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**FINAL**

**NO ACTION  
DECISION DOCUMENT  
SITE 10**

**MCB, CAMP LEJUENE, NORTH CAROLINA**

**CONTRACT TASK ORDER 0060**

**MAY, 2005**

*Prepared for:*

**DEPARTMENT OF THE NAVY  
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*Norfolk, Virginia***

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*Prepared by:*

**CH2M HILL, INC.  
*Herndon, Virginia***

**MICHAEL BAKER JR., INC.  
*Moon Township, Pennsylvania***

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## ATTACHMENTS

- A State of North Carolina Approval Letter
- B USEPA Region IV Approval Letter

## ACRONYMS AND ABBREVIATIONS

AOC	Area of Concern
Baker	Baker Environmental, Inc.
bgs	Below Ground Surface
BRA	Baseline Risk Assessment
CDI	Chronic Daily Intake
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CERCLIS	Comprehensive Environmental Response, Compensation, and Liability Information System
COPCs	Contaminants of Potential Concern
CT	Central Tendency
DD	Decision Document
DON	Department of the Navy
ECOC	Ecological Contaminants of Concern
FFA	Federal Facilities Agreement
ft/ft	feet per foot
HI	Hazard Index
HQ	Hazard Quotient
IAS	Initial Assessment Study
ICR	Incremental Cancer Risk
IEUBK	Integrated Exposure Uptake Biokinetic Model
ILCR	Incremental Lifetime Cancer Risk
LANTDIV	Atlantic Division Naval Facilities Engineering Command
MCAS	Marine Corps Air Station
MCB	Marine Corps Base
msl	Mean Sea Level
mg/kg	milligrams per kilogram
NA	No Action
NC DENR	North Carolina Department of Environment and Natural Resources
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
NCWQS	North Carolina Water Quality Standards
NFRAP	No Further Response Action Plan
NOAEL	no observed adverse effect level
NPL	National Priorities List
NTU	Neophelometric Turbidity Unit

**LIST OF ACRONYMS AND ABBREVIATIONS**  
**(Continued)**

ORNL	Oak Ridge National Laboratory
OSWER	Office of Solid Waste and Emergency Response
PA	Preliminary Assessment
PAH	Polynuclear Aromatic Hydrocarbon
PCB	Polychlorinated Biphenyl
ppm	parts per million
RA	Removal Action or Remedial Action
RAGS	Risk Assessment Guidance for Superfund
RBC	Risk-Based Concentrations
RID	Reference Dose
RI/FS	Remedial Investigation/Feasibility Study
RME	Reasonable Maximum Exposure
SARA	Superfund Amendments and Reauthorization Act
SB NSW	nutrient sensitive waters capable of sustaining primary and secondary recreation, aquatic life, propagation and survival, fishing, and wildlife
SI	Site Investigation
SSL	Sediment Screening Level
STSC	Superfund Technical Support Center
SVOC	Semi-Volatile Organic Compound
SWSL	Surface Water Screening Level
TAL	Target Analyte List
TCL	Target Compound List
µg/dl	microgram per deciliter
µg/kg	micrograms per kilogram
UCL	Upper Confidence Limit
USCS	Unified Soil Classification System
USEPA	United States Environmental Protection Agency
USGS	United States Geologic Society
VOC	Volatile Organic Compound
WAR	Water and Air Research

## DECLARATION

### **SITE NAME AND LOCATION**

Site 10  
Original Base Landfill  
Marine Corps Base, Camp Lejeune, North Carolina

### **STATEMENT OF BASIS**

This No Action (NA) decision is based on the results of a Site Investigation (SI) that consisted of two phases conducted at Site 10 in March 1998 and March 2001, respectively. The SI included a review of previous investigations, a site survey, installation of temporary and permanent groundwater monitoring wells, and associated soil, groundwater, surface water and sediment sampling. The Department of the Navy (DON) and the Marine Corps have obtained concurrence from the State of North Carolina Department of Environment and Natural Resources (NC DENR) and from the United States Environmental Protection Agency (USEPA) Region IV on the selected remedy. Copies of the NC DENR and USEPA approval letters are presented in Attachments A and B.

### **DESCRIPTION OF THE SELECTED REMEDY**

Based on the current conditions at Site 10, it has been determined that no threat to public health and the environment exists. Therefore, no action under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), as amended by the Superfund Amendments and Reauthorization Act of 1986 (SARA), is warranted.

### **DECLARATION STATEMENT**

This NA Decision Document (DD) represents the selected action for Site 10, developed in accordance with CERCLA, as amended by SARA, and the National Oil and Hazardous Substances Pollution Contingency Plan (NCP). Because contaminant levels at the site have been determined to present no significant threat to human health and/or the environment, it has been determined that a "no action" decision is protective of human health and the environment, attains federal and state applicable or relevant and appropriate requirements (ARARs), and is cost-effective. The statutory preference for treatment is not satisfied because treatment was not found to be necessary.

Brynn T. Ashton

Signature

Mr. Brynn T. Ashton

Head, Environmental Quality Branch, Environmental Management Division

Installation and Environment Division

Marine Corps Base, Camp Lejeune, NC

4-27-05

Date

## DECISION SUMMARY

### **1.0 INTRODUCTION**

Marine Corps Base (MCB), Camp Lejeune was placed on the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) National Priorities List (NPL) on October 4, 1989 (54 Federal Register 41015, October 5, 1989). Subsequent to this listing, the United States Environmental Protection Agency (USEPA) Region IV; the North Carolina Department of Environment and Natural Resources (NC DENR); and the United States Department of the Navy (DON) entered into a Federal Facilities Agreement (FFA) on March 1, 1991 (effective date) for MCB, Camp Lejeune. The objectives of the FFA are:

- To ensure that the environmental impacts with past and present activities at MCB, Camp Lejeune are thoroughly investigated and appropriate CERCLA response actions are developed and implemented as necessary to protect the public health, welfare and the environment;
- To establish a procedural framework and schedule for developing, implementing and monitoring appropriate response actions at MCB, Camp Lejeune in accordance with CERCLA, the NCP, and USEPA policy relevant to remediation at MCB, Camp Lejeune; and
- To facilitate cooperation, exchange of information and participation of the parties in such action.

The Fiscal Year 2001 Site Management Plan for MCB, Camp Lejeune, the primary document referenced in the FFA, accounts for each of the sites at the Base and provides detailed strategic planning. Many of the sites listed in the FFA have been investigated through the completion of Remedial Investigation/Feasibility Studies (RI/FS). However, several sites, (Site 10 included) did not warrant a full scale RI/FS. As such, Site 10 was investigated by completing Site Investigation (SI) Studies. The goal of these investigations was to determine if a full RI study was necessary or if a decision of no action was appropriate.

This No Action (NA) Decision Document (DD) supports no action for Site 10. The purpose of this NA DD is to summarize the existing data for the site and to describe the Marine Corps' rationale for selecting the NA alternative.

Decision documents of this type can fall into four categories. The category into which a site is placed is determined by the investigation(s) that have been conducted at the site. They are divided as follows: Category I - NA decision is based on the results of a Preliminary Assessment (PA), a PA supplement, or an equivalent effort; Category II - NA decision is based on the results of a Site Inspection, a Site Inspection supplement, or an equivalent effort; Category III - NA decision is based on the results of a RI and, if required, an FS, or an equivalent effort; Category IV - NA decision is based on the completion of a removal action or remedial action (RA) (including interim actions), or an equivalent effort.

Site 10 is a Category II designation. The SI was completed to determine if further investigations were warranted. The SI completed at Site 10 provides sufficient information about the history, nature of the site and subsequently verifies the lack of contamination. Therefore, a Category II - NA DD is herein presented in accordance with all Category II requirements.

The objectives of this NA DD for Site 10 are:

- To briefly describe the location, history and environmental setting of Site 10 and its relationship to MCB, Camp Lejeune;
- To describe the current status of the site based on the results of the related investigations; and
- To assess the potential risks to human health and environment at the site.

Data from the Phase I and II SI (Baker Environmental, Inc. [Baker] July 2001) were used to derive and support no action for Site 10. The SI was initiated to detect and characterize potential impacts to human health and the environment and to determine if the site required further investigative work. The SI included a review of previous investigations, a site survey, installation of temporary and permanent groundwater monitoring wells, and associated soil, groundwater, surface water and sediment sampling.

### **1.1 Site Location and Description**

To provide the reader with the entire framework of Site 10, the following subsections discuss site locations and descriptions for both MCB, Camp Lejeune and Site 10.

#### **1.1.1 MCB, Camp Lejeune**

MCB, Camp Lejeune is located on the coastal plain of North Carolina in Onslow County. The facility is bisected by the New River and encompasses approximately 236 square miles (of which approximately 40 square miles is water, made up by the New River and its tributaries). The New River flows in a southeasterly direction and forms a large estuary before entering the Atlantic Ocean. The southeastern border of MCB, Camp Lejeune is the Atlantic Ocean shoreline. The western and northeastern boundaries of the facility are U.S. Route 17 and State Route 24, respectively. The City of Jacksonville borders MCB, Camp Lejeune to the north.

Construction of MCB, Camp Lejeune began in April 1941 at the Hadnot Point Industrial Area, where major functions of the base are centered today. The facility was designed to be the "World's Most Complete Amphibious Training Base". The MCB, Camp Lejeune complex consists of six geographical and operational locations under the jurisdiction of the Base Command. These areas include Camp Geiger, Montford Point (which includes Camp Johnson), Courthouse Bay, Mainside, the Rifle Range Area, and the Greater Sandy Run Area. Marine Corps Air Station (MCAS) New River is operationally under the control of MCAS Cherry Point. However, MCB, Camp Lejeune is responsible for the facilities and environmental management of MCAS New River.

The Air Station and Camp Geiger are considered as a single urban area possessing two separate missions and supported by two unrelated groups of personnel. The MCAS New River encompasses 2,772 acres and is located in the northwestern section of the complex 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.

### **1.1.2 Site 10**

Site 10, referred to as the Original Base Landfill, is in the northeast portion of the MCB, Camp Lejeune. As shown on Figure 1-1, Site 10 is located on the western side of Holcomb Boulevard, approximately 1,600 feet south of Wallace Creek. Figure 1-2 is a site location map which shows the boundary and features of the surrounding area. The site is located west of open storage lots 201 and 203, as well as RI Sites 6 and 82.

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.

A 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. Numerous "foxholes" and ammunition casings indicate that military maneuvers are conducted in the area.

### **1.2 Site History and Enforcement Activities**

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.

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 (Baker, 1995) was conducted 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.

The SI activities at Site 10 have included sampling of surface soil, subsurface soil, groundwater, sediment and surface water, evaluating the resultant analytical data, and the performance of a qualitative and quantitative risk assessment. These studies provided the information necessary to determine if the site had contributed hazardous substances to the environment.

The NCP states that sites which the USEPA determines to need no additional evaluation are given a "No Further Response Action Plan (NFRAP)" designation within the CERCLA Information System (CERCLIS). Through this designation, no supplemental investigation or remediation work will be performed at the site unless new information is presented indicating that the initial decision was not appropriate. This NA DD presents the pertinent information that supports the conclusion that Site 10 poses little or no potential threat to human health and the environment.

There are currently no enforcement activities in place at the site.

### **1.2.1 Investigative Activities**

As mentioned above, the conditions at Site 10 have been evaluated through several separate investigative activities. The following subsections provide a summary of the previous studies completed at the site along with the results of the SI.

#### **1.2.1.1 Previous Investigations**

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 would require further investigation.

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 investigation included five soil borings, installation of three temporary monitoring wells, and an aerial photo review. All samples were analyzed for full Target Compound List (TCL) organics and Target Analyte List (TAL) inorganics. Figure 1-2 shows the area investigated during the Expedited Site Characterization.

At the time of the investigation, it was believed that the landfill 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. The data gaps included the lack of site coverage needed to conduct a human health risk assessment, adequate groundwater flow direction calculations, and further evaluation of two ponds located on the southern half of the site. From these site-specific data needs, SI objectives were established to meet the data deficiencies for Site 10. SI results are presented in the following section.

#### **1.2.1.2 Site Investigation**

Field work for Phases I and II of the SI was completed by Baker in March 1998, and March 2001 with the subsequent final report completed in July 2001. The investigations included researching the previous studies and completing additional investigative tasks. 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 RI. The field activities included a site survey, surface and subsurface

soil sampling, installation of temporary monitoring wells and subsequent groundwater sampling, surface water sampling and sediment sampling. The Phase II investigation was conducted to delineate inorganic groundwater contamination, which may have been inaccurate in the Phase I investigation due to high Nephelometric Turbidity Unit (NTU) readings in collected temporary monitoring well samples. The Phase II field activities included installation of six permanent monitoring wells and subsequent groundwater sampling.

During the Phase I field investigation, Baker supervised the advancement of 25 soil borings, construction of nine temporary monitoring wells in the shallow aquifer and subsequent sampling, and collection of six surface water and sediment samples. Sampling locations during the Phase I investigation are shown on Figure 1-2. Soil borings (10-SB01 through 10-SB25) were advanced 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. Soils at the site were analyzed for TCL organics and TAL inorganics. Groundwater samples (IR10-TW01 through IR10-TW10) were analyzed for the same parameters. Surface water and sediment samples were also analyzed for TCL organics and TAL inorganics as well as total cyanide. Table 1-1 provides a summary of the detected compounds and analytes by media.

During the Phase II investigation, soil borings were advanced for the sole purpose of installing six permanent shallow groundwater monitoring wells (IR10-MW02, IR10-MW03, IR10-MW04, IR10-MW06, IR10-MW08 and IR10-MW09). The borings were terminated at a depth of approximately 7 feet below the static water level. Since these borings were placed in the same locations as six of the temporary wells (IR10-TW02, IR10-TW03, IR10-TW04, IR10-TW06, IR10-TW08, and IR10-TW09), no additional soil samples were collected for analysis. Sampling locations during the Phase II investigation are provided on Figure 1-3. The groundwater samples were analyzed for TAL inorganics. Table 1-2 provides a summary of the detected compounds and analytes in groundwater.

Tables 1-3 to 1-6 present the selection of Contaminants of Potential Concern (COPCs) for each environmental medium from the Baseline Risk Assessment (BRA) conducted for the SI report (Baker, July 2001). 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 Risk-Based Concentrations (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, 1995) and were therefore, not retained as COPCs in any medium under investigation at Site 10. RBCs are promulgated by the USEPA Region III as a tool to determine potential risk to human health from contaminants in soil and groundwater. Region III RBC values were derived using conservative USEPA promulgated default values and the most recent toxicological criteria available. RBCs for potentially carcinogenic and noncarcinogenic chemicals were individually derived based on a target Incremental Lifetime Cancer Risk (ILCR) of  $1 \times 10^{-6}$  and a target Hazard Quotient (HQ) of 1.0, respectively. For potential carcinogens, the toxicity criteria applicable to the derivation of the RBC are oral and inhalation cancer slope factors; for noncarcinogens, they are chronic oral and inhalation reference doses. For noncarcinogens, each RBC value was reduced by a factor of 10 to ensure that chemicals with additive effects are not prematurely eliminated during screening (USEPA, 1993).

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

- 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, 1989). The general assessment of COPCs may also involve comparing detection levels to additional contaminant-specific criteria. North Carolina Water Quality Standards (NCWQS) for Surface Water (NC DENR, 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.

#### *Surface Soil*

A total of 25 surface soil samples were collected at Site 10. Five volatile organic compounds (VOCs) were detected in the surface soil samples. 1,1-Dichloroethene, trichloroethene, benzene, toluene, and chlorobenzene were detected at relatively low concentrations (less than 10 micrograms per kilogram [ $\mu\text{g}/\text{kg}$ ]). 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.

Eleven semi-volatile organic compounds (SVOCs) were detected in the surface soil samples collected at the site. Surface soil samples from soil borings IR10-SB03, -SB04, -SB05, -SB18 and -SB19 contained the largest number of SVOCs detected at the site, ranging from 38  $\mu\text{g}/\text{kg}$  to 190  $\mu\text{g}/\text{kg}$ . 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. Therefore, these SVOCs were not retained as Site 10 surface soil COPCs.

Pesticides were detected in five of the 25 samples submitted for laboratory analysis. 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 following pesticides were detected in the Site 10 surface soil samples: heptachlor, heptachlor epoxide, endosulfan I, dieldrin, 4,4'-DDE, endrin, 4,4'-DDT, and endrin aldehyde. These pesticides were detected at maximum concentrations less than their respective residential soil RBCs. Therefore, they were not retained as COPCs.

The only polychlorinated biphenyl (PCB) detected at the site was the compound Aroclor-1260. 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. The origin of this contamination is not known, however, it is suspected that it may be associated with the detections of the PAHs. This PCB was detected below the respective residential soil RBC. Therefore, it was not retained as COPC.

Site 10 surface soil inorganic data summary and COPC selection results are presented in Table 1-3. 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*

Twenty-two subsurface (i.e., greater than one-foot below ground surface) soil samples were collected at Site 10. There were no PCB compounds detected among the subsurface samples. Four VOCs were detected as follows: 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 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. 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 1-4. 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 3.1.3 for an interpretation of results.

### *Surface Water*

A total of 6 sampling stations were established at Site 10 for collecting surface water/sediment samples. As depicted on Figure 1-2, 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. 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 micrograms per liter ( $\mu\text{g/l}$ ). No SVOCs, pesticides or PCBs were detected in any of the samples collected at the site. 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 1-5. 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 NCWQSS. Consequently, aluminum, iron, mercury, and zinc were retained as Site 10 surface water COPCs.

### *Sediment*

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. 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.

Site 10 sediment organic data summary and COPC selection results are presented in Table 1-6. 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 1-6. 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.

## *Groundwater*

The groundwater investigation at Site 10 entailed the collection of samples from nine temporary monitoring wells installed at the site during the Phase I investigation and six permanent monitoring wells installed during the Phase II investigation. The groundwater samples collected during the Phase I investigation were analyzed for TCL organics and TAL inorganics. The groundwater samples collected during the Phase II investigation were only analyzed for TAL inorganics.

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 1-7. 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 OSWER Directive #9355.4-12. Refer to Section 3.1.3 for an interpretation of results.

### **1.2.2 Regulatory Agency/Public Involvement**

The USEPA and NC DENR have been actively involved with the investigation of this site through report review and partnering meetings. Concurrence has been reached that no further investigative activities are needed at Site 10.

## **2.0 SUMMARY OF SITE CHARACTERISTICS**

This section summarizes information pertaining to MCB, Camp Lejeune existing background information. In addition, specific information relevant to Site 10 is presented.

### **2.1 Climatology**

MCB, Camp Lejeune experiences hot and humid summers; however, ocean breezes frequently produce a cooling effect. The winter months tend to be mild, with occasional brief cold spells. Average daily temperatures range from 34° F to 54° F in January, the coldest month, and 72° F to 89° F in July, the hottest month. The average yearly rainfall is 52.4 inches.

### **2.2 Physiography, Geology and Soils**

MCB, Camp Lejeune is located in the Atlantic Coastal Plain physiographic province. The sediments of this province consist primarily of sand, silt, and clay. Other sediments may be present, including shell beds and gravel. Sediments may be of marine or continental origin. United States Geological Survey (USGS) studies at MCB, Camp Lejeune indicate that the base is underlain by sand, silt, clay, calcareous clay and partially cemented limestone. The combined thickness of these sediments beneath the base is approximately 1,500 feet.

Site 10 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). Portions of the area also contain fill material including rusted metal, brick, broken glass, charred wood and clay to a depth of seven feet below ground surface (bgs). This is expected since this site was originally used as a small landfill during base construction.

### **2.3 Hydrogeology**

The aquifers of primary interest are the surficial aquifer and the underlying Castle Hayne aquifer.

The surficial aquifer consists of interfingering beds of sand, clay, sandy clay, and silt that contain some peat and shells. The thickness of the surficial aquifer ranges from 0 to 73 feet and averages nearly 25 feet over MCB, Camp Lejeune. The beds are thin and discontinuous, and have limited lateral continuity. This aquifer is not used for water supply at MCB, Camp Lejeune. The Castle Hayne aquifer lies below the surficial aquifer and consists primarily of unconsolidated sand, shell fragments, and fossiliferous limestone. Between the surficial aquifer and Castle Hayne aquifer lies the Castle Hayne confining unit which consists of clay, silt, and sandy clay beds. The Castle Hayne aquifer is about 150 to 350 feet thick, increasing in thickness to the ocean. The top of the aquifer lies approximately 20 to 73 feet bgs. Onslow County and MCB, Camp Lejeune lie in an area where the Castle Hayne aquifer generally contains freshwater; therefore, the Castle Hayne aquifer is a viable potable water source for the region's population.

According to the data collected by Baker during the Site 10 SI and base-wide RI studies, the surficial unit consists mainly of a fine sand with silt, although medium-grained sand occurs to a lesser extent (Baker, July 1996). 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. A map of

Site 10 surface topography is provided in Figure 2-1. In general, the groundwater was encountered between 0.27 and 12.62 feet bgs during field activities. Groundwater contour lines generated from Phase I water levels taken in March 1998 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, as shown in Figure 2-2. Groundwater contour lines generated from the Phase II water levels taken in February 2001 are consistent with the Phase I water levels, as shown in Figure 1-3. Groundwater flow appears to somewhat parallel the topography of the site with the highest groundwater elevations corresponding to the highest surface elevations. 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 2-2). The groundwater gradient in this area was calculated to be  $2.7 \times 10^{-2}$  feet per foot (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  $1.1 \times 10^{-2}$  ft/ft.

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 2-3). 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 2-1.

#### **2.4 Surface Water**

The dominant surface water feature at MCB, Camp Lejeune is the New River. It receives drainage from a majority of the base. At MCB, Camp Lejeune, the New River flows in a southerly direction into the Atlantic Ocean through the New River Inlet.

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. According to ground surface elevations measured during the SI, Site 10 does not lie within the 100-year floodplain of the New River, Wallace Creek or Bearhead Creek.

As mentioned earlier, 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. 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.

## **2.5 Land Use**

Land use within the Base is influenced by topography and ground cover, environmental policy, and base operational requirements. Much of the land within MCB, Camp Lejeune consists of freshwater swamps that are wooded and largely unsuitable for development. In addition, 3,000 acres of sensitive estuary and other areas were set aside for the protection of threatened and endangered species and are to remain undeveloped. Operational restrictions and regulations, such as explosive quantity safety distances, impact-weighted noise thresholds, and aircraft landing and clearance zones, may also greatly constrain and influence development (LANTDIV, 1988). The combined military and civilian population of MCB, Camp Lejeune has been the single greatest factor contributing to the rapid population growth of Jacksonville and adjacent communities, particularly during the period from 1940 to 1960.

## **2.6 Receptors**

A conceptual site model of potential sources, migration pathways and human receptors was developed to encompass all current and future routes for potential exposure at Site 10 (Baker, July 2001). Figure 2-4 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

The contaminants detected at the site in surface soils, subsurface soils, and groundwater can migrate from the various media in several ways, including:

- 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.

### **3.0 BASELINE RISK ASSESSMENT**

The BRA from the SI report conducted for Site 10 evaluated the projected impact of COPCs on human health and/or the environment, now and in the future, in a "no further remedial action scenario" (Baker, July 2001). The BRA process examines the data generated during the sampling and analytical phase of the 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 components of the BRA include:

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

#### **3.1 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.

### **3.1.1 Exposure Pathways**

This section presents exposure pathways, shown in Figure 2-4, associated with each environmental medium and each human receptor group for Site 10. Each pathway was qualitatively evaluated for further consideration in the quantitative risk analysis. Table 3-1 presents the selection of exposure pathways at Site 10 as described below.

#### *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.

#### *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.

#### *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.

#### *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.

### 3.1.2 Human Health Risks

Total Incremental Cancer Risk (ICR) and Hazard Index (HI) values associated with exposure to environmental media at Site 10 (surface soil, subsurface soil, groundwater, and surface water/sediment) are presented in Table 3-2.

A cancer risk range of  $1 \times 10^{-6}$  to  $1 \times 10^{-4}$  is used to evaluate calculated ICR levels. Any ICR value within this range is considered "acceptable"; an ICR greater than  $1 \times 10^{-4}$  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  $ICR=2.6 \times 10^{-7}$ ) and surface water (i.e.,  $HI=0.002$ ) were within the acceptable risk levels (i.e.,  $HI < 1$  and  $1 \times 10^{-6} < ICR < 1 \times 10^{-4}$ ).

#### *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  $ICR=5.6 \times 10^{-7}$ ) and surface water (i.e.,  $HI=0.001$ ) were within acceptable risk levels (i.e.,  $HI < 1$  and  $1 \times 10^{-6} < ICR < 1 \times 10^{-4}$ ).

#### *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  $ICR=2.7 \times 10^{-7}$ ) and surface water (i.e.,  $HI=0.001$ ) were within acceptable risk levels (i.e.,  $HI < 1$  and  $1 \times 10^{-6} < ICR < 1 \times 10^{-4}$ ).

#### *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  $ICR=5.1 \times 10^{-6}$ ), groundwater (i.e.,  $HI=0.06$ ) and surface water (i.e.,  $HI=0.001$  and  $ICR=5.1 \times 10^{-6}$ ) were within acceptable risk levels (i.e.,  $HI < 1$  and  $1 \times 10^{-6} < ICR < 1 \times 10^{-4}$ ).

#### *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<sup>-6</sup>), 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<sup>-6</sup><ICR<1x10<sup>-4</sup>).

#### *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<sup>-7</sup>) and the carcinogenic risks for subsurface soil (i.e., ICR=1.1x10<sup>-6</sup>) were within the acceptable risk levels (i.e., HI<1 and 1x10<sup>-4</sup><ICR<1x10<sup>-6</sup>).

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 3-3).

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 3.2.5 Iron for a more detailed discussion of the uncertainties associated with the toxicological studies of iron.

#### **3.1.3 Lead Results**

The USEPA OSWER directive recommends using a lead screening value of 400 parts per million (ppm) in soil and 15 µg/L in groundwater. If the concentration of soil or groundwater exceed the screening criteria, OSWER recommends using the USEPA's Integrated Exposure Uptake Biokinetic (IEUBK) Model for Lead in Children, Windows version (USEPA, 2001c) 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 (Baker, July 2001).

Lead was detected in Site 10 at a maximum detected concentration of 2.9 µg/L in the groundwater and 2,630 milligrams per kilogram (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 microgram per deciliter (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.

As recommended by guidance, the arithmetic mean for lead in subsurface soil (151 mg/kg) was used as the exposure point concentrations for the IEUBK model. All other exposure parameters used in the model were default values recommended by the IEUBK model guidance document (USEPA,

2001c). This arithmetic mean concentration resulted in a 0.581 percent probability of the blood lead levels exceeding 10 µg/dl, which is within the acceptable levels.

### **3.2 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
- Central Tendency-Case Scenarios
- Compounds not Qualitatively Evaluated

#### **3.2.1 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 bgs.

#### **3.2.2 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.

#### **3.2.3 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.

### **3.2.4 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.

### **3.2.5 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 Reference Dose (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.

### **3.2.6 CT-Case Scenarios**

The central tendency (CT) risk descriptor was used for data sets when the Reasonable Maximum Exposure (RME) concentration term showed a potential risk to human health, specifically, to future construction workers. The CT concentration term utilized was the 95% Upper Confidence Limit (UCL) (USEPA, 1993). In addition, USEPA standard default exposure factors for central tendency

were used in the Chronic Daily Intake (CDI) calculations. The results of the CT calculations are summarized below.

As shown in Table 3-4 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 3-4).

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 3.2.5 Iron for a more detailed discussion of the uncertainties associated with the toxicological effects of iron.

As shown in Table 3-4, under the CT-case scenario the total site carcinogenic risks to the future construction worker were within the acceptable risk levels (i.e.,  $1 \times 10^{-4} < ICR < 1 \times 10^{-6}$ ).

### **3.3 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 3-2.

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.

#### **3.3.1 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.

#### **3.3.2 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 3-3).

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 3.2.5 "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 (Baker, July 2001).

## 4.0 ECOLOGICAL RISK SCREENING

This section presents the results of the focused Ecological Risk Screening conducted for the terrestrial and aquatic environments associated with Site 10 from the SI report (Baker, July 2001). The primary objective of the focused 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.

This focused 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 4-1). Table 4-1 summarizes the assessment endpoints, risk hypotheses, and measurement endpoints selected for this ecological screening evaluation.

Tables 4-2 to 4-5 provide the various criteria and toxicological benchmarks used as screening values (toxicological thresholds) for chemicals analyzed in groundwater, surface water, sediment, and surface soil and the resulting HQ's. 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 Tables 4-2 to 4-5. They have been excluded from evaluation since they are essential macronutrients (Robbins 1983) with very low toxicity (USEPA 1989). Ecological Contaminants of Concern (ECOCs) are identified and discussed in the sections that follow.

### *Surface Soil*

VOCs, 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.

Sixteen inorganics were detected at concentrations exceeding the surface soil screening criteria and were retained as ECOCs. Table 4-2 summarizes the ECOCs, the frequency of detection and detected concentrations.

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.

#### *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 nine 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. 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 4-3 summarizes the frequency and range of sediment analytical data compared to sediment screening criteria.

#### *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 ten 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. The maximum detected concentrations of aluminum, iron, lead, mercury, 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. The maximum detected

concentrations of arsenic and copper were below the surface water screening values and consequently were not retained as ECOCs. Table 4-4 summarizes the frequency and range of surface water analytical data compared to surface water screening criteria.

#### *Groundwater*

Seven groundwater samples associated with Site 10 (including one duplicate) were collected (February and March 2001) and analyzed for TAL inorganic compounds. Table 4-5 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, manganese, and vanadium were not evaluated due to a lack of surface water screening criteria but 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.

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.

#### **4.1 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 Oak Ridge National Laboratory (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, 1996) 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.

## 4.2 Ecological Risk Screening Summary and Conclusions

### *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, 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 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 was conducted and is presented in the SI report (Baker, July 2001). 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 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 the SI report (Baker, July 2001). 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

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 ECOs, no additional evaluation of the non-detected compounds in the surface soil is recommended.

#### *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.

#### *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.

#### *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.

In summary, no additional ecological evaluation of surface soil, subsurface soil, surface water, sediment or groundwater is recommended based on the results as presented above from the SI report.

## 5.0 CONCLUSIONS AND RECOMENDATIONS

This section presents conclusions and recommendations based on the data obtained during the Phase I and the Phase II investigations from Site 10 and reported in the previous sections of this report. The conclusions are as follows:

### VOCs

- Very few VOCs were detected in the surface and subsurface soil samples collected at the site during the Phase I investigation. The detected concentrations were less than the residential screening criteria; therefore, no VOCs were retained as COPCs.
- 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).
- Summary: Although VOCs were detected in the investigated media, they were not detected above the respective screening criteria. Therefore, no VOCs were retained as COPCs.

### SVOCs

- A fairly large number of 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 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.
- Summary: SVOCs were detected in the surface and subsurface soil; however, only the SVOCs in the subsurface soil were detected above screening criteria and therefore were retained as COPCs.

### Pesticides

- 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.

- Summary: Pesticides were detected in the soil and sediment; however, the concentrations did not exceed screening criteria and were therefore not retained as COPCs.

#### PCBs

- 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.
- Summary: PCBs were detected in the surface soil did not exceed screening criteria and were therefore not retained as COPCs.

#### Inorganics

- 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.
- Inorganics were detected in the soil, sediment and groundwater above screening criteria; therefore, they were retained as COPCs.

#### Risk Analyses

- 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 2L Groundwater Protection Standards. Previous investigations have shown that elevated inorganic 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 are 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 been 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.

## **6.0 DESCRIPTION OF THE NA ALTERNATIVE**

No evidence exists to suggest that the area of investigation at Site 10 is sufficiently contaminated to pose a threat to human health or the environment. Current site conditions and environmental testing data indicated that no action is warranted at Site 10.

**7.0 RESPONSIVENESS SUMMARY**

No public comments were received pertaining to this NA DD.

## 8.0 REFERENCES

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**TABLES**

TABLE 1-1

PHASE I SITE INVESTIGATION  
SUMMARY OF SITE CONTAMINATION  
SITE 10 - ORIGINAL BASE LANDFILL  
MCB, CAMP LEJEUNE, NORTH CAROLINA  
NA DECISION DOCUMENT, CTO-0060

Media	Fraction	Detected Contaminants or Analytes	Detection Frequency	Concentration Range		Location of Maximum Detection	
				Min.	Max.		
Surface Soil	Volatiles	1,1-Dichloroethene	1/25	2.6 J	2.6 J	IR10-SB08-00	
		Trichloroethene	2/25	2.3 J	2.4 J	IR10-SB08-00	
		Benzene	1/25	4.9 J	4.9 J	IR10-SB08-00	
		Toluene	11/25	1.1 J	8.1 J	IR10-SB23-00	
	Semivolatiles	Chlorobenzene	1/25	4.5 J	4.5 J	IR10-SB08-00	
		Phenanthrene	3/25	64 J	140 J	IR10-SB03-00	
		Di-n-butyl phthalate	6/25	38 J	67 J	IR10-SB08-00	
		Fluoranthene	5/25	65 J	190 J	IR10-SB03-00	
		Pyrene	5/25	51 J	140 J	IR10-SB03-00	
		Benzo(a)anthracene	4/25	59 J	86 J	IR10-SB03-00	
		Chrysene	5/25	39 J	93 J	IR10-SB03-00	
		Benzo(b)fluoranthene	5/25	46 J	92 J	IR10-SB03-00	
		Benzo(k)fluoranthene	5/25	42 J	96 J	IR10-SB03-00	
		Benzo(a)pyrene	5/25	42 J	84 J	IR10-SB03-00	
		Indeno(1,2,3-cd)pyrene	4/25	44 J	58 J	IR10-SB03-00	
		Benzo(ghi)perylene	3/25	40 J	45 J	IR10-SB19-00	
		Pesticides	Heptachlor	1/25	1.2 NJ	1.2 NJ	IR10-SB09-00
			Heptachlor epoxide	1/25	2.4 NJ	2.4 NJ	IR10-SB09-00
	Endosulfan I		1/25	4.3 J	4.3 J	IR10-SB09-00	
	Dieldrin		1/25	2.2 NJ	2.2 NJ	IR10-SB09-00	
	4,4'-DDE		1/25	2.1 NJ	2.1 NJ	IR10-SB12-00	
	Endrin		1/25	2.4 NJ	2.4 NJ	IR10-SB09-00	
	4,4'-DDT		2/25	3.1 J	6.2	IR10-SB03-00	
	PCBs	Endrin aldehyde	1/25	4.9	4.9	IR10-SB20-00	
	PCBs	Aroclor 1260	1/25	85 J	85 J	IR10-SB04-00	
	Metals	Aluminum	25/25	66.6	10200 J	IR10-SB25-00	
		Antimony	3/25	5.3 J	12.5 J	IR10-SB03-00	
		Arsenic	1/25	11.6	11.6	IR10-SB25-00	
		Barium	25/25	0.58 J	173	IR10-SB25-00	
		Beryllium	2/25	0.16 J	1.7 J	IR10-SB25-00	
		Cadmium	1/25	0.86 J	0.86 J	IR10-SB19-00	
		Calcium	25/25	33.5 J	28900 J	IR10-SB06-00	
		Chromium	21/25	0.78 J	11.2 J	IR10-SB25-00	
		Cobalt	4/25	0.97 J	8.8 J	IR10-SB25-00	
		Copper	25/25	0.46 J	43.8	IR10-SB25-00	
		Iron	17/25	170 J	7740 J	IR10-SB25-00	
		Lead	25/25	0.6 J	85.1	IR10-SB19-00	
		Magnesium	25/25	8.5 J	687 J	IR10-SB25-00	
		Manganese	25/25	1.9 J	73.3 J	IR10-SB25-00	
		Mercury	21/25	0.022 J	0.27	IR10-SB25-00	
		Nickel	7/25	2.1 J	17.3	IR10-SB25-00	
		Potassium	8/25	146 J	1600 J	IR10-SB25-00	
		Selenium	5/25	0.61 J	2	IR10-SB25-00	
		Silver	2/25	1.4 J	3	IR10-SB03-00	
		Sodium	25/25	10.9 J	281 J	IR10-SB25-00	
		Vanadium	8/25	3.1 J	31.4	IR10-SB25-00	
		Zinc	18/25	2.9 J	304 J	IR10-SB19-00	

TABLE 1-1 (Continued)

PHASE I SITE INVESTIGATION  
SUMMARY OF SITE CONTAMINATION  
SITE 10 - ORIGINAL BASE LANDFILL  
MCB, CAMP LEJEUNE, NORTH CAROLINA  
NA DECISION DOCUMENT, CTO-0060

Media	Fraction	Detected Contaminants or Analytes	Detection Frequency	Concentration Range		Location of Maximum Detection	
				Min.	Max.		
Subsurface Soil	Volatiles	Bromomethane	1/22	250 J	250 J	IR10-SB19-01	
		Methylene chloride	1/22	260 J	260 J	IR10-SB19-01	
		Acetone	1/22	7100	7100	IR10-SB19-01	
		Toluene	2/22	2 J	3.6 J	IR10-SB19-01	
	Semivolatiles	Naphthalene	1/22	70 J	70 J	IR10-SB03-03	
		Acenaphthene	1/22	210 J	210 J	IR10-SB03-03	
		Dibenzofuran	1/22	76 J	76 J	IR10-SB03-03	
		Fluorene	1/22	160 J	160 J	IR10-SB03-03	
		Phenanthrene	1/22	1900	1900	IR10-SB03-03	
		Anthracene	1/22	370 J	370 J	IR10-SB03-03	
		Carbazole	1/22	200 J	200 J	IR10-SB03-03	
		Di-n-butyl phthalate	7/22	42 J	48 J	IR10-SB02-02,IR10-SB03-03,IR10-SB05-04	
		Fluoranthene	1/22	2900	2900	IR10-SB03-03	
		Pyrene	1/22	2100	2100	IR10-SB03-03	
		Benzo(a)anthracene	1/22	1200	1200	IR10-SB03-03	
		Chrysene	1/22	1300	1300	IR10-SB03-03	
		Benzo(b)fluoranthene	1/22	1200	1200	IR10-SB03-03	
		Benzo(k)fluoranthene	1/22	950	950	IR10-SB03-03	
		Benzo(a)pyrene	1/22	1100	1100	IR10-SB03-03	
		Indeno(1,2,3-cd)pyrene	1/22	570	570	IR10-SB03-03	
		Dibenz(a,h)anthracene	1/22	280 J	280 J	IR10-SB03-03	
		Benzo(ghi)perylene	1/22	480	480	IR10-SB03-03	
		Pesticides	Endosulfan I	1/22	1.3 J	1.3 J	IR10-SB06-03
			Endrin	1/22	2.5 NJ	2.5 NJ	IR10-SB03-03
	Endosulfan II		1/22	4.7	4.7	IR10-SB03-03	
	4,4'-DDD		1/22	2.9 NJ	2.9 NJ	IR10-SB03-03	
	Methoxychlor		1/22	13 J	13 J	IR10-SB15-01	
	Endrin ketone		1/22	4 J	4 J	IR10-SB03-03	
	Metals	Aluminum	22/22	40.2 J	5910	IR10-SB04-03	
		Antimony	3/22	7.3 J	84.2	IR10-SB04-03	
		Arsenic	3/22	0.99 J	37.2	IR10-SB04-03	
		Barium	22/22	0.88 J	589	IR10-SB04-03	
		Beryllium	1/22	0.12 J	0.12 J	IR10-SB03-03	
		Cadmium	1/22	7.9	7.9	IR10-SB03-03	
		Calcium	22/22	26.9 J	25100 J	IR10-SB04-03	
		Chromium	21/22	0.91 J	66.5	IR10-SB04-03	
		Cobalt	7/22	0.84 J	53.2	IR10-SB04-03	
		Copper	22/22	0.39 J	3340	IR10-SB04-03	
		Iron	22/22	102 J	218000	IR10-SB04-03	
		Lead	22/22	0.72	2630	IR10-SB04-03	
		Magnesium	22/22	5.8 J	1050 J	IR10-SB04-03	
		Manganese	22/22	1.6 J	948	IR10-SB04-03	
		Mercury	16/22	0.022 J	0.16	IR10-SB04-03	
		Nickel	6/22	1.9 J	147	IR10-SB04-03	
		Potassium	6/22	165 J	636 J	IR10-SB04-03	
		Selenium	3/22	0.65 J	1.1 J	IR10-SB19-01	
		Silver	4/22	1.1 J	11.3	IR10-SB03-03	
		Sodium	22/22	9.5 J	336 J	IR10-SB04-03	
		Thallium	1/22	1.1 J	1.1 J	IR10-SB11-02	
		Vanadium	5/22	3.9 J	6.6 J	IR10-SB19-01	
		Zinc	13/22	2.5 J	1250	IR10-SB04-03	
		Total Cyanide	1/22	0.62 J	0.62 J	IR10-SB04-03	

TABLE 1-1 (Continued)

PHASE I SITE INVESTIGATION  
SUMMARY OF SITE CONTAMINATION  
SITE 10 - ORIGINAL BASE LANDFILL  
MCB, CAMP LEJEUNE, NORTH CAROLINA  
NA DECISION DOCUMENT, CTO-0060

Media	Fraction	Detected Contaminants or Analytes	Detection Frequency	Concentration Range		Location of Maximum Detection
				Min.	Max.	
Groundwater	Metals	Aluminum	9/9	4300 J	78800 J	IR10-TW08-98A
		Arsenic	5/9	6 J	18.2	IR10-TW08-98A
		Barium	9/9	33.6 J	186 J	IR10-TW08-98A
		Beryllium	1/9	0.65 J	0.65 J	IR10-TW08-98A
		Calcium	9/9	1630 J	52700	IR10-TW06-98A
		Chromium	9/9	17.1	136	IR10-TW08-98A
		Cobalt	8/9	3.7 J	10.5 J	IR10-TW08-98A
		Copper	5/9	16.8 J	37.7	IR10-TW09-98A
		Iron	9/9	5030	28400	IR10-TW08-98A
		Lead	9/9	7.2	54.8	IR10-TW08-98A
		Magnesium	9/9	726 J	3930 J	IR10-TW06-98A
		Manganese	9/9	33.2	146	IR10-TW08-98A
		Mercury	8/9	0.033 J	0.3	IR10-TW08-98A,IR10-TW09-98A
		Nickel	5/9	8.6 J	16.3 J	IR10-TW08-98A
		Potassium	9/9	1720 J	5160	IR10-TW08-98A
		Silver	2/9	4.5 J	5.7 J	IR10-TW07-98A
		Sodium	9/9	3340 J	10600	IR10-TW05-98A
		Thallium	6/9	3.1 J	5.2 J	IR10-TW01-98A
		Vanadium	9/9	11.8 J	123	IR10-TW08-98A
		Zinc	5/9	30.1	72.1	IR10-TW09-98A
Surface Water	Volatiles	Toluene	2/6	1.3 J	1.3 J	IR10-SW03,IR10-SW04
	Metals	Aluminum	6/6	127 J	1270	IR10-SW05
		Arsenic	5/6	2.4 J	5 J	IR10-SW04
		Barium	5/6	8.2 J	37.1 J	IR10-SW04
		Calcium	6/6	2340 J	33200	IR10-SW04
		Copper	1/6	3 J	3 J	IR10-SW03
		Iron	6/6	424	2210	IR10-SW04
		Lead	5/6	1.1 J	7.1	IR10-SW04
		Magnesium	6/6	949 J	2470 J	IR10-SW03
		Manganese	6/6	45.9	415	IR10-SW04
		Mercury	4/6	0.032 J	0.06 J	IR10-SW04
		Potassium	4/6	937 J	1860 J	IR10-SW04
		Sodium	6/6	3080 J	6040	IR10-SW04
		Vanadium	6/6	12.6 J	19.8 J	IR10-SW04
		Zinc	6/6	39.9	95.9	IR10-SW04
Sediment	Volatiles	2-Butanone	1/6	52	52	IR10-SD01-06
		Toluene	6/6	4.2 J	97	IR10-SD04-06
	Pesticides	4,4'-DDT	2/6	4 J	4 J	IR10-SD05-06,IR10-SD06-06
		Endrin aldehyde	1/6	3.1 J	3.1 J	IR10-SD06-06
	Metals	Aluminum	6/6	834 J	3150 J	IR10-SD05-06
		Barium	6/6	1.9 J	18.2 J	IR10-SD04-06
		Calcium	6/6	113 J	1630 J	IR10-SD04-06
		Copper	2/6	3.5 J	4 J	IR10-SD01-06
		Iron	6/6	191 J	1110 J	IR10-SD06-06
		Lead	6/6	4	22.7	IR10-SD04-06
		Magnesium	6/6	29.4 J	122 J	IR10-SD06-06
		Manganese	6/6	1.2 J	6.7	IR10-SD01-06,IR10-SD06-06
		Mercury	2/6	0.047 J	0.06 J	IR10-SD03-06
		Potassium	3/6	182 J	246 J	IR10-SD04-06
		Selenium	1/6	0.76 J	0.76 J	IR10-SD02-06
Vanadium	2/6	3.4 J	3.9 J	IR10-SD05-06		
Zinc	6/6	7.2	12.1	IR10-SD04-06		

Notes:  
Organic concentrations are presented in ug/L for liquid and ug/kg for solids (ppb)  
Inorganic concentrations for soils are presented in mg/kg (ppm)  
J = Estimated value  
NJ = Presumptive evidence for the presence of the material at an estimated value.

TABLE 1-2

PHASE II SITE INVESTIGATION  
 SUMMARY OF SITE CONTAMINATION  
 SITE 10 - ORIGINAL BASE LANDFILL  
 MCB, CAMP LEJEUNE, NORTH CAROLINA  
 NA DECISION DOCUMENT, CTO-0060

Media	Fraction	Detected Analytes	Detection Frequency	Concentration Range		Location of Maximum Detection
				Min.	Max.	
Groundwater	Metals	Aluminum	5/6	398 J	3150 J	10-MW09
		Barium	6/6	17.6 J	29.7 J	10-MW03
		Calcium	6/6	727 J	62400 J	10-MW06
		Chromium	1/6	8.4 J	8.4 J	10-MW09
		Cobalt	4/6	0.82 J	1.4 J	10-MW03
		Copper	5/6	0.88 J	3.4	10-MW09
		Iron	6/6	94.9 J	1110 J	10-MW09
		Lead	1/6	2.9 J	2.9 J	10-MW09
		Magnesium	6/6	488 J	4910 J	10-MW06
		Manganese	6/6	14.5 J	49.8	10-MW09
		Nickel	6/6	1.8 J	10.6 J	10-MW03
		Potassium	6/6	259 J	2600 J	10-MW06
		Silver	1/6	0.58 J	0.58 J	10-MW04
		Sodium	6/6	4500 J	14000 J	10-MW06
		Vanadium	4/6	0.95 J	4.2 J	10-MW09
Zinc	2/6	2.5 J	8.3 J	10-MW09		

Notes: Concentrations are presented in ug/L (ppb)  
 J = Estimated value

**TABLE 1-3  
BASELINE RISK ASSESSMENT, SI REPORT  
SURFACE SOIL DATA COMPARED TO HUMAN HEALTH SCREENING VALUES  
SITE 10 - ORIGINAL BASE LANDFILL  
MCB, CAMP LEJEUNE, NORTH CAROLINA  
NA DECISION DOCUMENT, CTO-0060**

Scenario Timeframe: Current, Future
Medium: Surface Soil
Exposure Medium: Surface Soil
Exposure Point: Surface Soil

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	Potential ARAR/TBC Value	Potential ARAR/TBC Source	COPC Flag	Rationale for (3) Contaminant Deletion or Selection
<b>VOLATILES (ug/kg)</b>															
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	N/A	N/A	NO	BSL
Benzene	4.9	J	4.9	J	µg/kg	IR10-SB08-00	1/25	11U - 20UJ	4.9	NA	1.16E+04 C	N/A	N/A	NO	BSL
Chlorobenzene	4.5	J	4.5	J	µg/kg	IR10-SB08-00	1/25	11U - 20UJ	4.5	NA	1.56E+05 N	N/A	N/A	NO	BSL
Toluene	1.1	J	8.1	J	µg/kg	IR10-SB23-00	11/25	11U - 20UJ	8.1	NA	1.56E+06 N	N/A	N/A	NO	BSL
Trichloroethene (TCE)	2.3	J	2.4	J	µg/kg	IR10-SB08-00	2/25	11U - 20UJ	2.4	NA	5.81E+04 C	N/A	N/A	NO	BSL
<b>SEMIVOLATILES (ug/kg)</b>															
Benzo(a)anthracene	59	J	86	J	µg/kg	IR10-SB03-00	4/25	350U - 650U	86	NA	8.75E+02 C	N/A	N/A	NO	BSL
Benzo(a)pyrene	42	J	84	J	µg/kg	IR10-SB03-00	5/25	350U - 650U	84	NA	8.75E+01 C	N/A	N/A	NO	BSL
Benzo(b)fluoranthene	46	J	92	J	µg/kg	IR10-SB03-00	5/25	350U - 650U	92	NA	8.75E+02 C	N/A	N/A	NO	BSL
Benzo(g,h,i)perylene	40	J	45	J	µg/kg	IR10-SB19-00	3/25	350U - 650U	45	NA	2.35E+05 N <sup>(2)</sup>	N/A	N/A	NO	BSL
Benzo(k)fluoranthene	42	J	96	J	µg/kg	IR10-SB03-00	5/25	350U - 650U	96	NA	8.75E+03 C	N/A	N/A	NO	BSL
Chrysene	39	J	93	J	µg/kg	IR10-SB03-00	5/25	350U - 650U	93	NA	8.75E+04 C	N/A	N/A	NO	BSL
Di-n-butyl phthalate (DBP)	38	J	67	J	µg/kg	IR10-SB08-00	6/25	350U - 650U	67	NA	7.82E+05 N	N/A	N/A	NO	BSL
Fluoranthene	65	J	190	J	µg/kg	IR10-SB03-00	5/25	350U - 650U	190	NA	3.13E+05 N	N/A	N/A	NO	BSL
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	N/A	N/A	NO	BSL
Phenanthrene	64	J	140	J	µg/kg	IR10-SB03-00	3/25	350U - 650U	140	NA	2.35E+05 N <sup>(2)</sup>	N/A	N/A	NO	BSL
Pyrene	51	J	140	J	µg/kg	IR10-SB03-00	5/25	350U - 650U	140	NA	2.35E+05 N	N/A	N/A	NO	BSL
<b>PESTICIDES/PCBS (ug/kg)</b>															
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	N/A	N/A	NO	BSL
4,4'-DDT	3.1	J	6.2	J	µg/kg	IR10-SB03-00	2/25	3.5U - 6.5U	6.2	NA	1.88E+03 C	N/A	N/A	NO	BSL
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	N/A	N/A	NO	BSL
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 <sup>(6)</sup>	N/A	N/A	NO	BSL
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	N/A	N/A	NO	BSL
Endrin Aldehyde	4.9	J	4.9	J	µg/kg	IR10-SB20-00	1/25	3.5U - 6.5U	4.9	NA	2.35E+03 N <sup>(1)</sup>	N/A	N/A	NO	BSL
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	N/A	N/A	NO	BSL
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	N/A	N/A	NO	BSL
Aroclor-1260	85	J	85	J	µg/kg	IR10-SB04-00	1/25	35U - 65U	85	NA	3.19E+02 C	N/A	N/A	NO	BSL
<b>TOTAL METALS (mg/kg)</b>															
Aluminum	66.6		10,200	J	mg/kg	IR10-SB25-00	25/25	(4)	10,200	29.4 - 7280	7.82E+03 N	N/A	N/A	YES	ASL
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	N/A	N/A	YES	ASL
Arsenic	11.6		11.6	J	mg/kg	IR10-SB25-00	1/25	0.48U - 2.5U	11.6	0.27 - 0.85 J	4.26E-01 C	N/A	N/A	YES	ASL
Barium	0.58	J	173	J	mg/kg	IR10-SB25-00	25/25	(4)	173	0.73 J - 19.5	5.48E+02 N	N/A	N/A	NO	BSL
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	N/A	N/A	NO	BSL
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	N/A	N/A	NO	BSL
Calcium	33.5	J	28,900	J	mg/kg	IR10-SB06-00	25/25	(4)	28,900	12.4 J - 17400	N/A N	N/A	N/A	NO	NUT

**TABLE 1-3 (Continued)**  
**BASELINE RISK ASSESSMENT, SI REPORT**  
**SURFACE SOIL DATA COMPARED TO HUMAN HEALTH SCREENING VALUES**  
**SITE 10 - ORIGINAL BASE LANDFILL**  
**MCB, CAMP LEJEUNE, NORTH CAROLINA**  
**NA DECISION DOCUMENT, CTO-0060**

Scenario Timeframe: Current, Future
Medium: Surface Soil
Exposure Medium: Surface Soil
Exposure Point: Surface Soil

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	Potential ARAR/TBC Value	Potential ARAR/TBC Source	COPC Flag	Rationale for (3) Contaminant Deletion or Selection
<b>TOTAL METALS (mg/kg) (Cont)</b>															
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 <sup>(5)</sup>	N/A	N/A	NO	BSL
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	N/A	N/A	NO	BSL
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	N/A	N/A	NO	BSL
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	N/A	N/A	YES	ASL
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 <sup>(5)</sup>	N/A	N/A	NO	NTX
Magnesium	8.5	J	687	J	mg/kg	IR10-SB25-00	25/25	(4)	687	9.8 J - 1610	N/A N	N/A	N/A	NO	NUT
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	N/A	N/A	NO	BSL
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 <sup>(10)</sup>	N/A	N/A	NO	BSL
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	N/A	N/A	NO	BSL
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	N/A	N/A	NO	NUT
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	N/A	N/A	NO	BSL
Silver	1.4	J	3		mg/kg	IR10-SB03-00	2/25	2.1U - 4U	3	NA	3.91E+01 N	N/A	N/A	NO	BSL
Sodium	10.9	J	281	J	mg/kg	IR10-SB25-00	25/25	(4)	281	NA	N/A N	N/A	N/A	NO	NUT
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	N/A	N/A	NO	BSL
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	N/A	N/A	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)

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

Deletion Reason:  
 Below Screening Level (BSL)  
 Essential Nutrient (NUT)  
 No Toxicity Information (NTX)

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

(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.

C = Carcinogenic mg/kg = milligrams per kilogram

N = Non-Carcinogenic ug/kg = microgram per kilogram

**TABLE I-4**  
**BASELINE RISK ASSESSMENT, SI REPORT**  
**SUBSURFACE SOIL DATA COMPARED TO HUMAN HEALTH SCREENING VALUES**  
**SITE 10 - ORIGINAL BASE LANDFILL**  
**MCB, CAMP LEJEUNE, NORTH CAROLINA**  
**NA DECISION DOCUMENT, CTO-0060**

Scenario Timeframe: Future
Medium: Subsurface Soil
Exposure Medium: Subsurface Soil
Exposure Point: Subsurface Soil

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	Potential ARAR/TBC Value	Potential ARAR/TBC Source	COPC Flag	Rationale for (2) Contaminant Deletion or Selection
<b>VOLATILES (ug/kg)</b>															
Acetone	7,100		7,100		µg/kg	IR10-SB19-01	1/22	11U - 8300U	7,100	NA	7.82E+05 N	N/A	N/A	NO	BSL
Bromomethane	250	J	250	J	µg/kg	IR10-SB19-01	1/22	11U - 12U	250	NA	1.10E+04 N	N/A	N/A	NO	BSL
Methylene Chloride	260	J	260	J	µg/kg	IR10-SB19-01	1/22	11U - 12U	260	NA	8.52E+04 C	N/A	N/A	NO	BSL
Toluene	2	J	3.6	J	µg/kg	IR10-SB19-01	2/22	11U - 12U	3.6	NA	1.56E+06 N	N/A	N/A	NO	BSL
<b>SEMI-VOLATILES (ug/kg)</b>															
Acenaphthene	210	J	210	J	µg/kg	IR10-SB03-03	1/22	350U - 410U	210	NA	4.69E+05 N	N/A	N/A	NO	BSL
Anthracene	370	J	370	J	µg/kg	IR10-SB03-03	1/22	350U - 410U	370	NA	2.35E+06 N	N/A	N/A	NO	BSL
Benzo(a)anthracene	1,200		1,200		µg/kg	IR10-SB03-03	1/22	350U - 410U	1,200	NA	8.75E+02 C	N/A	N/A	YES	ASL
Benzo(a)pyrene	1,100		1,100		µg/kg	IR10-SB03-03	1/22	350U - 410U	1,100	NA	8.75E+01 C	N/A	N/A	YES	ASL
Benzo(b)fluoranthene	1,200		1,200		µg/kg	IR10-SB03-03	1/22	350U - 410U	1,200	NA	8.75E+02 C	N/A	N/A	YES	ASL
Benzo(g,h,i)perylene	480		480		µg/kg	IR10-SB03-03	1/22	350U - 410U	480	NA	2.35E+05 N <sup>(2)</sup>	N/A	N/A	NO	BSL
Benzo(k)fluoranthene	950		950		µg/kg	IR10-SB03-03	1/22	350U - 410U	950	NA	8.75E+03 C	N/A	N/A	YES	CHEM
Carbazole	200	J	200	J	µg/kg	IR10-SB03-03	1/22	350U - 410U	200	NA	3.19E+04 C	N/A	N/A	YES	CHEM
Chrysene	1,300		1,300		µg/kg	IR10-SB03-03	1/22	350U - 410U	1,300	NA	8.75E+04 C	N/A	N/A	YES	CHEM
Dibenz(a,h)anthracene	280	J	280	J	µg/kg	IR10-SB03-03	1/22	350U - 410U	280	NA	8.75E+01 C	N/A	N/A	YES	ASL
Dibenzofuran	76	J	76	J	µg/kg	IR10-SB03-03	1/22	350U - 410U	76	NA	3.13E+04 N	N/A	N/A	NO	BSL
Di-n-butyl phthalate (DBP)	42	J	48	J	µg/kg	IR10-SB02-02,IR10-SB03-03,IR10-SB05-	7/22	350U - 410U	48	NA	7.82E+05 N	N/A	N/A	NO	BSL
Fluoranthene	2,900		2,900		µg/kg	IR10-SB03-03	1/22	350U - 410U	2,900	NA	3.13E+05 N	N/A	N/A	NO	BSL
Fluorene	160	J	160	J	µg/kg	IR10-SB03-03	1/22	350U - 410U	160	NA	3.13E+05 N	N/A	N/A	NO	BSL
Indeno(1,2,3-cd)pyrene	570		570		µg/kg	IR10-SB03-03	1/22	350U - 410U	570	NA	8.75E+02 C	N/A	N/A	YES	CHEM
Naphthalene	70	J	70	J	µg/kg	IR10-SB03-03	1/22	350U - 410U	70	NA	1.56E+05 N	N/A	N/A	NO	BSL
Phenanthrene	1,900		1,900		µg/kg	IR10-SB03-03	1/22	350U - 410U	1,900	NA	2.35E+05 N <sup>(3)</sup>	N/A	N/A	NO	BSL
Pyrene	2,100		2,100		µg/kg	IR10-SB03-03	1/22	350U - 410U	2,100	NA	2.35E+05 N	N/A	N/A	NO	BSL
<b>PESTICIDES/PCBS (ug/kg)</b>															
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	N/A	N/A	NO	BSL
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 <sup>(6)</sup>	N/A	N/A	NO	BSL
Endosulfan II	4.7		4.7		µg/kg	IR10-SB03-03	1/22	3.5U - 4.1U	4.7	NA	4.69E+04 N <sup>(6)</sup>	N/A	N/A	NO	BSL
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	N/A	N/A	NO	BSL
Endrin Ketone	4	J	4	J	µg/kg	IR10-SB03-03	1/22	3.5U - 4.1U	4	NA	2.35E+03 N <sup>(7)</sup>	N/A	N/A	NO	BSL
Methoxychlor	13	J	13	J	µg/kg	IR10-SB15-01	1/22	18U - 21UJ	13	NA	3.91E+04 N	N/A	N/A	NO	BSL
<b>TOTAL METALS (mg/kg)</b>															
Aluminum	40.2	J	5,910		mg/kg	IR10-SB04-03	22/22	(4)	5,910	260 J - 9900	7.82E+03 N	N/A	N/A	NO	BSL
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	N/A	N/A	YES	ASL
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	N/A	N/A	YES	ASL
Barium	0.88	J	589		mg/kg	IR10-SB04-03	22/22	(4)	589	0.67 J - 18.2	5.48E+02 N	N/A	N/A	YES	ASL
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	N/A	N/A	NO	BSL
Cadmium	7.9		7.9		mg/kg	IR10-SB03-03	1/22	1.1U - 3.8U	7.9	NA	3.91E+00 N	N/A	N/A	YES	ASL

**TABLE 1-4 (Continued)**  
**BASELINE RISK ASSESSMENT, SI REPORT**  
**SUBSURFACE SOIL DATA COMPARED TO HUMAN HEALTH SCREENING VALUES**  
**SITE 10 - ORIGINAL BASE LANDFILL**  
**MCB, CAMP LEJEUNE, NORTH CAROLINA**  
**NA DECISION DOCUMENT, CTO-0060**

Scenario Timeframe: Future
Medium: Subsurface Soil
Exposure Medium: Subsurface Soil
Exposure Point: Subsurface Soil

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	Potential ARAR/TBC Value	Potential ARAR/TBC Source	COPC Flag	Rationale for (2) Contaminant Deletion or Selection
<b>TOTAL METALS (mg/kg) (Cont)</b>															
Calcium	26.9	J	25,100	J	mg/kg	IR10-SB04-03	22/22	(4)	25,100	12.7 J - 499	N/A N	N/A	N/A	NO	NUT
Chromium	0.91	J	66.5	J	mg/kg	IR10-SB04-03	21/22	2.2U - 2.2U	66.5	0.83 - 13.2	2.35E+01 N <sup>(6)</sup>	N/A	N/A	YES	ASL
Cobalt	0.84	J	53.2	J	mg/kg	IR10-SB04-03	7/22	10.6U - 12.4U	53.2	0.1 J - 0.84	1.56E+02 N	N/A	N/A	NO	BSL
Copper	0.39	J	3340	J	mg/kg	IR10-SB04-03	22/22	(4)	3340	0.23 J - 3.3	3.13E+02 N	N/A	N/A	YES	ASL
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	N/A	N/A	NO	BSL
Iron	102	J	218,000	J	mg/kg	IR10-SB04-03	22/22	(4)	218,000	81.5 - 4600	2.35E+03 N	N/A	N/A	YES	ASL
Lead	0.72	J	2,630	J	mg/kg	IR10-SB04-03	22/22	(4)	2,630	1.1 J - 6	4.00E+02 N <sup>(9)</sup>	N/A	N/A	NO	NTX
Magnesium	5.8	J	1,050	J	mg/kg	IR10-SB04-03	22/22	(4)	1,050	13.5 J - 216	N/A N	N/A	N/A	NO	NUT
Manganese	1.6	J	948	J	mg/kg	IR10-SB04-03	22/22	(4)	948	0.75 J - 7.1	1.56E+02 N	N/A	N/A	YES	ASL
Mercury	0.022	J	0.16	J	mg/kg	IR10-SB04-03	16/22	0.11U - 0.12U	0.16	0.021 J - 0.061 J	2.35E+00 N <sup>(10)</sup>	N/A	N/A	NO	BSL
Nickel	1.9	J	147	J	mg/kg	IR10-SB04-03	6/22	8.4U - 9.9U	147	0.12 J - 3.6	1.56E+02 N	N/A	N/A	NO	BSL
Potassium	165	J	636	J	mg/kg	IR10-SB04-03	6/22	1060U - 1240U	636	16 J - 292	N/A N	N/A	N/A	NO	NUT
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	N/A	N/A	NO	BSL
Silver	1.1	J	11.3	J	mg/kg	IR10-SB03-03	4/22	2.1U - 7.5U	11.3	NA	3.91E+01 N	N/A	N/A	NO	BSL
Sodium	9.5	J	336	J	mg/kg	IR10-SB04-03	22/22	(4)	336	NA	N/A N	N/A	N/A	NO	NUT
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	N/A	N/A	YES	ASL
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	N/A	N/A	NO	BSL
Zinc	2.5	J	1,250	J	mg/kg	IR10-SB04-03	13/22	2.3U - 3.4U	1,250	0.33 J - 7.9	2.35E+03 N	N/A	N/A	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 mg/kg = milligrams per kilogram  
 N = Non-Carcinogenic ug/kg = microgram per kilogram

**TABLE 1-5**  
**BASELINE RISK ASSESSMENT, SI REPORT**  
**SURFACE WATER DATA COMPARED TO HUMAN HEALTH SCREENING VALUES**  
**SITE 10 - ORIGINAL BASE LANDFILL**  
**MCB, CAMP LEJEUNE, NORTH CAROLINA**  
**NA DECISION DOCUMENT, CTO-0060**

Scenario Timeframe: Future
Medium: Surface Water
Exposure Medium: Surface Water
Exposure Point: Surface Water

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 NC Wtr Qual	Screening Toxicity Value NC Wtr Qual (6)	Potential ARAR/TBC Source	COPC Flag	Rationale for (2) Contaminant Deletion or Selection
<b>VOLATILES (ug/l)</b>															
Toluene	1.3	J	1.3	J	µg/L	IR10-SW03,IR10-SW04	2/6	10U - 10U	1.3		1.10E+01 N	1.10E+01	N/A	NO	BSL
<b>METALS (ug/l)</b>															
Aluminum	127	J	1,270		µg/L	IR10-SW05	6/6	(3)	1,270		8.70E+01 N	8.70E+01	N/A	YES	ASL
Arsenic	2.4	J	5	J	µg/L	IR10-SW04	5/6	10U - 10U	5		5.00E+01 C	5.00E+01	N/A	NO	BSL
Barium	8.2	J	37.1	J	µg/L	IR10-SW04	5/6	4.2U - 4.2U	37.1		1.40E+03 N	1.40E+03	N/A	NO	BSL
Calcium	2,340	J	33,200		µg/L	IR10-SW04	6/6	(3)	33,200		N/A N	N/A	N/A	NO	NUT
Copper	3	J	3	J	µg/L	IR10-SW03	1/6	2.5U - 10.7U	3		7.00E+00 N	7.00E+00	N/A	NO	BSL
Iron	424		2,210		µg/L	IR10-SW04	6/6	(3)	2,210		1.00E+03 N	1.00E+03	N/A	YES	ASL
Lead	1.1	J	7.1		µg/L	IR10-SW04	5/6	3U - 3U	7.1		2.50E+01 N	2.50E+01	N/A	NO	NTX
Magnesium	949	J	2,470	J	µg/L	IR10-SW03	6/6	(3)	2,470		N/A N	N/A	N/A	NO	NUT
Manganese	45.9		415		µg/L	IR10-SW04	6/6	(3)	415		N/A N	N/A	N/A	NO	NTX
Mercury	0.032	J	0.06	J	µg/L	IR10-SW04	4/6	0.2U - 0.2U	0.06		1.20E-02 N	1.20E-02	N/A	YES	ASL
Potassium	937	J	1,860	J	µg/L	IR10-SW04	4/6	5000U - 5000U	1,860		N/A N	N/A	N/A	NO	NUT
Sodium	3,080	J	6,040		µg/L	IR10-SW04	6/6	(3)	6,040		N/A N	N/A	N/A	NO	NUT
Vanadium	12.6	J	19.8	J	µg/L	IR10-SW04	6/6	(3)	19.8		4.70E+01 N	4.70E+01	N/A	NO	BSL
Zinc	39.9		95.9		µg/L	IR10-SW04	6/6	(3)	95.9		5.00E+01 N	5.00E+01	N/A	YES	ASL

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

(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)

J - Analyte present - Reported value is estimated

U - Not detected

Deletion Reason: Below Screening Level (BSL)  
 Essential Nutrient (NUT)  
 No Toxicity Information (NTX)

C = Carcinogenic  
 N = Non-Carcinogenic

µg/L = microgram per liter

(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 1-6**  
**BASELINE RISK ASSESSMENT, SI REPORT**  
**SEDIMENT WATER DATA COMPARED TO HUMAN HEALTH SCREENING VALUES**  
**SITE 10 - ORIGINAL BASE LANDFILL**  
**MCB, CAMP LEJEUNE, NORTH CAROLINA**  
**NA DECISION DOCUMENT, CTO-0060**

Scenario Timeframe: Current, Future
Medium: Sediment
Exposure Medium: Sediment
Exposure Point: Sediment

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	Potential ARAR/TBC Value	Potential ARAR/TBC Source	COPC Flag	Rationale for (2) Contaminant Deletion or Selection
<b>VOLATILES (ug/kg)</b>															
2-Butanone (MEK)	52		52		µg/kg	IR10-SD01-06	1/6	13U - 18U	52		4.69E+06 N	N/A	N/A	NO	BSL
Toluene	4.2	J	97		µg/kg	IR10-SD04-06	6/6	(3)	97		1.56E+06 N	N/A	N/A	NO	BSL
<b>PESTICIDES/PCBS (ug/kg)</b>															
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	N/A	N/A	NO	BSL
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 <sup>(4)</sup>	N/A	N/A	NO	BSL
<b>METALS (mg/kg)</b>															
Aluminum	834	J	3150	J	mg/kg	IR10-SD05-06	6/6	(3)	3150		7.82E+03 N	N/A	N/A	NO	BSL
Barium	1.9	J	18.2	J	mg/kg	IR10-SD04-06	6/6	(3)	18.2		5.48E+02 N	N/A	N/A	NO	BSL
Calcium	113	J	1630	J	mg/kg	IR10-SD04-06	6/6	(3)	1630		N/A N	N/A	N/A	NO	NUT
Copper	3.5	J	4	J	mg/kg	IR10-SD01-06	2/6	1.3U - 2.9U	4		3.13E+02 N	N/A	N/A	NO	BSL
Iron	191	J	1110	J	mg/kg	IR10-SD06-06	6/6	(3)	1110		2.35E+03 N	N/A	N/A	NO	BSL
Lead	4		22.7		mg/kg	IR10-SD04-06	6/6	(3)	22.7		4.00E+02 N <sup>(5)</sup>	N/A	N/A	NO	NTX
Magnesium	29.4	J	122	J	mg/kg	IR10-SD06-06	6/6	(3)	122		N/A N	N/A	N/A	NO	NUT
Manganese	1.2	J	6.7		mg/kg	IR10-SD01-06,IR10-SD06-06	6/6	(3)	6.7		1.56E+02 N	N/A	N/A	NO	BSL
Mercury	0.047	J	0.06	J	mg/kg	IR10-SD03-06	2/6	0.14U - 0.18U	0.06		2.35E+00 N <sup>(6)</sup>	N/A	N/A	NO	BSL
Potassium	182	J	246	J	mg/kg	IR10-SD04-06	3/6	1330U - 1550U	246		N/A N	N/A	N/A	NO	NUT
Selenium	0.76	J	0.76	J	mg/kg	IR10-SD02-06	1/6	1.3U - 1.8U	0.76		3.91E+01 N	N/A	N/A	NO	BSL
Vanadium	3.4	J	3.9	J	mg/kg	IR10-SD05-06	2/6	13.3U - 18.4U	3.9		5.48E+01 N	N/A	N/A	NO	BSL
Zinc	7.2		12.1		mg/kg	IR10-SD04-06	6/6	(3)	12.1		2.35E+03 N	N/A	N/A	NO	BSL

Definitions: N/A = Not Applicable

(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)

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 I-7**  
**BASELINE RISK ASSESSMENT, SI REPORT**  
**GROUNDWATER DATA COMPARED TO HUMAN HEALTH SCREENING VALUES**  
**SITE 10 - ORIGINAL BASE LANDFILL**  
**MCB, CAMP LEJEUNE, NORTH CAROLINA**  
**NA DECISION DOCUMENT, CTO-0060**

Scenario Timeframe: Future
Medium: Groundwater
Exposure Medium: Groundwater
Exposure Point: Groundwater

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 TapWtr RBCs	Potential ARAR/TBC Value	Potential ARAR/TBC Source	COPC Flag	Rationale for (2) Contaminant Deletion or Selection
<b>METALS (ug/l)</b>															
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
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
Calcium	727	J	62,400	J	µg/L	10-MW0601A	7/7	(3)	62,400		N/A N	N/A	N/A	NO	NUT
Chromium	8.4	J	8.4	J	µg/L	10-MW0901A	1/7	0.6U - 5.4U	8.4		1.10E+01 N <sup>(4)</sup>	100	MCL	NO	BSL
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
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 <sup>(5)</sup>	NO	BSL
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
Lead	2.9	J	2.9	J	µg/L	10-MW0901A	1/7	1.7U - 1.7U	2.9		1.50E+01 N <sup>(5)</sup>	15	MCL <sup>(5)</sup>	NO	NTX
Magnesium	486	J	4,910	J	µg/L	10-MW0601A	7/7	(3)	4,910		N/A N	N/A	N/A	NO	NUT
Manganese	14.3	J	49.8	J	µg/L	10-MW0901A	7/7	(3)	49.8		7.30E+01 N	N/A	N/A	NO	BSL
Nickel	1.8	J	10.6	J	µg/L	10-MW0301A	7/7	(3)	10.6		7.30E+01 N	100	MCL	NO	BSL
Potassium	229	J	2,600	J	µg/L	10-MW0601A	7/7	(3)	2,600		N/A N	N/A	N/A	NO	NUT
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
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
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
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

(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)

J - Analyte present - Reported value is estimated

Deletion Reason:  
 Below Screening Level (BSL)  
 Essential Nutrient (NUT)  
 No Toxicity Information (NTX)

C = Carcinogenic  
 N = Non-Carcinogenic

ug/L = microgram per liter

(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 2-1**  
**SUMMARY OF SUPPLY WELLS IN THE VICINITY OF SITE 10**  
**SITE 10, ORIGINAL BASE LANDFILL**  
**MCB, CAMP LEJEUNE, NORTH CAROLINA**  
**NO DECISION DOCUMENT, CTO-0060**

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 / inactive
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 3-1  
 BASELINE RISK ASSESSMENT, SI REPORT  
 SELECTION OF EXPOSURE PATHWAYS  
 SITE 10 - ORIGINAL BASE LANDFILL  
 MCB, CAMP LEJEUNE, NORTH CAROLINA  
 NA DECISION DOCUMENT, CTO-0060**

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 Ingestion	On-site On-site	Quant Quant	Potential future residential development. Potential future residential development.
					Child	Dermal Ingestion	On-site On-site	Quant Quant	Potential future residential development. Potential future residential development.
				Construction Worker	Adult	Dermal Ingestion	On-site On-site	Quant Quant	Excavation, construction activities for potential future development. Excavation, construction activities for potential future development.
					Resident	Adult	Inhalation	On-site	Quant
				Construction Worker	Adult	Inhalation	On-site	Quant	Excavation, construction activities for potential future development.
					Child	Inhalation	On-site	Quant	Potential future residential development.
	Air	Fugitive Dusts	Resident	Adult	Inhalation	On-site	Quant	Potential future residential development.	
				Child	Inhalation	On-site	Quant	Potential future residential development.	
	Subsurface Soil	Subsurface Soil	Site 10 Subsurface Soil	Construction Worker	Adult	Dermal Ingestion	On-site	Quant	Excavation, construction activities for potential future development.
					Adult	Inhalation	On-site	Quant	Excavation, construction activities for potential future development.
	Groundwater	Groundwater	Tap Water	Resident	Adult	Dermal Ingestion	On-site On-site	Quant Quant	Potential future residential development. Potential future residential development.
					Child	Dermal Ingestion	On-site On-site	Quant Quant	Potential future residential development. 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 Ingestion	On-site On-site	Quant Quant	Potential future recreational activities Potential future recreational activities
					Child	Dermal Ingestion	On-site On-site	Quant Quant	Potential future recreational activities Potential future recreational activities
Sediment	Sediment	Standing Water Body	Resident	Adult	Dermal Ingestion	On-site On-site	Quant Quant	Potential future recreational activities Potential future recreational activities	
				Child	Dermal Ingestion	On-site On-site	Quant Quant	Potential future recreational activities Potential future recreational activities	

**TABLE 3-2**  
**BASELINE RISK ASSESSMENT, SI REPORT**  
**TOTAL HUMAN HEALTH SITE RISK**  
**SITE 10 – ORIGINAL BASE LANDFILL**  
**MCB, CAMP LEJEUNE, NORTH CAROLINA**  
**NA DECISION DOCUMENT, CTO-0060**

Receptors	Surface Soil		Subsurface Soil		Groundwater		Surface Water		Total	
	ICR	HI	ICR	HI	ICR	HI	ICR	HI	ICR	HI
Current Military Personnel	$2.6 \times 10^{-7}$	0.09	NA	NA	NA	NA	NA	0.002	$2.6 \times 10^{-7}$	0.09
Current Adult Trespasser	$5.6 \times 10^{-7}$	0.03	NA	NA	NA	NA	NA	0.001	$5.6 \times 10^{-7}$	0.03
Current Older Child Trespasser	$2.7 \times 10^{-7}$	0.04	NA	NA	NA	NA	NA	0.001	$2.7 \times 10^{-7}$	0.04
Future Adult Resident	$5.1 \times 10^{-6}$	0.25	NA	NA	0	0.06	NA	0.001	$5.1 \times 10^{-6}$	0.31
Future Young Child Resident	$4.5 \times 10^{-6}$	0.82	NA	NA	0	0.15	NA	0.01	$4.5 \times 10^{-6}$	0.98
Future Construction Worker (RME)	$2.9 \times 10^{-7}$	0.32	$1.1 \times 10^{-6}$	1.53	NA	NA	NA	NA	$1.4 \times 10^{-6}$	1.85
Future Construction Worker (CT)	$2.9 \times 10^{-7}$	0.32	$9.7 \times 10^{-7}$	1.41	NA	NA	NA	NA	$1.3 \times 10^{-6}$	1.73

Notes:

- ICR = Incremental Lifetime Cancer Risk
- HI = Hazard Index
- Total = Soil + Groundwater + Surface Water
- NA = Not Applicable
- RME = Reasonable Maximum Exposure
- CT = Central Tendency

**TABLE 3-3  
 BASELINE RISK ASSESSMENT, SI REPORT  
 SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs FOR THE FUTURE CONSTRUCTION WORKER  
 REASONABLE MAXIMUM EXPOSURE  
 SITE 10 - ORIGINAL BASE LANDFILL  
 MCB, CAMP LEJEUNE, NORTH CAROLINA  
 NA DECISION DOCUMENT, CTO-0060**

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 (o) Whole Body (o) Skin / CVS (o) Liver / CVS / GIS	2.9E-02	3.0E-04	1.3E-02	4.3E-02
			Antimony	--	--	--	--	Antimony		9.2E-02	--	1.1E-01	2.0E-01
			Arsenic	2.1E-07	2.1E-11	7.9E-08	2.9E-07	Arsenic		3.2E-02	--	1.2E-02	4.5E-02
			Iron	--	--	--	--	Iron		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)					(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 3-4**  
**BASELINE RISK ASSESSMENT, SI REPORT**  
**SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs FOR THE FUTURE CONSTRUCTION WORKER**  
**CENTRAL TENDENCY**  
**SITE 10 - ORIGINAL BASE LANDFILL**  
**MCB, CAMP LEJEUNE, NORTH CAROLINA**  
**NA DECISION DOCUMENT, CTO-0060**

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 (o) Whole Body (o) Skin / CVS (o) Liver / CVS / GIS	2.9E-02	3.0E-04	1.3E-02	4.3E-02
			Antimony	--	--	--	--	Antimony		9.2E-02	--	1.1E-01	2.0E-01
			Arsenic	2.1E-07	2.1E-11	7.9E-08	2.9E-07	Arsenic		3.2E-02	--	1.2E-02	4.5E-02
			Iron	--	--	--	--	Iron		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

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 = 0.03

**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

**TABLE 4-1**  
**ECOLOGICAL RISK SCREENING, SI REPORT**  
**ASSESSMENT ENDPOINTS, RISK HYPOTHESES, AND MEASUREMENT ENDPOINTS**  
**SITE 10 - ORIGINAL BASE LANDFILL**  
**MCB, CAMP LEJUENE, NORTH CAROLINA**  
**NA DECISION DOCUMENT, CTO-0060**

Assessment Endpoint	Risk Hypothesis	Measurement Endpoint
<b>Terrestrial Habitat</b>		
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
<b>Aquatic Habitat</b>		
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 pond?	Comparison of chemical concentrations in seep water and groundwater to surface water screening values.

**TABLE 4-2**  
**ECOLOGICAL RISK SCREENING, SI REPORT**  
**FREQUENCY AND RANGE OF SURFACE SOIL DATA COMPARED TO ECOLOGICAL SCREENING VALUES**  
**SITE 10 - ORIGINAL BASE LANDFILL**  
**MCB, CAMP LEJUENE, NORTH CAROLINA**  
**NA DECISION DOCUMENT, CTO-0060**

Analyte	Contaminant Frequency/Range					Surface Soil Screening Levels (SSSL)	Reference	Max. HQ <sup>(2)</sup>	ECOC?	Comments	Mean HQ <sup>(3)</sup>
	Frequency of Detection	Range of Positive Detections	Range of Non-Detects	Arithmetic Mean (Half Non-Detects)	Value used in Screen <sup>(1)</sup>						
<b>Volatile Organics (ug/kg):</b>											
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 4-2 (Continued)**  
**FREQUENCY AND RANGE OF SURFACE SOIL DATA COMPARED TO ECOLOGICAL SCREENING VALUES**  
**SITE 10 - ORIGINAL BASE LANDFILL**  
**MCB, CAMP LEJUENE, NORTH CAROLINA**  
**NA DECISION DOCUMENT, CTO-0060**

Analyte	Contaminant Frequency/Range					Surface Soil Screening Levels (SSSL)	Reference	Max. HQ <sup>(2)</sup>	ECOC?	Comments	Mean HQ <sup>(3)</sup>
	Frequency of Detection	Range of Positive Detections	Range of Non-Detects	Arithmetic Mean (Half Non-Detects)	Value used in Screen <sup>(1)</sup>						
<b>Volatile Organics (ug/kg)(Cont):</b>											
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	--
<b>Semivolatile Organics (ug/kg):</b>											
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 4-2 (Continued)**  
**FREQUENCY AND RANGE OF SURFACE SOIL DATA COMPARED TO ECOLOGICAL SCREENING VALUES**  
**SITE 10 - ORIGINAL BASE LANDFILL**  
**MCB, CAMP LEJUENE, NORTH CAROLINA**  
**NA DECISION DOCUMENT, CTO-0060**

Analyte	Contaminant Frequency/Range					Surface Soil Screening Levels (SSSL)	Reference	Max. HQ <sup>(2)</sup>	ECOC?	Comments	Mean HQ <sup>(3)</sup>
	Frequency of Detection	Range of Positive Detections	Range of Non-Detects	Arithmetic Mean (Half Non-Detects)	Value used in Screen <sup>(1)</sup>						
<b>Semivolatile Organics (ug/kg)(Cont):</b>											
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 4-2 (Continued)**  
**FREQUENCY AND RANGE OF SURFACE SOIL DATA COMPARED TO ECOLOGICAL SCREENING VALUES**  
**SITE 10 - ORIGINAL BASE LANDFILL**  
**MCB, CAMP LEJUENE, NORTH CAROLINA**  
**NA DECISION DOCUMENT, CTO-0060**

Analyte	Contaminant Frequency/Range					Surface Soil Screening Levels (SSSL)	Reference	Max. HQ <sup>(2)</sup>	ECOC?	Comments	Mean HQ <sup>(3)</sup>
	Frequency of Detection	Range of Positive Detections	Range of Non-Detects	Arithmetic Mean (Half Non-Detects)	Value used in Screen <sup>(1)</sup>						
<b>Semivolatile Organics (ug/kg)(Cont):</b>											
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 4-2 (Continued)**  
**FREQUENCY AND RANGE OF SURFACE SOIL DATA COMPARED TO ECOLOGICAL SCREENING VALUES**  
**SITE 10 - ORIGINAL BASE LANDFILL**  
**MCB, CAMP LEJUENE, NORTH CAROLINA**  
**NA DECISION DOCUMENT, CTO-0060**

Analyte	Contaminant Frequency/Range					Surface Soil Screening Levels (SSSL)	Reference	Max. HQ <sup>(2)</sup>	ECOC?	Comments	Mean HQ <sup>(3)</sup>
	Frequency of Detection	Range of Positive Detections	Range of Non-Detects	Arithmetic Mean (Half Non-Detects)	Value used in Screen <sup>(1)</sup>						
<b>Semivolatile Organics (ug/kg)(Cont):</b>											
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	--
<b>Pesticides/PCBS (ug/kg):</b>											
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 4-2 (Continued)  
 FREQUENCY AND RANGE OF SURFACE SOIL DATA COMPARED TO ECOLOGICAL SCREENING VALUES  
 SITE 10 - ORIGINAL BASE LANDFILL  
 MCB, CAMP LEJUENE, NORTH CAROLINA  
 NA DECISION DOCUMENT, CTO-0060

Analyte	Contaminant Frequency/Range					Surface Soil Screening Levels (SSSL)	Reference	Max. HQ <sup>(2)</sup>	ECOC?	Comments	Mean HQ <sup>(3)</sup>
	Frequency of Detection	Range of Positive Detections	Range of Non-Detects	Arithmetic Mean (Half Non-Detects)	Value used in Screen <sup>(1)</sup>						
<b>Pesticides/PCBs (ug/kg)(Cont):</b>											
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 4-2 (Continued)**  
**FREQUENCY AND RANGE OF SURFACE SOIL DATA COMPARED TO ECOLOGICAL SCREENING VALUES**  
**SITE 10 - ORIGINAL BASE LANDFILL**  
**MCB, CAMP LEJUENE, NORTH CAROLINA**  
**NA DECISION DOCUMENT, CTO-0060**

Analyte	Contaminant Frequency/Range					Surface Soil Screening Levels (SSSL)	Reference	Max. HQ <sup>(2)</sup>	ECOC?	Comments	Mean HQ <sup>(3)</sup>
	Frequency of Detection	Range of Positive Detections	Range of Non-Detects	Arithmetic Mean (Half Non-Detects)	Value used in Screen <sup>(1)</sup>						
<b>Pesticides/PCBS (ug/kg)(Cont):</b>											
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
<b>Inorganics (mg/kg):</b>											
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 4-2 (Continued)**  
**FREQUENCY AND RANGE OF SURFACE SOIL DATA COMPARED TO ECOLOGICAL SCREENING VALUES**  
**SITE 10 - ORIGINAL BASE LANDFILL**  
**MCB, CAMP LEJUENE, NORTH CAROLINA**  
**NA DECISION DOCUMENT, CTO-0060**

Analyte	Contaminant Frequency/Range					Surface Soil Screening Levels (SSSL)	Reference	Max. HQ <sup>(2)</sup>	ECOC?	Comments	Mean HQ <sup>(3)</sup>
	Frequency of Detection	Range of Positive Detections	Range of Non-Detects	Arithmetic Mean (Half Non-Detects)	Value used in Screen <sup>(1)</sup>						
<b>Inorganics (mg/kg)(Cont):</b>											
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.

<sup>(1)</sup> The value used in the screen represents the maximum detected or non-detected concentration.

<sup>(2)</sup> The maximum HQ represents the value used in the screen divided by the surface soil screening value.

<sup>(3)</sup> 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 4-3**  
**ECOLOGICAL RISK SCREENING, SI REPORT**  
**FREQUENCY AND RANGE OF SEDIMENT DATA COMPARED TO FRESHWATER ECOLOGICAL SCREENING VALUES**  
**SITE 10 - ORIGINAL BASE LANDFILL**  
**MCB, CAMP LEJUENE NORTH CAROLINA**  
**NA DECISION DOCUMENT, CTO-0060**

Analyte	Contaminant Frequency/Range					Freshwater Sediment Screening Levels (SSL)	Reference	Max. HQ <sup>(2)</sup>	ECOC?	Comments	Mean HQ <sup>(3)</sup>
	Frequency of Detection	Range of Positive Detections	Range of Non-Detects	Arithmetic Mean (Half Non-Detects)	Value used in Screen <sup>(1)</sup>						
<b>Volatile Organics (ug/kg):</b>											
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 4-3 (Continued)**  
**ECOLOGICAL RISK SCREENING, SI REPORT**  
**FREQUENCY AND RANGE OF SEDIMENT DATA COMPARED TO FRESHWATER ECOLOGICAL SCREENING VALUES**  
**SITE 10 - ORIGINAL BASE LANDFILL**  
**MCB, CAMP LEJUENE NORTH CAROLINA**  
**NA DECISION DOCUMENT, CTO-0060**

Analyte	Contaminant Frequency/Range					Freshwater Sediment Screening Levels (SSL)	Reference	Max. HQ <sup>(2)</sup>	ECOC?	Comments	Mean HQ <sup>(3)</sup>
	Frequency of Detection	Range of Positive Detections	Range of Non-Detects	Arithmetic Mean (Half Non-Detects)	Value used in Screen <sup>(1)</sup>						
<b>Volatile Organics (ug/kg)(Cont):</b>											
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	--
<b>Semivolatile Organics (ug/kg):</b>											
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 4-3 (Continued)**  
**ECOLOGICAL RISK SCREENING, SI REPORT**  
**FREQUENCY AND RANGE OF SEDIMENT DATA COMPARED TO FRESHWATER ECOLOGICAL SCREENING VALUES**  
**SITE 10 - ORIGINAL BASE LANDFILL**  
**MCB, CAMP LEJUENE NORTH CAROLINA**  
**NA DECISION DOCUMENT, CTO-0060**

Analyte	Contaminant Frequency/Range					Freshwater Sediment Screening Levels (SSL)	Reference	Max. HQ <sup>(2)</sup>	ECOC?	Comments	Mean HQ <sup>(3)</sup>
	Frequency of Detection	Range of Positive Detections	Range of Non-Detects	Arithmetic Mean (Half Non-Detects)	Value used in Screen <sup>(1)</sup>						
<b>Semivolatile Organics (ug/kg)(Cont):</b>											
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 4-3 (Continued)**  
**ECOLOGICAL RISK SCREENING, SI REPORT**  
**FREQUENCY AND RANGE OF SEDIMENT DATA COMPARED TO FRESHWATER ECOLOGICAL SCREENING VALUES**  
**SITE 10 - ORIGINAL BASE LANDFILL**  
**MCB, CAMP LEJUENE NORTH CAROLINA**  
**NA DECISION DOCUMENT, CTO-0060**

Analyte	Contaminant Frequency/Range					Freshwater Sediment Screening Levels (SSL)	Reference	Max. HQ <sup>(2)</sup>	ECOC?	Comments	Mean HQ <sup>(3)</sup>
	Frequency of Detection	Range of Positive Detections	Range of Non-Detects	Arithmetic Mean (Half Non-Detects)	Value used in Screen <sup>(1)</sup>						
<b>Semivolatiles Organics (ug/kg)(Cont):</b>											
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	--
<b>Pesticides/PCBs (ug/kg):</b>											
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 4-3 (Continued)**  
**ECOLOGICAL RISK SCREENING, SI REPORT**  
**FREQUENCY AND RANGE OF SEDIMENT DATA COMPARED TO FRESHWATER ECOLOGICAL SCREENING VALUES**  
**SITE 10 - ORIGINAL BASE LANDFILL**  
**MCB, CAMP LEJUENE NORTH CAROLINA**  
**NA DECISION DOCUMENT, CTO-0060**

Analyte	Contaminant Frequency/Range					Freshwater Sediment Screening Levels (SSL)	Reference	Max. HQ <sup>(2)</sup>	ECOC?	Comments	Mean HQ <sup>(3)</sup>
	Frequency of Detection	Range of Positive Detections	Range of Non-Detects	Arithmetic Mean (Half Non-Detects)	Value used in Screen <sup>(1)</sup>						
<b>Pesticides/PCBs (ug/kg)(Cont):</b>											
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
<b>Inorganics (mg/kg):</b>											
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 4-3 (Continued)**  
**ECOLOGICAL RISK SCREENING, SI REPORT**  
**FREQUENCY AND RANGE OF SEDIMENT DATA COMPARED TO FRESHWATER ECOLOGICAL SCREENING VALUES**  
**SITE 10 - ORIGINAL BASE LANDFILL**  
**MCB, CAMP LEJUENE NORTH CAROLINA**  
**NA DECISION DOCUMENT, CTO-0060**

Analyte	Contaminant Frequency/Range					Freshwater Sediment Screening Levels (SSL)	Reference	Max. HQ <sup>(2)</sup>	ECOC?	Comments	Mean HQ <sup>(3)</sup>
	Frequency of Detection	Range of Positive Detections	Range of Non-Detects	Arithmetic Mean (Half Non-Detects)	Value used in Screen <sup>(1)</sup>						
<b>Inorganics (mg/kg)(Cont):</b>											
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

- <sup>(1)</sup> The value used in the screen represents the maximum detected or non-detected concentration.
- <sup>(2)</sup> The maximum HQ represents the value used in the screen divided by the freshwater sediment screening value.
- <sup>(3)</sup> 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 4-4**  
**FREQUENCY AND RANGE OF SURFACE WATER DATA COMPARED TO FRESHWATER ECOLOGICAL SCREENING VALUES**  
**SITE 10 - ORIGINAL BASE LANDFILL**  
**MCB, CAMP LEJUENE, NORTH CAROLINA**  
**NA DECISION DOCUMENT, CTO-0060**

Analyte	Contaminant Frequency/Range					Surface Water Screening Levels (SWSL)	Reference	Max. HQ <sup>(2)</sup>	ECOC?	Comments	Mean HQ <sup>(3)</sup>
	Frequency of Detection	Range of Positive Detections	Range of Non-Detects	Arithmetic Mean (Half Non-Detects)	Value used in Screen <sup>(1)</sup>						
<b>Volatile Organics (ug/L):</b>											
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 4-4 (Continued)**  
**FREQUENCY AND RANGE OF SURFACE WATER DATA COMPARED TO FRESHWATER ECOLOGICAL SCREENING VALUES**  
**SITE 10 - ORIGINAL BASE LANDFILL**  
**MCB, CAMP LEJUENE, NORTH CAROLINA**  
**NA DECISION DOCUMENT, CTO-0060**

Analyte	Contaminant Frequency/Range					Surface Water Screening Levels (SWSL)	Reference	Max. HQ <sup>(2)</sup>	ECOC?	Comments	Mean HQ <sup>(3)</sup>
	Frequency of Detection	Range of Positive Detections	Range of Non-Detects	Arithmetic Mean (Half Non-Detects)	Value used in Screen <sup>(1)</sup>						
<b>Volatile Organics (ug/L)(Cont):</b>											
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	--
<b>Semivolatile Organics (ug/L):</b>											
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 4-4 (Continued)**  
**FREQUENCY AND RANGE OF SURFACE WATER DATA COMPARED TO FRESHWATER ECOLOGICAL SCREENING VALUES**  
**SITE 10 - ORIGINAL BASE LANDFILL**  
**MCB, CAMP LEJUENE, NORTH CAROLINA**  
**NA DECISION DOCUMENT, CTO-0060**

Analyte	Contaminant Frequency/Range					Surface Water Screening Levels (SWSL)	Reference	Max. HQ <sup>(2)</sup>	ECOC?	Comments	Mean HQ <sup>(3)</sup>
	Frequency of Detection	Range of Positive Detections	Range of Non-Detects	Arithmetic Mean (Half Non-Detects)	Value used in Screen <sup>(1)</sup>						
<b>Semivolatile Organics (ug/L)(Cont):</b>											
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 4-4 (Continued)**  
**FREQUENCY AND RANGE OF SURFACE WATER DATA COMPARED TO FRESHWATER ECOLOGICAL SCREENING VALUES**  
**SITE 10 - ORIGINAL BASE LANDFILL**  
**MCB, CAMP LEJUENE, NORTH CAROLINA**  
**NA DECISION DOCUMENT, CTO-0060**

Analyte	Contaminant Frequency/Range					Surface Water Screening Levels (SWSL)	Reference	Max. HQ <sup>(2)</sup>	ECOC?	Comments	Mean HQ <sup>(3)</sup>
	Frequency of Detection	Range of Positive Detections	Range of Non-Detects	Arithmetic Mean (Half Non-Detects)	Value used in Screen <sup>(1)</sup>						
<b>Semivolatile Organics (ug/L)(Cont):</b>											
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	--
<b>Pesticides/PCBs (ug/L):</b>											
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 4-4 (Continued)**  
**FREQUENCY AND RANGE OF SURFACE WATER DATA COMPARED TO FRESHWATER ECOLOGICAL SCREENING VALUES**  
**SITE 10 - ORIGINAL BASE LANDFILL**  
**MCB, CAMP LEJUENE, NORTH CAROLINA**  
**NA DECISION DOCUMENT, CTO-0060**

Analyte	Contaminant Frequency/Range					Surface Water Screening Levels (SWSL)	Reference	Max. HQ <sup>(2)</sup>	ECOC?	Comments	Mean HQ <sup>(3)</sup>
	Frequency of Detection	Range of Positive Detections	Range of Non-Detects	Arithmetic Mean (Half Non-Detects)	Value used in Screen <sup>(1)</sup>						
<b>Pesticides/PCBs (ug/L)(Cont):</b>											
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
<b>Total Inorganics (ug/L):</b>											
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 4-4 (Continued)**  
**FREQUENCY AND RANGE OF SURFACE WATER DATA COMPARED TO FRESHWATER ECOLOGICAL SCREENING VALUES**  
**SITE 10 - ORIGINAL BASE LANDFILL**  
**MCB, CAMP LEJUENE, NORTH CAROLINA**  
**NA DECISION DOCUMENT, CTO-0060**

Analyte	Contaminant Frequency/Range					Surface Water Screening Levels (SWSL)	Reference	Max. HQ <sup>(2)</sup>	ECOC?	Comments	Mean HQ <sup>(3)</sup>
	Frequency of Detection	Range of Positive Detections	Range of Non-Detects	Arithmetic Mean (Half Non-Detects)	Value used in Screen <sup>(1)</sup>						
<b>Total Inorganics (ug/L)(Cont):</b>											
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 Protection 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

<sup>(1)</sup> The value used in the screen represents the maximum detected or non-detected concentration.

<sup>(2)</sup> The maximum HQ represents the value used in the screen divided by the freshwater screening value.

<sup>(3)</sup> 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.

<sup>(4)</sup> The screening value for this compound is pH dependent. A pH of 7.8 S.U. was assumed.

<sup>(5)</sup> The surface water screening value shown is for trivalent arsenic.

<sup>(6)</sup> This screening value is hardness dependent. The mean hardness value of 89.2 mg/L CaCO<sub>3</sub> was calculated by using the following USEPA equation: 2.497(Ca, mg/L) + 4.118(Mg, mg/L).

**TABLE 4-5**  
**ECOLOGICAL RISK SCREENING, SI REPORT**  
**FREQUENCY AND RANGE OF GROUNDWATER DATA COMPARED TO FRESHWATER ECOLOGICAL SCREENING VALUES**  
**SITE 10 - ORIGINAL BASE LANDFILL**  
**MCB, CAMP LEJUENE, NORTH CAROLINA**  
**NA DECISION DOCUMENT, CTO-0060**

Analyte	Contaminant Frequency/Range					Surface Water Screening Levels (SWSL)	Reference	Max. HQ <sup>(2)</sup>	ECOC?	Comments	Mean HQ <sup>(3)</sup>
	Frequency of Detection	Range of Positive Detections	Range of Non-Detects	Arithmetic Mean (Half Non-Detects)	Value used in Screen <sup>(1)</sup>						
<b>Total Inorganics (ug/L):</b>											
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<sub>3</sub> was calculated by using the following USEPA equation:  
 $2.497(\text{Ca, mg/L}) + 4.118(\text{Mg, mg/L})$ .

**FIGURES**

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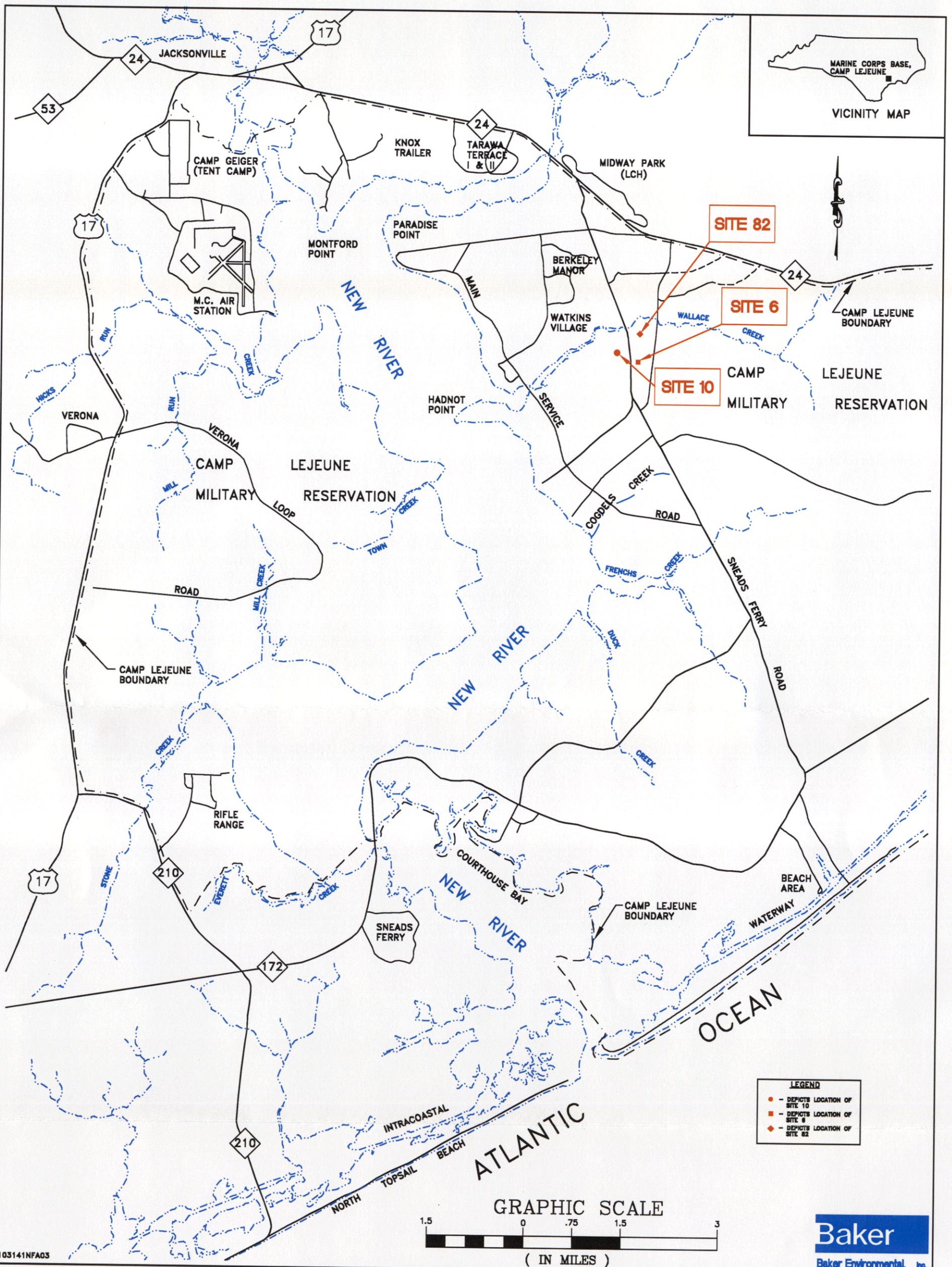
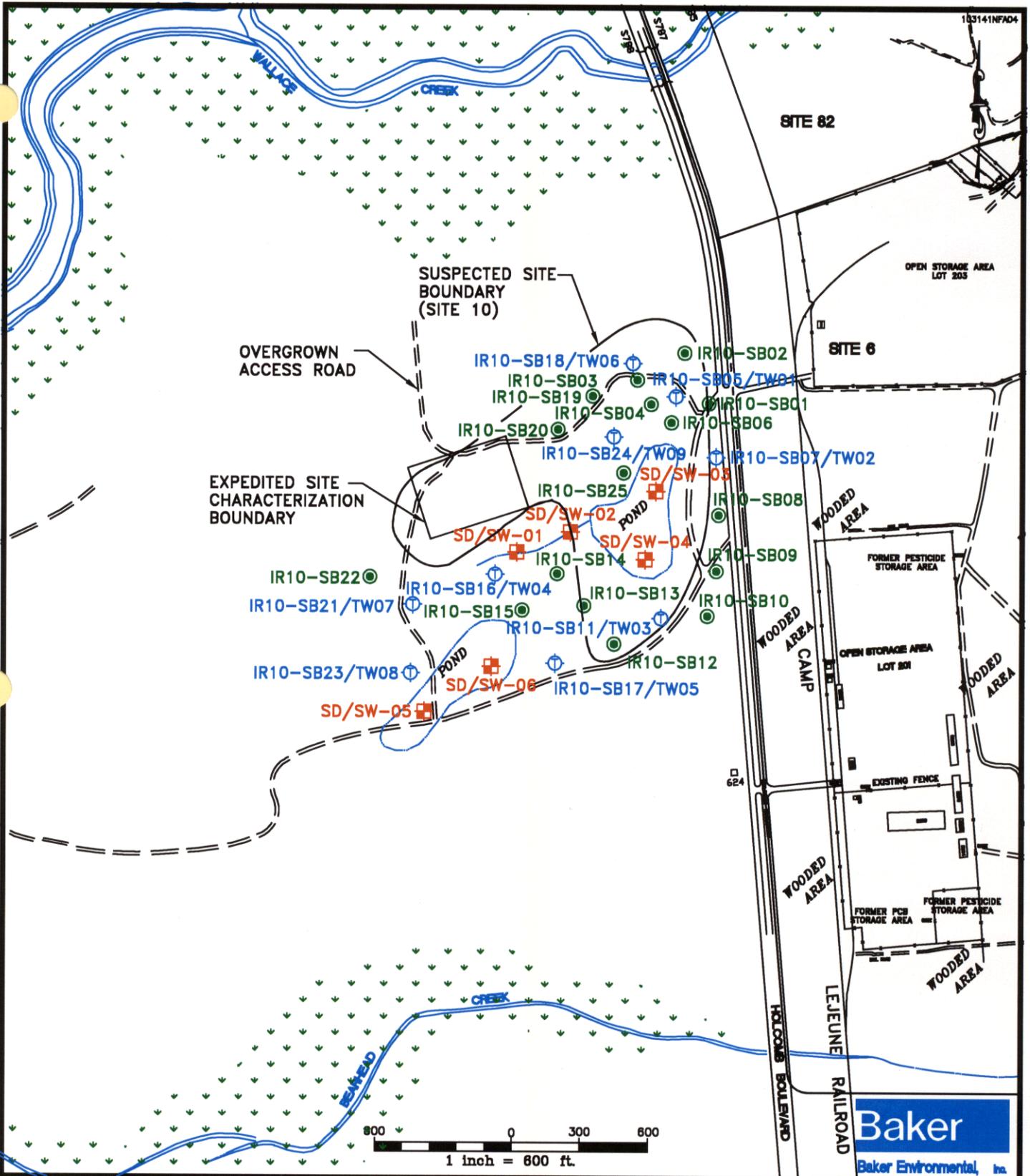


FIGURE 1-1  
 CAMP LEJEUNE AND SITE  
 LOCATION MAP  
 SITE 10 - ORIGINAL BASE LANDFILL  
 NA DECISION DOCUMENT, CTO - 060  
 MARINE CORPS BASE, CAMP LEJEUNE  
 NORTH CAROLINA

103141NFA03

**Baker**  
 Baker Environmental, Inc.

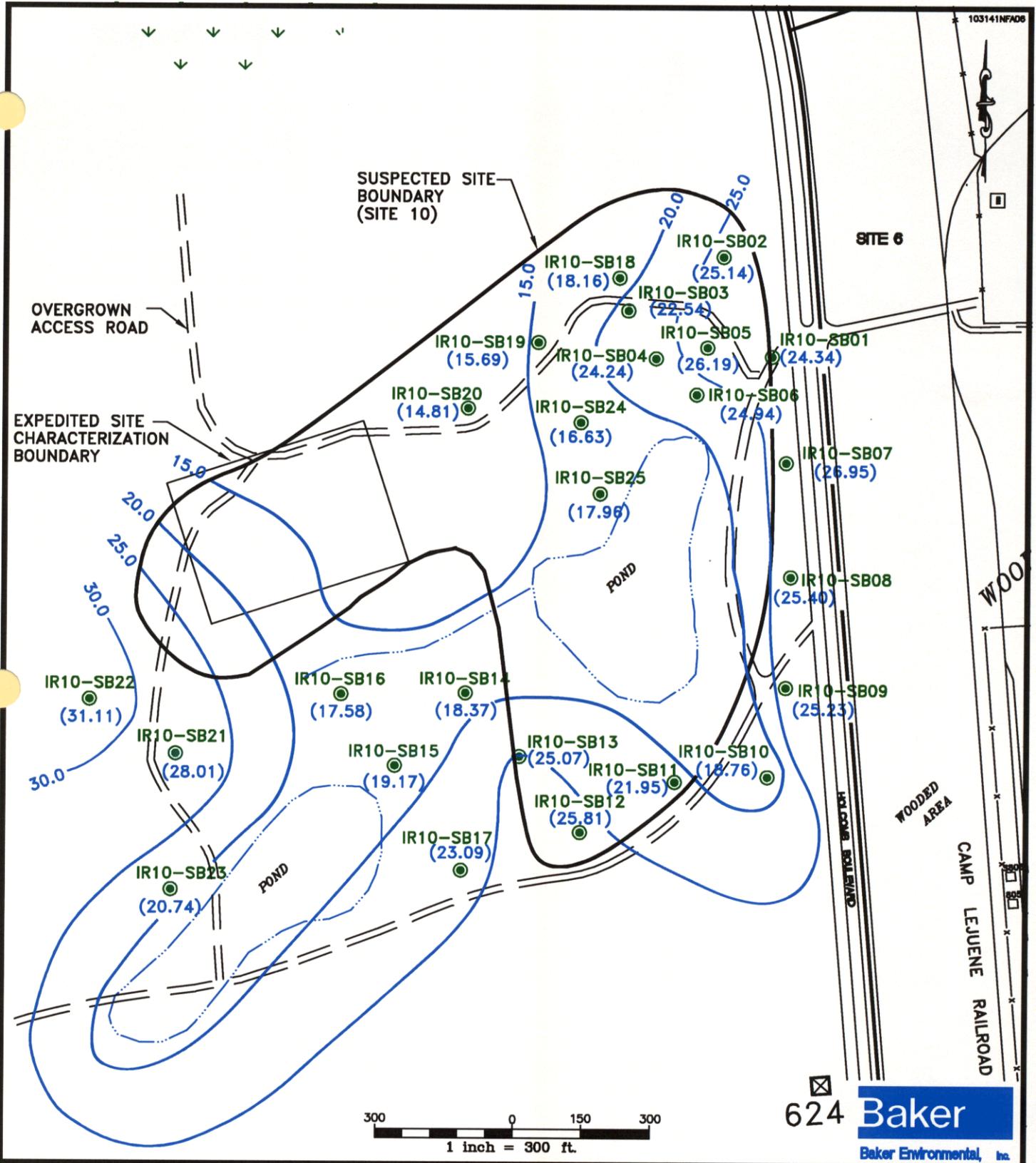


**LEGEND**

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

**FIGURE 1-2**  
**PHASE I SITE INVESTIGATION**  
**SAMPLE LOCATION MAP**  
**SITE 10 – ORIGINAL BASE LANDFILL**  
**NA DECISION DOCUMENT, CTO – 060**  
**MARINE CORPS BASE, CAMP LEJEUNE**  
**NORTH CAROLINA**





**LEGEND**

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

**FIGURE 2-1**  
**PHASE I SITE INVESTIGATION**  
**SURFACE TOPOGRAPHY MAP**  
**SITE 10 - ORIGINAL BASE LANDFILL**  
**NA DECISION DOCUMENT, CTO - 060**  
**MARINE CORPS BASE, CAMP LEJEUNE**  
**NORTH CAROLINA**

**GRADIENT CALCULATIONS ( FEET VERTICAL / FEET HORIZONTAL ) :**

$$A-A' = \frac{4'}{150'} = 2.67 \times 10^{-2}$$

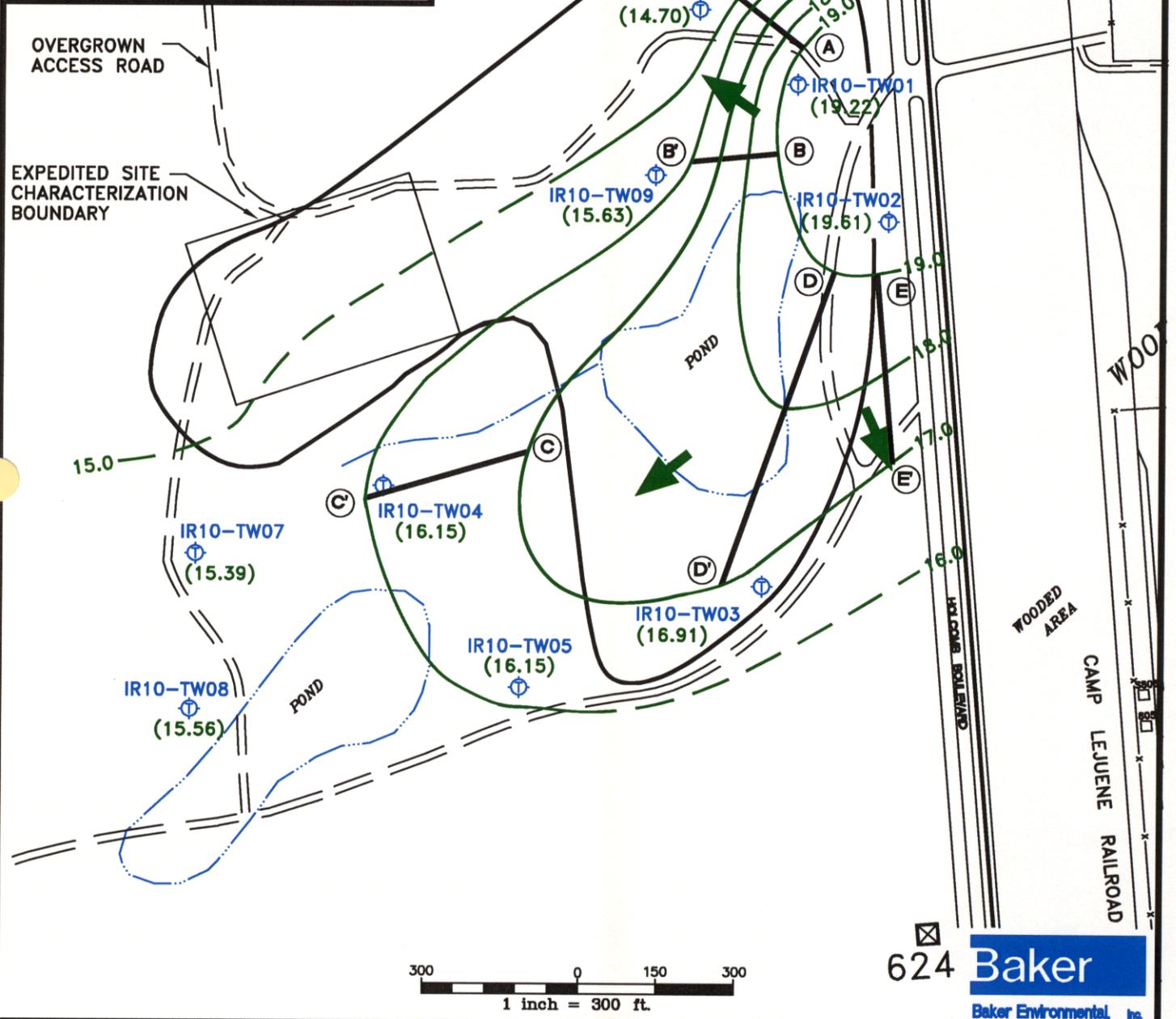
$$B-B' = \frac{3'}{180'} = 1.67 \times 10^{-2}$$

$$C-C' = \frac{1'}{300'} = 3.3 \times 10^{-3}$$

$$D-D' = \frac{2'}{690'} = 2.9 \times 10^{-3}$$

$$E-E' = \frac{2'}{360'} = 5.6 \times 10^{-3}$$

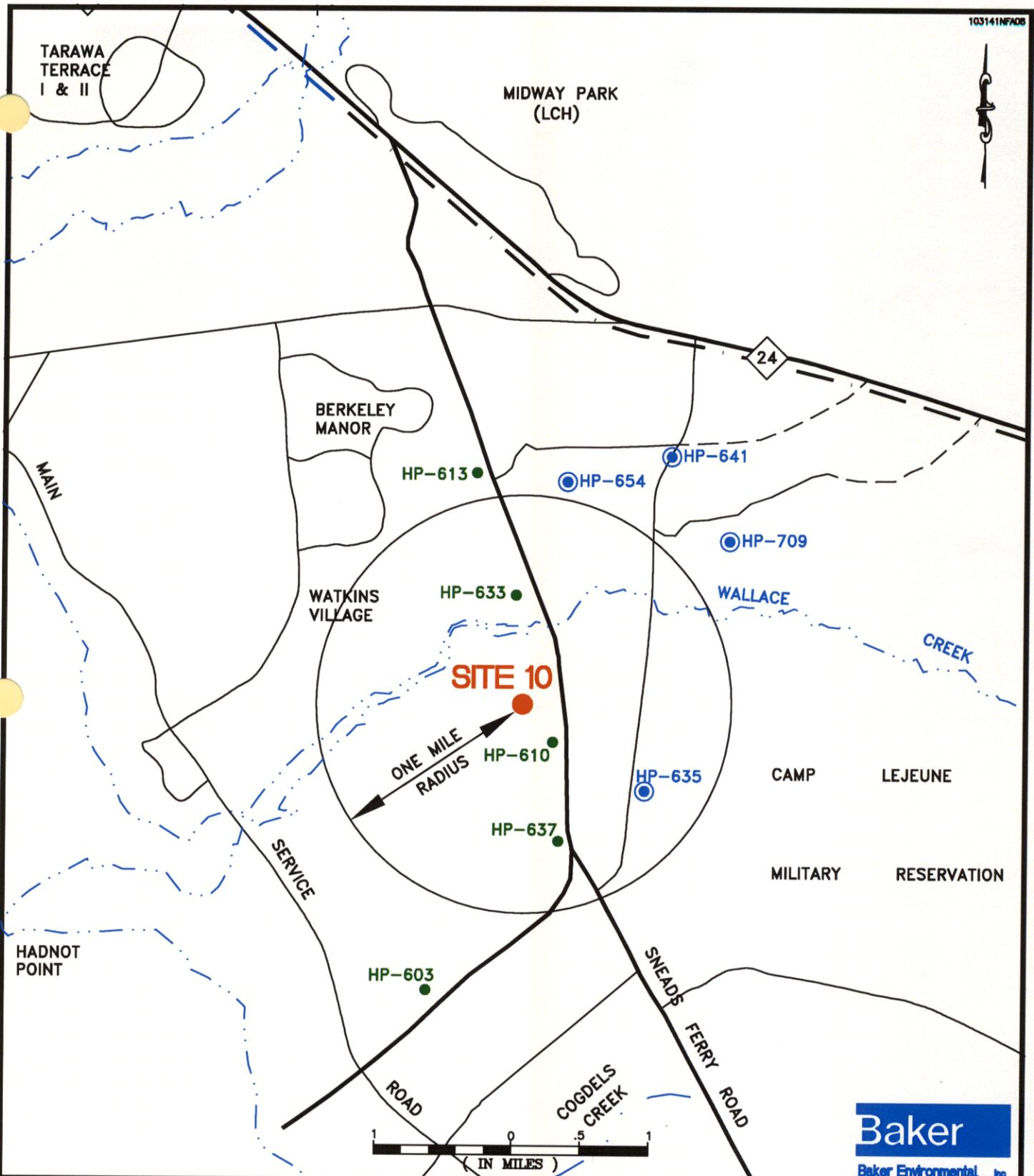
AVERAGE GRADIENT (SITE 10) =  $1.1 \times 10^{-2}$



**LEGEND**

- TEMPORARY WELL LOCATION WITH SURFACE AND SUBSURFACE SOIL SAMPLES
- (19.22) - GROUNDWATER ELEVATION
- DIRECTION OF GROUNDWATER FLOW
- GROUNDWATER CONTOUR
- HYDRAULIC GRADIENT HORIZONTAL DISTANCE

**FIGURE 2-2**  
 PHASE I SITE INVESTIGATION  
 GROUNDWATER CONTOUR MAP  
 SITE 10 - ORIGINAL BASE LANDFILL  
 NA DECISION DOCUMENT, CTO - 060  
 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

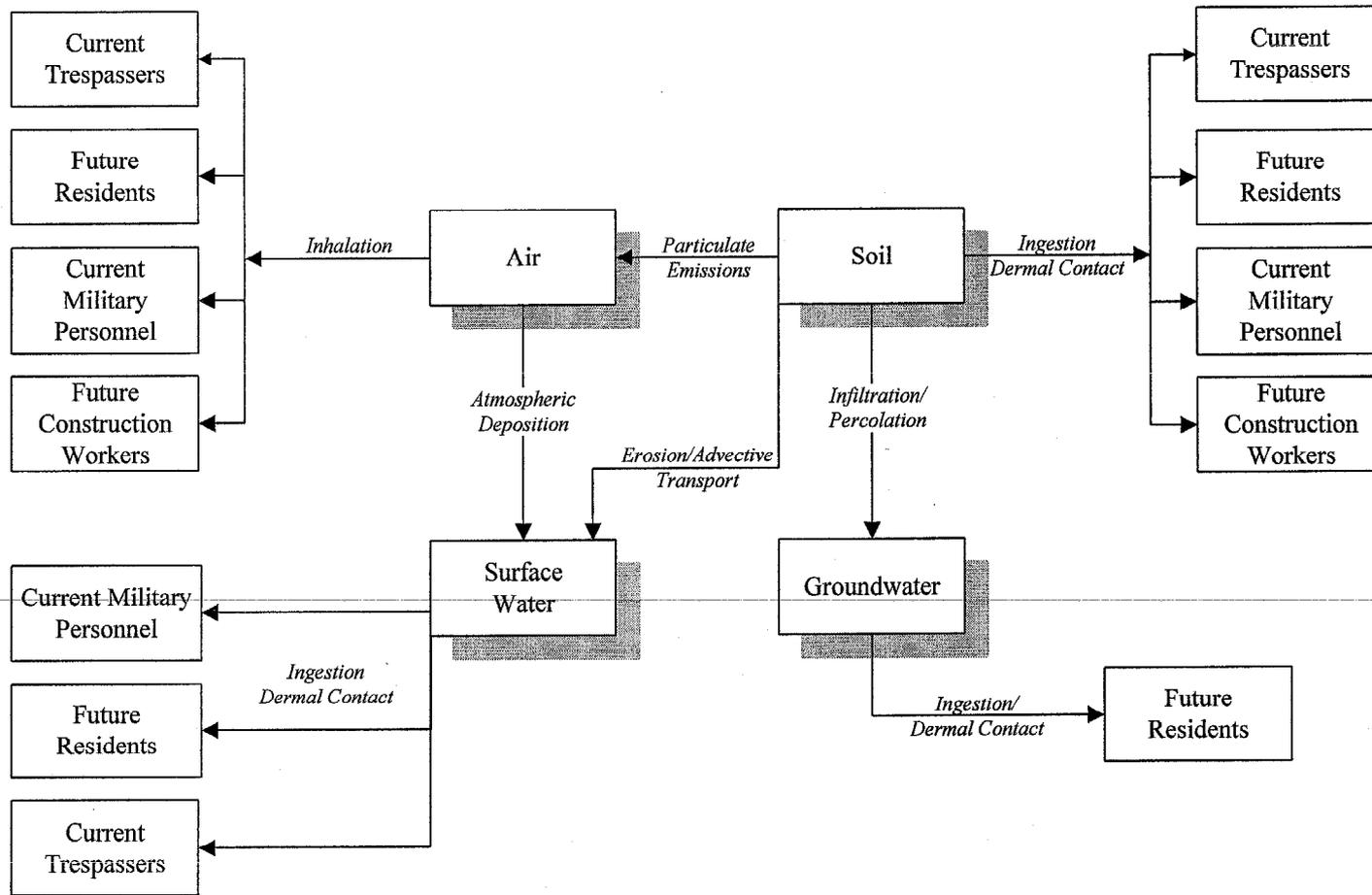
SOURCE: USGS WATER RESOURCES INVESTIGATION REPORT 89-4096.

**FIGURE 2-3**  
**SUPPLY WELL LOCATION MAP**  
**SITE 10 - ORIGINAL BASE LANDFILL**  
**NA DECISION DOCUMENT, CTO - 060**

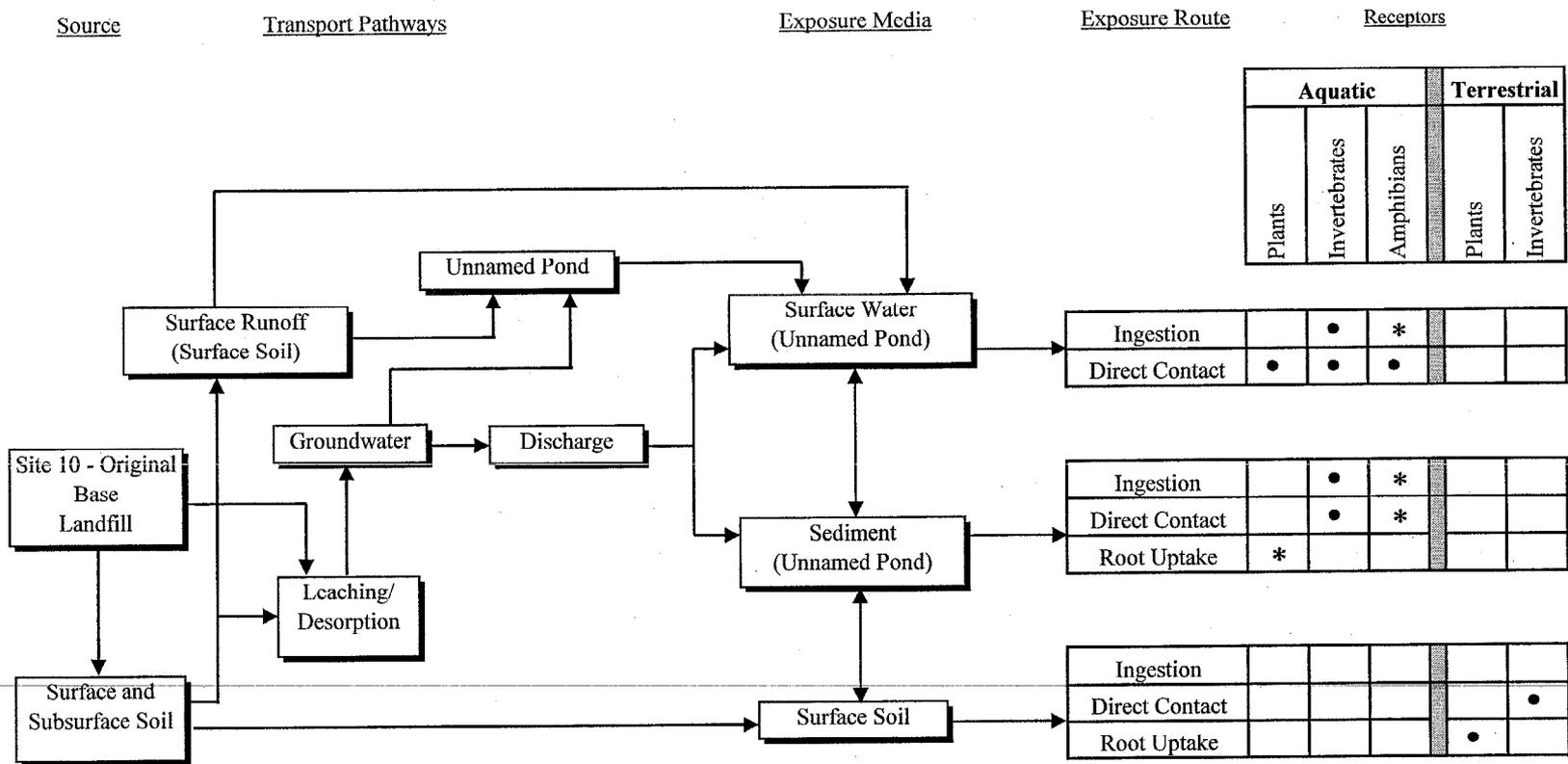
MARINE CORPS BASE, CAMP LEJEUNE  
 NORTH CAROLINA

FIGURE 2-4

BASELINE RISK ASSESSMENT, SI REPORT  
CONCEPTUAL SITE MODEL  
FOR CURRENT AND FUTURE HUMAN RECEPTORS  
SITE 10 - ORIGINAL BASE LANDFILL  
MCB, CAMP LEJEUNE, NORTH CAROLINA  
NA DECISION DOCUMENT, CTO-0060



**FIGURE 4-1**  
**ECOLOGICAL RISK SCREENING, SI REPORT**  
**PRELIMINARY ECOLOGICAL CONCEPTUAL MODEL**  
**SITE 10 - ORIGINAL BASE LANDFILL**  
**MCB, CAMP LEJUENE, NORTH CAROLINA**  
**NA DECISION DOCUMENT, CTO-0060**



———> Solid line indicates a potential complete and significant transport/exposure pathway that was evaluated  
 • Receptor evaluated quantitatively  
 \* Receptor not evaluated quantitatively

**ATTACHMENT A**  
**STATE OF NORTH CAROLINA APPROVAL LETTER**

---

North Carolina  
Department of Environment and Natural Resources  
Division of Waste Management

Michael F. Easley, Governor  
William G. Ross Jr., Secretary  
Dexter R. Matthews, Director



March 14, 2005

NAVFAC Atlantic  
Attn: Daniel R Hood  
Code: OPCEV  
NC/Caribbean IPT, EV Business Line  
6506 Hampton Blvd  
Norfolk, VA 23508-1273

RE: State Concurrence on No Further Action Decision Document  
Site 10 Original Base Landfill  
MCB Camp Lejeune, NC  
Soil and Groundwater  
Camp Lejeune, NC6170022580  
Jacksonville, Onslow County, North Carolina

Dear Mr. Hood:

The NC Superfund Section received and reviewed the Draft Final No Further Action (NFA) Decision Document (DD) for the Site 10 Original Base Landfill Site date July 2001 and concurs with the proposed NFA DD subject to the following condition:

The State's concurrence is based on the information contained in the July 2001 Site Investigation Report and the July 2001 NFA DD and the Base Background Studies. Should we receive additional information that significantly affects the conclusions of the NFA, we may modify or withdraw this concurrence with written notice to the Naval Facilities Engineering Command for Camp Lejeune and the EPA Region IV.

Site 10 is a Preliminary Assessment Site and has never been listed as an NPL Site for Camp Lejeune. The site has no widespread surface soil contamination and the only groundwater contamination is Iron that is below the Bases background average as documented in Table 7-1 of the Draft Base Background Groundwater Study dated August 2002. The site had an isolated detection of Lead contaminated subsurface soil at boring location 10-SB04-03 at 2630mg/kg which is in excess of the residential and industrial human health risk concentrations. This detection was in subsurface soil and is the only high concentration of lead in soil at Site 10 and therefore, risk to this isolated concentration of lead will be screened out when averaged over the entire site.

1646 Mail Service Center, Raleigh, North Carolina 27699-1646  
Phone: 919-733-4996 \ FAX: 919-715-3605 \ Internet: [www.enr.state.nc.us](http://www.enr.state.nc.us)

Mr. Daniel Hood

3-04-2004

Page 2 of 2

According to Table 4-10 of the July 2001 Site Investigation Report, the arithmetic mean of lead in subsurface soil at Site 10 is 151.51 mg/kg (ppm). This is well below the residential risk concentration of 400 mg/kg.

If you have any questions or comments, please contact me, at (919) 733-2801, extension 341 or email [Randy.McElveen@ncmail.net](mailto:Randy.McElveen@ncmail.net)

Sincerely,

Randy McElveen  
Environmental Engineer  
Superfund Section

Cc: David Lown, Superfund Section  
Bob Lowder, EMD/IR  
Gena Townsend, USEPA

**ATTACHMENT B**  
**USEPA REGION IV APPROVAL LETTER**

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**UNITED STATES ENVIRONMENTAL PROTECTION  
AGENCY**

**REGION 4  
SAM NUNN ATLANTA FEDERAL CENTER  
61 FORSYTH STREET, S.W.  
ATLANTA, GEORGIA 30303**

February 24, 2005

4WD-FFB

Commanding General  
Attn: EMD/EQB  
Marine Corps Base  
PSC Box 20004  
Camp Lejeune, NC 28542-0004

SUBJ: MCB Camp Lejeune  
No Further Action Decision Document  
Site 10 – Original Base Landfill

Dear Sir:

The U.S. Environmental Protection Agency (EPA) Region 4 has reviewed the above subject decision document, dated July 2001, and concurs with the selected No Further Action Remedy for Site 10. This remedy is supported by the previously completed Pre-Remedial Investigation Screening Study. There are no additional comments and this document can proceed to finalization.

This remedial action is protective of human health and the environment, complies with Federal and State requirements that are legally applicable or relevant and appropriate to the remedial action and is cost effective.

If there are any questions or comments, I can be reached at (404) 562-8538.

Sincerely,

Gena D. Townsend

Digitally signed by Gena D. Townsend  
DN: cn = Gena D. Townsend, o = US, ou = US  
EPA, ou = WDFFB  
Reason: I am approving this document  
Date: 2005.02.24 09:03:10 -0500

Gena D. Townsend  
Senior Project Manager

cc: Robert Lowder, Camp Lejeune  
Randy McElveen, NCDENR  
Daniel Hood, NAVFAC Atlantic