2001 and concluded March 2, 2001; investigative derived waste (IDW) management was conducted on May 11, 2001. All field activities were performed in accordance with the project plans submitted January 1998 and the Phase II sample strategy plan (SSP) submitted February 9, 2001.

A summary of these activities, as well as details of any modifications to the plans, is discussed in the following sections.

2.1 Soil Investigation

A soil investigation was conducted during Phase I to assess whether soils at the site have been contaminated by debris disposed during the site's operation as a landfill. Additionally, the investigation was conducted to assess human health, ecological, and environmental risks associated with contact, inhalation and possible ingestion of surface and subsurface soil particles. The following subsections describe the drilling procedures, sample locations, sample methods and analytical program for the site.

During the Phase I field investigation, Baker supervised the advancement of 25 soil borings (10-SB01 through 10-SB25) using a geoprobe sampling device. The soil borings were advanced for the purpose of sample collection, geologic identification and description, and temporary monitoring well installation. Drilling activities were conducted using a truck-mounted geoprobe rig and a hand sampling unit supplied and operated by Parratt Wolff, Inc. of Raleigh, North Carolina. Soil cuttings were not generated during the drilling program, therefore eliminating the need for containerization and sampling. Drilling and sampling activities were performed using Level D personal protection and operations were continuously monitored with a photoionization detector (PID). All soil boring and temporary monitoring well locations are shown on Figure 2-1.

The soil borings were advanced to two ranges of depth for different purposes. Procedures varied depending upon the type of soil boring needed at each location. Sixteen (16) borings were advanced for soil classification and sample collection purposes only and were terminated at the water table

(approximately one to 15 feet below ground surface [bgs]). These borings were designed for collection of information pertaining to soil contamination in areas where temporary groundwater monitoring wells were not planned or where information was needed concerning soils only.

During Phase I, Baker supervised the completion of nine (9) soil borings as temporary monitoring wells extending approximately five to 10 feet below the water table. These borings were terminated at approximately six to 18 feet bgs. They were designed to allow construction of temporary groundwater monitoring wells with screens that intersect the water table (Figure 2-2).

Soil boring 10-SB23/TW08 (located west of the site) was designed and constructed to be used as a control sample point. Control samples are samples which may not represent background conditions, but represent the current state of soil/groundwater quality unaffected by site activities. Since two RI sites exist directly east of the site (upgradient), a control point is best suited for this site.

All borings advanced during the Phase I field investigation were continuously sampled to the water table (located approximately 0.3 to 14 feet bgs) and every five feet thereafter until termination of the boring. Soil samples were obtained via a direct push soil sampler following methods outlined in the Project Plans for Site 10 (Baker 1998). The sampling protocols were modified in some cases where the site geologist needed more information about a particular soil type. Once the target depth was reached, the boring was backfilled with bentonite pellets and hydrated.

Each soil sample was classified by the site geologist. Soils were classified and field screened with a PID, recorded in the field logbook, and later transposed onto boring log records. Classification included characterization of soil type, grain size, color, moisture content and other pertinent information such as indications of contamination. Lithologic descriptions of site soils are provided on the Test Boring and Well Construction Records in Appendix A.

During Phase II, soil borings were advanced for the sole purpose of installing permanent groundwater monitoring wells. The borings were terminated at a depth of approximately 7 feet below the static water level. As with the Phase I investigation, the soils were classified by the site geologist and recorded in the field logbook. Since these borings were placed in the same locations as the temporary wells, no additional soil samples were collected for analysis.

2.1.1 Surface and Subsurface Soils

Selection of soil boring/monitoring well locations during Phase I were based on Camp Lejeune historical records, previous site investigations, and a preliminary grid pattern established across the site. The grid was established to best determine if materials disposed at the site may have contaminated soils and/or shallow groundwater at the site. A summary of the sample numbers and analytical parameters is provided in the Data Tracking Summary in Appendix B.

Surface soil samples were collected from 25 borings as shown on Figure 2-1, using stainless steel spoons and aluminum pie plates. Samples were collected from zero to 12 inches bgs after the first few inches of top soil and matted roots were removed. The VOC samples were placed directly into the appropriate laboratory supplied containers immediately after collection. The remaining samples were composited in an aluminum pie pan and mixed to homogenize the sample, then placed into the appropriate sample containers. All samples were temporarily stored in ice-filled coolers until shipment to Quanterra Environmental Services in Knoxville, Tennessee, for analyses. The stainless steel spoons were decontaminated prior to sample collection according to the procedures outlined in the Project Plans (Baker, 1998).

A single vadose zone, subsurface soil sample was collected from directly above the water table in each boring. The samples were collected with a direct push soil sampling system. Analytical samples were collected in the same manner as surface soil samples.

2.1.2 Analytical Program for Soils

The analytical program for the soil investigation at Site 10 focused on the suspected contaminants of concern based on previous disposal practices, site activities, and findings of previous investigations. In general, soils at the site were analyzed for Target Compound List (TCL) organics and Target Analyte List (TAL) inorganics.

All soil samples retained for analysis were prepared and handled according to USEPA Region IV Standard Operating Procedures (SOPs) as outlined in the Project Plans (Baker, 1998). Chain-of-Custody documentation, which includes information such as sample numbers, date, time of sampling, and sampling party accompanied the samples to the laboratory and is provided in Appendix C. Samples were shipped overnight via overnight courier to the off-site laboratory.

2.2 Groundwater Investigation

The groundwater investigation at Site 10 consisted of two different field sampling events. The Phase I investigation consisted of constructing nine temporary groundwater monitoring wells, purging, sampling, and static water measurement. The intent of this investigation was to confirm the presence or absence of groundwater contamination in the shallow aquifer and evaluate groundwater flow patterns across the site. Phase II involved the installation of six permanent groundwater monitoring wells to determine the concentrations of dissolved inorganics in groundwater.

The field procedures and sampling methods employed for these studies were implemented in accordance with USEPA Region IV SOPs (USEPA, 1996). Specific sampling procedures are detailed in the Project Plans (Baker 1998) and the Phase II SSP.

2.2.1 Monitoring Well Construction Details

The nine temporary groundwater monitoring wells installed at Site 10 during Phase I were constructed of 1-inch nominal diameter, schedule 40, flush-jointed and threaded, polyvinyl chloride (PVC) casing with 0.010 slotted screen. The wells were constructed with a five or 10-foot section of screen allowing the screened portion of the well to intercept the water table. The screened interval of the well was placed inside a "well sock" in order to prevent fine sediment from passing through the slotted screen. The native soils were allowed to collapse around the well, filling the annulus between the well screen sock and the borehole wall. Upon completion of sampling activities, the well was removed and the borehole was backfilled with bentonite and hydrated. The wells were constructed in accordance with the Project Plans (Baker 1998) and USEPA Region IV SOPs (USEPA, 1996). Well construction details can be found on Table 2-1.

Temporary monitoring well 10-TW08 is located west of the site and was designed and constructed to be used as a control sample point. Since two RI sites exist east of the site (upgradient), a control point is best suited for this site.

During the Phase II field investigation six permanent monitoring wells were installed at the same location as six of the nine temporary wells installed during the original 1998 SI (Figure 2-3). The permanent wells were installed at temporary well locations IR10-TW02, IR10-TW03, IR10-TW04, IR10-TW06, IR10-TW08, and IR10-TW09 using a drill rig owned and operated by Parratt-Wolff, Inc. located in Raleigh, North Carolina. The wells were installed using 6-1/4 inch, inside diameter (ID), hollow stem augers (HSA) to an approximate depth of 7 feet below the groundwater table. The wells were constructed using two-inch ID, schedule 40, flush-jointed and threaded, PVC casing with 0.010 inch slotted screen. The wells were constructed in a manner allowing the screen to intersect the water table. Graded sand was used to fill the annulus between the screen and the borehole wall and bentonite chips were placed on top of the sand and used to inhibit any rainwater or surficial fluids from entering the groundwater prior to sampling. A four foot by four foot by six inch concrete pad and a protective steel casing was installed over the PVC riser to protect the well from damage. After completion, the wells were surveyed by a surveyor registered in North Carolina. Construction details are summarized on Table 2-1.

A single round of water levels were collected at Site 10 during both the Phase I and Phase II field investigations to establish groundwater flow direction in the shallow aquifer. Measurements were collected on March 22 and 23, 1998 and March 1, 2001. The results for both events are summarized on Table 2-1. All groundwater measurements were recorded from the top of the PVC casing using an electronic measuring tape to the nearest 0.01 feet.

2.2.2 Groundwater Sampling

Groundwater samples were collected from the temporary wells during Phase I to confirm the presence or absence of contamination in the surficial aquifer. Prior to collecting the samples, the wells were purged of a minimum of three to five well volumes using low-flow techniques. Groundwater recovered during the groundwater sampling program was contained and handled in accordance with the Project Plans (Baker, 1998). Temperature, conductivity, turbidity and pH were collected after each well volume was removed to determine that the groundwater had stabilized prior to sampling. Stabilization is defined as pH measurements remain within 0.1 standard units, specific conductance

varies less than 10 percent, and temperature is consistent for at least three consecutive readings. Table 2-2 summarizes the results of pH, temp, specific conductance and turbidity obtained during purging activities.

Samples were collected using a peristaltic pump and Teflon tubing. Flow rates were less than 1/4 gallon per minute to establish low flow conditions. This method of purging allows less disturbance within the water column therefore, fewer sediments are captured during sampling creating a false impression of high inorganics in groundwater and the potential of organic compound volatilization is decreased. The tubing was dedicated to each well and discarded upon completion of sample collection.

The use of well sock material and low flow purging techniques used during Phase I was insufficient in reducing the amount of sediment in the water column, and high NTU reading for turbidity were recorded. The high turbidity may have led to exceedences in inorganics at federal and North Carolina levels. Therefore, permanent monitoring wells were installed in an attempt to reduce the amount of sediment captured during sampling.

Groundwater samples were collected from six permanent monitoring wells installed during the Phase II investigation to evaluate inorganic concentrations in the surficial aquifer. Prior to sample collection, the wells were developed using a well pump and surging method. Temperature, conductivity, turbidity, and pH were again monitored and recorded. During the Phase II investigation, the six permanent monitoring wells were purged and sampled using the same methods employed for the Phase I investigation. The measurements are summarized on Table 2-3.

During both phases, groundwater was introduced directly from the tubing into the appropriate laboratory supplied sample container and stored on ice in a cooler during both phases of the site investigation. Preparation of the samples for shipment to the laboratory incorporated similar procedures as to those described for soil samples and are outlined in the Project Plans (Baker 1998). Chain-of-Custody documentation accompanied the samples to the analytical laboratory (Chain-of-Custodies for both sampling events is provided in Appendix C). Samples were shipped overnight via overnight courier to Quanterra Environmental Laboratory in Knoxville, Tennessee during the Phase I investigation, and to Compuchem Laboratories in Cary, NC during Phase II.

2.2.3 Analytical Program for Groundwater Samples

The samples retained for analysis during the Phase I investigation were prepared and handled according to USEPA Region IV Standard Operating Procedures (SOPs) as outlined in the Project Plans (Baker, 1998). All groundwater samples were analyzed for TCL organics and TAL inorganics via CLP protocols. A summary of the sample numbers and parameters analyzed are provided in the Data Tracking Summary in Appendix B.

The samples collected for analysis during the Phase II investigation were prepared and handled according to the same USEPA Region IV Standard Operating Procedures (SOPs) as outlined in the Project Plans (Baker, 1998). The groundwater samples that were collected were analyzed for Target Analyte List (TAL) total metals in accordance with CLP methods, DQO Level IV.

2.3 Surface Water/Sediment Investigation

Baker collected surface water and sediment samples during Phase I from two surface water bodies located within the boundaries of the site to assess possible impacts from the site and assist in human health and ecological risk assessments. The surface water/sediment investigation was conducted on March 21, 1998. The Project Plans issued in January 1998 (Baker, 1998) specified that six sample locations will be used during the site investigation to determine if surface water and sediment in Bearhead Creek and Wallace Creek have been affected by materials disposed at the site. These creeks were located approximately 1380 feet south and 1620 feet north, respectively.

As the investigation began, it was noted that two surface water bodies (i.e., ponds or marshes) were located on site. Evidence observed at the site indicated that these surface water bodies may exist during wet seasons only. However, it was determined that samples from the surface water bodies would most likely be a better representation of site conditions rather than Bearhead Creek and Wallace Creek. Both Bearhead and Wallace creeks receive groundwater and surface water from many locations throughout Hadnot Point and could not accurately represent water quality exiting Site 10. The six locations were moved the two ponds within the boundaries of the site.

2.3.1 Surface Water Sample Collection

Baker collected the surface water samples from the approximate mid-vertical point at each location by dipping an unpreserved sample jar into the water by hand (if the water was greater than one foot deep). If the water was less than one-foot deep, care was taken while collecting the sample to ensure that the sampler did not contact and/or stir up the sediments, while still being relatively close to the sediment-water interface.

Since the water bodies were nearly stagnate, samples were collected with care to minimize disturbance in the water body. Sediment samples were collected after the surface water samples to minimize sediment disturbance and suspension. If surface water samples had been collected after the sediment samples, potentially contaminated sediments could be captured within the surface water sample and could potentially affect the results of the sample analyses.

Care was taken when collecting samples for analysis of volatile organic compounds (VOCs) to avoid excessive agitation that could result in loss of VOCs. VOC samples were collected prior to the collection of other parameters. The sample bottles were filled by pouring down the side until the container was completely filled leaving no headspace. Each filled bottle was checked for bubbles and rejected if encountered.

Each sampling location was marked by placing a wooden stake and bright colored flagging at the nearest bank. The sampling location was marked with indelible ink on the stake. In addition, the distance from the bank and the approximate location of the sample was estimated and recorded in the field log book of one of the Baker personnel. Photographs were taken to document the physical characteristics of the sampling location.

2.3.2 Sediment Sample Collection

At each sediment sampling station, samples were collected at a depth of zero to six inches. The six to 12 inch interval was unobtainable because the coring device could not penetrate the soils. The samples were collected using a decontaminated stainless steel sediment corer fitted with a new disposable plastic liner, eggshell catch, and a decontaminated plastic nosecone.

Sampling personnel pushed the sediment corer using the necessary extension rods, between four and six inches into the sediment. The sediment corer was then withdrawn and the plastic liner was removed from the corer. The sediment was placed into clean aluminum pie pans for compositing.

Baker collected the samples for the VOC analysis with a clean stainless steel spoon. The remaining sediment was homogenized and transferred into their respective sample jars. This process was repeated until enough sediment was obtained to fill all the sample jars.

2.3.3 Surface Water/Sediment Sample Analysis

Surface water/sediment samples were analyzed for TCL organics and TAL inorganics. A summary of the sample numbers and parameters analyzed are provided in the Data Tracking Summary in Appendix B. The samples were prepared and handled in accordance with the Project Plans (Baker 1998) and USEPA Region IV SOPs (USEPA, 1996).

2.4 Investigation Derived Waste

Investigation derived waste (IDW) was generated during both the Phase I and Phase II field programs. The IDW generated during the Phase I investigation was purge water from sampling the temporary groundwater monitoring wells. The IDW generated during the Phase II investigation was soil cuttings from monitoring well installation and purge and development water from the six permanent monitoring wells. The following paragraphs describe the procedures for IDW management at Site 10.

Groundwater generated from well purging during Phase I was placed in a clean 55-gallon drum and temporarily stored at the site. A sample was collected analyzed for TCL organics and TAL inorganics. Upon receipt of the analytical results, the water was treated at the Lot 203 Groundwater Treatment Facility.

Soil cutting generated from the permanent monitoring well installation during Phase II was placed in clean 55-gallon drums, properly labeled, and temporarily stored at the site. A composite sample was collected and analyzed for Target Compound Leaching Procedure (TCLP) organics and inorganics, and Resource Conservation and Recovery Act (RCRA) hazardous waste characteristics (corrosivity, reactivity, and ignitability), and PCB's.

Upon analytical confirmation, the soil cuttings were transported to a staging facility a Michael Street. The soil was removed from the 55-gallon drums, and placed in temporary containment bins. The drums were triple rinsed using a pressurized steam cleaner, crushed, and crushed for recycling.

Groundwater generated from well purging and sampling during the Phase II investigation was placed in clean 55-gallon drums, properly labeled, and temporarily stored at the site. A composite sample was collected and analyzed for full TCL organics and TAL total metals using CLP protocol.

Upon analytical confirmation, the groundwater generated during the Phase II investigation was disposed of at Site 10. The empty 55-gallon drums were triple rinsed using a pressurized steam cleaner, transported from Site 10 to a disposal facility on Michael Street, and crushed for recycling.

Personal protective equipment (PPE) (e.g., nitrile gloves, tyvek, etc.) were double bagged, labeled and disposed as solid waste in a refuse container located near Baker's field trailer and eventually was emptied at a sanitary landfill. If the PPE had been exposed to potentially hazardous substances or excessively contaminated soil or groundwater, the equipment would have been placed in a drum and disposed.

2.5 References

Baker, 1998. Baker Environmental, Inc., Site Investigation Final Project Plans, MCB Camp Lejeune, North Carolina. Prepared for the Department of the Navy, Naval Facilities Engineering Command, Atlantic Division, Norfolk, Virginia, January 1998.

U.S. Environmental Protection Agency, Region IV, 1996. Environmental Investigations Standard Operating Procedures and Quality Assurance Manual. May 1996.

SECTION 2.0 TABLES

TABLE 2-1

SUMMARY OF PHASE I AND PHASE II MONITORING WELL CONSTRUCTION DETAILS
AND GROUNDWATER LEVEL MEASUREMENTS
SITE 10 - ORIGINAL BASE LANDFILL
MCB, CAMP LEJEUNE, NORTH CAROLINA
SITE INVESTIGATION, CTO-0369

Well No.	Date Installed	Consultant Supervising Well Installation	Top of PVC Casing Elevation (feet, above msl)	Ground Surface Elevation (feet, above msl)	Boring Depth (feet, bgs)	Well Depth (feet, bgs)	Depth to Sand Pack (feet, bgs)	Depth to Bentonite (feet, bgs)	Screen Interval Depth (feet, bgs)	Depth to Groundwater (feet, below top of casing)
IR10-TW01	3/18/98	BAKER	28.20	26.19	16.0	14.3	N/A	N/A	4.3 to 14.3	6.97
IR10-TW02	3/18/98	BAKER	28.17	26.95	14.0	13.13	N/A	N/A	3.1 to 13.1	7.34
IR10-TW03	3/18/98	BAKER	23.41	21.95	12.0	11.4	N/A	N/A	1.4 to 11.4	5.04
IR10-TW04	3/18/98	BAKER	18.88	17.58	7.0	7.0	N/A	N/A	2.0 to 7.0	1.43
IR10-TW05	3/18/98	BAKER	24.36	23.09	14.0	13.23	N/A	N/A	3.2 to 13.2	6.94
IR10-TW06	3/19/98	BAKER	19.75	18.61	12.0	11.81	N/A	N/A	1.8 to 11.8	3.91
IR10-TW07	3/19/98	BAKER	29.14	28.01	18.0	17.22	N/A	N/A	7.2 to 17.2	12.62
IR10-TW08	3/19/98	BAKER	22.24	20.74	14.0	12.98	N/A	N/A	3.0 to 13.0	5.18
IR10-TW09	3/19/98	BAKER	18.20	16.63	7.0	5.43	N/A	N/A	0.4 to 5.4	0.27
10-MW02	2/27/01	BAKER	29.86	27.04	18.0	17.33	5.0	3.0	7.0 - 17.0	12.45
10-MW03	2/27/01	BAKER	24.48	21.63	14.0	13.30	2.0	1.0	3.0 - 13.0	8.35
10-MW04	2/28/01	BAKER	20.13	17.13	12.0	12.56	1.0	0.1	2.0 - 12.0	7.06
10-MW06	2/27/01	BAKER	21.75	18.68	14.0	13.56	2.0	0.1	3.0 - 13.0	8.40
10-MW08	2/28/01	BAKER	23.81	20.81	14.0	13.97	2.0	0.1	4.0 - 14.0	11.23
10-MW09	2/28/01	BAKER	19.66	16.59	11.0	10.96	0.5	0.1	1.0 - 11.0	3.84

Notes:

msl = Mean Sea Level
bgs = Below Ground Surface
N/A = Not Applicable
PVC = Polyvinyl chloride

TABLE 2-2

SUMMARY OF PHASE I GROUNDWATER SAMPLING FIELD PARAMETERS
SITE 10 - ORIGINAL BASE LANDFILL
MCB, CAMP LEJEUNE, NORTH CAROLINA
SITE INVESTIGATION, CTO - 0369

Well Number	Sampling Date	Well Depth (ft)[1]	Purge Volume (gal)	Field Parameters				
				Well Volume	Specific Cond.[2] (umhos/cm)	pH (SU)[3]	Cond. Temp.[4] (deg. C)	Turbidity (NTU)[6]
IR10-TW01	3/22/98	16.31	0.3	1	115	6.6	15.2	>200
				2	106.6	6.63	15.2	>200
				3	106.6	6.57	15.1	>200
				4	105.7	6.55	15.1	>200
				5	105.8	6.54	15.1	> 200
				6	104.5	6.47	15.3	>200
				7	105.8	6.53	15.3	>200
				8	***105.8***	***6.53***	***15.5***	***>200***
IR10-TW02	3/22/98	14.35	0.2	1	59.9	5.75	15.3	>200
				2	60.6	5.68	15.1	>200
				3	59.9	5.62	15.1	>200
				4	59	5.55	15.1	>200
				5	58.3	5.53	15.1	>200
				6	57.1	5.48	15.1	>200
				7	56.6	5.46	15.0	>200
				8	56.1	5.42	14.8	>200
				9	55	5.37	15.0	>200
				10	55.3	5.36	15.0	>200
				11	55.3	5.41	14.9	>200
				12	***54.6***	***5.39***	***15.0***	***>200***

Notes:

(1) - Measured from top of PVC Casing

(2) - Specific Conductance at 25 deg. C

(3) - SU = Standard Units

(4) - Temperature Measured with Cond. Meter

(5) - Temperature Measured with pH Meter

(6) - NTU = Nephelometric Turbidity Units

The bold and italicized parameters where taken immediately prior to sampling the well.

TABLE 2-2 (Continued)

SUMMARY OF PHASE I GROUNDWATER SAMPLING FIELD PARAMETERS
SITE 10 - ORIGINAL BASE LANDFILL
MCB, CAMP LEJEUNE, NORTH CAROLINA
SITE INVESTIGATION, CTO-0369

Well Number	Sampling Date	Well Depth (ft)[1]	Purge Volume (gal)	Field Parameters				
				Well Volume	Specific Cond.[2] (umhos/cm)	pH (SU)[3]	Cond. Temp.[4] (deg. C)	Turbidity (NTU)[6]
IR10-TW03	3/22/98	12.86	0.25	1	53	6.06	14.6	>200
				2	49.9	5.84	14.6	>200
				3	47	5.71	14.5	>200
				4	45	5.62	14.5	>200
				5	44.6	5.53	14.6	>200
				6	44.1	5.46	14.5	>200
				7	43.4	5.42	14.5	>200
				8	***43.1***	***5.41***	***14.5***	***>200***
IR10-TW04	3/22/98	8.3	0.2	1	63.9	5.04	13.3	>200
				2	62.8	4.92	13.1	>200
				3	62.6	4.86	13.1	>200
				4	62	4.78	13.0	>200
				5	61.6	4.72	13.1	>200
				6	61.2	4.65	13.0	>200
				7	61.2	4.62	13.0	>200
				8	61.2	4.59	13.0	>200
				9	61.2	4.56	13.0	>200
				10	***61.1***	***4.52***	***13.0***	***>200***

Notes:

[1] - Measured from top of PVC Casing

[2] - Specific Conductance at 25 deg. C

[3] - SU = Standard Units

[4] - Temperature Measured with Cond. Meter

[5] - Temperature Measured with pH Meter

[6] - NTU = Nephelometric Turbidity Units

The bold and italicized parameters where taken immediately prior to sampling the well.

TABLE 2-2 (Continued)

SUMMARY OF PHASE I GROUNDWATER SAMPLING FIELD PARAMETERS
SITE 10 - ORIGINAL BASE LANDFILL
MCB, CAMP LEJEUNE, NORTH CAROLINA
SITE INVESTIGATION, CTO - 0369

Well Number	Sampling Date	Well Depth (ft)[1]	Purge Volume (gal)	Field Parameters				
				Well Volume	Specific Cond.[2] (umhos/cm)	pH (SU)[3]	Cond. Temp.[4] (deg. C)	Turbidity (NTU)[6]
IR10-TW05	3/22/98	14.50	0.25	1	113	4.94	15.2	>200
				2	113.2	4.90	15.5	>200
				3	116	4.84	15.2	>200
				4	118.7	4.75	15.2	>200
				5	118.8	4.74	15.1	>200
				6	118.4	4.70	15.2	>200
				7	118.5	4.68	15.0	>200
				8	***117.1***	***4.67***	***15.1***	***113.80***
IR10-TW06	3/22/98	12.95	0.3	1	285.9	6.78	14.8	>200
				2	289	6.78	14.5	>200
				3	290.6	6.75	14.4	>200
				4	287.7	6.76	14.3	>200
				5	285.5	6.74	14.1	>200
				6	285.3	6.73	14.2	>200
				7	284.7	6.74	14.2	>200
				8	***283.1***	***6.75***	***14.2***	***>200***
IR10-TW07	3/23/98	18.35	0.2	1	99.3	5.57	16.1	>200
				2	101.6	5.48	15.8	>200
				3	100.4	5.40	15.7	>200
				4	98.2	5.33	15.8	>200
				5	98	5.29	15.7	184.0

Notes:

(1) - Measured from top of PVC Casing

(2) - Specific Conductance at 25 deg. C

(3) - SU = Standard Units

(4) - Temperature Measured with Cond. Meter

(5) - Temperature Measured with pH Meter

(6) - NTU = Nephelometric Turbidity Units

The bold and italicized parameters where taken immediately prior to sampling the well.

TABLE 2-2 (Continued)

SUMMARY OF PHASE I GROUNDWATER SAMPLING FIELD PARAMETERS
SITE 10 - ORIGINAL BASE LANDFILL
MCB, CAMP LEJEUNE, NORTH CAROLINA
SITE INVESTIGATION, CTO - 0369

Well Number	Sampling Date	Well Depth (ft)[1]	Purge Volume (gal)	Field Parameters				
				Well Volume	Specific Cond.[2] (umhos/cm)	pH (SU)[3]	Cond. Temp.[4] (deg. C)	Turbidity (NTU)[6]
IR10-TW07	3/23/98	18.35	0.2	6	97.5	5.24	15.7	125.00
				7	96.8	5.22	15.7	115.00
				8	95.9	5.18	15.7	95.00
				9	96.3	5.15	15.7	43.00
				10	95.9	5.13	15.5	36.00
				11	96.1	5.12	15.7	15.00
				12	***95.5***	***5.09***	***15.7***	***12.00***
IR10-TW08	3/23/98	14.48	0.3	1	42.9	5.70	15.2	>200
				2	39	5.66	14.8	>200
				3	38.4	5.64	15.0	>200
				4	38.1	5.60	14.8	>200
				5	38.8	5.61	14.8	>200
				6	39.1	5.58	14.8	>200
				7	39	5.54	14.9	>200
				8	39.4	5.59	14.8	>200
				9	***39.4***	***5.51***	***14.8***	***>200***
IR10-TW09	3/22/98	7.0	0.2	1	162.6	5.77	12.8	>200
				2	146	5.71	12.7	>200
				3	145.8	5.68	12.7	>200
				4	144.7	5.66	12.6	>200

Notes:

[1] - Measured from top of PVC Casing

[2] - Specific Conductance at 25 deg. C

[3] - SU = Standard Units

[4] - Temperature Measured with Cond. Meter

[5] - Temperature Measured with pH Meter

[6] - NTU = Nephelometric Turbidity Units

The bold and italicized parameters where taken immediately prior to sampling the well.

TABLE 2-2 (Continued)

SUMMARY OF PHASE I GROUNDWATER SAMPLING FIELD PARAMETERS
SITE 10 - ORIGINAL BASE LANDFILL
MCB, CAMP LEJEUNE, NORTH CAROLINA
SITE INVESTIGATION, CTO - 0369

Well Number	Sampling Date	Well Depth (ft)[1]	Purge Volume (gal)	Field Parameters				
				Well Volume	Specific Cond.[2] (umhos/cm)	pH (SU)[3]	Cond. Temp.[4] (deg. C)	Turbidity (NTU)[6]
IR10-TW09 (continued)	3/22/98	7.00	0.2	5	145.2	5.65	12.6	>200
				6	146.6	5.65	12.6	>200
				7	146.6	5.64	12.6	>200
				8	145	5.62	12.6	>200
				25	--	--	--	***>200***

Notes:
[1] - Measured from top of PVC Casing
[2] - Specific Conductance at 25 deg. C
[3] - SU = Standard Units
[4] - Temperature Measured with Cond. Meter
[5] - Temperature Measured with pH Meter
[6] - NTU = Nephelometric Turbidity Units
The bold and italicized parameters where taken immediately prior to sampling the well.

TABLE 2-3

SUMMARY OF PHASE II GROUNDWATER SAMPLING FIELD PARAMETERS
SITE 10 - ORIGINAL BASE LANDFILL
PHASE II SITE INVESTIGATION, CTO - 0369
MCB, CAMP LEJEUNE, NORTH CAROLINA

Well Number	Sampling Date	Well Depth (ft)[1]	Purge Volume (gal)	Field Parameters				
				Well Volume	Specific Cond.[2] (umhos/cm)	pH (SU)[3]	Temp.[4] (deg. C)	Turbidity (NTU)[6]
10-MW02	3/1/01	20.15	1.3	1	145	8.02	14.9	109
			2.6	2	152	7.92	15.4	25
			3.9	3	154	7.91	15.2	8
			5.2	***4***	***157***	***7.91***	***15.2***	***3***
10-MW03	3/1/01	16.15	1.3	1	329	5.40	13.6	113
			2.6	2	324	4.52	14.0	17
			3.9	***3***	***347***	***4.39***	***14.0***	***1***
10-MW04	3/1/01	15.56	1.4	1	55	7.93	12.4	45
			2.4	2	54	7.92	12.3	21
			3.8	3	56	7.95	12.2	9
			5.2	***4***	***54***	***7.94***	***12.3***	***5***
10-MW06	3/1/01	16.63	1.3	1	482	7.56	11.1	31
			2.6	2	457	7.74	11.6	9
			3.9	3	432	7.78	11.7	2
			5.2	4	439	7.78	11.8	3
			6.5	***5***	***433***	***7.71***	***12.0***	***3***
10-MW08	3/1/01	16.97	0.9	1	70	7.60	13.2	198
			1.8	2	54	7.74	13.6	95
			2.7	3	48	7.81	13.7	39
			3.6	4	46	7.85	13.9	26
			4.5	5	47	7.88	14.0	22
			5.4	6	42	7.88	13.9	25
			6.3	7	43	7.90	14.0	21
			7.2	8	40	7.90	14.1	22
			8.1	9	41	7.92	14.1	21
			9.0	10	39	7.94	14.0	20
			9.9	12	37	7.94	13.9	21
			10.8	***14***	***38***	***7.95***	***13.7***	***20***
10-MW09	3/1/01	14.03	1.7	1	950	5.70	11.6	129
			3.4	2	991	5.28	11.6	57
			5.1	3	928	5.24	11.7	31
			6.8	4	914	5.12	11.7	22
			8.5	5	918	5.14	11.7	16
			10.2	6	915	5.13	11.7	16
			11.9	7	919	5.15	11.8	14
			13.6	***8***	***920***	***5.15***	***11.8***	***10***

Notes:

(1) - Measured from top of PVC Casing

(2) - Specific Conductance at 25 deg. C

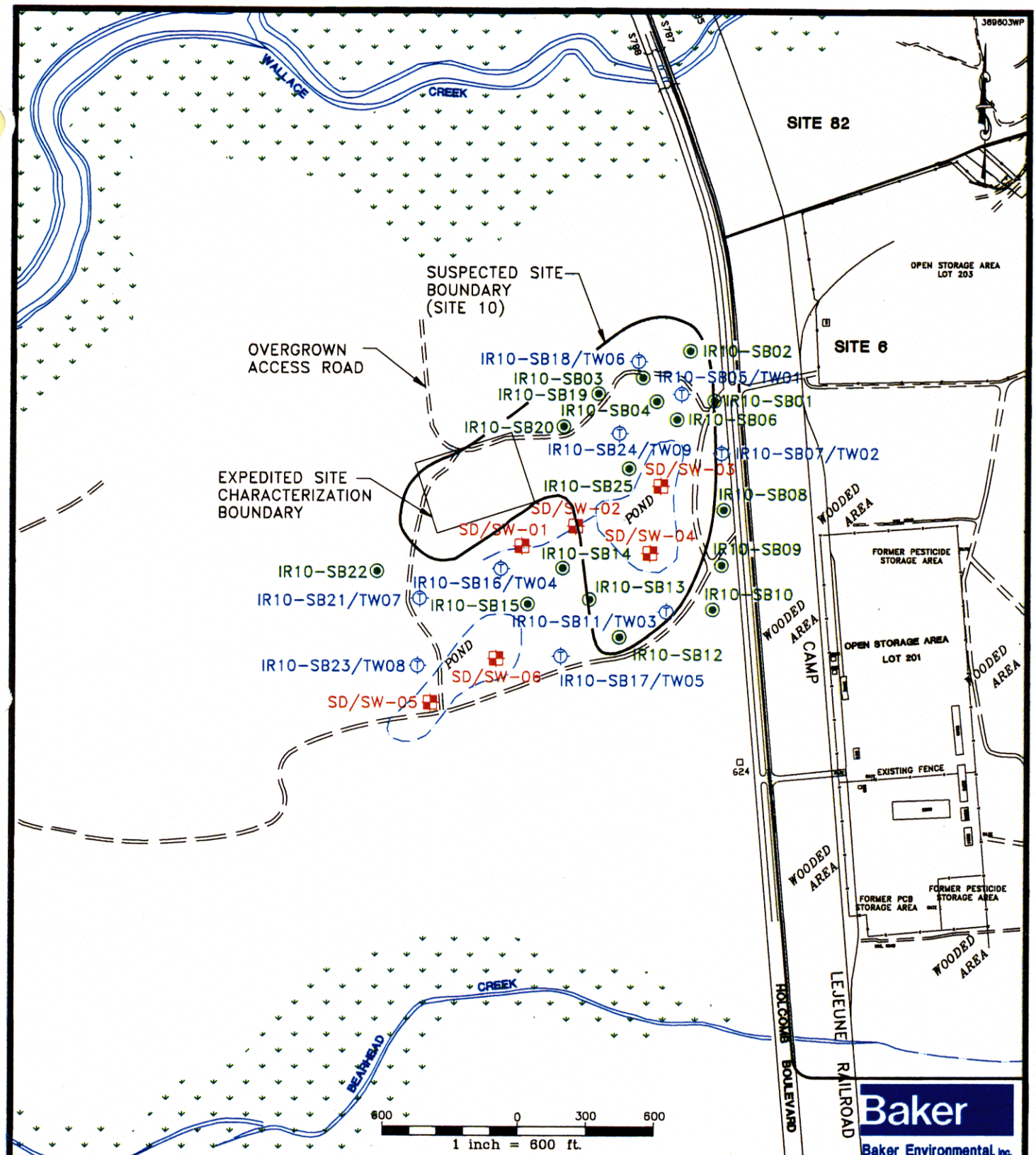
(3) - SU = Standard Units

(4) - Temperature Measured with Horiba

(6) - NTU = Nephelometric Turbidity Units

The bold and italicized parameters where taken immediately prior to sampling the well.

SECTION 2.0 FIGURES



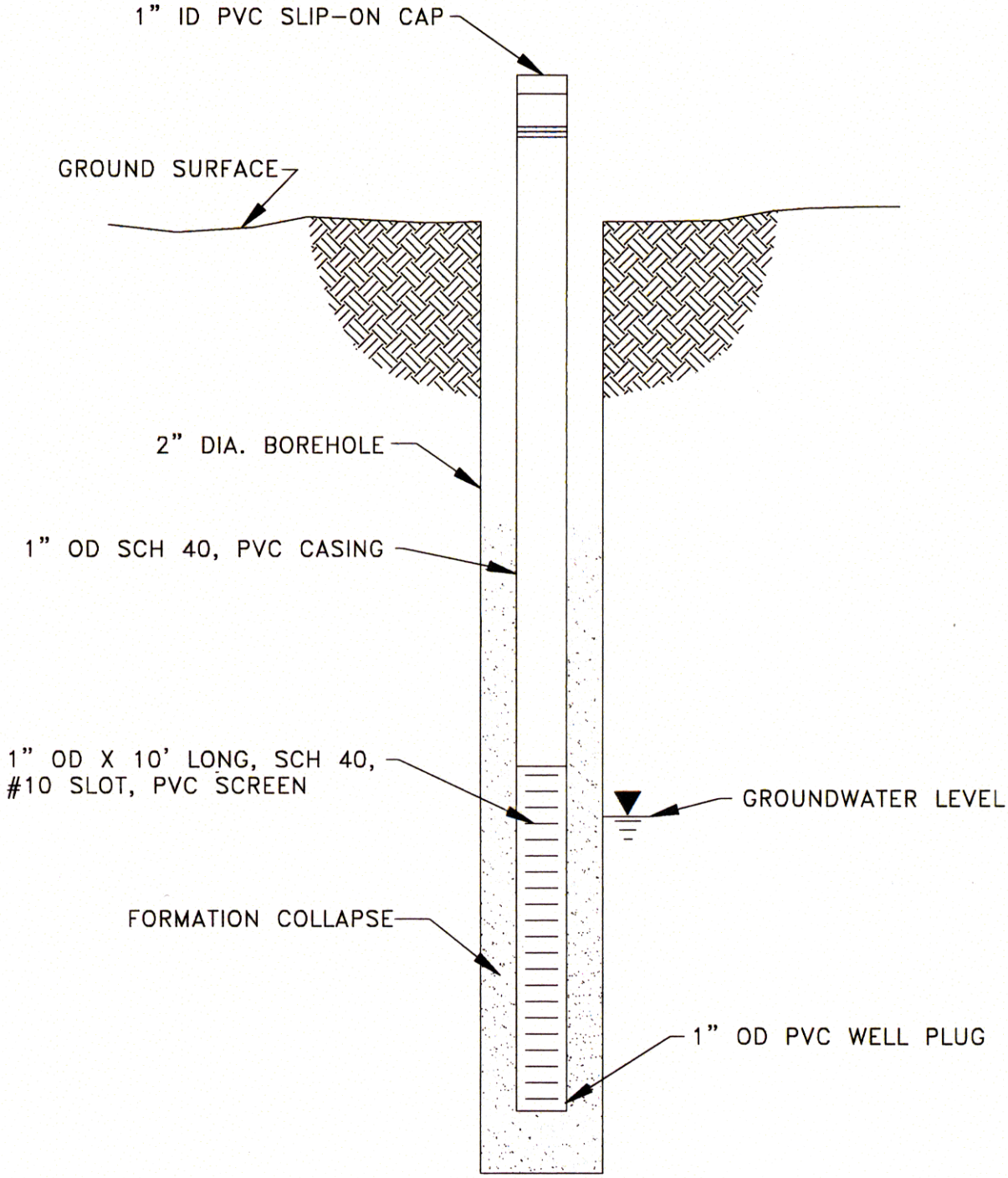
LEGEND

- TEMPORARY WELL LOCATION WITH SURFACE AND SUBSURFACE SOIL SAMPLES
- SEDIMENT/SURFACE WATER SAMPLE LOCATION
- SOIL BORING LOCATION

FIGURE 2-1
SAMPLE LOCATION MAP
SITE 10, ORIGINAL BASE LANDFILL
SITE INVESTIGATION, CTO - 0369

MARINE CORPS BASE, CAMP LEJEUNE
NORTH CAROLINA

369602WP

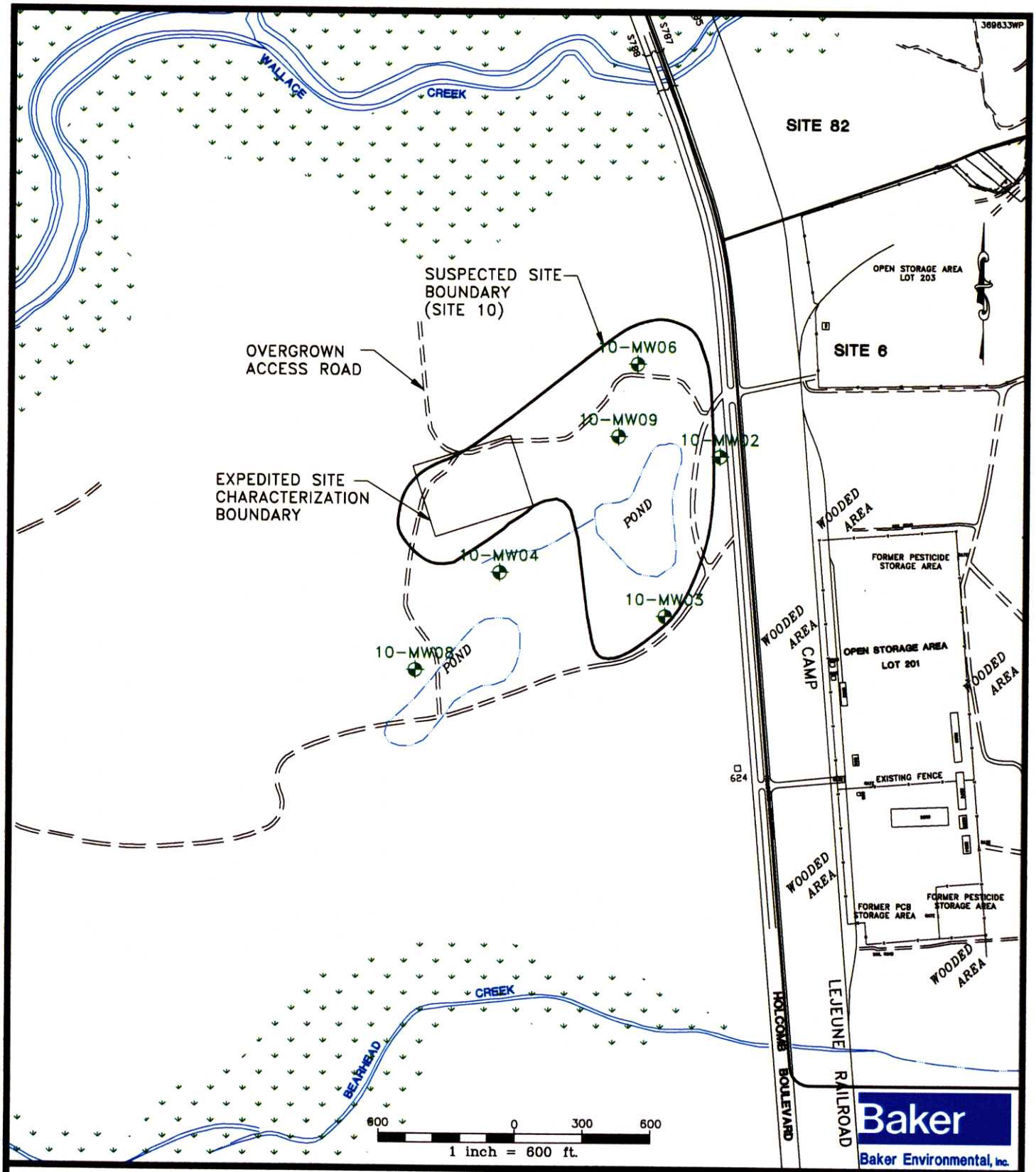


N.T.S.

Baker
Baker Environmental, Inc.

FIGURE 2-2
TYPICAL TEMPORARY GROUNDWATER
MONITORING WELL
SITE 10, ORIGINAL BASE LANDFILL
SITE INVESTIGATION, CTO - 0369

MARINE CORPS BASE, CAMP LEJEUNE
NORTH CAROLINA



LEGEND

⊕ – GROUNDWATER MONITORING WELL

FIGURE 2-3
MONITORING WELL LOCATION MAP
SITE 10, ORIGINAL BASE LANDFILL
PHASE II SITE INVESTIGATION
CTO – 0369
MARINE CORPS BASE, CAMP LEJEUNE
NORTH CAROLINA

3.0 PHYSICAL CHARACTERISTICS OF THE STUDY AREA

This section presents a discussion of the physical characteristics of the study area. Detailed discussions of site surface features, climatology and meteorology, hydrology, geology (regional and site), soils, hydrogeology (regional and site), land usage, ecology, and a water supply well inventory are included in this section. This information was obtained from available literature pertaining to MCB Camp Lejeune and from SI field activities.

3.1 Topography and Surface Features

The generally flat topography of MCB Camp Lejeune is typical of the North Carolina Coastal Plain. Elevations on the base vary from sea level to 72 feet above mean sea level (msl); however, the elevation of most of Camp Lejeune is between 20 and 40 feet msl (Figure 3-1).

Drainage at Camp Lejeune is generally toward the New River, except in areas near the coast which drain through the Intracoastal Waterway. In developed areas, natural drainage has been altered by asphalt cover, storm sewers, and drainage ditches. Approximately 70 percent of Camp Lejeune is in broad, flat interstream areas. Drainage is poor in these areas and the soils are often wet (Water and Air Research, Inc. [WAR], 1983).

The U.S. Army, Corps of Engineers has mapped the limits of 100-year floodplain at Camp Lejeune at 7.0 feet above msl in the upper reaches of the New River increasing downstream to 11 feet above msl near the coastal area (WAR, 1983). According to ground surface elevations measured during a site survey conducted during the SI indicate that Site 10 does not lie within the 100-year floodplain of the New River (Figure 3-2). The Flood Insurance Rate Maps (FIRM) for Onslow County, North Carolina, published by the Federal Emergency Management Agency (FEMA), confirms the site survey (FEMA, 1984) The 100-year floodplain for the New River, Wallace Creek and Bearhead Creek does not intersect the boundaries of the site.

The site is populated with trees varying in age from saplings to tress that are 30-40 years in age. A thick underbrush is also present throughout much of the site. Access roads used for military training maneuvers bound and bisect the site. Numerous "foxholes", ammunition boxes and spent ammunition

cartridges were observed throughout the site indicating it's use as a military training area. There are no buildings or other man-made structures located on site.

During the field investigations, two relatively shallow ponds (less than two feet deep) were present within the suspected boundaries of the site and sampled during the investigation. During sampling, it was noted that no aquatic life had been observed in the ponds. Evidence such as terrestrial plants growing beneath the level of the ponds, little to no sediment, and access roads passing through the ponds indicate that the ponds may exist on a seasonal basis only. A theory for the existence of these ponds is as follows. It is suspected that low-lying areas of the site accumulate water and form ponds during times when rainfall is at its peak (Figure 3-2). As the groundwater table rises and the soils become saturated, the ponds begin to accumulate surface water runoff. As the season progresses, the groundwater table begins to recede, the ponds become a source for groundwater recharge, and begin to diminish in size until they completely disappear. It is theorized that this cycle is repeated during rainy seasons and times when large amounts of precipitation can be expected (i.e., hurricanes and tropical storms). Evidence of this phenomena was observed during the Phase II investigation where one of the ponds was not present.

The topography of Site 10 ranges from approximately 14 to 31 feet above msl (Figure 3-2). The topography of the site slopes from the western, eastern and southern edges toward the middle and northern edge of the study area. The unnamed ponds observed at the site reside within the topographical low area. As illustrated on Figure 3-1, a topographical high exists west of the study area (west of soil boring IR10-SB22). The lowest elevation recorded within the study area existed in the vicinity of soil boring IR10-SB20.

Infiltration rates are expected to be fairly high because of the lack of site development (buildings, parking lots, paved roads, storm water systems, etc.). Low-lying areas throughout the site, such as the areas where the ponds exist, can become saturated and impede the infiltration of surface water in these areas.

3.2 Surface Water Hydrology

The following summary of surface water hydrology was originally presented in the Initial Assessment Study (IAS) report (WAR, 1983). The dominant surface water body at MCB Camp Lejeune is the

New River. It receives drainage from most of the Base. The river is short, with a course of approximately 50 miles on the central Coastal Plain of North Carolina. Over most of its course, the New River is confined to a narrow channel entrenched in Eocene and Oligocene limestones. South of Jacksonville, the river widens as it flows across less resistant sands, clays, and marls. At MCB Camp Lejeune, the New River flows in a southerly direction into the Atlantic Ocean through the New River Inlet. Several small coastal creeks that are not associated with the New River or its tributaries drain into the area of MCB Camp Lejeune. The New River, the Intracoastal Waterway and the Atlantic Ocean converge at the New River Inlet.

Classifications for surface waters in North Carolina have been published under Title 15 of the North Carolina Administration Code (North Carolina Department of Environment and Natural Resources [NC DENR], 1993). At MCB Camp Lejeune, the New River falls into three classifications. The portion of the river that passes from the Atlantic Coast Line railroad trestle to Mumford Point is classified as SC NSW HQW. This classification is defined as salt waters protected for secondary recreation, fishing, aquatic life including propagation and survival (SC) that are nutrient sensitive (NSW) and of high quality (HQW). The portion of the river that resided between Mumford Point to a line extending across the river from Grey Point to a point of land approximately 2200 yards downstream of the mouth of Duck Creek is classified as Class SC NSW. As previously described, these waters are similar to the waters upstream of Mumford Point, however they are not considered high quality waters. The remaining portion of the New River is classified as estuarine water suited for commercial shell fishing and all other tidal saltwater uses (SA).

Wallace and Bearhead Creeks border the northern and southern edges of the site. Both were classified as nutrient sensitive waters capable of sustaining primary and secondary recreation, aquatic life, propagation and survival, fishing, and wildlife (SB NSW) by NC DENR.

3.3 Geologic and Hydrogeologic Framework

The following paragraphs summarize the geologic and hydrogeologic framework for MCB, Camp Lejeune and Site 10

3.3.1 Regional Framework

Beneath Camp Lejeune are seven water-bearing hydrostratigraphic units, each comprised of one or more formations: an unnamed surficial unit of recent and Pleistocene age, the Castle Hayne aquifer of Oligocene and Eocene age, the Beaufort aquifer of Paleocene age, and four Upper Cretaceous aquifers (the Peedee, Black Creek, and the Upper and Lower Cape Fear). For practical purposes, the surficial unit is not considered an "aquifer" since it cannot yield sufficient amounts of water even for domestic use. This limitation of its use is probably due to its small thickness (which limits available drawdown) near Camp Lejeune. The underlying hydrostratigraphic units are much thicker and are capable of yielding adequate supplies of water; therefore, the underlying units can be practically considered "aquifers" and are referred to as such in this report.

Each of the six aquifers mentioned above provide drinking water to many industries, municipalities, and private well owners throughout the eastern Carolinas and have been described in detail by many authors including Cardinell et al (1993), Trapp (1992), and Eimers et al (1990). The surficial unit and the Castle Hayne aquifer are the only hydrologic units discussed in this report because: 1) the contaminants beneath MCB Camp Lejeune are either in the surficial unit or in the Castle Hayne aquifer; 2) only the Castle Hayne aquifer provides the drinking water for the base; and 3) the underlying aquifers are over 400 feet deep and effectively isolated by the Beaufort confining unit.

According to the data collected by Baker during the SI and base-wide remedial investigation (RI) studies, the surficial unit consists mainly of a fine sand with silt, although medium-grained sand occurs to a lesser extent (Baker, 1996). Across the base, the thickness of the surficial unit ranges from 0 to 73 feet. These deposits are undifferentiated Pleistocene and recent sediments. Also, sand beds of the Belgrade Formation of Miocene age are considered part of the surficial unit (Cardinell et al, 1993). The bottom of the surficial unit is at or near sea level over most of the base.

Recharge to the surficial aquifer is by rainfall. The aquifer receives more recharge in the winter than in the summer when much of the water evaporates or is transpired by plants before it can reach the water table. Most of the surficial groundwater is discharged to local streams, but some water passes through the underlying semiconfining unit. Recharge for the surficial aquifer is based on an average rainfall of 52 inches per year and an average recharge of 30 percent, or an annual recharge of approximately 16 inches per year (Table 3-1). The remaining 70 percent of the rainfall is lost as

surface runoff or evapotranspiration. Sixteen inches of recharge equates to 7,600,000 gallons per day (gpd) per square mile or approximately 114,000,000 gpd for all of MCB Camp Lejeune (based on 150 square miles of recharge area). Water levels in the wells tapping the surficial aquifer vary seasonally. The water table is generally highest in the winter and spring, and lowest in the summer and early fall. The estimated lateral hydraulic conductivity for the surficial aquifer is 50 feet per day (ft/d) and is based on a general composition of fine sand mixed with some silt and clay (Cardinal, et al., 1993).

A study of data from aquifer tests (pump tests) done at MCB Camp Lejeune was conducted by Baker in 1994 to evaluate aquifer characteristics and production capacities. The technical memorandum is provided in the Summary of Groundwater Data and Aquifer Characteristics in Appendix D. The information contained in this memorandum pertains primarily to the surficial aquifer. Average pumping rates were established between 0.5 to three g.p.m.; transmissivity ranged from 7.1 to 7,100 square feet per day (ft^2/day); storativity ranged from 1.5×10^3 to 7.5×10^2; and hydraulic conductivity was estimated to range from 0.5 to 1.4 ft/day. Although the aquifer is classified as GA (i.e., existing or a potential source of drinking water supply for humans), it is not used as a potable water source at MCB Camp Lejeune because of its low yielding production rates (typically less than three g.p.m.).

The Castle Hayne confining clay unit underlies the surficial unit and overlies the Castle Hayne aquifer. It is comprised of clay and/or sandy clay from one or more of the following lithologic units: the lower portion of the Miocene Belgrade Formation, the upper portion of the Oligocene River Bend Formation, or the upper portion of the Eocene Castle Hayne Formation (Cardinell et al, 1993). The thickness of this confining unit averages about nine feet near Camp Lejeune and has been breached by the New River and some of its larger tributaries. This observation is one of the keys to understanding groundwater flow near the base: the localized absence of the confining unit near the New River (or a large tributary) allows a strong hydraulic communication between the surficial unit and the Castle Hayne aquifer. Cardinell et al (1993) graphically contoured the thickness of the this confining unit.

The Castle Hayne confining unit is composed of silt, clay and sandy clay beds. These beds form a unit across MCB Camp Lejeune that may be represented by one or more geological units such as the deposits at the bottom of the surficial aquifer, the uppermost beds of the River Bend Formation or the uppermost beds of the Castle Hayne Formation. Overall, the Castle Hayne confining unit may be

characterized as a group of less permeable beds at the top of the Castle Hayne aquifer that have been eroded in places. The thickness of the confining unit ranges from zero to 26 feet thick, averaging nine feet thick where present. No discernible trend in the thickness of the confining unit exists although it is more than 20 feet thick only in the southern and southwestern parts of the Base. The vertical hydraulic conductivity of the Castle Hayne confining unit was estimated to range from 0.0014 to 0.41 ft/d. These values are comparable to those determined for silts and clays and therefore, this unit may only be partly effective at retarding the vertical movement of groundwater between the surficial and Castle Hayne aquifers (Cardinell, et al., 1993).

The Castle Hayne aquifer primarily resides within the River Bend Formation consisting of sand, cemented shells and limestone. The upper portion of the aquifer is comprised of calcareous sands with some thin clay and silt beds. The sand becomes increasingly limy with depth. The lower portion of the aquifer is primarily unconsolidated limestone and sandy limestone interbedded with clay and sand. Additionally, buried paleostream channels, containing various deposits, exist within the aquifer. The top of the aquifer ranges from 10 feet above msl to 70 feet below msl and is irregular over most of the northern portion of MCB Camp Lejeune. The aquifer is more regular in areas southeast of the New River, where it slopes southeastward. The Castle Hayne thickens to the east, from 160 feet in the Camp Geiger area to more than 400 feet at the eastern boundary of MCB Camp Lejeune.

Estimated transmissivity, hydraulic conductivity and storage coefficient values for the Castle Hayne aquifer range from 6,100 to 183,300 gpd/ft, 14 to 91 ft/d and 2×10^{-4} to 1.9×10^{-3}, respectively. An aquifer pump test conducted by Environmental Science and Engineering (ESE) (1988) in the Hadnot Point Industrial Area, using an existing water supply well (HP642), indicates an average transmissivity and storage coefficient of 9,600 gpd/ft and 8.8×10^{-4}, respectively (ESE, 1988). Table 3-2 summarizes the previously stated information.

Recharge of the Castle Hayne aquifer at MCB Camp Lejeune is primarily received from the surficial aquifer. Natural discharge is to the New River and its major tributaries. The Castle Hayne aquifer provides roughly seven million gallons of water to MCB Camp Lejeune. Groundwater pumping has not significantly affected natural head gradients in the aquifer.

MCB Camp Lejeune lies in an area where the upper part of the Castle Hayne aquifer contains freshwater. Saltwater is found in the bottom of the aquifer in the region and in the New River estuary;

both are of concern in managing water withdrawals from the aquifer. Over pumping the deeper parts of the aquifer or in areas hydraulically connected to estuarine streams could cause saltwater intrusions. The aquifer underlying most of the area contains water having less than 120 milligrams per liter (mg/L) of chloride.

3.3.2 Site-Specific Framework

Information regarding surface soil classifications was obtained from a study entitled Soil Survey, Camp Lejeune, North Carolina (USDA, 1984). The soils at the site are categorized into one of four soil complexes mapped at MCB Camp Lejeune including: Baymeade fine sand (BaB), Kureb fine sand (KuB), Marvyn loamy fine sand (MaC) or Pactolus fine sand (Pa).

Surface soils along the northern side of the study area are classified as Pactolus fine sand according to the Soil Conservation Service (SCS). This classification is reserved for soils in woodland areas that are nearly level and moderately well drained. Infiltration is rapid and surface runoff is slow. The dominant native trees are loblolly pine, sweet gum, water oak, willow oak and red maple. The uses of this soil for military training include unsurfaced roads for tracked and heavy-wheeled vehicles, light vehicle traffic and bivouac. Tracked vehicles are likely to disturb the surface creating large holes. In the absence of ground cover, this soil is susceptible to accelerated erosion on trails.

A strip of the study area that starts at the southwest corner, passes through the middle of the site to the northeast corner has been classified as the Marvyn loamy fine sand soil complex according to the SCS. This soil complex is typically found in long, narrow areas located in woodlands. Infiltration and surface water runoff rates are moderate. The major canopy trees are loblolly and longleaf pines, red and white oaks, and hickory. Although this soil is easily damaged by vehicle traffic in military training areas, it is often necessary for tactical vehicles to cross these areas in order to traverse the landscape. The destruction of the vegetative cover leaves the surface vulnerable to erosion and rutting.

Surface soils along the eastern edge of the study area (adjacent to Holcomb Boulevard) are classified as Kureb fine sand according to the SCS. This soil is similar to the Pactolus fine sand. This classification is typically applied to soils within woodlands with rapid infiltration and slow surface water runoff rates. The native trees are longleaf pine, turkey oak and live oak. Military training uses

include unsurfaced roads for tracked and heavy-wheeled vehicles, light vehicle traffic and bivouac. In the absence of vegetative cover, the soil is susceptible to accelerated erosion.

The remaining surface soils within the study area are classified as the Baymeade fine sand soil complex according to the SCS. This soil is very similar to the Kureb fine sand and the Pactolus fine sand soil complexes. This soil complex is well drained and typically mapped on uplands. Most of the acreage mapped as Baymeade fine sand is located in woodlands used for tracked and heavy-wheeled vehicle traffic. Infiltration rates are rapid and surface drainage is slow. The major canopy trees include longleaf pine, loblolly pine, southern red oak, white oak, and hickory. As with the other soils mapped within the study area, this soil is susceptible to accelerated erosion rates if the vegetative cover has been destroyed.

During the Phase I and Phase II investigations, numerous soil borings were advanced within the study area. The soil borings were advanced for sample collection, monitoring well installation, and soil description. Subsurface soil descriptions are provided in the Test Boring and Well Construction Records in Appendix A. The following provides a detailed description of the stratigraphy underlying the study area.

Soil conditions are generally uniform throughout the study area. Typically, the soils consist of unconsolidated deposits of brown to gray sands, with trace amounts of silt. These soils represent the Quaternary age "undifferentiated" deposits which overlay the Belgrade and River Bend Formations. Sands are fine grained and very well sorted. Based on field observations, the sands classify as well graded sand (SW) according to the Unified Soil Classification System (USCS).

Geologic cross-sections were constructed to illustrate subsurface soil beneath the study area. As shown on Figure 3-3, the site was traversed to provide a cross-sectional view of the study area. The following paragraphs discuss each of the four cross-sections that traverse the site.

Cross-section A-A' depicts subsurface soils to an elevation of 6.7 feet above msl from the northeastern to the southwestern portion of the study area. As illustrated on Figure 3-4, the soil underlying this portion of the study area consists of the forementioned fine sand with trace amounts of silt. Fill material was discovered in the vicinity of soil boring IR10-SB04. These materials were expected since the site was originally used as a small landfill during base construction. The amount

of material recovered in the geoprobe sampler was small and in some cases no material was recovered during advancement of this soil boring. The lack of sample recovery made it very difficult to accurately describe the type of materials encountered during advancement of soil boring IR10-SB04. However, some attempts recovered samples of rusted metal, brick, charred wood and clay to a depth of seven feet, below ground surface (bgs). Soil boring IR10-SB04 was advanced near the edge of a sudden change in topographical relief at the site (Figure 3-2). It was suspected that landfilling operations may have caused the topography of the site to have been artificially elevated in this area. Therefore, soil borings were advanced in the vicinity of the topographical ridge (located in the vicinity of soil borings IR10-SB03, IR10-SB04 and IR10-SB06) to determine if the relief in topography is natural or man-made. Soil boring IR10-SB04 proved that some of the material disposed at the site has helped to create this topographical ridge.

Cross-section B-B' depicts subsurface soils to an elevation of 6.6 feet above msl from the northern to southern portion of the study area (Figure 3-5). Overall, the soil types were consistent with the A-A' cross-section. As noted in previous text, in the area of soil boring IR10-SB03 fill material was encountered. The material consisted of rusted metal, broken glass, brick debris, charred wood and clay. This material is similar to the material encountered in soil boring IR10-SB04.

The bottom of the unnamed pond (located between soil borings IR10-SB25 and IR10-SB11/TW03) appears to be at approximately the same elevation as the groundwater table. The depth of the pond was measured to be a maximum depth of approximately one to two feet at the time of sediment and surface water sample collection. This provides some credence to the theory that the water contained within the unnamed ponds is the result of surface water accumulation in the topographical low areas of the study area during times of heavy precipitation.

Typically at MCB Camp Lejeune, a higher water table is observed in the winter and spring and a lower water table is noted in the summer and fall. According to historical rainfall data provided by the Naval Oceanography Command Detachment, rainfall increases throughout the summer with July recording the largest quantity per year on average. A decrease in amount of rain is usually observed in August; however, the month of August historically records the second highest quantity of rain for the entire year with the month of June recording the third highest amount (Table 3-1). During the spring of 1998, the following quantities of rain were recorded by Headquarters and Headquarters

Squadron Station Weather (H and HSSW) located at the Marine Corps Air Station (MCAS), New River:

- February - 10.68 inches
- March - 2.43 inches
- April - 3.28 inches

The quantities reported for March were about average, and April was below the historical average. However, February recorded an all-time maximum precipitation for readings taken at the base.

Groundwater was encountered at varying depths during the Phase I and Phase II drilling programs. The variation was primarily attributed to changes in surface topography. In general, the groundwater was encountered between 0.27 and 12.62 feet bgs during field activities.

As previously described in Section 2.2.1, a single round of groundwater measurements were collected during each of the field investigations (March 18 and 19, 1998 and March 1, 2001). The water levels were collected from temporary monitoring wells installed within the study area during the Phase I and from the 6 permanent monitoring wells installed during the 2001 Phase II investigation. The measurements are recorded on Table 2-1 and groundwater elevations and flow patterns are depicted on Figure 3-6 and Figure 3-7.

Groundwater contour lines generated from Phase I water levels indicates that groundwater flows from the eastern edge of the study area (in the vicinity of IR10-TW01 and IR10-TW02) to the northwest, west and southwest. Groundwater flow appears to somewhat parallel the topography of the site with the highest groundwater elevations corresponding to the highest surface elevations (Figure 3-1). Groundwater crossing the study area is suspected to discharge to Bearhead Creek (south) and Wallace Creek (north). The unnamed ponds located in the middle and southwestern portions of the study area appear to be sources of groundwater recharge. The groundwater gradient becomes less steep in the vicinity of these ponds providing evidence that surface water trapped within these topographical depressions recharges groundwater beneath the study area. Gradient calculations indicate that the steepest gradient observed at the site during the Phase I investigation appears to be in the vicinity of temporary monitoring wells IR10-TW01 and IR10-TW06 (Figure 3-6). The groundwater gradient in this area was calculated to be 2.7×10^{-2} ft/ft. This area corresponds to a relatively steep decline

in surficial elevation. The average gradient was calculated for the site and determined to be 1.1×10^{-2} ft/ft.

Groundwater contour lines generated from Phase II static water elevations indicates that groundwater flows from the eastern edge of the site (in the vicinity of 10-MW02) to the Northwest, west, and southwest. Groundwater flow resembles that which was observed during the Phase I investigation, parallel to topography, with the highest ground elevations corresponding to the highest groundwater elevations (see Figure 3-7). Gradient calculations based on Phase II data indicate that the steepest gradient observed at the site is in the vicinity of 10-MW06. This well is located in the portion of the site where the steepest gradient was measured during Phase I. The groundwater gradient in this area was calculated to be 1.0×10^{-2}.

3.4 Land Use and Demographics

MCB Camp Lejeune presently covers an area of approximately 236 square miles. Currently, the military population of MCB Camp Lejeune is approximately 41,000 active duty personnel. The military dependent community is more than 32,000 civilian employees performing facilities management and support functions. The population of Onslow County has grown from 17,738 in 1940, before the formation of the Base, to its present population of 121,350.

During World War II, MCB Camp Lejeune was used as a training area to prepare Marines for combat. This has been a continuing function of the facility during the Korean and Vietnam Conflicts and the recent Gulf War (i.e., Desert Storm). Toward the end of World War II, the Base was designated as home for the Second Marine Division. Since then, Fleet Marine Forces units also have been stationed here as tenant commands.

The existing land patterns in the various geographic areas within the MCB are listed, per geographic area, on Table 3-3. In addition, the number of acres comprising each land use category has been estimated and provided on the table.

3.5 Climatology

Although coastal North Carolina lacks distinct wet and dry seasons, there is some seasonal variation in average precipitation (see Table 3-1). July receives the most precipitation and rainfall amounts during summer are generally the greatest. Daily showers during the summer are common, and so are periods of one or two weeks without rain. Connective showers and thunderstorms contribute to the variability of precipitation during the summer months. October receives the least amount of precipitation, on average. Throughout the winter and spring months precipitation occurs primarily as migratory low pressure storms. MCB Camp Lejeune's average yearly rainfall is approximately 52 inches. Table 3-1 presents a climatic summary of data collected during 35 years (January 1955 to December 1990) of observations at MCAS New River.

Coastal plain temperatures are moderated by the proximity of the Atlantic Ocean which effectively reduces the average daily temperature fluctuation. Lying 50 miles offshore at its nearest point, the Gulf Stream has little effect on coastal temperatures. The southern reach of the cold Labrador Current offsets any warming effect the Gulf Stream might otherwise provide.

MCB Camp Lejeune experiences hot and humid summers, however ocean breezes frequently produce cooling effects. The winter months are 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.

Observations of sky conditions indicate yearly averages of approximately 112 clear, 105 partly cloudy, and 148 cloudy days. 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. During the months of September and October, the winds blow from the north-northwest at an average speed of 6.9 miles per hour.

3.6 Water Supply

Potable water for MCB Camp Lejeune is supplied entirely by groundwater. The Base does not have established groundwater preservation areas; however, because the Base controls more than 110,000 acres of land, and because much of this land has remained undeveloped, the undeveloped areas serve

the function of groundwater preserves. Groundwater usage is roughly seven million gpd (Cardinell, et al., 1993). Groundwater is pumped from approximately 77 of 90 water supply wells located within the boundaries of MCB Camp Lejeune. According to Base personnel, groundwater is treated at five plants located at Hadnot Point, Holcomb Boulevard, MCAS New River, Courthouse Bay and Onslow Beach having a total capacity of 15.8 million gpd.

All of the water supply wells use the Castle Hayne aquifer. The Castle Hayne aquifer is a highly permeable, semi-confined aquifer that can yield several hundred to 1,000 g.p.m. in municipal and industrial wells in the MCB Camp Lejeune area. The water supply wells at the Base average 162 feet in depth; eight inches in diameter (casing); and yield 174 g.p.m. (Harned, et al., 1989). The water is typically a hard, calcium bicarbonate type. Information concerning the supply wells was gathered from the Wellhead Management Program Engineering Study 91-36 (Geophex, 1991), the Preliminary Draft Report Wellhead Monitoring Study 92-34 (Greenhorne and O'Mara, Inc., 1992), and interviews with Base personnel.

Four active wells (HP-654, HP-641, HP-709, and HP-635) and five wells listed as off-line (HP-613, HP-633, HP-603, HP-610, and HP-637) are located within or just beyond a one-mile radius of Site 10 (Figure 3-7). Production well HP-610 is located approximately 1000 feet from the site. The total depth of this well is 190 feet bgs and is screened from 60 to 190 feet bgs. Although this well is presently listed as "off-line", this well has the potential to be made active if needed. Specific information for each of the production wells in the vicinity of the site such as USGS I.D. number, approximate distance and direction from the site to each of the wells, the year the well was installed, depth of the well, screened interval, its diameter and present status has been summarized on Table 3-4.

3.7 Ecological Characteristics

The Natural Resources and Environmental Affairs (NREA) Division of MCB Camp Lejeune, the U.S. Fish and Wildlife Service, and the North Carolina Wildlife Resource Commission have entered into an agreement for the protection of endangered and threatened species that might inhabit MCB Camp Lejeune. Habitats are maintained at MCB Camp Lejeune for the preservation and protection of rare and endangered species through the Base's forest and wildlife management programs. Full protection is provided to such species, and critical habitat is designated in management plans to

prevent or mitigate adverse effects of Base activities. Special emphasis is placed on habitat and sightings of alligators, osprey, bald eagles, cougars, dusky seaside sparrows, and red-cockaded woodpeckers (WAR, 1983).

Camp Lejeune covers approximately 153,000 acres, 84 percent of which is forested (United States Marine Corps [USMC], 1987). Approximately 45 percent of this is pine forest, 22 percent is mixed pine/hardwood forest, and 17 percent is hardwood forest. Nine percent of the Base, a total of 3,587 acres, is wetland and includes pure pond pine stands, mixed pond pine/hardwood stands, marshes, pocosins, and wooded swamps. The Base also contains 80 miles of tidal streams, 21 miles of marine shoreline, and 12 freshwater ponds. Over half of the 153,000 acres located within the boundaries of MCB Camp Lejeune are under forestry management. Timber producing areas are under even-aged management with the exception of those areas along streams and swamps. These areas are managed to provide both wildlife habitat and erosion control. Forest management provides wood production, increased wildlife populations, enhancement of natural beauty, soil protection, prevention of stream pollution, and protection of endangered species (WAR, 1983).

Because of the natural resources on the Base, forested areas are actively managed for timber. Game species are also managed for hunting, and ponds are maintained for fishing. Game species managed include wild turkey, white-tailed deer, black bear, grey and fox squirrels, bobwhite quail, eastern cottontail and marsh rabbits, raccoons, and wood ducks.

Aquatic ecosystems on MCB Camp Lejeune consist of small lakes, the New River estuary, numerous tributaries, creeks, and part of the Intracoastal Waterway. A wide variety of freshwater and saltwater fish species exist here. Freshwater ponds are under management to produce optimum yields and ensure continued harvest of desirable fish species (WAR, 1983). Freshwater fish in the streams and ponds include largemouth bass, redbreast sunfish, bluegill, chain pickerel, yellow perch, and catfish. Reptiles include alligators, turtles, and snakes, including venomous species. Both recreational and commercial fishing are practiced in the waterways of the New River and its tributaries (WAR, 1983).

Many natural communities are present in the coastal plain. Subcommunities and variations of these major community types are also present and alterations of natural communities have occurred in response to disturbance and intervention (i.e., forest cleared to become pasture). The natural communities found in the Camp Lejeune area are summarized as follows:

- Loblolly Pine Forest - a dominant forest type at Camp Lejeune. Pine forest often has a dense hardwood subcanopy and shrub understory because of clear-cutting and/or fire suppression. Dense shading results in a sparse ground layer of vegetation with little probability or rare species occurring (LeBlond et. al., 1994).

- Hardwood Forest - Found primarily in stream floodplains and on slopes and terraces next to stream valleys and estuarine features. Stream floodplain communities include cypress - gum swamp and coastal plain small stream swamp. Very few rare species are found in hardwood forests, but the communities themselves can be quite rare (LeBlond et. al., 1994).

- Loblolly Pine/Hardwoods Community - The predominant forest type at Camp Lejeune. Second growth forest that includes loblolly pine with a mix of hardwoods - oak, hickory, sweetgum, sour gum, red maple, and holly (oak is the predominant hardwood). These forests have a low probability for rare species because of the lack of herbaceous development and overall plant diversity (LeBlond et. al.,1994).

- Longleaf Pine Forest and Longleaf Pine/Hardwood Forests - Contain critical, fire maintained natural communities: Pine Savanna, Wet Pine Flatwoods, Mesic Pine Flatwoods, Pine/Scrub Oak Sanhill, and Zeric Sanhill Scrub. Some longleaf pine forests have developed in old fields and cut-over areas. The Federal endangered red-cockaded woodpecker (Picoides Borealis) is essentially restricted to opened, burned longleaf pine forests. The pine savannas and wet pine flatwood communities are particularly important habitats for several rare species (LeBlond et. al., 1994).

- Maritime Forest - Develop on the lee side of stable sands and dunes protected from the ocean. Live oak is an indicator species with pine, cedar, yaupon, holly, and laurel oak. Deciduous hardwoods may be present where forest is mature (USMC, 1987).

- Pond Pine Forest - These forests are primarily found in pocosins and are classified by Schafale and Wealkey (1990) as the Pond Pine Woodland natural community. Red bay, sweet bay, and loblolly bay are important components of this community. These forests frequently produce areas of high plant diversity and support several rare species. The Federal

endangered loosestrife (Lysimachia asperulifolia) is found in this community (LeBlond et. al., 1994).

- Freshwater Marsh - Occurs upstream from tidal marshes and downstream from non-tidal freshwater wetlands. Cattails, sedges, and rushes are present, On the coast of North Carolina, swamps are more common than marshes (USMC, 1987).

- Salt Marsh - These areas occur in saline tidal areas protected from tidal action by barrier beach features. The barrier islands fronting the Atlantic Ocean support Brackish Marsh, Upper Beach, Dune Grass, and Martitime Wet and Dry Grassland communities. Regularly flooded, tidally influenced areas dominated by salt-tolerant grasses. Saltwater cordgrass is a characteristic species. Tidal mud flats may be present during low tide. These dynamic communities are critical to such Federal endangered species as the piping plover (Charadrius Melodus) and the Federal threatened American loggerhead turtle (Caretta caretta) and the green turtle (Chelonia Mydas) (LeBlond et. al., 1994).

- Salt Shrub Thicket - High areas of salt marshes and beach areas behind dunes. Subjected to salt spray and periodic saltwater flooding. Dominated by salt resistant shrubs.

- Dunes/Beaches - Zones from the ocean shore to the maritime forest. Subjected to sand, salt, wind, and water.

- Ponds and Lakes - Low depressional areas where water table reaches the surface or where ground is impermeable. In ponds rooted plants can grow across the bottom, Fish populations managed in these ponds include redear, bluegill, largemouth bass, and channel catfish (USMC, 1987).

- Open Water - Marine and estuarine water and all underlying bottoms below the intertidal zone.

3.8 Wetlands

NC DENR's Division of Environmental Management (DEM) has developed guidance concerning activities that may impact wetlands (NC DENR, 1992). In addition, certain activities affecting wetlands also are regulated by the U.S. Corps of Engineers. The U.S. Fish and Wildlife Service has prepared National Wetland Inventory (NWI) maps for the Camp Lejeune, North Carolina area by stereoscopic analysis of high altitude aerial photographs (United States Department of the Interior [USDI], 1982).

Wetland ecosystems at MCB Camp Lejeune can be categorized into five habitat types: (1) pond pine or pocosin; (2) sweet gum, water oak, cypress, and tupelo; (3) sweet bay, swamp black gum, and red maple; (4) tidal marshes; and, (5) coastal beaches. Pocosins provide excellent habitat for bear and deer because these areas are seldom disturbed by humans. The presence of pocosin-type habitat at MCB Camp Lejeune is primarily responsible for the continued existence of black bear in the area. Many of the pocosins are overgrown with brush and pine species that would not be profitable to harvest (WAR, 1983).

Sweet gum, water oak, cypress, and tupelo habitat is found in the rich, moist bottomlands along streams and rivers. This habitat extends to the marine shorelines. Deer, bear, turkey, and waterfowl are commonly found in this type of habitat (WAR, 1983).

Sweet bay, swamp black gum, and red maple habitat exist in the floodplain areas of MCB Camp Lejeune. Fauna including waterfowl, mink, otter, raccoon, deer, bear, and gray squirrel frequent this habitat (WAR, 1983).

The tidal marsh at the mouth of the New River is one of the few remaining North Carolina coastal areas relatively free from filling or other manmade changes. This habitat, which consists of marsh and aquatic plants such as algae, cattails, saltgrass, cordgrass, bulrush, and spikerush, provides wildlife with food and cover. Migratory waterfowl, alligators, raccoons, and river otter exist in this habitat (WAR, 1983).

Coastal beaches along the Intracoastal Waterway and along the outer banks of MCB Camp Lejeune are used for recreation and to house a small military command unit. Basic assault training maneuvers

are also conducted along these beaches. Training regulations presently restrict activities that would impact ecologically sensitive coastal barrier dunes. The coastal beaches provides habitat for many shorebirds (WAR, 1983).

3.9 Threatened and Endangered Species

Certain species have been granted protection by the U.S. Fish and Wildlife Services (FWS) under the Federal Endangered Species Act (16 U.S.C. 1531-1544) (FWS, 1973), and/or by the North Carolina Wildlife Resources Commission (NC WRC), under the North Carolina Endangered Species Act (G.S. 113-331 to 113-337) (NC WRC, 1992). 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.

Surveys have been conducted to identify threatened or endangered species at Camp Lejeune and several programs are underway to manage and protect them. Table 3-5 lists protected species present at the base and their protected classifications. Of these species, the red-cockaded woodpecker, American alligator, and sea turtles are covered by specific protection programs.

The red-cockaded woodpecker is classified as state endangered. This species requires a specific habitat in mature, living longleaf or loblolly pine trees. The birds exist in family groups and young are raised cooperatively. At Camp Lejeune, 2,512 acres of habitat have been identified and marked for protection. Research on the bird at Camp Lejeune began in 1985 and information has been collected to determine home ranges, population size and composition, reproductive success, and habitat use. An annual roost survey is conducted and 36 colonies of birds have been located.

The American alligator is considered threatened in the northernmost part of its range, which includes North Carolina. The alligator is found in freshwater, estuarine, and saltwater wetlands in Camp Lejeune. Base wetlands are maintained and protected for the alligator. Signs have been erected where alligators are known to live. Annual surveys of Wallace, Southwest, French, Duck, Mill, and Stone Creeks have been conducted since 1977 to identify alligators and their habitats on base.

Two protected sea turtles, the Atlantic loggerhead and Atlantic green turtle, nest on Onslow Beach at Camp Lejeune and are both classified as threatened species. The green turtle was found nesting in 1980; the sighting was the first time the species was observed nesting north of Georgia. The turtle returned to nest in 1985. Turtle nests on the beach are surveyed and protected, turtles are tagged, and annual turtle status reports are issued.

Four bird species (black skimmer, piping plover, Bachman's sparrow, and peregrine falcon) have also been identified during surveys at Camp Lejeune. The piping plover and peregrine falcon are classified as threatened species. The black skimmer and Bachman's sparrow are classified as special concern (state). The black skimmer and piping plover are sea and shore birds respectively. Skimmers nest on low sandy islands and sand bars along the coast and piping plovers prefer beaches with broad open sandy flats above the high tide line. Skimmers feed above open water and piping plovers feed along the edge of incoming waves. Like the black skimmer and piping plover, Bachman's sparrows are very specific in their habitat requirements. They live in open stretches of pines with grasses and scattered shrubs for ground cover. Bachman's sparrows were observed at numerous locations throughout the southern portion of Camp Lejeune.

In addition to the protected species that breed or forage at Camp Lejeune, several protected whales migrate through the coastal waters off the base during the spring and fall. These include the Atlantic right whale, finback whale, sei whale, and sperm whale. Before artillery or bombing practice is conducted in the area, aerial surveys are made to assure that whales are not present in the impact areas.

A natural heritage resources survey was conducted at Camp Lejeune (LeBlond, 1991) to identify threatened or endangered plants and areas of significant natural interest. From this survey, the rough-leaf loosestrife was the only specie identified that is both Federal and state endangered. Also, several state endangered/threatened and Federal and state candidate species were found on the Base.

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SECTION 3.0 TABLES

TABLE 3-1

CLIMATIC DATA SUMMARY FOR MCB, CAMP LEJEUNE
SITE 10, ORIGINAL BASE LANDFILL
MCB, CAMP LEJEUNE, NORTH CAROLINA
SITE INVESTIGATION, CTO-0369

	Precipitation (Inches)			Relative Humidity (Percent)	Temperature (Fahrenheit)			Mean Number of Days With				
								Precipitation		Temperature		
	Maximum	Minimum	Average		Maximum	Minimum	Average	>=0.01"	>=0.5"	>=90F	>=75F	<=32F
January	7.5	1.4	4.0	79	54	34	44	11	2	0	1	16
February	9.1	.9	3.9	78	57	36	47	10	3	0	2	11
March	8	.8	3.9	80	64	43	54	10	3	*	5	5
April	8.8	.5	3.1	79	73	51	62	8	2	1	13	*
May	8.4	.6	4.0	83	80	60	70	10	3	2	25	0
June	11.8	2.2	5.2	84	86	67	77	10	4	7	29	0
July	14.3	4.0	7.7	86	89	72	80	14	5	13	31	0
August	12.6	1.7	6.2	89	88	71	80	12	4	11	31	0
September	12.8	.8	4.6	89	83	66	75	9	3	4	27	0
October	8.9	.6	2.9	86	75	54	65	7	2	*	17	*
November	6.7	.6	3.2	83	67	45	56	8	2	0	7	3
December	6.6	.4	3.7	81	58	37	48	9	2	0	2	12
Annual	65.9	38.2	52.4	83	73	53	63	118	35	39	189	48

Notes:

* = Mean no. of days less than 0.5 days
Source: Naval Oceanography Command Detachment, Asheville, North Carolina. Measurements obtained from January 1955 to December 1990.

TABLE 3-2

HYDRAULIC PROPERTY ESTIMATES OF THE CASTLE HAYNE AQUIFER AND CONFINING UNIT
SITE 10, ORIGINAL BASE LANDFILL
MCB, CAMP LEJEUNE, NORTH CAROLINA
SITE INVESTIGATION, CTO 369

Hydraulic Properties	USGS Phase I Study[1]	USGS Aquifer Test[2]	ESE, Inc. [3]	DEHNR Aquifer Test[4]	RASA Estimate[5]
Aquifer transmissivity (cubic foot per day per square foot times foot of aquifer thickness)	4,300 to 24,500 average 9,500	1,140 to 1,325	820 to 1,740 average 1,280	900	10,140 to 26,000
Aquifer hydraulic conductivity (foot per day)	14 to 82 average 35	20 to 60	--	18 to 91 average 54	45 to 80 average 65
Aquifer storage coefficient (dimensionless)	--	2.0×10^{-4} to 2.2×10^{-4}	5.0×10^{-4} to 1.0×10^{-3} average 8.0×10^{-4}	1.9×10^{-3}	--
Confining-unit vertical hydraulic conductivity (foot per day)	--	3.0×10^{-2} to 4.1×10^{-1}	1.4×10^{-3} to 5.1×10^{-2} average 3.5×10^{-3}	--	--

Notes:

(1) Analysis of specific capacity data from Harned and others (1989).
(2) Aquifer test at well HP-708.
(3) Aquifer test at Hadnot Point well HP-642 from Environmental Sciences and Engineering, Inc. (1988).
(4) Unpublished aquifer test data at well X24s2x, from DEHNR well records (1985).
(5) Transmissivities based on range of aquifer thickness and average hydraulic conductivity from Winner and Coble (1989).

Source: Cardinell, et al., 1993.

TABLE 3-3

LAND UTILIZATION: DEVELOPED AREAS ACRES/LAND USE (PERCENT) FOR MCB, CAMP LEJEUNE
SITE 10, ORIGINAL BASE LANDFILL
MCB, CAMP LEJEUNE, NORTH CAROLINA
SITE INVESTIGATION, CTO - 0369

Geographic Area	Oper.	Training (Instruc.)	Maint.	Supply/ Storage	Medical	Admin.	Family Housing	Troop Housing	CM	CO	Recreat.	Utility	Total
Hadnot Point	**31 (2.9)**	**15 (1.4)**	**154 (14.3)**	**157 (14.4)**	**10 (0.9)**	**122 (11.3)**	**22 (2.0)**	**196 (18.1)**	**115 (10.7)**	**36 (3.3)**	**182 (16.9)**	**40 (3.7)**	**1,080 (100)**
Paradise Point	1 (0)		3 (0.4)	1 (0)			343 (34)	19 (1.9)	31 (3.1)		610 (60.4)	2 (0.2)	1,010 (100)
Berkeley Manor/ Watkins Village							406 (80)		41 (8.1)	1 (0.2)	57 (11.2)	2 (0.5)	507 (100)
Midway Park		1 (0.4)		2 (0.7)		2 (0.7)	248 (92.2)		8 (3.0)	3 (1.1)	4 (1.5)	1 (0.4)	269 (100)
Tarawa Terrace I and II			3 (0.5)			1 (0.3)	428 (77.4)		55 (9.9)	11 (2.0)	47 (8.5)	8 (1.4)	553 (100)
Knox Trailer							57 (100)						57 (100)
French Creek	8 (1.4)	1 (0.2)	74 (12.7)	266 (45.6)	3 (0.5)	7 (1.2)		122 (20.9)	22 (3.8)	6 (1.0)	74 (12.7)		583 (100)
Courthouse Bay		73 (28.6)	28 (10.9)	14 (5.5)		12 (4.7)	12 (4.7)	43 (16.9)	15 (5.9)	4 (1.6)	43 (16.9)	11 (4.3)	255 (100)
Onslow Beach	6 (9.8)	1 (1.6)	3 (4.8)	2 (3.2)	1 (1.6)	2 (3.2)		2 (3.2)	12 (19.3)		25 (40.3)	8 (13.0)	62 (100)
Rifle Range		1 (1.3)	1 (1.3)	7 (8.8)	1 (1.3)	5 (6.3)	7 (8.8)	30 (37.5)	5 (6.3)	1 (1.3)	9 (11.3)	13 (16.3)	80 (100)
Camp Geiger (including the MCAS)	4 (1.9)	15 (6.9)	19 (8.8)	50 (23.1)		23 (10.6)		54 (25.0)	27 (12.5)	2 (1.0)	16 (7.4)	6 (2.8)	216 (100)
Montford Point	6 (2.6)	48 (20.5)	2 (0.9)	4 (1.7)	2 (0.9)	9 (3.9)		82 (35.2)	20 (8.6)	1 (0.4)	49 (21.0)	10 (4.3)	233 (100)
Base-Wide Misc.	1 (0.8)			87 (68.0)		3 (2.3)			19 (14.8)			18 (14.1)	128 (100)
TOTAL	**57 (1.1)**	**155 (3.1)**	**287 (5.7)**	**590 (11.7)**	**17 (0.38)**	**186 (3.7)**	**1,523 (30.2)**	**548 (10.8)**	**370 (7.4)**	**65 (1.3)**	**1,116 (22.2)**	**119 (2.4)**	**5,033 (100)**

Note: [1]Upper number is acres, lower number is overall percent.

TABLE 3-4
SUMMARY OF SUPPLY WELLS IN THE VACINITY OF SITE 10
SITE 10, ORIGINAL BASE LANDFILL
MCB, CAMP LEJEUNE, NORTH CAROLINA
SITE INVESTIGATION, CTO - 0369

Well No.	USGS ID No.	Approx. Distance/Direction Site to Well	Year Drilled	Depth	Screened Interval	Well Diameter (in)	Status
HP-603	3440100772032.1	11,550 SW	1941	195	70 - 195	8	off-line
HP-610	3441120771954.1	1,980 SE	1942	190	60 - 190	8	off-line
HP-613	3442290772020.1	8,910 N	1942	150	60 - 150	8	off-line
HP-633	3441580772006.1	4,290 N	1959	205	55 - 205	8	off-line
HP-635	3440550771933.1	5,775 SE	1959	215	65 - 215	8	on-line / active
HP-637	3440390771954.1	3,795 S	1969	172	90 - 172	8	off-line
HP-641	3442290771922.1	11,055 NE	1971	178	108 - 168	8	on-line / active
HP-654	3442270771953.1	8,745 N	1978	183	unknown	unknown	on-line / active
HP-709	3442130771859.1	10,230 NE	1985	140	70 - 140	10	on-line / active

Note:

(1) off-line = not presently being used, however easily activated
(2) on-line = presently being used for water supply
N = North
NE = North-east
S = South
SE = South-east
SW = South-west

TABLE 3-5

PROTECTED SPECIES AT MCB, CAMP LEJEUNE
SITE 10, ORIGINAL BASE LANDFILL
MCB, CAMP LEJEUNE, NORTH CAROLINA
SITE INVESTIGATION, CTO-0369

Species	Protected Classification
Animals:	
American alligator (Alligator mississippienis)	SC
Bachmans sparrow (Aimophilia aestivalis)	FCan, SC
Green (Atlantic) turtle (Chelonia m. mydas)	T(f), T(s)
Loggerhead turtle (Caretta caretta)	T(f), T(s)
Peregrine falcon (Falco peregrinus)	E(f), E(s)
Piping plover (Charadrius melodus)	T(f), T(s)
Red-cockaded woodpecker (Picoides borealis)	E(f), E(s)
Southern Hognose Snake (Heterodon simus)	FCan, SR
Diamondback Terrapin (Malaclemys terrapin)	FCan, SC
Carolina Gopher Frog (Rana capito capito)	FCan, SC
Cooper's Hawk (Accipiter cooperii)	SC
Eastern Diamondback Rattlesnake (Crotalus adamanteus)	SR
Eastern Coral Snake (Micrurus fulvius)	SR
Pigmy Rattlesnake (Sistrurus miliarius)	SR
Black Bear (Ursus americanus)	SR
Plants:	
Rough-leaf loosestrife (Lysimachia asperulifolia)	E(f), E(s)
Seabeach Amaranth (Amaranthus pumilus)	T(f), T(s)
Chapman's Sedge (Carex chapmanii)	FCan
Hirst's Witchgrass (Dichanthelium sp.)	FCan
Pondspice (Litsea aestivalis)	FCan
Boykin's Lobelia (Lobelia boykinii)	FCan
Loose Watermilfoil (Myriophyllum laxum)	FCan,T(s)
Awned Meadowbeauty (Rhexia aristosa)	FCan,T(s)
Carolina Goldenrod (Solidago pulchra)	FCan, E(s)
Carolina Asphodel (Tofieldia glabra)	FCan
Venus Flytrap (Dionaea muscipula)	FCan
Flaxleaf Gerardia (Agalinis linifolia)	SR
Pinebarrens Goober Grass (Amphicarpum purshii)	SR
Longleaf Three-awn (Aristida palustris)	SR
Pinebarrens Sandreed (Calamovilfa brevipilis)	E(s)
Warty Sedge (Carex verrucosa)	SR
Smooth Sawgrass (Cladium mariscoides)	SR
Leconte's Flatsedge (Cyperus lecontei)	SR

TABLE 3-5 (Continued)

PROTECTED SPECIES AT MCB, CAMP LEJEUNE
SITE 10, ORIGINAL BASE LANDFILL
MCB, CAMP LEJEUNE, NORTH CAROLINA
SITE INVESTIGATION, CTO-0369

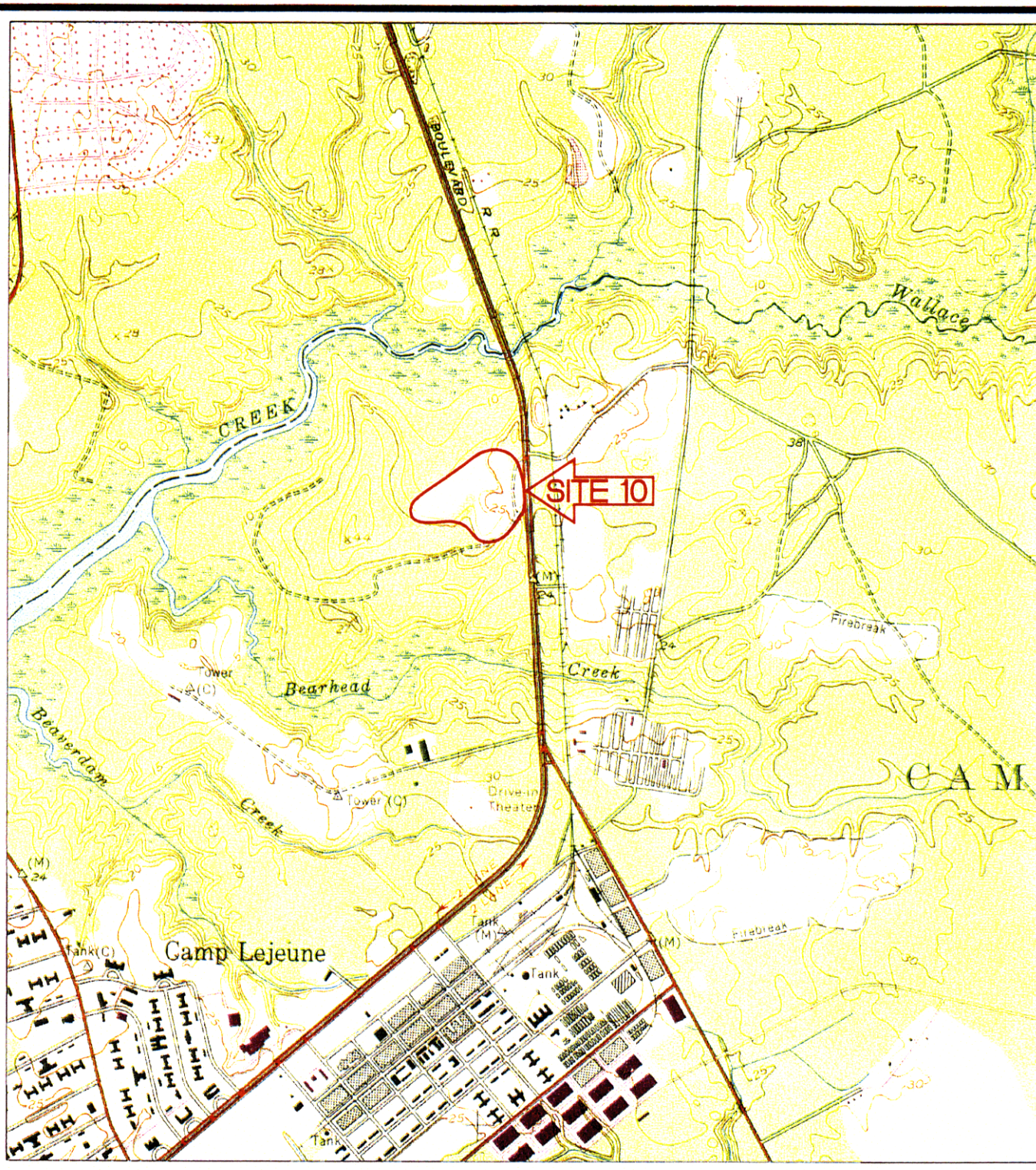
Species	Protected Classification
Erectleaf Witchgrass (Dichanthelium erectifolium)	SR
Horsetail Spikerush (Eleocharis equisetoides)	SR
Sand Spikerush (Eleocharis montevidensis)	SR
Flaxleaf Seedbox (Ludwigia linifolia)	SR
Torrey's Muhley (Muhlenbergia torreyana)	E(s)
Southeastern Panic Grass (Panicum tenerum)	SR
Spoonflower (Peltandra sagittifolia)	SR
Shadow-witch (Ponthieva racemosa)	SR
West Indies Meadowbeauty (Rhexia cubensis)	SR
Pale Beakrush (Rhynchospora pallida)	SR
Longbeak Baldsedge (Rhynchospora scirpoides)	SR
Tracy's Beakrush (Rhynchospora tracyi)	SR
Canby's Bulrush (Scirpus etuberculatus)	SR
Slender Nutrush (Scleria minor)	SR
Lejeune Goldenrod (Solidago sp.)	SR
Dwarf Bladderwort (Utricularia olivacea)	T(s)
Elliott's Yellow-eyed Grass (Xyris elliottii)	SR
Carolina Dropseed (Sporobolus sp.)	T(s)

Legend:

E(f) = Federal Endangered
T(f) = Federal Threatened
Fcan = Candidate for Federal Listing
E(s) = State Endangered
T(s) = State Threatened
SC = State Special Concern
SR = State Rare

Source: LeBlond, 1994

SECTION 3.0 FIGURES



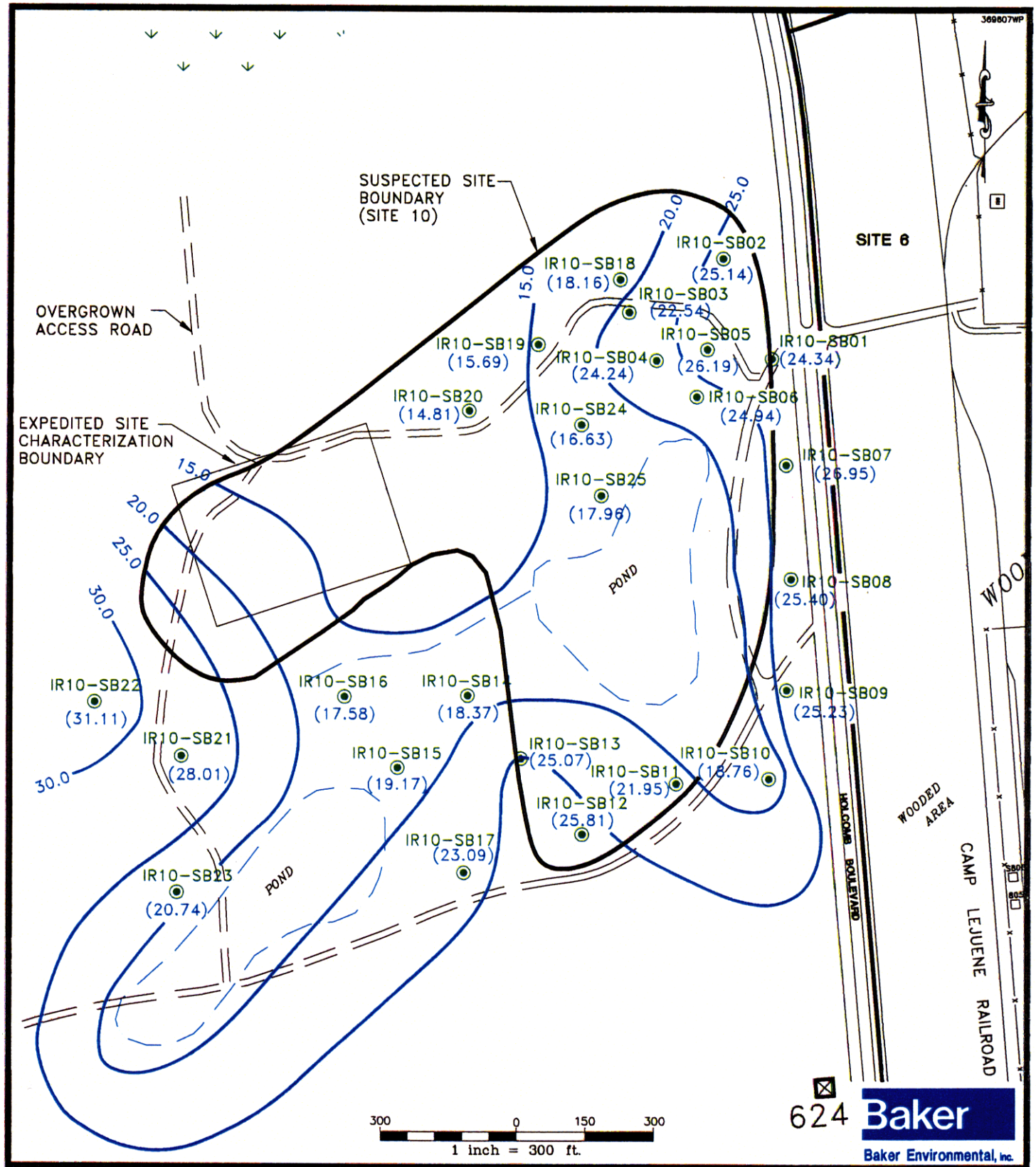
SOURCE:
U.S.G.S. QUAD MAP
NORTH CAROLINA QUADRANGLE, 1971

2000 0 1000 2000
1 inch = 2000 ft.

Baker
Baker Environmental, Inc.

FIGURE 3-1
REGIONAL SURFACE TOPOGRAPHY MAP
SITE 10, ORIGINAL BASE LANDFILL
SITE INVESTIGATION, CTO - 0369

MARINE CORPS BASE, CAMP LEJEUNE
NORTH CAROLINA

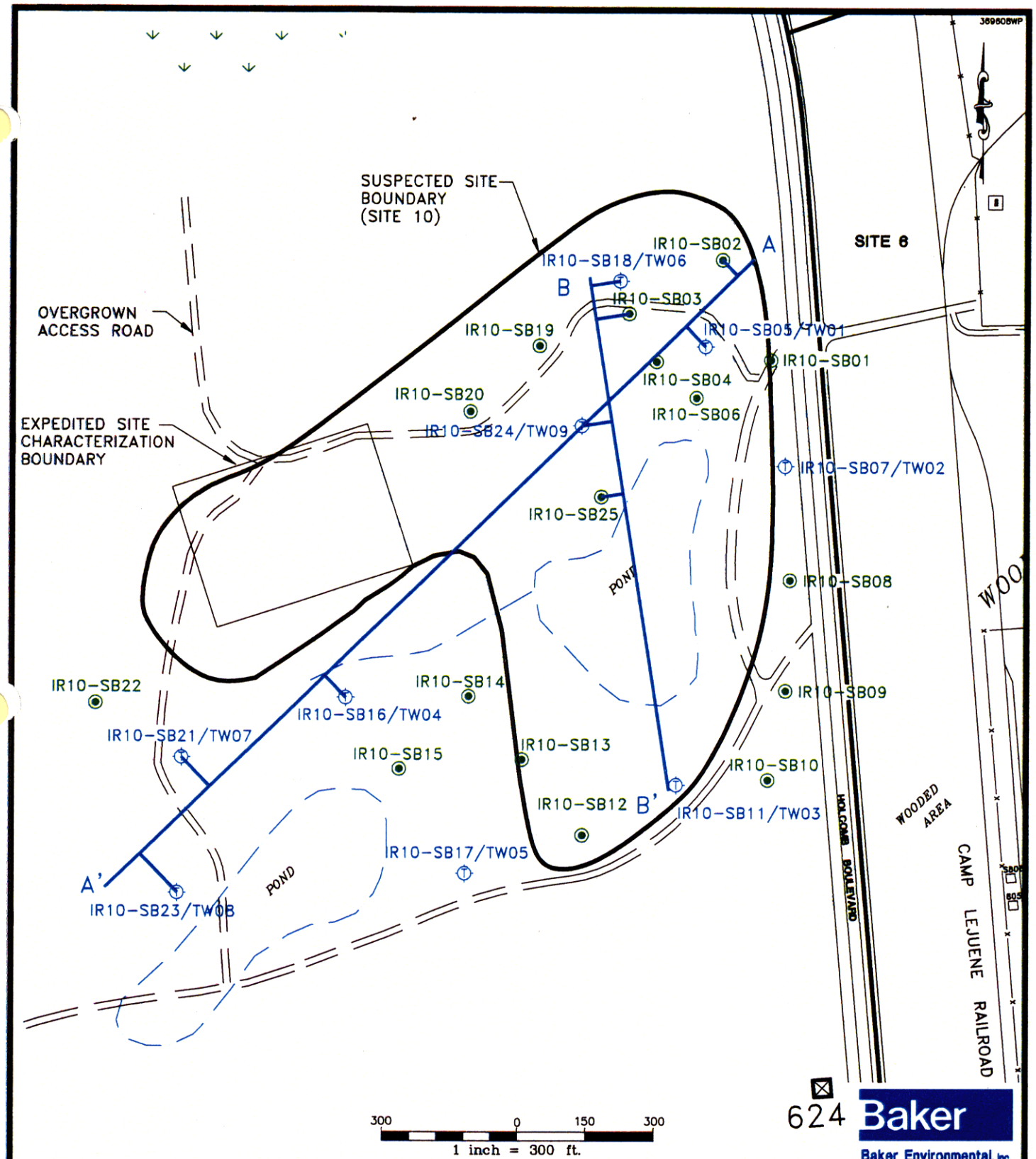


LEGEND

- ⊙ – SOIL BORING LOCATION
- (19.22) – SURFACE ELEVATION
- 15.0 – TOPOGRAPHICAL CONTOUR LINE

FIGURE 3-2
SITE-SPECIFIC
SURFACE TOPOGRAPHY MAP
SITE 10, ORIGINAL BASE LANDFILL
SITE INVESTIGATION, CTO – 0369

MARINE CORPS BASE, CAMP LEJEUNE
NORTH CAROLINA



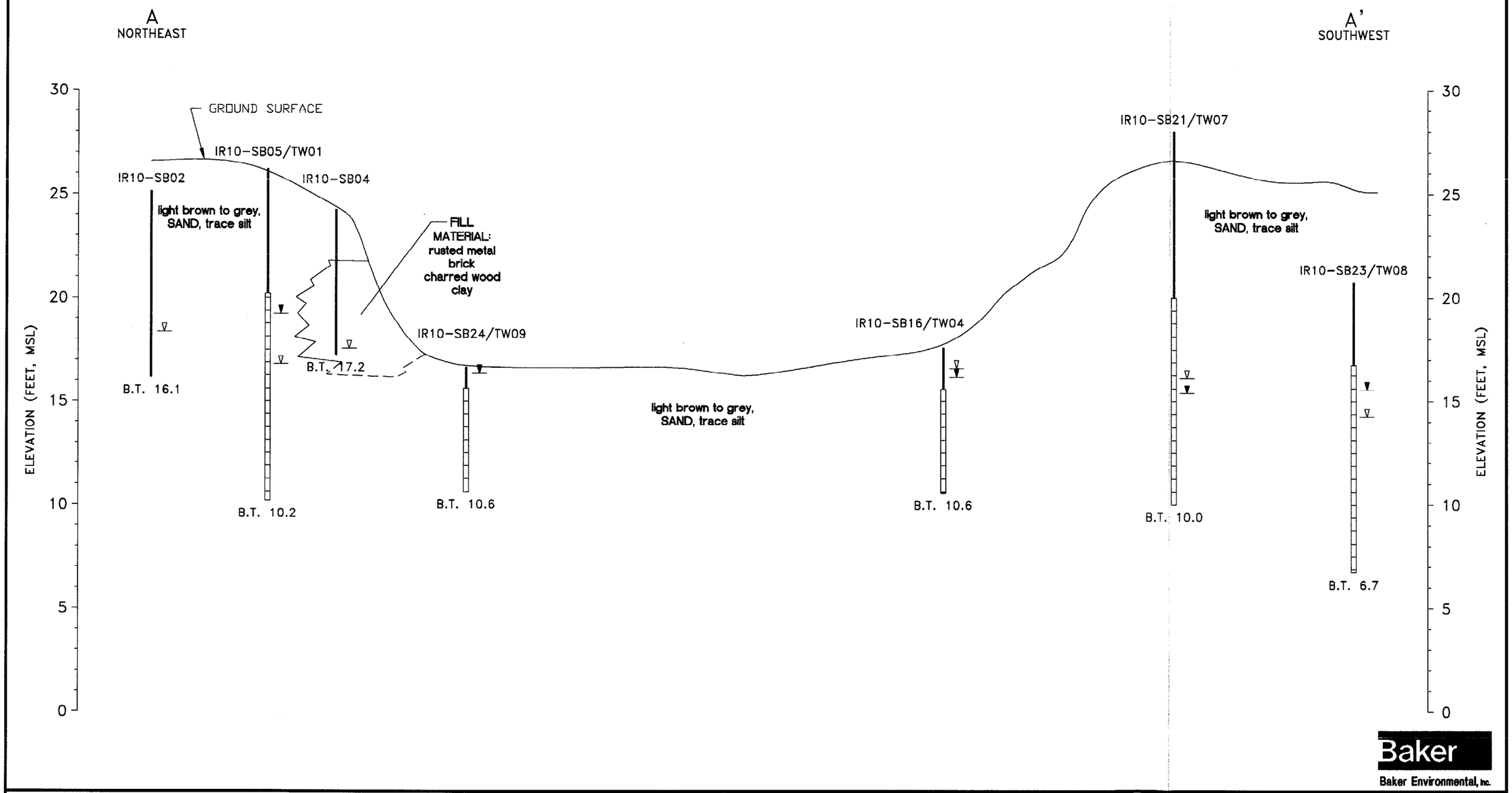
LEGEND

- TEMPORARY WELL LOCATION WITH SURFACE AND SUBSURFACE SOIL SAMPLES
- SOIL BORING LOCATION
- A —— A' – HYDROGEOLOGIC CROSS-SECTION
- SITE BOUNDARY
- WETLANDS
- OVERGROWN ACCESS ROAD

FIGURE 3-3
HYDROGEOLOGIC CROSS-SECTION LOCATION MAP
SITE 10, ORIGINAL BASE LANDFILL
SITE INVESTIGATION, CTO – 0369

MARINE CORPS BASE, CAMP LEJEUNE
NORTH CAROLINA

369609WP



LEGEND

- GROUNDWATER ELEVATION (MARCH 22 AND 23, 1998)
- GROUNDWATER ENCOUNTERED DURING DRILLING (MARCH 18 AND 19, 1998)
- B.T. X' BORING TERMINATED, ELEVATION MSL
- WELL SCREEN INTERVAL
- ESTIMATED — — — PROJECTED

170 0 85 170 340

Horizontal Scale: 1 inch = 170 ft.

5 0 2.5 5 10

Vertical Scale: 1 inch = 5 ft.

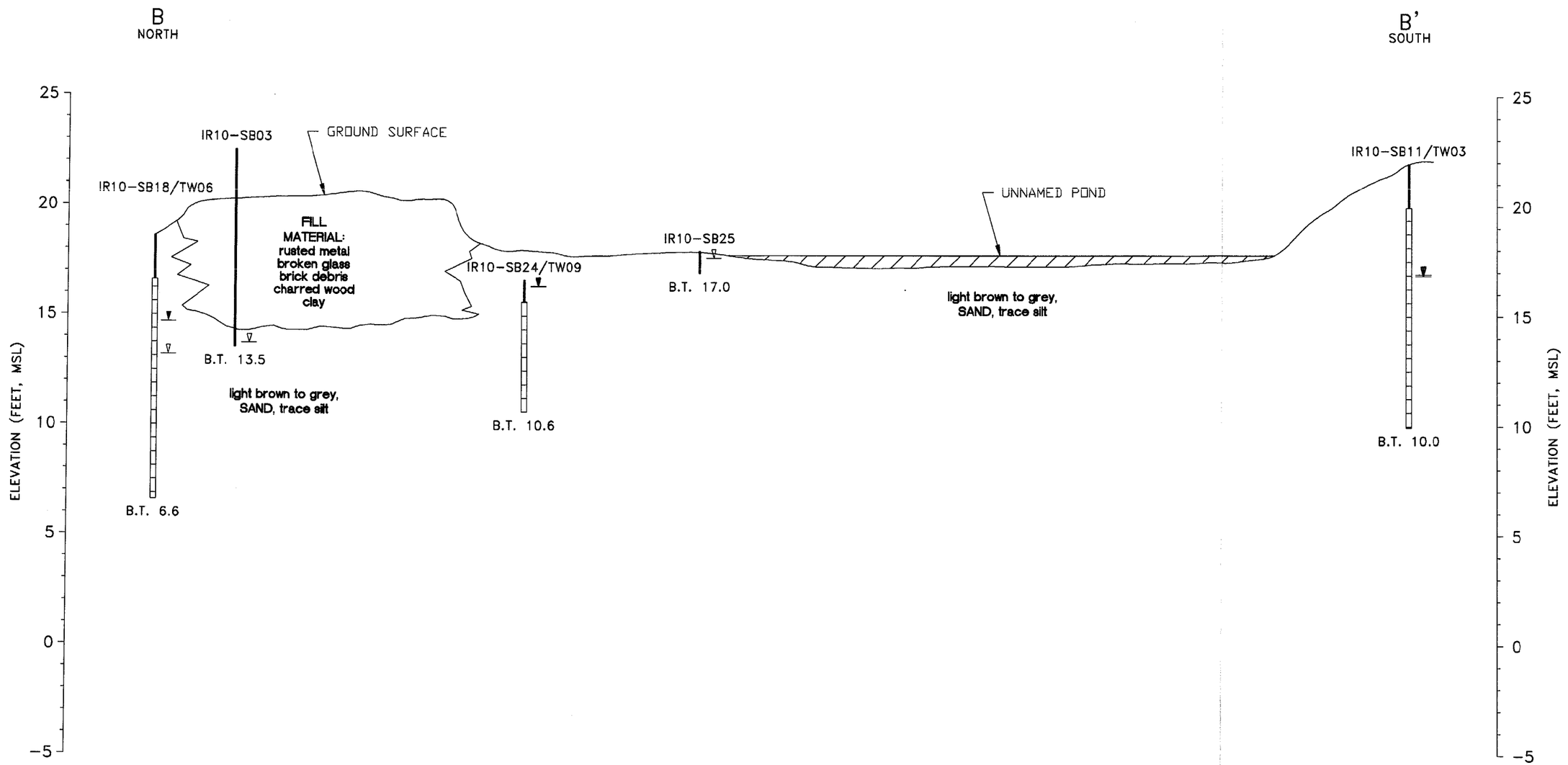
THE SOIL BORING INFORMATION IS CONSIDERED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT THE RESPECTIVE BORING LOCATIONS. SUBSURFACE CONDITIONS INTERPOLATED BETWEEN BORINGS ARE ESTIMATED BASED ON ACCEPTED SOIL ENGINEERING PRINCIPLES AND GEOLOGIC JUDGEMENT.

FIGURE 3-4
HYDROGEOLOGIC CROSS-SECTION A-A'
SITE 10, ORIGINAL BASE LANDFILL
SITE INVESTIGATION, CTO - 0369

MARINE CORPS BASE, CAMP LEJEUNE
NORTH CAROLINA

03266EB42

369610WP



Baker
Baker Environmental, Inc.

LEGEND

- GROUNDWATER ELEVATION (MARCH 22 AND 23, 1998)
- GROUNDWATER ENCOUNTERED DURING DRILLING (MARCH 18 AND 19, 1998)
- B.T. X' BORING TERMINATED, ELEVATION MSL
- WELL SCREEN INTERVAL
- ESTIMATED — — — PROJECTED
- SURFACE WATER
- UNNAMED POND
- BOTTOM OF POND

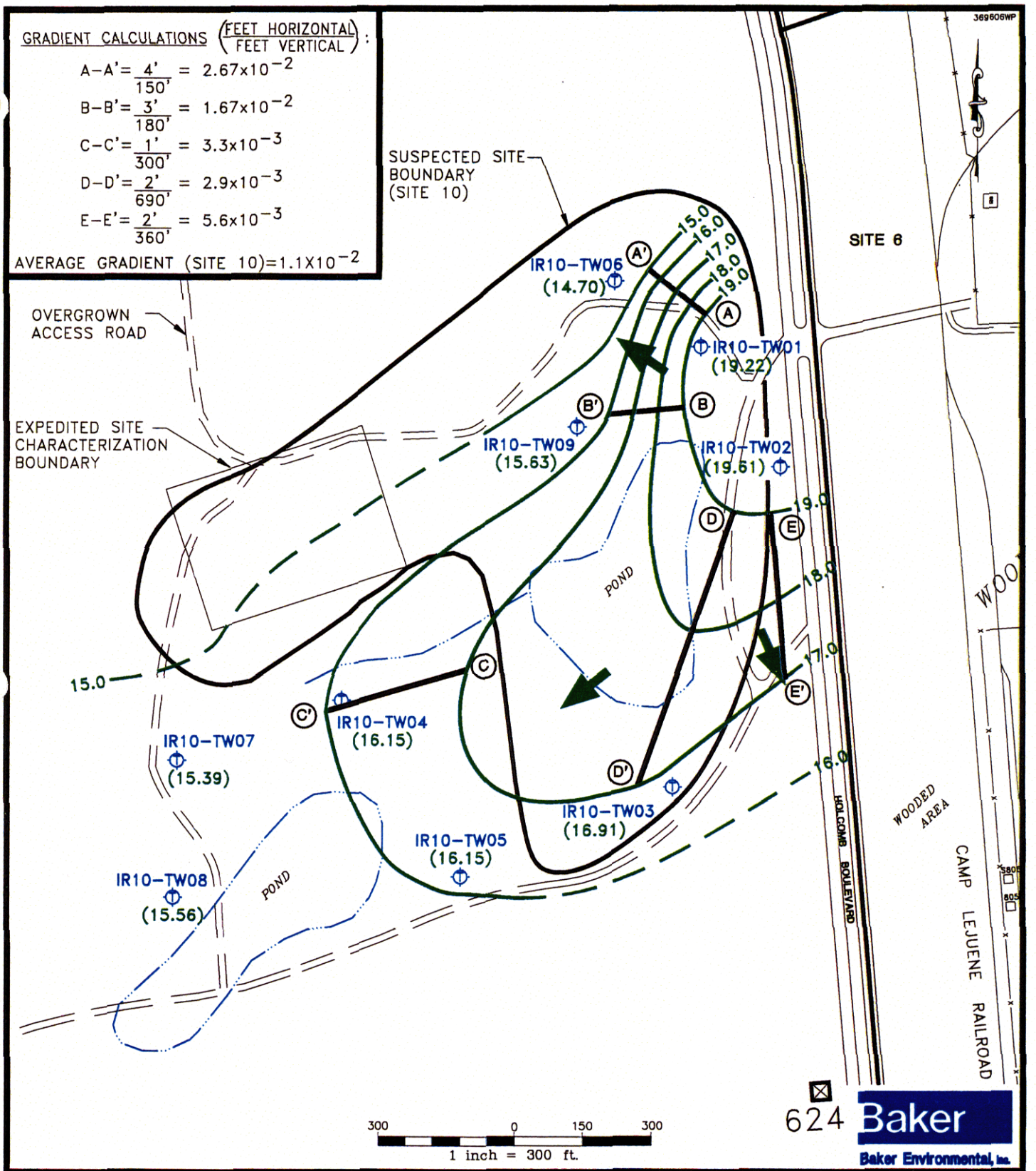
100 0 50 100 200
Horizontal Scale: 1 inch = 100 ft.

5 0 2.5 5 10
Vertical Scale: 1 inch = 5 ft.

THE SOIL BORING INFORMATION IS CONSIDERED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT THE RESPECTIVE BORING LOCATIONS. SUBSURFACE CONDITIONS INTERPOLATED BETWEEN BORINGS ARE ESTIMATED BASED ON ACCEPTED SOIL ENGINEERING PRINCIPLES AND GEOLOGIC JUDGEMENT.

FIGURE 3-5
HYDROGEOLOGIC CROSS-SECTION B-B'
SITE 10, ORIGINAL BASE LANDFILL
SITE INVESTIGATION, CTO - 0369

MARINE CORPS BASE, CAMP LEJEUNE
NORTH CAROLINA

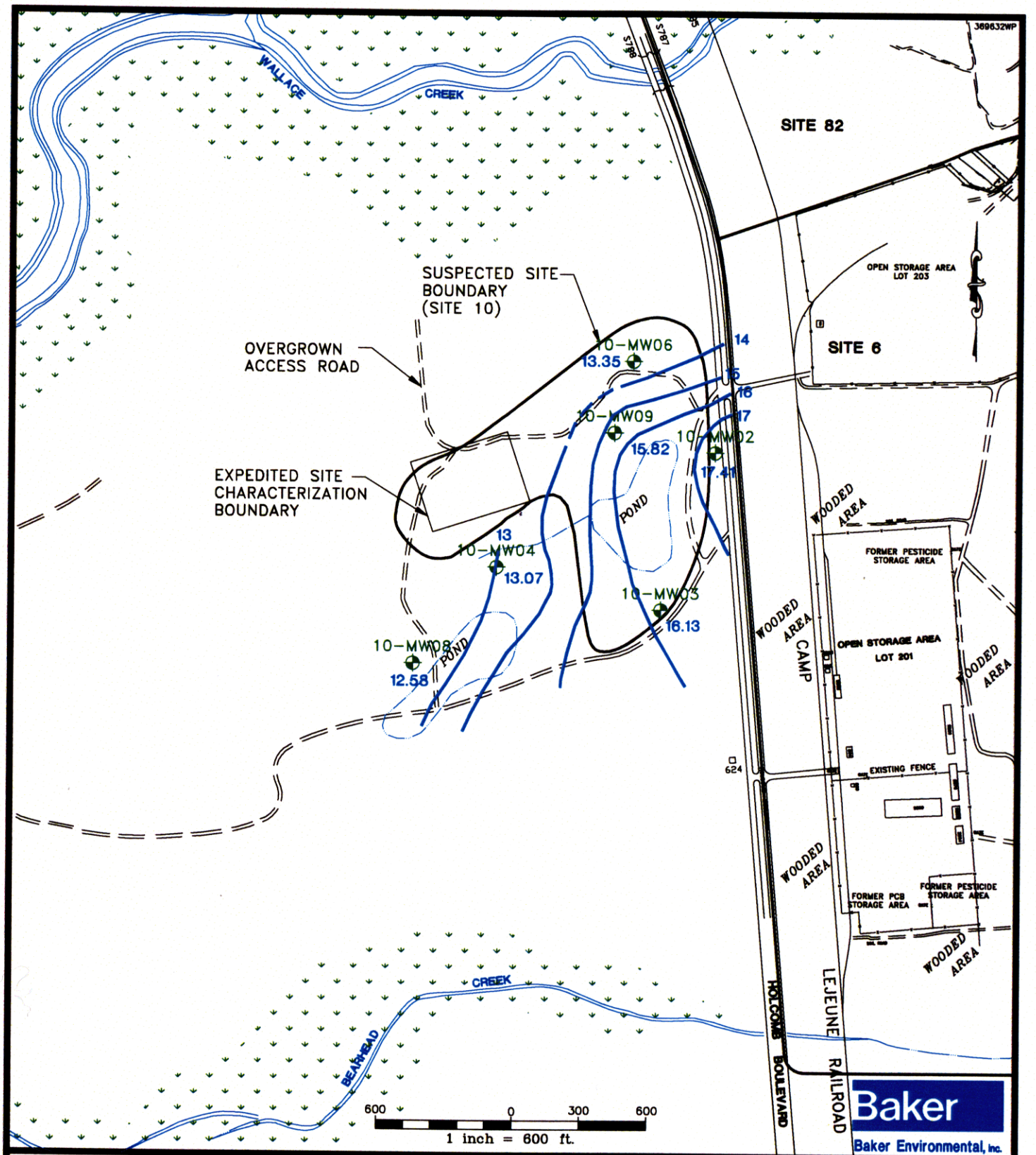


LEGEND

- ⌖ – TEMPORARY WELL LOCATION WITH SURFACE AND SUBSURFACE SOIL SAMPLES
- (19.22) – GROUNDWATER ELEVATION
- → – DIRECTION OF GROUNDWATER FLOW
- 15.0 – GROUNDWATER CONTOUR
- (A') — (A) – HYDRAULIC GARDIENT HORIZONTAL DISTANCE

FIGURE 3–6
GROUNDWATER CONTOUR MAP
SITE 10, ORIGINAL BASE LANDFILL
SITE INVESTIGATION, CTO – 0369

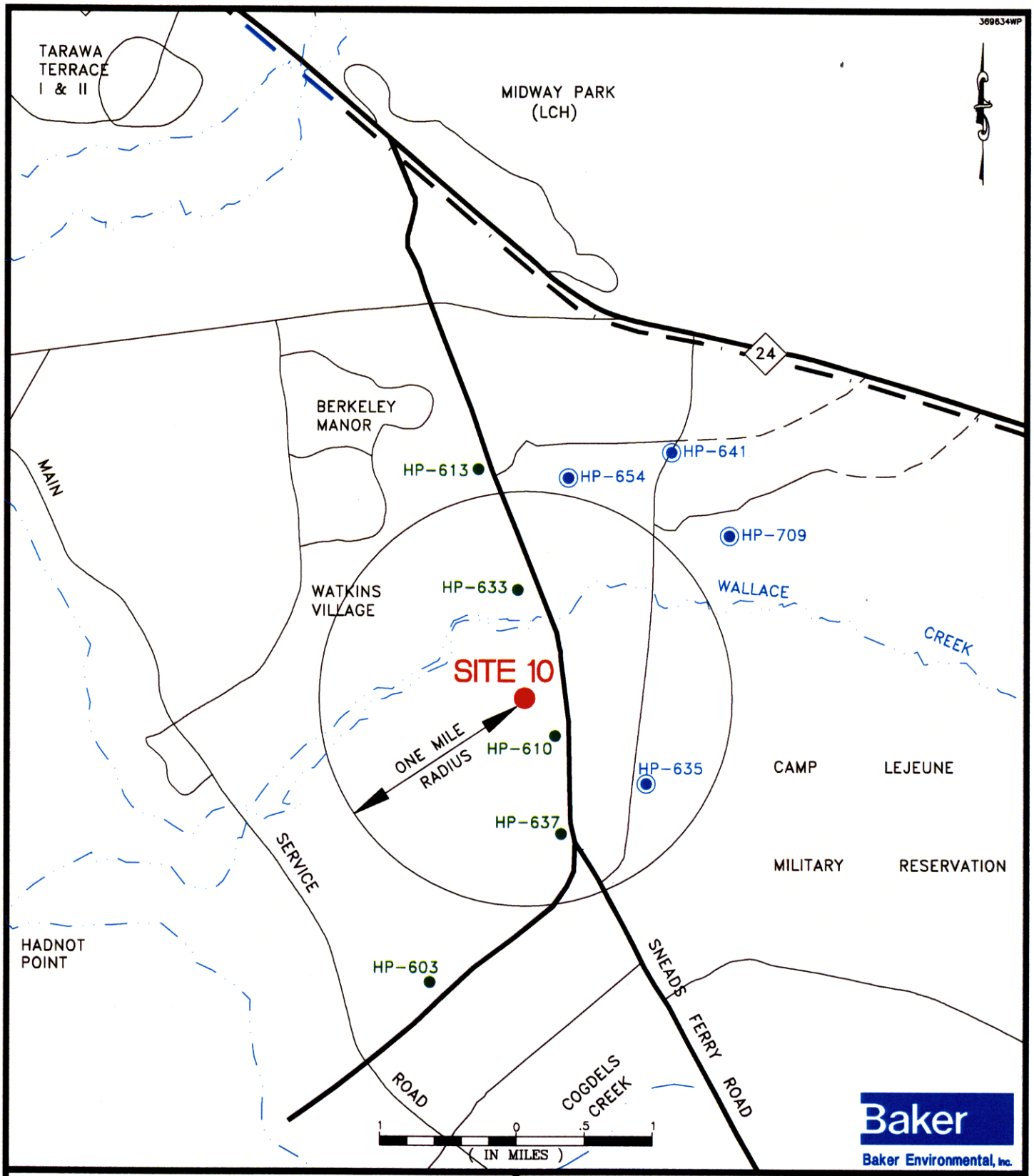
MARINE CORPS BASE, CAMP LEJEUNE
NORTH CAROLINA



LEGEND

- GROUNDWATER MONITORING WELL
- —14— GROUNDWATER CONTOUR LINE AND ELEVATION

FIGURE 3-7
2001 GROUNDWATER CONTOUR MAP
SITE 10, ORIGINAL BASE LANDFILL
PHASE II SITE INVESTIGATION
CTO - 0369
MARINE CORPS BASE, CAMP LEJEUNE
NORTH CAROLINA



LEGEND

- DEPICTS LOCATION OF SITE 10
- DEPICTS OFF-LINE WATER SUPPLY WELL
- DEPICTS ON-LINE WATER SUPPLY WELL

SOURCE: USGS WATER RESOURCES INVESTIGATION REPORT 89-4096.

FIGURE 3-8
SUPPLY WELL LOCATION MAP
SITE 10 - ORIGINAL BASE LANDFILL
SITE INVESTIGATION
CTO - 0369
MARINE CORPS BASE, CAMP LEJEUNE
NORTH CAROLINA

4.0 NATURE AND EXTENT OF CONTAMINATION

The objective of this section is to describe the nature and extent of contamination at Site 10. The Phase I conducted at Site 10 in 1998 was an expanded Site Investigation that included a human health risk assessment, an ecological screening , and more soil boring and temporary monitoring wells than is typical for a Site Investigation. However, due to high turbidity levels in the groundwater, a Phase II investigation was conducted in 2001 at Site 10. The Phase II investigation was limited to only groundwater. The characterization in all media sampled was accomplished through environmental sample collection and laboratory analysis of soil, groundwater, surface water, and sediment. The analytical results are summarized on tables and figures, which are located at the end of this section.

Analytical parameters can be segregated into two broad categories: organics and inorganics. The organic compounds included in the analytical program do not occur naturally. Therefore, any organics detected in the samples collected from the site can be attributed to either site or sampling/laboratory contamination. However, many of the inorganic compounds included in the analytical program do exist naturally. In order to accurately present the nature and extent of contamination, detected parameters that are either common laboratory contaminants (organics) or are naturally occurring (inorganics) must be segregated from those that can be attributed to on- site or off-site activities.

4.1 Data Management and Tracking

Analytical data generated during the Phase I and the Phase II site investigations were submitted for third-party validation to Heartland Environmental Services, Inc (Heartland), of St. Charles, Missouri. Procedures established by the National Functional Guidelines for Organic (United States Environmental Protection Agency [USEPA], 1991) and Inorganic (USEPA, 1988) Analyses were followed during the validation process. Validation of the analytical data through established procedures served to reduce the inherent uncertainties associated with its usability. Data qualified as "J" were retained as estimated. Estimated analytical results within a data set are common and considered usable by the USEPA. Data may be qualified as estimated for several reasons including: an exceedence of holding times; high or low surrogate recovery; intra-sample variability; or the

reported value is below the Contract Required Detection Limit (CRDL) or the Contract Required Quantitation Limit (CRQL).

Additional data qualifiers were employed during the validation of data. The "NJ" qualifier denotes that a compound was tentatively identified, but the reported value may not be accurate or precise. Compounds which were not detected and had inaccurate or imprecise quantitation limits were assigned the "UJ" qualifier. The "B" qualifier identifies a compound that was detected in the method blank associated with the sample. If the sample result has serious deficiencies with regard to the ability to analyze the sample and meet quality control criteria, the compound is assigned the "R" qualifier and the data is rejected. No data collected during this SI was rejected.

The management and tracking of data from the time of field collection to receipt of the validated electronic analytical results is of primary importance and reflects the overall quality of the analytical results. Field samples and their corresponding analytical tests were recorded on the chain-of-custody sheets, included as Appendix C. The chain-of-custody forms were checked against the Field Sampling and Analysis Plan (Baker, 1998) to determine if all designated samples were collected for the appropriate parameters. Similarly, the validated information was compared to laboratory information as a final check. In summary, the tracking information was used to identify the following items:

- Identify sample discrepancies between the analysis plan and the field investigation
- Verify that the laboratory received all samples, and analyzed for the correct parameters
- Verify that the data validator received a complete data set
- Ensure that a complete data set was available for each media of concern prior to entering results into the database

4.2 Non-Site Related Analytical Results

Some organic and inorganic constituents detected in soil, groundwater, surface water and sediments at Site 10 are attributable to non-site related conditions or activities. Two primary sources of non-site

related results include laboratory contaminants and naturally-occurring inorganic elements. In addition, non-site related operational activities and conditions may contribute to "on-site" contamination. A discussion of non-site related analytical results for the site is provided in the following subsections.

4.2.1 Laboratory Contaminants

Blank samples (i.e., rinsate, field, trip) provide a measure of contamination that has been introduced into a sample set during the collection, transportation, preparation and/or analysis of samples. To prevent the inclusion of non-site related contaminants from further assessment, the concentrations for chemicals in blanks are compared with analytical results from the site.

Common laboratory contaminants (i.e., acetone, 2-butanone, chloroform, methylene chloride, toluene, and phthalate esters) were considered as positive results only when observed concentrations exceeded ten times the maximum concentration detected in any blank. If the concentration of a common laboratory contaminant was less than ten times the maximum blank concentration, then it was concluded that the chemical was not detected in that particular sample (USEPA, 1989a). Organic constituents contained in blanks that were not considered common laboratory contaminants were considered as positive results only when observed concentrations exceeded five times the maximum concentration detected in any blank (USEPA, 1989b). All Target Compound List (TCL) compounds less than five times the maximum level of contamination noted in any blank were not considered detected in that sample. However, if a compound was detected as blank contamination and yet could be considered site related contamination based on present and/or past operations conducted at the site, then the contaminant was considered to be site related. Refer to Table 4-1 for a summary of organic compounds and associated maximum concentration detected in Quality Assurance/Quality Control (QA/QC) blanks by media.

When assessing soil concentrations, the CRQL and percent moisture were accounted for in order to correlate solid and aqueous quantitation limits. For example, when assessing semivolatile contaminants the CRQL for solid samples is 33 to 66 times (depending on the contaminant) that of aqueous samples. In order to assess contaminant levels in soil samples using an aqueous blank concentration, the concentration must be multiplied by 5 or 10 (noncommon or common lab

contaminant) and then multiplied by 33 or 66 to correct for the variance in the CRQL. This value is then divided by the percent moisture determined for the sample.

4.2.2 Naturally-Occurring Inorganic Elements

In order to differentiate inorganic contamination due to site operations from naturally-occurring inorganic elements in site media, the results of the sample analyses were compared to information regarding background conditions at Camp Lejeune. The following guidelines were used for each media:

- Soil: MCB, Camp Lejeune Base Background Soil Samples
- Groundwater: MCB, Camp Lejeune Background Groundwater Samples

The following subsections address the various comparison criteria used to evaluate the analytical results from soil, groundwater, surface water and sediment samples collected at Site 10.

4.2.2.1 Soil

In general, chemical-specific standards and criteria are not available for soil. As a result, Base background concentrations have been compiled from a number of locations throughout Camp Lejeune to evaluate background levels of inorganic elements in the surface and subsurface soil. Organic contaminants, unlike inorganic elements, do not occur naturally. Therefore, it is probable that all organic contaminants detected in the surface and subsurface soil are attributable to activities which have then or are currently taking place within or surrounding the study area.

Site control sample and base background concentration values for inorganic elements in surface and subsurface soil at Camp Lejeune are presented in Tables 4-2 and 4-3, respectively. The background ranges are based on analytical results of background samples collected in areas not known to have been impacted by site operations or disposal activities at Camp Lejeune. Installation Restoration (IR) Sites 6 and 82 are located upgradient of Site 10 eliminating the possibility of collecting site background samples. Therefore, site control samples were collected west of Site 10 in an area not suspected to have been impacted by site operations. The Base background data is summarized in a report submitted to LANTDIV and MCB, Camp Lejeune on April 25, 2001 (Baker, 2001)

4.2.2.2 Groundwater

Background groundwater monitoring wells are installed to assess the natural state and quality of groundwater. Natural in this sense implies that the groundwater has not been altered due to human activity. In some cases, these monitoring wells provide data that is representative of naturally occurring conditions. In other cases, these wells may not be representative of naturally occurring conditions, if other base-related activities have altered the natural state of groundwater. In the latter case, the well samples would be classified as "control" samples. Control samples are samples which may not represent background conditions, but represent the current state of groundwater quality upgradient of the site. During the past few years, a number of background wells have been installed throughout the base as part of individual site investigations. Most of these wells provide control samples. Data collected from these wells are representative of "base-wide" groundwater quality.

Because IR Sites 6 and 82 are located upgradient of Site 10, a single temporary groundwater monitoring well (IR10-TW08) was installed in an area suspected to have been outside the boundaries of the site and not impacted by site-related operations. The groundwater sample collected from this well is considered to be a control sample and will provide a baseline for sample comparison. This sample will be used in conjunction with the basewide background groundwater monitoring wells to assess the state of groundwater quality at Site 10.

Chemical-specific standards and criteria are available for evaluation of groundwater analytical results. In the subsequent sections, which address the analytical results of samples collected during the groundwater investigation, only those inorganic parameters with concentrations exceeding applicable Federal and/or State regulations will be discussed. In order to supplement comparison criteria, a number of base-specific background (i.e., upgradient) samples were compiled as part of a study to evaluate levels of inorganic elements in groundwater at Camp Lejeune. Appendix F presents Baker's Draft Report Evaluation of Metals in Groundwater, June 1994, prepared for the Department of Navy (DoN), Atlantic Division Naval Facilities Engineering Command (Baker, 1994).

Groundwater samples were analyzed for total metals parameters during the field work conducted at the site. USEPA Region IV requires that unfiltered inorganic concentrations be used in evaluating applicable or relevant and appropriate requirements (ARARs) and risk to human health and the environment. During purging and development of the temporary groundwater monitoring wells,

sediment concentrations less than 10 nephelometric turbidity units (NTUs) could not be acquired indicating a higher percentage of sediment was present. The sediment captured during sampling activities increases the chance that small particles of silt and clay dissolved during sample preservation would generate an unrealistically high value of metals in the sample. In a situation where sediment is captured with the groundwater, the unfiltered sample reflects a combination of the concentrations of inorganics in the natural lithology and dissolved in the groundwater. Elevated concentrations in groundwater samples may include such elements as aluminum, iron and magnesium which may be associated with clay particles.

Groundwater in the Camp Lejeune area is naturally rich in iron and manganese often exceeding the federal maximum contaminant levels (MCLs) and North Carolina Water Quality Standards (NCWQS) of 300 and 50 μg/L, respectively. Elevated levels of iron and manganese, at concentrations above the MCL and NCWQS were reported in samples collected from a number of base potable water supply wells which were installed at depths greater than 162 feet bgs (Greenehorne and O'Mara, 1992). Iron and manganese concentrations in several monitoring wells at Site 10 exceeded the MCL and NCWQS but fell within the range of concentrations for samples collected elsewhere at the base.

4.3 State and Federal Criteria and Standards

Contaminant concentrations detected in samples collected at the site were compared to established contaminant-specific federal and state criteria and standards. These criteria and standards include the USEPA MCLs, North Carolina Department of Environment and Natural Resources (NC DENR), Method I, Category S3:G1, S3:G3, G1 and/or G3 (less than 250 feet), target concentrations, NCWQS, Region IV Surface Soil Screening Values (SSSVs), and the Lowest Wildlife Drinking Water Benchmark.

The only enforceable federal regulatory standards for water are the MCLs. In addition to the federal standards, North Carolina developed the NCWQS for groundwater and surface water. Regulatory guidelines were used for comparative purposes to infer the potential health risks and environmental impacts when necessary. Relevant regulatory guidelines include federal Ambient Water Quality Criteria (AWQC) and Health Advisories.

NC DENR has established pre-calculated risk based contaminant concentrations based on the potential for soil contaminants to leach into groundwater. These soil concentrations protect resulting groundwater contamination from exceeding the target groundwater concentrations. In addition, Base background concentrations were compiled to evaluate background levels of inorganic constituents in the surface and subsurface soil.

A brief explanation of the criteria and standards used for the comparison of site analytical results is presented below.

Maximum Contaminant Levels - 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 (USEPA, 1996).

North Carolina Department of Environment and Natural Resources, Method I, Category S3:G1 and S3:G3, Target Concentrations - The S3 category applies to contaminants in soil that have the potential to impact groundwater. All contaminated soil is considered to have the potential to impact groundwater in the absence of documentation to the contrary. S3 concentrations protect groundwater from exceeding target groundwater concentrations (NC DENR, 1996).

There are three S3 subcategories, one corresponding to each groundwater category. The S3:G1 subcategory applies to soil at sites where contaminants potentially impact groundwater used for drinking water or non-drinking water exposures such as swimming pools or irrigation. The S3:G2 subcategory applies to soil at sites where contaminants potentially impact indoor air by migration from the soil to groundwater to indoor air. The S3:G3 subcategory applies to soil at sites where the contaminants potentially impact groundwater which migrates to surface water.

North Carolina Department of Environment and Natural Resources, Method I, Category G1, Target Concentrations - The G1 category applies to contaminants in groundwater that have the potential to impact drinking water and non-drinking water exposures such as swimming pools or

irrigation. The target concentrations are the groundwater quality standards or interim standards established in 15A NCAC 2L .0202. The groundwater standards and interim standards are developed using state and federal guidelines for the protection of human health (NC DENR, 1996).

North Carolina Department of Environment and Natural Resources, Method I, Category G3, Target Concentrations - The G-3 category focuses on the transfer of groundwater contaminants to surface water, taking into account chemical concentration, biodegradation, and distance from the groundwater contaminant plume to the surface water body. Surface water quality standards for the protection of human health (based on fish consumption) and aquatic life, as published in 15A NCAC 2B .0200, were used in determining the Method I G3 target concentrations (NC DENR, 1996).

Method I target concentrations for category G3 are listed in Table 3.2 of the draft North Carolina Risk Analysis Framework by distance of the groundwater plume's leading edge from the potentially impacted surface water body. To use the Method I G3 target concentrations, the responsible party must determine if the site meets the following criteria:

- Groundwater plume is not in fractured bedrock;
- Groundwater plume's leading edge (PLE) is greater than or equal to 250 feet from the surface water body;
- Groundwater plume length is less than 100 feet;
- Potentially impacted surface water is not classified as trout waters (Tr) or water supplies (WS-I through WS-V and FWS); and
- Groundwater saturated thickness above bedrock is greater than 15 feet.

This category is divided into three categories. To determine which distance applies at a site, the following increments are used:

- Distance from PLE to the surface water body is greater or equal to 250 and less than 500 feet, use 250 feet (the most stringent of the three subcategories);

- Distance from PLE to the surface water body is greater or equal to 500 and less than 1000 feet, use 500 feet; or

- Distance from PLE to the surface water body is greater or equal to 1000 feet, use 1000 feet (the least stringent of the three subcategories).

The target concentrations were developed by NC DENR using a computer software package referred to as the G3 Groundwater Contaminant Transport Model or G3CTM. This software calculates the maximum contaminant concentration that may exist in groundwater at the source without presenting a threat to surface water quality standards. The model considers the surface water quality standard, low-flow characteristics of neighboring surface water bodies, the hydrogeological characteristics of the affected aquifer, the distance of the contaminant source to the surface water body, and the dimensions of the groundwater plume at the time of assessment. These target concentrations relate only to the discharge of contaminated groundwater to surface water and are not applicable to direct discharges to surface waters.

Region IV Surface Soil Screening Values (SSSVs) - The SSSVs used in this evaluation were supplied by the Region IV Biological Technical Assistant Group (BTAG). The SSSVs themselves, however, were compiled from other sources including the Canadian Council of Ministers of the Environment (CCME) (CCME, 1997), the Dutch Ministry of Housing (MOH) (MOH, 1994), Spatial Planning and Environment Intervention Values and Target Values - Soil Quality Standards, and the Beyer Soil Criteria for Evaluating the Severity of Contamination under the Dutch Soil Cleanup Act (Bayer, 1990).

The CCME values are designed to protect most terrestrial receptors. The MOH Intervention Values are concentrations in the soil at which 50% of the species may undergo adverse effects. The MOH Target values for metals are concentrations that are regarded as non-contaminated and as such, are lower than the Intervention Values. The Beyer Dutch Soil Cleanup Act values have been developed by the Netherlands for determining the need for soil cleanup. The SSSVs used for the ecological evaluation, were the lowest value between the three above-referenced documents.

Lowest Wildlife Drinking Water Benchmark - Surface water contaminant concentrations will be compared against wildlife drinking water benchmarks developed by Health Sciences Research Division, Oak Ridge, Tennessee (ORNL, 1996). The benchmarks were developed from No Observed Adverse Effects Levels (NOAELs) for test species that were then extrapolated to common wildlife species using a body weight scaling equation. Because Region IV BTAG questions the predictiveness of the scaling equation, the lowest drinking water benchmark from all of the species was used as a conservative measure.

4.4 Analytical Results

The analytical results of the surface soil, subsurface soil, groundwater, surface water, and sediment sampling performed at Site 10 are presented in the following sections. A summary of site contamination by media is provided in Tables 4-4 through 4-21. The Frequency of Detection Summaries for all media at Site 10 are presented in Appendix G. All samples collected for the SI were analyzed for TCL organic compounds and target analyte list (TAL) inorganics (including cyanide), using Contract Laboratory Program (CLP) protocols and Level IV data quality.

4.4.1 Soil Investigation

Unique sample notations were employed to identify soil samples and sample depths at Site 10. The "SB" designation denotes samples collected from soil borings. The following suffix designations refer to the depth at which a sample was obtained:

- 00 - ground surface to 12 inches below ground surface (i.e., surface soil)
- 01 - 1 to 3 feet below ground surface
- 02 - 3 to 5 feet below ground surface
- 03 - 5 to 7 feet below ground surface
- 04 - 7 to 9 feet below ground surface
- 05 - 9 to 11 feet below ground surface
- 06 - 11 to 13 feet below ground surface
- 07 - 13 to 15 feet below ground surface
- 08 - 15 to 17 feet below ground surface

4.4.1.1 Surface Soil

A total of 25 surface soil samples were collected from Site 10. The samples were collected for the purpose of assessing surface soil conditions throughout the site. Surface soil sample detection summaries and data summaries for organic compounds and inorganic elements analyzed for the purpose of the Phase I are presented in Tables 4-4 and 4-5. The locations and analytical results of these samples are shown on Figure 4-1.

Five volatile organic compounds (VOCs) were detected in the surface soil samples (Table 4-4). 1,1-Dichloroethene, trichloroethene, benzene, toluene, and chlorobenzene were detected at relatively low concentrations (less than 10 μg/kg). None of these compounds were detected at concentrations exceeding North Carolina, Method I, Category S3:G1 or S3:G3 target concentrations (Table 4-5).

Eleven semi-volatile organic compounds (SVOCs) were detected in the surface soil samples collected at the site (Table 4-4). Surface soil samples from soil borings IR10-SB03, -SB04, -SB05, -SB18 and -SB19 contained the largest number of SVOCs detected at the site. These polynuclear aromatic hydrocarbons (PAHs) are commonly formed during combustion. Given their prevalence in the northern portion of the site, detections of these compounds may indicate that materials (natural or man-made) may have been burned in this portion of the site. None of the compounds were detected at concentrations which exceeded screening criteria. Benzo(b)fluoranthene, benzo(z)fluoranthene, benzo(a)pyrene, and indeno(1,2,3-cd)pyrene did not have target concentrations for comparison.

Pesticides were detected in five of the 25 samples submitted for laboratory analysis (Table 4-4). Three compounds were detected at concentrations exceeding comparison criteria. Heptachlor, heptachlor epoxide and endrin were detected in the surface soil sample collected from sample location IR10-SB09 in excess of the North Carolina, Method I, Category S3:G3, Target Concentrations (250 ft). Five of the eight pesticides detected in the surface soils at Site 10 were detected in the surface soil sample collected from IR10-SB09 (located along the southeastern edge of the site, along Holcomb Boulevard). The origin of this contamination is unknown as this sample location is outside the suspected boundary of the landfill and no debris or evidence of disposal was identified.

The only polychlorinated biphenyl (PCB) detected at the site was the compound Aroclor-1260 (Table 4-4). This compound was detected in the sample collected from sample location IR10-SB04. This is the same area of the site where the majority of the PAHs were detected. NC DENR has not established target concentrations under the Method I, Category S3:G1 or S3:G3 or Arochlor 1260. Although PCBs are known carcinogens, the concentration detected in sample IR10-SB04-00 was relatively low (85J μg/kg) and not considered to be a risk. The origin of this contamination is not known, however, it is suspected that it may be associated with the detections of the PAHs.

A total of 19 metals were detected in the surface soil samples collected across Site 10 (Tables 4-7 and 4-8). Iron, manganese, mercury and silver exceeded both the North Carolina, Method I, Category S3:G1 and S3:G3, Target Concentrations while copper, nickel and zinc only exceeded the Category S3:G3, Target Concentrations. Aluminum, antimony, beryllium, cobalt, magnesium, and vanadium do not have target concentrations established by NC DENR for either category used as screening criteria. Therefore, these elements were compared to the Base background concentrations included in the report generated by Baker and submitted to LANTDIV and MCB, Camp Lejuene on April 25, 2001. Soil samples IR10-SB25-00 (the control sample) and IR10-SB03-00 contained concentrations of aluminum, antimony, cobalt and magnesium in excess of base background concentrations.

Mercury was detected in 21 of 25 samples at concentrations exceeding comparison criteria. The detections ranged from 0.022 J to 0.27 mg/kg. Base background concentrations for mercury ranged from 0.01 to 0.13 mg/kg. The source of the mercury contamination is not known for certain, but given the prevalence of the detections it may be the result of past operations at the site.

4.4.1.2 Subsurface Soil

Subsurface soil samples were collected at 22 locations across the site. These samples were collected to determine if soils beneath the site have been contaminated by activities conducted at the site. Subsurface soil sample detection summaries and data summaries for organic compounds and inorganic elements are presented in Tables 4-8 through 4-11 and the locations of these samples are shown on Figure 4-2.

Four VOCs were detected in the samples collected during the SI (see Table 4-8). Three of the compounds (i.e., methylene chloride, acetone and toluene) are listed as common laboratory contaminants (USEPA, 1989a). However, these compounds were not detected in any of the trip blanks or equipment rinsates. Only acetone was detected in the field blank (IR10-FB02) collected from distilled water used for decontamination at a concentration of 110 μg/kg. However, the source of the acetone detections is suspected to be the result of field decontamination and not site related. Both methylene chloride and acetone are such volatile compounds that neither compound would remain for long in an open environment such as the site. Additionally, toluene may not be site related given the relatively low levels detected at the site (2 J to 3.6 J μg/kg). Of the four VOCs, only methylene chloride and acetone exceeded the comparison criteria.

Analysis of the subsurface samples detected a total of 18 SVOCs. Only two compounds were detected at concentrations which exceeded comparison criteria. Benzo(a)anthracene was detected in the sample collected from soil boring IR10-SB03 at a concentration of 1200 μg/kg exceeding both Categories S3:G1 and S3:G3 Target Concentrations. Additionally, chrysene was detected in the same sample at a concentration of 1300 μg/kg exceeding the target concentration for Category S3:G3. The subsurface soil sample IR10-SB03-03 contained the maximum detections for all of the 18 SVOCs detected. The boring log for this soil boring denoted that fill materials such as brick fragments, broken glass and charred wood had been encountered during drilling. The area near soil boring IR10-SB03 may have been used for burning materials or just disposing of such materials.

A total of six pesticides were detected in subsurface samples collected from soil borings IR10-SB03, -SB06, and -SB15, one which exceeded the Category S3:G3 Target Concentration. Endrin was detected at a concentration of 2.5 NJ μg/kg exceeding the target concentration of 1.1 μg/kg. No PCBs were detected in any of the subsurface soil samples collected throughout the site.

Twenty metals and cyanide were detected in subsurface samples collected across the site (Table 4-10). Aluminum, barium, chromium, copper, iron, lead, magnesium, manganese, mercury, and zinc were detected most often in the subsurface soil samples. Only aluminum and magnesium did not have North Carolina, Method I, Category S3:G1 or S3:G3, Target Concentrations. Therefore, they were compared to base background ranges to determine if detected levels are within typical levels detected at MCB, Camp Lejeune.

Aluminum detections are all within base background levels, however, magnesium was detected at a concentration exceeding the base background levels in one sample (IR10-SB04-03). Arsenic, cadmium, chromium, copper, iron, lead, manganese, mercury, nickel, silver and zinc were detected at concentrations exceeding categories S3:G1 and S3:G3, target concentrations. Iron and mercury concentrations were detected at levels exceeding the target concentrations more than any of the other metals.

4.4.1.3 Extent of Contamination

Positive detections of organic and inorganic compounds in both the surface and subsurface soil samples at Site 10 are depicted on Figures 4-1 and 4-2. These figures depict the distribution of organic and inorganic contamination which exceed NC DENR, Method I Categories S3:G1 and/or S3:G3 Target Concentrations.

The only volatiles detected at concentrations in excess of the target concentrations were methylene chloride and acetone. Both of these compounds were detected in the subsurface sample collected from soil boring IR10-SB04. These compounds are common laboratory contaminants and are not suspected to be site related.

Semivolatiles detected in excess of the target concentrations include benzo(a)anthracene and chrysene. Both of these compounds were detected in subsurface soil sample IR10-SB03-03. The boring log for this soil boring indicated charred wood and fill material within the sampling interval. The origin of the semivolatile contamination in this sample appears to be related to the material buried in the vicinity of the boring.

Heptachlor, heptachlor epoxide and endrin were the only pesticides detected in the soils that exceeded the target concentrations. All three of these contaminants were detected in the surface soil sample collected from soil boring IR10-SB09 and may be the result of an isolated spill. The source of this contamination is unknown and although site history does not indicate that pesticides were disposed or handled at the site, unrestricted access would allow an incident to occur unnoticed. However, the relatively low concentrations and limited extent indicates that this may be the result of a single, small-scale incident unrelated to the past and present operations at the site.

Inorganic contamination was detected throughout the site in both surface and subsurface soil samples. Most of the contaminants were detected in soil samples collected in the vicinity of the northern-most access road (Figures 4-1 and 4-2). The source for the inorganic contamination in this area is theorized to be the metal and brick debris spotted on the surface in various locations along this road and the fill material observed during soil boring advancement in the northern-most portion of the site.

4.4.2 Groundwater Investigation

Groundwater samples were collected from nine temporary groundwater monitoring wells installed at the site during the Phase I investigation and the six permanent wells installed during the Phase II investigation. The groundwater samples collected during the Phase I investigation were analyzed for TCL organics and TAL inorganics. Analytical results for these samples are included on Tables 4-12, 4-13 and 4-14 and depicted on Figures 4-3 and 4-4. Contaminant concentrations were compared to the Federal MCLs, and the North Carolina, Method I, Category G1 and G3, Target Concentrations. The groundwater samples collected during the Phase II investigation were only analyzed for TAL total metals. Analytical results for these samples are included on Tables 4-13 and 4-14. Contaminant concentrations were compared to the Federal MCLs and North Carolina's 2L Groundwater Protection Standards.

No organics (VOCs, SVOCs, pesticides or PCBs) were detected in any of the samples collected at the site during the Phase I investigation. However, 17 metals were detected. Aluminum, barium, cobalt, iron, lead, magnesium, manganese, mercury, and vanadium were the most frequently detected contaminants. Chromium, lead and thallium exceeded the Federal MCLs a total of two, five and six times, respectively (Table 4-14). Category G1, Target Concentrations were exceeded by chromium (5 times), iron (9), lead (5)and manganese (7). Additionally, Category G3, Target Concentrations were exceeded by concentrations of arsenic (5), beryllium (1), chromium (9), copper (5), iron (9), manganese (9), mercury (8), nickel (5), silver (2), thallium (6), and zinc (5) detected in the samples collected at the site. It should be noted that North Carolina, Method I, Category G3, Target Concentrations are very conservative comparison criteria.

The Phase II investigation detected 16 inorganic compounds (Table 4-13). No detected contaminants exceeded the Federal MCL limits. Groundwater samples collected from monitoring

wells (10-MW03, 10-MW04, 10-MW08, and 10-MW09) contained iron at concentrations in excess of the North Carolina 2L Groundwater Protection (Table 4-14).

Inorganics detected at the site are most likely related to the types of materials disposed at the site (construction materials). Metal debris was observed throughout the site during the site visit and field program. The distribution of contaminants is not typical of an isolated spill or release. It is suspected that the contaminants may be the result of rusting metal debris and breakdown of various construction materials.

4.4.3 Surface Water/Sediment Investigation

A total of 6 sampling stations were establish at Site 10 for collecting surface water/sediment samples. As depicted on Figure 4-5, two samples were collected from the southwestern pond, two from the northeastern pond, and two were collected from the stream leading away from the northeastern pond. Surface water/sediment samples were analyzed for TCL organics, TAL metals and total cyanide. Summaries of surface water and sediment contamination are provided on Tables 4-15 through 4-21.

4.4.3.1 Surface Water Investigation

A comparison of contamination detected in surface water samples to the Lowest Wildlife Drinking Water Benchmarks (Region IV BTAG values) is provided on Table 4-17. These benchmarks were used because surface water consumption is the most likely pathway for contaminants to affect terrestrial wildlife within the vicinity of the site. Surface water sample summaries for organic compounds and inorganic elements are presented on Tables 4-15 and 4-16.

Toluene was the only VOC detected in any of the surface water samples collected during the SI. Surface water samples IR10-SW03 and IR10-SW04 contained toluene concentrations of 1.3 J µg/l. No SVOCs, pesticides or PCBs were detected in any of the samples collected at the site.

Eleven metals were detected including aluminum, arsenic, barium, copper, iron, lead, magnesium, manganese, mercury, vanadium, and zinc. Copper was the only element detected in less than four of the six samples collected at the site. Detection of these metals is not unexpected due to the number

of metals detected in soil and groundwater samples collected at Site 10. The only metal which exceeded the Lowest Wildlife Drinking Water Benchmark was iron.

4.4.3.2 Sediment Investigation

Two samples were proposed for each sampling station from zero to 6 and 6 to 12 inches below the sediment surface. However, because of site conditions, only the zero to 6 inch sample was collected at each of the six locations. Contaminants detected in the samples were compared to Region IV SSSVs . The soils beneath the water surface in the ponded areas were determined not to be sediments but rather submerged surface soils. The ponded areas are portions of the site that are low-lying and collect surface water runoff during rainy periods of the year. They are seasonal features at the site. The soils beneath the water level of these ponded areas do not support a viable aquatic community except possibly some amphibians and aquatic insects and therefore are not considered sediments. Detections of organic compounds and inorganic elements are summarized on Table 4-18 through 4-21.

Toluene was detected in all six and 2-butanone was detected in one of the samples collected at the site. Both of these compounds are common laboratory contaminants. Detections of 2-butanone may be the result of non-site related contamination, however, toluene detections may be related to materials disposed or spilled at the site. No documentation exists that would indicate that toluene was disposed at the site, however with military maneuvers on-going, the fact exists that an accidental release could occur at the site. Toluene is a common solvent and used in the formulation of gasoline.

Two pesticides (4,4'-DDT and endrin aldehyde) were detected in samples collected from the southwestern pond. No SVOCs or PCBs were detected in the samples.

Eleven metals were detected in the samples collected from the stream and ponded areas. They included aluminum, barium, copper, iron, lead, magnesium, manganese, mercury, selenium, vanadium, and zinc. These particular analytes are similar to the ones detected in the surface water samples collected at these same sampling stations. Four metals were detected at concentrations which caused them to be considered to be a possible ecological concern (aluminum, iron, manganese, and selenium). With the exception of selenium, these contaminants were detected in each of the samples

collected in the stream and the ponded areas. The remaining analytes were determined to be below the Region IV SSSVs or had low toxicity potential.

4.5 Summary

Very few VOCs were detected in soil, groundwater, sediment, and surface water samples collected during the Phase I at the site. Toluene was the only contaminant that could be considered a possible site related contaminant.

Several SVOCs were detected in soil samples collected from the site during the Phase I investigation. All but one of the detected compounds were PAHs and are suspected to be the result of burned and/or buried materials in the vicinity of soil boring IR10-SB03.

Pesticides were detected at diminutis concentrations in several soil and sediment samples collected during the Phase I. The only sample containing concentrations of pesticides in excess of comparison criteria was the surface soil sample collected from soil boring IR10-SB09. However, relatively low concentrations and limited extent indicate that these contaminants may be the result of a single small-scale incident as a result of past operations at the site (i.e. pest control).

A single detection of Aroclor-1260 was observed in a surface soil sample from IR10-SB04 during the Phase I investigation. Although PCBs are known carcinogens, the concentration detected in the sample was relatively low (85J mg/kg) and not considered to be a risk.

During the Phase I investigation numerous inorganics were detected in the soil, groundwater, surface water, and sediment. It was suspected that the breakdown of construction debris (Iron, brick, concrete, etc.) was the source of the inorganic contamination. It was suspected that sediment-laden groundwater samples (turbidity of 200 NTUs) presented an inflated view of actual groundwater contamination.

The Phase II investigation detected inorganic concentrations a levels a magnitude lower than those detected during the Phase I investigation. There were no inorganics that exceeded the Federal MCL standards. Iron was the only contaminant detected above North Carolina 2L Groundwater Protection

Standards. Previous investigations have shown that elevated Iron concentrations are naturally occurring throughout the Base.

4.5 References

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SECTION 4.0 TABLES

TABLE 4-1

SUMMARY OF BLANK CONTAMINANT RESULTS
SITE 10 - ORIGINAL BASE LANDFILL
MCB, CAMP LEJEUNE, NORTH CAROLINA
SITE INVESTIGATION, CTO-0369

Constituent	Maximum Concentration Detected in Blank (µg/L)	Medium Associated with Maximum Concentration Detected in Blank	Type of Blank with Maximum Detected Value	Concentration for Comparison[1] (Aqueous -µg/L)	Concentration for Comparison[2] (Solid - µg/kg)
Volatiles					
Acetone	110	Soil	Field	1,100	1,100
Chloroform	4.7J	Soil	Field	23	23
Bromodichloromethane	1.5J	Soil	Field	7	7
Semivolatiles - (Phase I)					
4-Methylphenol	2.6J	Soil	Field	13	86
Demethyl phthalate	54	Soil	Field	540	1,782
Diethyl phthalate	1.6J	Soil	Field	16	53
Bis (2-ethylhexyl) phthalate	2.5J	Soil	Field	25	83
Inorganics					
Aluminum	1.9J	Soil	Field	645	645
Arsenic	2.4J	Soil	Equipment Rinsate	12	12
Barium	11J	Soil	Field	55	55
Calcium	21,700	Soil	Field	108,500	108,500
Iron	166	Soil	Equipment Rinsate	830	830
Lead	1.5J	Soil	Field	7.5	7.5
Magnesium	2,500	Soil	Field	12,500	12,500
Manganese	5.4	Soil	Field	27	27
Potassium	854J	Soil	Field	4,270	4,270
Silver	4.1J	Soil	Equipment Rinsate	20.5	20.5
Sodium	9,900	Soil	Field	49,500	49,500
Vanadium	11.7J	Soil	Equipment Rinsate	58.5	58.5
Zinc	32.5	Soil	Field	162.5	162.5

Notes:

(1) Concentration is five or ten times (for common laboratory blank contaminants) the maximum detected concentration in a blank.
(2) Concentration is five or ten times the maximum detected concentration in a blank; converted to µg/kg.
(3) Semivolatile blank concentrations are multiplied by 33 or 66 to account for matrix difference.

NA - Not applicable

TABLE 4-2

COMPARISON OF SITE BACKGROUND CONCENTRATIONS TO BASE BACKGROUND LEVELS IN SURFACE SOILS SITE 10 - ORIGINAL BASE LANDFILL SITE INVESTIGATION, CTO-0369 MCB, CAMP LEJEUNE, NORTH CAROLINA

	Site Background (mg/kg)	Base Background (mg/kg)
Aluminum	144J	ND - 17,600
Antimony	ND	ND - 0.9J
Arsenic	ND	ND - 1.3J
Barium	1.7J	ND - 24.0
Beryllium	ND	ND 0.53J
Cadmium	ND	ND - 0.11J
Calcium	71.4J	ND - 105,000
Chromium	0.83J	ND - 12.6
Cobalt	ND	ND - 0.51J
Copper	1.8J	ND - 38.5
Iron	170J	26.3 - 12,200J
Lead	1.7	0.45 - 38.5J
Magnesium	13.7J	ND - 1610
Manganese	3.8J	ND - 49.0
Mercury	ND	ND - 0.12J
Nickel	ND	ND - 1.8
Potassium	ND	ND - 263J
Selenium	0.61J	ND - 3.4
Silver	ND	ND - 1.1
Sodium	16.6J	ND - 307
Thallium	ND	ND
Vanadium	3.1J	ND - 26.2
Zinc	4.4J	ND - 73.9

Note:

ND = Not Detected
J = Estimated

TABLE 4-3

COMPARISON OF SITE BACKGROUND CONCENTRATIONS
TO BASE BACKGROUND LEVELS IN SUBSURFACE SOILS
SITE 10 - ORIGINAL BASE LANDFILL
SITE INVESTIGATION, CTO-0369
MCB, CAMP LEJEUNE, NORTH CAROLINA

	Site Background (mg/kg)	Base Background (mg/kg)
Aluminum	906J	260J - 16,800
Antimony	ND	ND - 0.5J
Arsenic	ND	ND - 9.3
Barium	2.3J	067J - 27.1
Beryllium	ND	ND - 0.91
Cadmium	ND	ND
Calcium	66.6J	ND - 4950
Chromium	2J	0.83-23.3
Cobalt	ND	ND - 6.8
Copper	1.2J	ND - 6.7
Iron	303J	81.5 - 15,600
Lead	1.2	1.0 - 12.2J
Magnesium	29.5J	ND - 1250
Manganese	2.7J	0.57J - 67.6
Mercury	ND	ND - 0.16J
Nickel	ND	ND - 12.3
Potassium	ND	ND - 869J
Selenium	ND	ND - 1.3
Silver	ND	ND - 0.36J
Sodium	15.8J	ND
Thallium	ND	ND
Vanadium	4.5J	0.35J - 39.0
Zinc	13.4J	ND - 39.7

Note:

ND = Not Detected
J = Estimates

TABLE 4-4

DETECTION SUMMARY
SURFACE SOIL - ORGANIC COMPOUNDS
SITE 10 - ORIGINAL BASE LANDFILL
MCB, CAMP LEJEUNE, NORTH CAROLINA
SITE INVESTIGATION, CTO-0369

SAMPLE ID	IR10-SB01-00	IR10-SB02-00	IR10-SB03-00	IR10-SB04-00	IR10-SB05-00	IR10-SB06-00	IR10-SB07-00	IR10-SB08-00
SAMPLE DATE	03-18-1998	03-18-1998	03-18-1998	03-18-1998	03-18-1998	03-18-1998	03-18-1998	03-18-1998
DEPTH	0 - 1'	0 - 1'	0 - 1'	0 - 1'	0 - 1'	0 - 1'	0 - 1'	0 - 1'
VOLATILES (ug/kg)								
1,1-Dichloroethene	12 U	13 U	11 U	11 U	11 U	12 U	11 U	2.6 J
Trichloroethene	12 U	13 U	11 U	11 U	2.3 J	12 U	11 U	2.4 J
Benzene	12 U	13 U	11 U	11 U	11 U	12 U	11 U	4.9 J
Toluene	1.3 J	13 U	11 U	11 U	11 U	12 U	1.1 J	5.9 J
Chlorobenzene	12 U	13 U	11 U	11 U	11 U	12 U	11 U	4.5 J
SEMIVOLATILES (ug/kg)								
Phenanthrene	400 U	420 U	140 J	370 U	64 J	410 U	350 U	370 U
Di-n-butyl phthalate	400 U	52 J	49 J	370 U	48 J	410 U	350 U	67 J
Fluoranthene	400 U	420 U	190 J	65 J	140 J	410 U	350 U	370 U
Pyrene	400 U	420 U	140 J	51 J	120 J	410 U	350 U	370 U
Benzo(a)anthracene	400 U	420 U	86 J	370 U	73 J	410 U	350 U	370 U
Chrysene	400 U	420 U	93 J	39 J	77 J	410 U	350 U	370 U
Benzo(b)fluoranthene	400 U	420 U	92 J	46 J	84 J	410 U	350 U	370 U
Benzo(k)fluoranthene	400 U	420 U	96 J	42 J	78 J	410 U	350 U	370 U
Benzo(a)pyrene	400 U	420 U	84 J	42 J	76 J	410 U	350 U	370 U
Indeno(1,2,3-cd)pyrene	400 U	420 U	58 J	370 U	53 J	410 U	350 U	370 U
Benzo(ghi)perylene	400 U	420 U	380 U	370 U	40 J	410 U	350 U	370 U

NOTES:
J = Estimated value
U = Not detected.
NJ = Presumptive evidence for the presence of the material at an estimated value.
ug/kg = micrograms per kilograms

TABLE 4-4

DETECTION SUMMARY
SURFACE SOIL - ORGANIC COMPOUNDS
SITE 10 - ORIGINAL BASE LANDFILL
MCB, CAMP LEJEUNE, NORTH CAROLINA
SITE INVESTIGATION, CTO-0369

SAMPLE ID	IR10-SB01-00	IR10-SB02-00	IR10-SB03-00	IR10-SB04-00	IR10-SB05-00	IR10-SB06-00	IR10-SB07-00	IR10-SB08-00
SAMPLE DATE	03-18-1998	03-18-1998	03-18-1998	03-18-1998	03-18-1998	03-18-1998	03-18-1998	03-18-1998
DEPTH	0 - 1'	0 - 1'	0 - 1'	0 - 1'	0 - 1'	0 - 1'	0 - 1'	0 - 1'
PESTICIDES/PCBS (ug/kg)								
Heptachlor	2.1 U	2.1 U	1.9 U	1.9 U	1.9 U	2.1 U	1.8 U	1.9 U
Heptachlor epoxide	2.1 U	2.1 U	1.9 U	1.9 U	1.9 U	2.1 U	1.8 U	1.9 U
Endosulfan I	2.1 U	2.1 U	1.9 U	1.9 U	1.9 U	2.1 U	1.8 U	1.9 U
Dieldrin	4 U	4.2 U	3.8 U	3.7 U	3.6 U	4.1 U	3.5 U	3.7 U
4,4'-DDE	4 U	4.2 U	3.8 U	3.7 U	3.6 U	4.1 U	3.5 U	3.7 U
Endrin	4 U	4.2 U	3.8 U	3.7 U	3.6 U	4.1 U	3.5 U	3.7 U
4,4'-DDT	4 U	4.2 U	6.2	3.7 U	3.6 U	4.1 U	3.5 U	3.7 U
Endrin aldehyde	4 U	4.2 U	3.8 U	3.7 U	3.6 U	4.1 U	3.5 U	3.7 U
Aroclor 1260	40 U	42 U	38 U	85 J	36 U	41 U	35 U	37 U

NOTES:
J = Estimated value
U = Not detected.
NJ = Presumptive evidence for the presence of the material at an estimated value.
ug/kg = micrograms per kilograms

TABLE 4-4

DETECTION SUMMARY
SURFACE SOIL - ORGANIC COMPOUNDS
SITE 10 - ORIGINAL BASE LANDFILL
MCB, CAMP LEJEUNE, NORTH CAROLINA
SITE INVESTIGATION, CTO-0369

SAMPLE ID	IR10-SB09-00	IR10-SB10-00	IR10-SB11-00	IR10-SB12-00	IR10-SB13-00	IR10-SB14-00	IR10-SB15-00	IR10-SB16-00
SAMPLE DATE	03-18-1998	03-18-1998	03-18-1998	03-18-1998	03-18-1998	03-18-1998	03-18-1998	03-18-1998
DEPTH	0 - 1'	0 - 1'	0 - 1'	0 - 1'	0 - 1'	0 - 1'	0 - 1'	0 - 1'
VOLATILES (ug/kg)								
1,1-Dichloroethene	11 U	11 U	11 U	11 U	11 U	11 U	11 U	12 U
Trichloroethene	11 U	11 U	11 U	11 U	11 U	11 U	11 U	12 U
Benzene	11 U	11 U	11 U	11 U	11 U	11 U	11 U	12 U
Toluene	11 U	1.6 J	1.3 J	11 U	1.2 J	11 U	11 U	12 U
Chlorobenzene	11 U	11 U	11 U	11 U	11 U	11 U	11 U	12 U
SEMIVOLATILES (ug/kg)								
Phenanthrene	380 U	370 U	350 U	360 U	350 U	380 U	370 U	400 U
Di-n-butyl phthalate	380 U	44 J	350 U	360 U	350 U	380 U	370 U	400 U
Fluoranthene	380 U	370 U	350 U	360 U	350 U	380 U	370 U	400 U
Pyrene	380 U	370 U	350 U	360 U	350 U	380 U	370 U	400 U
Benzo(a)anthracene	380 U	370 U	350 U	360 U	350 U	380 U	370 U	400 U
Chrysene	380 U	370 U	350 U	360 U	350 U	380 U	370 U	400 U
Benzo(b)fluoranthene	380 U	370 U	350 U	360 U	350 U	380 U	370 U	400 U
Benzo(k)fluoranthene	380 U	370 U	350 U	360 U	350 U	380 U	370 U	400 U
Benzo(a)pyrene	380 U	370 U	350 U	360 U	350 U	380 U	370 U	400 U
Indeno(1,2,3-cd)pyrene	380 U	370 U	350 U	360 U	350 U	380 U	370 U	400 U
Benzo(ghi)perylene	380 U	370 U	350 U	360 U	350 U	380 U	370 U	400 U

NOTES:

J = Estimated value

U = Not detected.

NJ = Presumptive evidence for the presence of the material at an estimated value.

ug/kg = micrograms per kilograms

TABLE 4-4

DETECTION SUMMARY
SURFACE SOIL - ORGANIC COMPOUNDS
SITE 10 - ORIGINAL BASE LANDFILL
MCB, CAMP LEJEUNE, NORTH CAROLINA
SITE INVESTIGATION, CTO-0369

SAMPLE ID	IR10-SB09-00	IR10-SB10-00	IR10-SB11-00	IR10-SB12-00	IR10-SB13-00	IR10-SB14-00	IR10-SB15-00	IR10-SB16-00
SAMPLE DATE	03-18-1998	03-18-1998	03-18-1998	03-18-1998	03-18-1998	03-18-1998	03-18-1998	03-18-1998
DEPTH	0 - 1'	0 - 1'	0 - 1'	0 - 1'	0 - 1'	0 - 1'	0 - 1'	0 - 1'
PESTICIDES/PCBS (ug/kg)								
Heptachlor	1.2 NJ	1.9 U	1.8 U	1.8 U	1.8 U	1.9 U	1.9 U	2.1 U
Heptachlor epoxide	2.4 NJ	1.9 U	1.8 U	1.8 U	1.8 U	1.9 U	1.9 U	2.1 U
Endosulfan I	4.3 J	1.9 U	1.8 U	1.8 U	1.8 U	1.9 U	1.9 U	2.1 U
Dieldrin	2.2 NJ	3.7 U	3.5 U	3.6 U	3.5 U	3.8 U	3.7 U	4 U
4,4'-DDE	3.8 U	3.7 U	3.5 U	2.1 NJ	3.5 U	3.8 U	3.7 U	4 U
Endrin	2.4 NJ	3.7 U	3.5 U	3.6 U	3.5 U	3.8 U	3.7 U	4 U
4,4'-DDT	3.8 U	3.7 U	3.5 U	3.1 J	3.5 U	3.8 U	3.7 U	4 U
Endrin aldehyde	3.8 U	3.7 U	3.5 U	3.6 U	3.5 U	3.8 U	3.7 U	4 U
Aroclor 1260	38 U	37 U	35 U	36 U	35 U	38 U	37 U	40 U

NOTES:

J = Estimated value

U = Not detected.

NJ = Presumptive evidence for the presence of the material at an estimated value.

ug/kg = micrograms per kilograms

TABLE 4-4

DETECTION SUMMARY
SURFACE SOIL - ORGANIC COMPOUNDS
SITE 10 - ORIGINAL BASE LANDFILL
MCB, CAMP LEJEUNE, NORTH CAROLINA
SITE INVESTIGATION, CTO-0369

SAMPLE ID	IR10-SB17-00	IR10-SB18-00	IR10-SB19-00	IR10-SB20-00	IR10-SB21-00	IR10-SB22-00	IR10-SB23-00	IR10-SB24-00
SAMPLE DATE	03-18-1998	03-19-1998	03-19-1998	03-19-1998	03-19-1998	03-19-1998	03-19-1998	03-19-1998
DEPTH	0 - 1'	0 - 1'	0 - 1'	0 - 1'	0 - 1'	0 - 1'	0 - 1'	0 - 1'
VOLATILES (ug/kg)								
1,1-Dichloroethene	11 U	11 U	12 U	15 U	11 U	11 U	11 U	13 U
Trichloroethene	11 U	11 U	12 U	15 U	11 U	11 U	11 U	13 U
Benzene	11 U	11 U	12 U	15 U	11 U	11 U	11 U	13 U
Toluene	11 U	2 J	2.4 J	2.6 J	11 U	1.4 J	8.1 J	13 U
Chlorobenzene	11 U	11 U	12 U	15 U	11 U	11 U	11 U	13 U
SEMIVOLATILES (ug/kg)								
Phenanthrene	350 U	110 J	380 U	480 U	370 U	370 U	360 U	430 U
Di-n-butyl phthalate	350 U	380 U	380 U	480 U	38 J	370 U	360 U	430 U
Fluoranthene	350 U	150 J	82 J	480 U	370 U	370 U	360 U	430 U
Pyrene	350 U	120 J	84 J	480 U	370 U	370 U	360 U	430 U
Benzo(a)anthracene	350 U	68 J	59 J	480 U	370 U	370 U	360 U	430 U
Chrysene	350 U	76 J	61 J	480 U	370 U	370 U	360 U	430 U
Benzo(b)fluoranthene	350 U	56 J	65 J	480 U	370 U	370 U	360 U	430 U
Benzo(k)fluoranthene	350 U	77 J	86 J	480 U	370 U	370 U	360 U	430 U
Benzo(a)pyrene	350 U	69 J	74 J	480 U	370 U	370 U	360 U	430 U
Indeno(1,2,3-cd)pyrene	350 U	44 J	49 J	480 U	370 U	370 U	360 U	430 U
Benzo(ghi)perylene	350 U	40 J	45 J	480 U	370 U	370 U	360 U	430 U

NOTES:
J = Estimated value
U = Not detected.
NJ = Presumptive evidence for the presence of the material at an estimated value.
ug/kg = micrograms per kilograms

TABLE 4-4

DETECTION SUMMARY
SURFACE SOIL - ORGANIC COMPOUNDS
SITE 10 - ORIGINAL BASE LANDFILL
MCB, CAMP LEJEUNE, NORTH CAROLINA
SITE INVESTIGATION, CTO-0369

SAMPLE ID	IR10-SB17-00	IR10-SB18-00	IR10-SB19-00	IR10-SB20-00	IR10-SB21-00	IR10-SB22-00	IR10-SB23-00	IR10-SB24-00
SAMPLE DATE	03-18-1998	03-19-1998	03-19-1998	03-19-1998	03-19-1998	03-19-1998	03-19-1998	03-19-1998
DEPTH	0 - 1'	0 - 1'	0 - 1'	0 - 1'	0 - 1'	0 - 1'	0 - 1'	0 - 1'
PESTICIDES/PCBS (ug/kg)								
Heptachlor	1.8 U	1.9 U	2 U	2.5 U	1.9 U	1.9 U	1.9 U	2.2 U
Heptachlor epoxide	1.8 U	1.9 U	2 U	2.5 U	1.9 U	1.9 U	1.9 U	2.2 U
Endosulfan I	1.8 U	1.9 U	2 U	2.5 U	1.9 U	1.9 U	1.9 U	2.2 U
Dieldrin	3.5 U	3.8 U	3.8 U	4.8 U	3.7 U	3.7 U	3.6 U	4.3 U
4,4'-DDE	3.5 U	3.8 U	3.8 U	4.8 U	3.7 U	3.7 U	3.6 U	4.3 U
Endrin	3.5 U	3.8 U	3.8 U	4.8 U	3.7 U	3.7 U	3.6 U	4.3 U
4,4'-DDT	3.5 U	3.8 U	3.8 U	4.8 U	3.7 U	3.7 U	3.6 U	4.3 U
Endrin aldehyde	3.5 U	3.8 U	3.8 U	4.9	3.7 U	3.7 U	3.6 U	4.3 U
Aroclor 1260	35 U	38 U	38 U	48 U	37 U	37 U	36 U	43 U

NOTES:
J = Estimated value
U = Not detected.
NJ = Presumptive evidence for the presence of the material at an estimated value.
ug/kg = micrograms per kilograms

TABLE 4-4

DETECTION SUMMARY
SURFACE SOIL - ORGANIC COMPOUNDS
SITE 10 - ORIGINAL BASE LANDFILL
MCB, CAMP LEJEUNE, NORTH CAROLINA
SITE INVESTIGATION, CTO-0369

SAMPLE ID	IR10-SB25-00
SAMPLE DATE	03-19-1998
DEPTH	0 - 1'
VOLATILES (ug/kg)	
1,1-Dichloroethene	20 UJ
Trichloroethene	20 UJ
Benzene	20 UJ
Toluene	20 UJ
Chlorobenzene	20 UJ
SEMIVOLATILES (ug/kg)	
Phenanthrene	650 U
Di-n-butyl phthalate	650 U
Fluoranthene	650 U
Pyrene	650 U
Benzo(a)anthracene	650 U
Chrysene	650 U
Benzo(b)fluoranthene	650 U
Benzo(k)fluoranthene	650 U
Benzo(a)pyrene	650 U
Indeno(1,2,3-cd)pyrene	650 U
Benzo(ghi)perylene	650 U

NOTES:
J = Estimated value
U = Not detected.
NJ = Presumptive evidence for the presence of the material at an estimated value.
ug/kg = micrograms per kilograms

TABLE 4-4

DETECTION SUMMARY
SURFACE SOIL - ORGANIC COMPOUNDS
SITE 10 - ORIGINAL BASE LANDFILL
MCB, CAMP LEJEUNE, NORTH CAROLINA
SITE INVESTIGATION, CTO-0369

SAMPLE ID	IR10-SB25-00
SAMPLE DATE	03-19-1998
DEPTH	0 - 1'
PESTICIDES/PCBS (ug/kg)	
Heptachlor	3.4 U
Heptachlor epoxide	3.4 U
Endosulfan I	3.4 U
Dieldrin	6.5 U
4,4'-DDE	6.5 U
Endrin	6.5 U
4,4'-DDT	6.5 U
Endrin aldehyde	6.5 U
Aroclor 1260	65 U

NOTES:
J = Estimated value
U = Not detected.
NJ = Presumptive evidence for the presence of the material at an estimated value.
ug/kg = micrograms per kilograms

TABLE 4-4

DETECTION SUMMARY
SURFACE SOIL - ORGANIC COMPOUNDS
SITE 10 - ORIGINAL BASE LANDFILL
MCB, CAMP LEJEUNE, NORTH CAROLINA
SITE INVESTIGATION, CTO-0369

SAMPLE ID SAMPLE DATE DEPTH	Minimum Non-Detect	Maximum Non-Detect	Minimum Detected	Maximum Detected	Location of Maximum Detect	Frequency of Detection	Arithmatic Mean Positive Detects	Median Positive Detects
VOLATILES (ug/kg)								
1,1-Dichloroethene	11 U	20 UJ	2.6 J	2.6 J	IR10-SB08-00	1/25	2.6	2.6
Trichloroethene	11 U	20 UJ	2.3 J	2.4 J	IR10-SB08-00	2/25	2.35	2.35
Benzene	11 U	20 UJ	4.9 J	4.9 J	IR10-SB08-00	1/25	4.9	4.9
Toluene	11 U	20 UJ	1.1 J	8.1 J	IR10-SB23-00	11/25	2.63	1.6
Chlorobenzene	11 U	20 UJ	4.5 J	4.5 J	IR10-SB08-00	1/25	4.5	4.5
SEMIVOLATILES (ug/kg)								
Phenanthrene *	350 U	650 U	64 J	140 J	IR10-SB03-00	3/25	104.67	110
Di-n-butyl phthalate	350 U	650 U	38 J	67 J	IR10-SB08-00	6/25	49.67	48.5
Fluoranthene	350 U	650 U	65 J	190 J	IR10-SB03-00	5/25	125.4	140
Pyrene	350 U	650 U	51 J	140 J	IR10-SB03-00	5/25	103	120
Benzo(a)anthracene	350 U	650 U	59 J	86 J	IR10-SB03-00	4/25	71.5	70.5
Chrysene	350 U	650 U	39 J	93 J	IR10-SB03-00	5/25	69.2	76
Benzo(b)fluoranthene	350 U	650 U	46 J	92 J	IR10-SB03-00	5/25	68.6	65
Benzo(k)fluoranthene	350 U	650 U	42 J	96 J	IR10-SB03-00	5/25	75.8	78
Benzo(a)pyrene	350 U	650 U	42 J	84 J	IR10-SB03-00	5/25	69	74
Indeno(1,2,3-cd)pyrene	350 U	650 U	44 J	58 J	IR10-SB03-00	4/25	51	51
Benzo(ghi)perylene	350 U	650 U	40 J	45 J	IR10-SB19-00	3/25	41.67	40

NOTES:
J = Estimated value
U = Not detected.
NJ = Presumptive evidence for the presence of the material at an estimated value.
ug/kg = micrograms per kilograms

TABLE 4-4

DETECTION SUMMARY
SURFACE SOIL - ORGANIC COMPOUNDS
SITE 10 - ORIGINAL BASE LANDFILL
MCB, CAMP LEJEUNE, NORTH CAROLINA
SITE INVESTIGATION, CTO-0369

SAMPLE ID SAMPLE DATE DEPTH	Minimum Non-Detect	Maximum Non-Detect	Minimum Detected	Maximum Detected	Location of Maximum Detect	Frequency of Detection	Arithmatic Mean Positive Detects	Median Positive Detects
PESTICIDES/PCBS (ug/kg)								
Heptachlor	1.8 U	3.4 U	1.2 NJ	1.2 NJ	IR10-SB09-00	1/25	1.2	1.2
Heptachlor epoxide	1.8 U	3.4 U	2.4 NJ	2.4 NJ	IR10-SB09-00	1/25	2.4	2.4
Endosulfan I	1.8 U	3.4 U	4.3 J	4.3 J	IR10-SB09-00	1/25	4.3	4.3
Dieldrin	3.5 U	6.5 U	2.2 NJ	2.2 NJ	IR10-SB09-00	1/25	2.2	2.2
4,4'-DDE	3.5 U	6.5 U	2.1 NJ	2.1 NJ	IR10-SB12-00	1/25	2.1	2.1
Endrin	3.5 U	6.5 U	2.4 NJ	2.4 NJ	IR10-SB09-00	1/25	2.4	2.4
4,4'-DDT	3.5 U	6.5 U	3.1 J	6.2	IR10-SB03-00	2/25	4.65	4.65
Endrin aldehyde	3.5 U	6.5 U	4.9	4.9	IR10-SB20-00	1/25	4.9	4.9
Aroclor 1260	35 U	65 U	85 J	85 J	IR10-SB04-00	1/25	85	85

NOTES:
J = Estimated value
U = Not detected.
NJ = Presumptive evidence for the presence of the material at an estimated value.
ug/kg = micrograms per kilograms

TABLE 4-5

DATA SUMMARY
SURFACE SOIL - ORGANIC COMPOUNDS
SITE 10 - ORIGINAL BASE LANDFILL
MCB, CAMP LEJEUNE, NORTH CAROLINA
SITE INVESTIGATION, CTO-0369

CONSTITUENTS	North Carolina Method I, Category S3:G-1 Target Concentrations	North Carolina Method I, Category S3:G-3 Target Concentrations (250 ft)	Minimum Detected	Maximum Detected	Location of Maximum Detect	North Carolina Method I, Category S3:G-1 Target Concentrations Exceedance Count	North Carolina Method I, Category S3:G-3 Target Concentrations (250 ft) Exceedance Count
VOLATILES (ug/kg)							
1,1-Dichloroethene	44.5	50.9	2.6 J	2.6 J	IR10-SB08-00	0	0
Trichloroethene	18.3	1510	2.3 J	2.4 J	IR10-SB08-00	0	0
Benzene	5.6	1000	4.9 J	4.9 J	IR10-SB08-00	0	0
Toluene	7275	200	1.1 J	8.1 J	IR10-SB23-00	0	0
Chlorobenzene	438	438000	4.5 J	4.5 J	IR10-SB08-00	0	0
SEMIVOLATILES (ug/kg)							
Phenanthrene	59640	NE	64 J	140 J	IR10-SB03-00	0	0
Di-n-butyl phthalate	24800	1060000	38 J	67 J	IR10-SB08-00	0	0
Fluoranthene	276080	131000	65 J	190 J	IR10-SB03-00	0	0
Pyrene	286440	109000	51 J	140 J	IR10-SB03-00	0	0
Benzo(a)anthracene	343	878	59 J	86 J	IR10-SB03-00	0	0
Chrysene	38150	976	39 J	93 J	IR10-SB03-00	0	0
Benzo(b)fluoranthene	NE	NE	46 J	92 J	IR10-SB03-00	0	0
Benzo(k)fluoranthene	NE	NE	42 J	96 J	IR10-SB03-00	0	0
Benzo(a)pyrene	NE	NE	42 J	84 J	IR10-SB03-00	0	0
Indeno(1,2,3-cd)pyrene	NE	NE	44 J	58 J	IR10-SB03-00	0	0
Benzo(ghi)perylene	6720000	3920	40 J	45 J	IR10-SB19-00	0	0
PESTICIDES/PCBS (ug/kg)							
Heptachlor	2.4	0.16	1.2 NJ	1.2 NJ	IR10-SB09-00	0	1
Heptachlor epoxide	6.7	0.459	2.4 NJ	2.4 NJ	IR10-SB09-00	0	1
Endosulfan I	NE	NE	4.3 J	4.3 J	IR10-SB09-00	0	0
Dieldrin	NE	NE	2.2 NJ	2.2 NJ	IR10-SB09-00	0	0
4,4'-DDE	NE	NE	2.1 NJ	2.1 NJ	IR10-SB12-00	0	0
Endrin	440	1.1	2.4 NJ	2.4 NJ	IR10-SB09-00	0	1
4,4'-DDT	NE	NE	3.1 J	6.2	IR10-SB03-00	0	0
Endrin aldehyde	NE	NE	4.9	4.9	IR10-SB20-00	0	0
Aroclor 1260	NE	NE	85 J	85 J	IR10-SB04-00	0	0

TABLE 4-6

DETECTION SUMMARY
SURFACE SOIL - TOTAL INORGANIC CONSTITUENTS
SITE 10 - ORIGINAL BASE LANDFILL
MCB, CAMP LEJEUNE, NORTH CAROLINA
SITE INVESTIGATION, CTO-0369

SAMPLE ID	IR10-SB01-00	IR10-SB02-00	IR10-SB03-00	IR10-SB04-00	IR10-SB05-00	IR10-SB06-00	IR10-SB07-00	IR10-SB08-00	IR10-SB09-00
SAMPLE DATE	03-18-1998	03-18-1998	03-18-1998	03-18-1998	03-18-1998	03-18-1998	03-18-1998	03-18-1998	03-18-1998
DEPTH	0 - 1'	0 - 1'	0 - 1'	0 - 1'	0 - 1'	0 - 1'	0 - 1'	0 - 1'	0 - 1'
TOTAL METALS (mg/kg)									
Aluminum	1110	163	2070	2760	1510	2810	66.6	714	4160
Antimony	14.7 U	15.1 U	12.5 J	13.6 U	13.2 U	14.8 U	12.8 U	13.3 U	13.7 U
Arsenic	2.4 U	2.5 U	2.3 U	2.3 U	2.2 U	2.5 U	2.1 U	2.2 U	0.58 U
Barium	3 J	1.7 J	11.9 J	18.3 J	5 J	41.5 J	0.85 J	2.5 J	8.2 J
Beryllium	1.2 U	1.3 U	1.1 U	1.1 U	1.1 U	1.2 U	1.1 U	1.1 U	1.1 U
Cadmium	1.2 U	1.3 U	1.1 U	1.1 U	1.1 U	1.2 U	1.1 U	1.1 U	1.1 U
Calcium	378 J	81.7 J	1270 J	3600 J	746 J	28900 J	45.4 J	169 J	313 J
Chromium	1.9 J	1.2 J	4.2	4.7	2.2	6.7	0.78 J	1.3 J	4.3
Cobalt	12.2 U	12.6 U	2.6 J	11.3 U	11 U	0.97 J	10.6 U	11.1 U	11.4 U
Copper	0.93 J	1 J	3.9 J	7.9	1.1 J	13.7	1.5 J	1.2 J	1.7 J
Iron	543	127 U	1460	2290	704	1450	81 U	428	1860
Lead	9.9	1.8	23.3	37.7	6.6	57.3	2.7	10.4	10.3
Magnesium	37.4 J	19.9 J	89.1 J	141 J	72.5 J	443 J	11.2 J	40.6 J	105 J
Manganese	3.7	3.1 J	16.1	19.1	5.2	50.6	2.5 J	7.2	5.9
Mercury	0.027 J	0.032 J	0.044 J	0.1 J	0.029 J	0.18	0.038 J	0.033 J	0.049 J
Nickel	9.8 U	10.1 U	2.4 J	2.1 J	8.8 U	2.7 J	8.5 U	8.9 U	9.1 U
Potassium	189 J	1260 U	274 J	1130 U	1100 U	302 J	176 J	154 J	1140 U
Selenium	1.2 U	1.3 U	1.1 U	0.65 J	0.79 J	1.2 U	1.1 U	1.1 U	1.1 U
Silver	2.4 U	2.5 U	3	2.3 U	2.2 U	1.4 J	2.1 U	2.2 U	2.3 U
Sodium	22.2 J	21.9 J	25.5 J	30.1 J	16.3 J	40.6 J	40.2 J	21.7 J	22.6 J
Vanadium	12.2 U	12.6 U	3.6 U	1.5 U	11 U	2.9 U	10.6 U	11.1 U	5.9 U
Zinc	3.1 J	3.3 J	41.7	49.2	7.1	77.5	4.2 J	7.1	6.2

NOTES:
J = Estimated value
U = Not detected.
ND = Not detected
mg/kg = milligrams per kilograms

TABLE 4-6

DETECTION SUMMARY
SURFACE SOIL - TOTAL INORGANIC CONSTITUENTS
SITE 10 - ORIGINAL BASE LANDFILL
MCB, CAMP LEJEUNE, NORTH CAROLINA
SITE INVESTIGATION, CTO-0369

SAMPLE ID	IR10-SB10-00	IR10-SB11-00	IR10-SB12-00	IR10-SB13-00	IR10-SB14-00	IR10-SB15-00	IR10-SB16-00	IR10-SB17-00	IR10-SB18-00
SAMPLE DATE	03-18-1998	03-18-1998	03-18-1998	03-18-1998	03-18-1998	03-18-1998	03-18-1998	03-18-1998	03-19-1998
DEPTH	0 - 1'	0 - 1'	0 - 1'	0 - 1'	0 - 1'	0 - 1'	0 - 1'	0 - 1'	0 - 1'
TOTAL METALS (mg/kg)									
Aluminum	115	150 J	1430 J	90.2 J	72 J	169 J	879 J	80.4 J	2150 J
Antimony	13.4 U	12.8 U	5.3 J	12.8 U	13.7 U	6 J	14.6 U	12.9 U	13.8 U
Arsenic	2.2 U	2.1 U	2.2 U	2.1 U	2.3 U	2.2 U	2.4 U	2.2 U	1.1 U
Barium	4.3 J	2 J	2.5 J	0.87 J	1.2 J	3.5 J	3.5 J	0.58 J	7 J
Beryllium	1.1 U	1.1 U	1.1 U	1.1 U	1.1 U	1.1 U	1.2 U	1.1 U	1.1 U
Cadmium	1.1 U	1.1 U	1.1 U	1.1 U	1.1 U	1.1 U	1.2 U	1.1 U	1.1 U
Calcium	144 J	63.2 J	47.3 J	33.5 J	42.2 J	76.6 J	91.1 J	36.7 J	539 J
Chromium	2.2 U	2.1 U	1.9 J	0.81 J	1.2 J	2.2 U	1.1 J	2.2 U	3 J
Cobalt	11.2 U	10.7 U	10.8 U	10.7 U	11.4 U	11.1 U	12.2 U	10.8 U	11.5 U
Copper	0.46 J	0.64 J	1.5 J	1 J	1.5 J	0.81 J	0.69 J	0.75 J	3.3 J
Iron	98.8 U	119 U	527 J	101 U	78.8 U	77.9 U	319 J	88.3 U	1530 J
Lead	3.7	1.9	6.4	1.6	1.6	1.9	2.8	0.6 J	10.3
Magnesium	21.5 J	12.3 J	35 J	11.8 J	16.7 J	13 J	24.9 J	8.5 J	61.4 J
Manganese	3.1 J	3 J	2.2 J	2.7 J	3.2 J	1.9 J	6.7	2.7 J	7.6 J
Mercury	0.03 J	0.024 J	0.031 J	0.022 J	0.026 J	0.03 J	0.035 J	0.024 J	0.11 U
Nickel	8.9 U	8.5 U	8.7 U	8.6 U	9.1 U	8.9 U	9.7 U	8.6 U	9.2 U
Potassium	146 J	1070 U	1080 U	1070 U	185 J	1110 U	1220 U	1080 U	1150 U
Selenium	1.1 U	1.1 U	1.1 U	1.1 U	1.1 U	1.1 U	1.2 U	1.1 U	1.1 U
Silver	2.2 U	2.1 U	2.2 U	2.1 U	2.3 U	2.2 U	2.4 U	2.2 U	2.3 U
Sodium	20.8 J	10.9 J	17 J	15.4 J	14.4 J	17.4 J	23.5 J	13.3 J	20.4 J
Vanadium	11.2 U	10.7 U	2.5 U	10.7 U	11.4 U	11.1 U	12.2 U	10.8 U	4.7 J
Zinc	2.3 U	3.7 U	12	2.9 U	2.7 U	2.4 U	3.6 U	2.9 U	13.9 J

NOTES:
J = Estimated value
U = Not detected.
ND = Not detected
mg/kg = milligrams per kilograms

TABLE 4-6

DETECTION SUMMARY
SURFACE SOIL - TOTAL INORGANIC CONSTITUENTS
SITE 10 - ORIGINAL BASE LANDFILL
MCB, CAMP LEJEUNE, NORTH CAROLINA
SITE INVESTIGATION, CTO-0369

SAMPLE ID	IR10-SB19-00	IR10-SB20-00	IR10-SB21-00	IR10-SB22-00	IR10-SB23-00	IR10-SB24-00	IR10-SB25-00
SAMPLE DATE	03-19-1998	03-19-1998	03-19-1998	03-19-1998	03-19-1998	03-19-1998	03-19-1998
DEPTH	0 - 1'	0 - 1'	0 - 1'	0 - 1'	0 - 1'	0 - 1'	0 - 1'
TOTAL METALS (mg/kg)							
Aluminum	4090 J	2240 J	381 J	398 J	144 J	1910 J	10200 J
Antimony	13.9 U	17.5 U	13.4 U	13.4 U	13.1 U	15.5 U	23.8 U
Arsenic	1.1 U	1.1 U	0.53 U	0.6 U	0.48 U	0.85 U	11.6
Barium	41.6 J	24.5 J	1 J	3.2 J	1.7 J	18 J	173
Beryllium	0.16 J	1.5 U	1.1 U	1.1 U	1.1 U	1.3 U	1.7 J
Cadmium	0.86 J	1.5 U	1.1 U	1.1 U	1.1 U	1.3 U	2 U
Calcium	2420	2770	40.8 J	81.8 J	71.4 J	295 J	4810
Chromium	6.4 J	3.4 J	1 J	1.4 J	0.83 J	4.1 J	11.2 J
Cobalt	1 J	14.6 U	11.2 U	11.2 U	10.9 U	12.9 U	8.8 J
Copper	20.6	18.1	0.53 J	1.3 J	1.8 J	23.1	43.8
Iron	3240 J	1580 J	347 J	356 J	170 J	1640 J	7740 J
Lead	85.1	33.7	2.3	3	1.7	53.7	23
Magnesium	378 J	196 J	14.4 J	24.4 J	13.7 J	58.8 J	687 J
Manganese	48.5 J	39 J	3.3 J	5.6 J	3.8 J	12 J	73.3 J
Mercury	0.038 J	0.034 J	0.11 U	0.11 U	0.11 U	0.094 J	0.27
Nickel	4.2 J	2.7 J	8.9 U	9 U	8.8 U	2.7 J	17.3
Potassium	1160 U	1460 U	1120 U	1120 U	1090 U	1290 U	1600 J
Selenium	1.2 U	1 J	1.1 U	1.1 U	0.61 J	1.3 U	2
Silver	2.3 U	2.9 U	2.2 U	2.2 U	2.2 U	2.6 U	4 U
Sodium	28.1 J	38.7 J	16.9 J	20.2 J	16.6 J	21.4 J	281 J
Vanadium	8.7 J	8.1 J	5.2 J	4.5 J	3.1 J	6.3 J	31.4
Zinc	304 J	44.2 J	2.9 J	3.9 J	4.4 J	53.7 J	128 J

NOTES:
J = Estimated value
U = Not detected.
ND = Not detected
mg/kg = milligrams per kilograms

TABLE 4-6

DETECTION SUMMARY
SURFACE SOIL - TOTAL INORGANIC CONSTITUENTS
SITE 10 - ORIGINAL BASE LANDFILL
MCB, CAMP LEJEUNE, NORTH CAROLINA
SITE INVESTIGATION, CTO-0369

SAMPLE ID SAMPLE DATE DEPTH	Minimum Non-Detect	Maximum Non-Detect	Minimum Detected	Maximum Detected	Location of Maximum Detect	Frequency of Detection	Arithmatic Mean Positive Detects	Median Positive Detects
TOTAL METALS (mg/kg)								
Aluminum	ND	ND	66.6	10200 J	IR10-SB25-00	25/25	1594.49	879
Antimony	12.8 U	23.8 U	5.3 J	12.5 J	IR10-SB03-00	3/25	7.93	6
Arsenic	0.48 U	2.5 U	11.6	11.6	IR10-SB25-00	1/25	11.6	11.6
Barium	ND	ND	0.58 J	173	IR10-SB25-00	25/25	15.26	3.5
Beryllium	1.1 U	1.5 U	0.16 J	1.7 J	IR10-SB25-00	2/25	0.93	0.93
Cadmium	1.1 U	2 U	0.86 J	0.86 J	IR10-SB19-00	1/25	0.86	0.86
Calcium	ND	ND	33.5 J	28900 J	IR10-SB06-00	25/25	1882.63	144
Chromium	2.1 U	2.2 U	0.78 J	11.2 J	IR10-SB25-00	21/25	3.03	1.9
Cobalt	10.6 U	14.6 U	0.97 J	8.8 J	IR10-SB25-00	4/25	3.34	1.8
Copper	ND	ND	0.46 J	43.8	IR10-SB25-00	25/25	6.11	1.5
Iron	77.9 U	127 U	170 J	7740 J	IR10-SB25-00	17/25	1540.24	1450
Lead	ND	ND	0.6 J	85.1	IR10-SB19-00	25/25	15.73	6.4
Magnesium	ND	ND	8.5 J	687 J	IR10-SB25-00	25/25	101.48	35
Manganese	ND	ND	1.9 J	73.3 J	IR10-SB25-00	25/25	13.28	5.2
Mercury	0.11 U	0.11 U	0.022 J	0.27	IR10-SB25-00	21/25	0.06	0.03
Nickel	8.5 U	10.1 U	2.1 J	17.3	IR10-SB25-00	7/25	4.87	2.7
Potassium	1070 U	1460 U	146 J	1600 J	IR10-SB25-00	8/25	378.25	187
Selenium	1.1 U	1.3 U	0.61 J	2	IR10-SB25-00	5/25	1.01	0.79
Silver	2.1 U	4 U	1.4 J	3	IR10-SB03-00	2/25	2.2	2.2
Sodium	ND	ND	10.9 J	281 J	IR10-SB25-00	25/25	32.68	21.4
Vanadium	1.5 U	12.6 U	3.1 J	31.4	IR10-SB25-00	8/25	9	5.75
Zinc	2.3 U	3.7 U	2.9 J	304 J	IR10-SB19-00	18/25	42.58	9.55

NOTES:
J = Estimated value
U = Not detected.
ND = Not detected
mg/kg = milligrams per kilograms

TABLE 4-7

DATA SUMMARY
SURFACE SOIL - TOTAL INORGANIC CONSTITUENTS
SITE 10 - ORIGINAL BASE LANDFILL
MCB, CAMP LEJEUNE, NORTH CAROLINA
SITE INVESTIGATION, CTO-0369

CONSTITUENTS	North Carolina Method I, Category S3:G-1 Target Concentrations	North Carolina Method I, Category S3:G-3 Target Concentrations (250 ft)	Base Background (mg/kg)	Minimum Detected	Maximum Detected	Location of Maximum Detect	North Carolina Method I, Category S3:G-1 Target Concentrations Exceedance Count	North Carolina Method I, Category S3:G-3 Target Concentrations (250 ft) Exceedance Count
TOTAL METALS (mg/kg)								
Aluminum	NE	NE	17.7 - 9,570	66.6	10200 J	IR10-SB25-00	0	0
Antimony	NE	NE	0.33 - 8	5.3 J	12.5 J	IR10-SB03-00	0	0
Arsenic	26.2	65.5	0.065 - 3.9	11.6	11.6	IR10-SB25-00	0	0
Barium	848	NE	0.65 - 20.8	0.58 J	173	IR10-SB25-00	0	0
Beryllium	NE	NE	0.02 - 0.26	0.16 J	1.7 J	IR10-SB25-00	0	0
Cadmium	2.72	2.72	0.04 - 1.0	0.86 J	0.86 J	IR10-SB19-00	0	0
Calcium	NE	NE	4.25 - 10,700	33.5 J	28900 J	IR10-SB06-00	0	0
Chromium	27.2	NE	0.33 - 12.5	0.78 J	11.2 J	IR10-SB25-00	0	0
Cobalt	NE	NE	0.185 - 4.15	0.97 J	8.8 J	IR10-SB25-00	0	0
Copper	704	5.28	0.5 - 87.2	0.46 J	43.8	IR10-SB25-00	0	6
Iron	151.2	1260	69.7 - 9,640	170 J	7740 J	IR10-SB25-00	17	9
Lead	270.06	1130	0.47 - 142	0.6 J	85.1	IR10-SB19-00	0	0
Magnesium	NE	NE	2.55 - 610	8.5 J	687 J	IR10-SB25-00	0	0
Manganese	65.2	326	0.87 - 66	1.9 J	73.3 J	IR10-SB25-00	1	0
Mercury	0.0154	0.00042	0.01 - 0.13	0.022 J	0.27	IR10-SB25-00	21	21
Nickel	56.4	11.7	0.45 - 7.2	2.1 J	17.3	IR10-SB25-00	0	1
Potassium	NE	NE	1 - 416	146 J	1600 J	IR10-SB25-00	0	0
Selenium	12.2	3.05	0.075 - 1.3	0.61 J	2	IR10-SB25-00	0	0
Silver	0.223	0.00186	0.0435 - 4.3	1.4 J	3	IR10-SB03-00	2	2
Sodium	NE	NE	4.7 - 126	10.9 J	281 J	IR10-SB25-00	0	0
Vanadium	NE	NE	0.305 - 48.6	3.1 J	31.4	IR10-SB25-00	0	0
Zinc	1100.4	65.5	0.3 - 28.3	2.9 J	304 J	IR10-SB19-00	0	3

NOTES:
J = Estimated value
NE = Not established
ND = Not detected
mg/kg = milligrams per kilograms

TABLE 4-8

DETECTION SUMMARY
SUBSURFACE SOIL - ORGANIC COMPOUNDS
SITE 10 - ORIGINAL BASE LANDFILL
MCB, CAMP LEJEUNE, NORTH CAROLINA
SITE INVESTIGATION, CTO-0369

SAMPLE ID	IR10-SB01-02	IR10-SB02-02	IR10-SB03-03	IR10-SB04-03	IR10-SB05-04	IR10-SB06-03	IR10-SB07-03	IR10-SB08-02
SAMPLE DATE	03-18-1998	03-18-1998	03-18-1998	03-18-1998	03-18-1998	03-18-1998	03-18-1998	03-18-1998
DEPTH	3 - 5'	3 - 5'	5 - 7'	5 - 7'	7 - 9'	5 - 7'	5 - 7'	3 - 5'
VOLATILES (ug/kg)								
Bromomethane	12 U	11 U	12 U	12 U	12 U	12 U	12 U	11 U
Methylene chloride	12 U	11 U	12 U	12 U	12 U	12 U	12 U	11 U
Acetone	18 U	11 U	22 U	12 U	150 U	8300 U	84 U	82 U
Toluene	12 U	11 U	12 U	12 U	12 U	12 U	12 U	11 U
SEMIVOLATILES (ug/kg)								
Naphthalene	390 U	350 U	70 J	410 U	380 U	410 U	400 U	350 U
Acenaphthene	390 U	350 U	210 J	410 U	380 U	410 U	400 U	350 U
Dibenzofuran	390 U	350 U	76 J	410 U	380 U	410 U	400 U	350 U
Fluorene	390 U	350 U	160 J	410 U	380 U	410 U	400 U	350 U
Phenanthrene	390 U	350 U	1900	410 U	380 U	410 U	400 U	350 U
Anthracene	390 U	350 U	370 J	410 U	380 U	410 U	400 U	350 U
Carbazole	390 U	350 U	200 J	410 U	380 U	410 U	400 U	350 U
Di-n-butyl phthalate	42 J	48 J	48 J	44 J	48 J	47 J	47 J	350 U
Fluoranthene	390 U	350 U	2900	410 U	380 U	410 U	400 U	350 U
Pyrene	390 U	350 U	2100	410 U	380 U	410 U	400 U	350 U
Benzo(a)anthracene	390 U	350 U	1200	410 U	380 U	410 U	400 U	350 U
Chrysene	390 U	350 U	1300	410 U	380 U	410 U	400 U	350 U
Benzo(b)fluoranthene	390 U	350 U	1200	410 U	380 U	410 U	400 U	350 U
Benzo(k)fluoranthene	390 U	350 U	950	410 U	380 U	410 U	400 U	350 U
Benzo(a)pyrene	390 U	350 U	1100	410 U	380 U	410 U	400 U	350 U
Indeno(1,2,3-cd)pyrene	390 U	350 U	570	410 U	380 U	410 U	400 U	350 U
Dibenz(a,h)anthracene	390 U	350 U	280 J	410 U	380 U	410 U	400 U	350 U
Benzo(ghi)perylene	390 U	350 U	480	410 U	380 U	410 U	400 U	350 U

NOTES:

J = Estimated value

U = Not detected.

UJ = Not detected. Quantitation limit may be inaccurate or imprecise.

NJ = Presumptive evidence for the presence of the material at an estimated value.

ug/kg = micrograms per kilograms

TABLE 4-8

DETECTION SUMMARY
SUBSURFACE SOIL - ORGANIC COMPOUNDS
SITE 10 - ORIGINAL BASE LANDFILL
MCB, CAMP LEJEUNE, NORTH CAROLINA
SITE INVESTIGATION, CTO-0369

SAMPLE ID	IR10-SB01-02	IR10-SB02-02	IR10-SB03-03	IR10-SB04-03	IR10-SB05-04	IR10-SB06-03	IR10-SB07-03	IR10-SB08-02
SAMPLE DATE	03-18-1998	03-18-1998	03-18-1998	03-18-1998	03-18-1998	03-18-1998	03-18-1998	03-18-1998
DEPTH	3 - 5'	3 - 5'	5 - 7'	5 - 7'	7 - 9'	5 - 7'	5 - 7'	3 - 5'
PESTICIDES/PCBS (ug/kg)								
Endosulfan I	2 U	1.8 U	2 U	2.1 U	2 U	1.3 J	2.1 U	1.8 U
Endrin	3.9 U	3.5 U	2.5 NJ	4.1 U	3.8 U	4.1 U	4 U	3.5 U
Endosulfan II	3.9 U	3.5 U	4.7	4.1 U	3.8 U	4.1 U	4 U	3.5 U
4,4'-DDD	3.9 U	3.5 U	2.9 NJ	4.1 U	3.8 U	4.1 U	4 U	3.5 U
Methoxychlor	20 UJ	18 UJ	20 UJ	21 UJ	20 UJ	21 UJ	21 UJ	18 UJ
Endrin ketone	3.9 U	3.5 U	4 J	4.1 U	3.8 U	4.1 U	4 U	3.5 U

NOTES:
J = Estimated value
U = Not detected.
UJ = Not detected. Quantitation limit may be inaccurate or imprecise.
NJ = Presumptive evidence for the presence of the material at an estimated value.
ug/kg = micrograms per kilograms

TABLE 4-8

DETECTION SUMMARY
SUBSURFACE SOIL - ORGANIC COMPOUNDS
SITE 10 - ORIGINAL BASE LANDFILL
MCB, CAMP LEJEUNE, NORTH CAROLINA
SITE INVESTIGATION, CTO-0369

SAMPLE ID	IR10-SB09-03	IR10-SB10-01	IR10-SB11-02	IR10-SB12-04	IR10-SB13-04	IR10-SB14-01	IR10-SB15-01	IR10-SB16-01
SAMPLE DATE	03-18-1998	03-18-1998	03-18-1998	03-18-1998	03-18-1998	03-18-1998	03-18-1998	03-18-1998
DEPTH	5 - 7'	1 - 3'	3 - 5'	7 - 9'	7 - 9'	1 - 3'	1 - 3'	1 - 3'
VOLATILES (ug/kg)								
Bromomethane	11 U	12 U	11 U	11 U	11 U	12 U	11 U	12 U
Methylene chloride	11 U	12 U	11 U	11 U	11 U	12 U	11 U	12 U
Acetone	11 U	12 U	31 U	22 U	51 U	17 U	11 U	13 U
Toluene	11 U	12 U	11 U	11 U	11 U	12 U	11 U	12 U
SEMIVOLATILES (ug/kg)								
Naphthalene	370 U	410 U	380 U	360 U	370 U	410 U	370 U	410 U
Acenaphthene	370 U	410 U	380 U	360 U	370 U	410 U	370 U	410 U
Dibenzofuran	370 U	410 U	380 U	360 U	370 U	410 U	370 U	410 U
Fluorene	370 U	410 U	380 U	360 U	370 U	410 U	370 U	410 U
Phenanthrene	370 U	410 U	380 U	360 U	370 U	410 U	370 U	410 U
Anthracene	370 U	410 U	380 U	360 U	370 U	410 U	370 U	410 U
Carbazole	370 U	410 U	380 U	360 U	370 U	410 U	370 U	410 U
Di-n-butyl phthalate	370 U	410 U	380 U	360 U	370 U	410 U	370 U	410 U
Fluoranthene	370 U	410 U	380 U	360 U	370 U	410 U	370 U	410 U
Pyrene	370 U	410 U	380 U	360 U	370 U	410 U	370 U	410 U
Benzo(a)anthracene	370 U	410 U	380 U	360 U	370 U	410 U	370 U	410 U
Chrysene	370 U	410 U	380 U	360 U	370 U	410 U	370 U	410 U
Benzo(b)fluoranthene	370 U	410 U	380 U	360 U	370 U	410 U	370 U	410 U
Benzo(k)fluoranthene	370 U	410 U	380 U	360 U	370 U	410 U	370 U	410 U
Benzo(a)pyrene	370 U	410 U	380 U	360 U	370 U	410 U	370 U	410 U
Indeno(1,2,3-cd)pyrene	370 U	410 U	380 U	360 U	370 U	410 U	370 U	410 U
Dibenz(a,h)anthracene	370 U	410 U	380 U	360 U	370 U	410 U	370 U	410 U
Benzo(ghi)perylene	370 U	410 U	380 U	360 U	370 U	410 U	370 U	410 U

NOTES:
J = Estimated value
U = Not detected.
UJ = Not detected. Quantitation limit may be inaccurate or imprecise.
NJ = Presumptive evidence for the presence of the material at an estimated value.
ug/kg = micrograms per kilograms

TABLE 4-8

DETECTION SUMMARY
SUBSURFACE SOIL - ORGANIC COMPOUNDS
SITE 10 - ORIGINAL BASE LANDFILL
MCB, CAMP LEJEUNE, NORTH CAROLINA
SITE INVESTIGATION, CTO-0369

SAMPLE ID	IR10-SB09-03	IR10-SB10-01	IR10-SB11-02	IR10-SB12-04	IR10-SB13-04	IR10-SB14-01	IR10-SB15-01	IR10-SB16-01
SAMPLE DATE	03-18-1998	03-18-1998	03-18-1998	03-18-1998	03-18-1998	03-18-1998	03-18-1998	03-18-1998
DEPTH	5 - 7'	1 - 3'	3 - 5'	7 - 9'	7 - 9'	1 - 3'	1 - 3'	1 - 3'
PESTICIDES/PCBS (ug/kg)								
Endosulfan I	1.9 U	2.1 U	1.9 U	1.9 U	1.9 U	2.1 U	1.9 U	2.1 U
Endrin	3.7 U	4.1 U	3.8 U	3.6 U	3.7 U	4.1 U	3.7 U	4.1 U
Endosulfan II	3.7 U	4.1 U	3.8 U	3.6 U	3.7 U	4.1 U	3.7 U	4.1 U
4,4'-DDD	3.7 U	4.1 U	3.8 U	3.6 U	3.7 U	4.1 U	3.7 U	4.1 U
Methoxychlor	19 UJ	21 UJ	19 UJ	19 UJ	19 UJ	21 UJ	13 J	21 UJ
Endrin ketone	3.7 U	4.1 U	3.8 U	3.6 U	3.7 U	4.1 U	3.7 U	4.1 U

NOTES:
J = Estimated value
U = Not detected.
UJ = Not detected. Quantitation limit may be inaccurate or imprecise.
NJ = Presumptive evidence for the presence of the material at an estimated value.
ug/kg = micrograms per kilograms

TABLE 4-8

DETECTION SUMMARY
SUBSURFACE SOIL - ORGANIC COMPOUNDS
SITE 10 - ORIGINAL BASE LANDFILL
MCB, CAMP LEJEUNE, NORTH CAROLINA
SITE INVESTIGATION, CTO-0369

SAMPLE ID	IR10-SB17-03	IR10-SB18-02	IR10-SB19-01	IR10-SB21-05	IR10-SB22-07	IR10-SB23-03
SAMPLE DATE	03-18-1998	03-19-1998	03-19-1998	03-19-1998	03-19-1998	03-19-1998
DEPTH	5 - 7'	3 - 5'	1 - 3'	9 - 11'	13 - 15'	5 - 7'
VOLATILES (ug/kg)						
Bromomethane	11 U	12 U	250 J	11 U	11 U	12 U
Methylene chloride	11 U	12 U	260 J	11 U	11 U	12 U
Acetone	11 U	23 U	7100	21 U	11 U	12 U
Toluene	11 U	2 J	3.6 J	11 U	11 U	12 U
SEMIVOLATILES (ug/kg)						
Naphthalene	360 U	400 U	390 U	360 U	360 U	400 U
Acenaphthene	360 U	400 U	390 U	360 U	360 U	400 U
Dibenzofuran	360 U	400 U	390 U	360 U	360 U	400 U
Fluorene	360 U	400 U	390 U	360 U	360 U	400 U
Phenanthrene	360 U	400 U	390 U	360 U	360 U	400 U
Anthracene	360 U	400 U	390 U	360 U	360 U	400 U
Carbazole	360 U	400 U	390 U	360 U	360 U	400 U
Di-n-butyl phthalate	360 U	400 U	390 U	360 U	360 U	400 U
Fluoranthene	360 U	400 U	390 U	360 U	360 U	400 U
Pyrene	360 U	400 U	390 U	360 U	360 U	400 U
Benzo(a)anthracene	360 U	400 U	390 U	360 U	360 U	400 U
Chrysene	360 U	400 U	390 U	360 U	360 U	400 U
Benzo(b)fluoranthene	360 U	400 U	390 U	360 U	360 U	400 U
Benzo(k)fluoranthene	360 U	400 U	390 U	360 U	360 U	400 U
Benzo(a)pyrene	360 U	400 U	390 U	360 U	360 U	400 U
Indeno(1,2,3-cd)pyrene	360 U	400 U	390 U	360 U	360 U	400 U
Dibenz(a,h)anthracene	360 U	400 U	390 U	360 U	360 U	400 U
Benzo(ghi)perylene	360 U	400 U	390 U	360 U	360 U	400 U

NOTES:
J = Estimated value
U = Not detected.
UJ = Not detected. Quantitation limit may be inaccurate or imprecise.
NJ = Presumptive evidence for the presence of the material at an estimated value.
ug/kg = micrograms per kilograms

TABLE 4-8

DETECTION SUMMARY
SUBSURFACE SOIL - ORGANIC COMPOUNDS
SITE 10 - ORIGINAL BASE LANDFILL
MCB, CAMP LEJEUNE, NORTH CAROLINA
SITE INVESTIGATION, CTO-0369

SAMPLE ID	IR10-SB17-03	IR10-SB18-02	IR10-SB19-01	IR10-SB21-05	IR10-SB22-07	IR10-SB23-03
SAMPLE DATE	03-18-1998	03-19-1998	03-19-1998	03-19-1998	03-19-1998	03-19-1998
DEPTH	5 - 7'	3 - 5'	1 - 3'	9 - 11'	13 - 15'	5 - 7'
PESTICIDES/PCBS (ug/kg)						
Endosulfan I	1.9 U	2.1 U	2 U	1.9 U	1.9 U	2 U
Endrin	3.6 U	4 U	3.9 U	3.6 U	3.6 U	4 U
Endosulfan II	3.6 U	4 U	3.9 U	3.6 U	3.6 U	4 U
4,4'-DDD	3.6 U	4 U	3.9 U	3.6 U	3.6 U	4 U
Methoxychlor	19 UJ	21 UJ	20 UJ	19 UJ	19 UJ	20 UJ
Endrin ketone	3.6 U	4 U	3.9 U	3.6 U	3.6 U	4 U

NOTES:
J = Estimated value
U = Not detected.
UJ = Not detected. Quantitation limit may be inaccurate or imprecise.
NJ = Presumptive evidence for the presence of the material at an estimated value.
ug/kg = micrograms per kilograms

TABLE 4-8

DETECTION SUMMARY
SUBSURFACE SOIL - ORGANIC COMPOUNDS
SITE 10 - ORIGINAL BASE LANDFILL
MCB, CAMP LEJEUNE, NORTH CAROLINA
SITE INVESTIGATION, CTO-0369

SAMPLE ID SAMPLE DATE DEPTH	Minimum Non-Detect	Maximum Non-Detect	Minimum Detected	Maximum Detected	Location of Maximum Detect	Frequency of Detection	Arithmatic Mean Positive Detects	Median Positive Detects
VOLATILES (ug/kg)								
Bromomethane	11 U	12 U	250 J	250 J	IR10-SB19-01	1/22	250	250
Methylene chloride	11 U	12 U	260 J	260 J	IR10-SB19-01	1/22	260	260
Acetone	11 U	8300 U	7100	7100	IR10-SB19-01	1/22	7100	7100
Toluene	11 U	12 U	2 J	3.6 J	IR10-SB19-01	2/22	2.8	2.8
SEMIVOLATILES (ug/kg)								
Naphthalene	350 U	410 U	70 J	70 J	IR10-SB03-03	1/22	70	70
Acenaphthene	350 U	410 U	210 J	210 J	IR10-SB03-03	1/22	210	210
Dibenzofuran	350 U	410 U	76 J	76 J	IR10-SB03-03	1/22	76	76
Fluorene	350 U	410 U	160 J	160 J	IR10-SB03-03	1/22	160	160
Phenanthrene	350 U	410 U	1900	1900	IR10-SB03-03	1/22	1900	1900
Anthracene	350 U	410 U	370 J	370 J	IR10-SB03-03	1/22	370	370
Carbazole	350 U	410 U	200 J	200 J	IR10-SB03-03	1/22	200	200
Di-n-butyl phthalate	350 U	410 U	42 J	48 J	IR10-SB02-02,IR10-SB03-03,IR10-SB05-04	7/22	46.29	47
Fluoranthene	350 U	410 U	2900	2900	IR10-SB03-03	1/22	2900	2900
Pyrene	350 U	410 U	2100	2100	IR10-SB03-03	1/22	2100	2100
Benzo(a)anthracene	350 U	410 U	1200	1200	IR10-SB03-03	1/22	1200	1200
Chrysene	350 U	410 U	1300	1300	IR10-SB03-03	1/22	1300	1300
Benzo(b)fluoranthene	350 U	410 U	1200	1200	IR10-SB03-03	1/22	1200	1200
Benzo(k)fluoranthene	350 U	410 U	950	950	IR10-SB03-03	1/22	950	950
Benzo(a)pyrene	350 U	410 U	1100	1100	IR10-SB03-03	1/22	1100	1100
Indeno(1,2,3-cd)pyrene	350 U	410 U	570	570	IR10-SB03-03	1/22	570	570
Dibenz(a,h)anthracene	350 U	410 U	280 J	280 J	IR10-SB03-03	1/22	280	280
Benzo(ghi)perylene	350 U	410 U	480	480	IR10-SB03-03	1/22	480	480

NOTES:
J = Estimated value
U = Not detected.
UJ = Not detected. Quantitation limit may be inaccurate or imprecise.
NJ = Presumptive evidence for the presence of the material at an estimated value.
ug/kg = micrograms per kilograms

TABLE 4-8

DETECTION SUMMARY
SUBSURFACE SOIL - ORGANIC COMPOUNDS
SITE 10 - ORIGINAL BASE LANDFILL
MCB, CAMP LEJEUNE, NORTH CAROLINA
SITE INVESTIGATION, CTO-0369

SAMPLE ID SAMPLE DATE DEPTH	Minimum Non-Detect	Maximum Non-Detect	Minimum Detected	Maximum Detected	Location of Maximum Detect	Frequency of Detection	Arithmatic Mean Positive Detects	Median Positive Detects
PESTICIDES/PCBS (ug/kg)								
Endosulfan I	1.8 U	2.1 U	1.3 J	1.3 J	IR10-SB06-03	1/22	1.3	1.3
Endrin	3.5 U	4.1 U	2.5 NJ	2.5 NJ	IR10-SB03-03	1/22	2.5	2.5
Endosulfan II	3.5 U	4.1 U	4.7	4.7	IR10-SB03-03	1/22	4.7	4.7
4,4'-DDD	3.5 U	4.1 U	2.9 NJ	2.9 NJ	IR10-SB03-03	1/22	2.9	2.9
Methoxychlor	18 UJ	21 UJ	13 J	13 J	IR10-SB15-01	1/22	13	13
Endrin ketone	3.5 U	4.1 U	4 J	4 J	IR10-SB03-03	1/22	4	4

NOTES:
J = Estimated value
U = Not detected.
UJ = Not detected. Quantitation limit may be inaccurate or imprecise.
NJ = Presumptive evidence for the presence of the material at an estimated value.
ug/kg = micrograms per kilograms

TABLE 4-9

DATA SUMMARY
SUBSURFACE SOIL - ORGANIC COMPOUNDS
SITE 10 - ORIGINAL BASE LANDFILL
MCB, CAMP LEJEUNE, NORTH CAROLINA
SITE INVESTIGATION, CTO-0369

CONSTITUENTS	North Carolina Method I, Category S3:G-1 Target Concentrations	North Carolina Method I, Category S3:G-3 Target Concentrations (250 ft)	Minimum Detected	Maximum Detected	Location of Maximum Detect	North Carolina Method I, Category S3:G-1 Target Concentrations Exceedance Count	North Carolina Method I, Category S3:G-3 Target Concentrations (250 ft) Exceedance Count
VOLATILES (ug/kg)							
Bromomethane	NE	181000	250 J	250 J	IR10-SB19-01	0	0
Methylene chloride	22.1	17700	260 J	260 J	IR10-SB19-01	1	0
Acetone	2810	NE	7100	7100	IR10-SB19-01	1	0
Toluene	7275	200	2 J	3.6 J	IR10-SB19-01	0	0
SEMIVOLATILES (ug/kg)							
Naphthalene	584	NE	70 J	70 J	IR10-SB03-03	0	0
Acenaphthene	8160	174000	210 J	210 J	IR10-SB03-03	0	0
Dibenzofuran	NE	NE	76 J	76 J	IR10-SB03-03	0	0
Fluorene	44297	150000	160 J	160 J	IR10-SB03-03	0	0
Phenanthrene	59640	NE	1900	1900	IR10-SB03-03	0	0
Anthracene	995000	306000	370 J	370 J	IR10-SB03-03	0	0
Carbazole	NE	NE	200 J	200 J	IR10-SB03-03	0	0
Di-n-butyl phthalate	24800	1060000	42 J	48 J	IR10-SB02-02,IR10-SB03-03,IR10-SB05-04	0	0
Fluoranthene	276080	131000	2900	2900	IR10-SB03-03	0	0
Pyrene	286440	109000	2100	2100	IR10-SB03-03	0	0
Benzo(a)anthracene	343	878	1200	1200	IR10-SB03-03	1	1
Chrysene	38150	976	1300	1300	IR10-SB03-03	0	1
Benzo(b)fluoranthene	NE	NE	1200	1200	IR10-SB03-03	0	0
Benzo(k)fluoranthene	NE	NE	950	950	IR10-SB03-03	0	0
Benzo(a)pyrene	NE	NE	1100	1100	IR10-SB03-03	0	0
Indeno(1,2,3-cd)pyrene	NE	NE	570	570	IR10-SB03-03	0	0
Dibenz(a,h)anthracene	NE	NE	280 J	280 J	IR10-SB03-03	0	0
Benzo(ghi)perylene	6720000	3920	480	480	IR10-SB03-03	0	0

NOTES:
J = Estimated value
U = Not detected.
NJ = Presumptive evidence for the presence of the material at an estimated value.
NE = Not established
ug/kg = micrograms per kilograms

TABLE 4-9

DATA SUMMARY
SUBSURFACE SOIL - ORGANIC COMPOUNDS
SITE 10 - ORIGINAL BASE LANDFILL
MCB, CAMP LEJEUNE, NORTH CAROLINA
SITE INVESTIGATION, CTO-0369

CONSTITUENTS	North Carolina Method I, Category S3:G-1 Target Concentrations	North Carolina Method I, Category S3:G-3 Target Concentrations (250 ft)	Minimum Detected	Maximum Detected	Location of Maximum Detect	North Carolina Method I, Category S3:G-1 Target Concentrations Exceedance Count	North Carolina Method I, Category S3:G-3 Target Concentrations (250 ft) Exceedance Count
PESTICIDES/PCBS (ug/kg)							
Endosulfan I	NE	NE	1.3 J	1.3 J	IR10-SB06-03	0	0
Endrin	440	1.1	2.5 NJ	2.5 NJ	IR10-SB03-03	0	1
Endosulfan II	NE	NE	4.7	4.7	IR10-SB03-03	0	0
4,4'-DDD	NE	NE	2.9 NJ	2.9 NJ	IR10-SB03-03	0	0
Methoxychlor	56140	120	13 J	13 J	IR10-SB15-01	0	0
Endrin ketone	NE	NE	4 J	4 J	IR10-SB03-03	0	0

NOTES:
J = Estimated value
U = Not detected.
NJ = Presumptive evidence for the presence of the material at an estimated value.
NE = Not established
ug/kg = micrograms per kilograms

TABLE 4-10

DETECTION SUMMARY
SUBSURFACE SOIL - TOTAL INORGANIC CONSTITUENTS
SITE 10 - ORIGINAL BASE LANDFILL
MCB, CAMP LEJEUNE, NORTH CAROLINA
SITE INVESTIGATION, CTO-0369

SAMPLE ID	IR10-SB01-02	IR10-SB02-02	IR10-SB03-03	IR10-SB04-03	IR10-SB05-04	IR10-SB06-03	IR10-SB07-03	IR10-SB08-02	IR10-SB09-03
SAMPLE DATE	03-18-1998	03-18-1998	03-18-1998	03-18-1998	03-18-1998	03-18-1998	03-18-1998	03-18-1998	03-18-1998
DEPTH	3 - 5'	3 - 5'	5 - 7'	5 - 7'	7 - 9'	5 - 7'	5 - 7'	3 - 5'	5 - 7'
TOTAL METALS (mg/kg)									
Aluminum	971	837	2790	5910	2040	2500	1070	40.2 J	1770 J
Antimony	14.1 U	12.8 U	7.4 J	84.2	13.9 U	14.9 U	14.6 U	12.7 U	13.3 U
Arsenic	2.4 U	2.1 U	3.6	37.2	2.3 U	0.99 J	2.4 U	2.1 U	2.2 U
Barium	2.3 J	2.2 J	94	589	3.4 J	28.8 J	2.8 J	0.88 J	2.5 J
Beryllium	1.2 U	1.1 U	0.12 J	3.8 U	1.2 U	1.2 U	1.2 U	1.1 U	1.1 U
Cadmium	1.2 U	1.1 U	7.9	3.8 U	1.2 U	1.2 U	1.2 U	1.1 U	1.1 U
Calcium	111 J	82.8 J	13200 J	25100 J	249 J	4160 J	43.9 J	26.9 J	51.4 J
Chromium	1.5 J	3.1	21.6	66.5	3.7	8	1.9 J	1.4 J	3.3
Cobalt	0.84 J	10.7 U	6.9 J	53.2	11.6 U	3.2 J	12.2 U	10.6 U	11.1 U
Copper	1.9 J	0.88 J	50.6	3340	1.5 J	23.3	1.8 J	0.57 J	1.5 J
Iron	338	451	39100	218000	615	18700	337	102	707 J
Lead	1.8	1.4	532	2630	2.4	126	3.6	0.72	1.8
Magnesium	30.4 J	30.7 J	558 J	1050 J	56 J	125 J	23.3 J	5.8 J	48.7 J
Manganese	44.7	3.2	250	948	2.8 J	127	1.6 J	4.1	3.5
Mercury	0.031 J	0.022 J	0.12	0.16	0.032 J	0.12	0.12 U	0.023 J	0.11 U
Nickel	9.4 U	8.5 U	12.3	147	9.3 U	7.9 J	9.8 U	8.4 U	8.9 U
Potassium	1180 U	1070 U	316 J	636 J	1160 U	345 J	1220 U	1060 U	170 J
Selenium	1.2 U	1.1 U	1.2 U	1.2 U	1.2 U	1.2 U	1.2 U	1.1 U	1.1 U
Silver	1.1 J	2.1 U	11.3	7.5 U	2.3 U	2.5 U	2.4 U	2.1 U	2.2 U
Sodium	42.4 J	17.1 J	99.6 J	336 J	19.8 J	31.7 J	14.8 J	15.1 J	19 J
Thallium	2.4 U	2.1 U	2.3 U	2.6 U	2.3 U	2.5 U	2.4 U	2.1 U	2.2 U
Vanadium	11.8 U	10.7 U	11.7 U	37.5 U	11.6 U	12.4 U	12.2 U	10.6 U	11.1 U
Zinc	2.8 J	2.3 U	1080	1250	3.7 J	193	8.6	2.5 J	3 U
Total Cyanide	2.4 U	2.1 U	2.3 U	0.62 J	2.3 U	2.5 U	2.4 U	2.1 U	2.2 U

NOTES:
J = Estimated value
U = Not detected.
ND = Not detected.
ug/kg = micrograms per kilograms

TABLE 4-10

DETECTION SUMMARY
SUBSURFACE SOIL - TOTAL INORGANIC CONSTITUENTS
SITE 10 - ORIGINAL BASE LANDFILL
MCB, CAMP LEJEUNE, NORTH CAROLINA
SITE INVESTIGATION, CTO-0369

SAMPLE ID	IR10-SB10-01	IR10-SB11-02	IR10-SB12-04	IR10-SB13-04	IR10-SB14-01	IR10-SB15-01	IR10-SB16-01	IR10-SB17-03	IR10-SB18-02
SAMPLE DATE	03-18-1998	03-18-1998	03-18-1998	03-18-1998	03-18-1998	03-18-1998	03-18-1998	03-18-1998	03-19-1998
DEPTH	1 - 3'	3 - 5'	7 - 9'	7 - 9'	1 - 3'	1 - 3'	1 - 3'	5 - 7'	3 - 5'
TOTAL METALS (mg/kg)									
Aluminum	1910 J	1230 J	3490 J	1280 J	1960 J	110 J	4050 J	986 J	1700 J
Antimony	14.7 U	13.6 U	13.3 U	7.3 J	14.9 U	13.4 U	14.9 U	13.2 U	14.6 U
Arsenic	2.5 U	2.3 U	2.2 U	2.3 U	2.5 U	2.2 U	2.5 U	2.2 U	2.4 U
Barium	1.8 J	1.9 J	6.2 J	2.7 J	2.2 J	0.93 J	3.9 J	1.9 J	4.2 J
Beryllium	1.2 U	1.1 U	1.1 U	1.1 U	1.2 U	1.1 U	1.2 U	1.1 U	1.2 U
Cadmium	1.2 U	1.1 U	1.1 U	1.1 U	1.2 U	1.1 U	1.2 U	1.1 U	1.2 U
Calcium	71.4 J	34.3 J	34.5 J	32.1 J	47.9 J	43.7 J	42.3 J	39.2 J	210 J
Chromium	1.6 J	2.2 J	4.2	1.4 J	0.91 J	2.2 U	2.4 J	1.5 J	3 J
Cobalt	12.3 U	0.88 J	11 U	0.99 J	12.4 U	11.2 U	12.4 U	11 U	12.2 U
Copper	1 J	1 J	0.98 J	0.53 J	0.9 J	0.39 J	1.7 J	0.52 J	1.2 J
Iron	182 J	506 J	914 J	383 J	231 J	102 J	293 J	410 J	499 J
Lead	2.2	1.5	2.8	1.9	1.7	0.91	2.4	1.7	1.5
Magnesium	41.7 J	37 J	109 J	42.4 J	26.6 J	8.6 J	58.6 J	29.3 J	58.6 J
Manganese	4.3	1.8 J	2.7 J	15.4	2.6 J	4.2	3 J	2.4 J	2.9 J
Mercury	0.047 J	0.027 J	0.027 J	0.028 J	0.03 J	0.024 J	0.039 J	0.028 J	0.12 U
Nickel	9.8 U	9.1 U	8.8 U	9 U	9.9 U	8.9 U	9.9 U	8.8 U	9.8 U
Potassium	1230 U	165 J	206 J	1130 U	1240 U	1120 U	1240 U	1100 U	1220 U
Selenium	1.2 U	1.1 U	1.1 U	1.1 U	1.2 U	1.1 U	1.2 U	0.65 J	1 J
Silver	2.5 U	2.3 U	2.2 U	1.4 J	2.5 U	2.2 U	2.5 U	2.2 U	2.4 U
Sodium	43.2 J	21.3 J	16.7 J	16.3 J	12.9 J	11.6 J	9.5 J	12.8 J	21 J
Thallium	2.5 U	1.1 J	2.2 U	2.3 U	2.5 U	2.2 U	2.5 U	2.2 U	2.4 U
Vanadium	12.3 U	11.4 U	3.4 U	1.7 U	12.4 U	11.2 U	1.7 U	11 U	3.9 J
Zinc	2.4 U	4.8	2.8 U	2.7 U	3 U	2.6 U	3.4 U	3.4 U	7.5 J
Total Cyanide	2.5 U	2.3 U	2.2 U	2.3 U	2.5 U	2.2 U	2.5 U	2.2 U	2.4 U

NOTES:
J = Estimated value
U = Not detected.
ND = Not detected.
ug/kg = micrograms per kilograms

TABLE 4-10

DETECTION SUMMARY
SUBSURFACE SOIL - TOTAL INORGANIC CONSTITUENTS
SITE 10 - ORIGINAL BASE LANDFILL
MCB, CAMP LEJEUNE, NORTH CAROLINA
SITE INVESTIGATION, CTO-0369

SAMPLE ID	IR10-SB19-01	IR10-SB21-05	IR10-SB22-07	IR10-SB23-03
SAMPLE DATE	03-19-1998	03-19-1998	03-19-1998	03-19-1998
DEPTH	1 - 3'	9 - 11'	13 - 15'	5 - 7'
TOTAL METALS (mg/kg)				
Aluminum	2810 J	2610 J	2320 J	906 J
Antimony	14.1 U	13.1 U	13.1 U	14.4 U
Arsenic	0.84 U	0.54 U	2.2 U	2.4 U
Barium	7.9 J	3.3 J	5 J	2.3 J
Beryllium	1.2 U	1.1 U	1.1 U	1.2 U
Cadmium	1.2 U	1.1 U	1.1 U	1.2 U
Calcium	445 J	62.8 J	72.2 J	66.6 J
Chromium	3.4 J	4.5 J	5.4 J	2 J
Cobalt	1.1 J	10.9 U	11 U	12 U
Copper	4 J	0.92 J	1.1 J	1.2 J
Iron	976 J	726 J	928 J	303 J
Lead	10.7	2.4	2.5	1.2
Magnesium	84.5 J	75.9 J	81.8 J	29.5 J
Manganese	4.3 J	3.1 J	3.9	2.7 J
Mercury	0.03 J	0.11 U	0.11 U	0.12 U
Nickel	2.6 J	1.9 J	1.9 J	9.6 U
Potassium	1170 U	1090 U	1100 U	1200 U
Selenium	1.1 J	1.1 U	1.1 U	1.2 U
Silver	1.6 J	2.2 U	2.2 U	2.4 U
Sodium	21.2 J	16 J	19.9 J	15.8 J
Thallium	2.3 U	2.2 U	2.2 U	2.4 U
Vanadium	6.6 J	6.1 J	5.9 J	4.5 J
Zinc	18.6 J	7.6 J	17.8 J	13.4 J
Total Cyanide	2.3 U	2.2 U	2.2 U	2.4 U

NOTES:
J = Estimated value
U = Not detected.
ND = Not detected.
ug/kg = micrograms per kilograms

TABLE 4-10

DETECTION SUMMARY
SUBSURFACE SOIL - TOTAL INORGANIC CONSTITUENTS
SITE 10 - ORIGINAL BASE LANDFILL
MCB, CAMP LEJEUNE, NORTH CAROLINA
SITE INVESTIGATION, CTO-0369

SAMPLE ID SAMPLE DATE DEPTH	Minimum Non-Detect	Maximum Non-Detect	Minimum Detected	Maximum Detected	Location of Maximum Detect	Frequency of Detection	Arithmatic Mean Positive Detects	Median Positive Detects
TOTAL METALS (mg/kg)								
Aluminum	ND	ND	40.2 J	5910	IR10-SB04-03	22/22	1967.74	1840
Antimony	12.7 U	14.9 U	7.3 J	84.2	IR10-SB04-03	3/22	32.97	7.4
Arsenic	0.54 U	2.5 U	0.99 J	37.2	IR10-SB04-03	3/22	13.93	3.6
Barium	ND	ND	0.88 J	589	IR10-SB04-03	22/22	35.01	2.75
Beryllium	1.1 U	3.8 U	0.12 J	0.12 J	IR10-SB03-03	1/22	0.12	0.12
Cadmium	1.1 U	3.8 U	7.9	7.9	IR10-SB03-03	1/22	7.9	7.9
Calcium	ND	ND	26.9 J	25100 J	IR10-SB04-03	22/22	2010.32	64.7
Chromium	2.2 U	2.2 U	0.91 J	66.5	IR10-SB04-03	21/22	6.83	3
Cobalt	10.6 U	12.4 U	0.84 J	53.2	IR10-SB04-03	7/22	9.59	1.1
Copper	ND	ND	0.39 J	3340	IR10-SB04-03	22/22	156.25	1.15
Iron	ND	ND	102 J	218000	IR10-SB04-03	22/22	12945.59	475
Lead	ND	ND	0.72	2630	IR10-SB04-03	22/22	151.51	2.05
Magnesium	ND	ND	5.8 J	1050 J	IR10-SB04-03	22/22	118.7	45.55
Manganese	ND	ND	1.6 J	948	IR10-SB04-03	22/22	65.37	3.35
Mercury	0.11 U	0.12 U	0.022 J	0.16	IR10-SB04-03	16/22	0.05	0.03
Nickel	8.4 U	9.9 U	1.9 J	147	IR10-SB04-03	6/22	28.93	5.25
Potassium	1060 U	1240 U	165 J	636 J	IR10-SB04-03	6/22	306.33	261
Selenium	1.1 U	1.2 U	0.65 J	1.1 J	IR10-SB19-01	3/22	0.92	1
Silver	2.1 U	7.5 U	1.1 J	11.3	IR10-SB03-03	4/22	3.85	1.5
Sodium	ND	ND	9.5 J	336 J	IR10-SB04-03	22/22	37.9	18.05
Thallium	2.1 U	2.6 U	1.1 J	1.1 J	IR10-SB11-02	1/22	1.1	1.1
Vanadium	1.7 U	37.5 U	3.9 J	6.6 J	IR10-SB19-01	5/22	5.4	5.9
Zinc	2.3 U	3.4 U	2.5 J	1250	IR10-SB04-03	13/22	200.79	8.6
Total Cyanide	2.1 U	2.5 U	0.62 J	0.62 J	IR10-SB04-03	1/22	0.62	0.62

NOTES:
J = Estimated value
U = Not detected.
ND = Not detected.
ug/kg = micrograms per kilograms

TABLE 4-11

DATA SUMMARY
SUBSURFACE SOIL - TOTAL INORGANIC CONSTITUENTS
SITE 10 - ORIGINAL BASE LANDFILL
MCB, CAMP LEJEUNE, NORTH CAROLINA
SITE INVESTIGATION, CTO-0369

CONSTITUENTS	North Carolina Method I, Category S3:G-1 Target Concentrations	North Carolina Method I, Category S3:G-3 Target Concentrations (250 ft)	Base Background (mg/kg)	Minimum Detected	Maximum Detected	Location of Maximum Detect	North Carolina Method I, Category S3:G-1 Target Concentrations Exceedance Count	North Carolina Method I, Category S3:G-3 Target Concentrations (250 ft) Exceedance Count
TOTAL METALS (mg/kg)								
Aluminum	NE	NE	16.9 - 11,000	40.2 J	5910	IR10-SB04-03	0	0
Antimony	NE	NE	0.355 - 6.9	7.3 J	84.2	IR10-SB04-03	0	0
Arsenic	26.2	65.5	0.033 - 15.4	0.99 J	37.2	IR10-SB04-03	1	0
Barium	848	NE	0.65 - 22.6	0.88 J	589	IR10-SB04-03	0	0
Beryllium	NE	NE	0.01 - 0.31	0.12 J	0.12 J	IR10-SB03-03	0	0
Cadmium	2.72	2.72	0.155 - 1.2	7.9	7.9	IR10-SB03-03	1	1
Calcium	NE	NE	4.75 - 4,410	26.9 J	25100 J	IR10-SB04-03	0	0
Chromium	27.2	NE	0.65 - 66.4	0.91 J	66.5	IR10-SB04-03	1	0
Cobalt	NE	NE	0.175 - 7	0.84 J	53.2	IR10-SB04-03	0	0
Copper	704	5.28	0.16 - 9.5	0.39 J	3340	IR10-SB04-03	1	3
Iron	151.2	1260	63.3 - 90,500	102 J	218000	IR10-SB04-03	20	3
Lead	270.06	1130	0.465 - 21.4	0.72	2630	IR10-SB04-03	2	1
Magnesium	NE	NE	2.85 - 852	5.8 J	1050 J	IR10-SB04-03	0	0
Manganese	65.2	326	0.395 - 19.9	1.6 J	948	IR10-SB04-03	3	1
Mercury	0.0154	0.00042	0.01 - 0.68	0.022 J	0.16	IR10-SB04-03	16	16
Nickel	56.4	11.7	0.45 - 9.2	1.9 J	147	IR10-SB04-03	1	2
Potassium	NE	NE	1.05 - 1,250	165 J	636 J	IR10-SB04-03	0	0
Selenium	12.2	3.05	0.085 - 2.4	0.65 J	1.1 J	IR10-SB19-01	0	0
Silver	0.223	0.00186	0.175 - 1	1.1 J	11.3	IR10-SB03-03	4	4
Sodium	NE	NE	2.2 - 141	9.5 J	336 J	IR10-SB04-03	0	0
Thallium	NE	NE	0.055 - 2.7	1.1 J	1.1 J	IR10-SB11-02	0	0
Vanadium	NE	NE	0.34 - 69.4	3.9 J	6.6 J	IR10-SB19-01	0	0
Zinc	1100.4	65.5	0.32 - 26.6	2.5 J	1250	IR10-SB04-03	1	3
Cyanide	31100	505	NE	0.62 J	0.62 J	IR10-SB04-03	0	0

NOTES:
J = Estimated value
NE = Not established
ND = Not detected.
ug/kg = micrograms per kilograms

TABLE 4-12

DETECTION SUMMARY
GROUNDWATER - ORGANIC COMPOUNDS
SITE 10 - ORIGINAL BASE LANDFILL
MCB, CAMP LEJEUNE, NORTH CAROLINA
SITE INVESTIGATION, CTO-0369

SAMPLE ID	IR10-TW01-98A	IR10-TW02-98A	IR10-TW03-98A	IR10-TW04-98A	IR10-TW05-98A	IR10-TW06-98A	IR10-TW07-98A	IR10-TW08-98A	IR10-TW09-98A
SAMPLE DATE	03-22-1998	03-22-1998	03-22-1998	03-22-1998	03-22-1998	03-22-1998	03-23-1998	03-23-1998	03-22-1998

VOLATILES (ug/l)	NO DETECTS
SEMIVOLATILES (ug/l)	NO DETECTS
PESTICIDES/PCBS (ug/l)	NO DETECTS

TABLE 4-13

DETECTION SUMMARY
GROUNDWATER - TOTAL INORGANIC CONSTITUENTS
SITE 10 - ORIGINAL BASE LANDFILL
MCB, CAMP LEJEUNE, NORTH CAROLINA
SITE INVESTIGATION, CTO 0369

SAMPLE ID	IR10-TW01-98A	IR10-TW02-98A	IR10-TW03-98A	IR10-TW04-98A	IR10-TW05-98A	IR10-TW06-98A	IR10-TW07-98A	IR10-TW08-98A
LAB SAMPLE ID	NA	NA	NA	NA	NA	NA	NA	NA
SAMPLE DATE	03-22-1998	03-22-1998	03-22-1998	03-22-1998	03-22-1998	03-22-1998	03-23-1998	03-23-1998
METALS (ug/l)								
Aluminum	16600 J	37500 J	57100 J	33700 J	17100 J	27300 J	4300 J	78800 J
Antimony	60 U	24.2 U	60 U	60 U	60 U	24.3 U	30.3 U	27.5 U
Arsenic	10 U	6.4 J	16.4	10 U	6 J	10 U	13.9	18.2
Barium	33.6 J	62 J	110 J	93.6 J	78.7 J	42.9 J	57.3 J	186 J
Beryllium	5 U	5 U	5 U	5 U	5 U	5 U	5 U	0.65 J
Cadmium	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Calcium	16800	1820 J	1630 J	1740 J	5620	52700	2060 J	2850 J
Chromium	64	82.2	107	48.4	35.9	36.4	17.1	136
Cobalt	3.8 J	4.3 J	6.2 J	7.2 J	3.9 J	50 U	6 J	10.5 J
Copper	10.8 U	16.8 J	22.2 J	24.6 J	8.4 U	7.9 U	7 U	25.3
Cyanide, total	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Iron	6830	16900	25600	10400	8220	5030	8240	28400
Lead	10.6	31.1	41	33.4	14.2	10.6	7.2	54.8
Magnesium	726 J	1530 J	1820 J	1300 J	2000 J	3930 J	3350 J	3030 J
Manganese	72.1	109	119	88.3	91.7	33.2	49.1	146
Mercury	0.054 J	0.083 J	0.087 J	0.13 J	0.077 J	0.033 J	0.2 U	0.3
Nickel	40 U	14.4 J	13.8 J	16.1 J	40 U	40 U	40 U	16.3 J
Potassium	1930 J	3300 J	3560 J	2170 J	1720 J	2970 J	1740 J	5160
Selenium	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Silver	10 U	10 U	10 U	10 U	10 U	10 U	5.7 J	4.5 J
Sodium	3340 J	4350 J	3510 J	6480	10600	6550	7970	4670 J
Thallium	5.2 J	3.6 J	3.9 J	3.1 J	10 U	10 U	3.5 J	10 U
Vanadium	11.8 J	38.6 J	62.1	18.4 J	32.7 J	38.8 J	38.5 J	123
Zinc	21 U	34.5	30.1	31.2	16.2 U	18.6 U	14.9 U	43.3

NOTES:
J = Estimated value
U = Not detected.
ND = Not detected
ug/l = micrograms per liter

TABLE 4-13 (Continued)

DETECTION SUMMARY
GROUNDWATER - TOTAL INORGANIC CONSTITUENTS
SITE 10 - ORIGINAL BASE LANDFILL
MCB, CAMP LEJEUNE, NORTH CAROLINA
SITE INVESTIGATION, CTO-0369

SAMPLE ID	IR10-TW09-98A	10-MW0201A	10-MW0301A	10-MW0401A	10-MW0401ADUP	10-MW0601A	10-MW0801A	10-MW0901A
LAB SAMPLE ID	NA	Q1920-1	Q1920-2	Q1920-3	Q1920-4	Q1920-5	Q1920-6	Q1920-7
SAMPLE DATE	03-22-1998	3/1/01	3/1/01	3/1/01	3/1/01	3/1/01	3/1/01	3/1/01
METALS (ug/l)								
Aluminum	24400 J	186 U	560 J	899 J	861 J	398 J	1780 J	3150 J
Antimony	25.2 U	2.5 U	2.5 U	2.5 U	2.5 U	2.5 U	2.5 U	2.5 U
Arsenic	10 U	4.2 U	4.2 U	4.2 U	4.2 U	4.2 U	4.2 U	4.2 U
Barium	61.8 J	24.5 J	29.7 J	29 J	28.9 J	26.6 J	17.6 J	27.3 J
Beryllium	5 U	0.18 U	0.24 U	0.22 U	0.22 U	0.21 U	0.21 U	0.2 U
Cadmium	5 U	0.6 U	0.6 U	0.6 U	0.6 U	0.6 U	0.6 U	0.6 U
Calcium	13500	19300	1720 J	727 J	728 J	62400	770 J	12600
Chromium	55.1	4.3 U	5.4 U	3.6 U	3 U	0.6 U	4 U	8.4 J
Cobalt	3.7 J	0.87 J	1.4 J	0.7 U	1.2 J	0.7 U	0.88 J	0.82 J
Copper	37.7	1.6 J	2.5 J	0.88 J	1 J	0.7 U	0.99 J	3.4 J
Cyanide, total	10 U	NA	NA	NA	NA	NA	NA	NA
Iron	12000	140 J	558 J	373 J	401 J	94.9 J	493 J	1110 J
Lead	43.6	1.7 U	1.7 U	1.7 U	1.7 U	1.7 U	1.7 U	2.9 J
Magnesium	2220 J	911 J	663 J	488 J	486 J	4910 J	577 J	2100 J
Manganese	114	24.1	25.7	14.5 J	14.3 J	21.8	18.7	49.8
Mercury	0.3	0.1 UJ	0.1 UJ	0.1 UJ	0.1 UJ	0.1 UJ	0.1 UJ	0.1 UJ
Nickel	8.6 J	9 J	10.6 J	6.4 J	6.4 J	1.8 J	5.6 J	8.8 J
Potassium	2560 J	1360 J	846 J	259 J	229 J	2600 J	451 J	2170 J
Selenium	5 U	4.8 U	4.8 U	4.8 U	4.8 U	4.8 U	4.8 U	4.8 U
Silver	10 U	0.5 U	0.5 U	0.58 J	0.5 U	0.5 U	0.5 U	0.5 U
Sodium	9750	8030 J	5640 J	7210 J	7020 J	14000 J	4500 J	10700 J
Thallium	3.3 J	6.2 U	6.2 U	6.2 U	6.2 U	6.2 U	6.2 U	6.2 U
Vanadium	32.8 J	0.7 U	0.7 U	0.99 J	1.1 J	0.95 J	3 J	4.2 J
Zinc	72.1	1.1 U	1.1 U	1.1 U	1.1 U	1.1 U	2.5 J	8.3 J

NOTES:
J = Estimated value
U = Not detected.
ND = Not detected
ug/l = micrograms per liter

TABLE 4-13 (Continued)

DETECTION SUMMARY
GROUNDWATER - TOTAL INORGANIC CONSTITUENTS
SITE 10 - ORIGINAL BASE LANDFILL
MCB, CAMP LEJEUNE, NORTH CAROLINA
SITE INVESTIGATION, CTO-0369

SAMPLE ID LAB SAMPLE ID SAMPLE DATE	Minimum Non-Detect	Maximum Non-Detect	Minimum Detected	Maximum Detected	Location of Maximum Detect	Frequency of Detection	Arithmatic Mean Positive Detects	Median Positive Detects
METALS (ug/l)								
Aluminum	186 U	186 U	398 J	78800 J	IR10-TW08-98A	15/16	20296.53	16600
Antimony	2.5 U	60 U	ND	ND	ND	0/16	ND	ND
Arsenic	4.2 U	10 U	6 J	18.2	IR10-TW08-98A	5/16	12.18	13.9
Barium	ND	ND	17.6 J	186 J	IR10-TW08-98A	16/16	56.84	38.25
Beryllium	0.18 U	5 U	0.65 J	0.65 J	IR10-TW08-98A	1/16	0.65	0.65
Cadmium	0.6 U	5 U	ND	ND	ND	0/16	ND	ND
Calcium	ND	ND	727 J	62400	10-MW0601A	16/16	12310.31	2455
Chromium	0.6 U	5.4 U	8.4 J	136	IR10-TW08-98A	10/16	59.05	51.75
Cobalt	0.7 U	50 U	0.82 J	10.5 J	IR10-TW08-98A	13/16	3.91	3.8
Copper	0.7 U	10.8 U	0.88 J	37.7	IR10-TW09-98A	11/16	12.45	3.4
Cyanide, total	10 U	10 U	ND	ND	ND	0/9	ND	ND
Iron	ND	ND	94.9 J	28400	IR10-TW08-98A	16/16	7799.37	5930
Lead	1.7 U	1.7 U	2.9 J	54.8	IR10-TW08-98A	10/16	24.94	22.65
Magnesium	ND	ND	486 J	4910 J	10-MW0601A	16/16	1877.56	1675
Manganese	ND	ND	14.3 J	146	IR10-TW08-98A	16/16	61.96	49.45
Mercury	0.1 UJ	0.2 U	0.033 J	0.3	IR10-TW08-98A,IR10-TW09-98A	8/16	0.13	0.09
Nickel	40 U	40 U	1.8 J	16.3 J	IR10-TW08-98A	12/16	9.82	8.9
Potassium	ND	ND	229 J	5160	IR10-TW08-98A	16/16	2064.06	2050
Selenium	4.8 U	5 U	ND	ND	ND	0/16	ND	ND
Silver	0.5 U	10 U	0.58 J	5.7 J	IR10-TW07-98A	3/16	3.59	4.5
Sodium	ND	ND	3340 J	14000 J	10-MW0601A	16/16	7145	6785
Thallium	6.2 U	10 U	3.1 J	5.2 J	IR10-TW01-98A	6/16	3.77	3.55
Vanadium	0.7 U	0.7 U	0.95 J	123	IR10-TW08-98A	14/16	29.07	25.55
Zinc	1.1 U	21 U	2.5 J	72.1	IR10-TW09-98A	7/16	31.71	31.2

NOTES:
J = Estimated value
U = Not detected.
ND = Not detected
ug/l = micrograms per liter

TABLE 4-14

DATA SUMMARY
GROUNDWATER - INORGANIC CONSTITUENTS and CYANIDE
SITE 10 - ORIGINAL BASE LANDFILL
MCB, CAMP LEJEUNE, NORTH CAROLINA
SITE INVESTIGATION, CTO-0369

SAMPLE DATE	USEPA Maximum Contaminant Levels (ug/L)	North Carolina Method I, Category G-1 Target Concentrations	North Carolina Method I, Category G-3 Target Concentrations (250)	Minimum Detected	Maximum Detected	Location of Maximum Detect	US - Primary Maximum Contaminant Levels (ug/L) Exceedance Count	North Carolina Method I, Category G-1 Target Concentrations Exceedance Count	North Carolina Method I, Category G-3 Target Concentrations (250) Exceedance Count
METALS (ug/l)									
Aluminum	NE	NE	NE	398 J	78800 J	IR10-TW08-98A	0	0	0
Arsenic	50	50	0.125	6 J	18.2	IR10-TW08-98A	0	0	5
Barium	2000	2000	NE	17.6 J	186 J	IR10-TW08-98A	0	0	0
Beryllium	4	NE	0.000293	0.65 J	0.65 J	IR10-TW08-98A	0	0	1
Calcium	NE	NE	NE	727 J	62400	10-MW0601A	0	0	0
Chromium	100	50	0.05	8.4 J	136	IR10-TW08-98A	2	5	10
Cobalt	NE	NE	NE	0.82 J	10.5 J	IR10-TW08-98A	0	0	0
Copper	1300	1000	0.0075	0.88 J	37.7	IR10-TW09-98A	0	0	11
Iron	NE	300	2.5	94.9 J	28400	IR10-TW08-98A	0	14	16
Lead	15	15	0.625	2.9 J	54.8	IR10-TW08-98A	5	5	10
Magnesium	NE	NE	NE	486 J	4910 J	10-MW0601A	0	0	0
Manganese	NE	50	0.25	14.3 J	146	IR10-TW08-98A	0	7	16
Mercury	2	1.1	0.00003	0.033 J	0.3	IR10-TW08-98A,IR10-TW09-98A	0	0	8
Nickel	100	100	0.0208	1.8 J	16.3 J	IR10-TW08-98A	0	0	12
Potassium	NE	NE	NE	229 J	5160	IR10-TW08-98A	0	0	0
Silver	NE	18	0.00015	0.58 J	5.7 J	IR10-TW07-98A	0	0	3
Sodium	NE	NE	NE	3340 J	14000 J	10-MW0601A	0	0	0
Thallium	2	NE	0.0158	3.1 J	5.2 J	IR10-TW01-98A	6	0	6
Vanadium	NE	NE	NE	0.95 J	123	IR10-TW08-98A	0	0	0
Zinc	NE	2100	0.125	2.5 J	72.1	IR10-TW09-98A	0	0	7

NOTES:
J = Estimated value
NE = Not established
ND = Not detected
ug/l = micrograms per liter

TABLE 4-15

DETECTION SUMMARY
SURFACE WATER - ORGANIC COMPOUNDS
SITE 10 - ORIGINAL BASE LANDFILL
MCB, CAMP LEJEUNE, NORTH CAROLINA
SITE INVESTIGATION, CTO-0369

SAMPLE ID	IR10-SW01	IR10-SW02	IR10-SW03	IR10-SW04	IR10-SW05	IR10-SW06
SAMPLE DATE	03-21-1998	03-21-1998	03-21-1998	03-21-1998	03-21-1998	03-21-1998
VOLATILES (ug/l)						
Toluene	10 U	10 U	1.3 J	1.3 J	10 U	10 U

NOTES:

J = Estimated value

U = Not detected.

ug/l = micrograms per liter

TABLE 4-15

DETECTION SUMMARY
SURFACE WATER - ORGANIC COMPOUNDS
SITE 10 - ORIGINAL BASE LANDFILL
MCB, CAMP LEJEUNE, NORTH CAROLINA
SITE INVESTIGATION, CTO-0369

SAMPLE ID SAMPLE DATE	Minimum Non-Detect	Maximum Non-Detect	Minimum Detected	Maximum Detected	Location of Maximum Detect	Frequency of Detection	Arithmatic Mean Positive Detects	Median Positive Detects
VOLATILES (ug/l)								
Toluene	10 U	10 U	1.3 J	1.3 J	IR10-SW03,IR10-SW04	2/6	1.3	1.3

NOTES:

J = Estimated value

U = Not detected.

ug/l = micrograms per liter

TABLE 4-16

DETECTION SUMMARY
SURFACE WATER - TOTAL INORGANIC CONSTITUENTS
SITE 10 - ORIGINAL BASE LANDFILL
MCB, CAMP LEJEUNE, NORTH CAROLINA
SITE INVESTIGATION, CTO-0369

SAMPLE ID	IR10-SW01	IR10-SW02	IR10-SW03	IR10-SW04	IR10-SW05	IR10-SW06
SAMPLE DATE	03-21-1998	03-21-1998	03-21-1998	03-21-1998	03-21-1998	03-21-1998
METALS (ug/l)						
Aluminum	156 J	171 J	127 J	931	1270	253
Arsenic	3.4 J	2.7 J	2.4 J	5 J	10 U	2.6 J
Barium	24 J	24.3 J	25.8 J	37.1 J	8.2 J	4.2 U
Calcium	26700	26900	30500	33200	2470 J	2340 J
Copper	2.5 U	3.4 U	3 J	10.7 U	7.8 U	4.9 U
Iron	577	895	424	2210	822	598
Lead	1.5 J	2.3 J	1.1 J	7.1	1.8 J	3 U
Magnesium	2250 J	2270 J	2470 J	2410 J	949 J	1030 J
Manganese	60.9	45.9	153	415	101	92.6
Mercury	0.2 U	0.05 J	0.2 U	0.06 J	0.04 J	0.032 J
Potassium	937 J	1010 J	1250 J	1860 J	5000 U	5000 U
Sodium	5440	5380	5890	6040	3080 J	3190 J
Vanadium	18 J	13.8 J	17.8 J	19.8 J	18 J	12.6 J
Zinc	39.9	45.4	49.7	95.9	52.5	45.3

NOTES:
J = Estimated value
U = Not detected.
ND = Not detected
ug/l = micrograms per liter

TABLE 4-16

DETECTION SUMMARY
SURFACE WATER - TOTAL INORGANIC CONSTITUENTS
SITE 10 - ORIGINAL BASE LANDFILL
MCB, CAMP LEJEUNE, NORTH CAROLINA
SITE INVESTIGATION, CTO-0369

SAMPLE ID SAMPLE DATE	Minimum Non-Detect	Maximum Non-Detect	Minimum Detected	Maximum Detected	Location of Maximum Detect	Frequency of Detection	Arithmatic Mean Positive Detects	Median Positive Detects
METALS (ug/l)								
Aluminum	ND	ND	127 J	1270	IR10-SW05	6/6	484.67	212.00
Arsenic	10 U	10 U	2.4 J	5 J	IR10-SW04	5/6	3.22	2.70
Barium	4.2 U	4.2 U	8.2 J	37.1 J	IR10-SW04	5/6	23.88	24.30
Calcium	ND	ND	2340 J	33200	IR10-SW04	6/6	20351.67	26800.00
Copper	2.5 U	10.7 U	3 J	3 J	IR10-SW03	1/6	3.00	3.00
Iron	ND	ND	424	2210	IR10-SW04	6/6	921.00	710.00
Lead	3 U	3 U	1.1 J	7.1	IR10-SW04	5/6	2.76	1.80
Magnesium	ND	ND	949 J	2470 J	IR10-SW03	6/6	1896.50	2260.00
Manganese	ND	ND	45.9	415	IR10-SW04	6/6	144.73	96.80
Mercury	0.2 U	0.2 U	0.032 J	0.06 J	IR10-SW04	4/6	0.05	0.05
Potassium	5000 U	5000 U	937 J	1860 J	IR10-SW04	4/6	1264.25	1130.00
Sodium	ND	ND	3080 J	6040	IR10-SW04	6/6	4836.67	5410.00
Vanadium	ND	ND	12.6 J	19.8 J	IR10-SW04	6/6	16.67	17.90
Zinc	ND	ND	39.9	95.9	IR10-SW04	6/6	54.78	47.55

NOTES:
J = Estimated value
U = Not detected.
ND = Not detected
ug/l = micrograms per liter

TABLE 4-17

DATA SUMMARY
SURFACE WATER - ORGANIC AND INORGANIC COMPOUNDS
SITE 10 - ORIGINAL BASE LANDFILL
MCB, CAMP LEJEUNE, NORTH CAROLINA
SITE INVESTIGATION, CTO-0369

Analyte	Lowest Wildlife Drinking Water Benchmark[1]	No. of Positive Detects/No. of Samples	Range of Positive Detections	No. Of Positive Detects Above Benchmark	Max. HQ	Ecological Contaminant of Concern ?	Comments
Volatiles (µg/L)							
Toluene	60,.300	2/6	1.3J - 1.3J	0	2.2e-5	No	Below Benchmark Value
Inorganics (µg/L)							
Aluminum	4,474	6/6	127J - 1,270	0	0.28	No	Below Benchmark Value
Arsenic	292	5/6	2.4J - 5J	0	0.17	No	Below Benchmark Value
Barium	23,100	5/6	8.2J - 37.1J	0	0.002	No	Below Benchmark Value
Calcium	NA	6/6	2,340J - 33,200	NA	NA	No	Low Toxicity
Copper	65,200	1/6	3J	0	4.6e-5	No	Below Benchmark Value
Iron	NA	6/6	424 - 2,210	NA	NA	Yes	
Lead	4,860	5/6	1.1J - 7.1	0	0.001	No	Below Benchmark Value
Magnesium	NA	6/6	949J - 2,470J	NA	NA	No	Low Toxicity
Manganese	377,000	6/6	45.9 - 415	0	0.001	No	Below Benchmark Value
Mercury	28	4/6	0.032J - 0.06J	0	0.002	No	Below Benchmark Value
Potassium	NA	4/6	937J - 1,860J	NA	NA	No	Low Toxicity
Sodium	NA	6/6	3,080J - 6,040	NA	NA	No	Low Toxicity
Vanadium	835	6/6	12.6J - 19.8J	0	0.024	No	Below Benchmark Value
Zinc	62,300	6/6	39.9 - 95.9	0	0.002	No	Below Benchmark Value

Notes:

Highlighted areas represent hazard quotients greater than one or analytes that did not have a benchmark with which to assess the analyte.

HQ Hazard Quotient
J Analyte was positively identified, value is estimated
NA Not Applicable
µg/L micrograms per liter

[1] Region IV BTAG values used

TABLE 4-18

DETECTION SUMMARY
SEDIMENT - ORGANIC COMPOUNDS
SITE 10 - ORIGINAL BASE LANDFILL
MCB, CAMP LEJEUNE, NORTH CAROLINA
SITE INVESTIGATION, CTO-0369

SAMPLE ID	IR10-SD01-06	IR10-SD02-06	IR10-SD03-06	IR10-SD04-06	IR10-SD05-06	IR10-SD06-06
SAMPLE DATE	03-21-1998	03-21-1998	03-21-1998	03-21-1998	03-21-1998	03-21-1998
DEPTH	0 - 6'	0 - 6'	0 - 6'	0 - 6'	0 - 6'	0 - 6'
VOLATILES (ug/kg)						
2-Butanone	52	14 U	13 U	18 U	14 UJ	15 U
Toluene	22	16	4.2 J	97	7.4 J	16
PESTICIDES/PCBS (ug/kg)						
4,4'-DDT	4.7 U	4.5 U	4.4 U	6.1 U	4 J	4 J
Endrin aldehyde	4.7 U	4.5 U	4.4 U	6.1 U	4.7 U	3.1 J

NOTES:
J = Estimated value
U = Not detected.
ND = Not detected
ug/kg = micrograms per kilograms

TABLE 4-18

DETECTION SUMMARY
SEDIMENT - ORGANIC COMPOUNDS
SITE 10 - ORIGINAL BASE LANDFILL
MCB, CAMP LEJEUNE, NORTH CAROLINA
SITE INVESTIGATION, CTO-0369

SAMPLE ID SAMPLE DATE DEPTH	Minimum Non-Detect	Maximum Non-Detect	Minimum Detected	Maximum Detected	Location of Maximum Detect 5	Frequency of Detection	Arithmatic Mean Positive Detects	Median Positive Detects
VOLATILES (ug/kg)								
2-Butanone	13 U	18 U	52	52	IR10-SD01-06	1/6	52	52
Toluene	ND	ND	4.2 J	97	IR10-SD04-06	6/6	27.1	16
PESTICIDES/PCBS (ug/kg)								
4,4'-DDT	4.4 U	6.1 U	4 J	4 J	IR10-SD05-06,IR10-SD06-06	2/6	4	4
Endrin aldehyde	4.4 U	6.1 U	3.1 J	3.1 J	IR10-SD06-06	1/6	3.1	3.1

NOTES:
J = Estimated value
U = Not detected.
ND = Not detected
ug/kg = micrograms per kilograms

TABLE 4-19

DATA SUMMARY
SEDIMENT - ORGANIC COMPOUNDS
SITE 10 - ORIGINAL BASE LANDFILL
MCB, CAMP LEJEUNE, NORTH CAROLINA
SITE INVESTIGATION, CTO-0369

Analyte	Region IV Surface Soil Screening Levels (SSSLs)[1]	No. of Positive Detects/No. of Samples	Range of Positive Detections	No. of Positive Detects Above SSSL	Max. HQ	Ecological Contaminant of Concern ?	Comments
Volatiles (µg/kg)							
2-Butanone	NA	1/6	52	NA	NA	Yes	
Toluene	50	6/6	4.2J - 97	1	1.94	Yes	
Pesticides/PCBs (µg/kg)							
4,4'-DDT	2.5	2/6	4J - 4J	2	1.60	Yes	
Endrin Aldehyde	1[3]	1/6	3.1J	1	3.10	Yes	

Notes:

HQ Hazard Quotient
J Value Estimated
NA Not Applicable
SSSL Surface Soil Screening Level
mg/kg micrograms per kilogram
µg/L micrograms per liter

(1) Region IV BTAG values used
(2) Value for Pyrene used as a conservative measure
(3) Endrin used as a surrogate for endrin aldehyde
(4) Value used for total PCBs

TABLE 4-20

DETECTION SUMMARY
SEDIMENT - TOTAL INORGANIC CONSTITUENTS
SITE 10 - ORIGINAL BASE LANDFILL
MCB, CAMP LEJEUNE, NORTH CAROLINA
SITE INVESTIGATION, CTO-0369

SAMPLE ID	IR10-SD01-06	IR10-SD02-06	IR10-SD03-06	IR10-SD04-06	IR10-SD05-06	IR10-SD06-06
SAMPLE DATE	03-21-1998	03-21-1998	03-21-1998	03-21-1998	03-21-1998	03-21-1998
DEPTH	0 - 6'	0 - 6'	0 - 6'	0 - 6'	0 - 6'	0 - 6'
METALS (mg/kg)						
Aluminum	3040 J	834 J	1100 J	1090 J	3150 J	2960 J
Barium	12.3 J	1.9 J	3.5 J	18.2 J	5.8 J	5.9 J
Calcium	579 J	113 J	262 J	1630 J	200 J	251 J
Copper	4 J	2.2 U	1.3 U	3.5 J	2.9 U	2.8 U
Iron	544 J	191 J	225 J	802 J	872 J	1110 J
Lead	8.4	4	4	22.7	4.9	5.4
Magnesium	82 J	29.4 J	48.6 J	118 J	106 J	122 J
Manganese	6.7	1.2 J	2.5 J	4.9 J	5.1	6.7
Mercury	0.14 U	0.14 U	0.06 J	0.18 U	0.047 J	0.15 U
Potassium	1430 U	182 J	1330 U	246 J	233 J	1550 U
Selenium	1.4 U	0.76 J	1.3 U	1.8 U	1.4 U	1.5 U
Vanadium	14.3 U	13.6 U	13.3 U	18.4 U	3.9 J	3.4 J
Zinc	10	7.8	7.3	12.1	7.2	8.9

NOTES:
J = Estimated value
U = Not detected.
ND = Not detected
mg/kg = milligrams per kilograms

TABLE 4-20

DETECTION SUMMARY
SEDIMENT - TOTAL INORGANIC CONSTITUENTS
SITE 10 - ORIGINAL BASE LANDFILL
MCB, CAMP LEJEUNE, NORTH CAROLINA
SITE INVESTIGATION, CTO-0369

SAMPLE ID SAMPLE DATE DEPTH	Minimum Non-Detect	Maximum Non-Detect	Minimum Detected	Maximum Detected	Location of Maximum Detect	Frequency of Detection	Arithmatic Mean Positive Detects	Median Positive Detects
METALS (mg/kg)								
Aluminum	ND	ND	834 J	3150 J	IR10-SD05-06	6/6	2029	2030
Barium	ND	ND	1.9 J	18.2 J	IR10-SD04-06	6/6	7.93	5.85
Calcium	ND	ND	113 J	1630 J	IR10-SD04-06	6/6	505.83	256.5
Copper	1.3 U	2.9 U	3.5 J	4 J	IR10-SD01-06	2/6	3.75	3.75
Iron	ND	ND	191 J	1110 J	IR10-SD06-06	6/6	624	673
Lead	ND	ND	4	22.7	IR10-SD04-06	6/6	8.23	5.15
Magnesium	ND	ND	29.4 J	122 J	IR10-SD06-06	6/6	84.33	94
Manganese	ND	ND	1.2 J	6.7	IR10-SD01-06,IR10-SD06-06	6/6	4.52	5
Mercury	0.14 U	0.18 U	0.047 J	0.06 J	IR10-SD03-06	2/6	0.05	0.05
Potassium	1330 U	1550 U	182 J	246 J	IR10-SD04-06	3/6	220.33	233
Selenium	1.3 U	1.8 U	0.76 J	0.76 J	IR10-SD02-06	1/6	0.76	0.76
Vanadium	13.3 U	18.4 U	3.4 J	3.9 J	IR10-SD05-06	2/6	3.65	3.65
Zinc	ND	ND	7.2	12.1	IR10-SD04-06	6/6	8.88	8.35

NOTES:
J = Estimated value
U = Not detected.
ND = Not detected
mg/kg = milligrams per kilograms

TABLE 4-21

DATA SUMMARY
SEDIMENT - INORGANIC COMPOUNDS
SITE 10 - ORIGINAL BASE LANDFILL
MCB, CAMP LEJEUNE, NORTH CAROLINA
SITE INVESTIGATION, CTO-0369

Analyte	Region IV Surface Soil Screening Levels (SSSLs)[1]	No. of Positive Detects/No. of Samples	Range of Positive Detections	No. of Positive Detects Above SSSL	Max. HQ	Ecological Contaminant of Concern ?	Comments
Inorganics (mg/kg):							
Aluminum	NA	6/6	834J - 3,150J	NA	NA	Yes	
Barium	200	6/6	1.9J - 18.2J	0	0.09	No	Below SSSL
Calcium	NA	6/6	113J - 1,630J	NA	NA	No	Low Toxicity
Copper	36	2/6	3.5J - 4J	0	0.11	No	Below SSSL
Iron	NA	6/6	191J - 1,110J	NA	NA	Yes	
Lead	70	6/6	4 - 22.7	0	0.32	No	Below SSSL
Magnesium	NA	6/6	29.4J - 122J	NA	NA	No	Low Toxicity
Manganese	NA	6/6	1.2J - 6.7	NA	NA	Yes	
Mercury	0.3	2/6	0.047J - 0.06J	0	0.20	No	Below SSSL
Potassium	NA	3/6	182J - 246J	NA	NA	No	Low Toxicity
Selenium	NA	1/6	0.76J - 0.76J	NA	NA	Yes	
Vanadium	130	2/6	3.4J - 3.9J	0	0.03	No	Below SSSL
Zinc	140	6/6	7.2 - 12.1	0	0.09	No	Below SSSL

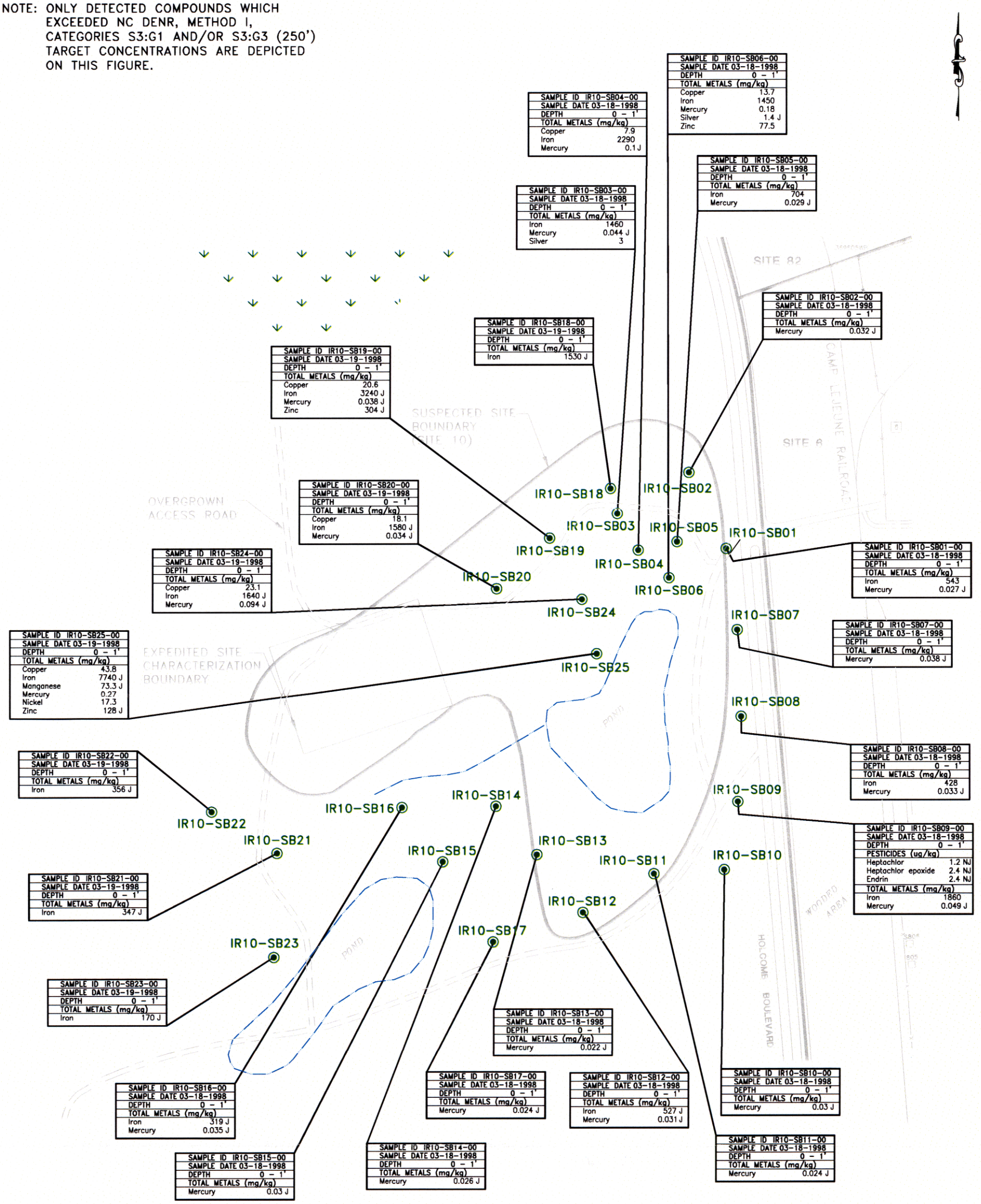
Notes:

HQ Hazard Quotient
J Value Estimated
NA Not Applicable
SSSL Surface Soil Screening Level
mg/kg micrograms per kilogram
µg/L micrograms per liter

(1) Region IV BTAG values used
(2) Value for Pyrene used as a conservative measure
(3) Endrin used as a surrogate for endrin aldehyde
(4) Value used for total PCBs

SECTION 4.0 FIGURES

NOTE: ONLY DETECTED COMPOUNDS WHICH EXCEEDED NC DENR, METHOD I, CATEGORIES S3:G1 AND/OR S3:G3 (250') TARGET CONCENTRATIONS ARE DEPICTED ON THIS FIGURE.



SAMPLE ID IR10-SB04-00	
SAMPLE DATE 03-18-1998	
DEPTH	0 - 1'
TOTAL METALS (mg/kg)	
Copper	7.9
Iron	2290
Mercury	0.1 J

SAMPLE ID IR10-SB06-00	
SAMPLE DATE 03-18-1998	
DEPTH	0 - 1'
TOTAL METALS (mg/kg)	
Copper	13.7
Iron	1450
Mercury	0.18
Silver	1.4 J
Zinc	77.5

SAMPLE ID IR10-SB05-00	
SAMPLE DATE 03-18-1998	
DEPTH	0 - 1'
TOTAL METALS (mg/kg)	
Iron	704
Mercury	0.029 J

SAMPLE ID IR10-SB03-00	
SAMPLE DATE 03-18-1998	
DEPTH	0 - 1'
TOTAL METALS (mg/kg)	
Iron	1460
Mercury	0.044 J
Silver	3

SAMPLE ID IR10-SB02-00	
SAMPLE DATE 03-18-1998	
DEPTH	0 - 1'
TOTAL METALS (mg/kg)	
Mercury	0.032 J

SAMPLE ID IR10-SB18-00	
SAMPLE DATE 03-19-1998	
DEPTH	0 - 1'
TOTAL METALS (mg/kg)	
Iron	1530 J

SAMPLE ID IR10-SB19-00	
SAMPLE DATE 03-19-1998	
DEPTH	0 - 1'
TOTAL METALS (mg/kg)	
Copper	20.6
Iron	3240 J
Mercury	0.038 J
Zinc	304 J

SAMPLE ID IR10-SB20-00	
SAMPLE DATE 03-19-1998	
DEPTH	0 - 1'
TOTAL METALS (mg/kg)	
Copper	18.1
Iron	1580 J
Mercury	0.034 J

SAMPLE ID IR10-SB01-00	
SAMPLE DATE 03-18-1998	
DEPTH	0 - 1'
TOTAL METALS (mg/kg)	
Iron	543
Mercury	0.027 J

SAMPLE ID IR10-SB24-00	
SAMPLE DATE 03-19-1998	
DEPTH	0 - 1'
TOTAL METALS (mg/kg)	
Copper	23.1
Iron	1640 J
Mercury	0.094 J

SAMPLE ID IR10-SB07-00	
SAMPLE DATE 03-18-1998	
DEPTH	0 - 1'
TOTAL METALS (mg/kg)	
Mercury	0.038 J

SAMPLE ID IR10-SB25-00	
SAMPLE DATE 03-19-1998	
DEPTH	0 - 1'
TOTAL METALS (mg/kg)	
Copper	43.8
Iron	7740 J
Manganese	73.3 J
Mercury	0.27
Nickel	17.3
Zinc	128 J

SAMPLE ID IR10-SB08-00	
SAMPLE DATE 03-18-1998	
DEPTH	0 - 1'
TOTAL METALS (mg/kg)	
Iron	428
Mercury	0.033 J

SAMPLE ID IR10-SB22-00	
SAMPLE DATE 03-19-1998	
DEPTH	0 - 1'
TOTAL METALS (mg/kg)	
Iron	356 J

SAMPLE ID IR10-SB09-00	
SAMPLE DATE 03-18-1998	
DEPTH	0 - 1'
PESTICIDES (ug/kg)	
Heptachlor	1.2 NJ
Heptachlor epoxide	2.4 NJ
Endrin	2.4 NJ
TOTAL METALS (mg/kg)	
Iron	1860
Mercury	0.049 J

SAMPLE ID IR10-SB21-00	
SAMPLE DATE 03-19-1998	
DEPTH	0 - 1'
TOTAL METALS (mg/kg)	
Iron	347 J

SAMPLE ID IR10-SB23-00	
SAMPLE DATE 03-19-1998	
DEPTH	0 - 1'
TOTAL METALS (mg/kg)	
Iron	170 J

SAMPLE ID IR10-SB13-00	
SAMPLE DATE 03-18-1998	
DEPTH	0 - 1'
TOTAL METALS (mg/kg)	
Mercury	0.022 J

SAMPLE ID IR10-SB16-00	
SAMPLE DATE 03-18-1998	
DEPTH	0 - 1'
TOTAL METALS (mg/kg)	
Iron	319 J
Mercury	0.035 J

SAMPLE ID IR10-SB17-00	
SAMPLE DATE 03-18-1998	
DEPTH	0 - 1'
TOTAL METALS (mg/kg)	
Mercury	0.024 J

SAMPLE ID IR10-SB12-00	
SAMPLE DATE 03-18-1998	
DEPTH	0 - 1'
TOTAL METALS (mg/kg)	
Iron	527 J
Mercury	0.031 J

SAMPLE ID IR10-SB10-00	
SAMPLE DATE 03-18-1998	
DEPTH	0 - 1'
TOTAL METALS (mg/kg)	
Mercury	0.03 J

SAMPLE ID IR10-SB15-00	
SAMPLE DATE 03-18-1998	
DEPTH	0 - 1'
TOTAL METALS (mg/kg)	
Mercury	0.03 J

SAMPLE ID IR10-SB14-00	
SAMPLE DATE 03-18-1998	
DEPTH	0 - 1'
TOTAL METALS (mg/kg)	
Mercury	0.026 J

SAMPLE ID IR10-SB11-00	
SAMPLE DATE 03-18-1998	
DEPTH	0 - 1'
TOTAL METALS (mg/kg)	
Mercury	0.024 J

300 0 150 300

1 inch = 300 ft.

Baker

Baker Environmental, Inc.

369617WP

LEGEND

- SOIL BORING LOCATION
- SITE BOUNDARY
- WETLANDS
- OVERGROWN ACCESS ROAD

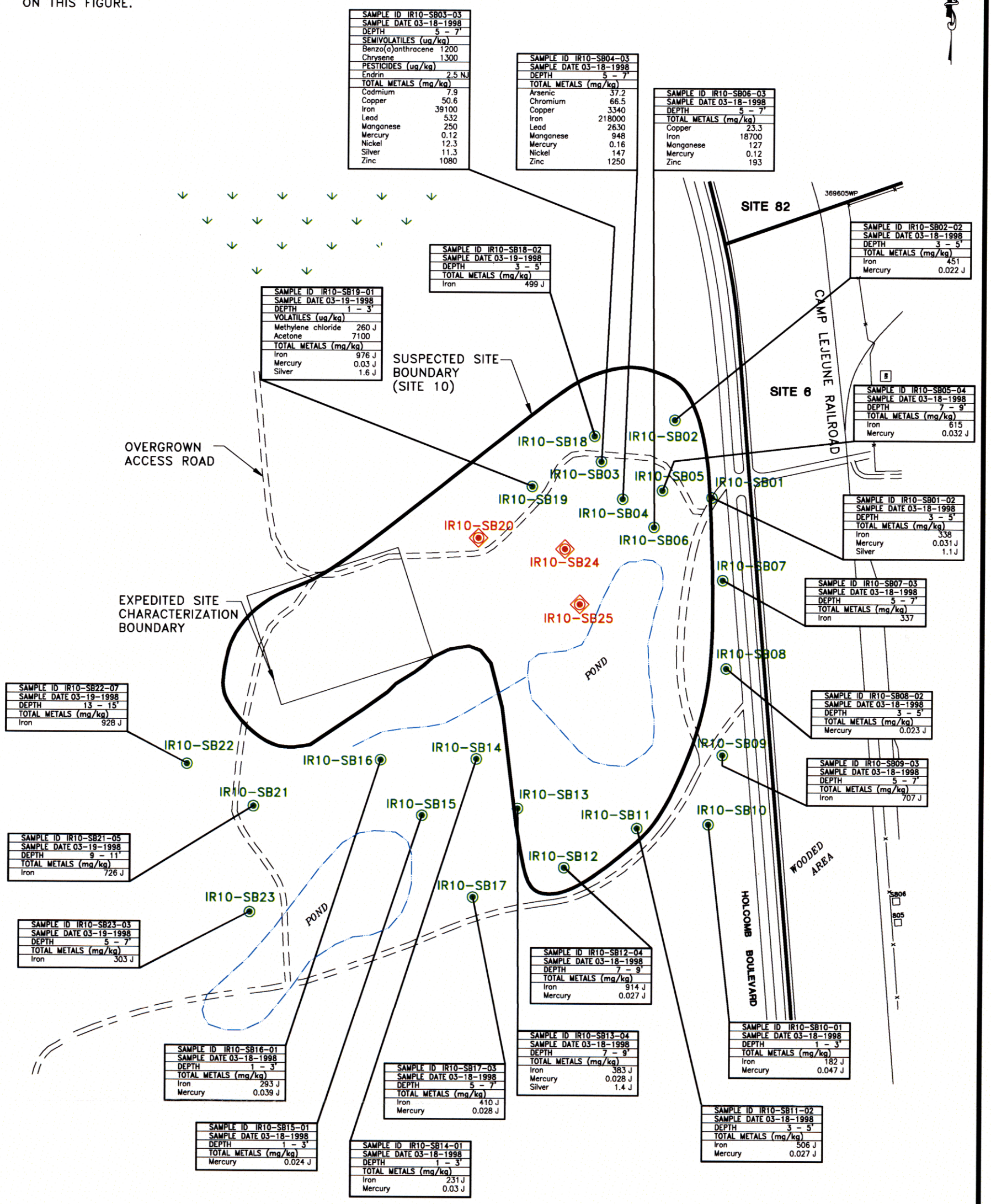
mg/kg - MILLIGRAMS PER KILOGRAM
ug/kg - MICROGRAMS PER KILOGRAM
J - ESTIMATED

SOURCE: LANTDIV, OCT. 1991

FIGURE 4-1
SURFACE SOIL SAMPLES CONTAINING ORGANIC AND INORGANIC COMPOUNDS IN EXCESS OF COMPARISON CRITERIA
SITE 10, ORIGINAL BASE LANDFILL
SITE INVESTIGATION, CTO - 0369

MARINE CORPS BASE, CAMP LEJEUNE
NORTH CAROLINA

NOTE: ONLY DETECTED COMPOUNDS WHICH EXCEEDED NC DENR, METHOD I, CATEGORIES S3:G1 AND/OR S3:G3 (250') TARGET CONCENTRATIONS ARE DEPICTED ON THIS FIGURE.



LEGEND

- SOIL BORING LOCATION
- SUBSURFACE SOIL SAMPLE NOT TAKEN DUE TO LOW WATER TABLE
- SITE BOUNDARY
- WETLANDS
- OVERGROWN ACCESS ROAD

mg/kg – MILLIGRAMS PER KILOGRAM
ug/kg – MICROGRAMS PER KILOGRAM
J – ESTIMATED

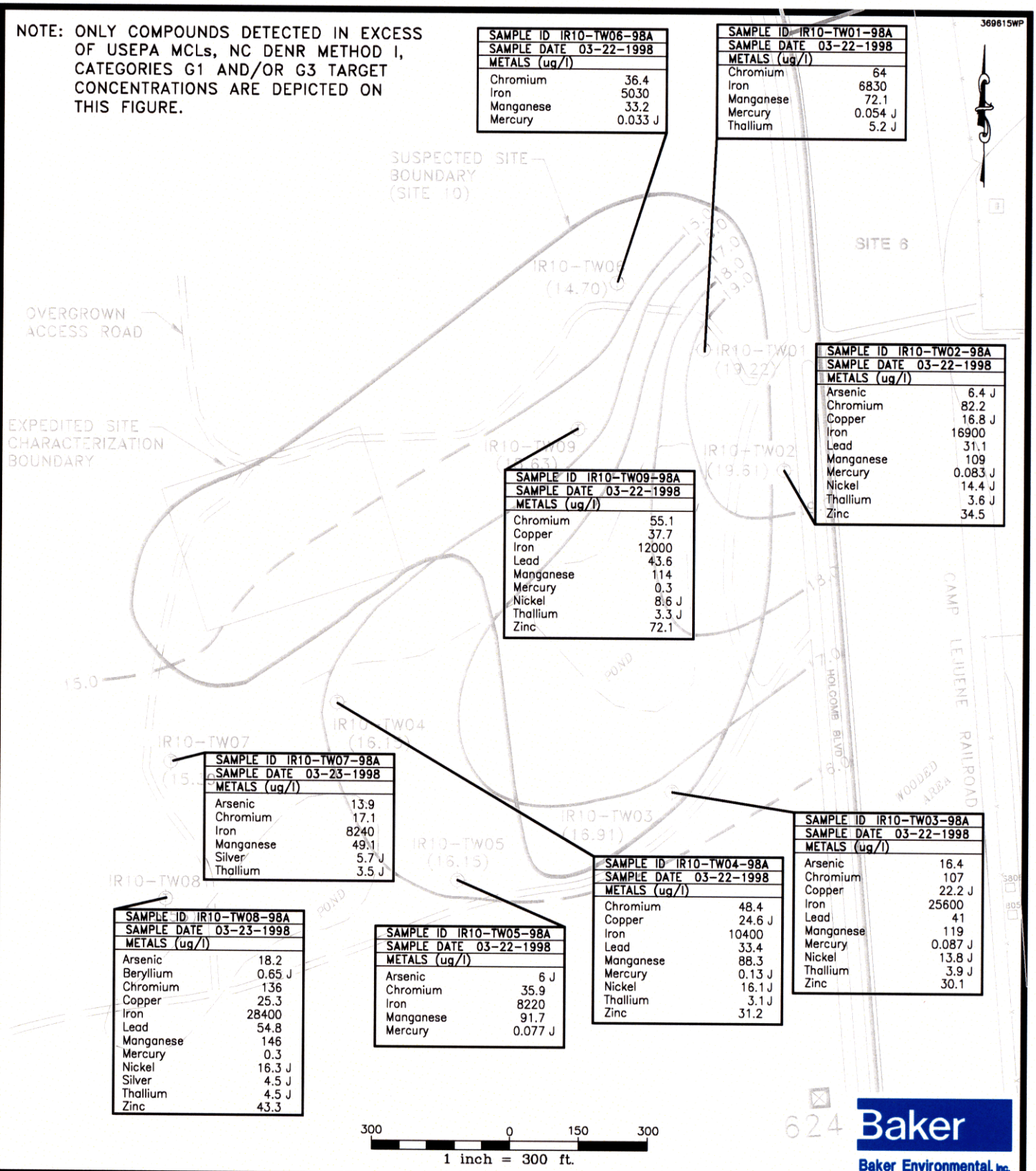
SOURCE: LANTDIV, OCT. 1991

FIGURE 4-2
SUBSURFACE SOIL SAMPLES CONTAINING ORGANIC AND INORGANIC COMPOUNDS IN EXCESS OF COMPARISON CRITERIA
SITE 10, ORIGINAL BASE LANDFILL
SITE INVESTIGATION, CTO – 0369

MARINE CORPS BASE, CAMP LEJEUNE
NORTH CAROLINA

NOTE: ONLY COMPOUNDS DETECTED IN EXCESS OF USEPA MCLs, NC DENR METHOD I, CATEGORIES G1 AND/OR G3 TARGET CONCENTRATIONS ARE DEPICTED ON THIS FIGURE.

369815WP



SAMPLE ID IR10-TW06-98A	
SAMPLE DATE 03-22-1998	
METALS (ug/l)	
Chromium	36.4
Iron	5030
Manganese	33.2
Mercury	0.033 J

SAMPLE ID IR10-TW01-98A	
SAMPLE DATE 03-22-1998	
METALS (ug/l)	
Chromium	64
Iron	6830
Manganese	72.1
Mercury	0.054 J
Thallium	5.2 J

SAMPLE ID IR10-TW02-98A	
SAMPLE DATE 03-22-1998	
METALS (ug/l)	
Arsenic	6.4 J
Chromium	82.2
Copper	16.8 J
Iron	16900
Lead	31.1
Manganese	109
Mercury	0.083 J
Nickel	14.4 J
Thallium	3.6 J
Zinc	34.5

SAMPLE ID IR10-TW09-98A	
SAMPLE DATE 03-22-1998	
METALS (ug/l)	
Chromium	55.1
Copper	37.7
Iron	12000
Lead	43.6
Manganese	114
Mercury	0.3
Nickel	8.6 J
Thallium	3.3 J
Zinc	72.1

SAMPLE ID IR10-TW07-98A	
SAMPLE DATE 03-23-1998	
METALS (ug/l)	
Arsenic	13.9
Chromium	17.1
Iron	8240
Manganese	49.1
Silver	5.7 J
Thallium	3.5 J

SAMPLE ID IR10-TW03-98A	
SAMPLE DATE 03-22-1998	
METALS (ug/l)	
Arsenic	16.4
Chromium	107
Copper	22.2 J
Iron	25600
Lead	41
Manganese	119
Mercury	0.087 J
Nickel	13.8 J
Thallium	3.9 J
Zinc	30.1

SAMPLE ID IR10-TW04-98A	
SAMPLE DATE 03-22-1998	
METALS (ug/l)	
Chromium	48.4
Copper	24.6 J
Iron	10400
Lead	33.4
Manganese	88.3
Mercury	0.13 J
Nickel	16.1 J
Thallium	3.1 J
Zinc	31.2

SAMPLE ID IR10-TW08-98A	
SAMPLE DATE 03-23-1998	
METALS (ug/l)	
Arsenic	18.2
Beryllium	0.65 J
Chromium	136
Copper	25.3
Iron	28400
Lead	54.8
Manganese	146
Mercury	0.3
Nickel	16.3 J
Silver	4.5 J
Thallium	4.5 J
Zinc	43.3

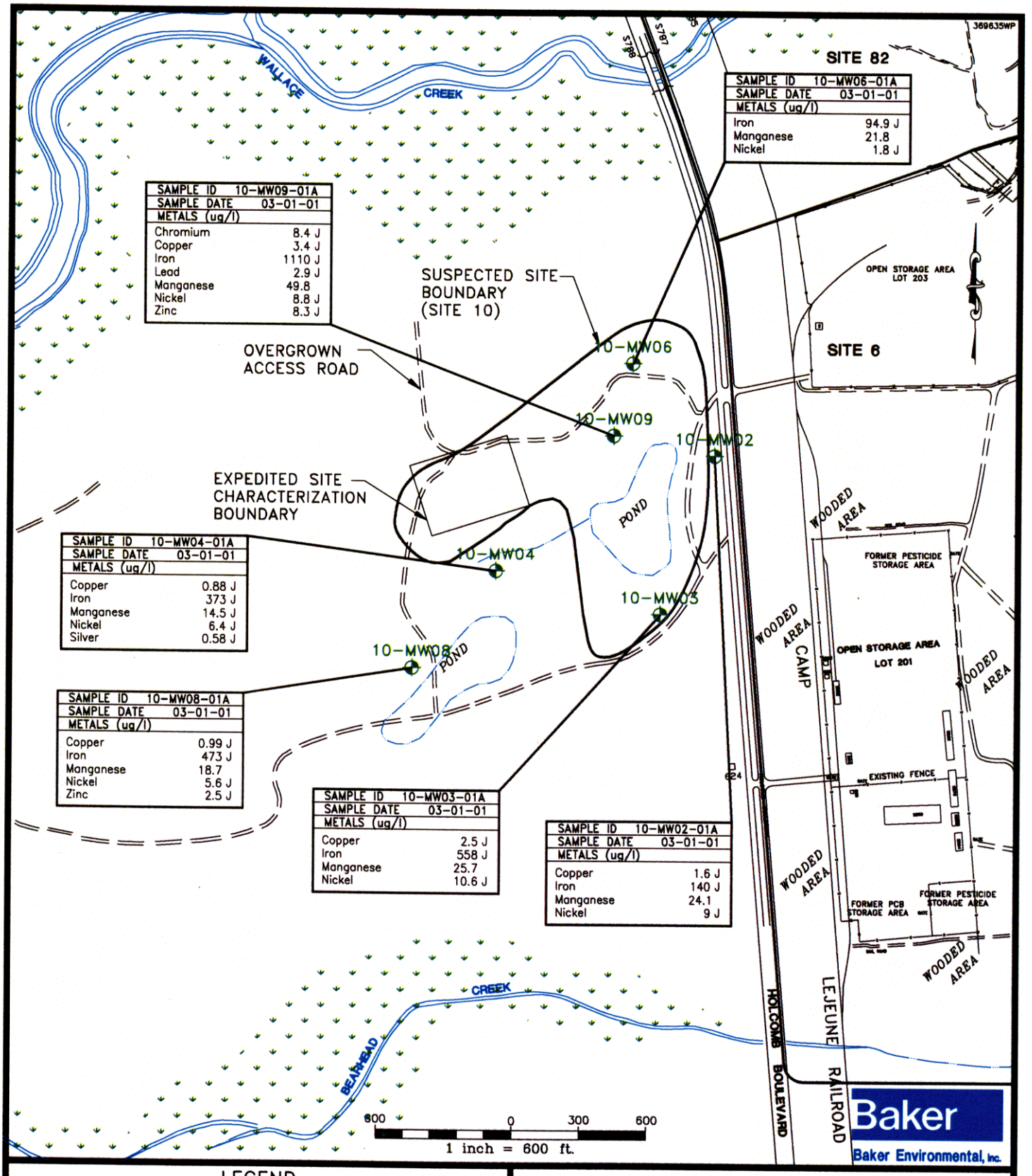
SAMPLE ID IR10-TW05-98A	
SAMPLE DATE 03-22-1998	
METALS (ug/l)	
Arsenic	6 J
Chromium	35.9
Iron	8220
Manganese	91.7
Mercury	0.077 J

Baker
Baker Environmental, Inc.

LEGEND

- ① – TEMPORARY WELL LOCATION
- (19.22) – GROUNDWATER ELEVATION
- (15.0) – GROUNDWATER CONTOUR
- ug/L – MICROGRAMS PER LITER
- J – ESTIMATED

FIGURE 4-3
PHASE I GROUNDWATER SAMPLES CONTAINING INORGANIC COMPOUNDS IN EXCESS OF COMPARISON CRITERIA
SITE 10, ORIGINAL BASE LANDFILL SITE INVESTIGATION, CTO – 0369
MARINE CORPS BASE, CAMP LEJEUNE
NORTH CAROLINA

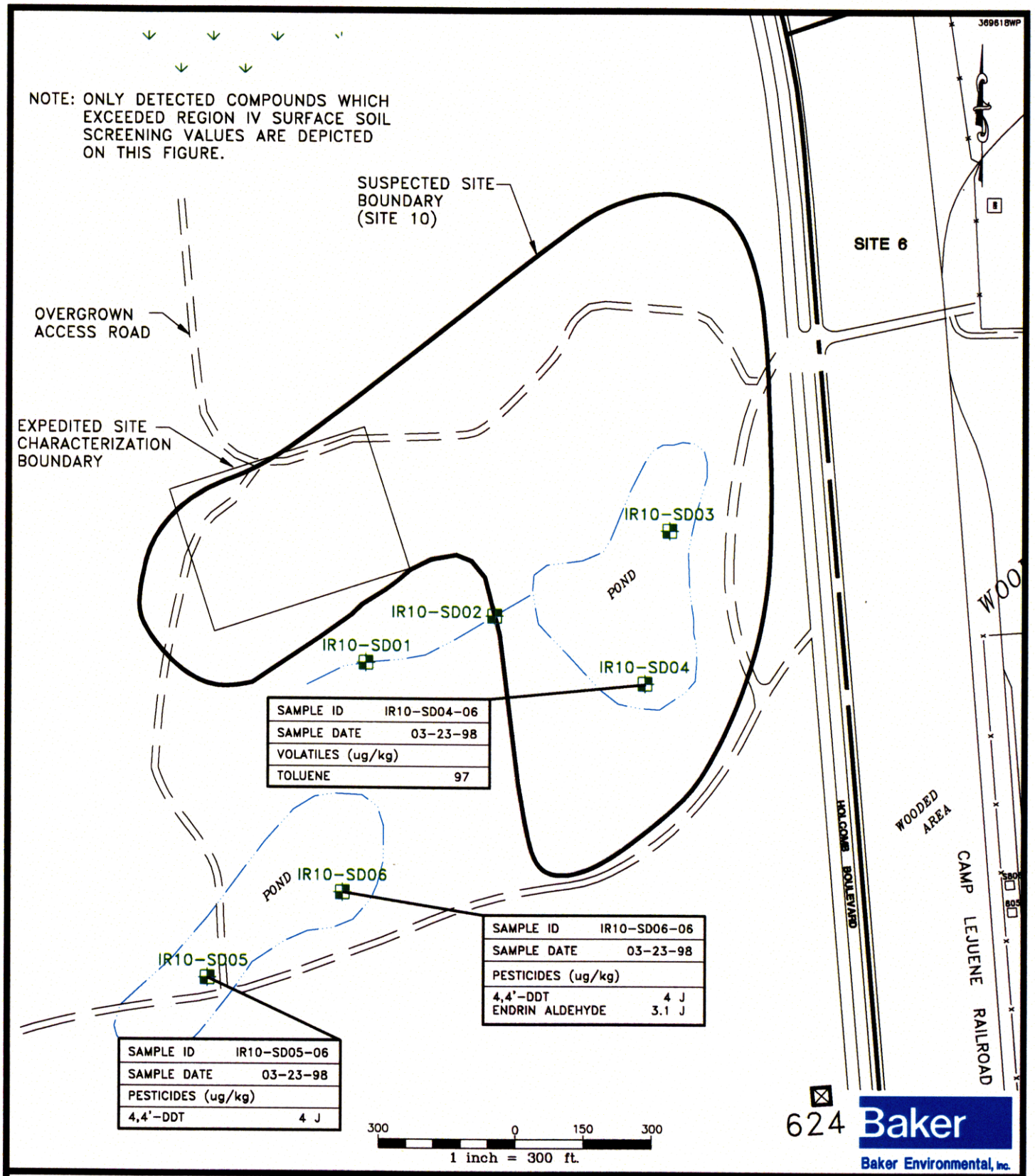


LEGEND

◆ – GROUNDWATER MONITORING WELL
ug/L – MICROGRAMS PER LITER
J – ESTIMATED

NOTE: ONLY COMPOUNDS DETECTED IN EXCESS OF USEPA MCLs, NC DENR METHOD I, CATEGORIES G1 AND/OR G3 TARGET CONCENTRATIONS ARE DEPICTED ON THIS FIGURE.

FIGURE 4-4
PHASE II GROUNDWATER SAMPLES CONTAINING INORGANIC COMPOUNDS IN EXCESS OF COMPARISON CRITERIA
SITE 10, ORIGINAL BASE LANDFILL
SITE INVESTIGATION, CTO – 0369
MARINE CORPS BASE, CAMP LEJEUNE
NORTH CAROLINA



LEGEND

- SITE BOUNDARY
- WETLANDS
- OVERGROWN ACCESS ROAD
- SEDIMENT SAMPLING LOCATION

FIGURE 4-5
SEDIMENT SAMPLES CONTAINING ORGANIC COMPOUNDS IN EXCESS OF COMPARISON CRITERIA
SITE 10, ORIGINAL BASE LANDFILL
SITE INVESTIGATION, CTO - 0369

MARINE CORPS BASE, CAMP LEJEUNE
NORTH CAROLINA

5.0 CONTAMINANT FATE AND TRANSPORT

The potential for a contaminant to migrate and persist in an environmental medium is critical when evaluating the potential for a chemical to elicit an adverse human health or ecological effect. 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 presents a discussion of the various physical and chemical properties of contaminants detected at Site 10 that impact the fate and transport of the contaminants in the environment. The basis for this discussion of contaminant fate and transport is presented in Section 4.0, Nature and Extent of Contamination.

5.1 Chemical and Physical Properties Impacting Fate and Transport

Table 5-1 presents the physical and chemical properties associated with a representative group of organic contaminants detected at the site which determine inherent environmental mobility and fate. These properties include:

- Vapor pressure
- Water solubility
- Octanol/water partition coefficient
- Organic carbon partition coefficient
- Specific gravity
- Henry's Law constant
- Mobility index

A discussion of the environmental significance of each of these properties follows.

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 polynuclear aromatic hydrocarbons (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.

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.

The octanol/water partition coefficient (K_{ow}) 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 partition coefficient (K_{oc}) indicates the tendency of an organic chemical to adhere to soil particles. Contaminants with high soil/sediment partition 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.

Specific gravity is the ratio of the weight 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.

A quantitative assessment of mobility has been developed that uses water solubility (S), vapor pressure (VP), and organic carbon partition coefficient (K_{oc}) (Laskowski, 1983). This value is referred to as the Mobility Index (MI). It is defined as:

$$MI = \log[(S*VP)/K_{oc}]$$

A scale to evaluate MI is presented by Ford and Gurba (1984):

Relative MI	Mobility Description
> 5	extremely mobile
0 to 5	very mobile
-5 to 0	slightly mobile
-10 to -5	immobile
< -10	very immobile

5.2 Contaminant Transport Pathways

Based on the evaluation of existing conditions at Site 10, the following potential contaminant transport pathways have been identified:

- Erosion of contaminated soils and transportation of the soils to surface water and sediment.
- Off-site atmospheric deposition of windblown dust.
- Leaching of soil contaminants to groundwater.
- Migration of groundwater contaminants off site.
- Groundwater infiltration from the shallow aquifer to the deep aquifer.
- Groundwater discharge to surface water.

It should be noted that the surface water references in Section 5 are to Wallace and Bearhead Creeks as opposed to the ponded areas on the site. Because of their temporary nature, there would be no significant transport pathways associated with the ponded areas. Wallace and Bearhead Creeks, however, are both permanent surface water bodies which would receive the discharge from the site.

Contaminants released to the environment could also undergo the following during transportation:

- Physical transformations: volatilization, precipitation
- Chemical transformations: photolysis, hydrolysis, oxidation, reduction
- Biological transformation: biodegradation
- Accumulation in one or more media

The following paragraphs describe the potential transport pathways listed above.

5.2.1 Erosion of Contaminated Soils and Transportation to Surface Water and Sediment

Surface water run-off can transport contaminated surface soils from the site to a surface water body, contaminating the surface water and/or sediment. This is influenced by the velocity of the surface water run-off; vegetation; grain size of the soils; solubility of the contaminants; distance to the water body and the proximity of the contaminated soils to the water body.

Surface soils at Site 10 are primarily sands with high infiltration rates and slow surface drainage (Section 3.3.2). Although the majority of Site 10 is covered with vegetation, in some cases it is only sparsely covered. In addition, there are access roads that bound and bisect the site, large holes which have been formed by tracked and heavy-wheeled vehicles used for military training, and "foxholes" used for military training which also disturb the vegetation. In the absence of vegetative cover, the soil is susceptible to accelerated erosion. Erosion occurring at the site has the possibility to transport potential contaminants to Wallace or Bearhead Creeks or other portions of the site such as the low-lying ponded areas. Because of the large distance between Site 10 and Wallace or Bearhead Creeks, this transport pathway would be very unlikely. Analytical results indicate, however, that erosion may have transported some contamination from the surface soil to the temporarily ponded areas on the site.

5.2.2 Off-Site Deposition of Windblown Dust

Wind can act as a contaminant transport pathway agent by eroding exposed soil and exposed sediment and blowing it across or even off site. This is influenced by: wind velocity, moisture, the grain size/density of the soil/sediment particles and the amount of vegetative cover over the soil or sediment.

The majority of Site 10 is covered and would not be susceptible to much wind erosion. However, the vehicle pathways and sparsely vegetated areas would be susceptible and could be considered a source of any airborne contaminant carried by dust particles.

5.2.3 Leaching of Soil Contaminants to Groundwater

Contaminants that adhere to soil particles or have accumulated in soil pore spaces can leach and migrate vertically to the groundwater. This is influenced by the depth to the water table, precipitation, infiltration, physical and chemical properties of the soil, and physical and chemical properties of the contaminant.

Groundwater samples were collected from nine temporary groundwater monitoring wells during the Phase I and six permanent monitoring wells during the Phase II. The wells were designed to monitor the shallow aquifer beneath the site. The groundwater results can be compared to soil sample analytical results to determine if contaminants detected in soil have migrated or may migrate in the future, to underlying groundwater.

Although soil contamination exists at Site 10, little groundwater contamination was observed. This can be explained by the low mobilities of the PAHs and pesticides, which would inhibit the leaching of these contaminants into the groundwater. However, there may have been some leaching of inorganics.

5.2.4 Migration of Groundwater Contaminants

Contaminants leaching from soils to underlying groundwater can migrate as dissolved constituents in groundwater in the direction of groundwater flow. Three general processes govern the migration

of dissolved contaminants caused by the flow of water: (1) advection - movement caused by flow of groundwater; (2) dispersion - movement caused by irregular mixing of waters during advection; and (3) retardation - principally chemical mechanisms which occur during advection. Subsurface transport of the immiscible contaminants is governed by a set of factors different from those of dissolved contaminants. The potential movement of immiscible organic liquids (non-aqueous phase liquids) will not be discussed in this section.

Advection is the process which most strongly influences the migration of dissolved organic solutes. Groundwater, under water table aquifer conditions (i.e., unconfined aquifer), generally flows from regions of the subsurface where the water table is under a higher head (i.e., recharge areas) to regions where the water table is under a lower head (i.e., discharge areas). Hydraulic gradient is the term used to describe the magnitude of this force (i.e., the slope of the water table). In general, the gradient usually follows the topography for shallow, uniform sandy aquifers which are commonly found in coastal regions. In general, groundwater flow velocities, in sandy aquifers under natural gradient conditions, are probably between 10 meters/year to 100 meters/year (Lyman, et al., 1982).

The average seepage velocity of groundwater flow at Site 10 for the shallow zone can be estimated

$$V_x = \frac{Ki}{N_e} \quad \textit{(Fetter, 1988)}$$

using a variation of Darcy's Equation:

Where:	V_x	=	average seepage velocity
	K	=	hydraulic conductivity (cm/sec)
	i	=	hydraulic gradient
	N_e	=	effective porosity

Thus, when monitoring wells or potable supply wells in sandy aquifers are located hundreds of meters downgradient of a contaminant source, the average travel time for the groundwater to flow from the source to the well point is typically on the order of years. In the zone of influence created by a high capacity production well or well field; however, the artificially increased gradient could substantially increase the local velocity, and the average travel times for groundwater flow are increased.

Dispersion results from two basic processes, molecular diffusion and mechanical mixing. The kinetic activity of dissolved solutes result in diffusion of solutes from a zone of high concentration to a lower concentration. Dispersion and spreading during transport result in the dilution of contaminants (maximum concentration of contaminant decreases with distance from the plume). For simple hydrogeological systems, the spreading is reported to be proportional to the flow rate. Furthermore, dispersion in the direction of flow is often observed to be markedly greater than dispersion in the directions transverse (perpendicular) to the flow. In the absence of detailed studies to determine dispersive characteristics at Site 10, longitudinal and transverse dispersivities are estimated based on similar hydrogeological systems (Mackay, et al., 1985).

Some dissolved contaminants may interact with the aquifer solids encountered along the flow path through adsorption, partitioning, ion exchange, and other processes. The interactions result in the contaminant distribution between aqueous phase and aquifer solids, diminution of concentrations in the aqueous phase, and retardation of the movement of the contaminant relative to groundwater flow. The higher the fraction of the contaminant sorbed, the more retarded its transport. Certain halogenated organic solvents sorption is affected by hydrophobility (antipathy for dissolving in water) and the fraction of solid organic matter in the aquifer solids (organic carbon content). If the aquifer below Site 10 is homogeneous, sorption of hydrophobic organic solute should be constant in space and time. If the sorptive interaction is at equilibrium and completely reversible, the solute should move at a constant average velocity equal to the average velocity of the groundwater divided by the retardation factor.

Organic contaminants can be transformed into other organic compounds by a complex set of chemical and biological mechanisms. The principal classes of chemical reactions that can affect organic contaminants in water are hydrolysis and oxidation. However, it is believed that most chemical reactions occurring in the groundwater zone are likely to be slow compared with transformations mediated by microorganisms. Certain organic groundwater contaminants can be biologically transformed by microorganisms attached to solid surfaces within the aquifer. Factors which affect the rates of biotransformation of organic compounds include: water temperature and pH, the number of species of microorganisms present, the concentration of substrate, and presence of microbial toxicants and nutrients, and the availability of electron acceptors. Transformation of a toxic organic solute is no assurance that it has been converted to harmless or even less harmless hazardous products. Biotransformation of common groundwater contaminants, such as

trichloroethene and tetrachloroethene, can result in the formation of such intermediates as vinyl chloride (Mackay, et al., 1985).

The interaction of non-ionic organic compounds with solid phases can also be used to predict the fate of the highly nonpolar organic contaminants (i.e., 4,4'-DDT, polychlorinated biphenyls [PCBs]). Sorptive binding is proportional to the organic content of the sorbent. Sorption of non-ionic organic pesticides can be attributed to an active fraction of the soil organic matter (Lyman et al., 1982). The uptake of neutral organics by soils results from their partitioning to the solutes aqueous solubility and to its liquid-liquid (e.g., octanol-water) partition coefficient. Currently, information is available on the interrelation of soil organic properties to the binding of pesticides, herbicides, and high molecular weight pollutants such as PCBs. However, data is lacking for the non-ionic components of solvents and fuels. Organic matrices in natural systems that have varying origins, degrees of humification, and degrees of association with inorganic matrices exhibit dissimilarities in their ability to sorb non-ionic organic contaminants.

The soils and sediments formed or deposited on the land surface can act as a reservoir for inorganic contaminants. Soils contain surface-active mineral and humic constituents involved in reactions that affect metal retention. The surfaces of fine-grained soil particles are very active chemically; surface sites are negatively or positively charged or they are electronically neutral. Oppositely charged metallic counterions from solutions in soils (i.e., groundwater) are attracted to these charged surfaces. The relative proportions of ions attracted to these various sites depends on the degree of acidity or alkalinity of the soil, on its mineralogical composition, and on its content of organic matter. The extent of adsorption depends on either the respective charges on the adsorbing surface and the metallic cation. In addition to these adsorption reactions, precipitation of new mineral phases also may occur if the chemical composition of the soil solution becomes supersaturated with respect to the insoluble precipitates. Of the probable precipitates, the most important of these phases are hydroxides, carbonates, and sulfides. The precipitation of hydroxide minerals is important for metals such as iron and aluminum. The precipitation of carbonate minerals is significant for calcium and barium; and the precipitation of sulfide minerals dominates the soil chemistry of zinc, cadmium, and mercury. A number of precipitates may form if metals are added to soils. The concentration of metal in solution, will be controlled, at equilibrium, by the solid phase that results in the lowest value of the activity of the metallic ion in solution (Evans, 1989).

5.2.5 Groundwater Discharge to Surface Water

Groundwater flow appears to somewhat parallel to the topography of the site with the highest groundwater elevations corresponding to the highest surface elevations (Figure 3-1). Groundwater crossing the study area splits and discharges to Bearhead Creek (south) and Wallace Creek (north). Groundwater can transport contamination to these creeks, however, it is dependent on the solubility of the contamination. Like groundwater flow, three general processes govern the flow of the water: advection, dispersion and retardation. These three processes are described in detail in Section 5.2.5.

5.2.6 Groundwater Infiltration from the Shallow to the Deep Aquifer

Vertical movement of groundwater from one aquifer system to another, through a semi-confining unit is dependent on a number of factors including: intrinsic permeability of all involved units; density of the fluid (i.e., water and/or contaminant); viscosity of the fluid; hydraulic head; unit thickness; effective porosity; and bulk density of the soil comprising the semi-confining unit. Although only a shallow aquifer was evaluated in this SI, vertical movement from the shallow aquifer to one of the deeper aquifers could occur.

5.3 Fate and Transport Summary

The following paragraphs summarize the contaminant group fate and transport data for contaminants detected in media collected at Site 10 during the Phase I and Phase II investigations.

5.3.1 Volatile Organic Compounds

During the Phase I investigation one volatile organic compound (VOC), toluene, was detected as an ecological contaminant of concern (ECOC) in the sediment. VOCs tend to be mobile in environmental media as indicated by their presence in groundwater and their corresponding values. Their environmental mobility is a function of high water solubilities, high vapor pressures, low K_{ow} and K_{oc} values, and high mobility indices (see Table 5-1). Without a continuing source, however, VOCs do not generally tend to persist in environmental media because photolysis, oxidation, and biodegradation figure significantly in their removal.

5.3.2 Polynuclear Aromatic Hydrocarbons

PAH contamination was detected in the surface and subsurface soil during the Phase I investigation. The low water solubilities and high K_{ow} and $K_{oc,}$ indicate a strong tendency for PAHs to adsorb to soils. Of the PAHs, fluoranthene, is probably the best marker compound, since it is consistently the most abundant of the PAHs measured and provides the strongest correlation with total PAH values. Benzo(g, h, i) perylene is usually the most abundant compound in soils with low PAH values, but becomes less important with increasing total PAH values. Other PAHs are benzo(a)anthracene, chrysene, pyrene, benzo(g,h,i) perylene, benzo(b)fluoranthene and phenanthrene. Their mobility indices indicate that they are relatively immobile from a physical-chemical standpoint. An exception is naphthalene, which is considered only slightly immobile because of somewhat higher water solubility (Jones, et al., 1989).

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 (Jones, et al., 1989).

PAHs are somewhat persistent in the environment. In general, their persistence increases with increasing aromatic ring numbers. 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.

5.3.3 Pesticides/PCBs

Pesticide contamination was detected in the surface soil and sediment, and one PCB, Aroclor-1260, was detected in the surface soil during the Phase I investigation. 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 (K_d) is the distribution of a pesticide between soil and water. In general, the K_d values are higher for high organic carbon soil than for low organic carbon soils. Therefore, soils with high K_d 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 K_{oc} and K_{ow} values. Adsorption of these contaminants to soil and sediment is the major fate of these contaminants in the environment.

5.3.4 Inorganics

During the Phase I investigation inorganics were retained as contaminants of concern (COCs) in all media with the exception of sediment. However, during the Phase II groundwater investigation inorganics were detected at levels a magnitude lower than during the Phase I investigation. Iron was the only constituent to exceed North Carolina 2L Groundwater Protection Standards. 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 processes 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. As stated in Section 4.4.2, the metals that exceeded state and/or federal standards in groundwater at the site during the Phase I were aluminum, arsenic, chromium, iron, lead, manganese, thallium, and vanadium. Iron was the only metal to exceed North Carolina 2L Groundwater Protection Standards during the Phase II

5.4 References

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SECTION 5.0 TABLES

TABLE 5-1

PHYSICAL AND CHEMICAL PROPERTIES OF ORGANIC COMPOUNDS
SITE 10 - ORIGINAL BASE LANDFILL
MCB, CAMP LEJEUNE, NORTH CAROLINA
SITE INVESTIGATION, CTO-369

COPCs	Vapor Pressure (mm Hg)	Water Solubility (mg/L)	Log K_{ow}	Log K_{oc}	Specific Gravity (g/cm^3)	Henry's Law Constant ($atm\text{-}m^3/mole$)	Mobility Index
Volatile Organic Compounds							
1,1-Dichloroethene	$6.00 \times 10^{+02}$	$2.30 \times 10^{+03}$	1.84	1.81	1.22	3.40×10^{-02}	4
2-Butanone	$7.75 \times 10^{+01}$	$2.68 \times 10^{+05}$	0.65	0.26	0.81	2.74×10^{-05}	7
Toluene	$2.81 \times 10^{+01}$	$5.35 \times 10^{+02}$	2.73	2.47	0.88	6.37×10^{-03}	7
Semivolatile Organic Compounds							
Carbazole	--	--	3.29	--	1.10	--	--
Benzo(a)anthracene	2.20×10^{-08}	5.70×10^{-03}	5.60	6.14	1.32	1.16×10^{-06}	-16
Chrysene	3.60×10^{-09}	1.80×10^{-03}	5.61	5.30	1.22	1.05×10^{-06}	-16
Benzo(b)fluoranthene	5.00×10^{-07}	1.40×10^{-02}	6.06	5.74	--	1.19×10^{-05}	-14
Benzo(k)fluoranthene	5.10×10^{-07}	4.30×10^{-03}	6.06	5.74	--	3.94×10^{-05}	-14
Benzo(a)pyrene	5.60×10^{-09}	1.20×10^{-03}	6.06	6.74	--	1.55×10^{-06}	-18
Indeno(1,2,3-cd)pyrene	1.00×10^{-10}	5.30×10^{-04}	6.50	6.20	--	6.86×10^{-08}	-19
Dibenzo(a,h)anthracene	1.00×10^{-10}	5.00×10^{-04}	6.80	6.52	--	7.33×10^{-08}	-20
Phenanthrene	6.80×10^{-04}	$1.00 \times 10^{+00}$	4.46	4.15	1.03	1.59×10^{-04}	-7
Di-n-butylphthalate	1.00×10^{-05}	$1.30 \times 10^{+01}$	5.23	5.60	1.05	2.82×10^{-07}	-9
Fluoranthene	5.0×10^{-06}	0.265	5.33	4.64	--	5.12×10^{-06}	-11
Pyrene	2.5×10^{-06}	0.14	5.32	4.91	1.271	5.10×10^{-06}	-12
Pesticides/PCBS							
Heptachlor	3.00×10^{-04}	1.80×10^{-01}	4.40	4.08	1.57	8.19×10^{-04}	-8
Heptachlor Epoxide	3.00×10^{-04}	1.80×10^{-01}	4.40	4.08	1.57	8.19×10^{-04}	-8
Endosulfan I	9.00×10^{-03}	5.30×10^{-01}	-1.70	-2.02	1.15	$1.00 \times 10\text{-}^{05}$	-0.3
Dieldrin	1.78×10^{-07}	1.95×10^{-01}	3.50	3.23	1.75	4.58×10^{-07}	-11
4,4'-DDT	5.50×10^{-06}	5.00×10^{-03}	6.19	5.39	--	5.13×10^{-04}	-13
Endrin Aldehyde	2.00×10^{-07}	$5.00 \times 10^{+01}$	3.15	2.83	1.70	2.00×10^{-09}	-8
Aroclor-1260	7.70×10^{-05}	3.10×10^{-02}	6.04	5.72	0.66	1.07×10^{-03}	-11

Notes:

NA = Not Available

TABLE 5-1 (Continued)

PHYSICAL AND CHEMICAL PROPERTIES OF ORGANIC COMPOUNDS
SITE 10 - ORIGINAL BASE LANDFILL
MCB, CAMP LEJEUNE, NORTH CAROLINA
SITE INVESTIGATION, CTO-369

COPCs	=	Contaminants of Potential Concern
mm Hg	=	millimeters of Mercury
mg/L	=	milligram per liter
Log kow	=	Octanol/water coefficient
Log koc	=	Sediment Partition Coefficient
g/cm3	=	grams per cubic centimeter
atm-m3/mole	=	atmosphere cubic meters per mole

References:

ATSDR, 1989
Clement, 1985
Howard, 1989-1991
Montgomery, 1990
Sax and Lewis, 1987
SCDM, 1991, 1992
SPHEM, 1986
USEPA, 1986
USEPA, 1986a
Verscheuren, 1983

TABLE 5-2

RELATIVE MOBILITIES OF INORGANICS AS A FUNCTION OF ENVIRONMENTAL CONDITIONS (Eh, pH)
SITE 10 - ORIGINAL BASE LANDFILL
MCB, CAMP LEJEUNE, NORTH CAROLINA
SITE INVESTIGATION, CTO-369

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			

Source: Swartzbaugh, et al., "Remediating Sites Contaminated with Heavy Metals." Hazardous Materials Control, November/December 1992.

6.0 BASELINE RISK ASSESSMENT

6.1 Introduction

This Baseline Risk Assessment (BRA) evaluates the projected impact of contaminants of potential concern (COPCs) on human health and/or the environment, now and in the future, in a "no further remedial action scenario." The BRA process examines the data generated during the sampling and analytical phase of the site investigation (SI) and identifies areas of concern (AOCs) and COPCs with respect to geographical, demographic, physical and biological characteristics of the study area. These factors are combined with an understanding of physical and chemical properties of site-associated contaminants, (relative to environmental fate and transport processes) and are then used to estimate contaminant concentrations at logical exposure pathway endpoints. Finally, contaminant intake levels are calculated for hypothetical receptors. Toxicological properties are applied in order to estimate potential public health threats posed by detected contaminants.

The BRA for Site 10, Original Base Landfill, has been conducted in accordance with current United States Environmental Protection Agency (USEPA) Risk Assessment Guidance (USEPA, 1989a and USEPA, 1991b) and USEPA Region IV Supplemental Risk Guidance (USEPA, 1995a).

The components of the BRA include:

- Hazard Identification
- Exposure Assessment
- Toxicity Assessment
- Risk Characterization
- Uncertainty Analysis
- Conclusions of the BRA and potential site risk

The BRA is divided into eight sections beginning with the Introduction. Section 6.2 presents the Hazard Identification, which presents criteria for selecting COPCs. COPCs are chosen, for each environmental medium at each site, from an overall list of detected contaminants. Section 6.3 presents the Exposure Assessment, which lists site characteristics, identifies potential exposure pathways, and describes current and future exposure scenarios. In section 6.4, the Toxicity

Assessment, advisory criteria for evaluating human health risk is presented. Section 6.5 is the Risk Characterization. Section 6.6 addresses Sources of Uncertainty in the BRA. Section 6.7 provides conclusions regarding potential human health impacts, in terms of total site risk. Section 6.8 lists references sited in the BRA text. Referenced tables and figures are presented after the text portion of this section.

6.2 Hazard Identification

Data generated during the site investigation and previous studies at the site were used to draw conclusions and to identify data gaps in the BRA. The data were evaluated to assess which data were of sufficient quality to include in the risk assessment. The objective when selecting data to include in the risk assessment was to provide accurate and precise data to characterize contamination and evaluate exposure pathways.

6.2.1 Data Evaluation and Reduction

The initial hazard identification step entailed the validation and evaluation of the site data to determine its usability in the risk assessment. This process resulted in the identification of COPCs for the site. During this validation and evaluation, data that would result in inaccurate conclusions (e.g., data that were rejected or attributed to blank contamination, as qualified by the validator) were reduced within the data set. Data reduction entailed the removal of unreliable data from the original data set based on the guidelines established by USEPA. A summary of the data quality was presented in Section 4.0.

6.2.2 Identification of Data Suitable for Use in a Quantitative Risk Assessment

To provide for accurate conclusions to be drawn from sampling results, analytical data were reviewed and evaluated. This section presents the criteria that were used to review, reduce, and summarize the analytical data. These criteria are consistent with USEPA guidance for data reduction.

Five environmental media were investigated at Site 10 during this RI: surface soils (zero to one foot below ground surface [bgs]), subsurface soils (one to fifteen feet bgs), shallow groundwater, surface water, and sediment. For the BRA, the surface soil and subsurface soil data were evaluated as single

data sets. That is, the data were not segregated into areas of concern. Surface water and sediment samples were collected from a shallow pond of standing rain water within the site boundaries. These media were assessed for potential risk to human receptors.

Data collected during the March, 1998 sampling event were evaluated in this risk assessment. The previous investigations conducted at this site are detailed in Section 1.0 of this report.

Shallow groundwater is currently not utilized as a potable source at the site. Although the shallow aquifer is classified as GA (i.e., existing or potential source of drinking water for humans), it is not used as a potable water source at Marine Corps Base (MCB), Camp Lejeune because of its low yielding production rates. However, there remains the possibility that upon closure of this facility, residential housing could be constructed, and shallow groundwater used for potable purposes in the future. Therefore, in accordance with USEPA guidance, groundwater exposure was conservatively evaluated for future residential receptors.

For current receptors (military personnel and trespassers), potable water is supplied by the base treatment facilities via water supply wells that are set in the lower reaches of the Castle Hayne aquifer (200 to 300 feet bgs). Current operating wells are periodically monitored for control purposes. Hence, assessing current risks to contaminants detected in the shallow aquifer for current receptors is unnecessary and, if estimated, may present an unlikely risk. Therefore, groundwater exposure to current receptors was not estimated for this investigation.

Information relating to the nature and extent of contamination at the site is provided in Section 4.0 of this report. The discussion provided in Section 4.0 also was utilized in the selection of COPCs at the site. The reduced data sets for all media of concern at the site are provided in Appendix G of this report.

6.2.3 Criteria for Selecting Contaminants of Potential Concern

As recommended in the Region IV Bulletin (USEPA, 1995a), criteria used in selecting COPCs from constituents detected during the field sampling and analytical phase of the investigation are:

- Comparison to USEPA Region III Risk-Based Concentrations (RBCs)
- Comparison to field and laboratory blank data

In addition, some criteria used in the general assessment of COPCs selected from the media investigated during this SI include:

- Historical information
- Persistence
- Mobility
- Comparison to anthropogenic levels
- Toxicity
- Comparison to background or naturally occurring levels
- State and federal standards and criteria

USEPA's Risk Assessment Guidance for Superfund (RAGS) provides the criteria used to establish COPCs (USEPA, 1989a). The general assessment of COPCs may also involve comparing detection levels to additional contaminant-specific criteria. A brief description of the selection criteria used in choosing final COPCs is presented below. North Carolina Water Quality Standards for Surface Water (NCDENR, 1998) were used as a screening tool for surface water. North Carolina Risk Analysis Framework target concentrations for soil and groundwater were used for qualitative comparison only.

6.2.3.1 USEPA Region III RBCs

RBC values are derived using conservative USEPA promulgated default values and the most recent toxicological criteria available. The RBCs for potentially carcinogenic chemicals are based on a target ICR of $1x10^{-6}$. The RBCs for noncarcinogens are based on a target hazard quotient of 1.0. In order to account for cumulative risk from multiple chemicals in a medium, it is necessary to derive the RBCs based on a target hazard quotient of 0.1. Re-derivation of the noncarcinogenic RBCs based on a target hazard quotient of 0.1, while using the most recent toxicological criteria available, results in a set of values that can be used as screening values. In order to provide the accurate screening values, the noncarcinogenic RBCs were divided by a factor of ten. For potential carcinogens, the toxicity criteria applicable to the derivation of RBC values are oral and inhalation cancer slope factors (CSFs); for noncarcinogens, they are chronic oral and inhalation reference doses (RfDs). These toxicity criteria are subject to change as more updated information and results from the most recent toxicological/epidemiological studies become available. Therefore, the use of toxicity criteria in the

derivation of RBC values requires that the screening concentrations be updated periodically to reflect changes in the toxicity criteria. The RBC table is issued on a semi-annual basis. It should be noted that the most recent update was published in May 2001.

6.2.3.2 Contaminant Concentrations in Blanks

If a chemical is detected in both the environmental sample and a blank sample, it may not be retained as a COPC in accordance with RAGS depending on the concentration of the chemical in the media (USEPA, 1989b). Therefore, blank data were compared with results from environmental samples. If the blanks contained detectable results for common laboratory contaminants (i.e., acetone, 2-butanone, methylene, chloride, toluene, and phthalate esters), environmental sample results were considered as positive results only if they exceeded 10 times the maximum amount detected in the associated blank. If the chemical detected in the blank(s) is not a common laboratory contaminant, environmental sample results were considered as positive results only if they exceeded five times the maximum amount detected in the associated blank(s) (USEPA, 1991a). Furthermore, the elimination of an environmental sample result would directly correlate to a reduction in the prevalence of the contaminant in that media.

When assessing soil and sediment concentrations, the Contract Required Quantitation Limits (CRQLs) and percent moisture are accounted for in order to correlate solid and aqueous quantitation limits. For example, when assessing semivolatile, pesticide, polychlorinated biphenyl (PCB), and nitramine contaminants, the CRQL for solid samples is 33 to 66 times (depending on the contaminant) that of the aqueous samples; this correction is not necessary for the evaluation of volatile COPCs. Therefore, in order to assess contaminant levels in solid samples using an aqueous blank concentration, the concentration was multiplied by 5 or 10 (noncommon or common laboratory contaminants, respectively) and then multiplied by 33 to correct for the variance in the CRQL. Accounting for multipliers greater than 33 or the percent moisture was not necessary for this data set. Associated blanks for the site included trip blanks and rinsate blanks. The aforementioned methodologies for evaluating blanks were implemented during third party analytical data validation prior to the selection of COPCs in the risk assessments. Quality Assurance/Quality Control (QA/QC) data summaries are presented in Appendix H.

6.2.3.3 Historical Information

Using historical information to associate contaminants with site activities, when combined with the following selection procedures, helps determine contaminant retention for, or elimination from, evaluation in the BRA.

6.2.3.4 Persistence

Contaminant persistence in the environment varies in accordance with factors such as microbial content in soil and water, organic carbon content, contaminant concentration, climate and potential for microbes to degrade a contaminant under site conditions. In addition, chemical degradation, (i.e., hydrolysis) photochemical degradation and certain fate processes such as absorption may contribute to the elimination or retention of a particular compound in a given medium.

6.2.3.5 Mobility

A contaminant's physical and chemical properties are responsible for its transport in the environment. These properties, in conjunction with site conditions, determine whether a contaminant will have a greater tendency to volatilize into the air, out of surface soils or surface waters, or to relocate via advection or diffusion through soils, groundwaters, and surface waters. Physical and chemical properties also determine tendency for contaminant adsorption onto soil/sediment particles. In summary, environmental mobility factors can increase or decrease contaminant effects on human health and/or the environment.

6.2.3.6 Anthropogenic Levels

Ubiquitous anthropogenic background concentrations result from sources of contamination not related to the site, such as combustion of fossil fuels (i.e., automobiles), plant synthesis, natural fires and factories. Polynuclear aromatic hydrocarbons (PAHs) are examples of ubiquitous, anthropogenic chemicals. Sometimes it is difficult to determine whether contamination is actually site-incurred, or caused by contaminant-producing activities that are not site-related (i.e., anthropogenic). It then follows that systematically omitting anthropogenic background chemicals from the risk assessment

may produce false negative results. For this reason, anthropogenic chemicals are typically not eliminated as COPCs without considering other selection criteria.

6.2.3.7 Toxicity

Contaminant toxicity assessment must be incorporated when selecting COPCs with respect to human health risk. Toxic properties to be considered in COPC selection include weight-of-evidence classification, carcinogenicity, mutagenicity, teratogenicity, systemic effects and reproductive toxicity. Bioaccumulation and bioconcentration properties may affect the severity of toxic response in an organism and/or subsequent receptors; these additional properties are evaluated if relevant data exist.

Despite their inherent toxicity, certain inorganic contaminants are essential nutrients (e.g., calcium, magnesium, potassium, sodium). As such, these contaminants need not be considered in a quantitative risk assessment, if one of the following conditions applies: (1) they are detected at relatively low concentrations, (i.e., below two times average base-specific background levels or slightly elevated above naturally occurring levels) or (2) the contaminant is toxic at doses much higher than those which can be assimilated through exposures at the site.

6.2.3.8 Background or Naturally Occurring Levels

Naturally occurring levels of chemicals are present under ambient conditions. Generally, a comparison to naturally occurring levels applies only to inorganic analytes, because the majority of organic contaminants are not naturally occurring. Background samples are collected from areas that are known to be uninfluenced by site contamination. Sample concentrations for surface and subsurface soil were compared to base-specific (i.e., twice the base-wide average concentration) background levels. It should be noted that background data was used for qualitative analysis of COPCs only. COPCs were not chosen based on comparison to background data. Background soil data is presented in Appendix E.

6.2.3.9 State and Federal Criteria and Standards

Contaminant concentrations in aqueous media can be compared to contaminant-specific state and federal criteria. This risk assessment utilizes North Carolina Water Quality Standards (NC WQS) for groundwater and surface water. The only enforceable federal regulatory standards for water are Federal Maximum Contaminant Levels (MCLs).

Regulatory guidelines are used, when necessary, to infer potential health risks and environmental impacts. Health Advisories (HA) are relevant regulatory guidelines. An explanation of the federal and state criteria and standards used for qualitative evaluation of contaminants is presented below. It should be emphasized that COPCs were not chosen based on comparison to state and federal criteria. However, these standards and criteria were used for a qualitative analysis of the COPCs.

Target Concentrations, North Carolina Risk Analysis Framework - Soil - These soil concentrations were derived using standard USEPA risk assessment equations for the ingestion of soil in residential exposures (NC DENR, 1996).

Target Concentrations, North Carolina Risk Analysis Framework - Groundwater - These target concentrations for drinking water and non-drinking water exposures, such as swimming pools or irrigation, are the groundwater quality standards or interim standards established in 15A NCAC 2L.0202 (i.e., North Carolina Water Quality Standards described below). The groundwater standards and interim standards are developed using state and federal guidelines for the protection of human health (NC DENR, 1996).

North Carolina Water Quality Standards (NC WQSs) - Groundwater - NC WQSs are the maximum allowable concentrations resulting from any discharge of contaminants to the land or waters of the state, which may be tolerated without creating a threat to human health or which otherwise render the groundwater unsuitable for its intended purpose (NC DENR, 1994). The North Carolina Groundwater Standards (15A NCAC 2L. 0202) were used as a screening tool for this risk assessment.

Maximum Contaminant Levels (MCLs) - Federal Groundwater Standards - 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 (USEPA, 1996).

North Carolina Water Quality Standards (Surface Water) - The NCWQSs for surface water are the standard concentrations that, either alone or in conjunction with other wastes in surface waters, will neither render waters injurious to aquatic life, wildlife, or public health, nor impair the waters for any designated use. North Carolina Water Quality Standards for Surface Water (NCDENR, 1998) were used as a screening tool for this risk assessment.

Ambient Water Quality Criteria (AWQC) - AWQCs 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 human health AWQCs 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 10^{-7} to 10^{-5} range) (USEPA, 1992d).

As stated previously, COPCs in all media of concern at the site were compared with these aforementioned criteria. The results of the standards/criteria/To Be Considered (TBC) comparison for the site are presented in Tables 6-1 through 6-5.

6.2.4 Selection of Contaminants of Potential Concern

The following sections present an overview of the analytical data obtained for each environmental medium during the SI and the subsequent retention or elimination of COPCs using the aforementioned selection criteria. The primary criterion used in selecting a chemical as a COPC at each site was comparing the maximum detected sample concentration to the USEPA Region III RBCs (USEPA, 2001). In conjunction with the concentration comparisons to the USEPA Region III

RBCs, evaluation of laboratory contaminants was conducted. Furthermore, calcium, magnesium, potassium, and sodium were detected in almost every sample, regardless of the medium; however, these constituents were considered to be essential nutrients (USEPA, 1995a) and were therefore, not retained as COPCs in any medium under investigation at Site 10.

Tables 6-1 through 6-5 present the selection of COPCs for each environmental medium based on a comparison of the maximum detected concentration with the USEPA Region III RBC values, and other applicable criteria. Information is presented in these tables only for those constituents detected at least once, in the medium of interest. Other statistical information is presented in Appendix I.

Surface Soil

Site 10 surface soil organic data summary and COPC selection results are presented in Table 6-1. Twenty-five surface soil samples were analyzed for Target Compound List (TCL) volatile organic compounds (VOCs). 1,1-Dichloroethene, trichloroethene, benzene, toluene, and chlorobenzene were detected in the Site 10 surface soil samples. These VOCs were detected at maximum concentrations less than their respective residential soil RBCs. Therefore, these VOCs were not retained as Site 10 surface soil COPCs.

Twenty-five surface soil samples were analyzed for TCL semivolatile organic compounds (SVOCs). Primarily, polynuclear aromatic hydrocarbons (PAHs) were detected in the surface soil samples. The following PAHs were detected at maximum concentrations less than their respective residential soil RBCs: phenanthrene, fluoranthene, pyrene, benzo(a)anthracene, chrysene, benzo(b)fluoranthene, benzo(k)fluoranthene, benzo(a)pyrene, indeno(1,2,3-cd)pyrene, and benzo(g,h,i)perylene. In addition, di-n-butylphthalate was detected in Site 10 surface soil samples at a maximum concentration less than its residential soil RBC. Therefore, these SVOCs were not retained as Site 10 surface soil COPCs.

Twenty-five surface soil samples were analyzed for TCL pesticides and polychlorinated biphenyls (PCBs). The following pesticides were detected in the Site 10 surface soil samples: heptachlor, heptaclor epoxide, endosulfan I, dieldrin, 4,4'-DDE, endrin, 4,4'-DDT, and endrin aldehyde. One PCB, aroclor-1260, was also detected in the surface soil samples. These pesticides and the PCB

were detected at maximum concentrations less than their respective residential soil RBCs. Therefore, they were not retained as COPCs.

Site 10 surface soil inorganic data summary and COPC selection results are presented in Table 6-1. Twenty-five surface soil samples were analyzed for Target Analyte List (TAL) inorganics. Inorganics were detected in every sample. Aluminum, antimony, arsenic, and iron were detected in almost every sample. The maximum detected concentrations of the aforementioned analytes exceeded their respective residential soil RBCs. Consequently, aluminum, antimony, arsenic, and iron were retained as Site 10 surface soil COPCs.

Subsurface Soil

Site 10 subsurface soil organic data summary and COPC selection results are presented in Table 6-2. Twenty-two subsurface soil samples were analyzed for TCL VOCs. The following VOCs were detected: bromomethane, methylene chloride, acetone, and toluene. Bromomethane, methylene chloride, acetone, and toluene were detected at maximum concentrations less than their respective residential soil RBCs. Therefore, these VOCs were not retained as Site 10 subsurface soil COPCs. There were no toxicity criteria available for bromomethane and therefore, it was not retained as a COPC.

Twenty-two subsurface soil samples were analyzed for TCL SVOCs. Primarily, PAHs were detected in the subsurface soil samples. The following PAHs were detected at maximum concentrations less than corresponding residential soil RBCs and were not retained as subsurface soil COPCs: naphthalene, acenaphthene, dibenzofuran, fluorene, phenanthrene, anthracene, fluoranthene, pyrene, and benzo(g,h,i)perylene. Di-n-butylphthalate was also detected at a maximum concentration less than its residential soil RBC and was not retained as a COPC. Benzo(a)anthracene, benzo(b)fluoranthene, benzo(a)pyrene, and dibenz(a,h)anthracene were detected at concentrations that exceeded their corresponding residential soil RBCs and were therefore, retained as subsurface soil COPCs. In addition, since related carcinogenic PAHs may act synergistically, carbazole, chrysene, benzo(k)fluoranthene, and indeno(1,2,3-cd)pyrene were also retained as subsurface soil COPCs.

Twenty-two subsurface soil samples were analyzed for TCL pesticides and PCBs. The following pesticides were detected: endosulfan I, endrin, endosulfan II, 4,4'-DDD, methoxychlor, and endrin ketone. These pesticides were detected at concentrations less than corresponding residential soil RBCs. There were no PCBs detected in the subsurface soil samples. Therefore, no pesticides or PCBs were retained as Site 10 subsurface soil COPCs.

Site 10 subsurface soil inorganic data summary and COPC selection results are presented in Table 6-2. Twenty-two subsurface soil samples were analyzed for TAL inorganics. Inorganics were detected in every sample. Antimony, arsenic, barium, cadmium, chromium, copper, iron, manganese, and thallium were detected in almost every sample. The maximum detected concentrations of the aforementioned inorganics exceeded their respective and residential soil RBCs or action level. Consequently, antimony, arsenic, barium, cadmium, chromium, copper, iron, lead, manganese, and thallium were retained as Site 10 subsurface soil COPCs.

Lead was not retained as a COPC due to the unavailability of toxicity criteria. Lead concentrations were compared to screening levels developed in the USEPA's Office of Solid Waste and Emergency Response (OSWER) Directive #9355.4-12. Refer to Section 6.5.2 for an interpretation of results.

Groundwater

Nine groundwater samples were collected from Site 10 in March 1998 and analyzed for TCL VOCs, SVOCs, pesticides, and PCBs. There were no organic compounds detected in the Site 10 groundwater samples. Therefore, there were no VOCs, SVOCs, pesticides, or PCBs retained as groundwater COPCs at Site 10. Inorganics were detected in every sample, and aluminum, arsenic, chromium, iron, manganese, thallium, and vanadium exceeded their respective tap water RBCs.

It was determined that the March 1998 groundwater samples may have had excessively high levels of inorganics due to the nature of the well installation, development, and sampling. Therefore, permanent wells were installed and seven additional groundwater samples were obtained in March 2001. These samples were analyzed TAL inorganics only. Site 10 groundwater inorganic data summary and COPC selection results are presented in Table 6-3. Only iron exceeded its tap water RBC. Consequently, only iron was retained as a Site 10 groundwater COPC.

Lead was not retained as a COPC due to the unavailability of toxicity criteria. Lead concentrations were compared to screening levels developed in the USEPA's Office of Solid Waste and Emergency Response (OSWER) Directive #9355.4-12. Refer to Section 6.5.2 for an interpretation of results.

Surface Water

Site 10 surface water organic data summary and COPC selection results are presented in Table 6-4. Six surface water samples were analyzed for TCL VOCs. Toluene was detected at a maximum concentration less than its NC WQS and was not retained as a surface water COPC.

Six surface water samples collected from Site 10 were analyzed for SVOCs, pesticides, and PCBs. There were no SVOCs, pesticides, or PCBs detected in the surface water samples. Therefore, no SVOCs, pesticides, or PCBs were retained as Site 10 surface water COPCs.

Site 10 surface water inorganic data summary and COPC selection results are presented in Table 6-4. Six surface water samples were analyzed for TAL inorganics. Inorganics were detected in every sample. Aluminum, iron, mercury, and zinc were detected frequently. The maximum detected concentrations of these analytes exceeded their respective NC WQSs. Consequently, aluminum, iron, mercury, and zinc were retained as Site 10 surface water COPCs.

Sediment

Site 10 sediment organic data summary and COPC selection results are presented in Table 6-5. Six sediment samples were analyzed for TCL VOCs. The following VOCs were detected in Site 10 sediment samples: 2-butanone and toluene. These VOCs were detected at maximum concentrations less than corresponding residential soil RBCs. Therefore, these VOCs were not retained as Site 10 sediment COPCs.

Six sediment samples were analyzed for TCL SVOCs. There were no SVOCs detected in the Site 10 sediment samples. Therefore, no SVOCs were retained as sediment COPCs.

Six sediment samples were analyzed for pesticides and PCBs. 4,4'-DDT and endrin aldehyde were detected in the Site 10 sediment samples. They were detected at maximum concentrations less than

corresponding residential soil RBCs. Therefore, these pesticides were not retained as Site 10 sediment COPCs. There were no PCBs detected in the sediment samples. Therefore, no PCBs were retained as Site 10 sediment COPCs.

Site 10 sediment inorganic data summary and COPC selection results are presented in Table 6-5. Six sediment samples were analyzed for TAL inorganics. Inorganics were detected in every sample at concentrations less than corresponding residential soil RBCs. Therefore, no inorganics were retained as Site 10 sediment COPCs.

6.2.4.7 Summary of COPCs

Table 6-6 presents a summary of COPCs identified in each environmental medium sampled at Site 10.

6.3 Exposure Assessment

This section addresses potential human exposure pathways at Site 10 and presents 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 site conceptual model. Exposure pathways to be retained for quantitative evaluation are subsequently selected, based on the conceptual site model.

6.3.1 Conceptual Site Model of Potential Exposure

A conceptual site model of potential sources, migration pathways and human receptors is developed to encompass all current and future routes for potential exposure at Site 10. Figure 6-1 presents the Site 10 conceptual model. Inputs to the conceptual model include qualitative descriptions of current and future land use patterns in the vicinity of the sites. The following list of receptors is developed for a quantitative health risk analysis:

- Current trespassers (older child [7-16 years] and adult)
- Current military personnel
- Future on-site residents (child [1-6 years] and adult)
- Future construction worker

Contaminants detected in surface soils are discussed in Section 4.0 (Nature and Extent of Contamination) and in Section 6.2.2, selection of COPCs. Migration of COPCs from these sources can occur in the following ways:

- Leaching of contaminants from surface soil to water-bearing zones.
- Vertical migration from shallow water-bearing zones to deeper flow systems.
- Horizontal migration in groundwater in the direction of groundwater flow.
- Groundwater discharge into local streams.
- Wind erosion and subsequent deposition of windblown dust.

The potential for a contaminant to migrate spatially and persist in environmental media is important in estimating exposure.

Current and Future Scenarios

Current receptors that were evaluated in this BRA are adult and older child trespassers who may gain unauthorized access to the site and military personnel who may be conducting work or training related activities in the area. Trespassers and military personnel could potentially be exposed to surface soil via incidental ingestion, dermal contact, and inhalation of fugitive dusts. There are also small "ponds" of standing water. Potential exposure pathways for the current receptors are surface water and sediment incidental ingestion and dermal contact. It should be noted that there were no COPCs retained in Site 10 sediment. Therefore, the exposure pathway for direct contact with Site 10 sediment was eliminated from further evaluation. Since these pools of water are too shallow for swimming activities, a wading scenario was considered when evaluating current trespassers and military personnel for exposure to Site 10 surface water. Presently, the groundwater at the site is not used for potable purposes. Consequently, exposure to groundwater was not considered to be applicable for current receptors at the site.

A conservative exposure scenario was examined for a future residential population for Site 10. It is unlikely that these sites will be developed for residential use in the future. However, to be conservative groundwater exposure to a future residential child and adult receptor was assessed. It assumed that a private well could be installed on-site in the future case. The potential exposure pathways were ingestion, dermal contact, and inhalation of VOCs while showering. Since there

were no VOCs retained as COPCs in the Site 10 groundwater, it was not necessary to evaluate the inhalation of VOCs while showering. In addition, surface soil and surface water exposure was evaluated for Site 10 future adult and child residents. Potential exposure to sediment was not evaluated since there were no COPCs retained in the Site 10 sediment. Therefore, the potential exposure pathways are ingestion and dermal contact of surface soil and surface water. In addition, future residents were evaluated for surface soil exposure via inhalation of fugitive dusts

Finally, surface and subsurface (one to 15 bgs) soil exposure resulting from future excavation and construction activities was assessed. A future construction worker was evaluated for subsurface soil ingestion, dermal contact, and inhalation of fugitive dusts for Site 10.

6.3.2 Exposure Pathways

This section presents exposure pathways, shown in Figure 6-1, associated with each environmental medium and each human receptor group for Site 10. It then qualitatively evaluates each pathway for further consideration in the quantitative risk analysis. Table 6-7 presents the selection of exposure pathways at Site 10.

6.3.2.1 Surface Soil

Surface soil exposure is available for contact by current trespassers and military personnel and/or future residents and future construction workers. Exposure pathways involving ingestion, dermal contact, and inhalation of airborne particulates are evaluated for the current trespassers, military personnel and future residents and construction workers.

6.3.2.2 Subsurface Soil

Subsurface soil (one to fifteen feet bgs) is available for contact only during excavation activities, so potential exposure to subsurface soil is limited to future construction workers. Exposure pathways involving ingestion, dermal contact, and inhalation of airborne particulates are evaluated for future construction workers only.

6.3.2.3 Groundwater

Currently, shallow groundwater at Sites 10 is not used as a potable supply for current receptors. However, it will be conservatively assumed that in the future, (albeit unlikely due to poor production rates) shallow groundwater may be tapped for potable water. In this scenario, potential exposure pathways are ingestion, dermal contact and inhalation of volatile contaminants while showering. Groundwater exposure is evaluated for future residential children and adults. It was not necessary to evaluate the inhalation of VOCs while showering since there were no VOCs retained as groundwater COPCs.

6.3.2.3 Surface Water/Sediment

Access to surface water at Site 10 is limited to the small pool of standing water. In a current or future scenario, swimming is unlikely due to the shallowness of the water. However, a wading scenario is considered a conservative estimation of potential exposure. Surface water exposure pathways include ingestion and dermal contact. Sediment exposure was not evaluated since there were no COPCs retained in Site 10 sediment. Exposure is evaluated for current trespassers and military personnel and future residential children and adults.

6.3.3 Quantification of Exposure

The chemical concentrations used in the estimation of chronic daily intakes (CDIs) for each medium are considered to be representative of the types of potential exposure encountered by each receptor. Exposure can occur discretely or at a number of sampling locations depending on the type of scenario considered for a given receptor. Furthermore, certain environmental media such as groundwater and surface water are migratory and chemical concentrations detected in these media change frequently over time. Soil and sediment are, by nature, less transitory. The manner in which environmental data are represented also depends on the number of samples and sampling locations available for a given area and a given medium. Tables 6-8 through 6-11 present medium-specific exposure point concentration summaries for each medium evaluated in this BRA.

To quantify exposure, analytical data must be evaluated to determine its distributional nature. In general, two types of distributions are applied to environmental data; these are the normal and

log-normal distributions. The arithmetic mean describes a normal distribution, while a geometric mean describes lognormal distribution. Most large data sets from soil sampling are log-normally distributed rather than normally distributed. While the geometric mean is a convenient parameter for describing central tendencies of log-normal data sets, it bears no logical connection to the cumulative intake that would result from long-term contact with site contaminants (USEPA, 1992c). The geometric mean of a set of sampling results may not adequately represent random exposure and therefore, is not an appropriate basis for estimating the concentration term. Most Agency health criteria are based on the long-term (arithmetic) average exposure which is expressed as the sum of all daily intakes divided by the total number of days in the averaging period. Therefore, the choice of the arithmetic mean concentration is a more appropriate measure for estimating exposure (USEPA, 1992c).

Potential exposure to surface soil, subsurface soil, and surface water at Site 10, regardless of location, is considered as having an equal probability of occurrence as an individual moves randomly across the site. Therefore, for these media, the exposure point concentration for a constituent in the intake equation can be reasonably estimated as the arithmetic average concentration of site sampling data. USEPA supplemental risk assessment guidance (USEPA, 1992c) states that the average concentration is an appropriate estimator of the exposure concentration for two reasons: 1) carcinogenic and chronic noncarcinogenic toxicity criteria are based on lifetime average exposures; and 2) the average concentration is most representative of the concentration that would be contacted over time. However, uncertainty is inherent in the estimation of the true average constituent concentration at the site.

In order to account for this uncertainty and to be health protective, USEPA risk assessment guidance (USEPA, 1989a) requires that an upper bound estimate of the arithmetic mean concentration, be used to calculate CDI. This estimate, which should be in the high end of the concentration frequency distribution, is called the Reasonable Maximum Exposure (RME) concentration. The RME concentration is defined as the highest concentration that could reasonably be expected to be contacted via a given pathway over a long-term exposure period.

Assuming all data sets originate from a skewed underlying distribution, lognormal distribution is used to represent all relevant media. The 95 percent upper confidence limit (UCL) for lognormal distribution is used for each contaminant (i.e., as the RME concentration) in a given data set in order

to quantify conservative exposure values. For exposure areas with limited amounts of data or extreme variability in measured data, the 95 percent UCL can be greater than the maximum measured concentration; therefore, in cases where the 95 percent UCL for a contaminant exceeds the maximum detected value in a given data set, the maximum result was used in the estimate of exposure. However, the true mean may still be higher than this maximum value (i.e., the 95 percent UCL indicates a higher mean is possible), especially if the most contaminated portion of the site has not been sampled (USEPA, 1992c). Statistical summaries are presented in Appendix I.

The 95 percent UCL of the lognormal distribution was calculated using the following equation

$$Lognormal\ 95\%\ UCL = e^{(\bar{x} \cdot 0.5s^2 \cdot sH\ \sqrt{n-1})}$$

(USEPA, 1992c):

where:

UCL	=	upper confidence limit
e	=	constant (base of the natural log, equal to 2.718)
$\bar{x}$	=	mean of the transformed data
s	=	standard deviation of the transformed data
H	=	H-statistic (Gilbert, 1987)
n	=	number of samples

In addition to the RME risk descriptor, which is represented by the maximum and/or 95% UCL concentration for the selected COPC, the central tendency (CT) risk descriptor was also used for data sets when the RME concentration term showed a potential risk to human health, specifically, to future construction workers. The CT concentration term utilized was the 95% UCL (USEPA, 1993). The CT concentrations were then utilized to calculate chemical intakes for the CT-case scenarios. The results of the CT calculations are presented in Section 6.6.6.

There were no organic compounds detected in Site 10 groundwater. Inorganics were detected in almost every sample and were the only constituents retained as groundwater COPCs. Therefore, the human health risk assessment for future groundwater use incorporates groundwater data collected from monitoring wells in March 2001. In this BRA, the groundwater RME exposure

scenario presents the maximum groundwater exposure and used the maximum detected concentrations of the COPCs in the CDI calculations. In this manner, a worst case, as well as a point source scenario is presented.

6.3.4 Calculation of Chronic Daily Intakes (CDI)

In order to numerically calculate risks for current and future human receptors at Site 10, a CDI must be computed for each COPC, in each relevant exposure pathway. The Risk Calculation Spreadsheets (Appendix J) contains CDI equations for specific exposure scenarios (USEPA, 1989a).

The following paragraphs present the general equations and input parameters used to calculate CDIs. USEPA promulgated exposure factors are used in conjunction with USEPA standard default exposure factors for both the CT and RME exposure scenarios; however, the CT exposure scenario was utilized only for future construction worker receptors. Furthermore, when USEPA exposure factors are not available, best professional judgement and site-specific information are used to derive a conservative and defensible value. Tables 6-12 through 6-24 present the exposure factors used in the estimation of potential CDIs for COPCs retained for each receptor. The following paragraphs present the rationale for the RME assumptions for each receptor group evaluated in the baseline RA. The CT assumptions for the future adult and child residents, though not discussed below, are presented in the exposure factors tables specific to the future residential scenarios.

Carcinogenic risk is calculated as an incremental lifetime risk, and thereby involves exposure duration (years) over the course of a lifetime (70 years, or 25,550 days).

Assessing the potential for adverse noncarcinogenic health effects, on the other hand, involves average annual exposure. Exposure time and frequency represent the number of hours of exposure per day, and days of exposure per year, respectively. Generally, the potential for adverse noncarcinogenic health effects for certain exposure routes (e.g., soil ingestion) is greater for children, as the combination of a lower body weight and an exposure frequency equal to that of an adult increases their ingestion rates.

Current and future residential exposure scenarios address 1 to 6-year old children weighing 15 kilograms (kg) and adults weighing 70 kg, on average. An exposure duration of four years is used

for the current military personnel exposure scenario. A one year duration is used for future construction workers.

6.3.4.1 Incidental Ingestion of Soil

The equation for CDI, calculated for all human receptors potentially experiencing incidental soil

$$CDI = \frac{C \ x \ IR \ x \ CF \ x \ Fi \ x \ EF \ x \ ED}{BW \ x \ AT_c \ or \ AT_{nc}}$$

ingestion, is as follows:

Where:

C	=	Contaminant concentration in soil (mg/kg)
IR	=	Ingestion rate (mg/day)
CF	=	Conversion factor (1E-6 kg/mg)
Fi	=	Fraction ingested from source (dimensionless)
EF	=	Exposure frequency (days/year)
ED	=	Exposure duration (years)
BW	=	Body weight (kg)
AT_c	=	Averaging time, carcinogen (days)
AT_{nc}	=	Averaging time, noncarcinogen (days)

The following paragraphs explain the exposure assumptions used to evaluate the impact of COPCs in incidental soil ingestion. In each exposure scenario, the Fi value, indicates the portion of ingested soils that originated from Site 10 versus other sources.

Current Military Personnel

Military personnel may be exposed to COPCs by ingesting surface soil during the course of work or training related activities conducted at Site 10.

The IR for military personnel exposed to surficial soils is assumed to be 100 mg/day (USEPA, 1989a). An EF of 143 days per year is used in conjunction with a 4-year ED. The EF value

assumes 3 days per week for the spring and fall months, and 5 days per week for the summer months. Each season was assumed to extend for three months.

Carcinogens have an AT of 25,550 days (70 years x 365 days/year), and the AT for noncarcinogens is 1,460 days (4 years x 365 days/year). Adult average BW is 70 kg (USEPA, 1989a). A summary of these values is presented in Table 6-12.

Current On-Site Trespassers

Adult and older child trespassers may be exposed to COPCs through incidental ingestion of surface soil in the event they would gain unauthorized access to the site.

An IR of 100 mg/day (USEPA, 1989a) is assigned to both the adult and older child (age 7-16 years). An EF of 48 days per year is used in conjunction with a 10-year ED for older children and 24-year ED for adults. The EF value represents a site-specific professional judgement, where exposure to surface soil is estimated at 8 days per month for 6 months per year.

An AT of 25,550 days is used for carcinogens, and the AT for noncarcinogens is 3,650 days (10 years ED x 365 days/year) for the older child and 8,760 days (24 years x 365 days/year) for the adult. The average BW for the older child is 45 kg (USEPA, 1995a), and the BW for adults is 70 kg. A summary of these values is presented in Tables 6-13 and 6-14.

Future On-Site Residents

Future on-site residents may be exposed to COPCs in surface soil during outdoor activities around their homes. In addition, children and adults may be exposed to COPCs by incidental ingestion of surface soil through hand-to-mouth contact.

The IR values for adults and children in this scenario are assumed to be 100 mg/day and 200 mg/day, respectively (USEPA, 1989). The EF for both receptor groups is 350 days per year (USEPA, 1995a). Residential exposure duration (ED) is divided into two parts. First, a six-year ED, used for young children, represents the period of highest soil ingestion (200 mg/day). Second, a 30-year ED, used for adults, represents a period of lower soil ingestion (100 mg/day) (USEPA,

1991a and 1995a). The BW of future residential children (age 1 to 6 years) is assumed to be 15 kg, and 70 kg is used as the BW for future residential adults (USEPA, 1989a).

AT values of 25,550 days and 10,950 days (30 years x 365 days/year) are assigned to potentially carcinogenic and noncarcinogenic constituents, respectively, to estimate adult CDIs. The AT used for children exposed to noncarcinogens is 2,190 days (6 years x 365 days/year). A summary of these values is presented in Tables 6-15 and 6-16.

Future Construction Worker

Construction workers may be exposed to COPCs through incidental ingestion of surface and subsurface soil during the course of excavation activities.

An IR of 480 mg/day is assigned to future construction workers. A 250-day per year EF is used in conjunction with a 1-year ED, representing the estimated length of a typical construction job (USEPA, 1991b). AT_{nc} is 365 days (USEPA, 1989a). The fraction ingested (Fi) is assumed to be 1.0. The BW used for an adult is 70 kg. Finally, the AT_c is 25,550 days. A summary of these values is presented in Table 6-17.

6.3.4.2 Dermal Contact with Soil

The equation for CDI, calculated for all human receptors potentially experiencing dermal contact

$$CDI = \frac{C \times CF \times SA \times AF \times ABS \times EF \times ED}{BW \times AT_c \text{ or } AT_{nc}}$$

with soil, is as follows:

Where:

C	=	Contaminant concentration in 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_c	=	Averaging time, carcinogen (days)
AT_{nc}	=	Averaging time, noncarcinogen (days)

The following paragraphs explain the exposure assumptions used to evaluate the impact of COPCs in dermal contact with soil.

Military Personnel

Base personnel may be exposed to COPCs through dermal contact with surface soil, during the course of training or work related activities.

It is assumed that military personnel taking part in training or work related activities at Site 10 wear military issue work clothes consisting of a short-sleeved shirt, fatigue trousers (long pants), and boots. Exposed body parts include the hands (117 cm^2), head (1,430 cm^2), and arms (3,540 cm^2) (USEPA, 1997). The total skin surface area available for contact with COPCs for the military personnel is 5,100 cm^2.

USEPA default dermal absorption values of 0.05% or 3% for VOCs, 10% for SVOCs, nitramines and pesticides, 6% for PCBs, 1% for inorganics, and 3% for arsenic were applied in evaluating dermal exposures to soil (USEPA, 1995b). Data on AF is limited. A value of 1.0 mg/cm^2 is used in this assessment (USEPA, 1995a).

The ED, EF, BW, and AT values are the same as those used in the incidental soil ingestion scenario. A summary of these values is presented in Table 6-12.

Current Trespassers

Older child and adult trespassers may be exposed to COPCs through dermal contact with Site 10 surface soil in the event they gain unauthorized access to the site.

It is assumed that older child trespassers involved in recreational activities have approximately 3,480 cm^2 of skin surface available for contact with COPCs (USEPA, 1992a). The SA for adult trespassers is assumed to be 5,800 cm^2 (USEPA, 1997). These values represent individuals wearing a short-sleeved shirt, shorts, and shoes. Exposed body parts include head, hands, forearms, and lower legs, and represent 25 percent of total body surface area.

USEPA default dermal absorption values of 0.05% or 3% for VOCs, 10% for SVOCs, nitramines and pesticides, 6% for PCBs, 1% for inorganics, and 3% for arsenic were applied in evaluating dermal exposures to soil (USEPA, 1995b). Data on AF is limited. A value of 1.0 mg/cm^2 is used in this assessment (USEPA, 1995a). The ED, EF, BW, and AT values are the same as those used in the incidental ingestion scenario. A summary of these values is presented in Tables 6-13 and 6-14.

Future On-Site Residents

Future on-site residents may be exposed to COPCs through dermal contact with surface soil during outdoor activities near their homes.

The SA values represent reasonable worst case scenarios for an individual wearing a short-sleeved shirt, shorts, and shoes. The exposed skin surface area is limited to the head, hands, forearms, and lower legs. Twenty-five percent of the upper-bound total body surface area yields a default SA of 5,800 cm^2 for adults (USEPA, 1997). The exposed skin surface area for a child (2,100 cm^2) is estimated using an average of the 95th percentiles of the total body surface areas of a male child and a female child (ages two to seven years), multiplied by 25 percent (USEPA, 1997).

ED, EF, BW, and AT values are the same at those used in the incidental ingestion scenario. The AF and ABS values are the same as those used in the military personnel scenario. A summary of these values is presented in Tables 6-15 and 6-16.

Future Construction Worker

Construction workers may be exposed to COPCs through dermal contact with surface and subsurface soil during excavation activities. It is assumed that a construction worker wears a short-

sleeved shirt, long pants, and boots. However, the potential exists for dust particles to migrate under the clothes so that more of the skin is exposed to soils than that not covered by clothes (USEPA, 1997). Therefore, the total SA for the construction worker is 25 percent of the total body surface area for an adult, or 5,800 cm^2.

ED and EF values are the same as those used in the incidental soil ingestion scenario. The AF and ABS values are the same as those used in the military personnel scenario. A summary of these values is presented in Table 6-17.

6.3.4.3 Inhalation of Fugitive Particulates

The equation for CDI, calculated for future residents and base personnel potentially inhaling

$$CDI = \frac{C \ x \ IR \ x \ ET \ x \ EF \ x \ ED \ x \ 1/PEF}{BW \ x \ AT_c \ or \ AT_{nc}}$$

particulates, is as follows:

Where:

C	=	Contaminant concentration in soil (mg/kg)
IR	=	Inhalation rate (m^3/hr)
ET	=	Exposure time (hr/day)
EF	=	Exposure frequency (days/year)
ED	=	Exposure duration (years)
1/PEF	=	Particulate emission factor (m^3/kg)
BW	=	Body weight (kg)
AT_c	=	Averaging time, carcinogen (days)
AT_{nc}	=	Averaging time, noncarcinogen (days)

PEF relates contaminant concentrations in soil to concentrations of respirable particles in air, from surface soil fugitive dust emissions. A default PEF is used in this assessment (USEPA, 1989b). Particulate emissions at contaminated sites occur vis-a-vis wind erosion, and thereby vary according to irritability of the surface material. The PEF is 1.32×10^9 m^3/kg for all receptors in this scenario (Cowherd et al., 1985).

The following paragraphs explain the exposure assumptions used to evaluate COPC impact in particulate inhalation.

Military Personnel

During work related activities, military personnel may inhale surface soil COPCs emitted as fugitive dust from surface soil. An inhalation rate of 20 m^3/day is used in this scenario (USEPA, 1991a) along with an ET of 8 hours/day. ED, EF, BW and AT values are the same as those used in the incidental soil ingestion scenario. A summary of these values is presented in Table 6-12.

Current Trespassers

During recreational activities, adolescent and adult trespassers may inhale surface soil COPCs emitted as fugitive dust. An inhalation rate of 20 m^3/day is used for both adolescents and adults in this scenario (USEPA, 1991a). ED, EF, BW and AT values are the same as those used in the incidental soil ingestion scenario. A summary of these values is presented in Tables 6-13 and 6-14.

Future On-Site Residents

Future on-site residents may be exposed to surface soil COPCs by inhaling fugitive dust during outdoor activities near their homes. The adult IR for residential exposure scenarios is 20 m^3/day (USEPA, 1995a) and 15 m^3/day (USEPA, 1995a) is used for children. ED, EF, BW and AT values are the same as those used the incidental soil ingestion scenario. A summary of these values is presented in Tables 6-15 and 6-16.

Future Construction Worker

Construction workers may be exposed to COPCs through inhalation of fugitive particulates in subsurface soil during excavation activities. The IR is 20 m^3/day (USEPA, 1991a). ED, EF, BW and AT values are the same as those used in the incidental soil ingestion scenario. A summary of these values is presented in Table 6-17.

6.3.4.4 Ingestion of Groundwater

Currently at Site 10, deep groundwater provides the potable water supply. Due to the generally poor production rates in the shallow aquifer, it is not likely that the shallow aquifer will be developed as a potable water supply. However, should residential housing be constructed in the future, shallow groundwater may be used to provide potable supplies. Currently, there are four supply wells within a one mile radius of Site 10. These supply wells utilize the Castle Hayne aquifer. If well contamination is reported, the wells are no longer used as potable water supplies.

The equation for CDI, calculated for all human receptors potentially ingesting groundwater, is as

$$CDI = \frac{C \; x \; IR \; x \; EF \; x \; ED}{BW \; x \; AT_c \; or \; AT_{nc}}$$

follows:

Where:

C	=	Contaminant concentration is groundwater (mg/L)
IR	=	Ingestion rate (L/day)
EF	=	Exposure frequency (days/year)
ED	=	Exposure duration (years)
BW	=	Body weight (kg)
AT_c	=	Averaging time, carcinogen (days)
AT_{nc}	=	Averaging time, noncarcinogen (days)

The following paragraphs explain the exposure assumptions used to calculate the impact of COPCs in groundwater ingestion.

Future On-Site Residents

Exposure to COPCs by groundwater ingestion is a possible future exposure pathway for children and adults.

A 6-year-old child weighing 15kg has an IR of 1.0 L/day. This rate provides a conservative exposure estimate in terms of systemic health effects. This value assumes that children obtain all

the tap water they drink from the same source for 350 days/year (EF). AT is 2,190 days (6 years x 365 days/year) for noncarcinogenic compound exposure.

The IR for adults is 2 L/day (USEPA, 1989a). The ED is 30 years, the national upper-bound (90th percentile) time spent at one residence (USEPA, 1989b). The AT for noncarcinogens is 10,950 days. An AT of 25,550 days (70 years x 365 days/year) is used to evaluate exposure to potential carcinogenic compounds, for children and adults. A summary of groundwater ingestion exposure assessment input parameters is presented in Tables 6-18 and 6-19.

6.3.4.5 Dermal Contact with Groundwater

The equation for CDI, calculated for all human receptors potentially experiencing dermal contact

$$CDI = \frac{C \text{ x } SA \text{ x } PC \text{ x } ET \text{ x } EF \text{ x } ED \text{ x } CF}{BW \text{ x } AT_c \text{ or } AT_{nc}}$$

with groundwater, is as follows:

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 (1 L/1000 cm^3)
BW	=	Body weight (kg)
AT_c	=	Averaging time, carcinogen (days)
AT_{nc}	=	Averaging time, noncarcinogen (days)

The following paragraphs explain the exposure assumptions used to evaluate the impact of COPCs in dermal contact with groundwater.

Future On-Site Residents

Children and adults may be exposed to COPCs through dermal contact with groundwater while bathing or showering. It is assumed that bathing takes place 350 days/year (EF). The SA available for dermal absorption is estimated at 8,380 cm^2 for children and 23,000 cm^2 for adults (USEPA, 1997). The ET for bathing or showering is 0.25 hours/day (USEPA, 1989a), a conservative estimate. The ED, BW and AT values are the same as those used in the groundwater ingestion scenario.

The PC indicates the movement of a chemical through the skin and into the blood stream. The permeability of a chemical is an important property in evaluating actual absorbed dose; however, many compounds do not have published PC values. The permeability constants for these compounds are calculated according to USEPA guidance (USEPA, 1992a). A summary of dermal contact with groundwater exposure assessment input parameters is presented in Tables 6-18 and 6-19.

6.3.4.5 Incidental Ingestion of Surface Water

The equation for CDI, calculated for all human receptors potentially ingesting surface water, is as follows:

$$CDI = \frac{C \text{ x } IR \text{ x } ET \text{ x } EF \text{ x } ED}{BW \text{ x } AT_c \text{ or } AT_{nc}}$$

Where:	C	=	Contaminant concentration in surface water (mg/L)
	IR	=	Ingestion rate (L/hr)
	ET	=	Exposure time (hrs/event)
	EF	=	Exposure frequency (events/year)
	ED	=	Exposure duration (years)
	BW	=	Body weight (kg)
	AT_c	=	Averaging time, carcinogen (days)

AT_{nc} = Averaging time, noncarcinogen (days)

The following paragraphs explain the exposure assumptions used to evaluate the impact of COPCs in surface water ingestion.

Military Personnel

Base personnel may be exposed to COPCs through accidental ingestion of surface water during the course of training or work related activities. The IR, ET and EF values used for an adult apply to military personnel. The IR is 0.01 L/hr (USEPA, 1995a). The ET is 2.6 hr/day (USEPA, 1992a). The EF is 143 days/yr. This value represents a conservative approximation of time spent in the vicinity of the ponded areas at Site 10.

The ED value represents a standard military tour of duty duration, or four years. BW and AT values are the same as those used in surface soil exposure scenarios. These values are presented in Table 6-20.

Current Trespassers

Adolescent and adult trespassers may be exposed to COPCs through accidental ingestion with Site 10 surface water in the event they gain unauthorized access to the site. The IR value for both the adult and adolescent is 0.01 L/hr (USEPA, 1995a). The ET is 2.6 hr/day (USEPA, 1992a). The EF is 48 days/year. The EF value represents a site-specific professional judgement, where exposure to surface water is estimated at 8 days per month for 6 months per year.

The ED, BW, and AT values are the same as those used in surface soil exposure scenarios. These values are presented in Tables 6-21 and 6-22.

Future On-Site Residents

The IR, ET and EF values used for future residents apply to both children and adults. The IR is 0.05 L/hr for children and 0.01 L/hr for adults (USEPA, 1995a). The ET is 2.6 hr/day (USEPA, 1992a).

The EF is 48 days/yr. This value represents a conservative approximation of time spent in the vicinity of the ponded areas at Site 10.

The ED, BW, and AT values for the residents are the same as those in the groundwater exposure scenarios. BW and AT values are also the same as those used in groundwater exposure scenarios. These values are presented in Tables 6-23 and 6-24.

6.3.4.7 Dermal Contact with Surface Water

The equation for CDI, for all residents potentially experiencing dermal contact with surface water, is as follows:

$$CDI = \frac{C \; x \; CF \; x \; SA \; x \; PC \; x \; EF \; x \; ED \; x \; ET}{BW \; x \; AT_c \; or \; AT_{nc}}$$

Where:	C	=	Contaminant concentration in surface water (mg/L)
	CF	=	Conversion factor (L/cm^3)
	PC	=	Permeability constant (cm/hour)
	EF	=	Exposure frequency (days/year)
	ED	=	Exposure duration (years)
	ET	=	Exposure time (hours/day)
	BW	=	Body weight (kg)
	AT_c	=	Averaging time carcinogen (days)
	AT_{nc}	=	Averaging time noncarcinogen (days)

The following paragraphs explain the exposure assumptions used to evaluate the impact of COPCs in dermal contact with surface water.

Military Personnel

It is assumed that military personnel taking part in training or work related activities at Site 10 wear military issue work clothes consisting of a short-sleeved shirt, fatigue trousers (long pants), and

boots. The total skin surface area available for contact with COPCs in surface water for the military personnel is 5,100 cm^2.

The ET, EF, ED, BW and AT values are the same as those used for military personnel in the surface water ingestion exposure scenario. These values are presented in Table 6-20.

Current Trespassers

The SA values assumed for adult and adolescent trespassers involved in recreational activities are 5,800 cm^2 and 3,480 cm^2, respectively. The ET, EF, ED, BW and AT values are the same as those used for the adult and adolescent trespassers in the surface water ingestion exposure scenario. These values are presented in Tables 6-21 and 6-22.

Future On-Site Residents

SA values represent dermal surface area of hands, forearms and lower extremities exposed for contact with surface water. SA is 2,100 cm^2 for children and 5,800 cm^2 for adults (USEPA, 1997).

ET, EF, ED, BW and AT values are the same as those used for future children and adult residents in the surface water ingestion exposure scenario. These values are presented in Tables 6-23 and 6-24.

Appendix N contains CDI calculation spreadsheets for specific exposure scenarios (USEPA, 1989a).

6.4 Toxicity Assessment

This section reviews toxicological information available for COPCs identified in Section 6.2.

6.4.1 Toxicological Evaluation

Toxicological evaluation addresses the inherent toxicity of chemical compounds. It consists of the review of scientific data to determine the nature and extent of the potential human health and

environmental effects associated with exposure to various contaminants. Toxicity factors for the COPCs retained for Site 10 are presented on Tables 6-25 through 6-28.

Because of uncertainties in exposure estimates and inherent difficulties in determining causal relationships established by epidemiological studies, human data from occupational exposures are often insufficient for determining quantitative indices of toxicity. For this reason, animal bioassays are conducted under controlled conditions, and results are extrapolated to humans. There are several stages in this extrapolation. First, to account for species differences, conversion factors are used to apply test animal data to human studies. Second, high dosage administered to test animals must be translated into lower dosage, more typical of human exposure. When developing acceptable human doses of noncarcinogenic contaminants, safety factors and modifying factors are applied to animal test results. When studying carcinogens, mathematical models are used to convert high dosage effects to effects at lower dosages. Epidemiological data can then be used to determine credibility of these experimentally derived indices.

An RfD is an experimentally derived exposure index for noncarcinogenic contaminants, and a CSF is an experimentally derived exposure index for carcinogens. These values are addressed, within the context of dose-response evaluation, in the next section.

Available toxicological information indicates that many COPCs have both carcinogenic and noncarcinogenic health effects in humans and/or experimental animals. Although COPCs may cause adverse health and environmental effects, dose-response relationships and exposure must be evaluated before receptor risk can be determined. Dose-response relationships correlate dose magnitude with the probability of toxic effects, as discussed in the following section.

6.4.2 Dose-Response Evaluation

An important component in risk assessment is the relationship between the dose of a compound 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.

6.4.2.1 Carcinogenic Slope Factor

CSFs are used to estimate upper-bound lifetime probability of developing cancer as a result of exposure to a particular dose of a potential carcinogen (USEPA, 1989a). This factor is generally reported in $(mg/kg/day)^{-1}$ CSF is derived by converting high dose-response values produced by animal studies to low dose-response values, and by using an assumed low-dosage linear multistage model. The value used in reporting the slope factor is the upper 95th percent confidence limit.

USEPA weight of evidence (WOE) classifications accompany CSFs. They provide the WOE according to which particular contaminants are defined as potential human carcinogens.

The USEPA's Human Health Assessment Group (HHAG) classifies carcinogenic potential by placing chemicals into one of the following groups, according to WOE from epidemiological 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 based on epidemiological studies; 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

RfDs are developed for chronic and/or subchronic chemical exposure and is based solely on noncarcinogenic effects of chemical substances. It is defined as an estimate of the daily exposure level for a human population that is not likely to produce 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 the appropriate "uncertainty factor (UF)". Effect levels are determined by laboratory or epidemiological studies. The UF is based on the availability of toxicity data.

UFs usually consist of multiples of 10, where each factor represents a specific area of uncertainty naturally present in the extrapolation process. These UFs are presented below and were taken from the Risk Assessment Guidance Document for Superfund, Volume I, Human Health Evaluation Manual (Part A) (USEPA, 1989a):

- 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 UFs, 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 WOE classifications are presented in Tables 6-27 and 6-28. The hierarchy for choosing these values is as follows (USEPA, 1989a):

- Integrated Risk Information System (IRIS)
- Health Effects Assessment Summary Table (HEAST)
- USEPA National Center for Environmental Assessment Office (EPA-NCEA)

The IRIS database is updated monthly and contains both verified CSFs and RfDs. The USEPA has formed the Carcinogen Risk Assessment Verification Endeavor (CRAVE) Workgroup to review and to validate toxicity values used in developing CSFs. Once the slope factors have been verified with extensive peer review, they appear in the IRIS database. Like the Crave Workgroup, an RfD Workgroup has been formed by the USEPA to review existing data used to derive RfDs. Once RfDs have been verified, they also appear in IRIS.

HEAST, on the other hand, provides both interim (unverified) and verified CSFs and RFDs. This document is published quarterly and incorporates any applicable changes to its database.

6.5 Risk Characterization

This section presents estimated incremental lifetime cancer risks (ICRs) and hazard indices (HIs) for identified receptor groups possibly exposed to COPCs by the exposure pathways presented in Section 6.3.

Quantitative risk calculations for carcinogenic compounds estimate ICR levels for individuals in a given population. An ICR of $1x10^{-6}$, for example, indicates that, within a lifetime of exposure to site-specific contamination, one additional case of cancer may occur per one million exposed individuals.

$$ICR = \sum_{i=1}^{n} CDI_i \; X \; CSF_i$$

The following represents an individual's total ICR:

where CDI_i is the chronic daily intake (mg/kg/day) for compound i, and CSF_i is the compound's carcinogenic slope factor [$(mg/kg/day)^{-1}$]. The CSF is defined as an upper 95th percentile confidence limit of the probability of a carcinogenic response, based on experimental animal data. The CDI defines 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 is 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.

Quantitative noncarcinogenic effect calculations assume that noncarcinogenic compounds have threshold values for toxicological effects. Noncarcinogenic effect weighs CDI against threshold levels (RfDs). Noncarcinogenic effect is estimated by calculating the hazard index (HI), defined by the following equation:

$$= \sum_{i=1}^{n} HQ_i$$

$$HI = HQ_1 + HQ_2 + \ldots HQ_n$$

$$\text{where } HQ_i = CDI_i / RfD_i$$

where HQ_i is the hazard quotient for contaminant i, CDI_i is chronic daily intake (mg/kg/day) and RfD_i is the reference dose (mg/kg/day) for contaminant i, over a prolonged period of exposure.

6.5.1 Human Health Risks

ICR and HI values associated with exposure to environmental media at Site 10 (surface soil, subsurface soil, groundwater, and surface water/sediment) are presented in Tables 6-29 through 6-35. Total carcinogenic risks and noncarcinogenic effects, per medium, for all relevant receptor groups, are provided in these tables. ICR and HI are also broken down to show risks from specific exposure pathways: ingestion, dermal contact and inhalation (where applicable).

A cancer risk range of $1x10^{-6}$ to $1x10^{-4}$ is used to evaluate calculated ICR levels. Any ICR value within this range is considered "acceptable"; an ICR greater than $1x10^{-4}$ denotes an existing cancer risk. A ratio of 1.0 is used as an upper limit to which calculated HI values are compared. Any HI exceeding 1.0 indicates the potential for noncarcinogenic adverse health effects to occur subsequent to exposure (USEPA, 1989a).

Current Military Personnel

The current military personnel receptor was evaluated for potential noncarcinogenic hazards and carcinogenic risk from exposure to surface soil and surface water. Sediment was not evaluated since there were no COPCs retained for Site 10 sediment. The noncarcinogenic hazards and carcinogenic risks for surface soil (i.e., HI=0.09 and ICR=2.6 $x10^{-7}$) and surface water (i.e., HI=0.002) were within the acceptable risk levels (i.e., HI<1 and $1x10^{-6}$<ICR<$1x10^{-4}$). These results are presented in Table 6-29.

Current Adult Trespasser

In the current scenario, an adult trespasser receptor was evaluated for potential risk from exposure to site surface soil and surface water. Sediment was not evaluated since there were no COPCs retained for Site 10 sediment. The potential noncarcinogenic and carcinogenic risks from exposure to the surface soil (i.e., HI=0.03 and ICR=5.6 $x10^{-7}$) and surface water (i.e., HI=0.001) were within acceptable risk levels (i.e., HI<1 and $1x10^{-6}$<ICR<$1x10^{-4}$). These results are presented in Table 6-30.

Current Older Child Trespasser

In the current scenario, an older child trespasser receptor was evaluated for potential risk from exposure to site surface soil and surface water. Sediment was not evaluated since there were no COPCs retained for Site 10 sediment. The potential noncarcinogenic and carcinogenic risks from exposure to the surface soil (i.e., HI=0.04 and ICR=2.7 $x10^{-7}$) and surface water (i.e., HI=0.001) were within acceptable risk levels (i.e., HI<1 and $1x10^{-6}$<ICR<$1x10^{-4}$). These results are presented in Table 6-31.

Future Adult Resident

The future adult resident receptor was evaluated for potential risk from exposure to surface soil, groundwater, and surface water in the future scenario. Sediment was not evaluated since there were no COPCs retained for Site 10 sediment. The potential noncarcinogenic and carcinogenic risks from exposure to the surface soil (i.e., HI=0.25 and ICR=5.1 $x10^{-6}$), groundwater (i.e., HI=0.06) and surface water (i.e., HI=0.001 and ICR=5.1 $x10^{-6}$) were within acceptable risk levels (i.e., HI<1 and $1x10^{-6}$<ICR<$1x10^{-4}$). The results are summarized in Table 6-32.

Future Child Resident

The future child receptor was evaluated for potential risk from exposure to surface soil, groundwater, and surface water in the future scenario. Sediment was not evaluated since there were no COPCs retained for Site 10 sediment. The potential noncarcinogenic hazards and carcinogenic risks from exposure to the surface soil (i.e., HI=0.82 and ICR=$4.5x10^{-6}$), groundwater (i.e., HI=0.15), and surface water (i.e., HI=0.01) were within acceptable risk levels (i.e., HI<1 and $1x10^{-6}$<ICR<$1x10^{-4}$). The results are summarized in Table 6-33.

Future Construction Worker

The construction worker was evaluated for potential noncarcinogenic hazards and carcinogenic risk from exposure to surface and subsurface soil in the future scenario. The noncarcinogenic hazards and carcinogenic risks for surface soil (i.e., HI=0.32 and ICR=$2.9x10^{-7}$) and the carcinogenic risks for subsurface soil (i.e., ICR=$1.1x10^{-6}$) were within the acceptable risk levels (i.e., HI<1 and $1x10^{-4}$<ICR<$1x10^{-6}$). Table 6-34 presents these results.

The sum of the noncarcinogenic risks for exposure to surface and subsurface soil via all exposure routes was 1.85, and exceeds the acceptable risk level of one. In the subsurface scenario, the total subsurface noncarcingenic risk level was 1.5. This was due primarily to the ingestion and dermal pathways (having HIs of 0.94 and 0.59, respectively). Antimony, arsenic, chromium, and iron were the main contributors to this elevated noncarcinogenic effect in subsurface soil. It should be noted that although the total HI value for surface and subsurface soil exceeded one, all HI values for the various body systems/target organs were below one (refer to Table 6-34).

Iron had a relatively large HQ value of 0.53 for subsurface soil, and accounted for approximately 35 percent of this elevated noncarcinogenic effect. Refer to Section 6.6.5 Iron for a more detailed discussion of the uncertainties associated with the toxicological studies of iron.

6.5.2 Lead Results

The USEPA OSWER directive recommends using a lead screening value of 400 ppm in soil and 15 μg/L in groundwater. If the concentration of soil or groundwater exceed the screening criteria, OSWER recommends using the IEUBK model for evaluating potential risk to children from environmental exposures to lead under residential scenarios. Although the only exposure pathway where lead was a risk driver was in the adult construction worker, not residential child, the IEUBK was used to evaluate the risk from lead in a conservative manner.

Lead was detected in Site 10 at a maximum detected concentration of 2.9 μg/L in the groundwater and 2,630 mg/kg in the subsurface soil. The USEPA lead IEUBK model was used to determine if exposure to groundwater or subsurface soil would result in unacceptable levels in younger children upon exposure. Blood lead levels are considered unacceptable when a greater than five percent probability exists that the blood lead levels will exceed 10 μg/dl.

The maximum detected concentration of lead found in the groundwater was used in the model. The remaining model parameters used were the default factors supplied in the model. This maximum concentration resulted in a 0.917 percent probability of the blood lead levels exceeding 10 μg/dl, which is within the acceptable levels. Figure 6-2 illustrates these results.

The maximum detected concentration of lead found in the subsurface soil was used in the model. The remaining model parameters used were the default factors supplied in the model. This maximum concentration resulted in a 66.82 percent probability of the blood lead levels exceeding 10 μg/dl, which exceeds acceptable levels. Figure 6-3 illustrates these results.

6.6 Sources of Uncertainty

Uncertainties may arise during the risk assessment process. This section presents site-specific sources of uncertainty in the risk assessment:

- Sampling strategy
- Analytical data
- Exposure Assessment
- Toxicity Assessment
- Iron
- CT-Case Scenarios
- Compounds not qualitatively evaluated

6.6.1 Sampling Strategy

As an environmental medium, soil is available for direct contact exposure, and it is often the main source of contamination released to other media. Soil sampling intervals should be appropriate for the exposure pathways and contaminant transport routes of concern. Subsurface soil samples are necessary to generate data for exposure assessment when soil excavation is possible, or if leaching of chemicals to groundwater is likely. Subsurface soil samples are collected at depths greater than one foot below the ground surface.

6.6.2 Analytical Data

The credibility of the BRA relies on the quality of the analytical data available to the risk assessor. Analytical data are limited by the precision and accuracy of the analytical method of analysis. In addition, the statistical methods used to compile and analyze data (mean concentration, standard deviation, and detection frequencies) are subject to uncertainty in the ability to acquire data.

Data validation serves to reduce some of the inherent uncertainty associated with 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 risk estimation. Data can be qualified as "J" (estimated) for many reasons, including a slight exceedence of holding times, high or low surrogate recovery, or intra-sample variability. Data qualified with "J" were retained for risk assessment. Organic data qualified with "B"(detected in blank) were not applied to risk analysis. Dismissing data points qualified with "B" did not significantly increase uncertainty in the risk assessment.

6.6.3 Exposure Assessment

When performing exposure assessments, uncertainties can 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 can arise in estimating contaminant intakes resulting from contact with a particular medium.

Estimating the contaminant concentration in a given medium to which a human receptor may be exposed can be as simple as deriving the 95th percent upper confidence limit of the mean for a given data set. More complex methods for deriving contaminant concentration are necessary when exposure to COPCs in a given medium occurs subsequent to contaminant release from another medium, or when analytical data are not available to characterize the release. In this case, modeling is usually employed to estimate potential human exposure.

To estimate receptor intake, certain assumptions must be made about exposure events, exposure durations and the corresponding assimilation of contaminants by the receptor. Exposure factors have been created from a range of values generated by studies conducted by the scientific community, and have been reviewed by the USEPA. Conservative assumption for daily intakes are employed throughout the BRA when values are not available; they are designed to produce low error, to protect human health and to yield reasonable clean-up goals. In all instances, the values, conservative scientific judgments and conservative assumptions used in the risk assessment concur with USEPA guidelines.

6.6.4 Toxicity Assessment

In making quantitative estimates about the toxicity of varying chemical doses, uncertainties arise from two sources. First, existing data usually provide insufficient information about toxic exposure and subsequent effects. Human exposure data display inherent temporal variability and often lack adequate concentration estimates. Animal studies are often used to subsidize available human data. In the process of extrapolating animal results to humans; however, more uncertainties can arise. Second, in order to obtain visible toxic effects in experimental animals, high chemical doses are employed over short periods of time. Doses typical of human exposure, however, are much lower, relative to those doses administered to experimental animals. In order to apply animal test results

to human exposure assessments, then, data must be adjusted to extrapolate from high dose effects to low dose effects.

In extrapolating effects from animal receptors to human receptors, and from high doses to low doses, scientific judgment and conservative assumptions are employed. In selecting animal studies for use in dose response calculations, the following factors are considered:

- Studies are preferred in which the animal closely mimics human pharmacokinetics
- Studies are preferred in which dose intake most closely mimics intake route and duration for humans
- Studies are preferred in which the most sensitive responses to the compound in question is demonstrated

In order to evaluate compounds that cause threshold effects, (i.e., noncarcinogens) safety factors are taken into account when experimental results are extrapolated from animals to humans, and from high to low doses.

Employing conservative assumptions yields quantitative toxicity indices that are not expected to underestimate potential toxic effects, but may overestimate these effects by some magnitude.

6.6.5 Iron

The element iron has been given a RBC value and toxicity values with which to evaluate potential human health risks. The studies that prompted the addition of a RBC value for iron are provisional only and have not undergone formal review by the USEPA. A provisional RfD has been derived for iron by the Superfund Technical Support Center (STSC) division of the Environmental Criteria and Affects Office. The provisional RfD is based on a "no observed adverse effect level" (NOAEL). Developing an RfD for iron is problematic because the dose-response curve for iron is "U-shaped". That is, health effects such as anemia occur at low doses due to deficiency (occurring in the U.S. in approximately 3.3 million women of childbearing age and 240,000 children aged 1–2 years), and high doses can produce toxic effects such as hemosiderosis and liver cirrhosis, while doses in

between are beneficial for most of the population. The NOAEL is based on a study that compared the average intake of iron in the American population with biochemical indices of iron in blood (Looker et al., 1988) to demonstrate that the average intake was sufficient to prevent iron deficiency and insufficient to cause toxic effects of iron overload. The NOAEL (0.15 to 0.27 mg/kg-day) is divided by an uncertainty factor of 1, since iron is an essential element, to produce a provisional RfD of 0.3 mg/kg-day (STSC, 1999).

Although the STSC (1999) report places a high confidence in the critical study upon which the RfD is based; they place a medium confidence in the RfD. The RfD is reported to supply adequate levels of iron to meet the lifetime nutritional requirements for adults and adolescents but may not be protective of people with inherited disorders of iron metabolism (e.g., hemochromatosis which occurs in up to one million individuals in the U.S.) (MMWR, 1998) and could be conservative if applied to exposure scenarios involving forms of iron with low bioavailability. This last point is borne out by studies of Ethiopian populations that have the highest per capita iron intake in the world (471 mg/day average daily intake) but for which adverse health effects have not been observed. This is attributed to the low bioavailability of the iron in Ethiopian food (STSC, 1999).

As applied to an incidental soil ingestion exposure scenario, it is important to note that the contribution of intake of iron from soil is expected to be minimal compared to dietary intake. For example, assuming soil with iron concentration of 15,000 mg/kg (a conservative estimate of background concentrations of iron in soil) and ingestion of 50 mg/day for adults, produces only 0.01 mg/kg-day iron from soil compared to a normal dietary level of 0.3mg/kg-day. Furthermore, the bioavailability of iron from minerals in soil is expected to be significantly lower than the bioavailability of iron from food. (However, actual levels of bioavailability of iron from soil are not known.) For these reasons, and the fact that the primary sensitive population is those individuals with the medical condition of hemochromatosis which is caused by abnormal absorption of iron and which appears to occur irrespective of excess iron intake, the iron RfD is considered very conservative for use in risk assessment from environmental exposures and should be interpreted with considerable uncertainty.

For the construction worker scenario where the total site HI exceeded 1, iron had a relatively large HQ value of 0.53 for all exposure routes to surface soil. If the provisional iron RBC value were reduced, a large proportion of the risk for these sites would be eliminated. However, by evaluating

iron in the risk assessment, a conservative approach is taken and potential toxic effects may be estimated.

In summary, 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.

6.6.6 CT-Case Scenarios

The CT risk descriptor was used for data sets when the RME concentration term showed a potential risk to human health, specifically, to future construction workers. The CT concentration term utilized was the 95% UCL (USEPA, 1993). In addition, USEPA standard default exposure factors for central tendency were used in the CDI calculations. The results of the CT calculations are summarized below.

As shown in Table 6-35 under the CT-case scenario there was an unacceptable noncarcinogenic hazards to the future construction worker from subsurface soil (HI=1.4). This elevated HI value was primarily from the ingestion pathway (HI=0.82).

Antimony, arsenic, chromium, and iron were the main contributors to this elevated noncarcinogenic effect in subsurface soil. It should be noted that although the total HI value for surface and subsurface soil exceeded one, all HI values for the various body systems/target organs were below one (refer to Table 6-35).

Iron had a relatively large HQ value of 0.47 for subsurface soil, and accounted for approximately 35 percent of this elevated noncarcinogenic effect. Refer to Section 6.6.5 Iron for a more detailed discussion of the uncertainties associated with the toxicological effects of iron.

As shown in Tables 6-35, under the CT-case scenario the total site carcinogenic risks to the future construction worker were within the acceptable risk levels (i.e., $1x10^{-4}$<ICR<$1x10^{-6}$).

6.7 BRA Conclusions

The BRA highlights the media of interest for human health effects at Site 10 by identifying areas with risk values greater than acceptable levels. Current and future potential receptors at the site included current military personnel, current adult and older child (7-16 years of age) trespassers, future adult and young child (1-6 years of age) residents, and future construction workers. The total risk from the site for these receptors was estimated by summing the multiple pathways likely to affect the receptor during a given activity. Exposure to surface soil and surface water were assessed for the current receptors. Surface soil, groundwater, and surface water exposures were evaluated for the future residents. Surface and subsurface soil exposures were evaluated for the future construction worker. Total site risks for Site 10 are summarized in Table 6-36.

Lead was not included as a COPC due to the lack of toxicity criteria; however it was evaluated by comparing the concentrations to screening criteria developed by OSWER and by utilizing the IEUBK model. The risk to children from groundwater exposure were negligible (0.917 percent probability of the blood lead levels exceeding 10 μg/dl). The risk to children from soil exposure were 66.82 percent which exceeded the acceptable levels.

6.7.1 Current Scenario

In the current case, the following receptors were assessed: military personnel and adult and older child trespassers. Receptor exposure to surface soil and surface water at Site 10 was examined. Sediment exposure was not evaluated since there were no COPCs selected for Site 10 sediment; hence, the complete exposure pathway for direct contact with the sediment was eliminated. The risks calculated for all exposure pathways for the current military personnel and trespassers were within acceptable risk ranges.

6.7.2 Future Scenario

In the future case, child and adult residents were assessed for potential exposure to surface soil groundwater, and surface water. Sediment exposure was not evaluated for the reasons given above. The potential noncarcinogenic and carcinogenic risks for the child and adult resident receptors were within acceptable levels.

A future construction worker was evaluated for surface and subsurface soil exposure. In the Site 10 surface and subsurface soil exposure scenario, there are potential noncarcinogenic adverse health effects from ingestion, inhalation, and dermal contact with soil for the construction worker. The sum of the noncarcinogenic risks for exposure to surface and subsurface soil via all exposure routes was 1.85, and exceeds the acceptable risk level of one. In the subsurface scenario, the total subsurface noncarcinogenic risk level was 1.5. This was due primarily to the ingestion and dermal pathways (having HIs of 0.94 and 0.59, respectively). Antimony, arsenic, chromium, and iron were the main contributors to this elevated noncarcinogenic effect in subsurface soil. It should be noted that although the total HI value for surface and subsurface soil exceeded one, all HI values for the various body systems/target organs were below one (refer to Table 6-34).

Iron had a relatively large HQ value of 0.53 for subsurface soil, and accounted for approximately 35 percent of this elevated noncarcinogenic effect. As indicated in Section 6.6.5 "Iron," there are uncertainties associated with the toxicological studies of iron. Based on the exposure scenarios evaluated in this Baseline RA, potentially unacceptable risks for the future construction worker are unlikely, and Baker recommends that the site require no further action in the form of investigation or remediation.

6.8 References

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SECTION 6.0 TABLES

TABLE 6-1
OCCURRENCE, DISTRIBUTION AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN
SITE 10 - ORIGINAL BASE LANDFILL
MCB CAMP LEJEUNE
JACKSONVILLE, NC

Scenario Timeframe: Current, Future
Medium: Surface Soil
Exposure Medium: Surface Soil
Exposure Point: Surface Soil

CAS Number	Chemical	Minimum Concentration	Minimum Qualifier	Maximum Concentration	Maximum Qualifier	Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits	Concentration Used for Screening	Background Value (1)	Screening (2) Toxicity Value ResRBC	COPC Flag	Rationale for (3) Contaminant Deletion or Selection
	VOLATILES (ug/kg)													
75-35-4	1,1-Dichloroethene	2.6	J	2.6	J	µg/kg	IR10-SB08-00	1/25	11U - 20UJ	2.6	NA	1.06E+03 C	NO	BSL
71-43-2	Benzene	4.9	J	4.9	J	µg/kg	IR10-SB08-00	1/25	11U - 20UJ	4.9	NA	1.16E+04 C	NO	BSL
108-90-7	Chlorobenzene	4.5	J	4.5	J	µg/kg	IR10-SB08-00	1/25	11U - 20UJ	4.5	NA	1.56E+05 N	NO	BSL
108-88-3	Toluene	1.1	J	8.1	J	µg/kg	IR10-SB23-00	11/25	11U - 20UJ	8.1	NA	1.56E+06 N	NO	BSL
79-01-6	Trichloroethene (TCE)	2.3	J	2.4	J	µg/kg	IR10-SB08-00	2/25	11U - 20UJ	2.4	NA	5.81E+04 C	NO	BSL
	SEMIVOLATILES (ug/kg)													
56-55-3	Benzo(a)anthracene	59	J	86	J	µg/kg	IR10-SB03-00	4/25	350U - 650U	86	NA	8.75E+02 C	NO	BSL
50-32-8	Benzo(a)pyrene	42	J	84	J	µg/kg	IR10-SB03-00	5/25	350U - 650U	84	NA	8.75E+01 C	NO	BSL
205-99-2	Benzo(b)fluoranthene	46	J	92	J	µg/kg	IR10-SB03-00	5/25	350U - 650U	92	NA	8.75E+02 C	NO	BSL
191-24-2	Benzo(g,h,i)perylene	40	J	45	J	µg/kg	IR10-SB19-00	3/25	350U - 650U	45	NA	2.35E+05 N (5)	NO	BSL
207-08-9	Benzo(k)fluoranthene	42	J	96	J	µg/kg	IR10-SB03-00	5/25	350U - 650U	96	NA	8.75E+03 C	NO	BSL
218-01-9	Chrysene	39	J	93	J	µg/kg	IR10-SB03-00	5/25	350U - 650U	93	NA	8.75E+04 C	NO	BSL
84-74-2	Di-n-butyl phthalate (DBP)	38	J	67	J	µg/kg	IR10-SB08-00	6/25	350U - 650U	67	NA	7.82E+05 N	NO	BSL
206-44-0	Fluoranthene	65	J	190	J	µg/kg	IR10-SB03-00	5/25	350U - 650U	190	NA	3.13E+05 N	NO	BSL
193-39-5	Indeno(1,2,3-cd)pyrene	44	J	58	J	µg/kg	IR10-SB03-00	4/25	350U - 650U	58	NA	8.75E+02 C	NO	BSL
85-01-8	Phenanthrene	64	J	140	J	µg/kg	IR10-SB03-00	3/25	350U - 650U	140	NA	2.35E+05 N (5)	NO	BSL
129-00-0	Pyrene	51	J	140	J	µg/kg	IR10-SB03-00	5/25	350U - 650U	140	NA	2.35E+05 N	NO	BSL
	PESTICIDES/PCBS (ug/kg)													
72-55-9	4,4'-DDE	2.1	NJ	2.1	NJ	µg/kg	IR10-SB12-00	1/25	3.5U - 6.5U	2.1	NA	1.88E+03 C	NO	BSL
50-29-3	4,4'-DDT	3.1	J	6.2		µg/kg	IR10-SB03-00	2/25	3.5U - 6.5U	6.2	NA	1.88E+03 C	NO	BSL
60-57-1	Dieldrin	2.2	NJ	2.2	NJ	µg/kg	IR10-SB09-00	1/25	3.5U - 6.5U	2.2	NA	3.99E+01 C	NO	BSL
959-98-8	Endosulfan I	4.3	J	4.3	J	µg/kg	IR10-SB09-00	1/25	1.8U - 3.4U	4.3	NA	4.69E+04 N (6)	NO	BSL
72-20-8	Endrin	2.4	NJ	2.4	NJ	µg/kg	IR10-SB09-00	1/25	3.5U - 6.5U	2.4	NA	2.35E+03 N	NO	BSL
7421-93-4	Endrin Aldehyde	4.9		4.9		µg/kg	IR10-SB20-00	1/25	3.5U - 6.5U	4.9	NA	2.35E+03 N (7)	NO	BSL
76-44-8	Heptachlor	1.2	NJ	1.2	NJ	µg/kg	IR10-SB09-00	1/25	1.8U - 3.4U	1.2	NA	1.42E+02 C	NO	BSL
1024-57-3	Heptachlor Epoxide	2.4	NJ	2.4	NJ	µg/kg	IR10-SB09-00	1/25	1.8U - 3.4U	2.4	NA	7.02E+01 C	NO	BSL
11096-82-5	Aroclor-1260	85	J	85	J	µg/kg	IR10-SB04-00	1/25	35U - 65U	85	NA	3.19E+02 C	NO	BSL
	TOTAL METALS (mg/kg)													
7429-90-5	Aluminum	66.6		10,200	J	mg/kg	IR10-SB25-00	25/25	(4)	10,200	29.4 - 7280	7.82E+03 N	YES	ASL
7440-36-0	Antimony	5.3	J	12.5	J	mg/kg	IR10-SB03-00	3/25	12.8U - 23.8U	12.5	0.25 J - 0.55 J	3.13E+00 N	YES	ASL
7440-38-2	Arsenic	11.6		11.6		mg/kg	IR10-SB25-00	1/25	0.48U - 2.5U	11.6	0.27 - 0.85 J	4.26E-01 C	YES	ASL
7440-39-3	Barium	0.58	J	173		mg/kg	IR10-SB25-00	25/25	(4)	173	0.73 J - 19.5	5.48E+02 N	NO	BSL
7440-41-7	Beryllium	0.16	J	1.7	J	mg/kg	IR10-SB25-00	2/25	1.1U - 1.5U	1.7	0.012 J - 0.11 J	1.56E+01 N	NO	BSL
7440-43-9	Cadmium	0.86	J	0.86	J	mg/kg	IR10-SB19-00	1/25	1.1U - 2U	0.86	0.037 J - 0.064 J	3.91E+00 N	NO	BSL
7440-70-2	Calcium	33.5	J	28,900	J	mg/kg	IR10-SB06-00	25/25	(4)	28,900	12.4 J - 17400	N/A N	NO	NUT

TABLE 6-1 (Continued)
OCCURRENCE, DISTRIBUTION AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN
SITE 10 - ORIGINAL BASE LANDFILL
MCB CAMP LEJEUNE
JACKSONVILLE, NC

Scenario Timeframe: Current, Future
Medium: Surface Soil
Exposure Medium: Surface Soil
Exposure Point: Surface Soil

CAS Number	Chemical	Minimum Concentration	Minimum Qualifier	Maximum Concentration	Maximum Qualifier	Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits	Concentration Used for Screening	Background Value (1)	Screening (2) Toxicity Value ResRBC	COPC Flag	Rationale for (3) Contaminant Deletion or Selection
	TOTAL METALS (mg/kg) (Cont)													
7440-47-3	Chromium	0.78	J	11.2	J	mg/kg	IR10-SB25-00	21/25	2.1U - 2.2U	11.2	0.24 J - 9.7	2.35E+01 N (8)	NO	BSL
7440-48-4	Cobalt	0.97	J	8.8	J	mg/kg	IR10-SB25-00	4/25	10.6U - 14.6U	8.8	0.089 J - 0.4 J	1.56E+02 N	NO	BSL
7440-50-8	Copper	0.46	J	43.8		mg/kg	IR10-SB25-00	25/25	(4)	43.8	0.29 J - 38.5	3.13E+02 N	NO	BSL
7439-89-6	Iron	170	J	7,740	J	mg/kg	IR10-SB25-00	17/25	77.9U - 127U	7,740	26.3 - 3830	2.35E+03 N	YES	ASL
7439-92-1	Lead	0.6	J	85.1		mg/kg	IR10-SB19-00	25/25	(4)	85.1	0.45 - 38.5 J	4.00E+02 N (9)	NO	NTX
7439-95-4	Magnesium	8.5	J	687	J	mg/kg	IR10-SB25-00	25/25	(4)	687	9.8 J - 1610	N/A N	NO	NUT
7439-96-5	Manganese	1.9	J	73.3	J	mg/kg	IR10-SB25-00	25/25	(4)	73.3	0.64 J - 25.9	1.56E+02 N	NO	BSL
7439-97-6	Mercury	0.022	J	0.27		mg/kg	IR10-SB25-00	21/25	0.11U - 0.11U	0.27	0.02 J - 0.12 J	2.35E+00 N (10)	NO	BSL
7440-02-0	Nickel	2.1	J	17.3		mg/kg	IR10-SB25-00	7/25	8.5U - 10.1U	17.3	0.11 J - 1.8	1.56E+02 N	NO	BSL
7440-09-7	Potassium	146	J	1,600	J	mg/kg	IR10-SB25-00	8/25	1070U - 1460U	1,600	5.8 J - 263 J	N/A N	NO	NUT
7782-49-2	Selenium	0.61	J	2		mg/kg	IR10-SB25-00	5/25	1.1U - 1.3U	2	0.25 J - 0.46 J	3.91E+01 N	NO	BSL
7440-22-4	Silver	1.4	J	3		mg/kg	IR10-SB03-00	2/25	2.1U - 4U	3	NA	3.91E+01 N	NO	BSL
7440-23-5	Sodium	10.9	J	281	J	mg/kg	IR10-SB25-00	25/25	(4)	281	NA	N/A N	NO	NUT
7440-62-2	Vanadium	3.1	J	31.4		mg/kg	IR10-SB25-00	8/25	1.5U - 12.6U	31.4	0.14 J - 13.4	5.48E+01 N	NO	BSL
7440-66-6	Zinc	2.9	J	304	J	mg/kg	IR10-SB19-00	18/25	2.3U - 3.7U	304	0.36 J - 73.9	2.35E+03 N	NO	BSL

(1) Background - Base Fine Sand, Range of positive detects
(2) All non-carcinogenic RBCs were divided by 10 to account for potential additive effects of chemicals
(3) Rationale Codes Selection Reason: Above Screening Levels (ASL)
Same Chemical Class (CHEM)
No Screening Criteria (NSC)
Retained in Another Media (RAM)

Deletion Reason: Below Screening Level (BSL)
Essential Nutrient (NUT)
No Toxicity Information (NTX)

(4) No detection limits given; analyte detected in every sample.
(5) Screening value for pyrene used as a surrogate.
(6) Screening value for endosulfan used as a surrogate.
(7) Screening value for endrin used as a surrogate.
(8) Screening value for chromium VI used.
(9) Action level for lead.
(10) Screening values for mercuric chloride used as a surrogate.

Definitions:
N/A = Not Applicable
SQL = Sample Quantitation Limit
COPC = Chemical of Potential Concern
ARAR/TBC = Applicable or Relevant and Appropriate Requirement/To Be Considered

J - Analyte present - Reported value is estimated
NJ - Presumptive evidence for the presence of the material at an estimated value
U - Not detected
UJ - Reported quantitation limit is qualified as estimated

C = Carcinogenic
N = Non-Carcinogenic
mg/kg = milligrams per kilogram
ug/kg = microgram per kilogram

TABLE 6-2
OCCURRENCE, DISTRIBUTION AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN
SITE 10 - ORIGINAL BASE LANDFILL
MCB CAMP LEJEUNE
JACKSONVILLE, NC

Scenario Timeframe: Future
Medium: Subsurface Soil
Exposure Medium: Subsurface Soil
Exposure Point: Subsurface Soil

CAS Number	Chemical	Minimum Concentration	Minimum Qualifier	Maximum Concentration	Maximum Qualifier	Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits	Concentration Used for Screening	Background Value	Screening (1) Toxicity Value ResRBC	COPC Flag	Rationale for (2) Contaminant Deletion or Selection
	VOLATILES (ug/kg)													
67-64-1	Acetone	7,100		7,100		µg/kg	IR10-SB19-01	1/22	11U - 8300U	7,100	NA	7.82E+05 N	NO	BSL
74-83-9	Bromomethane	250	J	250	J	µg/kg	IR10-SB19-01	1/22	11U - 12U	250	NA	1.10E+04 N	NO	BSL
75-09-2	Methylene Chloride	260	J	260	J	µg/kg	IR10-SB19-01	1/22	11U - 12U	260	NA	8.52E+04 C	NO	BSL
108-88-3	Toluene	2	J	3.6	J	µg/kg	IR10-SB19-01	2/22	11U - 12U	3.6	NA	1.56E+06 N	NO	BSL
	SEMIVOLATILES (ug/kg)													
83-32-9	Acenaphthene	210	J	210	J	µg/kg	IR10-SB03-03	1/22	350U - 410U	210	NA	4.69E+05 N	NO	BSL
120-12-7	Anthracene	370	J	370	J	µg/kg	IR10-SB03-03	1/22	350U - 410U	370	NA	2.35E+06 N	NO	BSL
56-55-3	Benzo(a)anthracene	1,200		1,200		µg/kg	IR10-SB03-03	1/22	350U - 410U	1,200	NA	8.75E+02 C	YES	ASL
50-32-8	Benzo(a)pyrene	1,100		1,100		µg/kg	IR10-SB03-03	1/22	350U - 410U	1,100	NA	8.75E+01 C	YES	ASL
205-99-2	Benzo(b)fluoranthene	1,200		1,200		µg/kg	IR10-SB03-03	1/22	350U - 410U	1,200	NA	8.75E+02 C	YES	ASL
191-24-2	Benzo(g,h,i)perylene	480		480		µg/kg	IR10-SB03-03	1/22	350U - 410U	480	NA	2.35E+05 N (5)	NO	BSL
207-08-9	Benzo(k)fluoranthene	950		950		µg/kg	IR10-SB03-03	1/22	350U - 410U	950	NA	8.75E+03 C	YES	CHEM
86-74-8	Carbazole	200	J	200	J	µg/kg	IR10-SB03-03	1/22	350U - 410U	200	NA	3.19E+04 C	YES	CHEM
218-01-9	Chrysene	1,300		1,300		µg/kg	IR10-SB03-03	1/22	350U - 410U	1,300	NA	8.75E+04 C	YES	CHEM
53-70-3	Dibenz(a,h)anthracene	280	J	280	J	µg/kg	IR10-SB03-03	1/22	350U - 410U	280	NA	8.75E+01 C	YES	ASL
132-64-9	Dibenzofuran	76	J	76	J	µg/kg	IR10-SB03-03	1/22	350U - 410U	76	NA	3.13E+04 N	NO	BSL
84-74-2	Di-n-butyl phthalate (DBP)	42	J	48	J	µg/kg	IR10-SB02-02,IR10-SB03-03,IR10-SB05-04	7/22	350U - 410U	48	NA	7.82E+05 N	NO	BSL
206-44-0	Fluoranthene	2,900		2,900		µg/kg	IR10-SB03-03	1/22	350U - 410U	2,900	NA	3.13E+05 N	NO	BSL
86-73-7	Fluorene	160	J	160	J	µg/kg	IR10-SB03-03	1/22	350U - 410U	160	NA	3.13E+05 N	NO	BSL
193-39-5	Indeno(1,2,3-cd)pyrene	570		570		µg/kg	IR10-SB03-03	1/22	350U - 410U	570	NA	8.75E+02 C	YES	CHEM
91-20-3	Naphthalene	70	J	70	J	µg/kg	IR10-SB03-03	1/22	350U - 410U	70	NA	1.56E+05 N	NO	BSL
85-01-8	Phenanthrene	1,900		1,900		µg/kg	IR10-SB03-03	1/22	350U - 410U	1,900	NA	2.35E+05 N (5)	NO	BSL
129-00-0	Pyrene	2,100		2,100		µg/kg	IR10-SB03-03	1/22	350U - 410U	2,100	NA	2.35E+05 N	NO	BSL
	PESTICIDES/PCBS (ug/kg)													
72-54-8	4,4'-DDD	2.9	NJ	2.9	NJ	µg/kg	IR10-SB03-03	1/22	3.5U - 4.1U	2.9	NA	2.66E+03 C	NO	BSL
959-98-8	Endosulfan I	1.3	J	1.3	J	µg/kg	IR10-SB06-03	1/22	1.8U - 2.1U	1.3	NA	4.69E+04 N (6)	NO	BSL
33213-65-9	Endosulfan II	4.7		4.7		µg/kg	IR10-SB03-03	1/22	3.5U - 4.1U	4.7	NA	4.69E+04 N (6)	NO	BSL
72-20-8	Endrin	2.5	NJ	2.5	NJ	µg/kg	IR10-SB03-03	1/22	3.5U - 4.1U	2.5	NA	2.35E+03 N	NO	BSL
53494-70-5	Endrin Ketone	4	J	4	J	µg/kg	IR10-SB03-03	1/22	3.5U - 4.1U	4	NA	2.35E+03 N (7)	NO	BSL
72-43-5	Methoxychlor	13	J	13	J	µg/kg	IR10-SB15-01	1/22	18UJ - 21UJ	13	NA	3.91E+04 N	NO	BSL
	TOTAL METALS (mg/kg)													
7429-90-5	Aluminum	40.2	J	5,910		mg/kg	IR10-SB04-03	22/22	(4)	5,910	260 J - 9900	7.82E+03 N	NO	BSL
7440-36-0	Antimony	7.3	J	84.2		mg/kg	IR10-SB04-03	3/22	12.7U - 14.9U	84.2	0.2 J - 0.41 J	3.13E+00 N	YES	ASL
7440-38-2	Arsenic	0.99	J	37.2		mg/kg	IR10-SB04-03	3/22	0.54U - 2.5U	37.2	0.34 J - 1.1	4.26E-01 C	YES	ASL
7440-39-3	Barium	0.88	J	589		mg/kg	IR10-SB04-03	22/22	(4)	589	0.67 J - 18.2	5.48E+02 N	YES	ASL
7440-41-7	Beryllium	0.12	J	0.12	J	mg/kg	IR10-SB03-03	1/22	1.1U - 3.8U	0.12	0.013 J - 0.097 J	1.56E+01 N	NO	BSL
7440-43-9	Cadmium	7.9		7.9		mg/kg	IR10-SB03-03	1/22	1.1U - 3.8U	7.9	NA	3.91E+00 N	YES	ASL

TABLE 6-2 (Continued)
OCCURRENCE, DISTRIBUTION AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN
SITE 10 - ORIGINAL BASE LANDFILL
MCB CAMP LEJEUNE
JACKSONVILLE, NC

Scenario Timeframe: Future
Medium: Subsurface Soil
Exposure Medium: Subsurface Soil
Exposure Point: Subsurface Soil

CAS Number	Chemical	Minimum Concentration	Minimum Qualifier	Maximum Concentration	Maximum Qualifier	Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits	Concentration Used for Screening	Background Value	Screening (1) Toxicity Value ResRBC	COPC Flag	Rationale for (2) Contaminant Deletion or Selection
	TOTAL METALS (mg/kg) (Cont)													
7440-70-2	Calcium	26.9	J	25,100	J	mg/kg	IR10-SB04-03	22/22	(4)	25,100	12.7 J - 499	N/A N	NO	NUT
7440-47-3	Chromium	0.91	J	66.5		mg/kg	IR10-SB04-03	21/22	2.2U - 2.2U	66.5	0.83 - 13.2	2.35E+01 N (8)	YES	ASL
7440-48-4	Cobalt	0.84	J	53.2		mg/kg	IR10-SB04-03	7/22	10.6U - 12.4U	53.2	0.1 J - 0.84	1.56E+02 N	NO	BSL
7440-50-8	Copper	0.39	J	3340		mg/kg	IR10-SB04-03	22/22	(4)	3340	0.23 J - 3.3	3.13E+02 N	YES	ASL
57-12-5	Cyanide, total	0.62	J	0.62	J	mg/kg	IR10-SB04-03	1/22	2.1U - 2.5U	0.62	NA	1.56E+02 N	NO	BSL
7439-89-6	Iron	102	J	218,000		mg/kg	IR10-SB04-03	22/22	(4)	218,000	81.5 - 4600	2.35E+03 N	YES	ASL
7439-92-1	Lead	0.72		2,630		mg/kg	IR10-SB04-03	22/22	(4)	2,630	1.1 J - 6	4.00E+02 N (9)	NO	NTX
7439-95-4	Magnesium	5.8	J	1,050	J	mg/kg	IR10-SB04-03	22/22	(4)	1,050	13.5 J - 216	N/A N	NO	NUT
7439-96-5	Manganese	1.6	J	948		mg/kg	IR10-SB04-03	22/22	(4)	948	0.75 J - 7.1	1.56E+02 N	YES	ASL
7439-97-6	Mercury	0.022	J	0.16		mg/kg	IR10-SB04-03	16/22	0.11U - 0.12U	0.16	0.021 J - 0.061 J	2.35E+00 N (10)	NO	BSL
7440-02-0	Nickel	1.9	J	147		mg/kg	IR10-SB04-03	6/22	8.4U - 9.9U	147	0.12 J - 3.6	1.56E+02 N	NO	BSL
7440-09-7	Potassium	165	J	636	J	mg/kg	IR10-SB04-03	6/22	1060U - 1240U	636	16 J - 292	N/A N	NO	NUT
7782-49-2	Selenium	0.65	J	1.1	J	mg/kg	IR10-SB19-01	3/22	1.1U - 1.2U	1.1	0.24 J - 0.47 J	3.91E+01 N	NO	BSL
7440-22-4	Silver	1.1	J	11.3		mg/kg	IR10-SB03-03	4/22	2.1U - 7.5U	11.3	NA	3.91E+01 N	NO	BSL
7440-23-5	Sodium	9.5	J	336	J	mg/kg	IR10-SB04-03	22/22	(4)	336	NA	N/A N	NO	NUT
7440-28-0	Thallium	1.1	J	1.1	J	mg/kg	IR10-SB11-02	1/22	2.1U - 2.6U	1.1	NA	5.48E-01 N	YES	ASL
7440-62-2	Vanadium	3.9	J	6.6	J	mg/kg	IR10-SB19-01	5/22	1.7U - 37.5U	6.6	0.6 J - 13.7	5.48E+01 N	NO	BSL
7440-66-6	Zinc	2.5	J	1,250		mg/kg	IR10-SB04-03	13/22	2.3U - 3.4U	1,250	0.33 J - 7.9	2.35E+03 N	NO	BSL

(1) Background - Base Sand, Range of positive detects
(2) All non-carcinogenic RBCs were divided by 10 to account for potential additive effects of chemicals
(3) Rationale Codes Selection Reason: Above Screening Levels (ASL)
Same Chemical Class (CHEM)
No Screening Criteria (NSC)
Retained in Another Media (RAM)

Deletion Reason: Below Screening Level (BSL)
Essential Nutrient (NUT)
No Toxicity Information (NTX)

(4) No detection limits given; analyte detected in every sample.
(5) Screening value for pyrene used as a surrogate.
(6) Screening value for endosulfan used as a surrogate.
(7) Screening value for endrin used as a surrogate.
(8) Screening value for chromium VI used.
(9) Action level for lead.
(10) Screening values for mercuric chloride used as a surrogate.

Definitions:
N/A = Not Applicable
SQL = Sample Quantitation Limit
COPC = Chemical of Potential Concern
ARAR/TBC = Applicable or Relevant and Appropriate Requirement/To Be Considered

J - Analyte present - Reported value is estimated
NJ - Presumptive evidence for the presence of the material at an estimated value
U - Not detected
UJ - Reported quantitation limit is qualified as estimated

C = Carcinogenic
N = Non-Carcinogenic

mg/kg = milligrams per kilogram
ug/kg = microgram per kilogram

TABLE 6-3
OCCURRENCE, DISTRIBUTION AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN
SITE 10 - ORIGINAL BASE LANDFILL
MCB CAMP LEJEUNE
JACKSONVILLE, NC

Scenario Timeframe: Future
Medium: Groundwater
Exposure Medium: Groundwater
Exposure Point: Groundwater

CAS Number	Chemical	Minimum Concentration	Minimum Qualifier	Maximum Concentration	Maximum Qualifier	Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits	Concentration Used for Screening	Screening (1) Toxicity Value TapWtr RBCs	Potential ARAR/TBC Value	Potential ARAR/TBC Source	COPC Flag	Rationale for (2) Contaminant Deletion or Selection
	METALS (ug/l)														
7429-90-5	Aluminum	398	J	3,150	J	µg/L	10-MW0901A	6/7	186U - 186U	3,150	3.65E+03 N	N/A	N/A	NO	BSL
7440-39-3	Barium	17.6	J	29.7	J	µg/L	10-MW0301A	7/7	(3)	29.7	2.56E+02 N	2,000	MCL	NO	BSL
7440-70-2	Calcium	727	J	62,400		µg/L	10-MW0601A	7/7	(3)	62,400	N/A N	N/A	N/A	NO	NUT
7440-47-3	Chromium	8.4	J	8.4	J	µg/L	10-MW0901A	1/7	0.6U - 5.4U	8.4	1.10E+01 N (4)	100	MCL	NO	BSL
7440-48-4	Cobalt	0.82	J	1.4	J	µg/L	10-MW0301A	5/7	0.7U - 0.7U	1.4	7.30E+01 N	N/A	N/A	NO	BSL
7440-50-8	Copper	0.88	J	3.4	J	µg/L	10-MW0901A	6/7	0.7U - 0.7U	3.4	1.46E+02 N	1,300	MCL (5)	NO	BSL
7439-89-6	Iron	94.9	J	1,110	J	µg/L	10-MW0901A	7/7	(3)	1,110	1.10E+03 N	N/A	N/A	YES	ASL
7439-92-1	Lead	2.9	J	2.9	J	µg/L	10-MW0901A	1/7	1.7U - 1.7U	2.9	1.50E+01 N (5)	15	MCL (5)	NO	NTX
7439-95-4	Magnesium	486	J	4,910	J	µg/L	10-MW0601A	7/7	(3)	4,910	N/A N	N/A	N/A	NO	NUT
7439-96-5	Manganese	14.3	J	49.8		µg/L	10-MW0901A	7/7	(3)	49.8	7.30E+01 N	N/A	N/A	NO	BSL
7440-02-0	Nickel	1.8	J	10.6	J	µg/L	10-MW0301A	7/7	(3)	10.6	7.30E+01 N	100	MCL	NO	BSL
7440-09-7	Potassium	229	J	2,600	J	µg/L	10-MW0601A	7/7	(3)	2,600	N/A N	N/A	N/A	NO	NUT
7440-22-4	Silver	0.58	J	0.58	J	µg/L	10-MW0401A	1/7	0.5U - 0.5U	0.58	1.83E+01 N	N/A	N/A	NO	BSL
7440-23-5	Sodium	4,500	J	14,000	J	µg/L	10-MW0601A	7/7	(3)	14,000	N/A N	N/A	N/A	NO	NUT
7440-62-2	Vanadium	0.95	J	4.2	J	µg/L	10-MW0901A	5/7	0.7U - 0.7U	4.2	2.56E+01 N	N/A	N/A	NO	BSL
7440-66-6	Zinc	2.5	J	8.3	J	µg/L	10-MW0901A	2/7	1.1U - 1.1U	8.3	1.10E+03 N	N/A	N/A	NO	BSL

Definitions: N/A = Not Applicable
SQL = Sample Quantitation Limit
COPC = Chemical of Potential Concern
ARAR/TBC = Applicable or Relevant and Appropriate Requirement/To Be Considered

J - Analyte present - Reported value is estimated

C = Carcinogenic
N = Non-Carcinogenic

ug/L = microgram per liter

(1) All non-carcinogenic RBCs were divided by 10 to account for potential additive effects of chemicals
(2) Rationale Codes Selection Reason Above Screening Levels (ASL)
Same Chemical Class (CHEM)
No Screening Criteria (NSC)
Retained in Another Media (RAM)

Deletion Reason: Below Screening Level (BSL)
Essential Nutrient (NUT)
No Toxicity Information (NTX)

(3) No detection limits given; analyte detected in every sample.
(4) Screening value for chromium VI used.
(5) Action level for copper and lead.

TABLE 6-4
OCCURRENCE, DISTRIBUTION AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN
SITE 10 - ORIGINAL BASE LANDFILL
MCB CAMP LEJEUNE
JACKSONVILLE, NC

Scenario Timeframe: Future
Medium: Surface Water
Exposure Medium: Surface Water
Exposure Point: Surface Water

CAS Number	Chemical	Minimum Concentration	Minimum Qualifier	Maximum Concentration	Maximum Qualifier	Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits	Concentration Used for Screening	Screening (1) Toxicity Value NC Wtr Qual		COPC Flag	Rationale for (2) Contaminant Deletion or Selection
	VOLATILES (ug/l)													
108-88-3	Toluene	1.3	J	1.3	J	µg/L	IR10-SW03,IR10-SW04	2/6	10U - 10U	1.3	1.10E+01	N	NO	BSL
	METALS (ug/l)													
7429-90-5	Aluminum	127	J	1,270		µg/L	IR10-SW05	6/6	(3)	1,270	8.70E+01	N	YES	ASL
7440-38-2	Arsenic	2.4	J	5	J	µg/L	IR10-SW04	5/6	10U - 10U	5	5.00E+01	C	NO	BSL
7440-39-3	Barium	8.2	J	37.1	J	µg/L	IR10-SW04	5/6	4.2U - 4.2U	37.1	1.40E+03	N	NO	BSL
7440-70-2	Calcium	2,340	J	33,200		µg/L	IR10-SW04	6/6	(3)	33,200	N/A	N	NO	NUT
7440-50-8	Copper	3	J	3	J	µg/L	IR10-SW03	1/6	2.5U - 10.7U	3	7.00E+00	N	NO	BSL
7439-89-6	Iron	424		2,210		µg/L	IR10-SW04	6/6	(3)	2,210	1.00E+03	N	YES	ASL
7439-92-1	Lead	1.1	J	7.1		µg/L	IR10-SW04	5/6	3U - 3U	7.1	2.50E+01	N	NO	NTX
7439-95-4	Magnesium	949	J	2,470	J	µg/L	IR10-SW03	6/6	(3)	2,470	N/A	N	NO	NUT
7439-96-5	Manganese	45.9		415		µg/L	IR10-SW04	6/6	(3)	415	N/A	N	NO	NTX
7439-97-6	Mercury	0.032	J	0.06	J	µg/L	IR10-SW04	4/6	0.2U - 0.2U	0.06	1.20E-02	N	YES	ASL
7440-09-7	Potassium	937	J	1,860	J	µg/L	IR10-SW04	4/6	5000U - 5000U	1,860	N/A	N	NO	NUT
7440-23-5	Sodium	3,080	J	6,040		µg/L	IR10-SW04	6/6	(3)	6,040	N/A	N	NO	NUT
7440-62-2	Vanadium	12.6	J	19.8	J	µg/L	IR10-SW04	6/6	(3)	19.8	4.70E+01	N	NO	BSL
7440-66-6	Zinc	39.9		95.9		µg/L	IR10-SW04	6/6	(3)	95.9	5.00E+01	N	YES	ASL

(1) North Carolina Water Quality Standards for Surface Water (NCDENR, 1998)
(2) Rationale Codes Selection Reason: Above Screening Levels (ASL)
Same Chemical Class (CHEM)
No Screening Criteria (NSC)
Retained in Another Media (RAM)

Deletion Reason: Below Screening Level (BSL)
Essential Nutrient (NUT)
No Toxicity Information (NTX)

Definitions: N/A = Not Applicable
SQL = Sample Quantitation Limit
COPC = Chemical of Potential Concern
ARAR/TBC = Applicable or Relevant and Appropriate Requirement/To Be Considered

J - Analyte present - Reported value is estimated
U - Not detected

C = Carcinogenic ug/L = microgram per liter
N = Non-Carcinogenic

(3) No detection limits given; analyte detected in every sample.
(4) Action level for lead.
(5) Screening values for mercuric chloride used as a surrogate.

TABLE 6-5
OCCURRENCE, DISTRIBUTION AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN
SITE 10 - ORIGINAL BASE LANDFILL
MCB CAMP LEJEUNE
JACKSONVILLE, NC

Scenario Timeframe: Current, Future
Medium: Sediment
Exposure Medium: Sediment
Exposure Point: Sediment

CAS Number	Chemical	Minimum Concentration	Minimum Qualifier	Maximum Concentration	Maximum Qualifier	Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits	Concentration Used for Screening	Screening (1) Toxicity Value ResRBC	COPC Flag	Rationale for (2) Contaminant Deletion or Selection
	VOLATILES (ug/kg)												
78-93-3	2-Butanone (MEK)	52		52		µg/kg	IR10-SD01-06	1/6	13U - 18U	52	4.69E+06 N	NO	BSL
108-88-3	Toluene	4.2	J	97		µg/kg	IR10-SD04-06	6/6	(3)	97	1.56E+06 N	NO	BSL
	PESTICIDES/PCBS (ug/kg)												
50-29-3	4,4'-DDT	4	J	4	J	µg/kg	IR10-SD05-06,IR10-SD06-06	2/6	4.4U - 6.1U	4	1.88E+03 C	NO	BSL
7421-93-4	Endrin Aldehyde	3.1	J	3.1	J	µg/kg	IR10-SD06-06	1/6	4.4U - 6.1U	3.1	2.35E+03 N (4)	NO	BSL
	METALS (mg/kg)												
7429-90-5	Aluminum	834	J	3150	J	mg/kg	IR10-SD05-06	6/6	(3)	3150	7.82E+03 N	NO	BSL
7440-39-3	Barium	1.9	J	18.2	J	mg/kg	IR10-SD04-06	6/6	(3)	18.2	5.48E+02 N	NO	BSL
7440-70-2	Calcium	113	J	1630	J	mg/kg	IR10-SD04-06	6/6	(3)	1630	N/A N	NO	NUT
7440-50-8	Copper	3.5	J	4	J	mg/kg	IR10-SD01-06	2/6	1.3U - 2.9U	4	3.13E+02 N	NO	BSL
7439-89-6	Iron	191	J	1110	J	mg/kg	IR10-SD06-06	6/6	(3)	1110	2.35E+03 N	NO	BSL
7439-92-1	Lead	4		22.7		mg/kg	IR10-SD04-06	6/6	(3)	22.7	4.00E+02 N (5)	NO	NTX
7439-95-4	Magnesium	29.4	J	122	J	mg/kg	IR10-SD06-06	6/6	(3)	122	N/A N	NO	NUT
7439-96-5	Manganese	1.2	J	6.7		mg/kg	IR10-SD01-06,IR10-SD06-06	6/6	(3)	6.7	1.56E+02 N	NO	BSL
7439-97-6	Mercury	0.047	J	0.06	J	mg/kg	IR10-SD03-06	2/6	0.14U - 0.18U	0.06	2.35E+00 N (6)	NO	BSL
7440-09-7	Potassium	182	J	246	J	mg/kg	IR10-SD04-06	3/6	1330U - 1550U	246	N/A N	NO	NUT
7782-49-2	Selenium	0.76	J	0.76	J	mg/kg	IR10-SD02-06	1/6	1.3U - 1.8U	0.76	3.91E+01 N	NO	BSL
7440-62-2	Vanadium	3.4	J	3.9	J	mg/kg	IR10-SD05-06	2/6	13.3U - 18.4U	3.9	5.48E+01 N	NO	BSL
7440-66-6	Zinc	7.2		12.1		mg/kg	IR10-SD04-06	6/6	(3)	12.1	2.35E+03 N	NO	BSL

(1) All non-carcinogenic RBCs were divided by 10 to account for potential additive effects of chemicals
(2) Rationale Codes Selection Reason: Above Screening Levels (ASL)
Same Chemical Class (CHEM)
No Screening Criteria (NSC)
Retained in Another Media (RAM)

Deletion Reason: Below Screening Level (BSL)
Essential Nutrient (NUT)
No Toxicity Information (NTX)

Definitions: N/A = Not Applicable
SQL = Sample Quantitation Limit
COPC = Chemical of Potential Concern
ARAR/TBC = Applicable or Relevant and Appropriate Requirement/To Be Considered

J - Analyte present - Reported value is estimated
U - Not detected

C = Carcinogenic
N = Non-Carcinogenic

mg/kg = milligrams per kilogram
ug/kg = microgram per kilogram

(3) No detection limits given; analyte detected in every sample.
(4) Screening value for endrin used as a surrogate.
(5) Action level for lead.
(6) Screening values for mercuric chloride used as a surrogate.

TABLE 6-6

SUMMARY OF COPCs IN ENVIRONMENTAL MEDIA OF CONCERN
SITE 10 - ORIGINAL BASE LANDFILL
MCB, CAMP LEJEUNE
JACKSONVILLE, NC

Contaminant	Surface Soil	Subsurface Soil	Groundwater	Surface Water	Sediment
Semivolatiles					
Benzo(a)anthracene		X			
Chrysene		X			
Benzo(b)fluoranthene		X			
Benzo(k)fluoranthene		X			
Benzo(a)pyrene		X			
Indeno(1,2,3-cd)pyrene		X			
Diben(a,h)anthracene		X			
Carbazole		X			
Metals					
Aluminum	X			X	
Antimony	X	X			
Arsenic	X	X			
Barium		X			
Cadmium		X			
Chromium		X			
Copper		X			
Iron	X	X	X	X	
Manganese		X			
Mercury				X	
Thallium		X			
Vanadium					
Zinc				X	

TABLE 6-7
SELECTION OF EXPOSURE PATHWAYS
SITE 10 - ORIGINAL BASE LANDFILL
MCB, CAMP LEJEUNE
JACKSONVILLE, NC

Scenario Timeframe	Medium	Exposure Medium	Exposure Point	Receptor Population	Receptor Age	Exposure Route	On-Site/ Off-Site	Type of Analysis	Rationale for Selection or Exclusion of Exposure Pathway
Current	Surface Soil	Surface Soil	Site 10 Surface Soil	Trespasser/Visitor	Adult	Dermal	On-site	Quant	Individuals could potentially gain access to the site.
						Ingestion	On-site	Quant	Individuals could potentially gain access to the site.
					Older Child	Dermal	On-site	Quant	Individuals could potentially gain access to the site.
						Ingestion	On-site	Quant	Individuals could potentially gain access to the site.
				Military Personnel	Adult	Dermal	On-site	Quant	Personnel may access site for work/training related activities
						Ingestion	On-site	Quant	Personnel may access site for work/training related activities
		Air	Fugitive Dusts	Trespasser/Visitor	Adult	Inhalation	On-site	Quant	Individuals could potentially gain access to the site.
					Older Child	Inhalation	On-site	Quant	Individuals could potentially gain access to the site.
				Military Personnel	Adult	Inhalation	On-site	Quant	Personnel may access site for work/training related activities
	Surface Water	Surface Water	Standing Water Body	Trespasser/Visitor	Adult	Dermal	On-site	Quant	Individuals could potentially gain access to the site.
						Ingestion	On-site	Quant	Individuals could potentially gain access to the site.
					Older Child	Dermal	On-Site	Quant	Individuals could potentially gain access to the site.
						Ingestion	On-Site	Quant	Individuals could potentially gain access to the site.
				Military Personnel	Adult	Dermal	On-site	Quant	Personnel may access site for work/training related activities
						Ingestion	On-site	Quant	Personnel may access site for work/training related activities
	Sediment	Sediment	Standing Water Body	Trespasser/Visitor	Adult	Dermal	On-site	Quant	Individuals could potentially gain access to the site.
						Ingestion	On-site	Quant	Individuals could potentially gain access to the site.
					Older Child	Dermal	On-site	Quant	Individuals could potentially gain access to the site.
						Ingestion	On-site	Quant	Individuals could potentially gain access to the site.
				Military Personnel	Adult	Dermal	On-site	Quant	Personnel may access site for work/training related activities
						Ingestion	On-site	Quant	Personnel may access site for work/training related activities

TABLE 6-7 (Continued)
SELECTION OF EXPOSURE PATHWAYS
SITE 10 - ORIGINAL BASE LANDFILL
MCB, CAMP LEJEUNE
JACKSONVILLE, NC

Scenario Timeframe	Medium	Exposure Medium	Exposure Point	Receptor Population	Receptor Age	Exposure Route	On-Site/ Off-Site	Type of Analysis	Rationale for Selection or Exclusion of Exposure Pathway
Future	Surface Soil	Surface Soil	Site 10 Surface Soil	Resident	Adult	Dermal	On-site	Quant	Potential future residential development.
						Ingestion	On-site	Quant	Potential future residential development.
					Child	Dermal	On-site	Quant	Potential future residential development.
						Ingestion	On-site	Quant	Potential future residential development.
				Construction Worker	Adult	Dermal	On-site	Quant	Excavation, construction activities for potential future development.
						Ingestion	On-site	Quant	Excavation, construction activities for potential future development.
		Air	Fugitive Dusts	Resident	Adult	Inhalation	On-site	Quant	Potential future residential development.
					Child	Inhalation	On-site	Quant	Potential future residential development.
				Construction Worker	Adult	Inhalation	On-site	Quant	Excavation, construction activities for potential future development.
	Subsurface Soil	Subsurface Soil	Site 10 Subsurface Soil	Construction Worker	Adult	Dermal Ingestion	On-site	Quant	Excavation, construction activities for potential future development.
		Air	Fugitive Dusts	Construction Worker	Adult	Inhalation	On-site	Quant	Excavation, construction activities for potential future development.
	Groundwater	Groundwater	Tap Water	Resident	Adult	Dermal	On-site	Quant	Potential future residential development.
						Ingestion	On-site	Quant	Potential future residential development.
					Child	Dermal	On-site	Quant	Potential future residential development.
						Ingestion	On-site	Quant	Potential future residential development.
		Air	Tap Water - Water Vapors at Showerhead	Resident	Adult	Inhalation	On-site	Quant	Potential future residential development.
					Child	Inhalation	On-site	Quant	Potential future residential development.
	Surface Water	Surface Water	Standing Water Body	Resident	Adult	Dermal	On-site	Quant	Potential future recreational activiiets
					Child	Ingestion	On-site	Quant	Potential future recreational activiiets
	Sediment	Sediment	Standing Water Body	Resident	Adult	Dermal	On-site	Quant	Potential future recreational activiiets
						Ingestion	On-site	Quant	Potential future recreational activiiets
					Child	Dermal	On-site	Quant	Potential future recreational activiiets
						Ingestion	On-site	Quant	Potential future recreational activiiets

TABLE 6-8
MEDIUM-SPECIFIC EXPOSURE POINT CONCENTRATION SUMMARY
SITE 10 - ORIGINAL BASE LANDFILL
MCB CAMP LEJEUNE
JACKSONVILLE, NC

Medium: Surface Soil
Exposure Medium: Surface Soil
Exposure Point: Surface Soil

Chemical of Potential Concern	Units	Arithmetic Mean of Normal Data	95% UCL of Data	Maximum Detected Concentration	Maximum Qualifier	EPC Units	Reasonable Maximum Exposure			Central Tendency		
							Medium EPC Value	Medium EPC Statistic	Medium EPC Rationale	Medium EPC Value	Medium EPC Statistic	Medium EPC Rationale
Aluminum	mg/kg	1,594	6,227	10,200	J	mg/kg	6,227	95% UCL	(1)	6,227	95% UCL	(1)
Antimony	mg/kg	7.27	7.82	12.5	J	mg/kg	7.82	95% UCL	(1)	7.82	95% UCL	(1)
Arsenic	mg/kg	1.31	2.06	11.6		mg/kg	2.06	95% UCL	(1)	2.06	95% UCL	(1)
Iron	mg/kg	1,063	1,623	7,740	J	mg/kg	1,623	95% UCL	(1)	1,623	95% UCL	(1)

For non-detects, 1/2 sample quantitation limit was used as a proxy concentration.
Options: Maximum Detected Value (Max); 95% UCL of Normal Data (95% UCL-N); Mean of Normal Data (Mean-N).

(1) Conservative estimate of the arithmetic average concentration.
(2) 95% UCL exceeds maximum detected concentration. Therefore, maximum concentration used for EPC.
(3) Data set contains fewer than five samples. Therefore, maximum concentration used for EPC.

TABLE 6-9
MEDIUM-SPECIFIC EXPOSURE POINT CONCENTRATION SUMMARY
SITE 10 - ORIGINAL BASE LANDFILL
MCB CAMP LEJEUNE
JACKSONVILLE, NC

Medium: Subsurface Soil
Exposure Medium: Subsurface Soil
Exposure Point: Subsurface Soil

Chemical of Potential Concern	Units	Arithmetic Mean of Data	95% UCL of Data	Maximum Detected Concentration	Maximum Qualifier	EPC Units	Reasonable Maximum Exposure			Central Tendency		
							Medium EPC Value	Medium EPC Statistic	Medium EPC Rationale	Medium EPC Value	Medium EPC Statistic	Medium EPC Rationale
Benzo(a)anthracene	mg/kg	0.237	0.316	1.2		mg/kg	0.316	95% UCL	(1)	0.316	95% UCL	(1)
Benzo(a)pyrene	mg/kg	0.233	0.304	1.1		mg/kg	0.304	95% UCL	(1)	0.304	95% UCL	(1)
Benzo(b)fluoranthene	mg/kg	0.237	0.316	1.2		mg/kg	0.316	95% UCL	(1)	0.316	95% UCL	(1)
Benzo(k)fluoranthene	mg/kg	0.226	0.285	0.95		mg/kg	0.285	95% UCL	(1)	0.285	95% UCL	(1)
Carbazole	mg/kg	0.192	0.196	0.2	J	mg/kg	0.196	95% UCL	(1)	0.196	95% UCL	(1)
Chrysene	mg/kg	0.242	0.329	1.3		mg/kg	0.329	95% UCL	(1)	0.329	95% UCL	(1)
Dibenz(a,h)anthracene	mg/kg	0.195	0.203	0.28	J	mg/kg	0.203	95% UCL	(1)	0.203	95% UCL	(1)
Indeno(1,2,3-cd)pyrene	mg/kg	0.209	0.239	0.57		mg/kg	0.239	95% UCL	(1)	0.239	95% UCL	(1)
Antimony	mg/kg	10.5	16.5	84.2		mg/kg	16.5	95% UCL	(1)	16.5	95% UCL	(1)
Arsenic	mg/kg	2.82	5.65	37.2		mg/kg	5.65	95% UCL	(1)	5.65	95% UCL	(1)
Barium	mg/kg	35.0	81.0	589		mg/kg	81.0	95% UCL	(1)	81.0	95% UCL	(1)
Cadmium	mg/kg	0.968	1.55	7.9		mg/kg	1.55	95% UCL	(1)	1.55	95% UCL	(1)
Chromium	mg/kg	6.57	11.7	66.5		mg/kg	11.7	95% UCL	(1)	11.7	95% UCL	(1)
Copper	mg/kg	156	417	3340		mg/kg	417	95% UCL	(1)	417	95% UCL	(1)
Iron	mg/kg	12,946	30,064	218,000		mg/kg	30,064	95% UCL	(1)	30,064	95% UCL	(1)
Manganese	mg/kg	65.4	141	948		mg/kg	141	95% UCL	(1)	141	95% UCL	(1)
Thallium	mg/kg	1.16	1.19	1.1	J	mg/kg	1.1	Max	(2)	1.1	Max	(2)

For non-detects, 1/2 sample quantitation limit was used as a proxy concentration.

Options: Maximum Detected Value (Max); 95% UCL of Normal Data (95% UCL-N); Mean of Normal Data (Mean-N).

(1) Conservative estimate of the arithmetic average concentration.

(2) 95% UCL exceeds maximum detected concentration. Therefore, maximum concentration used for EPC.

TABLE 6-10
MEDIUM-SPECIFIC EXPOSURE POINT CONCENTRATION SUMMARY
SITE 10 - ORIGINAL BASE LANDFILL
MCB CAMP LEJEUNE
JACKSONVILLE, NC

Medium: Groundwater
Exposure Medium: Groundwater
Exposure Point: Groundwater

Chemical of Potential Concern (4)	Units	Arithmetic Mean of Normal Data	95% UCL of Normal Data	Maximum Detected Concentration	Maximum Qualifier	EPC Units	Reasonable Maximum Exposure			Central Tendency		
							Medium EPC Value	Medium EPC Statistic	Medium EPC Rationale	Medium EPC Value	Medium EPC Statistic	Medium EPC Rationale
Iron	mg/L	0.453	0.700	1.11	J	mg/L	0.700	95% UCL	(1)	0.700	95% UCL	(1)

For non-detects, 1/2 sample quantitation limit was used as a proxy concentration.
Options: Maximum Detected Value (Max); 95% UCL of Normal Data (95% UCL-N); Mean of Normal Data (Mean-N).

(1) Conservative estimate of the arithmetic average concentration.
(2) 95% UCL exceeds maximum detected concentration. Therefore, maximum concentration used for EPC.
(3) Data set contains fewer than five samples. Therefore, maximum concentration used for EPC.
(4) Only total metals retained as COPCs

TABLE 6-11
MEDIUM-SPECIFIC EXPOSURE POINT CONCENTRATION SUMMARY
SITE 10 - ORIGINAL BASE LANDFILL
MCB CAMP LEJEUNE
JACKSONVILLE, NC

Medium: Surface Water
Exposure Medium: Surface Water
Exposure Point: Surface Water

Chemical of Potential Concern (4)	Units	Arithmetic Mean of Normal Data	95% UCL of Normal Data	Maximum Detected Concentration	Maximum Qualifier	EPC Units	Reasonable Maximum Exposure			Central Tendency		
							Medium EPC Value	Medium EPC Statistic	Medium EPC Rationale	Medium EPC Value	Medium EPC Statistic	Medium EPC Rationale
Aluminum	mg/L	0.485	3.18	1.27		mg/L	1.27	Max	(2)	1.27	Max	(2)
Iron	mg/L	0.921	1.94	2.21		mg/L	1.94	95% UCL	(1)	1.94	95% UCL	(1)
Mercury	mg/L	0.0000637	0.0000881	0.00006	J	mg/L	0.00006	Max	(2)	0.00006	Max	(2)
Zinc	mg/L	0.0548	0.0717	0.0959		mg/L	0.0717	95% UCL	(1)	0.0717	95% UCL	(1)

For non-detects, 1/2 sample quantitation limit was used as a proxy concentration.
Options: Maximum Detected Value (Max); 95% UCL of Normal Data (95% UCL-N); Mean of Normal Data (Mean-N).

(1) Conservative estimate of the arithmetic average concentration.
(2) 95% UCL exceeds maximum detected concentration. Therefore, maximum concentration used for EPC.
(3) Data set contains fewer than five samples. Therefore, maximum concentration used for EPC.
(4) Only total metals retained as COPCs

TABLE 6-12
VALUES USED FOR DAILY INTAKE CALCULATIONS
SITE 10 - ORIGINAL BASE LANDFILL
MCB CAMP LEJEUNE
JACKSONVILLE, NC

Scenario Timeframe: Current
Medium: Surface Soil
Exposure Medium: Surface Soil
Exposure Point: Surface Soil
Receptor Population: Military Worker
Receptor Age: Adult

Exposure Route	Parameter Code	Parameter Definition	Units	RME Value	RME Rationale/ Reference	CT Value	CT Rationale/ Reference	Intake Equation/ Model Name
Ingestion	C	Contaminant Concentration in Soil	mg/kg	See Table	See Table	--	--	Chronic Daily Intake (CDI) (mg/kg-day) =
	IR-S	Ingestion Rate of Soil	mg/day	100	USEPA, 1989	--	--	C x IR x CF x Fi x EF x ED x 1/BW x 1/AT
	CF	Conversion Factor	kg/mg	1.00E-06	USEPA, 1989	--	--	
	Fi	Fraction Ingested from Source	NA	1	Professional Judgement	--	--	
	EF	Exposure Frequency	days/year	143	Professional Judgement	--	--	
	ED	Exposure Duration	years	4	Standard Tour of Duty	--	--	
	BW	Body Weight	kg	70	USEPA, 1989	--	--	
	AT-C	Averaging Time (Cancer)	days	25,550	USEPA, 1989	--	--	
	AT-N	Averaging Time (Non-Cancer)	days	1,460	USEPA, 1989	--	--	
Dermal	C	Contaminant Concentration in Soil	mg/kg	See Table	See Table	--	--	CDI (mg/kg-day) =
	CF	Conversion Factor	kg/mg	1.00E-06	USEPA, 1989	--	--	C x CF x SA x AF x ABS x EF x ED x
	SA	Surface Area Available for Contact	cm2/day	5,100	USEPA, 1997	--	--	1/BW x1/AT
	AF	Soil to Skin Adherence Factor	mg/cm2	1	USEPA, 1995	--	--	
	ABS	Absorption Factor	NA	(1)	USEPA, 1995	--	--	
	EF	Exposure Frequency	days/year	143	Professional Judgement	--	--	
	ED	Exposure Duration	years	4	Standard Tour of Duty	--	--	
	BW	Body Weight	kg	70	USEPA, 1989	--	--	
	AT-C	Averaging Time (Cancer)	days	25,550	USEPA, 1989	--	--	
	AT-N	Averaging Time (Non-Cancer)	days	1,460	USEPA, 1989	--	--	
Inhalation	C	Contaminant Concentration in Soil	mg/kg	See Table	See Table	--	--	CDI (mg/kg-day) =
	RR	Respiration Rate	m3/hour	0.8	USEPA, 1995	--	--	C x IR x ET x EF x ED x 1/PEF x
	ET	Exposure Time	hours/day	8	Professional Judgement	--	--	1/BW x1/AT
	EF	Exposure Frequency	days/year	143	Professional Judgement	--	--	
	ED	Exposure Duration	years	4	Standard Tour of Duty	--	--	
	PEF	Particulate Emission Factor	m3/kg	1.32E+09	USEPA, 1996	--	--	
	BW	Body Weight	kg	70	USEPA, 1989	--	--	
	AT-C	Averaging Time (Cancer)	days	25,550	USEPA, 1989	--	--	
	AT-N	Averaging Time (Non-Cancer)	days	1,460	USEPA, 1989	--	--	

(1) USEPA Region III default values of 0.05% for VOCs, 10% for SVOCs, nitramines, and pesticides, 6% for PCBs, 3% for arsenic, and 1% for inorganics were used for ABS values.

Sources:

Cowherd, et al.: Rapid Assessment of Exposure to Particulate Emissions from Surface Contamination. OHEA. EPA/600/8-85/002.
USEPA, 1989: Risk Assessment Guidance for Superfund Vol 1, Human Health Evaluation Manual, Part A. OERR. EPA/540/1-89/002.
USEPA, 1991: Risk Assessment Guidance for Superfund Vol 1, Human Health Evaluation Manual Supplemental Guidance: Standard Default Exposure Factors.
USEPA, 1992: Risk Assessment Guidance for Superfund Vol 1, Human Health Evaluation Manual Supplemental Guidance: Dermal Risk Assessment.
USEPA, 1995: Assessing Dermal Exposure from Soil.
USEPA, 1997: Exposure Factors Handbook. Vol. 1: General Factors. ORD. EPA/600/P-95/002Fa.

TABLE 6-13
VALUES USED FOR DAILY INTAKE CALCULATIONS
SITE 10 - ORIGINAL BASE LANDFILL
MCB CAMP LEJEUNE
JACKSONVILLE, NC

Scenario Timeframe: Current
Medium: Surface Soil
Exposure Medium: Surface Soil
Exposure Point: Surface Soil
Receptor Population: Trespasser
Receptor Age: Adult

Exposure Route	Parameter Code	Parameter Definition	Units	RME Value	RME Rationale/ Reference	CT Value	CT Rationale/ Reference	Intake Equation/ Model Name
Ingestion	C	Contaminant Concentration in Soil	mg/kg	See Table	See Table	--	--	Chronic Daily Intake (CDI) (mg/kg-day) =
	IR-S	Ingestion Rate of Soil	mg/day	100	USEPA, 1989	--	--	C x IR x CF x Fi x EF x ED x 1/BW x 1/AT
	CF	Conversion Factor	kg/mg	1.00E-06	USEPA, 1989	--	--	
	Fi	Fraction Ingested from Source	NA	1	Professional Judgement	--	--	
	EF	Exposure Frequency	days/year	48	Professional Judgement	--	--	
	ED	Exposure Duration	years	24	USEPA, 1989	--	--	
	BW	Body Weight	kg	70	USEPA, 1989	--	--	
	AT-C	Averaging Time (Cancer)	days	25,550	USEPA, 1989	--	--	
	AT-N	Averaging Time (Non-Cancer)	days	8,760	USEPA, 1989	--	--	
Dermal	C	Contaminant Concentration in Soil	mg/kg	See Table	See Table	--	--	CDI (mg/kg-day) =
	CF	Conversion Factor	kg/mg	1.00E-06	USEPA, 1989	--	--	C x CF x SA x AF x ABS x EF x ED x
	SA	Surface Area Available for Contact	cm2/day	5,800	USEPA, 1997	--	--	1/BW x1/AT
	AF	Soil to Skin Adherence Factor	mg/cm2	1	USEPA, 1995	--	--	
	ABS	Absorption Factor	NA	(1)	USEPA, 1995	--	--	
	EF	Exposure Frequency	days/year	48	Professional Judgement	--	--	
	ED	Exposure Duration	years	24	USEPA, 1989	--	--	
	BW	Body Weight	kg	70	USEPA, 1989	--	--	
	AT-C	Averaging Time (Cancer)	days	25,550	USEPA, 1989	--	--	
	AT-N	Averaging Time (Non-Cancer)	days	8,760	USEPA, 1989	--	--	
Inhalation	C	Contaminant Concentration in Soil	mg/kg	See Table	See Table	--	--	CDI (mg/kg-day) =
	RR	Respiration Rate	m3/hour	0.8	USEPA, 1995	--	--	C x IR x ET x EF x ED x 1/PEF x
	ET	Exposure Time	hours/day	24	Professional Judgement	--	--	1/BW x1/AT
	EF	Exposure Frequency	days/year	48	Professional Judgement	--	--	
	ED	Exposure Duration	years	24	USEPA, 1989	--	--	
	PEF	Particulate Emission Factor	m3/kg	1.32E+09	USEPA, 1996	--	--	
	BW	Body Weight	kg	70	USEPA, 1989	--	--	
	AT-C	Averaging Time (Cancer)	days	25,550	USEPA, 1989	--	--	
	AT-N	Averaging Time (Non-Cancer)	days	8,760	USEPA, 1989	--	--	

(1) USEPA Region III default values of 0.05% for VOCs, 10% for SVOCs, nitramines, and pesticides, 6% for PCBs, 3% for arsenic, and 1% for inorganics were used for ABS values.

Sources:

USEPA, 1989: Risk Assessment Guidance for Superfund. Vol 1: Human Health Evaluation Manual, Part A. OERR. EPA/540/1-89/002.

USEPA, 1995: Assessing Dermal Exposure from Soil.

USEPA, 1997: Exposure Factors Handbook. Vol. 1: General Factors. ORD. EPA/600/P-95/002Fa.

TABLE 6-14
VALUES USED FOR DAILY INTAKE CALCULATIONS
SITE 10 - ORIGINAL BASE LANDFILL
MCB CAMP LEJEUNE
JACKSONVILLE, NC

Scenario Timeframe: Current
Medium: Surface Soil
Exposure Medium: Surface Soil
Exposure Point: Surface Soil
Receptor Population: Trespasser
Receptor Age: Older Child

Exposure Route	Parameter Code	Parameter Definition	Units	RME Value	RME Rationale/ Reference	CT Value	CT Rationale/ Reference	Intake Equation/ Model Name
Ingestion	C	Contaminant Concentration in Soil	mg/kg	See Table	See Table	--	--	Chronic Daily Intake (CDI) (mg/kg-day) =
	IR-S	Ingestion Rate of Soil	mg/day	100	USEPA, 1989	--	--	C x IR x CF x Fi x EF x ED x 1/BW x 1/AT
	CF	Conversion Factor	kg/mg	1.00E-06	USEPA, 1989	--	--	
	Fi	Fraction Ingested from Source	NA	1	Professional Judgement	--	--	
	EF	Exposure Frequency	days/year	48	Professional Judgement	--	--	
	ED	Exposure Duration	years	10	USEPA, 1989	--	--	
	BW	Body Weight	kg	45	USEPA, 1997	--	--	
	AT-C	Averaging Time (Cancer)	days	25,550	USEPA, 1989	--	--	
	AT-N	Averaging Time (Non-Cancer)	days	3,650	USEPA, 1989	--	--	
Dermal	C	Contaminant Concentration in Soil	mg/kg	See Table	See Table	--	--	CDI (mg/kg-day) =
	CF	Conversion Factor	kg/mg	1.00E-06	USEPA, 1989	--	--	C x CF x SA x AF x ABS x EF x ED x
	SA	Surface Area Available for Contact	cm2/day	3,480	USEPA, 1992	--	--	1/BW x1/AT
	AF	Soil to Skin Adherence Factor	mg/cm2	1	USEPA, 1995	--	--	
	ABS	Absorption Factor	NA	(1)	USEPA, 1995	--	--	
	EF	Exposure Frequency	days/year	48	Professional Judgement	--	--	
	ED	Exposure Duration	years	10	USEPA, 1989	--	--	
	BW	Body Weight	kg	45	USEPA, 1997	--	--	
	AT-C	Averaging Time (Cancer)	days	25,550	USEPA, 1989	--	--	
	AT-N	Averaging Time (Non-Cancer)	days	3,650	USEPA, 1989	--	--	
Inhalation	C	Contaminant Concentration in Soil	mg/kg	See Table	See Table	--	--	CDI (mg/kg-day) =
	RR	Respiration Rate	m3/hour	0.8	USEPA, 1995	--	--	C x IR x ET x EF x ED x 1/PEF x
	ET	Exposure Time	hours/day	24	Professional Judgement	--	--	1/BW x1/AT
	EF	Exposure Frequency	days/year	48	Professional Judgement	--	--	
	ED	Exposure Duration	years	10	USEPA, 1989	--	--	
	PEF	Particulate Emission Factor	m3/kg	1.32E+09	USEPA, 1996	--	--	
	BW	Body Weight	kg	45	USEPA, 1997	--	--	
	AT-C	Averaging Time (Cancer)	days	25,550	USEPA, 1989	--	--	
	AT-N	Averaging Time (Non-Cancer)	days	3,650	USEPA, 1989	--	--	

(1) USEPA Region III default values of 0.05% for VOCs, 10% for SVOCs, nitramines, and pesticides, 6% for PCBs, 3% for arsenic, and 1% for inorganics were used for ABS values.

Sources:

USEPA, 1989: Risk Assessment Guidance for Superfund. Vol 1: Human Health Evaluation Manual, Part A. OERR. EPA/540/1-89/002.

USEPA, 1992: Risk Assessment Guidance for Superfund Vol 1, Human Health Evaluation Manual Supplemental Guidance. Dermal Risk Assessment.

USEPA, 1995: Assessing Dermal Exposure from Soil.

USEPA, 1997: Exposure Factors Handbook. Vol. 1: General Factors. ORD. EPA/600/P-95/002Fa.

TABLE 6-15
VALUES USED FOR DAILY INTAKE CALCULATIONS
SITE 10 - ORIGINAL BASE LANDFILL
MCB CAMP LEJEUNE
JACKSONVILLE, NC

Scenario Timeframe: Future
Medium: Surface Soil
Exposure Medium: Surface Soil
Exposure Point: Surface Soil
Receptor Population: Resident
Receptor Age: Adult

Exposure Route	Parameter Code	Parameter Definition	Units	RME Value	RME Rationale/ Reference	CT Value	CT Rationale/ Reference	Intake Equation/ Model Name
Ingestion	C	Contaminant Concentration in Soil	mg/kg	See Table	See Table	See Table	See Table	Chronic Daily Intake (CDI) (mg/kg-day) =
	IR-S	Ingestion Rate of Soil	mg/day	100	USEPA, 1989	50	USEPA, 1993	C x IR x CF x Fi x EF x ED x 1/BW x 1/AT
	CF	Conversion Factor	kg/mg	1.00E-06	USEPA, 1989	1.00E-06	USEPA, 1989	
	Fi	Fraction Ingested from Source	NA	1	Professional Judgement	1	Professional Judgement	
	EF	Exposure Frequency	days/year	350	USEPA, 1991	234	USEPA, 1993	
	ED	Exposure Duration	years	30	USEPA, 1989	9	USEPA, 1993	
	BW	Body Weight	kg	70	USEPA, 1989	70	USEPA, 1989	
	AT-C	Averaging Time (Cancer)	days	25,550	USEPA, 1989	25,550	USEPA, 1989	
	AT-N	Averaging Time (Non-Cancer)	days	10,950	USEPA, 1989	3,285	USEPA, 1993	
Dermal	C	Contaminant Concentration in Soil	mg/kg	See Table	See Table	See Table	See Table	CDI (mg/kg-day) =
	CF	Conversion Factor	kg/mg	1.00E-06	USEPA, 1989	1.00E-06	USEPA, 1989	C x CF x SA x AF x ABS x EF x ED x
	SA	Surface Area Available for Contact	cm2/day	5,800	USEPA, 1997	5,000	USEPA, 1992	1/BW x1/AT
	AF	Soil to Skin Adherence Factor	mg/cm2	1	USEPA, 1995	0.2	USEPA, 1992	
	ABS	Absorption Factor	NA	(1)	USEPA, 1995	(1)	USEPA, 1995	
	EF	Exposure Frequency	days/year	350	USEPA, 1991	234	USEPA, 1993	
	ED	Exposure Duration	years	30	USEPA, 1989	9	USEPA, 1993	
	BW	Body Weight	kg	70	USEPA, 1989	70	USEPA, 1989	
	AT-C	Averaging Time (Cancer)	days	25,550	USEPA, 1989	25,550	USEPA, 1989	
	AT-N	Averaging Time (Non-Cancer)	days	10,950	USEPA, 1989	3,285	USEPA, 1993	
Inhalation	C	Contaminant Concentration in Soil	mg/kg	See Table	See Table	See Table	See Table	CDI (mg/kg-day) =
	RR	Respiration Rate	m3/hour	0.8	USEPA, 1995	0.8	USEPA, 1995	C x IR x ET x EF x ED x 1/PEF x
	ET	Exposure Time	hours/day	24	Professional Judgement	24	Professional Judgement	1/BW x1/AT
	EF	Exposure Frequency	days/year	350	USEPA, 1991	234	USEPA, 1993	
	ED	Exposure Duration	years	30	USEPA, 1989	9	USEPA, 1993	
	PEF	Particulate Emission Factor	m3/kg	1.32E+09	USEPA, 1996	1.32E+09	USEPA, 1996	
	BW	Body Weight	kg	70	USEPA, 1989	70	USEPA, 1989	
	AT-C	Averaging Time (Cancer)	days	25,550	USEPA, 1989	25,550	USEPA, 1989	
	AT-N	Averaging Time (Non-Cancer)	days	10,950	USEPA, 1989	3,285	USEPA, 1993	

(1) USEPA Region III default values of 0.05% for VOCs, 10% for SVOCs, nitramines, and pesticides, 6% for PCBs, 3% for arsenic, and 1% for inorganics were used for ABS values.

Sources:

USEPA, 1989: Risk Assessment Guidance for Superfund. Vol 1: Human Health Evaluation Manual, Part A. OERR. EPA/540/1-89/002.
USEPA, 1993: "Superfund's Standard Default Exposure Factors for the Central Tendency and Reasonable Maximum Exposure." November, 1994.
USEPA, 1995: Assessing Dermal Exposure from Soil.
USEPA, 1997: Exposure Factors Handbook. Vol. 1: General Factors. ORD. EPA/600/P-95/002Fa.

TABLE 6-16
VALUES USED FOR DAILY INTAKE CALCULATIONS
SITE 10 - ORIGINAL BASE LANDFILL
MCB CAMP LEJEUNE
JACKSONVILLE, NC

Scenario Timeframe: Future
Medium: Surface Soil
Exposure Medium: Surface Soil
Exposure Point: Surface Soil
Receptor Population: Resident
Receptor Age: Younger Child

Exposure Route	Parameter Code	Parameter Definition	Units	RME Value	RME Rationale/ Reference	CT Value	CT Rationale/ Reference	Intake Equation/ Model Name
Ingestion	C	Contaminant Concentration in Soil	mg/kg	See Table	See Table	See Table	See Table	Chronic Daily Intake (CDI) (mg/kg-day) =
	IR-S	Ingestion Rate of Soil	mg/day	200	USEPA, 1989	100	USEPA, 1993	C x IR x CF x Fi x EF x ED x 1/BW x 1/AT
	CF	Conversion Factor	kg/mg	1.00E-06	USEPA, 1989	1.00E-06	--	
	Fi	Fraction Ingested from Source	NA	1	Professional Judgement	1	USEPA, 1989	
	EF	Exposure Frequency	days/year	350	USEPA, 1991	234	USEPA, 1993	
	ED	Exposure Duration	years	6	USEPA, 1989	6	USEPA, 1989	
	BW	Body Weight	kg	15	USEPA, 1991	15	USEPA, 1989	
	AT-C	Averaging Time (Cancer)	days	25,550	USEPA, 1989	25,550	USEPA, 1989	
	AT-N	Averaging Time (Non-Cancer)	days	2,190	USEPA, 1989	2,190	USEPA, 1989	
Dermal	C	Contaminant Concentration in Soil	mg/kg	See Table	See Table	See Table	See Table	CDI (mg/kg-day) =
	CF	Conversion Factor	kg/mg	1.00E-06	USEPA, 1989	1.00E-06	--	C x CF x SA x AF x ABS x EF x ED x
	SA	Surface Area Available for Contact	cm2/day	2,100	USEPA, 1997	2,000	USEPA, 1992	1/BW x1/AT
	AF	Soil to Skin Adherence Factor	mg/cm2	1	USEPA, 1995	0.2	USEPA, 1992	
	ABS	Absorption Factor	NA	(1)	USEPA, 1995	(1)	USEPA, 1995	
	EF	Exposure Frequency	days/year	350	USEPA, 1991	234	USEPA, 1993	
	ED	Exposure Duration	years	6	USEPA, 1989	6	USEPA, 1989	
	BW	Body Weight	kg	15	USEPA, 1991	15	USEPA, 1989	
	AT-C	Averaging Time (Cancer)	days	25,550	USEPA, 1989	25,550	USEPA, 1989	
	AT-N	Averaging Time (Non-Cancer)	days	2,190	USEPA, 1989	2,190	USEPA, 1989	
Inhalation	C	Contaminant Concentration in Soil	mg/kg	See Table	See Table	See Table	See Table	CDI (mg/kg-day) =
	RR	Respiration Rate	m3/hour	0.6	USEPA, 1995	0.6	USEPA, 1995	C x IR x ET x EF x ED x 1/PEF x
	ET	Exposure Time	hours/day	24	Professional Judgement	24	USEPA, 1991	1/BW x1/AT
	EF	Exposure Frequency	days/year	350	USEPA, 1991	234	USEPA, 1993	
	ED	Exposure Duration	years	6	USEPA, 1989	6	USEPA, 1989	
	PEF	Particulate Emission Factor	m3/kg	1.32E+09	USEPA, 1996	1.32E+09	USEPA, 1996	
	BW	Body Weight	kg	15	USEPA, 1991	15	USEPA, 1989	
	AT-C	Averaging Time (Cancer)	days	25,550	USEPA, 1989	25,550	USEPA, 1989	
	AT-N	Averaging Time (Non-Cancer)	days	2,190	USEPA, 1989	2,190	USEPA, 1989	

(1) USEPA Region III default values of 0.05% for VOCs, 10% for SVOCs, nitramines, and pesticides, 6% for PCBs, 3% for arsenic, and 1% for inorganics were used for ABS values.
NA - Not Applicable
Sources:
USEPA, 1989: Risk Assessment Guidance for Superfund. Vol 1: Human Health Evaluation Manual, Part A. OERR. EPA/540/1-89/002.
USEPA, 1993: "Superfund's standard Default Exposure Factors for the Central Tendency and Reasonable Maximum Exposure." November, 1993.
USEPA, 1995: Assessing Dermal Exposures from Soil.

TABLE 6-17
VALUES USED FOR DAILY INTAKE CALCULATIONS
SITE 10 - ORIGINAL BASE LANDFILL
MCB CAMP LEJEUNE
JACKSONVILLE, NC

Scenario Timeframe: Future
Medium: Surface and Subsurface Soil
Exposure Medium: Surface and Subsurface Soil
Exposure Point: Surface and Subsurface Soil
Receptor Population: Construction Worker
Receptor Age: Adult

Exposure Route	Parameter Code	Parameter Definition	Units	RME Value	RME Rationale/ Reference	CT Value	CT Rationale/ Reference	Intake Equation/ Model Name
Ingestion	C	Contaminant Concentration in Soil	mg/kg	See Table	See Table	See Table	See Table	Chronic Daily Intake (CDI) (mg/kg-day) =
	IR-S	Ingestion Rate of Soil	mg/day	480	USEPA, 1997	480	USEPA, 1997	C x IR x CF x Fi x EF x ED x 1/BW x 1/AT
	CF	Conversion Factor	kg/mg	1.00E-06	USEPA, 1989	1.00E-06	--	
	Fi	Fraction Ingested from Source	NA	1	USEPA, 1989	1	Professional Judgement	
	EF	Exposure Frequency	days/year	250	USEPA, 1991	219	USEPA, 1993	
	ED	Exposure Duration	years	1	Professional Judgement	1	USEPA, 1991	
	BW	Body Weight	kg	70	USEPA, 1989	70	USEPA, 1989	
	AT-C	Averaging Time (Cancer)	days	25,550	USEPA, 1989	25,550	USEPA, 1989	
	AT-N	Averaging Time (Non-Cancer)	days	365	USEPA, 1989	365	USEPA, 1989	
Dermal	C	Contaminant Concentration in Soil	mg/kg	See Table	See Table	See Table	See Table	CDI (mg/kg-day) =
	CF	Conversion Factor	kg/mg	1.00E-06	USEPA, 1989	1.00E-06	--	C x CF x SA x AF x ABS x EF x ED x
	SA	Surface Area Available for Contact	cm2/day	5,800	USEPA, 1997	3,230	USEPA, 1992	1/BW x1/AT
	AF	Soil to Skin Adherence Factor	mg/cm2	1	USEPA, 1995	1	USEPA, 1995	
	ABS	Absorption Factor	NA	(1)	USEPA, 1995	(1)	USEPA, 1995	
	EF	Exposure Frequency	days/year	250	USEPA, 1991	219	USEPA, 1993	
	ED	Exposure Duration	years	1	Professional Judgement	1	USEPA, 1991	
	BW	Body Weight	kg	70	USEPA, 1989	70	USEPA, 1989	
	AT-C	Averaging Time (Cancer)	days	25,550	USEPA, 1989	25,550	USEPA, 1989	
	AT-N	Averaging Time (Non-Cancer)	days	365	USEPA, 1989	365	USEPA, 1989	
Inhalation	C	Contaminant Concentration in Soil	mg/kg	See Table	See Table	See Table	See Table	CDI (mg/kg-day) =
	RR	Respiration Rate	m3/hour	0.8	USEPA, 1995	0.8	USEPA, 1995	C x IR x ET x EF x ED x 1/PEF x
	ET	Exposure Time	hours/day	8	Professional Judgement	8	Professional Judgement	1/BW x1/AT
	EF	Exposure Frequency	days/year	250	USEPA, 1991	219	USEPA, 1993	
	ED	Exposure Duration	years	1	Professional Judgement	1	USEPA, 1991	
	PEF	Particulate Emission Factor	m3/kg	1.32E+09	USEPA, 1996	1.32E+09	USEPA, 1996	
	BW	Body Weight	kg	70	USEPA, 1989	70	USEPA, 1989	
	AT-C	Averaging Time (Cancer)	days	25,550	USEPA, 1989	25,550	USEPA, 1989	
	AT-N	Averaging Time (Non-Cancer)	days	365	USEPA, 1989	365	USEPA, 1989	

(1) USEPA Region III default values of 0.05% for VOCs, 10% for SVOCs, nitramines, and pesticides, 6% for PCBs, 3% for arsenic, and 1% for inorganics were used for ABS values.

Sources:

Cowherd, et al.: Rapid Assessment of Exposure to Particulate Emissions from Surface Contamination. OHEA. EPA/600/8-85/002.
USEPA, 1989: Risk Assessment Guidance for Superfund Vol 1, Human Health Evaluation Manual, Part A. OERR. EPA/540/1-89/002.
USEPA, 1991: Risk Assessment Guidance for Superfund Vol 1, Human Health Evaluation Manual Supplemental Guidance: Standard Default Exposure Factors.
USEPA, 1992: Risk Assessment Guidance for Superfund Vol 1, Human Health Evaluation Manual Supplemental Guidance: Dermal Risk Assessment.
USEPA, 1995: Assessing Dermal Exposure from Soil.
USEPA, 1997: Exposure Factors Handbook. Vol. 1: General Factors. ORD. EPA/600/P-95/002Fa.

TABLE 6-18
VALUES USED FOR DAILY INTAKE CALCULATIONS
SITE 10 - ORIGINAL BASE LANDFILL
MCB CAMP LEJEUNE
JACKSONVILLE, NC

Scenario Timeframe: Future
Medium: Groundwater
Exposure Medium: Groundwater
Exposure Point: GroundWater
Receptor Population: Resident
Receptor Age: Adult

Exposure Route	Parameter Code	Parameter Definition	Units	RME Value	RME Rationale/ Reference	CT Value	CT Rationale/ Reference	Intake Equation/ Model Name
Ingestion	C	Contaminant Concentration in Groundwater	mg/L	See Table	See Table	See Table	See Table	Chronic Daily Intake (CDI) (mg/kg-day) =
	IR-W	Ingestion Rate of Groundwater	L/day	2	USEPA, 1995	1.4	USEPA, 1993	C x IR-W x EF x ED x 1/BW x 1/AT
	EF	Exposure Frequency	days/year	350	Professional Judgement	234	USEPA, 1993	
	ED	Exposure Duration	years	30	USEPA, 1989	9	USEPA, 1993	
	BW	Body Weight	kg	70	USEPA, 1989	70	USEPA, 1989	
	AT-C	Averaging Time (Cancer)	days	25,550	USEPA, 1989	25,550	USEPA, 1989	
	AT-N	Averaging Time (Non-Cancer)	days	10,950	USEPA, 1989	3,285	USEPA, 1989	
Dermal	C	Contaminant Concentration in Groundwater	mg/L	See Table	See Table	See Table	See Table	CDI (mg/kg-day) =
	CF	Conversion Factor	L/cm3	1.00E-03	USEPA, 1989	1.00E-03	USEPA, 1989	C x CF x SA x PC x ET x EF x ED x
	SA	Surface Area Available for Contact	cm2	23,000	USEPA, 1997	20,000	USEPA, 1992	1/BW x1/AT
	PC	Permeability Constant	cm/hour	Chemical Specific	USEPA, 1992	Chemical Specific	USEPA, 1992	
	ET	Exposure Time	hours/day	0.25	USEPA, 1989	1	USEPA, 1992	
	EF	Exposure Frequency	days/year	350	Professional Judgement	234	USEPA, 1993	
	ED	Exposure Duration	years	30	USEPA, 1989	9	USEPA, 1993	
	BW	Body Weight	kg	70	USEPA, 1989	70	USEPA, 1989	
	AT-C	Averaging Time (Cancer)	days	25,550	USEPA, 1989	25,550	USEPA, 1989	
	AT-N	Averaging Time (Non-Cancer)	days	10,950	USEPA, 1989	3,285	USEPA, 1989	
Inhalation	C	Contaminant Concentration in Soil	mg/L	See Table	See Table	See Table	See Table	CDI (mg/kg-day) =
	RR	Respiration Rate	m3/hour	--	--	0.83	USEPA, 1997	C x IR x ET x EF x ED x 1/PEF x
	ET	Exposure Time	hours/day	0.25	USEPA, 1989	1	USEPA, 1992	1/BW x1/AT
	EF	Exposure Frequency	days/year	350	Professional Judgement	234	USEPA, 1993	
	ED	Exposure Duration	years	30	USEPA, 1989	9	USEPA, 1993	
	PEF	Particulate Emission Factor	m3/kg	--	--	--	--	
	BW	Body Weight	kg	70	USEPA, 1989	70	USEPA, 1989	
	AT-C	Averaging Time (Cancer)	days	25,550	USEPA, 1989	25,550	USEPA, 1989	
	AT-N	Averaging Time (Non-Cancer)	days	10,950	USEPA, 1989	3,285	USEPA, 1989	

NA - Not Applicable
Sources:
USEPA, 1989: Risk Assessment Guidance for Superfund. Vol 1: Human Health Evaluation Manual, Part A. OERR. EPA/540/1-89/002.
USEPA, 1992: Dermal Exposure Assessment: Principles and Applications. OHEA. EPA/600/8-91/011B.
USEPA, 1993: "Superfund's Standard Default Exposure Factors for the Central Tendency and Reasonable Maximum Exposure." November, 1993.
USEPA, 1997: Exposure Factors Handbook. Vol. 1: General Factors. ORD. EPA/600/P-95/002Fa.

TABLE 6-19
VALUES USED FOR DAILY INTAKE CALCULATIONS
SITE 10 - ORIGINAL BASE LANDFILL
MCB CAMP LEJEUNE
JACKSONVILLE, NC

Scenario Timeframe: Future
Medium: Groundwater
Exposure Medium: Groundwater
Exposure Point: GroundWater
Receptor Population: Resident
Receptor Age: Younger Child

Exposure Route	Parameter Code	Parameter Definition	Units	RME Value	RME Rationale/ Reference	CT Value	CT Rationale/ Reference	Intake Equation/ Model Name
Ingestion	C	Contaminant Concentration in Groundwater	mg/L	See Table	See Table	See Table	See Table	Chronic Daily Intake (CDI) (mg/kg-day) =
	IR-W	Ingestion Rate of Groundwater	L/day	1	USEPA, 1989	1	USEPA, 1995	C x IR-W x EF x ED x 1/BW x 1/AT
	EF	Exposure Frequency	days/year	350	Professional Judgement	234	USEPA, 1993	
	ED	Exposure Duration	years	6	USEPA, 1989	6	USEPA, 1989	
	BW	Body Weight	kg	15	USEPA, 1989	15	USEPA, 1989	
	AT-C	Averaging Time (Cancer)	days	25,550	USEPA, 1989	25,550	USEPA, 1989	
	AT-N	Averaging Time (Non-Cancer)	days	2,190	USEPA, 1989	2,190	USEPA, 1989	
Dermal	C	Contaminant Concentration in Groundwater	mg/L	See Table	See Table	See Table	See Table	CDI (mg/kg-day) =
	CF	Conversion Factor	L/cm3	1.00E-03	USEPA, 1989	1.00E-03	--	C x CF x SA x PC x ET x EF x ED x
	SA	Surface Area Available for Contact	cm2	8,380	USEPA, 1997	7,930	USEPA, 1992	1/BW x1/AT
	PC	Permeability Constant	cm/hour	Chemical Specific	USEPA, 1992	Chemical Specific	USEPA, 1992	
	ET	Exposure Time	hours/day	0.25	USEPA, 1989	0.25	USEPA, 1992	
	EF	Exposure Frequency	days/year	350	Professional Judgement	234	USEPA, 1993	
	ED	Exposure Duration	years	6	USEPA, 1989	6	USEPA, 1989	
	BW	Body Weight	kg	15	USEPA, 1989	15	USEPA, 1989	
	AT-C	Averaging Time (Cancer)	days	25,550	USEPA, 1989	25,550	USEPA, 1989	
	AT-N	Averaging Time (Non-Cancer)	days	2,190	USEPA, 1989	2,190	USEPA, 1989	
Inhalation	C	Contaminant Concentration in Soil	mg/L	See Table	See Table	See Table	See Table	CDI (mg/kg-day) =
	RR	Respiration Rate	m3/hour	--	--	0.42	USEPA, 1997	C x IR x ET x EF x ED x 1/PEF x
	ET	Exposure Time	hours/day	0.25	USEPA, 1989	0.25	USEPA, 1992	1/BW x1/AT
	EF	Exposure Frequency	days/year	350	Professional Judgement	234	USEPA, 1993	
	ED	Exposure Duration	years	6	USEPA, 1989	6	USEPA, 1989	
	PEF	Particulate Emission Factor	m3/kg	--	--	--	--	
	BW	Body Weight	kg	15	USEPA, 1989	15	USEPA, 1989	
	AT-C	Averaging Time (Cancer)	days	25,550	USEPA, 1989	25,550	USEPA, 1989	
	AT-N	Averaging Time (Non-Cancer)	days	2,190	USEPA, 1989	2,190	USEPA, 1989	

Sources:
USEPA, 1989: Risk Assessment Guidance for Superfund. Vol 1: Human Health Evaluation Manual, Part A. OERR. EPA/540/1-89/002.
USEPA, 1992: Dermal Exposure Assessment: Principles and Applications. OHEA. EPA/600/8-91/011B.
USEPA, 1993: "Superfund's Standard Default Exposure Factors for the Central Tendency and Reasonable Maximum Exposure." November, 1993.
USEPA, 1997: Exposure Factors Handbook. Vol. 1: General Factors. ORD. EPA/600/P-95/002Fa.

TABLE 6-20
VALUES USED FOR DAILY INTAKE CALCULATIONS
SITE 10 - ORIGINAL BASE LANDFILL
MCB CAMP LEJEUNE
JACKSONVILLE, NC

Scenario Timeframe: Current
Medium: Surface Water
Exposure Medium: Surface Water
Exposure Point: Surface Water
Receptor Population: Military Worker
Receptor Age: Adult

Exposure Route	Parameter Code	Parameter Definition	Units	RME Value	RME Rationale/ Reference	CT Value	CT Rationale/ Reference	Intake Equation/ Model Name
Ingestion	C	Contaminant Concentration in Groundwater	mg/L	See Table	See Table	--	--	Chronic Daily Intake (CDI) (mg/kg-day) =
	IR-W	Ingestion Rate of Surface Water	L/hour	0.01	USEPA, 1995	--	--	C x IR-W x EF x ED x 1/BW x 1/AT
	ET	Exposure Time	hours/day	2.6	USEPA, 1992	--	--	
	EF	Exposure Frequency	days/year	143	Professional Judgement	--	--	
	ED	Exposure Duration	years	4	Standard Tour of Duty	--	--	
	BW	Body Weight	kg	70	USEPA, 1989	--	--	
	AT-C	Averaging Time (Cancer)	days	25,550	USEPA, 1989	--	--	
	AT-N	Averaging Time (Non-Cancer)	days	1,460	USEPA, 1989	--	--	
Dermal	C	Contaminant Concentration in Groundwater	mg/L	See Table	See Table	--	--	CDI (mg/kg-day) =
	CF	Conversion Factor	L/cm3	1.00E-03	USEPA, 1989	--	--	C x CF x SA x PC x ET x EF x ED x
	SA	Surface Area Available for Contact	cm2	5,100	USEPA, 1997	--	--	1/BW x1/AT
	PC	Permeability Constant	cm/hour	Chemical Specific	USEPA, 1992	--	--	
	ET	Exposure Time	hours/day	2.6	USEPA, 1992	--	--	
	EF	Exposure Frequency	days/year	143	Professional Judgement	--	--	
	ED	Exposure Duration	years	4	Standard Tour of Duty	--	--	
	BW	Body Weight	kg	70	USEPA, 1989	--	--	
	AT-C	Averaging Time (Cancer)	days	25,550	USEPA, 1989	--	--	
	AT-N	Averaging Time (Non-Cancer)	days	1,460	USEPA, 1989	--	--	

Sources:
USEPA, 1989: Risk Assessment Guidance for Superfund. Vol 1: Human Health Evaluation Manual, Part A. OERR. EPA/540/1-89/002.
USEPA, 1992: Dermal Exposure Assessment: Principles and Applications. OHEA. EPA/600/8-91/011B.
USEPA, 1997: Exposure Factors Handbook. Vol. 1: General Factors. ORD. EPA/600/P-95/002Fa.

TABLE 6-21
VALUES USED FOR DAILY INTAKE CALCULATIONS
SITE 10 - ORIGINAL BASE LANDFILL
MCB CAMP LEJEUNE
JACKSONVILLE, NC

Scenario Timeframe: Current
Medium: Surface Water
Exposure Medium: Surface Water
Exposure Point: Surface Water
Receptor Population: Trespasser
Receptor Age: Adult

Exposure Route	Parameter Code	Parameter Definition	Units	RME Value	RME Rationale/ Reference	CT Value	CT Rationale/ Reference	Intake Equation/ Model Name
Ingestion	C	Contaminant Concentration in Groundwater	mg/L	See Table	See Table	--	--	Chronic Daily Intake (CDI) (mg/kg-day) =
	IR-W	Ingestion Rate of Surface Water	L/hour	0.01	USEPA, 1995	--	--	C x IR-W x EF x ED x 1/BW x 1/AT
	ET	Exposure Time	hours/day	2.6	USEPA, 1989	--	--	
	EF	Exposure Frequency	days/year	48	Professional Judgement	--	--	
	ED	Exposure Duration	years	24	USEPA, 1989	--	--	
	BW	Body Weight	kg	70	USEPA, 1989	--	--	
	AT-C	Averaging Time (Cancer)	days	25,550	USEPA, 1989	--	--	
	AT-N	Averaging Time (Non-Cancer)	days	8,760	USEPA, 1989	--	--	
Dermal	C	Contaminant Concentration in Groundwater	mg/L	See Table	See Table	--	--	CDI (mg/kg-day) =
	CF	Conversion Factor	L/cm3	1.00E-03	USEPA, 1989	--	--	C x CF x SA x PC x ET x EF x ED x
	SA	Surface Area Available for Contact	cm2	5,800	USEPA, 1997	--	--	1/BW x1/AT
	PC	Permeability Constant	cm/hour	Chemical Specific	USEPA, 1992	--	--	
	ET	Exposure Time	hours/day	2.6	USEPA, 1989	--	--	
	EF	Exposure Frequency	days/year	48	Professional Judgement	--	--	
	ED	Exposure Duration	years	24	USEPA, 1989	--	--	
	BW	Body Weight	kg	70	USEPA, 1989	--	--	
	AT-C	Averaging Time (Cancer)	days	25,550	USEPA, 1989	--	--	
	AT-N	Averaging Time (Non-Cancer)	days	8,760	USEPA, 1989	--	--	

Sources:
USEPA, 1989: Risk Assessment Guidance for Superfund. Vol 1: Human Health Evaluation Manual, Part A. OERR. EPA/540/1-89/002.
USEPA, 1992: Dermal Exposure Assessment: Principles and Applications. OHEA. EPA/600/8-91/011B.
USEPA, 1997: Exposure Factors Handbook. Vol. 1: General Factors. ORD. EPA/600/P-95/002Fa.

TABLE 6-22
VALUES USED FOR DAILY INTAKE CALCULATIONS
SITE 10 - ORIGINAL BASE LANDFILL
MCB CAMP LEJEUNE
JACKSONVILLE, NC

Scenario Timeframe: Current
Medium: Surface Water
Exposure Medium: Surface Water
Exposure Point: Surface Water
Receptor Population: Trespasser
Receptor Age: Older Child

Exposure Route	Parameter Code	Parameter Definition	Units	RME Value	RME Rationale/ Reference	CT Value	CT Rationale/ Reference	Intake Equation/ Model Name
Ingestion	C	Contaminant Concentration in Groundwater	mg/L	See Table	See Table	--	--	Chronic Daily Intake (CDI) (mg/kg-day) =
	IR-W	Ingestion Rate of Groundwater	L/hour	0.01	USEPA, 1995	--	--	C x IR-W x EF x ED x 1/BW x 1/AT
	ET	Exposure Time	hours/day	2.6	USEPA, 1989	--	--	
	EF	Exposure Frequency	days/year	48	Professional Judgement	--	--	
	ED	Exposure Duration	years	10	USEPA, 1989	--	--	
	BW	Body Weight	kg	45	USEPA, 1997	--	--	
	AT-C	Averaging Time (Cancer)	days	25,550	USEPA, 1989	--	--	
	AT-N	Averaging Time (Non-Cancer)	days	3,650	USEPA, 1989	--	--	
Dermal	C	Contaminant Concentration in Groundwater	mg/L	See Table	See Table	--	--	CDI (mg/kg-day) =
	CF	Conversion Factor	L/cm3	1.00E-03	USEPA, 1989	--	--	C x CF x SA x PC x ET x EF x ED x
	SA	Surface Area Available for Contact	cm2	3,480	USEPA, 1992	--	--	1/BW x1/AT
	PC	Permeability Constant	cm/hour	Chemical Specific	USEPA, 1992	--	--	
	ET	Exposure Time	hours/day	2.6	USEPA, 1989	--	--	
	EF	Exposure Frequency	days/year	48	Professional Judgement	--	--	
	ED	Exposure Duration	years	10	USEPA, 1989	--	--	
	BW	Body Weight	kg	45	USEPA, 1997	--	--	
	AT-C	Averaging Time (Cancer)	days	25,550	USEPA, 1989	--	--	
	AT-N	Averaging Time (Non-Cancer)	days	3,650	USEPA, 1989	--	--	

Sources:
USEPA, 1989: Risk Assessment Guidance for Superfund. Vol 1: Human Health Evaluation Manual, Part A. OERR. EPA/540/1-89/002.
USEPA, 1992: Dermal Exposure Assessment: Principles and Applications. OHEA. EPA/600/8-91/011B.
USEPA, 1997: Exposure Factors Handbook. Vol. 1: General Factors. ORD. EPA/600/P-95/002Fa.

TABLE 6-23
VALUES USED FOR DAILY INTAKE CALCULATIONS
SITE 10 - ORIGINAL BASE LANDFILL
MCB CAMP LEJEUNE
JACKSONVILLE, NC

Scenario Timeframe: Future
Medium: Surface Water
Exposure Medium: Surface Water
Exposure Point: Surface Water
Receptor Population: Resident
Receptor Age: Adult

Exposure Route	Parameter Code	Parameter Definition	Units	RME Value	RME Rationale/ Reference	CT Value	CT Rationale/ Reference	Intake Equation/ Model Name
Ingestion	C	Contaminant Concentration in Groundwater	mg/L	See Table	See Table	See Table	See Table	Chronic Daily Intake (CDI) (mg/kg-day) =
	IR-W	Ingestion Rate of Surface Water	L/hour	0.01	USEPA, 1995	0.01	USEPA, 1995	C x IR-W x EF x ED x 1/BW x 1/AT
	ET	Exposure Time	hours/day	2.6	USEPA, 1992	2.6	USEPA, 1992	
	EF	Exposure Frequency	days/year	48	Professional Judgement	234	USEPA, 1993	
	ED	Exposure Duration	years	30	USEPA, 1989	9	USEPA, 1993	
	BW	Body Weight	kg	70	USEPA, 1989	70	USEPA, 1989	
	AT-C	Averaging Time (Cancer)	days	25,550	USEPA, 1989	25550	USEPA, 1989	
	AT-N	Averaging Time (Non-Cancer)	days	10,950	USEPA, 1989	3285	USEPA, 1993	
Dermal	C	Contaminant Concentration in Groundwater	mg/L	See Table	See Table	See Table	See Table	CDI (mg/kg-day) =
	CF	Conversion Factor	L/cm3	1.00E-03	USEPA, 1989	0.001	USEPA, 1989	C x CF x SA x PC x ET x EF x ED x
	SA	Surface Area Available for Contact	cm2	5,800	USEPA, 1997	5000	USEPA, 1992	1/BW x1/AT
	PC	Permeability Constant	cm/hour	Chemical Specific	USEPA, 1992	Chemical Specific	USEPA, 1992	
	ET	Exposure Time	hours/day	2.6	USEPA, 1992	2.6	USEPA, 1992	
	EF	Exposure Frequency	days/year	48	Professional Judgement	234	USEPA, 1993	
	ED	Exposure Duration	years	30	USEPA, 1989	9	USEPA, 1993	
	BW	Body Weight	kg	70	USEPA, 1989	70	USEPA, 1989	
	AT-C	Averaging Time (Cancer)	days	25,550	USEPA, 1989	25550	USEPA, 1989	
	AT-N	Averaging Time (Non-Cancer)	days	10,950	USEPA, 1989	3285	USEPA, 1993	

NA - Not Applicable.
Sources:
USEPA, 1989: Risk Assessment Guidance for Superfund. Vol 1: Human Health Evaluation Manual, Part A. OERR. EPA/540/1-89/002.
USEPA, 1992: Dermal Exposure Assessment: Principles and Applications. OHEA. EPA/600/8-91/011B.
USEPA, 1993: "Superfund's Standard Default Exposure Factors for the Central Tendency and Reasonable Maximum Exposure." November, 1993.
USEPA, 1995: Supplemental Guidance to RAGS: Region IV Bulletins. OHS. November, 1995.
USEPA, 1997: Exposure Factors Handbook. Vol. 1: General Factors. ORD. EPA/600/P-95/002Fa.

TABLE 6-24
VALUES USED FOR DAILY INTAKE CALCULATIONS
SITE 10 - ORIGINAL BASE LANDFILL
MCB CAMP LEJEUNE
JACKSONVILLE, NC

Scenario Timeframe: Future
Medium: Surface Water
Exposure Medium: Surface Water
Exposure Point: Surface Water
Receptor Population: Resident
Receptor Age: Younger Child

Exposure Route	Parameter Code	Parameter Definition	Units	RME Value	RME Rationale/ Reference	CT Value	CT Rationale/ Reference	Intake Equation/ Model Name
Ingestion	C	Contaminant Concentration in Groundwater	mg/L	See Table	See Table	See Table	See Table	Chronic Daily Intake (CDI) (mg/kg-day) =
	IR-W	Ingestion Rate of Surface Water	L/hour	0.05	USEPA, 1995	0.05	USEPA, 1995	C x IR-W x EF x ED x 1/BW x 1/AT
	ET	Exposure Time	hours/day	2.6	USEPA, 1992	2.6	USEPA, 1992	
	EF	Exposure Frequency	days/year	48	Professional Judgement	48	Professional Judgement	
	ED	Exposure Duration	years	6	USEPA, 1989	6	USEPA, 1989	
	BW	Body Weight	kg	15	USEPA, 1991	15	USEPA, 1989	
	AT-C	Averaging Time (Cancer)	days	25,550	USEPA, 1989	25550	USEPA, 1989	
	AT-N	Averaging Time (Non-Cancer)	days	2,190	USEPA, 1989	2190	USEPA, 1989	
Dermal	C	Contaminant Concentration in Groundwater	mg/L	See Table	See Table	See Table	See Table	CDI (mg/kg-day) =
	CF	Conversion Factor	L/cm3	1.00E-03	USEPA, 1989	0.001	--	C x CF x SA x PC x ET x EF x ED x
	SA	Surface Area Available for Contact	cm2	2,100	USEPA, 1997	2000	USEPA, 1993	1/BW x1/AT
	PC	Permeability Constant	cm/hour	Chemical Specific	USEPA, 1992	Chemical Specific	USEPA, 1992	
	ET	Exposure Time	hours/day	2.6	USEPA, 1992	2.6	USEPA, 1992	
	EF	Exposure Frequency	days/year	48	Professional Judgement	48	Professional Judgement	
	ED	Exposure Duration	years	6	USEPA, 1989	6	USEPA, 1989	
	BW	Body Weight	kg	15	USEPA, 1991	15	USEPA, 1989	
	AT-C	Averaging Time (Cancer)	days	25,550	USEPA, 1989	25550	USEPA, 1989	
	AT-N	Averaging Time (Non-Cancer)	days	2,190	USEPA, 1989	2190	USEPA, 1989	

NA - Not Applicable.
Sources:
USEPA, 1989: Risk Assessment Guidance for Superfund. Vol 1: Human Health Evaluation Manual, Part A. OERR. EPA/540/1-89/002.
USEPA, 1992: Dermal Exposure Assessment: Principles and Applications. OHEA. EPA/600/8-91/011B.

TABLE 6-25
NON-CANCER TOXICITY DATA -- ORAL/DERMAL
SITE 10 - ORIGINAL BASE LANDFILL
MCB CAMP LEJEUNE
JACKSONVILLE, NC

Chemical of Potential Concern	Chronic/ Subchronic	Oral RfD Value	Oral RfD Units	Oral to Dermal Adjustment Factor (1)	Adjusted Dermal RfD (2)	Units	Primary Target Organ	Combined Uncertainty/Modifying Factors	Sources of RfD: Target Organ	Dates of RfD: Target Organ (3) (MM/DD/YY)
Benzo(a)anthracene	NA	NA	(mg/kg/day)	100%	NA	(mg/kg/day)	NA	NA	NA	NA
Benzo(a)pyrene	NA	NA	(mg/kg/day)	100%	NA	(mg/kg/day)	NA	NA	NA	NA
Benzo(b)fluoranthene	NA	NA	(mg/kg/day)	100%	NA	(mg/kg/day)	NA	NA	NA	NA
Benzo(k)fluoranthene	NA	NA	(mg/kg/day)	100%	NA	(mg/kg/day)	NA	NA	NA	NA
Carbazole	NA	NA	(mg/kg/day)	100%	NA	(mg/kg/day)	NA	NA	NA	NA
Chrysene	NA	NA	(mg/kg/day)	100%	NA	(mg/kg/day)	NA	NA	NA	NA
Dibenz(a,h)anthracene	NA	NA	(mg/kg/day)	100%	NA	(mg/kg/day)	NA	NA	NA	NA
Indeno(1,2,3-cd)pyrene	NA	NA	(mg/kg/day)	100%	NA	(mg/kg/day)	NA	NA	NA	NA
Aluminum	Chronic	1.00E+00	(mg/kg/day)	27%	2.70E-01	(mg/kg/day)	CNS	100/1	NCEA	4/26/00
Antimony	Chronic	4.00E-04	(mg/kg/day)	10%	4.00E-05	(mg/kg/day)	Whole Body	1000/1	IRIS	5/23/00
Arsenic	Chronic	3.00E-04	(mg/kg/day)	95%	2.85E-04	(mg/kg/day)	Skin / CVS	3/1	IRIS	9/18/00
Barium	Subchronic	7.00E-02	(mg/kg/day)	100%	7.00E-02	(mg/kg/day)	Kidney	3/1	IRIS	9/18/00
Cadmium	Chronic	1.00E-03	(mg/kg/day)	5%	5.00E-05	(mg/kg/day)	Kidney	10/1	IRIS	9/18/00
Chromium	Chronic	3.00E-03	(mg/kg/day)	1%	3.00E-05	(mg/kg/day)	GIS	300/3	IRIS	9/18/00
Copper	Chronic	4.00E-02	(mg/kg/day)	60%	2.40E-02	(mg/kg/day)	GIS	NA	HEAST	7/1/97
Iron	Chronic	3.00E-01	(mg/kg/day)	100%	3.00E-01	(mg/kg/day)	Liver / CVS / GIS	NA	NCEA	4/26/00
Manganese	Chronic	2.00E-02	(mg/kg/day)	100%	2.00E-02	(mg/kg/day)	CNS	1/1	IRIS	9/19/00
Mercury	Subchronic	3.00E-04	(mg/kg/day)	100%	3.00E-04	(mg/kg/day)	ImS	1000/1	IRIS	9/19/00
Thallium	Subchronic	7.00E-05	(mg/kg/day)	100%	7.00E-05	(mg/kg/day)	CVS	3000/1	Other	3/29/99
Zinc	Chronic	3.00E-01	(mg/kg/day)	25%	7.50E-02	(mg/kg/day)	CVS	3/1	IRIS	9/19/00

Notes:

(1) Refer to RAGS, Part A
(2) Adjusted dermal RfD = Oral RfD * Adj Factor
(3) For IRIS values, provide the date IRIS was searched.
For HEAST values, provide the date of HEAST.
For NCEA values, provide the date of the article provided by NCEA.

NA = Not Applicable

Target Organ Abbreviations:
CNS = Central Nervous System
CVS = Cardiovascular System
GIS = Gastrointestinal System

Sources:
IRIS = Integrated Risk Information System
HEAST= Health Effects Assessment Summary Tables
NCEA = National Center for Environmental Assessment, USEPA
RE = Region 9 Route Extrapolation

TABLE 6-26
NON-CANCER TOXICITY DATA -- INHALATION
SITE 10 - ORIGINAL BASE LANDFILL
MCB CAMP LEJEUNE
JACKSONVILLE, NC

Chemical of Potential Concern	Chronic/ Subchronic	Value Inhalation RfC	Units	Adjusted Inhalation RfD (1)	Units	Primary Target Organ	Combined Uncertainty/Modifying Factors	Sources of RfC:RfD: Target Organ	Dates (2) (MM/DD/YY)
Benzo(a)anthracene	NA	NA	NA	NA	mg/kg/day	NA	NA	NA	NA
Benzo(a)pyrene	NA	NA	NA	NA	mg/kg/day	NA	NA	NA	NA
Benzo(b)fluoranthene	NA	NA	NA	NA	mg/kg/day	NA	NA	NA	NA
Benzo(k)fluoranthene	NA	NA	NA	NA	mg/kg/day	NA	NA	NA	NA
Carbazole	NA	NA	NA	NA	mg/kg/day	NA	NA	NA	NA
Chrysene	NA	NA	NA	NA	mg/kg/day	NA	NA	NA	NA
Dibenz(a,h)anthracene	NA	NA	NA	NA	mg/kg/day	NA	NA	NA	NA
Indeno(1,2,3-cd)pyrene	NA	NA	NA	NA	mg/kg/day	NA	NA	NA	NA
Aluminum	Chronic	NA	NA	1.00E-03	mg/kg/day	CNS	100/1	NCEA	4/26/00
Antimony	NA	NA	NA	NA	mg/kg/day	NA	NA	NA	NA
Arsenic	NA	NA	NA	NA	mg/kg/day	NA	NA	NA	NA
Barium	Subchronic	5.0E-03	ug/m3	1.40E-04	mg/kg/day	Fetus	100/1	HEAST Alternative	7/1/97
Cadmium	NA	5.7E-05	mg/kg-day	5.70E-05	mg/kg/day	NA	NA	NCEA	9/1/00
Chromium	Subchronic	8.0E-06	mg/m3	3.00E-05	mg/kg/day	RsS	90/1 (aerosols), 300/1 (particulates)	IRIS	9/18/00
Copper	NA	NA	NA	NA	mg/kg/day	NA	NA	NA	NA
Iron	NA	NA	NA	NA	mg/kg/day	NA	NA	NA	NA
Manganese	Chronic	5.0E-05	mg/m3	1.43E-05	mg/kg/day	CNS	1000/1	IRIS	9/19/00
Mercury	Chronic	3.0E-04	mg/m3	8.60E-05	mg/kg/day	CNS	30/1	IRIS	9/19/00
Thallium	NA	NA	NA	NA	mg/kg/day	NA	NA	NA	NA
Zinc	NA	NA	NA	NA	mg/kg/day	NA	NA	NA	NA

Notes:

(1) Provide equation used for derivation in text.
(2) For IRIS values, provide the date IRIS was searched.
For HEAST values, provide the date of HEAST.
For NCEA values, provide the date of the article provided by NCEA.

NA = Not Applicable

Target Organ Abbreviations:
CNS = Central Nervous System
RsS = Respiratory System

Sources:
IRIS = Integrated Risk Information System
HEAST= Health Effects Assessment Summary Tables
NCEA = National Center for Environmental Assessment, USEP
RE = Region 9 Route Extrapolation

TABLE 6-27
CANCER TOXICITY DATA -- ORAL/DERMAL
SITE 10 - ORIGINAL BASE LANDFILL
MCB CAMP LEJEUNE
JACKSONVILLE, NC

Chemical of Potential Concern	Oral Cancer Slope Factor	Oral to Dermal Adjustment Factor	Adjusted Dermal Cancer Slope Factor (1)	Units	Weight of Evidence/ Cancer Guideline Description	Source	Date (2) (MM/DD/YY)
Benzo(a)anthracene	7.30E-01	100%	NA	$(mg/kg/day)^{-1}$	B2	NCEA	4/26/00
Benzo(a)pyrene	7.30E+00	100%	NA	$(mg/kg/day)^{-1}$	B2	IRIS	9/18/00
Benzo(b)fluoranthene	7.30E-01	100%	NA	$(mg/kg/day)^{-1}$	B2	NCEA	4/26/00
Benzo(k)fluoranthene	7.30E-02	100%	NA	$(mg/kg/day)^{-1}$	B2	NCEA	4/26/00
Carbazole	2.00E-02	100%	NA	$(mg/kg/day)^{-1}$	B2	HEAST	7/1/97
Chrysene	7.30E-03	100%	NA	$(mg/kg/day)^{-1}$	B2	NCEA	4/26/00
Dibenz(a,h)anthracene	7.30E+00	100%	NA	$(mg/kg/day)^{-1}$	B2	NCEA	4/26/00
Indeno(1,2,3-cd)pyrene	7.30E-01	100%	NA	$(mg/kg/day)^{-1}$	B2	NCEA	4/26/00
Aluminum	NA	27%	NA	$(mg/kg/day)^{-1}$	D	NA	NA
Antimony	NA	10%	NA	$(mg/kg/day)^{-1}$	D	NA	NA
Arsenic	1.50E+00	95%	1.58E+00	$(mg/kg/day)^{-1}$	A	IRIS	9/18/00
Barium	NA	100%	NA	$(mg/kg/day)^{-1}$	E	NA	NA
Cadmium	NA	5%	NA	$(mg/kg/day)^{-1}$	D	IRIS	9/18/00
Chromium	NA	1%	NA	$(mg/kg/day)^{-1}$	D	IRIS	9/18/00
Copper	NA	60%	NA	$(mg/kg/day)^{-1}$	D	IRIS	9/18/00
Iron	NA	100%	NA	$(mg/kg/day)^{-1}$	D	NA	NA
Manganese	NA	100%	NA	$(mg/kg/day)^{-1}$	D	IRIS	9/19/00
Mercury	NA	100%	NA	$(mg/kg/day)^{-1}$	D	IRIS	9/19/00
Thallium	NA	100%	NA	$(mg/kg/day)^{-1}$	D	NA	NA
Zinc	NA	25%	NA	$(mg/kg/day)^{-1}$	D	IRIS	9/19/00

Notes:

(1) Adjusted dermal CSF = Oral CSF / Adj Factor
(2) For IRIS values, provide the date IRIS was searched.
For HEAST values, provide the date of HEAST.
For NCEA values, provide article date provided by NCEA.

NA = Not Applicable

Sources:
IRIS = Integrated Risk Information System
HEAST= Health Effects Assessment Summary Tables
NCEA = National Center for Environmental Assessment, EPA
RE = Region 9 Route Extrapolation

EPA Group:
A - Human carcinogen
B1 - Probable human carcinogen - indicates that limited human data are available
B2 - Probable human carcinogen - indicates sufficient evidence in animals and inadequate or no evidence in humans
C - Possible human carcinogen
D - Not classifiable as a human carcinogen
E - Evidence of noncarcinogenicity

Weight of Evidence:
Known/Likely (EPA classes A, B1, B2, C)
Cannot be Determined (EPA class D)
Not Likely (EPA class E)

TABLE 6-28
CANCER TOXICITY DATA -- INHALATION
SITE 10 - ORIGINAL BASE LANDFILL
MCB CAMP LEJEUNE
JACKSONVILLE, NC

Chemical of Potential Concern	Unit Risk	Units	Adjustment (1)	Inhalation Cancer Slope Factor	Units	Weight of Evidence/ Cancer Guideline Description	Source	Date (2) (MM/DD/YY)
Benzo(a)anthracene	NA	NA	NA	NA	mg/kg/day	D	NA	NA
Benzo(a)pyrene	8.9E-04	ug/m3	3,500	3.10E+00	mg/kg/day	B2	NCEA	4/26/00
Benzo(b)fluoranthene	NA	NA	NA	NA	mg/kg/day	B2	NA	NA
Benzo(k)fluoranthene	NA	NA	NA	NA	mg/kg/day	B2	NA	NA
Carbazole	NA	NA	NA	NA	mg/kg/day	D	NA	NA
Chrysene	NA	NA	NA	NA	mg/kg/day	B2	IRIS	9/18/00
Dibenz(a,h)anthracene	NA	NA	NA	NA	mg/kg/day	D	NA	NA
Indeno(1,2,3-cd)pyrene	NA	NA	NA	NA	mg/kg/day	B2	IRIS	9/18/00
Aluminum	NA	NA	NA	NA	mg/kg/day	D	NA	NA
Antimony	NA	NA	NA	NA	mg/kg/day	D	NA	NA
Arsenic	4.3E-03	ug/m3	3,500	1.51E+01	mg/kg/day	A	IRIS	9/18/00
Barium	NA	NA	NA	NA	mg/kg/day	D	NA	NA
Cadmium	1.8E-03	ug/m3	3,500	6.30E+00	mg/kg/day	B1	IRIS	5/23/00
Chromium	8E-6 (aerosols) / 1E-4 (particulates)	mg/m3	3,500	4.10E+01	mg/kg/day	A	HEAST	7/1/97
Copper	NA	NA	NA	NA	mg/kg/day	D	IRIS	9/18/00
Iron	NA	NA	NA	NA	mg/kg/day	D	NA	NA
Manganese	NA	NA	NA	NA	mg/kg/day	D	IRIS	9/19/00
Mercury	NA	NA	NA	NA	mg/kg/day	D	IRIS	9/19/00
Thallium	NA	NA	NA	NA	mg/kg/day	D	NA	NA
Zinc	NA	NA	NA	NA	mg/kg/day	D	IRIS	9/19/00

Notes:

(1) Adjustment Factor applied to Unit Risk to calculate Inhalation Slope Factor = 70kg x 1/20m3/day x 1000ug/mg
(2) For IRIS values, provide the date IRIS was searched.
For HEAST values, provide the date of HEAST.
For NCEA values, provide the date of the article provided by NCEA.

NA = Not Applicable

Sources:
IRIS = Integrated Risk Information System
HEAST= Health Effects Assessment Summary Tables
NCEA = National Center for Environmental Assessment, USEPA

EPA Group:
A - Human carcinogen
B1 - Probable human carcinogen - indicates that limited human data are available
B2 - Probable human carcinogen - indicates sufficient evidence in animals and inadequate or no evidence in humans
C - Possible human carcinogen
D - Not classifiable as a human carcinogen
E - Evidence of noncarcinogenicity

Weight of Evidence:
Known/Likely (EPA classes A, B1, B2, C)
Cannot be Determined (EPA class D)
Not Likely (EPA class E)

TABLE 6-29
SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs
REASONABLE MAXIMUM EXPOSURE
SITE 10 - ORIGINAL BASE LANDFILL
MCB CAMP LEJEUNE
JACKSONVILLE, NC

Scenario Timeframe: Current
Receptor Population: Military Personnel
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical	Carcinogenic Risk				Chemical	Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Routes Total		Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Routes Total
Surface Soil	Surface Soil	Surface Soil	Aluminum	--	--	--	--	Aluminum	CNS	3.5E-03	1.7E-04	6.6E-03	1.0E-02
			Antimony	--	--	--	--	Antimony	(o) Whole Body	1.1E-02	--	5.6E-02	6.7E-02
			Arsenic	9.9E-08	4.8E-11	1.6E-07	2.6E-07	Arsenic	(o) Skin / CVS	3.8E-03	--	6.2E-03	1.0E-02
			Iron	--	--	--	--	Iron	(o) Liver / CVS / GIS	3.0E-03	--	1.5E-03	4.6E-03
			(Total)	9.9E-08	4.8E-11	1.6E-07	2.6E-07	(Total)		2.1E-02	1.7E-04	7.0E-02	9.2E-02
Surface Water	Surface Water	Surface Water	Aluminum	--	--	--	--	Aluminum	CNS	1.8E-04	--	3.5E-04	5.3E-04
			Iron	--	--	--	--	Iron	(o) Liver / CVS / GIS	9.4E-04	--	4.8E-04	1.4E-03
			Mercury	--	--	--	--	Mercury	(o) ImS, (i) CNS	2.9E-05	--	1.5E-05	4.4E-05
			Zinc	--	--	--	--	Zinc	(o) CVS	3.5E-05	--	7.1E-05	1.1E-04
			(Total)	--	--	--	0.0E+00	(Total)		1.2E-03	--	9.2E-04	2.1E-03

Notes:
Target Organ Abbreviations:
CNS = Central Nervous System
CVS = Cardiovascular System
GIS = Gastrointestinal System

(o) Oral exposure
(i) Inhalation exposure

Total Risk Across Surface Soil	2.6E-07
Total Risk Across Surface Water	0.0E+00
Total Risk Across All Media and All Exposure Routes	2.6E-07

All Exposure Routes:

Total Central Nervous System HI =	0.01

Total Hazard Index Across Surface Soil	0.09
Total Hazard Index Across Surface Water	0.002
Total Hazard Index Across All Media and All Exposure Routes	0.09

Oral and Dermal Exposure Routes:

Oral / Dermal Whole Body HI =	0.07
Oral / Dermal Gastrointestinal System HI =	0.01
Oral / Dermal Cardiovascular System HI =	0.02
Oral / Dermal Skin HI =	0.01
Oral / Dermal Liver HI =	0.01

TABLE 6-30
SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs
REASONABLE MAXIMUM EXPOSURE
SITE 10 - ORIGINAL BASE LANDFILL
MCB CAMP LEJEUNE
JACKSONVILLE, NC

Scenario Timeframe: Current, Future
Receptor Population: Trespasser
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical	Carcinogenic Risk				Chemical	Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Routes Total		Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Routes Total
Surface Soil	Surface Soil	Surface Soil	Aluminum	--	--	--	--	Aluminum	CNS	1.2E-03	1.7E-04	2.5E-03	3.9E-03
			Antimony	--	--	--	--	Antimony	(o) Whole Body	3.7E-03	--	2.1E-02	2.5E-02
			Arsenic	2.0E-07	2.9E-10	3.6E-07	5.6E-07	Arsenic	(o) Skin / CVS	1.3E-03	--	2.4E-03	3.6E-03
			Iron	--	--	--	--	Iron	(o) Liver / CVS / GIS	1.0E-03	--	5.9E-04	1.6E-03
			(Total)	2.0E-07	2.9E-10	3.6E-07	5.6E-07	(Total)		7.1E-03	1.7E-04	2.7E-02	3.4E-02
Surface Water	Surface Water	Surface Water	Aluminum	--	--	--	--	Aluminum	CNS	6.2E-05	--	1.3E-04	2.0E-04
			Iron	--	--	--	--	Iron	(o) Liver / CVS / GIS	3.2E-04	--	1.8E-04	5.0E-04
			Mercury	--	--	--	--	Mercury	(o) ImS, (i) CNS	9.8E-06	--	5.7E-06	1.5E-05
			Zinc	--	--	--	--	Zinc	(o) CVS	1.2E-05	--	2.7E-05	3.9E-05
			(Total)	--	--	--	0.0E+00	(Total)		4.0E-04	--	3.5E-04	7.5E-04

Notes:
Target Organ Abbreviations:
CNS = Central Nervous System
CVS = Cardiovascular System
GIS = Gastrointestinal System
(o) Oral exposure
(i) Inhalation exposure

Total Risk Across Surface Soil	5.6E-07
Total Risk Across Surface Water	0.0E+00
Total Risk Across All Media and All Exposure Routes	5.6E-07

Total Hazard Index Across Surface Soil	0.03
Total Hazard Index Across Surface Water	0.001
Total Hazard Index Across All Media and All Exposure Routes	0.03

All Exposure Routes:

Total Central Nervous System HI =	0.00

Oral and Dermal Exposure Routes:

Oral / Dermal Whole Body HI =	0.02
Oral / Dermal Gastrointestinal System HI =	0.00
Oral / Dermal Cardiovascular System HI =	0.01
Oral / Dermal Skin HI =	0.00
Oral / Dermal Liver HI =	0.00

TABLE 6-31
SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs
REASONABLE MAXIMUM EXPOSURE
SITE 10 - ORIGINAL BASE LANDFILL
MCB CAMP LEJEUNE
JACKSONVILLE, NC

Scenario Timeframe: Current, Future
Receptor Population: Trespasser
Receptor Age: Older Child

Medium	Exposure Medium	Exposure Point	Chemical	Carcinogenic Risk				Chemical	Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Routes Total		Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Routes Total
Surface Soil	Surface Soil	Surface Soil	Aluminum	--	--	--	--	Aluminum	CNS	1.8E-03	2.6E-04	2.3E-03	4.4E-03
			Antimony	--	--	--	--	Antimony	(o) Whole Body	5.7E-03	--	2.0E-02	2.6E-02
			Arsenic	1.3E-07	1.9E-10	1.4E-07	2.7E-07	Arsenic	(o) Skin / CVS	2.0E-03	--	2.2E-03	4.2E-03
			Iron	--	--	--	--	Iron	(o) Liver / CVS / GIS	1.6E-03	--	5.5E-04	2.1E-03
			(Total)	1.3E-07	1.9E-10	1.4E-07	2.7E-07	(Total)		1.1E-02	2.6E-04	2.5E-02	3.6E-02
Surface Water	Surface Water	Surface Water	Aluminum	--	--	--	--	Aluminum	CNS	9.6E-05	--	1.2E-04	2.2E-04
			Iron	--	--	--	--	Iron	(o) Liver / CVS / GIS	4.9E-04	--	1.7E-04	6.6E-04
			Mercury	--	--	--	--	Mercury	(o) ImS, (i) CNS	1.5E-05	--	5.3E-06	2.0E-05
			Zinc	--	--	--	--	Zinc	(o) CVS	1.8E-05	--	2.5E-05	4.3E-05
			(Total)	--	--	--	0.0E+00	(Total)		6.2E-04	--	3.3E-04	9.5E-04

Notes:
Target Organ Abbreviations:
CNS = Central Nervous System
CVS = Cardiovascular System
GIS = Gastrointestinal System
(o) Oral exposure
(i) Inhalation exposure

Total Risk Across Surface Soil	2.7E-07
Total Risk Across Surface Water	0.0E+00
Total Risk Across All Media and All Exposure Routes	2.7E-07

All Exposure Routes:

Total Central Nervous System HI =	0.00

Total Hazard Index Across Surface Soil	0.04
Total Hazard Index Across Surface Water	0.001
Total Hazard Index Across All Media and All Exposure Routes	0.04

Oral and Dermal Exposure Routes:

Oral / Dermal Whole Body HI =	0.03
Oral / Dermal Gastrointestinal System HI =	0.00
Oral / Dermal Cardiovascular System HI =	0.01
Oral / Dermal Skin HI =	0.00
Oral / Dermal Liver HI =	0.00

TABLE 6-32
SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs
REASONABLE MAXIMUM EXPOSURE
SITE 10 - ORIGINAL BASE LANDFILL
MCB CAMP LEJEUNE
JACKSONVILLE, NC

Scenario Timeframe: Future
Receptor Population: Resident - RME
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical	Carcinogenic Risk				Chemical	Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Routes Total		Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Routes Total
Surface Soil	Surface Soil	Surface Soil	Aluminum	--	--	--	--	Aluminum	CNS	8.5E-03	1.2E-03	1.8E-02	2.8E-02
			Antimony	--	--	--	--	Antimony	(o) Whole Body	2.7E-02	--	1.6E-01	1.8E-01
			Arsenic	1.8E-06	2.7E-09	3.3E-06	5.1E-06	Arsenic	(o) Skin / CVS	9.4E-03	--	1.7E-02	2.7E-02
			Iron	--	--	--	--	Iron	(o) Liver / CVS / GIS	7.4E-03	--	4.3E-03	1.2E-02
			(Total)	1.8E-06	2.7E-09	3.3E-06	5.1E-06	(Total)		5.2E-02	1.2E-03	2.0E-01	2.5E-01
Groundwater	Groundwater	Tap (Beneficial Use)	Iron	--	--	--	--	Iron	(o) Liver / CVS / GIS	6.4E-02	--	1.8E-04	6.4E-02
			(Total)	--	--	--	0.0E+00	(Total)		6.4E-02	--	1.8E-04	6.4E-02
Surface Water	Surface Water	Surface Water	Aluminum	--	--	--	--	Aluminum	CNS	6.2E-05	--	1.3E-04	2.0E-04
			Iron	--	--	--	--	Iron	(o) Liver / CVS / GIS	3.2E-04	--	1.8E-04	5.0E-04
			Mercury	--	--	--	--	Mercury	(o) ImS, (i) CNS	9.8E-06	--	5.7E-06	1.5E-05
			Zinc	--	--	--	--	Zinc	(o) CVS	1.2E-05	--	2.7E-05	3.9E-05
			(Total)	--	--	--	0.0E+00	(Total)		4.0E-04	--	3.5E-04	7.5E-04

Notes:
Target Organ Abbreviations:
CNS = Central Nervous System
CVS = Cardiovascular System
GIS = Gastrointestinal System
(o) Oral exposure
(i) Inhalation exposure

Total Risk Across Surface Soil	5.1E-06
Total Risk Across Groundwater	0.0E+00
Total Risk Across Surface Water	0.0E+00
Total Risk Across All Media and All Exposure Routes	5.1E-06

Total Hazard Index Across Surface Soil	0.25
Total Hazard Index Across Groundwater	0.06
Total Hazard Index Across Surface Water	0.001
Total Hazard Index Across All Media and All Exposure Routes	0.31

All Exposure Routes:

Total Central Nervous System HI =	0.03

Oral and Dermal Exposure Routes:

Oral / Dermal Whole Body HI =	0.18
Oral / Dermal Gastrointestinal System HI =	0.08
Oral / Dermal Cardiovascular System HI =	0.10
Oral / Dermal Skin HI =	0.03
Oral / Dermal Liver HI =	0.08

TABLE 6-33
SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs
REASONABLE MAXIMUM EXPOSURE
SITE 10 - ORIGINAL BASE LANDFILL
MCB CAMP LEJEUNE
JACKSONVILLE, NC

Scenario Timeframe: Future
Receptor Population: Resident - RME
Receptor Age: Young Child

Medium	Exposure Medium	Exposure Point	Chemical	Carcinogenic Risk				Chemical	Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Routes Total		Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Routes Total
Surface Soil	Surface Soil	Surface Soil	Aluminum	--	--	--	--	Aluminum	CNS	8.0E-02	4.3E-03	3.1E-02	1.1E-01
			Antimony	--	--	--	--	Antimony	(o) Whole Body	2.5E-01	--	2.6E-01	5.1E-01
			Arsenic	3.4E-06	1.9E-09	1.1E-06	4.5E-06	Arsenic	(o) Skin / CVS	8.8E-02	--	2.9E-02	1.2E-01
			Iron	--	--	--	--	Iron	(o) Liver / CVS / GIS	6.9E-02	--	7.3E-03	7.6E-02
			(Total)	3.4E-06	1.9E-09	1.1E-06	4.5E-06	(Total)		4.9E-01	4.3E-03	3.3E-01	8.2E-01
Groundwater	Groundwater	Tap (Beneficial Use)	Iron	--	--	--	--	Iron	(o) Liver / CVS / GIS	1.5E-01	--	3.1E-04	1.5E-01
			(Total)	--	--	--	0.0E+00	(Total)		1.5E-01	--	3.1E-04	1.5E-01
Surface Water	Surface Water	Surface Water	Aluminum	--	--	--	--	Aluminum	CNS	1.4E-03	--	2.3E-04	1.7E-03
			Iron	--	--	--	--	Iron	(o) Liver / CVS / GIS	7.4E-03	--	3.1E-04	7.7E-03
			Mercury	--	--	--	--	Mercury	(o) ImS, (i) CNS	2.3E-04	--	9.6E-06	2.4E-04
			Zinc	--	--	--	--	Zinc	(o) CVS	2.7E-04	--	4.6E-05	3.2E-04
			(Total)	--	--	--	0.0E+00	(Total)		9.3E-03	--	5.9E-04	9.9E-03

Notes:
Target Organ Abbreviations:
CNS = Central Nervous System
CVS = Cardiovascular System
GIS = Gastrointestinal System
(o) Oral exposure
(i) Inhalation exposure

Total Risk Across Surface Soil	4.5E-06
Total Risk Across Groundwater	0.0E+00
Total Risk Across Surface Water	0.0E+00
Total Risk Across All Media and All Exposure Routes	4.5E-06

Total Hazard Index Across Surface Soil	0.82
Total Hazard Index Across Groundwater	0.15
Total Hazard Index Across Surface Water	0.01
Total Hazard Index Across All Media and All Exposure Routes	0.98

All Exposure Routes:

Total Central Nervous System HI =	0.12

Oral and Dermal Exposure Routes:

Oral / Dermal Whole Body HI =	0.51
Oral / Dermal Gastrointestinal System HI =	0.23
Oral / Dermal Cardiovascular System HI =	0.35
Oral / Dermal Skin HI =	0.12
Oral / Dermal Liver HI =	0.23

TABLE 6-34
SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs
REASONABLE MAXIMUM EXPOSURE
SITE 10 - ORIGINAL BASE LANDFILL
MCB CAMP LEJEUNE
JACKSONVILLE, NC

Scenario Timeframe: Future
Receptor Population: Construction Worker
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical	Carcinogenic Risk				Chemical	Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Routes Total		Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Routes Total
Surface Soil	Surface Soil	Surface Soil											
			Aluminum	--	--	--	--	Aluminum	CNS	2.9E-02	3.0E-04	1.3E-02	4.3E-02
			Antimony	--	--	--	--	Antimony	(o) Whole Body	9.2E-02	--	1.1E-01	2.0E-01
			Arsenic	2.1E-07	2.1E-11	7.9E-08	2.9E-07	Arsenic	(o) Skin / CVS	3.2E-02	--	1.2E-02	4.5E-02
			Iron	--	--	--	--	Iron	(o) Liver / CVS / GIS	2.5E-02	--	3.1E-03	2.8E-02
			(Total)	2.1E-07	2.1E-11	7.9E-08	2.9E-07	(Total)		1.8E-01	3.0E-04	1.4E-01	3.2E-01
Subsurface Soil	Subsurface Soil	Subsurface Soil											
			Benzo(a)anthracene	1.5E-08	--	--	1.5E-08	Benzo(a)anthracene	NA	--	--	--	--
			Benzo(a)pyrene	1.5E-07	6.4E-13	--	1.5E-07	Benzo(a)pyrene	NA	--	--	--	--
			Benzo(b)fluoranthene	1.5E-08	--	--	1.5E-08	Benzo(b)fluoranthene	NA	--	--	--	--
			Benzo(k)fluoranthene	1.4E-09	--	--	1.4E-09	Benzo(k)fluoranthene	NA	--	--	--	--
			Carbazole	2.6E-10	--	--	2.6E-10	Carbazole	NA	--	--	--	--
			Chrysene	1.6E-10	--	--	1.6E-10	Chrysene	NA	--	--	--	--
			Dibenz(a,h)anthracene	1.0E-07	--	--	1.0E-07	Dibenz(a,h)anthracene	NA	--	--	--	--
			Indeno(1,2,3-cd)pyrene	1.2E-08	--	--	1.2E-08	Indeno(1,2,3-cd)pyrene	NA	--	--	--	--
			Antimony	--	--	--	--	Antimony	(o) Whole Body	1.9E-01	--	2.3E-01	4.3E-01
			Arsenic	5.7E-07	5.8E-11	2.2E-07	7.9E-07	Arsenic	(o) Skin / CVS	8.8E-02	--	3.4E-02	1.2E-01
			Barium	--	--	--	--	Barium	(o) Kidney, (i) Fetus	5.4E-03	2.7E-05	6.6E-04	6.1E-03
			Cadmium	--	6.6E-12	--	6.6E-12	Cadmium	(o) Kidney	7.3E-03	1.3E-06	1.8E-02	2.5E-02
			Chromium	--	3.3E-10	--	3.3E-10	Chromium	(o) GIS, (i) RsS	1.8E-02	1.9E-05	2.2E-01	2.4E-01
			Copper	--	--	--	--	Copper	(o) GIS	4.9E-02	--	9.9E-03	5.9E-02
			Iron	--	--	--	--	Iron	(o) Liver / CVS / GIS	4.7E-01	--	5.7E-02	5.3E-01
			Manganese	--	--	--	--	Manganese	CNS	3.3E-02	4.7E-04	4.0E-03	3.8E-02
			Thallium	--	--	--	--	Thallium	(o) CVS	7.4E-02	--	8.9E-03	8.3E-02
			(Total)	8.6E-07	3.9E-10	2.2E-07	1.1E-06	(Total)		9.4E-01	5.1E-04	5.9E-01	**1.5E+00**

Total Risk Across Surface Soil	2.9E-07
Total Risk Across Subsurface Soil	1.1E-06
Total Risk Across All Media and All Exposure Routes	1.4E-06

Total Hazard Index Across Surface Soil	0.32
Total Hazard Index Across Subsurface Soil	1.53
Total Hazard Index Across All Media and All Exposure Routes	1.85

Notes:

Target Organ Abbreviations:

CNS = Central Nervous System
CVS = Cardiovascular System
GIS = Gastrointestinal System
RsS = Respiratory System

(o) Oral exposure
(i) Inhalation exposure

All Exposure Routes:

Total Central Nervous System HI =	0.04

Inhalation Exposure Routes:

Inhalation Respiratory System HI =	1.86E-05
Inhalation Fetus HI =	2.74E-05

Oral and Dermal Exposure Routes:

Oral / Dermal Whole Body HI =	0.43
Oral / Dermal Gastrointestinal System HI =	0.83
Oral / Dermal Cardiovascular System HI =	0.73
Oral / Dermal Skin HI =	0.12
Oral / Dermal Kidney HI =	0.03
Oral / Dermal Liver HI =	0.53

TABLE 6-35
SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs
CENTRAL TENDENCY
SITE 10 - ORIGINAL BASE LANDFILL
MCB CAMP LEJEUNE
JACKSONVILLE, NC

Scenario Timeframe: Future
Receptor Population: Construction Worker
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical	Carcinogenic Risk				Chemical	Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Routes Total		Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Routes Total
Surface Soil	Surface Soil	Surface Soil											
			Aluminum	--	--	--	--	Aluminum	CNS	2.9E-02	3.0E-04	1.3E-02	4.3E-02
			Antimony	--	--	--	--	Antimony	(o) Whole Body	9.2E-02	--	1.1E-01	2.0E-01
			Arsenic	2.1E-07	2.1E-11	7.9E-08	2.9E-07	Arsenic	(o) Skin / CVS	3.2E-02	--	1.2E-02	4.5E-02
			Iron	--	--	--	--	Iron	(o) Liver / CVS / GIS	2.5E-02	--	3.1E-03	2.8E-02
			(Total)	2.1E-07	2.1E-11	7.9E-08	2.9E-07	(Total)		1.8E-01	3.0E-04	1.4E-01	3.2E-01
Subsurface Soil	Subsurface Soil	Subsurface Soil											
			Benzo(a)anthracene	1.4E-08	--	--	1.4E-08	Benzo(a)anthracene	NA	--	--	--	--
			Benzo(a)pyrene	1.3E-07	6.4E-13	--	1.3E-07	Benzo(a)pyrene	NA	--	--	--	--
			Benzo(b)fluoranthene	1.4E-08	--	--	1.4E-08	Benzo(b)fluoranthene	NA	--	--	--	--
			Benzo(k)fluoranthene	1.2E-09	--	--	1.2E-09	Benzo(k)fluoranthene	NA	--	--	--	--
			Carbazole	2.3E-10	--	--	2.3E-10	Carbazole	NA	--	--	--	--
			Chrysene	1.4E-10	--	--	1.4E-10	Chrysene	NA	--	--	--	--
			Dibenz(a,h)anthracene	8.7E-08	--	--	8.7E-08	Dibenz(a,h)anthracene	NA	--	--	--	--
			Indeno(1,2,3-cd)pyrene	1.0E-08	--	--	1.0E-08	Indeno(1,2,3-cd)pyrene	NA	--	--	--	--
			Antimony	--	--	--	--	Antimony	(o) Whole Body	1.7E-01	--	2.3E-01	4.0E-01
			Arsenic	5.0E-07	5.8E-11	2.2E-07	7.1E-07	Arsenic	(o) Skin / CVS	7.7E-02	--	3.4E-02	1.1E-01
			Barium	--	--	--	--	Barium	(o) Kidney, (i) Fetus	4.8E-03	2.7E-05	6.6E-04	5.4E-03
			Cadmium	--	6.6E-12	--	6.6E-12	Cadmium	(o) Kidney	6.4E-03	1.3E-06	1.8E-02	2.4E-02
			Chromium	--	3.3E-10	--	3.3E-10	Chromium	(o) GIS, (i) RsS	1.6E-02	1.9E-05	2.2E-01	2.4E-01
			Copper	--	--	--	--	Copper	(o) GIS	4.3E-02	--	9.9E-03	5.3E-02
			Iron	--	--	--	--	Iron	(o) Liver / CVS / GIS	4.1E-01	--	5.7E-02	4.7E-01
			Manganese	--	--	--	--	Manganese	CNS	2.9E-02	4.7E-04	4.0E-03	3.3E-02
			Thallium	--	--	--	--	Thallium	(o) CVS	6.5E-02	--	8.9E-03	7.4E-02
			(Total)	7.5E-07	3.9E-10	2.2E-07	9.7E-07	(Total)		8.2E-01	5.1E-04	5.9E-01	**1.4E+00**

Total Risk Across Surface Soil	2.9E-07
Total Risk Across Subsurface Soil	9.7E-07
Total Risk Across All Media and All Exposure Routes	1.3E-06

Total Hazard Index Across Surface Soil	0.32
Total Hazard Index Across Subsurface Soil	1.41
Total Hazard Index Across All Media and All Exposure Routes	1.73

All Exposure Routes:

Total Central Nervous System HI =	0.03

Inhalation Exposure Routes:

Inhalation Respiratory System HI =	1.86E-05
Inhalation Fetus HI =	2.74E-05

Oral and Dermal Exposure Routes:

Oral / Dermal Whole Body HI =	0.40
Oral / Dermal Gastrointestinal System HI =	0.76
Oral / Dermal Cardiovascular System HI =	0.65
Oral / Dermal Skin HI =	0.11
Oral / Dermal Kidney HI =	0.03
Oral / Dermal Liver HI =	0.47

Notes:
Target Organ Abbreviations:
CNS = Central Nervous System
CVS = Cardiovascular System
GIS = Gastrointestinal System
RsS = Respiratory System

(o) Oral exposure
(i) Inhalation exposure

TABLE 6-36

TOTAL SITE RISK
SITE 10 – ORIGINAL BASE LANDFILL
MCB CAMP LEJEUNE
JACKSONVILLE, NC

Receptors	Surface Soil		Subsurface Soil		Groundwater		Surface Water		Total	
	ICR	HI	ICR	HI	ICR	HI	ICR	HI	ICR	HI
Current Military Personnel	2.6×10^{-7}	0.09	NA	NA	NA	NA	NA	0.002	2.6×10^{-7}	0.09
Current Adult Trespasser	5.6×10^{-7}	0.03	NA	NA	NA	NA	NA	0.001	5.6×10^{-7}	0.03
Current Older Child Trespasser	2.7×10^{-7}	0.04	NA	NA	NA	NA	NA	0.001	2.7×10^{-7}	0.04
Future Adult Resident	5.1×10^{-6}	0.25	NA	NA	0	0.06	NA	0.001	5.1×10^{-6}	0.31
Future Young Child Resident	4.5×10^{-6}	0.82	NA	NA	0	0.15	NA	0.01	4.5×10^{-6}	0.98
Future Construction Worker (RME)	2.9×10^{-7}	0.32	1.1×10^{-6}	1.53	NA	NA	NA	NA	1.4×10^{-6}	1.85
Future Construction Worker (CT)	2.9×10^{-7}	0.32	9.7×10^{-7}	1.41	NA	NA	NA	NA	1.3×10^{-6}	1.73

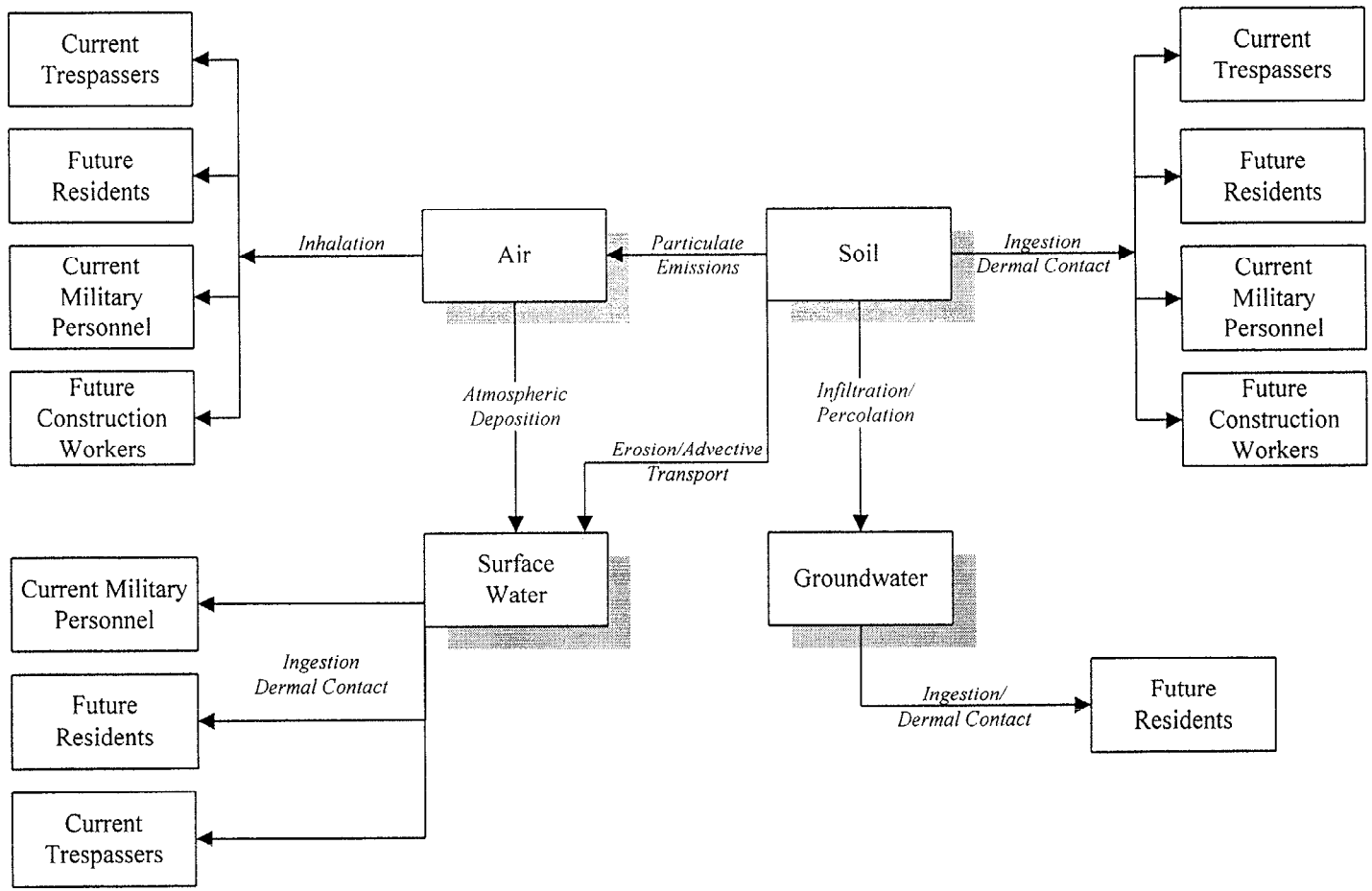
Notes:

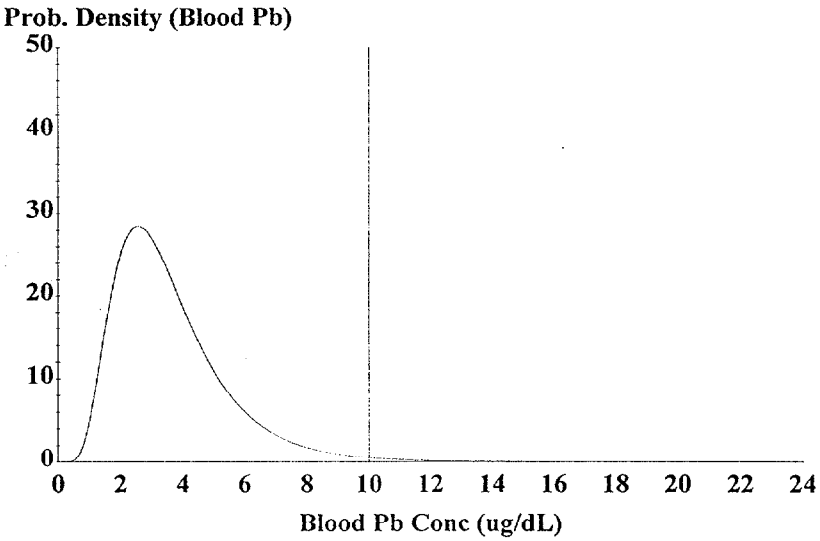
ICR = Incremental Lifetime Cancer Risk
HI = Hazard Index
Total = Soil + Groundwater + Surface Water
NA = Not Applicable

SECTION 6.0 FIGURES

FIGURE 6-1

CONCEPTUAL SITE MODEL
FOR CURRENT AND FUTURE HUMAN RECEPTORS
SITE 10 - ORIGINAL BASE LANDFILL
MCB, CAMP LEJEUNE, NORTH CAROLINA
SITE INVESTIGATION, CTO-0369



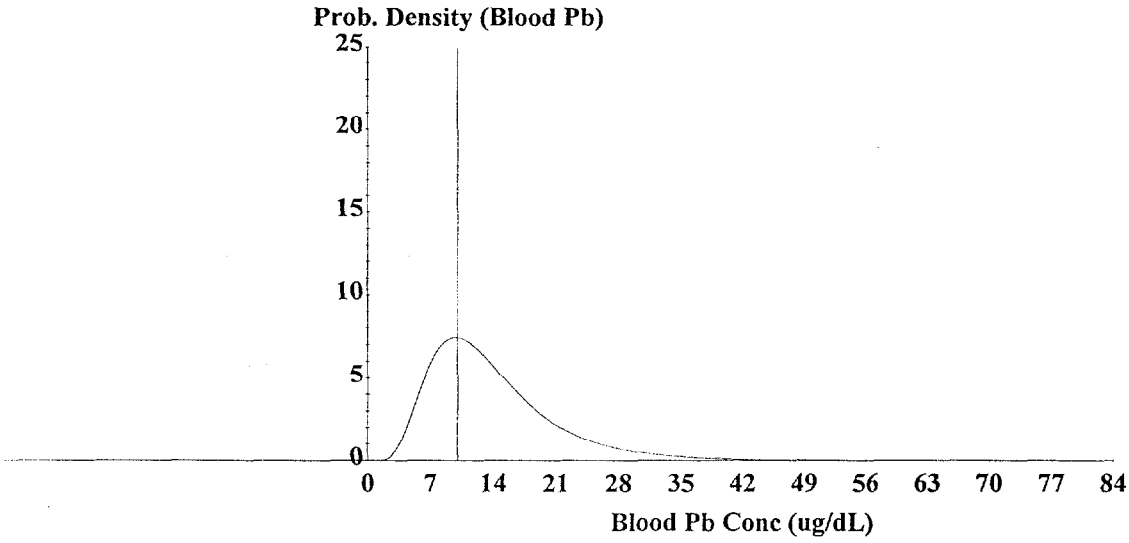


Cutoff = 10.000 ug/dl
Geo Mean = 3.327
% Above = 0.917
% Below = 99.083

Age Range = 0 to 84 months
Time Step = Every 4 Hours
Run Mode = Research

Figure 6-2

Probability Distribution of Blood Lead Levels – Groundwater Exposure
Site 10 – Original Base Landfill
MCB, Camp Lejeune, North Carolina
Site Investigation, CTO-0269



Cutoff = 10.000 ug/dl
Geo Mean = 12.742
% Above = 66.822
% Below = 33.178

Age Range = 0 to 84 months
Time Step = Every 4 Hours
Run Mode = Research

Figure 6-3

Probability Distribution of Blood Lead Levels – Subsurface Soil Exposure
Site 10 – Original Base Landfill
MCB, Camp Lejeune, North Carolina
Site Investigation, CTO-0269

7.0 ECOLOGICAL RISK SCREENING

This section presents the results of a focussed Ecological Risk Screening conducted for the terrestrial and aquatic environments associated with Site 10 (Original Base Landfill) at Marine Corps Base (MCB) Camp Lejeune. The primary objective of the focussed Ecological Risk Screening was (1) to determine whether past site operations at Site 10 have caused unacceptable risks to terrestrial and aquatic receptors inhabiting the site, and (2) to determine whether additional ecological studies are warranted at this site. Additionally, data gaps or areas of unacceptable uncertainty requiring the collection of additional data for subsequent ecological evaluations (if any) will also be identified. The risk assessment methodologies used in this evaluation were consistent with those outlined in the Guidelines for Ecological Risk Assessment (United States Environmental Protection Agency [USEPA], 1998), the Ecological Risk Assessment Guidance for Superfund (RAGS) (USEPA, 1997), and the Supplemental Guidance to RAGS: Region 4 Ecological Risk Assessment Bulletins (USEPA 2001).

This ecological risk screening focused on the terrestrial and aquatic habitats at Site 10. Potential risks to soil invertebrates and terrestrial plants were assessed by comparing surface soil analytical data to USEPA Region IV screening values. In addition to identifying the potential risks to terrestrial receptors, potential risks to the aquatic community residing within the unnamed pond at Site 10 were also evaluated based on a comparison of surface water/sediment analytical data to USEPA Region IV screening values. Groundwater potentially discharging into the unnamed pond was also compared to surface water screening values assuming no dilution or natural attenuation.

7.1 Problem Formulation

This focussed ecological risk screening was designed to evaluate potential threats to sensitive terrestrial (soil invertebrates and terrestrial plants) and aquatic receptors (benthic macroinvertebrates, amphibians, and aquatic plants) resulting from exposure to site contaminants present within various surface soil, surface water, and sediment. The first step in this evaluation consists of problem formulation. The problem formulation process for an ecological risk assessment addresses the following five issues: (1) the identification of the environmental setting and contaminants known or expected to exist at the site (2) possible fate and transport mechanisms of site contaminants (3) mechanisms of ecotoxicity associated with the site contaminants and likely

categories of ecological receptors that could be affected (4) identification of complete exposure pathways (5) and the selection of endpoints to screen for ecological risk (USEPA 1998). Highlights of the problem formulation step are presented in the preliminary ecological conceptual model (Figure 7-1).

7.1.1 Environmental Setting

Site 10, referred to as the Original Base Landfill, is located on the western side of Holcomb Boulevard, approximately 1,600 feet south of Wallace Creek and 1,750 feet north of Bearhead Creek. Open storage lots 201 and 203, as well as RI Sites 6 and 82 are located east of Site 10. The Original Base Landfill was reported to be approximately five to ten acres in size during full operation.

Five habitat units are present at Site 10: an open area, deciduous forest, pine forest, ecotones between the open areas and the forests, and an unnamed pond. Scattered pines were identified within the deciduous forest. Numerous birds and mammals were identified in the area. No protected species have been reported or observed at Site 10. The site is not located within any ecologically protected or sensitive areas. Information used to evaluate rare species, natural communities, and critical areas at this site was obtained from the IAS (WAR, 1983) and a habitat inventory conducted for Camp Lejeune (LeBlond et al., 1994). Specific details on the local ecology at Site 10 are presented in Section 3.

Surface soil sampling was conducted within the terrestrial upland areas of the site while surface water and sediment sampling were conducted within the aquatic environment associated with the unnamed pond. Groundwater data from on-site wells was also used in this evaluation.

7.1.2 Transport Pathways

A transport pathway describes the mechanisms whereby chemicals may be transported from a source of contamination to ecologically relevant media. Transport pathways for Site 10 are illustrated in the preliminary ecological conceptual model (see Figure 7-1). Only complete, potentially significant pathways were evaluated in this focussed ecological risk screening. Complete and potentially significant pathways are shown as solid lines. As depicted in the preliminary ecological conceptual

model (see Figure 7-1), the primary mechanisms for contaminant transport from Site 10 source areas are listed below.

- Overland transport of chemicals from surface soil via surface runoff to downgradient surface soil and surface water (unnamed pond).

- Leaching of chemicals from surface soil and/or subsurface soil by infiltrating precipitation and transport to surface water via groundwater.

- Uptake by biota from soil and sediment and trophic transfer to upper trophic level receptors.

Although a potentially complete and significant pathway, the transfer of contaminants to upper trophic level ecological receptors via food chain transfer is beyond the scope of this preliminary ecological screening and therefore was not evaluated.

7.1.3 Exposure Pathways and Exposure Routes

An exposure pathway links a source of contamination with one or more receptors through exposure via one or more media. Exposure, and thus potential risk, can only occur if complete exposure pathways exist with the following conditions:

- A source and mechanism of chemical release into the environment

- An environmental transport medium

- A point of potential contact with the medium

- A feasible exposure route at the contact point

A discussion of potential complete exposure pathways for ecological receptors is presented below. Specific pathways addressed by this ecological screening evaluation are also identified.

Groundwater Exposure Pathway. The potential release source for the groundwater exposure pathway is the construction debris and burned wastes reportedly disposed of in the landfill. Release mechanisms are leaching/desorption of chemicals to subsurface soil and vertical migration with infiltrating precipitation to groundwater (or leaching/desorption directly to groundwater). Contaminated surface soil and subsurface soil may also serve as a release source for the groundwater exposure pathway (leaching/desorption and vertical migration with infiltrating precipitation). Although a potential source and mechanism of release exist, the groundwater exposure pathway does not represent a complete exposure pathway since groundwater is not inhabited by ecological receptors.

Ecological receptors may potentially be exposed to chemicals in groundwater if the chemicals migrate with the groundwater to surface water and or sediment. Based on groundwater flow direction (see Figure 3-6), groundwater flows from the landfill area toward the unnamed pond located at the southern portion of the site. Ecological receptors either residing in the unnamed pond or using this surface water body as a source of food and/or drinking water may be exposed to chemicals migrating with groundwater. An evaluation of potential exposures resulting from the migration of chemicals with groundwater to the unnamed pond is addressed in the evaluation of the surface water and sediment exposure pathway below.

Surface Water and Sediment Exposure Pathway. Potential release sources for the surface water and sediment exposure pathway are surface soil and groundwater. Chemicals may potentially migrate to the unnamed pond with surface soil and groundwater.

Surface run-off from the landfill area likely also flows into the unnamed pond. Therefore, horizontal contaminant migration with surface runoff to the unnamed pond surface water and sediment is possible. Horizontal migration with fugitive dust from wind erosion is also a potential complete transport pathway to the unnamed pond. However, given the extensive and dense vegetative cover over the majority of the site, this transport pathway is considered insignificant.

Aquatic life (invertebrates and amphibians) may be exposed to chemicals that have potentially migrated to the unnamed pond through incidental ingestion, direct contact, and ingestion of plant and/or animal tissues for chemicals that have entered the food web (i.e., food chain transfer). Aquatic vegetation (i.e., algae) within the unnamed pond (i.e., algae) may be exposed to chemicals directly

from the water (direct contact) or through root uptake from the substrate. It is noted that unrooted, floating aquatic plants and rooted submerged vascular aquatic plants were not observed within the unnamed pond during any of the site visits. Mammals and birds using the unnamed pond as a potential food and/or drinking water source may be exposed to chemicals in surface water and sediment through ingestion, direct contact, and food chain transfer.

Other receptors that may forage within the unnamed pond include reptiles and amphibians. The potential exposure routes for reptiles and amphibians are ingestion of surface water and sediment, direct contact with surface water and sediment, and food chain transfer. It is noted that for all potential receptors, exposures from food chain transfer will be limited to those chemicals that bioaccumulate in lower trophic level organisms or biomagnify through successive trophic levels.

The surface water and sediment exposure pathway for aquatic receptors was evaluated by comparing surface water, sediment and groundwater analytical data to the USEPA Region IV recommended surface water and sediment screening values.

Subsurface Soil and Surface Soil Exposure Pathway. The release source for the subsurface soil (native soils and fill) and surface soil exposure pathway is the waste contained within the on-site landfill. Release mechanisms from the landfill wastes include leaching/desorption. Contaminated surface soil also may serve as a release source for downgradient areas. The release mechanism from contaminated surface soil is horizontal migration with surface runoff and fugitive dust emissions. As discussed above, the dense and extensive vegetative cover present over the majority of the site will minimize wind erosion; therefore, this transport pathway to downgradient surface soil is considered insignificant.

Soil invertebrates, such as earthworms, may be exposed to chemicals in surface soil through direct contact and ingestion. Terrestrial plants may be exposed to chemicals in surface soil through root uptake. Terrestrial birds may be exposed to chemicals in surface soil through incidental ingestion and food chain transfer. Dermal absorption in birds is mostly excluded through feather coverings; however, preening will contribute to incidental ingestion. Mammals and reptiles may be exposed to chemicals in surface soil through incidental ingestion and food chain transfer. For mammals and some reptiles (e.g. snakes) dermal absorption is mostly excluded through fur and scale coverings, respectively. Similar to preening by birds, grooming by mammals will contribute to incidental

ingestion. It is noted that for all potential terrestrial receptors, exposure from food chain transfer will be limited to those chemicals that bioaccumulate in lower trophic level organisms or biomagnify through successive trophic levels.

Subsurface soil and fill is not considered a complete exposure pathway for terrestrial receptors for the following reasons:

- The mass of most root systems is within the surface soil
- Most soil heterotrophic activity is within the surface organic layer
- Soil invertebrates occur on the surface or within the oxidized root zone

Surface soil is considered a complete exposure pathway for terrestrial receptors. The surface soil exposure pathway was evaluated by comparing contaminant concentrations in the surface soil to the USEPA Region IV recommended Soil Screening Values.

Air Exposure Pathway. Contaminated surface soil may serve as a release source for the air exposure pathway (fugitive dust emissions from wind erosion). In addition to this release mechanism, volatilization of contaminants from surface soil, groundwater and surface water may also occur. Terrestrial mammals, birds, and reptiles may be exposed to chemicals in fugitive dust emissions and volatilization through inhalation. As discussed, the dense vegetative cover prevalent throughout the site minimizes fugitive dust emissions to ambient air and would also limit the area over which volatilization of contaminants could potentially occur. Furthermore, low concentrations of volatile organic compounds were detected in the sampled environmental media making any occurring volatilization minimal and irrelevant. For these reasons, the inhalation exposure pathway is considered insignificant for terrestrial receptors.

7.1.4 Endpoints and Risk Hypotheses

The conclusion of the problem formulation includes the selection of ecological endpoints, which are based on the preliminary conceptual model. Two types of endpoints, assessment endpoints and measurement endpoints, are defined as part of the ecological screening process as are risk hypotheses

or risk questions (USEPA 1997). An assessment endpoint is an explicit expression of the environmental component or value that is to be protected. A measurement endpoint is a measurable ecological characteristic that is related to the component or value chosen as the assessment endpoint. The considerations for selecting assessment and measurement endpoints are summarized in USEPA (1997) and discussed in detail in Suter II (1989, 1990, 1993). Risk hypotheses are testable hypotheses about the relationship among the assessment endpoints and their predicted responses.

Endpoints define ecological attributes that are to be protected (assessment endpoints) and a measurable characteristic of those attributes (measurement endpoints) that can be used to gauge the degree of impact that has or may occur. Assessment endpoints most often relate to attributes of biological populations or communities, and are intended to focus the risk assessment on particular components of the ecosystem that could be adversely affected by chemicals attributable to the site (USEPA 1997). Assessment endpoints contain an entity (e.g., fish) and an attribute of that entity (e.g., survival rate). Individual assessment endpoints usually encompass a group of species or populations (the receptor) with some common characteristic, such as specific exposure route or contaminant sensitivity, with the receptor then used to represent the assessment endpoint in the risk evaluation.

Assessment and measurement endpoints may involve ecological components from any level of biological organization, from individual organisms to the ecosystem itself (USEPA 1992). Effects on individuals are important for some receptors, such as rare, threatened, and endangered species; however, population and community-level effects are typically more relevant to ecosystems. Population and community-level effects are usually difficult to evaluate directly without long-term and extensive study. However, measurement endpoint evaluations at the individual level, such as an evaluation of the effects of chemical exposure on reproduction, can be used to predict effects on an assessment endpoint at the population or community level. In addition, use of criteria values (e.g., Ambient Water Quality Criteria for the Protection of Aquatic Life) designed to protect the vast majority (e.g., 95 percent) of the components of a community can be useful in evaluating potential population and/or community-level effects.

Table 7-1 summarizes the assessment endpoints, risk hypotheses, and measurement endpoints selected for this ecological screening evaluation. The basis for the selection of the assessment endpoints is presented below. The population traits of interest for each of the assessment endpoints

(survival, growth, and reproduction) represent components of a healthy population. Failure or impairment of survival, growth, or reproduction will adversely affect the ability of the population to be healthy and viable and fill its appropriate role in an ecosystem.

Survival, Growth and Reproduction of Terrestrial Plant Communities. Terrestrial plants, including herbs, shrubs, and trees are vital to the development and function of a balanced terrestrial habitat. Plants serve as a valuable resource to the terrestrial community for several reasons including: their role as primary producers; they take energy from sunlight and use it to convert carbon dioxide into glucose or other sugars through a process termed photosynthesis; they provide a food source for many terrestrial organisms; they offer cover and protection for many species of birds and mammals; and they afford nesting sites for many species of birds, etc. In addition to their critical functions within the terrestrial environment, many plants are also valued by society for their marketability (hardwoods), aesthetic properties (wildflowers) and medicinal purposes (herbs).

Survival, Growth, and Reproduction of Soil Invertebrate Communities. Soil invertebrates provide important functions to the terrestrial habitat including nutrient cycling and soil conditioning. Soil invertebrates also serve as a primary food source for many species of mammalian, avian and reptilian wildlife.

Survival, Growth, and Reproduction of Aquatic Plant Communities. Aquatic plants, including algae, are critical to an aquatic ecosystem. In their role as primary producers, they also take energy from sunlight and use it to convert carbon dioxide into glucose or other sugars through photosynthesis. As such, they form the base of the aquatic food web and function as the first step in nutrient and energy transfer through the food web.

Survival, Growth, and Reproduction of Benthic Invertebrate Communities. Benthic invertebrates provide important functions in nutrient recycling and availability and sediment conditioning. Benthic invertebrates also serve as the forage base for many aquatic and semi-aquatic species. By serving as prey species for many upper trophic predators (e.g., fish), they are critical to the maintenance of the communities of upper trophic level species. Thus, healthy, viable sediment invertebrate communities are necessary for a well-developed and balanced aquatic ecosystem.

Survival, Growth, and Reproduction of Amphibian Communities. Amphibians (e.g., frogs and salamanders) provide a link in nutrient and energy transfer, serving as prey for semi-aquatic mammals and birds. They are often reflective of aquatic ecosystem health and many are valued by society for their visual and vocal traits.

7.2 Ecological Effects Evaluation

The sections that follow describe the various criteria and toxicological benchmarks used as screening values (toxicological thresholds) for chemicals analyzed in groundwater, surface water, sediment, and surface soil. The USEPA Region IV's recommended chemical-specific surface water, sediment and surface soil screening values are summarized in Table 7-2. The screening values represent conservative exposure thresholds above which adverse ecological effects may occur. Although analyzed for in groundwater, surface water, sediment, and surface soil, calcium, magnesium, potassium, and sodium were not evaluated by this ecological screening evaluation. As such screening values for these chemicals are not shown in Table 7-2. They have been excluded from evaluation since they are essential macronutrients (Robbins 1983) with very low toxicity (USEPA 1989).

7.2.1 Surface Water Screening Values

Surface water screening values used in this evaluation were obtained from the USEPA Region IV Ecological Risk Assessment Bulletins – Supplement to RAGS.

7.2.1.1 Chemical-Specific Considerations for Surface Water Screening Values

The Region IV recommended chronic surface water screening values for cadmium, copper, lead, nickel, and zinc, as well as the chronic value for trivalent chromium are expressed as a function of water hardness. A mean, site-specific water hardness value for the unnamed pond was estimated from available calcium and magnesium data (Franson 1992). The site-specific, mean hardness value (83 mg/L $CaCO_3$) was used to adjust the hardness dependent surface water screening values.

The surface water screening value selected for pentachlorophenol is expressed as a function of pH. A default pH value of 7.8 S.U. was used to adjust the chronic criterion for this organic chemical (USEPA 2001).

7.2.2 Sediment Screening Values

Identical to the surface water screening values, sediment screening values used in this evaluation were obtained from the USEPA Region IV Ecological Risk Assessment Bulletins – Supplement to RAGS.

At the screening level, it is important to minimize the chances of concluding that there is no risk when in fact risks exist (USEPA 1998). As a measure of conservatism, the reported effect levels, as opposed to the PQL's, for all of the recommended sediment screening values were used in this evaluation. This measure of conservatism strengthens the conclusion that negligible ecological risk exists or that certain contaminants and exposure pathways associated with Site 10 are eliminated from further ecological evaluation (USEPA 1998).

7.2.3 Surface Soil Screening Values

As in the case of the surface water and sediment, the surface soil screening values used in this evaluation were also obtained from the USEPA Region IV Ecological Risk Assessment Bulletins – Supplement to RAGS. The recommended soil screening values presented by Region 4 in the Ecological Risk Assessment Bulletins were obtained from Beyer (1990), Efroymson et al. (1997), Canadian Council of Ministers of the Environment (1997), the Dutch Ministry of Housing, Spatial Planning and Environment (1994), and Crommentuijn et al. (1997).

7.2.4 Screening Level Risk Calculation

Maximum exposure concentrations (abiotic media) were compared with the corresponding screening values to derive screening risk estimates. The outcome of this process is a list of Ecological Chemicals of Potential Concern (ECOCs) for each media-pathway-receptor combination evaluated or a conclusion of acceptable risk.

ECOCs are selected using the hazard quotient (HQ) method. HQs are calculated by dividing the chemical concentration in the medium being evaluated by the corresponding medium-specific screening value:

$$Hazard\ Quotient = \frac{Maximum\ Exposure\ Concentration}{Screening\ Value\ or\ \ Benchmark\ Value}$$

Chemicals with HQs greater than or equal to 1.0 are considered ECOCs in this ecological screening evaluation. HQs equal to or exceeding 1.0 indicate the potential for risk since the chemical concentration or dose (exposure) exceeds the screening value (effect). However, screening values and exposure estimates are derived using intentionally conservative assumptions such that HQs greater than or equal to one do not necessarily indicate that risks are present or impacts are occurring. Rather, it identifies chemical-pathway-receptor combinations requiring further evaluation. Following the same reasoning, HQs that are less than one indicate that risks are very unlikely, enabling a conclusion of no unacceptable risk to be reached with high confidence.

The following conservative methodology was used when selecting ECOCs for abiotic media:

- The maximum detected chemical concentration in each media (surface soil, sediment, surface water, and groundwater) was used to calculate HQs

- Chemicals without medium-specific screening values for a particular chemical were retained as ECOCs for that medium

- The maximum detection limit for non-detected chemicals in each media was used to calculated HQ's

The resulting HQ's from the screening level risk calculations are presented in the media specific screening Tables, 7-3 through 7-7. ECOCs are identified and discussed in the sections that follow.

7.2.4.1 Surface Soil

Twenty-seven surface soil samples were collected and analyzed for TCL organics, pesticides/ polychlorinated biphenyls (PCBs), TAL metals, and cyanide. Volatile organic compounds (VOCs), semivolatile organic compounds (SVOCs), pesticides, PCBs, and inorganic compounds were detected in the surface soil. The VOCs 1,1-dichloroethene, trichloroethene, benzene, toluene, and chlorobenzene were detected in at least one surface soil sample. The maximum detected

concentration of trichloroethene exceeded the surface soil screening value and as a result this compound was retained as an ECOC. The compound 1,1-dichloroethene does not have a USEPA Region IV recommended surface soil screening value and, as a result was also retained as an ECOC. The maximum detected concentrations of the remaining detected VOCs were below the USEPA Region IV recommended surface soil screening values and consequently these compounds were not retained as ECOCs.

The maximum detected concentrations of the SVOCs, phenanthrene, fluoranthene, and pyrene produced HQ values greater than one. As a result, they were retained as ECOCs. The detected SVOCs benzo(a)anthracene, chrysene, benzo(b)fluoranthene, benzo(k)fluoranthene, indeno(1,2,3-c,d)pyrene, and benzo(g,h,i)perylene did not have surface soil screening values available for comparison, and as a result were retained as ECOCs. Di-n-butylphthalate was detected, but the maximum detected concentration was well below the surface soil screening value. This compound was not retained as an ECOC.

The maximum detected concentrations of the pesticides dieldrin, endrin, and 4,4'-DDT exceeded the surface soil screening values and were retained as ECOCs. The PCB Aroclor-1260 was detected in one sample and produced an HQ value greater than one. This PCB was also retained as an ECOC. The pesticides heptachlor, heptachlor epoxide, Endosulfan I, 4,4'-DDE, and endrin aldehyde were detected but did not have surface soil screening criteria available for comparison. As a result these pesticides were retained as ECOCs.

Several of the non-detected VOCs, SVOCs, and pesticides/PCBs either did not have USEPA Region IV surface soil screening values or the method detection limit exceeded the surface soil screening values. In either case the compound was retained as an ECOC. However, further evaluation of non-detected compounds is not warranted. Table 7-3 summarizes the frequency and range of surface soil data compared to the surface soil screening values. Table 7-7 provides a summary of the ecological chemicals of concern in the surface soil at Site 10.

7.1.4.2 Sediment

Four sediment samples were collected and analyzed for TCL organics, TAL metals, and cyanide from the unnamed pond at Site 10. Two VOCs, 2-butanone and toluene, and twelve inorganic

compounds were detected in the sediment of the unnamed pond. The VOCs 2-butanone and toluene were retained as ECOCs due to a lack of sediment screening criteria. Several of the non-detected VOCs, SVOCs, and pesticides/PCBs either did not have USEPA Region IV sediment screening values or the method detection limit exceeded the sediment screening values. In either case the compounds were retained as ECOCs. However, further evaluation of non-detected compounds is not warranted. None of the maximum detected concentrations of inorganic compounds that had sediment screening values for comparison produced HQ values greater than one. The inorganic compounds, aluminum, barium, iron, manganese, and selenium were detected but did not have sediment screening values available for comparison. As a result these compounds were retained as sediment ECOCs. The inorganic compounds, barium, manganese, and vanadium were detected in the surface water but had no surface water screening values for comparison. As a result, these compounds were also retained as ECOCs. Several of the non-detected inorganic compounds either did not have USEPA Region IV sediment screening values or the method detection limit exceeded the sediment screening values. In either case the compounds were retained as ECOCs. However, further evaluation of non-detected compounds is not warranted. However, due to the fact that the compounds were not detected further ecological evaluation of these chemicals is not warranted. Table 7-4 summarizes the frequency and range of sediment analytical data compared to sediment screening criteria. Table 7-8 provides a summary of the ecological chemicals of concern in the sediment at Site 10.

7.1.4.3 Surface Water

Four surface water samples were collected and analyzed for TCL organics, TAL metals, and cyanide from the unnamed pond at Site 10. One VOC, toluene, and fourteen inorganic compounds were detected in the surface water of the unnamed pond. Toluene was not retained as an ECOC in the surface water because the maximum detected concentration was below the surface water screening value (HQ < 1.0). Several of the non-detected VOCs, SVOCs, and pesticides/PCBs either did not have USEPA Region IV surface water screening values or the method detection limit exceeded the surface water screening values. In either case the compound was retained as an ECOC. However, further evaluation of these non-detected compounds is not warranted. The maximum detected concentrations of aluminum, iron, lead, mercury, selenium, silver, thallium, and zinc produced HQ values greater than one and as a result were retained as surface water ECOCs. The inorganic compounds, barium, manganese, and vanadium were detected in the surface water but had no

surface water screening values for comparison. As a result, these compounds were also retained as ECOCs. However, due to the fact that the compounds were not detected further ecological evaluation of these chemicals is not warranted. The maximum detected concentrations of arsenic and copper were below the surface water screening values and consequently were not retained as ECOCs. Table 7-5 summarizes the frequency and range of surface water analytical data compared to surface water screening criteria. Table 7-9 provides a summary of the ecological chemicals of concern in the surface water at Site 10.

7.1.4.4 Groundwater

Seven groundwater samples associated with Site 10 (including one duplicate) were collected (February and March 2001) and analyzed for TAL inorganic compounds. Table 7-6 presents the results of the groundwater data compared to surface water screening values. A total of 12 inorganic compounds were detected in the groundwater. Of these 12, the maximum detected concentrations of aluminum, iron, lead, and silver produced HQ values greater than one and were retained as ECOCs. The compounds barium, chromium, cobalt, and vanadium were not evaluated due to a lack of surface water screening criteria and also were retained as ECOCs. The maximum detected concentrations of copper, nickel, and zinc were below the surface water screening values and consequently were not retained as ECOCs. Table 7-10 provides a summary of the ECOCs in the groundwater associated with Site 10.

Several non-detected inorganic compounds either did not have screening criteria available for comparison or the maximum detection limit exceeded the screening value. In both cases the compounds were retained as ECOCs. Although retained as ECOCs, additional evaluation of the non-detected compounds in the groundwater is not recommended.

7.3 Uncertainty Analysis

The procedures used in this evaluation to assess risks to ecological receptors, as in all such assessments, are subject to uncertainties. The surface soil, surface water, sediment and groundwater samples assessed in this screening were collected in two sampling efforts. The results of these sampling efforts will only provide a "snapshot in time" of the ecological environment.

Potential adverse impacts to terrestrial flora and fauna were evaluated by comparing the detected compound concentrations to surface soil benchmark values obtained in literature references. There is uncertainty assessing the terrestrial environment using these benchmark values. Most of these studies do not take into account soil type, which may have a great influence on the toxicity of the contaminants. For example, soil with high organic carbon content will tend to absorb many of the organic compounds, thus making them less bioavailable to terrestrial receptors. Also, various inorganic compounds in surface soil tend to have high degrees of variability. The variability of the inorganic concentrations in surface soil in turn magnifies the uncertainty associated with using the literature toxicity values to assess the risk posed to the terrestrial environment.

The benchmark values are based on both field and growth chamber studies; therefore, the reported toxic concentrations are not always equivalent to actual field conditions. In addition, some of the ORNL benchmark values used for comparison purposes had low levels of confidence assigned to the values based on the low number of studies performed (less than ten studies) and the lack of diversity of species tested.

In the case of chromium, to be conservative, screening levels were estimated from the chromium VI form of the element. Chromium III, which is orders of magnitude less toxic than chromium VI, is most likely to be the predominant form in the environment.

There is uncertainty in the ecological endpoint comparison. The surface water screening levels are established to be protective of *most* of the potential ecological receptors. However, some species will not be protected by the values because of their increased sensitivity to the chemicals. For example, the Ambient Water Quality Criteria developed by the United States Environmental Protection Agency, in theory, only protect 95 percent of the exposed species. Therefore, there may be some sensitive species present that may not be protected with these criteria. In addition, most of the values are established using laboratory tests, where the concentrations of certain water quality parameters (pH, total organic carbon) that may influence toxicity are most likely at different concentrations than in the site water.

Additionally, current USEPA guidance (USEPA 1996a) indicates that the dissolved metal fraction should be preferentially used to the total metal fraction in surface water screening. For conservatism, total concentrations were used in the ecological screening evaluation for the groundwater and surface

water screens. High levels of suspended solids and solids-adsorbed metals would result in overstating bioavailable groundwater and surface water concentrations and thus potential exposures and risks.

Potential adverse impacts to aquatic receptors from contaminants in the sediment were evaluated by comparing the detected concentrations of compounds in the sediment to Sediment Screening Levels (SSLs). These SSLs have more uncertainty associated with them than do the Surface Water Screening Levels (SWSLs), since the procedures for developing them are not as established as those used in developing SWSLs. In addition, sediment chemistry and compositional features such as pH, acid volatile sulfide, and total organic carbon, have a significant impact on the bioavailability and toxicity of various contaminants. The SSLs were developed using data obtained from freshwater and marine environments. This means that it is possible that the SSL for one compound was derived from data on freshwater environments, while the SSL for another compound was derived from data on marine environments. When SSLs developed in freshwater are applied to tidal freshwater environments or vice versa, uncertainty is introduced because of the differences in bioavailability of contaminants in the differing aquatic systems and because of differences in the toxicity of individual contaminants to freshwater organisms relative to saltwater organisms.

A few of the contaminants detected at Site 10 do not have screening levels or benchmark values available to evaluate the detected concentrations. The contaminants without screening levels were retained as ECOCs, but were not quantitatively evaluated for risks to terrestrial or aquatic flora and fauna in this evaluation. The following detected surface soil contaminants did not have SSSLs available to evaluate detected concentrations: 1,1-dichloroethene, benzo(a)anthracene, chrysene, benzo(b)fluoranthene, benzo(k)fluoranthene, indeno(1,2,3-c,d)pyrene, benzo(g,h,i)perylene, heptachlor, heptachlor epoxide, endosulfan I, and endrin aldehyde. In the sediment, 2-butanone, toluene, aluminum, barium, iron, manganese, and selenium did not have sediment screening values available for comparison. Surface water screening values for the detected compounds manganese and vanadium were not available for comparison. Additionally, the following compounds detected in the groundwater did not have surface water screening values available for comparison: barium, chromium, cobalt, manganese, and vanadium. The contaminants without screening values were retained as ECOCs, but were not quantitatively evaluated. Although unlikely, these contaminants could be contaminants of concern at the site.

Finally, the toxicity of chemical mixtures is not well understood. All the toxicity information used in this screening for evaluating risk to the ecological receptors is for individual chemicals. Chemical mixtures can affect the organisms very differently than the individual chemicals due to synergistic or antagonistic effects. In addition, the species used to develop the toxicity data may not be present at the site, or have the potential to exist at the site. Depending on the sensitivity of the tested species to the species at the site, use of the toxicity values may overestimate or underestimate risk.

7.4 Results

This section presents the results of the ecological risk screening conducted on the terrestrial and aquatic habitats at Site 10.

7.4.1 Surface Soil

Surface soil analytical data from Site 10 was evaluated by a comparison to conservative surface soil screening values for the protection of terrestrial receptor populations including soil invertebrates and terrestrial plant communities.

With the exception of toluene and trichloroethene, the VOCs detected in the surface soil appeared to be limited to a single sample site between the site boundary and Holcomb Boulevard (IR10-SB08). Trichloroethene was also detected at a second sampling location, (IR10-SB05) near the site boundary along the overgrown access road. Toluene was detected (13/27) at sampling locations spanning the site. The maximum detected concentration of toluene occurred in the sample taken (IR10-SD06) from the sometimes flooded, low-lying area located at the southern portion of the site. With the exception of toluene (13/27), the infrequent detections of the VOCs 1,1-dichloroethene (1/27), benzene (1/27), chlorobenzene (1/27) and trichloroethene (2/27) suggest very localized surface soil contamination. The low detected concentrations (i.e. HQ for toluene < 1.0) of these compounds along with the low frequencies of detection suggest that adverse population level effects to terrestrial ecological receptors resulting from the presence of the detected VOCs are highly unlikely. As a result no additional ecological evaluation of VOCs in the surface soil is recommended.

The SVOC, Di-n-butylphthalate (6/27), was detected in samples collected from the IR10-02, IR10-03, IR10-05, IR10-08, IR10-10, and IR10-21 sampling locations. None of the detected

concentrations of this compound exceeded the surface soil screening criteria. Therefore, no further ecological evaluation of this SVOC is warranted.

The remainder of the detected SVOCs, primarily polyaromatic hydrocarbon (PAH) compounds, occurred along the northern part of the site boundary, immediately surrounding a portion of the overgrown access road (IR10-SB03, IR10-SB04, IR10-SB05, IR10-SB18, and IR10-SB19). Surface soil screening values for the detected compounds benzo(a)anthracene (4/27), chrysene (5/27), benzo(b)fluoranthene (5/27), benzo(k)fluoranthene (5/27), indeno(1,2,3-cd)pyrene (4/27), and benzo(g,h,i)perylene (3/27) were not available to assess potential risks. However, benzo(a)pyrene is generally thought to be the most toxic of the PAH compounds. Therefore, it is reasonable to apply the 100 μg/kg surface soil screening value for benzo(a)pyrene to the previously listed PAH compounds lacking surface soil screening values. Application of the 100 μg/kg surface soil screening value to the maximum detected concentrations of benzo(a)anthracene (86 μg/kg), chrysene (93 μg/kg), benzo(b)fluoranthene (92 μg/kg), benzo(k)fluoranthene (96 μg/kg), indeno(1,2,3-cd)pyrene (58 μg/kg), and benzo(g,h,i)perylene (45 μg/kg) produced HQ values less than one in all cases. Therefore additional ecological evaluation of these PAH compounds is not warranted.

The maximum detected concentrations of three PAH compounds, phenanthrene (140 μg/kg), fluoranthene (190 μg/kg) and pyrene (140 μg/kg), exceeded the surface soil screening value of 100 μg/kg. Comparing the maximum detected concentrations of these PAHs to the Region IV recommended surface soil screening value of 100 μg/kg resulted in HQ values (phenanthrene [1.4], fluoranthene [1.9], and pyrene [1.4]) that only slightly exceeded the reference HQ value of one. While a statement of negligible risk can not be made since these three PAH compounds were detected in the surface soil at concentrations greater than the screening values, the conservative nature of this screening evaluation likely overestimated risks associated with their presence in the environment. Therefore, no additional ecological evaluation of these PAH compounds is warranted.

Pesticides were detected in the southeast (IR10-SB09 and IR10-SB12) and northwest (IR10-SB03, IR10-SB-19, IR10-SB20) boundaries of the site boundary. In addition, pesticides were also detected in the sometimes flooded area at the southwestern portion of the site (IR10-SD05 and IR10-SD06). With the exception of 4,4'-DDT (4/27) and endrin aldehyde (2/27), the pesticides were detected in only one surface soil sample per compound. The low detection frequencies and low detected

concentrations of the pesticides (HQ ranged from 2.48 to 4.40), indicate that potential risks to terrestrial ecological receptor populations at Site 10 are minimal. In order to account for bioaccumulation and biomagnification of the pesticides, food chain exposure modeling using the short-tailed shrew was conducted and is presented in Appendix K. The results of the modeling (HQs < 1.0 for all pesticides) provide additional support to the conclusion that potential risks to terrestrial ecological receptor populations are minimal. Furthermore, the detected pesticides are likely the result of historical base wide application rather than disposal activities associated with Site 10 landfill. For these reasons, no additional ecological evaluation of the pesticides is recommended.

One PCB, Aroclor-1260, was detected at the northwest corner of the site boundary (IR10-SB04). The detected PCB, Aroclor-1260 (1/27), appears to be an extremely isolated instance and as a result adverse population level effects associated with the presence of this compound are highly unlikely. As was the case for the pesticides, food chain modeling was also conducted for the detected PCB. The results of the modeling (see Appendix K) support the conclusion that potential risks associated with the PCB are minimal and very unlikely to cause adverse population level effects. Therefore, no further ecological evaluation of this compound is recommended.

Inorganics were detected in all of the soil sample locations. The majority of maximum detections of inorganic compounds occurred at the center of the site (IR10-SB25), and the northern portion, along the overgrown access road (IR10-SB19 and IR10-SB03). Several of the maximum detected concentrations of inorganic compounds exceeded the surface soil screening criteria. Since many inorganic compounds are known to bioaccumulate or biomagnify through food chain transfer, all of the detected inorganic compounds in the surface soil were carried through the food chain model presented in Appendix A. As is evidenced by the results of the model, the detected concentrations of the inorganic compounds in the surface soil pose negligible risks to upper trophic level receptors via food chain exposure. In order to more accurately determine the quantities of metals which are site related versus naturally occurring, it is recommended that the detected concentrations of the inorganic compounds in the surface soil be compared to Camp Lejuene background concentrations prior to the initiation of any additional ecological evaluation.

Additionally, several non-detected compounds (both organic and inorganic) either did not have surface soil screening criteria or the upper reporting limit for the non-detected compound exceeded the surface soil screening criteria. Although retained as surface soil ECOCs, no additional evaluation of the non-detected compounds in the surface soil is recommended.

7.4.2 Sediment

Sediment analytical data from Site 10 was evaluated by a comparison to sediment screening values for the protection of aquatic receptor populations including benthic invertebrates, aquatic plants and amphibians.

Two VOCs, 2-butanone (1/4) and toluene (4/4), were detected in the sediments of the unnamed pond. A quantitative evaluation of these compounds could not be performed due to a lack of sediment screening criteria. However, the detected concentrations of these compounds are below the sediment screening values for other similar organic compounds and as a result should not be considered for further ecological evaluation. No other organic compounds were detected in the unnamed pond sediments.

Several inorganic compounds including aluminum, barium, copper, iron, lead, manganese, mercury, selenium, and zinc were detected in the sediments of the unnamed pond. The maximum detected concentrations of copper, lead, mercury, and zinc were below the sediment screening values. The remainder of the detected compounds could not be evaluated due to a lack of sediment screening criteria.

Additionally, several non-detected compounds either did not have sediment screening criteria or the maximum non-detected value exceeded the screening criteria. Although retained as ECOCs, no additional evaluation of the non-detected compounds in the sediment is recommended.

7.4.3 Surface water

Surface water analytical data from Site 10 was evaluated by a comparison to surface water screening values for the protection of aquatic receptors populations including benthic invertebrates, aquatic plants and amphibians.

Toluene (2/4) was the only detected organic compound in the surface water from the unnamed pond at Site 10. The maximum detected concentration of this compound was several orders of magnitude below the surface water screening criteria.

Several inorganic compounds including aluminum, arsenic, barium, copper, iron, lead, manganese, mercury, vanadium and zinc were detected in the surface water samples from the unnamed pond. The detected concentrations of aluminum, iron, lead, mercury, and zinc exceeded the surface water screening criteria and produced HQ values ranging from 1.06 for zinc to 10.70 for aluminum. The detected compounds barium, manganese, and vanadium did not have surface water screening values available for comparison. As previously stated, *total* concentrations were used in this ecological screening evaluation for the surface water screen. It is likely that high levels of suspended solids and solids-adsorbed metals resulted in the overestimation of the bioavailable fraction of inorganic compounds in the surface water, and thus potential exposures and risks. While a statement of negligible risk can not be made since these inorganic chemicals were detected in the surface water at concentrations greater than the screening values, the conservative nature of this screening evaluation likely overestimated risks associated with their presence in the environment. Therefore, no additional ecological evaluation of the metals is warranted.

Additionally, several non-detected compounds either did not have surface water screening criteria or the maximum non-detected value exceeded the screening criteria. Although retained as ECOCs, no additional evaluation of the non-detected compounds in the surface water is recommended.

7.4.4 Groundwater

Groundwater analytical data from Site 10 was evaluated by a comparison to surface water screening values for the protection of aquatic receptors populations including benthic invertebrates, aquatic plants and amphibians assuming direct discharge to the unnamed pond with no dilution or natural attenuation. The HQ values for aluminum (36.21), iron (1.11), lead (1.16) and silver (48.33) exceeded the reference value of one. The detected compounds barium (7/7), chromium (1/7), cobalt (5/7), manganese (7/7), and vanadium (5/7) did not have surface water screening criteria available for comparison. As was the case for the surface water samples, *total* concentrations were used in this ecological screening evaluation for the groundwater screen. It is likely that high levels of suspended solids and solids-adsorbed metals resulted in the overestimation of the bioavailable fraction of inorganic compounds in the groundwater, and thus potential exposures and risks. As an additional measure of conservatism, no dilution or natural attenuation of contaminants in the groundwater migrating to the surface water was considered. While a statement of negligible risk cannot be made since these inorganic chemicals were detected in the groundwater at concentrations greater than the

surface water screening values, the conservative nature of this screening evaluation likely overestimated risks associated with their presence in the environment. Therefore, no additional ecological evaluation of the metals is warranted. As a result these compounds were all retained as groundwater ECOCs .

Additionally, several non-detected compounds in the groundwater either did not have surface water screening criteria or the maximum non-detected value exceeded the screening criteria. Although retained as ECOCs, no additional evaluation of the non-detected compounds in the groundwater is recommended.

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SECTION 7.0 TABLES

TABLE 7-1
ASSESSMENT ENDPOINTS, RISK HYPOTHESES, AND MEASUREMENT ENDPOINTS
SITE 10 - ORIGINAL BASE LANDFILL
MARINE CORPS BASE, CAMP LEJUENE,
NORTH CAROLINA

Assessment Endpoint	Risk Hypothesis	Measurement Endpoint
Terrestrial Habitat		
Survival, growth, and reproduction of soil invertebrate communities.	Are site-related chemical concentrations in surface soils sufficient to adversely soil invertebrate communities?	Comparison of chemical concentrations in surface soils to surface soil screening values.
Survival, growth, and reproduction of terrestrial plant communities.	Are site-related chemical concentrations in surface soil sufficient to adversely effect terrestrial plant communities?	Comparison of chemical concentrations in surface soil to surface soil screening values.
Assessment Endpoint	**Risk Hypothesis**	**Measurement Endpoint**
Aquatic Habitat		
Survival, growth, and reproduction of unnamed pond benthic invertebrate communities.	Are site-related chemical concentrations in unnamed pond surface water/sediment and/or groundwater sufficient to adversely effect benthic macroinvertebrate communities?	Comparison of chemical concentrations in unnamed pond surface water/sediment and groundwater to surface water and/or sediment screening values.
Survival, growth, and reproduction of unnamed pond aquatic plant communities.	Are site-related chemical concentrations in surface water and groundwater sufficient to adversely effect aquatic plant communities in the unnamed pond?	Comparison of chemical concentrations in surface water and groundwater to surface water screening values.
Survival, growth, and reproduction of unnamed pond amphibian communities.	Are site-related chemical concentrations in surface water and/or groundwater sufficient to adversely effect amphibian communities in the unnamed	Comparison of chemical concentrations in seep water and groundwater to surface water screening values.

TABLE 7-2
MEDIA-SPECIFIC SCREENING VALUES
SITE 10 - ORIGINAL BASE LANDFILL
MARINE CORPS BASE, CAMP LEJUENE
NORTH CAROLINA

TAL/TCL Compounds	USEPA Region IV Recommended Surface Soil Screening Values			USEPA Region IV Recommended Freshwater Screening Values			USEPA Region IV Recommended Sediment Screening Values		
	(µg/kg) (1)	Reference	Comment	(µg/L) (2)	Reference	Comment	(µg/kg) (3)	Reference	Comment
Volatile Organics:									
1,1,1-Trichloroethane	NE	--		528	USEPA Region IV		NE	--	
1,1,2,2-Tetrachloroethane	NE	--		240	USEPA Region IV		NE	--	
1,1,2-Trichloroethane	NE	--		940	USEPA Region IV		NE	--	
1,1-Dichloroethane	NE	--		NE	--		NE	--	
1,1-Dichloroethene	NE	--		303	USEPA Region IV		NE	--	
1,2-Dichloroethane	400	MHSPE 1994		2000	USEPA Region IV		NE	--	
1,2-Dichloroethene (Total)	NE	--		NE	--		NE	--	
1,2-Dichloroethene (cis)	NE	--		NE	--		NE	--	
1,2-Dichloroethene (trans)	NE	--		NE	--		NE	--	
1,2-Dichloropropane	700,000	Efroymson et. al. 1997		525	USEPA Region IV		NE	--	
2-Butanone	NE	--		NE	--		NE	--	
2-Hexanone	NE	--		NE	--		NE	--	
4-Methyl-2-Pentanone	NE	--		NE	--		NE	--	
Acetone	NE	--		NE	--		NE	--	
Benzene	50	MHSPE 1994		53	USEPA Region IV		NE	--	
Bromodichloromethane	NE	--		NE	--		NE	--	
Bromoform	NE	--		293	USEPA Region IV		NE	--	
Bromomethane	NE	--		NE	--		NE	--	
Carbon Disulfide	NE	--		NE	--		NE	--	
Carbon Tetrachloride	1,000,000	Efroymson et. al. 1997		352	USEPA Region IV		NE	--	
Chlorobenzene	50	Beyer 1990		195	--		NE	--	
Chloroethane	NE	--		NE	--		NE	--	
Chloroform	1	MHSPE 1994		289	USEPA Region IV		NE	--	
Chloromethane	NE	--		NE	--		NE	--	
cis-1,2-Dichloroethene	NE	--		NE	--		NE	--	
cis-1,3-Dichloropropene	NE	--		24.4	USEPA Region IV		NE	--	
Dibromochloromethane	NE	--		NE	--		NE	--	
Ethylbenzene	50	Beyer 1990 and MHSPE 1994		453	USEPA Region IV		NE	--	
Methylene Chloride	NE	--		1930	USEPA Region IV		NE	--	

TABLE 7-2
MEDIA-SPECIFIC SCREENING VALUES
SITE 10 - ORIGINAL BASE LANDFILL
MARINE CORPS BASE, CAMP LEJUENE
NORTH CAROLINA

TAL/TCL Compounds	USEPA Region IV Recommended Surface Soil Screening Values			USEPA Region IV Recommended Freshwater Screening Values			USEPA Region IV Recommended Sediment Screening Values		
	(µg/kg) (1)	Reference	Comment	(µg/L) (2)	Reference	Comment	(µg/kg) (3)	Reference	Comment
Volatile Organics (Cont):									
Styrene	100	Beyer 1990 and MHSPE 1994		NE	--		NE	--	
Tetrachloroethene	100	MHSPE 1994		84	USEPA Region IV		NE	--	
Toluene	50	Beyer 1990 and MHSPE 1994		175	USEPA Region IV		NE	--	
trans-1,2-Dichloroethene	NE	--		1350	USEPA Region IV		NE	--	
trans-1,3-Dichloropropene	NE	--		24.4	USEPA Region IV	Cis and Trans isomers	NE	--	
Trichloroethene (TCE)	1	MHSPE 1994		NE	--		NE	--	
Vinyl Chloride	10	MHSPE 1994		NE	--		NE	--	
Xylene (Total)	50	Beyer 1990 and MHSPE 1994		NE	--		NE	--	
Semivolatile Organics:									
1,2,4-Trichlorobenzene	NE	--		44.9	USEPA Region IV		NE	--	
1,2-Dichlorobenzene	NE	--		15.8	USEPA Region IV		NE	--	
1,3-Dichlorobenzene	NE	--		50.2	USEPA Region IV		NE	--	
1,4-Dichlorobenzene	NE	--		11.2	USEPA Region IV		NE	--	
2,2'-Oxybis (1-Chloropropane)	NE	--		NE	--		NE	--	
2,4,5-Trichlorophenol	4,000	Efroymson et. al. 1997		NE	--		NE	--	
2,4,6-Trichlorophenol	10,000	Efroymson et. al. 1997		3.2	USEPA Region IV		NE	--	
2,4-Dichlorophenol	NE	--		36.5	USEPA Region IV		NE	--	
2,4-Dinitrophenol	20,000	Efroymson et. al. 1997		6.2	USEPA Region IV		NE	--	
2,4-Dinitrotoluene	NE	--		310	USEPA Region IV		NE	--	
2,4-Dimethylphenol	NE	--		21.2	USEPA Region IV		NE	--	
2,6-Dinitrotoluene	NE	--		NE	--		NE	--	
2-Chloronaphthalene	NE	--		NE	--		NE	--	
2-Chlorophenol	NE	--		43.8	USEPA Region IV		NE	--	
2-Methylnaphthalene	NE	--		NE	--		20.23	USEPA 2001	
2-Methylphenol	NE	--		NE	--		NE	--	
2-Nitroaniline	NE	--		NE	--		NE	--	
2-Nitrophenol	NE	--		3500	USEPA Region IV		NE	--	
3,3'-Dichlorobenzidine	NE	--		NE	--		NE	--	
3-Nitroaniline	NE	--		NE	--		NE	--	

TABLE 7-2
MEDIA-SPECIFIC SCREENING VALUES
SITE 10 - ORIGINAL BASE LANDFILL
MARINE CORPS BASE, CAMP LEJUENE
NORTH CAROLINA

TAL/TCL Compounds	USEPA Region IV Recommended Surface Soil Screening Values			USEPA Region IV Recommended Freshwater Screening Values			USEPA Region IV Recommended Sediment Screening Values		
	(µg/kg) (1)	Reference	Comment	(µg/L) (2)	Reference	Comment	(µg/kg) (3)	Reference	Comment
Semivolatile Organics (Cont):									
4,6-Dinitro-2-Methylphenol	NE	--		2.3	USEPA Region IV		NE	--	
4-Bromophenyl-Phenylether	NE	--		NE	--		NE	--	
4-Chloro-3-Methylphenol	NE	--		0.3	USEPA Region IV		NE	--	
4-Chloroaniline	NE	--		NE	--		NE	--	
4-Chlorophenyl-Phenylether	NE	--		NE	--		NE	--	
4-Methylphenol	NE	--		NE	--		NE	--	
4-Nitroaniline	NE	--		NE	--		NE	--	
4-Nitrophenol	7,000	Efroymson et. al. 1997		82.8	USEPA Region IV		NE	--	
Acenaphthene	20,000	Efroymson et. al. 1997		17	USEPA Region IV		6.71	MacDonald 1994	
Acenaphthylene	NE	--		NE	--		5.87	MacDonald 1994	
Anthracene	100	Beyer 1990		NE	--		46.9	MacDonald 1994	
Benzo(a)anthracene	NE	--		NE	--		74.8	MacDonald 1994	
Benzo(a)pyrene	100	Beyer 1990		NE	--		88.8	MacDonald 1994	
Benzo(b)fluoranthene	NE	--		NE	--		NE	--	
Benzo(g,h,i)perylene	NE	--		NE	--		NE	--	
Benzo(k)fluoranthene	NE	--		NE	--		NE	--	
bis(2-Chloroethoxy)ether	NE	--		NE	--		NE	--	
bis(2-Chloroethoxy)methane	NE	--		NE	--		NE	--	
bis(2-Ethylhexyl)phthalate	NE	--		0.299	USEPA Region IV		182	MacDonald 1994	
Butylbenzylphthalate	NE	--		22	USEPA Region IV		NE	--	
Carbazole	NE	--		NE	--		NE	--	
Chrysene	NE	--		NE	--		108	MacDonald 1994	
Dibenzo(a,h)anthracene	NE	--		NE	--		6.22	MacDonald 1994	
Dibenzofuran	NE	--		NE	--		NE	--	
Diethylphthalate	100,000	Efroymson et. al. 1997		521	USEPA Region IV		NE	--	
Dimethylphthalate	200,000	Efroymson et. al. 1997		330	USEPA Region IV		NE	--	
Di-n-butylphthalate	200,000	Efroymson et. al. 1997		9.4	USEPA Region IV		NE	--	
Di-n-octylphthalate	NE	--		NE	--		NE	--	
Fluoranthene	100	Beyer 1990		39.8	USEPA Region IV		113	MacDonald 1994	

TABLE 7-2
MEDIA-SPECIFIC SCREENING VALUES
SITE 10 - ORIGINAL BASE LANDFILL
MARINE CORPS BASE, CAMP LEJUENE
NORTH CAROLINA

TAL/TCL Compounds	USEPA Region IV Recommended Surface Soil Screening Values			USEPA Region IV Recommended Freshwater Screening Values			USEPA Region IV Recommended Sediment Screening Values		
	(µg/kg) (1)	Reference	Comment	(µg/L) (2)	Reference	Comment	(µg/kg) (3)	Reference	Comment
Semivolatile Organics (Cont):									
Fluorene	30,000	Efroymson et. al. 1997		NE	--		21.2	MacDonald 1994	
Hexachlorobenzene	2.5	MHSPE 1994		NE	--		NE	--	
Hexachlorobutadiene	NE	--		0.93	USEPA Region IV		NE	--	
Hexachlorocyclopentadiene	10,000	Efroymson et. al. 1997		0.07	USEPA Region IV		NE	--	
Hexachloroethane	NE	--		9.8	USEPA Region IV		NE	--	
Indeno(1,2,3-cd)pyrene	NE	--		NE	--		NE	--	
Isophorone	NE	--		1170	USEPA Region IV		NE	--	
Naphthalene	100	Beyer 1990		62	USEPA Region IV		34.6	MacDonald 1994	
Nitrobenzene	40,000	Efroymson et. al. 1997		270	USEPA Region IV		NE	--	
n-Nitroso-di-n-propylamine	NE	--		NE	--		NE	--	
n-Nitrosodiphenylamine	20,000	Efroymson et. al. 1997		58.5	USEPA Region IV		NE	--	
Pentachlorophenol	2	MHSPE 1994		12.8	USEPA Region IV	pH = 7.8 S.U.	NE	--	
Phenanthrene	100	Beyer 1990		NE	--		86.7	MacDonald 1994	
Phenol	50	MHSPE 1994		256	USEPA Region IV		NE	--	
Pyrene	100	Beyer 1990		NE	--		153	MacDonald 1994	
PCBs/Pesticides:									
Aldrin	2.5	MHSPE 1994		0.3	USEPA Region IV		NE	--	
alpha-Chlordane	NE	--		0.0043	USEPA Region IV	Total Chlordane	0.5	Long et. al. 1991	Total Chlordane
beta-Chlordane	NE	--		0.0043	USEPA Region IV	Total Chlordane	0.5	Long et. al. 1991	Total Chlordane
gamma-Chlordane	NE	--		0.0043	USEPA Region IV	Total Chlordane	0.5	Long et. al. 1991	Total Chlordane
4,4'-DDT	2.5	MHSPE 1994	Total DDT, DDE, and DDD	0.001	USEPA Region IV		1.19	MacDonald 1994	
4,4'-DDE	2.5	MHSPE 1994	Total DDT, DDE, and DDD	10.5	USEPA Region IV		2.07	MacDonald 1994	
4-4'-DDD	2.5	MHSPE 1994	Total DDT, DDE, and DDD	0.0064	USEPA Region IV		1.22	MacDonald 1994	
Dieldrin	0.5	MHSPE 1994		0.0019	USEPA Region IV		0.02	Long et. al. 1991	
Endrin	1	MHSPE 1994		0.0023	USEPA Region IV		0.02	Long et. al. 1991	
Endrin aldehyde	NE	--		NE	--		NE	--	
Endrin ketone	NE	--		NE	--		NE	--	

TABLE 7-2
MEDIA-SPECIFIC SCREENING VALUES
SITE 10 - ORIGINAL BASE LANDFILL
MARINE CORPS BASE, CAMP LEJUENE
NORTH CAROLINA

TAL/TCL Compounds	USEPA Region IV Recommended Surface Soil Screening Values			USEPA Region IV Recommended Freshwater Screening Values			USEPA Region IV Recommended Sediment Screening Values		
	(µg/kg) (1)	Reference	Comment	(µg/L) (2)	Reference	Comment	(µg/kg) (3)	Reference	Comment
PCBs/Pesticides (cont.):									
alpha-BHC	2.5	MHSPE 1994		500	USEPA Region IV		NE	--	
beta-BHC	1	MHSPE 1994		5,000	USEPA Region IV		NE	--	
delta-BHC	NE	--		NE	--		NE	--	
gamma-BHC (lindane)	0.05	MHSPE 1994		0.08	USEPA Region IV		0.32	MacDonald 1994	
Heptachlor	NE	--		0.0038	USEPA Region IV		NE	--	
Heptachlor epoxide	NE	--		0.0038	USEPA Region IV		NE	--	
Endosulfan II	NE	--		0.056	USEPA Region IV		NE	--	
Endosulfan II	NE	--		0.056	USEPA Region IV		NE	--	
Endosulfan sulfate	NE	--		NE	--		NE	--	
Methoxychlor	NE	--		NE	--		NE	--	
Toxaphene	NE	--		0.0002	USEPA Region IV		NE	--	
Aroclor 1016	20	MHSPE 1994	Total PCBs	0.014	USEPA Region IV		21.6	MacDonald 1994	Total PCBs
Aroclor 1221	20	MHSPE 1994	Total PCBs	0.014	USEPA Region IV		21.6	MacDonald 1994	Total PCBs
Aroclor 1232	20	MHSPE 1994	Total PCBs	0.014	USEPA Region IV		21.6	MacDonald 1994	Total PCBs
Aroclor 1242	20	MHSPE 1994	Total PCBs	0.014	USEPA Region IV		21.6	MacDonald 1994	Total PCBs
Aroclor 1248	20	MHSPE 1994	Total PCBs	0.014	USEPA Region IV		21.6	MacDonald 1994	Total PCBs
Aroclor 1254	20	MHSPE 1994	Total PCBs	0.014	USEPA Region IV		21.6	MacDonald 1994	Total PCBs
Aroclor 1260	20	MHSPE 1994	Total PCBs	0.014	USEPA Region IV		21.6	MacDonald 1994	Total PCBs
PCBs (total)	20	MHSPE 1994		NE	--		21.6	MacDonald 1994	
Inorganics (mg/kg or ug/L):									
Aluminum	50	Efroymson et. al. 1997		87	USEPA Region IV		NE	--	
Antimony	3.5	Crommentuijn et. al. 1997		160	USEPA Region IV		2	Long et. al. 1991	
Arsenic	10	Efroymson et. al. 1997		190	USEPA Region IV	Trivalent (+3) form	7.24	MacDonald 1994	
Barium	165	Crommentuijn et. al. 1997		NE	--		NE	--	
Beryllium	1.1	Crommentuijn et. al. 1997		0.53	USEPA Region IV		NE	--	
Cadmium	1.6	Crommentuijn et. al. 1997		0.97	USEPA Region IV	Hardness dependent	0.676	MacDonald 1994	
Chromium (Total)	0.4	Efroymson et. al. 1997 and CCME 1997		NE	--		52.3	MacDonald 1994	
Chromium III	NE	--		177.51	USEPA Region IV	Hardness dependent	NE	--	

TABLE 7-2
MEDIA-SPECIFIC SCREENING VALUES
SITE 10 - ORIGINAL BASE LANDFILL
MARINE CORPS BASE, CAMP LEJUENE
NORTH CAROLINA

TAL/TCL Compounds	USEPA Region IV Recommended Surface Soil Screening Values			USEPA Region IV Recommended Freshwater Screening Values			USEPA Region IV Recommended Sediment Screening Values		
	(ug/kg) (1)	Reference	Comment	(ug/L) (2)	Reference	Comment	(ug/kg) (3)	Reference	Comment
Inorganics (mg/kg or ug/L)(Cont):									
Chromium VI	NE	--		11	--		NE	--	
Cobalt	20	Beyer 1990, Efroymson et. al. 1997, and MHSPE 1994		NE	--		NE	--	
Copper	40	Crommentuijn et. al. 1997		10.07	USEPA Region IV	Hardness dependent	18.7	MacDonald 1994	
Iron	200	Efroymson et. al. 1997		1000	USEPA Region IV		NE	--	
Lead	50	Beyer 1990 and Efroymson et. al. 1997		2.51	USEPA Region IV	Hardness dependent	30.2	MacDonald 1994	
Manganese	100	Efroymson et. al. 1997		NE	--		NE	--	
Mercury	0.1	Efroymson et. al. 1997		0.012	USEPA Region IV		0.13	MacDonald 1994	
Nickel	30	Efroymson et. al. 1997		134.53	USEPA Region IV	Hardness dependent	15.9	Long et. al. 1995	
Selenium	0.81	Crommentuijn et. al. 1997		5	USEPA Region IV		NE	--	
Silver	2	Efroymson et. al. 1997		0.012	USEPA Region IV		0.733	MacDonald 1994	
Thallium	1	Efroymson et. al. 1997		4	USEPA Region IV		NE	--	
Vanadium	2	Efroymson et. al. 1997		NE	--		NE	--	
Zinc	50	Efroymson et. al. 1997		90.42	USEPA Region IV	Hardness dependent	124	MacDonald 1994	
Cyanide (Total)	0.9	CCME 1997		5.2	USEPA Region IV		NE	--	

Notes:

TAL = Target Analyte List
TCL = Target Compound List
ug/kg = microgram per kilogram
USEPA = United States Environmental Protection Agency
ug/L = microgram per liter
mg/kg = milligram per kilogram
NE = Not Established

(1) Soil screening values are in microgram per kilogram (ug/kg) for volatile and semivolatile organic compounds and in milligram per kilogram (mg/kg) for inorganic compounds.
(2) Surface water screening values are in microgram per liter (ug/L) for all listed compounds.
(3) Sediment screening values are in microgram per kilogram (ug/kg) for volatile and semivolatile organic compounds and in milligram per kilogram (mg/kg) for inorganic compounds.

TABLE 7-3
FREQUENCY AND RANGE OF SURFACE SOIL DATA COMPARED TO SURFACE SOIL SCREENING VALUES
SITE 10 - ORIGINAL BASE LANDFILL
MARINE CORPS BASE, CAMP LEJUENE
NORTH CAROLINA

Analyte	Contaminant Frequency/Range					Surface Soil Screening Levels (SSSL)	Reference	Max. HQ (2)	ECOC?	Comments	Mean HQ (3)
	Frequency of Detection	Range of Positive Detections	Range of Non-Detects	Arithmetic Mean (Half Non-Detects)	Value used in Screen (1)						
Volatile Organics (ug/kg):											
Chloromethane	0/27	NA	11U - 20UJ	6.02	20	NE	--	NA	Yes	No SSSL	--
Bromomethane	0/27	NA	11U - 20UJ	6.02	20	NE	--	NA	Yes	No SSSL	--
Vinyl chloride	0/27	NA	11U - 20UJ	6.02	20	10	USEPA Region IV	2.00	Yes	HQ > 1.0	0.60
Chloroethane	0/27	NA	11U - 20UJ	6.02	20	NE	--	NA	Yes	No SSSL	--
Methylene chloride	0/27	NA	11U - 20UJ	6.02	20	NE	--	NA	Yes	No SSSL	--
Acetone	0/27	NA	11U - 1800U	72.54	1800	NE	--	NA	Yes	No SSSL	--
Carbon disulfide	0/27	NA	11U - 20UJ	6.02	20	NE	--	NA	Yes	No SSSL	--
1,1-Dichloroethene	1/27	2.6J - 2.6J	11U - 20UJ	5.91	2.6	NE	--	NA	Yes	No SSSL	--
1,1-Dichloroethane	0/27	NA	11U - 20UJ	6.02	20	NE	--	NA	Yes	No SSSL	--
1,2-Dichloroethene (total)	0/27	NA	11U - 20UJ	6.02	20	NE	--	NA	Yes	No SSSL	--
Chloroform	0/27	NA	11U - 20UJ	6.02	20	1	USEPA Region IV	20.00	Yes	HQ > 1.0	6.02
1,2-Dichloroethane	0/27	NA	11U - 20UJ	6.02	20	400	USEPA Region IV	0.05	No	HQ < 1.0	--
2-Butanone	0/27	NA	11U - 20UJ	6.02	20	NE	--	NA	Yes	No SSSL	--
1,1,1-Trichloroethane	0/27	NA	11U - 20UJ	6.02	20	NE	--	NA	Yes	No SSSL	--
Carbon tetrachloride	0/27	NA	11U - 20UJ	6.02	20	1000000	USEPA Region IV	0.00	No	HQ < 1.0	--
Bromodichloromethane	0/27	NA	11U - 20UJ	6.02	20	NE	--	NA	Yes	No SSSL	--
1,2-Dichloropropane	0/27	NA	11U - 20UJ	6.02	20	700000	USEPA Region IV	0.00	No	HQ < 1.0	--
cis-1,3-Dichloropropene	0/27	NA	11U - 20UJ	6.02	20	NE	--	NA	Yes	No SSSL	--
Trichloroethene	2/27	2.3J - 2.4J	11U - 20UJ	5.79	2.4	1	USEPA Region IV	2.40	Yes	HQ > 1.0	2.40
Dibromochloromethane	0/27	NA	11U - 20UJ	6.02	20	NE	--	NA	Yes	No SSSL	--
1,1,2-Trichloroethane	0/27	NA	11U - 20UJ	6.02	20	NE	--	NA	Yes	No SSSL	--

TABLE 7-3
FREQUENCY AND RANGE OF SURFACE SOIL DATA COMPARED TO SURFACE SOIL SCREENING VALUES
SITE 10 - ORIGINAL BASE LANDFILL
MARINE CORPS BASE, CAMP LEJUENE
NORTH CAROLINA

Analyte	Contaminant Frequency/Range					Surface Soil Screening Levels (SSSL)	Reference	Max. HQ (2)	ECOC?	Comments	Mean HQ (3)
	Frequency of Detection	Range of Positive Detections	Range of Non-Detects	Arithmetic Mean (Half Non-Detects)	Value used in Screen (1)						
Volatile Organics (ug/kg)(Cont):											
Benzene	1/27	4.9J - 4.9J	11U - 20UJ	6.00	4.9	50	USEPA Region IV	0.10	No	HQ < 1.0	--
trans-1,3-Dichloropropene	0/27	NA	11U - 20UJ	6.02	20	NE	--	NA	Yes	No SSSL	--
Bromoform	0/27	NA	11U - 20UJ	6.02	20	NE	--	NA	Yes	No SSSL	--
4-Methyl-2-pentanone	0/27	NA	11U - 20UJ	6.02	20	NE	--	NA	Yes	No SSSL	--
2-Hexanone	0/27	NA	11U - 20UJ	6.02	20	NE	--	NA	Yes	No SSSL	--
Tetrachloroethene	0/27	NA	11U - 20UJ	6.02	20	100	USEPA Region IV	0.20	No	HQ < 1.0	--
1,1,2,2-Tetrachloroethane	0/27	NA	11U - 20UJ	6.02	20	NE	--	NA	Yes	No SSSL	--
Toluene	13/27	1.1J - 16	11U - 20UJ	5.07	16	50	USEPA Region IV	0.32	No	HQ < 1.0	--
Chlorobenzene	1/27	4.5J - 4.5J	11U - 20UJ	5.98	4.5	50	USEPA Region IV	0.09	No	HQ < 1.0	--
Ethylbenzene	0/27	NA	11U - 20UJ	6.02	20	50	USEPA Region IV	0.40	No	HQ < 1.0	--
Styrene	0/27	NA	11U - 20UJ	6.02	20	100	USEPA Region IV	0.20	No	HQ < 1.0	--
Xylenes (total)	0/27	NA	11U - 20UJ	6.02	20	50	USEPA Region IV	0.40	No	HQ < 1.0	--
Semivolatile Organics (ug/kg):											
Phenol	0/27	NA	350U - 650U	199.44	650	50	USEPA Region IV	13.00	Yes	HQ > 1.0	3.99
bis(2-Chloroethyl)ether	0/27	NA	350U - 650U	199.44	650	NE	--	NA	Yes	No SSSL	--
2-Chlorophenol	0/27	NA	350U - 650U	199.44	650	NE	--	NA	Yes	No SSSL	--
1,3-Dichlorobenzene	0/27	NA	350U - 650U	199.44	650	NE	--	NA	Yes	No SSSL	--
1,4-Dichlorobenzene	0/27	NA	350U - 650U	199.44	650	NE	--	NA	Yes	No SSSL	--
1,2-Dichlorobenzene	0/27	NA	350U - 650U	199.44	650	NE	--	NA	Yes	No SSSL	--
3,3'-Dichlorobenzidine	0/27	NA	350U - 650U	199.44	650	NE	--	NA	Yes	No SSSL	--
2,2'-Oxybis(1-Chloropropane)	0/27	NA	350U - 650U	199.44	650	NE	--	NA	Yes	No SSSL	--

TABLE 7-3
FREQUENCY AND RANGE OF SURFACE SOIL DATA COMPARED TO SURFACE SOIL SCREENING VALUES
SITE 10 - ORIGINAL BASE LANDFILL
MARINE CORPS BASE, CAMP LEJUENE
NORTH CAROLINA

Analyte	Contaminant Frequency/Range					Surface Soil Screening Levels (SSSL)	Reference	Max. HQ (2)	ECOC?	Comments	Mean HQ (3)
	Frequency of Detection	Range of Positive Detections	Range of Non-Detects	Arithmetic Mean (Half Non-Detects)	Value used in Screen (1)						
Semivolatile Organics (ug/kg)(Cont):											
N-Nitrosodi-n-propylamine	0/27	NA	350U - 650U	199.44	650	NE	--	NA	Yes	No SSSL	--
4-Methylphenol	0/27	NA	350U - 650U	199.44	650	NE	--	NA	Yes	No SSSL	--
Hexachloroethane	0/27	NA	350U - 650U	199.44	650	NE	--	NA	Yes	No SSSL	--
Nitrobenzene	0/27	NA	350U - 650U	199.44	650	40000	USEPA Region IV	0.02	No	HQ < 1.0	--
Isophorone	0/27	NA	350U - 650U	199.44	650	NE	--	NA	Yes	No SSSL	--
2-Nitroaniline	0/27	NA	880U - 1600U	499.44	1600	NE	--	NA	Yes	No SSSL	--
2,4-Dimethylphenol	0/27	NA	350U - 650U	199.44	650	NE	--	NA	Yes	No SSSL	--
bis(2-Chloroethoxy)methane	0/27	NA	350U - 650U	199.44	650	NE	--	NA	Yes	No SSSL	--
2,4-Dichlorophenol	0/27	NA	350U - 650U	199.44	650	NE	--	NA	Yes	No SSSL	--
1,2,4-Trichlorobenzene	0/27	NA	350U - 650U	199.44	650	NE	--	NA	Yes	No SSSL	--
Naphthalene	0/27	NA	350U - 650U	199.44	650	100	USEPA Region IV	6.50	Yes	HQ > 1.0	1.99
4-Chloroaniline	0/27	NA	350U - 650U	199.44	650	NE	--	NA	Yes	No SSSL	--
Hexachlorobutadiene	0/27	NA	350U - 650U	199.44	650	NE	--	NA	Yes	No SSSL	--
4-Chloro-3-methylphenol	0/27	NA	350U - 650U	199.44	650	NE	--	NA	Yes	No SSSL	--
2-Methylnaphthalene	0/27	NA	350U - 650U	199.44	650	NE	--	NA	Yes	No SSSL	--
Hexachlorocyclopentadiene	0/27	NA	350U - 650U	199.44	650	10000	USEPA Region IV	0.07	No	HQ < 1.0	--
2,4,6-Trichlorophenol	0/27	NA	350U - 650U	199.44	650	10000	USEPA Region IV	0.07	No	HQ < 1.0	--
2,4,5-Trichlorophenol	0/27	NA	880U - 1600U	499.44	1600	4000	USEPA Region IV	0.40	No	HQ < 1.0	--
2-Chloronaphthalene	0/27	NA	350U - 650U	199.44	650	NE	--	NA	Yes	No SSSL	--
2-Methylphenol	0/27	NA	350U - 650U	199.44	650	NE	--	NA	Yes	No SSSL	--

TABLE 7-3
FREQUENCY AND RANGE OF SURFACE SOIL DATA COMPARED TO SURFACE SOIL SCREENING VALUES
SITE 10 - ORIGINAL BASE LANDFILL
MARINE CORPS BASE, CAMP LEJUENE
NORTH CAROLINA

Analyte	Contaminant Frequency/Range					Surface Soil Screening Levels (SSSL)	Reference	Max. HQ (2)	ECOC?	Comments	Mean HQ (3)
	Frequency of Detection	Range of Positive Detections	Range of Non-Detects	Arithmetic Mean (Half Non-Detects)	Value used in Screen (1)						
Semivolatile Organics (ug/kg)(Cont):											
Dimethylphthalate	0/27	NA	350U - 650U	199.44	650	200000	USEPA Region IV	0.00	No	HQ < 1.0	--
Acenaphthylene	0/27	NA	350U - 650U	199.44	650	NE	--	NA	Yes	No SSSL	--
2,6-Dinitrotoluene	0/27	NA	350U - 650U	199.44	650	NE	--	NA	Yes	No SSSL	--
3-Nitroaniline	0/27	NA	880U - 1600U	499.44	1600	NE	--	NA	Yes	No SSSL	--
Acenaphthene	0/27	NA	350U - 650U	199.44	650	20000	USEPA Region IV	0.03	No	HQ < 1.0	--
2,4-Dinitrophenol	0/27	NA	880U - 1600U	499.44	1600	20000	USEPA Region IV	0.08	No	HQ < 1.0	--
4-Nitrophenol	0/26	NA	880U - 1600U	495.58	1600	7000	USEPA Region IV	0.23	No	HQ < 1.0	--
Dibenzofuran	0/27	NA	350U - 650U	199.44	650	NE	--	NA	Yes	No SSSL	--
2,4-Dinitrotoluene	0/27	NA	350U - 650U	199.44	650	NE	--	NA	Yes	No SSSL	--
Diethylphthalate	0/27	NA	350U - 650U	199.44	650	100000	USEPA Region IV	0.01	No	HQ < 1.0	--
4-Chlorophenyl phenyl ether	0/27	NA	350U - 650U	199.44	650	NE	--	NA	Yes	No SSSL	--
Fluorene	0/27	NA	350U - 650U	199.44	650	30000	USEPA Region IV	0.02	No	HQ < 1.0	--
4-Nitroaniline	0/27	NA	880U - 1600U	499.44	1600	NE	--	NA	Yes	No SSSL	--
4,6-Dinitro-2-methylphenol	0/27	NA	880U - 1600U	499.44	1600	NE	--	NA	Yes	No SSSL	--
N-Nitrosodiphenylamine	0/27	NA	350U - 650U	199.44	650	20000	USEPA Region IV	0.03	No	HQ < 1.0	--
4-Bromophenyl phenyl ether	0/27	NA	350U - 650U	199.44	650	NE	--	NA	Yes	No SSSL	--
Hexachlorobenzene	0/27	NA	350U - 650U	199.44	650	2.5	USEPA Region IV	260.00	Yes	HQ > 1.0	79.78
Pentachlorophenol	0/27	NA	880U - 1600U	499.44	1600	2	USEPA Region IV	800.00	Yes	HQ > 1.0	249.72
Phenanthrene	3/27	64J - 140J	350U - 650U	190.33	140	100	USEPA Region IV	1.40	Yes	HQ > 1.0	1.40
Anthracene	0/27	NA	350U - 650U	199.44	650	100	USEPA Region IV	6.50	Yes	HQ > 1.0	1.99

TABLE 7-3
FREQUENCY AND RANGE OF SURFACE SOIL DATA COMPARED TO SURFACE SOIL SCREENING VALUES
SITE 10 - ORIGINAL BASE LANDFILL
MARINE CORPS BASE, CAMP LEJUENE
NORTH CAROLINA

Analyte	Contaminant Frequency/Range					Surface Soil Screening Levels (SSSL)	Reference	Max. HQ (2)	ECOC?	Comments	Mean HQ (3)
	Frequency of Detection	Range of Positive Detections	Range of Non-Detects	Arithmetic Mean (Half Non-Detects)	Value used in Screen (1)						
Semivolatile Organics (ug/kg)(Cont):											
Carbazole	0/27	NA	350U - 650U	199.44	650	NE	--	NA	Yes	No SSSL	--
Di-n-butylphthalate	6/27	38J - 67J	350U - 650U	168.44	67	200000	USEPA Region IV	0.00	No	HQ < 1.0	--
Fluoranthene	5/27	65J - 190J	350U - 650U	188.04	190	100	USEPA Region IV	1.90	Yes	HQ > 1.0	1.88
Pyrene	5/27	51J - 140J	350U - 650U	183.89	140	100	USEPA Region IV	1.40	Yes	HQ > 1.0	1.40
Butyl benzyl phthalate	0/27	NA	350U - 650U	199.44	650	NE	--	NA	Yes	No SSSL	--
2-Nitrophenol	0/27	NA	350U - 650U	199.44	650	NE	--	NA	Yes	No SSSL	--
Benzo(a)anthracene	4/27	59J - 86J	350U - 650U	182.26	86	NE	--	NA	Yes	No SSSL	--
Chrysene	5/27	39J - 93J	350U - 650U	177.63	93	NE	--	NA	Yes	No SSSL	--
bis(2-Ethylhexyl)phthalate	0/27	NA	350U - 650U	199.44	650	NE	--	NA	Yes	No SSSL	--
Di-n-octyl phthalate	0/27	NA	350U - 650U	199.44	650	NE	--	NA	Yes	No SSSL	--
Benzo(b)fluoranthene	5/27	46J - 92J	350U - 650U	177.52	92	NE	--	NA	Yes	No SSSL	--
Benzo(k)fluoranthene	5/27	42J - 96J	350U - 650U	178.85	96	NE	--	NA	Yes	No SSSL	--
Benzo(a)pyrene	5/27	42J - 84J	350U - 650U	177.59	84	100	USEPA Region IV	0.84	No	HQ < 1.0	--
Indeno(1,2,3-cd)pyrene	4/27	44J - 58J	350U - 650U	179.22	58	NE	--	NA	Yes	No SSSL	--
Dibenz(a,h)anthracene	0/27	NA	350U - 650U	199.44	650	NE	--	NA	Yes	No SSSL	--
Benzo(g,h,i)perylene	3/27	40J - 45J	350U - 650U	183.33	45	NE	--	NA	Yes	No SSSL	--
Pesticides/PCBS (ug/kg):											
alpha-BHC	0/27	NA	1.8U - 3.4U	1.02	3.4	2.5	USEPA Region IV	1.36	Yes	HQ > 1.0	0.41
beta-BHC	0/27	NA	1.8UJ - 3.4UJ	1.02	3.4	1	USEPA Region IV	3.40	Yes	HQ > 1.0	1.02
delta-BHC	0/27	NA	1.8U - 3.4U	1.02	3.4	NE	--	NA	Yes	No SSSL	--
gamma-BHC (Lindane)	0/27	NA	1.8U - 3.4U	1.02	3.4	0.05	USEPA Region IV	68.00	Yes	HQ > 1.0	20.48

TABLE 7-3
FREQUENCY AND RANGE OF SURFACE SOIL DATA COMPARED TO SURFACE SOIL SCREENING VALUES
SITE 10 - ORIGINAL BASE LANDFILL
MARINE CORPS BASE, CAMP LEJUENE
NORTH CAROLINA

Analyte	Contaminant Frequency/Range					Surface Soil Screening Levels (SSSL)	Reference	Max. HQ (2)	ECOC?	Comments	Mean HQ (3)
	Frequency of Detection	Range of Positive Detections	Range of Non-Detects	Arithmetic Mean (Half Non-Detects)	Value used in Screen (1)						
Pesticides/PCBs (ug/kg)(Cont):											
Heptachlor	1/27	1.2NJ - 1.2NJ	1.8U - 3.4U	1.03	1.2	NE	--	NA	Yes	No SSSL	--
Aldrin	0/27	NA	1.8U - 3.4U	1.02	3.4	2.5	USEPA Region IV	1.36	Yes	HQ > 1.0	0.41
Heptachlor epoxide	1/27	2.4NJ - 2.4NJ	1.8U - 3.4U	1.08	2.4	NE	--	NA	Yes	No SSSL	--
Endosulfan I	1/27	4.3J - 4.3J	1.8U - 3.4U	1.15	4.3	NE	--	NA	Yes	No SSSL	--
Dieldrin	1/27	2.2NJ - 2.2NJ	3.5U - 6.5U	2.01	2.2	0.5	USEPA Region IV	4.40	Yes	HQ > 1.0	4.01
4,4'-DDE	1/27	2.1NJ - 2.1NJ	3.5U - 6.5U	2.01	2.1	2.5	USEPA Region IV	0.84	No	HQ < 1.0	--
Endrin	1/27	2.4NJ - 2.4NJ	3.5U - 6.5U	2.01	2.4	1	USEPA Region IV	2.40	Yes	HQ > 1.0	2.01
Endosulfan II	0/27	NA	3.5U - 6.5U	1.99	6.5	NE	--	NA	Yes	No SSSL	--
4,4'-DDD	0/27	NA	3.5U - 6.5U	1.99	6.5	2.5	USEPA Region IV	2.60	Yes	HQ > 1.0	0.80
Endosulfan sulfate	0/27	NA	3.5U - 6.5U	1.99	6.5	NE	--	NA	Yes	No SSSL	--
4,4'-DDT	4/27	3.1J - 6.2	3.5U - 6.5U	2.32	6.2	2.5	USEPA Region IV	2.48	Yes	HQ > 1.0	0.93
Methoxychlor	0/27	NA	18UJ - 34UJ	10.24	34	NE	--	NA	Yes	No SSSL	--
Endrin ketone	0/27	NA	3.5U - 6.5U	1.99	6.5	NE	--	NA	Yes	No SSSL	--
Endrin aldehyde	2/27	3.1J - 4.9	3.5U - 6.5U	2.11	4.9	NE	--	NA	Yes	No SSSL	--
alpha-Chlordane	0/27	NA	1.8U - 3.4U	1.02	3.4	NE	--	NA	Yes	No SSSL	--
gamma-Chlordane	0/27	NA	1.8U - 3.4U	1.02	3.4	NE	--	NA	Yes	No SSSL	--
Toxaphene	0/27	NA	180U - 340U	102.41	340	NE	--	NA	Yes	No SSSL	--
Aroclor-1016	0/27	NA	35U - 65U	19.94	65	20	USEPA Region IV	3.25	Yes	HQ > 1.0	1.00
Aroclor-1221	0/27	NA	71U - 130U	40.39	130	20	USEPA Region IV	6.50	Yes	HQ > 1.0	2.02
Aroclor-1232	0/27	NA	35U - 65U	19.94	65	20	USEPA Region IV	3.25	Yes	HQ > 1.0	1.00

TABLE 7-3
FREQUENCY AND RANGE OF SURFACE SOIL DATA COMPARED TO SURFACE SOIL SCREENING VALUES
SITE 10 - ORIGINAL BASE LANDFILL
MARINE CORPS BASE, CAMP LEJUENE
NORTH CAROLINA

Analyte	Contaminant Frequency/Range					Surface Soil Screening Levels (SSSL)	Reference	Max. HQ (2)	ECOC?	Comments	Mean HQ (3)
	Frequency of Detection	Range of Positive Detections	Range of Non-Detects	Arithmetic Mean (Half Non-Detects)	Value used in Screen (1)						
Pesticides/PCBS (ug/kg)(Cont):											
Aroclor-1242	0/27	NA	35U - 65U	19.94	65	20	USEPA Region IV	3.25	Yes	HQ > 1.0	1.00
Aroclor-1248	0/27	NA	35U - 65U	19.94	65	20	USEPA Region IV	3.25	Yes	HQ > 1.0	1.00
Aroclor-1254	0/27	NA	35U - 65U	19.94	65	20	USEPA Region IV	3.25	Yes	HQ > 1.0	1.00
Aroclor-1260	1/27	85J - 85J	35U - 65U	22.41	85	20	USEPA Region IV	4.25	Yes	HQ > 1.0	1.12
Inorganics (mg/kg):											
Aluminum	27/27	66.6 - 10200J	NA	1702.67	10200	50	USEPA Region IV	204.00	Yes	HQ > 1.0	34.05
Antimony	3/27	5.3J - 12.5J	12.8U - 23.8U	7.39	12.5	3.5	USEPA Region IV	3.57	Yes	HQ > 1.0	2.11
Arsenic	1/27	11.6 - 11.6	0.48U - 3.1U	1.33	11.6	10	USEPA Region IV	1.16	Yes	HQ > 1.0	0.13
Barium	27/27	0.58J - 173	NA	14.56	173	165	USEPA Region IV	1.05	Yes	HQ > 1.0	0.09
Beryllium	2/27	0.16J - 1.7J	1.1U - 1.5U	0.61	1.7	1.1	USEPA Region IV	1.55	Yes	HQ > 1.0	0.56
Cadmium	1/27	0.86J - 0.86J	1.1U - 2U	0.61	0.86	1.6	USEPA Region IV	0.54	No	HQ < 1.0	--
Chromium	21/27	0.78J - 11.2J	2.1U - 4.1U	2.66	11.2	0.4	USEPA Region IV	28.00	Yes	HQ > 1.0	6.65
Cobalt	4/27	0.97J - 8.8J	10.6U - 15.5U	5.52	8.8	20	USEPA Region IV	0.44	No	HQ < 1.0	--
Copper	25/27	0.46J - 43.8	2.8U - 2.9U	5.77	43.8	40	USEPA Region IV	1.10	Yes	HQ > 1.0	0.14
Iron	19/27	170J - 7740J	77.9U - 127U	1057.48	7740	200	USEPA Region IV	38.70	Yes	HQ > 1.0	5.29
Lead	27/27	0.6J - 85.1	NA	14.95	85.1	50	USEPA Region IV	1.70	Yes	HQ > 1.0	0.30
Manganese	27/27	1.9J - 73.3J	NA	12.73	73.3	100	USEPA Region IV	0.73	No	HQ < 1.0	--
Mercury	22/27	0.022J - 0.27	0.11U - 0.15U	0.06	0.27	0.1	USEPA Region IV	2.70	Yes	HQ > 1.0	0.57
Nickel	7/27	2.1J - 17.3	8.5U - 12.4U	4.71	17.3	30	USEPA Region IV	0.58	No	HQ < 1.0	--

TABLE 7-3
FREQUENCY AND RANGE OF SURFACE SOIL DATA COMPARED TO SURFACE SOIL SCREENING VALUES
SITE 10 - ORIGINAL BASE LANDFILL
MARINE CORPS BASE, CAMP LEJUENE
NORTH CAROLINA

Analyte	Contaminant Frequency/Range					Surface Soil Screening Levels (SSSL)	Reference	Max. HQ [2]	ECOC?	Comments	Mean HQ [3]
	Frequency of Detection	Range of Positive Detections	Range of Non-Detects	Arithmetic Mean (Half Non-Detects)	Value used in Screen [1]						
Inorganics (mg/kg)(Cont):											
Selenium	5/27	0.61J - 2	1.1U - 1.5U	0.66	2	0.81	USEPA Region IV	2.47	Yes	HQ > 1.0	0.82
Silver	2/27	1.4J - 3	2.1U - 4U	1.28	3	2	USEPA Region IV	1.50	Yes	HQ > 1.0	0.64
Thallium	0/27	NA	2.1U - 4U	1.21	4	1	USEPA Region IV	4.00	Yes	HQ > 1.0	1.21
Vanadium	10/27	3.1J - 31.4	1.5U - 12.6U	5.75	31.4	2	USEPA Region IV	15.70	Yes	HQ > 1.0	2.88
Zinc	20/27	2.9J - 304J	2.3U - 3.7U	29.36	304	50	USEPA Region IV	6.08	Yes	HQ > 1.0	0.59
Total Cyanide	0/27	NA	2.1U - 4U	1.21	4	0.9	USEPA Region IV	4.44	Yes	HQ > 1.0	1.34

Notes:

HQ = Hazard Quotient
ECOC = Ecological Contaminant of Concern
ug/kg = microgram per kilogram
mg/kg = miligram per kilogram
NA = Not Applicable
NE = Note Established

USEPA = United States Environmental Protection Agency
U = Chemical was not detected above the method detection limit
J = Estimated Value
NJ = Presumptive evidence for the presence of the material at an estimated value.

[1] The value used in the screen represents the maximum detected or non-detected concentration.
[2] The maximum HQ represents the value used in the screen divided by the surface soil screening value.
[3] The mean HQ represents the mean (half non-detect) concentration divided by the screening value. In cases where the mean exceeds the maximum the maximum value is used.

TABLE 7-4
FREQUENCY AND RANGE OF SEDIMENT DATA COMPARED TO FRESHWATER SEDIMENT SCREENING VALUES
SITE 10 - ORIGINAL BASE LANDFILL
MARINE CORPS BASE, CAMP LEJUENE
NORTH CAROLINA

Analyte	Contaminant Frequency/Range					Freshwater Sediment Screening Levels (SSL)	Reference	Max. HQ (2)	ECOC?	Comments	Mean HQ (3)
	Frequency of Detection	Range of Positive Detections	Range of Non-Detects	Arithmetic Mean (Half Non-Detects)	Value used in Screen (1)						
Volatile Organics (ug/kg):											
Chloromethane	0/4	NA	13U - 18U	7.38	18	NE	--	NA	Yes	No SSL	--
Bromomethane	0/4	NA	13U - 18U	7.38	18	NE	--	NA	Yes	No SSL	--
Vinyl chloride	0/4	NA	13U - 18U	7.38	18	NE	--	NA	Yes	No SSL	--
Chloroethane	0/4	NA	13U - 18U	7.38	18	NE	--	NA	Yes	No SSL	--
Methylene chloride	0/4	NA	13U - 18U	7.38	18	NE	--	NA	Yes	No SSL	--
Acetone	0/4	NA	41U - 1800U	260.88	1800	NE	--	NA	Yes	No SSL	--
Carbon disulfide	0/4	NA	13U - 18U	7.38	18	NE	--	NA	Yes	No SSL	--
1,1-Dichloroethene	0/4	NA	13U - 18U	7.38	18	NE	--	NA	Yes	No SSL	--
1,1-Dichloroethane	0/4	NA	13U - 18U	7.38	18	NE	--	NA	Yes	No SSL	--
1,2-Dichloroethene (total)	0/4	NA	13U - 18U	7.38	18	NE	--	NA	Yes	No SSL	--
Chloroform	0/4	NA	13U - 18U	7.38	18	NE	--	NA	Yes	No SSL	--
1,2-Dichloroethane	0/4	NA	13U - 18U	7.38	18	NE	--	NA	Yes	No SSL	--
2-Butanone	1/4	52 - 52	13U - 18U	18.63	52	NE	--	NA	Yes	No SSL	--
1,1,1-Trichloroethane	0/4	NA	13U - 18U	7.38	18	NE	--	NA	Yes	No SSL	--
Carbon tetrachloride	0/4	NA	13U - 18U	7.38	18	NE	--	NA	Yes	No SSL	--
Bromodichloromethane	0/4	NA	13U - 18U	7.38	18	NE	--	NA	Yes	No SSL	--
1,2-Dichloropropane	0/4	NA	13U - 18U	7.38	18	NE	--	NA	Yes	No SSL	--
cis-1,3-Dichloropropene	0/4	NA	13U - 18U	7.38	18	NE	--	NA	Yes	No SSL	--
Trichloroethene	0/4	NA	13U - 18U	7.38	18	NE	--	NA	Yes	No SSL	--
Dibromochloromethane	0/4	NA	13U - 18U	7.38	18	NE	--	NA	Yes	No SSL	--
1,1,2-Trichloroethane	0/4	NA	13U - 18U	7.38	18	NE	--	NA	Yes	No SSL	--
Benzene	0/4	NA	13U - 18U	7.38	18	NE	--	NA	Yes	No SSL	--
trans-1,3-Dichloropropene	0/4	NA	13U - 18U	7.38	18	NE	--	NA	Yes	No SSL	--
Bromoform	0/4	NA	13U - 18U	7.38	18	NE	--	NA	Yes	No SSL	--
4-Methyl-2-pentanone	0/4	NA	13U - 18U	7.38	18	NE	--	NA	Yes	No SSL	--
2-Hexanone	0/4	NA	13U - 18U	7.38	18	NE	--	NA	Yes	No SSL	--

TABLE 7-4
FREQUENCY AND RANGE OF SEDIMENT DATA COMPARED TO FRESHWATER SEDIMENT SCREENING VALUES
SITE 10 - ORIGINAL BASE LANDFILL
MARINE CORPS BASE, CAMP LEJUENE
NORTH CAROLINA

Analyte	Contaminant Frequency/Range					Freshwater Sediment Screening Levels (SSL)	Reference	Max. HQ (2)	ECOC?	Comments	Mean HQ (3)
	Frequency of Detection	Range of Positive Detections	Range of Non-Detects	Arithmetic Mean (Half Non-Detects)	Value used in Screen (1)						
Volatile Organics (ug/kg)(Cont):											
Tetrachloroethene	0/4	NA	13U - 18U	7.38	18	NE	--	NA	Yes	No SSL	--
1,1,2,2-Tetrachloroethane	0/4	NA	13U - 18U	7.38	18	NE	--	NA	Yes	No SSL	--
Toluene	4/4	4.2J - 97	NA	34.80	97	NE	--	NA	Yes	No SSL	--
Chlorobenzene	0/4	NA	13U - 18U	7.38	18	NE	--	NA	Yes	No SSL	--
Ethylbenzene	0/4	NA	13U - 18U	7.38	18	NE	--	NA	Yes	No SSL	--
Styrene	0/4	NA	13U - 18U	7.38	18	NE	--	NA	Yes	No SSL	--
Xylenes (total)	0/4	NA	13U - 18U	7.38	18	NE	--	NA	Yes	No SSL	--
Semivolatile Organics (ug/kg):											
Phenol	0/4	NA	440U - 610U	246.25	610	NE	--	NA	Yes	No SSL	--
bis(2-Chloroethyl) ether	0/4	NA	440U - 610U	246.25	610	NE	--	NA	Yes	No SSL	--
2-Chlorophenol	0/4	NA	440U - 610U	246.25	610	NE	--	NA	Yes	No SSL	--
1,3-Dichlorobenzene	0/4	NA	440U - 610U	246.25	610	NE	--	NA	Yes	No SSL	--
1,4-Dichlorobenzene	0/4	NA	440U - 610U	246.25	610	NE	--	NA	Yes	No SSL	--
1,2-Dichlorobenzene	0/4	NA	440U - 610U	246.25	610	NE	--	NA	Yes	No SSL	--
3,3'-Dichlorobenzidine	0/4	NA	440U - 610U	246.25	610	NE	--	NA	Yes	No SSL	--
2,2'-Oxybis(1-Chloropropane)	0/4	NA	440U - 610U	246.25	610	NE	--	NA	Yes	No SSL	--
N-Nitrosodi-n-propylamine	0/4	NA	440U - 610U	246.25	610	NE	--	NA	Yes	No SSL	--
4-Methylphenol	0/4	NA	440U - 610U	246.25	610	NE	--	NA	Yes	No SSL	--
Hexachloroethane	0/4	NA	440U - 610U	246.25	610	NE	--	NA	Yes	No SSL	--
Nitrobenzene	0/4	NA	440U - 610U	246.25	610	NE	--	NA	Yes	No SSL	--
Isophorone	0/4	NA	440U - 610U	246.25	610	NE	--	NA	Yes	No SSL	--
2-Nitroaniline	0/4	NA	1100U - 1500U	612.50	1500	NE	--	NA	Yes	No SSL	--
2,4-Dimethylphenol	0/4	NA	440U - 610U	246.25	610	NE	--	NA	Yes	No SSL	--
bis(2-Chloroethoxy)methane	0/4	NA	440U - 610U	246.25	610	NE	--	NA	Yes	No SSL	--
2,4-Dichlorophenol	0/4	NA	440U - 610U	246.25	610	NE	--	NA	Yes	No SSL	--
1,2,4-Trichlorobenzene	0/4	NA	440U - 610U	246.25	610	NE	--	NA	Yes	No SSL	--
Naphthalene	0/4	NA	440U - 610U	246.25	610	34.6	USEPA Region IV	17.63	Yes	HQ > 1.0	7.12
4-Chloroaniline	0/4	NA	440U - 610U	246.25	610	NE	--	NA	Yes	No SSL	--

TABLE 7-4
FREQUENCY AND RANGE OF SEDIMENT DATA COMPARED TO FRESHWATER SEDIMENT SCREENING VALUES
SITE 10 - ORIGINAL BASE LANDFILL
MARINE CORPS BASE, CAMP LEJUENE
NORTH CAROLINA

Analyte	Contaminant Frequency/Range					Freshwater Sediment Screening Levels (SSL)	Reference	Max. HQ (2)	ECOC?	Comments	Mean HQ (3)
	Frequency of Detection	Range of Positive Detections	Range of Non-Detects	Arithmetic Mean (Half Non-Detects)	Value used in Screen (1)						
Semivolatile Organics (ug/kg)(Cont):											
Hexachlorobutadiene	0/4	NA	440U - 610U	246.25	610	NE	--	NA	Yes	No SSL	--
4-Chloro-3-methylphenol	0/4	NA	440U - 610U	246.25	610	NE	--	NA	Yes	No SSL	--
2-Methylnaphthalene	0/4	NA	440U - 610U	246.25	610	20.23	USEPA Region IV	30.15	Yes	HQ > 1.0	12.17
Hexachlorocyclopentadiene	0/4	NA	440U - 610U	246.25	610	NE	--	NA	Yes	No SSL	--
2,4,6-Trichlorophenol	0/4	NA	440U - 610U	246.25	610	NE	--	NA	Yes	No SSL	--
2,4,5-Trichlorophenol	0/4	NA	1100U - 1500U	612.50	1500	NE	--	NA	Yes	No SSL	--
2-Chloronaphthalene	0/4	NA	440U - 610U	246.25	610	NE	--	NA	Yes	No SSL	--
2-Methylphenol	0/4	NA	440U - 610U	246.25	610	NE	--	NA	Yes	No SSL	--
Dimethyl phthalate	0/4	NA	440U - 610U	246.25	610	NE	--	NA	Yes	No SSL	--
Acenaphthylene	0/4	NA	440U - 610U	246.25	610	5.87	USEPA Region IV	103.92	Yes	HQ > 1.0	41.95
2,6-Dinitrotoluene	0/4	NA	440U - 610U	246.25	610	NE	--	NA	Yes	No SSL	--
3-Nitroaniline	0/4	NA	1100U - 1500U	612.50	1500	NE	--	NA	Yes	No SSL	--
Acenaphthene	0/4	NA	440U - 610U	246.25	610	6.71	USEPA Region IV	90.91	Yes	HQ > 1.0	36.70
2,4-Dinitrophenol	0/4	NA	1100U - 1500U	612.50	1500	NE	--	NA	Yes	No SSL	--
4-Nitrophenol	0/3	NA	1100UJ - 1200UJ	566.67	1200	NE	--	NA	Yes	No SSL	--
Dibenzofuran	0/4	NA	440U - 610U	246.25	610	NE	--	NA	Yes	No SSL	--
2,4-Dinitrotoluene	0/4	NA	440U - 610U	246.25	610	NE	--	NA	Yes	No SSL	--
Diethyl phthalate	0/4	NA	440U - 610U	246.25	610	NE	--	NA	Yes	No SSL	--
4-Chlorophenyl phenyl ether	0/4	NA	440U - 610U	246.25	610	NE	--	NA	Yes	No SSL	--
Fluorene	0/4	NA	440U - 610U	246.25	610	21.2	USEPA Region IV	28.77	Yes	HQ > 1.0	11.62
4-Nitroaniline	0/4	NA	1100U - 1500U	612.50	1500	NE	--	NA	Yes	No SSL	--
4,6-Dinitro-2-methylphenol	0/4	NA	1100U - 1500U	612.50	1500	NE	--	NA	Yes	No SSL	--
N-Nitrosodiphenylamine	0/4	NA	440U - 610U	246.25	610	NE	--	NA	Yes	No SSL	--
4-Bromophenyl phenyl ether	0/4	NA	440U - 610U	246.25	610	NE	--	NA	Yes	No SSL	--
Hexachlorobenzene	0/4	NA	440U - 610U	246.25	610	NE	--	NA	Yes	No SSL	--
Pentachlorophenol	0/4	NA	1100U - 1500U	612.50	1500	NE	--	NA	Yes	No SSL	--
Phenanthrene	0/4	NA	440U - 610U	246.25	610	86.7	USEPA Region IV	7.04	Yes	HQ > 1.0	2.84
Anthracene	0/4	NA	440U - 610U	246.25	610	46.9	USEPA Region IV	13.01	Yes	HQ > 1.0	5.25

TABLE 7-4
FREQUENCY AND RANGE OF SEDIMENT DATA COMPARED TO FRESHWATER SEDIMENT SCREENING VALUES
SITE 10 - ORIGINAL BASE LANDFILL
MARINE CORPS BASE, CAMP LEJUENE
NORTH CAROLINA

Analyte	Contaminant Frequency/Range					Freshwater Sediment Screening Levels (SSL)	Reference	Max. HQ (2)	ECOC?	Comments	Mean HQ (3)
	Frequency of Detection	Range of Positive Detections	Range of Non-Detects	Arithmetic Mean (Half Non-Detects)	Value used in Screen (1)						
Semivolatile Organics (ug/kg)(Cont):											
Carbazole	0/4	NA	440U - 610U	246.25	610	NE	--	NA	Yes	No SSL	--
Di-n-butyl phthalate	0/4	NA	440U - 610U	246.25	610	NE	--	NA	Yes	No SSL	--
Fluoranthene	0/4	NA	440U - 610U	246.25	610	113	USEPA Region IV	5.40	Yes	HQ > 1.0	2.18
Pyrene	0/4	NA	440U - 610U	246.25	610	153	USEPA Region IV	3.99	Yes	HQ > 1.0	1.61
Butyl benzyl phthalate	0/4	NA	440U - 610U	246.25	610	NE	--	NA	Yes	No SSL	--
2-Nitrophenol	0/4	NA	440U - 610U	246.25	610	NE	--	NA	Yes	No SSL	--
Benzo(a)anthracene	0/4	NA	440U - 610U	246.25	610	74.8	USEPA Region IV	8.16	Yes	HQ > 1.0	3.29
Chrysene	0/4	NA	440U - 610U	246.25	610	108	USEPA Region IV	5.65	Yes	HQ > 1.0	2.28
bis(2-Ethylhexyl) phthalate	0/4	NA	440U - 610U	246.25	610	182	USEPA Region IV	3.35	Yes	HQ > 1.0	1.35
Di-n-octyl phthalate	0/4	NA	440U - 610U	246.25	610	NE	--	NA	Yes	No SSL	--
Benzo(b)fluoranthene	0/4	NA	440U - 610U	246.25	610	NE	--	NA	Yes	No SSL	--
Benzo(k)fluoranthene	0/4	NA	440U - 610U	246.25	610	NE	--	NA	Yes	No SSL	--
Benzo(a)pyrene	0/4	NA	440U - 610U	246.25	610	88.8	USEPA Region IV	6.87	Yes	HQ > 1.0	2.77
Indeno(1,2,3-cd)pyrene	0/4	NA	440U - 610U	246.25	610	NE	--	NA	Yes	No SSL	--
Dibenz(a,h)anthracene	0/4	NA	440U - 610U	246.25	610	6.22	USEPA Region IV	98.07	Yes	HQ > 1.0	39.59
Benzo(ghi)perylene	0/4	NA	440U - 610U	246.25	610	NE	--	NA	Yes	No SSL	--
Pesticides/PCBs (ug/kg):											
alpha-BHC	0/4	NA	2.3U - 3.1U	1.26	3.1	NE	--	NA	Yes	No SSL	--
beta-BHC	0/4	NA	2.3U - 3.1U	1.26	3.1	NE	--	NA	Yes	No SSL	--
delta-BHC	0/4	NA	2.3U - 3.1U	1.26	3.1	NE	--	NA	Yes	No SSL	--
gamma-BHC (Lindane)	0/4	NA	2.3U - 3.1U	1.26	3.1	0.32	USEPA Region IV	9.69	Yes	HQ > 1.0	3.95
Heptachlor	0/4	NA	2.3U - 3.1U	1.26	3.1	NE	--	NA	Yes	No SSL	--
Aldrin	0/4	NA	2.3U - 3.1U	1.26	3.1	NE	--	NA	Yes	No SSL	--
Heptachlor epoxide	0/4	NA	2.3U - 3.1U	1.26	3.1	NE	--	NA	Yes	No SSL	--
Endosulfan I	0/4	NA	2.3U - 3.1U	1.26	3.1	NE	--	NA	Yes	No SSL	--
Dieldrin	0/4	NA	4.4U - 6.1U	2.46	6.1	0.02	USEPA Region IV	305.00	Yes	HQ > 1.0	123.13
4,4'-DDE	0/4	NA	4.4U - 6.1U	2.46	6.1	2.07	USEPA Region IV	2.95	Yes	HQ > 1.0	1.19

TABLE 7-4
FREQUENCY AND RANGE OF SEDIMENT DATA COMPARED TO FRESHWATER SEDIMENT SCREENING VALUES
SITE 10 - ORIGINAL BASE LANDFILL
MARINE CORPS BASE, CAMP LEJUENE
NORTH CAROLINA

Analyte	Contaminant Frequency/Range					Freshwater Sediment Screening Levels (SSL)	Reference	Max. HQ (2)	ECOC?	Comments	Mean HQ (3)
	Frequency of Detection	Range of Positive Detections	Range of Non-Detects	Arithmetic Mean (Half Non-Detects)	Value used in Screen (1)						
Pesticides/PCBs (ug/kg)(Cont):											
Endrin	0/4	NA	4.4U - 6.1U	2.46	6.1	0.02	USEPA Region IV	305.00	Yes	HQ > 1.0	123.13
Endosulfan II	0/4	NA	4.4U - 6.1U	2.46	6.1	NE	--	NA	Yes	No SSL	--
4,4'-DDD	0/4	NA	4.4U - 6.1U	2.46	6.1	1.22	USEPA Region IV	5.00	Yes	HQ > 1.0	2.02
Endosulfan sulfate	0/4	NA	4.4U - 6.1U	2.46	6.1	NE	--	NA	Yes	No SSL	--
4,4'-DDT	0/4	NA	4.4U - 6.1U	2.46	6.1	1.19	USEPA Region IV	5.13	Yes	HQ > 1.0	2.07
Methoxychlor	0/4	NA	23UJ - 31UJ	12.63	31	NE	--	NA	Yes	No SSL	--
Endrin ketone	0/4	NA	4.4U - 6.1U	2.46	6.1	NE	--	NA	Yes	No SSL	--
Endrin aldehyde	0/4	NA	4.4U - 6.1U	2.46	6.1	NE	--	NA	Yes	No SSL	--
alpha-Chlordane	0/4	NA	2.3U - 3.1U	1.26	3.1	0.5	USEPA Region IV	6.20	Yes	HQ > 1.0	2.53
gamma-Chlordane	0/4	NA	2.3U - 3.1U	1.26	3.1	0.5	USEPA Region IV	6.20	Yes	HQ > 1.0	2.53
Toxaphene	0/4	NA	230U - 310U	126.25	310	NE	--	NA	Yes	No SSL	--
Aroclor 1016	0/4	NA	44U - 61U	24.63	61	21.6	USEPA Region IV	2.82	Yes	HQ > 1.0	1.14
Aroclor 1221	0/4	NA	89U - 120U	49.50	120	21.6	USEPA Region IV	5.56	Yes	HQ > 1.0	2.29
Aroclor 1232	0/4	NA	44U - 61U	24.63	61	21.6	USEPA Region IV	2.82	Yes	HQ > 1.0	1.14
Aroclor 1242	0/4	NA	44U - 61U	24.63	61	21.6	USEPA Region IV	2.82	Yes	HQ > 1.0	1.14
Aroclor 1248	0/4	NA	44U - 61U	24.63	61	21.6	USEPA Region IV	2.82	Yes	HQ > 1.0	1.14
Aroclor 1254	0/4	NA	44U - 61U	24.63	61	21.6	USEPA Region IV	2.82	Yes	HQ > 1.0	1.14
Aroclor 1260	0/4	NA	44U - 61U	24.63	61	21.6	USEPA Region IV	2.82	Yes	HQ > 1.0	1.14
Inorganics (mg/kg):											
Aluminum	4/4	834J - 3040J	NA	1516.00	3040	NE	--	NA	Yes	No SSL	--
Antimony	0/4	NA	16U - 22.1U	8.95	22.1	2	Long et. al. 1991	11.05	Yes	HQ > 1.0	4.48
Arsenic	0/4	NA	2.7U - 3.7U	1.50	3.7	7.24	USEPA Region IV	0.51	No	HQ < 1.0	--
Barium	4/4	1.9J - 18.2J	NA	8.98	18.2	NE	--	NA	Yes	No SSL	--
Beryllium	0/4	NA	1.3U - 1.8U	0.74	1.8	NE	--	NA	Yes	No SSL	--
Cadmium	0/4	NA	1.3U - 1.8U	0.74	1.8	0.676	USEPA Region IV	2.66	Yes	HQ > 1.0	1.09

TABLE 7-4
FREQUENCY AND RANGE OF SEDIMENT DATA COMPARED TO FRESHWATER SEDIMENT SCREENING VALUES
SITE 10 - ORIGINAL BASE LANDFILL
MARINE CORPS BASE, CAMP LEJUENE
NORTH CAROLINA

Analyte	Contaminant Frequency/Range					Freshwater Sediment Screening Levels (SSL)	Reference	Max. HQ (2)	ECOC?	Comments	Mean HQ (3)
	Frequency of Detection	Range of Positive Detections	Range of Non-Detects	Arithmetic Mean (Half Non-Detects)	Value used in Screen (1)						
Inorganics (mg/kg)(Cont):											
Chromium	0/4	NA	1.9U - 4.2U	1.43	4.2	52.3	USEPA Region IV	0.08	No	HQ < 1.0	--
Cobalt	0/4	NA	13.3U - 18.4U	7.45	18.4	NE	--	NA	Yes	No SSL	--
Copper	2/4	3.5J - 4J	1.3U - 2.2U	2.31	4	18.7	USEPA Region IV	0.21	No	HQ < 1.0	--
Iron	4/4	191J - 802J	NA	440.50	802	NE	--	NA	Yes	No SSL	--
Lead	4/4	4 - 22.7	NA	9.78	22.7	30.2	USEPA Region IV	0.75	No	HQ < 1.0	--
Manganese	4/4	1.2J - 6.7	NA	3.83	6.7	NE	--	NA	Yes	No SSL	--
Mercury	1/4	0.06J - 0.06J	0.14U - 0.18U	0.07	0.06	0.13	USEPA Region IV	0.46	No	HQ < 1.0	--
Nickel	0/4	NA	10.7U - 14.7U	5.98	14.7	15.9	USEPA Region IV	0.92	No	HQ < 1.0	--
Selenium	1/4	0.76J - 0.76J	1.3U - 1.8U	0.75	0.76	NE	--	NA	Yes	No SSL	--
Silver	0/4	NA	1.8U - 2.9U	1.26	2.9	0.733	USEPA Region IV	3.96	Yes	HQ > 1.0	1.72
Thallium	0/4	NA	1.3U - 2.9U	1.20	2.9	NE	--	NA	Yes	No SSL	--
Vanadium	0/4	NA	13.3U - 18.4U	7.45	18.4	NE	--	NA	Yes	No SSL	--
Zinc	4/4	7.3 - 12.1	NA	9.30	12.1	124	USEPA Region IV	0.10	No	HQ < 1.0	--
Total Cyanide	0/4	NA	2.7U - 3.7U	1.50	3.7	NE	--	NA	Yes	No SSL	--

Notes:

HQ = Hazard Quotient
ECOC = Ecological Contaminant of Concern
ug/kg = microgram per kilogram
mg/kg = miligram per kilogram
NA = Not Applicable

USEPA = United States Environmental Protection Agency
NE = Note Established
U = Chemical was not detected above the method detection limit
J = Estimated Value
UJ = Estimated method detection limit

(1) The value used in the screen represents the maximum detected or non-detected concentration.
(2) The maximum HQ represents the value used in the screen divided by the freshwater sediment screening value.
(3) The mean HQ represents the mean (half non-detect) concentration divided by the screening value. In cases where the mean exceeds the maximum the maximum value is used.

TABLE 7-5
FREQUENCY AND RANGE OF SURFACE WATER DATA COMPARED TO FRESHWATER SCREENING VALUES
SITE 10 - ORIGINAL BASE LANDFILL
MARINE CORPS BASE, CAMP LEJUENE
NORTH CAROLINA

Analyte	Contaminant Frequency/Range					Surface Water Screening Levels (SWSL)	Reference	Max. HQ (2)	ECOC?	Comments	Mean HQ (3)
	Frequency of Detection	Range of Positive Detections	Range of Non-Detects	Arithmetic Mean (Half Non-Detects)	Value used in Screen (1)						
Volatile Organics (ug/L):											
Chloromethane	0/4	NA	10U	5.00	10	NE	--	NA	Yes	No SWSL	--
Bromomethane	0/4	NA	10U	5.00	10	NE	--	NA	Yes	No SWSL	--
Vinyl chloride	0/4	NA	10U	5.00	10	NE	--	NA	Yes	No SWSL	--
Chloroethane	0/4	NA	10U	5.00	10	NE	--	NA	Yes	No SWSL	--
Methylene chloride	0/4	NA	10U	5.00	10	1930	USEPA Region IV	0.01	No	HQ < 1.0	--
Acetone	0/4	NA	10U	5.00	10	NE	--	NA	Yes	No SWSL	--
Carbon disulfide	0/4	NA	10U	5.00	10	NE	--	NA	Yes	No SWSL	--
1,1-Dichloroethene	0/4	NA	10U	5.00	10	303	USEPA Region IV	0.03	No	HQ < 1.0	--
1,1-Dichloroethane	0/4	NA	10U	5.00	10	NE	--	NA	Yes	No SWSL	--
1,2-Dichloroethene (total)	0/4	NA	10U	5.00	10	NE	--	NA	Yes	No SWSL	--
Chloroform	0/4	NA	10U	5.00	10	289	USEPA Region IV	0.03	No	HQ < 1.0	--
1,2-Dichloroethane	0/4	NA	10U	5.00	10	2000	USEPA Region IV	0.01	No	HQ < 1.0	--
2-Butanone	0/4	NA	10U	5.00	10	NE	--	NA	Yes	No SWSL	--
1,1,1-Trichloroethane	0/4	NA	10U	5.00	10	528	USEPA Region IV	0.02	No	HQ < 1.0	--
Carbon tetrachloride	0/4	NA	10U	5.00	10	352	USEPA Region IV	0.03	No	HQ < 1.0	--
Bromodichloromethane	0/4	NA	10U	5.00	10	NE	--	NA	Yes	No SWSL	--
1,2-Dichloropropane	0/4	NA	10U	5.00	10	525	USEPA Region IV	0.02	No	HQ < 1.0	--
cis-1,3-Dichloropropene	0/4	NA	10U	5.00	10	24.4	USEPA Region IV	0.41	No	HQ < 1.0	--
Trichloroethene	0/4	NA	10U	5.00	10	NE	--	NA	Yes	No SWSL	--
Dibromochloromethane	0/4	NA	10U	5.00	10	NE	--	NA	Yes	No SWSL	--
1,1,2-Trichloroethane	0/4	NA	10U	5.00	10	940	USEPA Region IV	0.01	No	HQ < 1.0	--
Benzene	0/4	NA	10U	5.00	10	53	USEPA Region IV	0.19	No	HQ < 1.0	--
trans-1,3-Dichloropropene	0/4	NA	10U	5.00	10	24.4	USEPA Region IV	0.41	No	HQ < 1.0	--
Bromoform	0/4	NA	10U	5.00	10	293	USEPA Region IV	0.03	No	HQ < 1.0	--
4-Methyl-2-pentanone	0/4	NA	10U	5.00	10	NE	--	NA	Yes	No SWSL	--
2-Hexanone	0/4	NA	10U	5.00	10	NE	--	NA	Yes	No SWSL	--

TABLE 7-5
FREQUENCY AND RANGE OF SURFACE WATER DATA COMPARED TO FRESHWATER SCREENING VALUES
SITE 10 - ORIGINAL BASE LANDFILL
MARINE CORPS BASE, CAMP LEJUENE
NORTH CAROLINA

Analyte	Contaminant Frequency/Range					Surface Water Screening Levels (SWSL)	Reference	Max. HQ (2)	ECOC?	Comments	Mean HQ (3)
	Frequency of Detection	Range of Positive Detections	Range of Non-Detects	Arithmetic Mean (Half Non-Detects)	Value used in Screen (1)						
Volatile Organics (ug/L)(Cont):											
Tetrachloroethene	0/4	NA	10U	5.00	10	84	USEPA Region IV	0.12	No	HQ < 1.0	--
1,1,2,2-Tetrachloroethane	0/4	NA	10U	5.00	10	240	USEPA Region IV	0.04	No	HQ < 1.0	--
Toluene	2/4	1.3J - 1.3J	10U	3.15	1.3	175	USEPA Region IV	0.01	No	HQ < 1.0	--
Chlorobenzene	0/4	NA	10U	5.00	10	195	--	0.05	No	HQ < 1.0	--
Ethylbenzene	0/4	NA	10U	5.00	10	453	USEPA Region IV	0.02	No	HQ < 1.0	--
Styrene	0/4	NA	10U	5.00	10	NE	--	NA	Yes	No SWSL	--
Xylenes (total)	0/4	NA	10U	5.00	10	NE	--	NA	Yes	No SWSL	--
Semivolatile Organics (ug/L):											
Phenol	0/4	NA	10U	5.00	10	256	USEPA Region IV	0.04	No	HQ < 1.0	--
bis(2-Chloroethyl)ether	0/4	NA	10U	5.00	10	NE	--	NA	Yes	No SWSL	--
2-Chlorophenol	0/4	NA	10U	5.00	10	43.8	USEPA Region IV	0.23	No	HQ < 1.0	--
1,3-Dichlorobenzene	0/4	NA	10U	5.00	10	50.2	USEPA Region IV	0.20	No	HQ < 1.0	--
1,4-Dichlorobenzene	0/4	NA	10U	5.00	10	11.2	USEPA Region IV	0.89	No	HQ < 1.0	--
1,2-Dichlorobenzene	0/4	NA	10U	5.00	10	15.8	USEPA Region IV	0.63	No	HQ < 1.0	--
3,3'-Dichlorobenzidine	0/4	NA	10U	5.00	10	NE	--	NA	Yes	No SWSL	--
2,2'-Oxybis(1-Chloropropane)	0/4	NA	10U	5.00	10	NE	--	NA	Yes	No SWSL	--
N-Nitrosodi-n-propylamine	0/4	NA	10U	5.00	10	NE	--	NA	Yes	No SWSL	--
4-Methylphenol	0/4	NA	10U	5.00	10	NE	--	NA	Yes	No SWSL	--
Hexachloroethane	0/4	NA	10U	5.00	10	9.8	USEPA Region IV	1.02	Yes	HQ > 1.0	--
Nitrobenzene	0/4	NA	10U	5.00	10	270	USEPA Region IV	0.04	No	HQ < 1.0	--
Isophorone	0/4	NA	10U	5.00	10	1170	USEPA Region IV	0.01	No	HQ < 1.0	--
2-Nitroaniline	0/4	NA	25U	12.50	25	NE	--	NA	Yes	No SWSL	--
2,4-Dimethylphenol	0/4	NA	10U	5.00	10	21.2	USEPA Region IV	0.47	No	HQ < 1.0	--
bis(2-Chloroethoxy)methane	0/4	NA	10U	5.00	10	NE	--	NA	Yes	No SWSL	--
2,4-Dichlorophenol	0/4	NA	10U	5.00	10	36.5	USEPA Region IV	0.27	No	HQ < 1.0	--
1,2,4-Trichlorobenzene	0/4	NA	10U	5.00	10	44.9	USEPA Region IV	0.22	No	HQ < 1.0	--
Naphthalene	0/4	NA	10U	5.00	10	62	USEPA Region IV	0.16	No	HQ < 1.0	--
4-Chloroaniline	0/4	NA	10U	5.00	10	NE	--	NA	Yes	No SWSL	--
Hexachlorobutadiene	0/4	NA	10U	5.00	10	0.93	USEPA Region IV	10.75	Yes	HQ > 1.0	5.38

TABLE 7-5
FREQUENCY AND RANGE OF SURFACE WATER DATA COMPARED TO FRESHWATER SCREENING VALUES
SITE 10 - ORIGINAL BASE LANDFILL
MARINE CORPS BASE, CAMP LEJUENE
NORTH CAROLINA

Analyte	Contaminant Frequency/Range					Surface Water Screening Levels (SWSL)	Reference	Max. HQ (2)	ECOC?	Comments	Mean HQ (3)
	Frequency of Detection	Range of Positive Detections	Range of Non-Detects	Arithmetic Mean (Half Non-Detects)	Value used in Screen (1)						
Semivolatile Organics (ug/L)(Cont):											
4-Chloro-3-methylphenol	0/4	NA	10U	5.00	10	0.3	USEPA Region IV	33.33	Yes	HQ > 1.0	16.67
2-Methylnaphthalene	0/4	NA	10U	5.00	10	NE	--	NA	Yes	No SWSL	--
Hexachlorocyclopentadiene	0/4	NA	10U	5.00	10	0.07	USEPA Region IV	142.86	Yes	HQ > 1.0	71.43
2,4,6-Trichlorophenol	0/4	NA	10U	5.00	10	3.2	USEPA Region IV	3.13	Yes	HQ > 1.0	1.56
2,4,5-Trichlorophenol	0/4	NA	25U	12.50	25	NE	--	NA	Yes	No SWSL	--
2-Chloronaphthalene	0/4	NA	10U	5.00	10	NE	--	NA	Yes	No SWSL	--
2-Methylphenol	0/4	NA	10U	5.00	10	NE	--	NA	Yes	No SWSL	--
Dimethylphthalate	0/4	NA	10U	5.00	10	330	USEPA Region IV	0.03	No	HQ < 1.0	--
Acenaphthylene	0/4	NA	10U	5.00	10	NE	--	NA	Yes	No SWSL	--
2,6-Dinitrotoluene	0/4	NA	10U	5.00	10	NE	--	NA	Yes	No SWSL	--
3-Nitroaniline	0/4	NA	25U	12.50	25	NE	--	NA	Yes	No SWSL	--
Acenaphthene	0/4	NA	10U	5.00	10	17	USEPA Region IV	0.59	No	HQ < 1.0	--
2,4-Dinitrophenol	0/4	NA	25U	12.50	25	6.2	USEPA Region IV	4.03	Yes	HQ > 1.0	2.02
4-Nitrophenol	0/4	NA	25U	12.50	25	82.8	USEPA Region IV	0.30	No	HQ < 1.0	--
Dibenzofuran	0/4	NA	10U	5.00	10	NE	--	NA	Yes	No SWSL	--
2,4-Dinitrotoluene	0/4	NA	10U	5.00	10	310	USEPA Region IV	0.03	No	HQ < 1.0	--
Diethylphthalate	0/4	NA	10U	5.00	10	521	USEPA Region IV	0.02	No	HQ < 1.0	--
4-Chlorophenyl phenyl ether	0/4	NA	10U	5.00	10	NE	--	NA	Yes	No SWSL	--
Fluorene	0/4	NA	10U	5.00	10	NE	--	NA	Yes	No SWSL	--
4-Nitroaniline	0/4	NA	25U	12.50	25	NE	--	NA	Yes	No SWSL	--
4,6-Dinitro-2-methylphenol	0/4	NA	25U	12.50	25	2.3	USEPA Region IV	10.87	Yes	HQ > 1.0	5.43
N-Nitrosodiphenylamine	0/4	NA	10U	5.00	10	58.5	USEPA Region IV	0.17	No	HQ < 1.0	--
4-Bromophenyl phenyl ether	0/4	NA	10U	5.00	10	NE	--	NA	Yes	No SWSL	--
Hexachlorobenzene	0/4	NA	10U	5.00	10	NE	--	NA	Yes	No SWSL	--
Pentachlorophenol	0/4	NA	25U	12.50	25	12.79430308	USEPA Region IV	1.95	Yes	HQ > 1.0	0.98
Phenanthrene	0/4	NA	10U	5.00	10	NE	--	NA	Yes	No SWSL	--
Anthracene	0/4	NA	10U	5.00	10	NE	--	NA	Yes	No SWSL	--
Carbazole	0/4	NA	10U	5.00	10	NE	--	NA	Yes	No SWSL	--

TABLE 7-5
FREQUENCY AND RANGE OF SURFACE WATER DATA COMPARED TO FRESHWATER SCREENING VALUES
SITE 10 - ORIGINAL BASE LANDFILL
MARINE CORPS BASE, CAMP LEJUENE
NORTH CAROLINA

Analyte	Contaminant Frequency/Range					Surface Water Screening Levels (SWSL)	Reference	Max. HQ (2)	ECOC?	Comments	Mean HQ (3)
	Frequency of Detection	Range of Positive Detections	Range of Non-Detects	Arithmetic Mean (Half Non-Detects)	Value used in Screen (1)						
Semivolatile Organics (ug/L)(Cont):											
Di-n-butylphthalate	0/4	NA	10U	5.00	10	9.4	USEPA Region IV	1.06	Yes	HQ > 1.0	0.53
Fluoranthene	0/4	NA	10U	5.00	10	39.8	USEPA Region IV	0.25	No	HQ < 1.0	--
Pyrene	0/4	NA	10U	5.00	10	NE	--	NA	Yes	No SWSL	--
Butyl benzyl phthalate	0/4	NA	10U	5.00	10	22	USEPA Region IV	0.45	No	HQ < 1.0	--
2-Nitrophenol	0/4	NA	10U	5.00	10	3500	USEPA Region IV	0.00	No	HQ < 1.0	--
Benzo(a)anthracene	0/4	NA	10U	5.00	10	NE	--	NA	Yes	No SWSL	--
Chrysene	0/4	NA	10U	5.00	10	NE	--	NA	Yes	No SWSL	--
bis(2-Ethylhexyl)phthalate	0/4	NA	10U	5.00	10	0.299	USEPA Region IV	33.44	Yes	HQ > 1.0	16.72
Di-n-octyl phthalate	0/4	NA	10U	5.00	10	NE	--	NA	Yes	No SWSL	--
Benzo(b)fluoranthene	0/4	NA	10U	5.00	10	NE	--	NA	Yes	No SWSL	--
Benzo(k)fluoranthene	0/4	NA	10U	5.00	10	NE	--	NA	Yes	No SWSL	--
Benzo(a)pyrene	0/4	NA	10U	5.00	10	NE	--	NA	Yes	No SWSL	--
Indeno(1,2,3-cd)pyrene	0/4	NA	10U	5.00	10	NE	--	NA	Yes	No SWSL	--
Dibenz(a,h)anthracene	0/4	NA	10U	5.00	10	NE	--	NA	Yes	No SWSL	--
Benzo(g,h,i)perylene	0/4	NA	10U	5.00	10	NE	--	NA	Yes	No SWSL	--
Pesticides/PCBs (ug/L):											
alpha-BHC	0/4	NA	0.05U	0.03	0.05	500	USEPA Region IV	0.00	No	HQ < 1.0	--
beta-BHC	0/4	NA	0.05U	0.03	0.05	5000	USEPA Region IV	0.00	No	HQ < 1.0	--
delta-BHC	0/4	NA	0.05U	0.03	0.05	NE	--	NA	Yes	No SWSL	--
gamma-BHC (Lindane)	0/4	NA	0.05U	0.03	0.05	0.08	USEPA Region IV	0.63	No	HQ < 1.0	--
Heptachlor	0/4	NA	0.05U	0.03	0.05	0.0038	USEPA Region IV	13.16	Yes	HQ > 1.0	6.58
Aldrin	0/4	NA	0.05U	0.03	0.05	0.3	USEPA Region IV	0.17	No	HQ < 1.0	--
Heptachlor epoxide	0/4	NA	0.05U	0.03	0.05	0.0038	USEPA Region IV	13.16	Yes	HQ > 1.0	6.58
Endosulfan I	0/4	NA	0.05U	0.03	0.05	0.056	USEPA Region IV	0.89	No	HQ < 1.0	--
Dieldrin	0/4	NA	0.1U	0.05	0.1	0.0019	USEPA Region IV	52.63	Yes	HQ > 1.0	26.32
4,4'-DDE	0/4	NA	0.1U	0.05	0.1	10.5	USEPA Region IV	0.01	No	HQ < 1.0	--
Endrin	0/4	NA	0.1U	0.05	0.1	0.0023	USEPA Region IV	43.48	Yes	HQ > 1.0	21.74
Endosulfan II	0/4	NA	0.1U	0.05	0.1	0.056	USEPA Region IV	1.79	Yes	HQ > 1.0	0.89

TABLE 7-5
FREQUENCY AND RANGE OF SURFACE WATER DATA COMPARED TO FRESHWATER SCREENING VALUES
SITE 10 - ORIGINAL BASE LANDFILL
MARINE CORPS BASE, CAMP LEJUENE
NORTH CAROLINA

Analyte	Contaminant Frequency/Range					Surface Water Screening Levels (SWSL)	Reference	Max. HQ (2)	ECOC?	Comments	Mean HQ (3)
	Frequency of Detection	Range of Positive Detections	Range of Non-Detects	Arithmetic Mean (Half Non-Detects)	Value used in Screen (1)						
Pesticides/PCBs (ug/L)(Cont):											
4,4'-DDD	0/4	NA	0.1U	0.05	0.1	0.0064	USEPA Region IV	15.63	Yes	HQ > 1.0	7.81
Endosulfan sulfate	0/4	NA	0.1U	0.05	0.1	NE	--	NA	Yes	No SWSL	--
4,4'-DDT	0/4	NA	0.1U	0.05	0.1	0.001	USEPA Region IV	100	Yes	HQ > 1.0	50
Methoxychlor	0/4	NA	0.5UJ	0.25	0.5	NE	--	NA	Yes	No SWSL	--
Endrin ketone	0/4	NA	0.1U	0.05	0.1	NE	--	NA	Yes	No SWSL	--
Endrin aldehyde	0/4	NA	0.1U	0.05	0.1	NE	--	NA	Yes	No SWSL	--
alpha-Chlordane	0/4	NA	0.05U	0.03	0.05	0.0043	USEPA Region IV	11.63	Yes	HQ > 1.0	5.81
gamma-Chlordane	0/4	NA	0.05U	0.03	0.05	0.0043	USEPA Region IV	11.63	Yes	HQ > 1.0	5.81
Toxaphene	0/4	NA	5U	2.50	5	0.0002	USEPA Region IV	25000	Yes	HQ > 1.0	12500
Aroclor-1016	0/4	NA	1U	0.50	1	0.014	USEPA Region IV	71.43	Yes	HQ > 1.0	35.71
Aroclor-1221	0/4	NA	2U	1.00	2	0.014	USEPA Region IV	142.86	Yes	HQ > 1.0	71.43
Aroclor-1232	0/4	NA	1U	0.50	1	0.014	USEPA Region IV	71.43	Yes	HQ > 1.0	35.71
Aroclor-1242	0/4	NA	1U	0.50	1	0.014	USEPA Region IV	71.43	Yes	HQ > 1.0	35.71
Aroclor-1248	0/4	NA	1U	0.50	1	0.014	USEPA Region IV	71.43	Yes	HQ > 1.0	35.71
Aroclor-1254	0/4	NA	1U	0.50	1	0.014	USEPA Region IV	71.43	Yes	HQ > 1.0	35.71
Aroclor-1260	0/4	NA	1U	0.50	1	0.014	USEPA Region IV	71.43	Yes	HQ > 1.0	35.71
Total Inorganics (ug/L):											
Aluminum	4/4	127J - 931	NA	346.25	931	87	USEPA Region IV	10.70	Yes	HQ > 1.0	3.98
Antimony	0/4	NA	60U	30.00	60	160	USEPA Region IV	0.38	No	HQ < 1.0	--
Arsenic	4/4	2.4J - 5J	NA	3.38	5	190	USEPA Region IV	0.03	No	HQ < 1.0	--
Barium	4/4	24J - 37.1J	NA	27.80	37.1	NE	--	NA	Yes	No SWSL	--
Beryllium	0/4	NA	5U	2.50	5	0.53	USEPA Region IV	9.43	Yes	HQ > 1.0	4.72
Cadmium	0/4	NA	5U	2.50	5	0.97	USEPA Region IV	5.17	Yes	HQ > 1.0	2.58
Chromium, Total	0/4	NA	3.2U - 10U	3.44	10	NE	--	NA	Yes	No SWSL	--
Cobalt	0/4	NA	50U	25.00	50	NE	--	NA	Yes	No SWSL	--

TABLE 7-5
FREQUENCY AND RANGE OF SURFACE WATER DATA COMPARED TO FRESHWATER SCREENING VALUES
SITE 10 - ORIGINAL BASE LANDFILL
MARINE CORPS BASE, CAMP LEJUENE
NORTH CAROLINA

Analyte	Contaminant Frequency/Range					Surface Water Screening Levels (SWSL)	Reference	Max. HQ (2)	ECOC?	Comments	Mean HQ (3)
	Frequency of Detection	Range of Positive Detections	Range of Non-Detects	Arithmetic Mean (Half Non-Detects)	Value used in Screen (1)						
Total Inorganics (ug/L)(Cont):											
Copper	1/4	3J - 3J	2.5U - 10.7U	2.83	3	10.07	USEPA Region IV	0.30	No	HQ < 1.0	--
Iron	4/4	424 - 2210	NA	1026.50	2210	1000	USEPA Region IV	2.21	Yes	HQ > 1.0	1.03
Lead	4/4	1.1J - 7.1	NA	3.00	7.1	2.51	USEPA Region IV	2.83	Yes	HQ > 1.0	1.20
Manganese	4/4	45.9 - 415	NA	168.70	415	NE	--	NA	Yes	No SWSL	--
Mercury	2/4	0.05J - 0.06J	0.2U	0.08	0.06	0.012	USEPA Region IV	5.00	Yes	HQ > 1.0	6.46
Nickel	0/4	NA	40U	20.00	40	135	USEPA Region IV	0.30	No	HQ < 1.0	--
Selenium	0/4	NA	4U - 5U	2.38	5	5	USEPA Region IV	1.00	Yes	HQ > 1.0	0.48
Silver	0/4	NA	10U	5.00	10	0.012	USEPA Region IV	833	Yes	HQ > 1.0	417
Thallium	0/4	NA	10U	5.00	10	4	USEPA Region IV	2.50	Yes	HQ > 1.0	1.25
Vanadium	4/4	13.8J - 19.8J	NA	17.35	19.8	NE	--	NA	Yes	No SWSL	--
Zinc	4/4	39.9 - 95.9	NA	57.73	95.9	90	USEPA Region IV	1.06	Yes	HQ > 1.0	0.64
Cyanide, Total	0/4	NA	10U	5.00	10	5.2	USEPA Region IV	1.92	Yes	HQ > 1.0	0.96

Notes:

HQ = Hazard Quotient
ECOC = Ecological Contaminant of Concern
ug/L = microgram per liter
USEPA = United States Environmental Protecion Agency

NA = Not Applicable
NE = Note Established
J = Estimated Value

U = Chemical was not detected above the method detection limit
UJ = Estimated method detection limit

(1) The value used in the screen represents the maximum detected or non-detected concentration.
(2) The maximum HQ represents the value used in the screen divided by the freshwater screening value.
(3) The mean HQ represents the mean (half non-detect) concentration divided by the screening value. In cases where the mean exceeds the maximum the maximum value is used.
(4) The screening value for this compound is pH dependent. A pH of 7.8 S.U. was assumed.
(5) The surface water screening value shown is for trivalent arsenic.
(6) This screening value is hardness dependent. The mean hardness value of 89.2 mg/L $CaCO_3$ was calculated by using the following USEPA equation: 2.497(Ca, mg/L) + 4.118(Mg, mg/L).

TABLE 7-6
FREQUENCY AND RANGE OF GROUNDWATER DATA COMPARED TO FRESHWATER SCREENING VALUES
SITE 10 - ORIGINAL BASE LANDFILL
MARINE CORPS BASE, CAMP LEJUENE
NORTH CAROLINA

Analyte	Contaminant Frequency/Range					Surface Water Screening Levels (SWSL)	Reference	Max. HQ (2)	ECOC?	Comments	Mean HQ (3)
	Frequency of Detection	Range of Positive Detections	Range of Non-Detects	Arithmetic Mean (Half Non-Detects)	Value used in Screen (1)						
Total Inorganics (ug/L):											
Aluminum	6/7	398J - 3150J	186U	1105.86	3150	87.0	USEPA Region IV	36.21	Yes	HQ > 1.0	12.71
Antimony	0/7	NA	2.5U	1.25	2.5	160	USEPA Region IV	0.02	No	HQ < 1.0	--
Arsenic	0/7	NA	4.2U	2.10	4.2	190	USEPA Region IV	0.02	No	HQ < 1.0	--
Barium	7/7	17.6J - 29.7J	NA	26.23	29.7	NE	--	NA	Yes	No SWSL	--
Beryllium	0/7	NA	0.18U - 0.24U	0.11	0.24	0.53	USEPA Region IV	0.45	No	HQ < 1.0	--
Cadmium	0/7	NA	0.6U	0.30	0.6	0.97	USEPA Region IV	0.62	No	HQ < 1.0	--
Chromium	1/7	8.4J - 8.4J	0.6U - 5.4U	2.69	8.4	NE	--	NA	Yes	No SWSL	--
Cobalt	5/7	0.82J - 1.4J	0.7U	0.84	1.4	NE	--	NA	Yes	No SWSL	--
Copper	6/7	0.88J - 3.4J	0.7U	1.53	3.4	10.1	USEPA Region IV	0.34	No	HQ < 1.0	--
Iron	7/7	94.9J - 1110J	NA	452.84	1110	1000	USEPA Region IV	1.11	Yes	HQ > 1.0	0.45
Lead	1/7	2.9J - 2.9J	1.7U	1.14	2.9	2.5	USEPA Region IV	1.16	Yes	HQ > 1.0	0.46
Manganese	7/7	14.3J - 49.8	NA	24.13	49.8	NE	--	NA	Yes	No SWSL	--
Mercury	0/7	NA	0.1UJ	0.05	0.1	0.01	USEPA Region IV	8.33	Yes	HQ > 1.0	4.17
Nickel	7/7	1.8J - 10.6J	NA	6.94	10.6	135	USEPA Region IV	0.08	No	HQ < 1.0	--
Selenium	0/7	NA	4.8U	2.40	4.8	5	USEPA Region IV	0.96	No	HQ < 1.0	--
Silver	1/7	0.58J - 0.58J	0.5U	0.30	0.58	0.01	USEPA Region IV	48.33	Yes	HQ > 1.0	24.76
Thallium	0/7	NA	6.2U	3.10	6.2	4	USEPA Region IV	1.55	Yes	HQ > 1.0	0.78
Vanadium	5/7	0.95J - 4.2J	0.7U	1.56	4.2	NE	--	NA	Yes	No SWSL	--
Zinc	2/7	2.5J - 8.3J	1.1U	1.94	8.3	90.4	USEPA Region IV	0.09	No	HQ < 1.0	--

Notes:

HQ = Hazard Quotient
NA = Not Applicable
ug/L = microgram per liter

NE = Note Established
ECOC = Ecological Contaminant of Concern
U = Chemical was not detected above the method detection limit

J = Estimated Value

(1) The value used in the screen represents the maximum detected or non-detected concentration.

(2) The maximum HQ represents the value used in the screen divided by the freshwater screening value.

(3) The mean HQ represents the mean (half non-detect) concentration divided by the screening value. In cases where the mean exceeds the maximum the maximum value is used.

(4) The screening value for this compound is pH dependent. A pH of 7.8 S.U. was assumed.

(5) The surface water screening value shown is for trivalent arsenic.

(6) This screening value is hardness dependent. The mean hardness value of 89.2 mg/L $CaCO_3$ was calculated by using the following USEPA equation: 2.497(Ca, mg/L) + 4.118(Mg, mg/L).

TABLE 7-7
SUMMARY OF ECOLOGICAL CHEMICALS OF CONCERN IN SURFACE SOIL
SITE 10 - ORIGINAL BASE LANDFILL
MARINE CORPS BASE, CAMP LEJUENE
NORTH CAROLINA

The Detected Concentrations of the Chemical in the Surface Soil Exceeded the Screening Value	The Method Detection Limit for the Chemical in the Surface Soil Exceeded the Screening Value	Non-Detected Chemicals Lacking a USEPA Region IV Surface Soil Screening Value	Detected Chemicals Lacking a USEPA Region IV Surface Soil Screening Value
Trichloroethene	Vinyl chloride	Chloromethane	1,1-Dichloroethene
Phenanthrene	Chloroform	Bromomethane	Benzo(a)anthracene
Fluoranthene	Phenol	Chloroethane	Chrysene
Pyrene	Naphthalene	Methylene chloride	Benzo(b)fluoranthene
Dieldrin	Hexachlorobenzene	Acetone	Benzo(k)fluoranthene
Endrin	Pentachlorophenol	Carbon disulfide	Indeno(1,2,3-cd)pyrene
4,4'-DDT	Anthracene	1,1-Dichloroethane	Benzo(g,h,i)perylene
Aroclor-1260	alpha-BHC	1,2-Dichloroethene (total)	Heptachlor
Aluminum	beta-BHC	2-Butanone	Heptachlor epoxide
Antimony	gamma-BHC (Lindane)	1,1,1-Trichloroethane	Endosulfan I
Arsenic	Aldrin	Bromodichloromethane	Endrin aldehyde
Barium	4,4'-DDD	cis-1,3-Dichloropropene	
Beryllium	Aroclor-1016	Dibromochloromethane	
Chromium	Aroclor-1221	1,1,2-Trichloroethane	
Copper	Aroclor-1232	trans-1,3-Dichloropropene	
Iron	Aroclor-1242	Bromoform	
Lead	Aroclor-1248	4-Methyl-2-pentanone	
Mercury	Aroclor-1254	2-Hexanone	
Selenium	Thallium	1,1,2,2-Tetrachloroethane	
Silver	Total Cyanide	bis(2-Chloroethyl)ether	
Vanadium		2-Chlorophenol	
Zinc		1,3-Dichlorobenzene	
		1,4-Dichlorobenzene	
		1,2-Dichlorobenzene	
		3,3'-Dichlorobenzidine	
		2,2'-Oxybis(1-Chloropropane)	
		N-Nitrosodi-n-propylamine	
		4-Methylphenol	

TABLE 7-7 (continued)
SUMMARY OF ECOLOGICAL CHEMICALS OF CONCERN IN SURFACE SOIL
SITE 10 - ORIGINAL BASE LANDFILL
MARINE CORPS BASE, CAMP LEJUENE
NORTH CAROLINA

The Detected Concentrations of the Chemical in the Surface Soil Exceeded the Screening Value	The Method Detection Limit for the Chemical in the Surface Soil Exceeded the Screening Value	Non-Detected Chemicals Lacking a USEPA Region IV Surface Soil Screening Value	Detected Chemicals Lacking a USEPA Region IV Surface Soil Screening Value
		Hexachloroethane	
		Isophorone	
		2-Nitroaniline	
		2,4-Dimethylphenol	
		bis(2-Chloroethoxy)methane	
		2,4-Dichlorophenol	
		1,2,4-Trichlorobenzene	
		4-Chloroaniline	
		Hexachlorobutadiene	
		4-Chloro-3-methylphenol	
		2-Methylnaphthalene	
		2-Chloronaphthalene	
		2-Methylphenol	
		Acenaphthylene	
		2,6-Dinitrotoluene	
		3-Nitroaniline	
		Dibenzofuran	
		2,4-Dinitrotoluene	
		4-Chlorophenyl phenyl ether	
		4-Nitroaniline	
		4,6-Dinitro-2-methylphenol	
		4-Bromophenyl phenyl ether	
		Carbazole	
		Butyl benzyl phthalate	
		2-Nitrophenol	
		Benzo(a)anthracene	
		bis(2-Ethylhexyl)phthalate	
		Di-n-octyl phthalate	
		Indeno(1,2,3-cd)pyrene	

TABLE 7-7 (continued)
SUMMARY OF ECOLOGICAL CHEMICALS OF CONCERN IN SURFACE SOIL
SITE 10 - ORIGINAL BASE LANDFILL
MARINE CORPS BASE, CAMP LEJUENE
NORTH CAROLINA

The Detected Concentrations of the Chemical in the Surface Soil Exceeded the Screening Value	The Method Detection Limit for the Chemical in the Surface Soil Exceeded the Screening Value	Non-Detected Chemicals Lacking a USEPA Region IV Surface Soil Screening Value	Detected Chemicals Lacking a USEPA Region IV Surface Soil Screening Value
		Dibenz(a,h)anthracene	
		Benzo(g,h,i)perylene	
		delta-BHC	
		Endosulfan II	
		Endosulfan sulfate	
		Methoxychlor	
		Endrin ketone	
		alpha-Chlordane	
		gamma-Chlordane	
		Toxaphene	

TABLE 7-8
SUMMARY OF ECOLOGICAL CHEMICALS OF CONCERN IN SEDIMENT
SITE 10 - ORIGINAL BASE LANDFILL
MARINE CORPS BASE, CAMP LEJUENE
NORTH CAROLINA

The Detected Concentration of the Chemical in the Sediment Exceeded the Screening Value	The Method Detection Limit for the Chemical in the Sediment Exceeded the Screening Value	Non-Detected Chemicals Lacking USEPA Region IV Sediment Screening Value	Detected Chemicals Lacking USEPA Region IV Sediment Screening Value
	Naphthalene	Chloromethane	2-Butanone
	2-Methylnaphthalene	Bromomethane	Toluene
	Acenaphthylene	Vinyl chloride	Aluminum
	Acenaphthene	Chloroethane	Barium
	Fluorene	Methylene chloride	Iron
	Phenanthrene	Acetone	Manganese
	Anthracene	Carbon disulfide	Selenium
	Fluoranthene	1,1-Dichloroethene	
	Pyrene	1,1-Dichloroethane	
	Benzo(a)anthracene	1,2-Dichloroethene (total)	
	Chrysene	Chloroform	
	bis(2-Ethylhexyl) phthalate	1,2-Dichloroethane	
	Benzo(a)pyrene		
	Dibenz(a,h)anthracene	1,1,1-Trichloroethane	
	gamma-BHC (Lindane)	Carbon tetrachloride	
	Dieldrin	Bromodichloromethane	
	4,4'-DDE	1,2-Dichloropropane	
	Endrin	cis-1,3-Dichloropropene	
	4,4'-DDD	Trichloroethene	
	4,4'-DDT	Dibromochloromethane	
	alpha-Chlordane	1,1,2-Trichloroethane	
	gamma-Chlordane	Benzene	
	Aroclor 1016	trans-1,3-Dichloropropene	
	Aroclor 1221	Bromoform	
	Aroclor 1232	4-Methyl-2-pentanone	
	Aroclor 1242	2-Hexanone	
	Aroclor 1248	Tetrachloroethene	
	Aroclor 1254	1,1,2,2-Tetrachloroethane	

TABLE 7-8 (continued)
SUMMARY OF ECOLOGICAL CHEMICALS OF CONCERN IN SEDIMENT
SITE 10 - ORIGINAL BASE LANDFILL
MARINE CORPS BASE, CAMP LEJUENE
NORTH CAROLINA

The Detected Concentration of the Chemical in the Sediment Exceeded the Screening Value	The Method Detection Limit for the Chemical in the Sediment Exceeded the Screening Value	The Chemical Does Not have a USEPA Region IV Sediment Screening Value	Detected Chemicals Lacking USEPA Region IV Sediment Screening Value
	Aroclor 1260	Chlorobenzene	
	Antimony	Ethylbenzene	
	Cadmium	Styrene	
	Silver	Xylenes (total)	
		Phenol	
		bis(2-Chloroethyl) ether	
		2-Chlorophenol	
		1,3-Dichlorobenzene	
		1,4-Dichlorobenzene	
		1,2-Dichlorobenzene	
		3,3'-Dichlorobenzidine	
		2,2'-Oxybis(1-Chloropropane)	
		N-Nitrosodi-n-propylamine	
		4-Methylphenol	
		Hexachloroethane	
		Nitrobenzene	
		Isophorone	
		2-Nitroaniline	
		2,4-Dimethylphenol	
		bis(2-Chloroethoxy)methane	
		2,4-Dichlorophenol	
		1,2,4-Trichlorobenzene	
		4-Chloroaniline	
		Hexachlorobutadiene	
		4-Chloro-3-methylphenol	
		Hexachlorocyclopentadiene	

TABLE 7-8 (continued)
SUMMARY OF ECOLOGICAL CHEMICALS OF CONCERN IN SEDIMENT
SITE 10 - ORIGINAL BASE LANDFILL
MARINE CORPS BASE, CAMP LEJUENE
NORTH CAROLINA

The Detected Concentration of the Chemical in the Sediment Exceeded the Screening Value	The Method Detection Limit for the Chemical in the Sediment Exceeded the Screening Value	The Chemical Does Not have a USEPA Region IV Sediment Screening Value	Detected Chemicals Lacking USEPA Region IV Sediment Screening Value
		2,4,6-Trichlorophenol	
		2,4,5-Trichlorophenol	
		2-Chloronaphthalene	
		2-Methylphenol	
		Dimethyl phthalate	
		2,6-Dinitrotoluene	
		3-Nitroaniline	
		2,4-Dinitrophenol	
		4-Nitrophenol	
		Dibenzofuran	
		2,4-Dinitrotoluene	
		Diethyl phthalate	
		4-Chlorophenyl phenyl ether	
		4-Nitroaniline	
		4,6-Dinitro-2-methylphenol	
		N-Nitrosodiphenylamine	
		4-Bromophenyl phenyl ether	
		Hexachlorobenzene	
		Pentachlorophenol	
		Carbazole	
		Di-n-butyl phthalate	
		Butyl benzyl phthalate	
		2-Nitrophenol	
		Di-n-octyl phthalate	
		Benzo(b)fluoranthene	
		Benzo(k)fluoranthene	

TABLE 7-8 (continued)
SUMMARY OF ECOLOGICAL CHEMICALS OF CONCERN IN SEDIMENT
SITE 10 - ORIGINAL BASE LANDFILL
MARINE CORPS BASE, CAMP LEJUENE
NORTH CAROLINA

The Detected Concentration of the Chemical in the Sediment Exceeded the Screening Value	The Method Detection Limit for the Chemical in the Sediment Exceeded the Screening Value	The Chemical Does Not have a USEPA Region IV Sediment Screening Value	Detected Chemicals Lacking USEPA Region IV Sediment Screening Value
		Indeno(1,2,3-cd)pyrene	
		Benzo(ghi)perylene	
		alpha-BHC	
		beta-BHC	
		delta-BHC	
		Heptachlor	
		Aldrin	
		Heptachlor epoxide	
		Endosulfan I	
		Endosulfan II	
		Endosulfan sulfate	
		Methoxychlor	
		Endrin ketone	
		Endrin aldehyde	
		Toxaphene	
		Beryllium	
		Cobalt	
		Thallium	
		Vanadium	
		Total Cyanide	

TABLE 7-9
SUMMARY OF ECOLOGICAL CHEMICALS OF CONCERN IN SURFACE WATER
SITE 10 - ORIGINAL BASE LANDFILL
MARINE CORPS BASE, CAMP LEJUENE
NORTH CAROLINA

The Detected Concentration of the Chemical in the Surface Water Exceeded the Screening Value	The Method Detection Limit for the Chemical in the Surface Water Exceeded the Screening Value	Non-Detected Chemicals Lacking a USEPA Region IV Surface Water Screening Value	Detected Chemicals Lacking a USEPA Region IV Surface Water Screening Value
Aluminum	Hexachloroethane	Chloromethane	Barium
Iron	Hexachlorobutadiene	Bromomethane	Manganese
Lead	4-Chloro-3-methylphenol	Vinyl chloride	Vanadium
Mercury	Hexachlorocyclopentadiene	Chloroethane	
Zinc	2,4,6-Trichlorophenol	Acetone	
	2,4-Dinitrophenol	Carbon disulfide	
	4,6-Dinitro-2-methylphenol	1,1-Dichloroethane	
	Pentachlorophenol	1,2-Dichloroethene (total)	
	Di-n-butylphthalate	2-Butanone	
	bis(2-Ethylhexyl)phthalate	Bromodichloromethane	
	Heptachlor	Trichloroethene	
	Heptachlor epoxide	Dibromochloromethane	
	Dieldrin	4-Methyl-2-pentanone	
	Endrin	2-Hexanone	
	Endosulfan II	Styrene	
	4,4'-DDD	Xylenes (total)	
	4,4'-DDT	bis(2-Chloroethyl)ether	
	alpha-Chlordane	3,3'-Dichlorobenzidine	
	gamma-Chlordane	2,2'-Oxybis(1-Chloropropane)	
	Toxaphene	N-Nitrosodi-n-propylamine	
	Aroclor-1016	4-Methylphenol	
	Aroclor-1221	2-Nitroaniline	
	Aroclor-1232	bis(2-Chloroethoxy)methane	
	Aroclor-1242	4-Chloroaniline	
	Aroclor-1248	2-Methylnaphthalene	
	Aroclor-1254	2,4,5-Trichlorophenol	
	Aroclor-1260	2-Chloronaphthalene	
	Beryllium	2-Methylphenol	
	Cadmium	Acenaphthalene	

TABLE 7-9 (continued)
SUMMARY OF ECOLOGICAL CHEMICALS OF CONCERN IN SURFACE WATER
SITE 10 - ORIGINAL BASE LANDFILL
MARINE CORPS BASE, CAMP LEJUENE
NORTH CAROLINA

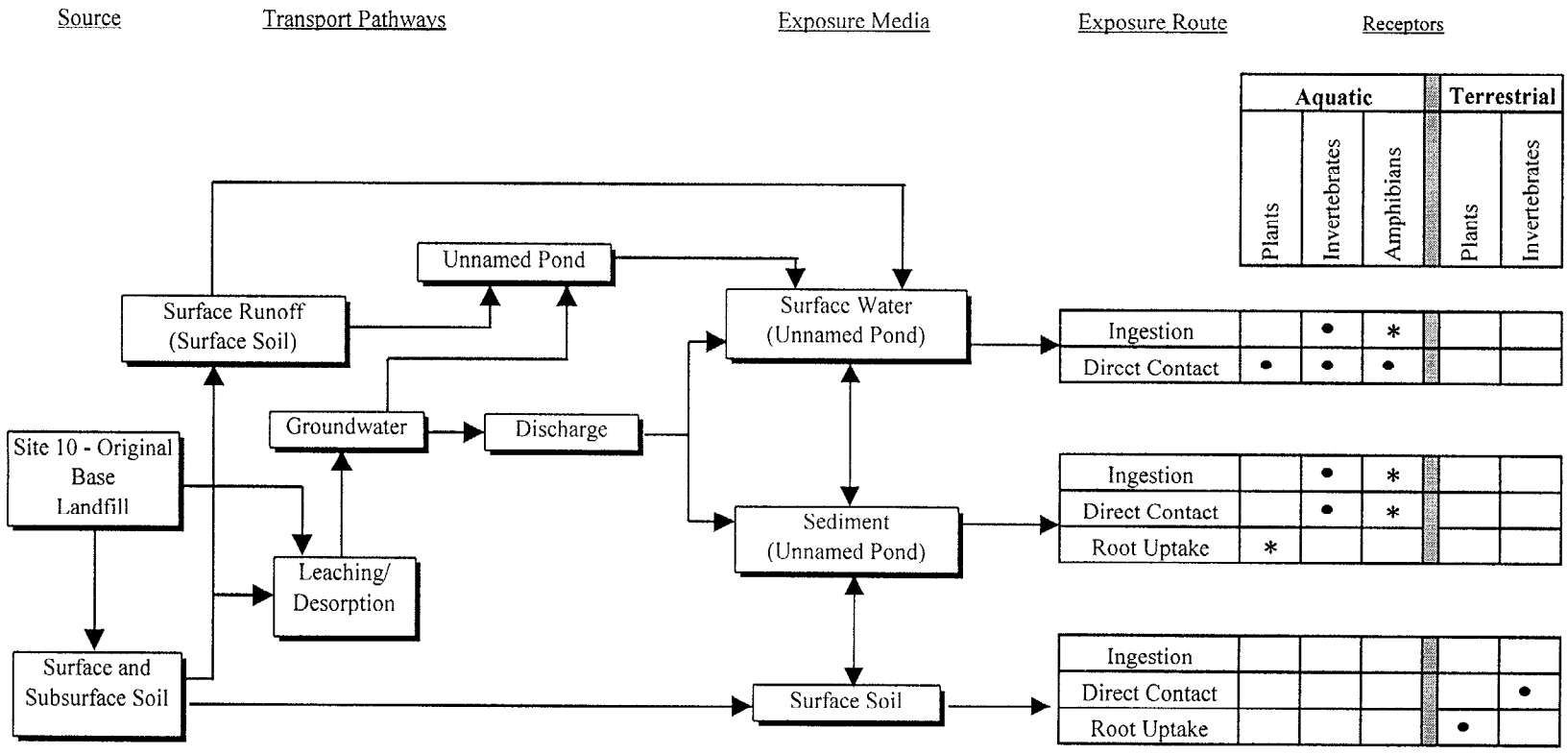
The Detected Concentration of the Chemical in the Surface Water Exceeded the Screening Value	The Method Detection Limit for the Chemical in the Surface Water Exceeded the Screening Value	The Chemical Does Not have a USEPA Region IV Surface Water Screening Value	Detected Chemicals Lacking a USEPA Region IV Surface Water Screening Value
	Selenium	2,6-Dinitrotoluene	
	Silver	3-Nitroaniline	
	Thallium	Dibenzofuran	
	Cyanide, Total	4-Chlorophenyl phenyl ether	
		Fluorene	
		4-Nitroaniline	
		4-Bromophenyl phenyl ether	
		Hexachlorobenzene	
		Phenanthrene	
		Anthracene	
		Carbazole	
		Pyrene	
		Benzo(a)anthracene	
		Chrysene	
		Di-n-octyl phthalate	
		Benzo(b)fluoranthene	
		Benzo(k)fluoranthene	
		Benzo(a)pyrene	
		Indeno(1,2,3-cd)pyrene	
		Dibenz(a,h)anthracene	
		Benzo(g,h,i)perylene	
		delta-BHC	
		Endosulfan sulfate	
		Methoxychlor	
		Endrin ketone	
		Endrin aldehyde	
		Chromium, Total	
		Cobalt	

TABLE 7-10
SUMMARY OF ECOLOGICAL CHEMICALS OF CONCERN IN GROUNDWATER
SITE 10 - ORIGINAL BASE LANDFILL
MARINE CORPS BASE, CAMP LEJUENE
NORTH CAROLINA

The Detected Concentration of th Chemical in the Groundwater Exceeded the Screening Value	The Method Detection Limit for the Chemical in the Groundwater Exceeded the Screening Value	Non-detected Chemical Lacking a USEPA Region IV Surface Water Screening Value	Detected Chemical Lacking a USEPA Region IV Surface Water Screening Value
Aluminum	Mercury	Barium	Barium
Iron	Thallium	Chromium, Total	Chromium
Lead		Cobalt	Cobalt
Silver		Manganese	Manganese
		Vanadium	Vanadium

SECTION 7.0 FIGURES

FIGURE 7-1
PRELIMINARY ECOLOGICAL CONCEPTUAL MODEL
SITE 10 - ORIGINAL BASE LANDFILL
MARINE CORPS BASE, CAMP LEJUENE,
NORTHCAROLINA



Solid line indicates a potential complete and significant transport/exposure pathway that was evaluated

• Receptor evaluated quantitatively

* Receptor not evaluated quantitatively

8.0 CONCLUSIONS AND RECOMMENDATIONS

This section presents conclusions and recommendations based on the data obtained during the Phase I and Phase II investigations conducted at Site 10 and reported in the previous sections of this report. The conclusions are as follows:

- Very few volatile organic compounds (VOCs) were detected in the surface and subsurface soil samples collected at the site during the Phase I investigation. The only VOCs that were detected in excess of the target concentrations for soils were methylene chloride and acetone. Both of these compounds are common laboratory contaminants and are not suspected to be site related.

- No VOCs were detected in groundwater samples collected at the site.

- Toluene was the only VOC detected in surface water samples, and toluene and 2-butanone were the only VOCs detected in sediment samples collected at the site. Both are common laboratory contaminants, however the detections of toluene may be due to activities conducted at the site (i.e., military maneuvers).

- A fairly large number of semivolatiles (SVOCs) were detected in the soils collected for analysis during the Phase I investigation. The majority of the detections appear to be concentrated in the northern-most portion of the site, near soil boring IR10-SB03. The log for this soil boring indicates that charred wood and fill material was observed within the sampling interval. The high concentration of polynuclear aromatic hydrocarbons (PAHs) may be the result of the combustion of materials buried in the vicinity of soil boring IR10-SB03.

- No SVOCs were detected in groundwater, surface water or sediment samples collected at the site.

- A few pesticides were detected in soil samples at concentrations exceeding the target concentrations. Heptachlor, heptachlor epoxide and endrin were detected in the surface soil sample collected from soil boring IR10-SB09. Since pesticides were not detected

throughout the site (as would be the case if pesticide application was the source of contamination), an isolated spill is suspected for their detection.

- No pesticides were detected in any groundwater and surface water samples. Two pesticides were detected in sediment samples collected from the southwestern pond.

- Polychlorinated Biphenols (PCBs) were detected in a surface soil sample collected from soil boring IR10-SB04. Arochlor 1260 was detected in the same area as most of the PAHs were detected. The source of this contamination may be the same as the PAHs, material burned at the site. PCBs were not detected in any other sample collected at the site.

- The inorganic concentrations detected in the soils, groundwater, sediment and surface water samples collected across the site may be the result of the breakdown of buried materials at the site.

- The Phase II investigation detected inorganic concentrations in groundwater at concentrations a magnitude lower than the previous investigation. Iron was the only contaminant to exceed North Carolina 2 L Groundwater Protection Standards. Previous investigations have shown that elevated iron concentrations are naturally occurring throughout the Base.

- Carcinogenic and non-carcinogenic risks calculated for military personnel, adult trespassers and older child trespassers under the current scenario were determined to be within acceptable ranges. Carcinogenic and noncarcinogenic risks for the future child and adult residents and determined to be within acceptable ranges. Carcinogenic risks for construction workers under the future scenario were determined to be within acceptable ranges. In the subsurface soil exposure scenario, there are potential noncarcinogenic adverse health effects from ingestion and dermal contact by the construction worker. However, it should be noted that the acceptable risk level is not exceeded for any one organ system/target organ, and iron (which has uncertainties associated with its toxicity) accounted for approximately 35 percent of the elevated noncarcinogenic effect. Therefore, using this conservative approach in the risk assessment may overestimate the noncarcinogenic effects in the construction worker scenario.

- The ecological risk screening indicates that risk to aquatic receptor groups (e.g., aquatic plants, amphibians, etc.) may exist in surface water and groundwater due to inorganics detected during the SI. However, it was noted that the conservative nature of this screening may have overestimated risks. Upper trophic level aquatic receptors were not evaluated as part of this ecological risk screening, therefore, chemicals detected in surface water/sediment may present unacceptable risk to these receptors.

Based on the findings of this investigation, Baker recommends that no further action be taken at this site.

APPENDIX A
TEST BORING AND WELL CONSTRUCTION RECORDS

Baker

Baker Environmental

TEST BORING AND WELL CONSTRUCTION RECORD

PROJECT: Site 10 - Original Base Landfill, MCB, Camp Lejeune, Jacksonville, North Carolina

CTO NO.: 62470-369 BORING NO.: IR10-SB01

COORDINATES: EAST: 2501462.274 NORTH: 346689.0181

ELEVATION: SURFACE: 24.34 TOP OF PVC CASING: N/A

Rig: CME Drill Rig with Geoprobe Attachment									
	Split Spoon	Casing	Augers	Geoprobe Samplier	Date	Progress (Ft.)	Weather	Depth to Water (Ft.)	Time
Size (ID)				0.75 inch	3/18/98	9.0	warm	5.9	7:05
Length				2.0 feet					
Type				Geoprobe					
Hammer Wt.									
Fall									
Stickup									

Remarks: Soil Boring was advanced with a Geoprobe samplier

SAMPLE TYPE

S = Split Spoon
T = Shelby Tube
R = Air Rotary
D = Denison
N = No Sample
A = Auger
W = Wash
C = Core
G = Geoprobe
HA = Hand Auger

DEFINITIONS

Sample I.D. = Sample Identification
PID = Photo Ionization Detector measurement
BG = Reading at point source same as background
SAA = Same As Above

Depth (Ft.)	Sample Type & No.	Sample Rec. (Ft.,%)	Sample I.D.	PID (ppm)	Visual Description	Elevation (Ft. MSL)
1	HA-1	1.0	369-SB01-00	BG	Light Grey, **SAND**, fine grained, trace silt, dry	
2	G-1	2.0		BG	Note: At 0.8 feet, color changes to Dark Brown	23.54
3					Note: At 1.4 feet, color changes to Light Brown	22.94
4	G-2	1.8		BG	SAA	
5						
6	G-3	1.6	369-SB01-02	BG	SAA	
7						
8	G-4	2.0		BG	SAA	
9					9.0 9.0	15.34
10					**Terminated at 9.0 feet**	

DRILLING CO.: Parratt-Wolff, Inc. BAKER REP.: James S. Culp

DRILLER: Layne Pech BORING NO.: IR10-SB01 SHEET 1 OF 1

Baker

Baker Environmental

TEST BORING AND WELL CONSTRUCTION RECORD

PROJECT:	Site 10 - Original Base Landfill, MCB, Camp Lejeune, Jacksonville, North Carolina		
CTO NO.:	62470-369	BORING NO.:	IR10-SB02
COORDINATES:	EAST: 2501354.941	NORTH:	346908.0154
ELEVATION:	SURFACE: 25.14	TOP OF PVC CASING:	N/A

Rig: CME Drill Rig with Geoprobe Attachment

	Split Spoon	Casing	Augers	Geoprobe Samplier	Date	Progress (Ft.)	Weather	Depth to Water (Ft.)	Time
Size (ID)				0.75 inch	3/18/98	9.0	warm	6.8	7:41
Length				2.0 feet					
Type				Geoprobe					
Hammer Wt.									
Fall									
Stickup									

Remarks: Soil Boring was advanced with a Geoprobe samplier

SAMPLE TYPE

S = Split Spoon
T = Shelby Tube
R = Air Rotary
D = Denison
N = No Sample
A = Auger
W = Wash
C = Core
G = Geoprobe
HA = Hand Auger

DEFINITIONS

Sample I.D. = Sample Identification
PID = Photo Ionization Detector measurement
BG = Reading at point source same as background
SAA = Same As Above

Depth (Ft.)	Sample Type & No.	Sample Rec. (Ft.,%)	Sample I.D.	PID (ppm)	Visual Description	Elevation (Ft. MSL)
1	HA-1	1.0	369-SB01-00	BG	Light Grey, **SAND**, fine grained, trace silt, dry Note: At 0.5 feet, color changes to Light Brown	24.64
2 3	G-1	2.0		BG	Note: At 1.5 feet, color changes to Dark Brown	23.64
4 5	G-2	1.8		BG	SAA	
6 7	G-3	1.6	369-SB01-02	BG	SAA	
8 9	G-4	2.0		BG	Note: At 7.7 feet, color changes to Light Brown 9.0 9.0	17.44 16.14
10					**Terminated at 9.0 feet**	

DRILLING CO.:	Parratt-Wolff, Inc.	BAKER REP.:	James S. Culp
DRILLER:	Layne Pech	BORING NO.:	IR10-SB02 SHEET 1 OF 1

Baker

Baker Environmental

TEST BORING AND WELL CONSTRUCTION RECORD

PROJECT:	Site 10 - Original Base Landfill, MCB, Camp Lejeune, Jacksonville, North Carolina		
CTO NO.:	62470-369	BORING NO.:	IR10-SB03
COORDINATES:	EAST: 2501147.618	NORTH:	346789.8182
ELEVATION:	SURFACE: 22.54	TOP OF PVC CASING:	N/A

Rig: CME Drill Rig with Geoprobe Attachment	Split Spoon	Casing	Augers	Geoprobe Samplier	Date	Progress (Ft.)	Weather	Depth to Water (Ft.)	Time
Size (ID)				0.75 inch	3/18/98	9.0	warm	8.8	8:07
Length				2.0 feet					
Type				Geoprobe					
Hammer Wt.									
Fall									
Stickup									

Remarks: Soil Boring was advanced with a Geoprobe samplier

SAMPLE TYPE

S = Split Spoon
T = Shelby Tube
R = Air Rotary
D = Denison
N = No Sample
A = Auger
W = Wash
C = Core
G = Geoprobe
HA = Hand Auger

DEFINITIONS

Sample I.D. = Sample Identification
PID = Photo Ionization Detector measurement
BG = Reading at point source same as background
SAA = Same As Above

Depth (Ft.)	Sample Type & No.	Sample Rec. (Ft.,%)	Sample I.D.	PID (ppm)	Visual Description	Elevation (Ft. MSL)
1	HA-1	1.0	369-SB03-00	BG	Light Brown, **SAND**, fine grained, trace silt, dry	
2	G-1	0.9		BG	2.3	20.24
3					Rusted Metal, Broken Glass, Brick Debris, Charred Wood, Clay (fill material)	
4	G-2	0.5		BG	SAA	
5						
6	G-3	0.4	369-SB03-03	BG	Note: Sampled 5 - 7 and 7 - 9 foot intervals due to a lack of sample recovery in both intervals	
7						
8	G-4	0.6		BG	SAA	
9					8.4 Light Brown, **SAND**, trace silt, wet	14.14 13.54
10					**Terminated at 9.0 feet**	

DRILLING CO.:	Parratt-Wolff, Inc.	BAKER REP.:	James S. Culp
DRILLER:	Layne Pech	BORING NO.:	IR10-SB03 SHEET 1 OF 1

Baker

Baker Environmental

TEST BORING AND WELL CONSTRUCTION RECORD

PROJECT:	Site 10 - Original Base Landfill, MCB, Camp Lejeune, Jacksonville, North Carolina		
CTO NO.:	62470-369	BORING NO.:	IR10-SB04
COORDINATES:	EAST: 2501208.487	NORTH:	346684.4572
ELEVATION:	SURFACE: 24.24	TOP OF PVC CASING:	N/A

Rig: CME Drill Rig with Geoprobe Attachment	Split Spoon	Casing	Augers	Geoprobe Samplier	Date	Progress (Ft.)	Weather	Depth to Water (Ft.)	Time
Size (ID)				0.75 inch	3/18/98	7.0	warm	6.7	8:25
Length				2.0 feet					
Type				Geoprobe					
Hammer Wt.									
Fall									
Stickup									

Remarks: Soil Boring was advanced with a Geoprobe samplier

SAMPLE TYPE

S = Split Spoon
T = Shelby Tube
R = Air Rotary
D = Denison
N = No Sample
A = Auger
W = Wash
C = Core
G = Geoprobe
HA = Hand Auger

DEFINITIONS

Sample I.D. = Sample Identification
PID = Photo Ionization Detector measurement
BG = Reading at point source same as background
SAA = Same As Above

Depth (Ft.)	Sample Type & No.	Sample Rec. (Ft.,%)	Sample I.D.	PID (ppm)	Visual Description	Elevation (Ft. MSL)
1	HA-1	1.0	369-SB04-00	BG	Dark Gray, **SAND**, fine grained, trace silt, dry	
2	G-1	1.9		BG	2.5	21.74
3					Rusted Metal, Broken Glass, Brick Debris, Charred Wood, Clay (fill material)	
4	G-2	0.5		BG		
5						
6	G-3	0.6	369-SB04-03	BG	Note: Sampled 3 - 5 and 5 - 7 foot intervals due to a lack of sample recovery in both intervals	
7					7.0	17.24
8					**Terminated at 7.0 feet**	
9						
10						

DRILLING CO.:	Parratt-Wolff, Inc.	BAKER REP.:	James S. Culp
DRILLER:	Layne Pech	BORING NO.:	IR10-SB04 SHEET 1 OF 1

Baker

Baker Environmental

TEST BORING AND WELL CONSTRUCTION RECORD

PROJECT:	Site 10 - Original Base Landfill, MCB, Camp Lejeune, Jacksonville, North Carolina		
CTO NO.:	62470-369	BORING NO.:	IR10-SB05/TW01
COORDINATES:	EAST: 2501317.429	NORTH:	346718.1319
ELEVATION:	SURFACE: 26.19	TOP OF PVC CASING:	28.20

Rig: CME Drill Rig with Geoprobe Attachment	Split Spoon	Casing	Augers	Geoprobe Samplier	Date	Progress (Ft.)	Weather	Depth to Water (Ft.)	Time
Size (ID)				0.75 inch	3/18/98	16.0	warm	9.4	8:50
Length				2.0 feet	3/22/98			6.97	11:00
Type				Geoprobe					
Hammer Wt.									
Fall									
Stickup									

Remarks: Natural soils were allowed to collapse around temporary well after installation

SAMPLE TYPE

S = Split Spoon
T = Shelby Tube
R = Air Rotary
D = Denison
N = No Sample
A = Auger
W = Wash
C = Core
G = Geoprobe Sampler
HA = Hand Auger

WELL INFORMATION

Type	Diam.	Top Depth (Ft.)	Bottom Depth (Ft.)
PVC, Schedule 40 Riser	1"	2.01	-6.0
PVC, 0.010 Slot Screen	1"	-6.0	-16.0

Depth (Ft.)	Sample Type & No.	Sample Rec. (Ft.,%)	Sample I.D.	PID (ppm)	Visual Description	Well Installation Detail	Elevation (Ft. MSL)
1	HA-1	1.0	369-SB05-00	BG	Light Brown, SAND, trace silt, dry		
2	G-1	2.0		BG	SAA		
3							
4	G-2	1.8		BG	SAA		
5							
6	G-3	2.0		BG	SAA	6.0	20.19
7						▼	19.22
8	G-4	2.0	369-SB05-04	BG	Note: At 7.2 feet, color changes to Dark Brown		18.99
9							
10	G-5	1.6		BG	Match to Sheet 2		

DRILLING CO.:	Parratt - Wolff, Inc.	BAKER REP.:	James S. Culp
DRILLER:	Layne Pech	BORING NO.:	IR10-SB05/TW01

Baker
Baker Environmental

TEST BORING AND WELL CONSTRUCTION RECORD

PROJECT: Site 10 - Original Base Landfill, MCB, Camp Lejeune, Jacksonville, North Carolina
CTO NO.: 62470-369 BORING NO.: IR10-SB05/TW01

SAMPLE TYPE

S = Split Spoon A = Auger
T = Shelby Tube W = Wash
R = Air Rotary C = Core
G = Geoprobe Samplier HA = Hand Augered N = No Sample

DEFINITIONS

Sample I.D. = Sample Identification
PID = Photo Ionization Detector measurement
BG = Reading at point source same as background
SAA = Same As Above

Depth (Ft.)	Sample Type & No.	Sample Rec. (Ft.,%)	Sample I.D.	PID (ppm)	Visual Description	Well Installation Detail	Elevation (Ft. MSL)
11					Continued from Sheet 1		
12	G-6	2.0		BG	Note: At 11.2 feet, color changes to Dark Gray		14.99
13							
14	G-7	1.9		BG	Note: At 14.5 feet, color changes to Light Gray		11.69
15							
16	N	--			16.0 16.0	16.0	10.19
17					**Terminated at 16.0 feet**		
18							
19							
20							
21							
22							
23							
24							
25							
26							
27							
28							

DRILLING CO.: Parratt - Wolff, Inc. BAKER REP.: James S. Culp SHEET 2 OF 2
DRILLER: Layne Pech BORING NO.: IR10-SB05/TW01

Baker

Baker Environmental

TEST BORING AND WELL CONSTRUCTION RECORD

PROJECT:	Site 10 - Original Base Landfill, MCB, Camp Lejeune, Jacksonville, North Carolina		
CTO NO.:	62470-369	BORING NO.:	IR10-SB06
COORDINATES:	EAST: 2501297.664	NORTH:	346604.9607
ELEVATION:	SURFACE: 24.94	TOP OF PVC CASING:	N/A

Rig: CME Drill Rig with Geoprobe Attachment

	Split Spoon	Casing	Augers	Geoprobe Samplier	Date	Progress (Ft.)	Weather	Depth to Water (Ft.)	Time
Size (ID)				0.75 inch	3/18/98	9.0	warm	7.1	10:33
Length				2.0 feet					
Type				Geoprobe					
Hammer Wt.									
Fall									
Stickup									

Remarks: Soil Boring was advanced with a Geoprobe samplier

SAMPLE TYPE

S = Split Spoon
T = Shelby Tube
R = Air Rotary
D = Denison
N = No Sample
A = Auger
W = Wash
C = Core
G = Geoprobe
HA = Hand Auger

DEFINITIONS

Sample I.D. = Sample Identification
PID = Photo Ionization Detector measurement
BG = Reading at point source same as background
SAA = Same As Above

Depth (Ft.)	Sample Type & No.	Sample Rec. (Ft.,%)	Sample I.D.	PID (ppm)	Visual Description	Elevation (Ft. MSL)
1	HA-1	1.0	369-SB06-00	BG	Light Brown, **SAND**, fine grained, trace silt, dry	
2	G-1	1.9		BG	SAA	
3					3.5	21.44
4	G-2	1.2		BG	Rusted Metal, Broken Glass, Brick Debris, Charred Wood, Clay (fill material)	
5						
6	G-3	1.4	369-SB06-03	BG	SAA	
7					7.0	17.94
8	G-4	1.8		BG	Dark Brown, **SAND**, fine grained, trace silt, moist to wet	
9					9.0	15.94
10					**Terminated at 9.0 feet**	

DRILLING CO.:	Parratt-Wolff, Inc.	BAKER REP.:	James S. Culp
DRILLER:	Layne Pech	BORING NO.:	IR10-SB06 SHEET 1 OF 1

Baker
Baker Environmental

TEST BORING AND WELL CONSTRUCTION RECORD

PROJECT: Site 10 - Original Base Landfill, MCB, Camp Lejeune, Jacksonville, North Carolina
CTO NO.: 62470-369 BORING NO.: IR10-SB07/TW02
COORDINATES: EAST: 2501494.246 NORTH: 346455.5056
ELEVATION: SURFACE: 26.95 TOP OF PVC CASING: 28.17

Rig: CME Drill Rig with Geoprobe Attachment

	Split Spoon	Casing	Augers	Geoprobe Samplier	Date	Progress (Ft.)	Weather	Depth to Water (Ft.)	Time
Size (ID)				0.75 inch	3/18/98	14.0	warm	7.0	12:30
Length				2.0 feet	3/22/98			7.34	14:20
Type				Geoprobe					
Hammer Wt.									
Fall									
Stickup									

Remarks: Natural soils were allowed to collapse around temporary well after installation

SAMPLE TYPE

S = Split Spoon A = Auger
T = Shelby Tube W = Wash
R = Air Rotary C = Core
D = Denison G = Geoprobe Sampler
N = No Sample HA = Hand Auger

WELL INFORMATION

Type	Diam.	Top Depth (Ft.)	Bottom Depth (Ft.)
PVC, Schedule 40 Riser	1"	1.22	-4.0
PVC, 0.010 Slot Screen	1"	-4.0	-14.0

Depth (Ft.)	Sample Type & No.	Sample Rec. (Ft.,%)	Sample I.D.	PID (ppm)	Visual Description	Well Installation Detail	Elevation (Ft. MSL)
1	HA-1	1.0	369-SB07-00	BG	Light Gray, **SAND**, trace silt, dry		
2	G-1	2.0		BG	Note: At 1.9 feet, color changes to Dark Brown		25.05
3					Note: At 2.3 feet, color changes to Light Brown		24.65
4	G-2	2.0		BG		4.0	22.95
5							
6	G-3	1.7	369-SB07-03	BG	Note: At 5.5 feet, color changes to Light Gray		21.45
7							
8	G-4	1.9		BG	SAA	▼	19.61
9							
10	G-5	1.8		BG	Match to Sheet 2		

DRILLING CO.: Parratt - Wolff, Inc. BAKER REP.: James S. Culp SHEET 1 OF 2
DRILLER: Layne Pech BORING NO.: IR10-SB07/TW02

Baker

Baker Environmental

TEST BORING AND WELL CONSTRUCTION RECORD

PROJECT: Site 10 - Original Base Landfill, MCB, Camp Lejeune, Jacksonville, North Carolina

CTO NO.: 62470-369 BORING NO.: IR10-SB07/TW02

SAMPLE TYPE

S = Split Spoon A = Auger
T = Shelby Tube W = Wash
R = Air Rotary C = Core
G = Geoprobe Samplier HA = Hand Augered N = No Sample

DEFINITIONS

Sample I.D. = Sample Identification
PID = Photo Ionization Detector measurement
BG = Reading at point source same as background
SAA = Same As Above

Depth (Ft.)	Sample Type & No.	Sample Rec. (Ft.,%)	Sample I.D.	PID (ppm)	Visual Description	Well Installation Detail	Elevation (Ft. MSL)
11					Continued from Sheet 1		
12	G-6	2.0		BG	SAA		
13							
14	N	--			14.0 14.0	14.0	12.95
15					**Terminated at 14.0 feet**		
16							
17							
18							
19							
20							
21							
22							
23							
24							
25							
26							
27							
28							

DRILLING CO.: Parratt - Wolff, Inc. BAKER REP.: James S. Culp SHEET 2 OF 2

DRILLER: Layne Pech BORING NO.: IR10-SB07/TW02

Baker

Baker Environmental

TEST BORING AND WELL CONSTRUCTION RECORD

PROJECT:	Site 10 - Original Base Landfill, MCB, Camp Lejeune, Jacksonville, North Carolina		
CTO NO.:	62470-369	BORING NO.:	IR10-SB08
COORDINATES:	EAST: 2501505.485	NORTH:	346204.7468
ELEVATION:	SURFACE: 25.40	TOP OF PVC CASING:	N/A

Rig: CME Drill Rig with Geoprobe Attachment	Split Spoon	Casing	Augers	Geoprobe Samplier	Date	Progress (Ft.)	Weather	Depth to Water (Ft.)	Time
Size (ID)				0.75 inch	3/18/98	9.0	warm	5.3	11:11
Length				2.0 feet					
Type				Geoprobe					
Hammer Wt.									
Fall									
Stickup									

Remarks: Soil Boring was advanced with a Geoprobe samplier

SAMPLE TYPE

S = Split Spoon
T = Shelby Tube
R = Air Rotary
D = Denison
N = No Sample
A = Auger
W = Wash
C = Core
G = Geoprobe
HA = Hand Auger

DEFINITIONS

Sample I.D. = Sample Identification
PID = Photo Ionization Detector measurement
BG = Reading at point source same as background
SAA = Same As Above

Depth (Ft.)	Sample Type & No.	Sample Rec. (Ft.,%)	Sample I.D.	PID (ppm)	Visual Description		Elevation (Ft. MSL)
1	HA-1	1.0	369-SB08-00	BG	Light Gray, **SAND**, fine grained, trace silt, dry		
2	G-1	1.9		BG	SAA		
3							
4	G-2	1.2	369-SB08-02	BG	SAA		
5							
6	G-3	1.4		BG	5.7	5.7	19.70
					Dark Brown, **PEAT**, some sand, wet	6.1	19.30
7					Dark Brown, **SAND**, little silt, moist to wet		
8	G-4	1.8		BG	SAA		
9					9.0	9.0	16.40
10					**Terminated at 9.0 feet**		

DRILLING CO.:	Parratt-Wolff, Inc.	BAKER REP.:	James S. Culp
DRILLER:	Layne Pech	BORING NO.:	IR10-SB08 SHEET 1 OF 1

Baker
Baker Environmental

TEST BORING AND WELL CONSTRUCTION RECORD

PROJECT:	Site 10 - Original Base Landfill, MCB, Camp Lejeune, Jacksonville, North Carolina		
CTO NO.:	62470-369	BORING NO.:	IR10-SB09
COORDINATES:	EAST: 2501496.095	NORTH:	345960.274
ELEVATION:	SURFACE: 25.23	TOP OF PVC CASING:	N/A

Rig: CME Drill Rig with Geoprobe Attachment	Split Spoon	Casing	Augers	Geoprobe Samplier	Date	Progress (Ft.)	Weather	Depth to Water (Ft.)	Time
Size (ID)				0.75 inch	3/18/98	9.0	warm	6.9	12:30
Length				2.0 feet					
Type				Geoprobe					
Hammer Wt.									
Fall									
Stickup									

Remarks: Soil Boring was advanced with a Geoprobe samplier

SAMPLE TYPE

S = Split Spoon
T = Shelby Tube
R = Air Rotary
D = Denison
N = No Sample
A = Auger
W = Wash
C = Core
G = Geoprobe
HA = Hand Auger

DEFINITIONS

Sample I.D. = Sample Identification
PID = Photo Ionization Detector measurement
BG = Reading at point source same as background
SAA = Same As Above

Depth (Ft.)	Sample Type & No.	Sample Rec. (Ft.,%)	Sample I.D.	PID (ppm)	Visual Description	Elevation (Ft. MSL)
1	HA-1	1.0	369-SB09-00 duplicate, ms/msd	BG	Brown, **SAND**, fine grained, trace silt, dry	
2	G-1	1.9		BG	SAA	
3						
4	G-2	1.2		BG	SAA	
5						
6	G-3	1.4	369-SB09-03	BG	SAA	
7						
8	G-4	1.8		BG	Note: At 6.8 feet, color changes to Light Gray	18.43
9					9.0 9.0	16.23
10					**Terminated at 9.0 feet**	

DRILLING CO.:	Parratt-Wolff, Inc.	BAKER REP.:	James S. Culp
DRILLER:	Layne Pech	BORING NO.:	IR10-SB09 SHEET 1 OF 1

Baker

Baker Environmental

TEST BORING AND WELL CONSTRUCTION RECORD

PROJECT:	Site 10 - Original Base Landfill, MCB, Camp Lejeune, Jacksonville, North Carolina		
CTO NO.:	62470-369	BORING NO.:	IR10-SB10
COORDINATES:	EAST: 2501457.087	NORTH:	345764.5014
ELEVATION:	SURFACE: 18.76	TOP OF PVC CASING:	N/A

Rig: CME Drill Rig with Geoprobe Attachment	Split Spoon	Casing	Augers	Geoprobe Samplier	Date	Progress (Ft.)	Weather	Depth to Water (Ft.)	Time
Size (ID)				0.75 inch	3/18/98	5.0	warm	3.0	13:20
Length				2.0 feet					
Type				Geoprobe					
Hammer Wt.									
Fall									
Stickup									

Remarks: Soil Boring was advanced with a Geoprobe samplier

SAMPLE TYPE

S = Split Spoon
T = Shelby Tube
R = Air Rotary
D = Denison
N = No Sample
A = Auger
W = Wash
C = Core
G = Geoprobe
HA = Hand Auger

DEFINITIONS

Sample I.D. = Sample Identification
PID = Photo Ionization Detector measurement
BG = Reading at point source same as background
SAA = Same As Above

Depth (Ft.)	Sample Type & No.	Sample Rec. (Ft.,%)	Sample I.D.	PID (ppm)	Visual Description	Elevation (Ft. MSL)
1	HA-1	1.0	369-SB10-00	BG	Light Gray, **SAND**, fine grained, trace silt, dry	
					1.5	17.26
2	G-1	2.0	369-SB10-01	BG	Dark Brown, **SAND**, fine grained, little silt, damp	
3						
4	G-2	1.9		BG	SAA	
5						13.76
6					**Terminated at 5.0 feet**	
7						
8						
9						
10						

DRILLING CO.:	Parratt-Wolff, Inc.	BAKER REP.:	James S. Culp
DRILLER:	Layne Pech	BORING NO.:	IR10-SB10 SHEET 1 OF 1

Baker

Baker Environmental

TEST BORING AND WELL CONSTRUCTION RECORD

PROJECT:	Site 10 - Original Base Landfill, MCB, Camp Lejeune, Jacksonville, North Carolina			
CTO NO.:	62470-369		BORING NO.:	IR10-SB11/TW03
COORDINATES:	EAST:	2501254.347	NORTH:	345752.9386
ELEVATION:	SURFACE:	21.95	TOP OF PVC CASING:	23.41

Rig: CME Drill Rig with Geoprobe Attachment

	Split Spoon	Casing	Augers	Geoprobe Samplier	Date	Progress (Ft.)	Weather	Depth to Water (Ft.)	Time
Size (ID)				0.75 inch	3/18/98	12.0	warm	5.1	13:50
Length				2.0 feet	3/22/98			5.04	15:15
Type				Geoprobe					
Hammer Wt.									
Fall									
Stickup									

Remarks: Natural soils were allowed to collapse around temporary well after installation

SAMPLE TYPE

S = Split Spoon
T = Shelby Tube
R = Air Rotary
D = Denison
N = No Sample
A = Auger
W = Wash
C = Core
G = Geoprobe Sampler
HA = Hand Auger

WELL INFORMATION

Type	Diam.	Top Depth (Ft.)	Bottom Depth (Ft.)
PVC, Schedule 40 Riser	1"	1.46	-2.0
PVC, 0.010 Slot Screen	1"	-2.0	-12.0

Depth (Ft.)	Sample Type & No.	Sample Rec. (Ft.,%)	Sample I.D.	PID (ppm)	Visual Description	Well Installation Detail	Elevation (Ft. MSL)
1	HA-1	1.0	369-SB11-00	BG	Light Gray, **SAND**, trace silt, dry		
2	G-1	2.0		BG	Note: At 1.2 feet, color changes to Brown	2.0	20.75 19.95
3							
4	G-2	2.0	369-SB11-02	BG	SAA		
5						▼	16.91
6	G-3	2.0		BG	SAA		
7							
8	G-4	1.9		BG	Note: At 6.8 feet, color changes to Light Gray		15.15
9							
10	G-5	1.6		BG	Match to Sheet 2		

DRILLING CO.:	Parratt - Wolff, Inc.	BAKER REP.:	James S. Culp
DRILLER:	Layne Pech	BORING NO.:	IR10-SB11/TW03

Baker

Baker Environmental

TEST BORING AND WELL CONSTRUCTION RECORD

PROJECT: Site 10 - Original Base Landfill, MCB, Camp Lejeune, Jacksonville, North Carolina

CTO NO.: 62470-369 BORING NO.: IR10-SB11/TW03

SAMPLE TYPE

S = Split Spoon A = Auger
T = Shelby Tube W = Wash
R = Air Rotary C = Core
G = Geoprobe Samplier HA = Hand Augered N = No Sample

DEFINITIONS

Sample I.D. = Sample Identification
PID = Photo Ionization Detector measurement
BG = Reading at point source same as background
SAA = Same As Above

Depth (Ft.)	Sample Type & No.	Sample Rec. (Ft.,%)	Sample I.D.	PID (ppm)	Visual Description	Well Installation Detail	Elevation (Ft. MSL)
11					Continued from Sheet 1		
	N	--					
12					12.0 12.0	12.0	9.95
					Terminated at 12.0 feet		
13							
14							
15							
16							
17							
18							
19							
20							
21							
22							
23							
24							
25							
26							
27							
28							

DRILLING CO.: Parratt - Wolff, Inc. BAKER REP.: James S. Culp SHEET 2 OF 2

DRILLER: Layne Pech BORING NO.: IR10-SB11/TW03

Baker
Baker Environmental

TEST BORING AND WELL CONSTRUCTION RECORD

PROJECT:	Site 10 - Original Base Landfill, MCB, Camp Lejeune, Jacksonville, North Carolina		
CTO NO.:	62470-369	BORING NO.:	IR10-SB12
COORDINATES:	EAST: 2501048.126	NORTH:	345641.694
ELEVATION:	SURFACE: 25.81	TOP OF PVC CASING:	N/A

Rig: CME Drill Rig with Geoprobe Attachment

	Split Spoon	Casing	Augers	Geoprobe Samplier	Date	Progress (Ft.)	Weather	Depth to Water (Ft.)	Time
Size (ID)				0.75 inch	3/18/98	9.0	warm	8.9	14:30
Length				2.0 feet					
Type				Geoprobe					
Hammer Wt.									
Fall									
Stickup									

Remarks: Soil Boring was advanced with a Geoprobe samplier

SAMPLE TYPE

S = Split Spoon
T = Shelby Tube
R = Air Rotary
D = Denison
N = No Sample
A = Auger
W = Wash
C = Core
G = Geoprobe
HA = Hand Auger

DEFINITIONS

Sample I.D. = Sample Identification
PID = Photo Ionization Detector measurement
BG = Reading at point source same as background
SAA = Same As Above

Depth (Ft.)	Sample Type & No.	Sample Rec. (Ft.,%)	Sample I.D.	PID (ppm)	Visual Description	Elevation (Ft. MSL)
1	HA-1	1.0	369-SB12-00	BG	Light Gray, **SAND**, fine grained, trace silt, dry	
2	G-1	1.6		BG	Note: At 3.5 feet, color changes to Brown	22.31
3						
4	G-2	1.4		BG	SAA	
5						
6	G-3	2.0		BG	SAA	
7						
8	G-4	2.0	369-SB12-04	BG	SAA	
9					9.0 9.0	16.81
10					**Terminated at 9.0 feet**	

DRILLING CO.:	Parratt-Wolff, Inc.	BAKER REP.:	James S. Culp
DRILLER:	Layne Pech	BORING NO.:	IR10-SB12 SHEET 1 OF 1

Baker

Baker Environmental

TEST BORING AND WELL CONSTRUCTION RECORD

PROJECT: Site 10 - Original Base Landfill, MCB, Camp Lejeune, Jacksonville, North Carolina

CTO NO.: 62470-369 BORING NO.: IR10-SB15

COORDINATES: EAST: 2500643.104 NORTH: 345787.5875

ELEVATION: SURFACE: 19.17 TOP OF PVC CASING: N/A

Rig: CME Drill Rig with Geoprobe Attachment									
	Split Spoon	Casing	Augers	Geoprobe Samplier	Date	Progress (Ft.)	Weather	Depth to Water (Ft.)	Time
Size (ID)				0.75 inch	3/18/98	5.0	warm	2.7	15:50
Length				2.0 feet					
Type				Geoprobe					
Hammer Wt.									
Fall									
Stickup									

Remarks: Soil Boring was advanced with a Geoprobe samplier

SAMPLE TYPE

S = Split Spoon
T = Shelby Tube
R = Air Rotary
D = Denison
N = No Sample
A = Auger
W = Wash
C = Core
G = Geoprobe
HA = Hand Auger

DEFINITIONS

Sample I.D. = Sample Identification
PID = Photo Ionization Detector measurement
BG = Reading at point source same as background
SAA = Same As Above

Depth (Ft.)	Sample Type & No.	Sample Rec. (Ft.,%)	Sample I.D.	PID (ppm)	Visual Description	Elevation (Ft. MSL)
1	HA-1	1.0	369-SB14-00	BG	Light Gray, **SAND**, fine grained, trace silt, dry	
2	G-1	1.7	369-SB14-01	BG	SAA	
3						
4	G-2	1.2		BG	SAA	
5						14.17
6					**Terminated at 5.0 feet**	
7						
8						
9						
10						

DRILLING CO.: Parratt-Wolff, Inc. BAKER REP.: James S. Culp

DRILLER: Layne Pech BORING NO.: IR10-SB15 SHEET 1 OF 1

Baker

Baker Environmental

TEST BORING AND WELL CONSTRUCTION RECORD

PROJECT:	Site 10 - Original Base Landfill, MCB, Camp Lejeune, Jacksonville, North Carolina		
CTO NO.:	62470-369	BORING NO.:	IR10-SB16/TW04
COORDINATES:	EAST: 2500525.279	NORTH:	345943.7536
ELEVATION:	SURFACE: 17.58	TOP OF PVC CASING:	18.88

Rig: CME Drill Rig with Geoprobe Attachment									
	Split Spoon	Casing	Augers	Geoprobe Samplier	Date	Progress (Ft.)	Weather	Depth to Water (Ft.)	Time
Size (ID)				0.75 inch	3/18/98	7.0	warm	1.0	16:20
Length				2.0 feet	3/22/98			1.43	16:10
Type				Geoprobe					
Hammer Wt.									
Fall									
Stickup									

Remarks: Natural soils were allowed to collapse around temporary well after installation

SAMPLE TYPE

S = Split Spoon
T = Shelby Tube
R = Air Rotary
D = Denison
N = No Sample
A = Auger
W = Wash
C = Core
G = Geoprobe Sampler
HA = Hand Auger

WELL INFORMATION

Type	Diam.	Top Depth (Ft.)	Bottom Depth (Ft.)
PVC, Schedule 40 Riser	1"	1.3	-2.0
PVC, 0.010 Slot Screen	1"	-2.0	-7.0

Depth (Ft.)	Sample Type & No.	Sample Rec. (Ft.,%)	Sample I.D.	PID (ppm)	Visual Description	Well Installation Detail	Elevation (Ft. MSL)
1	HA-1	1.0	369-SB16-00	BG	Gray, **SAND**, trace silt, dry to wet	▼	16.15
2	G-1	1.7	369-SB16-01	BG	*Note: Sample was collected below groundwater level*	2.0	15.58
3							
4	G-2	1.6		BG	SAA		
5							
6	G-3	2.0		BG	SAA		
7					7.0 7.0	7.0	10.58
8					**Terminated at 7.0 feet**		
9							
10							

DRILLING CO.:	Parratt - Wolff, Inc.	BAKER REP.:	James S. Culp SHEET 1 OF 1
DRILLER:	Layne Pech	BORING NO.:	IR10-SB16/TW04

Baker

Baker Environmental

TEST BORING AND WELL CONSTRUCTION RECORD

PROJECT:	Site 10 - Original Base Landfill, MCB, Camp Lejeune, Jacksonville, North Carolina		
CTO NO.:	62470-369	BORING NO.:	IR10-SB17/TW05
COORDINATES:	EAST: 2500788.793	NORTH:	345557.3403
ELEVATION:	SURFACE: 23.09	TOP OF PVC CASING:	24.36

Rig: CME Drill Rig with Geoprobe Attachment	Split Spoon	Casing	Augers	Geoprobe Samplier	Date	Progress (Ft.)	Weather	Depth to Water (Ft.)	Time
Size (ID)				0.75 inch	3/18/98		warm	6.8	16:40
Length				2.0 feet	3/22/98			6.94	14:35
Type				Geoprobe					
Hammer Wt.									
Fall									
Stickup									

Remarks: Natural soils were allowed to collapse around temporary well after installation

SAMPLE TYPE

S = Split Spoon
T = Shelby Tube
R = Air Rotary
D = Denison
N = No Sample
A = Auger
W = Wash
C = Core
G = Geoprobe Sampler
HA = Hand Auger

WELL INFORMATION

Type	Diam.	Top Depth (Ft.)	Bottom Depth (Ft.)
PVC, Schedule 40 Riser	1"	1.27	-4.0
PVC, 0.010 Slot Screen	1"	-4.0	-14.0

Depth (Ft.)	Sample Type & No.	Sample Rec. (Ft.,%)	Sample I.D.	PID (ppm)	Visual Description	Well Installation Detail	Elevation (Ft. MSL)
1	HA-1	1.0	369-SB17-00	BG	Light Gray, **SAND**, trace silt, dry		
2	G-1	1.9		BG	2.0		21.09
3					Brown, **SAND**, fine grained, some to little silt, dry 3.0		20.09
4	G-2	2.0		BG	Brown, **SAND**, fine grained, trace silt, dry	4.0	19.09
5							
6	G-3	1.9	369-SB17-03	BG	SAA		
7						▼	16.15
8	G-4	1.4		BG	SAA		
9							
10	G-5	1.8		BG	Match to Sheet 2		

DRILLING CO.:	Parratt - Wolff, Inc.	BAKER REP.:	James S. Culp SHEET 1 OF 2
DRILLER:	Layne Pech	BORING NO.:	IR10-SB17/TW05

Baker

Baker Environmental

TEST BORING AND WELL CONSTRUCTION RECORD

PROJECT: Site 10 - Original Base Landfill, MCB, Camp Lejeune, Jacksonville, North Carolina

CTO NO.: 62470-369 BORING NO.: IR10-SB17/TW05

SAMPLE TYPE

S = Split Spoon A = Auger
T = Shelby Tube W = Wash
R = Air Rotary C = Core
G = Geoprobe Samplier HA = Hand Augered N = No Sample

DEFINITIONS

Sample I.D. = Sample Identification
PID = Photo Ionization Detector measurement
BG = Reading at point source same as background
SAA = Same As Above

Depth (Ft.)	Sample Type & No.	Sample Rec. (Ft.,%)	Sample I.D.	PID (ppm)	Visual Description	Well Installation Detail	Elevation (Ft. MSL)
11					Continued from Sheet 1		
12	G-6	2.0		BG	SAA		
13							
14	N	--			14.0 14.0	14.0	9.09
15					**Terminated at 14.0 feet**		
16							
17							
18							
19							
20							
21							
22							
23							
24							
25							
26							
27							
28							

DRILLING CO.: Parratt - Wolff, Inc. BAKER REP.: James S. Culp SHEET 2 OF 2

DRILLER: Layne Pech BORING NO.: IR10-SB17/TW05

Baker
Baker Environmental

TEST BORING AND WELL CONSTRUCTION RECORD

PROJECT:	Site 10 - Original Base Landfill, MCB, Camp Lejeune, Jacksonville, North Carolina		
CTO NO.:	62470-369	BORING NO.:	IR10-SB18/TW06
COORDINATES:	EAST: 2501127.971	NORTH:	346861.6796
ELEVATION:	SURFACE: 18.61	TOP OF PVC CASING:	19.75

Rig: CME Drill Rig with Geoprobe Attachment

	Split Spoon	Casing	Augers	Geoprobe Samplier	Date	Progress (Ft.)	Weather	Depth to Water (Ft.)	Time
Size (ID)				0.75 inch	3/19/98	12.0	warm	5.4	11:25
Length				2.0 feet	3/22/98			3.91	13:20
Type				Geoprobe					
Hammer Wt.									
Fall									
Stickup									

Remarks: Natural soils were allowed to collapse around temporary well after installation

SAMPLE TYPE

S = Split Spoon
T = Shelby Tube
R = Air Rotary
D = Denison
N = No Sample
A = Auger
W = Wash
C = Core
G = Geoprobe Sampler
HA = Hand Auger

WELL INFORMATION

Type	Diam.	Top Depth (Ft.)	Bottom Depth (Ft.)
PVC, Schedule 40 Riser	1"	1.14	-2.0
PVC, 0.010 Slot Screen	1"	-2.0	-12.0

Depth (Ft.)	Sample Type & No.	Sample Rec. (Ft.,%)	Sample I.D.	PID (ppm)	Visual Description	Well Installation Detail	Elevation (Ft. MSL)
1	HA-1	1.0	369-SB18-00 duplicate, ms/msd	BG	Light Brown, **SAND**, fine grained, trace silt, dry		
2	G-1	1.6		BG	SAA	2.0	16.61
3							
4	G-2	1.8	369-SB18-02	BG	SAA	▼	14.70
5							
6	G-3	2.0		BG	SAA		
7							
8	G-4	1.3		BG	SAA		
9							
10	G-5	1.7		BG	Match to Sheet 2		

DRILLING CO.:	Parratt - Wolff, Inc.	BAKER REP.:	James S. Culp SHEET 1 OF 2
DRILLER:	Layne Pech	BORING NO.:	IR10-SB18/TW06

Baker

Baker Environmental

TEST BORING AND WELL CONSTRUCTION RECORD

PROJECT: Site 10 - Original Base Landfill, MCB, Camp Lejeune, Jacksonville, North Carolina

CTO NO.: 62470-369 BORING NO.: IR10-SB18/TW06

SAMPLE TYPE

S = Split Spoon A = Auger
T = Shelby Tube W = Wash
R = Air Rotary C = Core
G = Geoprobe Samplier HA = Hand Augered N = No Sample

DEFINITIONS

Sample I.D. = Sample Identification
PID = Photo Ionization Detector measurement
BG = Reading at point source same as background
SAA = Same As Above

Depth (Ft.)	Sample Type & No.	Sample Rec. (Ft.,%)	Sample I.D.	PID (ppm)	Visual Description	Well Installation Detail	Elevation (Ft. MSL)
11					Continued from Sheet 1		
	N	--					
12					12.0 12.0	12.0	6.61
					Terminated at 12.0 feet		
13							
14							
15							
16							
17							
18							
19							
20							
21							
22							
23							
24							
25							
26							
27							
28							

DRILLING CO.: Parratt - Wolff, Inc. BAKER REP.: James S. Culp SHEET 2 OF 2

DRILLER: Layne Pech BORING NO.: IR10-SB18/TW06

Baker
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TEST BORING AND WELL CONSTRUCTION RECORD

PROJECT:	Site 10 - Original Base Landfill, MCB, Camp Lejeune, Jacksonville, North Carolina		
CTO NO.:	62470-369	BORING NO.:	IR10-SB19
COORDINATES:	EAST: 2500951.566	NORTH:	346719.2681
ELEVATION:	SURFACE: 15.69	TOP OF PVC CASING:	N/A

Rig: CME Drill Rig with Geoprobe Attachment

	Split Spoon	Casing	Augers	Geoprobe Samplier	Date	Progress (Ft.)	Weather	Depth to Water (Ft.)	Time
Size (ID)				0.75 inch	3/19/98	5.0	warm	3.3	12:25
Length				2.0 feet					
Type				Geoprobe					
Hammer Wt.									
Fall									
Stickup									

Remarks: Soil Boring was advanced with a Geoprobe samplier

SAMPLE TYPE

S = Split Spoon
T = Shelby Tube
R = Air Rotary
D = Denison
N = No Sample
A = Auger
W = Wash
C = Core
G = Geoprobe
HA = Hand Auger

DEFINITIONS

Sample I.D. = Sample Identification
PID = Photo Ionization Detector measurement
BG = Reading at point source same as background
SAA = Same As Above

Depth (Ft.)	Sample Type & No.	Sample Rec. (Ft.,%)	Sample I.D.	PID (ppm)	Visual Description	Elevation (Ft. MSL)
1	HA-1	1.0	369-SB19-00	BG	Light Brown, **SAND**, fine grained, trace silt, dry	
2	G-1	1.1	369-SB19-01	BG	SAA	
3						
4	G-2	2.0		BG	SAA	
5						10.69
6					**Terminated at 5.0 feet**	
7						
8						
9						
10						

DRILLING CO.:	Parratt-Wolff, Inc.	BAKER REP.:	James S. Culp
DRILLER:	Layne Pech	BORING NO.:	IR10-SB19 SHEET 1 OF 1

Baker

Baker Environmental

TEST BORING AND WELL CONSTRUCTION RECORD

PROJECT:	Site 10 - Original Base Landfill, MCB, Camp Lejeune, Jacksonville, North Carolina		
CTO NO.:	62470-369	BORING NO.:	IR10-SB20
COORDINATES:	EAST: 2500789.972	NORTH:	346574.0129
ELEVATION:	SURFACE: 14.01	TOP OF PVC CASING:	N/A

Rig: CME Drill Rig with Geoprobe Attachment	Split Spoon	Casing	Augers	Geoprobe Samplier	Date	Progress (Ft.)	Weather	Depth to Water (Ft.)	Time
Size (ID)				0.75 inch	3/19/98	3.0	warm	1.0	12:40
Length				2.0 feet					
Type				Geoprobe					
Hammer Wt.									
Fall									
Stickup									

Remarks: Soil Boring was advanced with a Geoprobe samplier

SAMPLE TYPE

S = Split Spoon
A = Auger
T = Shelby Tube
W = Wash
R = Air Rotary
C = Core
D = Denison
G = Geoprobe
N = No Sample
HA = Hand Auger

DEFINITIONS

Sample I.D. = Sample Identification
PID = Photo Ionization Detector measurement
BG = Reading at point source same as background
SAA = Same As Above

Depth (Ft.)	Sample Type & No.	Sample Rec. (Ft.,%)	Sample I.D.	PID (ppm)	Visual Description	Elevation (Ft. MSL)
1	HA-1	1.0	369-SB20-00	BG	Brown, **SAND**, fine grained, trace silt, wet	
2	G-1	1.0		BG	*Note: No sample was collected at depth due to shallow groundwater*	
3					3.0 3.0	11.01
4					**Terminated at 3.0 feet**	
5						
6						
7						
8						
9						
10						

DRILLING CO.:	Parratt-Wolff, Inc.	BAKER REP.:	James S. Culp
DRILLER:	Layne Pech	BORING NO.:	IR10-SB20 SHEET 1 OF 1

Baker

Baker Environmental

TEST BORING AND WELL CONSTRUCTION RECORD

PROJECT:	Site 10 - Original Base Landfill, MCB, Camp Lejeune, Jacksonville, North Carolina		
CTO NO.:	62470-369	BORING NO.:	IR10-SB21/TW07
COORDINATES:	EAST: 2500164.414	NORTH:	345812.1296
ELEVATION:	SURFACE: 28.01	TOP OF PVC CASING:	29.14

Rig: CME Drill Rig with Geoprobe Attachment	Split Spoon	Casing	Augers	Geoprobe Samplier	Date	Progress (Ft.)	Weather	Depth to Water (Ft.)	Time
Size (ID)				0.75 inch	3/19/98	18.0	warm	11.9	13:45
Length				2.0 feet	3/23/98			12.62	12:20
Type				Geoprobe					
Hammer Wt.									
Fall									
Stickup									

Remarks: Natural soils were allowed to collapse around temporary well after installation

SAMPLE TYPE

S = Split Spoon
A = Auger
T = Shelby Tube
W = Wash
R = Air Rotary
C = Core
D = Denison
G = Geoprobe Sampler
N = No Sample
HA = Hand Auger

WELL INFORMATION

Type	Diam.	Top Depth (Ft.)	Bottom Depth (Ft.)
PVC, Schedule 40 Riser	1"	1.13	-8.0
PVC, 0.010 Slot Screen	1"	-8.0	-18.0

Depth (Ft.)	Sample Type & No.	Sample Rec. (Ft.,%)	Sample I.D.	PID (ppm)	Visual Description	Well Installation Detail	Elevation (Ft. MSL)
1	HA-1	1.0	369-SB21-00	BG	Light Brown, **SAND**, fine grained, trace silt, dry		
2	G-1	1.9		BG	Note: Silt content is increasing		
3							
4	G-2	2.0		BG	SAA		
5							
					5.5 — Gray, **SAND**, fine grained, trace silt, dry	5.5	22.51
6	G-3	1.7		BG			
7							
8	G-4	1.9		BG	SAA	8.0	20.01
9							
10	G-5	1.9	369-SB21-05	BG	Match to Sheet 2		

DRILLING CO.:	Parratt - Wolff, Inc.	BAKER REP.:	James S. Culp SHEET 1 OF 2
DRILLER:	Layne Pech	BORING NO.:	IR10-SB21/TW07

Baker

Baker Environmental

TEST BORING AND WELL CONSTRUCTION RECORD

PROJECT: Site 10 - Original Base Landfill, MCB, Camp Lejeune, Jacksonville, North Carolina

CTO NO.: 62470-369 BORING NO.: IR10-SB21/TW07

SAMPLE TYPE

S = Split Spoon A = Auger
T = Shelby Tube W = Wash
R = Air Rotary C = Core
G = Geoprobe Samplier HA = Hand Augered N = No Sample

DEFINITIONS

Sample I.D. = Sample Identification
PID = Photo Ionization Detector measurement
BG = Reading at point source same as background
SAA = Same As Above

Depth (Ft.)	Sample Type & No.	Sample Rec. (Ft.,%)	Sample I.D.	PID (ppm)	Visual Description	Well Installation Detail	Elevation (Ft. MSL)
11					Continued from Sheet 1		
12	G-6	2.0		BG	SAA	▼	15.39
13							
14	G-7	2.0		BG	SAA		
15							
16	G-8	2.0		BG	SAA		
17							
18	N	--			18.0 18.0	18.0	10.01
19					**Terminated at 18.0 feet**		
20							
21							
22							
23							
24							
25							
26							
27							
28							

DRILLING CO.: Parratt - Wolff, Inc. BAKER REP.: James S. Culp SHEET 2 OF 2

DRILLER: Layne Pech BORING NO.: IR10-SB21/TW07

Baker

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TEST BORING AND WELL CONSTRUCTION RECORD

PROJECT:	Site 10 - Original Base Landfill, MCB, Camp Lejeune, Jacksonville, North Carolina		
CTO NO.:	62470-369	BORING NO.:	IR10-SB22
COORDINATES:	EAST: 2499975.436	NORTH:	345930.8948
ELEVATION:	SURFACE: 31.11	TOP OF PVC CASING:	N/A

Rig: CME Drill Rig with Geoprobe Attachment	Split Spoon	Casing	Augers	Geoprobe Samplier	Date	Progress (Ft.)	Weather	Depth to Water (Ft.)	Time
Size (ID)				0.75 inch	3/19/98	15.0	warm	14.9	14:30
Length				2.0 feet					
Type				Geoprobe					
Hammer Wt.									
Fall									
Stickup									

Remarks: Soil Boring was advanced with a Geoprobe samplier

SAMPLE TYPE

S = Split Spoon
T = Shelby Tube
R = Air Rotary
D = Denison
N = No Sample
A = Auger
W = Wash
C = Core
G = Geoprobe
HA = Hand Auger

DEFINITIONS

Sample I.D. = Sample Identification
PID = Photo Ionization Detector measurement
BG = Reading at point source same as background
SAA = Same As Above

Depth (Ft.)	Sample Type & No.	Sample Rec. (Ft.,%)	Sample I.D.	PID (ppm)	Visual Description	Elevation (Ft. MSL)
1	HA-1	1.0	369-SB22-00 duplicate	BG	Light Brown, **SAND**, fine grained, trace silt, dry	
2	G-1	1.9		BG	SAA	
3					3.8	27.31
4	G-2	2.0		BG	Brown, **SAND**, fine grained, some silt, dry 4.4	26.71
5					Brown, **SAND**, fine grained, trace silt, dry	
6	G-3	1.9		BG	SAA	
7					Note: At 7.3 feet, color changes to Gray	23.81
8	G-4	2.0		BG		
9						
10	G-5	1.7		BG	SAA	

DRILLING CO.:	Parratt-Wolff, Inc.	BAKER REP.:	James S. Culp
DRILLER:	Layne Pech	BORING NO.:	IR10-SB22 SHEET 1 OF 2

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TEST BORING AND WELL CONSTRUCTION RECORD

PROJECT: Site 10 - Original Base Landfill, MCB, Camp Lejeune, Jacksonville, North Carolina
CTO NO.: 62470-369 BORING NO.: IR10-SB22

SAMPLE TYPE
S = Split Spoon A = Auger
T = Shelby Tube W = Wash
R = Air Rotary C = Core
G = Geoprobe Samplier HA = Hand Auger N = No Sample

DEFINITIONS
Sample I.D. = Sample Identification
PID = Photo Ionization Detector measurement
BG = Reading at point source same as background
SAA = Same As Above

Depth (Ft.)	Sample Type & No.	Sample Rec. (Ft.,%)	Sample I.D.	PID (ppm)	Visual Description	Elevation (Ft. MSL)
11					Continued from Sheet 1	
12	G-6	1.6		BG	SAA	
13						
14	G-7	2.0	369-SB22-07	BG	SAA	
15						16.11
16					**Terminated at 15.0 feet**	
17						
18						
19						
20						
21						
22						
23						
24						
25						
26						
27						
28						

DRILLING CO.: Parratt-Wolff, Inc. BAKER REP.: James S. Culp
DRILLER: Layne Pech BORING NO.: IR10-SB22 SHEET 2 OF 2

Baker
Baker Environmental

TEST BORING AND WELL CONSTRUCTION RECORD

PROJECT:	Site 10 - Original Base Landfill, MCB, Camp Lejeune, Jacksonville, North Carolina		
CTO NO.:	62470-369	BORING NO.:	IR10-SB23/TW08
COORDINATES:	EAST: 2500155.222	NORTH:	345513.1133
ELEVATION:	SURFACE: 20.74	TOP OF PVC CASING:	22.24

Rig: CME Drill Rig with Geoprobe Attachment

	Split Spoon	Casing	Augers	Geoprobe Samplier	Date	Progress (Ft.)	Weather	Depth to Water (Ft.)	Time
Size (ID)				0.75 inch	3/19/98	14.0	warm	6.5	15:10
Length				2.0 feet	3/23/98			5.18	11:30
Type				Geoprobe					
Hammer Wt.									
Fall									
Stickup									

Remarks: Natural soils were allowed to collapse around temporary well after installation

SAMPLE TYPE

S = Split Spoon	A = Auger
T = Shelby Tube	W = Wash
R = Air Rotary	C = Core
D = Denison	G = Geoprobe Sampler
N = No Sample	HA = Hand Auger

WELL INFORMATION

Type	Diam.	Top Depth (Ft.)	Bottom Depth (Ft.)
PVC, Schedule 40 Riser	1"	1.5	-4.0
PVC, 0.010 Slot Screen	1"	-4.0	-14.0

Depth (Ft.)	Sample Type & No.	Sample Rec. (Ft.,%)	Sample I.D.	PID (ppm)	Visual Description	Well Installation Detail	Elevation (Ft. MSL)
1	HA-1	1.0	369-SB23-00	BG	Light Brown, **SAND**, fine grained, trace silt, dry		
2	G-1	1.7		BG	SAA		
3							
4	G-2	1.9		BG	SAA	4.0	16.74
5						▼	15.56
6	G-3	2.0	369-SB23-03	BG			
7							
8	G-4	2.0		BG	SAA		
9							
10	G-5	2.0		BG	Note: At 9.5 feet, color changes to Gray Match to Sheet 2		

DRILLING CO.:	Parratt - Wolff, Inc.	BAKER REP.:	James S. Culp
DRILLER:	Layne Pech	BORING NO.:	IR10-SB23/TW08

Baker

Baker Environmental

TEST BORING AND WELL CONSTRUCTION RECORD

PROJECT: Site 10 - Original Base Landfill, MCB, Camp Lejeune, Jacksonville, North Carolina

CTO NO.: 62470-369 BORING NO.: IR10-SB23/TW08

SAMPLE TYPE

S = Split Spoon A = Auger
T = Shelby Tube W = Wash
R = Air Rotary C = Core
G = Geoprobe Samplier HA = Hand Augered N = No Sample

DEFINITIONS

Sample I.D. = Sample Identification
PID = Photo Ionization Detector measurement
BG = Reading at point source same as background
SAA = Same As Above

Depth (Ft.)	Sample Type & No.	Sample Rec. (Ft.,%)	Sample I.D.	PID (ppm)	Visual Description	Well Installation Detail	Elevation (Ft. MSL)
11					Continued from Sheet 1		
12	G-6	2.0		BG	SAA		
13							
14	N	--			14.0 14.0	14.0	6.74
15					**Terminated at 14.0 feet**		
16							
17							
18							
19							
20							
21							
22							
23							
24							
25							
26							
27							
28							

DRILLING CO.: Parratt - Wolff, Inc. BAKER REP.: James S. Culp SHEET 2 OF 2

DRILLER: Layne Pech BORING NO.: IR10-SB23/TW08

Baker

Baker Environmental

TEST BORING AND WELL CONSTRUCTION RECORD

PROJECT:	Site 10 - Original Base Landfill, MCB, Camp Lejeune, Jacksonville, North Carolina		
CTO NO.:	62470-369	BORING NO.:	IR10-SB24/TW09
COORDINATES:	EAST: 2501045.191	NORTH:	346543.1475
ELEVATION:	SURFACE: 16.63	TOP OF PVC CASING:	18.20

Rig: CME Drill Rig with Geoprobe Attachment	Split Spoon	Casing	Augers	Geoprobe Samplier	Date	Progress (Ft.)	Weather	Depth to Water (Ft.)	Time
Size (ID)				0.75 inch	3/19/98	6.0	warm	0.3	16:30
Length				2.0 feet	3/22/98			0.27	9:17
Type				Geoprobe					
Hammer Wt.									
Fall									
Stickup									

Remarks: Natural soils were allowed to collapse around temporary well after installation

SAMPLE TYPE

S = Split Spoon
T = Shelby Tube
R = Air Rotary
D = Denison
N = No Sample
A = Auger
W = Wash
C = Core
G = Geoprobe Sampler
HA = Hand Auger

WELL INFORMATION

Type	Diam.	Top Depth (Ft.)	Bottom Depth (Ft.)
PVC, Schedule 40 Riser	1"	1.57	-1.0
PVC, 0.010 Slot Screen	1"	-1.0	-6.0

Depth (Ft.)	Sample Type & No.	Sample Rec. (Ft.,%)	Sample I.D.	PID (ppm)	Visual Description	Well Installation Detail	Elevation (Ft. MSL)
1	HA-1	1.0	369-SB24-00	BG	Gray, **SAND**, trace silt, dry to wet	▼ 1.0	15.63
2	N	--			*Note: No sample was collected at depth*		
3							
4	N	--		BG	SAA		
5							
6	N	--		BG	6.0 6.0	6.0	10.63
7					**Terminated at 6.0 feet**		
8							
9							
10							

DRILLING CO.:	Parratt - Wolff, Inc.	BAKER REP.:	James S. Culp SHEET 1 OF 1
DRILLER:	Layne Pech	BORING NO.:	IR10-SB24/TW09

Baker
Baker Environmental

TEST BORING AND WELL CONSTRUCTION RECORD

PROJECT:	Site 10 - Original Base Landfill, MCB, Camp Lejeune, Jacksonville, North Carolina		
CTO NO.:	62470-369	BORING NO.:	IR10-SB25
COORDINATES:	EAST: 2501088.095	NORTH:	346386.9293
ELEVATION:	SURFACE: 17.96	TOP OF PVC CASING:	N/A

Rig: CME Drill Rig with Geoprobe Attachment

	Split Spoon	Casing	Augers	Geoprobe Samplier	Date	Progress (Ft.)	Weather	Depth to Water (Ft.)	Time
Size (ID)				0.75 inch	3/19/98	1.0	warm	0.3	16:50
Length				2.0 feet					
Type				Geoprobe					
Hammer Wt.									
Fall									
Stickup									

Remarks: Soil Boring was advanced with a Geoprobe samplier

SAMPLE TYPE

S = Split Spoon
T = Shelby Tube
R = Air Rotary
D = Denison
N = No Sample
A = Auger
W = Wash
C = Core
G = Geoprobe
HA = Hand Auger

DEFINITIONS

Sample I.D. = Sample Identification
PID = Photo Ionization Detector measurement
BG = Reading at point source same as background
SAA = Same As Above

Depth (Ft.)	Sample Type & No.	Sample Rec. (Ft.,%)	Sample I.D.	PID (ppm)	Visual Description	Elevation (Ft. MSL)
1	HA-1	1.0	369-SB25-00	BG	Brown, **SAND**, fine grained, trace silt, wet 1.0 1.0	16.96
2					**Terminated at 1.0 feet**	
3						
4						
5						
6						
7						
8						
9						
10						

DRILLING CO.:	Parratt-Wolff, Inc.	BAKER REP.:	James S. Culp
DRILLER:	Layne Pech	BORING NO.:	IR10-SB25 SHEET 1 OF 1

Baker

Baker Environmental

TEST BORING AND WELL CONSTRUCTION RECORD

PROJECT:	Site 10 - Original Base Landfill, MCB, Camp Lejeune, Jacksonville, North Carolina		
CTO NO.:	62470-369	BORING NO.:	IR10-SB13
COORDINATES:	EAST: 2500915.074	NORTH:	345808.1725
ELEVATION:	SURFACE: 25.07	TOP OF PVC CASING:	N/A

Rig: CME Drill Rig with Geoprobe Attachment	Split Spoon	Casing	Augers	Geoprobe Samplier	Date	Progress (Ft.)	Weather	Depth to Water (Ft.)	Time
Size (ID)				0.75 inch	3/18/98	9.0	warm	8.5	15:00
Length				2.0 feet					
Type				Geoprobe					
Hammer Wt.									
Fall									
Stickup									

Remarks: Soil Boring was advanced with a Geoprobe samplier

SAMPLE TYPE

S = Split Spoon
T = Shelby Tube
R = Air Rotary
D = Denison
N = No Sample
A = Auger
W = Wash
C = Core
G = Geoprobe
HA = Hand Auger

DEFINITIONS

Sample I.D. = Sample Identification
PID = Photo Ionization Detector measurement
BG = Reading at point source same as background
SAA = Same As Above

Depth (Ft.)	Sample Type & No.	Sample Rec. (Ft.,%)	Sample I.D.	PID (ppm)	Visual Description	Elevation (Ft. MSL)
1	HA-1	1.0	369-SB13-00	BG	Light Gray, **SAND**, fine grained, trace silt, dry	
2	G-1	2.0		BG	Note: At 1.5 feet, color changes to Brown	23.57
3					SAA	
4	G-2	2.0		BG		
5					Note: At 4.2 feet, color chages to Light Gray	20.87
6	G-3	1.9		BG	SAA	
7						
8	G-4	2.0	369-SB13-04	BG	SAA	
9					9.0 9.0	16.07
10					**Terminated at 9.0 feet**	

DRILLING CO.:	Parratt-Wolff, Inc.	BAKER REP.:	James S. Culp
DRILLER:	Layne Pech	BORING NO.:	IR10-SB13 SHEET 1 OF 1

Baker
Baker Environmental

TEST BORING AND WELL CONSTRUCTION RECORD

PROJECT:	Site 10 - Original Base Landfill, MCB, Camp Lejeune, Jacksonville, North Carolina		
CTO NO.:	62470-369	BORING NO.:	IR10-SB14
COORDINATES:	EAST: 2500796.77	NORTH:	345947.0892
ELEVATION:	SURFACE: 18.37	TOP OF PVC CASING:	N/A

Rig: CME Drill Rig with Geoprobe Attachment	Split Spoon	Casing	Augers	Geoprobe Samplier	Date	Progress (Ft.)	Weather	Depth to Water (Ft.)	Time
Size (ID)				0.75 inch	3/18/98	5.0	warm	1.3	15:20
Length				2.0 feet					
Type				Geoprobe					
Hammer Wt.									
Fall									
Stickup									

Remarks: Soil Boring was advanced with a Geoprobe samplier

SAMPLE TYPE

S = Split Spoon
T = Shelby Tube
R = Air Rotary
D = Denison
N = No Sample
A = Auger
W = Wash
C = Core
G = Geoprobe
HA = Hand Auger

DEFINITIONS

Sample I.D. = Sample Identification
PID = Photo Ionization Detector measurement
BG = Reading at point source same as background
SAA = Same As Above

Depth (Ft.)	Sample Type & No.	Sample Rec. (Ft.,%)	Sample I.D.	PID (ppm)	Visual Description	Elevation (Ft. MSL)
1	HA-1	1.0	369-SB14-00	BG	Light Gray, **SAND**, fine grained, trace silt, dry	
2	G-1	2.0	369-SB14-01	BG	*Note: Sample was collected below groundwater level*	
					2.6	15.77
3					Dark Brown, **PEAT**, some sand, wet 3.1	15.27
4	G-2	1.9		BG	Light Gray, **SAND**, fine grained, trace silt, wet	
5						13.37
6					**Terminated at 5.0 feet**	
7						
8						
9						
10						

DRILLING CO.:	Parratt-Wolff, Inc.	BAKER REP.:	James S. Culp
DRILLER:	Layne Pech	BORING NO.:	IR10-SB14 SHEET 1 OF 1

Baker

Baker Environmental

TEST BORING AND WELL CONSTRUCTION RECORD

PROJECT:	Site 10; phase II field investigation		
PROJ. NO.:	CTO-0369	BORING NO.:	MW02
COORDINATES:	EAST: 2501494.250	NORTH:	346455.51
ELEVATION:	SURFACE: 27.04	TOP OF PVC CASING:	29.86

Rig: Diedrich D-50

	Split Spoon	Casing	Augers	Core Barrel	Date	Progress (Ft.)	Weather	Depth to Water (Ft.)
Size (ID)	1 7/8		6 1/4		2/27/01	18'	Sunny mid 60's	12.45
Length	24"		5'					
Type	SS		HS					
Hammer Wt.	140lbs							
Fall	30"							

Remarks:

SAMPLE TYPE

S = Split Spoon A = Auger
T = Shelby Tube W = Wash
R = Air Rotary C = Core
D = Denison P = Piston
N = No Sample

WELL INFORMATION

Type	Diam.	Top Depth (Ft.)	Depth (Ft.)
PVC riser	2"	29.86	20.04
PVC 0.010 inch screen	2"	20.04	9.84

Depth (Ft.)	Sample Type & No.	Sample Rec. (Ft.,%)	SPT	PID (ppm) ps/bg	Visual Description	Well Installation Detail	Elevation (Ft. MSL) 27.04
1	S	1.0 50%	1 W.O.H. 1 1	0.0 / 0.0	Fine sand, trace silt, moist, very loose, light gray		
2					2.0		
3	S	1.8 90%	1 2 2 2	0.0 / 0.0	Fine sand, trace silt, moist, very loose, brown	3.0	24.04
4							
5	S	2.0 100%	4 2 3 4	0.0 / 0.0	4.8	5.0	22.04
6					Fine sand, trace silt, moist, very loose, light gray 6.0		
7	S	1.8 90%	3 3 4 5	0.0 / 0.0	Fine sand, trace silt, moist, loose, light gray	7.0	20.04
8							
9	S	1.7 85%	6 6 9 11	0.0 / 0.0	9.5		
10			2		Fine sand, trace silt, wet, firm gray 10.0		

DRILLING CO.:	Parratt Wolff	BAKER REP.:	David D. Schilling
DRILLER:	Chip	BORING NO.:	MW02 SHEET 1 OF 2

Baker

Baker Environmental

TEST BORING AND WELL CONSTRUCTION RECORD

PROJECT: Site 10; phase II field investigation

CTO NO.: CTO-0369 BORING NO.: MW02

SAMPLE TYPE

S = Split Spoon A = Auger
T = Shelby Tube W = Wash
R = Air Rotary C = Core
D = Denison P = Piston N = No Sample

DEFINITIONS

SPT = Standard Penetration Test (ASTM D1586)
PID = Photo Ionization Detector Measurement
MSL = Mean Sea Level
ps/bg = point source/background

Depth (Ft.)	Sample Type & No.	Sample Rec. (Ft.,%)	SPT	PID (ppm) ps/bg	Visual Description	Well Installation Detail	Elevation (Ft. MSL) 16.54
11	S	1.4	2	0.0	Continued from Sheet 1		
		70%	6	0.0	Fine sand, trace silt, wet,		
12			7		loose, light brown		
			6				
13	S	2.0	8	0.0			
		100%	9	0.0			
14			11		14.0		
			5		Fine sand, trace silt, wet, firm,		
15	S	2.0	6	0.0	light orangish brown		
		100%	11	0.0			
16			18		16.0		
			6		Fine sand, trace silt, wet, loose		
17	S	2.0	5	0.0	mottled orange and light brown	17.2	9.84
		100%	3	0.0			
18			7		18.0		9.04
19					End of Boring = 18.0		
20							
21							
22							
23							
24							
25							
26							
27							
28							
29							
30							

DRILLING CO.: Parratt Wolff BAKER REP.: David D. Schilling

DRILLER: Chip BORING NO.: MW02 SHEET 2 OF 2

Baker

Baker Environmental

TEST BORING AND WELL CONSTRUCTION RECORD

PROJECT:	Site 10; phase II field investigation		
PROJ. NO.:	CTO-0369	BORING NO.:	MW03
COORDINATES: EAST:	2501254.350	NORTH:	345752.94
ELEVATION: SURFACE:	21.63	TOP OF PVC CASING:	24.48

Rig: Diedrich D-50	Split Spoon	Casing	Augers	Core Barrel	Date	Progress (Ft.)	Weather	Depth to Water (Ft.)
Size (ID)	1 7/8		6 1/4		2/27/01	14'	Sunny mid 60's	8.35
Length	24"		5'					
Type	SS		HS					
Hammer Wt.	140lbs							
Fall	30"							

Remarks:

SAMPLE TYPE

S = Split Spoon A = Auger
T = Shelby Tube W = Wash
R = Air Rotary C = Core
D = Denison P = Piston
N = No Sample

WELL INFORMATION

Type	Diam.	Top Depth (Ft.)	Bottom Depth (Ft.)
PVC riser	2"	24.48	18.63
PVC 0.010 inch screen	2"	18.63	8.63

Depth (Ft.)	Sample Type & No.	Sample Rec. (Ft.,%)	SPT	PID (ppm) ps/bg	Visual Description	Well Installation Detail	Elevation (Ft. MSL) 21.63
1, 2	S	1.6 80%	1 1 1 1	0.1 0.1	Fine sand, trace silt, moist, very loose, dark gray (0.3–0.9); Fine sand, trace silt, moist, very loose, light gray (0.9–2.0)	1.0	20.63
3, 4	S	1.8 90%	1 2 2 2	0.1 0.1	Fine sand, trace silt, moist, very loose, dark brown (2.0–3.0); Fine sand, trace silt, moist, very loose, mottled orangish brown and light brown (3.0–4.0)	2.0	19.63
5, 6	S	1.9 95%	2 2 3 5	0.1 0.1	Fine sand, trace silt, moist, very loose, mottled dark brown and light brown (4.0–4.8); Fine sand, trace silt, moist, loose, light brown (4.8–5.7)	3.0	18.63
7, 8	S	1.9 95%	6 6 7 9	0.1 0.1	Fine sand, trace silt, wet, loose, light brown (5.7–7.3); Fine sand, trace silt, wet, loose, orangish brown (7.3–8.6)		
9, 10	S	2.0 100%	5 5 6 8	0.1 0.1	Fine sand, trace silt, wet, loose, gray (8.6–10.0)		
			1		Match to Sheet 2		

DRILLING CO.:	Parratt Wolff	BAKER REP.:	David D. Schilling
DRILLER:	Chip	BORING NO.:	MW03 SHEET 1 OF 2

Baker

Baker Environmental

TEST BORING AND WELL CONSTRUCTION RECORD

PROJECT: Site 10; phase II field investigation

CTO NO.: CTO-0369 BORING NO.: MW03

SAMPLE TYPE

S = Split Spoon A = Auger
T = Shelby Tube W = Wash
R = Air Rotary C = Core
D = Denison P = Piston N = No Sample

DEFINITIONS

SPT = Standard Penetration Test (ASTM D1586)
PID = Photo Ionization Detector Measurement
MSL = Mean Sea Level
ps/bg = point source/background

Depth (Ft.)	Sample Type & No.	Sample Rec. (Ft.,%)	SPT	PID (ppm) ps/bg	Visual Description	Well Installation Detail	Elevation (Ft. MSL) 11.13
11	S	1.8	1	0.1	Continued from Sheet 1		
		90%	4	0.1	Fine sand, trace silt, wet,		
12			4		very loose, light gray 12.0		
			3		Fine sand, trace silt, wet,		
13	S	2	4	0.1	loose, light gray, orange	13.0	8.63
		100%	8	0.1	motteling		
14			8		14.0		7.63
15					End of Boring = 14.0'		
16							
17							
18							
19							
20							
21							
22							
23							
24							
25							
26							
27							
28							
29							
30							

DRILLING CO.: Parratt Wolff BAKER REP.: David D. Schilling

DRILLER: Chip BORING NO.: MW03 SHEET 2 OF 2

Baker

Baker Environmental

TEST BORING AND WELL CONSTRUCTION RECORD

PROJECT:	Site 10; phase II field investigation		
PROJ. NO.:	CTO-0369	BORING NO.:	MW04
COORDINATES:	EAST: 2500525.280	NORTH:	345943.75
ELEVATION:	SURFACE: 17.13	TOP OF PVC CASING:	20.13

Rig: Diedrich D-50

	Split Spoon	Casing	Augers	Core Barrel	Date	Progress (Ft.)	Weather	Depth to Water (Ft.)
Size (ID)	1 7/8		6 1/4		2/28/01	12	Cloudy low 50's	4.00
Length	24"		5'					
Type	SS		HS					
Hammer Wt.	140lbs							
Fall	30"							

Remarks:

SAMPLE TYPE

S = Split Spoon A = Auger
T = Shelby Tube W = Wash
R = Air Rotary C = Core
D = Denison P = Piston
N = No Sample

WELL INFORMATION

Type	Diam.	Top Depth (Ft.)	Bottom Depth (Ft.)
PVC riser	2"	20.13	15.13
PVC 0.010 inch screen	2"	15.13	4.73

Depth (Ft.)	Sample Type & No.	Sample Rec. (Ft.,%)	SPT	PID (ppm) ps/bg	Visual Description	Well Installation Detail	Elevation (Ft. MSL) 17.13
1, 2	S	1.6 80%	W.O.H. 2 3 3	0.1 / 0.1	Fine sand, trace silt, moist, very loose, brown (0.5–0.8); Fine sand,trace silt, moist,very loose, dark gray (0.8–2.0)	1.0 / 2.0	16.13 / 15.13
3, 4	S	1.7 85%	3 3 4 4	0.1 / 0.1	Fine sand,trace silt, moist,very loose, light brownish gray (2.0–4.0); Fine sand, trace silt, moist, very loose, brown (4.0–6.0)		
5, 6	S	1.5 75%	3 3 4 4	0.1 / 0.1	Fine sand, trace silt, wet, loose, brown (6.0–8.0)		
7, 8	S	2.0 100%	3 4 7 9	0.1 / 0.1	Fine sand, trace silt, wet, loose, light grayish brown (8.0–10.0)		
9, 10	S	2.0 100%	6 6 4 4	0.1 / 0.1	Fine sand, trace silt, wet, loose, light brownish gray (10.0–)		
			W.O.H.		Match to Sheet 2		

DRILLING CO.:	Parratt Wolff	BAKER REP.:	David D. Schilling
DRILLER:	Chip	BORING NO.:	MW04 SHEET 1 OF 2

Baker

Baker Environmental

TEST BORING AND WELL CONSTRUCTION RECORD

PROJECT: Site 10; phase II field investigation

CTO NO.: CTO-0369 BORING NO.: MW04

SAMPLE TYPE	DEFINITIONS
S = Split Spoon A = Auger	SPT = Standard Penetration Test (ASTM D1586)
T = Shelby Tube W = Wash	PID = Photo Ionization Detector Measurement
R = Air Rotary C = Core	MSL = Mean Sea Level
D = Denison P = Piston N = No Sample	ps/bg = point source/background

Depth (Ft.)	Sample Type & No.	Sample Rec. (Ft.,%)	SPT	PID (ppm) ps/bg	Visual Description	Well Installation Detail	Elevation (Ft. MSL) 6.63
11	S	2.0 100%	W.O.H. 1 2	0.1 0.1	Continued from Sheet 1		
					Fine sand, trace silt, wet, very loose, light gray (11.5–12.0)	12.0	5.13
12					Fine sand and clay, wet, semi-plastic, greenish gray		
13					End of boring = 12.0		
14							
15							
16							
17							
18							
19							
20							
21							
22							
23							
24							
25							
26							
27							
28							
29							
30							

DRILLING CO.: Parratt Wolff BAKER REP.: David D. Schilling

DRILLER: Chip BORING NO.: MW04 SHEET 2 OF 2

Baker

Baker Environmental

TEST BORING AND WELL CONSTRUCTION RECORD

PROJECT:	Site 10; phase II field investigation		
PROJ. NO.:	CTO-0369	BORING NO.:	MW06
COORDINATES:	EAST: 2501127.970	NORTH:	346861.68
ELEVATION:	SURFACE: 18.68	TOP OF PVC CASING:	21.75

Rig: Diedrich D-50	Split Spoon	Casing	Augers	Core Barrel	Date	Progress (Ft.)	Weather	Depth to Water (Ft.)
Size (ID)	1 7/8		6 1/4		2/27/01	14'	Sunny mid 60's	8.40
Length	24"		5'					
Type	SS		HS					
Hammer Wt.	140lbs							
Fall	30"							

Remarks:

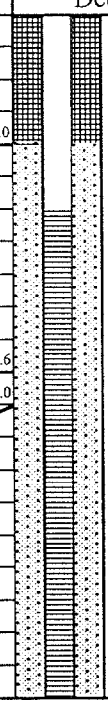
SAMPLE TYPE

S = Split Spoon A = Auger
T = Shelby Tube W = Wash
R = Air Rotary C = Core
D = Denison P = Piston
N = No Sample

WELL INFORMATION

Type	Diam.	Top Depth (Ft.)	Bottom Depth (Ft.)
PVC riser	2"	21.75	15.68
PVC 0.010 inch screen	2"	15.68	5.28

Depth (Ft.)	Sample Type & No.	Sample Rec. (Ft.,%)	SPT	PID (ppm) ps/bg	Visual Description	Well Installation Detail	Elevation (Ft. MSL) 18.68
1, 2	S	0.9 45%	2 3 3 5	0.0 / 0.0	Fine sand, trace silt, moist, loose, light brown	2.0	16.68
3, 4	S	1.7 85%	6 6 7 6	0.0 / 0.0	Fine sand, trace silt, moist, loose, light gray	3.0	15.68
5, 6	S	1.7 85%	5 5 6 6	0.0 / 0.0		5.6	
7, 8	S	2.0 100%	3 3 3 3	0.0 / 0.0	Fine sand, trace silt, wet, loose, light brown; Fine sand, trace silt, wet, very loose, light brown	6.0	
9, 10	S	1.8 90%	3 2 2 3	0.0 / 0.0			
			2		Match to Sheet 2		



DRILLING CO.:	Parratt Wolff	BAKER REP.:	David D. Schilling
DRILLER:	Chip	BORING NO.:	MW06 SHEET 1 OF 2

Baker

Baker Environmental

TEST BORING AND WELL CONSTRUCTION RECORD

PROJECT: Site 10; phase II field investigation

CTO NO.: CTO-0369 BORING NO.: MW06

SAMPLE TYPE

S = Split Spoon A = Auger
T = Shelby Tube W = Wash
R = Air Rotary C = Core
D = Denison P = Piston N = No Sample

DEFINITIONS

SPT = Standard Penetration Test (ASTM D1586)
PID = Photo Ionization Detector Measurement
MSL = Mean Sea Level
ps/bg = point source/background

Depth (Ft.)	Sample Type & No.	Sample Rec. (Ft.,%)	SPT	PID (ppm) ps/bg	Visual Description	Well Installation Detail	Elevation (Ft. MSL) 8.18
11	S	2.0	2	0.0	Continued from Sheet 1		
		100%	3	0.0	Fine sand, trace silt, wet,		
12			4		very loose, light brown		
			3				
13	S	2	1	0.1			
		100%	1	0.1		13.4	5.28
14					14.0		4.68
					End of Boring = 14.0'		
15							
16							
17							
18							
19							
20							
21							
22							
23							
24							
25							
26							
27							
28							
29							
30							

DRILLING CO.: Parratt Wolff BAKER REP.: David D. Schilling

DRILLER: Chip BORING NO.: MW06 SHEET 2 OF 2

Baker

Baker Environmental

TEST BORING AND WELL CONSTRUCTION RECORD

PROJECT: Site 10; phase II field investigation

PROJ. NO.: CTO-0369 BORING NO.: MW08

COORDINATES: EAST: 2500155.220 NORTH: 345513.11

ELEVATION: SURFACE: 20.81 TOP OF PVC CASING: 23.81

Rig: Diedrich D-50								
	Split Spoon	Casing	Augers	Core Barrel	Date	Progress (Ft.)	Weather	Depth to Water (Ft.)
Size (ID)	1 7/8		6 1/4		2/28/01	14	Cloudy low 50's	7.00
Length	24"		5'					
Type	SS		HS					
Hammer Wt.	140lbs							
Fall	30"							

Remarks:

SAMPLE TYPE

S = Split Spoon A = Auger
T = Shelby Tube W = Wash
R = Air Rotary C = Core
D = Denison P = Piston
N = No Sample

WELL INFORMATION

Type	Diam.	Top Depth (Ft.)	Bottom Depth (Ft.)
PVC riser	2"	23.81	16.81
PVC 0.010 inch screen	2"	16.81	6.81

Depth (Ft.)	Sample Type & No.	Sample Rec. (Ft.,%)	SPT	PID (ppm) ps/bg	Visual Description	Well Installation Detail	Elevation (Ft. MSL) 20.81
1	S	1.8 90%	W.O.H. 1 1 2	0.1 0.1	Fine sand, trace silt, moist, very loose, light gray (1.3)		
2					Fine sand, trace silt, moist, very loose, orangish brown (2.0)	2.0	18.81
3	S	1.9 95%	2 2 3 3	0.1 0.1	Fine sand, trace silt, moist, very loose, light brown, orange staining (4.0)	4.0	16.81
5	S	1.7 85%	2 2 3 4	0.1 0.1	Fine sand, trace silt, moist, very loose, light brown (6.7)		
7	S	1.7 85%	3 4 4 5	0.1 0.1	Fine sand, trace silt, wet, loose, light brown (8.0)		
9	S	1.9 95%	5 8 10 11	0.1 0.1	Fine sand, trace clay, wet, loose, light gray, orange motteling		
			4		Match to Sheet 2		

DRILLING CO.: Parratt Wolff BAKER REP.: David D. Schilling

DRILLER: Chip BORING NO.: MW08 SHEET 1 OF 2

Baker

Baker Environmental

TEST BORING AND WELL CONSTRUCTION RECORD

PROJECT: Site 10; phase II field investigation

CTO NO.: CTO-0369 BORING NO.: MW08

SAMPLE TYPE

S = Split Spoon A = Auger
T = Shelby Tube W = Wash
R = Air Rotary C = Core
D = Denison P = Piston N = No Sample

DEFINITIONS

SPT = Standard Penetration Test (ASTM D1586)
PID = Photo Ionization Detector Measurement
MSL = Mean Sea Level
ps/bg = point source/background

Depth (Ft.)	Sample Type & No.	Sample Rec. (Ft.,%)	SPT	PID (ppm) ps/bg	Visual Description	Well Installation Detail	Elevation (Ft. MSL) 10.31
11	S	2.0	5	0.1	Continued from Sheet 1		
		100%	5	0.1	Fine sand, trace clay, wet, loose, light gray, orange motteling (1.7–12.0)		
12			7				
			4		Fine sand & clay, wet, plastic, loose, brownish gray (12.0–13.4)		
13	S	2.0	5	0.1			
		100%	7	0.1	Fine sand, trace clay, wet, loose light gray (13.4–14.0)		
14			7			14.0	6.81
15					Fine sand & clay, wet, plastic, loose, light gray		
16					End of Boring = 14.0		
17							
18							
19							
20							
21							
22							
23							
24							
25							
26							
27							
28							
29							
30							

DRILLING CO.: Parratt Wolff BAKER REP.: David D. Schilling

DRILLER: Chip BORING NO.: MW08 SHEET 2 OF 2

Baker

Baker Environmental

TEST BORING AND WELL CONSTRUCTION RECORD

PROJECT: Site 10; phase II field investigation

PROJ. NO.: CTO-0369 BORING NO.: MW09

COORDINATES: EAST: 2501045.190 NORTH: 346543.15

ELEVATION: SURFACE: 16.59 TOP OF PVC CASING: 19.66

Rig: Diedrich D-50	Split Spoon	Casing	Augers	Core Barrel	Date	Progress (Ft.)	Weather	Depth to Water (Ft.)
Size (ID)	1 7/8		6 1/4		2/27/01	4'	Cloudy low 50's	0.50
Length	24"		5'		2/28/01	8'	Cloudy low 50's	
Type	SS		HS					
Hammer Wt.	140lbs							
Fall	30"							

Remarks:

SAMPLE TYPE

S = Split Spoon A = Auger
T = Shelby Tube W = Wash
R = Air Rotary C = Core
D = Denison P = Piston
N = No Sample

WELL INFORMATION

Type	Diam.	Top Depth (Ft.)	Bottom Depth (Ft.)
PVC riser	2"	19.66	15.59
PVC 0.010 inch screen	2"	15.59	5.59

Depth (Ft.)	Sample Type & No.	Sample Rec. (Ft.,%)	SPT	PID (ppm) ps/bg	Visual Description	Well Installation Detail	Elevation (Ft. MSL) 16.59
1	S	0.8 40%	W.O.H. 2 2 2	0.0 / 0.0	Fine sand, some silt, moist, very loose, dark brown (0.5)	0.5 / 1.0	16.09 / 15.59
2					Fine sand, trace silt, wet, very loose, light brown		
3	S	1.9 95%	3 4 6 6	0.0 / 0.0			
4					Fine sand, trace silt, wet, very loose, light gray (3.8)		
5	S	2.0 100%	3 2 4 6	0.1 / 0.1			
6							
7	S	2.0 100%	1 3 7 8	0.1 / 0.1			
8					(8.0)		
9	S	2.0 100%	6 5 7 9	0.1 / 0.1	Fine sand, trace silt, wet, loose, light gray, light orange staining		
10							
			2		Match to Sheet 2		

DRILLING CO.: Parratt Wolff BAKER REP.: David D. Schilling

DRILLER: Chip BORING NO.: MW09 SHEET 1 OF 2

Baker

Baker Environmental

TEST BORING AND WELL CONSTRUCTION RECORD

PROJECT: Site 10; phase II field investigation

CTO NO.: CTO-0369 BORING NO.: MW09

SAMPLE TYPE	DEFINITIONS
S = Split Spoon A = Auger	SPT = Standard Penetration Test (ASTM D1586)
T = Shelby Tube W = Wash	PID = Photo Ionization Detector Measurement
R = Air Rotary C = Core	MSL = Mean Sea Level
D = Denison P = Piston N = No Sample	ps/bg = point source/background

Depth (Ft.)	Sample Type & No.	Sample Rec. (Ft.,%)	SPT	PID (ppm) ps/bg	Visual Description	Well Installation Detail	Elevation (Ft. MSL) 6.09
11	S	2.0	3	0.1	Continued from Sheet 1	11.0	5.59
		100%	3	0.1	Fine sand, trace silt, wet, loose, light		
12			8		gray, light orange staining 12.0		4.59
					End of Boring = 12.0'		
13							
14							
15							
16							
17							
18							
19							
20							
21							
22							
23							
24							
25							
26							
27							
28							
29							
30							

DRILLING CO.: Parratt Wolff BAKER REP.: David D. Schilling

DRILLER: Chip BORING NO.: MW09 SHEET 2 OF 2

APPENDIX B
SAMPLING SUMMARIES

Sample Tracking and Chain-of-Custody Documentation - Site 10
Soil Sampling, CTO-369
MCB Camp Lejuene, North Carolina

SAMPLE ID	DATE SHIPPED	Analysis Requested				LOT #
		TCL Volatiles	TCL Semivolatiles	TCL Pest/PCBs	TAL Metals/CN	
COC# 3476						
369-SB01-00	3/18/98	X	X	X	X	H8C210110
369-SB01-02	3/18/98	X	X	X	X	H8C210110
369-SB02-00	3/18/98	X	X	X	X	H8C210110
369-SB02-02	3/18/98	X	X	X	X	H8C210110
369-SB03-00	3/18/98	X	X	X	X	H8C210110
369-SB03-03	3/18/98	X	X	X	X	H8C210110
369-SB04-00	3/18/98	X	X	X	X	H8C210110
369-SB04-03	3/18/98	X	X	X	X	H8C210110
369-SB05-00	3/18/98	X	X	X	X	H8C210110
369-SB05-00D	3/18/98	X	X	X	X	H8C210110
369-SB05-04	3/18/98	X	X	X	X	H8C210110
369-SB06-00	3/18/98	X	X	X	X	H8C210110
369-SB06-03	3/18/98	X	X	X	X	H8C210110
369-SB07-00	3/18/98	X	X	X	X	H8C210110
369-SB07-03	3/18/98	X	X	X	X	H8C210110
369-SB08-00	3/18/98	X	X	X	X	H8C210110
369-SB08-02	3/18/98	X	X	X	X	H8C210110
369-SB09-00	3/18/98	X	X	X	X	H8C210110
369-SB09-00D	3/18/98	X	X	X	X	H8C210110
369-SB10-00	3/18/98	X	X	X	X	H8C210110
369-SB09-03	3/18/98	X	X	X	X	H8C210108
369-SB10-01	3/18/98	X	X	X	X	H8C210108
369-SB11-00	3/18/98	X	X	X	X	H8C210108
369-SB11-02	3/18/98	X	X	X	X	H8C210108
369-SB12-00	3/18/98	X	X	X	X	H8C210108
369-SB12-04	3/18/98	X	X	X	X	H8C210108
369-SB13-00	3/18/98	X	X	X	X	H8C210108
369-SB13-04	3/18/98	X	X	X	X	H8C210108
369-SB14-00	3/18/98	X	X	X	X	H8C210108
369-SB14-01	3/18/98	X	X	X	X	H8C210108
369-SB15-00	3/18/98	X	X	X	X	H8C210108
369-SB15-01	3/18/98	X	X	X	X	H8C210108
369-SB16-00	3/18/98	X	X	X	X	H8C210108
369-SB16-00D	3/18/98	X	X	X	X	H8C210108
369-SB16-01	3/18/98	X	X	X	X	H8C210108
369-SB17-00	3/18/98	X	X	X	X	H8C210108
369-SB17-03	3/18/98	X	X	X	X	H8C210108

Sample Tracking and Chain-of-Custody Documentation - Site 10
Soil Sampling, CTO-369
MCB Camp Lejuene, North Carolina

SAMPLE ID	DATE SHIPPED	Analysis Requested				LOT #
		TCL Volatiles	TCL Semivolatiles	TCL Pest/PCBs	TAL Metals/CN	
COC# 3477						
369-SB18-00	3/20/98	X	X	X	X	H8C230124
369-SB18-00D	3/20/98	X	X	X	X	H8C230124
369-SB18-02	3/20/98	X	X	X	X	H8C230124
369-SB19-00	3/20/98	X	X	X	X	H8C230124
369-SB19-01	3/20/98	X	X	X	X	H8C230124
369-SB20-00	3/20/98	X	X	X	X	H8C230124
369-SB21-00	3/20/98	X	X	X	X	H8C230124
369-SB21-05	3/20/98	X	X	X	X	H8C230124
369-SB22-00	3/20/98	X	X	X	X	H8C230124
369-SB22-07	3/20/98	X	X	X	X	H8C230124
369-SB23-00	3/20/98	X	X	X	X	H8C230124
369-SB23-00D	3/20/98	X	X	X	X	H8C230124
369-SB23-03	3/20/98	X	X	X	X	H8C230124
369-SB24-00	3/20/98	X	X	X	X	H8C230124
369-SB25-00	3/20/98	X	X	X	X	H8C230124
		52	52	52	52	

Sample Tracking and Chain-of-Custody Documentation - Site 10
Soil Sampling, CTO-369
MCB Camp Lejuene, North Carolina

SAMPLE ID	DATE SHIPPED	Analysis Requested				LOT #
		TCL Volatiles	TCL Semivolatiles	TCL Pesticides/PCBs	TAL Metals/CN	
COC# 3475						
369-TW01-01	3/23/98	X	X	X	X	H8C240173
369-TW02-01	3/23/98	X	X	X	X	H8C240173
369-TW03-01	3/23/98	X	X	X	X	H8C240173
369-TW04-01	3/23/98	X	X	X	X	H8C240173
369-TW05-01	3/23/98	X	X	X	X	H8C240173
369-TW06-01	3/23/98	X	X	X	X	H8C240173
369-TW09-01	3/23/98	X	X	X	X	H8C240173
369-TW07-01	3/23/98	X	X	X	X	H8C240173
369-TW07-01D	3/23/98	X	X	X	X	H8C240173
369-TW08-01	3/23/98	X	X	X	X	H8C240173
369-IDWAQ	3/23/98	X	X	X	X	H8C240173
		11	11	11	11	

Sample Tracking and Chain-of-Custody Documentation - Site 10
Soil Sampling, CTO-369
MCB Camp Lejuene, North Carolina

SAMPLE ID	DATE SHIPPED	Analysis Requested				LOT #
		TCL Volatiles	TCL Semivolatiles	TCL Pest/PCBs	TAL Metals/CN	
COC# 3475						
369-SW01	3/23/98	X	X	X	X	H8C240166
369-SW02	3/23/98	X	X	X	X	H8C240166
369-SW03	3/23/98	X	X	X	X	H8C240166
369-SW04	3/23/98	X	X	X	X	H8C240166
369-SW05	3/23/98	X	X	X	X	H8C240166
369-SW05D	3/23/98	X	X	X	X	H8C240166
369-SW06	3/23/98	X	X	X	X	H8C240166
		6	6	6	6	

Sample Tracking and Chain-of-Custody Documentation - Site 10
Soil Sampling, CTO-369
MCB Camp Lejuene, North Carolina

SAMPLE ID	DATE SHIPPED	Analysis Requested				LOT #
		TCL Volatiles	TCL Semivolatiles	TCL Pesticides/PCBs	TAL Metals/CN	
COC# 3475						
369-SD01-06	3/23/98	X	X	X	X	H8C240166
369-SD02-06	3/23/98	X	X	X	X	H8C240166
369-SD03-06	3/23/98	X	X	X	X	H8C240166
369-SD04-06	3/23/98	X	X	X	X	H8C240166
369-SD05-06	3/23/98	X	X	X	X	H8C240166
369-SD05-06D	3/23/98	X	X	X	X	H8C240166
369-SD06-06	3/23/98	X	X	X	X	H8C240166
		7	7	7	7	

Sample Tracking and Chain-of-Custody Documentation - Site 10
Soil Sampling, CTO-369
MCB Camp Lejuene, North Carolina

SAMPLE ID	DATE SHIPPED	Analysis Requested				LOT #
		TCL Volatiles	TCL Semivolatiles	TCL Pest/PCBs	TAL Metals/CN	
COC# 3476						
369-TB01	3/18/98	X				H8C210108
369-TB02	3/18/98	X				H8C210108
369-TB03	3/18/98	X				H8C210108
COC# 3477						
369-FB01	3/20/98	X	X	X	X	H8C230128
369-FB02	3/20/98	X	X	X	X	H8C230128
369-ER01	3/20/98	X	X	X	X	H8C230128
369-ER02	3/20/98	X	X	X	X	H8C230128
369-TB04	3/20/98	X				H8C230128
369-TB05	3/20/98	X				H8C230128
369-TB06	3/20/98	X				H8C230128
COC# 3475						
369-TB07	3/23/98	X				H8C240173
369-TB08	3/23/98	X				H8C240173
COC# 4059						
369-ER09	3/24/98	X	X	X	X	H8C250187
		13	5	5	5	

APPENDIX C
CHAIN-OF-CUSTODY RECORDS

Environmental Services
5815 Middlebrook Pike
Knoxville, Tennessee 37921
(615) 588-6401

ANALYSIS REQUEST AND CHAIN OF CUSTODY RECORD*

Reference Document No. 3475
Page 1 of 3

Project Name/No. 1 SITE 10, MCB, CLEJ
Sample Team Members 2 J. CULP / G. YARKOWSKI
Profit Center No. 3 SRN
Project Manager 4 J. CULP
Purchase Order No. 6 62470-369-0000-06000
Required Report Date 11

Samples Shipment Date 7 March 23, 1998
Lab Destination 8 Knoxville, TN
Lab Contact 9 Ms. Jaime McKinney
Project Contact/Phone 12 Ms. Karen Wood
Carrier/Waybill No. 13

Bill to: 5 MR. James S. Culp
420 Rouser Rd
Coraopolis, PA
15108

Report to: 10 MR. JAMES S. CULP
SAME ADDRESS

ONE CONTAINER PER LINE

Sample Number 14	Sample Description/Type 15	Date/Time Collected 16	Container Type 17	Sample Volume 18	Preservative 19	Requested Testing Program 20	Condition on Receipt 21	Disposal Record No. 22
369-SW01	Surface H2O	3-21-98 0915	GLASS/ PLASTIC		HNO3 HCL NAOH	TCL ORGANICS, CN, TAL INORGANICS	FOR LAB USE ONLY	
369-SW02		3-21-98 1015						
369-SW03		3-21-98 1050						
369-SW04		3-21-98 1315						
369-SW05		3-21-98 1345						
369-SW05D		3-21-98 1345					FOR LAB USE ONLY	
369-SW06		3-21-98 1420						
369-SD01-06	Sediment	3-21-98 0930	GLASS		—	TCL ORGANICS THL INORGANICS	* POOR RECOVERY	

Special Instructions: 23

Possible Hazard Identification: 24
Non-hazard ☐ Flammable ☐ Skin Irritant ☐ Poison B ☐ Unknown ☒

Sample Disposal: 25
Return to Client ☐ Disposal by Lab ☒ Archive (mos.)

Turnaround Time Required: 26
Normal ☒ Rush ☐

QC Level: 27
I. ☐ II. ☐ III. ☒ Project Specific (specify):

1. Relinquished by 28 (Signature/Affiliation) James S. Culp	Date: 3-23-98 Time: 1600	1. Received by 28 (Signature/Affiliation)	Date: Time:
2. Relinquished by (Signature/Affiliation)	Date: Time:	2. Received by (Signature/Affiliation)	Date: Time:
3. Relinquished by (Signature/Affiliation)	Date: Time:	3. Received by (Signature/Affiliation)	Date: Time:

Comments: 29

White: To accompany samples
Yellow: Field copy
*See back of form for special instructions.

MCA

Quanterra
Environmental Services
5815 Middlebrook Pike
Knoxville, Tennessee 37921
(423) 588-6401

ANALYSIS REQUEST AND CHAIN OF CUSTODY RECORD (cont.)*

Reference Document No.[30] 3475
Page 2 of ~~2~~ 3

Project Name Site 10, MCB CLET Project No. 62470-369-0000-06000 Samples Shipment Date March 23, 1998

ONE CONTAINER PER LINE

Sample[14] Number	Sample[15] Description/Type	Date/Time[16] Collected	Container[17] Type	Sample[18] Volume	Pre-[19] servative	Requested Testing[20] Program	Condition on[21] Receipt	Disposal[22] Record No.
369-SD02-06	Sediment	3-21-98 1030	GLASS		—	TCL ORGANICS TAL Inorganics		
369-SD03-06		3-21-98 1100			—		FOR LAB USE ONLY	
369-SD04-06		3-21-98 1330			—		* Poor Recovery	
369-SD05-06		3-21-98 1400			—			
369-SD05-06D		3-21-98 1400			—		FOR LAB USE ONLY	
369-SD06-06		3-21-98 1430			—			
369-TW01-01	GROUNDWATER	3-22-98 1145	GLASS/ PLASTIC		HCL NAOH HNO3	TCL ORGANICS, CN TAL INORGANICS	FOR LAB USE ONLY	
369-TW02-01		3-22-98 1500						
369-TW03-01		3-22-98 1600					FOR LAB USE ONLY	
369-TW04-01		3-22-98 1630						
369-TW05-01		3-22-98 1715						
369-TW06-01		3-22-98 1400					FOR LAB USE ONLY	
369-TW09-01		3-22-98 1030						
~~369-~~		~~3-22-98~~						
~~369-~~							FOR LAB USE ONLY	
~~369-~~								
~~369-~~							FOR LAB USE ONLY	
~~369-~~								
~~369-~~								
~~369-~~								

White: To accompany samples Yellow: Field copy

*See back of form for special instructions.

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Quanta Environmental Services
5815 Middlebrook Pike
Knoxville, Tennessee 37921
(423) 588-6401

ANALYSIS REQUEST AND CHAIN OF CUSTODY RECORD (cont.)*

Reference Document No.[30] 3475
Page 3 of 3

Project Name SITE 10, MCB CLEJ
Project No. 62470-369-0000-06000
Samples Shipment Date MARCH 23, 1998

ONE CONTAINER PER LINE

Sample[14] Number	Sample[15] Description/Type	Date/Time[16] Collected	Container[17] Type	Sample[18] Volume	Pre-[19] servative	Requested Testing[20] Program	Condition on[21] Receipt	Disposal[22] Record No.
369-TW07-01	Groundwater	3-23-98 1330			HCL NaOH HNO_3	TCL ORGANICS, CN TAL INORGANICS		
369-TW07-01D		3-23-98 1330			HCL NaOH HNO_3		FOR LAB USE ONLY	
369-TW07-01MS		3-23-98 1330						
369-TW07-01MSD		3-23-98 1330					FOR LAB USE ONLY	
369-TW08-01		3-23-98 1230						
369-IDWA	IDW	3-23-98 1900						
369-TB07	TRIP BLK	3-23-98			HCL	TCL VOA	FOR LAB USE ONLY	
~~396~~								
369-TB08	TRIP BLK	3-23-98			HCL	TCL VOA		
~~369-EB02~~	~~EQUIPMENT~~	~~3-23-98~~			~~HCL~~ ~~HNO_3~~	~~TAL ORGANICS, CN~~	FOR LAB USE ONLY	
							FOR LAB USE ONLY	
							FOR LAB USE ONLY	
							FOR LAB USE ONLY	

White: To accompany samples
Yellow: Field copy
*See back of form for special instructions.

MCA 3/15/91

Quanterra Environmental Services
5815 Middlebrook Pike
Knoxville, Tennessee 37921
(615) 588-6401

ANALYSIS REQUEST AND CHAIN OF CUSTODY RECORD*

Reference Document No. 3476
Page 1 of 3

Project Name/No. [1] SITE 10, MCB CLET 62470-369
Samples Shipment Date [7] MARCH 19, 1998
Bill to: [5] MR. JAMES S. CULP, 420 ROBSER RD., CORAOPOLIS, PA. 15108
Sample Team Members [2] Jim Culp/Gerry Yarkowski
Lab Destination [8] Knoxville
Profit Center No. [3] SRN
Lab Contact [9] Ms. Jamie McKinney
Project Manager [4] Jim Culp
Project Contact/Phone [12] Ms. KAREN WOOD
Report to: [10] MR. JAMES S. CULP, SAME ADDRESS.
Purchase Order No. [6] 62470-369-0000-06000
Carrier/Waybill No. [13]
Required Report Date [11] 35 days past shipment Receipt

ONE CONTAINER PER LINE

Sample Number [14]	Sample Description/Type [15]	Date/Time Collected [16]	Container Type [17]	Sample Volume [18]	Pre-servative [19]	Requested Testing Program [20]	Condition on Receipt [21]	Disposal Record No. [22]
369-SB01-00	SOIL	3-18-98 0715				TCL ORGANICS TAL ~~METALS~~ INORANICS	FOR LAB USE ONLY	
369-SB01-02	SOIL	3-18-98 0730						
369-SB02-00		3-18-98 0745						
369-SB02-02		3-18-98 0755						
369-SB03-00		3-18-98 0815					FOR LAB USE ONLY	
369-SB03-03		3-18-98 0830						
369-SB04-00		3-18-98 0840						
369-SB04-03		3-18-98 0845					* SAMPLE RECOVERY DID NOT PERMIT ADEQUATE SAMPLE RECOVERY	

Special Instructions: [23] Recoveries May Not Permit collection of proper Quantities.

Possible Hazard Identification: [24]
Non-hazard ☐ Flammable ☐ Skin Irritant ☐ Poison B ☐ Unknown ☐

Sample Disposal: [25]
Return to Client ☐ Disposal by Lab ☒ Archive (mos.)

Turnaround Time Required: [26]
Normal ☒ Rush ☐

QC Level: [27]
I. ☐ II. ☐ III. ☒ Project Specific (specify):

1. Relinquished by [28] (Signature/Affiliation) Baker Env. James S. Culp	Date: 3-18-98 Time: 1600	1. Received by [28] (Signature/Affiliation)	Date: Time:
2. Relinquished by (Signature/Affiliation)	Date: Time:	2. Received by (Signature/Affiliation)	Date: Time:
3. Relinquished by (Signature/Affiliation)	Date: Time:	3. Received by (Signature/Affiliation)	Date: Time:

Comments: [29]
ll Ms. Karen Wood upon Receipt of samples

White: To accompany samples
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*See back of form for special instructions.

Quantera Environmental Services
5815 Middlebrook Pike
Knoxville, Tennessee 37921
(423) 588-6401

ANALYSIS REQUEST AND CHAIN OF CUSTODY RECORD (cont.)*

Reference Document No. 3476
Page 2 of 3

Project Name SITE 10, MCB, CLEJ 62470-369-0000-06000
Project No. 62470-369-0000-06000
Samples Shipment Date March 19, 1998

ONE CONTAINER PER LINE

Sample Number 14	Sample Description/Type 15	Date/Time Collected 16	Container Type 17	Sample Volume 18	Preservative 19	Requested Testing Program 20	Condition on Receipt 21	Disposal Record No. 22
369-SB05-00	SOIL	3-18-98 0900				TCL ORGANICS TAL INORGANICS		
369-SB05-00D		3-18-98 0900					FOR LAB	
369-SB05-04		3-18-98 0910					USE ONLY	
369-SB06-00		3-18-98 1040						
369-SB06-03		3-18-98 1050					* Poor Sample	Recovery
369-SB07-00		3-18-98 1100						
369-SB07-03		3-18-98 1110						
369-SB08-00		3-18-98 1120						
369-SB08-02		3-18-98 1130						
369-SB09-00		3-18-98 1310						
369-SB09-00D		3-18-98 1310						
369-SB09-00MS		3-18-98 1310						
369-SB09-00 MS/MSD		3-18-98 1310						
369-SB10-00		3-18-98 1330						
369-SB09-03		3-18-98 1315					* Poor Sample	Recovery
369-SB10-01		3-18-98 1330					* Poor Sample	Recovery
369-SB11-00		3-18-98 1355						
369-SB11-02		3-18-98 1400						
36-SB12-00		3-18-98 1440						
36-SB12-04		3-18-98 1450						

White: To accompany samples
Yellow: Field copy
*See back of form for special instructions.

MCA 3/15/91

Quanterra
Environmental Services
5815 Middlebrook Pike
Knoxville, Tennessee 37921
(423) 588-6401

ANALYSIS REQUEST AND CHAIN OF CUSTODY RECORD (cont.)*

Reference Document No.[30] 3476
Page 3 of 3

Project Name Site 10, MCB CLEJ

Project No. 62470-369-0000-06000

Samples Shipment Date MARCH 19, 1998

ONE CONTAINER PER LINE

Sample[14] Number	Sample[15] Description/Type	Date/Time[16] Collected	Container[17] Type	Sample[18] Volume	Pre-[19] servative	Requested Testing[20] Program	Condition on[21] Receipt	Disposal[22] Record No.
369-SB13-00	SOIL	3-18-98 1505				TCL ORGANICS TAL Inorganics		
369-SB13-04		3-18-98 1510					FOR LAB USE ONLY	
369-SB14-00		3-18-98 1522						
369-SB14-01		3-18-98 1535					* Poor Sample Recovery	
369-SB15-00		3-18-98 1550					FOR LAB USE ONLY	
369-SB15-01		3-18-98 1600					* Poor Sample Recovery	
369-SB16-00		3-18-98 1620					FOR LAB USE ONLY	
369-SB16-000		3-18-98 1620						
369-SB16-01		3-18-98 1630					* Poor Sample Recovery	
369-SB17-00		3-18-98 1650					FOR LAB USE ONLY	
369-SB17-03		3-18-98 1700						
369-TB01	Water	3-18-98		40ML	HCL	TCL VOA	TRIP Blank	FOR LAB USE ONLY
369-TB02	Water	3-18-98		40ML	HCL		TRIP Blank	
369-TB03	Water	3-18-98		40ML	HCL		TRIP Blank	
							FOR LAB USE ONLY	
							FOR LAB USE ONLY	

White: To accompany samples
Yellow: Field copy
*See back of form for special instructions.

Quanterra Environmental Services
5815 Middlebrook Pike
Knoxville, Tennessee 37921
(615) 588-6401

ANALYSIS REQUEST AND CHAIN OF CUSTODY RECORD*

Reference Document No. 3477

Project Name/No. 1 SITE ID, MCB CLET
Sample Team Members 2 J. CULP / G. YARKOWSKY
Profit Center No. 3 SRN
Project Manager 4 J. CULP
Purchase Order No. 6 62470-369-0000-06000
Required Report Date 11

Samples Shipment Date 7 MARCH 20, 1998
Lab Destination 8 KNOXVILLE, TN
Lab Contact 9 Ms. JAIME McKINNEY
Project Contact/Phone 12 Ms. KAREN WOOD
Carrier/Waybill No. 13

Bill to: 5 MR. JAMES S. CULP
420 ROUSER RD.
CORAOPOLIS, PA
15108

Report to: 10 MR. JAMES S. CULP
SAME ADRESS

White: To accompany samples
Yellow: Field copy

ONE CONTAINER PER LINE

Sample Number 14	Sample Description/Type 15	Date/Time Collected 16	Container Type 17	Sample Volume 18	Pre-servative 19	Requested Testing Program 20	Condition on Receipt 21	Disposal Record No. 22
369-FB01	WATER	3-20-98 0730			HCL, NaOH, HNO_3	TCL ORGANICS, TAL INORGANICS, CN	*FIELD BLANK (POTABLE H_2O)	
369-SB18-00	SOIL	3-19-98 1145				TCL ORGANICS TAL INORGANICS	FOR LAB USE ONLY	
369-SB18-00D		3-19-98 1145						
369-SB18-00MS		3-19-98 1145						
369-SB18-00MS/MSD		3-19-98 1145						
369-SB18-02		3-19-98 1155					FOR LAB USE ONLY	
369-SB19-00		3-19-98 1230						
369-SB19-01		3-19-98 1235					*SHORT ON VOLUME	

Special Instructions: 23 SOME RECOVERIES DID NOT PERMIT COLLECTION OF ADEQUATE SAMPLE VOLUME.

Possible Hazard Identification: 24
Non-hazard ☐ Flammable ☐ Skin Irritant ☐ Poison B ☐ Unknown ☒

Sample Disposal: 25
Return to Client ☐ Disposal by Lab ☒ Archive (mos.)

Turnaround Time Required: 26
Normal ☒ Rush ☐

QC Level: 27
I. ☐ II. ☐ III. ☒ Project Specific (specify):

1. Relinquished by 28 (Signature/Affiliation) BEI James S. Culp	Date: 3-20-98 Time: 1600	1. Received by 28 (Signature/Affiliation)	Date: Time:
2. Relinquished by (Signature/Affiliation)	Date: Time:	2. Received by (Signature/Affiliation)	Date: Time:
3. Relinquished by (Signature/Affiliation)	Date: Time:	3. Received by (Signature/Affiliation)	Date: Time:

Comments: 29

*See back of form for special instructions.

Quanterra Environmental Services
5815 Middlebrook Pike
Knoxville, Tennessee 37921
(423) 588-6401

ANALYSIS REQUEST AND CHAIN OF CUSTODY RECORD (cont.)*

Reference Document No.[30] 3477
Page 2 of 2

Project Name SITE 10, MCB CLEJ
Project No. 62470-369-0000-06000
Samples Shipment Date March 20, 1998

ONE CONTAINER PER LINE

Sample[14] Number	Sample[15] Description/Type	Date/Time[16] Collected	Container[17] Type	Sample[18] Volume	Pre-[19] servative	Requested Testing[20] Program	Condition on[21] Receipt	Disposal[22] Record No.
369-SB20-00	SOIL	3-19-98 1250				TCL ORGANICS TAL INORGANICS	* No Subsurface Sample	
369-SB21-00		3-19-98 1345						
369-SB21-05		3-19-98 1400						
369-SB22-00		3-19-98 1435						
369-SB22-00		3-19-98 1435						
369-SB22-07		3-19-98 1448						
369-SB23-00		3-19-98 1520						
369-SB23-00D		3-19-98 1520						
369-SB23-00MS		3-19-98 1520						
369-SB23-00MS/MSD		3-19-98 1520						
369-SB23-03		3-19-98 1530						
369-SB24-00		3-19-98 1640					* No Subsurface Sample	
369-SB25-00		3-19-98 1710					* No Subsurface Sample	
369-FB02	WATER	3-20-98 1006				TCL ORGANICS, CN TAL INORGANICS	* Field Blank (Dist. H2O)	
369-ER01	WATER	3-18-98 1050					* Equipment Rinseate (Spoon)	
369-ER02	WATER	3-19-98 1000					* Equipment Rinseate (Auger)	
369-TB04		3-20-98				TCL VOAs	* Trip Blank	
369-TB05		3-20-98					* Trip Blank	
369-TB06		3-20-98					* Trip Blank	

FOR LAB USE ONLY

White: To accompany samples
Yellow: Field copy

*See back of form for special instructions.

MCA 3/15/91

Quanterra Environmental Services
5815 Middlebrook Pike
Knoxville, Tennessee 37921
(423) 588-6401

ANALYSIS REQUEST AND CHAIN OF CUSTODY RECORD*

Reference Document No. 4059
Page 1 of 1

Project Name/No. 1 Site 16, MCB CLE
Sample Team Members 2 J. Culp
Profit Center No. 3 SIRN
Project Manager 4 J. Culp
Purchase Order No. 6 62470-369-0000-0000
Required Report Date 11

Samples Shipment Date 7 3-24-98
Lab Destination 8 Knoxville, TN
Lab Contact 9 Ms. Jaime McKinney
Project Contact/Phone 12 Ms. Karen Wood
Carrier/Waybill No. 13

Bill to: 5 J. Culp
420 Rouser Rd
AOP #3
Coraopolis, PA
15108

Report to: 10 Same

White: To accompany samples
Yellow: Field copy

ONE CONTAINER PER LINE

Sample Number 14	Sample Description/Type 15	Date/Time Collected 16	Container Type 17	Sample Volume 18	Preservative 19	Requested Testing Program 20	Condition on Receipt 21	Disposal Record No. 22
369-ER03	EQUIP RINSEATE	3-21-98			HNO3 HCL	TCL organics TAL Inorganics		
							FOR LAB USE ONLY	
							FOR LAB USE ONLY	

Special Instructions: 23

Possible Hazard Identification: 24
Non-hazard ☐ Flammable ☐ Skin Irritant ☐ Poison B ☐ Unknown ☒

Sample Disposal: 25
Return to Client ☐ Disposal by Lab ☒ Archive (mos.)

Turnaround Time Required: 26
Normal ☒ Rush ☐

QC Level: 27
I. ☐ II. ☐ III. ☒ Project Specific (specify):

1. Relinquished by 28 (Signature/Affiliation) James S. Culp	Date: 3-24-98 Time: 1600	1. Received by 28 (Signature/Affiliation)	Date: Time:
2. Relinquished by (Signature/Affiliation)	Date: Time:	2. Received by (Signature/Affiliation)	Date: Time:
3. Relinquished by (Signature/Affiliation)	Date: Time:	3. Received by (Signature/Affiliation)	Date: Time:

Comments: 29

*See back of form for special instructions.

MCA 3/15/91

COMPUCHEM
a division of Liberty Analytical Corp.
501 Madison Avenue
Cary, NC 27513
1-800-833-5097

CHAIN-OF-CUSTODY RECORD

No. 056794

Project Name : Site 10 phase II investigation	Client Address : Baker Environmental	Point-of-Contact : David Schillings
Carrier :		Telephone No. : 412-269-6137
Airbill No. :		Sampling complete? Y or N (see Note 1)
Sampler Name : David Schillings	Sampler Signature :	Project-specific (PS) or Batch (B) QC ? ____

BOX #1	BOX #2	BOX #3	Box #4	Box #5
1. Surface Water	A. HCl + Ice	F. Filtered	H. High	C. CLP 3/90
2. Ground Water	B. HNO3 + Ice	U. Unfiltered	M. Medium	S. SW-846
3. Leachate	C. NaOH + Ice		L. Low	W. CWA 600-series
4. Rinsate	D. H2SO4 + Ice			O. Other____
5. Soil / Sediment / Sludge	E. Unpreserved			T. TCLP
6. Trip Blank	F. Ice Only			
7. Oil	G. Other____			
8. Waste	H. NaHSO4 + Ice			
9. Other____	I. ZnAc+NaOH + Ice			

Sample ID (9 characters maximum)	Date: Year: 2001	Time	Box #1 Matrix	Box #2 Preservative	Box #3 Filtered / Unfiltered	Box #4 Expected Conc.	Box #5 Method	No. of Bottles	Use for Lab QC (MS or DUP)	VOA	SVOC	Pesticide	PCB	Herbicide	Metals ~~Mercury~~	Cyanide	TOC / TOX	O&G / TPH					Remarks / Comments (see Notes 2 & 3)
10-MW0201A	3/1	11:05	2	B	U		C	1							X								
10-MW0301A	3/1	9:48	2	B	U		C	1							X								
10-MW0401A	3/1	10:20	2	B	U		C	1							X								
10-MW0401A	3/1	10:20	2	B	U		C	1	DUP						X								10-MW0401ADUP
10-MW0601A	3/1	8:20	2	B	U		C	1							X								
10-MW0801A	3/1	9:40	2	B	U		C	1							X								
10-MW0901A	3/1	9:00	2	B	U		C	1							X								
10-MW0901A	3/1	9:00	2	B	U		C	1	MS						X								10-MW0901AMS
10-MW0901A	3/1	9:00	2	B	U		C	1	MSD						X								10-MW0901AMSD
	/	:																					

Clients Special Instructions: Temperature ____ °C

Lab: Received in Good Condition? Y or N Describe Problems, If any:

#1 Relinquished By: (Sig) Date: 3/1/00	#2 Relinquished By: (Sig) Date:	#3 Relinquished By: (Sig) Date:
Company Name: Time:	Company Name: Time:	Company Name: Time:
#1 Received By: (Sig) Date:	#2 Received By: (Sig) Date:	#3 Received By: (Sig) Date:
Company Name: Time:	Company Name: Time:	Company Name: Time:

Note (1): If "N" lab will hold samples to await remainder of project-maximizing batch size and minimizing QC ratio; if "Y" lab will begin processing batches now.
Note (2): Samples stored 60 days after date report mailed at no extra charge. Note (3): All lab copies of data destroyed after three years.

CompuChem
a division of Liberty Analytical Corp.
501 Madison Avenue
Cary, NC 27513
1-800-833-5097

CHAIN-OF-CUSTODY RECORD

No. 05675

Project Name : Site 10 phase II investigation	Client Address : Bakel Environmental	Point-of-Contact : David Schilling
Carrier :		Telephone No. : 412-269-6137
Airbill No. :		Sampling complete? Y or N (see Note 1)
Sampler Name : David D. Schilling	Sampler Signature :	Project-specific (PS) or Batch (B) QC ? ____

BOX #1	BOX #2	BOX #3	Box #4	Box #5
1. Surface Water	A. HCl + Ice	F. Filtered	H. High	C. CLP 3/90
2. Ground Water	B. HNO3 + Ice	U. Unfiltered	M. Medium	S. SW-846
3. Leachate	C. NaOH + Ice		L. Low	W. CWA 600-series
4. Rinsate	D. H2SO4 + Ice			O. Other RCRA
5. Soil / Sediment / Sludge	E. Unpreserved			T. TCLP
6. Trip Blank	F. Ice Only			
7. Oil	G. Other____			
8. Waste	H. NaHSO4 + Ice			
9. Other____	I. ZnAc+NaOH + Ice			

Sample ID (9 characters maximum)	Date:Year: 2001	Time	Box #1 Matrix	Box #2 Preservative	Box #3 Filtered / Unfiltered	Box #4 Expected Conc.	Box #5 Method	No. of Bottles	Use for Lab QC (MS or DUP)	VOA	SVOC	Pesticide	PCB	Herbicide	Metals / Mercury Total	Cyanide Contaminants	TOC / TOX	O&G / TPH	TSS	TDS	Reactivity	Ignitability	Remarks / Comments (see Notes 2 & 3)
10-IDW →	3/1	12:45	2	ABE	U	C →	~~TO~~	8		3	2				1				1	1			10-IDWWATER01A
10-TB01 01A	3/1	13:00	6	A	U	L →	~~TH~~	2		2													10-TB01-01A
10-IDW →	3/1	13:30	5	F	U		TO	5		1	X	X	1	X	X	X					X	X	10-IDWSOIL-01A
	/	:																					
	/	:																					
	/	:																					
	/	:																					
	/	:																					
	/	:																					
	/	:																					

Clients Special Instructions: Temperature ____ °C

Lab: Received in Good Condition? Y or N **Describe Problems, If any:**

#1 Relinquished By: (Sig)	Date: 3/1/01	#2 Relinquished By: (Sig)	Date:	#3 Relinquished By: (Sig)	Date:
Company Name:	Time:	Company Name:	Time:	Company Name:	Time:
#1 Received By: (Sig)	Date:	#2 Received By: (Sig)	Date:	#3 Received By: (Sig)	Date:
Company Name:	Time:	Company Name:	Time:	Company Name:	Time:

Note (1): If "N" lab will hold samples to await remainder of project-maximizing batch size and minimizing QC ratio; if "Y" lab will begin processing batches now.
Note (2): Samples stored 60 days after date report mailed at no extra charge. Note (3): All lab copies of data destroyed after three years.

APPENDIX D
SUMMARY OF GROUNDWATER DATA AND AQUIFER CHARACTERISTICS

SUMMARY OF GROUNDWATER DATA AND AQUIFER CHARACTERISTICS
MARINE CORPS BASE, CAMP LEJEUNE
JACKSONVILLE, NORTH CAROLINA

SUMMARY

This study examines the utility of exploratory aquifer tests (pump tests) at investigation sites across Marine Corps Base, Camp Lejeune (MCB-CL). The study reviews the available information on the relevant water-bearing layers, considers the general characteristics and applicability of aquifer tests, and concludes:

- That available information is satisfactorily complete to allow appropriate designs of groundwater systems in the main operating areas of MCB-CL;
- That quantified characterization of the water-bearing layers in explored areas of MCB-CL can be extended to other areas having similar geologic terrane;
- That exploratory tests are no longer routinely required or advisable;
- That reconnaissance testing (well-head tests or slug tests) of each newly installed or otherwise uncharacterized data station is highly advisable; and,
- That performance testing of groundwater extraction systems should be the recommended form of evaluating and adjusting withdrawal systems.

BACKGROUND

This study considers the aquifer characteristics (especially, the Coefficient of Transmissivity) and the production capacities (available discharge rates) of the two water-bearing layers relevant to the studies at MCB-CL. These water-bearing layers are the (shallow or surficial) water table and the Upper Castle Hayne Aquifer.

The water table at MCB-CL occupies the water-bearing zone within 25 to 35 feet of the surface; the Castle Hayne, immediately below this. However, the separation of the water table and the Castle Hayne is not always obvious. Usually, this separation is effected only by the low permeability material of the water table transiting to the significantly more permeable material of the Upper Castle Hayne; there is rarely an aquiclude or aquitard of vertically extensive clay separating the water table from the Castle Hayne.

The data available for this summary derive from three main sources:

- Assessment of Hydrologic and Hydrogeologic Data at Camp Lejeune Marine Corps Base, North Carolina; U.S. Geological Survey, Water-Resources Investigation Report 89-4096; 1989
- Wellhead Management Program Engineering Study 91-36; Geophex, Ltd.; 22Jan91
- Various site investigations by Baker Environmental, Inc., and reported to LANTDIV and MCB-CL

DISTRIBUTION OF DATA

The data available from the various sources have been compiled on Tables 1, 2 and 3, with Table 3 summarizing the relevant flow information. The accompanying map indicates the distribution of stations from which data are available.

The tabulated data indicate the main characteristics of each water-bearing layer:

- There is low available production from the water table.
- There is an excessive availability of production from the Castle Hayne compared to the probably acceptable levels of treatment volumes foreseeable in groundwater remediation systems.

The water table had production capacities of less than 5 gallons per minute (gpm) in all cases tested. The specific capacities of the discharge wells were always less than 1 gallon per minute per foot of drawdown (gpm/ft). The transmissivities calculated were generally near or below 1000 gallons per day per foot of drawdown (gpd/ft); only the deeper wells, which intercepted at least part of the Castle Hayne, had transmissivities in a range indicative of an acceptably producing zone. The hydraulic conductivity values were commonly in the range of tenths of feet per day (ft/d). The low production rates, low transmissivities and low hydraulic conductivities indicate that the water table is only marginally, at best, under Darcian conditions. Calculations based on these data would, therefore, be highly unreliable. However, the available information all indicate an expectably low rate of groundwater discharge, which in turn would produce only a narrow radius of effect around an individual production well:

> The standard equation for calculation of the radius of capture around an individual well is $r_c=720Q/\pi Ti$. With a discharge rate (Q) of 3 gpm, a transmissivity (T) of 500 gpd/ft and a representative gradient of 0.005, the radius of capture would be 275 ft. However, this calculation applies only to Darcian conditions in a homogeneous medium; the water table at MCB-CL is marginally Darcian and is highly non-homogeneous. The calculation of radius must, therefore, be in some degree of error, with no more usable data or calculation possible.

The Castle Hayne has production capacities generally ranging above 200 gpm. The estimated transmissivities are at least in the range of several tens of thousands gpd/ft, with specific capacities usually about 5 to 10 gpm/ft. The calculated hydraulic conductivities are usually in the scores of feet per day. The available discharge from the Castle Hayne is, therefore, much greater than that from the water table. The limiting factor in remediation schemes for the Castle Hayne then becomes the amount of water that can be treated by an affordable system, usually less than 500 gpm; this value of 500 gpm would be available from one or two wells in the Castle Hayne. The high values of aquifer parameters, the relatively low total discharge and the low number of production wells would conspire to limit the radius of effect available to a remediation scheme:

> The standard equation for calculation of the radius of capture around an individual well is $r_c=720Q/\pi Ti$. With a Q of 500 gpm, a T of 50000 gpd/ft and a representative gradient of 0.005, the radius of capture would be only 460 ft.

COMPARABILITY OF DATA ACROSS MCB-CL

The stratigraphic sequences of MCB-CL containing the water table and the Upper Castle Hayne have been well characterized. The available information indicates that the lithology and the hydrologic conditions can be correlated stratigraphically across the base (Tables 1 and 2). From these correlations, aquifer performance can be predicted sufficiently for an engineering design whose final criteria for suitability are performance-based.

The upper water-bearing zone is a highly variable layering and intercalation of clay, silt and sand. This variability, however, is found within recognizable limits. These limits correspond to the range of hydrologic characteristics described previously. Similar correlation is available for the lithology and hydrology of the Upper Castle Hayne.

In areas not near stations catalogued in Tables 1, 2 and 3, a reconnaissance comparison of well-head tests (slug tests) and an examination of lithologic descriptions will likely be sufficient to support the engineering evaluation of the site. There is ample demonstration that lithology has a significant influence on the hydrology of a site, and that, for a given geologic terrane, the influence is fairly consistent. The geologic terrane of MCB-CL has been broadly characterized and correlated between lithologic (stratigraphic descriptions) and hydrologic (aquifer tests and well-head tests) sequences. Lithologic descriptions can now provide a good indication of hydrologic conditions at MCB-CL in areas of similar terrane.

GENERAL APPLICABILITY OF AQUIFER TESTS

Aquifer (pump) tests are an extremely dangerous activity at contamination sites. While the information available from aquifer tests is required for engineering design of withdrawal systems, aquifer tests should not be a reconnaissance or an initial step in the investigation. Full consideration must be made of the redistribution of contaminants expectable from the test, of the change in structural support of disposal features by relaxation or increase of hydrostatic loading, and so forth.

Consideration must also be made of alternative sources of acceptable data on the aquifer. In the case of MCB-CL, alternatives to exploratory aquifer tests are available from the tabulation and correlation of aquifer characteristics, production performance and geologic terrane presently available.

From the available information and in light of the relative consistency of the geologic terrane of MCB-CL, exploratory tests at MCB-CL are not generally required. Therefore, exploratory tests are not advisable and should not form part of the initial investigation of a site. While they may be useful in certain circumstances after the initial investigation of a site, they should not, in the general case, be part of the investigation. Sufficiently satisfactory information is presently available to allow the initial engineering design of a groundwater response.

While exploratory aquifer tests are not advisable, performance tests of a newly installed system are highly recommended. These tests, to some extent, are a normal part of the initial operation of a system. Only minor additional monitoring and modification of the system during operation would provide data directly relevant to the long-term operation of that system.

In the Coastal Plain of MCB-CL, the information from an exploratory data station not coincident with the long-term extraction system is not fully transferable. That is, if the test station and the

recovery station are not the same, the aquifer parameters and calculations based on those parameters will differ. This means that data from an exploratory station are no more reliably usable that the data presently available, unless the exploratory station is collocated with the recovery system. However, if the exploratory and recovery stations are identical, and considering that alternative sources of acceptable data on the aquifer are available and that a performance test must be run as part of the initial operation of a recovery system, the exploratory test represents a superfluous duplication of effort.

TABLE 1
CAMP LEJEUNE PUMP TEST DATA

Well Number	Well Depth (ft,BGS)	Well Diameter (in)	Total Aquifer Thickness (ft)	Screened Length (ft)	Screened Interval (ft,BGS)	Water-level Drawdown During Pumping (ft,BGS)	Pumping Rate (Recovery wells) GPM	Duration of Pumping (min)	Specific Capacity (pumping rate/ drawdown)	T (square ft/ day)	K (ft/day)	S	Soils (ft,BGS)
013RW-01*	23	2	15	20	3-23	8.773	1	480	0.11	7.17	0.48	NA	0-10 silt/clay, 10-23 sand.
013MW-18	13	2	15	10	3-13	0.297	NA	480	NA	105.98	7.06	1.40E-02	0-7 silt/clay, 7-13 sand.
013MW-21	14	2	15	10	4-14	0.31	NA	480	NA	82.27	5.48	2.77E-02	0-4 silt/sand, 0-14 clay/silt
108RW-01*	15	2	9	9.1	2.45-11.55	6.38	0.5	485	0.08	5.30	0.59	NA	very fine sand
108MW-04		2	9				NA	485	NA	118.63	13.18	1.33E-02	
108MW-15	12.5	2	9	9.03	2.79-11.82		NA	485	NA	56.78	6.31	7.33E-03	0-8 sand/silt, 8-10 silt/clay
109MW-15		2	15			0.939	NA	460	NA	76.26	5.08	1.11E-02	
109MW-17	14.5	2	15	10	4.5-14.5	0.545	NA	460	NA	163.10	10.87	7.30E-03	0-15 fine sand
109RW-01*	15	2	15	9.5	2-11.5	6.265	3	460	0.48	7.80	0.52	NA	0-4 sand, 4-8 silt, 8-15 sand
110RW-01* (Drawdown,Theis)	21.8	2	50	19.2	2-21.2	9.53	3	475	0.31	200.02	4.00	NA	0-10.5 sand/silt, 10.5-15 sand/clay, 15-21.5 sand/clay, 21.5- sand
110RW-01* (Drawdown,Cooper)										161.86	3.24	NA	
110RW-01* Recovery(Theis)										106.06	2.12	NA	
110DW-01 (Drawdown,Theis)	30.3	2	50	4.8	24.9-29.7	0.02	3	475	NA	7080.48	142.00	4.52E-03	0-4 sand/silt, 4-10.5 clay, 10.5-15.5 sand/silt,15.5-20.5 clay, 20.5-on sand
110DW-01 (Drawdown,Cooper)									NA	7099.20	142	4.51E-03	
110DW-02 (Drawdown,Theis)	30	2	50	4.7	24.7-29.4	0.52	NA	475	NA	5398.56	108.00	1.51E-03	0-3 sand and silt with clay layers, 3-11 sand and silt, 11-30 sand with some limited clay layers
110DW-02 (Drawdown,Cooper)									NA	5400.00	108	1.51E-03	
110DW-03 (Drawdown,Theis)	30	2	50	4.9	24.5-29.4	0.47	NA	475	NA	2952.00	59.00	7.48E-02	0-6 sand and silt , 6-12 sand, 12-23 sand/clay, 23-30 sand
110DW-03 (Drawdown,Cooper)									NA	3225.60	64	5.85E-02	

T = Transmissivity
K = Hydraulic Conductivity
S = Storativity
* = Pumping well
NA - Not applicable

TABLE 2

HYDRAULIC CONDUCTIVITY TEST RESULTS (SLUG TEST)

Well Number	Well Depth (ft,BGS)	Well Diameter (in)	Saturated Aquifer Thickness* (ft)	Screened Length (ft)	Screened Interval (ft,BGS)	K Rising (ft/day)	Soils (ft,BGS)
013MW-03	14	2	1	9.8	4-13.8	0.75	0-6 clay, 6-14 silt
013MW-04	14	2	8.13	9.8	4-13.8	0.27	0-8 clay, 8-14 silt
013MW-11	16	2	9.14	10	6-16	0.37	0-4 sand/silt, 4-14 clay, 14-16 sand
013MW-21	14	2	9.2	10	4-14	0.46	0-4 silt/sand, 4-14 clay
108MW-08	12.8	2	8.83	9.7	2.7-12.4	0.59	0-8 very fine sand, 8-12 clayey peat, 12-13 sandy clay
108MW-09	12.8	2	7.81	9.7	2.8-12.5	0.53	0-13 silt/sand
108MW-13	10.8	2	NA	9.02	0.69-9.71	0.061	0-2 very fine sand, 8-9.5 sandy clay
108MW-17	13.1	2	NA	9.03	3.39-12.42	0.59	0-8 fine grained sand, 8-9 clayey peat, 9-12.5 sandy clay
109MW-17	14.5	2	9.04	10	4.5-14.5	9.00	0-15 fine sand
109MW-18	14	2	10.19	10	4.5-14.5	5.70	0-3 sand, 3-10 silt, 10-14 sand
110MW-07	11.96	2	9	9.8	1.5-11.3	0.0115	0-2 clay/silt, 2-4 clay/sand, 4-6 sand, 6-10 silt/clay, 10-14 silt /sand
110MW-09	14.2	2	9.47	9.8	3.8-13.6	0.16	0-6 sand/silt, 6-9 clay/silt, 9-12 sand/silt, 12-14 clay
110DW-03	30	6	22.04	4.9	24.5-29.4	1.07	0-3 sand, 3-4 clay, 4-10 sand/silt, 10-12 sand, 12-13 clay,13-22 silt/clay, 22-30 sand
41GW-07	20.5	2	12.03	10	10.5-20.5	1.15	1-5 silty sand, 5-9 clay, 9-10 silty sand, 10-12 fill, 12-16 silty sand with 1 ft clay layer,16-21 sand
41GW-08	15	2	9.48	10	5-15	0.14	0-1 silty sand, 1-6 sand, 6-14 clay with sand and silt, 14-16 silty sand
41GW-09	21	2	11.89	10	11-21	3.67	0-5 clay and sand, 5-21 silty sand
41GW-10	13	2	8.59	10	3-13	0.94	0-2 silty sand, 2-7 sand, 7-9 silty sand and clay, 9-12 lithified sandstone, 12-13 sand. 13-14 lithified sandstone
41GW-12	16	2	12.45	10	6-16	4.57	0-4 silty sand, 4-14 sand, 14-17 lithified sandstone
69GW-09	20.5	2	14.22	10	10.5-20.5	1.7	1-4 Sand/silt, 4-10 clay some sand, 10-21 sand/silt
69GW-10	16	2	10.5	10	6-16	0.17	1-17 sand/silt
69GW-12	12.5	2	11.27	10.5	2-12.5	0.12	0-13.5 sand/silt
69GW-02D	125	2	22.1	10	40-50	0.29	0-125 silty sand **
69GW-12D	58	2	53.83	10	48-58	6.66	0-58 silty sand **
74GW-03A	18	2	13.58	10	8-18	0.59	0-17 silty sand, 17-18.5 sandy clay
74GW-06	16.5	2	8.18	9.74	15.5-26	6.33	1-26 sand/silt
74GW-08	23	2	10.51	10	13-23	3.55	0-1 silty sand, 1-24 sand

* Values taken from AQTESOL results. (Bottom of screened interval- water level)

** Due to depth, soils were very generally described.

K = Hydraulic Conductivity

TABLE 3

-CL5 CTO-232 CL5-1B1.wks 8SEP94 MCB-CAMP LEJEUNE

STATION	b ft	Q gpm	Sc gpm/ft	T ft-sq/d	T gpd/ft	K ft/d
013RW-01	15	1.0	0.11	7.2	54	0.5
013MW-1	15			106.0	793	7.1
013MW-2	15			82.3	615	5.5
013MW-03	1					0.8
013MW-04	8					0.3
013MW-11	9					0.4
013MW-21	8					0.5
41GW-07						1.2
41GW-08						0.1
41GW-09						3.7
41GW-10						0.9
41GW-12						4.6
69GW-09						1.7
69GW-10						0.2
69GW-12						0.1
69GW-02DW						0.3
69GW-12DW						6.7
74GW-03A						0.6
74GW-06						6.3
74GW-08						3.6
108RW-01	9	0.5	0.08	5.3	40	0.6
MW-0	9			118.6	887	13.2
108MW-1	9			56.8	425	6.3
108MW-08	9					0.6
108MW-09	8					0.5
108MW-13	8					0.1
108MW-17	8					0.6
109MW-1	15			76.3	570	5.1
109MW-1	15			163.1	1220	10.9
109RW-01	15	3.0	0.48	7.8	58	0.5
109MW-17	15					9.0
109MW-18	15					5.7
110RW-01	50	3.0	0.31	200.0	1496	4.0
110RW-01	50	3.0	0.31	161.9	1211	3.2
110RW-01	50	3.0		106.1	793	2.1
110DW-01	50			7080	52962	142.0
110DW-01	50			7099	53102	142.0
110DW-02	50			5399	40381	108.0
110DW-02	50			5400	40392	108.0
110DW-03	50			2952	22081	59.0
110DW-03	50			3226	24127	64.0
110MW-07	9					0.1
110MW-09	9					0.2
110DW-03	22					5.8

STATION	b ft	Q gpm	Sc gpm/ft	T ft-sq/d	T gpd/ft	K ft/d
BB-43	275	170	5.0	8900	66572	32.4
BB-44	275	450	10.0	17900	133892	65.1
BB-222	275	329	9.4	10600	79288	38.5
HP-612	285	275	5.4	7900	59092	27.7
HP-614	285	323	4.9	6600	49368	23.2
HP-621	300	200	9.1	24500	183260	81.7
HP-628	320	160	3.4	6400	47872	20.0
HP-629	300	210	5.7	7900	59092	26.3
HP-634	300	163	4.5	4300	32164	14.3
HP-636	300	211	6.8	6900	51612	23.0
HP-643	295	278	5.3	9700	72556	32.9
HP-644	300	246	4.3	8100	60588	27.0
HP-646	305	304	10.6	20200	151096	66.2
HP-647	305	500	9.8	18700	139876	61.3
HP-648	310	250	2.9	5600	41888	18.1
HP-649	310	257	2.6	5000	37400	16.1
HP-651	305	270	3.8	7300	54604	23.9
HP-652	320	218	2.2	4400	32912	13.8
HP-663	325	350	4.8	6400	47872	19.7
HP-699	275	250	5.7	7700	57596	28.0
HP-700	270	250	6.8	11500	86020	42.6
HP-701	275	250	7.2	12400	92752	45.1
HP-705	295	250	9.0	13100	97988	44.4
HP-706	300	250	3.8	4700	35156	15.7
HP-709	310	200	4.4	8500	63580	27.4
HP-710	310	200	5.1	9900	74052	31.9
HP-711	320	200	6.8	10700	80036	33.4
LCH-4006	295	540	10.0	14500	108460	49.2
LCH-4007	295	275	11.8	13700	102476	46.4
M-267	260	170	7.7	10300	77044	39.6
M-628	260	70	3.0	6100	45628	23.5
RR-229	290	429	12.2	19400	145112	66.9
TT-25	280	150	5.0	7200	53856	25.7

STATION	PUMPING LEVEL	Q gpm	Sc gpm/ft
HP-602	44	154	3.5
HP-603	30	129	4.3
HP-606	38	267	7.0
HP-607	46	246	5.3
HP-608	21	208	9.9
HP-609	45	199	4.4
HP-610	14	214	15.3
HP-613	17	157	9.2
HP-616	15	178	11.9
HP-620	9	224	24.9
HP-622	55	330	6.0
HP-623	30	210	7.0
HP-628	45	172	3.8
HP-629	45	216	4.8
HP-632	21	224	10.7
HP-633	18	205	11.4
HP-634	36	219	6.1
HP-635	33	151	4.6
HP-636	35	149	4.3
HP-637	40	130	3.3
HP-638	84	201	2.4
HP-639	52	[--]	0.0
HP-640	28	210	7.5
HP-641	44	351	8.0
HP-642	32	[--]	0.0
HP-643	35	269	7.7
HP-644	52	230	4.4
HP-645	40	192	4.8
HP-646	11	154	14.0
HP-647	26	302	11.6
HP-648	84	263	3.1
HP-649	80	100	1.3
HP-650	75	480	6.4
HP-651	69	242	3.5
HP-652	82	216	2.6
HP-653	29	197	6.8
HP-654	30	175	5.8
HP-655		[--]	ERR
HP-660		150	ERR
HP-661	37	275	7.4
HP-662	53	148	2.8
HP-663	23	100	4.3
HP-698	33	216	6.5
HP-699	21	140	6.7

STATION	PUMPING LEVEL	Q gpm	Sc gpm/ft
HP-700	39	192	4.9
HP-701	36	236	6.6
HP-703	33	293	8.9
HP-704	38	159	4.2
HP-705	25	214	8.6
HP-706	33	214	6.5
HP-707	51	50	1.0
HP-708	42	219	5.2
HP-709	52	239	4.6
HP-710	29	115	4.0
HP-711	56	235	4.2
HP-5186	38	336	8.8
LCH-4007	34	150	4.4
LCH-4009	22	349	15.9
TT-23	36	160	4.4
TT-25	22	130	5.9
TT-26	32	127	4.0
TT-31	28	111	4.0
TT-52	18	236	13.1
TT-54	20	119	6.0
TT-67	29	119	4.1
RR-45	11	192	17.5
RR-47	5	140	28.0
RR-97	14	170	12.1
RR-229	35	[--]	0.0
BB-44	11	125	11.4
BB-47	6	341	56.8
BB-218	17	192	11.3
BB-220	13	119	9.2
BB-221	19	230	12.1
TC-325	8	100	12.5
TC-502	1	180	180.0
TC-504	35	203	5.8
TC-600	32	172	5.4
TC-604	16	137	8.6
TC-700	28	125	4.5
TC-901	37	[--]	0.0
TC-1000	25	110	4.4
TC-1001	16	160	10.0
TC-1251	6	150	25.0
TC-1253	5	128	25.6
TC-1254	3	122	40.7
TC-1255	36	104	2.9
TC-1256	48	108	2.3

STATION	PUMPING LEVEL	Q gpm	Sc gpm/ft
AS-108	8	226	28.3
AS-131	11	310	28.2
AS-190	60	220	3.7
AS-191	16	220	13.8
AS-203	19	220	11.6
AS-4140	6	110	18.3
AS-4150	10	128	12.8
AS-5001	27	185	6.9
AS-5009	53	111	2.1
BA-164	21	214	10.2
BA-190	17	303	17.8

APPENDIX E
BASE SOIL BACKGROUND RESULTS

APPENDIX E
BASE BACKGROUND
SURFACE SOIL ANALYTICAL RESULTS
BACKGROUND STUDY
MCB, CAMP LEJEUNE, NORTH CAROLINA

SAMPLE ID	BASE-BG01-00	BASE-BG02-00	BASE-BG03-00	BASE-BG04-00	BASE-BG05-00	BASE-BG06-00	BASE-BG07-00	BASE-BG08-00
SAMPLE DATE	7/11/00	7/13/00	7/13/00	7/11/00	7/13/00	7/13/00	7/13/00	7/16/00
METALS (mg/kg)								
Aluminum	2040	1380	2090	8530	2320	3140	2170	3680 J
Antimony	0.22 UJ	0.24 UJ	0.27 J	0.32 UJ	0.19 U	0.22 UJ	0.2 U	0.32 J
Arsenic	0.28 U	0.73	0.27 U	0.42 J	0.3 J	0.27 U	0.27 U	0.62 J
Barium	3.9	6	6.3	14	9.5	6.7	7.3	16.7
Beryllium	0.062 U	0.058 U	0.042 J	0.11 U	0.094 J	0.038 U	0.029 J	0.077 J
Cadmium	0.021 U	0.021 U	0.021 U	0.021 U	0.02 U	0.021 U	0.021 U	0.023 U
Calcium	28.4 U	52.7 J	87.6 J	170	17400	152	299	11500
Chromium	2.7	0.85	1.9	9.4	2	3	2.3	4.6
Cobalt	0.086 U	0.19 J	0.083 U	0.4 J	0.12 J	0.14 J	0.083 U	0.44 J
Copper	0.33 J	0.73	0.88	1.3	0.41 U	0.83	0.84 U	2
Iron	251	365	971	5000	1040	623	1300	2410 J
Lead	3.2 J	3.1 J	3 J	7.4 J	4 J	4.6 J	12.1 J	8.2 J
Magnesium	25.9 J	27.9 J	47.4 J	274	333	65.3 J	45.4 J	286
Manganese	0.81 J	17	2.1 J	5.1	9.5 J	2.1	1.3 J	49
Mercury	0.041	0.028 UJ	0.048	0.038	0.044 U	0.053 UJ	0.056 U	0.052
Nickel	0.31 J	0.84	0.64	1.6	0.64	0.91	0.42 J	1.2
Potassium	46.4 J	22.3 J	34.4 J	169 J	45.8 J	73.8 J	35.9 J	139
Selenium	0.24 U	0.23 U	0.23 UJ	0.36 J	0.22 UJ	0.25 J	0.23 UJ	0.43 J
Silver	0.086 U	0.084 U	0.083 U	0.085 U	0.079 U	0.082 U	0.083 U	0.092 U
Sodium	30.8 U	26.2 U	62.8 U	37.7 U	64.7 U	61.1 U	73.1 U	129 U
Thallium	0.35 UJ	0.35 UJ	0.34 UJ	0.35 UJ	0.32 UJ	0.34 UJ	0.34 UJ	0.38 UJ
Vanadium	3.3	1.2 J	2.8	13.4	2.2 U	3.4	4.1	7.6
Zinc	0.9 U	1.5 U	2.5 U	3.8	2.7	2.8 U	3.5	6

APPENDIX E
BASE BACKGROUND
SURFACE SOIL ANALYTICAL RESULTS
BACKGROUND STUDY
MCB, CAMP LEJEUNE, NORTH CAROLINA

SAMPLE ID	BASE-BG09-00	BASE-BG10-00	BASE-BG11-00	BASE-BG12-00	BASE-BG13-00	BASE-BG14-00	BASE-BG15-00	BASE-BG16-00
SAMPLE DATE	7/14/00	7/13/00	7/11/00	7/11/00	7/11/00	7/12/00	7/16/00	7/13/00
METALS (mg/kg)								
Aluminum	190	5390	2540	9130	5390	3770	4730 J	4820
Antimony	0.26 J	0.19 U	0.42 UJ	0.44 UJ	0.49 J	0.23 UJ	0.3 J	0.34 J
Arsenic	0.26 U	0.64 J	0.83 J	0.73 J	0.49 J	0.3 U	0.3 U	1
Barium	1.6	12	14.1	19.6	9.2	12	10	20
Beryllium	0.02 J	0.07 J	0.11 J	0.14 J	0.09 U	0.098 U	0.1 J	0.072 J
Cadmium	0.02 U	0.02 U	0.11 J	0.033 U	0.022 U	0.023 U	0.023 U	0.056 J
Calcium	46.2 U	592	105000	200	75.3 J	344	44.3 J	8720
Chromium	0.51 J	6.4	9.7	9.6	6.1 J	3.3	5	7.4
Cobalt	0.082 U	0.34 J	0.3 J	0.45 J	0.31 J	0.1 J	0.51 J	0.29 J
Copper	2.1	1.5	2.9	2.2	1.6	0.57 J	1.6	5.8
Iron	126	3830	2420	6050	7900	2910	1220 J	3940
Lead	2.8	5.4 J	38.5 J	9.9 J	5.4 J	5.1 J	7.9 J	26.8 J
Magnesium	14 U	146	1610	241	130	114 J	131	330
Manganese	2.3 U	6.4 J	25.9	7.3	3.1	5.3	2.5	13.6 J
Mercury	0.053 U	0.05 U	0.069	0.06	0.018 U	0.032 J	0.061	0.26 U
Nickel	0.092 U	1.4	1.6	1.7	0.83	0.49 J	0.72	1.4
Potassium	13.2 U	88.4 J	263 J	168 J	162	61.7 J	124	102
Selenium	0.22 U	0.22 UJ	0.63 J	0.73 J	0.38 J	0.42 J	0.8	0.22 UJ
Silver	0.082 U	0.08 U	0.083 U	0.13 U	0.097 J	0.093 U	0.092 U	1.1
Sodium	73.7 U	69.1 U	307	46.9 U	39.8 U	38.5 U	102 U	62.2 U
Thallium	0.34 UJ	0.33 UJ	0.34 UJ	0.55 UJ	0.36 UJ	0.38 UJ	0.38 UJ	0.33 UJ
Vanadium	1.2 J	9.8	7.7	16.6	12.4 J	4.8	5.6	9.1
Zinc	1.5 J	3.4	18.4	4.8	4.3	2.8	1 J	25.2

APPENDIX E
BASE BACKGROUND
SURFACE SOIL ANALYTICAL RESULTS
BACKGROUND STUDY
MCB, CAMP LEJEUNE, NORTH CAROLINA

SAMPLE ID	BASE-BG17-00	BASE-BG18-00	BASE-BG19-00	BASE-BG20-00	BASE-BG21-00	BASE-BG22-00	BASE-BG23-00	BASE-BG24-00
SAMPLE DATE	7/13/00	7/14/00	7/14/00	7/16/00	7/15/00	7/14/00	7/11/00	7/13/00
METALS (mg/kg)								
Aluminum	2140	894	5680	2520 J	53.9	4270 J	2660	123
Antimony	0.19 U	0.2 U	0.2 U	0.34 J	0.19 U	0.25 J	0.9 J	0.37 UJ
Arsenic	0.26 U	0.27 U	0.83 J	0.29 U	0.26 U	0.85 J	0.28 U	0.27 U
Barium	6.1	2.4	15.2	9.2	2.3	9.2	9.1	3.6
Beryllium	0.047 J	0.01 U	0.075 J	0.061 J	0.016 J	0.038 J	0.066 U	0.013 U
Cadmium	0.02 U	0.021 U	0.021 U	0.022 U	0.02 U	0.02 U	0.021 U	0.021 U
Calcium	49.4 J	44.2 J	726	48.6 J	43.7 U	171	3840	327
Chromium	1.7	0.98	7.2	3.5	0.29 U	4.4	3.3 J	0.42 J
Cobalt	0.081 U	0.083 U	0.21 J	0.17 J	0.08 U	0.19 J	0.2 J	0.083 U
Copper	1.2	1.1	1.5	0.53 U	0.24 U	1.2	18.2	4.1
Iron	858	751	3280	707 J	44	1890 J	1440	106
Lead	8 J	4 J	11.7	4.3 J	0.45	8.7 J	32.5 J	3 J
Magnesium	48.7 J	18.8 J	193	75.2 J	9.5 U	95.9 J	106	56.2
Manganese	8.7 J	2.6 J	5.4 J	1.6	3.3 J	5.5	18.7	3.1
Mercury	0.037 U	0.033 U	0.1 U	0.032 J	0.045 U	0.04	0.028 J	0.036 UJ
Nickel	0.48 J	0.24 J	0.96	0.11 J	0.09 U	0.9	1.8	0.64 U
Potassium	27.6 J	15 J	135	74.2 J	6.5 U	73 J	54.7 J	36.8 J
Selenium	0.22 UJ	0.23 UJ	0.28 J	0.63	0.22 U	0.22 U	0.23 U	0.34 J
Silver	0.081 U	0.083 U	0.084 U	0.089 U	0.08 U	0.081 U	0.085 U	0.083 U
Sodium	55.7 U	53.3 U	82.3 U	103 U	46.5 U	75.8 U	52.4 U	85.7 U
Thallium	0.34 UJ	0.34 UJ	0.35 UJ	0.37 UJ	0.33 UJ	0.33 UJ	0.35 UJ	0.34 UJ
Vanadium	2.4	1.8 J	11.1	4.7	0.44 J	6.8	3.6 J	0.49 J
Zinc	5.2	3	5.2	0.36 J	0.24 U	1.9 J	25.4	10.8

APPENDIX E
BASE BACKGROUND
SURFACE SOIL ANALYTICAL RESULTS
BACKGROUND STUDY
MCB, CAMP LEJEUNE, NORTH CAROLINA

SAMPLE ID	BASE-BG25-00	BASE-BG26-00	BASE-BG27-00	BASE-BG28-00	BASE-BG29-00	BASE-BG30-00	BASE-BG31-00	BASE-BG32-00
SAMPLE DATE	7/15/00	7/14/00	7/14/00	7/15/00	7/12/00	7/12/00	7/16/00	7/15/00
METALS (mg/kg)								
Aluminum	1460	919	73 J	2870	2070	29.4	6350	1470
Antimony	0.31 J	0.37 J	0.26 J	0.19 U	0.2 UJ	0.22 UJ	0.22 UJ	0.22 U
Arsenic	0.46 J	0.25 U	0.33 U	0.35 J	0.27 U	0.26 U	0.3 U	0.3 U
Barium	5.7	4.3	0.73 J	6.9	5.9	0.28 U	24	2.2
Beryllium	0.082 J	0.026 J	0.013 U	0.05 J	0.038 U	0.018 U	0.08 J	0.033 J
Cadmium	0.02 U	0.019 U	0.026 U	0.056 J	0.021 U	0.02 U	0.023 U	0.023 U
Calcium	112	126	12.4 J	2030	4210	11.8 U	67.8 J	44.7 U
Chromium	1.4	1.3	0.22 U	4.3	2.8	0.17 U	4.1	1.3
Cobalt	0.089 J	0.076 U	0.1 U	0.16 J	0.1 J	0.079 U	0.26 J	0.094 U
Copper	0.97 U	1.3	0.34 U	1.7	1.6	0.9	1.2	0.82 U
Iron	884	456	51.4 J	2200	1660	26.3	2670	1030
Lead	7	3.2	1 J	3.4	3.8 J	0.53 J	5.7	2.3
Magnesium	88.6 J	29 J	7.2 U	107	92 J	6.9 U	115	38.5 J
Manganese	2.3 J	4.1 J	0.53 U	8.5 J	28	0.29 U	5	9.4 J
Mercury	0.063 U	0.048 U	0.021 J	0.071 U	0.027 UJ	0.017 U	0.12 J	0.066 U
Nickel	0.55	0.35 J	0.12 U	0.76	0.73 U	0.088 U	1.4	0.31 J
Potassium	34.2 J	17.6 U	5.8 J	66.3 J	58.9 J	3.8 U	79 J	28.9 J
Selenium	0.32 J	0.21 U	0.28 U	0.37 J	0.23 U	0.22 U	0.25 U	0.26 U
Silver	0.11 J	0.076 U	0.1 U	0.079 U	0.083 U	0.079 U	0.091 U	0.094 U
Sodium	78 U	48.5 U	112 U	49.5 U	50.8 U	28.8 U	78.7 U	94.3 U
Thallium	0.34 UJ	0.32 UJ	0.42 UJ	0.33 UJ	0.34 UJ	0.32 UJ	0.38 UJ	0.39 UJ
Vanadium	3.8	1.5 B	0.36 J	5.2	4.8	0.14 J	6.5	2.3 J
Zinc	5.6	2.7	0.31 U	3.1	5.7	1.1 U	2.8 U	1.8 J

APPENDIX E
BASE BACKGROUND
SURFACE SOIL ANALYTICAL RESULTS
BACKGROUND STUDY
MCB, CAMP LEJEUNE, NORTH CAROLINA

SAMPLE ID	BASE-BG33-00	BASE-BG34-00	BASE-BG35-00	BASE-BG36-00	BASE-BG37-00	BASE-BG38-00	BASE-BG39-00	BASE-BG40-00
SAMPLE DATE	7/14/00	7/15/00	7/16/00	7/15/00	7/16/00	7/16/00	7/16/00	7/16/00
METALS (mg/kg)								
Aluminum	31	1820	2630 J	670	2450 J	54.5	1040	17600 J
Antimony	0.2 U	0.28 J	0.46 J	0.28 J	0.55 J	0.2 UJ	0.23 UJ	0.6 J
Arsenic	0.27 U	0.26 U	0.27 U	0.28 U	0.35 U	0.27 U	0.32 U	1.3 J
Barium	0.48 U	3.5	6	2.2	1.6	0.93 J	4.4	15.7
Beryllium	0.018 J	0.036 J	0.06 J	0.033 J	0.014 U	0.01 U	0.012 U	0.53 J
Cadmium	0.021 U	0.02 U	0.021 U	0.022 U	0.027 U	0.021 U	0.037 J	0.033 U
Calcium	37.2 U	67.5 J	423	77.2 J	30.7 J	143	222	80.5 J
Chromium	0.26 U	1.9	2.2	0.9	2.6	0.24 J	1.4	12.6
Cobalt	0.083 U	0.12 J	0.15 J	0.086 U	0.11 U	0.084 U	0.098 U	0.36 J
Copper	0.28 U	2.2	38.5	1.1	1 U	0.43 J	0.88	1.4
Iron	40.2	836	1520 J	434	538 J	40.1	369	12200 J
Lead	1.2	2.6	4.3 J	3.9	2.4 J	0.99	5.8	8.7 J
Magnesium	10.1 U	53.5 J	159	32.1 J	19.8 J	21.6 J	24.7 J	226
Manganese	5.2 J	14.2 J	16.9	2.8 J	1 U	0.74 J	1.7	6.3
Mercury	0.036 U	0.063 U	0.04	0.08 U	0.029 J	0.051 J	0.086 J	0.11
Nickel	0.093 U	0.53	0.62	0.097 U	0.3 J	0.095 U	0.19 J	1.5
Potassium	10.3 U	29.8 J	47 J	18.8 U	23.7 J	10.2 J	18.7 J	133 J
Selenium	0.23 U	0.22 U	0.46 J	0.24 U	0.31 J	0.23 U	0.27 U	3.4
Silver	0.083 U	0.079 U	0.083 U	0.086 U	0.11 U	0.084 U	0.098 U	0.21 J
Sodium	73.2 U	69.1 U	111 U	67.4 U	127 U	83.6 U	94.8 U	159 U
Thallium	0.34 UJ	0.33 UJ	0.34 UJ	0.36 UJ	0.45 UJ	0.35 UJ	0.4 UJ	0.54 UJ
Vanadium	0.35 J	2.4	2.4	1.5 J	3.7	0.27 J	1.5 J	26.2
Zinc	0.37 U	5.4	3.4	1.3 J	5.3	1.6 U	6.3	2.1 J

APPENDIX E
BASE BACKGROUND
SURFACE SOIL ANALYTICAL RESULTS
BACKGROUND STUDY
MCB, CAMP LEJEUNE, NORTH CAROLINA

SAMPLE ID	BASE-BG41-00	BASE-BG42-00	BASE-BG43-00	BASE-BG44-00	BASE-BG45-00	BASE-BG46-00	BASE-BG47-00	BASE-BG48-00
SAMPLE DATE	7/15/00	7/16/00	7/16/00	7/16/00	7/17/00	7/13/00	7/16/00	7/12/00
METALS (mg/kg)								
Aluminum	1120	2420	79.6	3160	664	478	708	40.8
Antimony	0.48 J	0.33 UJ	0.2 UJ	0.2 UJ	0.2 UJ	0.46 J	0.2 UJ	0.2 UJ
Arsenic	0.37 J	0.29 U	0.28 U	0.58 J	0.27 U	0.27 U	0.27 U	0.27 U
Barium	2.5	4.6	1.1	13.8	2.7	2.1	4.5	0.32 U
Beryllium	0.037 J	0.041 J	0.011 U	0.079 J	0.012 J	0.01 U	0.016 J	0.015 U
Cadmium	0.064 J	0.022 U	0.021 U	0.021 U	0.021 U	0.021 U	0.02 U	0.021 U
Calcium	402	268	25.3 J	56.2 J	72.1 J	58.6 J	176	18 U
Chromium	1.7	2.3	0.41 J	2.7	1.2	0.7	1.3	0.3 U
Cobalt	0.097 U	0.14 J	0.085 U	0.13 J	0.084 U	0.083 U	0.11 J	0.083 U
Copper	1.2	5.4	0.29 J	0.96	0.44 J	4.9	0.89	0.16 U
Iron	724	1090	55.8	1400	346	298	412	34.8
Lead	2.1	3.7	1.5	6.1	1.7	5.5 J	2.4	0.57 J
Magnesium	42.2 J	81.1 J	9.8 J	68.9 J	25.8 J	22.2 J	30.1 J	5.2 U
Manganese	4.5 J	5.8	0.94 J	8.6	2	2 J	8	0.49 U
Mercury	0.05 U	0.059 J	0.047 J	0.096 J	0.06 J	0.038 U	0.058 J	0.017 U
Nickel	0.37 J	0.53 J	0.096 U	0.58	0.094 U	0.15 J	0.44 J	0.093 U
Potassium	21.9 U	33.6 J	13 J	39.7 J	23.6 J	19.4 J	24.7 J	4.7 U
Selenium	0.27 U	0.24 U	0.23 U	0.23 U	0.23 U	0.23 UJ	0.23 U	0.23 U
Silver	0.097 U	0.089 U	0.085 U	0.085 U	0.084 U	0.083 U	0.082 U	0.083 U
Sodium	95.4 U	74.3 U	78.8 U	85.1 U	85.7 U	52.9 U	78.2 U	26.5 U
Thallium	0.4 UJ	0.36 UJ	0.35 UJ	0.35 UJ	0.34 UJ	0.34 UJ	0.34 UJ	0.34 UJ
Vanadium	1.8 J	2 J	0.54 J	3.8	1.6 J	1.2 J	2.7	0.16 J
Zinc	1.5 J	73.9	1.3 U	2.8 U	1.6 U	8.5	2 U	0.67 U

APPENDIX E
BASE BACKGROUND
SURFACE SOIL ANALYTICAL RESULTS
BACKGROUND STUDY
MCB, CAMP LEJEUNE, NORTH CAROLINA

SAMPLE ID	BASE-BG49-00	BASE-BG50-00
SAMPLE DATE	7/12/00	7/12/00
METALS (mg/kg)		
Aluminum	7280	41.6
Antimony	0.2 UJ	0.27 UJ
Arsenic	0.39 J	0.27
Barium	19.5	0.69 U
Beryllium	0.11 J	0.017 U
Cadmium	0.021 U	0.021 U
Calcium	369	18.3 U
Chromium	6.9	0.45 U
Cobalt	0.37 J	0.083 U
Copper	0.98	0.16 U
Iron	2290	94.5
Lead	5.2 J	1.4 J
Magnesium	222	7.7 U
Manganese	3.7	0.64 J
Mercury	0.023 J	0.02 J
Nickel	1.3	0.094 U
Potassium	212 J	5 U
Selenium	0.23 U	0.23 U
Silver	0.085 U	0.083 U
Sodium	25.3 U	31.8 U
Thallium	0.35 UJ	0.34 UJ
Vanadium	10.5	0.54 J
Zinc	3.2	0.66 U

APPENDIX E
BASE BACKGROUND
SUB-SURFACE SOIL ANALYTICAL RESULTS
BACKGROUND STUDY
MCB, CAMP LEJEUNE, NORTH CAROLINA

SAMPLE ID	BASE-BG01-02	BASE-BG02-03	BASE-BG03-02	BASE-BG04-02	BASE-BG05-02	BASE-BG06-05	BASE-BG07-03	BASE-BG08-05	BASE-BG09-05
SAMPLE DATE	7/11/00	7/13/00	7/13/00	7/11/00	7/13/00	7/13/00	7/13/00	7/16/00	7/14/00
METALS (mg/kg)									
Aluminum	2830	6000	10700	4660	10900	3330	6860	1570 J	7640
Antimony	0.25 UJ	0.29 UJ	0.24 U	0.43 UJ	0.24 U	0.2 UJ	0.28 J	0.41 J	0.22 U
Arsenic	0.29 U	1 J	8.3	0.3 U	9.3	1.1	0.3 U	0.3 U	0.3 U
Barium	5.2	12.7	21.4	10.5	13.4	18.2	11.1	3.4	7.9
Beryllium	0.057 U	0.092 U	0.19 J	0.069 U	0.16 J	0.069 U	0.13 J	0.012 U	0.097 J
Cadmium	0.022 U	0.024 U	0.025 U	0.023 U	0.025 U	0.021 U	0.023 U	0.023 U	0.023 U
Calcium	16.1 U	235	172	104 J	1800	61.3 J	42.9 J	22.8 J	39.4 U
Chromium	2.8	13.2	20.8	5.6	19.3	5.2	9.3	3.2	7.5
Cobalt	0.088 U	0.14 J	0.47 J	0.22 J	0.46 J	0.1 J	1.1	0.092 U	0.35 J
Copper	0.16 U	1.8	3.6	0.44 J	3.9	1.4	1.8	0.48 U	0.72 U
Iron	322	3020	13300	1290	14000	2410	1450	1130 J	1330
Lead	3.1 J	8.6 J	10.7 J	5.2 J	10.7 J	3 J	6.6 J	2.5 J	5.1
Magnesium	62.3 J	323	572	151	568	78.1 J	212	63.3 J	214
Manganese	1.1	3.5	5.1 J	3	5.9 J	1.4	3.4 J	2	3.7 J
Mercury	0.041	0.032 UJ	0.09	0.03 J	0.045	0.028 UJ	0.036 U	0.029 J	0.055 U
Nickel	0.33 J	0.86	1.1	0.76	1.1	0.53 U	1.4	0.1 U	1.2
Potassium	45.7 J	303 J	565	131 J	518	66 J	275	57.9 J	292
Selenium	0.25 J	0.26 U	0.51 J	0.26 U	0.59 J	0.27 J	0.25 UJ	0.4 J	0.25 U
Silver	0.088 U	0.096 U	0.15 J	0.094 U	0.19 J	0.082 U	0.092 U	0.092 U	0.091 U
Sodium	29.2 U	68 U	86.2 U	38.4 U	63.8 U	49.6 U	98.3 U	102 U	51.2 U
Thallium	0.36 UJ	0.4 UJ	0.42 UJ	0.39 UJ	0.42 UJ	0.34 UJ	0.38 UJ	0.38 UJ	0.38 UJ
Vanadium	3	9.3	31.9	5.1	32	7.4	9.7	7.7	6.3
Zinc	2.1 U	4.2	6.4	2.9 U	6.5	2.4 U	4.3	0.28 U	4.2

APPENDIX E
BASE BACKGROUND
SUB-SURFACE SOIL ANALYTICAL RESULTS
BACKGROUND STUDY
MCB, CAMP LEJEUNE, NORTH CAROLINA

SAMPLE ID	BASE-BG10-03	BASE-BG11-03	BASE-BG12-04	BASE-BG13-03	BASE-BG14-01	BASE-BG15-03	BASE-BG16-04	BASE-BG17-04	BASE-BG18-02
SAMPLE DATE	7/13/00	7/11/00	7/11/00	7/11/00	7/12/00	7/16/00	7/13/00	7/13/00	7/14/00
METALS (mg/kg)									
Aluminum	1410	8800	1740	14900	4500	15600 J	1200	6850	260 J
Antimony	0.35 J	0.28 UJ	0.21 UJ	0.23 UJ	0.34 UJ	0.5 J	0.23 U	0.2 UJ	0.2 UJ
Arsenic	0.27 U	3.9	0.29 U	0.55 J	0.29 U	8.1	0.32 U	0.43 J	0.28 U
Barium	2	15.7	3.9	14.6	15.6	22.4	3.2	8.2	1.2
Beryllium	0.028 J	0.24 J	0.035 U	0.26 J	0.1 U	0.26 J	0.024 J	0.098 U	0.011 U
Cadmium	0.021 U	0.025 U	0.022 U	0.024 U	0.022 U	0.026 U	0.024 U	0.022 U	0.022 U
Calcium	63.2 J	148	29.7 U	112 J	4950	30.4 J	73.6 J	181	12.7 J
Chromium	1.6	22.6	1.8	15.9 J	4.6	23.3	1.6	9.3	0.83
Cobalt	0.083 U	0.32 J	0.11 J	0.67	0.23 J	0.71	0.098 U	0.32 J	0.087 U
Copper	0.3 U	4.2	0.24 J	3.2	1.2	3.5	0.31 U	0.85	0.43 U
Iron	356	5050	329	4100	2720	12000 J	481	1420	121 J
Lead	1.9 J	10 J	1.9 J	7.5 J	8.7 J	12.2 J	1.8 J	4.8 J	1.3 J
Magnesium	46.9 J	264	44.7 J	343	190	617	38.5 J	242	16.8 J
Manganese	1.3 J	4.5	2	5.2	17.2	6.7	1.6 J	3	1.9
Mercury	0.027 U	0.044 J	0.022 J	0.02 U	0.027 J	0.036 J	0.027 U	0.032 UJ	0.019 U
Nickel	0.2 J	1.2	0.37 J	1.6	1	2	0.34 J	0.93	0.097 U
Potassium	32 J	869 J	53.6 J	644	102 J	784	31.8 J	269 J	17.6 J
Selenium	0.23 UJ	0.49 J	0.24 U	0.26 U	0.3 J	1.3	0.27 UJ	0.24 U	0.24 U
Silver	0.083 U	0.1 U	0.088 U	0.096 U	0.088 U	0.36 J	0.098 U	0.086 U	0.087 U
Sodium	64.6 U	41 U	34.7 U	47.1 U	45.6 U	140 U	71.3 U	56.6 U	80.2 U
Thallium	0.34 UJ	0.42 UJ	0.36 UJ	0.4 UJ	0.36 UJ	0.42 UJ	0.4 UJ	0.35 UJ	0.36 UJ
Vanadium	1.7 J	24.2	1.9 J	13.6 J	7.2	39	2.3 J	8.8	0.75 J
Zinc	1.2 U	4.8	1.6 U	11.8	6.9	6.4	1.3 U	3.1 U	0.26 U

APPENDIX E
BASE BACKGROUND
SUB-SURFACE SOIL ANALYTICAL RESULTS
BACKGROUND STUDY
MCB, CAMP LEJEUNE, NORTH CAROLINA

SAMPLE ID	BASE-BG19-04	BASE-BG20-01	BASE-BG21-02	BASE-BG22-04	BASE-BG23-01	BASE-BG24-01	BASE-BG25-01	BASE-BG26-03	BASE-BG27--
SAMPLE DATE	7/14/00	7/16/00	7/15/00	7/14/00	7/11/00	7/13/00	7/14/00	7/14/00	7/14/00
METALS (mg/kg)									
Aluminum	4620	4070 J	8640	5810 J	9900	5260	1340	3630	4640 J
Antimony	0.21 U	0.23 UJ	0.22 U	0.31 J	0.31 J	0.22 U	0.2 J	0.32 J	0.4 J
Arsenic	0.88 J	0.31 U	0.3 U	0.28 U	0.92 J	0.31 U	0.27 U	0.28 U	0.34 J
Barium	5.3	10.4	7.1	7.4	13.9	3.2	4	6.8	15.3
Beryllium	0.058 J	0.062 J	0.081 J	0.07 J	0.095 U	0.023 J	0.028 J	0.049 J	0.07 J
Cadmium	0.022 U	0.024 U	0.023 U	0.022 U	0.022 U	0.024 U	0.021 U	0.022 U	0.021 U
Calcium	26.8 U	87.2 J	38.5 U	41.6 J	499	13 U	83.8 J	44.2 U	71.3 J
Chromium	5.3	7.8	9.4	7.4	9.6 J	5.2	1.5	4.2	4.5
Cobalt	0.14 J	0.21 J	0.74	0.22 J	0.84	0.25 J	0.084 U	0.2 J	0.6
Copper	0.7 U	0.95	0.66 U	0.94 U	3.1	0.43 U	0.25 J	2.8	1.7
Iron	1580	840 J	1770	877 J	4600	1370	953	1530	3440 J
Lead	3.3	5.1 J	6	4.1 J	4 J	2.6 J	1.9	2.8	3.5 J
Magnesium	130	144	193	166	197	55.2 J	65.5 J	101 J	216
Manganese	2 J	4.7	5.9	2.8	4.5	1 J	2.2	2.4 J	7.1
Mercury	0.047 U	0.031 J	0.061	0.018 U	0.024 J	0.051 U	0.025 J	0.054 U	0.022 J
Nickel	0.55 J	0.39 J	1.9	0.37 J	3.6	2	0.44 J	0.95	1.6
Potassium	130	176	190	235	189	33.6 J	33.4 J	64.2 J	121
Selenium	0.26 J	0.44 J	0.25 U	0.24 J	0.24 U	0.26 UJ	0.23 U	0.24 U	0.32 J
Silver	0.089 U	0.095 U	0.092 U	0.086 U	0.087 U	0.094 U	0.084 U	0.087 U	0.085 U
Sodium	44.6 U	116 U	83.9 U	87.2 U	40.7 U	62.8 U	89.6 U	55 U	65.2 U
Thallium	0.37 UJ	0.39 UJ	0.38 UJ	0.36 UJ	0.36 UJ	0.39 UJ	0.34 UJ	0.36 UJ	0.35 UJ
Vanadium	7.6	13.7	7.1	8.6	11.7 J	9.9	2.4	5.4	8.9
Zinc	1.5 J	0.33 J	3.4	0.84 J	5.1	1.3 U	1.3 U	2.5	1.8 J

APPENDIX E
BASE BACKGROUND
SUB-SURFACE SOIL ANALYTICAL RESULTS
BACKGROUND STUDY
MCB, CAMP LEJEUNE, NORTH CAROLINA

SAMPLE ID	BASE-BG28-02	BASE-BG29-02	BASE-BG30-01	BASE-BG31-04	BASE-BG32-03	BASE-BG33-02	BASE-BG34-03	BASE-BG35-01	BASE-BG36-01
SAMPLE DATE	7/15/00	7/12/00	7/12/00	7/16/00	7/15/00	7/14/00	7/15/00	7/16/00	7/15/00
METALS (mg/kg)									
Aluminum	16800	8160	3800	407	2540	1100 J	2200	1210 J	9670
Antimony	0.47 J	0.23 UJ	0.22 UJ	0.21 UJ	0.24 U	0.26 J	0.28 J	0.23 J	0.2 U
Arsenic	1.9	0.42 J	0.28 U	0.28 U	0.32 U	0.32 U	0.27 U	0.28 U	1.4
Barium	23.1	16.6	1.8	1.4	0.92 J	1.6	4	3.2	12.7
Beryllium	0.15 J	0.12 U	0.047 U	0.011 U	0.16 J	0.012 U	0.038 J	0.015 J	0.068 J
Cadmium	0.023 U	0.024 U	0.022 U	0.022 U	0.025 U	0.025 U	0.021 U	0.021 U	0.021 U
Calcium	557	98.7 J	14.5 U	21.3 J	35.6 U	9.1 U	44.2 U	112	66.7 J
Chromium	22.5	9.7	6.1	1	2.5	1.3	2.5	1.4	13.2
Cobalt	0.68	0.43 J	0.087 U	0.087 U	0.14 J	0.16 J	0.24 J	0.085 U	1
Copper	3	1.9	0.58	0.47 J	1.6	0.72 U	0.53 U	0.67	1 U
Iron	15600	4120	93.1	222	102	485 J	624	715 J	4310
Lead	8.1	6.2 J	3.6 J	1.6	1	1.1 J	1.4	1.7 J	5.2
Magnesium	525	266	16.9 J	22.6 J	12.3 U	39 J	86.3 J	54.8 J	209
Manganese	6.9 J	3.9	0.75 J	1 J	3.5 J	2.3	3.9 J	2.7	4.2 J
Mercury	0.057 U	0.026 UJ	0.039	0.042 J	0.067 U	0.021 J	0.053 U	0.025 J	0.081 U
Nickel	2.8	1.4	0.26 J	0.098 U	0.11 U	0.64	0.66	0.096 U	3
Potassium	434	264 J	28.5 J	22.6 J	17.2 U	22.4 J	51.1 J	37.2 J	124
Selenium	0.77	0.42 J	0.31 J	0.24 U	0.27 J	0.29 J	0.23 U	0.24 U	0.46 J
Silver	0.24 J	0.097 U	0.087 U	0.087 U	0.099 U	0.1 U	0.082 U	0.085 U	0.1 J
Sodium	59.4 U	53.3 U	28.7 U	72.3 U	59.5 U	84.3 U	64.7 U	101 U	57.5 U
Thallium	0.38 UJ	0.4 UJ	0.36 UJ	0.36 U	0.41 UJ	0.41 UJ	0.34 UJ	0.35 UJ	0.35 UJ
Vanadium	33.9	14	3	1.1 J	0.35 J	1.4 J	2.3	1.4 J	11.9
Zinc	7.4	6.1	0.84 U	1.3 U	0.31 U	0.3 U	1.1 J	0.26 U	2.3

APPENDIX E
BASE BACKGROUND
SUB-SURFACE SOIL ANALYTICAL RESULTS
BACKGROUND STUDY
MCB, CAMP LEJEUNE, NORTH CAROLINA

SAMPLE ID	BASE-BG37--	BASE-BG38-01	BASE-BG39-01	BASE-BG40-01	BASE-BG41-01	BASE-BG42-01	BASE-BG43-03	BASE-BG44-03	BASE-BG45-01
SAMPLE DATE	7/16/00	7/16/00	7/16/00	7/16/00	7/15/00	7/16/00	7/16/00	7/16/00	7/17/00
METALS (mg/kg)									
Aluminum	3720 J	372	2470 J	4780	3310	3500	1620	6450	4890
Antimony	0.22 UJ	0.23 UJ	0.27 J	0.23 UJ	0.24 U	0.22 UJ	0.2 UJ	0.26 UJ	0.22 UJ
Arsenic	0.3 U	0.32 U	0.31 U	0.32 U	0.43 J	0.37 J	0.27 U	0.3 U	3.2
Barium	4.2	0.67 J	4	5.7	3.1	5.9	1.8	8	5.7
Beryllium	0.012 U	0.012 U	0.013 J	0.036 J	0.046 J	0.054 J	0.01 U	0.04 J	0.042 J
Cadmium	0.023 U	0.025 U	0.024 U	0.025 U	0.025 U	0.023 U	0.021 U	0.023 U	0.023 U
Calcium	29.2 J	41.6 J	28 J	37.3 J	82.6 J	159	28.3 J	42.7 J	42 J
Chromium	4.4	1.2	2.7	4.4	4.8	2.2	1.7	7.1	9
Cobalt	0.23 J	0.098 U	0.14 J	0.41 J	0.099 U	0.092 U	0.11 J	0.26 J	0.13 J
Copper	0.43 U	0.23 J	0.44 U	0.59 J	0.48 U	3.3	1.2	0.75	0.72
Iron	1380 J	81.5	626 J	1440	776	1120	611	1720	2490
Lead	2.6 J	1.6	2.2 J	2.6	3.3 J	3.5	1.5	3.2	4.2
Magnesium	106 J	13.5 J	87.1 J	123 J	24.4 J	87 J	30.1 J	167	168
Manganese	2	1.1 J	1.8	1.9	0.74 J	4.2	1.3	2.6	2.6
Mercury	0.026 J	0.06 J	0.021 J	0.085 J	0.072 U	0.061 J	0.055 J	0.054 J	0.16 J
Nickel	0.94	0.11 U	0.12 J	1.2	0.42 J	0.52 J	0.71	0.8	0.5 J
Potassium	66.9 J	16 J	44.8 J	63.5 J	17.4 J	31 J	22.4 J	121 J	120 J
Selenium	0.47 J	0.27 U	0.26 U	0.27 U	0.27 UJ	0.25 U	0.23 U	0.25 U	0.26 U
Silver	0.093 U	0.098 U	0.094 U	0.098 U	0.099 U	0.092 U	0.083 U	0.092 U	0.093 U
Sodium	97 U	92 U	80.1 U	87.3 U	59.9 U	90.3 U	80.8 U	98.7 U	101 U
Thallium	0.38 UJ	0.41 UJ	0.39 UJ	0.4 UJ	0.41 UJ	0.38 UJ	0.34 UJ	0.38 UJ	0.38 UJ
Vanadium	4.6	0.6 J	2.6	5.7	2 J	2 J	1.7 J	7.1	6.6
Zinc	0.28 U	2 U	0.28 U	2.6 U	1 U	7.9	2.1 U	4.2	3.3

APPENDIX E
BASE BACKGROUND
SUB-SURFACE SOIL ANALYTICAL RESULTS
BACKGROUND STUDY
MCB, CAMP LEJEUNE, NORTH CAROLINA

SAMPLE ID	BASE-BG46-02	BASE-BG47-04	BASE-BG48-01	BASE-BG49-02	BASE-BG50-01
SAMPLE DATE	7/13/00	7/16/00	7/12/00	7/12/00	7/12/00
METALS (mg/kg)					
Aluminum	1450	5290	3640	9510	4680
Antimony	0.23 U	0.24 UJ	0.4 UJ	0.23 UJ	0.35 UJ
Arsenic	0.32 U	3.3	0.28 U	2.6	0.3 U
Barium	1.4	27.1	1.8	12.1	3.3
Beryllium	0.039 J	0.91	0.041 U	0.22 J	0.035 U
Cadmium	0.025 U	0.025 U	0.022 U	0.024 U	0.023 U
Calcium	12.6 U	458	21.3 U	256	16.9 U
Chromium	1.9	11.3	6.1	15.9	6.1
Cobalt	0.098 U	6.8	0.086 U	0.39 J	0.41 J
Copper	0.27 U	6.7	0.52 J	2.2	0.17 U
Iron	1250	8450	251	6550	1160
Lead	1.8 J	5.4	3.4 J	5.3 J	2.8 J
Magnesium	14.9 J	1250	28.7 J	367	58.6 J
Manganese	0.57 J	67.6	1.1	5.7	3.7
Mercury	0.042 U	0.059 J	0.044	0.034 J	0.042
Nickel	0.13 J	12.3	0.51 J	0.97	2
Potassium	11.9 J	668 J	34.3 J	546 J	46.4 J
Selenium	0.27 UJ	0.3 J	0.32 J	0.27 U	0.25 U
Silver	0.098 U	0.1 J	0.086 U	0.12 J	0.092 U
Sodium	62 U	66.4 U	37.1 U	37 U	33.5 U
Thallium	0.41 UJ	0.42 UJ	0.36 UJ	0.4 UJ	0.38 UJ
Vanadium	3.2	11.1	3	17.1	6.4
Zinc	1 U	39.7	1.5 U	5	1.9 U

APPENDIX F
EVALUATION OF METALS IN GROUNDWATER

DRAFT

EVALUATION OF METALS IN GROUNDWATER

MARINE CORPS BASE, CAMP LEJEUNE, NORTH CAROLINA

CONTRACT TASK ORDER 0177

JUNE 3, 1994

Prepared for:

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1.0 INTRODUCTION

Numerous groundwater investigations have been conducted at Marine Corps Base (MCB), Camp Lejeune under the Department of the Navy (DON) Installation Restoration Program (IRP). These studies have identified elevated levels of total metals in shallow groundwater at almost every site. The degree of contamination, based on dissolved metals analysis of groundwater samples, is limited. It is believed that the presence of elevated metals are not always related to past disposal activities for several reasons, which is the basis of this study.

Currently, Records of Decision (ROD) are being prepared for Operable Units No. 1 (Sites 21, 24, and 78) and No. 5 (Site 2). Both RODs are proposing to not remediate shallow groundwater which contains elevated levels of total metals above State groundwater standards (i.e., North Carolina Water Quality Standards) and/or Federal drinking water standards (i.e., Maximum Contaminant Levels). Specifically, remediation of shallow groundwater due to elevated total metals is not cost effective, or practical, due to the following: (1) the shallow aquifer is not used for potable supply; (2) the source of metals in groundwater cannot be correlated with soil data or previous disposal practices; (3) the extent of shallow groundwater contamination (based on total metals analysis) is widespread and in many cases undefinable, since there are no apparent contaminant plumes or patterns associated with the metals; and (4) deep groundwater, which is the source of potable water, is not significantly contaminated with metals above the standards.

2.0 STUDY OBJECTIVES

The DON/Marine Corps initiated a study on inorganics in groundwater throughout MCB Camp Lejeune to assess whether total metals in groundwater are related to disposal practices or to other factors. The overall goal of this study is to provide information that would be used in consideration of not remediating shallow groundwater at Operable Units No. 1 and No. 5, and possibly other operable units where total metals are elevated without cause. The following study objectives were identified:

(1) Determine whether the elevated total metals detected in the shallow aquifer are related to past disposal practices, well construction factors, sampling techniques, or suspended particulates in the samples;

(2) Determine whether total metals in shallow groundwater are elevated throughout the region or MCB Camp Lejeune;

(3) Determine whether there is a correlation between elevated total metals in groundwater and metals in soil; and

(4) Determine whether the concentrations of total metals (i.e., low versus high) is related to shallow and deep aquifer characteristics.

3.0 SCOPE OF WORK

Groundwater and soil data from a total of 21 sites were compiled as part of the overall study. Three of the 21 sites are located outside the boundary of the base. These sites include the ABC Cleaners Superfund Site, located along Route 24 in Jacksonville, and two sites located along Highway 17 (Off-site Properties No. 1 and No. 2). The two sites along Route 17 were investigated by the DON/Marine Corps as part of a real estate survey. The other 18 sites are located throughout various portions of MCB Camp Lejeune (see Figure 1).

Information from studies conducted by Baker and other consultants were obtained to evaluate metal concentrations in groundwater. The study focused on 14 metals of potential concern to human health and the environment. Some of the information was collected under the IR Program whereas other information was obtained during other investigations (e.g., ABC Cleaners RI/FS). The following data tables were then prepared to determine why total metals are generally elevated in shallow groundwater.

Table 1 - Total Metal Concentrations in Shallow Groundwater by Site

Table 2 - Summary of Repeat Sampling of Shallow Wells (Sites 2 and 78)

Table 3 - Dissolved Metal Concentrations in Shallow Groundwater by Site

Table 4 - Summary of Total Metal Concentrations in Upgradient Wells

Table 5 - Comparison of Subsurface Metal Concentrations in Uncontaminated and Contaminated Wells

Table 6 - Total Metal Concentrations in Deep Groundwater by Site

Table 7 - Summary of Field Parameters in Shallow Monitoring Wells, Deep Monitoring Wells, and Supply Wells

The tables are presented at the end of this report.

4.0 DATA ANALYSIS

The following discussion represents an analysis of the information contained in each of the previously mentioned tables.

Table 1 (Total Metal Concentrations in Shallow Groundwater)

All of the sites had at least one (and in most cases several) metal which exceeded either State water quality standards or Federal drinking water standards. The most frequently detected metals included chromium, lead, and manganese, which were detected at almost every site above drinking water standards. Other frequently detected metals which exceeded drinking water standards included arsenic, beryllium, cadmium, and nickel.

An analysis of the data from Table 1 indicates that elevated total metals are present in shallow groundwater at every site, including the three sites which are located off base. The two sites which did not exhibit significant contamination include the ABC Cleaners site (only chromium exceeded the standards) and Site 48 (only manganese exceeded the standards).

Total metals detected in shallow groundwater at Site 2 exceeded State and/or Federal standards in seven of the 11 shallow monitoring wells. Manganese was the most frequently detected metal (7/11). Lead (3/11), chromium (2/11), and cadmium (1/11) were also detected above the standards,, but less frequently (see Figure 2).

With the exception of Wells 78GW03 and 78GW19, total metals were detected at Site 78 (Hadnot Point Industrial Area) above Federal MCLs or NCWQS in every shallow well (see Figure 3). The extent of elevated total metals in groundwater is widespread, encompassing approximately one square mile (or approximately 660 acres) in total area. The distribution and concentration of total metals in shallow groundwater makes it virtually impossible to identify or illustrate contaminant plumes (see Figure 3).

An analysis of the total metals results indicates the following pattern. Samples exhibiting elevated levels of lead, chromium, or other contaminants of concern, also exhibited elevated levels of other metals such as aluminum, antimony, iron, and zinc. Samples which did not exhibit elevated levels of lead, chromium, or manganese also did not exhibit elevated levels of other metals. This pattern indicates that the elevated total metals are not limited to one or

two contaminants, which would be the case if a lead or chromium plume in the groundwater truly existed. In other words, if a site is impacted by a particular metal due to disposal activities (say chromium for example), then other metals such as aluminum, lead, or zinc should not be consistently elevated as in the case of samples collected from the shallow aquifer at MCB Camp Lejeune. This point is depicted in the data summary tables provided in Appendix A for Sites 2 and 78. These tables were taken from the Remedial Investigation Reports for Operable Units No. 1 and No. 5. As an example, note that sample numbers 78-MW08, 78-MW10, 78-MW11, and 78-MW12 all had elevated levels of total metals when compared to samples 78-MW09-2 and 78-MW09-3. It is clear that most of the metal concentrations in a particular sample follow a consistent pattern throughout.

Table 2 (Comparison of Repeat Sampling of Shallow Wells

Five wells from Sites 2 and 78 were randomly chosen to evaluate total metals concentrations between sampling rounds. The comparison was limited to only chromium, lead, and manganese since these contaminants were frequently detected throughout MCB Camp Lejeune. In several cases, metal concentrations were significantly different between the sampling rounds. If the shallow aquifer was impacted due to former disposal activities, a contaminant plume would be present and concentrations would not significantly deviate. The deviation in metal concentrations may indicate that sampling results are biased due to suspended particulates in the samples.

Table 3 (Dissolved Metal Concentration in Shallow Groundwater by Site)

The data base for Table 3 was limited to 12 sites since many of the previous investigations (i.e., prior to Navy CLEAN) did not analyze for dissolved metals. Nevertheless, an analysis of the 12 sites revealed that elevated levels of dissolved metals in groundwater is limited. Manganese was the most frequently detected metal above drinking water standards (10 of 12 sites exhibited elevated levels). Lead was detected at only one site (Site 21) above drinking water standards. Chromium was also detected at only one site (Site 78) above drinking water standards. No other metal was detected above the standards.

Literature searches have indicated that manganese is a naturally occurring metal in North Carolina. Therefore, the presence of manganese may not be attributable to site-related activities (Greenhorne & O'Mara, 1992).

An analysis of the data from Table 3 clearly shows a significant reduction in metal concentrations when compared to Table 1 (total metals in shallow groundwater). One possible reason for this reduction is that suspended solids or particles are not being introduced into the analysis of the sample due to filtering. A second possibility is that the metals are not significantly present in a dissolved state in shallow groundwater due to the species of metals under site conditions. It should be noted that calcium and sodium did not exhibit such a pattern since the salts of these metals are more soluble in water. For example, the concentrations of total calcium and total sodium versus dissolved calcium and dissolved sodium are similar and are not affected by the removal of the particulates during filtering. The fact that these salts do not exhibit the pattern that the other metals show supports the possibility that total metal concentrations are influenced by particulates in the sample.

Table 4 (Total Metals in Upgradient Shallow Wells)

The data base for Table 4 consists of groundwater results from 14 upgradient shallow monitoring wells (i.e., one well per site). These wells were installed to determine baseline groundwater quality to which on-site groundwater conditions could be compared. In some cases, the upgradient wells were located in areas where other base activities may have influenced groundwater quality.

The analysis of this data shows that manganese was the most frequently detected metal above Federal or State standards in upgradient shallow wells. Manganese was detected in 7 of the 14 upgradient wells above drinking water standards. Chromium and lead were also frequently detected above drinking water standards in upgradient (background) wells. These contaminants were detected in 6 of the 14 upgradient wells. At Site 2, samples collected from an upgradient well (2GW9) exhibited elevated levels of chromium (83µ/l), lead (27.2µ/l) and manganese (747µ/l). At Site 78, samples collected from upgradient wells 96W4 and 78GW26 did not exhibit elevated levels of total metals. The concentration range for metals detected above NC WQS and/of Federal MCLs in upgradient wells is provided below:

- beryllium (ND-46.5 µ/l)
- cadmium (ND-10 µ/l)
- chromium (ND-198 µ/l)
- lead (ND-78.8 µ/l)
- manganese (ND-747 µ/l)
- mercury (ND-1.6J µ/l)

Based on the above range representing upgradient wells, none of the on-site wells at Site 2 exhibited total metals above the maximum background concentrations. However, at Site 78, lead and chromium were detected above the maximum background in several on-site wells.

An analysis of the data from Table 4 indicates that shallow groundwater upgradient of some sites contains total metals above drinking water standards. A comparison of Table 4 data against Table 1 data indicates that shallow groundwater samples from upgradient wells are less contaminated than samples collected from on-site monitoring wells. However, it should be noted that the data base for Table 4 consists of only 14 wells whereas the data base for Table 1 consists of over 130 wells. Therefore, to assume that upgradient groundwater quality is better than on-site groundwater quality may not be justified due to the different data bases.

Table 5 (Comparison of Subsurface Metal Concentrations in Uncontaminated and Contaminated Wells)

The purpose of this table is to determine whether metal concentrations in soils correlate with the elevated levels of metals in shallow groundwater.

To evaluate this, metals in subsurface soils, representing an area of groundwater contamination, were compared to metals in subsurface soil in areas which did not exhibit groundwater contamination. If the elevated total metals in shallow groundwater are present due to former disposal activities, subsurface metals in soil representing an area of groundwater contamination would be expected to be elevated or higher than metals in subsurface soil representing a non-contaminated area. This evaluation assumes that the well exhibiting elevated total metals is within a source area and that the soil sample is representative of soil impacted by metal contamination.

As shown on Table 5, there is no clear pattern or correlation which indicates that elevated total metals are due to soil contamination. Note that in many cases, the concentration of metals which represent "non-contaminated" areas are greater than the metals which represent "contaminated" areas. Also note that the metals in subsurface soil are within or close to background subsurface metal concentrations. Therefore, this supports the possibility that in many cases at MCB Camp Lejeune, the elevated total metals in shallow groundwater cannot be attributable to a source or to past disposal practices.

Table 6 (Total Metals in Deep Monitoring Wells)

Table 6 presents total metal concentrations in deep groundwater for each site. The data base is limited to only 8 sites. Metal concentrations in supply wells were also included for comparison purposes.

As shown on Table 6, total metals in deep groundwater are below drinking water standards with a few exceptions. Arsenic and cadmium were detected above the standards in one deep monitoring well at Site 78 (see Figure 4). Manganese was detected in deep groundwater at three sites and a few of the supply wells. Lead was detected in one supply well at 16 µ/l, which is slightly above the drinking water standard of 15 µ/l.

Elevated total metals are not widespread in deep groundwater for two possible reasons. First, most metals are not very mobile in the environment. Second, deep groundwater samples may not have significant amounts of suspended particulates due to different geologic conditions. Soils in the deeper aquifer are more compacted and consist primarily of calcareous sands, clays, and limestone fragments. Soils in the shallow aquifer are loosely compacted and consist primarily of fine-grained sands, silts, and clays. This classification may support the possibility that suspended solids are collected during sampling, thereby influencing the analysis for total metals.

Table 7 (Summary of Field Parameters in Shallow, Deep, and Supply Wells)

Table 7 provides a range of pH and specific conductivity values representative of shallow and deep groundwater. In general, lower pH values were noted more often in shallow wells than in deep wells (including the supply wells). This condition may influence the leachability and speciation of metals in groundwater.

Deep groundwater usually exhibited higher specific conductivity values. High specific conductivity values are representative of high dissolved conditions. The fact that deep groundwater generally exhibited higher specific conductivity values indicates that most of the metals, if present, are in a dissolved state. The high specific conductivity values could also indicate less suspended particulates due to the geologic conditions of the deep aquifer. The lower specific conductivity values observed in shallow wells indicates that the metals in the shallow aquifer are not in a dissolved state. This also supports the possibility that suspended particulates in the shallow aquifer are influencing the analysis of total metals.

5.0 ANALYSIS OF THE STUDY OBJECTIVES

Each of the objectives identified for this study are analyzed below based on the information collected.

Objective No. 1 (Determine whether the elevated total metals in the shallow aquifer are related to past disposal practices, well construction factors, sampling techniques, or suspended particulates in the samples)

Based on the analysis of information provided in Tables 1 through 7 and Appendix A, it appears that suspended particulates in groundwater samples could influence the concentration of total metals in groundwater. Well construction factors and sampling techniques are probably not a significant factor since the data base is representative of data obtained by Baker, ESE (Site 28 and 30), Roy F. Weston (ABC Cleaners), and Halliburton NUS (Site 7). No particular pattern was noted between sites which Baker obtained the samples versus sites in which other consultants obtained the data. Sampling methods were also considered. For Sites 63 and 65 for example, samples were collected with a bailer. At Sites 2 and 78, samples were collected with a low flow pump. All four sites exhibited elevated levels of total metals in groundwater samples. In addition, due to the fact that deep groundwater quality is not significantly impacted with metals indicates that well construction or sampling techniques are probably not factors related to elevated total metals in groundwater.

With respect to past disposal practices, Table 5 clearly shows that soil concentrations do not correlate with elevated total metals in groundwater. Based on this analysis, and on many of the sites previously investigated, the source of total metals in groundwater cannot be attributable to soil contamination or disposal practices in many cases. This is based on both the history of the site as well as the analytical soil results. In some cases, total metals were detected at elevated levels even when the site history did not correlate with the contaminants found. For example, Sites 2 and 21 have a history of pesticide storage and handling, and there are no known disposal areas (i.e., buried debris) within the site boundary. Nevertheless, both of these sites exhibited several metals above drinking water standards that would not be expected to be present at high concentrations based on the historical use of the site. These metals included lead, chromium, beryllium, cadmium, and manganese.

Objective No. 2 (Determine whether total metals in shallow groundwater are elevated throughout the region or MCB Camp Lejeune)

Based on groundwater data obtained from both upgradient wells and off base wells, total metals were detected above drinking water standards in shallow groundwater in areas that would not be influenced by former disposal activities at the sites. Given that some of the upgradient wells are contaminated, it is apparent that total metals in shallow groundwater are elevated in certain areas of the base outside of the influence of site-related disposal activities. However, it is unknown whether the shallow aquifer upgradient of the sites is contaminated due to other base-related activities or whether the levels in groundwater samples are also elevated due to the influence of suspended fines in the samples.

Objective No. 3 (Determine whether there is a correlation between elevated total metals in groundwater and metals in soil)

An evaluation of the data presented in Table 5 shows that metals in soil samples collected in areas of groundwater contamination are not elevated when compared to metals in soil samples collected in areas that did not exhibit groundwater contamination. This supports the possibility that in many cases, elevated levels of total metals in shallow groundwater are not related to the disposal history at the site. As previously mentioned, sites which did not exhibit soil contamination (when compared to background soil levels) or did not have a history of disposal indicative of metals contamination still exhibited elevated levels of total metals in groundwater. Since there is no apparent correlation between metals in soil and total metals in groundwater, then the possibility exists that the elevated total metals in groundwater are biased high due to suspended particulates.

Objective No. 4 (Determine whether the concentrations of total metals in groundwater is related to shallow and deep aquifer characteristics)

There is some evidence that the geologic conditions of the shallow and deep aquifers influence the amount of total metals detected in groundwater samples. The fact that the deep aquifer generally exhibited higher specific conductivity values indicates that there is more dissolved constituents in the deep aquifer when compared to the shallow aquifer. This was evident when comparing Table 1 (total metals in shallow groundwater) to Table 6 (total metals in deep groundwater). Table 6 did not indicate significant levels of total metals in deep groundwater throughout MCB Camp Lejeune.

The geologic conditions of the shallow aquifer would tend to result in samples that may contain suspended particulates. The suspended particulates could influence the total metals concentrations in the samples.

6.0 CONCLUSIONS

1. Elevated levels of total metals in the shallow aquifer are probably influenced to some degree by the geologic conditions of the site.

2. There is no correlation between metal levels in soil and total metals in groundwater. Therefore, elevated total metals in groundwater cannot be attributable to soil contamination of past disposal practices.

3. Elevated levels of total metals in the shallow aquifer may be biased high due to suspended particulates in the samples.

4. Dissolved metals in groundwater were generally below Federal MCLs and NC WQS and therefore, do not present a significant problem at MCB Camp Lejeune.

5. Total and dissolved metal concentrations in the Castle Hayne aquifer were generally below drinking water standards and therefore, do not present a significant problem at MCB Camp Lejeune.

6. The presence of manganese in shallow and deep groundwater may be due to naturally occurring geologic conditions.

7.0 RECOMMENDATIONS

1. Remediation of total metals in the shallow aquifer at Operable Units 1 and 5 is not recommended based on the following:

   - Elevated metals in groundwater at both operable units does not appear to be related to soil contamination or past disposal practices;
   - The distribution of total metals in groundwater is not characteristic of a plume that would be present due to a source of contamination;
   - Remediation of total metals would not be practical from an engineering or cost standpoint; and
   - Currently, there is no human or environmental exposure to shallow groundwater.

2. Additional background wells should be installed at all sites in order to provide a baseline for comparing on-site groundwater quality.

Tables

TABLE 1
TOTAL METALS BY SITE
SHALLOW MONITORING WELLS
MCB, CAMP LEJEUNE, NORTH CAROLINA

Site Number Units	NCWQS ug/L	FEDERAL MCL ug/L	Site 1 ug/L	Site 2 ug/L	Site 6 ug/L	Site 7 ug/L	Site 9 ug/L	Site 21 ug/L	Site 24 ug/L	Site 28 ug/L	Site 30 ug/L	Site 41 ug/L	Site 43 ug/L	Site 44 ug/L
Arsenic	50	50	7.2 - 57.4	2.2 - 23.6	ND - 23.3	ND - 43.4J	ND	ND - 101	ND - 116J	5.4 - 13J	6.4 - 12J	2.4 - 36.3	ND - 23.4	ND - 570
Barium	2000	2000	335 - 833	46 - 1420	ND - 1020	427 - 641	ND - 1060	ND - 647	ND - 1120	78.8 - 576	60.1 - 396	55.2 - 999	220 - 745	315 - 3180
Beryllium	NE	4	2.7 J - 43.4	1 - 3	ND - 7.5	ND - 10.3J	ND	ND - 8	ND - 19	ND - 1.2J	ND - 2.4	0.80 - 42.8	1.5 - 4.2	1.4 - 36.6
Cadmium	5	5	ND - 12.9	7	ND	ND	ND	ND	ND - 12	3.3J - 17.3J	ND - 10.7J	3.2 - 110	ND - 6.9	ND - 32
Calcium	NA	NA	8850 - 726000	5710 - 450000	5430 - 64900	5050 - 51300	16100 - 90700	6130J - 63000J	ND - 151000	20200 - 160000	1730 - 11900	8750 - 828000	10300 - 91900	2430 - 191000
Chromium	50	100	172 - 627	11 - 117	ND - 201	47.8 - 220	ND - 214	ND - 348J	19 - 316	9.0J - 140	42.8 - 106J	10.5 - 244	161 - 249	126 - 895
Copper	1000	1300	44.6 - 117	3 - 23	ND - 175	17.7 - 36.4	ND - 39.7	ND - 84	ND - 52	18.8J - 75.4	15.8 - 42.5	16.3 - 1030	64.2 - 104	28.6 - 313
Lead	15	15	40.8J - 176J	2.7 - 44.8	ND - 200	23 - 37.3	ND - 127	ND - 2000J	3.1 - 89	20.3J - 234J	7.7J - 115J	4.8 - 9340	16.5 - 28.8	15.8 - 508
Manganese	50	50 (1)	123 - 1720	21 - 190	ND - 362	56.9 - 220	ND - 91.3	59 - 276J	29 - 518	82.2 - 304	78.5 - 578	56.6 - 2110	72.6 - 297	88 - 1730
Mercury	1.1	2	ND - 1.2J	ND	ND - .46	0.2 - 0.36	ND - 1.4	ND - 2.4J	ND - 3.2	ND - 1.4J	0.88J - 0.9J	0.13 - 0.92	ND - 0.24	ND - 1.1
Nickel	100	100	28.5 - 426	ND	ND - 41.9	ND	ND	ND - 123	ND - 140	ND - 59.8	17.1J - 52.6J	28.8 - 137	20.5 - 143	21.9 - 486
Sodium	NA	NA	9090 - 19000	ND - 103000	1110 - 68700	7040 - 156000	1390 - 4170	7950 - 15700	5230 - 19200	9480 - 74700	5320 - 8100	2080 - 40200	9160 - 22100	4060 - 12600
Vanadium	NE	NE	214 - 640	9 - 184	ND - 330	37.8 - 423	ND - 175	ND - 419	ND - 408	6.1 - 164	57 - 101	20.4 - 244	122 - 233	184 - 759
Zinc	2100	5000 (1)	ND - 1110	6 - 146	ND - 1620	83.6 - 133	ND - 118	27J - 487J	20 - 650	ND	79.2 - 104	25.7 - 5180	19 J - 661J	87.3 - 2800J

Site Number Units	Site 48 ug/L	Site 63 ug/L	Site 65 ug/L	Site 69 ug/L	Site 78 ug/L	Site 82 ug/L	ABC Cleaners ug/L	Offsite Property #1 ug/L	Offsite Property #2 ug/L
Arsenic	ND	ND - 23.4	ND - 308	2.9 - 29.0	ND - 405J	ND - 67.8	ND - 12	10.3 - 160	ND
Barium	18 - 51.3	56.1 - 5410	105 - 638	46.5 - 850	ND - 1250	ND - 540	35 - 220	ND - 468	ND
Beryllium	ND	ND - 3.1	ND	1.3 - 10.6	ND - 19	ND	NA	ND - 8.5	ND
Cadmium	2.2 - 3.3	ND	ND	2.4 - 11.4	ND - 21	ND	NA	ND	ND
Calcium	30600 - 115000	2830 - 24300	33300 - 181000	2010 - 38700	ND - 642000	6580 - 60800	790 - 16000	ND - 22800	ND - 5200
Chromium	5.8 - 17.5	4.4 - 134	50.1 - 364	15.1 - 159	ND - 858J	ND - 174	ND - 57	52.8 - 636	ND - 94
Copper	3.1 - 13.5	10.7 - 126	28.2 - 127	16.2 - 70.8	ND - 699	ND - 29.3	ND - 89	ND - 140	ND
Lead	ND	4.3 J - 369	19.1 - 132	7.8 - 188	ND - 360J	ND - 89	ND - 10	12.3 - 345	6.3 - 62.3
Manganese	38.1 - 585	50.3 - 1020	56.2 - 474	13.0 - 912	26 - 714	26.9 - 283	4 - 44	56 - 973	ND - 60.1
Mercury	0.04 - 0.09	ND - 0.20	ND - 0.29	0.10 - 0.94	ND - 1.5	ND - 0.66	NA	ND	ND
Nickel	ND	19.8 - 54.2	19.4 - 84.3	13.6 - 99.8	ND - 234	ND - 34.6	ND - 77	40.2 - 380	ND
Sodium	5730 - 8760	3150 - 7100	3850 - 11700	4790 - 41300	ND - 42500	5670 - 36500	5800 - 33000	ND - 9390	ND - 7630
Vanadium	3.4 - 12.8	7.9 - 163	59.8 - 433	17.3 - 210	ND - 1700	ND - 256	ND - 45	70 - 739	ND - 64.7
Zinc	ND - 30.3	58.5J - 1110J	148J - 406J	36.2 - 12100	63 - 967J	ND - 204	14 - 220	ND - 736	ND - 40.8

NOTES:
J - Value is estimated.
JB - Value is estimated below the CRDL, but greater than the IDL.
NE - Not established.
NA - Not analyzed.
ND - Not detected.
NCWQS - North Carolina Water Quality Standard
MCL - Maximum Contaminant Level
(1) - Secondary MCL

TABLE 2
COMPARISON OF REPEAT SAMPLING OF SHALLOW WELLS
MCB, CAMP LEJEUNE, NORTH CAROLINA

Well	2GW01		2GW03		2GW06		2GW08		2GW09	
Date	5/1993	3/1994	5/1993	3/1994	5/1993	3/1994	5/1993	3/1994	5/1993	3/1994
Chromium	18	ND	11	ND	15	ND	ND	ND	25	83
Lead	15.5 J	ND	3.5 J	ND	6.7 J	ND	ND	3.4	27.2 J	23.6
Manganese	55	47	21	ND	79	140	53	415	290	747

Well	78GW05		78GW08		78GW15		78GW16		78GW19	
Date	1/1991	4/1994	1/1991	4/1994	1/1991	4/1994	1/1991	4/1994	1/1991	4/1994
Chromium	ND	17 J	91.8	491 J	21.4	215 J	209	353 J	13.8	ND
Lead	13.6	13.1 J	54.1	131 J	16.6	53	100	224	31.7	8.3
Manganese	162	161 J	46.5	213 J	18.3	115	98.3	150	79	26

NOTES:
J - Value is estimated.
ND - Not detected.

TABLE 3
DISSOLVED METALS BY SITE
SHALLOW MONITORING WELLS
MCB, CAMP LEJEUNE, NORTH CAROLINA

Site Number / Units	NCWQS ug/L	FEDERAL MCL ug/L	Site 1 ug/L	Site 2 ug/L	Site 6 ug/L	Site 7 ug/L	Site 9 ug/L	Site 21 ug/L	Site 24 ug/L	Site 28 ug/L	Site 30 ug/L	Site 41 ug/L	Site 43 ug/L	Site 44 ug/L
Arsenic	50	50	NA	2.2 - 7.1	ND	NA	ND	ND - 10.6	ND - 16.3	NA	NA	2.2 - 4.7	NA	NA
Barium	2000	2000	NA	25 - 149	ND	NA	ND	ND	ND	NA	NA	12.4 - 451	NA	NA
Beryllium	NE	4	NA	1	ND	NA	ND	ND	ND	NA	NA	0.80 - 3.2	NA	NA
Cadmium	5	5	NA	ND	ND	NA	ND	ND - 5	ND	NA	NA	3.2 - 4.2	NA	NA
Calcium	NA	NA	NA	5800 - 441000	6230 - 57400	NA	15800 - 82400	35900	ND - 113000	NA	NA	4710 - 138000	NA	NA
Chromium	50	100	NA	10	ND	NA	ND	ND	ND	NA	NA	8.3 - 9.6	NA	NA
Copper	1000	1300	NA	2 - 9	ND	NA	ND	ND	ND	NA	NA	16.3 - 23.9	NA	NA
Lead	15	15	NA	2.1	ND	NA	ND	ND - 94	ND	NA	NA	1.0	NA	NA
Manganese	50	50 (1)	NA	17 - 129	ND - 92.7	NA	ND	40 - 134	ND - 320	NA	NA	7.1 - 521	NA	NA
Mercury	1.1	2	NA	ND	ND	NA	ND	ND	ND - 0.5	NA	NA	0.13 - 0.20	NA	NA
Nickel	100	100	NA	ND	ND	NA	ND	ND	ND - 57	NA	NA	28.8 - 31.2	NA	NA
Sodium	NA	NA	NA	ND - 103000	1420 - 70500	NA	1280 - 3860	16200	ND - 183000	NA	NA	2500 - 34200	NA	NA
Vanadium	NE	NE	NA	43	ND	NA	ND	ND	ND	NA	NA	20.4	NA	NA
Zinc	2100	5000 (1)	NA	8 - 35	ND - 350	NA	ND	6B - 50	ND - 437	NA	NA	10.6 - 125	NA	NA

Site Number / Units	Site 48 ug/L	Site 63 ug/L	Site 65 ug/L	Site 69 ug/L	Site 78 ug/L	Site 82 ug/L	ABC Cleaners ug/L	Offsite Property #1 ug/L	Offsite Property #2 ug/L
Arsenic	ND	NA	NA	2.9	ND - 21.6	ND	NA	ND - 18.8	ND
Barium	16.8 - 27.6	NA	NA	13.7 - 35.8	ND	ND	NA	ND	ND
Beryllium	ND	NA	NA	1.3	ND	ND	NA	ND	ND
Cadmium	ND - 3.1	NA	NA	2.4	ND	ND	NA	ND	ND
Calcium	72600 - 80700	NA	NA	764 - 10600	ND - 296000	15200 - 58500	NA	ND - 7710	ND
Chromium	ND	NA	NA	7.2	ND - 59	ND	NA	ND - 30.0	ND
Copper	2.6 - 7.6	NA	NA	16.2	ND - 121	ND	NA	ND - 10.7	ND
Lead	ND	NA	NA	1	ND - 17.2	ND	NA	ND - 15.8	ND
Manganese	39.7 - 539	NA	NA	8.5 - 139	ND - 152	21 - 127	NA	ND - 63.8	ND - 21.3
Mercury	0.05 - 0.09	NA	NA	0.1	ND - 0.6	ND	NA	ND	ND
Nickel	ND	NA	NA	13.6	ND	ND	NA	ND	ND
Sodium	6430 - 8920	NA	NA	5170 - 41100	ND - 42200	5980 - 36000	NA	ND - 9540	ND - 6750
Vanadium	ND	NA	NA	16.6	ND	ND	NA	ND	ND
Zinc	ND	NA	NA	7.0 - 7670	ND - 58	ND - 119	NA	ND - 468	ND - 222

NOTES:
J - Value is estimated.
JB - Value is estimated below the CRDL, but greater than the IDL.
NE - Not established.
NA - Not analyzed.
ND - Not detected.
NCWQS - North Carolina Water Quality Standard
MCL - Maximum Contaminant Level
(1) - Secondary MCL

TABLE 4
SUMMARY OF TOTAL METALS IN UPGRADIENT WELLS
SHALLOW MONITORING WELLS
MCB, CAMP LEJEUNE, NORTH CAROLINA

Well Number	NCWQS	FEDERAL MCL	Upgradient of Site 1	Upgradient of Site 2	Upgradient of Site 6	Upgradient of Site 7	Upgradient of Site 9	Upgradient of Sites 21 and 78	Upgradient of Site 24	Upgradient of Site 28	Upgradient of Site 30	Upgradient of Site 41	Upgradient of Site 43	Upgradient of Site 44
			1GW06	2GW09	6BP68	7GW03	9GW45	78GW26	24GW07	28GW04		41GW05		
Units	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L		ug/L		
Arsenic	50	50	17.8 J	12.9	ND	ND	ND	ND	3.7 J	7.4 J	No Upgradient Well Sites	13.1	No Upgradient Well Sites	No Upgradient Well Sites
Barium	2000	2000	548	328	257	428	71.3	ND	ND	576		55.7		
Beryllium	NE	4	3.2 J	3	ND	ND	ND	ND	ND	9.3 J		1.6		
Cadmium	5	5	ND	ND	ND	ND	ND	not reported	ND	3.3 J		10		
Chromium	50	100	193	75	198	124	ND	13	37	122		54.4		
Copper	1000	1300	64.8	25	35.6	36.4	ND	ND	ND	20.7 J		27		
Lead	15	15	78.8 J	27.2	64.4	30.3 J	ND	9	11.4	22.4 J		23.7		
Manganese	50	50 (1)	202	747	84.5	56.9 J	ND	ND	39	206		203		
Mercury	1.1	2	1.6 J	ND	ND	0.36	ND	ND	ND	ND		0.16		
Nickel	100	100	51.6	ND	ND	ND	ND	ND	ND	59.8		38		
Vanadium	NE	NE	214	86	209	152	ND	149	64	85.3		38.1		
Zinc	2100	5000 (1)	ND	103	56.6	86.4 J	ND	68.1	41	ND		173		

Well Number	Upgradient of Site 48	Upgradient of Site 63	Upgradient of Site 65	Upgradient of Site 69	Upgradient of Site 78	Upgradient of Site 82	Upgradient of ABC Cleaners	Upgradient of Offsite Property #1	Upgradient of Offsite Property #2
	48GW1			69GW07	9GW04	6MW38	MW-801		
Units	ug/L			ug/L	ug/L	ug/L	ug/L		
Arsenic	ND	No Upgradient Well Sites	No Upgradient Well Sites	2.9	ND	ND	ND	No Upgradient Well Sites	No Upgradient Well Sites
Barium	29.4 J			46.5	ND	ND	35		
Beryllium	ND			1.3	ND	ND	NA		
Cadmium	2.5 J			2.4	ND	ND	NA		
Chromium	ND			15.8	ND	ND	ND		
Copper	ND			16.2	ND	ND	ND		
Lead	ND			7.8	ND	ND	3		
Manganese	70.6			13	ND	ND	10		
Mercury	ND			0.1	ND	ND	NA		
Nickel	ND			13.6	ND	ND	ND		
Vanadium	3.4 J			17.3	ND	ND	9		
Zinc	ND			36.2	ND	ND	23		

NOTES:
J - Value is estimated.
JB - Value is estimated below the CRDL, but greater than the IDL.
NE - Not established.
NA - Not analyzed.
ND - Not detected.
NCWQS - North Carolina Water Quality Standard
MCL - Maximum Contaminant Level
(1) - Secondary MCL

TABLE 5
COMPARISON OF INORGANIC SUBSURFACE SOIL CONCENTRATIONS IN "CLEAN" AND "CONTAMINATED" WELLS
MCB, CAMP LEJEUNE, NORTH CAROLINA

	Camp Lejeune Background Subsurface Soil Data	Site 1		Site 2		Site 6		Site 7		Site 9		Site 21	
		"Clean"	"Contaminated"	"Clean"	"Contaminated"	"Clean"	"Contaminated"	"Clean"	"Contaminated"	"Clean"	"Contaminated"	"Clean"	"Contaminated"
Units	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
Well Number		--	--	2GW07	2GW09	6GW18	6GW15	7GW03	7GW02	9GW5	9GW1	21GW03	21GW02
Soil Sample Number		--	--	2-GW07-01	2 - GW09-02	6-GW18-0303	6-GW15-03	GW03-002	GW02-7595	9-GW5-03	9-SB35-03	21-GW03	21-GW02
Arsenic	0.03 - 0.47	NA	NA	1.7 J	ND	ND	ND	1.5	ND	ND	ND	ND	0.55 J
Barium	2 - 11	NA	NA	12.5 J	ND	ND	ND	6.6	71	ND	ND	ND	4.4 J
Beryllium	0.03 - 0.23	NA	NA	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Cadmium	0.17 - 1.2	NA	NA	ND	ND	ND	ND	1.3	4.5	ND	ND	ND	ND
Chromium	2 - 9	NA	NA	10.9 J	4.6	ND	3.8	5.2	6	ND	3.3 J	15.2	3.3 J
Copper	0.47 - 2	NA	NA	0.97 J	ND	ND	ND	ND	ND	ND	ND	ND	ND
Lead	1 - 12	NA	NA	8 J	4.3	3.3 J	3.2	2.5	34.4	1.6	93	7.1	0.9 J
Manganese	0.40 - 8	NA	NA	4.3 J	4.1	ND	1.8 B	3	115	ND	3.7 J	9.5	3.3 J
Mercury	0.01 - 0.11	NA	NA	0.3 J	ND	ND	ND	10.13	0.48	ND	ND	ND	ND
Nickel	0.70 - 5.0	NA	NA	ND	ND	ND	ND	3.4	11.8	ND	ND	ND	ND
Vanadium	0.75 - 13	NA	NA	13.8 J	ND	ND	2.9 B	5.5	4.5	ND	ND	15.5	4.4 J
Zinc	0.40 - 12	NA	NA	ND	ND	ND	ND	1.3	ND	ND	6.1 J	5.7	3 J

NOTES:
Shaded area indicates inorganic which exceeded a MCL and/or NCWQS in groundwater sample.
J - Value is estimated.
JB - Value is estimated below the CRDL, but greater than the IDL.
NA - No available wells to compare OR compound was not analyzed.
ND - Not detected.
NCWQS - North Carolina Water Quality Standard
MCL - Maximum Contaminant Level
(1) - Secondary MCL

TABLE 5
COMPARISON OF INORGANIC SUBSURFACE SOIL CONCENTRATIONS IN "CLEAN" AND "CONTAMINATED" WELLS
MCB, CAMP LEJEUNE, NORTH CAROLINA

	Site 24		Site 28		Site 30		Site 41		Site 43		Site 44	
	"Clean"	"Contaminated"	"Clean"	"Contaminated"	"Clean"	"Contaminated"	"Clean"	"Contaminated"	"Clean"	"Contaminated"	"Clean"	"Contaminated"
Units	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
Well Number	24GW10	24GW02	--	--	--	--	41GW04	41-GW11	43GW01	43GW02	44GW02	44GW01
Soil Sample Number	24-GW10	24-BDA-SB09	--	--	--	--	41-GW04-DW	41-GW11-01	43-GW01-00	43-GW02-00	44-GW02-035	--
Arsenic	ND	ND	NA	NA	NA	NA	0.51	1.6	ND	ND	ND	1.7
Barium	ND	ND	NA	NA	NA	NA	9.4	22.6	ND	ND	ND	17.9
Beryllium	ND	ND	NA	NA	NA	NA	0.18	0.18	ND	ND	ND	ND
Cadmium	ND	ND	NA	NA	NA	NA	0.73	0.73	8.3	ND	ND	ND
Chromium	11.2	9.1	NA	NA	NA	NA	3.6	11.4	8.5	6.7	38.1	16.9
Copper	ND	ND	NA	NA	NA	NA	3.7	22.3	3.4	ND	6.2 J	25.4 J
Lead	4.6 J	4.2 J	NA	NA	NA	NA	4.8	110	9.8	6.1	5.5	10.7
Manganese	4.7	6.1	NA	NA	NA	NA	3.7	35.2	7.1	4.2	3.4	20.4
Mercury	ND	ND	NA	NA	NA	NA	0.06	0.31	ND	ND	ND	ND
Nickel	ND	ND	NA	NA	NA	NA	6.6	6.6	7.6	5.4	3.1	3.3
Vanadium	18.4	10	NA	NA	NA	NA	6.8	9.3	7.2	5.8	3	14.7
Zinc	ND	7.8	NA	NA	NA	NA	7.7	130	20.1	3	3.2	34.9

NOTES:
Shaded area indicates inorganic which exceeded a MCL and/or NCWQS in groundwater sample.
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NA - No available wells to compare OR compound was not analyzed.
ND - Not detected.
NCWQS - North Carolina Water Quality Standard
MCL - Maximum Contaminant Level
(1) - Secondary MCL

TABLE 5
COMPARISON OF INORGANIC SUBSURFACE SOIL CONCENTRATIONS IN "CLEAN" AND "CONTAMINATED" WELLS
MCB, CAMP LEJEUNE, NORTH CAROLINA

	Site 48		Site 63		Site 65		Site 69		Site 78		Site 82	
	"Clean"	"Contaminated"	"Clean"	"Contaminated"	"Clean"	"Contaminated"	"Clean"	"Contaminated"	"Clean"	"Contaminated"	"Clean"	"Contaminated"
Units	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
Well Number	48-GW01	48-GW03	63MW03	63MW02	65MW03	65MW02	69-GW11	69-GW03	78GW34	78GW24-1	6-GW28	82MW3
Soil Sample Number	48-GW1A-01	48-C3-03	63-MW03-04	63-MW02-06	65-MW03-11	65-MW02-06	69-GW11-04	69-CSA-SB23-00	78-GW34	78-B903-SB03	6-GW28-09	6-GW27D-06
Arsenic	1.3	0.77 J	ND	ND	ND	13	0.68	0.63	ND	ND	0.31	15.9
Barium	21.1	15	ND	ND	3.4	6.8	5.6	3	ND	ND	ND	ND
Beryllium	0.2	0.19	ND	ND	ND	ND	0.3	0.28	ND	ND	ND	ND
Cadmium	1.4	1.8 J	ND	ND	NA	NA	0.56	0.52	ND	ND	ND	ND
Chromium	18.2	18.6	7.7	ND	5.9	13.7	6.8	17	18.5	33	2.6	3
Copper	3.5	3.8	ND	ND	1.5	3.1	3.8	3.5	3.4 B	ND	ND	ND
Lead	32.3	14.3	4.2	2.5	10	3.7	4.3	11	4.5 J	22 J	2.7	4.3
Manganese	411	7	4.9	13.3	3.5	6.9	4	12	9.2	ND	ND	ND
Mercury	ND	ND	ND	ND	NA	NA	0.06	0.05	ND	ND	ND	ND
Nickel	2.2	1.9 J	ND	ND	ND	ND	3.2	3	ND	ND	ND	ND
Vanadium	28.3	20.8 J	ND	ND	4.4	3	4.4	3.6	18.7	19.2	ND	ND
Zinc	ND	ND	ND	ND	2.7	5	3.2	3	7.9	ND	ND	ND

NOTES:
Shaded area indicates inorganic which exceeded a MCL and/or NCWQS in groundwater sample.
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NA - No available wells to compare OR compound was not analyzed.
ND - Not detected.
NCWQS - North Carolina Water Quality Standard
MCL - Maximum Contaminant Level
(1) - Secondary MCL

TABLE 5
COMPARISON OF INORGANIC SUBSURFACE SOIL CONCENTRATIONS IN "CLEAN" AND "CONTAMINATED" WELLS
MCB, CAMP LEJEUNE, NORTH CAROLINA

	ABC Cleaners		Offsite Property #1		Offsite Property #2	
	"Clean"	"Contaminated"	"Clean"	"Contaminated"	"Clean"	"Contaminated"
Units	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
Well Number	--	--	--	--	--	--
Soil Sample Number	--	--	--	--	--	--
Arsenic	NA	NA	NA	NA	NA	NA
Barium	NA	NA	NA	NA	NA	NA
Beryllium	NA	NA	NA	NA	NA	NA
Cadmium	NA	NA	NA	NA	NA	NA
Chromium	NA	NA	NA	NA	NA	NA
Copper	NA	NA	NA	NA	NA	NA
Lead	NA	NA	NA	NA	NA	NA
Manganese	NA	NA	NA	NA	NA	NA
Mercury	NA	NA	NA	NA	NA	NA
Nickel	NA	NA	NA	NA	NA	NA
Vanadium	NA	NA	NA	NA	NA	NA
Zinc	NA	NA	NA	NA	NA	NA

NOTES:
Shaded area indicates inorganic which exceeded a MCL and/or NCWQS in groundwater sample.
J - Value is estimated.
JB - Value is estimated below the CRDL, but greater than the IDL.
NA - No available wells to compare OR compound was not analyzed.
ND - Not detected.
NCWQS - North Carolina Water Quality Standard
MCL - Maximum Contaminant Level
(1) - Secondary MCL

TABLE 6
TOTAL METALS BY SITE
DEEP MONITORING WELLS
MCB, CAMP LEJEUNE, NORTH CAROLINA

	Site 1	Site 2	Site 6	Site 7	Site 9	Site 21	Site 24	Site 28	Site 30	Site 41	Site 43	Site 44	Site 48	Site 63	Site 65	Site 69	Site 78	Site 82	ABC Cleaners	Base Supply Wells (1)
Arsenic	No Deep Wells	ND	ND	No Deep Wells	ND	No Deep Wells	No Deep Wells	No Deep Wells	No Deep Wells	2.2 - 9.6	No Deep Wells	No Deep Wells	No Deep Wells	No Deep Wells	No Deep Wells	2.2 - 3.5	2 - 118 J	ND	ND - 14	ND
Barium		1420	ND		ND					22.6 - 186						42.3 - 58.0	ND - 547	ND	4 - 36	ND
Beryllium		ND	ND		ND					3.2						0.80 - 0.89	ND	ND	NA	NA
Cadmium		ND	ND		ND					4.2 - 4.7						3.2	ND - 21	ND	NA	ND
Chromium		16	ND		ND					9.6 - 40.5						8.3 - 20.7	ND - 10	ND	ND - 32	ND
Copper		ND	ND		ND					23.9						16.3	ND	ND	ND - 41	ND - 130
Lead		ND	ND		ND					1.0 - 11.1						3.1 - 6.8	ND	ND	ND - 10	ND - 16
Manganese		ND	ND - 33.5		ND					16.9 - 101						53.7 - 114	ND - 591	ND - 21.6	ND - 45	10 - 120
Mercury		ND	ND		ND					0.15 - 0.17						0.16 - 0.17	ND - 0.3	ND	NA	ND
Nickel		ND	ND		ND					31.2						28.8	ND	ND	ND - 14	NA
Vanadium		ND	ND		ND					20.4 - 49.8						20.4	ND - 24 J	ND	ND - 15	NA
Zinc		ND	ND		ND					17.8 - 83.8						31.1 - 48.7	ND - 181 J	ND	58 - 390	ND - 120

NOTES:
J - Value is estimated..
NA - Not analyzed.
ND - Not detected.
(1) - Range is based on 67 supply wells located throughout MCB, Camp Lejeune, NC.

TABLE 7
SUMMARY OF FIELD PARAMETERS IN
SHALLOW, DEEP, AND SUPPLY WELLS
MCB, CAMP LEJEUNE, NORTH CAROLINA

	Shallow Wells		Deep Wells		Supply Wells	
	Range (1)	Average Maximum	Range (2)	Average Maximum	Range (3)	Average Maximum
pH (standard units)	4.5 - 7.28	6.08	7.52 - 11.34	8.88	6.91 - 7.45	7.32
Specific Conductivity (micromhos/cm)	40 - 580	267	149 - 525	350	212 - 511	353

(1) - Based on data from 11 sites.
(2) - Based on data from 6 sites.
(3) - Based on data from 9 supply wells.

APPENDIX G
FREQUENCY OF DETECTION SUMMARIES

APPENDIX G.1
SURFACE SOIL

FREQUENCY OF DETECTION SUMMARY
SURFACE SOIL - ORGANIC COMPOUNDS
SITE 10 - ORIGINAL BASE LANDFILL
MCB, CAMP LEJEUNE, NORTH CAROLINA
SITE INVESTIGATION, CTO-0369

SAMPLE ID	IR10-SB01-00	IR10-SB02-00	IR10-SB03-00	IR10-SB04-00	IR10-SB05-00	IR10-SB06-00	IR10-SB07-00	IR10-SB08-00
SAMPLE DATE	03-18-1998	03-18-1998	03-18-1998	03-18-1998	03-18-1998	03-18-1998	03-18-1998	03-18-1998
DEPTH	0 - 1'	0 - 1'	0 - 1'	0 - 1'	0 - 1'	0 - 1'	0 - 1'	0 - 1'
VOLATILES (ug/kg)								
Chloromethane	12 U	13 U	11 U	11 U	11 U	12 U	11 U	11 U
Bromomethane	12 U	13 U	11 U	11 U	11 U	12 U	11 U	11 U
Vinyl chloride	12 U	13 U	11 U	11 U	11 U	12 U	11 U	11 U
Chloroethane	12 U	13 U	11 U	11 U	11 U	12 U	11 U	11 U
Methylene chloride	12 U	13 U	11 U	11 U	11 U	12 U	11 U	11 U
Acetone	12 U	13 U	11 U	11 U	11 U	12 U	11 U	11 U
Carbon disulfide	12 U	13 U	11 U	11 U	11 U	12 U	11 U	11 U
1,1-Dichloroethene	12 U	13 U	11 U	11 U	11 U	12 U	11 U	2.6 J
1,1-Dichloroethane	12 U	13 U	11 U	11 U	11 U	12 U	11 U	11 U
1,2-Dichloroethene (total)	12 U	13 U	11 U	11 U	11 U	12 U	11 U	11 U
Chloroform	12 U	13 U	11 U	11 U	11 U	12 U	11 U	11 U
1,2-Dichloroethane	12 U	13 U	11 U	11 U	11 U	12 U	11 U	11 U
2-Butanone	12 U	13 U	11 U	11 U	11 U	12 U	11 U	11 U
1,1,1-Trichloroethane	12 U	13 U	11 U	11 U	11 U	12 U	11 U	11 U
Carbon tetrachloride	12 U	13 U	11 U	11 U	11 U	12 U	11 U	11 U
Bromodichloromethane	12 U	13 U	11 U	11 U	11 U	12 U	11 U	11 U
1,2-Dichloropropane	12 U	13 U	11 U	11 U	11 U	12 U	11 U	11 U
cis-1,3-Dichloropropene	12 U	13 U	11 U	11 U	11 U	12 U	11 U	11 U
Trichloroethene	12 U	13 U	11 U	11 U	2.3 J	12 U	11 U	2.4 J
Dibromochloromethane	12 U	13 U	11 U	11 U	11 U	12 U	11 U	11 U
1,1,2-Trichloroethane	12 U	13 U	11 U	11 U	11 U	12 U	11 U	11 U
Benzene	12 U	13 U	11 U	11 U	11 U	12 U	11 U	4.9 J
trans-1,3-Dichloropropene	12 U	13 U	11 U	11 U	11 U	12 U	11 U	11 U
Bromoform	12 U	13 U	11 U	11 U	11 U	12 U	11 U	11 U
4-Methyl-2-pentanone	12 U	13 U	11 U	11 U	11 U	12 U	11 U	11 U
2-Hexanone	12 U	13 U	11 U	11 U	11 U	12 U	11 U	11 U
Tetrachloroethene	12 U	13 U	11 U	11 U	11 U	12 U	11 U	11 U
1,1,2,2-Tetrachloroethane	12 U	13 U	11 U	11 U	11 U	12 U	11 U	11 U
Toluene	1.3 J	13 U	11 U	11 U	11 U	12 U	1.1 J	5.9 J
Chlorobenzene	12 U	13 U	11 U	11 U	11 U	12 U	11 U	4.5 J
Ethylbenzene	12 U	13 U	11 U	11 U	11 U	12 U	11 U	11 U
Styrene	12 U	13 U	11 U	11 U	11 U	12 U	11 U	11 U
Xylenes (total)	12 U	13 U	11 U	11 U	11 U	12 U	11 U	11 U

FREQUENCY OF DETECTION SUMMARY
SURFACE SOIL - ORGANIC COMPOUNDS
SITE 10 - ORIGINAL BASE LANDFILL
MCB, CAMP LEJEUNE, NORTH CAROLINA
SITE INVESTIGATION, CTO-0369

SAMPLE ID	IR10-SB01-00	IR10-SB02-00	IR10-SB03-00	IR10-SB04-00	IR10-SB05-00	IR10-SB06-00	IR10-SB07-00	IR10-SB08-00
SAMPLE DATE	03-18-1998	03-18-1998	03-18-1998	03-18-1998	03-18-1998	03-18-1998	03-18-1998	03-18-1998
DEPTH	0 - 1'	0 - 1'	0 - 1'	0 - 1'	0 - 1'	0 - 1'	0 - 1'	0 - 1'
SEMIVOLATILES (ug/kg)								
Phenol	400 U	420 U	380 U	370 U	360 U	410 U	350 U	370 U
bis(2-Chloroethyl) ether	400 U	420 U	380 U	370 U	360 U	410 U	350 U	370 U
2-Chlorophenol	400 U	420 U	380 U	370 U	360 U	410 U	350 U	370 U
1,3-Dichlorobenzene	400 U	420 U	380 U	370 U	360 U	410 U	350 U	370 U
1,4-Dichlorobenzene	400 U	420 U	380 U	370 U	360 U	410 U	350 U	370 U
1,2-Dichlorobenzene	400 U	420 U	380 U	370 U	360 U	410 U	350 U	370 U
3,3'-Dichlorobenzidine	400 U	420 U	380 U	370 U	360 U	410 U	350 U	370 U
2,2'-Oxybis(1-Chloropropane)	400 U	420 U	380 U	370 U	360 U	410 U	350 U	370 U
N-Nitrosodi-n-propylamine	400 U	420 U	380 U	370 U	360 U	410 U	350 U	370 U
4-Methylphenol	400 U	420 U	380 U	370 U	360 U	410 U	350 U	370 U
Hexachloroethane	400 U	420 U	380 U	370 U	360 U	410 U	350 U	370 U
Nitrobenzene	400 U	420 U	380 U	370 U	360 U	410 U	350 U	370 U
Isophorone	400 U	420 U	380 U	370 U	360 U	410 U	350 U	370 U
2-Nitroaniline	1000 U	1000 U	940 U	940 U	910 U	1000 U	880 U	920 U
2,4-Dimethylphenol	400 U	420 U	380 U	370 U	360 U	410 U	350 U	370 U
bis(2-Chloroethoxy)methane	400 U	420 U	380 U	370 U	360 U	410 U	350 U	370 U
2,4-Dichlorophenol	400 U	420 U	380 U	370 U	360 U	410 U	350 U	370 U
1,2,4-Trichlorobenzene	400 U	420 U	380 U	370 U	360 U	410 U	350 U	370 U
Naphthalene	400 U	420 U	380 U	370 U	360 U	410 U	350 U	370 U
4-Chloroaniline	400 U	420 U	380 U	370 U	360 U	410 U	350 U	370 U
Hexachlorobutadiene	400 U	420 U	380 U	370 U	360 U	410 U	350 U	370 U
4-Chloro-3-methylphenol	400 U	420 U	380 U	370 U	360 U	410 U	350 U	370 U
2-Methylnaphthalene	400 U	420 U	380 U	370 U	360 U	410 U	350 U	370 U
Hexachlorocyclopentadiene	400 U	420 U	380 U	370 U	360 U	410 U	350 U	370 U
2,4,6-Trichlorophenol	400 U	420 U	380 U	370 U	360 U	410 U	350 U	370 U
2,4,5-Trichlorophenol	1000 U	1000 U	940 U	940 U	910 U	1000 U	880 U	920 U
2-Chloronaphthalene	400 U	420 U	380 U	370 U	360 U	410 U	350 U	370 U
2-Methylphenol	400 U	420 U	380 U	370 U	360 U	410 U	350 U	370 U
Dimethyl phthalate	400 U	420 U	380 U	370 U	360 U	410 U	350 U	370 U
Acenaphthylene	400 U	420 U	380 U	370 U	360 U	410 U	350 U	370 U
2,6-Dinitrotoluene	400 U	420 U	380 U	370 U	360 U	410 U	350 U	370 U
3-Nitroaniline	1000 U	1000 U	940 U	940 U	910 U	1000 U	880 U	920 U
Acenaphthene	400 U	420 U	380 U	370 U	360 U	410 U	350 U	370 U

FREQUENCY OF DETECTION SUMMARY
SURFACE SOIL - ORGANIC COMPOUNDS
SITE 10 - ORIGINAL BASE LANDFILL
MCB, CAMP LEJEUNE, NORTH CAROLINA
SITE INVESTIGATION, CTO-0369

SAMPLE ID	IR10-SB01-00	IR10-SB02-00	IR10-SB03-00	IR10-SB04-00	IR10-SB05-00	IR10-SB06-00	IR10-SB07-00	IR10-SB08-00
SAMPLE DATE	03-18-1998	03-18-1998	03-18-1998	03-18-1998	03-18-1998	03-18-1998	03-18-1998	03-18-1998
DEPTH	0 - 1'	0 - 1'	0 - 1'	0 - 1'	0 - 1'	0 - 1'	0 - 1'	0 - 1'
SEMIVOLATILES (ug/kg) (cont)								
2,4-Dinitrophenol	1000 U	1000 U	940 U	940 U	910 U	1000 U	880 U	920 U
4-Nitrophenol	1000 U	1000 U	940 U	940 U	910 U	1000 U	880 U	920 U
Dibenzofuran	400 U	420 U	380 U	370 U	360 U	410 U	350 U	370 U
2,4-Dinitrotoluene	400 U	420 U	380 U	370 U	360 U	410 U	350 U	370 U
Diethyl phthalate	400 U	420 U	380 U	370 U	360 U	410 U	350 U	370 U
4-Chlorophenyl phenyl ether	400 U	420 U	380 U	370 U	360 U	410 U	350 U	370 U
Fluorene	400 U	420 U	380 U	370 U	360 U	410 U	350 U	370 U
4-Nitroaniline	1000 U	1000 U	940 U	940 U	910 U	1000 U	880 U	920 U
4,6-Dinitro-2-methylphenol	1000 U	1000 U	940 U	940 U	910 U	1000 U	880 U	920 U
N-Nitrosodiphenylamine	400 U	420 U	380 U	370 U	360 U	410 U	350 U	370 U
4-Bromophenyl phenyl ether	400 U	420 U	380 U	370 U	360 U	410 U	350 U	370 U
Hexachlorobenzene	400 U	420 U	380 U	370 U	360 U	410 U	350 U	370 U
Pentachlorophenol	1000 U	1000 U	940 U	940 U	910 U	1000 U	880 U	920 U
Phenanthrene	400 U	420 U	140 J	370 U	64 J	410 U	350 U	370 U
Anthracene	400 U	420 U	380 U	370 U	360 U	410 U	350 U	370 U
Carbazole	400 U	420 U	380 U	370 U	360 U	410 U	350 U	370 U
Di-n-butyl phthalate	400 U	52 J	49 J	370 U	48 J	410 U	350 U	67 J
Fluoranthene	400 U	420 U	190 J	65 J	140 J	410 U	350 U	370 U
Pyrene	400 U	420 U	140 J	51 J	120 J	410 U	350 U	370 U
Butyl benzyl phthalate	400 U	420 U	380 U	370 U	360 U	410 U	350 U	370 U
2-Nitrophenol	400 U	420 U	380 U	370 U	360 U	410 U	350 U	370 U
Benzo(a)anthracene	400 U	420 U	86 J	370 U	73 J	410 U	350 U	370 U
Chrysene	400 U	420 U	93 J	39 J	77 J	410 U	350 U	370 U
bis(2-Ethylhexyl) phthalate	400 U	420 U	380 U	370 U	360 U	410 U	350 U	370 U
Di-n-octyl phthalate	400 U	420 U	380 U	370 U	360 U	410 U	350 U	370 U
Benzo(b)fluoranthene	400 U	420 U	92 J	46 J	84 J	410 U	350 U	370 U
Benzo(k)fluoranthene	400 U	420 U	96 J	42 J	78 J	410 U	350 U	370 U
Benzo(a)pyrene	400 U	420 U	84 J	42 J	76 J	410 U	350 U	370 U
Indeno(1,2,3-cd)pyrene	400 U	420 U	58 J	370 U	53 J	410 U	350 U	370 U
Dibenz(a,h)anthracene	400 U	420 U	380 U	370 U	360 U	410 U	350 U	370 U
Benzo(ghi)perylene	400 U	420 U	380 U	370 U	40 J	410 U	350 U	370 U

FREQUENCY OF DETECTION SUMMARY
SURFACE SOIL - ORGANIC COMPOUNDS
SITE 10 - ORIGINAL BASE LANDFILL
MCB, CAMP LEJEUNE, NORTH CAROLINA
SITE INVESTIGATION, CTO-0369

SAMPLE ID	IR10-SB01-00	IR10-SB02-00	IR10-SB03-00	IR10-SB04-00	IR10-SB05-00	IR10-SB06-00	IR10-SB07-00	IR10-SB08-00
SAMPLE DATE	03-18-1998	03-18-1998	03-18-1998	03-18-1998	03-18-1998	03-18-1998	03-18-1998	03-18-1998
DEPTH	0 - 1'	0 - 1'	0 - 1'	0 - 1'	0 - 1'	0 - 1'	0 - 1'	0 - 1'
PESTICIDES/PCBS (ug/kg)								
alpha-BHC	2.1 U	2.1 U	1.9 U	1.9 U	1.9 U	2.1 U	1.8 U	1.9 U
beta-BHC	2.1 U	2.1 U	1.9 U	1.9 U	1.9 U	2.1 U	1.8 U	1.9 U
delta-BHC	2.1 U	2.1 U	1.9 U	1.9 U	1.9 U	2.1 U	1.8 U	1.9 U
gamma-BHC (Lindane)	2.1 U	2.1 U	1.9 U	1.9 U	1.9 U	2.1 U	1.8 U	1.9 U
Heptachlor	2.1 U	2.1 U	1.9 U	1.9 U	1.9 U	2.1 U	1.8 U	1.9 U
Aldrin	2.1 U	2.1 U	1.9 U	1.9 U	1.9 U	2.1 U	1.8 U	1.9 U
Heptachlor epoxide	2.1 U	2.1 U	1.9 U	1.9 U	1.9 U	2.1 U	1.8 U	1.9 U
Endosulfan I	2.1 U	2.1 U	1.9 U	1.9 U	1.9 U	2.1 U	1.8 U	1.9 U
Dieldrin	4 U	4.2 U	3.8 U	3.7 U	3.6 U	4.1 U	3.5 U	3.7 U
4,4'-DDE	4 U	4.2 U	3.8 U	3.7 U	3.6 U	4.1 U	3.5 U	3.7 U
Endrin	4 U	4.2 U	3.8 U	3.7 U	3.6 U	4.1 U	3.5 U	3.7 U
Endosulfan II	4 U	4.2 U	3.8 U	3.7 U	3.6 U	4.1 U	3.5 U	3.7 U
4,4'-DDD	4 U	4.2 U	3.8 U	3.7 U	3.6 U	4.1 U	3.5 U	3.7 U
Endosulfan sulfate	4 U	4.2 U	3.8 U	3.7 U	3.6 U	4.1 U	3.5 U	3.7 U
4,4'-DDT	4 U	4.2 U	6.2	3.7 U	3.6 U	4.1 U	3.5 U	3.7 U
Methoxychlor	21 UJ	21 UJ	19 UJ	19 UJ	19 UJ	21 UJ	18 UJ	19 UJ
Endrin ketone	4 U	4.2 U	3.8 U	3.7 U	3.6 U	4.1 U	3.5 U	3.7 U
Endrin aldehyde	4 U	4.2 U	3.8 U	3.7 U	3.6 U	4.1 U	3.5 U	3.7 U
alpha-Chlordane	2.1 U	2.1 U	1.9 U	1.9 U	1.9 U	2.1 U	1.8 U	1.9 U
gamma-Chlordane	2.1 U	2.1 U	1.9 U	1.9 U	1.9 U	2.1 U	1.8 U	1.9 U
Toxaphene	210 U	210 U	190 U	190 U	190 U	210 U	180 U	190 U
Aroclor 1016	40 U	42 U	38 U	37 U	36 U	41 U	35 U	37 U
Aroclor 1221	82 U	84 U	76 U	76 U	74 U	83 U	71 U	74 U
Aroclor 1232	40 U	42 U	38 U	37 U	36 U	41 U	35 U	37 U
Aroclor 1242	40 U	42 U	38 U	37 U	36 U	41 U	35 U	37 U
Aroclor 1248	40 U	42 U	38 U	37 U	36 U	41 U	35 U	37 U
Aroclor 1254	40 U	42 U	38 U	37 U	36 U	41 U	35 U	37 U
Aroclor 1260	40 U	42 U	38 U	85 J	36 U	41 U	35 U	37 U

FREQUENCY OF DETECTION SUMMARY
SURFACE SOIL - ORGANIC COMPOUNDS
SITE 10 - ORIGINAL BASE LANDFILL
MCB, CAMP LEJEUNE, NORTH CAROLINA
SITE INVESTIGATION, CTO-0369

SAMPLE ID	IR10-SB09-00	IR10-SB10-00	IR10-SB11-00	IR10-SB12-00	IR10-SB13-00	IR10-SB14-00	IR10-SB15-00	IR10-SB16-00
SAMPLE DATE	03-18-1998	03-18-1998	03-18-1998	03-18-1998	03-18-1998	03-18-1998	03-18-1998	03-18-1998
DEPTH	0 - 1'	0 - 1'	0 - 1'	0 - 1'	0 - 1'	0 - 1'	0 - 1'	0 - 1'
VOLATILES (ug/kg)								
Chloromethane	11 U	11 U	11 U	11 U	11 U	11 U	11 U	12 U
Bromomethane	11 U	11 U	11 U	11 U	11 U	11 U	11 U	12 U
Vinyl chloride	11 U	11 U	11 U	11 U	11 U	11 U	11 U	12 U
Chloroethane	11 U	11 U	11 U	11 U	11 U	11 U	11 U	12 U
Methylene chloride	11 U	11 U	11 U	11 U	11 U	11 U	11 U	12 U
Acetone	11 U	11 U	1600 U	11 U	11 U	11 U	19 U	26 U
Carbon disulfide	11 U	11 U	11 U	11 U	11 U	11 U	11 U	12 U
1,1-Dichloroethene	11 U	11 U	11 U	11 U	11 U	11 U	11 U	12 U
1,1-Dichloroethane	11 U	11 U	11 U	11 U	11 U	11 U	11 U	12 U
1,2-Dichloroethene (total)	11 U	11 U	11 U	11 U	11 U	11 U	11 U	12 U
Chloroform	11 U	11 U	11 U	11 U	11 U	11 U	11 U	12 U
1,2-Dichloroethane	11 U	11 U	11 U	11 U	11 U	11 U	11 U	12 U
2-Butanone	11 U	11 U	11 U	11 U	11 U	11 U	11 U	12 U
1,1,1-Trichloroethane	11 U	11 U	11 U	11 U	11 U	11 U	11 U	12 U
Carbon tetrachloride	11 U	11 U	11 U	11 U	11 U	11 U	11 U	12 U
Bromodichloromethane	11 U	11 U	11 U	11 U	11 U	11 U	11 U	12 U
1,2-Dichloropropane	11 U	11 U	11 U	11 U	11 U	11 U	11 U	12 U
cis-1,3-Dichloropropene	11 U	11 U	11 U	11 U	11 U	11 U	11 U	12 U
Trichloroethene	11 U	11 U	11 U	11 U	11 U	11 U	11 U	12 U
Dibromochloromethane	11 U	11 U	11 U	11 U	11 U	11 U	11 U	12 U
1,1,2-Trichloroethane	11 U	11 U	11 U	11 U	11 U	11 U	11 U	12 U
Benzene	11 U	11 U	11 U	11 U	11 U	11 U	11 U	12 U
trans-1,3-Dichloropropene	11 U	11 U	11 U	11 U	11 U	11 U	11 U	12 U
Bromoform	11 U	11 U	11 U	11 U	11 U	11 U	11 U	12 U
4-Methyl-2-pentanone	11 U	11 U	11 U	11 U	11 U	11 U	11 U	12 U
2-Hexanone	11 U	11 U	11 U	11 U	11 U	11 U	11 U	12 U
Tetrachloroethene	11 U	11 U	11 U	11 U	11 U	11 U	11 U	12 U
1,1,2,2-Tetrachloroethane	11 U	11 U	11 U	11 U	11 U	11 U	11 U	12 U
Toluene	11 U	1.6 J	1.3 J	11 U	1.2 J	11 U	11 U	12 U
Chlorobenzene	11 U	11 U	11 U	11 U	11 U	11 U	11 U	12 U
Ethylbenzene	11 U	11 U	11 U	11 U	11 U	11 U	11 U	12 U
Styrene	11 U	11 U	11 U	11 U	11 U	11 U	11 U	12 U
Xylenes (total)	11 U	11 U	11 U	11 U	11 U	11 U	11 U	12 U

FREQUENCY OF DETECTION SUMMARY
SURFACE SOIL - ORGANIC COMPOUNDS
SITE 10 - ORIGINAL BASE LANDFILL
MCB, CAMP LEJEUNE, NORTH CAROLINA
SITE INVESTIGATION, CTO-0369

SAMPLE ID	IR10-SB09-00	IR10-SB10-00	IR10-SB11-00	IR10-SB12-00	IR10-SB13-00	IR10-SB14-00	IR10-SB15-00	IR10-SB16-00
SAMPLE DATE	03-18-1998	03-18-1998	03-18-1998	03-18-1998	03-18-1998	03-18-1998	03-18-1998	03-18-1998
DEPTH	0 - 1'	0 - 1'	0 - 1'	0 - 1'	0 - 1'	0 - 1'	0 - 1'	0 - 1'
SEMIVOLATILES (ug/kg)								
Phenol	380 U	370 U	350 U	360 U	350 U	380 U	370 U	400 U
bis(2-Chloroethyl) ether	380 U	370 U	350 U	360 U	350 U	380 U	370 U	400 U
2-Chlorophenol	380 U	370 U	350 U	360 U	350 U	380 U	370 U	400 U
1,3-Dichlorobenzene	380 U	370 U	350 U	360 U	350 U	380 U	370 U	400 U
1,4-Dichlorobenzene	380 U	370 U	350 U	360 U	350 U	380 U	370 U	400 U
1,2-Dichlorobenzene	380 U	370 U	350 U	360 U	350 U	380 U	370 U	400 U
3,3'-Dichlorobenzidine	380 U	370 U	350 U	360 U	350 U	380 U	370 U	400 U
2,2'-Oxybis(1-Chloropropane)	380 U	370 U	350 U	360 U	350 U	380 U	370 U	400 U
N-Nitrosodi-n-propylamine	380 U	370 U	350 U	360 U	350 U	380 U	370 U	400 U
4-Methylphenol	380 U	370 U	350 U	360 U	350 U	380 U	370 U	400 U
Hexachloroethane	380 U	370 U	350 U	360 U	350 U	380 U	370 U	400 U
Nitrobenzene	380 U	370 U	350 U	360 U	350 U	380 U	370 U	400 U
Isophorone	380 U	370 U	350 U	360 U	350 U	380 U	370 U	400 U
2-Nitroaniline	940 U	930 U	880 U	900 U	890 U	950 U	920 U	1000 U
2,4-Dimethylphenol	380 U	370 U	350 U	360 U	350 U	380 U	370 U	400 U
bis(2-Chloroethoxy)methane	380 U	370 U	350 U	360 U	350 U	380 U	370 U	400 U
2,4-Dichlorophenol	380 U	370 U	350 U	360 U	350 U	380 U	370 U	400 U
1,2,4-Trichlorobenzene	380 U	370 U	350 U	360 U	350 U	380 U	370 U	400 U
Naphthalene	380 U	370 U	350 U	360 U	350 U	380 U	370 U	400 U
4-Chloroaniline	380 U	370 U	350 U	360 U	350 U	380 U	370 U	400 U
Hexachlorobutadiene	380 U	370 U	350 U	360 U	350 U	380 U	370 U	400 U
4-Chloro-3-methylphenol	380 U	370 U	350 U	360 U	350 U	380 U	370 U	400 U
2-Methylnaphthalene	380 U	370 U	350 U	360 U	350 U	380 U	370 U	400 U
Hexachlorocyclopentadiene	380 U	370 U	350 U	360 U	350 U	380 U	370 U	400 U
2,4,6-Trichlorophenol	380 U	370 U	350 U	360 U	350 U	380 U	370 U	400 U
2,4,5-Trichlorophenol	940 U	930 U	880 U	900 U	890 U	950 U	920 U	1000 U
2-Chloronaphthalene	380 U	370 U	350 U	360 U	350 U	380 U	370 U	400 U
2-Methylphenol	380 U	370 U	350 U	360 U	350 U	380 U	370 U	400 U
Dimethyl phthalate	380 U	370 U	350 U	360 U	350 U	380 U	370 U	400 U
Acenaphthylene	380 U	370 U	350 U	360 U	350 U	380 U	370 U	400 U
2,6-Dinitrotoluene	380 U	370 U	350 U	360 U	350 U	380 U	370 U	400 U
3-Nitroaniline	940 U	930 U	880 U	900 U	890 U	950 U	920 U	1000 U
Acenaphthene	380 U	370 U	350 U	360 U	350 U	380 U	370 U	400 U

FREQUENCY OF DETECTION SUMMARY
SURFACE SOIL - ORGANIC COMPOUNDS
SITE 10 - ORIGINAL BASE LANDFILL
MCB, CAMP LEJEUNE, NORTH CAROLINA
SITE INVESTIGATION, CTO-0369

SAMPLE ID	IR10-SB09-00	IR10-SB10-00	IR10-SB11-00	IR10-SB12-00	IR10-SB13-00	IR10-SB14-00	IR10-SB15-00	IR10-SB16-00
SAMPLE DATE	03-18-1998	03-18-1998	03-18-1998	03-18-1998	03-18-1998	03-18-1998	03-18-1998	03-18-1998
DEPTH	0 - 1'	0 - 1'	0 - 1'	0 - 1'	0 - 1'	0 - 1'	0 - 1'	0 - 1'
SEMIVOLATILES (ug/kg) (cont)								
2,4-Dinitrophenol	940 U	930 U	880 U	900 U	890 U	950 U	920 U	1000 U
4-Nitrophenol	940 U	930 U	880 U	900 U	890 U	950 U	920 U	1000 U
Dibenzofuran	380 U	370 U	350 U	360 U	350 U	380 U	370 U	400 U
2,4-Dinitrotoluene	380 U	370 U	350 U	360 U	350 U	380 U	370 U	400 U
Diethyl phthalate	380 U	370 U	350 U	360 U	350 U	380 U	370 U	400 U
4-Chlorophenyl phenyl ether	380 U	370 U	350 U	360 U	350 U	380 U	370 U	400 U
Fluorene	380 U	370 U	350 U	360 U	350 U	380 U	370 U	400 U
4-Nitroaniline	940 U	930 U	880 U	900 U	890 U	950 U	920 U	1000 U
4,6-Dinitro-2-methylphenol	940 U	930 U	880 U	900 U	890 U	950 U	920 U	1000 U
N-Nitrosodiphenylamine	380 U	370 U	350 U	360 U	350 U	380 U	370 U	400 U
4-Bromophenyl phenyl ether	380 U	370 U	350 U	360 U	350 U	380 U	370 U	400 U
Hexachlorobenzene	380 U	370 U	350 U	360 U	350 U	380 U	370 U	400 U
Pentachlorophenol	940 U	930 U	880 U	900 U	890 U	950 U	920 U	1000 U
Phenanthrene	380 U	370 U	350 U	360 U	350 U	380 U	370 U	400 U
Anthracene	380 U	370 U	350 U	360 U	350 U	380 U	370 U	400 U
Carbazole	380 U	370 U	350 U	360 U	350 U	380 U	370 U	400 U
Di-n-butyl phthalate	380 U	44 J	350 U	360 U	350 U	380 U	370 U	400 U
Fluoranthene	380 U	370 U	350 U	360 U	350 U	380 U	370 U	400 U
Pyrene	380 U	370 U	350 U	360 U	350 U	380 U	370 U	400 U
Butyl benzyl phthalate	380 U	370 U	350 U	360 U	350 U	380 U	370 U	400 U
2-Nitrophenol	380 U	370 U	350 U	360 U	350 U	380 U	370 U	400 U
Benzo(a)anthracene	380 U	370 U	350 U	360 U	350 U	380 U	370 U	400 U
Chrysene	380 U	370 U	350 U	360 U	350 U	380 U	370 U	400 U
bis(2-Ethylhexyl) phthalate	380 U	370 U	350 U	360 U	350 U	380 U	370 U	400 U
Di-n-octyl phthalate	380 U	370 U	350 U	360 U	350 U	380 U	370 U	400 U
Benzo(b)fluoranthene	380 U	370 U	350 U	360 U	350 U	380 U	370 U	400 U
Benzo(k)fluoranthene	380 U	370 U	350 U	360 U	350 U	380 U	370 U	400 U
Benzo(a)pyrene	380 U	370 U	350 U	360 U	350 U	380 U	370 U	400 U
Indeno(1,2,3-cd)pyrene	380 U	370 U	350 U	360 U	350 U	380 U	370 U	400 U
Dibenz(a,h)anthracene	380 U	370 U	350 U	360 U	350 U	380 U	370 U	400 U
Benzo(ghi)perylene	380 U	370 U	350 U	360 U	350 U	380 U	370 U	400 U

FREQUENCY OF DETECTION SUMMARY
SURFACE SOIL - ORGANIC COMPOUNDS
SITE 10 - ORIGINAL BASE LANDFILL
MCB, CAMP LEJEUNE, NORTH CAROLINA
SITE INVESTIGATION, CTO-0369

SAMPLE ID	IR10-SB09-00	IR10-SB10-00	IR10-SB11-00	IR10-SB12-00	IR10-SB13-00	IR10-SB14-00	IR10-SB15-00	IR10-SB16-00
SAMPLE DATE	03-18-1998	03-18-1998	03-18-1998	03-18-1998	03-18-1998	03-18-1998	03-18-1998	03-18-1998
DEPTH	0 - 1'	0 - 1'	0 - 1'	0 - 1'	0 - 1'	0 - 1'	0 - 1'	0 - 1'
PESTICIDES/PCBS (ug/kg)								
alpha-BHC	1.9 U	1.9 U	1.8 U	1.8 U	1.8 U	1.9 U	1.9 U	2.1 U
beta-BHC	1.9 U	1.9 U	1.8 UJ	1.8 UJ	1.8 UJ	1.9 UJ	1.9 UJ	2.1 UJ
delta-BHC	1.9 U	1.9 U	1.8 U	1.8 U	1.8 U	1.9 U	1.9 U	2.1 U
gamma-BHC (Lindane)	1.9 U	1.9 U	1.8 U	1.8 U	1.8 U	1.9 U	1.9 U	2.1 U
Heptachlor	1.2 NJ	1.9 U	1.8 U	1.8 U	1.8 U	1.9 U	1.9 U	2.1 U
Aldrin	1.9 U	1.9 U	1.8 U	1.8 U	1.8 U	1.9 U	1.9 U	2.1 U
Heptachlor epoxide	2.4 NJ	1.9 U	1.8 U	1.8 U	1.8 U	1.9 U	1.9 U	2.1 U
Endosulfan I	4.3 J	1.9 U	1.8 U	1.8 U	1.8 U	1.9 U	1.9 U	2.1 U
Dieldrin	2.2 NJ	3.7 U	3.5 U	3.6 U	3.5 U	3.8 U	3.7 U	4 U
4,4'-DDE	3.8 U	3.7 U	3.5 U	2.1 NJ	3.5 U	3.8 U	3.7 U	4 U
Endrin	2.4 NJ	3.7 U	3.5 U	3.6 U	3.5 U	3.8 U	3.7 U	4 U
Endosulfan II	3.8 U	3.7 U	3.5 U	3.6 U	3.5 U	3.8 U	3.7 U	4 U
4,4'-DDD	3.8 U	3.7 U	3.5 U	3.6 U	3.5 U	3.8 U	3.7 U	4 U
Endosulfan sulfate	3.8 U	3.7 U	3.5 U	3.6 U	3.5 U	3.8 U	3.7 U	4 U
4,4'-DDT	3.8 U	3.7 U	3.5 U	3.1 J	3.5 U	3.8 U	3.7 U	4 U
Methoxychlor	19 UJ	19 UJ	18 UJ	18 UJ	18 UJ	19 UJ	19 UJ	21 UJ
Endrin ketone	3.8 U	3.7 U	3.5 U	3.6 U	3.5 U	3.8 U	3.7 U	4 U
Endrin aldehyde	3.8 U	3.7 U	3.5 U	3.6 U	3.5 U	3.8 U	3.7 U	4 U
alpha-Chlordane	1.9 U	1.9 U	1.8 U	1.8 U	1.8 U	1.9 U	1.9 U	2.1 U
gamma-Chlordane	1.9 U	1.9 U	1.8 U	1.8 U	1.8 U	1.9 U	1.9 U	2.1 U
Toxaphene	190 U	190 U	180 U	180 U	180 U	190 U	190 U	210 U
Aroclor 1016	38 U	37 U	35 U	36 U	35 U	38 U	37 U	40 U
Aroclor 1221	76 U	75 U	71 U	73 U	72 U	77 U	75 U	82 U
Aroclor 1232	38 U	37 U	35 U	36 U	35 U	38 U	37 U	40 U
Aroclor 1242	38 U	37 U	35 U	36 U	35 U	38 U	37 U	40 U
Aroclor 1248	38 U	37 U	35 U	36 U	35 U	38 U	37 U	40 U
Aroclor 1254	38 U	37 U	35 U	36 U	35 U	38 U	37 U	40 U
Aroclor 1260	38 U	37 U	35 U	36 U	35 U	38 U	37 U	40 U

FREQUENCY OF DETECTION SUMMARY
SURFACE SOIL - ORGANIC COMPOUNDS
SITE 10 - ORIGINAL BASE LANDFILL
MCB, CAMP LEJEUNE, NORTH CAROLINA
SITE INVESTIGATION, CTO-0369

SAMPLE ID	IR10-SB17-00	IR10-SB18-00	IR10-SB19-00	IR10-SB20-00	IR10-SB21-00	IR10-SB22-00	IR10-SB23-00	IR10-SB24-00
SAMPLE DATE	03-18-1998	03-19-1998	03-19-1998	03-19-1998	03-19-1998	03-19-1998	03-19-1998	03-19-1998
DEPTH	0 - 1'	0 - 1'	0 - 1'	0 - 1'	0 - 1'	0 - 1'	0 - 1'	0 - 1'
VOLATILES (ug/kg)								
Chloromethane	11 U	11 U	12 U	15 U	11 U	11 U	11 U	13 U
Bromomethane	11 U	11 U	12 U	15 U	11 U	11 U	11 U	13 U
Vinyl chloride	11 U	11 U	12 U	15 U	11 U	11 U	11 U	13 U
Chloroethane	11 U	11 U	12 U	15 U	11 U	11 U	11 U	13 U
Methylene chloride	11 U	11 U	12 U	15 U	11 U	11 U	11 U	13 U
Acetone	11 U	11 U	12 U	15 U	11 U	11 U	11 U	13 U
Carbon disulfide	11 U	11 U	12 U	15 U	11 U	11 U	11 U	13 U
1,1-Dichloroethene	11 U	11 U	12 U	15 U	11 U	11 U	11 U	13 U
1,1-Dichloroethane	11 U	11 U	12 U	15 U	11 U	11 U	11 U	13 U
1,2-Dichloroethene (total)	11 U	11 U	12 U	15 U	11 U	11 U	11 U	13 U
Chloroform	11 U	11 U	12 U	15 U	11 U	11 U	11 U	13 U
1,2-Dichloroethane	11 U	11 U	12 U	15 U	11 U	11 U	11 U	13 U
2-Butanone	11 U	11 U	12 U	15 U	11 U	11 U	11 U	13 U
1,1,1-Trichloroethane	11 U	11 U	12 U	15 U	11 U	11 U	11 U	13 U
Carbon tetrachloride	11 U	11 U	12 U	15 U	11 U	11 U	11 U	13 U
Bromodichloromethane	11 U	11 U	12 U	15 U	11 U	11 U	11 U	13 U
1,2-Dichloropropane	11 U	11 U	12 U	15 U	11 U	11 U	11 U	13 U
cis-1,3-Dichloropropene	11 U	11 U	12 U	15 U	11 U	11 U	11 U	13 U
Trichloroethene	11 U	11 U	12 U	15 U	11 U	11 U	11 U	13 U
Dibromochloromethane	11 U	11 U	12 U	15 U	11 U	11 U	11 U	13 U
1,1,2-Trichloroethane	11 U	11 U	12 U	15 U	11 U	11 U	11 U	13 U
Benzene	11 U	11 U	12 U	15 U	11 U	11 U	11 U	13 U
trans-1,3-Dichloropropene	11 U	11 U	12 U	15 U	11 U	11 U	11 U	13 U
Bromoform	11 U	11 U	12 U	15 U	11 U	11 U	11 U	13 U
4-Methyl-2-pentanone	11 U	11 U	12 U	15 U	11 U	11 U	11 U	13 U
2-Hexanone	11 U	11 U	12 U	15 U	11 U	11 U	11 U	13 U
Tetrachloroethene	11 U	11 U	12 U	15 U	11 U	11 U	11 U	13 U
1,1,2,2-Tetrachloroethane	11 U	11 U	12 U	15 U	11 U	11 U	11 U	13 U
Toluene	11 U	2 J	2.4 J	2.6 J	11 U	1.4 J	8.1 J	13 U
Chlorobenzene	11 U	11 U	12 U	15 U	11 U	11 U	11 U	13 U
Ethylbenzene	11 U	11 U	12 U	15 U	11 U	11 U	11 U	13 U
Styrene	11 U	11 U	12 U	15 U	11 U	11 U	11 U	13 U
Xylenes (total)	11 U	11 U	12 U	15 U	11 U	11 U	11 U	13 U

FREQUENCY OF DETECTION SUMMARY
SURFACE SOIL - ORGANIC COMPOUNDS
SITE 10 - ORIGINAL BASE LANDFILL
MCB, CAMP LEJEUNE, NORTH CAROLINA
SITE INVESTIGATION, CTO-0369

SAMPLE ID	IR10-SB17-00	IR10-SB18-00	IR10-SB19-00	IR10-SB20-00	IR10-SB21-00	IR10-SB22-00	IR10-SB23-00	IR10-SB24-00
SAMPLE DATE	03-18-1998	03-19-1998	03-19-1998	03-19-1998	03-19-1998	03-19-1998	03-19-1998	03-19-1998
DEPTH	0 - 1'	0 - 1'	0 - 1'	0 - 1'	0 - 1'	0 - 1'	0 - 1'	0 - 1'
SEMIVOLATILES (ug/kg)								
Phenol	350 U	380 U	380 U	480 U	370 U	370 U	360 U	430 U
bis(2-Chloroethyl) ether	350 U	380 U	380 U	480 U	370 U	370 U	360 U	430 U
2-Chlorophenol	350 U	380 U	380 U	480 U	370 U	370 U	360 U	430 U
1,3-Dichlorobenzene	350 U	380 U	380 U	480 U	370 U	370 U	360 U	430 U
1,4-Dichlorobenzene	350 U	380 U	380 U	480 U	370 U	370 U	360 U	430 U
1,2-Dichlorobenzene	350 U	380 U	380 U	480 U	370 U	370 U	360 U	430 U
3,3'-Dichlorobenzidine	350 U	380 U	380 U	480 U	370 U	370 U	360 U	430 U
2,2'-Oxybis(1-Chloropropane)	350 U	380 U	380 U	480 U	370 U	370 U	360 U	430 U
N-Nitrosodi-n-propylamine	350 U	380 U	380 U	480 U	370 U	370 U	360 U	430 U
4-Methylphenol	350 U	380 U	380 U	480 U	370 U	370 U	360 U	430 U
Hexachloroethane	350 U	380 U	380 U	480 U	370 U	370 U	360 U	430 U
Nitrobenzene	350 U	380 U	380 U	480 U	370 U	370 U	360 U	430 U
Isophorone	350 U	380 U	380 U	480 U	370 U	370 U	360 U	430 U
2-Nitroaniline	890 U	950 U	960 U	1200 U	930 U	930 U	910 U	1100 U
2,4-Dimethylphenol	350 U	380 U	380 U	480 U	370 U	370 U	360 U	430 U
bis(2-Chloroethoxy)methane	350 U	380 U	380 U	480 U	370 U	370 U	360 U	430 U
2,4-Dichlorophenol	350 U	380 U	380 U	480 U	370 U	370 U	360 U	430 U
1,2,4-Trichlorobenzene	350 U	380 U	380 U	480 U	370 U	370 U	360 U	430 U
Naphthalene	350 U	380 U	380 U	480 U	370 U	370 U	360 U	430 U
4-Chloroaniline	350 U	380 U	380 U	480 U	370 U	370 U	360 U	430 U
Hexachlorobutadiene	350 U	380 U	380 U	480 U	370 U	370 U	360 U	430 U
4-Chloro-3-methylphenol	350 U	380 U	380 U	480 U	370 U	370 U	360 U	430 U
2-Methylnaphthalene	350 U	380 U	380 U	480 U	370 U	370 U	360 U	430 U
Hexachlorocyclopentadiene	350 U	380 U	380 U	480 U	370 U	370 U	360 U	430 U
2,4,6-Trichlorophenol	350 U	380 U	380 U	480 U	370 U	370 U	360 U	430 U
2,4,5-Trichlorophenol	890 U	950 U	960 U	1200 U	930 U	930 U	910 U	1100 U
2-Chloronaphthalene	350 U	380 U	380 U	480 U	370 U	370 U	360 U	430 U
2-Methylphenol	350 U	380 U	380 U	480 U	370 U	370 U	360 U	430 U
Dimethyl phthalate	350 U	380 U	380 U	480 U	370 U	370 U	360 U	430 U
Acenaphthylene	350 U	380 U	380 U	480 U	370 U	370 U	360 U	430 U
2,6-Dinitrotoluene	350 U	380 U	380 U	480 U	370 U	370 U	360 U	430 U
3-Nitroaniline	890 U	950 U	960 U	1200 U	930 U	930 U	910 U	1100 U
Acenaphthene	350 U	380 U	380 U	480 U	370 U	370 U	360 U	430 U

FREQUENCY OF DETECTION SUMMARY
SURFACE SOIL - ORGANIC COMPOUNDS
SITE 10 - ORIGINAL BASE LANDFILL
MCB, CAMP LEJEUNE, NORTH CAROLINA
SITE INVESTIGATION, CTO-0369

SAMPLE ID	IR10-SB17-00	IR10-SB18-00	IR10-SB19-00	IR10-SB20-00	IR10-SB21-00	IR10-SB22-00	IR10-SB23-00	IR10-SB24-00
SAMPLE DATE	03-18-1998	03-19-1998	03-19-1998	03-19-1998	03-19-1998	03-19-1998	03-19-1998	03-19-1998
DEPTH	0 - 1'	0 - 1'	0 - 1'	0 - 1'	0 - 1'	0 - 1'	0 - 1'	0 - 1'
SEMIVOLATILES (ug/kg) (cont)								
2,4-Dinitrophenol	890 U	950 U	960 U	1200 U	930 U	930 U	910 U	1100 U
4-Nitrophenol	890 U	950 U	960 U	1200 U	930 U	930 U	910 U	1100 U
Dibenzofuran	350 U	380 U	380 U	480 U	370 U	370 U	360 U	430 U
2,4-Dinitrotoluene	350 U	380 U	380 U	480 U	370 U	370 U	360 U	430 U
Diethyl phthalate	350 U	380 U	380 U	480 U	370 U	370 U	360 U	430 U
4-Chlorophenyl phenyl ether	350 U	380 U	380 U	480 U	370 U	370 U	360 U	430 U
Fluorene	350 U	380 U	380 U	480 U	370 U	370 U	360 U	430 U
4-Nitroaniline	890 U	950 U	960 U	1200 U	930 U	930 U	910 U	1100 U
4,6-Dinitro-2-methylphenol	890 U	950 U	960 U	1200 U	930 U	930 U	910 U	1100 U
N-Nitrosodiphenylamine	350 U	380 U	380 U	480 U	370 U	370 U	360 U	430 U
4-Bromophenyl phenyl ether	350 U	380 U	380 U	480 U	370 U	370 U	360 U	430 U
Hexachlorobenzene	350 U	380 U	380 U	480 U	370 U	370 U	360 U	430 U
Pentachlorophenol	890 U	950 U	960 U	1200 U	930 U	930 U	910 U	1100 U
Phenanthrene	350 U	110 J	380 U	480 U	370 U	370 U	360 U	430 U
Anthracene	350 U	380 U	380 U	480 U	370 U	370 U	360 U	430 U
Carbazole	350 U	380 U	380 U	480 U	370 U	370 U	360 U	430 U
Di-n-butyl phthalate	350 U	380 U	380 U	480 U	38 J	370 U	360 U	430 U
Fluoranthene	350 U	150 J	82 J	480 U	370 U	370 U	360 U	430 U
Pyrene	350 U	120 J	84 J	480 U	370 U	370 U	360 U	430 U
Butyl benzyl phthalate	350 U	380 U	380 U	480 U	370 U	370 U	360 U	430 U
2-Nitrophenol	350 U	380 U	380 U	480 U	370 U	370 U	360 U	430 U
Benzo(a)anthracene	350 U	68 J	59 J	480 U	370 U	370 U	360 U	430 U
Chrysene	350 U	76 J	61 J	480 U	370 U	370 U	360 U	430 U
bis(2-Ethylhexyl) phthalate	350 U	380 U	380 U	480 U	370 U	370 U	360 U	430 U
Di-n-octyl phthalate	350 U	380 U	380 U	480 U	370 U	370 U	360 U	430 U
Benzo(b)fluoranthene	350 U	56 J	65 J	480 U	370 U	370 U	360 U	430 U
Benzo(k)fluoranthene	350 U	77 J	86 J	480 U	370 U	370 U	360 U	430 U
Benzo(a)pyrene	350 U	69 J	74 J	480 U	370 U	370 U	360 U	430 U
Indeno(1,2,3-cd)pyrene	350 U	44 J	49 J	480 U	370 U	370 U	360 U	430 U
Dibenz(a,h)anthracene	350 U	380 U	380 U	480 U	370 U	370 U	360 U	430 U
Benzo(ghi)perylene	350 U	40 J	45 J	480 U	370 U	370 U	360 U	430 U

FREQUENCY OF DETECTION SUMMARY
SURFACE SOIL - ORGANIC COMPOUNDS
SITE 10 - ORIGINAL BASE LANDFILL
MCB, CAMP LEJEUNE, NORTH CAROLINA
SITE INVESTIGATION, CTO-0369

SAMPLE ID	IR10-SB17-00	IR10-SB18-00	IR10-SB19-00	IR10-SB20-00	IR10-SB21-00	IR10-SB22-00	IR10-SB23-00	IR10-SB24-00
SAMPLE DATE	03-18-1998	03-19-1998	03-19-1998	03-19-1998	03-19-1998	03-19-1998	03-19-1998	03-19-1998
DEPTH	0 - 1'	0 - 1'	0 - 1'	0 - 1'	0 - 1'	0 - 1'	0 - 1'	0 - 1'
PESTICIDES/PCBS (ug/kg)								
alpha-BHC	1.8 U	1.9 U	2 U	2.5 U	1.9 U	1.9 U	1.9 U	2.2 U
beta-BHC	1.8 UJ	1.9 U	2 UJ	2.5 UJ	1.9 UJ	1.9 UJ	1.9 U	2.2 UJ
delta-BHC	1.8 U	1.9 U	2 U	2.5 U	1.9 U	1.9 U	1.9 U	2.2 U
gamma-BHC (Lindane)	1.8 U	1.9 U	2 U	2.5 U	1.9 U	1.9 U	1.9 U	2.2 U
Heptachlor	1.8 U	1.9 U	2 U	2.5 U	1.9 U	1.9 U	1.9 U	2.2 U
Aldrin	1.8 U	1.9 U	2 U	2.5 U	1.9 U	1.9 U	1.9 U	2.2 U
Heptachlor epoxide	1.8 U	1.9 U	2 U	2.5 U	1.9 U	1.9 U	1.9 U	2.2 U
Endosulfan I	1.8 U	1.9 U	2 U	2.5 U	1.9 U	1.9 U	1.9 U	2.2 U
Dieldrin	3.5 U	3.8 U	3.8 U	4.8 U	3.7 U	3.7 U	3.6 U	4.3 U
4,4'-DDE	3.5 U	3.8 U	3.8 U	4.8 U	3.7 U	3.7 U	3.6 U	4.3 U
Endrin	3.5 U	3.8 U	3.8 U	4.8 U	3.7 U	3.7 U	3.6 U	4.3 U
Endosulfan II	3.5 U	3.8 U	3.8 U	4.8 U	3.7 U	3.7 U	3.6 U	4.3 U
4,4'-DDD	3.5 U	3.8 U	3.8 U	4.8 U	3.7 U	3.7 U	3.6 U	4.3 U
Endosulfan sulfate	3.5 U	3.8 U	3.8 U	4.8 U	3.7 U	3.7 U	3.6 U	4.3 U
4,4'-DDT	3.5 U	3.8 U	3.8 U	4.8 U	3.7 U	3.7 U	3.6 U	4.3 U
Methoxychlor	18 UJ	19 UJ	20 UJ	25 UJ	19 UJ	19 UJ	19 UJ	22 UJ
Endrin ketone	3.5 U	3.8 U	3.8 U	4.8 U	3.7 U	3.7 U	3.6 U	4.3 U
Endrin aldehyde	3.5 U	3.8 U	3.8 U	4.9	3.7 U	3.7 U	3.6 U	4.3 U
alpha-Chlordane	1.8 U	1.9 U	2 U	2.5 U	1.9 U	1.9 U	1.9 U	2.2 U
gamma-Chlordane	1.8 U	1.9 U	2 U	2.5 U	1.9 U	1.9 U	1.9 U	2.2 U
Toxaphene	180 U	190 U	200 U	250 U	190 U	190 U	190 U	220 U
Aroclor 1016	35 U	38 U	38 U	48 U	37 U	37 U	36 U	43 U
Aroclor 1221	72 U	77 U	78 U	98 U	75 U	75 U	73 U	86 U
Aroclor 1232	35 U	38 U	38 U	48 U	37 U	37 U	36 U	43 U
Aroclor 1242	35 U	38 U	38 U	48 U	37 U	37 U	36 U	43 U
Aroclor 1248	35 U	38 U	38 U	48 U	37 U	37 U	36 U	43 U
Aroclor 1254	35 U	38 U	38 U	48 U	37 U	37 U	36 U	43 U
Aroclor 1260	35 U	38 U	38 U	48 U	37 U	37 U	36 U	43 U

FREQUENCY OF DETECTION SUMMARY
SURFACE SOIL - ORGANIC COMPOUNDS
SITE 10 - ORIGINAL BASE LANDFILL
MCB, CAMP LEJEUNE, NORTH CAROLINA
SITE INVESTIGATION, CTO-0369

SAMPLE ID	IR10-SB25-00
SAMPLE DATE	03-19-1998
DEPTH	0 - 1'
VOLATILES (ug/kg)	
Chloromethane	20 UJ
Bromomethane	20 UJ
Vinyl chloride	20 UJ
Chloroethane	20 UJ
Methylene chloride	20 UJ
Acetone	20 UJ
Carbon disulfide	20 UJ
1,1-Dichloroethene	20 UJ
1,1-Dichloroethane	20 UJ
1,2-Dichloroethene (total)	20 UJ
Chloroform	20 UJ
1,2-Dichloroethane	20 UJ
2-Butanone	20 UJ
1,1,1-Trichloroethane	20 UJ
Carbon tetrachloride	20 UJ
Bromodichloromethane	20 UJ
1,2-Dichloropropane	20 UJ
cis-1,3-Dichloropropene	20 UJ
Trichloroethene	20 UJ
Dibromochloromethane	20 UJ
1,1,2-Trichloroethane	20 UJ
Benzene	20 UJ
trans-1,3-Dichloropropene	20 UJ
Bromoform	20 UJ
4-Methyl-2-pentanone	20 UJ
2-Hexanone	20 UJ
Tetrachloroethene	20 UJ
1,1,2,2-Tetrachloroethane	20 UJ
Toluene	20 UJ
Chlorobenzene	20 UJ
Ethylbenzene	20 UJ
Styrene	20 UJ
Xylenes (total)	20 UJ

FREQUENCY OF DETECTION SUMMARY
SURFACE SOIL - ORGANIC COMPOUNDS
SITE 10 - ORIGINAL BASE LANDFILL
MCB, CAMP LEJEUNE, NORTH CAROLINA
SITE INVESTIGATION, CTO-0369

SAMPLE ID	IR10-SB25-00
SAMPLE DATE	03-19-1998
DEPTH	0 - 1'
SEMIVOLATILES (ug/kg)	
Phenol	650 U
bis(2-Chloroethyl) ether	650 U
2-Chlorophenol	650 U
1,3-Dichlorobenzene	650 U
1,4-Dichlorobenzene	650 U
1,2-Dichlorobenzene	650 U
3,3'-Dichlorobenzidine	650 U
2,2'-Oxybis(1-Chloropropane)	650 U
N-Nitrosodi-n-propylamine	650 U
4-Methylphenol	650 U
Hexachloroethane	650 U
Nitrobenzene	650 U
Isophorone	650 U
2-Nitroaniline	1600 U
2,4-Dimethylphenol	650 U
bis(2-Chloroethoxy)methane	650 U
2,4-Dichlorophenol	650 U
1,2,4-Trichlorobenzene	650 U
Naphthalene	650 U
4-Chloroaniline	650 U
Hexachlorobutadiene	650 U
4-Chloro-3-methylphenol	650 U
2-Methylnaphthalene	650 U
Hexachlorocyclopentadiene	650 U
2,4,6-Trichlorophenol	650 U
2,4,5-Trichlorophenol	1600 U
2-Chloronaphthalene	650 U
2-Methylphenol	650 U
Dimethyl phthalate	650 U
Acenaphthylene	650 U
2,6-Dinitrotoluene	650 U
3-Nitroaniline	1600 U
Acenaphthene	650 U

FREQUENCY OF DETECTION SUMMARY
SURFACE SOIL - ORGANIC COMPOUNDS
SITE 10 - ORIGINAL BASE LANDFILL
MCB, CAMP LEJEUNE, NORTH CAROLINA
SITE INVESTIGATION, CTO-0369

SAMPLE ID	IR10-SB25-00
SAMPLE DATE	03-19-1998
DEPTH	0 - 1'
SEMIVOLATILES (ug/kg) (cont)	
2,4-Dinitrophenol	1600 U
4-Nitrophenol	1600 U
Dibenzofuran	650 U
2,4-Dinitrotoluene	650 U
Diethyl phthalate	650 U
4-Chlorophenyl phenyl ether	650 U
Fluorene	650 U
4-Nitroaniline	1600 U
4,6-Dinitro-2-methylphenol	1600 U
N-Nitrosodiphenylamine	650 U
4-Bromophenyl phenyl ether	650 U
Hexachlorobenzene	650 U
Pentachlorophenol	1600 U
Phenanthrene	650 U
Anthracene	650 U
Carbazole	650 U
Di-n-butyl phthalate	650 U
Fluoranthene	650 U
Pyrene	650 U
Butyl benzyl phthalate	650 U
2-Nitrophenol	650 U
Benzo(a)anthracene	650 U
Chrysene	650 U
bis(2-Ethylhexyl) phthalate	650 U
Di-n-octyl phthalate	650 U
Benzo(b)fluoranthene	650 U
Benzo(k)fluoranthene	650 U
Benzo(a)pyrene	650 U
Indeno(1,2,3-cd)pyrene	650 U
Dibenz(a,h)anthracene	650 U
Benzo(ghi)perylene	650 U

FREQUENCY OF DETECTION SUMMARY
SURFACE SOIL - ORGANIC COMPOUNDS
SITE 10 - ORIGINAL BASE LANDFILL
MCB, CAMP LEJEUNE, NORTH CAROLINA
SITE INVESTIGATION, CTO-0369

SAMPLE ID	IR10-SB25-00
SAMPLE DATE	03-19-1998
DEPTH	0 - 1'
PESTICIDES/PCBS (ug/kg)	
alpha-BHC	3.4 U
beta-BHC	3.4 UJ
delta-BHC	3.4 U
gamma-BHC (Lindane)	3.4 U
Heptachlor	3.4 U
Aldrin	3.4 U
Heptachlor epoxide	3.4 U
Endosulfan I	3.4 U
Dieldrin	6.5 U
4,4'-DDE	6.5 U
Endrin	6.5 U
Endosulfan II	6.5 U
4,4'-DDD	6.5 U
Endosulfan sulfate	6.5 U
4,4'-DDT	6.5 U
Methoxychlor	34 UJ
Endrin ketone	6.5 U
Endrin aldehyde	6.5 U
alpha-Chlordane	3.4 U
gamma-Chlordane	3.4 U
Toxaphene	340 U
Aroclor 1016	65 U
Aroclor 1221	130 U
Aroclor 1232	65 U
Aroclor 1242	65 U
Aroclor 1248	65 U
Aroclor 1254	65 U
Aroclor 1260	65 U

FREQUENCY OF DETECTION SUMMARY
SURFACE SOIL - ORGANIC COMPOUNDS
SITE 10 - ORIGINAL BASE LANDFILL
MCB, CAMP LEJEUNE, NORTH CAROLINA
SITE INVESTIGATION, CTO-0369

SAMPLE ID SAMPLE DATE DEPTH	Minimum Non-Detect	Maximum Non-Detect	Minimum Detected	Maximum Detected	Location of Maximum Detect	Frequency of Detection	Arithmatic Mean Positive Detects	Median Positive Detects
VOLATILES (ug/kg)								
Chloromethane	11 U	20 UJ	ND	ND		0/25	--	--
Bromomethane	11 U	20 UJ	ND	ND		0/25	--	--
Vinyl chloride	11 U	20 UJ	ND	ND		0/25	--	--
Chloroethane	11 U	20 UJ	ND	ND		0/25	--	--
Methylene chloride	11 U	20 UJ	ND	ND		0/25	--	--
Acetone	11 U	1600 U	ND	ND		0/25	--	--
Carbon disulfide	11 U	20 UJ	ND	ND		0/25	--	--
1,1-Dichloroethene	11 U	20 UJ	2.6 J	2.6 J	IR10-SB08-00	1/25	2.6	2.6
1,1-Dichloroethane	11 U	20 UJ	ND	ND		0/25	--	--
1,2-Dichloroethene (total)	11 U	20 UJ	ND	ND		0/25	--	--
Chloroform	11 U	20 UJ	ND	ND		0/25	--	--
1,2-Dichloroethane	11 U	20 UJ	ND	ND		0/25	--	--
2-Butanone	11 U	20 UJ	ND	ND		0/25	--	--
1,1,1-Trichloroethane	11 U	20 UJ	ND	ND		0/25	--	--
Carbon tetrachloride	11 U	20 UJ	ND	ND		0/25	--	--
Bromodichloromethane	11 U	20 UJ	ND	ND		0/25	--	--
1,2-Dichloropropane	11 U	20 UJ	ND	ND		0/25	--	--
cis-1,3-Dichloropropene	11 U	20 UJ	ND	ND		0/25	--	--
Trichloroethene	11 U	20 UJ	2.3 J	2.4 J	IR10-SB08-00	2/25	2.35	2.35
Dibromochloromethane	11 U	20 UJ	ND	ND		0/25	--	--
1,1,2-Trichloroethane	11 U	20 UJ	ND	ND		0/25	--	--
Benzene	11 U	20 UJ	4.9 J	4.9 J	IR10-SB08-00	1/25	4.9	4.9
trans-1,3-Dichloropropene	11 U	20 UJ	ND	ND		0/25	--	--
Bromoform	11 U	20 UJ	ND	ND		0/25	--	--
4-Methyl-2-pentanone	11 U	20 UJ	ND	ND		0/25	--	--
2-Hexanone	11 U	20 UJ	ND	ND		0/25	--	--
Tetrachloroethene	11 U	20 UJ	ND	ND		0/25	--	--
1,1,2,2-Tetrachloroethane	11 U	20 UJ	ND	ND		0/25	--	--
Toluene	11 U	20 UJ	1.1 J	8.1 J	IR10-SB23-00	11/25	2.63	1.6
Chlorobenzene	11 U	20 UJ	4.5 J	4.5 J	IR10-SB08-00	1/25	4.5	4.5
Ethylbenzene	11 U	20 UJ	ND	ND		0/25	--	--
Styrene	11 U	20 UJ	ND	ND		0/25	--	--
Xylenes (total)	11 U	20 UJ	ND	ND		0/25	--	--

FREQUENCY OF DETECTION SUMMARY
SURFACE SOIL - ORGANIC COMPOUNDS
SITE 10 - ORIGINAL BASE LANDFILL
MCB, CAMP LEJEUNE, NORTH CAROLINA
SITE INVESTIGATION, CTO-0369

SAMPLE ID SAMPLE DATE DEPTH	Minimum Non-Detect	Maximum Non-Detect	Minimum Detected	Maximum Detected	Location of Maximum Detect	Frequency of Detection	Arithmatic Mean Positive Detects	Median Positive Detects
SEMIVOLATILES (ug/kg)								
Phenol	350 U	650 U	ND	ND		0/25	--	--
bis(2-Chloroethyl) ether	350 U	650 U	ND	ND		0/25	--	--
2-Chlorophenol	350 U	650 U	ND	ND		0/25	--	--
1,3-Dichlorobenzene	350 U	650 U	ND	ND		0/25	--	--
1,4-Dichlorobenzene	350 U	650 U	ND	ND		0/25	--	--
1,2-Dichlorobenzene	350 U	650 U	ND	ND		0/25	--	--
3,3'-Dichlorobenzidine	350 U	650 U	ND	ND		0/25	--	--
2,2'-Oxybis(1-Chloropropane)	350 U	650 U	ND	ND		0/25	--	--
N-Nitrosodi-n-propylamine	350 U	650 U	ND	ND		0/25	--	--
4-Methylphenol	350 U	650 U	ND	ND		0/25	--	--
Hexachloroethane	350 U	650 U	ND	ND		0/25	--	--
Nitrobenzene	350 U	650 U	ND	ND		0/25	--	--
Isophorone	350 U	650 U	ND	ND		0/25	--	--
2-Nitroaniline	880 U	1600 U	ND	ND		0/25	--	--
2,4-Dimethylphenol	350 U	650 U	ND	ND		0/25	--	--
bis(2-Chloroethoxy)methane	350 U	650 U	ND	ND		0/25	--	--
2,4-Dichlorophenol	350 U	650 U	ND	ND		0/25	--	--
1,2,4-Trichlorobenzene	350 U	650 U	ND	ND		0/25	--	--
Naphthalene	350 U	650 U	ND	ND		0/25	--	--
4-Chloroaniline	350 U	650 U	ND	ND		0/25	--	--
Hexachlorobutadiene	350 U	650 U	ND	ND		0/25	--	--
4-Chloro-3-methylphenol	350 U	650 U	ND	ND		0/25	--	--
2-Methylnaphthalene	350 U	650 U	ND	ND		0/25	--	--
Hexachlorocyclopentadiene	350 U	650 U	ND	ND		0/25	--	--
2,4,6-Trichlorophenol	350 U	650 U	ND	ND		0/25	--	--
2,4,5-Trichlorophenol	880 U	1600 U	ND	ND		0/25	--	--
2-Chloronaphthalene	350 U	650 U	ND	ND		0/25	--	--
2-Methylphenol	350 U	650 U	ND	ND		0/25	--	--
Dimethyl phthalate	350 U	650 U	ND	ND		0/25	--	--
Acenaphthylene	350 U	650 U	ND	ND		0/25	--	--
2,6-Dinitrotoluene	350 U	650 U	ND	ND		0/25	--	--
3-Nitroaniline	880 U	1600 U	ND	ND		0/25	--	--
Acenaphthene	350 U	650 U	ND	ND		0/25	--	--

FREQUENCY OF DETECTION SUMMARY
SURFACE SOIL - ORGANIC COMPOUNDS
SITE 10 - ORIGINAL BASE LANDFILL
MCB, CAMP LEJEUNE, NORTH CAROLINA
SITE INVESTIGATION, CTO-0369

SAMPLE ID SAMPLE DATE DEPTH	Minimum Non-Detect	Maximum Non-Detect	Minimum Detected	Maximum Detected	Location of Maximum Detect	Frequency of Detection	Arithmatic Mean Positive Detects	Median Positive Detects
SEMIVOLATILES (ug/kg) (cont)								
2,4-Dinitrophenol	880 U	1600 U	ND	ND		0/25	--	--
4-Nitrophenol	880 U	1600 U	ND	ND		0/25	--	--
Dibenzofuran	350 U	650 U	ND	ND		0/25	--	--
2,4-Dinitrotoluene	350 U	650 U	ND	ND		0/25	--	--
Diethyl phthalate	350 U	650 U	ND	ND		0/25	--	--
4-Chlorophenyl phenyl ether	350 U	650 U	ND	ND		0/25	--	--
Fluorene	350 U	650 U	ND	ND		0/25	--	--
4-Nitroaniline	880 U	1600 U	ND	ND		0/25	--	--
4,6-Dinitro-2-methylphenol	880 U	1600 U	ND	ND		0/25	--	--
N-Nitrosodiphenylamine	350 U	650 U	ND	ND		0/25	--	--
4-Bromophenyl phenyl ether	350 U	650 U	ND	ND		0/25	--	--
Hexachlorobenzene	350 U	650 U	ND	ND		0/25	--	--
Pentachlorophenol	880 U	1600 U	ND	ND		0/25	--	--
Phenanthrene	350 U	650 U	64 J	140 J	IR10-SB03-00	3/25	104.67	110
Anthracene	350 U	650 U	ND	ND		0/25	--	--
Carbazole	350 U	650 U	ND	ND		0/25	--	--
Di-n-butyl phthalate	350 U	650 U	38 J	67 J	IR10-SB08-00	6/25	49.67	48.5
Fluoranthene	350 U	650 U	65 J	190 J	IR10-SB03-00	5/25	125.4	140
Pyrene	350 U	650 U	51 J	140 J	IR10-SB03-00	5/25	103	120
Butyl benzyl phthalate	350 U	650 U	ND	ND		0/25	--	--
2-Nitrophenol	350 U	650 U	ND	ND		0/25	--	--
Benzo(a)anthracene	350 U	650 U	59 J	86 J	IR10-SB03-00	4/25	--	--
Chrysene	350 U	650 U	39 J	93 J	IR10-SB03-00	5/25	69.2	76
bis(2-Ethylhexyl) phthalate	350 U	650 U	ND	ND		0/25	--	--
Di-n-octyl phthalate	350 U	650 U	ND	ND		0/25	--	--
Benzo(b)fluoranthene	350 U	650 U	46 J	92 J	IR10-SB03-00	5/25	68.6	65
Benzo(k)fluoranthene	350 U	650 U	42 J	96 J	IR10-SB03-00	5/25	75.8	78
Benzo(a)pyrene	350 U	650 U	42 J	84 J	IR10-SB03-00	5/25	69	74
Indeno(1,2,3-cd)pyrene	350 U	650 U	44 J	58 J	IR10-SB03-00	4/25	51	51
Dibenz(a,h)anthracene	350 U	650 U	ND	ND		0/25	--	--
Benzo(ghi)perylene	350 U	650 U	40 J	45 J	IR10-SB19-00	3/25	41.67	40

FREQUENCY OF DETECTION SUMMARY
SURFACE SOIL - ORGANIC COMPOUNDS
SITE 10 - ORIGINAL BASE LANDFILL
MCB, CAMP LEJEUNE, NORTH CAROLINA
SITE INVESTIGATION, CTO-0369

SAMPLE ID SAMPLE DATE DEPTH	Minimum Non-Detect	Maximum Non-Detect	Minimum Detected	Maximum Detected	Location of Maximum Detect	Frequency of Detection	Arithmatic Mean Positive Detects	Median Positive Detects
PESTICIDES/PCBS (ug/kg)								
alpha-BHC	1.8 U	3.4 U	ND	ND		0/25	--	--
beta-BHC	1.8 UJ	3.4 UJ	ND	ND		0/25	--	--
delta-BHC	1.8 U	3.4 U	ND	ND		0/25	--	--
gamma-BHC (Lindane)	1.8 U	3.4 U	ND	ND		0/25	--	--
Heptachlor	1.8 U	3.4 U	1.2 NJ	1.2 NJ	IR10-SB09-00	1/25	1.2	1.2
Aldrin	1.8 U	3.4 U	ND	ND		0/25	--	--
Heptachlor epoxide	1.8 U	3.4 U	2.4 NJ	2.4 NJ	IR10-SB09-00	1/25	2.4	2.4
Endosulfan I	1.8 U	3.4 U	4.3 J	4.3 J	IR10-SB09-00	1/25	4.3	4.3
Dieldrin	3.5 U	6.5 U	2.2 NJ	2.2 NJ	IR10-SB09-00	1/25	2.2	2.2
4,4'-DDE	3.5 U	6.5 U	2.1 NJ	2.1 NJ	IR10-SB12-00	1/25	2.1	2.1
Endrin	3.5 U	6.5 U	2.4 NJ	2.4 NJ	IR10-SB09-00	1/25	2.4	2.4
Endosulfan II	3.5 U	6.5 U	ND	ND		0/25	--	--
4,4'-DDD	3.5 U	6.5 U	ND	ND		0/25	--	--
Endosulfan sulfate	3.5 U	6.5 U	ND	ND		0/25	--	--
4,4'-DDT	3.5 U	6.5 U	3.1 J	6.2	IR10-SB03-00	2/25	4.65	4.65
Methoxychlor	18 UJ	34 UJ	ND	ND		0/25	--	--
Endrin ketone	3.5 U	6.5 U	ND	ND		0/25	--	--
Endrin aldehyde	3.5 U	6.5 U	4.9	4.9	IR10-SB20-00	1/25	4.9	4.9
alpha-Chlordane	1.8 U	3.4 U	ND	ND		0/25	--	--
gamma-Chlordane	1.8 U	3.4 U	ND	ND		0/25	--	--
Toxaphene	180 U	340 U	ND	ND		0/25	--	--
Aroclor 1016	35 U	65 U	ND	ND		0/25	--	--
Aroclor 1221	71 U	130 U	ND	ND		0/25	--	--
Aroclor 1232	35 U	65 U	ND	ND		0/25	--	--
Aroclor 1242	35 U	65 U	ND	ND		0/25	--	--
Aroclor 1248	35 U	65 U	ND	ND		0/25	--	--
Aroclor 1254	35 U	65 U	ND	ND		0/25	--	--
Aroclor 1260	35 U	65 U	85 J	85 J	IR10-SB04-00	1/25	85	85

FREQUENCY OF DETECTION SUMMARY
SURFACE SOIL - TOTAL INORGANIC CONSTITUENTS and CYANIDE
SITE 10 - ORIGINAL BASE LANDFILL
MCB, CAMP LEJEUNE, NORTH CAROLINA
SITE INVESTIGATION, CTO-0369

SAMPLE ID	IR10-SB01-00	IR10-SB02-00	IR10-SB03-00	IR10-SB04-00	IR10-SB05-00	IR10-SB06-00	IR10-SB07-00	IR10-SB08-00	IR10-SB09-00
SAMPLE DATE	03-18-1998	03-18-1998	03-18-1998	03-18-1998	03-18-1998	03-18-1998	03-18-1998	03-18-1998	03-18-1998
DEPTH	0 - 1'	0 - 1'	0 - 1'	0 - 1'	0 - 1'	0 - 1'	0 - 1'	0 - 1'	0 - 1'
TOTAL METALS (mg/kg)									
Aluminum	1110	163	2070	2760	1510	2810	66.6	714	4160
Antimony	14.7 U	15.1 U	12.5 J	13.6 U	13.2 U	14.8 U	12.8 U	13.3 U	13.7 U
Arsenic	2.4 U	2.5 U	2.3 U	2.3 U	2.2 U	2.5 U	2.1 U	2.2 U	0.58 U
Barium	3 J	1.7 J	11.9 J	18.3 J	5 J	41.5 J	0.85 J	2.5 J	8.2 J
Beryllium	1.2 U	1.3 U	1.1 U	1.1 U	1.1 U	1.2 U	1.1 U	1.1 U	1.1 U
Cadmium	1.2 U	1.3 U	1.1 U	1.1 U	1.1 U	1.2 U	1.1 U	1.1 U	1.1 U
Calcium	378 J	81.7 J	1270 J	3600 J	746 J	28900 J	45.4 J	169 J	313 J
Chromium	1.9 J	1.2 J	4.2	4.7	2.2	6.7	0.78 J	1.3 J	4.3
Cobalt	12.2 U	12.6 U	2.6 J	11.3 U	11 U	0.97 J	10.6 U	11.1 U	11.4 U
Copper	0.93 J	1 J	3.9 J	7.9	1.1 J	13.7	1.5 J	1.2 J	1.7 J
Iron	543	127 U	1460	2290	704	1450	81 U	428	1860
Lead	9.9	1.8	23.3	37.7	6.6	57.3	2.7	10.4	10.3
Magnesium	37.4 J	19.9 J	89.1 J	141 J	72.5 J	443 J	11.2 J	40.6 J	105 J
Manganese	3.7	3.1 J	16.1	19.1	5.2	50.6	2.5 J	7.2	5.9
Mercury	0.027 J	0.032 J	0.044 J	0.1 J	0.029 J	0.18	0.038 J	0.033 J	0.049 J
Nickel	9.8 U	10.1 U	2.4 J	2.1 J	8.8 U	2.7 J	8.5 U	8.9 U	9.1 U
Potassium	189 J	1260 U	274 J	1130 U	1100 U	302 J	176 J	154 J	1140 U
Selenium	1.2 U	1.3 U	1.1 U	0.65 J	0.79 J	1.2 U	1.1 U	1.1 U	1.1 U
Silver	2.4 U	2.5 U	3	2.3 U	2.2 U	1.4 J	2.1 U	2.2 U	2.3 U
Sodium	22.2 J	21.9 J	25.5 J	30.1 J	16.3 J	40.6 J	40.2 J	21.7 J	22.6 J
Thallium	2.4 U	2.5 U	2.3 U	2.3 U	2.2 U	2.5 U	2.1 U	2.2 U	2.3 U
Vanadium	12.2 U	12.6 U	3.6 U	1.5 U	11 U	2.9 U	10.6 U	11.1 U	5.9 U
Zinc	3.1 J	3.3 J	41.7	49.2	7.1	77.5	4.2 J	7.1	6.2
Total Cyanide	2.4 U	2.5 U	2.3 U	2.3 U	2.2 U	2.5 U	2.1 U	2.2 U	2.3 U

FREQUENCY OF DETECTION SUMMARY
SURFACE SOIL - TOTAL INORGANIC CONSTITUENTS and CYANIDE
SITE 10 - ORIGINAL BASE LANDFILL
MCB, CAMP LEJEUNE, NORTH CAROLINA
SITE INVESTIGATION, CTO-0369

SAMPLE ID	IR10-SB10-00	IR10-SB11-00	IR10-SB12-00	IR10-SB13-00	IR10-SB14-00	IR10-SB15-00	IR10-SB16-00	IR10-SB17-00	IR10-SB18-00
SAMPLE DATE	03-18-1998	03-18-1998	03-18-1998	03-18-1998	03-18-1998	03-18-1998	03-18-1998	03-18-1998	03-19-1998
DEPTH	0 - 1'	0 - 1'	0 - 1'	0 - 1'	0 - 1'	0 - 1'	0 - 1'	0 - 1'	0 - 1'
TOTAL METALS (mg/kg)									
Aluminum	115	150 J	1430 J	90.2 J	72 J	169 J	879 J	80.4 J	2150 J
Antimony	13.4 U	12.8 U	5.3 J	12.8 U	13.7 U	6 J	14.6 U	12.9 U	13.8 U
Arsenic	2.2 U	2.1 U	2.2 U	2.1 U	2.3 U	2.2 U	2.4 U	2.2 U	1.1 U
Barium	4.3 J	2 J	2.5 J	0.87 J	1.2 J	3.5 J	3.5 J	0.58 J	7 J
Beryllium	1.1 U	1.1 U	1.1 U	1.1 U	1.1 U	1.1 U	1.2 U	1.1 U	1.1 U
Cadmium	1.1 U	1.1 U	1.1 U	1.1 U	1.1 U	1.1 U	1.2 U	1.1 U	1.1 U
Calcium	144 J	63.2 J	47.3 J	33.5 J	42.2 J	76.6 J	91.1 J	36.7 J	539 J
Chromium	2.2 U	2.1 U	1.9 J	0.81 J	1.2 J	2.2 U	1.1 J	2.2 U	3 J
Cobalt	11.2 U	10.7 U	10.8 U	10.7 U	11.4 U	11.1 U	12.2 U	10.8 U	11.5 U
Copper	0.46 J	0.64 J	1.5 J	1 J	1.5 J	0.81 J	0.69 J	0.75 J	3.3 J
Iron	98.8 U	119 U	527 J	101 U	78.8 U	77.9 U	319 J	88.3 U	1530 J
Lead	3.7	1.9	6.4	1.6	1.6	1.9	2.8	0.6 J	10.3
Magnesium	21.5 J	12.3 J	35 J	11.8 J	16.7 J	13 J	24.9 J	8.5 J	61.4 J
Manganese	3.1 J	3 J	2.2 J	2.7 J	3.2 J	1.9 J	6.7	2.7 J	7.6 J
Mercury	0.03 J	0.024 J	0.031 J	0.022 J	0.026 J	0.03 J	0.035 J	0.024 J	0.11 U
Nickel	8.9 U	8.5 U	8.7 U	8.6 U	9.1 U	8.9 U	9.7 U	8.6 U	9.2 U
Potassium	146 J	1070 U	1080 U	1070 U	185 J	1110 U	1220 U	1080 U	1150 U
Selenium	1.1 U	1.1 U	1.1 U	1.1 U	1.1 U	1.1 U	1.2 U	1.1 U	1.1 U
Silver	2.2 U	2.1 U	2.2 U	2.1 U	2.3 U	2.2 U	2.4 U	2.2 U	2.3 U
Sodium	20.8 J	10.9 J	17 J	15.4 J	14.4 J	17.4 J	23.5 J	13.3 J	20.4 J
Thallium	2.2 U	2.1 U	2.2 U	2.1 U	2.3 U	2.2 U	2.4 U	2.2 U	2.3 U
Vanadium	11.2 U	10.7 U	2.5 U	10.7 U	11.4 U	11.1 U	12.2 U	10.8 U	4.7 J
Zinc	2.3 U	3.7 U	12	2.9 U	2.7 U	2.4 U	3.6 U	2.9 U	13.9 J
Total Cyanide	2.2 U	2.1 U	2.2 U	2.1 U	2.3 U	2.2 U	2.4 U	2.2 U	2.3 U

FREQUENCY OF DETECTION SUMMARY
SURFACE SOIL - TOTAL INORGANIC CONSTITUENTS and CYANIDE
SITE 10 - ORIGINAL BASE LANDFILL
MCB, CAMP LEJEUNE, NORTH CAROLINA
SITE INVESTIGATION, CTO-0369

SAMPLE ID	IR10-SB19-00	IR10-SB20-00	IR10-SB21-00	IR10-SB22-00	IR10-SB23-00	IR10-SB24-00	IR10-SB25-00
SAMPLE DATE	03-19-1998	03-19-1998	03-19-1998	03-19-1998	03-19-1998	03-19-1998	03-19-1998
DEPTH	0 - 1'	0 - 1'	0 - 1'	0 - 1'	0 - 1'	0 - 1'	0 - 1'
TOTAL METALS (mg/kg)							
Aluminum	4090 J	2240 J	381 J	398 J	144 J	1910 J	10200 J
Antimony	13.9 U	17.5 U	13.4 U	13.4 U	13.1 U	15.5 U	23.8 U
Arsenic	1.1 U	1.1 U	0.53 U	0.6 U	0.48 U	0.85 U	11.6
Barium	41.6 J	24.5 J	1 J	3.2 J	1.7 J	18 J	173
Beryllium	0.16 J	1.5 U	1.1 U	1.1 U	1.1 U	1.3 U	1.7 J
Cadmium	0.86 J	1.5 U	1.1 U	1.1 U	1.1 U	1.3 U	2 U
Calcium	2420	2770	40.8 J	81.8 J	71.4 J	295 J	4810
Chromium	6.4 J	3.4 J	1 J	1.4 J	0.83 J	4.1 J	11.2 J
Cobalt	1 J	14.6 U	11.2 U	11.2 U	10.9 U	12.9 U	8.8 J
Copper	20.6	18.1	0.53 J	1.3 J	1.8 J	23.1	43.8
Iron	3240 J	1580 J	347 J	356 J	170 J	1640 J	7740 J
Lead	85.1	33.7	2.3	3	1.7	53.7	23
Magnesium	378 J	196 J	14.4 J	24.4 J	13.7 J	58.8 J	687 J
Manganese	48.5 J	39 J	3.3 J	5.6 J	3.8 J	12 J	73.3 J
Mercury	0.038 J	0.034 J	0.11 U	0.11 U	0.11 U	0.094 J	0.27
Nickel	4.2 J	2.7 J	8.9 U	9 U	8.8 U	2.7 J	17.3
Potassium	1160 U	1460 U	1120 U	1120 U	1090 U	1290 U	1600 J
Selenium	1.2 U	1 J	1.1 U	1.1 U	0.61 J	1.3 U	2
Silver	2.3 U	2.9 U	2.2 U	2.2 U	2.2 U	2.6 U	4 U
Sodium	28.1 J	38.7 J	16.9 J	20.2 J	16.6 J	21.4 J	281 J
Thallium	2.3 U	2.9 U	2.2 U	2.2 U	2.2 U	2.6 U	4 U
Vanadium	8.7 J	8.1 J	5.2 J	4.5 J	3.1 J	6.3 J	31.4
Zinc	304 J	44.2 J	2.9 J	3.9 J	4.4 J	53.7 J	128 J
Total Cyanide	2.3 U	2.9 U	2.2 U	2.2 U	2.2 U	2.6 U	4 U

FREQUENCY OF DETECTION SUMMARY
SURFACE SOIL - TOTAL INORGANIC CONSTITUENTS and CYANIDE
SITE 10 - ORIGINAL BASE LANDFILL
MCB, CAMP LEJEUNE, NORTH CAROLINA
SITE INVESTIGATION, CTO-0369

SAMPLE ID SAMPLE DATE DEPTH	Minimum Non-Detect	Maximum Non-Detect	Minimum Detected	Maximum Detected	Location of Maximum Detect	Frequency of Detection	Arithmatic Mean Positive Detects	Median Positive Detects
TOTAL METALS (mg/kg)								
Aluminum	ND	ND	66.6	10200 J	IR10-SB25-00	25/25	1594.49	879
Antimony	12.8 U	23.8 U	5.3 J	12.5 J	IR10-SB03-00	3/25	7.93	6
Arsenic	0.48 U	2.5 U	11.6	11.6	IR10-SB25-00	1/25	11.6	11.6
Barium	ND	ND	0.58 J	173	IR10-SB25-00	25/25	15.26	3.5
Beryllium	1.1 U	1.5 U	0.16 J	1.7 J	IR10-SB25-00	2/25	0.93	0.93
Cadmium	1.1 U	2 U	0.86 J	0.86 J	IR10-SB19-00	1/25	0.86	0.86
Calcium	ND	ND	33.5 J	28900 J	IR10-SB06-00	25/25	1882.63	144
Chromium	2.1 U	2.2 U	0.78 J	11.2 J	IR10-SB25-00	21/25	3.03	1.9
Cobalt	10.6 U	14.6 U	0.97 J	8.8 J	IR10-SB25-00	4/25	3.34	1.8
Copper	ND	ND	0.46 J	43.8	IR10-SB25-00	25/25	6.11	1.5
Iron	77.9 U	127 U	170 J	7740 J	IR10-SB25-00	17/25	1540.24	1450
Lead	ND	ND	0.6 J	85.1	IR10-SB19-00	25/25	15.73	6.4
Magnesium	ND	ND	8.5 J	687 J	IR10-SB25-00	25/25	101.48	35
Manganese	ND	ND	1.9 J	73.3 J	IR10-SB25-00	25/25	13.28	5.2
Mercury	0.11 U	0.11 U	0.022 J	0.27	IR10-SB25-00	21/25	0.06	0.03
Nickel	8.5 U	10.1 U	2.1 J	17.3	IR10-SB25-00	7/25	4.87	2.7
Potassium	1070 U	1460 U	146 J	1600 J	IR10-SB25-00	8/25	378.25	187
Selenium	1.1 U	1.3 U	0.61 J	2	IR10-SB25-00	5/25	1.01	0.79
Silver	2.1 U	4 U	1.4 J	3	IR10-SB03-00	2/25	2.2	2.2
Sodium	ND	ND	10.9 J	281 J	IR10-SB25-00	25/25	32.68	21.4
Thallium	2.1 U	4 U	ND	ND		0/25	#DIV/0!	#NUM!
Vanadium	1.5 U	12.6 U	3.1 J	31.4	IR10-SB25-00	8/25	9	5.75
Zinc	2.3 U	3.7 U	2.9 J	304 J	IR10-SB19-00	18/25	42.58	9.55
Total Cyanide	2.1 U	4 U	ND	ND		0/25	#DIV/0!	#NUM!

APPENDIX G.2
SUBSURFACE SOIL

FREQUENCY OF DETECTION SUMMARY
SUBSURFACE SOIL - ORGANIC COMPOUNDS
SITE 10 - ORIGINAL BASE LANDFILL
MCB, CAMP LEJEUNE, NORTH CAROLINA
SITE INVESTIGATION, CTO-0369

SAMPLE ID	IR10-SB01-02	IR10-SB02-02	IR10-SB03-03	IR10-SB04-03	IR10-SB05-04	IR10-SB06-03	IR10-SB07-03	IR10-SB08-02
SAMPLE DATE	03-18-1998	03-18-1998	03-18-1998	03-18-1998	03-18-1998	03-18-1998	03-18-1998	03-18-1998
DEPTH	3 - 5'	3 - 5'	5 - 7'	5 - 7'	7 - 9'	5 - 7'	5 - 7'	3 - 5'
VOLATILES (ug/kg)								
Chloromethane	12 U	11 U	12 U	12 U	12 U	12 U	12 U	11 U
Bromomethane	12 U	11 U	12 U	12 U	12 U	12 U	12 U	11 U
Vinyl chloride	12 U	11 U	12 U	12 U	12 U	12 U	12 U	11 U
Chloroethane	12 U	11 U	12 U	12 U	12 U	12 U	12 U	11 U
Methylene chloride	12 U	11 U	12 U	12 U	12 U	12 U	12 U	11 U
Acetone	18 U	11 U	22 U	12 U	150 U	8300 U	84 U	82 U
Carbon disulfide	12 U	11 U	12 U	12 U	12 U	12 U	12 U	11 U
1,1-Dichloroethene	12 U	11 U	12 U	12 U	12 U	12 U	12 U	11 U
1,1-Dichloroethane	12 U	11 U	12 U	12 U	12 U	12 U	12 U	11 U
1,2-Dichloroethene (total)	12 U	11 U	12 U	12 U	12 U	12 U	12 U	11 U
Chloroform	12 U	11 U	12 U	12 U	12 U	12 U	12 U	11 U
1,2-Dichloroethane	12 U	11 U	12 U	12 U	12 U	12 U	12 U	11 U
2-Butanone	12 U	11 U	12 U	12 U	12 U	12 U	12 U	11 U
1,1,1-Trichloroethane	12 U	11 U	12 U	12 U	12 U	12 U	12 U	11 U
Carbon tetrachloride	12 U	11 U	12 U	12 U	12 U	12 U	12 U	11 U
Bromodichloromethane	12 U	11 U	12 U	12 U	12 U	12 U	12 U	11 U
1,2-Dichloropropane	12 U	11 U	12 U	12 U	12 U	12 U	12 U	11 U
cis-1,3-Dichloropropene	12 U	11 U	12 U	12 U	12 U	12 U	12 U	11 U
Trichloroethene	12 U	11 U	12 U	12 U	12 U	12 U	12 U	11 U
Dibromochloromethane	12 U	11 U	12 U	12 U	12 U	12 U	12 U	11 U
1,1,2-Trichloroethane	12 U	11 U	12 U	12 U	12 U	12 U	12 U	11 U
Benzene	12 U	11 U	12 U	12 U	12 U	12 U	12 U	11 U
trans-1,3-Dichloropropene	12 U	11 U	12 U	12 U	12 U	12 U	12 U	11 U
Bromoform	12 U	11 U	12 U	12 U	12 U	12 U	12 U	11 U
4-Methyl-2-pentanone	12 U	11 U	12 U	12 U	12 U	12 U	12 U	11 U
2-Hexanone	12 U	11 U	12 U	12 U	12 U	12 U	12 U	11 U
Tetrachloroethene	12 U	11 U	12 U	12 U	12 U	12 U	12 U	11 U
1,1,2,2-Tetrachloroethane	12 U	11 U	12 U	12 U	12 U	12 U	12 U	11 U
Toluene	12 U	11 U	12 U	12 U	12 U	12 U	12 U	11 U
Chlorobenzene	12 U	11 U	12 U	12 U	12 U	12 U	12 U	11 U
Ethylbenzene	12 U	11 U	12 U	12 U	12 U	12 U	12 U	11 U
Styrene	12 U	11 U	12 U	12 U	12 U	12 U	12 U	11 U
Xylenes (total)	12 U	11 U	12 U	12 U	12 U	12 U	12 U	11 U

FREQUENCY OF DETECTION SUMMARY
SUBSURFACE SOIL - ORGANIC COMPOUNDS
SITE 10 - ORIGINAL BASE LANDFILL
MCB, CAMP LEJEUNE, NORTH CAROLINA
SITE INVESTIGATION, CTO-0369

SAMPLE ID	IR10-SB01-02	IR10-SB02-02	IR10-SB03-03	IR10-SB04-03	IR10-SB05-04	IR10-SB06-03	IR10-SB07-03	IR10-SB08-02
SAMPLE DATE	03-18-1998	03-18-1998	03-18-1998	03-18-1998	03-18-1998	03-18-1998	03-18-1998	03-18-1998
DEPTH	3 - 5'	3 - 5'	5 - 7'	5 - 7'	7 - 9'	5 - 7'	5 - 7'	3 - 5'
SEMIVOLATILES (ug/kg)								
Phenol	390 U	350 U	390 U	410 U	380 U	410 U	400 U	350 U
bis(2-Chloroethyl) ether	390 U	350 U	390 U	410 U	380 U	410 U	400 U	350 U
2-Chlorophenol	390 U	350 U	390 U	410 U	380 U	410 U	400 U	350 U
1,3-Dichlorobenzene	390 U	350 U	390 U	410 U	380 U	410 U	400 U	350 U
1,4-Dichlorobenzene	390 U	350 U	390 U	410 U	380 U	410 U	400 U	350 U
1,2-Dichlorobenzene	390 U	350 U	390 U	410 U	380 U	410 U	400 U	350 U
3,3'-Dichlorobenzidine	390 U	350 U	390 U	410 U	380 U	410 U	400 U	350 U
2,2'-Oxybis(1-Chloropropane)	390 U	350 U	390 U	410 U	380 U	410 U	400 U	350 U
N-Nitrosodi-n-propylamine	390 U	350 U	390 U	410 U	380 U	410 U	400 U	350 U
4-Methylphenol	390 U	350 U	390 U	410 U	380 U	410 U	400 U	350 U
Hexachloroethane	390 U	350 U	390 U	410 U	380 U	410 U	400 U	350 U
Nitrobenzene	390 U	350 U	390 U	410 U	380 U	410 U	400 U	350 U
Isophorone	390 U	350 U	390 U	410 U	380 U	410 U	400 U	350 U
2-Nitroaniline	980 U	890 U	970 U	1000 U	960 U	1000 U	1000 U	880 U
2,4-Dimethylphenol	390 U	350 U	390 U	410 U	380 U	410 U	400 U	350 U
bis(2-Chloroethoxy)methane	390 U	350 U	390 U	410 U	380 U	410 U	400 U	350 U
2,4-Dichlorophenol	390 U	350 U	390 U	410 U	380 U	410 U	400 U	350 U
1,2,4-Trichlorobenzene	390 U	350 U	390 U	410 U	380 U	410 U	400 U	350 U
Naphthalene	390 U	350 U	70 J	410 U	380 U	410 U	400 U	350 U
4-Chloroaniline	390 U	350 U	390 U	410 U	380 U	410 U	400 U	350 U
Hexachlorobutadiene	390 U	350 U	390 U	410 U	380 U	410 U	400 U	350 U
4-Chloro-3-methylphenol	390 U	350 U	390 U	410 U	380 U	410 U	400 U	350 U
2-Methylnaphthalene	390 U	350 U	390 U	410 U	380 U	410 U	400 U	350 U
Hexachlorocyclopentadiene	390 U	350 U	390 U	410 U	380 U	410 U	400 U	350 U
2,4,6-Trichlorophenol	390 U	350 U	390 U	410 U	380 U	410 U	400 U	350 U
2,4,5-Trichlorophenol	980 U	890 U	970 U	1000 U	960 U	1000 U	1000 U	880 U
2-Chloronaphthalene	390 U	350 U	390 U	410 U	380 U	410 U	400 U	350 U
2-Methylphenol	390 U	350 U	390 U	410 U	380 U	410 U	400 U	350 U
Dimethyl phthalate	390 U	350 U	390 U	410 U	380 U	410 U	400 U	350 U
Acenaphthylene	390 U	350 U	390 U	410 U	380 U	410 U	400 U	350 U
2,6-Dinitrotoluene	390 U	350 U	390 U	410 U	380 U	410 U	400 U	350 U
3-Nitroaniline	980 U	890 U	970 U	1000 U	960 U	1000 U	1000 U	880 U
Acenaphthene	390 U	350 U	210 J	410 U	380 U	410 U	400 U	350 U

FREQUENCY OF DETECTION SUMMARY
SUBSURFACE SOIL - ORGANIC COMPOUNDS
SITE 10 - ORIGINAL BASE LANDFILL
MCB, CAMP LEJEUNE, NORTH CAROLINA
SITE INVESTIGATION, CTO-0369

SAMPLE ID	IR10-SB01-02	IR10-SB02-02	IR10-SB03-03	IR10-SB04-03	IR10-SB05-04	IR10-SB06-03	IR10-SB07-03	IR10-SB08-02
SAMPLE DATE	03-18-1998	03-18-1998	03-18-1998	03-18-1998	03-18-1998	03-18-1998	03-18-1998	03-18-1998
DEPTH	3 - 5'	3 - 5'	5 - 7'	5 - 7'	7 - 9'	5 - 7'	5 - 7'	3 - 5'
SEMIVOLATILES (ug/kg) (cont)								
2,4-Dinitrophenol	980 U	890 U	970 U	1000 U	960 U	1000 U	1000 U	880 U
4-Nitrophenol	980 U	890 U	970 U	1000 U	960 U	1000 U	1000 U	880 U
Dibenzofuran	390 U	350 U	76 J	410 U	380 U	410 U	400 U	350 U
2,4-Dinitrotoluene	390 U	350 U	390 U	410 U	380 U	410 U	400 U	350 U
Diethyl phthalate	390 U	350 U	390 U	410 U	380 U	410 U	400 U	350 U
4-Chlorophenyl phenyl ether	390 U	350 U	390 U	410 U	380 U	410 U	400 U	350 U
Fluorene	390 U	350 U	160 J	410 U	380 U	410 U	400 U	350 U
4-Nitroaniline	980 U	890 U	970 U	1000 U	960 U	1000 U	1000 U	880 U
4,6-Dinitro-2-methylphenol	980 U	890 U	970 U	1000 U	960 U	1000 U	1000 U	880 U
N-Nitrosodiphenylamine	390 U	350 U	390 U	410 U	380 U	410 U	400 U	350 U
4-Bromophenyl phenyl ether	390 U	350 U	390 U	410 U	380 U	410 U	400 U	350 U
Hexachlorobenzene	390 U	350 U	390 U	410 U	380 U	410 U	400 U	350 U
Pentachlorophenol	980 U	890 U	970 U	1000 U	960 U	1000 U	1000 U	880 U
Phenanthrene	390 U	350 U	1900	410 U	380 U	410 U	400 U	350 U
Anthracene	390 U	350 U	370 J	410 U	380 U	410 U	400 U	350 U
Carbazole	390 U	350 U	200 J	410 U	380 U	410 U	400 U	350 U
Di-n-butyl phthalate	42 J	48 J	48 J	44 J	48 J	47 J	47 J	350 U
Fluoranthene	390 U	350 U	2900	410 U	380 U	410 U	400 U	350 U
Pyrene	390 U	350 U	2100	410 U	380 U	410 U	400 U	350 U
Butyl benzyl phthalate	390 U	350 U	390 U	410 U	380 U	410 U	400 U	350 U
2-Nitrophenol	390 U	350 U	390 U	410 U	380 U	410 U	400 U	350 U
Benzo(a)anthracene	390 U	350 U	1200	410 U	380 U	410 U	400 U	350 U
Chrysene	390 U	350 U	1300	410 U	380 U	410 U	400 U	350 U
bis(2-Ethylhexyl) phthalate	390 U	580 U	390 U	410 U	460 U	410 U	420 U	350 U
Di-n-octyl phthalate	390 U	350 U	390 U	410 U	380 U	410 U	400 U	350 U
Benzo(b)fluoranthene	390 U	350 U	1200	410 U	380 U	410 U	400 U	350 U
Benzo(k)fluoranthene	390 U	350 U	950	410 U	380 U	410 U	400 U	350 U
Benzo(a)pyrene	390 U	350 U	1100	410 U	380 U	410 U	400 U	350 U
Indeno(1,2,3-cd)pyrene	390 U	350 U	570	410 U	380 U	410 U	400 U	350 U
Dibenz(a,h)anthracene	390 U	350 U	280 J	410 U	380 U	410 U	400 U	350 U
Benzo(ghi)perylene	390 U	350 U	480	410 U	380 U	410 U	400 U	350 U

FREQUENCY OF DETECTION SUMMARY
SUBSURFACE SOIL - ORGANIC COMPOUNDS
SITE 10 - ORIGINAL BASE LANDFILL
MCB, CAMP LEJEUNE, NORTH CAROLINA
SITE INVESTIGATION, CTO-0369

SAMPLE ID	IR10-SB01-02	IR10-SB02-02	IR10-SB03-03	IR10-SB04-03	IR10-SB05-04	IR10-SB06-03	IR10-SB07-03	IR10-SB08-02
SAMPLE DATE	03-18-1998	03-18-1998	03-18-1998	03-18-1998	03-18-1998	03-18-1998	03-18-1998	03-18-1998
DEPTH	3 - 5'	3 - 5'	5 - 7'	5 - 7'	7 - 9'	5 - 7'	5 - 7'	3 - 5'
PESTICIDES/PCBS (ug/kg)								
alpha-BHC	2 U	1.8 U	2 U	2.1 U	2 U	2.1 U	2.1 U	1.8 U
beta-BHC	2 U	1.8 U	2 U	2.1 U	2 U	2.1 U	2.1 U	1.8 U
delta-BHC	2 U	1.8 U	2 U	2.1 U	2 U	2.1 U	2.1 U	1.8 U
gamma-BHC (Lindane)	2 U	1.8 U	2 U	2.1 U	2 U	2.1 U	2.1 U	1.8 U
Heptachlor	2 U	1.8 U	2 U	2.1 U	2 U	2.1 U	2.1 U	1.8 U
Aldrin	2 U	1.8 U	2 U	2.1 U	2 U	2.1 U	2.1 U	1.8 U
Heptachlor epoxide	2 U	1.8 U	2 U	2.1 U	2 U	2.1 U	2.1 U	1.8 U
Endosulfan I	2 U	1.8 U	2 U	2.1 U	2 U	1.3 J	2.1 U	1.8 U
Dieldrin	3.9 U	3.5 U	3.9 U	4.1 U	3.8 U	4.1 U	4 U	3.5 U
4,4'-DDE	3.9 U	3.5 U	3.9 U	4.1 U	3.8 U	4.1 U	4 U	3.5 U
Endrin	3.9 U	3.5 U	2.5 NJ	4.1 U	3.8 U	4.1 U	4 U	3.5 U
Endosulfan II	3.9 U	3.5 U	4.7	4.1 U	3.8 U	4.1 U	4 U	3.5 U
4,4'-DDD	3.9 U	3.5 U	2.9 NJ	4.1 U	3.8 U	4.1 U	4 U	3.5 U
Endosulfan sulfate	3.9 U	3.5 U	3.9 U	4.1 U	3.8 U	4.1 U	4 U	3.5 U
4,4'-DDT	3.9 U	3.5 U	3.9 UJ	4.1 U	3.8 U	4.1 U	4 U	3.5 U
Methoxychlor	20 UJ	18 UJ	20 UJ	21 UJ	20 UJ	21 UJ	21 UJ	18 UJ
Endrin ketone	3.9 U	3.5 U	4 J	4.1 U	3.8 U	4.1 U	4 U	3.5 U
Endrin aldehyde	3.9 U	3.5 U	3.9 U	4.1 U	3.8 U	4.1 U	4 U	3.5 U
alpha-Chlordane	2 U	1.8 U	2 U	2.1 U	2 U	2.1 U	2.1 U	1.8 U
gamma-Chlordane	2 U	1.8 U	2 U	2.1 U	2 U	2.1 U	2.1 U	1.8 U
Toxaphene	200 U	180 U	200 U	210 U	200 U	210 U	210 U	180 U
Aroclor 1016	39 U	35 U	39 U	41 U	38 U	41 U	40 U	35 U
Aroclor 1221	79 U	72 U	78 U	84 U	78 U	83 U	82 U	71 U
Aroclor 1232	39 U	35 U	39 U	41 U	38 U	41 U	40 U	35 U
Aroclor 1242	39 U	35 U	39 U	41 U	38 U	41 U	40 U	35 U
Aroclor 1248	39 U	35 U	39 U	41 U	38 U	41 U	40 U	35 U
Aroclor 1254	39 U	35 U	39 U	41 U	38 U	41 U	40 U	35 U
Aroclor 1260	39 U	35 U	39 U	41 U	38 U	41 U	40 U	35 U

FREQUENCY OF DETECTION SUMMARY
SUBSURFACE SOIL - ORGANIC COMPOUNDS
SITE 10 - ORIGINAL BASE LANDFILL
MCB, CAMP LEJEUNE, NORTH CAROLINA
SITE INVESTIGATION, CTO-0369

SAMPLE ID	IR10-SB09-03	IR10-SB10-01	IR10-SB11-02	IR10-SB12-04	IR10-SB13-04	IR10-SB14-01	IR10-SB15-01	IR10-SB16-01
SAMPLE DATE	03-18-1998	03-18-1998	03-18-1998	03-18-1998	03-18-1998	03-18-1998	03-18-1998	03-18-1998
DEPTH	5 - 7'	1 - 3'	3 - 5'	7 - 9'	7 - 9'	1 - 3'	1 - 3'	1 - 3'
VOLATILES (ug/kg)								
Chloromethane	11 U	12 U	11 U	11 U	11 U	12 U	11 U	12 U
Bromomethane	11 U	12 U	11 U	11 U	11 U	12 U	11 U	12 U
Vinyl chloride	11 U	12 U	11 U	11 U	11 U	12 U	11 U	12 U
Chloroethane	11 U	12 U	11 U	11 U	11 U	12 U	11 U	12 U
Methylene chloride	11 U	12 U	11 U	11 U	11 U	12 U	11 U	12 U
Acetone	11 U	12 U	31 U	22 U	51 U	17 U	11 U	13 U
Carbon disulfide	11 U	12 U	11 U	11 U	11 U	12 U	11 U	12 U
1,1-Dichloroethene	11 U	12 U	11 U	11 U	11 U	12 U	11 U	12 U
1,1-Dichloroethane	11 U	12 U	11 U	11 U	11 U	12 U	11 U	12 U
1,2-Dichloroethene (total)	11 U	12 U	11 U	11 U	11 U	12 U	11 U	12 U
Chloroform	11 U	12 U	11 U	11 U	11 U	12 U	11 U	12 U
1,2-Dichloroethane	11 U	12 U	11 U	11 U	11 U	12 U	11 U	12 U
2-Butanone	11 U	12 U	11 U	11 U	11 U	12 U	11 U	12 U
1,1,1-Trichloroethane	11 U	12 U	11 U	11 U	11 U	12 U	11 U	12 U
Carbon tetrachloride	11 U	12 U	11 U	11 U	11 U	12 U	11 U	12 U
Bromodichloromethane	11 U	12 U	11 U	11 U	11 U	12 U	11 U	12 U
1,2-Dichloropropane	11 U	12 U	11 U	11 U	11 U	12 U	11 U	12 U
cis-1,3-Dichloropropene	11 U	12 U	11 U	11 U	11 U	12 U	11 U	12 U
Trichloroethene	11 U	12 U	11 U	11 U	11 U	12 U	11 U	12 U
Dibromochloromethane	11 U	12 U	11 U	11 U	11 U	12 U	11 U	12 U
1,1,2-Trichloroethane	11 U	12 U	11 U	11 U	11 U	12 U	11 U	12 U
Benzene	11 U	12 U	11 U	11 U	11 U	12 U	11 U	12 U
trans-1,3-Dichloropropene	11 U	12 U	11 U	11 U	11 U	12 U	11 U	12 U
Bromoform	11 U	12 U	11 U	11 U	11 U	12 U	11 U	12 U
4-Methyl-2-pentanone	11 U	12 U	11 U	11 U	11 U	12 U	11 U	12 U
2-Hexanone	11 U	12 U	11 U	11 U	11 U	12 U	11 U	12 U
Tetrachloroethene	11 U	12 U	11 U	11 U	11 U	12 U	11 U	12 U
1,1,2,2-Tetrachloroethane	11 U	12 U	11 U	11 U	11 U	12 U	11 U	12 U
Toluene	11 U	12 U	11 U	11 U	11 U	12 U	11 U	12 U
Chlorobenzene	11 U	12 U	11 U	11 U	11 U	12 U	11 U	12 U
Ethylbenzene	11 U	12 U	11 U	11 U	11 U	12 U	11 U	12 U
Styrene	11 U	12 U	11 U	11 U	11 U	12 U	11 U	12 U
Xylenes (total)	11 U	12 U	11 U	11 U	11 U	12 U	11 U	12 U

FREQUENCY OF DETECTION SUMMARY
SUBSURFACE SOIL - ORGANIC COMPOUNDS
SITE 10 - ORIGINAL BASE LANDFILL
MCB, CAMP LEJEUNE, NORTH CAROLINA
SITE INVESTIGATION, CTO-0369

SAMPLE ID	IR10-SB09-03	IR10-SB10-01	IR10-SB11-02	IR10-SB12-04	IR10-SB13-04	IR10-SB14-01	IR10-SB15-01	IR10-SB16-01
SAMPLE DATE	03-18-1998	03-18-1998	03-18-1998	03-18-1998	03-18-1998	03-18-1998	03-18-1998	03-18-1998
DEPTH	5 - 7'	1 - 3'	3 - 5'	7 - 9'	7 - 9'	1 - 3'	1 - 3'	1 - 3'
SEMIVOLATILES (ug/kg)								
Phenol	370 U	410 U	380 U	360 U	370 U	410 U	370 U	410 U
bis(2-Chloroethyl) ether	370 U	410 U	380 U	360 U	370 U	410 U	370 U	410 U
2-Chlorophenol	370 U	410 U	380 U	360 U	370 U	410 U	370 U	410 U
1,3-Dichlorobenzene	370 U	410 U	380 U	360 U	370 U	410 U	370 U	410 U
1,4-Dichlorobenzene	370 U	410 U	380 U	360 U	370 U	410 U	370 U	410 U
1,2-Dichlorobenzene	370 U	410 U	380 U	360 U	370 U	410 U	370 U	410 U
3,3'-Dichlorobenzidine	370 U	410 U	380 U	360 U	370 U	410 U	370 U	410 U
2,2'-Oxybis(1-Chloropropane)	370 U	410 U	380 U	360 U	370 U	410 U	370 U	410 U
N-Nitrosodi-n-propylamine	370 U	410 U	380 U	360 U	370 U	410 U	370 U	410 U
4-Methylphenol	370 U	410 U	380 U	360 U	370 U	410 U	370 U	410 U
Hexachloroethane	370 U	410 U	380 U	360 U	370 U	410 U	370 U	410 U
Nitrobenzene	370 U	410 U	380 U	360 U	370 U	410 U	370 U	410 U
Isophorone	370 U	410 U	380 U	360 U	370 U	410 U	370 U	410 U
2-Nitroaniline	920 U	1000 U	940 U	920 U	940 U	1000 U	930 U	1000 U
2,4-Dimethylphenol	370 U	410 U	380 U	360 U	370 U	410 U	370 U	410 U
bis(2-Chloroethoxy)methane	370 U	410 U	380 U	360 U	370 U	410 U	370 U	410 U
2,4-Dichlorophenol	370 U	410 U	380 U	360 U	370 U	410 U	370 U	410 U
1,2,4-Trichlorobenzene	370 U	410 U	380 U	360 U	370 U	410 U	370 U	410 U
Naphthalene	370 U	410 U	380 U	360 U	370 U	410 U	370 U	410 U
4-Chloroaniline	370 U	410 U	380 U	360 U	370 U	410 U	370 U	410 U
Hexachlorobutadiene	370 U	410 U	380 U	360 U	370 U	410 U	370 U	410 U
4-Chloro-3-methylphenol	370 U	410 U	380 U	360 U	370 U	410 U	370 U	410 U
2-Methylnaphthalene	370 U	410 U	380 U	360 U	370 U	410 U	370 U	410 U
Hexachlorocyclopentadiene	370 U	410 U	380 U	360 U	370 U	410 U	370 U	410 U
2,4,6-Trichlorophenol	370 U	410 U	380 U	360 U	370 U	410 U	370 U	410 U
2,4,5-Trichlorophenol	920 U	1000 U	940 U	920 U	940 U	1000 U	930 U	1000 U
2-Chloronaphthalene	370 U	410 U	380 U	360 U	370 U	410 U	370 U	410 U
2-Methylphenol	370 U	410 U	380 U	360 U	370 U	410 U	370 U	410 U
Dimethyl phthalate	370 U	410 U	380 U	360 U	370 U	410 U	370 U	410 U
Acenaphthylene	370 U	410 U	380 U	360 U	370 U	410 U	370 U	410 U
2,6-Dinitrotoluene	370 U	410 U	380 U	360 U	370 U	410 U	370 U	410 U
3-Nitroaniline	920 U	1000 U	940 U	920 U	940 U	1000 U	930 U	1000 U
Acenaphthene	370 U	410 U	380 U	360 U	370 U	410 U	370 U	410 U

FREQUENCY OF DETECTION SUMMARY
SUBSURFACE SOIL - ORGANIC COMPOUNDS
SITE 10 - ORIGINAL BASE LANDFILL
MCB, CAMP LEJEUNE, NORTH CAROLINA
SITE INVESTIGATION, CTO-0369

SAMPLE ID	IR10-SB09-03	IR10-SB10-01	IR10-SB11-02	IR10-SB12-04	IR10-SB13-04	IR10-SB14-01	IR10-SB15-01	IR10-SB16-01
SAMPLE DATE	03-18-1998	03-18-1998	03-18-1998	03-18-1998	03-18-1998	03-18-1998	03-18-1998	03-18-1998
DEPTH	5 - 7'	1 - 3'	3 - 5'	7 - 9'	7 - 9'	1 - 3'	1 - 3'	1 - 3'
SEMIVOLATILES (ug/kg) (cont)								
2,4-Dinitrophenol	920 U	1000 U	940 U	920 U	940 U	1000 U	930 U	1000 U
4-Nitrophenol	920 U	1000 U	940 U	920 U	940 U	1000 U	930 U	1000 U
Dibenzofuran	370 U	410 U	380 U	360 U	370 U	410 U	370 U	410 U
2,4-Dinitrotoluene	370 U	410 U	380 U	360 U	370 U	410 U	370 U	410 U
Diethyl phthalate	370 U	410 U	380 U	360 U	370 U	410 U	370 U	410 U
4-Chlorophenyl phenyl ether	370 U	410 U	380 U	360 U	370 U	410 U	370 U	410 U
Fluorene	370 U	410 U	380 U	360 U	370 U	410 U	370 U	410 U
4-Nitroaniline	920 U	1000 U	940 U	920 U	940 U	1000 U	930 U	1000 U
4,6-Dinitro-2-methylphenol	920 U	1000 U	940 U	920 U	940 U	1000 U	930 U	1000 U
N-Nitrosodiphenylamine	370 U	410 U	380 U	360 U	370 U	410 U	370 U	410 U
4-Bromophenyl phenyl ether	370 U	410 U	380 U	360 U	370 U	410 U	370 U	410 U
Hexachlorobenzene	370 U	410 U	380 U	360 U	370 U	410 U	370 U	410 U
Pentachlorophenol	920 U	1000 U	940 U	920 U	940 U	1000 U	930 U	1000 U
Phenanthrene	370 U	410 U	380 U	360 U	370 U	410 U	370 U	410 U
Anthracene	370 U	410 U	380 U	360 U	370 U	410 U	370 U	410 U
Carbazole	370 U	410 U	380 U	360 U	370 U	410 U	370 U	410 U
Di-n-butyl phthalate	370 U	410 U	380 U	360 U	370 U	410 U	370 U	410 U
Fluoranthene	370 U	410 U	380 U	360 U	370 U	410 U	370 U	410 U
Pyrene	370 U	410 U	380 U	360 U	370 U	410 U	370 U	410 U
Butyl benzyl phthalate	370 U	410 U	380 U	360 U	370 U	410 U	370 U	410 U
2-Nitrophenol	370 U	410 U	380 U	360 U	370 U	410 U	370 U	410 U
Benzo(a)anthracene	370 U	410 U	380 U	360 U	370 U	410 U	370 U	410 U
Chrysene	370 U	410 U	380 U	360 U	370 U	410 U	370 U	410 U
bis(2-Ethylhexyl) phthalate	370 U	410 U	380 U	360 U	370 U	410 U	370 U	410 U
Di-n-octyl phthalate	370 U	410 U	380 U	360 U	370 U	410 U	370 U	410 U
Benzo(b)fluoranthene	370 U	410 U	380 U	360 U	370 U	410 U	370 U	410 U
Benzo(k)fluoranthene	370 U	410 U	380 U	360 U	370 U	410 U	370 U	410 U
Benzo(a)pyrene	370 U	410 U	380 U	360 U	370 U	410 U	370 U	410 U
Indeno(1,2,3-cd)pyrene	370 U	410 U	380 U	360 U	370 U	410 U	370 U	410 U
Dibenz(a,h)anthracene	370 U	410 U	380 U	360 U	370 U	410 U	370 U	410 U
Benzo(ghi)perylene	370 U	410 U	380 U	360 U	370 U	410 U	370 U	410 U

FREQUENCY OF DETECTION SUMMARY
SUBSURFACE SOIL - ORGANIC COMPOUNDS
SITE 10 - ORIGINAL BASE LANDFILL
MCB, CAMP LEJEUNE, NORTH CAROLINA
SITE INVESTIGATION, CTO-0369

SAMPLE ID	IR10-SB09-03	IR10-SB10-01	IR10-SB11-02	IR10-SB12-04	IR10-SB13-04	IR10-SB14-01	IR10-SB15-01	IR10-SB16-01
SAMPLE DATE	03-18-1998	03-18-1998	03-18-1998	03-18-1998	03-18-1998	03-18-1998	03-18-1998	03-18-1998
DEPTH	5 - 7'	1 - 3'	3 - 5'	7 - 9'	7 - 9'	1 - 3'	1 - 3'	1 - 3'
PESTICIDES/PCBS (ug/kg)								
alpha-BHC	1.9 U	2.1 U	1.9 U	1.9 U	1.9 U	2.1 U	1.9 U	2.1 U
beta-BHC	1.9 UJ	2.1 UJ	1.9 UJ	1.9 UJ	1.9 UJ	2.1 UJ	1.9 UJ	2.1 UJ
delta-BHC	1.9 U	2.1 U	1.9 U	1.9 U	1.9 U	2.1 U	1.9 U	2.1 U
gamma-BHC (Lindane)	1.9 U	2.1 U	1.9 U	1.9 U	1.9 U	2.1 U	1.9 U	2.1 U
Heptachlor	1.9 U	2.1 U	1.9 U	1.9 U	1.9 U	2.1 U	1.9 U	2.1 U
Aldrin	1.9 U	2.1 U	1.9 U	1.9 U	1.9 U	2.1 U	1.9 U	2.1 U
Heptachlor epoxide	1.9 U	2.1 U	1.9 U	1.9 U	1.9 U	2.1 U	1.9 U	2.1 U
Endosulfan I	1.9 U	2.1 U	1.9 U	1.9 U	1.9 U	2.1 U	1.9 U	2.1 U
Dieldrin	3.7 U	4.1 U	3.8 U	3.6 U	3.7 U	4.1 U	3.7 U	4.1 U
4,4'-DDE	3.7 U	4.1 U	3.8 U	3.6 U	3.7 U	4.1 U	3.7 U	4.1 U
Endrin	3.7 U	4.1 U	3.8 U	3.6 U	3.7 U	4.1 U	3.7 U	4.1 U
Endosulfan II	3.7 U	4.1 U	3.8 U	3.6 U	3.7 U	4.1 U	3.7 U	4.1 U
4,4'-DDD	3.7 U	4.1 U	3.8 U	3.6 U	3.7 U	4.1 U	3.7 U	4.1 U
Endosulfan sulfate	3.7 U	4.1 U	3.8 U	3.6 U	3.7 U	4.1 U	3.7 U	4.1 U
4,4'-DDT	3.7 U	4.1 U	3.8 U	3.6 U	3.7 U	4.1 U	3.7 U	4.1 U
Methoxychlor	19 UJ	21 UJ	19 UJ	19 UJ	19 UJ	21 UJ	13 J	21 UJ
Endrin ketone	3.7 U	4.1 U	3.8 U	3.6 U	3.7 U	4.1 U	3.7 U	4.1 U
Endrin aldehyde	3.7 U	4.1 U	3.8 U	3.6 U	3.7 U	4.1 U	3.7 U	4.1 U
alpha-Chlordane	1.9 U	2.1 U	1.9 U	1.9 U	1.9 U	2.1 U	1.9 U	2.1 U
gamma-Chlordane	1.9 U	2.1 U	1.9 U	1.9 U	1.9 U	2.1 U	1.9 U	2.1 U
Toxaphene	190 U	210 U	190 U	190 U	190 U	210 U	190 U	210 U
Aroclor 1016	37 U	41 U	38 U	36 U	37 U	41 U	37 U	41 U
Aroclor 1221	75 U	82 U	76 U	74 U	76 U	83 U	75 U	83 U
Aroclor 1232	37 U	41 U	38 U	36 U	37 U	41 U	37 U	41 U
Aroclor 1242	37 U	41 U	38 U	36 U	37 U	41 U	37 U	41 U
Aroclor 1248	37 U	41 U	38 U	36 U	37 U	41 U	37 U	41 U
Aroclor 1254	37 U	41 U	38 U	36 U	37 U	41 U	37 U	41 U
Aroclor 1260	37 U	41 U	38 U	36 U	37 U	41 U	37 U	41 U

FREQUENCY OF DETECTION SUMMARY
SUBSURFACE SOIL - ORGANIC COMPOUNDS
SITE 10 - ORIGINAL BASE LANDFILL
MCB, CAMP LEJEUNE, NORTH CAROLINA
SITE INVESTIGATION, CTO-0369

SAMPLE ID	IR10-SB17-03	IR10-SB18-02	IR10-SB19-01	IR10-SB21-05	IR10-SB22-07	IR10-SB23-03
SAMPLE DATE	03-18-1998	03-19-1998	03-19-1998	03-19-1998	03-19-1998	03-19-1998
DEPTH	5 - 7'	3 - 5'	1 - 3'	9 - 11'	13 - 15'	5 - 7'
VOLATILES (ug/kg)						
Chloromethane	11 U	12 U	12 U	11 U	11 U	12 U
Bromomethane	11 U	12 U	250 J	11 U	11 U	12 U
Vinyl chloride	11 U	12 U	12 U	11 U	11 U	12 U
Chloroethane	11 U	12 U	12 U	11 U	11 U	12 U
Methylene chloride	11 U	12 U	260 J	11 U	11 U	12 U
Acetone	11 U	23 U	7100	21 U	11 U	12 U
Carbon disulfide	11 U	12 U	12 U	11 U	11 U	12 U
1,1-Dichloroethene	11 U	12 U	12 U	11 U	11 U	12 U
1,1-Dichloroethane	11 U	12 U	12 U	11 U	11 U	12 U
1,2-Dichloroethene (total)	11 U	12 U	12 U	11 U	11 U	12 U
Chloroform	11 U	12 U	12 U	11 U	11 U	12 U
1,2-Dichloroethane	11 U	12 U	12 U	11 U	11 U	12 U
2-Butanone	11 U	12 U	12 U	11 U	11 U	12 U
1,1,1-Trichloroethane	11 U	12 U	12 U	11 U	11 U	12 U
Carbon tetrachloride	11 U	12 U	12 U	11 U	11 U	12 U
Bromodichloromethane	11 U	12 U	12 U	11 U	11 U	12 U
1,2-Dichloropropane	11 U	12 U	12 U	11 U	11 U	12 U
cis-1,3-Dichloropropene	11 U	12 U	12 U	11 U	11 U	12 U
Trichloroethene	11 U	12 U	12 U	11 U	11 U	12 U
Dibromochloromethane	11 U	12 U	12 U	11 U	11 U	12 U
1,1,2-Trichloroethane	11 U	12 U	12 U	11 U	11 U	12 U
Benzene	11 U	12 U	12 U	11 U	11 U	12 U
trans-1,3-Dichloropropene	11 U	12 U	12 U	11 U	11 U	12 U
Bromoform	11 U	12 U	12 U	11 U	11 U	12 U
4-Methyl-2-pentanone	11 U	12 U	12 U	11 U	11 U	12 U
2-Hexanone	11 U	12 U	12 U	11 U	11 U	12 U
Tetrachloroethene	11 U	12 U	12 U	11 U	11 U	12 U
1,1,2,2-Tetrachloroethane	11 U	12 U	12 U	11 U	11 U	12 U
Toluene	11 U	2 J	3.6 J	11 U	11 U	12 U
Chlorobenzene	11 U	12 U	12 U	11 U	11 U	12 U
Ethylbenzene	11 U	12 U	12 U	11 U	11 U	12 U
Styrene	11 U	12 U	12 U	11 U	11 U	12 U
Xylenes (total)	11 U	12 U	12 U	11 U	11 U	12 U

FREQUENCY OF DETECTION SUMMARY
SUBSURFACE SOIL - ORGANIC COMPOUNDS
SITE 10 - ORIGINAL BASE LANDFILL
MCB, CAMP LEJEUNE, NORTH CAROLINA
SITE INVESTIGATION, CTO-0369

SAMPLE ID	IR10-SB17-03	IR10-SB18-02	IR10-SB19-01	IR10-SB21-05	IR10-SB22-07	IR10-SB23-03
SAMPLE DATE	03-18-1998	03-19-1998	03-19-1998	03-19-1998	03-19-1998	03-19-1998
DEPTH	5 - 7'	3 - 5'	1 - 3'	9 - 11'	13 - 15'	5 - 7'
SEMIVOLATILES (ug/kg)						
Phenol	360 U	400 U	390 U	360 U	360 U	400 U
bis(2-Chloroethyl) ether	360 U	400 U	390 U	360 U	360 U	400 U
2-Chlorophenol	360 U	400 U	390 U	360 U	360 U	400 U
1,3-Dichlorobenzene	360 U	400 U	390 U	360 U	360 U	400 U
1,4-Dichlorobenzene	360 U	400 U	390 U	360 U	360 U	400 U
1,2-Dichlorobenzene	360 U	400 U	390 U	360 U	360 U	400 U
3,3'-Dichlorobenzidine	360 U	400 U	390 U	360 U	360 U	400 U
2,2'-Oxybis(1-Chloropropane)	360 U	400 U	390 U	360 U	360 U	400 U
N-Nitrosodi-n-propylamine	360 U	400 U	390 U	360 U	360 U	400 U
4-Methylphenol	360 U	400 U	390 U	360 U	360 U	400 U
Hexachloroethane	360 U	400 U	390 U	360 U	360 U	400 U
Nitrobenzene	360 U	400 U	390 U	360 U	360 U	400 U
Isophorone	360 U	400 U	390 U	360 U	360 U	400 U
2-Nitroaniline	910 U	1000 U	970 U	910 U	910 U	1000 U
2,4-Dimethylphenol	360 U	400 U	390 U	360 U	360 U	400 U
bis(2-Chloroethoxy)methane	360 U	400 U	390 U	360 U	360 U	400 U
2,4-Dichlorophenol	360 U	400 U	390 U	360 U	360 U	400 U
1,2,4-Trichlorobenzene	360 U	400 U	390 U	360 U	360 U	400 U
Naphthalene	360 U	400 U	390 U	360 U	360 U	400 U
4-Chloroaniline	360 U	400 U	390 U	360 U	360 U	400 U
Hexachlorobutadiene	360 U	400 U	390 U	360 U	360 U	400 U
4-Chloro-3-methylphenol	360 U	400 U	390 U	360 U	360 U	400 U
2-Methylnaphthalene	360 U	400 U	390 U	360 U	360 U	400 U
Hexachlorocyclopentadiene	360 U	400 U	390 U	360 U	360 U	400 U
2,4,6-Trichlorophenol	360 U	400 U	390 U	360 U	360 U	400 U
2,4,5-Trichlorophenol	910 U	1000 U	970 U	910 U	910 U	1000 U
2-Chloronaphthalene	360 U	400 U	390 U	360 U	360 U	400 U
2-Methylphenol	360 U	400 U	390 U	360 U	360 U	400 U
Dimethyl phthalate	360 U	400 U	390 U	360 U	360 U	400 U
Acenaphthylene	360 U	400 U	390 U	360 U	360 U	400 U
2,6-Dinitrotoluene	360 U	400 U	390 U	360 U	360 U	400 U
3-Nitroaniline	910 U	1000 U	970 U	910 U	910 U	1000 U
Acenaphthene	360 U	400 U	390 U	360 U	360 U	400 U

FREQUENCY OF DETECTION SUMMARY
SUBSURFACE SOIL - ORGANIC COMPOUNDS
SITE 10 - ORIGINAL BASE LANDFILL
MCB, CAMP LEJEUNE, NORTH CAROLINA
SITE INVESTIGATION, CTO-0369

SAMPLE ID	IR10-SB17-03	IR10-SB18-02	IR10-SB19-01	IR10-SB21-05	IR10-SB22-07	IR10-SB23-03
SAMPLE DATE	03-18-1998	03-19-1998	03-19-1998	03-19-1998	03-19-1998	03-19-1998
DEPTH	5 - 7'	3 - 5'	1 - 3'	9 - 11'	13 - 15'	5 - 7'
SEMIVOLATILES (ug/kg) (cont)						
2,4-Dinitrophenol	910 U	1000 U	970 U	910 U	910 U	1000 U
4-Nitrophenol	910 U	1000 U	970 U	910 U	910 U	1000 U
Dibenzofuran	360 U	400 U	390 U	360 U	360 U	400 U
2,4-Dinitrotoluene	360 U	400 U	390 U	360 U	360 U	400 U
Diethyl phthalate	360 U	400 U	390 U	360 U	360 U	400 U
4-Chlorophenyl phenyl ether	360 U	400 U	390 U	360 U	360 U	400 U
Fluorene	360 U	400 U	390 U	360 U	360 U	400 U
4-Nitroaniline	910 U	1000 U	970 U	910 U	910 U	1000 U
4,6-Dinitro-2-methylphenol	910 U	1000 U	970 U	910 U	910 U	1000 U
N-Nitrosodiphenylamine	360 U	400 U	390 U	360 U	360 U	400 U
4-Bromophenyl phenyl ether	360 U	400 U	390 U	360 U	360 U	400 U
Hexachlorobenzene	360 U	400 U	390 U	360 U	360 U	400 U
Pentachlorophenol	910 U	1000 U	970 U	910 U	910 U	1000 U
Phenanthrene	360 U	400 U	390 U	360 U	360 U	400 U
Anthracene	360 U	400 U	390 U	360 U	360 U	400 U
Carbazole	360 U	400 U	390 U	360 U	360 U	400 U
Di-n-butyl phthalate	360 U	400 U	390 U	360 U	360 U	400 U
Fluoranthene	360 U	400 U	390 U	360 U	360 U	400 U
Pyrene	360 U	400 U	390 U	360 U	360 U	400 U
Butyl benzyl phthalate	360 U	400 U	390 U	360 U	360 U	400 U
2-Nitrophenol	360 U	400 U	390 U	360 U	360 U	400 U
Benzo(a)anthracene	360 U	400 U	390 U	360 U	360 U	400 U
Chrysene	360 U	400 U	390 U	360 U	360 U	400 U
bis(2-Ethylhexyl) phthalate	360 U	400 U	390 U	360 U	630 U	400 U
Di-n-octyl phthalate	360 U	400 U	390 U	360 U	360 U	400 U
Benzo(b)fluoranthene	360 U	400 U	390 U	360 U	360 U	400 U
Benzo(k)fluoranthene	360 U	400 U	390 U	360 U	360 U	400 U
Benzo(a)pyrene	360 U	400 U	390 U	360 U	360 U	400 U
Indeno(1,2,3-cd)pyrene	360 U	400 U	390 U	360 U	360 U	400 U
Dibenz(a,h)anthracene	360 U	400 U	390 U	360 U	360 U	400 U
Benzo(ghi)perylene	360 U	400 U	390 U	360 U	360 U	400 U

FREQUENCY OF DETECTION SUMMARY
SUBSURFACE SOIL - ORGANIC COMPOUNDS
SITE 10 - ORIGINAL BASE LANDFILL
MCB, CAMP LEJEUNE, NORTH CAROLINA
SITE INVESTIGATION, CTO-0369

SAMPLE ID	IR10-SB17-03	IR10-SB18-02	IR10-SB19-01	IR10-SB21-05	IR10-SB22-07	IR10-SB23-03
SAMPLE DATE	03-18-1998	03-19-1998	03-19-1998	03-19-1998	03-19-1998	03-19-1998
DEPTH	5 - 7'	3 - 5'	1 - 3'	9 - 11'	13 - 15'	5 - 7'
PESTICIDES/PCBS (ug/kg)						
alpha-BHC	1.9 U	2.1 U	2 U	1.9 U	1.9 U	2 U
beta-BHC	1.9 UJ	2.1 UJ	2 U	1.9 UJ	1.9 UJ	2 UJ
delta-BHC	1.9 U	2.1 U	2 U	1.9 U	1.9 U	2 U
gamma-BHC (Lindane)	1.9 U	2.1 U	2 U	1.9 U	1.9 U	2 U
Heptachlor	1.9 U	2.1 U	2 U	1.9 U	1.9 U	2 U
Aldrin	1.9 U	2.1 U	2 U	1.9 U	1.9 U	2 U
Heptachlor epoxide	1.9 U	2.1 U	2 U	1.9 U	1.9 U	2 U
Endosulfan I	1.9 U	2.1 U	2 U	1.9 U	1.9 U	2 U
Dieldrin	3.6 U	4 U	3.9 U	3.6 U	3.6 U	4 U
4,4'-DDE	3.6 U	4 U	3.9 U	3.6 U	3.6 U	4 U
Endrin	3.6 U	4 U	3.9 U	3.6 U	3.6 U	4 U
Endosulfan II	3.6 U	4 U	3.9 U	3.6 U	3.6 U	4 U
4,4'-DDD	3.6 U	4 U	3.9 U	3.6 U	3.6 U	4 U
Endosulfan sulfate	3.6 U	4 U	3.9 U	3.6 U	3.6 U	4 U
4,4'-DDT	3.6 U	4 U	3.9 U	3.6 U	3.6 U	4 U
Methoxychlor	19 UJ	21 UJ	20 UJ	19 UJ	19 UJ	20 UJ
Endrin ketone	3.6 U	4 U	3.9 U	3.6 U	3.6 U	4 U
Endrin aldehyde	3.6 U	4 U	3.9 U	3.6 U	3.6 U	4 U
alpha-Chlordane	1.9 U	2.1 U	2 U	1.9 U	1.9 U	2 U
gamma-Chlordane	1.9 U	2.1 U	2 U	1.9 U	1.9 U	2 U
Toxaphene	190 U	210 U	200 U	190 U	190 U	200 U
Aroclor 1016	36 U	40 U	39 U	36 U	36 U	40 U
Aroclor 1221	74 U	82 U	79 U	73 U	73 U	81 U
Aroclor 1232	36 U	40 U	39 U	36 U	36 U	40 U
Aroclor 1242	36 U	40 U	39 U	36 U	36 U	40 U
Aroclor 1248	36 U	40 U	39 U	36 U	36 U	40 U
Aroclor 1254	36 U	40 U	39 U	36 U	36 U	40 U
Aroclor 1260	36 U	40 U	39 U	36 U	36 U	40 U

FREQUENCY OF DETECTION SUMMARY
SUBSURFACE SOIL - ORGANIC COMPOUNDS
SITE 10 - ORIGINAL BASE LANDFILL
MCB, CAMP LEJEUNE, NORTH CAROLINA
SITE INVESTIGATION, CTO-0369

SAMPLE ID SAMPLE DATE DEPTH	Minimum Non-Detect	Maximum Non-Detect	Minimum Detected	Maximum Detected	Location of Maximum Detect	Frequency of Detection	Arithmatic Mean Positive Detects	Median Positive Detects
VOLATILES (ug/kg)								
Chloromethane	11 U	12 U	ND	ND		0/22	--	--
Bromomethane	11 U	12 U	250 J	250 J	IR10-SB19-01	1/22	250	250
Vinyl chloride	11 U	12 U	ND	ND		0/22	--	--
Chloroethane	11 U	12 U	ND	ND		0/22	--	--
Methylene chloride	11 U	12 U	260 J	260 J	IR10-SB19-01	1/22	260	260
Acetone	11 U	8300 U	7100	7100	IR10-SB19-01	1/22	7100	7100
Carbon disulfide	11 U	12 U	ND	ND		0/22	--	--
1,1-Dichloroethene	11 U	12 U	ND	ND		0/22	--	--
1,1-Dichloroethane	11 U	12 U	ND	ND		0/22	--	--
1,2-Dichloroethene (total)	11 U	12 U	ND	ND		0/22	--	--
Chloroform	11 U	12 U	ND	ND		0/22	--	--
1,2-Dichloroethane	11 U	12 U	ND	ND		0/22	--	--
2-Butanone	11 U	12 U	ND	ND		0/22	--	--
1,1,1-Trichloroethane	11 U	12 U	ND	ND		0/22	--	--
Carbon tetrachloride	11 U	12 U	ND	ND		0/22	--	--
Bromodichloromethane	11 U	12 U	ND	ND		0/22	--	--
1,2-Dichloropropane	11 U	12 U	ND	ND		0/22	--	--
cis-1,3-Dichloropropene	11 U	12 U	ND	ND		0/22	--	--
Trichloroethene	11 U	12 U	ND	ND		0/22	--	--
Dibromochloromethane	11 U	12 U	ND	ND		0/22	--	--
1,1,2-Trichloroethane	11 U	12 U	ND	ND		0/22	--	--
Benzene	11 U	12 U	ND	ND		0/22	--	--
trans-1,3-Dichloropropene	11 U	12 U	ND	ND		0/22	--	--
Bromoform	11 U	12 U	ND	ND		0/22	--	--
4-Methyl-2-pentanone	11 U	12 U	ND	ND		0/22	--	--
2-Hexanone	11 U	12 U	ND	ND		0/22	--	--
Tetrachloroethene	11 U	12 U	ND	ND		0/22	--	--
1,1,2,2-Tetrachloroethane	11 U	12 U	ND	ND		0/22	--	--
Toluene	11 U	12 U	2 J	3.6 J	IR10-SB19-01	2/22	2.8	2.8
Chlorobenzene	11 U	12 U	ND	ND		0/22	--	--
Ethylbenzene	11 U	12 U	ND	ND		0/22	--	--
Styrene	11 U	12 U	ND	ND		0/22	--	--
Xylenes (total)	11 U	12 U	ND	ND		0/22	--	--

FREQUENCY OF DETECTION SUMMARY
SUBSURFACE SOIL - ORGANIC COMPOUNDS
SITE 10 - ORIGINAL BASE LANDFILL
MCB, CAMP LEJEUNE, NORTH CAROLINA
SITE INVESTIGATION, CTO-0369

SAMPLE ID SAMPLE DATE DEPTH	Minimum Non-Detect	Maximum Non-Detect	Minimum Detected	Maximum Detected	Location of Maximum Detect	Frequency of Detection	Arithmatic Mean Positive Detects	Median Positive Detects
SEMIVOLATILES (ug/kg)								
Phenol	350 U	410 U	ND	ND		0/22	--	--
bis(2-Chloroethyl) ether	350 U	410 U	ND	ND		0/22	--	--
2-Chlorophenol	350 U	410 U	ND	ND		0/22	--	--
1,3-Dichlorobenzene	350 U	410 U	ND	ND		0/22	--	--
1,4-Dichlorobenzene	350 U	410 U	ND	ND		0/22	--	--
1,2-Dichlorobenzene	350 U	410 U	ND	ND		0/22	--	--
3,3'-Dichlorobenzidine	350 U	410 U	ND	ND		0/22	--	--
2,2'-Oxybis(1-Chloropropane)	350 U	410 U	ND	ND		0/22	--	--
N-Nitrosodi-n-propylamine	350 U	410 U	ND	ND		0/22	--	--
4-Methylphenol	350 U	410 U	ND	ND		0/22	--	--
Hexachloroethane	350 U	410 U	ND	ND		0/22	--	--
Nitrobenzene	350 U	410 U	ND	ND		0/22	--	--
Isophorone	350 U	410 U	ND	ND		0/22	--	--
2-Nitroaniline	880 U	1000 U	ND	ND		0/22	--	--
2,4-Dimethylphenol	350 U	410 U	ND	ND		0/22	--	--
bis(2-Chloroethoxy)methane	350 U	410 U	ND	ND		0/22	--	--
2,4-Dichlorophenol	350 U	410 U	ND	ND		0/22	--	--
1,2,4-Trichlorobenzene	350 U	410 U	ND	ND		0/22	--	--
Naphthalene	350 U	410 U	70 J	70 J	IR10-SB03-03	1/22	70	70
4-Chloroaniline	350 U	410 U	ND	ND		0/22	--	--
Hexachlorobutadiene	350 U	410 U	ND	ND		0/22	--	--
4-Chloro-3-methylphenol	350 U	410 U	ND	ND		0/22	--	--
2-Methylnaphthalene	350 U	410 U	ND	ND		0/22	--	--
Hexachlorocyclopentadiene	350 U	410 U	ND	ND		0/22	--	--
2,4,6-Trichlorophenol	350 U	410 U	ND	ND		0/22	--	--
2,4,5-Trichlorophenol	880 U	1000 U	ND	ND		0/22	--	--
2-Chloronaphthalene	350 U	410 U	ND	ND		0/22	--	--
2-Methylphenol	350 U	410 U	ND	ND		0/22	--	--
Dimethyl phthalate	350 U	410 U	ND	ND		0/22	--	--
Acenaphthylene	350 U	410 U	ND	ND		0/22	--	--
2,6-Dinitrotoluene	350 U	410 U	ND	ND		0/22	--	--
3-Nitroaniline	880 U	1000 U	ND	ND		0/22	--	--
Acenaphthene	350 U	410 U	210 J	210 J	IR10-SB03-03	1/22	210	210

FREQUENCY OF DETECTION SUMMARY
SUBSURFACE SOIL - ORGANIC COMPOUNDS
SITE 10 - ORIGINAL BASE LANDFILL
MCB, CAMP LEJEUNE, NORTH CAROLINA
SITE INVESTIGATION, CTO-0369

SAMPLE ID SAMPLE DATE DEPTH	Minimum Non-Detect	Maximum Non-Detect	Minimum Detected	Maximum Detected	Location of Maximum Detect	Frequency of Detection	Arithmatic Mean Positive Detects	Median Positive Detects
SEMIVOLATILES (ug/kg) (cont)								
2,4-Dinitrophenol	880 U	1000 U	ND	ND		0/22	--	--
4-Nitrophenol	880 U	1000 U	ND	ND		0/22	--	--
Dibenzofuran	350 U	410 U	76 J	76 J	IR10-SB03-03	1/22	76	76
2,4-Dinitrotoluene	350 U	410 U	ND	ND		0/22	--	--
Diethyl phthalate	350 U	410 U	ND	ND		0/22	--	--
4-Chlorophenyl phenyl ether	350 U	410 U	ND	ND		0/22	--	--
Fluorene	350 U	410 U	160 J	160 J	IR10-SB03-03	1/22	160	160
4-Nitroaniline	880 U	1000 U	ND	ND		0/22	--	--
4,6-Dinitro-2-methylphenol	880 U	1000 U	ND	ND		0/22	--	--
N-Nitrosodiphenylamine	350 U	410 U	ND	ND		0/22	--	--
4-Bromophenyl phenyl ether	350 U	410 U	ND	ND		0/22	--	--
Hexachlorobenzene	350 U	410 U	ND	ND		0/22	--	--
Pentachlorophenol	880 U	1000 U	ND	ND		0/22	--	--
Phenanthrene	350 U	410 U	1900	1900	IR10-SB03-03	1/22	1900	1900
Anthracene	350 U	410 U	370 J	370 J	IR10-SB03-03	1/22	370	370
Carbazole	350 U	410 U	200 J	200 J	IR10-SB03-03	1/22	200	200
Di-n-butyl phthalate	350 U	410 U	42 J	48 J	IR10-SB02-02,IR10-SB03-03,IR10-SB05-04	7/22	46.29	47
Fluoranthene	350 U	410 U	2900	2900	IR10-SB03-03	1/22	2900	2900
Pyrene	350 U	410 U	2100	2100	IR10-SB03-03	1/22	2100	2100
Butyl benzyl phthalate	350 U	410 U	ND	ND		0/22	--	--
2-Nitrophenol	350 U	410 U	ND	ND		0/22	--	--
Benzo(a)anthracene	350 U	410 U	1200	1200	IR10-SB03-03	1/22	1200	1200
Chrysene	350 U	410 U	1300	1300	IR10-SB03-03	1/22	1300	1300
bis(2-Ethylhexyl) phthalate	350 U	630 U	ND	ND		0/22	--	--
Di-n-octyl phthalate	350 U	410 U	ND	ND		0/22	--	--
Benzo(b)fluoranthene	350 U	410 U	1200	1200	IR10-SB03-03	1/22	1200	1200
Benzo(k)fluoranthene	350 U	410 U	950	950	IR10-SB03-03	1/22	950	950
Benzo(a)pyrene	350 U	410 U	1100	1100	IR10-SB03-03	1/22	1100	1100
Indeno(1,2,3-cd)pyrene	350 U	410 U	570	570	IR10-SB03-03	1/22	570	570
Dibenz(a,h)anthracene	350 U	410 U	280 J	280 J	IR10-SB03-03	1/22	280	280
Benzo(ghi)perylene	350 U	410 U	480	480	IR10-SB03-03	1/22	480	480

FREQUENCY OF DETECTION SUMMARY
SUBSURFACE SOIL - ORGANIC COMPOUNDS
SITE 10 - ORIGINAL BASE LANDFILL
MCB, CAMP LEJEUNE, NORTH CAROLINA
SITE INVESTIGATION, CTO-0369

SAMPLE ID SAMPLE DATE DEPTH	Minimum Non-Detect	Maximum Non-Detect	Minimum Detected	Maximum Detected	Location of Maximum Detect	Frequency of Detection	Arithmatic Mean Positive Detects	Median Positive Detects
PESTICIDES/PCBS (ug/kg)								
alpha-BHC	1.8 U	2.1 U	ND	ND		0/22	--	--
beta-BHC	1.8 U	2.1 UJ	ND	ND		0/22	--	--
delta-BHC	1.8 U	2.1 U	ND	ND		0/22	--	--
gamma-BHC (Lindane)	1.8 U	2.1 U	ND	ND		0/22	--	--
Heptachlor	1.8 U	2.1 U	ND	ND		0/22	--	--
Aldrin	1.8 U	2.1 U	ND	ND		0/22	--	--
Heptachlor epoxide	1.8 U	2.1 U	ND	ND		0/22	--	--
Endosulfan I	1.8 U	2.1 U	1.3 J	1.3 J	IR10-SB06-03	1/22	1.3	1.3
Dieldrin	3.5 U	4.1 U	ND	ND		0/22	--	--
4,4'-DDE	3.5 U	4.1 U	ND	ND		0/22	--	--
Endrin	3.5 U	4.1 U	2.5 NJ	2.5 NJ	IR10-SB03-03	1/22	2.5	2.5
Endosulfan II	3.5 U	4.1 U	4.7	4.7	IR10-SB03-03	1/22	4.7	4.7
4,4'-DDD	3.5 U	4.1 U	2.9 NJ	2.9 NJ	IR10-SB03-03	1/22	2.9	2.9
Endosulfan sulfate	3.5 U	4.1 U	ND	ND		0/22	--	--
4,4'-DDT	3.5 U	4.1 U	ND	ND		0/22	--	--
Methoxychlor	18 UJ	21 UJ	13 J	13 J	IR10-SB15-01	1/22	13	13
Endrin ketone	3.5 U	4.1 U	4 J	4 J	IR10-SB03-03	1/22	4	4
Endrin aldehyde	3.5 U	4.1 U	ND	ND		0/22	--	--
alpha-Chlordane	1.8 U	2.1 U	ND	ND		0/22	--	--
gamma-Chlordane	1.8 U	2.1 U	ND	ND		0/22	--	--
Toxaphene	180 U	210 U	ND	ND		0/22	--	--
Aroclor 1016	35 U	41 U	ND	ND		0/22	--	--
Aroclor 1221	71 U	84 U	ND	ND		0/22	--	--
Aroclor 1232	35 U	41 U	ND	ND		0/22	--	--
Aroclor 1242	35 U	41 U	ND	ND		0/22	--	--
Aroclor 1248	35 U	41 U	ND	ND		0/22	--	--
Aroclor 1254	35 U	41 U	ND	ND		0/22	--	--
Aroclor 1260	35 U	41 U	ND	ND		0/22	--	--

FREQUENCY OF DETECTION SUMMARY
SUBSURFACE SOIL - INORGANIC CONSTITUENTS and CYANIDE
SITE 10 - ORIGINAL BASE LANDFILL
MCB, CAMP LEJEUNE, NORTH CAROLINA
SITE INVESTIGATION, CTO-0369

SAMPLE ID	IR10-SB01-02	IR10-SB02-02	IR10-SB03-03	IR10-SB04-03	IR10-SB05-04	IR10-SB06-03	IR10-SB07-03	IR10-SB08-02	IR10-SB09-03
SAMPLE DATE	03-18-1998	03-18-1998	03-18-1998	03-18-1998	03-18-1998	03-18-1998	03-18-1998	03-18-1998	03-18-1998
DEPTH	3 - 5'	3 - 5'	5 - 7'	5 - 7'	7 - 9'	5 - 7'	5 - 7'	3 - 5'	5 - 7'
TOTAL METALS (mg/kg)									
Aluminum	971	837	2790	5910	2040	2500	1070	40.2 J	1770 J
Antimony	14.1 U	12.8 U	7.4 J	84.2	13.9 U	14.9 U	14.6 U	12.7 U	13.3 U
Arsenic	2.4 U	2.1 U	3.6	37.2	2.3 U	0.99 J	2.4 U	2.1 U	2.2 U
Barium	2.3 J	2.2 J	94	589	3.4 J	28.8 J	2.8 J	0.88 J	2.5 J
Beryllium	1.2 U	1.1 U	0.12 J	3.8 U	1.2 U	1.2 U	1.2 U	1.1 U	1.1 U
Cadmium	1.2 U	1.1 U	7.9	3.8 U	1.2 U	1.2 U	1.2 U	1.1 U	1.1 U
Calcium	111 J	82.8 J	13200 J	25100 J	249 J	4160 J	43.9 J	26.9 J	51.4 J
Chromium	1.5 J	3.1	21.6	66.5	3.7	8	1.9 J	1.4 J	3.3
Cobalt	0.84 J	10.7 U	6.9 J	53.2	11.6 U	3.2 J	12.2 U	10.6 U	11.1 U
Copper	1.9 J	0.88 J	50.6	3340	1.5 J	23.3	1.8 J	0.57 J	1.5 J
Iron	338	451	39100	218000	615	18700	337	102	707 J
Lead	1.8	1.4	532	2630	2.4	126	3.6	0.72	1.8
Magnesium	30.4 J	30.7 J	558 J	1050 J	56 J	125 J	23.3 J	5.8 J	48.7 J
Manganese	44.7	3.2	250	948	2.8 J	127	1.6 J	4.1	3.5
Mercury	0.031 J	0.022 J	0.12	0.16	0.032 J	0.12	0.12 U	0.023 J	0.11 U
Nickel	9.4 U	8.5 U	12.3	147	9.3 U	7.9 J	9.8 U	8.4 U	8.9 U
Potassium	1180 U	1070 U	316 J	636 J	1160 U	345 J	1220 U	1060 U	170 J
Selenium	1.2 U	1.1 U	1.2 U	1.2 U	1.2 U	1.2 U	1.2 U	1.1 U	1.1 U
Silver	1.1 J	2.1 U	11.3	7.5 U	2.3 U	2.5 U	2.4 U	2.1 U	2.2 U
Sodium	42.4 J	17.1 J	99.6 J	336 J	19.8 J	31.7 J	14.8 J	15.1 J	19 J
Thallium	2.4 U	2.1 U	2.3 U	2.6 U	2.3 U	2.5 U	2.4 U	2.1 U	2.2 U
Vanadium	11.8 U	10.7 U	11.7 U	37.5 U	11.6 U	12.4 U	12.2 U	10.6 U	11.1 U
Zinc	2.8 J	2.3 U	1080	1250	3.7 J	193	8.6	2.5 J	3 U
Total Cyanide	2.4 U	2.1 U	2.3 U	0.62 j	2.3 U	2.5 U	2.4 U	2.1 U	2.2 U

FREQUENCY OF DETECTION SUMMARY
SUBSURFACE SOIL - INORGANIC CONSTITUENTS and CYANIDE
SITE 10 - ORIGINAL BASE LANDFILL
MCB, CAMP LEJEUNE, NORTH CAROLINA
SITE INVESTIGATION, CTO-0369

SAMPLE ID	IR10-SB10-01	IR10-SB11-02	IR10-SB12-04	IR10-SB13-04	IR10-SB14-01	IR10-SB15-01	IR10-SB16-01	IR10-SB17-03	IR10-SB18-02
SAMPLE DATE	03-18-1998	03-18-1998	03-18-1998	03-18-1998	03-18-1998	03-18-1998	03-18-1998	03-18-1998	03-19-1998
DEPTH	1 - 3'	3 - 5'	7 - 9'	7 - 9'	1 - 3'	1 - 3'	1 - 3'	5 - 7'	3 - 5'
TOTAL METALS (mg/kg)									
Aluminum	1910 J	1230 J	3490 J	1280 J	1960 J	110 J	4050 J	986 J	1700 J
Antimony	14.7 U	13.6 U	13.3 U	7.3 J	14.9 U	13.4 U	14.9 U	13.2 U	14.6 U
Arsenic	2.5 U	2.3 U	2.2 U	2.3 U	2.5 U	2.2 U	2.5 U	2.2 U	2.4 U
Barium	1.8 J	1.9 J	6.2 J	2.7 J	2.2 J	0.93 J	3.9 J	1.9 J	4.2 J
Beryllium	1.2 U	1.1 U	1.1 U	1.1 U	1.2 U	1.1 U	1.2 U	1.1 U	1.2 U
Cadmium	1.2 U	1.1 U	1.1 U	1.1 U	1.2 U	1.1 U	1.2 U	1.1 U	1.2 U
Calcium	71.4 J	34.3 J	34.5 J	32.1 J	47.9 J	43.7 J	42.3 J	39.2 J	210 J
Chromium	1.6 J	2.2 J	4.2	1.4 J	0.91 J	2.2 U	2.4 J	1.5 J	3 J
Cobalt	12.3 U	0.88 J	11 U	0.99 J	12.4 U	11.2 U	12.4 U	11 U	12.2 U
Copper	1 J	1 J	0.98 J	0.53 J	0.9 J	0.39 J	1.7 J	0.52 J	1.2 J
Iron	182 J	506 J	914 J	383 J	231 J	102 J	293 J	410 J	499 J
Lead	2.2	1.5	2.8	1.9	1.7	0.91	2.4	1.7	1.5
Magnesium	41.7 J	37 J	109 J	42.4 J	26.6 J	8.6 J	58.6 J	29.3 J	58.6 J
Manganese	4.3	1.8 J	2.7 J	15.4	2.6 J	4.2	3 J	2.4 J	2.9 J
Mercury	0.047 J	0.027 J	0.027 J	0.028 J	0.03 J	0.024 J	0.039 J	0.028 J	0.12 U
Nickel	9.8 U	9.1 U	8.8 U	9 U	9.9 U	8.9 U	9.9 U	8.8 U	9.8 U
Potassium	1230 U	165 J	206 J	1130 U	1240 U	1120 U	1240 U	1100 U	1220 U
Selenium	1.2 U	1.1 U	1.1 U	1.1 U	1.2 U	1.1 U	1.2 U	0.65 J	1 J
Silver	2.5 U	2.3 U	2.2 U	1.4 J	2.5 U	2.2 U	2.5 U	2.2 U	2.4 U
Sodium	43.2 J	21.3 J	16.7 J	16.3 J	12.9 J	11.6 J	9.5 J	12.8 J	21 J
Thallium	2.5 U	1.1 J	2.2 U	2.3 U	2.5 U	2.2 U	2.5 U	2.2 U	2.4 U
Vanadium	12.3 U	11.4 U	3.4 U	1.7 U	12.4 U	11.2 U	1.7 U	11 U	3.9 J
Zinc	2.4 U	4.8	2.8 U	2.7 U	3 U	2.6 U	3.4 U	3.4 U	7.5 J
Total Cyanide	2.5 U	2.3 U	2.2 U	2.3 U	2.5 U	2.2 U	2.5 U	2.2 U	2.4 U

FREQUENCY OF DETECTION SUMMARY
SUBSURFACE SOIL - INORGANIC CONSTITUENTS and CYANIDE
SITE 10 - ORIGINAL BASE LANDFILL
MCB, CAMP LEJEUNE, NORTH CAROLINA
SITE INVESTIGATION, CTO-0369

SAMPLE ID	IR10-SB19-01	IR10-SB21-05	IR10-SB22-07	IR10-SB23-03
SAMPLE DATE	03-19-1998	03-19-1998	03-19-1998	03-19-1998
DEPTH	1 - 3'	9 - 11'	13 - 15'	5 - 7'
TOTAL METALS (mg/kg)				
Aluminum	2810 J	2610 J	2320 J	906 J
Antimony	14.1 U	13.1 U	13.1 U	14.4 U
Arsenic	0.84 U	0.54 U	2.2 U	2.4 U
Barium	7.9 J	3.3 J	5 J	2.3 J
Beryllium	1.2 U	1.1 U	1.1 U	1.2 U
Cadmium	1.2 U	1.1 U	1.1 U	1.2 U
Calcium	445 J	62.8 J	72.2 J	66.6 J
Chromium	3.4 J	4.5 J	5.4 J	2 J
Cobalt	1.1 J	10.9 U	11 U	12 U
Copper	4 J	0.92 J	1.1 J	1.2 J
Iron	976 J	726 J	928 J	303 J
Lead	10.7	2.4	2.5	1.2
Magnesium	84.5 J	75.9 J	81.8 J	29.5 J
Manganese	4.3 J	3.1 J	3.9	2.7 J
Mercury	0.03 J	0.11 U	0.11 U	0.12 U
Nickel	2.6 J	1.9 J	1.9 J	9.6 U
Potassium	1170 U	1090 U	1100 U	1200 U
Selenium	1.1 J	1.1 U	1.1 U	1.2 U
Silver	1.6 J	2.2 U	2.2 U	2.4 U
Sodium	21.2 J	16 J	19.9 J	15.8 J
Thallium	2.3 U	2.2 U	2.2 U	2.4 U
Vanadium	6.6 J	6.1 J	5.9 J	4.5 J
Zinc	18.6 J	7.6 J	17.8 J	13.4 J
Total Cyanide	2.3 U	2.2 U	2.2 U	2.4 U

FREQUENCY OF DETECTION SUMMARY
SUBSURFACE SOIL - INORGANIC CONSTITUENTS and CYANIDE
SITE 10 - ORIGINAL BASE LANDFILL
MCB, CAMP LEJEUNE, NORTH CAROLINA
SITE INVESTIGATION, CTO-0369

SAMPLE ID SAMPLE DATE DEPTH	Minimum Non-Detect	Maximum Non-Detect	Minimum Detected	Maximum Detected	Location of Maximum Detect	Frequency of Detection	Arithmatic Mean Positive Detects	Median Positive Detects
TOTAL METALS (mg/kg)								
Aluminum	ND	ND	40.2 J	5910	IR10-SB04-03	22/22	1967.74	1840
Antimony	12.7 U	14.9 U	7.3 J	84.2	IR10-SB04-03	3/22	32.97	7.4
Arsenic	0.54 U	2.5 U	0.99 J	37.2	IR10-SB04-03	3/22	13.93	3.6
Barium	ND	ND	0.88 J	589	IR10-SB04-03	22/22	35.01	2.75
Beryllium	1.1 U	3.8 U	0.12 J	0.12 J	IR10-SB03-03	1/22	0.12	0.12
Cadmium	1.1 U	3.8 U	7.9	7.9	IR10-SB03-03	1/22	7.9	7.9
Calcium	ND	ND	26.9 J	25100 J	IR10-SB04-03	22/22	2010.32	64.7
Chromium	2.2 U	2.2 U	0.91 J	66.5	IR10-SB04-03	21/22	6.83	3
Cobalt	10.6 U	12.4 U	0.84 J	53.2	IR10-SB04-03	7/22	9.59	1.1
Copper	ND	ND	0.39 J	3340	IR10-SB04-03	22/22	156.25	1.15
Iron	ND	ND	102 J	218000	IR10-SB04-03	22/22	12945.59	475
Lead	ND	ND	0.72	2630	IR10-SB04-03	22/22	151.51	2.05
Magnesium	ND	ND	5.8 J	1050 J	IR10-SB04-03	22/22	118.7	45.55
Manganese	ND	ND	1.6 J	948	IR10-SB04-03	22/22	65.37	3.35
Mercury	0.11 U	0.12 U	0.022 J	0.16	IR10-SB04-03	16/22	0.05	0.03
Nickel	8.4 U	9.9 U	1.9 J	147	IR10-SB04-03	6/22	28.93	5.25
Potassium	1060 U	1240 U	165 J	636 J	IR10-SB04-03	6/22	306.33	261
Selenium	1.1 U	1.2 U	0.65 J	1.1 J	IR10-SB19-01	3/22	0.92	1
Silver	2.1 U	7.5 U	1.1 J	11.3	IR10-SB03-03	4/22	3.85	1.5
Sodium	ND	ND	9.5 J	336 J	IR10-SB04-03	22/22	37.9	18.05
Thallium	2.1 U	2.6 U	1.1 J	1.1 J	IR10-SB11-02	1/22	1.1	1.1
Vanadium	1.7 U	37.5 U	3.9 J	6.6 J	IR10-SB19-01	5/22	5.4	5.9
Zinc	2.3 U	3.4 U	2.5 J	1250	IR10-SB04-03	13/22	200.79	8.6
Total Cyanide	2.1 U	2.5 U	0.62 J	0.62 J	IR10-SB04-03	1/22	0.62	0.62

APPENDIX G.3
GROUNDWATER

FREQUENCY OF DETECTION SUMMARY
GROUNDWATER - ORGANICS
SITE 10 - ORIGINAL BASE LANDFILL
MCB, CAMP LEJEUNE, NORTH CAROLINA
SITE INVESTIGATION, CTO-0369

SAMPLE ID	IR10-TW01-98A	IR10-TW02-98A	IR10-TW03-98A	IR10-TW04-98A	IR10-TW05-98A	IR10-TW06-98A	IR10-TW07-98A
SAMPLE DATE	03-22-1998	03-22-1998	03-22-1998	03-22-1998	03-22-1998	03-22-1998	03-23-1998
VOLATILES (ug/l)							
Chloromethane	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Bromomethane	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Vinyl chloride	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Chloroethane	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Methylene chloride	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Acetone	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Carbon disulfide	10 U	10 U	10 U	10 U	10 U	10 U	10 U
1,1-Dichloroethene	10 U	10 U	10 U	10 U	10 U	10 U	10 U
1,1-Dichloroethane	10 U	10 U	10 U	10 U	10 U	10 U	10 U
1,2-Dichloroethene (total)	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Chloroform	10 U	10 U	10 U	10 U	10 U	10 U	10 U
1,2-Dichloroethane	10 U	10 U	10 U	10 U	10 U	10 U	10 U
2-Butanone	10 U	10 U	10 U	10 U	10 U	10 U	10 U
1,1,1-Trichloroethane	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Carbon tetrachloride	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Bromodichloromethane	10 U	10 U	10 U	10 U	10 U	10 U	10 U
1,2-Dichloropropane	10 U	10 U	10 U	10 U	10 U	10 U	10 U
cis-1,3-Dichloropropene	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Trichloroethene	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Dibromochloromethane	10 U	10 U	10 U	10 U	10 U	10 U	10 U
1,1,2-Trichloroethane	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Benzene	10 U	10 U	10 U	10 U	10 U	10 U	10 U
trans-1,3-Dichloropropene	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Bromoform	10 U	10 U	10 U	10 U	10 U	10 U	10 U
4-Methyl-2-pentanone	10 U	10 U	10 U	10 U	10 U	10 U	10 U
2-Hexanone	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Tetrachloroethene	10 U	10 U	10 U	10 U	10 U	10 U	10 U
1,1,2,2-Tetrachloroethane	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Toluene	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Chlorobenzene	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Ethylbenzene	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Styrene	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Xylenes (total)	10 U	10 U	10 U	10 U	10 U	10 U	10 U

FREQUENCY OF DETECTION SUMMARY
GROUNDWATER - ORGANICS
SITE 10 - ORIGINAL BASE LANDFILL
MCB, CAMP LEJEUNE, NORTH CAROLINA
SITE INVESTIGATION, CTO-0369

SAMPLE ID	IR10-TW01-98A	IR10-TW02-98A	IR10-TW03-98A	IR10-TW04-98A	IR10-TW05-98A	IR10-TW06-98A	IR10-TW07-98A
SAMPLE DATE	03-22-1998	03-22-1998	03-22-1998	03-22-1998	03-22-1998	03-22-1998	03-23-1998
SEMIVOLATILES (ug/l)							
Phenol	10 U	10 U	10 U	10 U	10 U	10 U	10 U
bis(2-Chloroethyl) ether	10 U	10 U	10 U	10 U	10 U	10 U	10 U
2-Chlorophenol	10 U	10 U	10 U	10 U	10 U	10 U	10 U
1,3-Dichlorobenzene	10 U	10 U	10 U	10 U	10 U	10 U	10 U
1,4-Dichlorobenzene	10 U	10 U	10 U	10 U	10 U	10 U	10 U
1,2-Dichlorobenzene	10 U	10 U	10 U	10 U	10 U	10 U	10 U
3,3'-Dichlorobenzidine	10 U	10 U	10 U	10 U	10 U	10 U	10 U
2,2'-Oxybis(1-Chloropropane)	10 U	10 U	10 U	10 U	10 U	10 U	10 U
N-Nitrosodi-n-propylamine	10 U	10 U	10 U	10 U	10 U	10 U	10 U
4-Methylphenol	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Hexachloroethane	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Nitrobenzene	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Isophorone	10 U	10 U	10 U	10 U	10 U	10 U	10 U
2-Nitroaniline	25 U	25 U	25 U	25 U	25 U	25 U	25 U
2,4-Dimethylphenol	10 U	10 U	10 U	10 U	10 U	10 U	10 U
bis(2-Chloroethoxy)methane	10 U	10 U	10 U	10 U	10 U	10 U	10 U
2,4-Dichlorophenol	10 U	10 U	10 U	10 U	10 U	10 U	10 U
1,2,4-Trichlorobenzene	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Naphthalene	10 U	10 U	10 U	10 U	10 U	10 U	10 U
4-Chloroaniline	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Hexachlorobutadiene	10 U	10 U	10 U	10 U	10 U	10 U	10 U
4-Chloro-3-methylphenol	10 U	10 U	10 U	10 U	10 U	10 U	10 U
2-Methylnaphthalene	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Hexachlorocyclopentadiene	10 U	10 U	10 U	10 U	10 U	10 U	10 U
2,4,6-Trichlorophenol	10 U	10 U	10 U	10 U	10 U	10 U	10 U
2,4,5-Trichlorophenol	25 U	25 U	25 U	25 U	25 U	25 U	25 U
2-Chloronaphthalene	10 U	10 U	10 U	10 U	10 U	10 U	10 U
2-Methylphenol	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Dimethyl phthalate	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Acenaphthylene	10 U	10 U	10 U	10 U	10 U	10 U	10 U
2,6-Dinitrotoluene	10 U	10 U	10 U	10 U	10 U	10 U	10 U
3-Nitroaniline	25 U	25 U	25 U	25 U	25 U	25 U	25 U
Acenaphthene	10 U	10 U	10 U	10 U	10 U	10 U	10 U
2,4-Dinitrophenol	25 U	25 U	25 U	25 U	25 U	25 U	25 U

FREQUENCY OF DETECTION SUMMARY
GROUNDWATER - ORGANICS
SITE 10 - ORIGINAL BASE LANDFILL
MCB, CAMP LEJEUNE, NORTH CAROLINA
SITE INVESTIGATION, CTO-0369

SAMPLE ID	IR10-TW01-98A	IR10-TW02-98A	IR10-TW03-98A	IR10-TW04-98A	IR10-TW05-98A	IR10-TW06-98A	IR10-TW07-98A
SAMPLE DATE	03-22-1998	03-22-1998	03-22-1998	03-22-1998	03-22-1998	03-22-1998	03-23-1998
SEMIVOLATILES (ug/l) (cont)							
4-Nitrophenol	25 UJ	25 UJ	25 UJ	25 UJ	25 UJ	25 UJ	25 U
Dibenzofuran	10 U	10 U	10 U	10 U	10 U	10 U	10 U
2,4-Dinitrotoluene	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Diethyl phthalate	10 U	10 U	10 U	10 U	10 U	10 U	10 U
4-Chlorophenyl phenyl ether	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Fluorene	10 U	10 U	10 U	10 U	10 U	10 U	10 U
4-Nitroaniline	25 U	25 U	25 U	25 U	25 U	25 U	25 U
4,6-Dinitro-2-methylphenol	25 U	25 U	25 U	25 U	25 U	25 U	25 U
N-Nitrosodiphenylamine	10 U	10 U	10 U	10 U	10 U	10 U	10 U
4-Bromophenyl phenyl ether	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Hexachlorobenzene	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Pentachlorophenol	25 U	25 U	25 U	25 U	25 U	25 U	25 U
Phenanthrene	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Anthracene	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Carbazole	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Di-n-butyl phthalate	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Fluoranthene	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Pyrene	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Butyl benzyl phthalate	10 U	10 U	10 U	10 U	10 U	10 U	10 U
2-Nitrophenol	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Benzo(a)anthracene	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Chrysene	10 U	10 U	10 U	10 U	10 U	10 U	10 U
bis(2-Ethylhexyl) phthalate	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Di-n-octyl phthalate	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Benzo(b)fluoranthene	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Benzo(k)fluoranthene	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Benzo(a)pyrene	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Indeno(1,2,3-cd)pyrene	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Dibenz(a,h)anthracene	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Benzo(ghi)perylene	10 U	10 U	10 U	10 U	10 U	10 U	10 U

FREQUENCY OF DETECTION SUMMARY
GROUNDWATER - ORGANICS
SITE 10 - ORIGINAL BASE LANDFILL
MCB, CAMP LEJEUNE, NORTH CAROLINA
SITE INVESTIGATION, CTO-0369

SAMPLE ID	IR10-TW01-98A	IR10-TW02-98A	IR10-TW03-98A	IR10-TW04-98A	IR10-TW05-98A	IR10-TW06-98A	IR10-TW07-98A
SAMPLE DATE	03-22-1998	03-22-1998	03-22-1998	03-22-1998	03-22-1998	03-22-1998	03-23-1998
PESTICIDES/PCBS (ug/l)							
alpha-BHC	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U
beta-BHC	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U
delta-BHC	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U
gamma-BHC (Lindane)	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U
Heptachlor	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U
Aldrin	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U
Heptachlor epoxide	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U
Endosulfan I	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U
Dieldrin	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U
4,4'-DDE	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U
Endrin	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U
Endosulfan II	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U
4,4'-DDD	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U
Endosulfan sulfate	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U
4,4'-DDT	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U
Methoxychlor	0.5 UJ	0.5 UJ	0.5 UJ	0.5 UJ	0.5 UJ	0.5 UJ	0.5 UJ
Endrin ketone	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U
Endrin aldehyde	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U
alpha-Chlordane	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U
gamma-Chlordane	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U
Toxaphene	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Aroclor 1016	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Aroclor 1221	2 U	2 U	2 U	2 U	2 U	2 U	2 U
Aroclor 1232	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Aroclor 1242	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Aroclor 1248	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Aroclor 1254	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Aroclor 1260	1 U	1 U	1 U	1 U	1 U	1 U	1 U

FREQUENCY OF DETECTION SUMMARY
GROUNDWATER - ORGANICS
SITE 10 - ORIGINAL BASE LANDFILL
MCB, CAMP LEJEUNE, NORTH CAROLINA
SITE INVESTIGATION, CTO-0369

SAMPLE ID	IR10-TW08-98A	IR10-TW09-98A
SAMPLE DATE	03-23-1998	03-22-1998
VOLATILES (ug/l)		
Chloromethane	10 U	10 U
Bromomethane	10 U	10 U
Vinyl chloride	10 U	10 U
Chloroethane	10 U	10 U
Methylene chloride	10 U	10 U
Acetone	10 U	10 U
Carbon disulfide	10 U	10 U
1,1-Dichloroethene	10 U	10 U
1,1-Dichloroethane	10 U	10 U
1,2-Dichloroethene (total)	10 U	10 U
Chloroform	10 U	10 U
1,2-Dichloroethane	10 U	10 U
2-Butanone	10 U	10 U
1,1,1-Trichloroethane	10 U	10 U
Carbon tetrachloride	10 U	10 U
Bromodichloromethane	10 U	10 U
1,2-Dichloropropane	10 U	10 U
cis-1,3-Dichloropropene	10 U	10 U
Trichloroethene	10 U	10 U
Dibromochloromethane	10 U	10 U
1,1,2-Trichloroethane	10 U	10 U
Benzene	10 U	10 U
trans-1,3-Dichloropropene	10 U	10 U
Bromoform	10 U	10 U
4-Methyl-2-pentanone	10 U	10 U
2-Hexanone	10 U	10 U
Tetrachloroethene	10 U	10 U
1,1,2,2-Tetrachloroethane	10 U	10 U
Toluene	10 U	10 U
Chlorobenzene	10 U	10 U
Ethylbenzene	10 U	10 U
Styrene	10 U	10 U
Xylenes (total)	10 U	10 U

FREQUENCY OF DETECTION SUMMARY
GROUNDWATER - ORGANICS
SITE 10 - ORIGINAL BASE LANDFILL
MCB, CAMP LEJEUNE, NORTH CAROLINA
SITE INVESTIGATION, CTO-0369

SAMPLE ID	IR10-TW08-98A	IR10-TW09-98A
SAMPLE DATE	03-23-1998	03-22-1998
SEMIVOLATILES (ug/l)		
Phenol	10 U	10 U
bis(2-Chloroethyl) ether	10 U	10 U
2-Chlorophenol	10 U	10 U
1,3-Dichlorobenzene	10 U	10 U
1,4-Dichlorobenzene	10 U	10 U
1,2-Dichlorobenzene	10 U	10 U
3,3'-Dichlorobenzidine	10 U	10 U
2,2'-Oxybis(1-Chloropropane)	10 U	10 U
N-Nitrosodi-n-propylamine	10 U	10 U
4-Methylphenol	10 U	10 U
Hexachloroethane	10 U	10 U
Nitrobenzene	10 U	10 U
Isophorone	10 U	10 U
2-Nitroaniline	25 U	25 U
2,4-Dimethylphenol	10 U	10 U
bis(2-Chloroethoxy)methane	10 U	10 U
2,4-Dichlorophenol	10 U	10 U
1,2,4-Trichlorobenzene	10 U	10 U
Naphthalene	10 U	10 U
4-Chloroaniline	10 U	10 U
Hexachlorobutadiene	10 U	10 U
4-Chloro-3-methylphenol	10 U	10 U
2-Methylnaphthalene	10 U	10 U
Hexachlorocyclopentadiene	10 U	10 U
2,4,6-Trichlorophenol	10 U	10 U
2,4,5-Trichlorophenol	25 U	25 U
2-Chloronaphthalene	10 U	10 U
2-Methylphenol	10 U	10 U
Dimethyl phthalate	10 U	10 U
Acenaphthylene	10 U	10 U
2,6-Dinitrotoluene	10 U	10 U
3-Nitroaniline	25 U	25 U
Acenaphthene	10 U	10 U
2,4-Dinitrophenol	25 U	25 U

FREQUENCY OF DETECTION SUMMARY
GROUNDWATER - ORGANICS
SITE 10 - ORIGINAL BASE LANDFILL
MCB, CAMP LEJEUNE, NORTH CAROLINA
SITE INVESTIGATION, CTO-0369

SAMPLE ID	IR10-TW08-98A	IR10-TW09-98A
SAMPLE DATE	03-23-1998	03-22-1998
SEMIVOLATILES (ug/l) (cont)		
4-Nitrophenol	25 UJ	25 UJ
Dibenzofuran	10 U	10 U
2,4-Dinitrotoluene	10 U	10 U
Diethyl phthalate	10 U	10 U
4-Chlorophenyl phenyl ether	10 U	10 U
Fluorene	10 U	10 U
4-Nitroaniline	25 U	25 U
4,6-Dinitro-2-methylphenol	25 U	25 U
N-Nitrosodiphenylamine	10 U	10 U
4-Bromophenyl phenyl ether	10 U	10 U
Hexachlorobenzene	10 U	10 U
Pentachlorophenol	25 U	25 U
Phenanthrene	10 U	10 U
Anthracene	10 U	10 U
Carbazole	10 U	10 U
Di-n-butyl phthalate	10 U	10 U
Fluoranthene	10 U	10 U
Pyrene	10 U	10 U
Butyl benzyl phthalate	10 U	10 U
2-Nitrophenol	10 U	10 U
Benzo(a)anthracene	10 U	10 U
Chrysene	10 U	10 U
bis(2-Ethylhexyl) phthalate	10 U	18 U
Di-n-octyl phthalate	10 U	10 U
Benzo(b)fluoranthene	10 U	10 U
Benzo(k)fluoranthene	10 U	10 U
Benzo(a)pyrene	10 U	10 U
Indeno(1,2,3-cd)pyrene	10 U	10 U
Dibenz(a,h)anthracene	10 U	10 U
Benzo(ghi)perylene	10 U	10 U

FREQUENCY OF DETECTION SUMMARY
GROUNDWATER - ORGANICS
SITE 10 - ORIGINAL BASE LANDFILL
MCB, CAMP LEJEUNE, NORTH CAROLINA
SITE INVESTIGATION, CTO-0369

SAMPLE ID	IR10-TW08-98A	IR10-TW09-98A
SAMPLE DATE	03-23-1998	03-22-1998
PESTICIDES/PCBS (ug/l)		
alpha-BHC	0.05 U	0.05 U
beta-BHC	0.05 U	0.05 U
delta-BHC	0.05 U	0.05 U
gamma-BHC (Lindane)	0.05 U	0.05 U
Heptachlor	0.05 U	0.05 U
Aldrin	0.05 U	0.05 U
Heptachlor epoxide	0.05 U	0.05 U
Endosulfan I	0.05 U	0.05 U
Dieldrin	0.1 U	0.1 U
4,4'-DDE	0.1 U	0.1 U
Endrin	0.1 U	0.1 U
Endosulfan II	0.1 U	0.1 U
4,4'-DDD	0.1 U	0.1 U
Endosulfan sulfate	0.1 U	0.1 U
4,4'-DDT	0.1 U	0.1 U
Methoxychlor	0.5 UJ	0.5 UJ
Endrin ketone	0.1 U	0.1 U
Endrin aldehyde	0.1 U	0.1 U
alpha-Chlordane	0.05 U	0.05 U
gamma-Chlordane	0.05 U	0.05 U
Toxaphene	5 U	5 U
Aroclor 1016	1 U	1 U
Aroclor 1221	2 U	2 U
Aroclor 1232	1 U	1 U
Aroclor 1242	1 U	1 U
Aroclor 1248	1 U	1 U
Aroclor 1254	1 U	1 U
Aroclor 1260	1 U	1 U

FREQUENCY OF DETECTION SUMMARY
GROUNDWATER - ORGANICS
SITE 10 - ORIGINAL BASE LANDFILL
MCB, CAMP LEJEUNE, NORTH CAROLINA
SITE INVESTIGATION, CTO-0369

SAMPLE ID SAMPLE DATE	Minimum Non-Detect	Maximum Non-Detect	Minimum Detected	Maximum Detected	Location of Maximum Detect	Frequency of Detection	Arithmatic Mean Positive Detects	Median Positive Detects
VOLATILES (ug/l)								
Chloromethane	10 U	10 U	ND	ND		0/9	--	--
Bromomethane	10 U	10 U	ND	ND		0/9	--	--
Vinyl chloride	10 U	10 U	ND	ND		0/9	--	--
Chloroethane	10 U	10 U	ND	ND		0/9	--	--
Methylene chloride	10 U	10 U	ND	ND		0/9	--	--
Acetone	10 U	10 U	ND	ND		0/9	--	--
Carbon disulfide	10 U	10 U	ND	ND		0/9	--	--
1,1-Dichloroethene	10 U	10 U	ND	ND		0/9	--	--
1,1-Dichloroethane	10 U	10 U	ND	ND		0/9	--	--
1,2-Dichloroethene (total)	10 U	10 U	ND	ND		0/9	--	--
Chloroform	10 U	10 U	ND	ND		0/9	--	--
1,2-Dichloroethane	10 U	10 U	ND	ND		0/9	--	--
2-Butanone	10 U	10 U	ND	ND		0/9	--	--
1,1,1-Trichloroethane	10 U	10 U	ND	ND		0/9	--	--
Carbon tetrachloride	10 U	10 U	ND	ND		0/9	--	--
Bromodichloromethane	10 U	10 U	ND	ND		0/9	--	--
1,2-Dichloropropane	10 U	10 U	ND	ND		0/9	--	--
cis-1,3-Dichloropropene	10 U	10 U	ND	ND		0/9	--	--
Trichloroethene	10 U	10 U	ND	ND		0/9	--	--
Dibromochloromethane	10 U	10 U	ND	ND		0/9	--	--
1,1,2-Trichloroethane	10 U	10 U	ND	ND		0/9	--	--
Benzene	10 U	10 U	ND	ND		0/9	--	--
trans-1,3-Dichloropropene	10 U	10 U	ND	ND		0/9	--	--
Bromoform	10 U	10 U	ND	ND		0/9	--	--
4-Methyl-2-pentanone	10 U	10 U	ND	ND		0/9	--	--
2-Hexanone	10 U	10 U	ND	ND		0/9	--	--
Tetrachloroethene	10 U	10 U	ND	ND		0/9	--	--
1,1,2,2-Tetrachloroethane	10 U	10 U	ND	ND		0/9	--	--
Toluene	10 U	10 U	ND	ND		0/9	--	--
Chlorobenzene	10 U	10 U	ND	ND		0/9	--	--
Ethylbenzene	10 U	10 U	ND	ND		0/9	--	--
Styrene	10 U	10 U	ND	ND		0/9	--	--
Xylenes (total)	10 U	10 U	ND	ND		0/9	--	--

FREQUENCY OF DETECTION SUMMARY
GROUNDWATER - ORGANICS
SITE 10 - ORIGINAL BASE LANDFILL
MCB, CAMP LEJEUNE, NORTH CAROLINA
SITE INVESTIGATION, CTO-0369

SAMPLE ID SAMPLE DATE	Minimum Non-Detect	Maximum Non-Detect	Minimum Detected	Maximum Detected	Location of Maximum Detect	Frequency of Detection	Arithmatic Mean Positive Detects	Median Positive Detects
SEMIVOLATILES (ug/l)								
Phenol	10 U	10 U	ND	ND		0/9	--	--
bis(2-Chloroethyl) ether	10 U	10 U	ND	ND		0/9	--	--
2-Chlorophenol	10 U	10 U	ND	ND		0/9	--	--
1,3-Dichlorobenzene	10 U	10 U	ND	ND		0/9	--	--
1,4-Dichlorobenzene	10 U	10 U	ND	ND		0/9	--	--
1,2-Dichlorobenzene	10 U	10 U	ND	ND		0/9	--	--
3,3'-Dichlorobenzidine	10 U	10 U	ND	ND		0/9	--	--
2,2'-Oxybis(1-Chloropropane)	10 U	10 U	ND	ND		0/9	--	--
N-Nitrosodi-n-propylamine	10 U	10 U	ND	ND		0/9	--	--
4-Methylphenol	10 U	10 U	ND	ND		0/9	--	--
Hexachloroethane	10 U	10 U	ND	ND		0/9	--	--
Nitrobenzene	10 U	10 U	ND	ND		0/9	--	--
Isophorone	10 U	10 U	ND	ND		0/9	--	--
2-Nitroaniline	25 U	25 U	ND	ND		0/9	--	--
2,4-Dimethylphenol	10 U	10 U	ND	ND		0/9	--	--
bis(2-Chloroethoxy)methane	10 U	10 U	ND	ND		0/9	--	--
2,4-Dichlorophenol	10 U	10 U	ND	ND		0/9	--	--
1,2,4-Trichlorobenzene	10 U	10 U	ND	ND		0/9	--	--
Naphthalene	10 U	10 U	ND	ND		0/9	--	--
4-Chloroaniline	10 U	10 U	ND	ND		0/9	--	--
Hexachlorobutadiene	10 U	10 U	ND	ND		0/9	--	--
4-Chloro-3-methylphenol	10 U	10 U	ND	ND		0/9	--	--
2-Methylnaphthalene	10 U	10 U	ND	ND		0/9	--	--
Hexachlorocyclopentadiene	10 U	10 U	ND	ND		0/9	--	--
2,4,6-Trichlorophenol	10 U	10 U	ND	ND		0/9	--	--
2,4,5-Trichlorophenol	25 U	25 U	ND	ND		0/9	--	--
2-Chloronaphthalene	10 U	10 U	ND	ND		0/9	--	--
2-Methylphenol	10 U	10 U	ND	ND		0/9	--	--
Dimethyl phthalate	10 U	10 U	ND	ND		0/9	--	--
Acenaphthylene	10 U	10 U	ND	ND		0/9	--	--
2,6-Dinitrotoluene	10 U	10 U	ND	ND		0/9	--	--
3-Nitroaniline	25 U	25 U	ND	ND		0/9	--	--
Acenaphthene	10 U	10 U	ND	ND		0/9	--	--
2,4-Dinitrophenol	25 U	25 U	ND	ND		0/9	--	--

FREQUENCY OF DETECTION SUMMARY
GROUNDWATER - ORGANICS
SITE 10 - ORIGINAL BASE LANDFILL
MCB, CAMP LEJEUNE, NORTH CAROLINA
SITE INVESTIGATION, CTO-0369

SAMPLE ID SAMPLE DATE	Minimum Non-Detect	Maximum Non-Detect	Minimum Detected	Maximum Detected	Location of Maximum Detect	Frequency of Detection	Arithmatic Mean Positive Detects	Median Positive Detects
SEMIVOLATILES (ug/l) (cont)								
4-Nitrophenol	25 UJ	25 UJ	ND	ND		0/9	--	--
Dibenzofuran	10 U	10 U	ND	ND		0/9	--	--
2,4-Dinitrotoluene	10 U	10 U	ND	ND		0/9	--	--
Diethyl phthalate	10 U	10 U	ND	ND		0/9	--	--
4-Chlorophenyl phenyl ether	10 U	10 U	ND	ND		0/9	--	--
Fluorene	10 U	10 U	ND	ND		0/9	--	--
4-Nitroaniline	25 U	25 U	ND	ND		0/9	--	--
4,6-Dinitro-2-methylphenol	25 U	25 U	ND	ND		0/9	--	--
N-Nitrosodiphenylamine	10 U	10 U	ND	ND		0/9	--	--
4-Bromophenyl phenyl ether	10 U	10 U	ND	ND		0/9	--	--
Hexachlorobenzene	10 U	10 U	ND	ND		0/9	--	--
Pentachlorophenol	25 U	25 U	ND	ND		0/9	--	--
Phenanthrene	10 U	10 U	ND	ND		0/9	--	--
Anthracene	10 U	10 U	ND	ND		0/9	--	--
Carbazole	10 U	10 U	ND	ND		0/9	--	--
Di-n-butyl phthalate	10 U	10 U	ND	ND		0/9	--	--
Fluoranthene	10 U	10 U	ND	ND		0/9	--	--
Pyrene	10 U	10 U	ND	ND		0/9	--	--
Butyl benzyl phthalate	10 U	10 U	ND	ND		0/9	--	--
2-Nitrophenol	10 U	10 U	ND	ND		0/9	--	--
Benzo(a)anthracene	10 U	10 U	ND	ND		0/9	--	--
Chrysene	10 U	10 U	ND	ND		0/9	--	--
bis(2-Ethylhexyl) phthalate	10 U	18 U	ND	ND		0/9	--	--
Di-n-octyl phthalate	10 U	10 U	ND	ND		0/9	--	--
Benzo(b)fluoranthene	10 U	10 U	ND	ND		0/9	--	--
Benzo(k)fluoranthene	10 U	10 U	ND	ND		0/9	--	--
Benzo(a)pyrene	10 U	10 U	ND	ND		0/9	--	--
Indeno(1,2,3-cd)pyrene	10 U	10 U	ND	ND		0/9	--	--
Dibenz(a,h)anthracene	10 U	10 U	ND	ND		0/9	--	--
Benzo(ghi)perylene	10 U	10 U	ND	ND		0/9	--	--

FREQUENCY OF DETECTION SUMMARY
GROUNDWATER - ORGANICS
SITE 10 - ORIGINAL BASE LANDFILL
MCB, CAMP LEJEUNE, NORTH CAROLINA
SITE INVESTIGATION, CTO-0369

SAMPLE ID SAMPLE DATE	Minimum Non-Detect	Maximum Non-Detect	Minimum Detected	Maximum Detected	Location of Maximum Detect	Frequency of Detection	Arithmatic Mean Positive Detects	Median Positive Detects
PESTICIDES/PCBS (ug/l)								
alpha-BHC	0.05 U	0.05 U	ND	ND		0/9	--	--
beta-BHC	0.05 U	0.05 U	ND	ND		0/9	--	--
delta-BHC	0.05 U	0.05 U	ND	ND		0/9	--	--
gamma-BHC (Lindane)	0.05 U	0.05 U	ND	ND		0/9	--	--
Heptachlor	0.05 U	0.05 U	ND	ND		0/9	--	--
Aldrin	0.05 U	0.05 U	ND	ND		0/9	--	--
Heptachlor epoxide	0.05 U	0.05 U	ND	ND		0/9	--	--
Endosulfan I	0.05 U	0.05 U	ND	ND		0/9	--	--
Dieldrin	0.1 U	0.1 U	ND	ND		0/9	--	--
4,4'-DDE	0.1 U	0.1 U	ND	ND		0/9	--	--
Endrin	0.1 U	0.1 U	ND	ND		0/9	--	--
Endosulfan II	0.1 U	0.1 U	ND	ND		0/9	--	--
4,4'-DDD	0.1 U	0.1 U	ND	ND		0/9	--	--
Endosulfan sulfate	0.1 U	0.1 U	ND	ND		0/9	--	--
4,4'-DDT	0.1 U	0.1 U	ND	ND		0/9	--	--
Methoxychlor	0.5 UJ	0.5 UJ	ND	ND		0/9	--	--
Endrin ketone	0.1 U	0.1 U	ND	ND		0/9	--	--
Endrin aldehyde	0.1 U	0.1 U	ND	ND		0/9	--	--
alpha-Chlordane	0.05 U	0.05 U	ND	ND		0/9	--	--
gamma-Chlordane	0.05 U	0.05 U	ND	ND		0/9	--	--
Toxaphene	5 U	5 U	ND	ND		0/9	--	--
Aroclor 1016	1 U	1 U	ND	ND		0/9	--	--
Aroclor 1221	2 U	2 U	ND	ND		0/9	--	--
Aroclor 1232	1 U	1 U	ND	ND		0/9	--	--
Aroclor 1242	1 U	1 U	ND	ND		0/9	--	--
Aroclor 1248	1 U	1 U	ND	ND		0/9	--	--
Aroclor 1254	1 U	1 U	ND	ND		0/9	--	--
Aroclor 1260	1 U	1 U	ND	ND		0/9	--	--

FREQUENCY OF DETECTION SUMMARY
GROUNDWATER - INORGANICS and CYANIDE
SITE 10 - ORIGINAL BASE LANDFILL
MCB, CAMP LEJEUNE, NORTH CAROLINA
SITE INVESTIGATION, CTO-0369

SAMPLE ID	IR10-TW01-98A	IR10-TW02-98A	IR10-TW03-98A	IR10-TW04-98A	IR10-TW05-98A	IR10-TW06-98A
SAMPLE DATE	03-22-1998	03-22-1998	03-22-1998	03-22-1998	03-22-1998	03-22-1998
METALS (ug/l)						
Aluminum	16600 J	37500 J	57100 J	33700 J	17100 J	27300 J
Antimony	60 U	24.2 U	60 U	60 U	60 U	24.3 U
Arsenic	10 U	6.4 J	16.4	10 U	6 J	10 U
Barium	33.6 J	62 J	110 J	93.6 J	78.7 J	42.9 J
Beryllium	5 U	5 U	5 U	5 U	5 U	5 U
Cadmium	5 U	5 U	5 U	5 U	5 U	5 U
Calcium	16800	1820 J	1630 J	1740 J	5620	52700
Chromium	64	82.2	107	48.4	35.9	36.4
Cobalt	3.8 J	4.3 J	6.2 J	7.2 J	3.9 J	50 U
Copper	10.8 U	16.8 J	22.2 J	24.6 J	8.4 U	7.9 U
Iron	6830	16900	25600	10400	8220	5030
Lead	10.6	31.1	41	33.4	14.2	10.6
Magnesium	726 J	1530 J	1820 J	1300 J	2000 J	3930 J
Manganese	72.1	109	119	88.3	91.7	33.2
Mercury	0.054 J	0.083 J	0.087 J	0.13 J	0.077 J	0.033 J
Nickel	40 U	14.4 J	13.8 J	16.1 J	40 U	40 U
Potassium	1930 J	3300 J	3560 J	2170 J	1720 J	2970 J
Selenium	5 U	5 U	5 U	5 U	5 U	5 U
Silver	10 U	10 U	10 U	10 U	10 U	10 U
Sodium	3340 J	4350 J	3510 J	6480	10600	6550
Thallium	5.2 J	3.6 J	3.9 J	3.1 J	10 U	10 U
Vanadium	11.8 J	38.6 J	62.1	18.4 J	32.7 J	38.8 J
Zinc	21 U	34.5	30.1	31.2	16.2 U	18.6 U
Cyanide, Total	10 U	10 U	10 U	10 U	10 U	10 U

FREQUENCY OF DETECTION SUMMARY
GROUNDWATER - INORGANICS and CYANIDE
SITE 10 - ORIGINAL BASE LANDFILL
MCB, CAMP LEJEUNE, NORTH CAROLINA
SITE INVESTIGATION, CTO-0369

SAMPLE ID	IR10-TW07-98A	IR10-TW08-98A	IR10-TW09-98A
SAMPLE DATE	03-23-1998	03-23-1998	03-22-1998
METALS (ug/l)			
Aluminum	4300 J	78800 J	24400 J
Antimony	30.3 U	27.5 U	25.2 U
Arsenic	13.9	18.2	10 U
Barium	57.3 J	186 J	61.8 J
Beryllium	5 U	0.65 J	5 U
Cadmium	5 U	5 U	5 U
Calcium	2060 J	2850 J	13500
Chromium	17.1	136	55.1
Cobalt	6 J	10.5 J	3.7 J
Copper	7 U	25.3	37.7
Iron	8240	28400	12000
Lead	7.2	54.8	43.6
Magnesium	3350 J	3030 J	2220 J
Manganese	49.1	146	114
Mercury	0.2 U	0.3	0.3
Nickel	40 U	16.3 J	8.6 J
Potassium	1740 J	5160	2560 J
Selenium	5 U	5 U	5 U
Silver	5.7 J	4.5 J	10 U
Sodium	7970	4670 J	9750
Thallium	3.5 J	10 U	3.3 J
Vanadium	38.5 J	123	32.8 J
Zinc	14.9 U	43.3	72.1
Cyanide, Total	10 U	10 U	10 U

FREQUENCY OF DETECTION SUMMARY
GROUNDWATER - INORGANICS and CYANIDE
SITE 10 - ORIGINAL BASE LANDFILL
MCB, CAMP LEJEUNE, NORTH CAROLINA
SITE INVESTIGATION, CTO-0369

SAMPLE ID SAMPLE DATE	Minimum Non-Detect	Maximum Non-Detect	Minimum Detected	Maximum Detected	Location of Maximum Detect	Frequency of Detection	Arithmatic Mean Positive Detects	Median Positive Detects
METALS (ug/l)								
Aluminum	ND	ND	4300 J	78800 J	IR10-TW08-98A	9/9	32977.78	27300
Antimony	24.2 U	60 U	ND	ND		0/9	--	--
Arsenic	10 U	10 U	6 J	18.2	IR10-TW08-98A	5/9	12.18	13.9
Barium	ND	ND	33.6 J	186 J	IR10-TW08-98A	9/9	80.66	62
Beryllium	5 U	5 U	0.65 J	0.65 J	IR10-TW08-98A	1/9	0.65	0.65
Cadmium	5 U	5 U	ND	ND		0/9	--	--
Calcium	ND	ND	1630 J	52700	IR10-TW06-98A	9/9	10968.89	2850
Chromium	ND	ND	17.1	136	IR10-TW08-98A	9/9	64.68	55.1
Cobalt	50 U	50 U	3.7 J	10.5 J	IR10-TW08-98A	8/9	5.70	5.15
Copper	7 U	10.8 U	16.8 J	37.7	IR10-TW09-98A	5/9	25.32	24.6
Iron	ND	ND	5030	28400	IR10-TW08-98A	9/9	13513.33	10400
Lead	ND	ND	7.2	54.8	IR10-TW08-98A	9/9	27.39	31.1
Magnesium	ND	ND	726 J	3930 J	IR10-TW06-98A	9/9	2211.78	2000
Manganese	ND	ND	33.2	146	IR10-TW08-98A	9/9	91.38	91.7
Mercury	0.2 U	0.2 U	0.033 J	0.3	IR10-TW08-98A,IR10-TW09-98A	8/9	0.13	0.085
Nickel	40 U	40 U	8.6 J	16.3 J	IR10-TW08-98A	5/9	13.84	14.4
Potassium	ND	ND	1720 J	5160	IR10-TW08-98A	9/9	2790.00	2560
Selenium	5 U	5 U	ND	ND		0/9	--	--
Silver	10 U	10 U	4.5 J	5.7 J	IR10-TW07-98A	2/9	5.10	5.1
Sodium	ND	ND	3340 J	10600	IR10-TW05-98A	9/9	6357.78	6480
Thallium	10 U	10 U	3.1 J	5.2 J	IR10-TW01-98A	6/9	3.77	3.55
Vanadium	ND	ND	11.8 J	123	IR10-TW08-98A	9/9	44.08	38.5
Zinc	14.9 U	21 U	30.1	72.1	IR10-TW09-98A	5/9	42.24	34.5
Cyanide, Total	10 U	10 U	ND	ND		0/9	--	--

APPENDIX G.4
SURFACE WATER

FREQUENCY OF DETECTION SUMMARY
SURFACE WATER - ORGANICS
SITE 10 - ORIGINAL BASE LANDFILL
MCB, CAMP LEJEUNE, NORTH CAROLINA
SITE INVESTIGATION, CTO-0369

SAMPLE ID	IR10-SW01	IR10-SW02	IR10-SW03	IR10-SW04	IR10-SW05	IR10-SW06
SAMPLE DATE	03-21-1998	03-21-1998	03-21-1998	03-21-1998	03-21-1998	03-21-1998
VOLATILES (ug/l)						
Chloromethane	10 U	10 U	10 U	10 U	10 U	10 U
Bromomethane	10 U	10 U	10 U	10 U	10 U	10 U
Vinyl chloride	10 U	10 U	10 U	10 U	10 U	10 U
Chloroethane	10 U	10 U	10 U	10 U	10 U	10 U
Methylene chloride	10 U	10 U	10 U	10 U	10 U	10 U
Acetone	10 U	10 U	10 U	10 U	10 U	10 U
Carbon disulfide	10 U	10 U	10 U	10 U	10 U	10 U
1,1-Dichloroethene	10 U	10 U	10 U	10 U	10 U	10 U
1,1-Dichloroethane	10 U	10 U	10 U	10 U	10 U	10 U
1,2-Dichloroethene (total)	10 U	10 U	10 U	10 U	10 U	10 U
Chloroform	10 U	10 U	10 U	10 U	10 U	10 U
1,2-Dichloroethane	10 U	10 U	10 U	10 U	10 U	10 U
2-Butanone	10 U	10 U	10 U	10 U	10 U	10 U
1,1,1-Trichloroethane	10 U	10 U	10 U	10 U	10 U	10 U
Carbon tetrachloride	10 U	10 U	10 U	10 U	10 U	10 U
Bromodichloromethane	10 U	10 U	10 U	10 U	10 U	10 U
1,2-Dichloropropane	10 U	10 U	10 U	10 U	10 U	10 U
cis-1,3-Dichloropropene	10 U	10 U	10 U	10 U	10 U	10 U
Trichloroethene	10 U	10 U	10 U	10 U	10 U	10 U
Dibromochloromethane	10 U	10 U	10 U	10 U	10 U	10 U
1,1,2-Trichloroethane	10 U	10 U	10 U	10 U	10 U	10 U
Benzene	10 U	10 U	10 U	10 U	10 U	10 U
trans-1,3-Dichloropropene	10 U	10 U	10 U	10 U	10 U	10 U
Bromoform	10 U	10 U	10 U	10 U	10 U	10 U
4-Methyl-2-pentanone	10 U	10 U	10 U	10 U	10 U	10 U
2-Hexanone	10 U	10 U	10 U	10 U	10 U	10 U
Tetrachloroethene	10 U	10 U	10 U	10 U	10 U	10 U
1,1,2,2-Tetrachloroethane	10 U	10 U	10 U	10 U	10 U	10 U
Toluene	10 U	10 U	1.3 J	1.3 J	10 U	10 U
Chlorobenzene	10 U	10 U	10 U	10 U	10 U	10 U
Ethylbenzene	10 U	10 U	10 U	10 U	10 U	10 U
Styrene	10 U	10 U	10 U	10 U	10 U	10 U
Xylenes (total)	10 U	10 U	10 U	10 U	10 U	10 U

FREQUENCY OF DETECTION SUMMARY
SURFACE WATER - ORGANICS
SITE 10 - ORIGINAL BASE LANDFILL
MCB, CAMP LEJEUNE, NORTH CAROLINA
SITE INVESTIGATION, CTO-0369

SAMPLE ID	IR10-SW01	IR10-SW02	IR10-SW03	IR10-SW04	IR10-SW05	IR10-SW06
SAMPLE DATE	03-21-1998	03-21-1998	03-21-1998	03-21-1998	03-21-1998	03-21-1998
SEMIVOLATILES (ug/l)						
Phenol	10 U	10 U	10 U	10 U	10 U	10 U
bis(2-Chloroethyl) ether	10 U	10 U	10 U	10 U	10 U	10 U
2-Chlorophenol	10 U	10 U	10 U	10 U	10 U	10 U
1,3-Dichlorobenzene	10 U	10 U	10 U	10 U	10 U	10 U
1,4-Dichlorobenzene	10 U	10 U	10 U	10 U	10 U	10 U
1,2-Dichlorobenzene	10 U	10 U	10 U	10 U	10 U	10 U
3,3'-Dichlorobenzidine	10 U	10 U	10 U	10 U	10 U	10 U
2,2'-Oxybis(1-Chloropropane)	10 U	10 U	10 U	10 U	10 U	10 U
N-Nitrosodi-n-propylamine	10 U	10 U	10 U	10 U	10 U	10 U
4-Methylphenol	10 U	10 U	10 U	10 U	10 U	10 U
Hexachlorocthane	10 U	10 U	10 U	10 U	10 U	10 U
Nitrobenzene	10 U	10 U	10 U	10 U	10 U	10 U
Isophorone	10 U	10 U	10 U	10 U	10 U	10 U
2-Nitroaniline	25 U	25 U	25 U	25 U	25 U	25 U
2,4-Dimethylphenol	10 U	10 U	10 U	10 U	10 U	10 U
bis(2-Chloroethoxy)methane	10 U	10 U	10 U	10 U	10 U	10 U
2,4-Dichlorophenol	10 U	10 U	10 U	10 U	10 U	10 U
1,2,4-Trichlorobenzene	10 U	10 U	10 U	10 U	10 U	10 U
Naphthalene	10 U	10 U	10 U	10 U	10 U	10 U
4-Chloroaniline	10 U	10 U	10 U	10 U	10 U	10 U
Hexachlorobutadiene	10 U	10 U	10 U	10 U	10 U	10 U
4-Chloro-3-methylphenol	10 U	10 U	10 U	10 U	10 U	10 U
2-Methylnaphthalene	10 U	10 U	10 U	10 U	10 U	10 U
Hexachlorocyclopentadiene	10 U	10 U	10 U	10 U	10 U	10 U
2,4,6-Trichlorophenol	10 U	10 U	10 U	10 U	10 U	10 U
2,4,5-Trichlorophenol	25 U	25 U	25 U	25 U	25 U	25 U
2-Chloronaphthalene	10 U	10 U	10 U	10 U	10 U	10 U
2-Methylphenol	10 U	10 U	10 U	10 U	10 U	10 U
Dimethyl phthalate	10 U	10 U	10 U	10 U	10 U	10 U
Acenaphthylene	10 U	10 U	10 U	10 U	10 U	10 U
2,6-Dinitrotoluene	10 U	10 U	10 U	10 U	10 U	10 U
3-Nitroaniline	25 U	25 U	25 U	25 U	25 U	25 U
Acenaphthene	10 U	10 U	10 U	10 U	10 U	10 U
2,4-Dinitrophenol	25 U	25 U	25 U	25 U	25 U	25 U

FREQUENCY OF DETECTION SUMMARY
SURFACE WATER - ORGANICS
SITE 10 - ORIGINAL BASE LANDFILL
MCB, CAMP LEJEUNE, NORTH CAROLINA
SITE INVESTIGATION, CTO-0369

SAMPLE ID	IR10-SW01	IR10-SW02	IR10-SW03	IR10-SW04	IR10-SW05	IR10-SW06
SAMPLE DATE	03-21-1998	03-21-1998	03-21-1998	03-21-1998	03-21-1998	03-21-1998
SEMIVOLATILES (ug/l) (cont)						
4-Nitrophenol	25 U	25 U	25 U	25 U	25 U	25 U
Dibenzofuran	10 U	10 U	10 U	10 U	10 U	10 U
2,4-Dinitrotoluene	10 U	10 U	10 U	10 U	10 U	10 U
Diethyl phthalate	10 U	10 U	10 U	10 U	10 U	10 U
4-Chlorophenyl phenyl ether	10 U	10 U	10 U	10 U	10 U	10 U
Fluorene	10 U	10 U	10 U	10 U	10 U	10 U
4-Nitroaniline	25 U	25 U	25 U	25 U	25 U	25 U
4,6-Dinitro-2-methylphenol	25 U	25 U	25 U	25 U	25 U	25 U
N-Nitrosodiphenylamine	10 U	10 U	10 U	10 U	10 U	10 U
4-Bromophenyl phenyl ether	10 U	10 U	10 U	10 U	10 U	10 U
Hexachlorobenzene	10 U	10 U	10 U	10 U	10 U	10 U
Pentachlorophenol	25 U	25 U	25 U	25 U	25 U	25 U
Phenanthrene	10 U	10 U	10 U	10 U	10 U	10 U
Anthracene	10 U	10 U	10 U	10 U	10 U	10 U
Carbazole	10 U	10 U	10 U	10 U	10 U	10 U
Di-n-butyl phthalate	10 U	10 U	10 U	10 U	10 U	10 U
Fluoranthene	10 U	10 U	10 U	10 U	10 U	10 U
Pyrene	10 U	10 U	10 U	10 U	10 U	10 U
Butyl benzyl phthalate	10 U	10 U	10 U	10 U	10 U	10 U
2-Nitrophenol	10 U	10 U	10 U	10 U	10 U	10 U
Benzo(a)anthracene	10 U	10 U	10 U	10 U	10 U	10 U
Chrysene	10 U	10 U	10 U	10 U	10 U	10 U
bis(2-Ethylhexyl) phthalate	10 U	10 U	10 U	10 U	10 U	10 U
Di-n-octyl phthalate	10 U	10 U	10 U	10 U	10 U	10 U
Benzo(b)fluoranthene	10 U	10 U	10 U	10 U	10 U	10 U
Benzo(k)fluoranthene	10 U	10 U	10 U	10 U	10 U	10 U
Benzo(a)pyrene	10 U	10 U	10 U	10 U	10 U	10 U
Indeno(1,2,3-cd)pyrene	10 U	10 U	10 U	10 U	10 U	10 U
Dibenz(a,h)anthracene	10 U	10 U	10 U	10 U	10 U	10 U
Benzo(ghi)perylene	10 U	10 U	10 U	10 U	10 U	10 U

FREQUENCY OF DETECTION SUMMARY
SURFACE WATER - ORGANICS
SITE 10 - ORIGINAL BASE LANDFILL
MCB, CAMP LEJEUNE, NORTH CAROLINA
SITE INVESTIGATION, CTO-0369

SAMPLE ID	IR10-SW01	IR10-SW02	IR10-SW03	IR10-SW04	IR10-SW05	IR10-SW06
SAMPLE DATE	03-21-1998	03-21-1998	03-21-1998	03-21-1998	03-21-1998	03-21-1998
PESTICIDES/PCBS (ug/l)						
alpha-BHC	0.05 U	0.05 U	0.05 U	0.05 U	0.05 UJ	0.05 UJ
beta-BHC	0.05 U	0.05 U	0.05 U	0.05 U	0.05 UJ	0.05 UJ
delta-BHC	0.05 U	0.05 U	0.05 U	0.05 U	0.05 UJ	0.05 UJ
gamma-BHC (Lindane)	0.05 U	0.05 U	0.05 U	0.05 U	0.05 UJ	0.05 UJ
Heptachlor	0.05 U	0.05 U	0.05 U	0.05 U	0.05 UJ	0.05 UJ
Aldrin	0.05 U	0.05 U	0.05 U	0.05 U	0.05 UJ	0.05 UJ
Heptachlor epoxide	0.05 U	0.05 U	0.05 U	0.05 U	0.05 UJ	0.05 UJ
Endosulfan I	0.05 U	0.05 U	0.05 U	0.05 U	0.05 UJ	0.05 UJ
Dieldrin	0.1 U	0.1 U	0.1 U	0.1 U	0.1 UJ	0.1 UJ
4,4'-DDE	0.1 U	0.1 U	0.1 U	0.1 U	0.1 UJ	0.1 UJ
Endrin	0.1 U	0.1 U	0.1 U	0.1 U	0.1 UJ	0.1 UJ
Endosulfan II	0.1 U	0.1 U	0.1 U	0.1 U	0.1 UJ	0.1 UJ
4,4'-DDD	0.1 U	0.1 U	0.1 U	0.1 U	0.1 UJ	0.1 UJ
Endosulfan sulfate	0.1 U	0.1 U	0.1 U	0.1 U	0.1 UJ	0.1 UJ
4,4'-DDT	0.1 U	0.1 U	0.1 U	0.1 U	0.1 UJ	0.1 UJ
Methoxychlor	0.5 UJ	0.5 UJ	0.5 UJ	0.5 UJ	0.5 UJ	0.5 UJ
Endrin ketone	0.1 U	0.1 U	0.1 U	0.1 U	0.1 UJ	0.1 UJ
Endrin aldehyde	0.1 U	0.1 U	0.1 U	0.1 U	0.1 UJ	0.1 UJ
alpha-Chlordane	0.05 U	0.05 U	0.05 U	0.05 U	0.05 UJ	0.05 UJ
gamma-Chlordane	0.05 U	0.05 U	0.05 U	0.05 U	0.05 UJ	0.05 UJ
Toxaphene	5 U	5 U	5 U	5 U	5 UJ	5 UJ
Aroclor 1016	1 U	1 U	1 U	1 U	1 UJ	1 UJ
Aroclor 1221	2 U	2 U	2 U	2 U	2 UJ	2 UJ
Aroclor 1232	1 U	1 U	1 U	1 U	1 UJ	1 UJ
Aroclor 1242	1 U	1 U	1 U	1 U	1 UJ	1 UJ
Aroclor 1248	1 U	1 U	1 U	1 U	1 UJ	1 UJ
Aroclor 1254	1 U	1 U	1 U	1 U	1 UJ	1 UJ
Aroclor 1260	1 U	1 U	1 U	1 U	1 UJ	1 UJ

FREQUENCY OF DETECTION SUMMARY
SURFACE WATER - ORGANICS
SITE 10 - ORIGINAL BASE LANDFILL
MCB, CAMP LEJEUNE, NORTH CAROLINA
SITE INVESTIGATION, CTO-0369

SAMPLE ID SAMPLE DATE	Minimum Non-Detect	Maximum Non-Detect	Minimum Detected	Maximum Detected	Location of Maximum Detect	Frequency of Detection	Arithmatic Mean Positive Detects	Median Positive Detects
VOLATILES (ug/l)								
Chloromethane	10 U	10 U	ND	ND		0/6	--	--
Bromomethane	10 U	10 U	ND	ND		0/6	--	--
Vinyl chloride	10 U	10 U	ND	ND		0/6	--	--
Chloroethane	10 U	10 U	ND	ND		0/6	--	--
Methylene chloride	10 U	10 U	ND	ND		0/6	--	--
Acetone	10 U	10 U	ND	ND		0/6	--	--
Carbon disulfide	10 U	10 U	ND	ND		0/6	--	--
1,1-Dichloroethene	10 U	10 U	ND	ND		0/6	--	--
1,1-Dichloroethane	10 U	10 U	ND	ND		0/6	--	--
1,2-Dichloroethene (total)	10 U	10 U	ND	ND		0/6	--	--
Chloroform	10 U	10 U	ND	ND		0/6	--	--
1,2-Dichloroethane	10 U	10 U	ND	ND		0/6	--	--
2-Butanone	10 U	10 U	ND	ND		0/6	--	--
1,1,1-Trichloroethane	10 U	10 U	ND	ND		0/6	--	--
Carbon tetrachloride	10 U	10 U	ND	ND		0/6	--	--
Bromodichloromethane	10 U	10 U	ND	ND		0/6	--	--
1,2-Dichloropropane	10 U	10 U	ND	ND		0/6	--	--
cis-1,3-Dichloropropene	10 U	10 U	ND	ND		0/6	--	--
Trichloroethene	10 U	10 U	ND	ND		0/6	--	--
Dibromochloromethane	10 U	10 U	ND	ND		0/6	--	--
1,1,2-Trichloroethane	10 U	10 U	ND	ND		0/6	--	--
Benzene	10 U	10 U	ND	ND		0/6	--	--
trans-1,3-Dichloropropene	10 U	10 U	ND	ND		0/6	--	--
Bromoform	10 U	10 U	ND	ND		0/6	--	--
4-Methyl-2-pentanone	10 U	10 U	ND	ND		0/6	--	--
2-Hexanone	10 U	10 U	ND	ND		0/6	--	--
Tetrachloroethene	10 U	10 U	ND	ND		0/6	--	--
1,1,2,2-Tetrachloroethane	10 U	10 U	ND	ND		0/6	--	--
Toluene	10 U	10 U	1.3 J	1.3 J	IR10-SW03,IR10-SW04	2/6	1.3	1.3
Chlorobenzene	10 U	10 U	ND	ND		0/6	--	--
Ethylbenzene	10 U	10 U	ND	ND		0/6	--	--
Styrene	10 U	10 U	ND	ND		0/6	--	--
Xylenes (total)	10 U	10 U	ND	ND		0/6	--	--

FREQUENCY OF DETECTION SUMMARY
SURFACE WATER - ORGANICS
SITE 10 - ORIGINAL BASE LANDFILL
MCB, CAMP LEJEUNE, NORTH CAROLINA
SITE INVESTIGATION, CTO-0369

SAMPLE ID SAMPLE DATE	Minimum Non-Detect	Maximum Non-Detect	Minimum Detected	Maximum Detected	Location of Maximum Detect	Frequency of Detection	Arithmatic Mean Positive Detects	Median Positive Detects
SEMIVOLATILES (ug/l)								
Phenol	10 U	10 U	ND	ND		0/6	--	--
bis(2-Chloroethyl) ether	10 U	10 U	ND	ND		0/6	--	--
2-Chlorophenol	10 U	10 U	ND	ND		0/6	--	--
1,3-Dichlorobenzene	10 U	10 U	ND	ND		0/6	--	--
1,4-Dichlorobenzene	10 U	10 U	ND	ND		0/6	--	--
1,2-Dichlorobenzene	10 U	10 U	ND	ND		0/6	--	--
3,3'-Dichlorobenzidine	10 U	10 U	ND	ND		0/6	--	--
2,2'-Oxybis(1-Chloropropane)	10 U	10 U	ND	ND		0/6	--	--
N-Nitrosodi-n-propylamine	10 U	10 U	ND	ND		0/6	--	--
4-Methylphenol	10 U	10 U	ND	ND		0/6	--	--
Hexachloroethane	10 U	10 U	ND	ND		0/6	--	--
Nitrobenzene	10 U	10 U	ND	ND		0/6	--	--
Isophorone	10 U	10 U	ND	ND		0/6	--	--
2-Nitroaniline	25 U	25 U	ND	ND		0/6	--	--
2,4-Dimethylphenol	10 U	10 U	ND	ND		0/6	--	--
bis(2-Chloroethoxy)methane	10 U	10 U	ND	ND		0/6	--	--
2,4-Dichlorophenol	10 U	10 U	ND	ND		0/6	--	--
1,2,4-Trichlorobenzene	10 U	10 U	ND	ND		0/6	--	--
Naphthalene	10 U	10 U	ND	ND		0/6	--	--
4-Chloroaniline	10 U	10 U	ND	ND		0/6	--	--
Hexachlorobutadiene	10 U	10 U	ND	ND		0/6	--	--
4-Chloro-3-methylphenol	10 U	10 U	ND	ND		0/6	--	--
2-Methylnaphthalene	10 U	10 U	ND	ND		0/6	--	--
Hexachlorocyclopentadiene	10 U	10 U	ND	ND		0/6	--	--
2,4,6-Trichlorophenol	10 U	10 U	ND	ND		0/6	--	--
2,4,5-Trichlorophenol	25 U	25 U	ND	ND		0/6	--	--
2-Chloronaphthalene	10 U	10 U	ND	ND		0/6	--	--
2-Methylphenol	10 U	10 U	ND	ND		0/6	--	--
Dimethyl phthalate	10 U	10 U	ND	ND		0/6	--	--
Acenaphthylene	10 U	10 U	ND	ND		0/6	--	--
2,6-Dinitrotoluene	10 U	10 U	ND	ND		0/6	--	--
3-Nitroaniline	25 U	25 U	ND	ND		0/6	--	--
Acenaphthene	10 U	10 U	ND	ND		0/6	--	--
2,4-Dinitrophenol	25 U	25 U	ND	ND		0/6	--	--

FREQUENCY OF DETECTION SUMMARY
SURFACE WATER - ORGANICS
SITE 10 - ORIGINAL BASE LANDFILL
MCB, CAMP LEJEUNE, NORTH CAROLINA
SITE INVESTIGATION, CTO-0369

SAMPLE ID SAMPLE DATE	Minimum Non-Detect	Maximum Non-Detect	Minimum Detected	Maximum Detected	Location of Maximum Detect	Frequency of Detection	Arithmatic Mean Positive Detects	Median Positive Detects
SEMIVOLATILES (ug/l) (cont)								
4-Nitrophenol	25 U	25 U	ND	ND		0/6	--	--
Dibenzofuran	10 U	10 U	ND	ND		0/6	--	--
2,4-Dinitrotoluene	10 U	10 U	ND	ND		0/6	--	--
Diethyl phthalate	10 U	10 U	ND	ND		0/6	--	--
4-Chlorophenyl phenyl ether	10 U	10 U	ND	ND		0/6	--	--
Fluorene	10 U	10 U	ND	ND		0/6	--	--
4-Nitroaniline	25 U	25 U	ND	ND		0/6	--	--
4,6-Dinitro-2-methylphenol	25 U	25 U	ND	ND		0/6	--	--
N-Nitrosodiphenylamine	10 U	10 U	ND	ND		0/6	--	--
4-Bromophenyl phenyl ether	10 U	10 U	ND	ND		0/6	--	--
Hexachlorobenzene	10 U	10 U	ND	ND		0/6	--	--
Pentachlorophenol	25 U	25 U	ND	ND		0/6	--	--
Phenanthrene	10 U	10 U	ND	ND		0/6	--	--
Anthracene	10 U	10 U	ND	ND		0/6	--	--
Carbazole	10 U	10 U	ND	ND		0/6	--	--
Di-n-butyl phthalate	10 U	10 U	ND	ND		0/6	--	--
Fluoranthene	10 U	10 U	ND	ND		0/6	--	--
Pyrene	10 U	10 U	ND	ND		0/6	--	--
Butyl benzyl phthalate	10 U	10 U	ND	ND		0/6	--	--
2-Nitrophenol	10 U	10 U	ND	ND		0/6	--	--
Benzo(a)anthracene	10 U	10 U	ND	ND		0/6	--	--
Chrysene	10 U	10 U	ND	ND		0/6	--	--
bis(2-Ethylhexyl) phthalate	10 U	10 U	ND	ND		0/6	--	--
Di-n-octyl phthalate	10 U	10 U	ND	ND		0/6	--	--
Benzo(b)fluoranthene	10 U	10 U	ND	ND		0/6	--	--
Benzo(k)fluoranthene	10 U	10 U	ND	ND		0/6	--	--
Benzo(a)pyrene	10 U	10 U	ND	ND		0/6	--	--
Indeno(1,2,3-cd)pyrene	10 U	10 U	ND	ND		0/6	--	--
Dibenz(a,h)anthracene	10 U	10 U	ND	ND		0/6	--	--
Benzo(ghi)perylene	10 U	10 U	ND	ND		0/6	--	--

FREQUENCY OF DETECTION SUMMARY
SURFACE WATER - ORGANICS
SITE 10 - ORIGINAL BASE LANDFILL
MCB, CAMP LEJEUNE, NORTH CAROLINA
SITE INVESTIGATION, CTO-0369

SAMPLE ID SAMPLE DATE	Minimum Non-Detect	Maximum Non-Detect	Minimum Detected	Maximum Detected	Location of Maximum Detect	Frequency of Detection	Arithmatic Mean Positive Detects	Median Positive Detects
PESTICIDES/PCBS (ug/l)								
alpha-BHC	0.05 UJ	0.05 UJ	ND	ND		0/6	--	--
beta-BHC	0.05 UJ	0.05 UJ	ND	ND		0/6	--	--
delta-BHC	0.05 UJ	0.05 UJ	ND	ND		0/6	--	--
gamma-BHC (Lindane)	0.05 UJ	0.05 UJ	ND	ND		0/6	--	--
Heptachlor	0.05 UJ	0.05 UJ	ND	ND		0/6	--	--
Aldrin	0.05 UJ	0.05 UJ	ND	ND		0/6	--	--
Heptachlor epoxide	0.05 UJ	0.05 UJ	ND	ND		0/6	--	--
Endosulfan I	0.05 UJ	0.05 UJ	ND	ND		0/6	--	--
Dieldrin	0.1 UJ	0.1 UJ	ND	ND		0/6	--	--
4,4'-DDE	0.1 UJ	0.1 UJ	ND	ND		0/6	--	--
Endrin	0.1 UJ	0.1 UJ	ND	ND		0/6	--	--
Endosulfan II	0.1 UJ	0.1 UJ	ND	ND		0/6	--	--
4,4'-DDD	0.1 UJ	0.1 UJ	ND	ND		0/6	--	--
Endosulfan sulfate	0.1 UJ	0.1 UJ	ND	ND		0/6	--	--
4,4'-DDT	0.1 UJ	0.1 UJ	ND	ND		0/6	--	--
Methoxychlor	0.5 UJ	0.5 UJ	ND	ND		0/6	--	--
Endrin ketone	0.1 UJ	0.1 UJ	ND	ND		0/6	--	--
Endrin aldehyde	0.1 UJ	0.1 UJ	ND	ND		0/6	--	--
alpha-Chlordane	0.05 UJ	0.05 UJ	ND	ND		0/6	--	--
gamma-Chlordane	0.05 UJ	0.05 UJ	ND	ND		0/6	--	--
Toxaphene	5 UJ	5 UJ	ND	ND		0/6	--	--
Aroclor 1016	1 UJ	1 UJ	ND	ND		0/6	--	--
Aroclor 1221	2 UJ	2 UJ	ND	ND		0/6	--	--
Aroclor 1232	1 UJ	1 UJ	ND	ND		0/6	--	--
Aroclor 1242	1 UJ	1 UJ	ND	ND		0/6	--	--
Aroclor 1248	1 UJ	1 UJ	ND	ND		0/6	--	--
Aroclor 1254	1 UJ	1 UJ	ND	ND		0/6	--	--
Aroclor 1260	1 UJ	1 UJ	ND	ND		0/6	--	--

FREQUENCY OF DETECTION SUMMARY
SURFACE WATER - INORGANIC CONSTITUENTS and CYANIDE
SITE 10 - ORIGINAL BASE LANDFILL
MCB, CAMP LEJEUNE, NORTH CAROLINA
SITE INVESTIGATION, CTO-0369

SAMPLE ID	IR10-SW01	IR10-SW02	IR10-SW03	IR10-SW04	IR10-SW05	IR10-SW06
SAMPLE DATE	03-21-1998	03-21-1998	03-21-1998	03-21-1998	03-21-1998	03-21-1998
METALS (ug/l)						
Aluminum	156 J	171 J	127 J	931	1270	253
Antimony	60 U	60 U	60 U	60 U	60 U	60 U
Arsenic	3.4 J	2.7 J	2.4 J	5 J	10 U	2.6 J
Barium	24 J	24.3 J	25.8 J	37.1 J	8.2 J	4.2 U
Beryllium	5 U	5 U	5 U	5 U	5 U	5 U
Cadmium	5 U	5 U	5 U	5 U	5 U	5 U
Calcium	26700	26900	30500	33200	2470 J	2340 J
Chromium	10 U	3.2 U	10 U	4.3 U	4.7 U	10 U
Cobalt	50 U	50 U	50 U	50 U	50 U	50 U
Copper	2.5 U	3.4 U	3 J	10.7 U	7.8 U	4.9 U
Iron	577	895	424	2210	822	598
Lead	1.5 J	2.3 J	1.1 J	7.1	1.8 J	3 U
Magnesium	2250 J	2270 J	2470 J	2410 J	949 J	1030 J
Manganese	60.9	45.9	153	415	101	92.6
Mercury	0.2 U	0.05 J	0.2 U	0.06 J	0.04 J	0.032 J
Nickel	40 U	40 U	40 U	40 U	40 U	40 U
Potassium	937 J	1010 J	1250 J	1860 J	5000 U	5000 U
Selenium	5 U	5 U	5 U	4 U	5 U	3.1 U
Silver	10 U	10 U	10 U	10 U	10 U	10 U
Sodium	5440	5380	5890	6040	3080 J	3190 J
Thallium	10 U	10 U	10 U	10 U	10 U	10 U
Vanadium	18 J	13.8 J	17.8 J	19.8 J	18 J	12.6 J
Zinc	39.9	45.4	49.7	95.9	52.5	45.3
Cyanide, Total	10 U	10 U	10 U	10 U	10 U	10 U

FREQUENCY OF DETECTION SUMMARY
SURFACE WATER - INORGANIC CONSTITUENTS and CYANIDE
SITE 10 - ORIGINAL BASE LANDFILL
MCB, CAMP LEJEUNE, NORTH CAROLINA
SITE INVESTIGATION, CTO-0369

SAMPLE ID SAMPLE DATE	Minimum Non-Detect	Maximum Non-Detect	Minimum Detected	Maximum Detected	Location of Maximum Detect	Frequency of Detection	Arithmatic Mean Positive Detects	Median Positive Detects
METALS (ug/l)								
Aluminum	ND	ND	127 J	1270	IR10-SW05	6/6	484.67	212.00
Antimony	60 U	60 U	ND	ND		0/6	--	--
Arsenic	10 U	10 U	2.4 J	5 J	IR10-SW04	5/6	3.22	2.70
Barium	4.2 U	4.2 U	8.2 J	37.1 J	IR10-SW04	5/6	23.88	24.30
Beryllium	5 U	5 U	ND	ND		0/6	--	--
Cadmium	5 U	5 U	ND	ND		0/6	--	--
Calcium	ND	ND	2340 J	33200	IR10-SW04	6/6	20351.67	26800.00
Chromium	3.2 U	10 U	ND	ND		0/6	--	--
Cobalt	50 U	50 U	ND	ND		0/6	--	--
Copper	2.5 U	10.7 U	3 J	3 J	IR10-SW03	1/6	3.00	3.00
Iron	ND	ND	424	2210	IR10-SW04	6/6	921.00	710.00
Lead	3 U	3 U	1.1 J	7.1	IR10-SW04	5/6	2.76	1.80
Magnesium	ND	ND	949 J	2470 J	IR10-SW03	6/6	1896.50	2260.00
Manganese	ND	ND	45.9	415	IR10-SW04	6/6	144.73	96.80
Mercury	0.2 U	0.2 U	0.032 J	0.06 J	IR10-SW04	4/6	0.05	0.05
Nickel	40 U	40 U	ND	ND		0/6	--	--
Potassium	5000 U	5000 U	937 J	1860 J	IR10-SW04	4/6	1264.25	1130.00
Selenium	3.1 U	5 U	ND	ND		0/6	--	--
Silver	10 U	10 U	ND	ND		0/6	--	--
Sodium	ND	ND	3080 J	6040	IR10-SW04	6/6	4836.67	5410.00
Thallium	10 U	10 U	ND	ND		0/6	--	--
Vanadium	ND	ND	12.6 J	19.8 J	IR10-SW04	6/6	16.67	17.90
Zinc	ND	ND	39.9	95.9	IR10-SW04	6/6	54.78	47.55
Cyanide, Total	10 U	10 U	ND	ND		0/6	--	--

APPENDIX G.5
SEDIMENT

FREQUENCY OF DETECTION SUMMARY
SEDIMENT - INORGANIC CONSTITUENTS and CYANIDE
SITE 10 - ORIGINAL BASE LANDFILL
MCB, CAMP LEJEUNE, NORTH CAROLINA
SITE INVESTIGATION, CTO-0369

SAMPLE ID	IR10-SD01-06	IR10-SD02-06	IR10-SD03-06	IR10-SD04-06	IR10-SD05-06	IR10-SD06-06
SAMPLE DATE	03-21-1998	03-21-1998	03-21-1998	03-21-1998	03-21-1998	03-21-1998
DEPTH	0 - 6'	0 - 6'	0 - 6'	0 - 6'	0 - 6'	0 - 6'
METALS (mg/kg)						
Aluminum	3040 J	834 J	1100 J	1090 J	3150 J	2960 J
Antimony	17.2 U	16.3 U	16 U	22.1 U	17.2 U	18.6 U
Arsenic	2.9 U	2.7 U	2.7 U	3.7 U	2.9 U	3.1 U
Barium	12.3 J	1.9 J	3.5 J	18.2 J	5.8 J	5.9 J
Beryllium	1.4 U	1.4 U	1.3 U	1.8 U	1.4 U	1.5 U
Cadmium	1.4 U	1.4 U	1.3 U	1.8 U	1.4 U	1.5 U
Calcium	579 J	113 J	262 J	1630 J	200 J	251 J
Chromium	4.2 U	2.2 U	1.9 U	3.1 U	4.1 U	3.7 U
Cobalt	14.3 U	13.6 U	13.3 U	18.4 U	14.3 U	15.5 U
Copper	4 J	2.2 U	1.3 U	3.5 J	2.9 U	2.8 U
Iron	544 J	191 J	225 J	802 J	872 J	1110 J
Lead	8.4	4	4	22.7	4.9	5.4
Magnesium	82 J	29.4 J	48.6 J	118 J	106 J	122 J
Manganese	6.7	1.2 J	2.5 J	4.9 J	5.1	6.7
Mercury	0.14 U	0.14 U	0.06 J	0.18 U	0.047 J	0.15 U
Nickel	11.5 U	10.9 U	10.7 U	14.7 U	11.5 U	12.4 U
Potassium	1430 U	182 J	1330 U	246 J	233 J	1550 U
Selenium	1.4 U	0.76 J	1.3 U	1.8 U	1.4 U	1.5 U
Silver	2.9 U	2.7 U	2.7 U	1.8 U	2.9 U	3.1 U
Sodium	41.2 U	29.5 U	29.6 U	52.6 U	36.4 U	45.5 U
Thallium	2.9 U	2.7 U	2.7 U	1.3 U	2.9 U	3.1 U
Vanadium	14.3 U	13.6 U	13.3 U	18.4 U	3.9 J	3.4 J
Zinc	10	7.8	7.3	12.1	7.2	8.9
Total Cyanide	2.9 U	2.7 U	2.7 U	3.7 U	2.9 U	3.1 U

FREQUENCY OF DETECTION SUMMARY
SEDIMENT - INORGANIC CONSTITUENTS and CYANIDE
SITE 10 - ORIGINAL BASE LANDFILL
MCB, CAMP LEJEUNE, NORTH CAROLINA
SITE INVESTIGATION, CTO-0369

SAMPLE ID SAMPLE DATE DEPTH	Minimum Non-Detect	Maximum Non-Detect	Minimum Detected	Maximum Detected	Location of Maximum Detect	Frequency of Detection	Arithmatic Mean Positive Detects	Median Positive Detects
METALS (mg/kg)								
Aluminum	ND	ND	834 J	3150 J	IR10-SD05-06	6/6	2029	2030
Antimony	16 U	22.1 U	ND	ND		0/6	--	--
Arsenic	2.7 U	3.7 U	ND	ND		0/6	--	--
Barium	ND	ND	1.9 J	18.2 J	IR10-SD04-06	6/6	7.93	5.85
Beryllium	1.3 U	1.8 U	ND	ND		0/6	--	--
Cadmium	1.3 U	1.8 U	ND	ND		0/6	--	--
Calcium	ND	ND	113 J	1630 J	IR10-SD04-06	6/6	505.83	256.5
Chromium	1.9 U	4.2 U	ND	ND		0/6	--	--
Cobalt	13.3 U	18.4 U	ND	ND		0/6	--	--
Copper	1.3 U	2.9 U	3.5 J	4 J	IR10-SD01-06	2/6	3.75	3.75
Iron	ND	ND	191 J	1110 J	IR10-SD06-06	6/6	624	673
Lead	ND	ND	4	22.7	IR10-SD04-06	6/6	8.23	5.15
Magnesium	ND	ND	29.4 J	122 J	IR10-SD06-06	6/6	84.33	94
Manganese	ND	ND	1.2 J	6.7	IR10-SD01-06,IR10-SD06-06	6/6	4.52	5
Mercury	0.14 U	0.18 U	0.047 J	0.06 J	IR10-SD03-06	2/6	0.05	0.05
Nickel	10.7 U	14.7 U	ND	ND		0/6	--	--
Potassium	1330 U	1550 U	182 J	246 J	IR10-SD04-06	3/6	220.33	233
Selenium	1.3 U	1.8 U	0.76 J	0.76 J	IR10-SD02-06	1/6	0.76	0.76
Silver	1.8 U	3.1 U	ND	ND		0/6	--	--
Sodium	29.5 U	52.6 U	ND	ND		0/6	--	--
Thallium	1.3 U	3.1 U	ND	ND		0/6	--	--
Vanadium	13.3 U	18.4 U	3.4 J	3.9 J	IR10-SD05-06	2/6	3.65	3.65
Zinc	ND	ND	7.2	12.1	IR10-SD04-06	6/6	8.88	8.35
Total Cyanide	2.7 U	3.7 U	ND	ND		0/6	--	--

FREQUENCY OF DETECTION SUMMARY
SEDIMENT - ORGANIC COMPOUNDS
SITE 10 - ORIGINAL BASE LANDFILL
MCB, CAMP LEJEUNE, NORTH CAROLINA
SITE INVESTIGATION, CTO-0369

SAMPLE ID	IR10-SD01-06	IR10-SD02-06	IR10-SD03-06	IR10-SD04-06	IR10-SD05-06	IR10-SD06-06
SAMPLE DATE	03-21-1998	03-21-1998	03-21-1998	03-21-1998	03-21-1998	03-21-1998
DEPTH	0 - 6'	0 - 6'	0 - 6'	0 - 6'	0 - 6'	0 - 6'
VOLATILES (ug/kg)						
Chloromethane	14 U	14 U	13 U	18 U	14 U	15 U
Bromomethane	14 U	14 U	13 U	18 U	14 U	15 U
Vinyl chloride	14 U	14 U	13 U	18 U	14 U	15 U
Chloroethane	14 U	14 U	13 U	18 U	14 U	15 U
Methylene chloride	14 U	14 U	13 U	18 U	14 U	15 U
Acetone	180 U	41 U	66 U	1800 U	1800 U	210 U
Carbon disulfide	14 U	14 U	13 U	18 U	14 U	15 U
1,1-Dichloroethene	14 U	14 U	13 U	18 U	14 U	15 U
1,1-Dichloroethane	14 U	14 U	13 U	18 U	14 U	15 U
1,2-Dichloroethene (total)	14 U	14 U	13 U	18 U	14 U	15 U
Chloroform	14 U	14 U	13 U	18 U	14 U	15 U
1,2-Dichloroethane	14 U	14 U	13 U	18 U	14 U	15 U
2-Butanone	52	14 U	13 U	18 U	14 UJ	15 U
1,1,1-Trichloroethane	14 U	14 U	13 U	18 U	14 U	15 U
Carbon tetrachloride	14 U	14 U	13 U	18 U	14 U	15 U
Bromodichloromethane	14 U	14 U	13 U	18 U	14 U	15 U
1,2-Dichloropropane	14 U	14 U	13 U	18 U	14 U	15 U
cis-1,3-Dichloropropene	14 U	14 U	13 U	18 U	14 U	15 U
Trichloroethene	14 U	14 U	13 U	18 U	14 U	15 U
Dibromochloromethane	14 U	14 U	13 U	18 U	14 U	15 U
1,1,2-Trichloroethane	14 U	14 U	13 U	18 U	14 U	15 U
Benzene	14 U	14 U	13 U	18 U	14 U	15 U
trans-1,3-Dichloropropene	14 U	14 U	13 U	18 U	14 U	15 U
Bromoform	14 U	14 U	13 U	18 U	14 U	15 U
4-Methyl-2-pentanone	14 U	14 U	13 U	18 U	14 U	15 U
2-Hexanone	14 U	14 U	13 U	18 U	14 U	15 U
Tetrachloroethene	14 U	14 U	13 U	18 U	14 U	15 U
1,1,2,2-Tetrachloroethane	14 U	14 U	13 U	18 U	14 U	15 U
Toluene	22	16	4.2 J	97	7.4 J	16
Chlorobenzene	14 U	14 U	13 U	18 U	14 U	15 U
Ethylbenzene	14 U	14 U	13 U	18 U	14 U	15 U
Styrene	14 U	14 U	13 U	18 U	14 U	15 U
Xylenes (total)	14 U	14 U	13 U	18 U	14 U	15 U

FREQUENCY OF DETECTION SUMMARY
SEDIMENT - ORGANIC COMPOUNDS
SITE 10 - ORIGINAL BASE LANDFILL
MCB, CAMP LEJEUNE, NORTH CAROLINA
SITE INVESTIGATION, CTO-0369

SAMPLE ID	IR10-SD01-06	IR10-SD02-06	IR10-SD03-06	IR10-SD04-06	IR10-SD05-06	IR10-SD06-06
SAMPLE DATE	03-21-1998	03-21-1998	03-21-1998	03-21-1998	03-21-1998	03-21-1998
DEPTH	0 - 6'	0 - 6'	0 - 6'	0 - 6'	0 - 6'	0 - 6'
SEMIVOLATILES (ug/kg)						
Phenol	470 U	450 U	440 U	610 U	470 U	510 U
bis(2-Chloroethyl) ether	470 U	450 U	440 U	610 U	470 U	510 U
2-Chlorophenol	470 U	450 U	440 U	610 U	470 U	510 U
1,3-Dichlorobenzene	470 U	450 U	440 U	610 U	470 U	510 U
1,4-Dichlorobenzene	470 U	450 U	440 U	610 U	470 U	510 U
1,2-Dichlorobenzene	470 U	450 U	440 U	610 U	470 U	510 U
3,3'-Dichlorobenzidine	470 U	450 U	440 U	610 U	470 U	510 U
2,2'-Oxybis(1-Chloropropane)	470 U	450 U	440 U	610 U	470 U	510 U
N-Nitrosodi-n-propylamine	470 U	450 U	440 U	610 U	470 U	510 U
4-Methylphenol	470 U	450 U	440 U	610 U	470 U	510 U
Hexachloroethane	470 U	450 U	440 U	610 U	470 U	510 U
Nitrobenzene	470 U	450 U	440 U	610 U	470 U	510 U
Isophorone	470 U	450 U	440 U	610 U	470 U	510 U
2-Nitroaniline	1200 U	1100 U	1100 U	1500 U	1200 U	1300 U
2,4-Dimethylphenol	470 U	450 U	440 U	610 U	470 U	510 U
bis(2-Chloroethoxy)methane	470 U	450 U	440 U	610 U	470 U	510 U
2,4-Dichlorophenol	470 U	450 U	440 U	610 U	470 U	510 U
1,2,4-Trichlorobenzene	470 U	450 U	440 U	610 U	470 U	510 U
Naphthalene	470 U	450 U	440 U	610 U	470 U	510 U
4-Chloroaniline	470 U	450 U	440 U	610 U	470 U	510 U
Hexachlorobutadiene	470 U	450 U	440 U	610 U	470 U	510 U
4-Chloro-3-methylphenol	470 U	450 U	440 U	610 U	470 U	510 U
2-Methylnaphthalene	470 U	450 U	440 U	610 U	470 U	510 U
Hexachlorocyclopentadiene	470 U	450 U	440 U	610 U	470 U	510 U
2,4,6-Trichlorophenol	470 U	450 U	440 U	610 U	470 U	510 U
2,4,5-Trichlorophenol	1200 U	1100 U	1100 U	1500 U	1200 U	1300 U
2-Chloronaphthalene	470 U	450 U	440 U	610 U	470 U	510 U
2-Methylphenol	470 U	450 U	440 U	610 U	470 U	510 U
Dimethyl phthalate	470 U	450 U	440 U	610 U	470 U	510 U
Acenaphthylene	470 U	450 U	440 U	610 U	470 U	510 U
2,6-Dinitrotoluene	470 U	450 U	440 U	610 U	470 U	510 U
3-Nitroaniline	1200 U	1100 U	1100 U	1500 U	1200 U	1300 U
Acenaphthene	470 U	450 U	440 U	610 U	470 U	510 U

FREQUENCY OF DETECTION SUMMARY
SEDIMENT - ORGANIC COMPOUNDS
SITE 10 - ORIGINAL BASE LANDFILL
MCB, CAMP LEJEUNE, NORTH CAROLINA
SITE INVESTIGATION, CTO-0369

SAMPLE ID	IR10-SD01-06	IR10-SD02-06	IR10-SD03-06	IR10-SD04-06	IR10-SD05-06	IR10-SD06-06
SAMPLE DATE	03-21-1998	03-21-1998	03-21-1998	03-21-1998	03-21-1998	03-21-1998
DEPTH	0 - 6'	0 - 6'	0 - 6'	0 - 6'	0 - 6'	0 - 6'
SEMIVOLATILES (ug/kg) (cont)						
2,4-Dinitrophenol	1200 U	1100 U	1100 U	1500 U	1200 U	1300 U
4-Nitrophenol	1200 UJ	1100 UJ	1100 UJ	1500 R	1200 R	1300 UJ
Dibenzofuran	470 U	450 U	440 U	610 U	470 U	510 U
2,4-Dinitrotoluene	470 U	450 U	440 U	610 U	470 U	510 U
Diethyl phthalate	470 U	450 U	440 U	610 U	470 U	510 U
4-Chlorophenyl phenyl ether	470 U	450 U	440 U	610 U	470 U	510 U
Fluorene	470 U	450 U	440 U	610 U	470 U	510 U
4-Nitroaniline	1200 U	1100 U	1100 U	1500 U	1200 U	1300 U
4,6-Dinitro-2-methylphenol	1200 U	1100 U	1100 U	1500 U	1200 U	1300 U
N-Nitrosodiphenylamine	470 U	450 U	440 U	610 U	470 U	510 U
4-Bromophenyl phenyl ether	470 U	450 U	440 U	610 U	470 U	510 U
Hexachlorobenzene	470 U	450 U	440 U	610 U	470 U	510 U
Pentachlorophenol	1200 U	1100 U	1100 U	1500 U	1200 U	1300 U
Phenanthrene	470 U	450 U	440 U	610 U	470 U	510 U
Anthracene	470 U	450 U	440 U	610 U	470 U	510 U
Carbazole	470 U	450 U	440 U	610 U	470 U	510 U
Di-n-butyl phthalate	470 U	450 U	440 U	610 U	470 U	510 U
Fluoranthene	470 U	450 U	440 U	610 U	470 U	510 U
Pyrene	470 U	450 U	440 U	610 U	470 U	510 U
Butyl benzyl phthalate	470 U	450 U	440 U	610 U	470 U	510 U
2-Nitrophenol	470 U	450 U	440 U	610 U	470 U	510 U
Benzo(a)anthracene	470 U	450 U	440 U	610 U	470 U	510 U
Chrysene	470 U	450 U	440 U	610 U	470 U	510 U
bis(2-Ethylhexyl) phthalate	470 U	450 U	440 U	610 U	470 U	510 U
Di-n-octyl phthalate	470 U	450 U	440 U	610 U	470 U	510 U
Benzo(b)fluoranthene	470 U	450 U	440 U	610 U	470 U	510 U
Benzo(k)fluoranthene	470 U	450 U	440 U	610 U	470 U	510 U
Benzo(a)pyrene	470 U	450 U	440 U	610 U	470 U	510 U
Indeno(1,2,3-cd)pyrene	470 U	450 U	440 U	610 U	470 U	510 U
Dibenz(a,h)anthracene	470 U	450 U	440 U	610 U	470 U	510 U
Benzo(ghi)perylene	470 U	450 U	440 U	610 U	470 U	510 U

FREQUENCY OF DETECTION SUMMARY
SEDIMENT - ORGANIC COMPOUNDS
SITE 10 - ORIGINAL BASE LANDFILL
MCB, CAMP LEJEUNE, NORTH CAROLINA
SITE INVESTIGATION, CTO-0369

SAMPLE ID	IR10-SD01-06	IR10-SD02-06	IR10-SD03-06	IR10-SD04-06	IR10-SD05-06	IR10-SD06-06
SAMPLE DATE	03-21-1998	03-21-1998	03-21-1998	03-21-1998	03-21-1998	03-21-1998
DEPTH	0 - 6'	0 - 6'	0 - 6'	0 - 6'	0 - 6'	0 - 6'
PESTICIDES/PCBS (ug/kg)						
alpha-BHC	2.4 U	2.3 U	2.3 U	3.1 U	2.4 U	2.6 U
beta-BHC	2.4 U	2.3 U	2.3 U	3.1 U	2.4 U	2.6 U
delta-BHC	2.4 U	2.3 U	2.3 U	3.1 U	2.4 U	2.6 U
gamma-BHC (Lindane)	2.4 U	2.3 U	2.3 U	3.1 U	2.4 U	2.6 U
Heptachlor	2.4 U	2.3 U	2.3 U	3.1 U	2.4 U	2.6 U
Aldrin	2.4 U	2.3 U	2.3 U	3.1 U	2.4 U	2.6 U
Heptachlor epoxide	2.4 U	2.3 U	2.3 U	3.1 U	2.4 U	2.6 U
Endosulfan I	2.4 U	2.3 U	2.3 U	3.1 U	2.4 U	2.6 U
Dieldrin	4.7 U	4.5 U	4.4 U	6.1 U	4.7 U	5.1 U
4,4'-DDE	4.7 U	4.5 U	4.4 U	6.1 U	4.7 U	5.1 U
Endrin	4.7 U	4.5 U	4.4 U	6.1 U	4.7 U	5.1 U
Endosulfan II	4.7 U	4.5 U	4.4 U	6.1 U	4.7 U	5.1 U
4,4'-DDD	4.7 U	4.5 U	4.4 U	6.1 U	4.7 U	5.1 U
Endosulfan sulfate	4.7 U	4.5 U	4.4 U	6.1 U	4.7 U	5.1 U
4,4'-DDT	4.7 U	4.5 U	4.4 U	6.1 U	4 J	4 J
Methoxychlor	24 UJ	23 UJ	23 UJ	31 UJ	24 UJ	26 UJ
Endrin ketone	4.7 U	4.5 U	4.4 U	6.1 U	4.7 U	5.1 U
Endrin aldehyde	4.7 U	4.5 U	4.4 U	6.1 U	4.7 U	3.1 J
alpha-Chlordane	2.4 U	2.3 U	2.3 U	3.1 U	2.4 U	2.6 U
gamma-Chlordane	2.4 U	2.3 U	2.3 U	3.1 U	2.4 U	2.6 U
Toxaphene	240 U	230 U	230 U	310 U	240 U	260 U
Aroclor 1016	47 U	45 U	44 U	61 U	47 U	51 U
Aroclor 1221	96 U	91 U	89 U	120 U	96 U	100 U
Aroclor 1232	47 U	45 U	44 U	61 U	47 U	51 U
Aroclor 1242	47 U	45 U	44 U	61 U	47 U	51 U
Aroclor 1248	47 U	45 U	44 U	61 U	47 U	51 U
Aroclor 1254	47 U	45 U	44 U	61 U	47 U	51 U
Aroclor 1260	47 U	45 U	44 U	61 U	47 U	51 U

FREQUENCY OF DETECTION SUMMARY
SEDIMENT - ORGANIC COMPOUNDS
SITE 10 - ORIGINAL BASE LANDFILL
MCB, CAMP LEJEUNE, NORTH CAROLINA
SITE INVESTIGATION, CTO-0369

SAMPLE ID SAMPLE DATE DEPTH	Minimum Non-Detect	Maximum Non-Detect	Minimum Detected	Maximum Detected	Location of Maximum Detect	Frequency of Detection	Arithmatic Mean Positive Detects	Median Positive Detects
VOLATILES (ug/kg)								
Chloromethane	13 U	18 U	ND	ND		0/6	--	--
Bromomethane	13 U	18 U	ND	ND		0/6	--	--
Vinyl chloride	13 U	18 U	ND	ND		0/6	--	--
Chloroethane	13 U	18 U	ND	ND		0/6	--	--
Methylene chloride	13 U	18 U	ND	ND		0/6	--	--
Acetone	41 U	1800 U	ND	ND		0/6	--	--
Carbon disulfide	13 U	18 U	ND	ND		0/6	--	--
1,1-Dichloroethene	13 U	18 U	ND	ND		0/6	--	--
1,1-Dichloroethane	13 U	18 U	ND	ND		0/6	--	--
1,2-Dichloroethene (total)	13 U	18 U	ND	ND		0/6	--	--
Chloroform	13 U	18 U	ND	ND		0/6	--	--
1,2-Dichloroethane	13 U	18 U	ND	ND		0/6	--	--
2-Butanone	13 U	18 U	52	52	IR10-SD01-06	1/6	52	52
1,1,1-Trichloroethane	13 U	18 U	ND	ND		0/6	--	--
Carbon tetrachloride	13 U	18 U	ND	ND		0/6	--	--
Bromodichloromethane	13 U	18 U	ND	ND		0/6	--	--
1,2-Dichloropropane	13 U	18 U	ND	ND		0/6	--	--
cis-1,3-Dichloropropene	13 U	18 U	ND	ND		0/6	--	--
Trichloroethene	13 U	18 U	ND	ND		0/6	--	--
Dibromochloromethane	13 U	18 U	ND	ND		0/6	--	--
1,1,2-Trichloroethane	13 U	18 U	ND	ND		0/6	--	--
Benzene	13 U	18 U	ND	ND		0/6	--	--
trans-1,3-Dichloropropene	13 U	18 U	ND	ND		0/6	--	--
Bromoform	13 U	18 U	ND	ND		0/6	--	--
4-Methyl-2-pentanone	13 U	18 U	ND	ND		0/6	--	--
2-Hexanone	13 U	18 U	ND	ND		0/6	--	--
Tetrachloroethene	13 U	18 U	ND	ND		0/6	--	--
1,1,2,2-Tetrachloroethane	13 U	18 U	ND	ND		0/6	--	--
Toluene	ND	ND	4.2 J	97	IR10-SD04-06	6/6	27.1	16
Chlorobenzene	13 U	18 U	ND	ND		0/6	--	--
Ethylbenzene	13 U	18 U	ND	ND		0/6	--	--
Styrene	13 U	18 U	ND	ND		0/6	--	--
Xylenes (total)	13 U	18 U	ND	ND		0/6	--	--

FREQUENCY OF DETECTION SUMMARY
SEDIMENT - ORGANIC COMPOUNDS
SITE 10 - ORIGINAL BASE LANDFILL
MCB, CAMP LEJEUNE, NORTH CAROLINA
SITE INVESTIGATION, CTO-0369

SAMPLE ID SAMPLE DATE DEPTH	Minimum Non-Detect	Maximum Non-Detect	Minimum Detected	Maximum Detected	Location of Maximum Detect	Frequency of Detection	Arithmatic Mean Positive Detects	Median Positive Detects
SEMIVOLATILES (ug/kg)								
Phenol	440 U	610 U	ND	ND		0/6	--	--
bis(2-Chloroethyl) ether	440 U	610 U	ND	ND		0/6	--	--
2-Chlorophenol	440 U	610 U	ND	ND		0/6	--	--
1,3-Dichlorobenzene	440 U	610 U	ND	ND		0/6	--	--
1,4-Dichlorobenzene	440 U	610 U	ND	ND		0/6	--	--
1,2-Dichlorobenzene	440 U	610 U	ND	ND		0/6	--	--
3,3'-Dichlorobenzidine	440 U	610 U	ND	ND		0/6	--	--
2,2'-Oxybis(1-Chloropropane)	440 U	610 U	ND	ND		0/6	--	--
N-Nitrosodi-n-propylamine	440 U	610 U	ND	ND		0/6	--	--
4-Methylphenol	440 U	610 U	ND	ND		0/6	--	--
Hexachloroethane	440 U	610 U	ND	ND		0/6	--	--
Nitrobenzene	440 U	610 U	ND	ND		0/6	--	--
Isophorone	440 U	610 U	ND	ND		0/6	--	--
2-Nitroaniline	1100 U	1500 U	ND	ND		0/6	--	--
2,4-Dimethylphenol	440 U	610 U	ND	ND		0/6	--	--
bis(2-Chloroethoxy)methane	440 U	610 U	ND	ND		0/6	--	--
2,4-Dichlorophenol	440 U	610 U	ND	ND		0/6	--	--
1,2,4-Trichlorobenzene	440 U	610 U	ND	ND		0/6	--	--
Naphthalene	440 U	610 U	ND	ND		0/6	--	--
4-Chloroaniline	440 U	610 U	ND	ND		0/6	--	--
Hexachlorobutadiene	440 U	610 U	ND	ND		0/6	--	--
4-Chloro-3-methylphenol	440 U	610 U	ND	ND		0/6	--	--
2-Methylnaphthalene	440 U	610 U	ND	ND		0/6	--	--
Hexachlorocyclopentadiene	440 U	610 U	ND	ND		0/6	--	--
2,4,6-Trichlorophenol	440 U	610 U	ND	ND		0/6	--	--
2,4,5-Trichlorophenol	1100 U	1500 U	ND	ND		0/6	--	--
2-Chloronaphthalene	440 U	610 U	ND	ND		0/6	--	--
2-Methylphenol	440 U	610 U	ND	ND		0/6	--	--
Dimethyl phthalate	440 U	610 U	ND	ND		0/6	--	--
Acenaphthylene	440 U	610 U	ND	ND		0/6	--	--
2,6-Dinitrotoluene	440 U	610 U	ND	ND		0/6	--	--
3-Nitroaniline	1100 U	1500 U	ND	ND		0/6	--	--
Acenaphthene	440 U	610 U	ND	ND		0/6	--	--

FREQUENCY OF DETECTION SUMMARY
SEDIMENT - ORGANIC COMPOUNDS
SITE 10 - ORIGINAL BASE LANDFILL
MCB, CAMP LEJEUNE, NORTH CAROLINA
SITE INVESTIGATION, CTO-0369

SAMPLE ID SAMPLE DATE DEPTH	Minimum Non-Detect	Maximum Non-Detect	Minimum Detected	Maximum Detected	Location of Maximum Detect	Frequency of Detection	Arithmatic Mean Positive Detects	Median Positive Detects
SEMIVOLATILES (ug/kg) (cont)								
2,4-Dinitrophenol	1100 U	1500 U	ND	ND		0/6	--	--
4-Nitrophenol	1100 UJ	1300 UJ	ND	ND		0/4	--	--
Dibenzofuran	440 U	610 U	ND	ND		0/6	--	--
2,4-Dinitrotoluene	440 U	610 U	ND	ND		0/6	--	--
Diethyl phthalate	440 U	610 U	ND	ND		0/6	--	--
4-Chlorophenyl phenyl ether	440 U	610 U	ND	ND		0/6	--	--
Fluorene	440 U	610 U	ND	ND		0/6	--	--
4-Nitroaniline	1100 U	1500 U	ND	ND		0/6	--	--
4,6-Dinitro-2-methylphenol	1100 U	1500 U	ND	ND		0/6	--	--
N-Nitrosodiphenylamine	440 U	610 U	ND	ND		0/6	--	--
4-Bromophenyl phenyl ether	440 U	610 U	ND	ND		0/6	--	--
Hexachlorobenzene	440 U	610 U	ND	ND		0/6	--	--
Pentachlorophenol	1100 U	1500 U	ND	ND		0/6	--	--
Phenanthrene	440 U	610 U	ND	ND		0/6	--	--
Anthracene	440 U	610 U	ND	ND		0/6	--	--
Carbazole	440 U	610 U	ND	ND		0/6	--	--
Di-n-butyl phthalate	440 U	610 U	ND	ND		0/6	--	--
Fluoranthene	440 U	610 U	ND	ND		0/6	--	--
Pyrene	440 U	610 U	ND	ND		0/6	--	--
Butyl benzyl phthalate	440 U	610 U	ND	ND		0/6	--	--
2-Nitrophenol	440 U	610 U	ND	ND		0/6	--	--
Benzo(a)anthracene	440 U	610 U	ND	ND		0/6	--	--
Chrysene	440 U	610 U	ND	ND		0/6	--	--
bis(2-Ethylhexyl) phthalate	440 U	610 U	ND	ND		0/6	--	--
Di-n-octyl phthalate	440 U	610 U	ND	ND		0/6	--	--
Benzo(b)fluoranthene	440 U	610 U	ND	ND		0/6	--	--
Benzo(k)fluoranthene	440 U	610 U	ND	ND		0/6	--	--
Benzo(a)pyrene	440 U	610 U	ND	ND		0/6	--	--
Indeno(1,2,3-cd)pyrene	440 U	610 U	ND	ND		0/6	--	--
Dibenz(a,h)anthracene	440 U	610 U	ND	ND		0/6	--	--
Benzo(ghi)perylene	440 U	610 U	ND	ND		0/6	--	--

FREQUENCY OF DETECTION SUMMARY
SEDIMENT - ORGANIC COMPOUNDS
SITE 10 - ORIGINAL BASE LANDFILL
MCB, CAMP LEJEUNE, NORTH CAROLINA
SITE INVESTIGATION, CTO-0369

SAMPLE ID SAMPLE DATE DEPTH	Minimum Non-Detect	Maximum Non-Detect	Minimum Detected	Maximum Detected	Location of Maximum Detect	Frequency of Detection	Arithmatic Mean Positive Detects	Median Positive Detects
PESTICIDES/PCBS (ug/kg)								
alpha-BHC	2.3 U	3.1 U	ND	ND		0/6	--	--
beta-BHC	2.3 U	3.1 U	ND	ND		0/6	--	--
delta-BHC	2.3 U	3.1 U	ND	ND		0/6	--	--
gamma-BHC (Lindane)	2.3 U	3.1 U	ND	ND		0/6	--	--
Heptachlor	2.3 U	3.1 U	ND	ND		0/6	--	--
Aldrin	2.3 U	3.1 U	ND	ND		0/6	--	--
Heptachlor epoxide	2.3 U	3.1 U	ND	ND		0/6	--	--
Endosulfan I	2.3 U	3.1 U	ND	ND		0/6	--	--
Dieldrin	4.4 U	6.1 U	ND	ND		0/6	--	--
4,4'-DDE	4.4 U	6.1 U	ND	ND		0/6	--	--
Endrin	4.4 U	6.1 U	ND	ND		0/6	--	--
Endosulfan II	4.4 U	6.1 U	ND	ND		0/6	--	--
4,4'-DDD	4.4 U	6.1 U	ND	ND		0/6	--	--
Endosulfan sulfate	4.4 U	6.1 U	ND	ND		0/6	--	--
4,4'-DDT	4.4 U	6.1 U	4 J	4 J	IR10-SD05-06,IR10-SD06-06	2/6	4	4
Methoxychlor	23 UJ	31 UJ	ND	ND		0/6	--	--
Endrin ketone	4.4 U	6.1 U	ND	ND		0/6	--	--
Endrin aldehyde	4.4 U	6.1 U	3.1 J	3.1 J	IR10-SD06-06	1/6	3.1	3.1
alpha-Chlordane	2.3 U	3.1 U	ND	ND		0/6	--	--
gamma-Chlordane	2.3 U	3.1 U	ND	ND		0/6	--	--
Toxaphene	230 U	310 U	ND	ND		0/6	--	--
Aroclor 1016	44 U	61 U	ND	ND		0/6	--	--
Aroclor 1221	89 U	120 U	ND	ND		0/6	--	--
Aroclor 1232	44 U	61 U	ND	ND		0/6	--	--
Aroclor 1242	44 U	61 U	ND	ND		0/6	--	--
Aroclor 1248	44 U	61 U	ND	ND		0/6	--	--
Aroclor 1254	44 U	61 U	ND	ND		0/6	--	--
Aroclor 1260	44 U	61 U	ND	ND		0/6	--	--

APPENDIX H
QA/QC SAMPLING RESULTS

APPENDIX H.1
FIELD BLANKS RESULTS

TRIP BLANKS
ORGANIC COMPOUNDS
SITE 10 - ORIGINAL BASE LANDFILL
MCB, CAMP LEJEUNE, NORTH CAROLINA
SITE INVESTIGATION, CTO-0369

SAMPLE ID	IR10-TB01	IR10-TB02	IR10-TB03	IR10-TB04	IR10-TB05	IR10-TB06	IR10-TB07	IR10-TB08
SAMPLE DATE	03-18-1998	03-18-1998	03-18-1998	03-20-1998	03-20-1998	03-20-1998	03-23-1998	03-23-1998
VOLATILES (ug/l)								
Chloromethane	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Bromomethane	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Vinyl chloride	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Chloroethane	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Methylene chloride	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Acetone	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Carbon disulfide	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
1,1-Dichloroethene	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
1,1-Dichloroethane	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
1,2-Dichloroethene (total)	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Chloroform	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
1,2-Dichloroethane	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
2-Butanone	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
1,1,1-Trichloroethane	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Carbon tetrachloride	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Bromodichloromethane	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
1,2-Dichloropropane	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
cis-1,3-Dichloropropene	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Trichloroethene	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Dibromochloromethane	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
1,1,2-Trichloroethane	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Benzene	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
trans-1,3-Dichloropropene	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Bromoform	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
4-Methyl-2-pentanone	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
2-Hexanone	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Tetrachloroethene	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
1,1,2,2-Tetrachloroethane	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Toluene	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Chlorobenzene	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Ethylbenzene	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Styrene	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Xylenes (total)	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U

FIELD BLANKS
ORGANIC COMPOUNDS
SITE 10 - ORIGINAL BASE LANDFILL
MCB, CAMP LEJEUNE, NORTH CAROLINA
SITE INVESTIGATION, CTO-0369

SAMPLE ID	IR10-FB01	IR10-FB02
SAMPLE DATE	03-20-1998	03-20-1998
VOLATILES (ug/l)		
Chloromethane	10 U	10 U
Bromomethane	10 U	10 U
Vinyl chloride	10 U	10 U
Chloroethane	10 U	10 U
Methylene chloride	10 U	10 U
Acetone	10 U	110
Carbon disulfide	10 U	10 U
1,1-Dichloroethene	10 U	10 U
1,1-Dichloroethane	10 U	10 U
1,2-Dichloroethene (total)	10 U	10 U
Chloroform	4.7 J	10 U
1,2-Dichloroethane	10 U	10 U
2-Butanone	10 U	10 U
1,1,1-Trichloroethane	10 U	10 U
Carbon tetrachloride	10 U	10 U
Bromodichloromethane	1.5 J	10 U
1,2-Dichloropropane	10 U	10 U
cis-1,3-Dichloropropene	10 U	10 U
Trichloroethene	10 U	10 U
Dibromochloromethane	10 U	10 U
1,1,2-Trichloroethane	10 U	10 U
Benzene	10 U	10 U
trans-1,3-Dichloropropene	10 U	10 U
Bromoform	10 U	10 U
4-Methyl-2-pentanone	10 U	10 U
2-Hexanone	10 U	10 U
Tetrachloroethene	10 U	10 U
1,1,2,2-Tetrachloroethane	10 U	10 U
Toluene	10 U	10 U
Chlorobenzene	10 U	10 U
Ethylbenzene	10 U	10 U
Styrene	10 U	10 U
Xylenes (total)	10 U	10 U

FIELD BLANKS
ORGANIC COMPOUNDS
SITE 10 - ORIGINAL BASE LANDFILL
MCB, CAMP LEJEUNE, NORTH CAROLINA
SITE INVESTIGATION, CTO-0369

SAMPLE ID	IR10-FB01	IR10-FB02
SAMPLE DATE	03-20-1998	03-20-1998
SEMIVOLATILES (ug/l)		
Phenol	10 U	84
bis(2-Chloroethyl) ether	10 U	10 U
2-Chlorophenol	10 U	10 U
1,3-Dichlorobenzene	10 U	10 U
1,4-Dichlorobenzene	10 U	10 U
1,2-Dichlorobenzene	10 U	10 U
3,3'-Dichlorobenzidine	10 U	10 U
2,2'-Oxybis(1-Chloropropane)	10 U	10 U
N-Nitrosodi-n-propylamine	10 U	10 U
4-Methylphenol	10 U	2.6 J
Hexachloroethane	10 U	10 U
Nitrobenzene	10 U	10 U
Isophorone	10 U	10 U
2-Nitroaniline	25 U	25 U
2,4-Dimethylphenol	10 U	10 U
bis(2-Chloroethoxy)methane	10 U	10 U
2,4-Dichlorophenol	10 U	10 U
1,2,4-Trichlorobenzene	10 U	10 U
Naphthalene	10 U	10 U
4-Chloroaniline	10 U	10 U
Hexachlorobutadiene	10 U	10 U
4-Chloro-3-methylphenol	10 U	10 U
2-Methylnaphthalene	10 U	10 U
Hexachlorocyclopentadiene	10 U	10 U
2,4,6-Trichlorophenol	10 U	10 U
2,4,5-Trichlorophenol	25 U	25 U
2-Chloronaphthalene	10 U	10 U
2-Methylphenol	10 U	1.1 J
Dimethyl phthalate	10 U	54
Acenaphthylene	10 U	10 U
2,6-Dinitrotoluene	10 U	10 U
3-Nitroaniline	25 U	25 U
Acenaphthene	10 U	10 U
2,4-Dinitrophenol	25 U	25 U

FIELD BLANKS
ORGANIC COMPOUNDS
SITE 10 - ORIGINAL BASE LANDFILL
MCB, CAMP LEJEUNE, NORTH CAROLINA
SITE INVESTIGATION, CTO-0369

SAMPLE ID	IR10-FB01	IR10-FB02
SAMPLE DATE	03-20-1998	03-20-1998
SEMIVOLATILES (ug/l) (cont)		
4-Nitrophenol	25 U	25 U
Dibenzofuran	10 U	10 U
2,4-Dinitrotoluene	10 U	10 U
Diethyl phthalate	10 U	1.6 J
4-Chlorophenyl phenyl ether	10 U	10 U
Fluorene	10 U	10 U
4-Nitroaniline	25 U	25 U
4,6-Dinitro-2-methylphenol	25 U	25 U
N-Nitrosodiphenylamine	10 U	10 U
4-Bromophenyl phenyl ether	10 U	10 U
Hexachlorobenzene	10 U	10 U
Pentachlorophenol	25 U	25 U
Phenanthrene	10 U	10 U
Anthracene	10 U	10 U
Carbazole	10 U	10 U
Di-n-butyl phthalate	10 U	10 U
Fluoranthene	10 U	10 U
Pyrene	10 U	10 U
Butyl benzyl phthalate	10 U	10 U
2-Nitrophenol	10 U	10 U
Benzo(a)anthracene	10 U	10 U
Chrysene	10 U	10 U
bis(2-Ethylhexyl) phthalate	2.5 J	10 U
Di-n-octyl phthalate	10 U	10 U
Benzo(b)fluoranthene	10 U	10 U
Benzo(k)fluoranthene	10 U	10 U
Benzo(a)pyrene	10 U	10 U
Indeno(1,2,3-cd)pyrene	10 U	10 U
Dibenz(a,h)anthracene	10 U	10 U
Benzo(ghi)perylene	10 U	10 U

FIELD BLANKS
ORGANIC COMPOUNDS
SITE 10 - ORIGINAL BASE LANDFILL
MCB, CAMP LEJEUNE, NORTH CAROLINA
SITE INVESTIGATION, CTO-0369

SAMPLE ID	IR10-FB01	IR10-FB02
SAMPLE DATE	03-20-1998	03-20-1998
PESTICIDES/PCBS (ug/l)		
alpha-BHC	0.05 U	0.05 U
beta-BHC	0.05 U	0.05 U
delta-BHC	0.05 U	0.05 U
gamma-BHC (Lindane)	0.05 U	0.05 U
Heptachlor	0.05 U	0.05 U
Aldrin	0.05 U	0.05 U
Heptachlor epoxide	0.05 U	0.05 U
Endosulfan I	0.05 U	0.05 U
Dieldrin	0.1 U	0.1 U
4,4'-DDE	0.1 U	0.1 U
Endrin	0.1 U	0.1 U
Endosulfan II	0.1 U	0.1 U
4,4'-DDD	0.1 U	0.1 U
Endosulfan sulfate	0.1 U	0.1 U
4,4'-DDT	0.1 U	0.1 U
Methoxychlor	0.5 UJ	0.5 UJ
Endrin ketone	0.1 U	0.1 U
Endrin aldehyde	0.1 U	0.1 U
alpha-Chlordane	0.05 U	0.05 U
gamma-Chlordane	0.05 U	0.05 U
Toxaphene	5 U	5 U
Aroclor 1016	1 U	1 U
Aroclor 1221	2 U	2 U
Aroclor 1232	1 U	1 U
Aroclor 1242	1 U	1 U
Aroclor 1248	1 U	1 U
Aroclor 1254	1 U	1 U
Aroclor 1260	1 U	1 U

FIELD BLANKS
TOTAL INORGANIC CONSTITUENTS and CYANIDE
SITE 10 - ORIGINAL BASE LANDFILL
MCB, CAMP LEJEUNE, NORTH CAROLINA
SITE INVESTIGATION, CTO-0369

SAMPLE ID	IR10-FB01	IR10-FB02
SAMPLE DATE	03-20-1998	03-20-1998
METALS (ug/l)		
Aluminum	129 J	200 U
Antimony	60 U	60 U
Arsenic	10 U	10 U
Barium	11 J	200 U
Beryllium	5 U	5 U
Cadmium	5 U	5 U
Calcium	21700	115 U
Chromium	10 U	10 U
Cobalt	50 U	50 U
Copper	16.5 U	25 U
Iron	161	38.5 U
Lead	1.5 J	3 U
Magnesium	2500 J	5000 U
Manganese	5.4 J	15 U
Mercury	0.2 U	0.2 U
Nickel	40 U	40 U
Potassium	854 J	5000 U
Selenium	3.6 U	3.2 U
Silver	10 U	10 U
Sodium	9900	52.6 U
Thallium	6.5 U	3.4 U
Vanadium	11.6 J	50 U
Zinc	32.5	7.3 U
Cyanide, Total	10 U	10 U

RINSATE BLANKS
ORGANIC COMPOUNDS
SITE 10 - ORIGINAL BASE LANDFILL
MCB, CAMP LEJEUNE, NORTH CAROLINA
SITE INVESTIGATION, CTO-0369

SAMPLE ID	IR10-ER01	IR10-ER02	IR10-ER03
SAMPLE DATE	03-18-1998	03-19-1998	03-21-1998
VOLATILES (ug/l)			
Chloromethane	10 U	10 U	10 U
Bromomethane	10 U	10 U	10 U
Vinyl chloride	10 U	10 U	10 U
Chloroethane	10 U	10 U	10 U
Methylene chloride	10 U	10 U	10 U
Acetone	10 U	10 U	10 U
Carbon disulfide	10 U	10 U	10 U
1,1-Dichloroethene	10 U	10 U	10 U
1,1-Dichloroethane	10 U	10 U	10 U
1,2-Dichloroethene (total)	10 U	10 U	10 U
Chloroform	10 U	10 U	10 U
1,2-Dichloroethane	10 U	10 U	10 U
2-Butanone	10 U	10 U	10 U
1,1,1-Trichloroethane	10 U	10 U	10 U
Carbon tetrachloride	10 U	10 U	10 U
Bromodichloromethane	10 U	10 U	10 U
1,2-Dichloropropane	10 U	10 U	10 U
cis-1,3-Dichloropropene	10 U	10 U	10 U
Trichloroethene	10 U	10 U	10 U
Dibromochloromethane	10 U	10 U	10 U
1,1,2-Trichloroethane	10 U	10 U	10 U
Benzene	10 U	10 U	10 U
trans-1,3-Dichloropropene	10 U	10 U	10 U
Bromoform	10 U	10 U	10 U
4-Methyl-2-pentanone	10 U	10 U	10 U
2-Hexanone	10 U	10 U	10 U
Tetrachloroethene	10 U	10 U	10 U
1,1,2,2-Tetrachloroethane	10 U	10 U	10 U
Toluene	10 U	10 U	10 U
Chlorobenzene	10 U	10 U	10 U
Ethylbenzene	10 U	10 U	10 U
Styrene	10 U	10 U	10 U
Xylenes (total)	10 U	10 U	10 U

RINSATE BLANKS
ORGANIC COMPOUNDS
SITE 10 - ORIGINAL BASE LANDFILL
MCB, CAMP LEJEUNE, NORTH CAROLINA
SITE INVESTIGATION, CTO-0369

SAMPLE ID	IR10-ER01	IR10-ER02	IR10-ER03
SAMPLE DATE	03-18-1998	03-19-1998	03-21-1998
SEMIVOLATILES (ug/l)			
Phenol	10 U	10 U	10 U
bis(2-Chloroethyl) ether	10 U	10 U	10 U
2-Chlorophenol	10 U	10 U	10 U
1,3-Dichlorobenzene	10 U	10 U	10 U
1,4-Dichlorobenzene	10 U	10 U	10 U
1,2-Dichlorobenzene	10 U	10 U	10 U
3,3'-Dichlorobenzidine	10 U	10 U	10 U
2,2'-Oxybis(1-Chloropropane)	10 U	10 U	10 U
N-Nitrosodi-n-propylamine	10 U	10 U	10 U
4-Methylphenol	10 U	10 U	10 U
Hexachloroethane	10 U	10 U	10 U
Nitrobenzene	10 U	10 U	10 U
Isophorone	10 U	10 U	10 U
2-Nitroaniline	25 U	25 U	25 U
2,4-Dimethylphenol	10 U	10 U	10 U
bis(2-Chloroethoxy)methane	10 U	10 U	10 U
2,4-Dichlorophenol	10 U	10 U	10 U
1,2,4-Trichlorobenzene	10 U	10 U	10 U
Naphthalene	10 U	10 U	10 U
4-Chloroaniline	10 U	10 U	10 U
Hexachlorobutadiene	10 U	10 U	10 U
4-Chloro-3-methylphenol	10 U	10 U	10 U
2-Methylnaphthalene	10 U	10 U	10 U
Hexachlorocyclopentadiene	10 U	10 U	10 U
2,4,6-Trichlorophenol	10 U	10 U	10 U
2,4,5-Trichlorophenol	25 U	25 U	25 U
2-Chloronaphthalene	10 U	10 U	10 U
2-Methylphenol	10 U	10 U	10 U
Dimethyl phthalate	10 U	10 U	10 U
Acenaphthylene	10 U	10 U	10 U
2,6-Dinitrotoluene	10 U	10 U	10 U
3-Nitroaniline	25 U	25 U	25 U
Acenaphthene	10 U	10 U	10 U

RINSATE BLANKS
ORGANIC COMPOUNDS
SITE 10 - ORIGINAL BASE LANDFILL
MCB, CAMP LEJEUNE, NORTH CAROLINA
SITE INVESTIGATION, CTO-0369

SAMPLE ID	IR10-ER01	IR10-ER02	IR10-ER03
SAMPLE DATE	03-18-1998	03-19-1998	03-21-1998
SEMIVOLATILES (ug/l) (cont)			
2,4-Dinitrophenol	25 U	25 U	25 U
4-Nitrophenol	25 U	25 U	25 U
Dibenzofuran	10 U	10 U	10 U
2,4-Dinitrotoluene	10 U	10 U	10 U
Diethyl phthalate	10 U	10 U	10 U
4-Chlorophenyl phenyl ether	10 U	10 U	10 U
Fluorene	10 U	10 U	10 U
4-Nitroaniline	25 U	25 U	25 U
4,6-Dinitro-2-methylphenol	25 U	25 U	25 U
N-Nitrosodiphenylamine	10 U	10 U	10 U
4-Bromophenyl phenyl ether	10 U	10 U	10 U
Hexachlorobenzene	10 U	10 U	10 U
Pentachlorophenol	25 U	25 U	25 U
Phenanthrene	10 U	10 U	10 U
Anthracene	10 U	10 U	10 U
Carbazole	10 U	10 U	10 U
Di-n-butyl phthalate	10 U	10 U	10 U
Fluoranthene	10 U	10 U	10 U
Pyrene	10 U	10 U	10 U
Butyl benzyl phthalate	10 U	10 U	10 U
2-Nitrophenol	10 U	10 U	10 U
Benzo(a)anthracene	10 U	10 U	10 U
Chrysene	10 U	10 U	10 U
bis(2-Ethylhexyl) phthalate	10 U	10 U	10 U
Di-n-octyl phthalate	10 U	10 U	10 U
Benzo(b)fluoranthene	10 U	10 U	10 U
Benzo(k)fluoranthene	10 U	10 U	10 U
Benzo(a)pyrene	10 U	10 U	10 U
Indeno(1,2,3-cd)pyrene	10 U	10 U	10 U
Dibenz(a,h)anthracene	10 U	10 U	10 U
Benzo(ghi)perylene	10 U	10 U	10 U

RINSATE BLANKS
ORGANIC COMPOUNDS
SITE 10 - ORIGINAL BASE LANDFILL
MCB, CAMP LEJEUNE, NORTH CAROLINA
SITE INVESTIGATION, CTO-0369

SAMPLE ID	IR10-ER01	IR10-ER02	IR10-ER03
SAMPLE DATE	03-18-1998	03-19-1998	03-21-1998
PESTICIDES/PCBS (ug/l)			
alpha-BHC	0.05 U	0.05 U	0.05 U
beta-BHC	0.05 U	0.05 U	0.05 U
delta-BHC	0.05 U	0.05 U	0.05 U
gamma-BHC (Lindane)	0.05 U	0.05 U	0.05 U
Heptachlor	0.05 U	0.05 U	0.05 U
Aldrin	0.05 U	0.05 U	0.05 U
Heptachlor epoxide	0.05 U	0.05 U	0.05 U
Endosulfan I	0.05 U	0.05 U	0.05 U
Dieldrin	0.1 U	0.1 U	0.1 U
4,4'-DDE	0.1 U	0.1 U	0.1 U
Endrin	0.1 U	0.1 U	0.1 U
Endosulfan II	0.1 U	0.1 U	0.1 U
4,4'-DDD	0.1 U	0.1 U	0.1 U
Endosulfan sulfate	0.1 U	0.1 U	0.1 U
4,4'-DDT	0.1 U	0.1 U	0.1 U
Methoxychlor	0.5 UJ	0.5 UJ	0.5 UJ
Endrin ketone	0.1 U	0.1 U	0.1 U
Endrin aldehyde	0.1 U	0.1 U	0.1 U
alpha-Chlordane	0.05 U	0.05 U	0.05 U
gamma-Chlordane	0.05 U	0.05 U	0.05 U
Toxaphene	5 U	5 U	5 U
Aroclor 1016	1 U	1 U	1 U
Aroclor 1221	2 U	2 U	2 U
Aroclor 1232	1 U	1 U	1 U
Aroclor 1242	1 U	1 U	1 U
Aroclor 1248	1 U	1 U	1 U
Aroclor 1254	1 U	1 U	1 U
Aroclor 1260	1 U	1 U	1 U

RINSATE BLANKS
TOTAL INORGANIC CONSTITUENTS and CYANIDE
SITE 10 - ORIGINAL BASE LANDFILL
MCB, CAMP LEJEUNE, NORTH CAROLINA
SITE INVESTIGATION, CTO-0369

SAMPLE ID	IR10-ER01	IR10-ER02	IR10-ER03
SAMPLE DATE	03-18-1998	03-19-1998	03-21-1998
METALS (ug/l)			
Aluminum	27.7 U	25.6 U	42.5 U
Antimony	60 U	60 U	25.4 U
Arsenic	10 U	2.4 J	10 U
Barium	1.1 U	1.3 U	200 U
Beryllium	5 U	5 U	5 U
Cadmium	5 U	5 U	5 U
Calcium	127 U	164 U	84.8 U
Chromium	10 U	10 U	4 U
Cobalt	50 U	50 U	50 U
Copper	2.4 U	1.7 U	4.1 U
Iron	60.6 U	166	69.5 U
Lead	3 U	3 U	3 U
Magnesium	5000 U	5000 U	5000 U
Manganese	15 U	1.8 J	15 U
Mercury	0.2 UJ	0.2 U	0.2 U
Nickel	40 U	40 U	40 U
Potassium	5000 U	5000 U	5000 U
Selenium	5 U	5 U	5 U
Silver	10 U	10 U	4.1 J
Sodium	56.5 U	58.5 U	149 J
Thallium	10 U	10 U	10 U
Vanadium	7.9 J	11.7 J	50 U
Zinc	14.8 U	23.2 U	10.8 U
Cyanide, Total	10 U	10 U	10 U

APPENDIX H.2
FIELD DUPLICATE RESULTS

FIELD DUPLICATE SUMMARY
SURFACE SOIL - ORGANIC COMPOUNDS
SITE 10 - ORIGINAL BASE LANDFILL
MCB, CAMP LEJEUNE, NORTH CAROLINA
SITE INVESTIGATION, CTO-0369

SAMPLE ID	IR10-SB05-00D	IR10-SB09-00D	IR10-SB16-00D	IR10-SB18-00D	IR10-SB22-00D	IR10-SB23-00D
SAMPLE DATE	03-18-1998	03-18-1998	03-18-1998	03-19-1998	03-19-1998	03-19-1998
DEPTH	0 - 1'	0 - 1'	0 - 1'	0 - 1'	0 - 1'	0 - 1'
VOLATILES (ug/kg)						
Chloromethane	11 U	11 U	12 U	12 U	11 U	11 U
Bromomethane	11 U	11 U	12 U	12 U	11 U	11 U
Vinyl chloride	11 U	11 U	12 U	12 U	11 U	11 U
Chloroethane	11 U	11 U	12 U	12 U	11 U	11 U
Methylene chloride	11 U	11 U	12 U	12 U	11 U	11 U
Acetone	11 U	11 U	12 U	12 U	11 U	11 U
Carbon disulfide	11 U	11 U	12 U	12 U	11 U	11 U
1,1-Dichloroethene	1.4 J	11 U	12 U	12 U	11 U	11 U
1,1-Dichloroethane	11 U	11 U	12 U	12 U	11 U	11 U
1,2-Dichloroethene (total)	11 U	11 U	12 U	12 U	11 U	11 U
Chloroform	11 U	11 U	12 U	12 U	11 U	11 U
1,2-Dichloroethane	11 U	11 U	12 U	12 U	11 U	11 U
2-Butanone	11 U	11 U	12 U	12 U	11 U	11 U
1,1,1-Trichloroethane	11 U	11 U	12 U	12 U	11 U	11 U
Carbon tetrachloride	11 U	11 U	12 U	12 U	11 U	11 U
Bromodichloromethane	11 U	11 U	12 U	12 U	11 U	11 U
1,2-Dichloropropane	11 U	11 U	12 U	12 U	11 U	11 U
cis-1,3-Dichloropropene	11 U	11 U	12 U	12 U	11 U	11 U
Trichloroethene	1.2 J	11 U	12 U	12 U	11 U	11 U
Dibromochloromethane	11 U	11 U	12 U	12 U	11 U	11 U
1,1,2-Trichloroethane	11 U	11 U	12 U	12 U	11 U	11 U
Benzene	1.2 J	11 U	12 U	12 U	11 U	11 U
trans-1,3-Dichloropropene	11 U	11 U	12 U	12 U	11 U	11 U
Bromoform	11 U	11 U	12 U	12 U	11 U	11 U
4-Methyl-2-pentanone	11 U	11 U	12 U	12 U	11 U	11 U
2-Hexanone	11 U	11 U	12 U	12 U	11 U	11 U
Tetrachloroethene	11 U	11 U	12 U	12 U	11 U	11 U
1,1,2,2-Tetrachloroethane	11 U	11 U	12 U	12 U	11 U	11 U
Toluene	1.9 J	11 U	12 U	1.4 J	2.2 J	2.7 J
Chlorobenzene	1.2 J	11 U	12 U	12 U	11 U	11 U
Ethylbenzene	11 U	11 U	12 U	12 U	11 U	11 U
Styrene	11 U	11 U	12 U	12 U	11 U	11 U
Xylenes (total)	11 U	11 U	12 U	12 U	11 U	11 U

FIELD DUPLICATE SUMMARY
SURFACE SOIL - ORGANIC COMPOUNDS
SITE 10 - ORIGINAL BASE LANDFILL
MCB, CAMP LEJEUNE, NORTH CAROLINA
SITE INVESTIGATION, CTO-0369

SAMPLE ID	IR10-SB05-00D	IR10-SB09-00D	IR10-SB16-00D	IR10-SB18-00D	IR10-SB22-00D	IR10-SB23-00D
SAMPLE DATE	03-18-1998	03-18-1998	03-18-1998	03-19-1998	03-19-1998	03-19-1998
DEPTH	0 - 1'	0 - 1'	0 - 1'	0 - 1'	0 - 1'	0 - 1'
SEMIVOLATILES (ug/kg)						
Phenol	360 U	370 U	400 U	400 U	370 U	360 U
bis(2-Chloroethyl) ether	360 U	370 U	400 U	400 U	370 U	360 U
2-Chlorophenol	360 U	370 U	400 U	400 U	370 U	360 U
1,3-Dichlorobenzene	360 U	370 U	400 U	400 U	370 U	360 U
1,4-Dichlorobenzene	360 U	370 U	400 U	400 U	370 U	360 U
1,2-Dichlorobenzene	360 U	370 U	400 U	400 U	370 U	360 U
3,3'-Dichlorobenzidine	360 U	370 U	400 U	400 U	370 U	360 U
2,2'-Oxybis(1-Chloropropane)	360 U	370 U	400 U	400 U	370 U	360 U
N-Nitrosodi-n-propylamine	360 U	370 U	400 U	400 U	370 U	360 U
4-Methylphenol	360 U	370 U	400 U	400 U	370 U	360 U
Hexachloroethane	360 U	370 U	400 U	400 U	370 U	360 U
Nitrobenzene	360 U	370 U	400 U	400 U	370 U	360 U
Isophorone	360 U	370 U	400 U	400 U	370 U	360 U
2-Nitroaniline	910 U	930 U	1000 U	1000 U	940 U	900 U
2,4-Dimethylphenol	360 U	370 U	400 U	400 U	370 U	360 U
bis(2-Chloroethoxy)methane	360 U	370 U	400 U	400 U	370 U	360 U
2,4-Dichlorophenol	360 U	370 U	400 U	400 U	370 U	360 U
1,2,4-Trichlorobenzene	360 U	370 U	400 U	400 U	370 U	360 U
Naphthalene	360 U	370 U	400 U	400 U	370 U	360 U
4-Chloroaniline	360 U	370 U	400 U	400 U	370 U	360 U
Hexachlorobutadiene	360 U	370 U	400 U	400 U	370 U	360 U
4-Chloro-3-methylphenol	360 U	370 U	400 U	400 U	370 U	360 U
2-Methylnaphthalene	360 U	370 U	400 U	400 U	370 U	360 U
Hexachlorocyclopentadiene	360 U	370 U	400 U	400 U	370 U	360 U
2,4,6-Trichlorophenol	360 U	370 U	400 U	400 U	370 U	360 U
2,4,5-Trichlorophenol	910 U	930 U	1000 U	1000 U	940 U	900 U
2-Chloronaphthalene	360 U	370 U	400 U	400 U	370 U	360 U
2-Methylphenol	360 U	370 U	400 U	400 U	370 U	360 U
Dimethyl phthalate	360 U	370 U	400 U	400 U	370 U	360 U
Acenaphthylene	360 U	370 U	400 U	400 U	370 U	360 U
2,6-Dinitrotoluene	360 U	370 U	400 U	400 U	370 U	360 U
3-Nitroaniline	910 U	930 U	1000 U	1000 U	940 U	900 U
Acenaphthene	360 U	370 U	400 U	400 U	370 U	360 U

FIELD DUPLICATE SUMMARY
SURFACE SOIL - ORGANIC COMPOUNDS
SITE 10 - ORIGINAL BASE LANDFILL
MCB, CAMP LEJEUNE, NORTH CAROLINA
SITE INVESTIGATION, CTO-0369

SAMPLE ID	IR10-SB05-00D	IR10-SB09-00D	IR10-SB16-00D	IR10-SB18-00D	IR10-SB22-00D	IR10-SB23-00D
SAMPLE DATE	03-18-1998	03-18-1998	03-18-1998	03-19-1998	03-19-1998	03-19-1998
DEPTH	0 - 1'	0 - 1'	0 - 1'	0 - 1'	0 - 1'	0 - 1'
SEMIVOLATILES (ug/kg) (cont)						
2,4-Dinitrophenol	910 U	930 U	1000 U	1000 U	940 U	900 U
4-Nitrophenol	910 U	930 U	1000 U	1000 U	940 U	900 U
Dibenzofuran	360 U	370 U	400 U	400 U	370 U	360 U
2,4-Dinitrotoluene	360 U	370 U	400 U	400 U	370 U	360 U
Diethyl phthalate	360 U	370 U	400 U	400 U	370 U	360 U
4-Chlorophenyl phenyl ether	360 U	370 U	400 U	400 U	370 U	360 U
Fluorene	360 U	370 U	400 U	400 U	370 U	360 U
4-Nitroaniline	910 U	930 U	1000 U	1000 U	940 U	900 U
4,6-Dinitro-2-methylphenol	910 U	930 U	1000 U	1000 U	940 U	900 U
N-Nitrosodiphenylamine	360 U	370 U	400 U	400 U	370 U	360 U
4-Bromophenyl phenyl ether	360 U	370 U	400 U	400 U	370 U	360 U
Hexachlorobenzene	360 U	370 U	400 U	400 U	370 U	360 U
Pentachlorophenol	910 U	930 U	1000 U	1000 U	940 U	900 U
Phenanthrene	120 J	370 U	400 U	130 J	370 U	360 U
Anthracene	360 U	370 U	400 U	41 J	370 U	360 U
Carbazole	360 U	370 U	400 U	400 U	370 U	360 U
Di-n-butyl phthalate	52 J	370 U	62 J	400 U	370 U	360 U
Fluoranthene	180 J	370 U	400 U	310 J	370 U	360 U
Pyrene	150 J	370 U	400 U	280 J	370 U	360 U
Butyl benzyl phthalate	360 U	370 U	400 U	400 U	370 U	360 U
2-Nitrophenol	360 U	370 U	400 U	400 U	370 U	360 U
Benzo(a)anthracene	89 J	370 U	400 U	180 J	370 U	360 U
Chrysene	92 J	370 U	400 U	180 J	370 U	360 U
bis(2-Ethylhexyl) phthalate	360 U	370 U	400 U	400 U	370 U	360 U
Di-n-octyl phthalate	360 U	370 U	400 U	400 U	370 U	360 U
Benzo(b)fluoranthene	84 J	370 U	400 U	150 J	370 U	360 U
Benzo(k)fluoranthene	97 J	370 U	400 U	190 J	370 U	360 U
Benzo(a)pyrene	84 J	370 U	400 U	170 J	370 U	360 U
Indeno(1,2,3-cd)pyrene	59 J	370 U	400 U	100 J	370 U	360 U
Dibenz(a,h)anthracene	360 U	370 U	400 U	41 J	370 U	360 U
Benzo(ghi)perylene	360 U	370 U	400 U	77 J	370 U	360 U

FIELD DUPLICATE SUMMARY
SURFACE SOIL - ORGANIC COMPOUNDS
SITE 10 - ORIGINAL BASE LANDFILL
MCB, CAMP LEJEUNE, NORTH CAROLINA
SITE INVESTIGATION, CTO-0369

SAMPLE ID	IR10-SB05-00D	IR10-SB09-00D	IR10-SB16-00D	IR10-SB18-00D	IR10-SB22-00D	IR10-SB23-00D
SAMPLE DATE	03-18-1998	03-18-1998	03-18-1998	03-19-1998	03-19-1998	03-19-1998
DEPTH	0 - 1'	0 - 1'	0 - 1'	0 - 1'	0 - 1'	0 - 1'
PESTICIDES/PCBS (ug/kg)						
alpha-BHC	1.9 U	1.9 U	2.1 U	2.1 U	1.9 U	1.8 U
beta-BHC	1.9 U	1.9 U	2.1 UJ	2.1 U	1.9 UJ	1.8 U
delta-BHC	1.9 U	1.9 U	2.1 U	2.1 U	1.9 U	1.8 U
gamma-BHC (Lindane)	1.9 U	1.9 U	2.1 U	2.1 U	1.9 U	1.8 U
Heptachlor	1.9 U	1.9 U	2.1 U	2.1 U	1.9 U	1.8 U
Aldrin	1.9 U	1.9 U	2.1 U	2.1 U	1.9 U	1.8 U
Heptachlor epoxide	1.9 U	1.9 U	2.1 U	2.1 U	1.9 U	1.8 U
Endosulfan I	1.9 U	1.9 U	2.1 U	2.1 U	1.9 U	1.8 U
Dieldrin	3.6 U	3.7 U	4 U	4 U	3.7 U	3.6 U
4,4'-DDE	3.6 U	3.7 U	4 U	4 U	3.7 U	4.6
Endrin	3.6 U	3.7 U	4 U	4 U	3.7 U	3.6 U
Endosulfan II	3.6 U	3.7 U	4 U	4 U	3.7 U	3.6 U
4,4'-DDD	3.6 U	3.7 U	4 U	4 U	3.7 U	4.3 J
Endosulfan sulfate	3.6 U	3.7 U	4 U	4 U	3.7 U	3.6 U
4,4'-DDT	3.6 U	3.7 U	4 U	4 U	3.6 NJ	6.4 J
Methoxychlor	19 UJ	19 UJ	21 UJ	21 UJ	19 UJ	18 UJ
Endrin ketone	3.6 U	3.7 U	4 U	4 U	3.7 U	3.6 U
Endrin aldehyde	3.6 U	3.7 U	4 U	4 U	3.7 U	3.6 U
alpha-Chlordane	1.9 U	2.4 J	2.1 U	2.1 U	1.9 U	1.8 U
gamma-Chlordane	1.9 U	1.9 U	2.1 U	2.1 U	1.9 U	1.1 J
Toxaphene	190 U	190 U	210 U	210 U	190 U	180 U
Aroclor 1016	36 U	37 U	40 U	40 U	37 U	36 U
Aroclor 1221	74 U	75 U	81 U	81 U	76 U	73 U
Aroclor 1232	36 U	37 U	40 U	40 U	37 U	36 U
Aroclor 1242	36 U	37 U	40 U	40 U	37 U	36 U
Aroclor 1248	36 U	37 U	40 U	40 U	37 U	36 U
Aroclor 1254	36 U	37 U	40 U	40 U	37 U	36 U
Aroclor 1260	36 U	37 U	40 U	40 U	37 U	36 U

FIELD DUPLICATE SUMMARY
SURFACE SOIL - TOTAL INORGANIC CONSTITUENTS and CYANIDE
SITE 10 - ORIGINAL BASE LANDFILL
MCB, CAMP LEJEUNE, NORTH CAROLINA
SITE INVESTIGATION, CTO-0369

SAMPLE ID	IR10-SB05-00D	IR10-SB09-00D	IR10-SB16-00D	IR10-SB18-00D	IR10-SB22-00D	IR10-SB23-00D
SAMPLE DATE	03-18-1998	03-18-1998	03-18-1998	03-19-1998	03-19-1998	03-19-1998
DEPTH	0 - 1'	0 - 1'	0 - 1'	0 - 1'	0 - 1'	0 - 1'
TOTAL METALS (mg/kg)						
Aluminum	2040	3160	1210 J	3250 J	460 J	112 J
Antimony	13.2 U	13.5 U	14.5 U	14.5 U	13.5 U	13 U
Arsenic	2.2 U	2.2 U	2.4 U	1.1 U	0.69 U	2.2 U
Barium	6.6 J	6.5 J	3.9 J	10.5 J	3.1 J	1.6 J
Beryllium	1.1 U	1.1 U	1.2 U	1.2 U	1.1 U	1.1 U
Cadmium	1.1 U	1.1 U	1.2 U	1.2 U	1.1 U	1.1 U
Calcium	415 J	232 J	95.7 J	838 J	140 J	79.6 J
Chromium	2.3	3.8	1.5 J	4 J	1.1 J	0.87 J
Cobalt	11 U	11.2 U	12.1 U	12.1 U	11.3 U	10.8 U
Copper	1.5 J	2.7 J	0.73 J	3.3 J	0.88 J	1.2 J
Iron	822	1360	420 J	2120 J	399 J	101 J
Lead	6.3	10.2	4	12.5	3.6	1.7
Magnesium	76.1 J	85.2 J	35.8 J	118 J	29 J	13 J
Manganese	5.4	5	5.3	15.5 J	6.7	3.1 J
Nickel	8.8 U	9 U	9.7 U	2.6 J	0.11 U	8.7 U
Potassium	150 J	281 J	1210 U	1210 U	9 U	1080 U
Selenium	1.1 U	1.1 U	1.2 U	0.82 J	1130 U	1.1 U
Silver	2.2 U	2.2 U	2.4 U	2.4 U	0.76 J	2.2 U
Sodium	22.3 J	38.1 J	17.9 J	42.5 J	2.3 U	11.5 J
Thallium	2.2 U	2.2 U	2.4 U	0.73 U	22.1 J	2.2 U
Vanadium	11 U	1.8 U	12.1 U	7.9 J	2.3 U	3.6 J
Zinc	6.5	5.6	4.3 J	26.5 J	4.3 J	6 J
Mercury	0.029 J	0.037 J	0.029 J	0.12 U	6.2 J	0.11 U
Total Cyanide	2.2 U	2.2 U	2.4 U	2.4 U	2.3 U	2.2 U

FIELD DUPLICATE SUMMARY
SEDIMENT - ORGANIC COMPOUNDS
SITE 10 - ORIGINAL BASE LANDFILL
MCB, CAMP LEJEUNE, NORTH CAROLINA
SITE INVESTIGATION, CTO-0369

SAMPLE ID	IR10-SD05-06D
SAMPLE DATE	03-21-1998
DEPTH	0 - 6'
VOLATILES (ug/kg)	
Chloromethane	14 U
Bromomethane	14 U
Vinyl chloride	14 U
Chloroethane	14 U
Methylene chloride	14 U
Acetone	1300 U
Carbon disulfide	14 U
1,1-Dichloroethene	14 U
1,1-Dichloroethane	14 U
1,2-Dichloroethene (total)	14 U
Chloroform	14 U
1,2-Dichloroethane	14 U
2-Butanone	26 J
1,1,1-Trichloroethane	14 U
Carbon tetrachloride	14 U
Bromodichloromethane	14 U
1,2-Dichloropropane	14 U
cis-1,3-Dichloropropene	14 U
Trichloroethene	14 U
Dibromochloromethane	14 U
1,1,2-Trichloroethane	14 U
Benzene	14 U
trans-1,3-Dichloropropene	14 U
Bromoform	14 U
4-Methyl-2-pentanone	14 UJ
2-Hexanone	14 UJ
Tetrachloroethene	14 UJ
1,1,2,2-Tetrachloroethane	14 UJ
Toluene	47 J
Chlorobenzene	14 UJ
Ethylbenzene	14 UJ
Styrene	14 UJ
Xylenes (total)	14 UJ

FIELD DUPLICATE SUMMARY
SEDIMENT - ORGANIC COMPOUNDS
SITE 10 - ORIGINAL BASE LANDFILL
MCB, CAMP LEJEUNE, NORTH CAROLINA
SITE INVESTIGATION, CTO-0369

SAMPLE ID	IR10-SD05-06D
SAMPLE DATE	03-21-1998
DEPTH	0 - 6'
SEMIVOLATILES (ug/kg)	
Phenol	460 U
bis(2-Chloroethyl) ether	460 U
2-Chlorophenol	460 U
1,3-Dichlorobenzene	460 U
1,4-Dichlorobenzene	460 U
1,2-Dichlorobenzene	460 U
3,3'-Dichlorobenzidine	460 U
2,2'-Oxybis(1-Chloropropane)	460 U
N-Nitrosodi-n-propylamine	460 U
4-Methylphenol	460 U
Hexachloroethane	460 U
Nitrobenzene	460 U
Isophorone	460 U
2-Nitroaniline	1200 U
2,4-Dimethylphenol	460 U
bis(2-Chloroethoxy)methane	460 U
2,4-Dichlorophenol	460 U
1,2,4-Trichlorobenzene	460 U
Naphthalene	460 U
4-Chloroaniline	460 U
Hexachlorobutadiene	460 U
4-Chloro-3-methylphenol	460 U
2-Methylnaphthalene	460 U
Hexachlorocyclopentadiene	460 U
2,4,6-Trichlorophenol	460 U
2,4,5-Trichlorophenol	1200 U
2-Chloronaphthalene	460 U
2-Methylphenol	460 U
Dimethyl phthalate	460 U
Acenaphthylene	460 U
2,6-Dinitrotoluene	460 U
3-Nitroaniline	1200 U
Acenaphthene	460 U

FIELD DUPLICATE SUMMARY
SEDIMENT - ORGANIC COMPOUNDS
SITE 10 - ORIGINAL BASE LANDFILL
MCB, CAMP LEJEUNE, NORTH CAROLINA
SITE INVESTIGATION, CTO-0369

SAMPLE ID	IR10-SD05-06D
SAMPLE DATE	03-21-1998
DEPTH	0 - 6'
SEMIVOLATILES (ug/kg) (cont)	
2,4-Dinitrophenol	1200 U
4-Nitrophenol	1200 R
Dibenzofuran	460 U
2,4-Dinitrotoluene	460 U
Diethyl phthalate	460 U
4-Chlorophenyl phenyl ether	460 U
Fluorene	460 U
4-Nitroaniline	1200 U
4,6-Dinitro-2-methylphenol	1200 U
N-Nitrosodiphenylamine	460 U
4-Bromophenyl phenyl ether	460 U
Hexachlorobenzene	460 U
Pentachlorophenol	1200 U
Phenanthrene	460 U
Anthracene	460 U
Carbazole	460 U
Di-n-butyl phthalate	460 U
Fluoranthene	460 U
Pyrene	460 U
Butyl benzyl phthalate	460 U
2-Nitrophenol	460 U
Benzo(a)anthracene	460 U
Chrysene	460 U
bis(2-Ethylhexyl) phthalate	460 U
Di-n-octyl phthalate	460 U
Benzo(b)fluoranthene	460 U
Benzo(k)fluoranthene	460 U
Benzo(a)pyrene	460 U
Indeno(1,2,3-cd)pyrene	460 U
Dibenz(a,h)anthracene	460 U
Benzo(ghi)perylene	460 U

FIELD DUPLICATE SUMMARY
SEDIMENT - ORGANIC COMPOUNDS
SITE 10 - ORIGINAL BASE LANDFILL
MCB, CAMP LEJEUNE, NORTH CAROLINA
SITE INVESTIGATION, CTO-0369

SAMPLE ID	IR10-SD05-06D
SAMPLE DATE	03-21-1998
DEPTH	0 - 6'
PESTICIDES/PCBS (ug/kg)	
alpha-BHC	2.4 U
beta-BHC	2.4 U
delta-BHC	2.4 U
gamma-BHC (Lindane)	2.4 U
Heptachlor	2.4 U
Aldrin	2.4 U
Heptachlor epoxide	2.4 U
Endosulfan I	2.4 U
Dieldrin	4.6 U
4,4'-DDE	4.6 U
Endrin	4.6 U
Endosulfan II	4.6 U
4,4'-DDD	4.6 U
Endosulfan sulfate	4.6 U
4,4'-DDT	4.6 U
Methoxychlor	24 UJ
Endrin ketone	4.6 U
Endrin aldehyde	4.6 U
alpha-Chlordane	2.4 U
gamma-Chlordane	2.4 U
Toxaphene	240 U
Aroclor 1016	46 U
Aroclor 1221	94 U
Aroclor 1232	46 U
Aroclor 1242	46 U
Aroclor 1248	46 U
Aroclor 1254	46 U
Aroclor 1260	46 U

FIELD DUPLICATE SUMMARY
SEDIMENT - TOTAL INORGANIC CONSTITUENTS and CYANIDE
SITE 10 - ORIGINAL BASE LANDFILL
MCB, CAMP LEJEUNE, NORTH CAROLINA
SITE INVESTIGATION, CTO-0369

SAMPLE ID	IR10-SD05-06D
SAMPLE DATE	03-21-1998
DEPTH	0 - 6'
METALS (mg/kg)	
Aluminum	6170 J
Antimony	16.8 U
Arsenic	0.6 J
Barium	10.7 J
Beryllium	1.4 U
Cadmium	1.4 U
Calcium	182 J
Chromium	8.2
Cobalt	1.4 J
Copper	5 J
Iron	1890 J
Lead	9.9
Magnesium	204 J
Manganese	6.7
Nickel	11.2 U
Potassium	433 J
Selenium	1.4 U
Silver	1.3 U
Sodium	36.3 U
Thallium	2.8 U
Vanadium	9 J
Zinc	13
Mercury	0.14 U
Total Cyanide	2.8 U

FIELD DUPLICATE SUMMARY
GROUNDWATER - ORGANIC COMPOUNDS
SITE 10 - ORIGINAL BASE LANDFILL
MCB, CAMP LEJEUNE, NORTH CAROLINA
SITE INVESTIGATION, CTO-0369

SAMPLE ID	IR10-TW07-98AD
SAMPLE DATE	03-23-1998
VOLATILES (ug/l)	
Chloromethane	10 U
Bromomethane	10 U
Vinyl chloride	10 U
Chloroethane	10 U
Methylene chloride	10 U
Acetone	10 U
Carbon disulfide	10 U
1,1-Dichloroethene	10 U
1,1-Dichloroethane	10 U
1,2-Dichloroethene (total)	10 U
Chloroform	10 U
1,2-Dichloroethane	10 U
2-Butanone	10 U
1,1,1-Trichloroethane	10 U
Carbon tetrachloride	10 U
Bromodichloromethane	10 U
1,2-Dichloropropane	10 U
cis-1,3-Dichloropropene	10 U
Trichloroethene	10 U
Dibromochloromethane	10 U
1,1,2-Trichloroethane	10 U
Benzene	10 U
trans-1,3-Dichloropropene	10 U
Bromoform	10 U
4-Methyl-2-pentanone	10 U
2-Hexanone	10 U
Tetrachloroethene	10 U
1,1,2,2-Tetrachloroethane	10 U
Toluene	10 U
Chlorobenzene	10 U
Ethylbenzene	10 U
Styrene	10 U
Xylenes (total)	10 U

FIELD DUPLICATE SUMMARY
GROUNDWATER - ORGANIC COMPOUNDS
SITE 10 - ORIGINAL BASE LANDFILL
MCB, CAMP LEJEUNE, NORTH CAROLINA
SITE INVESTIGATION, CTO-0369

SAMPLE ID	IR10-TW07-98AD
SAMPLE DATE	03-23-1998
SEMIVOLATILES (ug/l)	
Phenol	10 U
bis(2-Chloroethyl) ether	10 U
2-Chlorophenol	10 U
1,3-Dichlorobenzene	10 U
1,4-Dichlorobenzene	10 U
1,2-Dichlorobenzene	10 U
3,3'-Dichlorobenzidine	10 U
2,2'-Oxybis(1-Chloropropane)	10 U
N-Nitrosodi-n-propylamine	10 U
4-Methylphenol	10 U
Hexachloroethane	10 U
Nitrobenzene	10 U
Isophorone	10 U
2-Nitroaniline	25 U
2,4-Dimethylphenol	10 U
bis(2-Chloroethoxy)methane	10 U
2,4-Dichlorophenol	10 U
1,2,4-Trichlorobenzene	10 U
Naphthalene	10 U
4-Chloroaniline	10 U
Hexachlorobutadiene	10 U
4-Chloro-3-methylphenol	10 U
2-Methylnaphthalene	10 U
Hexachlorocyclopentadiene	10 U
2,4,6-Trichlorophenol	10 U
2,4,5-Trichlorophenol	25 U
2-Chloronaphthalene	10 U
2-Methylphenol	10 U
Dimethyl phthalate	10 U
Acenaphthylene	10 U
2,6-Dinitrotoluene	10 U
3-Nitroaniline	25 U
Acenaphthene	10 U
2,4-Dinitrophenol	25 U

FIELD DUPLICATE SUMMARY
GROUNDWATER - ORGANIC COMPOUNDS
SITE 10 - ORIGINAL BASE LANDFILL
MCB, CAMP LEJEUNE, NORTH CAROLINA
SITE INVESTIGATION, CTO-0369

SAMPLE ID	IR10-TW07-98AD
SAMPLE DATE	03-23-1998

SEMIVOLATILES (ug/l) (cont)

4-Nitrophenol	25 UJ
Dibenzofuran	10 U
2,4-Dinitrotoluene	10 U
Diethyl phthalate	10 U
4-Chlorophenyl phenyl ether	10 U
Fluorene	10 U
4-Nitroaniline	25 U
4,6-Dinitro-2-methylphenol	25 U
N-Nitrosodiphenylamine	10 U
4-Bromophenyl phenyl ether	10 U
Hexachlorobenzene	10 U
Pentachlorophenol	25 U
Phenanthrene	10 U
Anthracene	10 U
Carbazole	10 U
Di-n-butyl phthalate	10 U
Fluoranthene	10 U
Pyrene	10 U
Butyl benzyl phthalate	10 U
2-Nitrophenol	10 U
Benzo(a)anthracene	10 U
Chrysene	10 U
bis(2-Ethylhexyl) phthalate	10 U
Di-n-octyl phthalate	10 U
Benzo(b)fluoranthene	10 U
Benzo(k)fluoranthene	10 U
Benzo(a)pyrene	10 U
Indeno(1,2,3-cd)pyrene	10 U
Dibenz(a,h)anthracene	10 U
Benzo(ghi)perylene	10 U

FIELD DUPLICATE SUMMARY
GROUNDWATER - ORGANIC COMPOUNDS
SITE 10 - ORIGINAL BASE LANDFILL
MCB, CAMP LEJEUNE, NORTH CAROLINA
SITE INVESTIGATION, CTO-0369

SAMPLE ID	IR10-TW07-98AD
SAMPLE DATE	03-23-1998
PESTICIDES/PCBS (ug/l)	
alpha-BHC	0.05 U
beta-BHC	0.05 U
delta-BHC	0.05 U
gamma-BHC (Lindane)	0.05 U
Heptachlor	0.05 U
Aldrin	0.05 U
Heptachlor epoxide	0.05 U
Endosulfan I	0.05 U
Dieldrin	0.1 U
4,4'-DDE	0.1 U
Endrin	0.1 U
Endosulfan II	0.1 U
4,4'-DDD	0.1 U
Endosulfan sulfate	0.1 U
4,4'-DDT	0.1 U
Methoxychlor	0.5 UJ
Endrin ketone	0.1 U
Endrin aldehyde	0.1 U
alpha-Chlordane	0.05 U
gamma-Chlordane	0.05 U
Toxaphene	5 U
Aroclor 1016	1 U
Aroclor 1221	2 U
Aroclor 1232	1 U
Aroclor 1242	1 U
Aroclor 1248	1 U
Aroclor 1254	1 U
Aroclor 1260	1 U

FIELD DUPLICATE SUMMARY
GROUNDWATER - TOTAL INORGANIC CONSTITUENTS and CYANIDE
SITE 10 - ORIGINAL BASE LANDFILL
MCB, CAMP LEJEUNE, NORTH CAROLINA
SITE INVESTIGATION, CTO-0369

SAMPLE ID	IR10-TW07-98AD	
SAMPLE DATE	03-23-1998	
METALS (ug/l)		
Aluminum	8920	J
Antimony	60	U
Arsenic	36	
Barium	75.2	J
Beryllium	5	U
Cadmium	5	U
Calcium	2260	J
Chromium	28.3	
Cobalt	4.2	J
Copper	9.1	U
Iron	20100	
Lead	17.3	
Magnesium	3570	J
Manganese	61.7	
Mercury	0.061	J
Nickel	40	U
Potassium	1900	J
Selenium	5	U
Silver	4.5	J
Sodium	8320	
Thallium	10	U
Vanadium	108	
Zinc	16.4	U
Cyanide, Total	10	U

FIELD DUPLICATE SUMMARY
SURFACE WATER - ORGANIC COMPOUNDS
SITE 10 - ORIGINAL BASE LANDFILL
MCB, CAMP LEJEUNE, NORTH CAROLINA
SITE INVESTIGATION, CTO-0369

SAMPLE ID	IR10-SW05D
SAMPLE DATE	03-21-1998
VOLATILES (ug/l)	
Chloromethane	10 U
Bromomethane	10 U
Vinyl chloride	10 U
Chloroethane	10 U
Methylene chloride	10 U
Acetone	10 U
Carbon disulfide	10 U
1,1-Dichloroethene	10 U
1,1-Dichloroethane	10 U
1,2-Dichloroethene (total)	10 U
Chloroform	10 U
1,2-Dichloroethane	10 U
2-Butanone	10 U
1,1,1-Trichloroethane	10 U
Carbon tetrachloride	10 U
Bromodichloromethane	10 U
1,2-Dichloropropane	10 U
cis-1,3-Dichloropropene	10 U
Trichloroethene	10 U
Dibromochloromethane	10 U
1,1,2-Trichloroethane	10 U
Benzene	10 U
trans-1,3-Dichloropropene	10 U
Bromoform	10 U
4-Methyl-2-pentanone	10 U
2-Hexanone	10 U
Tetrachloroethene	10 U
1,1,2,2-Tetrachloroethane	10 U
Toluene	10 U
Chlorobenzene	10 U
Ethylbenzene	10 U
Styrene	10 U
Xylenes (total)	10 U

FIELD DUPLICATE SUMMARY
SURFACE WATER - ORGANIC COMPOUNDS
SITE 10 - ORIGINAL BASE LANDFILL
MCB, CAMP LEJEUNE, NORTH CAROLINA
SITE INVESTIGATION, CTO-0369

SAMPLE ID	IR10-SW05D
SAMPLE DATE	03-21-1998
SEMIVOLATILES (ug/l)	
Phenol	10 U
bis(2-Chloroethyl) ether	10 U
2-Chlorophenol	10 U
1,3-Dichlorobenzene	10 U
1,4-Dichlorobenzene	10 U
1,2-Dichlorobenzene	10 U
3,3'-Dichlorobenzidine	10 U
2,2'-Oxybis(1-Chloropropane)	10 U
N-Nitrosodi-n-propylamine	10 U
4-Methylphenol	10 U
Hexachloroethane	10 U
Nitrobenzene	10 U
Isophorone	10 U
2-Nitroaniline	25 U
2,4-Dimethylphenol	10 U
bis(2-Chloroethoxy)methane	10 U
2,4-Dichlorophenol	10 U
1,2,4-Trichlorobenzene	10 U
Naphthalene	10 U
4-Chloroaniline	10 U
Hexachlorobutadiene	10 U
4-Chloro-3-methylphenol	10 U
2-Methylnaphthalene	10 U
Hexachlorocyclopentadiene	10 U
2,4,6-Trichlorophenol	10 U
2,4,5-Trichlorophenol	25 U
2-Chloronaphthalene	10 U
2-Methylphenol	10 U
Dimethyl phthalate	10 U
Acenaphthylene	10 U
2,6-Dinitrotoluene	10 U
3-Nitroaniline	25 U
Acenaphthene	10 U
2,4-Dinitrophenol	25 U

FIELD DUPLICATE SUMMARY
SURFACE WATER - ORGANIC COMPOUNDS
SITE 10 - ORIGINAL BASE LANDFILL
MCB, CAMP LEJEUNE, NORTH CAROLINA
SITE INVESTIGATION, CTO-0369

SAMPLE ID	IR10-SW05D
SAMPLE DATE	03-21-1998
SEMIVOLATILES (ug/l) (cont)	
4-Nitrophenol	25 U
Dibenzofuran	10 U
2,4-Dinitrotoluene	10 U
Diethyl phthalate	10 U
4-Chlorophenyl phenyl ether	10 U
Fluorene	10 U
4-Nitroaniline	25 U
4,6-Dinitro-2-methylphenol	25 U
N-Nitrosodiphenylamine	10 U
4-Bromophenyl phenyl ether	10 U
Hexachlorobenzene	10 U
Pentachlorophenol	25 U
Phenanthrene	10 U
Anthracene	10 U
Carbazole	10 U
Di-n-butyl phthalate	10 U
Fluoranthene	10 U
Pyrene	10 U
Butyl benzyl phthalate	10 U
2-Nitrophenol	10 U
Benzo(a)anthracene	10 U
Chrysene	10 U
bis(2-Ethylhexyl) phthalate	10 U
Di-n-octyl phthalate	10 U
Benzo(b)fluoranthene	10 U
Benzo(k)fluoranthene	10 U
Benzo(a)pyrene	10 U
Indeno(1,2,3-cd)pyrene	10 U
Dibenz(a,h)anthracene	10 U
Benzo(ghi)perylene	10 U

FIELD DUPLICATE SUMMARY
SURFACE WATER - ORGANIC COMPOUNDS
SITE 10 - ORIGINAL BASE LANDFILL
MCB, CAMP LEJEUNE, NORTH CAROLINA
SITE INVESTIGATION, CTO-0369

SAMPLE ID	IR10-SW05D
SAMPLE DATE	03-21-1998
PESTICIDES/PCBS (ug/l)	
alpha-BHC	0.05 UJ
beta-BHC	0.05 UJ
delta-BHC	0.05 UJ
gamma-BHC (Lindane)	0.05 UJ
Heptachlor	0.05 UJ
Aldrin	0.05 UJ
Heptachlor epoxide	0.05 UJ
Endosulfan I	0.05 UJ
Dieldrin	0.1 UJ
4,4'-DDE	0.1 UJ
Endrin	0.1 UJ
Endosulfan II	0.1 UJ
4,4'-DDD	0.1 UJ
Endosulfan sulfate	0.1 UJ
4,4'-DDT	0.1 UJ
Methoxychlor	0.5 UJ
Endrin ketone	0.1 UJ
Endrin aldehyde	0.1 UJ
alpha-Chlordane	0.05 UJ
gamma-Chlordane	0.05 UJ
Toxaphene	5 UJ
Aroclor 1016	1 UJ
Aroclor 1221	2 UJ
Aroclor 1232	1 UJ
Aroclor 1242	1 UJ
Aroclor 1248	1 UJ
Aroclor 1254	1 UJ
Aroclor 1260	1 UJ

FIELD DUPLICATE SUMMARY
SURFACE WATER - TOTAL INORGANIC CONSTITUENTS and CYANIDE
SITE 10 - ORIGINAL BASE LANDFILL
MCB, CAMP LEJEUNE, NORTH CAROLINA
SITE INVESTIGATION, CTO-0369

SAMPLE ID	IR10-SW05D
SAMPLE DATE	03-21-1998
METALS (ug/l)	
Aluminum	1510
Antimony	60 U
Arsenic	2.4 J
Barium	9 J
Beryllium	5 U
Cadmium	5 U
Calcium	2660 J
Chromium	10 U
Cobalt	50 U
Copper	7.6 U
Iron	875
Lead	2.2 J
Magnesium	960 J
Manganese	104
Mercury	0.053 J
Nickel	40 U
Potassium	5000 U
Selenium	5 U
Silver	10 U
Sodium	3230 J
Thallium	10 U
Vanadium	15.7 J
Zinc	57.1
Cyanide, Total	10 U

APPENDIX I
STATISTICAL SUMMARIES

STATISTICAL SUMMARY
SURFACE SOIL - ORGANIC COMPOUNDS
SITE 10 - ORIGINAL BASE LANDFILL
MCB, CAMP LEJEUNE, NORTH CAROLINA
SITE INVESTIGATION, CTO-0369

SAMPLE ID SAMPLE DATE	Normal Arithmetic Mean	Normal Standard Deviation	Normal Upper 95% Confidence Level	Log Arithmatic Mean	Log Standard Deviation	Log Upper 95% Confidence Level
VOLATILES (ug/kg)						
1,1-Dichloroethene	5.8	1.18	6.2	1.74	0.21	6.3
Trichloroethene	5.67	1.39	6.15	1.7	0.29	6.36
Benzene	5.9	0.99	6.24	1.76	0.14	6.17
Toluene	4.54	2.43	5.37	1.32	0.7	6.5
Chlorobenzene	5.88	1.01	6.23	1.76	0.14	6.17
SEMIVOLATILES (ug/kg)						
Phenanthrene	185.96	44.62	201.23	5.19	0.28	207.02
Di-n-butyl phthalate	162.32	71.42	186.76	4.94	0.62	222.28
Fluoranthene	183.48	47.31	199.67	5.17	0.31	207.9
Pyrene	179	51.33	196.56	5.14	0.35	207.6
Benzo(a)anthracene	177.24	56.24	196.48	5.11	0.4	209.26
Chrysene	172.24	61.28	193.21	5.06	0.48	214.25
Benzo(b)fluoranthene	172.12	61.43	193.14	5.06	0.47	212.38
Benzo(k)fluoranthene	173.56	58.99	193.74	5.08	0.44	211.19
Benzo(a)pyrene	172.2	61.14	193.12	5.06	0.47	212.38
Indeno(1,2,3-cd)pyrene	173.96	62.71	195.42	5.06	0.52	224.21
Benzo(ghi)perylene	178.4	59.89	198.89	5.09	0.53	233.23
PESTICIDES/PCBS (ug/kg)						
Heptachlor	1.02	0.17	1.08	0.01	0.14	1.07
Heptachlor epoxide	1.06	0.32	1.17	0.03	0.22	1.15
Endosulfan I	1.14	0.68	1.37	0.06	0.32	1.26
Dieldrin	1.97	0.31	2.08	0.67	0.13	2.06
4,4'-DDE	1.97	0.31	2.08	0.67	0.13	2.06
Endrin	1.98	0.32	2.09	0.67	0.14	2.08
4,4'-DDT	2.18	0.92	2.49	0.73	0.28	2.39
Endrin aldehyde	2.06	0.66	2.29	0.69	0.22	2.22
Aroclor 1260	22.24	13.43	26.84	3.03	0.32	24.63

STATISTICAL SUMMARY
SURFACE SOIL - TOTAL INORGANIC CONSTITUENTS and CYANIDE
SITE 10 - ORIGINAL BASE LANDFILL
MCB, CAMP LEJEUNE, NORTH CAROLINA
SITE INVESTIGATION, CTO-0369

SAMPLE ID SAMPLE DATE	Normal Arithmetic Mean	Normal Standard Deviation	Normal Upper 95% Confidence Level	Log Arithmatic Mean	Log Standard Deviation	Log Upper 95% Confidence Level
TOTAL METALS (mg/kg)						
Aluminum	1594.49	2187.84	2343.12	6.46	1.52	6158.89
Antimony	7.27	1.62	7.82	1.96	0.19	7.74
Arsenic	1.31	2.17	2.05	-0.14	0.77	1.67
Barium	15.26	34.88	27.2	1.56	1.43	33.62
Beryllium	0.6	0.25	0.69	-0.57	0.35	0.69
Cadmium	0.6	0.11	0.64	-0.52	0.16	0.64
Calcium	1882.63	5770.3	3857.09	5.54	1.86	6501.26
Chromium	2.72	2.5	3.58	0.69	0.77	3.82
Cobalt	5.36	1.65	5.92	1.59	0.52	6.98
Copper	6.11	10.35	9.65	0.81	1.33	12.96
Iron	1062.8	1636.56	1622.79	5.91	1.65	4801.46
Lead	15.73	21.81	23.19	1.88	1.37	40.93
Magnesium	101.48	164.7	157.84	3.76	1.25	193.13
Manganese	13.28	18.84	19.73	1.91	1.08	22.58
Mercury	0.06	0.06	0.08	-3.12	0.63	0.07
Nickel	4.61	2.77	5.56	1.44	0.38	5.25
Potassium	514.04	287.65	612.47	6.1	0.58	672.27
Selenium	0.66	0.3	0.76	-0.47	0.28	0.72
Silver	1.26	0.41	1.4	0.2	0.23	1.37
Sodium	32.68	52.34	50.59	3.15	0.61	36.72
Vanadium	5.92	5.67	7.86	1.52	0.73	8.35
Zinc	31.07	64.63	53.18	2.06	1.63	97.44

STATISTICAL SUMMARY
SUBSURFACE SOIL - ORGANIC COMPOUNDS
SITE 10 - ORIGINAL BASE LANDFILL
MCB, CAMP LEJEUNE, NORTH CAROLINA
SITE INVESTIGATION, CTO-0369

SAMPLE ID SAMPLE DATE	Normal Arithmetic Mean	Normal Standard Deviation	Normal Upper 95% Confidence Level	Log Arithmatic Mean	Log Standard Deviation	Log Upper 95% Confidence Level
VOLATILES (ug/kg)						
Bromomethane	16.86	52.07	35.96	1.92	0.81	14.55
Methylene chloride	17.32	54.2	37.2	1.92	0.81	14.55
Acetone	525.57	1712.23	1153.73	2.94	1.98	803.85
Toluene	5.48	0.93	5.82	1.68	0.25	6.12
SEMIVOLATILES (ug/kg)						
Naphthalene	185.91	27.97	196.17	5.21	0.22	204.83
Acenaphthene	192.27	11.31	196.42	5.26	0.06	197.23
Dibenzofuran	186.18	26.79	196.01	5.21	0.2	201.8
Fluorene	190	12.54	194.6	5.24	0.07	194.17
Phenanthrene	269.09	364.42	402.78	5.36	0.49	296.7
Anthracene	199.55	39.52	214.05	5.28	0.15	210.44
Carbazole	191.82	10.75	195.76	5.26	0.06	197.23
Di-n-butyl phthalate	144.27	69.08	169.61	4.8	0.68	211.94
Fluoranthene	314.55	577.57	526.44	5.38	0.58	334.32
Pyrene	278.18	407.05	427.51	5.36	0.51	305.54
Benzo(a)anthracene	237.27	215.29	316.25	5.34	0.4	266.74
Chrysene	241.82	236.59	328.62	5.34	0.41	270.97
Benzo(b)fluoranthene	237.27	215.29	316.25	5.34	0.4	266.74
Benzo(k)fluoranthene	225.91	162.07	285.37	5.33	0.35	253.85
Benzo(a)pyrene	232.73	194	303.9	5.33	0.38	259.87
Indeno(1,2,3-cd)pyrene	208.64	81.4	238.5	5.3	0.24	226.97
Dibenz(a,h)anthracene	195.45	21.65	203.39	5.27	0.1	202.87
Benzo(ghi)perylene	204.55	62.43	227.45	5.29	0.2	218.61
PESTICIDES/PCBS (ug/kg)						
Endosulfan I	1	0.08	1.03	0	0.08	1.03
Endrin	1.94	0.16	2	0.66	0.08	2
Endosulfan II	2.04	0.6	2.26	0.69	0.2	2.2
4,4'-DDD	1.96	0.24	2.05	0.67	0.1	2.04
Methoxychlor	10.05	0.83	10.35	2.3	0.08	10.31
Endrin ketone	2.01	0.46	2.18	0.68	0.17	2.14

STATISTICAL SUMMARY
SUBSURFACE SOIL - INORGANIC CONSTITUENTS and CYANIDE
SITE 10 - ORIGINAL BASE LANDFILL
MCB, CAMP LEJEUNE, NORTH CAROLINA
SITE INVESTIGATION, CTO-0369

SAMPLE ID SAMPLE DATE	Normal Arithmetic Mean	Normal Standard Deviation	Normal Upper 95% Confidence Level	Log Arithmatic Mean	Log Standard Deviation	Log Upper 95% Confidence Level
TOTAL METALS (mg/kg)						
Aluminum	1967.74	1342.92	2460.41	7.23	1.12	5279.53
Antimony	10.49	16.47	16.53	2.05	0.53	11.38
Arsenic	2.82	7.7	5.64	0.23	0.88	2.96
Barium	35.01	125.33	80.99	1.49	1.5	40.4
Beryllium	0.61	0.3	0.72	-0.57	0.43	0.75
Cadmium	0.97	1.57	1.55	-0.38	0.6	1.08
Calcium	2010.32	5908.04	4177.77	4.89	1.95	5184.08
Chromium	6.57	14.07	11.73	1.13	0.99	8.79
Cobalt	6.97	10.51	10.83	1.5	0.9	10.83
Copper	156.25	711.19	417.16	0.75	2	95.32
Iron	12945.59	46660.45	30063.62	6.65	1.88	24736.71
Lead	151.51	565.31	358.9	1.44	2.11	393.17
Magnesium	118.7	236.36	205.41	3.96	1.14	207.88
Manganese	65.37	205.37	140.71	1.93	1.73	125.27
Mercury	0.05	0.04	0.06	-3.17	0.57	0.07
Nickel	11.25	30.39	22.4	1.65	0.84	11.57
Potassium	504.68	154.05	561.2	6.15	0.43	619.61
Selenium	0.62	0.14	0.67	-0.49	0.18	0.67
Silver	1.76	2.2	2.57	0.32	0.54	2.04
Sodium	37.9	69.26	63.31	3.12	0.79	46.05
Thallium	1.16	0.07	1.19	0.15	0.06	1.19
Vanadium	5.65	3.38	6.89	1.56	0.68	8.3
Zinc	119.23	341.88	244.65	1.9	2.08	565.98
Total Cyanide	1.13	0.13	1.18	0.11	0.14	1.19

STATISTICAL SUMMARY
GROUNDWATER - INORGANIC CONSTITUENTS and CYANIDE
SITE 10 - ORIGINAL BASE LANDFILL
MCB, CAMP LEJEUNE, NORTH CAROLINA
SITE INVESTIGATION, CTO-0369

SAMPLE ID SAMPLE DATE	Normal Arithmetic Mean	Normal Standard Deviation	Normal Upper 95% Confidence Level	Log Arithmatic Mean	Log Standard Deviation	Log Upper 95% Confidence Level
METALS (ug/l)						
Aluminum	32977.78	22779.09	47097.39	10.15	0.84	89320.94
Arsenic	8.99	5.51	12.41	2.05	0.56	14.73
Barium	80.66	46.12	109.25	4.27	0.51	126.45
Beryllium	2.29	0.62	2.67	0.77	0.45	3.43
Calcium	10968.89	16627.83	21275.64	8.52	1.25	59246.82
Chromium	64.68	37.80	88.11	4.01	0.63	120.49
Cobalt	7.84	6.80	12.05	1.85	0.62	13.68
Copper	15.96	12.37	23.63	2.41	0.96	52.99
Iron	13513.33	8393.56	18716.07	9.35	0.59	22761.3
Lead	27.39	17.30	38.11	3.09	0.75	61.38
Magnesium	2211.78	1037.99	2855.18	7.59	0.52	3546.1
Manganese	91.38	35.57	113.43	4.43	0.47	136.84
Mercury	0.13	0.10	0.19	-2.29	0.73	0.27
Nickel	16.58	3.93	19.02	2.78	0.28	20.46
Potassium	2790.00	1113.92	3480.46	7.87	0.37	3705.63
Silver	5.02	0.30	5.21	1.61	0.06	5.21
Sodium	6357.78	2651.68	8001.42	8.68	0.43	9123.58
Thallium	4.18	0.86	4.71	1.41	0.21	4.86
Vanadium	44.08	32.79	64.40	3.58	0.66	82.16
Zinc	27.39	21.53	40.74	3.01	0.84	70.81

STATISTICAL SUMMARY
SURFACE WATER - ORGANIC COMPOUNDS
SITE 10 - ORIGINAL BASE LANDFILL
MCB, CAMP LEJEUNE, NORTH CAROLINA
SITE INVESTIGATION, CTO-0369

SAMPLE ID SAMPLE DATE	Normal Arithmetic Mean	Normal Standard Deviation	Normal Upper 95% Confidence Level	Log Arithmatic Mean	Log Standard Deviation	Log Upper 95% Confidence Level
VOLATILES (ug/l)						
Toluene	3.77	1.91	5.34	1.16	0.7	11

STATISTICAL SUMMARY
SURFACE WATER - INORGANIC CONSTITUENTS and CYANIDE
SITE 10 - ORIGINAL BASE LANDFILL
MCB, CAMP LEJEUNE, NORTH CAROLINA
SITE INVESTIGATION, CTO-0369

SAMPLE ID SAMPLE DATE	Normal Arithmetic Mean	Normal Standard Deviation	Normal Upper 95% Confidence Level	Log Arithmatic Mean	Log Standard Deviation	Log Upper 95% Confidence Level
METALS (ug/l)						
Aluminum	484.67	490.71	888.35	5.76	0.99	3220.35
Arsenic	3.52	1.20	4.51	1.21	0.33	5.06
Barium	20.25	12.80	30.78	2.68	1.08	291.00
Calcium	20351.67	14109.74	31958.91	9.45	1.29	868267.01
Copper	2.94	1.51	4.18	0.96	0.53	5.97
Iron	921.00	654.47	1459.39	6.67	0.57	1938.47
Lead	2.55	2.26	4.41	0.71	0.66	6.45
Magnesium	1896.50	707.90	2478.85	7.47	0.45	3301.52
Manganese	144.73	137.51	257.85	4.69	0.78	496.25
Mercury	0.06	0.03	0.08	-2.85	0.47	0.11
Potassium	1676.17	715.96	2265.15	7.34	0.44	2852.33
Sodium	4836.67	1342.69	5941.22	8.45	0.31	6855.84
Vanadium	16.67	2.81	18.98	2.8	0.18	19.74
Zinc	54.78	20.60	71.73	3.96	0.31	76.93

STATISTICAL SUMMARY
SEDIMENT - ORGANIC COMPOUNDS
SITE 10 - ORIGINAL BASE LANDFILL
MCB, CAMP LEJEUNE, NORTH CAROLINA
SITE INVESTIGATION, CTO-0369

SAMPLE ID SAMPLE DATE	Normal Arithmetic Mean	Normal Standard Deviation	Normal Upper 95% Confidence Level	Log Arithmatic Mean	Log Standard Deviation	Log Upper 95% Confidence Level
VOLATILES (ug/kg)						
2-Butanone	14.83	18.23	29.83	2.32	0.81	55.88
Toluene	27.1	34.85	55.77	2.77	1.07	308.05
PESTICIDES/PCBS (ug/kg)						
4,4'-DDT	2.98	0.85	3.68	1.06	0.28	3.97
Endrin aldehyde	2.55	0.41	2.89	0.93	0.16	2.98

STATISTICAL SUMMARY
SEDIMENT - INORGANIC CONSTITUENTS and CYANIDE
SITE 10 - ORIGINAL BASE LANDFILL
MCB, CAMP LEJEUNE, NORTH CAROLINA
SITE INVESTIGATION, CTO-0369

SAMPLE ID SAMPLE DATE	Normal Arithmetic Mean	Normal Standard Deviation	Normal Upper 95% Confidence Level	Log Arithmatic Mean	Log Standard Deviation	Log Upper 95% Confidence Level
METALS (mg/kg)						
Aluminum	2029	1124.13	2953.75	7.47	0.62	5125.51
Barium	7.93	6.15	12.99	1.81	0.82	34.41
Calcium	505.83	572.95	977.16	5.81	0.94	2941.61
Copper	2.02	1.38	3.16	0.5	0.7	5.69
Iron	624	369.45	927.92	6.24	0.74	2131.27
Lead	8.23	7.27	14.21	1.88	0.67	21.23
Magnesium	84.33	38.27	115.81	4.32	0.57	184.87
Manganese	4.52	2.24	6.36	1.35	0.68	12.76
Mercury	0.07	0.01	0.08	-2.7	0.22	0.09
Potassium	469.33	275.81	696.22	5.98	0.66	1254.32
Selenium	0.74	0.09	0.81	-0.3	0.11	0.83
Vanadium	6.18	2.17	7.97	1.76	0.39	9.56
Zinc	8.88	1.9	10.44	2.17	0.2	10.75

APPENDIX J
HUMAN HEALTH RISK CALCULATION SPREADSHEETS

Computed by: KTW Checked by: MAS Date: 08/98

EXAMPLE SOIL INGESTION CALCULATIONS
SITE 10 - ORIGINAL BASE LANDFILL
CONTRACT TASK ORDER 0369

Purpose: Estimate intake/risk from ingestion of soil

$$Intake\ (mg/kg{\cdot}day) = \frac{C\ x\ CF\ x\ EF\ x\ ED\ x\ IR}{BW\ x\ AT}$$

Where:	C	=	Contaminant concentration in soil (mg/kg)
	CF	=	Conversion factor (kg/mg)
	EF	=	Exposure frequency (days/year)
	ED	=	Exposure duration (years)
	IR	=	Ingestion rate (mg/day)
	BW	=	Body weight (kg)
	AT_c	=	Averaging time carcinogen (days)
	AT_{nc}	=	Averaging time noncarcinogen (days)

Risks:

Carcinogens = Intake (mg/kg·day) x CSF $(mg/kg{\cdot}day)^{-1}$
Noncarcinogens = Intake (mg/kg·day)/RfD (mg/kg·day)

Example Carcinogen: Arsenic

$$Intake\ (mg/kg{\cdot}day) = \frac{1.67\ mg/kg\ x\ 100\ mg/day\ x\ 350\ days/yr\ x\ 30\ yr\ x\ 1.0E{-}6\ kg/mg}{70\ kg\ x\ 25{,}550\ days}$$

= 9.8E-07

Risk =9.8E-07 mg/kg·day x 1.5 $mg/kg{\cdot}day^{-1}$ = 1.5E-06

Example Noncarcinogen: Aluminum

$$Intake\ (mg/kg{\cdot}day) = \frac{6158.89\ mg/kg\ x\ 100\ mg/day\ x\ 350\ days/yr\ x\ 30\ yr\ x\ 1.0E{-}6\ kg/mg}{70\ kg\ x\ 10{,}950\ days}$$

= 8.4E-03

$$Risk = \frac{8.4E{-}03\ mg/kg{\cdot}day}{1.0\ mg/kg{\cdot}day} = 8.4E{-}03$$

Re: Site 10 Future Adult Resident

Computed by: KTW Checked by: MAS Date: 08/98

EXAMPLE DERMAL CONTACT WITH SOIL CALCULATIONS
SITE 10 - ORIGINAL BASE LANDFILL
CONTRACT TASK ORDER 0369

Purpose: Estimate intake/risk from dermal contact with soil

$$Intake\ (mg/kg{\cdot}day) = \frac{C \times CF \times SA \times AF \times ABS \times EF \times ED}{BW \times AT}$$

Where:	C	=	Contaminant concentration in soil (mg/kg)
	CF	=	Conversion factor (kg/mg)
	SA	=	Surface available for contact (cm^2/event)
	AF	=	Soil to skin adherence factor (mg/cm^2)
	ABS	=	Fraction absorbed (percent) - 0.01 organics, 0.001 inorganics
	EF	=	Exposure frequency (days/year)
	ED	=	Exposure duration (years)
	IR	=	Ingestion rate (mg/day)
	BW	=	Body weight (kg)
	AT_c	=	Averaging time carcinogen (days)
	AT_{nc}	=	Averaging time noncarcinogen (days)

Risks:

Carcinogens = Intake (mg/kg·day) x dermally - adjusted CSF $(mg/kg{\cdot}day)^{-1}$
Noncarcinogens = Intake (mg/kg·day)/ dermally - adjusted RfD (mg/kg·day)

Example Carcinogen: Arsenic

$$ntake\ (mg/kg{\cdot}day) = \frac{1.67\ mg/kg \times 1.0E{-}06\ kg/mg \times 5{,}800\ cm^2/event \times 0.001 \times 1\ mg/cm^2 \times 350\ days/yr \times 30\ yr}{70\ kg \times 25{,}550\ days}$$

= 5.7E-08

Risk = 5.7E-08 mg/kg·day x 7.5 $mg/kg{\cdot}day^{-1}$ = 4.3E-07

Example Noncarcinogen: Aluminum

$$Intake\ (mg/kg{\cdot}day) = \frac{6158.89\ mg/kg \times 1.0E{-}06\ kg/mg \times 5{,}800\ cm^2/event \times 1\ mg/cm^2 \times 0.001 \times 350\ days/yr \times 30\ yr}{70\ kg \times 10{,}950\ days}$$

= 4.9E-04

$$Risk = \frac{4.9E{-}04\ mg/kg{\cdot}day}{2.0E{-}01\ mg/kg{\cdot}day} = 2.4E{-}03$$

Re: Site 10 Future Adult Resident

Computed by: KTW Checked by: MAS Date: 08/98

EXAMPLE INHALATION OF PARTICULATES CALCULATIONS
SITE 10 - ORIGINAL BASE LANDFILL
CONTRACT TASK ORDER 0369

Purpose: Estimate intake/risk from the inhalation of soil particulates

$$Intake\ (mg/kg{\cdot}day) = \frac{C\ x\ IR\ x\ EF\ x\ ED\ x\ 1/PEF}{BW\ x\ AT}$$

Where:	C	=	Contaminant concentration in soil (mg/kg)
	IR	=	Inhalation rate (m^3/day)
	EF	=	Exposure frequency (days/year)
	ED	=	Exposure duration (years)
	PEF	=	Particulate Emission Factor (m^3/kg)
	BW	=	Body weight (kg)
	AT_c	=	Averaging time carcinogen (days)
	AT_{nc}	=	Averaging time noncarcinogen (days)

Risks:

Carcinogens = Intake (mg/kg·day) x CSF $(mg/kg{\cdot}day)^{-1}$
Noncarcinogens = Intake (mg/kg·day)/RfD (mg/kg·day)

Example Carcinogen: Arsenic

$$Intake\ (mg/kg{\cdot}day) = \frac{1.67\ mg/kg\ x\ 20\ m^3/day\ x\ 350\ days/yr\ x\ 30\ yr\ x\ 1/(1.32E{+}9\ m^3/kg)}{70\ kg\ x\ 25{,}550\ days}$$

=1.5E-10

Risk = 1.5E-10 mg/kg day x 15.1 mg/kg day^{-1} = 2.2E-09

Example Noncarcinogen: Aluminum

$$Intake\ (mg/kg{\cdot}day) = \frac{6158.89\ mg/kg\ x\ 20\ m^3/day\ x\ 350\ days/yr\ x\ 30\ yr\ x\ 1/(1.32E{+}9\ m^3/kg)}{70\ kg\ x\ 10{,}950\ days}$$

=1.3E-06

$$Risk = \frac{1.3E{-}06\ mg/kg{\cdot}day}{1.0E{-}03\ mg/kg{\cdot}day} = 1.3E{-}03$$

Re: Site 10 Future Adult Resident

Computed by: KTW Checked by: MAS Date: 08/98

EXAMPLE GROUNDWATER INGESTION CALCULATIONS
SITE 10 - ORIGINAL BASE LANDFILL
CONTRACT TASK ORDER 0369

Purpose: Estimate intake/risk from ingestion of groundwater

$$Intake\ (mg/kg{\cdot}day) = \frac{C \times IR \times EF \times ED}{BW \times AT}$$

Where:			
	C	=	Contaminant concentration in groundwater (mg/L)
	IR	=	Daily intake ingestion rate (L/day)
	EF	=	Exposure frequency (days/year)
	ED	=	Exposure duration (years)
	BW	=	Body weight (kg)
	AT_c	=	Averaging time carcinogen (days)
	AT_{nc}	=	Averaging time noncarcinogen (days)

Risks:

Carcinogens = Intake (mg/kg·day) x CSF $(mg/kg{\cdot}day)^{-1}$
Noncarcinogens = Intake (mg/kg·day)/RfD (mg/kg·day)

Example Carcinogen: Arsenic

$$Intake\ (mg/kg{\cdot}day) = \frac{0.0182\ mg/L \times 2\ L/day \times 350\ days/yr \times 30\ yrs}{70\ kg \times 25{,}550\ days}$$

= 2.1E-04

Risk = 2.1E-04 mg/kg·day x 1.5 $mg/kg{\cdot}day^{-1}$ = 3.2E-04

Example Noncarcinogen: Aluminum

$$Intake\ (mg/kg{\cdot}day) = \frac{78.8\ mg/L \times 2\ L/day \times 350\ days/yr \times 30\ yrs}{70\ kg \times 10{,}950\ days}$$

= 2.2

$$Risk = \frac{2.2\ mg/kg{\cdot}day}{1.0\ mg/kg{\cdot}day} = 2.2$$

Re: Site 10 Future Adult Resident

Computed by: KTW Checked by: MAS Date: 08/98

EXAMPLE DERMAL CONTACT WITH GROUNDWATER CALCULATIONS
SITE 10 - ORIGINAL BASE LANDFILL
CONTRACT TASK ORDER 0369

Purpose: Estimate intake/risk from dermal contact with groundwater

$$Intake\ (mg/kg{\cdot}day) = \frac{C \times CF \times SA \times PC \times ET \times EF \times ED}{BW \times AT}$$

Where:			
	C	=	Contaminant concentration in groundwater (mg/L)
	CF	=	Conversion factor (1 L/1,000 cm^3)
	SA	=	Exposed skin surface available for contact (cm^2)
	PC	=	Chemical-specific dermal permeability constant (cm/hr)
	ET	=	Exposure time (hr/day)
	EF	=	Exposure frequency (days/year)
	ED	=	Exposure duration (years)
	IR	=	Ingestion rate (L/day)
	BW	=	Body weight (kg)
	AT_c	=	Averaging time carcinogen (days)
	AT_{nc}	=	Averaging time noncarcinogen (days)

Risks:

Carcinogens = Intake (mg/kg·day) x CSF $(mg/kg{\cdot}day)^{-1}$
Noncarcinogens = Intake (mg/kg·day)/RfD (mg/kg·day)

Example Carcinogen: Arsenic

$$take\ (mg/kgday) = \frac{0.0182\ mg/L \times 1.0E{-}03\ L/cm^3 \times 23{,}000\ cm^2/event \times 1.0E{-}03\ cm/hr \times 0.25\ hr/day \times 350\ days/yr \times 30\ yr}{70\ kg \times 25{,}550\ days}$$

= 6.1E-07

Risk = 6.1E-07 mg/kg·day x 7.5 $mg/kg{\cdot}day^{-1}$ = 4.6E-06

Example Noncarcinogen: Aluminum

$$Intake\ (mg/kg{\cdot}day) = \frac{78.8\ mg/L \times 1.0E{-}03\ L/cm^3 \times 23{,}000\ cm^2/event \times 1.0E{-}03\ cm/hr \times 0.25\ hr/day \times 350\ days/yr \times 30\ yrs}{70\ kg \times 10{,}950\ days}$$

= 6.2E-03

$$Risk = \frac{6.2E{-}03\ mg/kg{\cdot}day}{2.0E{-}01\ mg/kg{\cdot}day} = 3.1E{-}02$$

Re: Site 10 Future Adult Resident

Computed by: KTW Checked by: MAS Date: 08/98

EXAMPLE SURFACE WATER INGESTION CALCULATIONS
SITE 10 - ORIGINAL BASE LANDFILL
CONTRACT TASK ORDER 0369

Purpose: Estimate intake/risk from ingestion of surface water

$$Intake\ (mg/kg{\cdot}day) = \frac{C \times IR \times EF \times ED \times ET}{BW \times AT}$$

Where:	C	=	Contaminant concentration in surface water (mg/L)
	IR	=	Daily intake ingestion rate (kg/meal)
	EF	=	Exposure frequency (meal/year)
	ED	=	Exposure duration (years)
	ET	=	Exposure time (hrs/day)
	BW	=	Body weight (kg)
	AT_c	=	Averaging time carcinogen (days)
	AT_{nc}	=	Averaging time noncarcinogen (days)

Risks:

Carcinogens = Intake (mg/kg·day) x CSF $(mg/kg{\cdot}day)^{-1}$
Noncarcinogens = Intake (mg/kg·day)/RfD (mg/kg·day)

Example Carcinogen: Arsenic

$$Intake\ (mg/kgday) = \frac{0.005\ mg/L \times 0.01\ L/day \times 48\ days/yr \times 30\ yrs \times 2.6\ hrs/day}{70\ kg \times 25{,}550\ days}$$

= 1.0E-07

Risk = 1.0E-07 mg/kg·day x 1.5 $mg/kg{\cdot}day^{-1}$ = 1.6E-07

Example Noncarcinogen: Aluminum

$$Intake\ (mg/kgday) = \frac{1.27\ mg/L \times 0.01\ L/day \times 48\ days/yr \times 30\ yrs \times 2.6\ hrs/day}{70\ kg \times 10{,}950\ days}$$

= 6.2E-05

$$Risk = \frac{6.2E{-}05\ mg/kgday}{1.0\ mg/kgday} = 6.2E{-}05$$

Re: Site 10 Future Adult Resident

Computed by: KTW Checked by: MAS Date: 08/98

EXAMPLE SURFACE WATER DERMAL CONTACT CALCULATIONS
SITE 10 - ORIGINAL BASE LANDFILL
CONTRACT TASK ORDER 0369

Purpose: Estimate intake/risk from dermal contact with surface water

$$Intake\ (mg/kgday) = \frac{C\ x\ SA\ x\ CF\ x\ EF\ x\ ED\ x\ ET\ x\ PC}{BW\ x\ AT}$$

Where:	C	=	Contaminant concentration in surface water (mg/L)
	SA	=	Skin surface area (cm^2)
	CF	=	Conversion factor (1 L/1,000 cm^3)
	EF	=	Exposure frequency (days/year)
	ED	=	Exposure duration (years)
	ET	=	Exposure time (hrs/day)
	PC	=	Chemical-specific dermal permeability constant (cm/hr)
	BW	=	Body weight (kg)
	AT_c	=	Averaging time carcinogen (days)
	AT_{nc}	=	Averaging time noncarcinogen (days)

Risks:

Carcinogens = Intake (mg/kg·day) x CSF $(mg/kg\cdot day)^{-1}$
Noncarcinogens = Intake (mg/kg·day)/RfD (mg/kg·day)

Example Carcinogen: Arsenic

$$Intake\ (mg/kgday) = \frac{0.005\ mg/L\ x\ 5{,}800\ cm^2\ x\ 48\ days/yr\ x\ 30\ yrs\ x\ 2.6\ hrs/day\ x\ 1.0E{-}3\ L/cm^3\ x\ 1E{-}03\ cm/hr}{70\ kg\ x\ 25{,}550\ days}$$

= 6.1E-08

Risk = 6.1E-08 mg/kg·day x 7.5 $mg/kg\cdot day^{-1}$ = 4.6E-07

Example Noncarcinogen: Aluminum

$$Intake\ (mg/kgday) = \frac{1.27\ mg/L\ x\ 5{,}800\ cm^2\ x\ 48\ days/yr\ x\ 30\ yrs\ x\ 2.6\ hrs/day\ x\ 1.0E{-}3\ L/cm^3\ x\ 1E{-}03\ cm/hr}{70\ kg\ x\ 10{,}950\ days}$$

= 3.6E-05

$$Risk = \frac{3.6E{-}05\ mg/kgday}{2.0E{-}01\ mg/kgday} = 1.8E{-}04$$

Re: Site 10 Future Adult Resident

ADULT MILITARY WORKERS - CURRENT SCENARIO
ACCIDENTAL INGESTION OF SURFACE SOIL - SITE 10 (ORIGINAL BASE LANDFILL)
REASONABLE MAXIMUM EXPOSURE
POTENTIAL CARCINOGENIC AND NONCARCINOGENIC RISKS
MCB CAMP LEJEUNE - JACKSONVILLE, NC

CDI (mg/kg/d)= (C*IR*CF*FI*EF*ED)/(BW*AT)
ILCR = CDI*CSFo
HQ = CDI/RfDo

Parameter	Units	Description	Military Worker	
CDI	mg/kg/d	Chronic daily intake	CS	(Chemical Specific)
ILCR	NA	Incremental lifetime cancer risk	CS	
CSFo	1/(mg/kg/d)	Oral cancer slope factor	CS	
HQ	NA	Hazard quotient	CS	
RfDo	mg/kg/d	Oral reference dose	CS	
C	mg/kg	Concentration of chemical in soil	CS	
IR-S	mg/day	Ingestion rate of soil	100	
CF	kg/mg	Conversion factor	1.00E-06	
FI	NA	Fraction of soil ingested from site	1	
EF	days/year	Exposure frequency	143	
ED	years	Exposure duration	4	
BW	kg	Body weight	70	
AT-C	days	Averaging time, carcinogens	25,550	
AT-N	days	Averaging time, noncarcinogens	1,460	

				Carcinogens			Noncarcinogens		
Parameter	C (mg/kg)	CSFo 1/(mg/kg/d)	RfDo (mg/kg/d)	CDI (mg/kg/d)	ILCR	% Contrib. Total ILCR	CDI (mg/kg/d)	HQ	% Contrib. HI
Aluminum	6,227	NA	1.0E+00	2.0E-04	--	--	3.5E-03	3.5E-03	16.4%
Antimony	7.82	NA	4.0E-04	2.5E-07	--	--	4.4E-06	1.1E-02	51.4%
Arsenic	2.06	1.5E+00	3.0E-04	6.6E-08	9.9E-08	100.0%	1.2E-06	3.8E-03	18.0%
Iron	1,623	NA	3.0E-01	5.2E-05	--	--	9.1E-04	3.0E-03	14.2%
				Total ILCR:	9.9E-08	100.0%	Total HI:	2.1E-02	100.0%

NOTES:
-- - Not applicable.
NA - Toxicity criterion not available.

ADULT MILITARY WORKERS - CURRENT SCENARIO
DERMAL CONTACT WITH SURFACE SOIL - SITE 10 (ORIGINAL BASE LANDFILL)
REASONABLE MAXIMUM EXPOSURE
POTENTIAL CARCINOGENIC AND NONCARCINOGENIC RISKS
MCB CAMP LEJEUNE - JACKSONVILLE, NC

DAD (mg/kg/d)= (C*CF*AF*ABS*SA*EF*ED)/(BW*AT)
ILCR = CDI*CSFd
HQ = CDI/RfDd

Parameter	Units	Description	Military Worker	
DAD	mg/kg/d	Dermally absorbed dose	CS	(Chemical Specific)
ILCR	NA	Incremental lifetime cancer risk	CS	
CSFd	1/(mg/kg/d)	Dermal cancer slope factor	CS	
HQ	NA	Hazard quotient	CS	
RfDd	mg/kg/d	Dermal reference dose	CS	
C	mg/kg	Concentration of chemical in soil	CS	
CF	kg/mg	Conversion factor	1.00E-06	
AF	mg/cm2	Soil to skin adherence factor	1	
ABS	NA	Absorption fraction	CS	
SA	cm2/day	Skin surface area available for contact	5,100	
EF	days/year	Exposure frequency	143	
ED	years	Exposure duration	4	
BW	kg	Body weight	70	
AT-C	days	Averaging time, carcinogens	25,550	
AT-N	days	Averaging time, noncarcinogens	1,460	

					Carcinogens			Noncarcinogens		
Parameter	C (mg/kg)	ABS	CSFd 1/(mg/kg/d)	RfDd (mg/kg/d)	DAD (mg/kg/d)	ILCR	% Contrib. Total ILCR	DAD (mg/kg/d)	HQ	% Contrib. HI
Aluminum	6,227	0.01	NA	2.7E-01	1.0E-04	--	--	1.8E-03	6.6E-03	9.4%
Antimony	7.82	0.01	NA	4.0E-05	1.3E-07	--	--	2.2E-06	5.6E-02	79.6%
Arsenic	2.06	0.03	1.6E+00	2.9E-04	1.0E-07	1.6E-07	100.0%	1.8E-06	6.2E-03	8.8%
Iron	1,623	0.01	NA	3.0E-01	2.6E-05	--	--	4.6E-04	1.5E-03	2.2%
					Total ILCR:	1.6E-07	100.0%	Total HI:	7.0E-02	100.0%

NOTES:
-- - Not applicable.
NA - Toxicity criterion not available.

ADULT MILITARY WORKERS - CURRENT SCENARIO
INHALATION OF FUGITIVE DUSTS EMANATING FROM SURFACE SOIL - SITE 10 (ORIGINAL BASE LANDFILL)
REASONABLE MAXIMUM EXPOSURE
POTENTIAL CARCINOGENIC AND NONCARCINOGENIC RISKS
MCB CAMP LEJEUNE - JACKSONVILLE, NC

CDI (mg/kg/d)= (Ca*RR*ET*EF*ED)/(BW*AT)
Where: Ca = C * (1/PEF)

ILCR = CDI*CSFi
HQ = CDI/RfDi

Parameter	Units	Description	Military Worker	
CDI	mg/kg/d	Chronic daily intake	CS	(Chemical Specific)
ILCR	NA	Incremental lifetime cancer risk	CS	
CSFi	1/(mg/kg/d)	Inhalation cancer slope factor	CS	
HQ	NA	Hazard quotient	CS	
RfDi	mg/kg/d	Inhalation reference dose	CS	
Ca	mg/m3	Concentration of chemical in air as fugitive dusts	CS	
C	mg/kg	Concentration of chemical in soil	CS	
PEF	m3/kg	Particulate emission factor	1.32E+09	
RR	m3/hour	Respiration rate	0.80	
ET	hours/day	Exposure time	8	
EF	days/year	Exposure frequency	143	
ED	years	Exposure duration	4	
BW	kg	Body weight	70	
AT-C	days	Averaging time, carcinogens	25,550	
AT-N	days	Averaging time, noncarcinogens	1,460	

					Carcinogens			Noncarcinogens		
Parameter	C (mg/kg)	Ca (mg/m3)	CSFi 1/(mg/kg/d)	RfDi (mg/kg/d)	CDI (mg/kg/d)	ILCR	% Contrib. Total ILCR	CDI (mg/kg/d)	HQ	% Contrib. HI
Aluminum	6,227	4.72E-06	NA	1.0E-03	9.7E-09	--	--	1.7E-07	1.7E-04	100.0%
Antimony	7.82	5.93E-09	NA	NA	1.2E-11	--	--	2.1E-10	--	--
Arsenic	2.06	1.56E-09	1.5E+01	NA	3.2E-12	4.8E-11	100.0%	5.6E-11	--	--
Iron	1,623	1.23E-06	NA	NA	2.5E-09	--	--	4.4E-08	--	--
					Total ILCR:	4.8E-11	100.0%	Total HI:	1.7E-04	100.0%

NOTES:
-- - Not applicable.
NA - Toxicity criterion not available.

ADULT MILITARY WORKERS - CURRENT SCENARIO
ACCIDENTAL INGESTION OF SURFACE WATER - SITE 10 (ORIGINAL BASE LANDFILL)
REASONABLE MAXIMUM EXPOSURE
POTENTIAL CARCINOGENIC AND NONCARCINOGENIC RISKS
MCB CAMP LEJEUNE - JACKSONVILLE, NC

CDI (mg/kg/d)= (C*IR*ET*EF*ED)/(BW*AT)
ILCR = CDI*CSFo
HQ = CDI/RfDo

Parameter	Units	Description	Military Worker	
CDI	mg/kg/d	Chronic daily intake	CS	(Chemical Specific)
ILCR	NA	Incremental lifetime cancer risk	CS	
CSFo	1/(mg/kg/d)	Oral cancer slope factor	CS	
HQ	NA	Hazard quotient	CS	
RfDo	mg/kg/d	Oral reference dose	CS	
C	mg/L	Concentration of chemical in water	CS	
IR-W	L/hour	Ingestion rate of water	0.01	
ET	hours/day	Exposure time	2.6	
EF	days/year	Exposure frequency	143	
ED	years	Exposure duration	4	
BW	kg	Body weight	70	
AT-C	days	Averaging time, carcinogens	25,550	
AT-N	days	Averaging time, noncarcinogens	1,460	

				Adult					
				Carcinogens			Noncarcinogens		
Parameter	Cw (mg/L)	CSFo 1/(mg/kg/d)	RfDo (mg/kg/d)	CDI (mg/kg/d)	ILCR	% Contrib. Total ILCR	CDI (mg/kg/d)	HQ	% Contrib. HI
Aluminum	1.27000	NA	1.0E+00	1.1E-05	--	--	1.8E-04	1.8E-04	15.5%
Iron	1.94441	NA	3.0E-01	1.6E-05	--	--	2.8E-04	9.4E-04	79.1%
Mercury	0.00006	NA	3.0E-04	5.0E-10	--	--	8.7E-09	2.9E-05	2.4%
Zinc	0.07173	NA	3.0E-01	6.0E-07	--	--	1.0E-05	3.5E-05	2.9%
				Total ILCR:	--	--	Total HI:	1.2E-03	100.0%

NOTES:
-- - Not applicable.
NA - Toxicity criterion not available.

ADULT MILITARY WORKERS - CURRENT SCENARIO
DERMAL CONTACT WITH SURFACE WATER - SITE 10 (ORIGINAL BASE LANDFILL)
REASONABLE MAXIMUM EXPOSURE
POTENTIAL CARCINOGENIC AND NONCARCINOGENIC RISKS
MCB CAMP LEJEUNE - JACKSONVILLE, NC

DAD (mg/kg/d)= (C*CF*Kp*SA*EF*ED*ET)/(BW*AT)

ILCR = CDI*CSFo Adj CSF Adj = CSF/AD
HQ = CDI/RfDo Adj RfD Adj = RfD*AD

Parameter	Units	Description	Military Worker	
DAD	mg/kg/d	Dermally absorbed dose	CS	(Chemical Specific)
ILCR	NA	Incremental lifetime cancer risk	CS	
CSFd	1/(mg/kg/d)	Dermal cancer slope factor	CS	
HQ	NA	Hazard quotient	CS	
RfDd	mg/kg/d	Dermal reference dose	CS	
SA	cm2	Skin surface area available for contact	5,100	
EF	days/year	Exposure frequency	143	
ED	years	Exposure duration	4	
ET	hours/day	Exposure time	2.6	
BW	kg	Body weight	70	
AT-C	days	Averaging time, carcinogens	25,550	
AT-N	days	Averaging time, noncarcinogens	1,460	
C	mg/L	Concentration of chemical in water	CS	
CF	L/cm3	Conversion factor	1.00E-03	
Kp	cm/hour	Dermal permeability coefficient	CS	
AD	NA	Adjustment for absorbed dose	CS	

					Adult					
					Carcinogens			Noncarcinogens		
Parameter	Cw (mg/L)	Kp (cm/hour)	CSFd 1/(mg/kg/d)	RfDd (mg/kg/d)	DAD (mg/kg/d)	ILCR	% Contrib. Total ILCR	DAD (mg/kg/d)	HQ	% Contrib. HI
Aluminum	1.27000	0.001	NA	2.7E-01	5.4E-06	--	--	9.4E-05	3.5E-04	38.1%
Iron	1.94441	0.001	NA	3.0E-01	8.2E-06	--	--	1.4E-04	4.8E-04	52.5%
Mercury	0.00006	0.001	NA	3.0E-04	2.5E-10	--	--	4.5E-09	1.5E-05	1.6%
Zinc	0.07173	0.001	NA	7.5E-02	3.0E-07	--	--	5.3E-06	7.1E-05	7.7%
					Total ILCR:	--	--	Total HI:	9.2E-04	100.0%

NOTES:
-- - Not applicable.
NA - Toxicity criterion not available.

ADULT AND YOUTH (AGES 6-15) TRESPASSERS - CURRENT SCENARIO
ACCIDENTAL INGESTION OF SURFACE SOIL - SITE 10 (ORIGINAL BASE LANDFILL)
REASONABLE MAXIMUM EXPOSURE
POTENTIAL CARCINOGENIC AND NONCARCINOGENIC RISKS
MCB CAMP LEJEUNE - JACKSONVILLE, NC

CDI (mg/kg/d)= (C*IR*CF*FI*EF*ED)/(BW*AT)
ILCR = CDI*CSFo
HQ = CDI/RfDo

Parameter	Units	Description	Adult	Youth	
CDI	mg/kg/d	Chronic daily intake	CS	CS	(Chemical Specific)
ILCR	NA	Incremental lifetime cancer risk	CS	CS	
CSFo	1/(mg/kg/d)	Oral cancer slope factor	CS	CS	
HQ	NA	Hazard quotient	CS	CS	
RfDo	mg/kg/d	Oral reference dose	CS	CS	
C	mg/kg	Concentration of chemical in soil	CS	CS	
CF	kg/mg	Conversion factor	1.00E-06	1.00E-06	
IR-S	mg/day	Ingestion Rate of soil	100	100	
FI	NA	Fraction of soil ingested from site	1	1	
EF	days/year	Exposure Frequency	48	48	
ED	years	Exposure Duration	24	10	
BW	kg	Body weight	70	45	
AT-C	days	Averaging time, carcinogens	25,550	25,550	
AT-N	days	Averaging time, noncarcinogens	8,760	3,650	

				Adult						Youth					
				Carcinogens			Noncarcinogens			Carcinogens			Noncarcinogens		
Parameter	C (mg/kg)	CSFo 1/(mg/kg/d)	RfDo (mg/kg/d)	CDI (mg/kg/d)	ILCR	% Contrib. Total ILCR	CDI (mg/kg/d)	HQ	% Contrib. HI	CDI (mg/kg/d)	ILCR	% Contrib. Total ILCR	CDI (mg/kg/d)	HQ	% Contrib. HI
Aluminum	6,227	NA	1.0E+00	4.0E-04	--	--	1.2E-03	1.2E-03	16.4%	2.6E-04	--	--	1.8E-03	1.8E-03	16.4%
Antimony	7.82	NA	4.0E-04	5.0E-07	--	--	1.5E-06	3.7E-03	51.4%	3.3E-07	--	--	2.3E-06	5.7E-03	51.4%
Arsenic	2.06	1.5E+00	3.0E-04	1.3E-07	2.0E-07	100.0%	3.9E-07	1.3E-03	18.0%	8.6E-08	1.3E-07	100.0%	6.0E-07	2.0E-03	18.0%
Iron	1,623	NA	3.0E-01	1.0E-04	--	--	3.0E-04	1.0E-03	14.2%	6.8E-05	--	--	4.7E-04	1.6E-03	14.2%
				Total ILCR:	2.0E-07	100.0%	Total HI:	7.1E-03	100.0%	Total ILCR:	1.3E-07	100.0%	Total HI:	1.1E-02	100.0%

NOTES:
-- - Not applicable.
NA - Toxicity criterion not available.

ADULT AND YOUTH (AGES 6-15) TRESPASSERS - CURRENT SCENARIO
DERMAL CONTACT WITH SURFACE SOIL - SITE 10 (ORIGINAL BASE LANDFILL)
REASONABLE MAXIMUM EXPOSURE
POTENTIAL CARCINOGENIC AND NONCARCINOGENIC RISKS
MCB CAMP LEJEUNE - JACKSONVILLE, NC

DAD (mg/kg/d)= (C*CF*AF*ABS*SA*EF*ED)/(BW*AT)
ILCR = CDI*CSFd
HQ = CDI/RfDd

Parameter	Units	Description	Adult	Youth	
DAD	mg/kg/d	Dermally absorbed dose	CS	CS	(Chemical Specific)
ILCR	NA	Incremental lifetime cancer risk	CS	CS	
CSFd	1/(mg/kg/d)	Dermal cancer slope factor	CS	CS	
HQ	NA	Hazard quotient	CS	CS	
RfDd	mg/kg/d	Dermal reference dose	CS	CS	
C	mg/kg	Concentration of chemical in soil	CS	CS	
ABS	NA	Absorption fraction	CS	CS	
CF	kg/mg	Conversion factor	1.00E-06	1.00E-06	
AF	mg/cm2	Soil to skin adherence factor	1	1	
SA	cm2/day	Skin surface area available for contact	5,800	3,480	
EF	days/year	Exposure Frequency	48	48	
ED	years	Exposure Duration	24	10	
BW	kg	Body weight	70	45	
AT-C	days	Averaging time, carcinogens	25,550	25,550	
AT-N	days	Averaging time, noncarcinogens	8,760	3,650	

					Adult						Youth					
					Carcinogens			Noncarcinogens			Carcinogens			Noncarcinogens		
Parameter	C (mg/kg)	ABS	CSFd 1/(mg/kg/d)	RfDd (mg/kg/d)	DAD (mg/kg/d)	ILCR	% Contrib. Total ILCR	DAD (mg/kg/d)	HQ	% Contrib. HI	DAD (mg/kg/d)	ILCR	% Contrib. Total ILCR	DAD (mg/kg/d)	HQ	% Contrib. HI
Aluminum	6,227	0.01	NA	2.7E-01	2.3E-04	--	--	6.8E-04	2.5E-03	9.4%	9.0E-05	--	--	6.3E-04	2.3E-03	9.4%
Antimony	7.82	0.01	NA	4.0E-05	2.9E-07	--	--	8.5E-07	2.1E-02	79.6%	1.1E-07	--	--	8.0E-07	2.0E-02	79.6%
Arsenic	2.06	0.03	1.6E+00	2.9E-04	2.3E-07	3.6E-07	100.0%	6.7E-07	2.4E-03	8.8%	9.0E-08	1.4E-07	100.0%	6.3E-07	2.2E-03	8.8%
Iron	1,623	0.01	NA	3.0E-01	6.1E-05	--	--	1.8E-04	5.9E-04	2.2%	2.4E-05	--	--	1.7E-04	5.5E-04	2.2%
					Total ILCR:	3.6E-07	100.0%	Total HI:	2.7E-02	100.0%	Total ILCR:	1.4E-07	100.0%	Total HI:	2.5E-02	100.0%

NOTES:
-- - Not applicable.
NA - Toxicity criterion not available.

ADULT AND YOUTH (AGES 6-15) TRESPASSERS - CURRENT SCENARIO
INHALATION OF FUGITIVE DUSTS EMANATING FROM SURFACE SOIL - SITE 10 (ORIGINAL BASE LANDFILL)
REASONABLE MAXIMUM EXPOSURE
POTENTIAL CARCINOGENIC AND NONCARCINOGENIC RISKS
MCB CAMP LEJEUNE - JACKSONVILLE, NC

CDI (mg/kg/d)= (Ca*RR*ET*EF*ED)/(BW*AT)
Where: Ca = C * (1/PEF)

ILCR = CDI*CSFi
HQ = CDI/RfDi

Parameter	Units	Description	Adult	Youth	
CDI	mg/kg/d	Chronic daily intake	CS	CS	(Chemical Specific)
ILCR	NA	Incremental lifetime cancer risk	CS	CS	
CSFi	1/(mg/kg/d)	Inhalation cancer slope factor	CS	CS	
HQ	NA	Hazard quotient	CS	CS	
RfDi	mg/kg/d	Inhalation reference dose	CS	CS	
Ca	mg/m3	Concentration of chemical in air as fugitive dusts	CS	CS	
C	mg/kg	Concentration of chemical in soil	CS	CS	
PEF	m3/kg	Particulate emission factor	1.32E+09	1.32E+09	
RR	m3/hour	Respiration rate	0.80	0.80	
ET	hours/day	Exposure time	24	24	
EF	days/year	Exposure Frequency	48	48	
ED	years	Exposure Duration	24	10	
BW	kg	Body weight	70	45	
AT-C	days	Averaging time, carcinogens	25,550	25,550	
AT-N	days	Averaging time, noncarcinogens	8,760	3,650	

					Adult						Youth					
					Carcinogens			Noncarcinogens			Carcinogens			Noncarcinogens		
Parameter	C (mg/kg)	Ca (mg/m3)	CSFi 1/(mg/kg/d)	RfDi (mg/kg/d)	CDI (mg/kg/d)	ILCR	% Contrib. Total ILCR	CDI (mg/kg/d)	HQ	% Contrib. HI	CDI (mg/kg/d)	ILCR	% Contrib. Total ILCR	CDI (mg/kg/d)	HQ	% Contrib. HI
Aluminum	6,227	4.72E-06	NA	1.0E-03	5.8E-08	--	--	1.7E-07	1.7E-04	100.0%	3.8E-08	--	--	2.6E-07	2.6E-04	100.0%
Antimony	7.82	5.93E-09	NA	NA	7.3E-11	--	--	2.1E-10	--	--	4.7E-11	--	--	3.3E-10	--	--
Arsenic	2.06	1.56E-09	1.5E+01	NA	1.9E-11	2.9E-10	100.0%	5.6E-11	--	--	1.2E-11	1.9E-10	100.0%	8.7E-11	--	--
Iron	1,623	1.23E-06	NA	NA	1.5E-08	--	--	4.4E-08	--	--	9.9E-09	--	--	6.9E-08	--	--
					Total ILCR:	2.9E-10	100.0%	Total HI:	1.7E-04	100.0%	Total ILCR:	1.9E-10	100.0%	Total HI:	2.6E-04	100.0%

NOTES:
-- - Not applicable.
NA - Toxicity criterion not available.

ADULT AND YOUTH (AGES 6-15) TRESPASSERS - CURRENT SCENARIO
ACCIDENTAL INGESTION OF SURFACE WATER - SITE 10 (ORIGINAL BASE LANDFILL)
REASONABLE MAXIMUM EXPOSURE
POTENTIAL CARCINOGENIC AND NONCARCINOGENIC RISKS
MCB CAMP LEJEUNE - JACKSONVILLE, NC

CDI (mg/kg/d)= (C*IR*ET*EF*ED)/(BW*AT)
ILCR = CDI*CSFo
HQ = CDI/RfDo

Parameter	Units	Description	Adult	Youth	
CDI	mg/kg/d	Chronic daily intake	CS	CS	(Chemical Specific)
ILCR	NA	Incremental lifetime cancer risk	CS	CS	
CSFo	1/(mg/kg/d)	Oral cancer slope factor	CS	CS	
HQ	NA	Hazard quotient	CS	CS	
RfDo	mg/kg/d	Oral reference dose	CS	CS	
C	mg/L	Concentration of chemical in water	CS	CS	
IR-W	L/hour	Ingestion Rate of water	0.01	0.01	
ET	hours/day	Exposure Time	2.6	2.6	
EF	days/year	Exposure Frequency	48	48	
ED	years	Exposure Duration	24	10	
BW	kg	Body weight	70	45	
AT-C	days	Averaging time, carcinogens	25,550	25,550	
AT-N	days	Averaging time, noncarcinogens	8,760	3,650	

				Adult						Older Child					
				Carcinogens			Noncarcinogens			Carcinogens			Noncarcinogens		
Parameter	Cw (mg/L)	CSFo 1/(mg/kg/d)	RfDo (mg/kg/d)	CDI (mg/kg/d)	ILCR	% Contrib. Total ILCR	CDI (mg/kg/d)	HQ	% Contrib. HI	CDI (mg/kg/d)	ILCR	% Contrib. Total ILCR	CDI (mg/kg/d)	HQ	% Contrib. HI
Aluminum	1.27	NA	1.0E+00	2.1E-05	--	--	6.2E-05	6.2E-05	15.5%	1.4E-05	--	--	9.6E-05	9.6E-05	15.5%
Iron	1.94	NA	3.0E-01	3.3E-05	--	--	9.5E-05	3.2E-04	79.1%	2.1E-05	--	--	1.5E-04	4.9E-04	79.1%
Mercury	0.00006	NA	3.0E-04	1.0E-09	--	--	2.9E-09	9.8E-06	2.4%	6.5E-10	--	--	4.6E-09	1.5E-05	2.4%
Zinc	0.0717	NA	3.0E-01	1.2E-06	--	--	3.5E-06	1.2E-05	2.9%	7.8E-07	--	--	5.4E-06	1.8E-05	2.9%
				Total ILCR:	--	--	Total HI:	4.0E-04	100.0%	Total ILCR:	--	--	Total HI:	6.2E-04	100.0%

NOTES:
-- - Not applicable.
NA - Toxicity criterion not available.

ADULT AND YOUTH (AGES 6-15) TRESPASSERS - CURRENT SCENARIO
DERMAL CONTACT WITH SURFACE WATER - SITE 10 (ORIGINAL BASE LANDFILL)
REASONABLE MAXIMUM EXPOSURE
POTENTIAL CARCINOGENIC AND NONCARCINOGENIC RISKS
MCB CAMP LEJEUNE - JACKSONVILLE, NC

DAD (mg/kg/d)= (C*CF*Kp*SA*EF*ED*ET)/(BW*AT)

ILCR = CDI*CSFo Adj CSF Adj = CSF/AD
HQ = CDI/RfDo Adj RfD Adj = RfD*AD

Parameter	Units	Description	Adult	Youth	
DAD	mg/kg/d	Dermally absorbed dose	CS	CS	(Chemical Specific)
ILCR	NA	Incremental lifetime cancer risk	CS	CS	
CSFd	1/(mg/kg/d)	Dermal cancer slope factor	CS	CS	
HQ	NA	Hazard quotient	CS	CS	
RfDd	mg/kg/d	Dermal reference dose	CS	CS	
SA	cm2	Skin surface area available for contact	5,800	3,480	
EF	days/year	Exposure frequency	48	48	
ED	years	Exposure duration	24	10	
ET	hours/day	Exposure time	2.6	2.6	
BW	kg	Body weight	70	45	
AT-C	days	Averaging time, carcinogens	25,550	25,550	
AT-N	days	Averaging time, noncarcinogens	8,760	3,650	
C	mg/L	Concentration of chemical in water	CS	CS	
CF	L/cm3	Conversion factor	1.00E-03	1.00E-03	
Kp	cm/hour	Dermal permeability coefficient	CS	CS	
AD	NA	Adjustment for Absorbed Dose	CS	CS	

					Adult						Young Child					
					Carcinogens			Noncarcinogens			Carcinogens			Noncarcinogens		
Parameter	Cw (mg/L)	Kp (cm/hour)	CSFd 1/(mg/kg/d)	RfDd (mg/kg/d)	DAD (mg/kg/d)	ILCR	% Contrib. Total ILCR	DAD (mg/kg/d)	HQ	% Contrib. HI	DAD (mg/kg/d)	ILCR	% Contrib. Total ILCR	DAD (mg/kg/d)	HQ	% Contrib. HI
Aluminum	1.27	1.0E-03	NA	2.7E-01	1.2E-05	--	--	3.6E-05	1.3E-04	38.1%	4.8E-06	--	--	3.4E-05	1.2E-04	38.1%
Iron	1.94	1.0E-03	NA	3.0E-01	1.9E-05	--	--	5.5E-05	1.8E-04	52.5%	7.3E-06	--	--	5.1E-05	1.7E-04	52.5%
Mercury	0.00006	1.0E-03	NA	3.0E-04	5.8E-10	--	--	1.7E-09	5.7E-06	1.6%	2.3E-10	--	--	1.6E-09	5.3E-06	1.6%
Zinc	0.0717	1.0E-03	NA	7.5E-02	7.0E-07	--	--	2.0E-06	2.7E-05	7.7%	2.7E-07	--	--	1.9E-06	2.5E-05	7.7%
					Total ILCR:	--	--	Total HI:	3.5E-04	100.0%	Total ILCR:	--	--	Total HI:	3.3E-04	100.0%

NOTES:
-- - Not applicable.
NA - Toxicity criterion not available.

ADULT AND YOUNG CHILD (AGES 1 TO 6 YEARS) RESIDENTS - FUTURE SCENARIO
ACCIDENTAL INGESTION OF SURFACE SOIL - SITE 10 (ORIGINAL BASE LANDFILL)
REASONABLE MAXIMUM EXPOSURE
POTENTIAL CARCINOGENIC AND NONCARCINOGENIC RISKS
MCB CAMP LEJEUNE - JACKSONVILLE, NC

CDI (mg/kg/d)= (C*IR*CF*FI*EF*ED)/(BW*AT)
ILCR = CDI*CSFo
HQ = CDI/RfDo

Parameter	Units	Description	Adult	Young Child	
CDI	mg/kg/d	Chronic daily intake	CS	CS	(Chemical Specific)
ILCR	NA	Incremental lifetime cancer risk	CS	CS	
CSFo	1/(mg/kg/d)	Oral cancer slope factor	CS	CS	
HQ	NA	Hazard quotient	CS	CS	
RfDo	mg/kg/d	Oral reference dose	CS	CS	
C	mg/kg	Concentration of chemical in soil	CS	CS	
IR-S	mg/day	Ingestion rate of soil	100	200	
CF	kg/mg	Conversion factor	1.00E-06	1.00E-06	
FI	NA	Fraction of soil ingested from site	1	1	
EF	days/year	Exposure frequency	350	350	
ED	years	Exposure duration	30	6	
BW	kg	Body weight	70	15	
AT-C	days	Averaging time, carcinogens	25,550	25,550	
AT-N	days	Averaging time, noncarcinogens	10,950	2,190	

				Adult						Young Child					
				Carcinogens			Noncarcinogens			Carcinogens			Noncarcinogens		
Parameter	C (mg/kg)	CSFo 1/(mg/kg/d)	RfDo (mg/kg/d)	CDI (mg/kg/d)	ILCR	% Contrib. Total ILCR	CDI (mg/kg/d)	HQ	% Contrib. HI	CDI (mg/kg/d)	ILCR	% Contrib. Total ILCR	CDI (mg/kg/d)	HQ	% Contrib. HI
Aluminum	6,227	NA	1.0E+00	3.7E-03	--	--	8.5E-03	8.5E-03	16.4%	6.8E-03	--	--	8.0E-02	8.0E-02	16.4%
Antimony	7.82	NA	4.0E-04	4.6E-06	--	--	1.1E-05	2.7E-02	51.4%	8.6E-06	--	--	1.0E-04	2.5E-01	51.4%
Arsenic	2.06	1.5E+00	3.0E-04	1.2E-06	1.8E-06	100.0%	2.8E-06	9.4E-03	18.0%	2.3E-06	3.4E-06	100.0%	2.6E-05	8.8E-02	18.0%
Iron	1,623	NA	3.0E-01	9.5E-04	--	--	2.2E-03	7.4E-03	14.2%	1.8E-03	--	--	2.1E-02	6.9E-02	14.2%
				Total ILCR:	1.8E-06	100.0%	Total HI:	5.2E-02	100.0%	Total ILCR:	3.4E-06	100.0%	Total HI:	4.9E-01	100.0%

NOTES:
-- - Not applicable.
NA - Toxicity criterion not available.

ADULT AND YOUNG CHILD (AGES 1 TO 6 YEARS) RESIDENTS - FUTURE SCENARIO
DERMAL CONTACT WITH SURFACE SOIL - SITE 10 (ORIGINAL BASE LANDFILL)
REASONABLE MAXIMUM EXPOSURE
POTENTIAL CARCINOGENIC AND NONCARCINOGENIC RISKS
MCB CAMP LEJEUNE - JACKSONVILLE, NC

DAD (mg/kg/d)= (C*CF*AF*ABS*SA*EF*ED)/(BW*AT)
ILCR = CDI*CSFd
HQ = CDI/RfDd

Parameter	Units	Description	Adult	Young Child	
DAD	mg/kg/d	Dermally absorbed dose	CS	CS	(Chemical Specific)
ILCR	NA	Incremental lifetime cancer risk	CS	CS	
CSFd	1/(mg/kg/d)	Dermal cancer slope factor	CS	CS	
HQ	NA	Hazard quotient	CS	CS	
RfDd	mg/kg/d	Dermal reference dose	CS	CS	
C	mg/kg	Concentration of chemical in soil	CS	CS	
CF	kg/mg	Conversion factor	1.00E-06	1.00E-06	
AF	mg/cm2	Soil to skin adherence factor	1	1	
ABS	NA	Absorption fraction	CS	CS	
SA	cm2/day	Skin surface area available for contact	5,800	2,100	
EF	days/year	Exposure frequency	350	350	
ED	years	Exposure duration	30	6	
BW	kg	Body weight	70	15	
AT-C	days	Averaging time, carcinogens	25,550	25,550	
AT-N	days	Averaging time, noncarcinogens	10,950	2,190	

					Adult						Young Child					
					Carcinogens			Noncarcinogens			Carcinogens			Noncarcinogens		
Parameter	C (mg/kg)	ABS	CSFd 1/(mg/kg/d)	RfDd (mg/kg/d)	DAD (mg/kg/d)	ILCR	% Contrib. Total ILCR	DAD (mg/kg/d)	HQ	% Contrib. HI	DAD (mg/kg/d)	ILCR	% Contrib. Total ILCR	DAD (mg/kg/d)	HQ	% Contrib. HI
Aluminum	6,227	0.01	NA	2.7E-01	2.1E-03	--	--	4.9E-03	1.8E-02	9.4%	7.2E-04	--	--	8.4E-03	3.1E-02	9.4%
Antimony	7.82	0.01	NA	4.0E-05	2.7E-06	--	--	6.2E-06	1.6E-01	79.6%	9.0E-07	--	--	1.1E-05	2.6E-01	79.6%
Arsenic	2.06	0.03	1.6E+00	2.9E-04	2.1E-06	3.3E-06	100.0%	4.9E-06	1.7E-02	8.8%	7.1E-07	1.1E-06	100.0%	8.3E-06	2.9E-02	8.8%
Iron	1,623	0.01	NA	3.0E-01	5.5E-04	--	--	1.3E-03	4.3E-03	2.2%	1.9E-04	--	--	2.2E-03	7.3E-03	2.2%
					Total ILCR:	3.3E-06	100.0%	Total HI:	2.0E-01	100.0%	Total ILCR:	1.1E-06	100.0%	Total HI:	3.3E-01	100.0%

NOTES:
-- - Not applicable.
NA - Toxicity criterion not available.

ADULT AND YOUNG CHILD (AGES 1 TO 6 YEARS) RESIDENTS - FUTURE SCENARIO
INHALATION OF FUGITIVE DUSTS EMANATING FROM SURFACE SOIL - SITE 10 (ORIGINAL BASE LANDFILL)
REASONABLE MAXIMUM EXPOSURE
POTENTIAL CARCINOGENIC AND NONCARCINOGENIC RISKS
MCB CAMP LEJEUNE - JACKSONVILLE, NC

CDI (mg/kg/d)= (Ca*RR*ET*EF*ED)/(BW*AT)
Where: Ca = C * (1/PEF)

ILCR = CDI*CSFi
HQ = CDI/RfDi

Parameter	Units	Description	Adult	Young Child	
CDI	mg/kg/d	Chronic daily intake	CS	CS	(Chemical Specific)
ILCR	NA	Incremental lifetime cancer risk	CS	CS	
CSFi	1/(mg/kg/d)	Inhalation cancer slope factor	CS	CS	
HQ	NA	Hazard quotient	CS	CS	
RfDi	mg/kg/d	Inhalation reference dose	CS	CS	
Ca	mg/m3	Concentration of chemical in air as fugitive dusts	CS	CS	
C	mg/kg	Concentration of chemical in soil	CS	CS	
PEF	m3/kg	Particulate emission factor	1.32E+09	1.32E+09	
RR	m3/hour	Respiration rate	0.80	0.60	
ET	hours/day	Exposure time	24	24	
EF	days/year	Exposure frequency	350	350	
ED	years	Exposure duration	30	6	
BW	kg	Body weight	70	15	
AT-C	days	Averaging time, carcinogens	25,550	25,550	
AT-N	days	Averaging time, noncarcinogens	10,950	2,190	

					Adult						Young Child					
					Carcinogens			Noncarcinogens			Carcinogens			Noncarcinogens		
Parameter	C (mg/kg)	Ca (mg/m3)	CSFi 1/(mg/kg/d)	RfDi (mg/kg/d)	CDI (mg/kg/d)	ILCR	% Contrib. Total ILCR	CDI (mg/kg/d)	HQ	% Contrib. HI	CDI (mg/kg/d)	ILCR	% Contrib. Total ILCR	CDI (mg/kg/d)	HQ	% Contrib. HI
Aluminum	6,227	4.72E-06	NA	1.0E-03	5.3E-07	--	--	1.2E-06	1.2E-03	100.0%	3.7E-07	--	--	4.3E-06	4.3E-03	100.0%
Antimony	7.82	5.93E-09	NA	NA	6.7E-10	--	--	1.6E-09	--	--	4.7E-10	--	--	5.5E-09	--	--
Arsenic	2.06	1.56E-09	1.5E+01	NA	1.8E-10	2.7E-09	100.0%	4.1E-10	--	--	1.2E-10	1.9E-09	100.0%	1.4E-09	--	--
Iron	1,623	1.23E-06	NA	NA	1.4E-07	--	--	3.2E-07	--	--	9.7E-08	--	--	1.1E-06	--	--
					Total ILCR:	2.7E-09	100.0%	Total HI:	1.2E-03	100.0%	Total ILCR:	1.9E-09	100.0%	Total HI:	4.3E-03	100.0%

NOTES:
-- - Not applicable.
NA - Toxicity criterion not available.

ADULT AND YOUNG CHILD (AGES 1 TO 6 YEARS) RESIDENTS - FUTURE SCENARIO
ACCIDENTAL INGESTION OF GROUNDWATER IN BENEFICIAL USE SCENARIO - SITE 10 (ORIGINAL BASE LANDFILL)
REASONABLE MAXIMUM EXPOSURE
POTENTIAL CARCINOGENIC AND NONCARCINOGENIC RISKS
MCB CAMP LEJEUNE - JACKSONVILLE, NC

CDI (mg/kg/d)= (C*IR*EF*ED)/(BW*AT)
ILCR = CDI*CSFo
HQ = CDI/RfDo

Parameter	Units	Description	Adult	Young Child	
CDI	mg/kg/d	Chronic daily intake	CS	CS	(Chemical Specific)
ILCR	NA	Incremental lifetime cancer risk	CS	CS	
CSFo	1/(mg/kg/d)	Oral cancer slope factor	CS	CS	
HQ	NA	Hazard quotient	CS	CS	
RfDo	mg/kg/d	Oral reference dose	CS	CS	
C	mg/L	Concentration of chemical in water	CS	CS	
IR-W	L/day	Ingestion rate of water	2	1	
EF	days/year	Exposure frequency	350	350	
ED	years	Exposure duration	30	6	
BW	kg	Body weight	70	15	
AT-C	days	Averaging time, carcinogens	25,550	25,550	
AT-N	days	Averaging time, noncarcinogens	10,950	2,190	

				Adult						Young Child					
				Carcinogens			Noncarcinogens			Carcinogens			Noncarcinogens		
Parameter	C (mg/L)	CSFo 1/(mg/kg/d)	RfDo (mg/kg/d)	CDI (mg/kg/d)	ILCR	% Contrib. Total ILCR	CDI (mg/kg/d)	HQ	% Contrib. HI	CDI (mg/kg/d)	ILCR	% Contrib. Total ILCR	CDI (mg/kg/d)	HQ	% Contrib. HI
Iron	0.700	NA	3.0E-01	8.2E-03	--	--	1.9E-02	6.4E-02	100.0%	3.8E-03	--	--	4.5E-02	1.5E-01	100.0%
				Total ILCR:	--	--	Total HI:	6.4E-02	100.0%	Total ILCR:	--	--	Total HI:	1.5E-01	100.0%

NOTES:
-- - Not applicable.
NA - Toxicity criterion not available.

ADULT AND YOUNG CHILD (AGES 1 TO 6 YEARS) RESIDENTS - FUTURE SCENARIO
DERMAL CONTACT WITH GROUNDWATER IN BENEFICIAL USE SCENARIO - SITE 10 (ORIGINAL BASE LANDFILL)
REASONABLE MAXIMUM EXPOSURE
POTENTIAL CARCINOGENIC AND NONCARCINOGENIC RISKS
MCB CAMP LEJEUNE - JACKSONVILLE, NC

DAD (mg/kg/d)= (C*CF*Kp*SA*EF*ED*ET)/(BW*AT)

ILCR = CDI*CSFo Adj CSF Adj = CSF/AD
HQ = CDI/RfDo Adj RfD Adj = RfD*AD

Parameter	Units	Description	Adult	Young Child	
DAD	mg/kg/d	Dermally absorbed dose	CS	CS	(Chemical Specific)
ILCR	NA	Incremental lifetime cancer risk	CS	CS	
CSFd	1/(mg/kg/d)	Dermal cancer slope factor	CS	CS	
HQ	NA	Hazard quotient	CS	CS	
RfDd	mg/kg/d	Dermal reference dose	CS	CS	
SA	cm2	Skin surface area available for contact	23,000	8,380	
EF	days/year	Exposure frequency	350	350	
ED	years	Exposure duration	30	6	
ET	hours/day	Exposure time	0	0.25	
BW	kg	Body weight	70	15	
AT-C	days	Averaging time, carcinogens	25,550	25,550	
AT-N	days	Averaging time, noncarcinogens	10,950	2,190	
C	mg/L	Concentration of chemical in water	CS	CS	
CF	L/cm3	Conversion factor	1.00E-03	1.00E-03	
Kp	cm/hour	Dermal permeability coefficient	CS	CS	
AD	NA	Adjustment for absorbed dose	CS	CS	

					Adult						Young Child					
					Carcinogens			Noncarcinogens			Carcinogens			Noncarcinogens		
Parameter	C (mg/L)	Kp (cm/hour)	CSFd 1/(mg/kg/d)	RfDd (mg/kg/d)	DAD (mg/kg/d)	ILCR	% Contrib. Total ILCR	DAD (mg/kg/d)	HQ	% Contrib. HI	DAD (mg/kg/d)	ILCR	% Contrib. Total ILCR	DAD (mg/kg/d)	HQ	% Contrib. HI
Iron	0.700	0.001	NA	3.0E-01	2.4E-05	--	--	5.5E-05	1.8E-04	100.0%	8.0E-06	--	--	9.4E-05	3.1E-04	100.0%
					Total ILCR:	--	--	Total HI:	1.8E-04	100.0%	Total ILCR:	--	--	Total HI:	3.1E-04	100.0%

NOTES:
-- - Not applicable.
NA - Toxicity criterion not available.

ADULT AND YOUNG CHILD (AGES 1 TO 6 YEARS) RESIDENTS - FUTURE SCENARIO
ACCIDENTAL INGESTION OF SURFACE WATER - SITE 10 (ORIGINAL BASE LANDFILL)
REASONABLE MAXIMUM EXPOSURE
POTENTIAL CARCINOGENIC AND NONCARCINOGENIC RISKS
MCB CAMP LEJEUNE - JACKSONVILLE, NC

CDI (mg/kg/d)= (C*IR*ET*EF*ED)/(BW*AT)
ILCR = CDI*CSFo
HQ = CDI/RfDo

Parameter	Units	Description	Adult	Young Child	
CDI	mg/kg/d	Chronic daily intake	CS	CS	(Chemical Specific)
ILCR	NA	Incremental lifetime cancer risk	CS	CS	
CSFo	1/(mg/kg/d)	Oral cancer slope factor	CS	CS	
HQ	NA	Hazard quotient	CS	CS	
RfDo	mg/kg/d	Oral reference dose	CS	CS	
C	mg/L	Concentration of chemical in water	CS	CS	
IR-W	L/hour	Ingestion rate of water	0.01	0.05	
ET	hours/day	Exposure time	2.6	2.6	
EF	days/year	Exposure frequency	48	48	
ED	years	Exposure duration	30	6	
BW	kg	Body weight	70	15	
AT-C	days	Averaging time, carcinogens	25,550	25,550	
AT-N	days	Averaging time, noncarcinogens	10,950	2,190	

				Adult						Young Child					
				Carcinogens			Noncarcinogens			Carcinogens			Noncarcinogens		
Parameter	C (mg/L)	CSFo 1/(mg/kg/d)	RfDo (mg/kg/d)	CDI (mg/kg/d)	ILCR	% Contrib. Total ILCR	CDI (mg/kg/d)	HQ	% Contrib. HI	CDI (mg/kg/d)	ILCR	% Contrib. Total ILCR	CDI (mg/kg/d)	HQ	% Contrib. HI
Aluminum	1.27000	NA	1.0E+00	2.7E-05	--	--	6.2E-05	6.2E-05	15.5%	1.2E-04	--	--	1.4E-03	1.4E-03	15.5%
Iron	1.94441	NA	3.0E-01	4.1E-05	--	--	9.5E-05	3.2E-04	79.1%	1.9E-04	--	--	2.2E-03	7.4E-03	79.1%
Mercury	0.00006	NA	3.0E-04	1.3E-09	--	--	2.9E-09	9.8E-06	2.4%	5.9E-09	--	--	6.8E-08	2.3E-04	2.4%
Zinc	0.07173	NA	3.0E-01	1.5E-06	--	--	3.5E-06	1.2E-05	2.9%	7.0E-06	--	--	8.2E-05	2.7E-04	2.9%
				Total ILCR:	--	--	Total HI:	4.0E-04	100.0%	Total ILCR:	--	--	Total HI:	9.3E-03	100.0%

NOTES:
-- - Not applicable.
NA - Toxicity criterion not available.

ADULT AND YOUNG CHILD (AGES 1 TO 6 YEARS) RESIDENTS - FUTURE SCENARIO
DERMAL CONTACT WITH SURFACE WATER - SITE 10 (ORIGINAL BASE LANDFILL)
REASONABLE MAXIMUM EXPOSURE
POTENTIAL CARCINOGENIC AND NONCARCINOGENIC RISKS
MCB CAMP LEJEUNE - JACKSONVILLE, NC

DAD (mg/kg/d)= (C*CF*Kp*SA*EF*ED*ET)/(BW*AT)

ILCR = CDI*CSFo Adj CSF Adj = CSF/AD
HQ = CDI/RfDo Adj RfD Adj = RfD*AD

Parameter	Units	Description	Adult	Young Child	
DAD	mg/kg/d	Dermally absorbed dose	CS	CS	(Chemical Specific)
ILCR	NA	Incremental lifetime cancer risk	CS	CS	
CSFd	1/(mg/kg/d)	Dermal cancer slope factor	CS	CS	
HQ	NA	Hazard quotient	CS	CS	
RfDd	mg/kg/d	Dermal reference dose	CS	CS	
SA	cm2	Skin surface area available for contact	5,800	2,100	
EF	days/year	Exposure frequency	48	48	
ED	years	Exposure duration	30	6	
ET	hours/day	Exposure time	2.6	2.6	
BW	kg	Body weight	70	15	
AT-C	days	Averaging time, carcinogens	25,550	25,550	
AT-N	days	Averaging time, noncarcinogens	10,950	2,190	
C	mg/L	Concentration of chemical in water	CS	CS	
CF	L/cm3	Conversion factor	1.00E-03	1.00E-03	
Kp	cm/hour	Dermal permeability coefficient	CS	CS	
AD	NA	Adjustment for absorbed dose	CS	CS	

					Adult						Young Child					
					Carcinogens			Noncarcinogens			Carcinogens			Noncarcinogens		
Parameter	C (mg/L)	Kp (cm/hour)	CSFd 1/(mg/kg/d)	RfDd (mg/kg/d)	DAD (mg/kg/d)	ILCR	% Contrib. Total ILCR	DAD (mg/kg/d)	HQ	% Contrib. HI	DAD (mg/kg/d)	ILCR	% Contrib. Total ILCR	DAD (mg/kg/d)	HQ	% Contrib. HI
Aluminum	1.27000	0.001	NA	2.7E-01	1.5E-05	--	--	3.6E-05	1.3E-04	38.1%	5.2E-06	--	--	6.1E-05	2.3E-04	38.1%
Iron	1.94441	0.001	NA	3.0E-01	2.4E-05	--	--	5.5E-05	1.8E-04	52.5%	8.0E-06	--	--	9.3E-05	3.1E-04	52.5%
Mercury	0.00006	0.001	NA	3.0E-04	7.3E-10	--	--	1.7E-09	5.7E-06	1.6%	2.5E-10	--	--	2.9E-09	9.6E-06	1.6%
Zinc	0.07173	0.001	NA	7.5E-02	8.7E-07	--	--	2.0E-06	2.7E-05	7.7%	2.9E-07	--	--	3.4E-06	4.6E-05	7.7%
					Total ILCR:	--	--	Total HI:	3.5E-04	100.0%	Total ILCR:	--	--	Total HI:	5.9E-04	100.0%

NOTES:
-- - Not applicable.
NA - Toxicity criterion not available.

ADULT CONSTRUCTION WORKERS - FUTURE SCENARIO
ACCIDENTAL INGESTION OF SURFACE SOIL - SITE 10 (ORIGINAL BASE LANDFILL)
REASONABLE MAXIMUM EXPOSURE
POTENTIAL CARCINOGENIC AND NONCARCINOGENIC RISKS
NAVAL WEAPONS STATION YORKTOWN - YORKTOWN, VIRGINIA

CDI (mg/kg/d)= (C*IR*CF*FI*EF*ED)/(BW*AT)
ILCR = CDI*CSFo
HQ = CDI/RfDo

Parameter	Units	Description	Construction Worker	
CDI	mg/kg/d	Chronic daily intake	CS	(Chemical Specific)
ILCR	NA	Incremental lifetime cancer risk	CS	
CSFo	1/(mg/kg/d)	Oral cancer slope factor	CS	
HQ	NA	Hazard quotient	CS	
RfDo	mg/kg/d	Oral reference dose	CS	
C	mg/kg	Concentration of chemical in soil	CS	
IR-S	mg/day	Ingestion rate of soil	480	
CF	kg/mg	Conversion factor	1.00E-06	
FI	NA	Fraction of soil ingested from site	1	
EF	days/year	Exposure frequency	250	
ED	years	Exposure duration	1	
BW	kg	Body weight	70	
AT-C	days	Averaging time, carcinogens	25,550	
AT-N	days	Averaging time, noncarcinogens	365	

				Carcinogens			Noncarcinogens		
Parameter	C (mg/kg)	CSFo 1/(mg/kg/d)	RfDo (mg/kg/d)	CDI (mg/kg/d)	ILCR	% Contrib. Total ILCR	CDI (mg/kg/d)	HQ	% Contrib. HI
Aluminum	6,227	NA	1.0E+00	4.2E-04	--	--	2.9E-02	2.9E-02	16.4%
Antimony	7.82	NA	4.0E-04	5.2E-07	--	--	3.7E-05	9.2E-02	51.4%
Arsenic	2.06	1.5E+00	3.0E-04	1.4E-07	2.1E-07	100.0%	9.7E-06	3.2E-02	18.0%
Iron	1,623	NA	3.0E-01	1.1E-04	--	--	7.6E-03	2.5E-02	14.2%
				Total ILCR:	2.1E-07	100.0%	Total HI:	1.8E-01	100.0%

NOTES:
-- - Not applicable.
NA - Toxicity criterion not available.

ADULT CONSTRUCTION WORKERS - FUTURE SCENARIO
DERMAL CONTACT WITH SURFACE SOIL - SITE 10 (ORIGINAL BASE LANDFILL)
REASONABLE MAXIMUM EXPOSURE
POTENTIAL CARCINOGENIC AND NONCARCINOGENIC RISKS
NAVAL WEAPONS STATION YORKTOWN - YORKTOWN, VIRGINIA

DAD (mg/kg/d)= (C*CF*AF*ABS*SA*EF*ED)/(BW*AT)
ILCR = CDI*CSFd
HQ = CDI/RfDd

Parameter	Units	Description	Construction Worker	
DAD	mg/kg/d	Dermally absorbed dose	CS	(Chemical Specific)
ILCR	NA	Incremental lifetime cancer risk	CS	
CSFd	1/(mg/kg/d)	Dermal cancer slope factor	CS	
HQ	NA	Hazard quotient	CS	
RfDd	mg/kg/d	Dermal reference dose	CS	
C	mg/kg	Concentration of chemical in soil	CS	
CF	kg/mg	Conversion factor	1.00E-06	
AF	mg/cm2	Soil to skin adherence factor	1	
ABS	NA	Absorption fraction	CS	
SA	cm2/day	Skin surface area available for contact	5,800	
EF	days/year	Exposure frequency	250	
ED	years	Exposure duration	1	
BW	kg	Body weight	70	
AT-C	days	Averaging time, carcinogens	25,550	
AT-N	days	Averaging time, noncarcinogens	365	

					Carcinogens			Noncarcinogens		
Parameter	C (mg/kg)	ABS	CSFd 1/(mg/kg/d)	RfDd (mg/kg/d)	DAD (mg/kg/d)	ILCR	% Contrib. Total ILCR	DAD (mg/kg/d)	HQ	% Contrib. HI
Aluminum	6,227	0.01	NA	2.7E-01	5.0E-05	--	--	3.5E-03	1.3E-02	9.4%
Antimony	7.82	0.01	NA	4.0E-05	6.3E-08	--	--	4.4E-06	1.1E-01	79.6%
Arsenic	2.06	0.03	1.6E+00	2.9E-04	5.0E-08	7.9E-08	100.0%	3.5E-06	1.2E-02	8.8%
Iron	1,623	0.01	NA	3.0E-01	1.3E-05	--	--	9.2E-04	3.1E-03	2.2%
					Total ILCR:	7.9E-08	100.0%	Total HI:	1.4E-01	100.0%

NOTES:
-- - Not applicable.
NA - Toxicity criterion not available.

ADULT CONSTRUCTION WORKERS - FUTURE SCENARIO
INHALATION OF FUGITIVE DUSTS EMANATING FROM SURFACE SOIL - SITE 10 (ORIGINAL BASE LANDFILL)
REASONABLE MAXIMUM EXPOSURE
POTENTIAL CARCINOGENIC AND NONCARCINOGENIC RISKS
NAVAL WEAPONS STATION YORKTOWN - YORKTOWN, VIRGINIA

CDI (mg/kg/d)= (Ca*RR*ET*EF*ED)/(BW*AT)
Where: Ca = C * (1/PEF)

ILCR = CDI*CSFi
HQ = CDI/RfDi

Parameter	Units	Description	Construction Worker	
CDI	mg/kg/d	Chronic daily intake	CS	(Chemical Specific)
ILCR	NA	Incremental lifetime cancer risk	CS	
CSFi	1/(mg/kg/d)	Inhalation cancer slope factor	CS	
HQ	NA	Hazard quotient	CS	
RfDi	mg/kg/d	Inhalation reference dose	CS	
Ca	mg/m3	Concentration of chemical in air as fugitive dusts	CS	
C	mg/kg	Concentration of chemical in soil	CS	
PEF	m3/kg	Particulate emission factor	1.32E+09	
RR	m3/hour	Respiration rate	0.80	
ET	hours/day	Exposure time	8	
EF	days/year	Exposure frequency	250	
ED	years	Exposure duration	1	
BW	kg	Body weight	70	
AT-C	days	Averaging time, carcinogens	25,550	
AT-N	days	Averaging time, noncarcinogens	365	

					Carcinogens			Noncarcinogens		
Parameter	C (mg/kg)	Ca (mg/m3)	CSFi 1/(mg/kg/d)	RfDi (mg/kg/d)	CDI (mg/kg/d)	ILCR	% Contrib. Total ILCR	CDI (mg/kg/d)	HQ	% Contrib. HI
Aluminum	6,227	4.72E-06	NA	1.0E-03	4.2E-09	--	--	3.0E-07	3.0E-04	100.0%
Antimony	7.82	5.93E-09	NA	NA	5.3E-12	--	--	3.7E-10	--	--
Arsenic	2.06	1.56E-09	1.5E+01	NA	1.4E-12	2.1E-11	100.0%	9.8E-11	--	--
Iron	1,623	1.23E-06	NA	NA	1.1E-09	--	--	7.7E-08	--	--
					Total ILCR:	2.1E-11	100.0%	Total HI:	3.0E-04	100.0%

NOTES:
-- - Not applicable.
NA - Toxicity criterion not available.

ADULT CONSTRUCTION WORKERS - FUTURE SCENARIO
ACCIDENTAL INGESTION OF SUBSURFACE SOIL - SITE 10 (ORIGINAL BASE LANDFILL)
REASONABLE MAXIMUM EXPOSURE
POTENTIAL CARCINOGENIC AND NONCARCINOGENIC RISKS
MCB CAMP LEJEUNE - JACKSONVILLE, NC

CDI (mg/kg/d)= (C*IR*CF*FI*EF*ED)/(BW*AT)
ILCR = CDI*CSFo
HQ = CDI/RfDo

Parameter	Units	Description	Construction Worker	
CDI	mg/kg/d	Chronic daily intake	CS	(Chemical Specific)
ILCR	NA	Incremental lifetime cancer risk	CS	
CSFo	1/(mg/kg/d)	Oral cancer slope factor	CS	
HQ	NA	Hazard quotient	CS	
RfDo	mg/kg/d	Oral reference dose	CS	
C	mg/kg	Concentration of chemical in soil	CS	
IR-S	mg/day	Ingestion rate of soil	480	
CF	kg/mg	Conversion factor	1.00E-06	
FI	NA	Fraction of soil ingested from site	1	
EF	days/year	Exposure frequency	250	
ED	years	Exposure duration	1	
BW	kg	Body weight	70	
AT-C	days	Averaging time, carcinogens	25,550	
AT-N	days	Averaging time, noncarcinogens	365	

				Carcinogens			Noncarcinogens		
Parameter	C (mg/kg)	CSFo 1/(mg/kg/d)	RfDo (mg/kg/d)	CDI (mg/kg/d)	ILCR	% Contrib. Total ILCR	CDI (mg/kg/d)	HQ	% Contrib. HI
Benzo(a)anthracene	0.316	7.3E-01	NA	2.1E-08	1.5E-08	1.8%	1.5E-06	--	--
Benzo(a)pyrene	0.304	7.3E+00	NA	2.0E-08	1.5E-07	17.3%	1.4E-06	--	--
Benzo(b)fluoranthene	0.316	7.3E-01	NA	2.1E-08	1.5E-08	1.8%	1.5E-06	--	--
Benzo(k)fluoranthene	0.285	7.3E-02	NA	1.9E-08	1.4E-09	0.2%	1.3E-06	--	--
Carbazole	0.196	2.0E-02	NA	1.3E-08	2.6E-10	0.0%	9.2E-07	--	--
Chrysene	0.329	7.3E-03	NA	2.2E-08	1.6E-10	0.0%	1.5E-06	--	--
Dibenz(a,h)anthracene	0.203	7.3E+00	NA	1.4E-08	1.0E-07	11.6%	9.6E-07	--	--
Indeno(1,2,3-cd)pyrene	0.239	7.3E-01	NA	1.6E-08	1.2E-08	1.4%	1.1E-06	--	--
Antimony	16.5	NA	4.0E-04	1.1E-06	--	--	7.8E-05	1.9E-01	20.6%
Arsenic	5.65	1.5E+00	3.0E-04	3.8E-07	5.7E-07	66.0%	2.7E-05	8.8E-02	9.4%
Barium	81.0	NA	7.0E-02	5.4E-06	--	--	3.8E-04	5.4E-03	0.6%
Cadmium	1.55	NA	1.0E-03	1.0E-07	--	--	7.3E-06	7.3E-03	0.8%
Chromium	11.7	NA	3.0E-03 (1)	7.9E-07	--	--	5.5E-05	1.8E-02	2.0%
Copper	417	NA	4.0E-02	2.8E-05	--	--	2.0E-03	4.9E-02	5.2%
Iron	30,064	NA	3.0E-01	2.0E-03	--	--	1.4E-01	4.7E-01	50.1%
Manganese	141	NA	2.0E-02	9.4E-06	--	--	6.6E-04	3.3E-02	3.5%
Thallium	1.1	NA	7.0E-05	7.4E-08	--	--	5.2E-06	7.4E-02	7.9%
				Total ILCR:	8.6E-07	100.0%	Total HI:	9.4E-01	100.0%

NOTES:
-- - Not applicable.
NA - Toxicity criterion not available.
(1) Value for chromium VI

ADULT CONSTRUCTION WORKERS - FUTURE SCENARIO
DERMAL CONTACT WITH SUBSURFACE SOIL - SITE 10 (ORIGINAL BASE LANDFILL)
REASONABLE MAXIMUM EXPOSURE
POTENTIAL CARCINOGENIC AND NONCARCINOGENIC RISKS
MCB CAMP LEJEUNE - JACKSONVILLE, NC

DAD (mg/kg/d)= (C*CF*AF*ABS*SA*EF*ED)/(BW*AT)
ILCR = CDI*CSFd
HQ = CDI/RfDd

Parameter	Units	Description	Construction Worker	
DAD	mg/kg/d	Dermally absorbed dose	CS	(Chemical Specific)
ILCR	NA	Incremental lifetime cancer risk	CS	
CSFd	1/(mg/kg/d)	Dermal cancer slope factor	CS	
HQ	NA	Hazard quotient	CS	
RfDd	mg/kg/d	Dermal reference dose	CS	
C	mg/kg	Concentration of chemical in soil	CS	
CF	kg/mg	Conversion factor	1.00E-06	
AF	mg/cm2	Soil to skin adherence factor	1	
ABS	NA	Absorption fraction	CS	
SA	cm2/day	Skin surface area available for contact	5,800	
EF	days/year	Exposure frequency	250	
ED	years	Exposure duration	1	
BW	kg	Body weight	70	
AT-C	days	Averaging time, carcinogens	25,550	
AT-N	days	Averaging time, noncarcinogens	365	

					Carcinogens			Noncarcinogens		
Parameter	C (mg/kg)	ABS	CSFd 1/(mg/kg/d)	RfDd (mg/kg/d)	DAD (mg/kg/d)	ILCR	% Contrib. Total ILCR	DAD (mg/kg/d)	HQ	% Contrib. HI
Benzo(a)anthracene	0.316	0.1	NA	NA	2.6E-08	--	--	1.8E-06	--	--
Benzo(a)pyrene	0.304	0.1	NA	NA	2.5E-08	--	--	1.7E-06	--	--
Benzo(b)fluoranthene	0.316	0.1	NA	NA	2.6E-08	--	--	1.8E-06	--	--
Benzo(k)fluoranthene	0.285	0.1	NA	NA	2.3E-08	--	--	1.6E-06	--	--
Carbazole	0.196	0.1	NA	NA	1.6E-08	--	--	1.1E-06	--	--
Chrysene	0.329	0.1	NA	NA	2.7E-08	--	--	1.9E-06	--	--
Dibenz(a,h)anthracene	0.203	0.1	NA	NA	1.6E-08	--	--	1.2E-06	--	--
Indeno(1,2,3-cd)pyrene	0.239	0.1	NA	NA	1.9E-08	--	--	1.4E-06	--	--
Antimony	16.5	0.01	NA	4.0E-05	1.3E-07	--	--	9.4E-06	2.3E-01	39.9%
Arsenic	5.65	0.03	1.6E+00	2.9E-04	1.4E-07	2.2E-07	100.0%	9.6E-06	3.4E-02	5.7%
Barium	81.0	0.01	NA	7.0E-02	6.6E-07	--	--	4.6E-05	6.6E-04	0.1%
Cadmium	1.55	0.01	NA	5.0E-05	1.3E-08	--	--	8.8E-07	1.8E-02	3.0%
Chromium	11.7	0.01	NA	3.0E-05 (1)	9.5E-08	--	--	6.7E-06	2.2E-01	37.7%
Copper	417	0.01	NA	2.4E-02	3.4E-06	--	--	2.4E-04	9.9E-03	1.7%
Iron	30,064	0.01	NA	3.0E-01	2.4E-04	--	--	1.7E-02	5.7E-02	9.7%
Manganese	141	0.01	NA	2.0E-02	1.1E-06	--	--	8.0E-05	4.0E-03	0.7%
Thallium	1.1	0.01	NA	7.0E-05	8.9E-09	--	--	6.2E-07	8.9E-03	1.5%
					Total ILCR:	2.2E-07	100.0%	Total HI:	5.9E-01	100.0%

NOTES:
-- - Not applicable.
NA - Toxicity criterion not available.
(1) Value for chromium VI

ADULT CONSTRUCTION WORKERS - FUTURE SCENARIO
INHALATION OF FUGITIVE DUSTS EMANATING FROM EXCAVATED SUBSURFACE SOIL - SITE 10 (ORIGINAL BASE LANDFILL)
REASONABLE MAXIMUM EXPOSURE
POTENTIAL CARCINOGENIC AND NONCARCINOGENIC RISKS
MCB CAMP LEJEUNE - JACKSONVILLE, NC

CDI (mg/kg/d)= (Ca*RR*ET*EF*ED)/(BW*AT)
Where: Ca = C * (1/PEF)

ILCR = CDI*CSFi
HQ = CDI/RfDi

Parameter	Units	Description	Construction Worker	
CDI	mg/kg/d	Chronic daily intake	CS	(Chemical Specific)
ILCR	NA	Incremental lifetime cancer risk	CS	
CSFi	1/(mg/kg/d)	Inhalation cancer slope factor	CS	
HQ	NA	Hazard quotient	CS	
RfDi	mg/kg/d	Inhalation reference dose	CS	
Ca	mg/m3	Concentration of chemical in air as fugitive dusts	CS	
C	mg/kg	Concentration of chemical in soil	CS	
PEF	m3/kg	Particulate emission factor	1.32E+09	
RR	m3/hour	Respiration rate	0.80	
ET	hours/day	Exposure time	8	
EF	days/year	Exposure frequency	250	
ED	years	Exposure duration	1	
BW	kg	Body weight	70	
AT-C	days	Averaging time, carcinogens	25,550	
AT-N	days	Averaging time, noncarcinogens	365	

Parameter	C (mg/kg)	Ca (mg/m3)	CSFi 1/(mg/kg/d)	RfDi (mg/kg/d)	Carcinogens CDI (mg/kg/d)	ILCR	% Contrib. Total ILCR	Noncarcinogens CDI (mg/kg/d)	HQ	% Contrib. HI
Benzo(a)anthracene	0.316	2.40E-10	NA	NA	2.1E-13	--	--	1.5E-11	--	--
Benzo(a)pyrene	0.304	2.30E-10	3.1E+00	NA	2.1E-13	6.4E-13	0.2%	1.4E-11	--	--
Benzo(b)fluoranthene	0.316	2.40E-10	NA	NA	2.1E-13	--	--	1.5E-11	--	--
Benzo(k)fluoranthene	0.285	2.16E-10	NA	NA	1.9E-13	--	--	1.4E-11	--	--
Carbazole	0.196	1.48E-10	NA	NA	1.3E-13	--	--	9.3E-12	--	--
Chrysene	0.329	2.49E-10	NA	NA	2.2E-13	--	--	1.6E-11	--	--
Dibenz(a,h)anthracene	0.203	1.54E-10	NA	NA	1.4E-13	--	--	9.6E-12	--	--
Indeno(1,2,3-cd)pyrene	0.239	1.81E-10	NA	NA	1.6E-13	--	--	1.1E-11	--	--
Antimony	16.5	1.25E-08	NA	NA	1.1E-11	--	--	7.8E-10	--	--
Arsenic	5.65	4.28E-09	1.5E+01	NA	3.8E-12	5.8E-11	14.8%	2.7E-10	--	--
Barium	81.0	6.14E-08	NA	1.4E-04	5.5E-11	--	--	3.8E-09	2.7E-05	5.3%
Cadmium	1.55	1.17E-09	6.3E+00	5.7E-05	1.0E-12	6.6E-12	1.7%	7.3E-11	1.3E-06	0.3%
Chromium	11.7	8.89E-09	4.1E+01 (1)	3.0E-05 (1)	8.0E-12	3.3E-10	83.4%	5.6E-10	1.9E-05	3.6%
Copper	417	3.16E-07	NA	NA	2.8E-10	--	--	2.0E-08	--	--
Iron	30,064	2.28E-05	NA	NA	2.0E-08	--	--	1.4E-06	--	--
Manganese	141	1.07E-07	NA	1.4E-05	9.5E-11	--	--	6.7E-09	4.7E-04	90.8%
Thallium	1.1	8.33E-10	NA	NA	7.5E-13	--	--	5.2E-11	--	--
					Total ILCR:	3.9E-10	100.0%	Total HI:	5.1E-04	100.0%

NOTES:
-- - Not applicable.
NA - Toxicity criterion not available.
(1) Value for chromium VI

ADULT CONSTRUCTION WORKERS - FUTURE SCENARIO
ACCIDENTAL INGESTION OF SURFACE SOIL - SITE 10 (ORIGINAL BASE LANDFILL)
CENTRAL TENDENCY
POTENTIAL CARCINOGENIC AND NONCARCINOGENIC RISKS
NAVAL WEAPONS STATION YORKTOWN - YORKTOWN, VIRGINIA

CDI (mg/kg/d)= (C*IR*CF*FI*EF*ED)/(BW*AT)
ILCR = CDI*CSFo
HQ = CDI/RfDo

Parameter	Units	Description	Construction Worker	
CDI	mg/kg/d	Chronic daily intake	CS	(Chemical Specific)
ILCR	NA	Incremental lifetime cancer risk	CS	
CSFo	1/(mg/kg/d)	Oral cancer slope factor	CS	
HQ	NA	Hazard quotient	CS	
RfDo	mg/kg/d	Oral reference dose	CS	
C	mg/kg	Concentration of chemical in soil	CS	
IR-S	mg/day	Ingestion rate of soil	480	
CF	kg/mg	Conversion factor	1.00E-06	
FI	NA	Fraction of soil ingested from site	1	
EF	days/year	Exposure frequency	219	
ED	years	Exposure duration	1	
BW	kg	Body weight	70	
AT-C	days	Averaging time, carcinogens	25,550	
AT-N	days	Averaging time, noncarcinogens	365	

				Carcinogens			Noncarcinogens		
Parameter	C (mg/kg)	CSFo 1/(mg/kg/d)	RfDo (mg/kg/d)	CDI (mg/kg/d)	ILCR	% Contrib. Total ILCR	CDI (mg/kg/d)	HQ	% Contrib. HI
Aluminum	6,227	NA	1.0E+00	3.7E-04	--	--	2.6E-02	2.6E-02	16.4%
Antimony	7.82	NA	4.0E-04	4.6E-07	--	--	3.2E-05	8.0E-02	51.4%
Arsenic	2.06	1.5E+00	3.0E-04	1.2E-07	1.8E-07	100.0%	8.5E-06	2.8E-02	18.0%
Iron	1,623	NA	3.0E-01	9.5E-05	--	--	6.7E-03	2.2E-02	14.2%
				Total ILCR:	1.8E-07	100.0%	Total HI:	1.6E-01	100.0%

NOTES:
-- - Not applicable.
NA - Toxicity criterion not available.

ADULT CONSTRUCTION WORKERS - FUTURE SCENARIO
DERMAL CONTACT WITH SURFACE SOIL - SITE 10 (ORIGINAL BASE LANDFILL)
CENTRAL TENDENCY
POTENTIAL CARCINOGENIC AND NONCARCINOGENIC RISKS
NAVAL WEAPONS STATION YORKTOWN - YORKTOWN, VIRGINIA

DAD (mg/kg/d)= (C*CF*AF*ABS*SA*EF*ED)/(BW*AT)
ILCR = CDI*CSFd
HQ = CDI/RfDd

Parameter	Units	Description	Construction Worker	
DAD	mg/kg/d	Dermally absorbed dose	CS	(Chemical Specific)
ILCR	NA	Incremental lifetime cancer risk	CS	
CSFd	1/(mg/kg/d)	Dermal cancer slope factor	CS	
HQ	NA	Hazard quotient	CS	
RfDd	mg/kg/d	Dermal reference dose	CS	
C	mg/kg	Concentration of chemical in soil	CS	
CF	kg/mg	Conversion factor	1.00E-06	
AF	mg/cm2	Soil to skin adherence factor	1	
ABS	NA	Absorption fraction	CS	
SA	cm2/day	Skin surface area available for contact	3,230	
EF	days/year	Exposure frequency	219	
ED	years	Exposure duration	1	
BW	kg	Body weight	70	
AT-C	days	Averaging time, carcinogens	25,550	
AT-N	days	Averaging time, noncarcinogens	365	

					Carcinogens			Noncarcinogens		
Parameter	C (mg/kg)	ABS	CSFd 1/(mg/kg/d)	RfDd (mg/kg/d)	DAD (mg/kg/d)	ILCR	% Contrib. Total ILCR	DAD (mg/kg/d)	HQ	% Contrib. HI
Aluminum	6,227	0.01	NA	2.7E-01	2.5E-05	--	--	1.7E-03	6.4E-03	9.4%
Antimony	7.82	0.01	NA	4.0E-05	3.1E-08	--	--	2.2E-06	5.4E-02	79.6%
Arsenic	2.06	0.03	1.6E+00	2.9E-04	2.4E-08	3.9E-08	100.0%	1.7E-06	6.0E-03	8.8%
Iron	1,623	0.01	NA	3.0E-01	6.4E-06	--	--	4.5E-04	1.5E-03	2.2%
					Total ILCR:	3.9E-08	100.0%	Total HI:	6.8E-02	100.0%

NOTES:
-- - Not applicable.
NA - Toxicity criterion not available.

ADULT CONSTRUCTION WORKERS - FUTURE SCENARIO
INHALATION OF FUGITIVE DUSTS EMANATING FROM SURFACE SOIL - SITE 10 (ORIGINAL BASE LANDFILL)
CENTRAL TENDENCY
POTENTIAL CARCINOGENIC AND NONCARCINOGENIC RISKS
NAVAL WEAPONS STATION YORKTOWN - YORKTOWN, VIRGINIA

CDI (mg/kg/d)= (Ca*RR*ET*EF*ED)/(BW*AT)
Where: Ca = C * (1/PEF)

ILCR = CDI*CSFi
HQ = CDI/RfDi

Parameter	Units	Description	Construction Worker	
CDI	mg/kg/d	Chronic daily intake	CS	(Chemical Specific)
ILCR	NA	Incremental lifetime cancer risk	CS	
CSFi	1/(mg/kg/d)	Inhalation cancer slope factor	CS	
HQ	NA	Hazard quotient	CS	
RfDi	mg/kg/d	Inhalation reference dose	CS	
Ca	mg/m3	Concentration of chemical in air as fugitive dusts	CS	
C	mg/kg	Concentration of chemical in soil	CS	
PEF	m3/kg	Particulate emission factor	1.32E+09	
RR	m3/hour	Respiration rate	0.80	
ET	hours/day	Exposure time	8	
EF	days/year	Exposure frequency	219	
ED	years	Exposure duration	1	
BW	kg	Body weight	70	
AT-C	days	Averaging time, carcinogens	25,550	
AT-N	days	Averaging time, noncarcinogens	365	

					Carcinogens			Noncarcinogens		
Parameter	C (mg/kg)	Ca (mg/m3)	CSFi 1/(mg/kg/d)	RfDi (mg/kg/d)	CDI (mg/kg/d)	ILCR	% Contrib. Total ILCR	CDI (mg/kg/d)	HQ	% Contrib. HI
Aluminum	6,227	4.72E-06	NA	1.0E-03	3.7E-09	--	--	2.6E-07	2.6E-04	100.0%
Antimony	7.82	5.93E-09	NA	NA	4.6E-12	--	--	3.3E-10	--	--
Arsenic	2.06	1.56E-09	1.5E+01	NA	1.2E-12	1.8E-11	100.0%	8.6E-11	--	--
Iron	1,623	1.23E-06	NA	NA	9.6E-10	--	--	6.7E-08	--	--
					Total ILCR:	1.8E-11	100.0%	Total HI:	2.6E-04	100.0%

NOTES:
-- - Not applicable.
NA - Toxicity criterion not available.

ADULT CONSTRUCTION WORKERS - FUTURE SCENARIO
ACCIDENTAL INGESTION OF SUBSURFACE SOIL - SITE 10 (ORIGINAL BASE LANDFILL)
CENTRAL TENDENCY
POTENTIAL CARCINOGENIC AND NONCARCINOGENIC RISKS
MCB CAMP LEJEUNE - JACKSONVILLE, NC

CDI (mg/kg/d)= (C*IR*CF*FI*EF*ED)/(BW*AT)
ILCR = CDI*CSFo
HQ = CDI/RfDo

Parameter	Units	Description	Construction Worker	
CDI	mg/kg/d	Chronic daily intake	CS	(Chemical Specific)
ILCR	NA	Incremental lifetime cancer risk	CS	
CSFo	1/(mg/kg/d)	Oral cancer slope factor	CS	
HQ	NA	Hazard quotient	CS	
RfDo	mg/kg/d	Oral reference dose	CS	
C	mg/kg	Concentration of chemical in soil	CS	
IR-S	mg/day	Ingestion rate of soil	480	
CF	kg/mg	Conversion factor	1.00E-06	
FI	NA	Fraction of soil ingested from site	1	
EF	days/year	Exposure frequency	219	
ED	years	Exposure duration	1	
BW	kg	Body weight	70	
AT-C	days	Averaging time, carcinogens	25,550	
AT-N	days	Averaging time, noncarcinogens	365	

				Carcinogens			Noncarcinogens		
Parameter	C (mg/kg)	CSFo 1/(mg/kg/d)	RfDo (mg/kg/d)	CDI (mg/kg/d)	ILCR	% Contrib. Total ILCR	CDI (mg/kg/d)	HQ	% Contrib. HI
Benzo(a)anthracene	0.316	7.3E-01	NA	1.9E-08	1.4E-08	1.8%	1.3E-06	--	--
Benzo(a)pyrene	0.304	7.3E+00	NA	1.8E-08	1.3E-07	17.3%	1.3E-06	--	--
Benzo(b)fluoranthene	0.316	7.3E-01	NA	1.9E-08	1.4E-08	1.8%	1.3E-06	--	--
Benzo(k)fluoranthene	0.285	7.3E-02	NA	1.7E-08	1.2E-09	0.2%	1.2E-06	--	--
Carbazole	0.196	2.0E-02	NA	1.2E-08	2.3E-10	0.0%	8.1E-07	--	--
Chrysene	0.329	7.3E-03	NA	1.9E-08	1.4E-10	0.0%	1.4E-06	--	--
Dibenz(a,h)anthracene	0.203	7.3E+00	NA	1.2E-08	8.7E-08	11.6%	8.4E-07	--	--
Indeno(1,2,3-cd)pyrene	0.239	7.3E-01	NA	1.4E-08	1.0E-08	1.4%	9.8E-07	--	--
Antimony	16.5	NA	4.0E-04	9.7E-07	--	--	6.8E-05	1.7E-01	20.6%
Arsenic	5.65	1.5E+00	3.0E-04	3.3E-07	5.0E-07	66.0%	2.3E-05	7.7E-02	9.4%
Barium	81.0	NA	7.0E-02	4.8E-06	--	--	3.3E-04	4.8E-03	0.6%
Cadmium	1.55	NA	1.0E-03	9.1E-08	--	--	6.4E-06	6.4E-03	0.8%
Chromium	11.7	NA	3.0E-03 (1)	6.9E-07	--	--	4.8E-05	1.6E-02	2.0%
Copper	417	NA	4.0E-02	2.5E-05	--	--	1.7E-03	4.3E-02	5.2%
Iron	30,064	NA	3.0E-01	1.8E-03	--	--	1.2E-01	4.1E-01	50.1%
Manganese	141	NA	2.0E-02	8.3E-06	--	--	5.8E-04	2.9E-02	3.5%
Thallium	1.1	NA	7.0E-05	6.5E-08	--	--	4.5E-06	6.5E-02	7.9%
				Total ILCR:	7.5E-07	100.0%	Total HI:	8.2E-01	100.0%

NOTES:
-- - Not applicable.
NA - Toxicity criterion not available.
(1) Value for chromium VI

ADULT CONSTRUCTION WORKERS - FUTURE SCENARIO
DERMAL CONTACT WITH SUBSURFACE SOIL - SITE 10 (ORIGINAL BASE LANDFILL)
CENTRAL TENDENCY
POTENTIAL CARCINOGENIC AND NONCARCINOGENIC RISKS
MCB CAMP LEJEUNE - JACKSONVILLE, NC

DAD (mg/kg/d)= (C*CF*AF*ABS*SA*EF*ED)/(BW*AT)
ILCR = CDI*CSFd
HQ = CDI/RfDd

Parameter	Units	Description	Construction Worker	
DAD	mg/kg/d	Dermally absorbed dose	CS	(Chemical Specific)
ILCR	NA	Incremental lifetime cancer risk	CS	
CSFd	1/(mg/kg/d)	Dermal cancer slope factor	CS	
HQ	NA	Hazard quotient	CS	
RfDd	mg/kg/d	Dermal reference dose	CS	
C	mg/kg	Concentration of chemical in soil	CS	
CF	kg/mg	Conversion factor	1.00E-06	
AF	mg/cm2	Soil to skin adherence factor	1	
ABS	NA	Absorption fraction	CS	
SA	cm2/day	Skin surface area available for contact	3,230	
EF	days/year	Exposure frequency	219	
ED	years	Exposure duration	1	
BW	kg	Body weight	70	
AT-C	days	Averaging time, carcinogens	25,550	
AT-N	days	Averaging time, noncarcinogens	365	

					Carcinogens			Noncarcinogens		
Parameter	C (mg/kg)	ABS	CSFd 1/(mg/kg/d)	RfDd (mg/kg/d)	DAD (mg/kg/d)	ILCR	% Contrib. Total ILCR	DAD (mg/kg/d)	HQ	% Contrib. HI
Benzo(a)anthracene	0.316	0.1	NA	NA	1.3E-08	--	--	8.8E-07	--	--
Benzo(a)pyrene	0.304	0.1	NA	NA	1.2E-08	--	--	8.4E-07	--	--
Benzo(b)fluoranthene	0.316	0.1	NA	NA	1.3E-08	--	--	8.8E-07	--	--
Benzo(k)fluoranthene	0.285	0.1	NA	NA	1.1E-08	--	--	7.9E-07	--	--
Carbazole	0.196	0.1	NA	NA	7.7E-09	--	--	5.4E-07	--	--
Chrysene	0.329	0.1	NA	NA	1.3E-08	--	--	9.1E-07	--	--
Dibenz(a,h)anthracene	0.203	0.1	NA	NA	8.0E-09	--	--	5.6E-07	--	--
Indeno(1,2,3-cd)pyrene	0.239	0.1	NA	NA	9.4E-09	--	--	6.6E-07	--	--
Antimony	16.5	0.01	NA	4.0E-05	6.5E-08	--	--	4.6E-06	1.1E-01	39.9%
Arsenic	5.65	0.03	1.6E+00	2.9E-04	6.7E-08	1.1E-07	100.0%	4.7E-06	1.6E-02	5.7%
Barium	81.0	0.01	NA	7.0E-02	3.2E-07	--	--	2.2E-05	3.2E-04	0.1%
Cadmium	1.55	0.01	NA	5.0E-05	6.1E-09	--	--	4.3E-07	8.6E-03	3.0%
Chromium	11.7	0.01	NA	3.0E-05 (1)	4.6E-08	--	--	3.2E-06	1.1E-01	37.7%
Copper	417	0.01	NA	2.4E-02	1.6E-06	--	--	1.2E-04	4.8E-03	1.7%
Iron	30,064	0.01	NA	3.0E-01	1.2E-04	--	--	8.3E-03	2.8E-02	9.7%
Manganese	141	0.01	NA	2.0E-02	5.6E-07	--	--	3.9E-05	1.9E-03	0.7%
Thallium	1.1	0.01	NA	7.0E-05	4.4E-09	--	--	3.0E-07	4.4E-03	1.5%
					Total ILCR:	1.1E-07	100.0%	Total HI:	2.9E-01	100.0%

NOTES:
-- - Not applicable.
NA - Toxicity criterion not available.
(1) Value for chromium VI

ADULT CONSTRUCTION WORKERS - FUTURE SCENARIO
INHALATION OF FUGITIVE DUSTS EMANATING FROM EXCAVATED SUBSURFACE SOIL - SITE 10 (ORIGINAL BASE LANDFILL)
CENTRAL TENDENCY
POTENTIAL CARCINOGENIC AND NONCARCINOGENIC RISKS
MCB CAMP LEJEUNE - JACKSONVILLE, NC

CDI (mg/kg/d)= (Ca*RR*ET*EF*ED)/(BW*AT)
Where: Ca = C * (1/PEF)

ILCR = CDI*CSFi
HQ = CDI/RfDi

Parameter	Units	Description	Construction Worker	
CDI	mg/kg/d	Chronic daily intake	CS	(Chemical Specific)
ILCR	NA	Incremental lifetime cancer risk	CS	
CSFi	1/(mg/kg/d)	Inhalation cancer slope factor	CS	
HQ	NA	Hazard quotient	CS	
RfDi	mg/kg/d	Inhalation reference dose	CS	
Ca	mg/m3	Concentration of chemical in air as fugitive dusts	CS	
C	mg/kg	Concentration of chemical in soil	CS	
PEF	m3/kg	Particulate emission factor	1.32E+09	
RR	m3/hour	Respiration rate	0.80	
ET	hours/day	Exposure time	8	
EF	days/year	Exposure frequency	219	
ED	years	Exposure duration	1	
BW	kg	Body weight	70	
AT-C	days	Averaging time, carcinogens	25,550	
AT-N	days	Averaging time, noncarcinogens	365	

					Carcinogens			Noncarcinogens		
Parameter	C (mg/kg)	Ca (mg/m3)	CSFi 1/(mg/kg/d)	RfDi (mg/kg/d)	CDI (mg/kg/d)	ILCR	% Contrib. Total ILCR	CDI (mg/kg/d)	HQ	% Contrib. HI
Benzo(a)anthracene	0.316	2.40E-10	NA	NA	1.9E-13	--	--	1.3E-11	--	--
Benzo(a)pyrene	0.304	2.30E-10	3.1E+00	NA	1.8E-13	5.6E-13	0.2%	1.3E-11	--	--
Benzo(b)fluoranthene	0.316	2.40E-10	NA	NA	1.9E-13	--	--	1.3E-11	--	--
Benzo(k)fluoranthene	0.285	2.16E-10	NA	NA	1.7E-13	--	--	1.2E-11	--	--
Carbazole	0.196	1.48E-10	NA	NA	1.2E-13	--	--	8.1E-12	--	--
Chrysene	0.329	2.49E-10	NA	NA	2.0E-13	--	--	1.4E-11	--	--
Dibenz(a,h)anthracene	0.203	1.54E-10	NA	NA	1.2E-13	--	--	8.5E-12	--	--
Indeno(1,2,3-cd)pyrene	0.239	1.81E-10	NA	NA	1.4E-13	--	--	9.9E-12	--	--
Antimony	16.5	1.25E-08	NA	NA	9.8E-12	--	--	6.9E-10	--	--
Arsenic	5.65	4.28E-09	1.5E+01	NA	3.4E-12	5.1E-11	14.8%	2.3E-10	--	--
Barium	81.0	6.14E-08	NA	1.4E-04	4.8E-11	--	--	3.4E-09	2.4E-05	5.3%
Cadmium	1.55	1.17E-09	6.3E+00	5.7E-05	9.2E-13	5.8E-12	1.7%	6.4E-11	1.1E-06	0.3%
Chromium	11.7	8.89E-09	4.1E+01 (1)	3.0E-05 (1)	7.0E-12	2.9E-10	83.4%	4.9E-10	1.6E-05	3.6%
Copper	417	3.16E-07	NA	NA	2.5E-10	--	--	1.7E-08	--	--
Iron	30,064	2.28E-05	NA	NA	1.8E-08	--	--	1.2E-06	--	--
Manganese	141	1.07E-07	NA	1.4E-05	8.4E-11	--	--	5.8E-09	4.1E-04	90.8%
Thallium	1.1	8.33E-10	NA	NA	6.5E-13	--	--	4.6E-11	--	--
					Total ILCR:	3.4E-10	100.0%	Total HI:	4.5E-04	100.0%

NOTES:
-- - Not applicable.
NA - Toxicity criterion not available.
(1) Value for chromium VI

APPENDIX K
SHORT-TAILED SHREW FOOD CHAIN MODEL

APPENDIX K
FOOD CHAIN MODEL

In order to provide additional support to the conclusion that risks to terrestrial receptors resulting from bioaccumulating chemicals detected in the surface soil are minimal, requiring no additional ecological evaluation, food chain modeling was conducted. The following paragraphs provide details of the modeling and various input parameters utilized.

The short-tailed shrew was chosen as a receptor species for the modeling based on the fact that it is a very small terrestrial mammal that consumes almost exclusively soil invertebrates (e.g. very sensitive to surface soil contaminants). Average (mean half non-detects) chemical concentrations were used to calculate exposure to the shrew via food chain transfer. In cases where the average concentration exceeded the maximum detected concentration, the maximum detected concentration was used. The average chemical concentrations provide a better estimate of the likely level of chemical exposure because the short-tailed shrew would be expected to forage in several different areas of the site, and, sometimes, off-site. Because some receptors are relatively immobile, *individuals* are more likely to be impacted by locations of maximum concentration. However, evaluation of the average exposure case is more instructive with regard to the level of impact that might be expected at the *population* level.

Not all chemicals were evaluated for food web exposures; only detected chemicals with the potential to bioaccumulate to a significant extent were evaluated. In general, bioaccumulating organic chemicals were defined as those with a maximum reported log octanol-water partition coefficient (K_{ow}) value of ≥ 3.0. All of the inorganic chemicals on the Target Analyte List (TAL) were also retained except for the essential macronutrients calcium, magnesium, sodium, and potassium and cyanide, which is readily metabolized and does not bioaccumulate (Eisler 1991).

Exposure to the shrew from chemicals in surface soil were determined by estimating the concentration of each chemical in each relevant dietary component. Incidental ingestion of soil was included when calculating the total exposure. Exposure via drinking water was also included in the food web model. Since receptors (and their prey) are not exposed directly to groundwater, food web exposures were not calculated based on groundwater concentrations.

Dietary items for which tissue concentrations were modeled included terrestrial soil invertebrates (i.e. earthworms). The methodologies used for tissue calculations are outlined in the paragraphs

that follow. The uptake of chemicals from the abiotic media into this food item was based (when available) on conservative (e.g., maximum or 90th percentile) bioconcentration factors (BCFs) or bioaccumulation factors (BAFs) from the literature. Default factors of 1.0 were used only when data were unavailable for a chemical in the literature.

Tissue concentrations in soil invertebrates (earthworms) were estimated by multiplying the maximum measured surface soil concentration for each chemical by chemical-specific BCFs or BAFs obtained from the literature. BCFs are calculated by dividing the concentration of a chemical in the tissues of an organism by the concentration of that same chemical in the surrounding environmental medium (in this case, soil) without accounting for uptake via the diet. BAFs consider both direct exposure to soil and exposure via the diet. Since earthworms consume soil, BAFs are more appropriate values and are used in the food web models when available. BAFs based on depurated analyses (soil was purged from the gut of the earthworm prior to analysis) are given preference over undepurated analyses when selecting BAF values since direct ingestion of soil is accounted for separately in the food web model.

The BCF/BAF values used were based on the ratio between dry-weight soil and dry-weight earthworm tissue. Literature values based on the ratio between dry-weight soil and wet-weight earthworm tissue were converted to a dry-weight basis by dividing the wet-weight BCF/BAF by the estimated solids content for earthworms (16 percent; USEPA 1993). For inorganic chemicals without available measured BAFs or BCFs, an earthworm BAF of 1.0 was assumed. The soil-to-earthworm BCFs/BAFs used in this evaluation are shown in Table K-1.

Dietary Intakes

Dietary intakes for the short-tailed shrew were calculated using the following formula (modified from USEPA [1993]):

$$DI_x = \frac{[[\sum_i (FIR)(FC_{xi})(PDF_i)] + [(FIR)(SC_x)(PDS)] + [(WIR)(WC_x)]]}{BW}$$

where: DI_x = Dietary intake for chemical x (mg chemical/kg body weight/day)

FIR = Food ingestion rate (kg/day, dry-weight)

FC_{xi} = Concentration of chemical x in food item i (mg/kg, dry weight)

PDF_i	=	Proportion of diet composed of food item i (dry weight basis)
SC_x	=	Concentration of chemical x in soil/sediment (mg/kg, dry weight)
PDS	=	Proportion of diet composed of soil/sediment (dry weight basis)
WIR	=	Water ingestion rate (L/day)
WC_x	=	Concentration of chemical x in water (mg/L)
BW	=	Body weight (kg, wet weight)

The following receptor-specific exposure assumptions were used in the equation. The diet of the short-tailed shrew was assumed to consist entirely of earthworms and soil. Incidental soil ingestion comprised 13 percent (Sample and Suter 1994) of the shrew's diet, while the remaining 87 percent (USEPA 1993) consisted of earthworms. The mean body weight of the short tailed shrew (0.01687 kg) was based on a study of male shrews in the fall in Pennsylvania reported in the USEPA's Wildlife Exposure Factors Handbook (1993). The food ingestion rate for the shrew (0.00936 kg/d – wet weight) was calculated by multiplying the mean body weight of the shrew by 55.5 percent (USEPA 1993). The mean body weight of the shrew was multiplied by 22.3 percent (USEPA 1993) resulting in a water ingestion rate of 0.00376 L/day.

Ingestion Screening Values

Ingestion screening values for dietary exposures were derived for each bioaccumulating chemical. Toxicological information from the literature for wildlife species most closely related to the short-tailed shrew was used, where available, but was supplemented by laboratory studies of non-wildlife species (e.g., laboratory mice) where necessary. The ingestion screening values are expressed as milligrams of the chemical per kilogram body weight of the receptor per day (mg/kg-BW/day).

Growth and reproduction were emphasized as assessment endpoints since they are the most relevant, ecologically, to maintaining viable populations and because they are generally the most studied chronic toxicological endpoints for ecological receptors. If several chronic toxicity studies were available from the literature, the most appropriate study was selected for each receptor species based on study design, study methodology, study duration, study endpoint, and test species. No Observed Adverse Effect Levels (NOAELs) based on growth and reproduction were utilized, where available, as the screening values. When chronic NOAEL values were unavailable, estimates were derived or extrapolated from chronic Lowest Observed Adverse Effect Levels (LOAELs) or acute values as follows:

- When values for chronic toxicity were not available, the median lethal dose (LD_{50}) was used. An uncertainty factor of 100 was used to convert the acute LD_{50} to a chronic NOAEL (i.e., the LD_{50} was multiplied by 0.01 to obtain the chronic NOAEL).

- An uncertainty factor of 10 was used to convert a reported LOAEL to a NOAEL.

Results

Ingestion screening values for the shrew are presented in Table K-2. The mean adjusted exposure concentrations, dose, and resulting adjusted HQ values are presented in Table K-3. HQs were calculated with NOAELs, LOAELs, and Maximum Acceptable Toxicant Concentrations (MATCs) (the geometric mean of the NOAEL and LOAEL). Calculations with NOAELs provide the most conservative risk estimate, while calculations with LOAELs provide the least conservative risk estimate. Calculations with MATCs provide realistic risk estimates since the MATC represents an estimation of the threshold concentration (i.e., the concentration above which a toxic effect on the test endpoint is produced). As Table K-4 illustrates, the only chemical presenting potential risks to the short-tailed shrew is aluminum. A NOAEL based HQ value of 1.2 was reported for aluminum. However, the reported MATC based HQ value for aluminum was below the reference HQ value of one. The result of this model indicates that potential risks resulting from the presence of bioaccumulating chemicals in the surface soil to the short-tailed shrew via food chain transfer are negligible.

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K-1
SOIL BIOCONCENTRATION FACTORS
USED FOR SOIL INVERTEBRATES
SITE 10 - ORIGINAL BASE LANDFILL
MARINE CORPS BASE, CAMP LEJUENE
NORTH CAROLINA

Chemical	Soil-Invertebrate BAF (dry weight)	
	Value	Reference
Inorganics		
Aluminum	0.053	Sample et al. 1998a
Antimony	0.063	Helmke et al. 1979
Arsenic	0.258	Sample et al. 1998a
Barium	0.36	Beyer and Stafford 1993
Beryllium	1	--
Cadmium	7.66	Sample et al. 1998a
Chromium	0.32	Sample et al. 1998a
Cobalt	0.38	Helmke et al. 1979
Copper	0.468	Sample et al. 1998a
Iron	0.038	Sample et al. 1998a
Lead	0.307	Sample et al. 1998a
Manganese	0.05	Sample et al. 1998a
Mercury	1.186	Sample et al. 1998a
Nickel	1.656	Sample et al. 1998a
Selenium	0.982	Sample et al. 1998a
Silver	1	--
Thallium	1	--
Vanadium	0.039	Sample et al. 1998a
Zinc	2.482	Sample et al. 1998a
Pesticides/PCBs		
4,4'-DDE	10.6	Menzie et al. 1992
4,4'-DDT	0.7	Menzie et al. 1992
Aroclor-1260	4.297	Sample et al. 1998a
Dieldrin	8	Beyer and Gish 1980
Endosulfan I	1	--
Endosulfan II	1	--
Endrin	1	--
Endrin Aldehyde	1	--
Heptachlor	10	Roberts and Dorough 1985
Heptachlor Epoxide	10	Roberts and Dorough 1985
Semivolatile Organics		
Benzo(a)anthracene	0.27	Beyer and Stafford 1993
Benzo(a)pyrene	0.34	Beyer and Stafford 1993
Benzo(b)fluoranthene	0.21	Beyer and Stafford 1993
Benzo(g,h,i)perylene	0.15	Beyer and Stafford 1993
Benzo(k)fluoranthene	0.21	Beyer and Stafford 1993
Chrysene	0.44	Beyer and Stafford 1993
Di-n-butylphthalate	1	--
Fluoranthene	0.37	Beyer and Stafford 1993
Indeno(1,2,3-cd)pyrene	0.41	Beyer and Stafford 1993
Phenanthrene	0.28	Beyer and Stafford 1993
Pyrene	0.39	Beyer and Stafford 1993
Volatile Organics		
Chlorobenzene	1	--
Toluene	1	--
Trichloroethene	1	--

K-2
SHORT TAILED SHREW TOXICITY INFORMATION
SITE 10 ORIGINAL BASE LANDFILL
MARINE CORPS BASE, CAMP LEJUENE
NORTH CAROLINA

Chemical	Test Organism	Body Weight kg	Duration	Exposure Route	Effect/Endpoint	LOAEL mg/kg/d	NOAEL mg/kg/d	Reference	Mean Shrew Body Weight kg	Shrew - Adj NOAEL mg/kg/d	Shrew - Adj LOAEL mg/kg/d	Shrew - Adj MATC mg/kg/d
Inorganics												
Aluminum	mouse	0.03	390 days	oral in water	reproduction	193	19.3	ATSDR 1990	0.01687	22.287	222.874	70.479
Antimony	mouse	0.03	lifetime	oral in water	lifespan/longevity	1.25	0.125	Sample et al. 1996	0.01687	0.144	1.443	0.456
Arsenic	mouse	0.03	3 generations	oral in water	reproduction	1.26	0.126	Sample et al. 1996	0.01687	0.146	1.455	0.460
Barium	rat	0.435	16 months	oral in water	growth/hypertension	19.8	5.1	Sample et al. 1996	0.01687	11.492	44.618	22.644
Beryllium	rat	0.35	lifetime	oral in water	longevity/weight loss	6.6	0.66	Sample et al. 1996	0.01687	1.409	14.086	4.454
Cadmium	rat	0.303	6 weeks	oral (gavage)	reproduction	10	1	Sample et al. 1996	0.01687	2.059	20.586	6.510
Chromium	rat	0.35	3 months	oral in water	mortality	131.4	13.14	Sample et al. 1996	0.01687	28.044	280.436	88.682
Cobalt	rat	0.35	69 days	oral in diet	reproduction	50	5	ATSDR 1992	0.01687	10.671	106.711	33.745
Copper	mink	1	357 days	oral in diet	reproduction	15.14	11.7	Sample et al. 1996	0.01687	32.464	42.009	36.930
Iron	rabbit	3.8	?	oral in diet	tolerance level	500	50	NAS 1980	0.01687	193.703	1937.034	612.544
Lead	rat	0.35	3 generations	oral in diet	reproduction	80	8	Sample et al. 1996	0.01687	17.074	170.737	53.992
Manganese	rat	0.35	224 days	oral in diet	reproduction	284	88	Sample et al. 1996	0.01687	187.811	606.117	337.395
Mercury	rat	0.35	3 generations	oral in diet	reproduction	0.16	0.032	Sample et al. 1996	0.01687	0.068	0.341	0.153
Nickel	rat	0.35	3 generations	oral in diet	reproduction	80	40	Sample et al. 1996	0.01687	85.369	170.737	120.729
Selenium	rat	0.35	1 year	oral in water	reproduction	0.33	0.2	Sample et al. 1996	0.01687	0.427	0.704	0.548
Silver	rat	0.35	2 weeks	oral in water	mortality	181	18.1	ATSDR 1990	0.01687	38.629	386.293	122.157
Thallium	rat	0.365	60 days	oral in water	reproduction	0.74	0.074	Sample et al. 1996	0.01687	0.160	1.596	0.505
Vanadium	rat	0.26	60 days +	oral intubation	reproduction	2.1	0.21	Sample et al. 1996	0.01687	0.416	4.161	1.316
Zinc	rat	0.35.	GD 1-16	oral in diet	reproduction	320	160	Sample et al. 1996	0.01687	341.474	682.949	482.918
Pesticides/PCBs												
4,4'-DDE	rat	0.35	2 years	oral in diet	reproduction	4	0.8	Sample et al. 1996	0.01687	1.707	8.537	3.818
4,4'-DDT	rat	0.35	2 years	oral in diet	reproduction	4	0.8	Sample et al. 1996	0.01687	1.707	8.537	3.818
Aroclor-1260	oldfield mouse	0.014	12 months	oral in diet	reproduction	0.68	0.068	Sample et al. 1996	0.01687	0.065	0.649	0.205
Dieldrin	rat	0.35	3 generations	oral in diet	reproduction	0.2	0.02	Sample et al. 1996	0.01687	0.043	0.427	0.135
Endosulfan I	rat	0.35	30 days	oral (intubation)	reproduction	15	1.5	Sample et al. 1996	0.01687	3.201	32.013	10.123
Endosulfan II	rat	0.35	30 days	oral (intubation)	reproduction	15	1.5	Sample et al. 1996	0.01687	3.201	32.013	10.123
Endrin	mouse	0.03	120 days	oral in diet	reproduction	0.92	0.092	Sample et al. 1996	0.01687	0.106	1.062	0.336
Endrin Aldehyde	mouse	0.03	120 days	oral in diet	reproduction	0.92	0.092	Sample et al. 1996	0.01687	0.106	1.062	0.336
Heptachlor	mink	1	181 days	oral in diet	reproduction	1	0.1	Sample et al. 1996	0.01687	0.277	2.775	0.877
Heptachlor Epoxide	mink	1	181 days	oral in diet	reproduction	1	0.1	Sample et al. 1996	0.01687	0.277	2.775	0.877
Semivolatile Organics												
Benzo(a)anthracene	mouse	0.03	GD 7-16	oral (intubation)	reproduction	10	1	Sample et al. 1996	0.01687	1.155	11.548	3.652
Benzo(a)pyrene	mouse	0.03	GD 7-16	oral (intubation)	reproduction	10	1	Sample et al. 1996	0.01687	1.155	11.548	3.652
Benzo(b)fluoranthene	mouse	0.03	GD 7-16	oral (intubation)	reproduction	10	1	Sample et al. 1996	0.01687	1.155	11.548	3.652
Benzo(g,h,i)perylene	mouse	0.03	19 to 29 days	oral in diet	reproduction	1330	133	ATSDR 1995	0.01687	153.587	1535.865	485.683
Benzo(k)fluoranthene	mouse	0.03	GD 7-16	oral (intubation)	reproduction	10	1	Sample et al. 1996	0.01687	1.155	11.548	3.652
Chrysene	mouse	0.03	GD 7-16	oral (intubation)	reproduction	10	1	Sample et al. 1996	0.01687	1.155	11.548	3.652
Di-n-butylphthalate	mouse	0.03	105 days	oral in diet	reproduction	1833	550	Sample et al. 1996	0.01687	635.132	2116.723	1159.482
Fluoranthene	mouse	0.03	13 weeks	oral (gavage)	hepatic	1250	125	ATSDR 1995	0.01687	144.348	1443.483	456.469
Indeno(1,2,3-cd)pyrene	mouse	0.03	GD 7-16	oral (intubation)	reproduction	10	1	Sample et al. 1996	0.01687	1.155	11.548	3.652
Phenanthrene	mouse	0.03	19 to 29 days	oral in diet	reproduction	1330	133	ATSDR 1995	0.01687	153.587	1535.865	485.683
Pyrene	mouse	0.03	19 to 29 days	oral in diet	reproduction	1330	133	ATSDR 1995	0.01687	153.587	1535.865	485.683
Volatile Organics												
Chlorobenzene	dog	12.7	chronic	?	liver	273	27.3	IRIS 1998	0.01687	143.000	1429.996	452.204
Toluene	mouse	0.03	GD 6-12	oral (gavage)	reproduction	260	26	Sample et al. 1996	0.01687	30.024	300.244	94.946
Trichloroethene	rat	0.35	?	oral	reproduction	10000	1000	Coulston and Kolbye 199	0.01687	2134.215	21342.154	6748.982

K-3

MEAN ADJUSTED EXPOSURE CONCENTRATIONS, DOSE AND HQ'S - SHORT TAILED SHREW

SITE 10 - ORIGINAL BASE LANDFILL

MARINE CORPS BASE, CAMP LEJUENE

NORTH CAROLINA

Chemical	Mean Drinking Water Concentration mg/L	Mean Soil Concentration mg/kg dw	Mean Terr Inv Concentration mg/kg dw	Mean Dose mg/kg/d	Mean Adjusted HQ NOAEL	Mean Adjusted HQ LOAEL	Mean Adjusted HQ MATC
Inorganics							
Aluminum	0.34625	1702.6741	90.2417273	26.70459844	1.20	0.12	0.38
Antimony	0.03	7.3926	0.4657338	0.128010905	0.89	0.09	0.28
Arsenic	0.003375	1.3285	0.342753	0.042568555	0.29	0.03	0.09
Barium	0.0278	14.5593	5.241348	0.57919754	0.05	0.01	0.03
Beryllium	0.0025	0.6115	0.6115	0.0548587	0.04	0.00	0.01
Cadmium	0.0025	0.6115	4.68409	0.369490713	0.18	0.02	0.06
Chromium	0.0034375	2.6619	0.851808	0.097302815	0.00	0.00	0.00
Cobalt	0.025	5.5174	2.096612	0.231243722	0.02	0.00	0.01
Copper	0.002825	5.7652	2.6981136	0.275628908	0.01	0.01	0.01
Cyanide*	0.005	1.2074	1.2074	0.10833212	0.00	0.00	0.00
Iron	1.0265	1057.4778	40.1841564	15.54090041	0.08	0.01	0.03
Lead	0.003	14.9481	4.5890667	0.527762803	0.03	0.00	0.01
Manganese	0.1687	12.7333	0.636665	0.233799506	0.00	0.00	0.00
Mercury	0.00006	0.0567	0.0672462	0.005863097	0.09	0.02	0.04
Nickel	0.02	4.7074	7.7954544	0.661047851	0.01	0.00	0.01
Selenium	0.002375	0.663	0.651066	0.058482052	0.14	0.08	0.11
Silver	0.005	1.2815	1.2815	0.1149122	0.00	0.00	0.00
Thallium	0.005	1.2074	1.2074	0.10833212	0.68	0.07	0.21
Vanadium	0.01735	5.7519	0.2243241	0.087599366	0.21	0.02	0.07
Zinc	0.057725	29.3611	72.8742502	5.981790287	0.02	0.01	0.01
Pesticides/PCBs							
4,4'-DDE	0.00005	0.0020056	0.02125936	0.001676716	0.00	0.00	0.00
4,4'-DDT	0.00005	0.0023167	0.00162169	0.000163179	0.00	0.00	0.00
Aroclor-1260	0.0005	0.0224074	0.096284598	0.007808734	0.12	0.01	0.04
Dieldrin	0.00005	0.0020056	0.0160448	0.00127386	0.03	0.00	0.01
Endosulfan I	0.000025	0.0011481	0.0011481	0.000107526	0.00	0.00	0.00
Endosulfan II	0.00005	0.0019944	0.0019944	0.000188253	0.00	0.00	0.00
Endrin	0.00005	0.002013	0.002013	0.000189904	0.00	0.00	0.00
Endrin Aldehyde	0.00005	0.0021074	0.0021074	0.000198287	0.00	0.00	0.00
Heptachlor	0.000025	0.0010333	0.010333	0.00081579	0.00	0.00	0.00
Heptachlor Epoxide	0.000025	0.0010778	0.010778	0.000850682	0.00	0.00	0.00
Semivolatile Organics							
Benzo(a)anthracene	0.005	0.086	0.02322	0.003901668	0.00	0.00	0.00
Benzo(a)pyrene	0.005	0.084	0.02856	0.004291127	0.00	0.00	0.00
Benzo(b)fluoranthene	0.005	0.092	0.01932	0.003669634	0.00	0.00	0.00
Benzo(g,h,i)perylene	0.005	0.045	0.00675	0.002155958	0.00	0.00	0.00
Benzo(k)fluoranthene	0.005	0.096	0.02016	0.003780705	0.00	0.00	0.00
Chrysene	0.005	0.093	0.04092	0.005349908	0.00	0.00	0.00
Di-n-butylphthalate	0.005	0.067	0.067	0.0070646	0.00	0.00	0.00
Fluoranthene	0.005	0.19	0.0703	0.008739457	0.00	0.00	0.00
Indeno(1,2,3-cd)pyrene	0.005	0.058	0.02378	0.0036217	0.00	0.00	0.00
Phenanthrene	0.005	0.14	0.0392	0.005759595	0.00	0.00	0.00
Pyrene	0.005	0.14	0.0546	0.006949338	0.00	0.00	0.00
Volatile Organics							
Chlorobenzene	0.005	0.0045	0.0045	0.0015146	0.00	0.00	0.00
Toluene	0.0013	0.0050667	0.0050667	0.000739823	0.00	0.00	0.00
Trichloroethene	0.005	0.0024	0.0024	0.00132812	0.00	0.00	0.00

K-4
SOIL BIOCONCENTRATION FACTORS USED FOR ANIMALS
SITE 10 - ORIGINAL BASE LANDFILL
MARINE CORPS BASE, CAMP LEJUENE
NORTH CAROLINA

Chemical	Soil-Mouse BAF (dry weight)		Soil-Vole BAF (dry weight)		Soil-Shrew BAF (dry weight)	
	Value	Reference	Value	Reference	Value	Reference
Inorganic Compounds						
Aluminum	--	see text	--	see text	--	see text
Antimony	--	see text	--	see text	--	see text
Arsenic	0.0033	Sample et al. 1998b	0.0054	Sample et al. 1998b	0.0039	Sample et al. 1998b
Barium	0.0451	Sample et al. 1998b	0.0689	Sample et al. 1998b	0.0548	Sample et al. 1998b
Beryllium	0.41	SWDIV 1996	0.41	SWDIV 1996	0.41	SWDIV 1996
Cadmium	0.144	Sample et al. 1998b	0.134	Sample et al. 1998b	2.212	Sample et al. 1998b
Chromium	0.092	Sample et al. 1998b	0.1249	Sample et al. 1998b	0.0939	Sample et al. 1998b
Cobalt	0.0168	Sample et al. 1998b	0.0315	Sample et al. 1998b	0.0251	Sample et al. 1998b
Copper	0.1107	Sample et al. 1998b	0.109	Sample et al. 1998b	0.5017	Sample et al. 1998b
Cyanide*	--	see text	--	see text	--	see text
Iron	0.0121	Sample et al. 1998b	0.0137	Sample et al. 1998b	0.013	Sample et al. 1998b
Lead	0.0548	Sample et al. 1998b	0.0406	Sample et al. 1998b	0.1478	Sample et al. 1998b
Manganese	--	see text	--	see text	--	see text
Mercury	0.0731	Sample et al. 1998b	0.0672	Sample et al. 1998b	0.0672	Sample et al. 1998b
Nickel	0.2587	Sample et al. 1998b	0.2631	Sample et al. 1998b	0.3487	Sample et al. 1998b
Selenium	0.2579	Sample et al. 1998b	0.0221	Sample et al. 1998b	0.273	Sample et al. 1998b
Silver	--	see text	--	see text	--	see text
Thallium	0.1124	Sample et al. 1998b	0.1124	Sample et al. 1998b	0.1124	Sample et al. 1998b
Vanadium	--	see text	--	see text	--	see text
Zinc	0.5092	Sample et al. 1998b	0.2929	Sample et al. 1998b	0.862	Sample et al. 1998b
Pesticides/PCBs						
4,4'-DDD	--	see text	--	see text	--	see text
4,4'-DDE	--	see text	--	see text	--	see text
4,4'-DDT	--	see text	--	see text	--	see text
Aldrin	--	see text	--	see text	--	see text
alpha-BHC	--	see text	--	see text	--	see text
alpha-Chlordane	--	see text	--	see text	--	see text
Aroclor-1016	--	see text	--	see text	--	see text
Aroclor-1221	--	see text	--	see text	--	see text
Aroclor-1232	--	see text	--	see text	--	see text
Aroclor-1242	--	see text	--	see text	--	see text
Aroclor-1248	--	see text	--	see text	--	see text
Aroclor-1254	--	see text	--	see text	--	see text
Aroclor-1260	--	see text	--	see text	--	see text
PCBs (total)	--	see text	--	see text	--	see text
beta-BHC	--	see text	--	see text	--	see text
delta-BHC	--	see text	--	see text	--	see text
Dieldrin	--	see text	--	see text	--	see text
Endosulfan I	--	see text	--	see text	--	see text
Endosulfan II	--	see text	--	see text	--	see text
Endosulfan Sulfate	--	see text	--	see text	--	see text
Endrin	--	see text	--	see text	--	see text
Endrin Aldehyde	--	see text	--	see text	--	see text
Endrin Ketone	--	see text	--	see text	--	see text
Gamma-BHC (Lindane)	--	see text	--	see text	--	see text
Gamma-Chlordane	--	see text	--	see text	--	see text
Heptachlor	--	see text	--	see text	--	see text
Heptachlor Epoxide	--	see text	--	see text	--	see text
Methoxychlor	--	see text	--	see text	--	see text
Toxaphene	--	see text	--	see text	--	see text
Semivolatile Organic Compounds						
1,2,4-Trichlorobenzene	--	see text	--	see text	--	see text
1,2-Dichlorobenzene	--	see text	--	see text	--	see text
1,3-Dichlorobenzene	--	see text	--	see text	--	see text
1,4-Dichlorobenzene	--	see text	--	see text	--	see text
2,2'-Oxybis(1-Chloropropane)*	--	see text	--	see text	--	see text
2,4,5-Trichlorophenol	--	see text	--	see text	--	see text
2,4,6-Trichlorophenol	--	see text	--	see text	--	see text
2,4-Dichlorophenol	--	see text	--	see text	--	see text
2,4-Dimethylphenol*	--	see text	--	see text	--	see text
2,4-Dinitrophenol*	--	see text	--	see text	--	see text
2,4-Dinitrotoluene*	--	see text	--	see text	--	see text
2,6-Dinitrotoluene*	--	see text	--	see text	--	see text
2-Chloronaphthalene	--	see text	--	see text	--	see text
2-Chlorophenol*	--	see text	--	see text	--	see text
2-Methylnaphthalene	--	see text	--	see text	--	see text
2-Methylphenol*	--	see text	--	see text	--	see text
2-Nitroaniline*	--	see text	--	see text	--	see text
2-Nitrophenol*	--	see text	--	see text	--	see text
3,3'-Dichlorobenzidine	--	see text	--	see text	--	see text
3-Nitroaniline*	--	see text	--	see text	--	see text

K-4
SOIL BIOCONCENTRATION FACTORS USED FOR ANIMALS
SITE 10 - ORIGINAL BASE LANDFILL
MARINE CORPS BASE, CAMP LEJUENE
NORTH CAROLINA

Chemical	Soil-Mouse BAF (dry weight)		Soil-Vole BAF (dry weight)		Soil-Shrew BAF (dry weight)	
	Value	Reference	Value	Reference	Value	Reference
4,6-Dinitro-2-Methylphenol*	--	see text	--	see text	--	see text
4-Bromophenyl-Phenylether	--	see text	--	see text	--	see text
4-Chloro-3-Methylphenol	--	see text	--	see text	--	see text
4-Chloroaniline*	--	see text	--	see text	--	see text
4-Chlorophenyl-Phenylether	--	see text	--	see text	--	see text
4-Methylphenol*	--	see text	--	see text	--	see text
4-Nitroaniline*	--	see text	--	see text	--	see text
4-Nitrophenol*	--	see text	--	see text	--	see text
Acenaphthene	--	see text	--	see text	--	see text
Acenaphthylene	--	see text	--	see text	--	see text
Anthracene	--	see text	--	see text	--	see text
Benzo(a)anthracene	--	see text	--	see text	--	see text
Benzo(a)pyrene	--	see text	--	see text	--	see text
Benzo(b)fluoranthene	--	see text	--	see text	--	see text
Benzo(g,h,i)perylene	--	see text	--	see text	--	see text
Benzo(k)fluoranthene	--	see text	--	see text	--	see text
Bis(2-Chloroethoxy)methane*	--	see text	--	see text	--	see text
Bis(2-Chloroethyl)ether*	--	see text	--	see text	--	see text
Bis(2-Ethylhexyl)phthalate	--	see text	--	see text	--	see text
Butylbenzylphthalate	--	see text	--	see text	--	see text
Carbazole	--	see text	--	see text	--	see text
Chrysene	--	see text	--	see text	--	see text
Dibenz(a,h)anthracene	--	see text	--	see text	--	see text
Dibenzofuran	--	see text	--	see text	--	see text
Diethylphthalate	--	see text	--	see text	--	see text
Dimethylphthalate*	--	see text	--	see text	--	see text
Di-n-butylphthalate	--	see text	--	see text	--	see text
Di-n-octylphthalate	--	see text	--	see text	--	see text
Fluoranthene	--	see text	--	see text	--	see text
Fluorene	--	see text	--	see text	--	see text
Hexachlorobutadiene	--	see text	--	see text	--	see text
Hexachlorobenzene	--	see text	--	see text	--	see text
Hexachlorocyclopentadiene	--	see text	--	see text	--	see text
Hexachloroethane	--	see text	--	see text	--	see text
Indeno(1,2,3-cd)pyrene	--	see text	--	see text	--	see text
Isophorone*	--	see text	--	see text	--	see text
Naphthalene	--	see text	--	see text	--	see text
Nitrobenzene*	--	see text	--	see text	--	see text
N-Nitroso-di-n-propylamine*	--	see text	--	see text	--	see text
N-Nitrosodiphenylamine	--	see text	--	see text	--	see text
Pentachlorophenol	--	see text	--	see text	--	see text
Phenanthrene	--	see text	--	see text	--	see text
Phenol*	--	see text	--	see text	--	see text
Pyrene	--	see text	--	see text	--	see text