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FINAL PRELIMINARY ASSESSMENT/SITE INSPECTION REPORT SITE 49 MARINE CORPS AIR STATION SUSPECTED MINOR DUMP MCB CAMP LEJEUNE NC

03/01/2011

CH2M HILL

Final

Preliminary Assessment/Site Inspection Report
Site 49, Marine Corps Air Station
Suspected Minor Dump

Marine Corps Base Camp Lejeune
Jacksonville, North Carolina

Prepared for

Department of the Navy
Naval Facilities Engineering Command
Mid-Atlantic

Contract No.
N62470-08-D-1000
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March 2011

Prepared by

CH2MHILL

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Contract Task Order - 040

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Under the

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NORTH CAROLINA LICENSED SEAL 1501 GEOLOGIST TEGWYN WILLIAMS

Executive Summary

A Preliminary Assessment/Site Inspection (PA/SI) was performed at Site 49, the Former Marine Corps Air Station (MCAS) Suspected Minor Dump, located on Marine Corps Base Camp Lejeune (MCB CamLej), North Carolina. The purpose of the PA/SI was to evaluate the potential presence and nature of environmental impacts that may have resulted from historical site activities, and to determine if additional investigation is warranted.

The site encompasses approximately 2 acres of wooded land along 800 feet (ft) of the New River shoreline. A steel building (AS810) currently used for storage of miscellaneous industrial materials is located approximately 50 ft from the northeast boundary. Site 49 was originally identified during the 1983 Initial Assessment Study (IAS) conducted by Water and Air Research, Inc. (WAR, 1983). According to the IAS report, minor quantities of paint-related waste may have been disposed of; however, no specific evidence or records exist concerning the presence of hazardous or toxic substances.

During field activities, debris consisting of old tires, brick and asphalt fragments, and general trash was identified in the northwest portion of the site and bricks were observed along the banks of the New River (both exposed and submerged). No evidence of paint or paint-related waste was observed.

Subsurface soil and groundwater samples were collected in July 2009 and based on the analytical results, additional groundwater samples were collected in February 2010. During the July 2009 event, subsurface soil and groundwater samples were collected and analyzed for target analyte list (TAL) metals, target compound list (TCL) semi-volatile organic compounds (SVOCs), and TCL volatile organic compounds (VOCs). During the February 2010 event, groundwater samples were collected and analyzed for TCL VOCs. The analytical results were compared to North Carolina Soil Screening Levels (NC SSLs) (North Carolina Department of Environment and Natural Resources [NCDENR], 2010), United States Environmental Protection Agency (USEPA) Industrial and Residential Soil Adjusted Regional Screening Levels (RSLs) (USEPA, 2010), and base background levels for metals constituents (Baker, 2001).

In soil samples collected during the July 2009 event, one VOC and two SVOCs were detected at concentrations exceeding at least one relevant standard and five metals were detected at concentrations exceeding both base background and at least one other relevant standard. In groundwater samples collected, three VOCs were detected at concentrations exceeding at least one relevant standard and eight metals were detected at concentrations that exceeded both base background and at least one other relevant standard. SVOCs were not detected in groundwater samples at concentrations exceeding regulatory criteria. Risk screening identified potential risks to human receptors from VOCs in groundwater. No risks were identified for human receptors from contaminants in soil or for ecological receptors from contaminants in either soil or groundwater.

In February 2010 additional groundwater data were collected to further assess the potential human health risk in groundwater. Eight VOCs were detected in groundwater samples at concentrations exceeding their respective regulatory standards, some by more than one order of magnitude. Based on these results, potential risks from VOCs in groundwater exist for both human and ecological receptors at Site 49 and, for this reason, a remedial investigation (RI) is recommended.

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Acronyms and Abbreviations

amsl	above mean sea level
bgs	below ground surface
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
COC	chain-of-custody
COPC	chemical of potential concern
°F	degrees Fahrenheit
DoN	Department of the Navy
DPT	direct push technology
FFA	Federal Facilities Agreement
ft	feet
FID	flame ionization detector
HHRS	human health risk screening
HQ	hazard quotient
IAS	Initial Assessment Study
ID	inside diameter
IDW	investigation-derived waste
IR	Installation Restoration
IRP	Installation Restoration Program
µg/kg	micrograms per kilogram
MCAS	Marine Corps Air Station
MCB CamLej	Marine Corps Base Camp Lejeune
MCL	maximum contaminant level
mgd	million gallons per day
mm	millimeter
MS/MSD	matrix spike/matrix spike duplicate
msl	mean sea level
NC	North Carolina
NCAC	North Carolina Administrative Code
NCDENR	North Carolina Department of Environment and Natural Resources
NCGWQS	North Carolina Groundwater Quality Standards
NC SSL	North Carolina Soil Screening Levels
NOAA	National Oceanic and Atmospheric Administration
NPL	National Priorities List
NTU	Nephelometric Turbidity Unit

PAH	polycyclic aromatic hydrocarbons
PA/SI	Preliminary Assessment/Site Inspection
POL	petroleum, oil, and lubricant
PVC	polyvinyl chloride
QA/QC	quality assurance/quality control
RI	remedial investigation
RSL	Regional Screening Level
SU	standard unit
SVOC	semi-volatile organic compound
TAL	target analyte list
TCL	target compound list
USEPA	United States Environmental Protection Agency
VOC	volatile organic compound
WAR	Water and Air Research, Inc.

SECTION 1

Introduction

This report presents the results of the Preliminary Assessment/Site Inspection (PA/SI) conducted at Site 49, the Marine Corps Air Station (MCAS) Suspected Minor Dump, located at Marine Corps Base (MCB) Camp Lejeune (MCB CamLej) in Jacksonville, North Carolina (NC). Site 49 was identified during the Initial Assessment Study (IAS) (Water and Air Research, Inc. [WAR, 1983]). Based upon the limited available historical information, the IAS concluded that Site 49 did not require further assessment. The PA/SI was conducted to evaluate the recommendation by WAR for no further assessment. A regional site location map of MCB CamLej and Site 49 is provided in **Figure 1-1**.

1.1 Objective and Approach

The objective of the PA/SI was to evaluate the potential presence and nature of environmental impacts to soil and groundwater which may have resulted from historical land use practices and validate the original determinations for no further assessment. The objective of the site assessment was accomplished by:

- Collecting information to characterize the environmental setting at the site, including hydrogeology, geology, topography, and anthropogenic influences
- Evaluating soil, groundwater, surface water, and sediment to assess the potential for impacts at concentrations of potential concern
- Assessing the potential risk to human health and the environment under a residential land use scenario
- Evaluating the need for additional investigation

1.2 Report Organization

This PA/SI report comprises the following sections:

- Section 1 - Introduction
- Section 2 – Background and Physical Characteristics
- Section 3 – Field Investigation Activities and Data Evaluation
- Section 4 – Results
- Section 5 – Conclusions and Recommendations
- Section 6 – References

Figures and tables are provided at the end of each respective section and appendixes are provided after Section 6.

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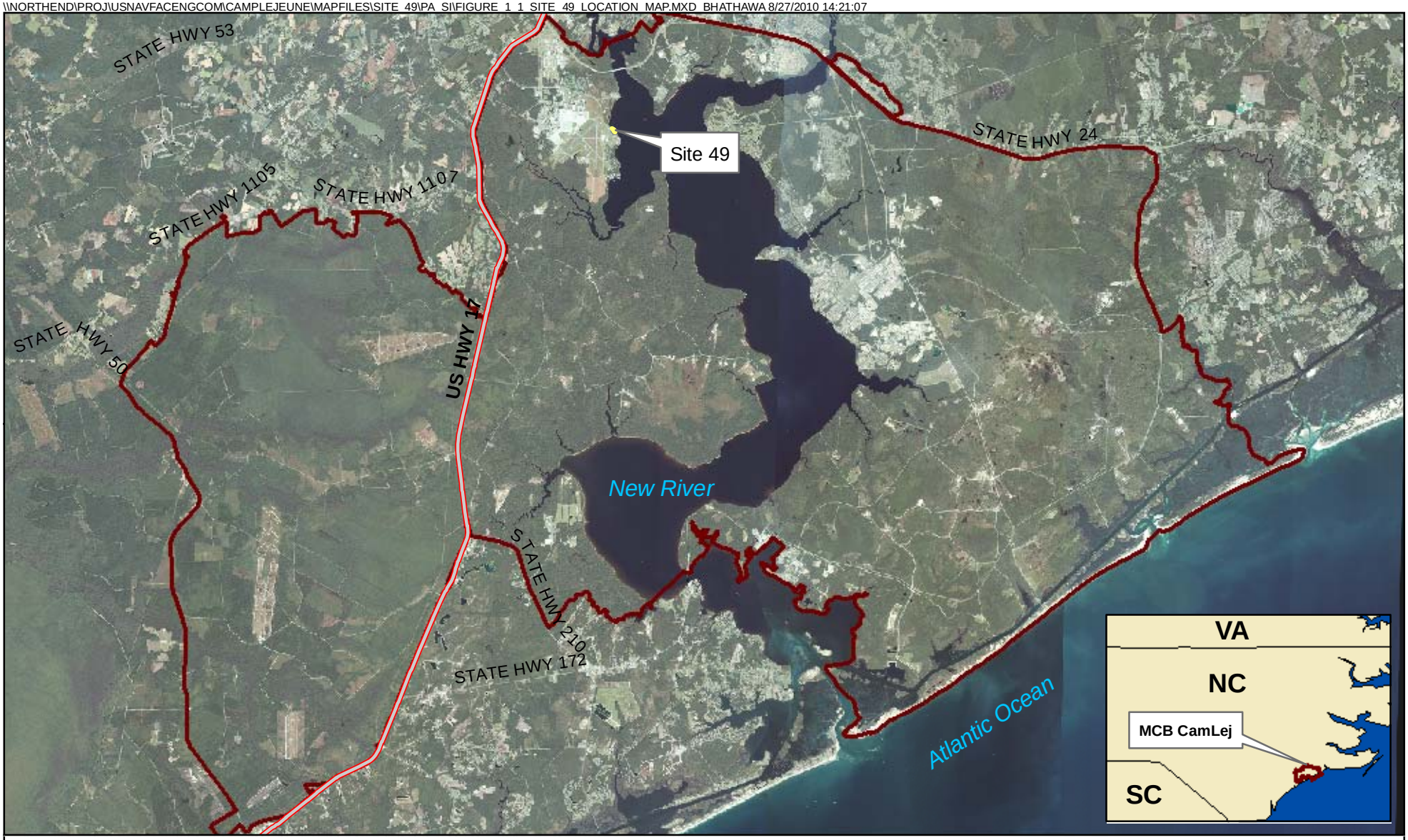

Legend

Highways

Installation Boundary

N

0 7,500 15,000 30,000 Feet

1 inch = 15,000 feet

Figure 1-1
Site Location Map
Site 49 PA/SI Report
MCB CamLej
North Carolina

CH2MHILL

Generated by: *Jeff Albano* Checked by: *David Lubell*

SECTION 2

Background and Physical Characteristics

MCB CamLej was commissioned in 1942 as a training area to prepare Marines for combat and is currently home to an active duty, dependent retiree, and civilian population of approximately 150,000 personnel. MCB CamLej provides housing, training facilities, logistical support, and administrative supplies for Fleet Marine Force units and other assigned units.

The Base encompasses approximately 236 square miles of land in Onslow County, NC adjacent to the southern boundary of the City of Jacksonville. Jacksonville is the largest city near MCB CamLej and contains approximately half of the county's total population. Since 1990, much of the MCB CamLej complex has been part of Jacksonville. The Base is bordered by the Atlantic Ocean to the east, U.S. Route 17 to the west, and State Route 24 to the north, and is bisected by the New River, which flows into the Atlantic Ocean in a southeasterly direction. MCAS New River is located in the northwest corner of the Base.

The Base was placed on the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) National Priorities List (NPL) effective November 4, 1989. Subsequent to this listing, United States Environmental Protection Agency (USEPA) Region IV, the North Carolina Department of Environment and Natural Resources (NCDENR), the United States Department of the Navy (DoN), and the Marine Corps entered into a Federal Facilities Agreement (FFA) for MCB CamLej. The primary purpose of the FFA was to ensure that environmental impacts associated with past and present activities at the Base are thoroughly investigated and that appropriate CERCLA response and Resource Conservation and Recovery Act (RCRA) corrective action alternatives are developed and implemented, as necessary, to protect public health and welfare and the environment.

2.1 Site Description and History

Site 49 is located at MCAS New River and encompasses approximately 2 acres of wooded land along 800 feet (ft) of the New River shoreline (**Figure 2-1**). The site was originally identified during the 1983 Initial Assessment Study (IAS) conducted by Water and Air Research, Inc. (WAR, 1983). According to the IAS report, minor quantities of paint-related wastes may have been disposed of at the site; however, due to the limited historical information, further assessment was not recommended.

Building AS810 is located approximately 50 ft from the northeast boundary of the site and is currently used for storage of miscellaneous industrial materials and paint supplies, based on observations during field activities. A drainage pipe exiting Building AS810 and terminating in the northeast portion of the site was identified during utility locating activities. The site is bisected by a drainage ditch which drains the areas associated with taxiways, runways, and miscellaneous buildings along Curtis Road and Longstaff Street. Various types of construction-related debris were observed on the surface at the site.

Four former Installation Restoration (IR) sites, Sites 48, 50, 51, and 52, are located in the vicinity of Site 49. Drainage ditches that drain the areas associated with the taxiways and runways are interconnected between Site 49 and the four former IR sites.

Figure 2-2 shows the locations of four neighboring former IR sites (Sites 48, 50, 51, and 52) in proximity to Site 49 and the drainage ditches. Background information concerning the four neighboring IR sites is presented in **Table 2-1**.

TABLE 2-1
Neighboring Sites

Former Sites	Location	Site Information
Site 48, the MCAS Mercury Dump	430 ft northwest of Site 49 along Longstaff Street	Building AS-804, located within Site 48, was constructed in 1955 and was used as the Administration Office and Photographic Lab from 1955 to 1990. From 1956 to 1966, mercury was drained from radar units and disposed of in small quantities behind the building. The site was identified during the IAS and a Confirmation Study, Supplemental Characterization Investigation, and RI were subsequently conducted. The investigations determined that there were no risks to human or ecological receptors and, based on this finding, Site 48 was closed with no further action required.
Site 50	Immediately adjacent to the southeast boundary of Site 49	Reported as a construction debris disposal site and identified during the IAS. The IAS did not recommend further assessment.
Site 51, the MCAS Football Field	800 ft to the southeast of Site 49 between Curtis Road and Longstaff Street	Reportedly the site was used for empty container disposal, including empty paint cans and hydraulic fluid cans, between 1967 and 1968. The IAS concluded that the quantities of waste, hazardous or not, were insignificant. A confirmatory site assessment is currently being conducted to verify the presence or absence of waste.
Site 52	0.7 mile to the west of Site 49 and south of the MCAS flight line	Reported as a petroleum, oil, and lubricant (POL) spill site with insignificant migration potential. Identified in the IAS with no further assessment recommended.

2.2 Regional and Facility-wide Physiography, Climate, and Surface Water Hydrology

MCB CamLej is located within the Tidewater region of the Atlantic Coastal Plain physiographic province. The Tidewater region is of low relief, with elevations averaging about 20 ft above mean sea level (amsl) and generally swampy. The Base is underlain by an eastward-thickening wedge of marine and non-marine sediments ranging in age from early Cretaceous to Holocene, that begins at the 'Fall Line' (western boundary of the Atlantic Coastal Plain physiographic province) and dips southeastward toward the coast. Along the coastline, several thousand feet of interlayered, unconsolidated sediment is present, consisting of gravel, sand, silt, clay deposits, calcareous clays, shell beds, sandstone, and limestone, that was deposited over pre-Cretaceous crystalline basement rock. Minor

amounts of detrital carbonate shells and secondary minerals, such as glauconite, siderite, and chlorite, often distinguish these sedimentary units.

Historical Coastal Plain sedimentation and deposition were controlled by fluctuations in sea level on a subsiding continental margin in marine and near-shore environments (Winner and Coble, 1989). Confining units associated with specific aquifers within the Coastal Plain region are composed of less permeable beds of clay and silt. Within the MCB CamLej area, approximately 1,500 ft of a sedimentary sequence that overlies the basement rock is composed of seven aquifers (the surficial, Castle Hayne, Beaufort, Peedee, Black Creek, and Upper and Lower Cape Fear Aquifers) and their associated confining units (Cardinell et al., 1993).

Recharge of aquifers within the Coastal Plain region generally occurs within interstream areas. Annual recharge to the aquifers has been estimated in the range of 5 to 20 inches of rainfall (Heath, 1989). Natural discharge of groundwater from the Coastal Plain aquifer system is generally into streams, swamps, and lakes. Evapotranspiration from the soil zone and upward leakage through confining units into streams, estuaries, swamps, and even the ocean also contribute to groundwater discharge. The New River estuary serves as the principal discharge area for groundwater from the Castle Hayne Aquifer within the vicinity of MCB CamLej (Harned et al., 1989).

Mild winters and hot, humid summers generally characterize climatic conditions within southeastern NC and at MCB CamLej. Winters are usually short and mild, with occasional brief cold periods. Average annual net precipitation is approximately 54 inches. Ambient air temperatures generally range from 37 to 60 degrees Fahrenheit (°F) in the winter months and 71°F to 88 °F during the summer months; summertime humidity averages 75 percent. Winds are generally south-southwesterly in the summer and north-northwesterly in the winter (National Oceanic and Atmospheric Administration [NOAA], 2002).

2.3 Physical Description, Geology, and Hydrogeology

The 2-acre site is undeveloped and covered by thick underbrush and trees. Land surface elevations within Site 49 range from sea level to just over 6 ft amsl, as shown on **Figure 2-1**. A drainage channel and associated wetlands are present in the northern half of the site. Areas of debris were observed in the northern-most portion of the site, consisting of tires, bricks and asphalt fragments, and general trash. Bricks and other construction-related debris were also observed along the New River.

Characterization of the geologic conditions within Site 49 is limited by the maximum depth of intrusive investigation (~20 ft below ground surface [bgs]). The shallow soils encountered at Site 49 belong to the undifferentiated Formation and consist mainly of clay and fine-grained sand with lesser amounts of clay and silt.

Boring logs describing the lithology of these shallow soil borings are included in **Appendix A**. **Figure 2-3** shows the location of a geological cross section (**Figure 2-4**) that trends from northwest to southeast through the site. **Figure 2-4** shows that the surface of Site 49 is mantled by a site-wide layer of sand, roughly 1 to 2 ft in thickness. The sand layer overlies sporadic areas of construction and demolition debris (up to 6 ft in thickness), and a laterally

continuous clay deposit that extends to roughly 12 ft bgs. Beneath the clay layer lie silty sands and clays.

Within Site 49, shallow groundwater occurs under unconfined conditions within the sediments of the undifferentiated Formation. The water table was encountered at depths ranging from 4.70 ft (IR49-TW03 in the northern portion of the site) to 10.91 ft (IR49-TW03 in the southern portion of the site). **Table 2-2** presents a summary of water level measurements obtained during the July 2009 field event. Given the proximity of Site 49 to the New River, groundwater is believed to be strongly tidally influenced.

Potable drinking water is supplied to MCB CamLej and surrounding areas by public water supply wells, upgradient of Site 49, and screened primarily in the Castle Hayne aquifer, much deeper than the surficial groundwater evaluated at Site 49.

Table 2-2
Groundwater Elevation Data
Site 49 PA/SI Report
MCB CamLej
North Carolina

Temporary Well ID	Date of Measurement	Top of Casing Elevation (ft msl)	Depth to Water (ft BTOC)	Groundwater Elevation (ft msl)
IR49-TW01	7/12/2009	4.38	4.70	-0.32
IR49-TW02	7/12/2009	5.98	7.61	-1.63
IR49-TW03	7/12/2009	9.07	10.91	-1.84

Notes:
ft msl - feet relative to mean sea level
ft BTOC- feet below top of casing
ft bmsl - feet below mean sea level
Created by: Jeff Albano/CLT
Checked by: David Lubell/RDU

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Legend

- Topographic Contour (2 ft interval)
- Drainage Feature
- Site 49 Boundary
- Jurisdictional Wetlands

Topography source:
Federal Emergency Management Agency

N

0 100 200 Feet

1 inch = 200 feet

Figure 2-1
Site Map
Site 49 PA/SI Report
MCB CamLej
North Carolina

CH2MHILL

Generated by: *Jeff Albano* Checked by: *David Lubell*

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Legend

- Drainage Feature
- Site Boundary
- Buildings
- Jurisdictional Wetlands

N

0 200 400 Feet

1 inch = 400 feet

Figure 2-2
Site Vicinity Map
Site 49 PA/SI Report
MCB CamLej
North Carolina

CH2MHILL

Generated by: *Jeff Albano* Checked by: *David Lubell*

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Legend

- Groundwater Sample Location
- Soil Sample Location
- Geologic Cross Section
- Site 49 Boundary

N

0 100 200 Feet

1 inch = 200 feet

Figure 2-3
Geological Cross Section Location Map
Site 49 PA/SI Report
MCB CamLej
North Carolina

CH2MHILL

Generated by: *Jeff Albano* Checked by: *David Lubell*

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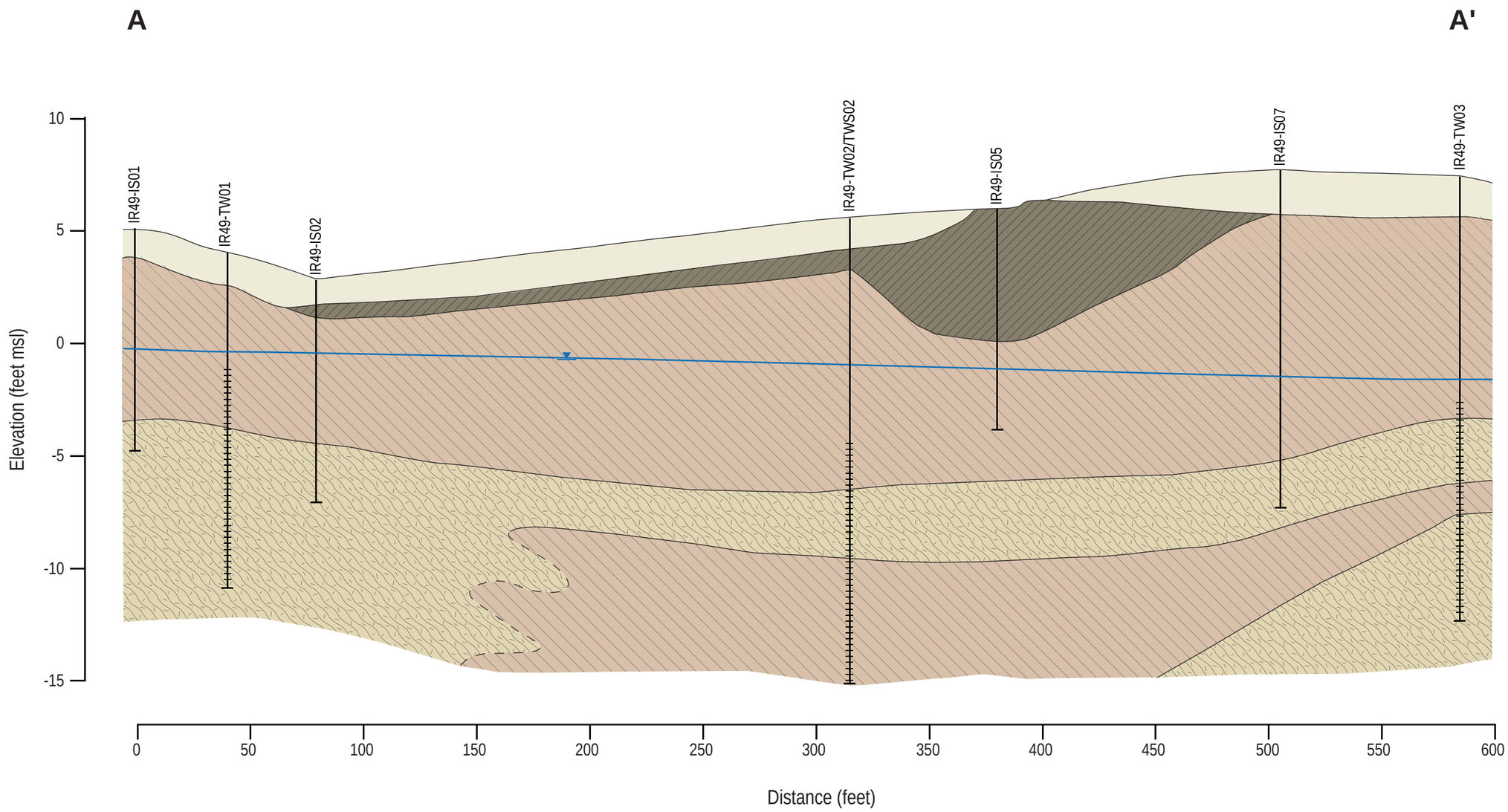

LEGEND

- Silty Sand
- Sand
- Clay
- Fill
- Soil Boring
- Screened Interval
- Potentiometric Surface of the Surficial Aquifer
- Inferred Lithologic Transition

Horizontal: 1" = 50'
Vertical: 1" = 5'
V.E. = 10x

Note:

Depth and thickness of the strata indicated on this section were generated from and interpolated between boring locaton. Actual Subsuface contitions may differ.

Figure 2-4
Site 49 Geologic Cross-Section
Site 49 Limited Site Assessment Report
MCB CamLej
North Carolina

CH2MHILL.

Created by: Jeff Albano Checked by: Teg Williams

SECTION 3

Field Investigation Activities and Data Evaluation

Field activities were conducted in July 2009 and February 2010 in accordance with the Confirmatory Sampling Work Plan for Sites 4, 23, 38, 42, 53, 55, 61, 62, and 66 (CH2M HILL, 2009) and the Final Master Project Plans (CH2M HILL, 2008). Due the limited historical information for Site 49, sampling locations were generally evenly distributed throughout the site, as shown on **Figure 3-1**.

3.1 Environmental Sampling

The site assessment field activities at Site 49 consisted of the following:

- Vegetation clearing
- Subsurface utility locating
- Subsurface soil sampling
- Temporary monitoring well installation
- Groundwater sampling
- Quality assurance/quality control (QA/QC) sampling
- Surveying
- Investigation-derived waste (IDW) management

Surface soil was not analyzed at Site 49 due to the amount of time elapsed since operations were conducted at the site. The details of the activities that were conducted at Site 49 are described in the subsections below.

3.1.1 Vegetation Clearing

In preparation for sampling activities, vegetation less than 3 inches in diameter, overhanging vines, and protruding branches that could interfere with safe and effective equipment access to sampling locations were removed by Wetlands & Woodlands of Wilmington, NC. Vegetation was cleared using a combination of mechanical and manual methods. Felled brush and trees were mulched and left in place.

3.1.2 Subsurface Utility Locating

Prior to subsurface sampling activities, the NC One Call Center was notified, and a private utility locating company (Accumark of Ashland, Virginia) was subcontracted to locate buried utilities within a 20-ft radius of each proposed intrusive sample location. During the locating activities, a drainage pipe was detected (**Figure 2-1)** originating from Building AS810 and terminating in the vicinity of subsurface soil sample location IR49-IS01 and temporary well IR49-TW01.

3.1.3 Subsurface Soil Sampling

Soil borings were advanced at 8 locations by NC-licensed well driller ARM Environmental Services, Inc. of Columbia, South Carolina, to depths ranging from 10 to 15 ft bgs using a direct push technology (DPT) rig. Continuous soil cores were collected in 5-ft acetate liners using a macrocore soil sampler and field-screened for VOCs using a calibrated flame ionization detector (FID). Eight subsurface soil samples (designated IR49-IS01, IR49-IS02, IR49-IS04 through IR49-IS08, and IR49-TW-S02.) were obtained from these soil borings (**Figure 3-1**). Soil lithologies were described by a CH2M HILL geologist following the Unified Soil Classification System and recorded on soil boring logs provided in **Appendix A**.

Field-screening of the soil cores did not detect the presence of VOCs, and therefore each subsurface soil sample was collected from roughly 2 ft above the water table, with sample depths ranging from 4 to 10 ft bgs. The samples were immediately packed on ice in coolers and shipped under chain-of-custody (COC) to a fixed based analytical laboratory (Empirical Laboratories of Nashville, Tennessee) for analysis of TCL VOCs via EPA SW-846 Method 8260, TCL target analyte list (TAL) metals, target compound list (TCL) semi-volatile organic compounds (SVOCs) via EPA SW-846 Method 8270, and TAL metals via EPA SW-846 Method 6010.

3.1.4 Temporary Monitoring Well Installation

During the July 2009 and February 2010 field events, 9 temporary groundwater monitoring wells were installed to assess groundwater quality. Details of the installation methods and materials used are provided below.

In July 2009, a DPT drill rig operated by ARM Environmental Services was used to install three temporary monitoring wells (IR49-TW01 through IR49-TW03) (**Figure 3-1)** to depths of 15 to 20 ft bgs (within the surficial aquifer). The temporary monitoring wells were constructed using 1-inch inside diameter (ID) polyvinyl chloride (PVC) casing with a 10-ft, 0.010-inch factory slotted well screen, equipped with a pre-packed sand filter. A granular bentonite seal was installed above the screened interval.

Following installation, each well was developed by surging with a ¾-inch bailer and pumping with a peristaltic pump. Once groundwater sampling was complete and the temporary wells were surveyed, the temporary wells were abandoned by a NC licensed driller in accordance with NC well construction standards.

Based upon the information obtained from the July 2009 field activities, six additional temporary monitoring wells (IR49-TW01R and IR49-TW04 through IR49-TW08) were installed using a DPT drill rig operated by ARM Environmental Services at Site 49 in February 2010. These wells were constructed using 1-inch ID PVC casing with a 10-ft length of 0.010-inch factory slotted well screen. The temporary monitoring well screens were not equipped with a pre-packed sand filter; however, a filter pack consisting of #3 filter sand (1.7 – 3.35 millimeter [mm] sieve size) was placed in the annular space around the well screen. A granular bentonite seal was installed above the sand filter. The six temporary wells were developed using the techniques noted above and abandoned by a NC licensed driller in accordance with NC well construction standards.

3.1.5 Groundwater Sampling

Following construction and development, groundwater monitoring wells were allowed to equilibrate for a minimum of 24 hours prior to gauging and sampling. Depth-to-water measurements were recorded (**Table 2-2**) from each well using an electronic water level probe.

During the July 2009 field activities, groundwater samples were collected from each of the three temporary monitoring wells (IR49-TW01 through IR49-TW03). Water was purged from the wells at a target rate of 0.3 to 0.5 liters per minute using a peristaltic pump and new, clean ¼-inch diameter polyethylene tubing. A water quality meter was used to monitor water quality parameters during the purging process. Groundwater samples were collected after water quality parameters had stabilized over three consecutive readings and at least one well volume had been purged. Stabilization occurred when pH measurements remained within 0.1 standard unit (SU), specific conductivity varied by no more than 10 percent, the temperature remained constant, and turbidity was below 10 Nephelometric Turbidity Units (NTUs) for three consecutive readings. If water quality parameters did not stabilize, at least three well volumes were purged prior to sampling. A summary of the water quality parameters is shown on **Table 3-1.**

During the February 2010 field activities, groundwater samples were collected for VOCs from six temporary wells (IR49-TW01R and IR49-TW04 through IR49-TW08). Due to the low permeability of the surficial aquifer in the vicinity of the six temporary monitoring wells, insufficient recharge was available to prevent each well from being pumped dry, even at low flow purge rates. Temporary monitoring well IR49-TW06 was the only temporary monitoring well that was not pumped dry while being purged These wells were allowed to fully recharge prior to collecting a groundwater sample.

Samples intended for metal analysis were collected directly from disposable tubing into laboratory-prepared sample bottles, samples intended for SVOC analysis were collected using a vacuum jug, and samples intended for VOC analysis were collected using the "straw method." Groundwater samples collected were immediately packed on ice in coolers and shipped via Federal Express under COC to Empirical Laboratories of Nashville, TN. All samples collected in July 2009 were analyzed for TCL VOCs via EPA SW-846 Method 8260, TCL SVOCs via EPA SW-846 Method 8270, and TAL metals via EPA SW-846 Method 6010. Groundwater samples collected in February 2010 were analyzed for TCL VOCs via EPA SW-846 Method 8260.

3.1.6 Quality Assurance/Quality Control Sampling

QA/QC samples were collected in the same types of laboratory-prepared containers as the field samples. QA/QC requirements for environmental sampling, handling, and management are detailed in Section 4 of the MRP Master Project Plans (CH2M HILL, 2008). Field QC samples, including trip blanks, field blanks, equipment blanks, duplicate samples, and matrix spike/matrix spike duplicate (MS/MSD) samples, were collected during the investigation and submitted for laboratory analysis. QC samples were collected at the following rates:

- One trip blank per cooler containing VOC samples
- One MS/MSD per 20 samples collected

- One duplicate per 10 samples collected
- One equipment blank per day
- One field blank per week

3.1.7 Surveying

Sampling locations associated with the July 2009 sampling event were surveyed in July 2009 by SEPI Engineering Group of Raleigh, NC. Temporary monitoring wells installed during the July 2009 sampling event were surveyed for horizontal and vertical coordinates. Temporary monitoring wells associated with the February 2010 sampling event were surveyed by Mayo and Associates of New Bern, NC for horizontal coordinates only. The locations were referenced both horizontally and vertically to permanent land monuments. The survey controls were tied to the North American Datum of 1983 and the North American Vertical Datum of 1988. Ground surface and monitoring well top of casing elevations were surveyed to the nearest 0.01 ft, and the horizontal control was to the nearest 0.10 ft. **Table 2-2** presents a summary of the vertical survey data.

3.1.8 Investigation-Derived Waste Management

IDW generated during both the July 2009 and February 2010 field activities was managed in accordance with the Master Project Plans (CH2M HILL, 2008). IDW included soil, purged groundwater, decontamination fluids, and personal protective equipment. Waste requiring offsite disposal was containerized in 55-gallon drums and staged at the Parachute Tower Road staging area.

3.2 Data Tracking and Validation

Samples and analytical data were managed and tracked from the time of field collection to receipt of validated electronic analytical results to ensure the overall quality of the data. Field samples and their corresponding analytical tests were recorded on COC forms, which accompanied the samples to the laboratory. COC entries were checked against the work plan to confirm that all designated samples were collected and submitted for the appropriate analyses. Upon receipt of the samples by the laboratories, a comparison to the field information was made to confirm that each sample was analyzed for the correct parameters. In addition, a check was made to ensure that the proper number and types of QA/QC samples were collected in accordance with the work plan.

Analytical data reports, in hard copy and electronic format, were submitted for third-party validation in accordance with the *National Functional Guidelines for Organic Data Review* (USEPA, 2008), and *National Functional Guidelines for Inorganic Data Review* (USEPA, 2004). These steps (third-party validation and electronic data handling) serve to reduce inherent uncertainties associated with data authenticity and usability. Analytical results and COC forms are included in **Appendix B**.)

Table 3-1
Groundwater Quality Parameters
Site 49 PA/SI Report
MCB CamLej
North Carolina

Temporary Monitoring Well	IR49-TW01	IR49-TW02	IR49-TW03	IR49-TW01R*	IR49-TW04*	IR49-TW05*	IR49-TW06	IR49-TW07*	IR49-TW08*
Sample Date	7/12/2009	7/12/2009	7/12/2009	2/18/2010	2/18/2010	2/18/2010	2/18/2010	2/18/2010	2/18/2010
Field Parameters									
Temperature (^{o}C)	20.76	21.30	19.38	13.56	11.41	11.84	13.76	13.32	11.35
Specific Conductivity (mS/cm)	0.302	1.151	6.889	0.207	2.125	0.282	0.161	0.190	0.343
Dissolved Oxygen (mg/l)	1.28	0.67	0.78	7.88	4.06	3.56	3.24	8.90	8.11
pH (SU)	4.49	5.31	3.39	5.48	5.85	5.87	4.84	5.24	6.31
Oxidation Reduction Potential (mV)	136.9	89.9	137.5	67.8	41.3	32.4	79.8	90.2	20.6
Turbidity (NTU)	55	120	23	61.3	NA	NA	4.69	17.3	39.7

Notes:
mg/L - milligrams per liter
mV - millivolts
mS/cm - milliSiemens per centimeter
^{o}C - degrees Celsius
NTU - Nephelometric Turbidity Unit
SU - Standard Unit
* - Well pumped dry
NA - Not Available
Created by: Jeff Albano/CLT
Reviewed by: David Lubell/RDU

\\NORTHEND\PROJ\USNAVFACENGCOM\CAMPLEJEUNE\MAPFILES\SITE_49\PA_SI\FIGURE_3_1_SAMPLE_LOCATION_MAP.MXD BHATHAWA 8/27/2010 14:14:45

Legend

- Temporary Well
- Soil Sample Location
- Site 49 Boundary

N

0 100 200 Feet

1 inch = 200 feet

Figure 3-1
Sample Location Map
Site 49 PA/SI Report
MCB CamLej
North Carolina

CH2MHILL

Generated by: *Jeff Albano* Checked by: *David Lubell*

SECTION 4

Data Evaluation and Risk Screening

This section presents the laboratory analytical test results for media sampled at Site 49. Analytical results for the subsurface soil and groundwater samples collected during field activities are provided in **Table 4-1** and **Table 4-2**, respectively. Locations where constituents were detected in subsurface soil and groundwater samples at concentrations that both exceed base background levels (if established) and one or more relevant criteria are shown on **Figures 4-1 and 4-2**, respectively**.**

4.1 Data Evaluation

The data collected during the PA/SI were evaluated using a conservative screening process to evaluate if site-related compounds are present at levels that could pose a risk to human and ecological receptors.

Metal target analytes detected in each medium were first compared to available base background data (Baker, 2001) and groundwater base background data (Baker, 2002).

Detected concentrations less than twice the mean base background concentrations are not considered to be related to a release associated with historical activity at the site. Concentrations of metal target analytes which exceeded twice the mean base background concentrations were compared against other regulatory standards as appropriate. Background concentrations are not currently available for organic analytes.

Following comparison with base background concentrations, all soil data requiring further evaluation were compared to North Carolina Soil Screening Levels (NC SSLs), and USEPA Adjusted Residential and Industrial Soil Regional Screening Levels (RSLs). Groundwater data requiring further evaluation were compared to USEPA Adjusted Groundwater RSLs and North Carolina Groundwater Quality Standards (NCGWQS). RSLs were adjusted for noncarcinogens to account for exposure to multiple constituents. When the USEPA maximum contaminant level (MCL) for a constituent was more stringent than the NCGWQS, the MCL was referenced instead of the NCGWQS, in accordance with Subchapter 2L of the North Carolina Administrative Code (NCAC) Title 15A (NCAC, 2010).

4.2 Subsurface Soil

In subsurface soil, one VOC and two SVOCs were detected at concentrations that exceeded at least one relevant standard, and five metals were detected at concentrations that exceeded both base background and at least on other relevant standard. Analytical results for subsurface soil samples, as well as the criteria to which they were compared, are presented in **Table 4-1**. The locations where concentrations exceeded relevant criteria are shown in **Figure 4-1**.

4.2.1 VOCs

1,1,2,2-tetrachloroethane (1,1,2,2-PCA) was detected in soil sampled from location IR49-IS02, collected from 6 ft bgs to 7 ft bgs, at a concentration of 2.42 microgram per kilogram (µg/kg), exceeding the NC SSL (1.2 µg/kg).

4.2.2 SVOCs

Two polycyclic aromatic hydrocarbons (PAHs), benzo(a)pyrene and benzo(b)fluoranthene, were detected in the subsurface soil sample collected from IR49-IS05 at concentrations of 500 µg/kg and 430 µg/kg, respectively, exceeding regulatory standards. Benzo(a)pyrene was detected at a concentration exceeding the Industrial RSL (59 µg/kg), the Residential RSL (15 µg/kg), and the NC SSL (59 µg/kg). Benzo(b)fluoranthene was detected at a concentration exceeding the Residential RSL (150 µg/kg).

The soil sample from IR49-IS05 was collected at an interval where the lithology consisted of fill which, as described in the soil boring logs provided in **Appendix A**, contained asphalt, a material that is commonly associated with PAH contamination. No other samples contained PAHs at similar concentrations.

4.2.3 Metals

Aluminum, arsenic, chromium, iron, and vanadium were detected at concentrations exceeding both base background and regulatory standards, as presented in **Table 4-3**.

The subsurface soil sample collected from fill material at IR49-IS05 did not contain metals at concentrations exceeding base background and regulatory standards. The remaining 7 samples were generally collected from clay-rich soil approximately 2 ft above the water table. Clays contain significant amounts of aluminum, iron, and magnesium and are typically found in conjunction with secondary oxide minerals, including iron oxides and manganese oxides. The concentrations detected are generally consistent with the clay geology and are assumed to not be associated with past historic activity at the site.

TABLE 4-3
Subsurface Soil Metal Exceedance Summary

	IR49-IS01	IR49-IS02	IR49-TW-S02	IR49-IS04	IR49-IS05	IR49-IS06	IR49-IS07	IR49-IS08
Aluminum	17,000	15,200	14,200	14,700	--	13,300	12,700	13,000
Arsenic	**2.1 J**	**6.8 J**	1.3 J	**2.1 J**	1.2 J	**2.9 J**	**2.9 J**	**4.4 J**
Chromium	**21.3 J**	**27.8 J**	**20.6 J**	**18.1 J**	2.5 J	**19.2 J**	**19.4 J**	**19.7 J**
Iron	6,430 J	18,400 J	4,200 J	6,130 J	2,050 J	6,710 J	7,880 J	11,800 J
Vanadium	--	40.6 J	--	--	--	--	--	--

Notes:
-- Metal did not exceed regulatory standards.
Shaded cells indicate an exceedance of 2 X mean base background.
Bold box indicates an exceedance of the NC SSL.
Bold text indicates an exceedance of the Industrial RSL.
Underlined indicates an exceedance of the Residential RSL.
IR49-IS05 did not contain metals at concentrations exceeding regulatory standards.
J - Analyte present, value may or may not be accurate or precise.

4.3 Groundwater

Three VOCs and eight metals were detected in groundwater samples collected during the July 2009 sampling event at concentrations exceeding regulatory criteria. SVOCs were not detected at concentrations exceeding regulatory criteria. Analytical results of the groundwater samples are provided in **Table 4-2**. The locations where concentrations exceeded relevant criteria are shown in **Figure 4-2**.

4.3.1 VOCs

1,1,2,2-PCA, 1,1,2-trichloroethane (1,1,2-TCA), and vinyl chloride were detected in the groundwater sample collected from temporary well IR49-TW01, located in the northwestern portion of Site 49 (**Figure 4-2** and **Table 4-4)**. VOCs were not detected in groundwater samples collected from IR49-TW02 or IR49-TW03.

A second groundwater sampling event was conducted at Site 49 in February 2010 to confirm and further delineate the VOC detections in the groundwater sample collected from IR49-TW01 during the July 2009 field event. Nine VOCs were detected at concentrations exceeding their respective regulatory standards, as shown on **Figure 4-2**. A summary of VOC-related groundwater exceedances at Site 49 is provided in **Table 4-5**.

TABLE 4-4
VOC Exceedance Summary (July 2009)

Volatile Organic Compound	Concentration Detected (µg/L) IR49-TW01
	07/12/09
1,1,2,2-Tetrachloroethane	**0.86 J**
1,1,2-Trichloroethane	**0.37 J**
Vinyl chloride	**0.93 J**

Notes:
Bold box indicates an exceedance of the NCGWQS.
Bold text indicates an exceedance of the Adjusted Tap Water RSL
J - Analyte present, value may or may not be accurate or precise
Concentrations are in micrograms per liter (µg/L)

TABLE 4-5
VOC Exceedance Summary (February 2010)

Volatile Organic Compound	IR49-TW01R	IR49-TW04	IR49-TW05	IR49-TW06	IR49-TW07	IR49-TW08
1,1,2,2-Tetrachloroethane	**1.54**	--	--	**1.96**	**78.5**	--
1,1,2-Trichloroethane	**1.35**	--	--	**1.72**	**6.02**	--
1,2-Dichloroethane	**0.405 J**	**0.345 J**	--	**0.62 J**	**0.563 J**	--
Benzene	**0.543 J**	--	--	--	**2.47**	--
cis-1,2-Dichloroethene	**76.5**	--	--	--	**155**	--
Tetrachloroethene	**0.504 J**	--	--	**1.23**	**1.33**	--
Trichloroethene	**54.7**	--	--	**8.81**	**276**	--
trans-1,2-Dichloroethene	**80.7**	--	--	**22.3**	**108**	--
Vinyl chloride	**3.51**	--	**1.05**	**22.1**	**16.8**	--

Notes:
-- VOC did not exceed regulatory standards.
Bold box indicates an exceedance of the NCGWQS.
Bold text indicates an exceedance of the Adjusted Tap Water RSL.
J - Analyte present, value may or may not be accurate or precise.
Concentrations are in micrograms per liter (µg/L)l

4.3.2 Metals

Seven metals were detected at concentrations exceeding both base background and regulatory standards in groundwater samples collected from Site 49 during the July 2009 field activities. These seven metals are listed in **Table 4-6**. As noted in Section 2.3, clayey lithology was observed throughout the site. Clays contain significant amounts of cations (positively charged atoms in a molecule) and generally consist of metals including aluminum, iron, and manganese. These metals can dissolve in groundwater, and therefore the elevated concentrations of metals in groundwater are common at sites where clays constitute the aquifer. The groundwater samples had elevated turbidity readings as well, indicating that greater than ideal sediment concentrations were present in the samples collected, which could also contribute to elevated metals concentrations. Additionally, groundwater at the site is believed to be tidally influenced by the New River based on both proximity and specific conductivity measured during groundwater sampling. This indicates that the groundwater may be brackish, providing a supplemental source of dissolved metals. Based on these lines of evidence, the source of the metals is assumed to be natural and not anthropogenic.

TABLE 4-6
Metal Exceedance Summary (July 2009)

	IR49-TW01	IR49-TW02	IR49-TW03
Aluminum	--	**3,810**	**39,400**
Arsenic	--	**3.4 J**	**6.8 J**
Chromium	**2.5 J**	**6.3 J**	--
Cobalt	--	--	**44.2**
Iron	**4,040**	**10,300**	**172,000**
Manganese	51.7	**287**	**305**
Nickel	--	--	**98.6**

Notes:
-- Metal concentration did not exceed regulatory standards.
Shaded cells indicate an exceedance of 2 X base background.
Bold box indicates an exceedance of the NC SSL.
Bold text indicates an exceedance of the Industrial RSL.
J - Analyte present, value may or may not be accurate or precise.

4.4 Human Health Risk Screening Summary

A conservative human health risk screening (HHRS) evaluation for subsurface soil and groundwater at Site 49 was performed to provide a preliminary indication of potential risks from constituents of potential concern (COPCs), and are used to help evaluate whether future unrestricted (i.e., residential) use of the site is acceptable based on human health risks or if the site requires further evaluation (e.g., a baseline risk assessment, additional data collection and evaluation). The HHRS was conducted in two phases and the full report is presented in **Appendix C**. The results indicated that there were no potential human health risks from exposure to subsurface soil. However, potential risk was identified for human receptors from exposure to metals and VOCs in groundwater and for vapor intrusion from groundwater. As discussed in Sections 4.2 and 4.3, elevated metals concentrations in groundwater are presumed to be related to site geology rather than historical operations

and therefore metals are not considered COPCs. Eight VOCs (1,1,2,2-PCA; 1,1,2-trichloroethane; 1,2-dichloroethane; benzene; tetrachloroethene; trichloroethene; vinyl chloride; and trans-1,2-dichloroethene) were identified as COPCs in groundwater.

4.5 Ecological Risk Screening Summary

An ecological risk screening (ERS) was conducted using the analytical results obtained from subsurface soil and groundwater sampling. Subsurface soil and groundwater were screened against benchmarks intended to be protective of ecological receptors. For each medium, the maximum concentration was compared to the screening value to derive a hazard quotient (HQ). The benchmarks were identified from the following sources: USEPA Region 4 Recommended Ecological Screening Values (USEPA, 2001), USEPA Ambient Water Quality Criteria (USEPA, 2009a), and USEPA Ecological Soil Screening Levels (USEPA, 2009b).

Based on the July 2009 data, no unacceptable risks were identified for ecological receptors from exposure to subsurface soil or groundwater at Site 49. A screening was not conducted using the February 2010 groundwater data; however, potentially unacceptable ecological risks are assumed based on the elevated VOCs detected in groundwater discharging to surface water. The full ERS report based on the July 2009 data is presented in **Appendix D**.

Table 4-1
Subsurface Soil Analytical Results
Site 49 PA/SI Report
MCB CamLej
North Carolina

Station ID	2 X Mean Base Background for Subsurface Soil	NCSSLs	Adjusted Industrial Soil RSL	Adjusted Residential Soil RSL	IR49-IS01		IR49-IS02	IR49-IS04	IR49-IS05	IR49-IS06	IR49-IS07	IR49-IS08	IR49-TW-SO2
Sample ID					IR49-IS01-7-8-09C	IR49-IS01D-7-8-09C	IR49-IS02-6-7-09C	IR49-IS04-6_5-7_5-09C	IR49-IS05-4-5-09C	IR49-IS06-7-8-09C	IR49-IS07-9-10-09C	IR49-IS08-8-9-09C	IR49-TW-S02-8-9-09C
Sample Date					07/08/09	07/08/09	07/09/09	07/09/09	07/09/09	07/09/09	07/09/09	07/09/09	07/09/09
Chemical Name													
Volatile Organic Compounds (µg/kg)													
1,1,2,2-Tetrachloroethane	--	1.2	2,800	560	9.4 U	10 U	2.4 J	9.7 U	14 U	10 U	10 U	9.7 U	9.8 U
cis-1,2-Dichloroethene	--	360	1,000,000	78,000	9.4 U	10 U	1.2 J	9.7 U	14 U	10 U	10 U	9.7 U	9.8 U
Cyclohexane	--	--	120,000	120,000	9.4 U	10 U	0.75 J	9.7 U	14 U	10 U	10 U	9.7 U	9.8 U
Ethylbenzene	--	8,100	27,000	5,400	0.78 J	10 U	9.6 U	9.7 U	1.3 J	10 U	0.79 J	0.77 J	9.8 U
Methylcyclohexane	--	--	--	--	9.4 U	10 U	0.69 J	9.7 U	14 U	10 U	10 U	9.7 U	9.8 U
Methylene chloride	--	23	53,000	11,000	10	4.4 J	5.3 J	3 J	14 U	10 U	10 U	9.7 U	2.3 J
Toluene	--	5,500	820,000	500,000	0.93 J	10 U	9.6 U	9.7 U	14 U	10 U	10 U	9.7 U	9.8 U
Trichloroethene	--	18	14,000	2,800	9.4 U	10 U	1.5 J	9.7 U	14 U	10 U	10 U	9.7 U	9.8 U
Xylene, total	--	6,000	260,000	63,000	3.2 J	10 U	9.6 U	9.7 U	14 U	10 U	10 U	9.7 U	1.5 J
Semivolatile Organic Compounds (µg/kg)													
Benzo(a)pyrene	--	59	210	15	6.6 U	6.9 U	1.5 J	6.7 U	**500 J**	6.5 U	1.4 J	1.5 J	1.3 J
Benzo(b)fluoranthene	--	600	2,100	150	62 U	64 U	2.3 J	63 U	430 J	61 U	65 U	63 U	2.1 J
Benzo(g,h,i)perylene	--	360,000	1,700,000	170,000	250 U	260 U	260 U	250 U	3,000	240 U	260 U	250 U	260 U
Caprolactam	--	18,000	31,000,000	3,100,000	200 J	190 J	160 J	150 J	2,100 UJ	150 J	260 U	150 J	230 J
Pyrene	--	220,000	1,700,000	170,000	250 U	260 U	260 U	250 U	410 J	240 U	260 U	250 U	260 U
Total Metals (mg/kg)													
Aluminum	10,369	--	99,000	7,700	14,900	17,000	15,200	14,700	1,540	13,300	12,700	13,000	14,200
Arsenic	2.12	5.8	1.6	0.39	**2.1 J**	1.5 J	**6.8 J**	**2.1 J**	1.2 J	**2.9 J**	**2.9 J**	**4.4 J**	1.3 J
Barium	16.6	580	19,000	1,500	21.9	26.2	18.5	17.8	14.1	21.2	24.1	23.1	16.5
Beryllium	0.165	--	200	16	0.167 J	0.192 J	0.18 J	0.155 J	0.114 J	0.164 J	0.185 J	0.192 J	0.179 J
Cadmium	0.023	3	80	7	0.299 U	0.315 U	0.315 U	0.311 U	0.116 J	0.301 U	0.314 U	0.304 U	0.314 U
Calcium	441	--	--	--	103 J	106 J	336	331	31,700	301 U	314 U	304 U	163 J
Chromium	14.5	3.8	5.6	0.29	**19.8 J**	**21.3 J**	**27.8 J**	**18.1 J**	2.5 J	**19.2 J**	**19.4 J**	**19.7 J**	**20.6 J**
Cobalt	0.822	--	30	2.3	0.63 J	0.79 J	0.43 J	0.53 J	0.59 J	0.62 J	0.57 J	0.55 J	0.68 J
Copper	2.56	700	4,100	310	3	4.3	4.2	2.6	2	3.2	2.9	2.9	3.3
Iron	5,439	150	72,000	5,500	6,430 J	4,020 J	18,400 J	6,130 J	2,050 J	6,710 J	7,880 J	11,800 J	4,200 J
Lead	8.49	270	800	400	14.5	16.4	13.5	13.7	6.2	12.8	12.2	13.7	19.7
Magnesium	363	--	--	--	489 J	577 J	704 J	460 J	4,710 J	498 J	567 J	512 J	542 J
Manganese	9.25	65	2,300	180	7	9.3	6.9	6.8	51.1	7	7.4	7.1	10.7
Mercury	0.071	1	31	2.4	0.041 U	0.025 J	0.043 U	0.039 U	0.031 U	0.021 J	0.047	0.036 J	0.02 J
Nickel	2.27	130	2,000	160	1.9	2.1 J	1.7	1.8	4.2	1.7	1.7	1.7	1.9
Potassium	361	--	--	--	491 J	568 J	663 J	425 J	228 J	527 J	576 J	552 J	609 J
Selenium	0.505	2.1	510	39	0.24 J	0.21 J	0.61	0.34	0.17 J	0.3 U	0.2 J	0.54	0.23 J
Sodium	68.3	--	--	--	299 UJ	315 UJ	277 J	224 J	257 UJ	142 J	232 J	92.4 J	232 J
Vanadium	17.2	--	520	39	30.9 J	15.6 J	40.6 J	23.9 J	22.6 J	25.9 J	20.2 J	38 J	16.4 J
Zinc	6.59	1,200	31,000	2,400	6.5	7.2	6.7	5.5	11	5.9	5.9	6.2	7

Notes:
Shading indicates exceedance of two times the mean base background concentration for subsurface soil
Bold box indicates exceedance of NC SSLs
Bold text indicates exceedance of Adjusted Industrial Soil RSLs
Underline indicates exceedance of Adjusted Residential Soil RSLs
RSLs were adjusted for noncarcinogens to account for exposure to multiple constituents
J - Analyte present, value may or may not be accurate or precise
U - The material was analyzed for, but not detected
UJ - Analyte not detected, quantitation limit may be inaccurate
mg/kg - Milligrams per kilogram
µg/kg - Micrograms per kilogram
SSL - Soil Screening Level
RSL - Residential Screening Level

Created by: Jeff Albano/CLT
Checked by: David Lubell/RDU

Table 4-2
Groundwater Analytical Results
Site 49 PA/SI Report
MCB CamLej
North Carolina

Station ID	2 X Mean Base Background for Groundwater	NCGWQS (January, 2010) *	Adjusted Tap Water RSLs	IR49-TW01		IR49-TW02	IR49-TW03	IR49-TW01R	IR49-TW04	IR49-TW05	IR49-TW06	IR49-TW07	IR49-TW08
Sample ID				IR49-TW01-09C	IR49-TW01D-09C	IR49-TW02-09C	IR49-TW03-09C	IR49-TW01R-10A	IR49-TW04-10A	IR49-TW05-10A	IR49-TW06-10A	IR49-TW07-10A	IR49-TW08-10A
Sample Date				07/12/09	07/12/09	07/12/09	07/12/09	02/18/10	02/19/10	02/18/10	02/18/10	02/18/10	02/18/10
Chemical Name													
Volatile Organic Compounds (µg/L)													
1,1,2,2-Tetrachloroethane	--	0.2	0.067	**0.71 J**	**0.86 J**	1 U	1 U	**1.54**	1 U	1 U	**1.96**	**78.5**	1 U
1,1,2-Trichloroethane	--	5	0.24	**0.34 J**	**0.37 J**	1 U	1 U	**1.35**	1 U	1 U	**1.72**	**6.02**	1 U
1,1-Dichloroethene	--	7	34	1 U	1 U	1 U	1 U	0.722 J	1 U	1 U	0.39 J	0.993 J	1 U
1,2-Dichloroethane	--	0.4	0.15	1 U	1 U	1 U	1 U	**0.405 J**	**0.345 J**	1 U	**0.62 J**	**0.563 J**	1 U
1,4-Dichlorobenzene	--	6	0.43	1 U	1 U	1 U	1 U	0.265 J	1 U	0.298 J	0.255 J	1 U	1 U
Acetone	--	6,000	2,200	2.5 U	2.5 U	4.6 U	2.5 U	5.5 U	2.96 J	2.64 J	5.5 U	5.5 U	6.07
Benzene	--	1	0.41	1 U	1 U	1 U	1 U	**0.543 J**	1 U	1 U	1 U	**2.47**	0.188 J
Carbon disulfide	--	700	100	1 U	0.21 J	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
cis-1,2-Dichloroethene	--	70	37	6.8	6.9	1 U	3.4	**76.5**	3.77	6.4	30.3	**155**	2.49
Cyclohexane	--	--	1,300	1 U	1 U	1 U	1 U	2.8	1 U	1 U	1 U	3.54	1 U
Ethylbenzene	--	600	1.5	1 U	1 U	1 U	1 U	0.178 J	1 U	1 U	1 U	0.182 J	1 U
Isopropylbenzene	--	70	68	1 UJ	1 UJ	1 U	1 UJ	0.443 J	1 U	1 U	0.265 J	0.522 J	1 U
Methylcyclohexane	--	--	--	1 U	1 U	1 U	1 U	3.46	1 U	1 U	2.7	5.86	1 U
Tetrachloroethene	--	0.7	0.11	1 U	1 U	1 U	1 U	**0.504 J**	1 U	1 U	**1.23**	**1.33**	1 U
trans-1,2-Dichloroethene	--	100	11	0.47 J	1.3	1 U	1 U	**80.7**	0.982 J	2.02	**22.3**	**108**	0.655 J
Trichloroethene	--	3	2	1.6	1.6	1 U	1 U	**54.7**	1.5 U	1.5 U	**8.81**	**276**	1.5 U
Vinyl chloride	--	0.03	0.016	**0.93 J**	**0.89 J**	1 U	1 U	**3.51**	1 U	**1.05**	**22.1**	**16.8**	1 U
Semivolatile Organic Compounds (µg/L)								NA	NA	NA	NA	NA	NA
No Detections				NA	NA	NA	NA						
Total Metals (µg/L)								NA	NA	NA	NA	NA	NA
Aluminum	1,886	--	3,700	1,130 J	755 J	**3,810**	**39,400**						
Arsenic	5.77	10	0.045	10 U	10 U	**3.4 J**	**6.8 J**						
Barium	86.2	700	730	30.5 J	38.8 J	76	182						
Beryllium	0.308	--	7.3	5 U	5 U	5 U	6.1						
Cadmium	0.358	2	1.8	5 U	5 U	5 U	1.1 J						
Calcium	69,078	--	--	12,200 J	12,300 J	96,900	71,800						
Chromium	3.13	10	0.043	**2.5 J**	10 U	**6.3 J**	10 U						
Cobalt	3.4	--	1.1	15 U	15 U	15 U	**44.2**						
Iron	5,999	300	2,600	**4,040**	**3,000**	**10,300**	**172,000**						
Lead	2.8	15	--	3 U	3 U	2.9 J	1.8 J						
Magnesium	6,363	--	--	2,040 J	2,040 J	7,880	129,000						
Manganese	214	50	88	33.2	51.7	**287**	**305**						
Nickel	7.97	100	73	8.3 J	14.2	9.4 J	**98.6**						
Potassium	3,277	--	--	1,060 J	1,070 J	1,630 J	8,800						
Sodium	22,508	--	--	27,700 J	31,500 J	75,800	1,150,000						
Vanadium	4.72	--	18	15 U	15 U	5.8 J	6.1 J						
Zinc	42.1	1,000	1,100	6.7 J	11 J	19.8 J	212						

Notes:

Shading indicates exceedance of two times the mean base background concentration for Groundwater

Bold box indicates exceedance of NCGWQS or the more conservative MCL

Bold text indicates exceedance of Adjusted Tap Water RSLs

RSLs were adjusted for noncarcinogens to account for exposure to multiple constituents

* - The MCL-Groundwater value is reported in place of the NC2LGW where the MCL value is more conservative

NA - Not analyzed

J - Analyte present, value may or may not be accurate or precise

R - Unreliable Result

U - The material was analyzed for, but not detected

UJ - Analyte not detected, quantitation limit may be inaccurate

µg/L - Micrograms per liter

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Checked By: Gordon Little/CLT

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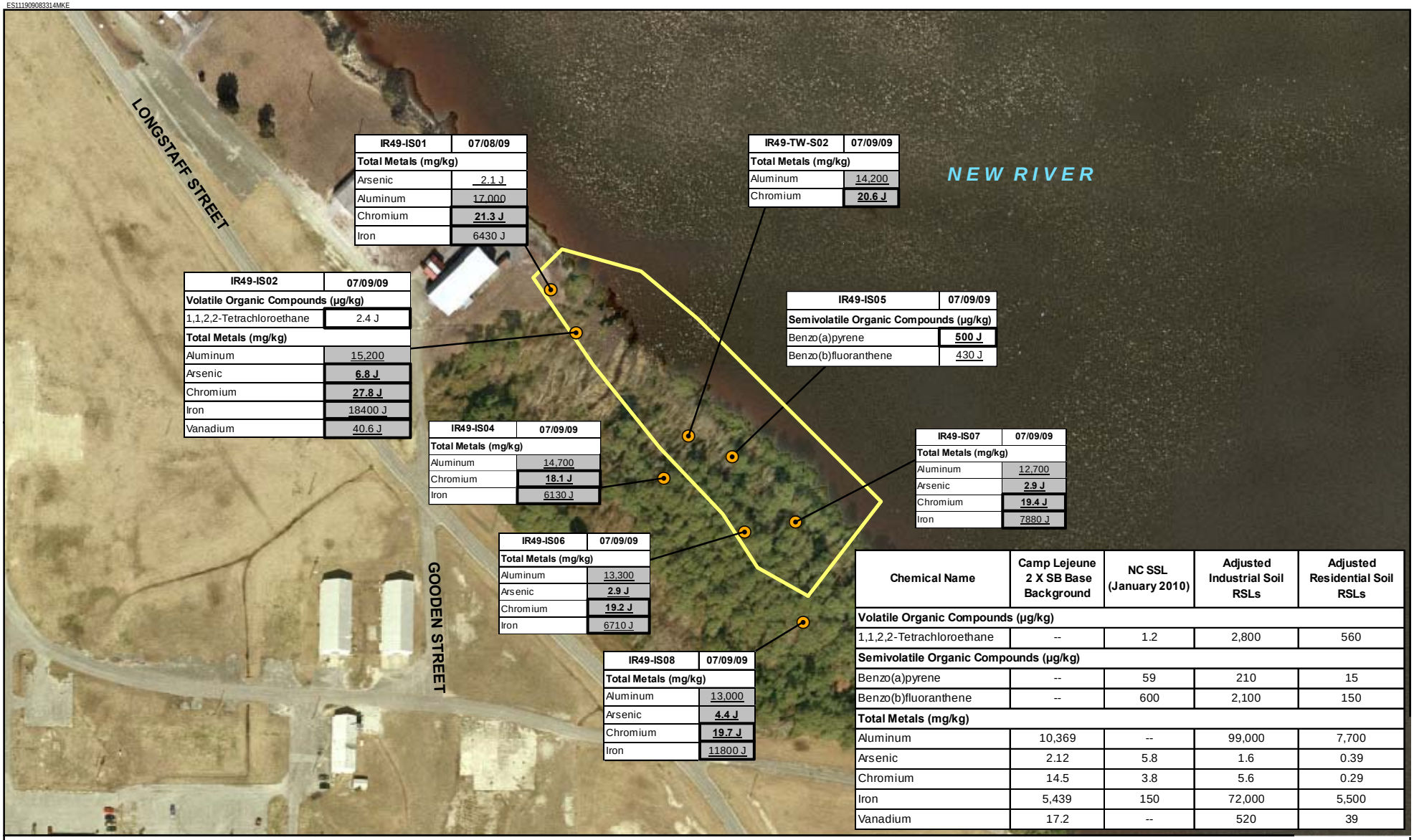

IR49-IS01	07/08/09
Total Metals (mg/kg)	
Arsenic	2.1 J
Aluminum	17,000
Chromium	**21.3 J**
Iron	6430 J

IR49-TW-S02	07/09/09
Total Metals (mg/kg)	
Aluminum	14,200
Chromium	**20.6 J**

IR49-IS02	07/09/09
Volatile Organic Compounds (µg/kg)	
1,1,2,2-Tetrachloroethane	2.4 J
Total Metals (mg/kg)	
Aluminum	15,200
Arsenic	**6.8 J**
Chromium	**27.8 J**
Iron	18400 J
Vanadium	40.6 J

IR49-IS05	07/09/09
Semivolatile Organic Compounds (µg/kg)	
Benzo(a)pyrene	**500 J**
Benzo(b)fluoranthene	430 J

IR49-IS04	07/09/09
Total Metals (mg/kg)	
Aluminum	14,700
Chromium	**18.1 J**
Iron	6130 J

IR49-IS07	07/09/09
Total Metals (mg/kg)	
Aluminum	12,700
Arsenic	**2.9 J**
Chromium	**19.4 J**
Iron	7880 J

IR49-IS06	07/09/09
Total Metals (mg/kg)	
Aluminum	13,300
Arsenic	**2.9 J**
Chromium	**19.2 J**
Iron	6710 J

IR49-IS08	07/09/09
Total Metals (mg/kg)	
Aluminum	13,000
Arsenic	**4.4 J**
Chromium	**19.7 J**
Iron	11800 J

Chemical Name	Camp Lejeune 2 X SB Base Background	NC SSL (January 2010)	Adjusted Industrial Soil RSLs	Adjusted Residential Soil RSLs
Volatile Organic Compounds (µg/kg)				
1,1,2,2-Tetrachloroethane	--	1.2	2,800	560
Semivolatile Organic Compounds (µg/kg)				
Benzo(a)pyrene	--	59	210	15
Benzo(b)fluoranthene	--	600	2,100	150
Total Metals (mg/kg)				
Aluminum	10,369	--	99,000	7,700
Arsenic	2.12	5.8	1.6	0.39
Chromium	14.5	3.8	5.6	0.29
Iron	5,439	150	72,000	5,500
Vanadium	17.2	--	520	39

Legend

- Soil Sample Location
- Site 49 Boundary

Notes:

Shading indicates exceedance of two times the mean base background concentration for subsurface soil

Bold box indicates exceedance of NC SSLs

Bold text indicates exceedance of Adjusted Industrial Soil RSLs

Underline indicates exceedance of Adjusted Residential Soil RSLs

N

0 100 200 Feet

1 inch = 200 feet

Figure 4-1
Subsurface Soil Exceedance Map
Site 49 PA/SI Report
MCB CamLej
North Carolina

CH2MHILL

Generated by: *Jeff Albano* Checked by: *Dave Lubell*

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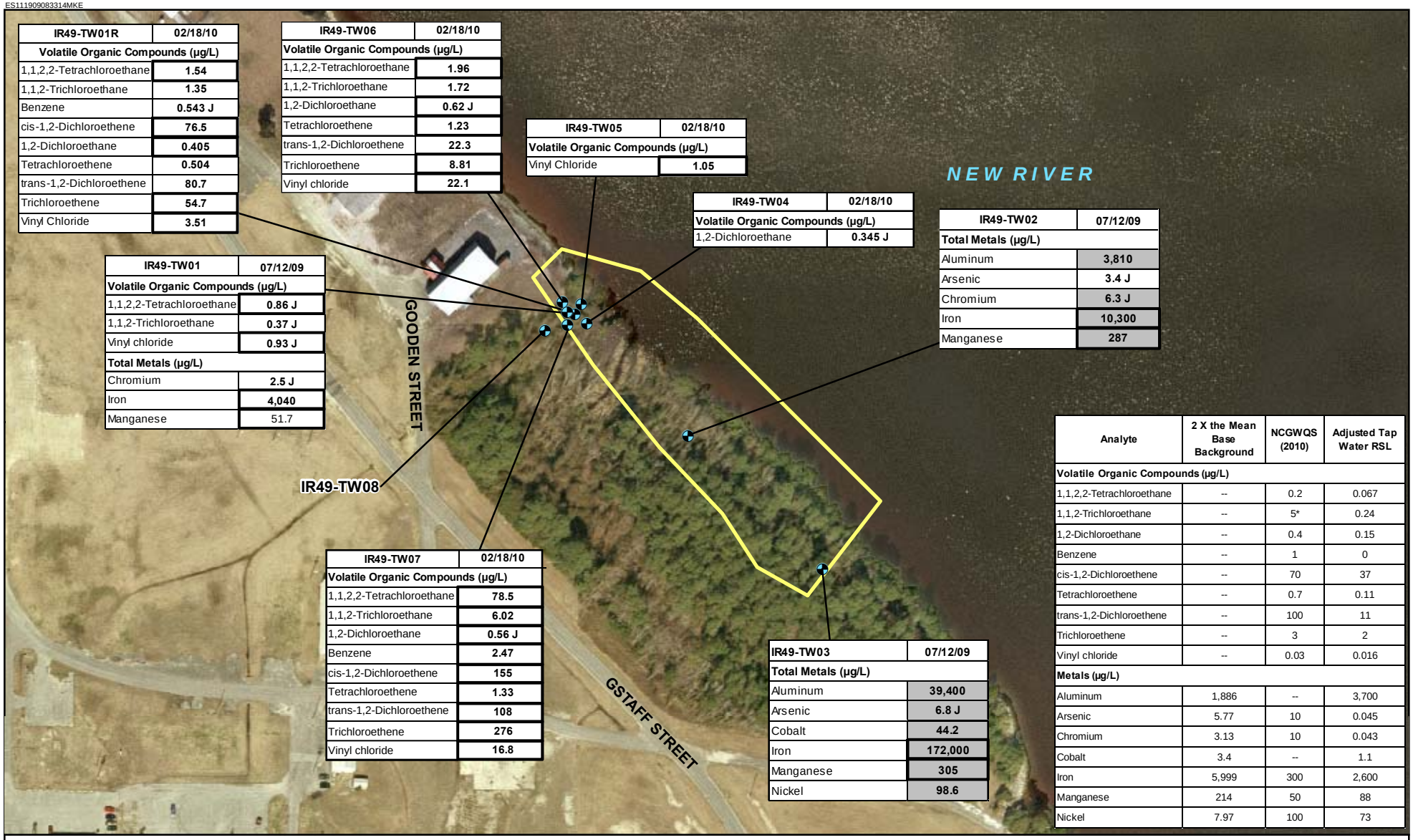

IR49-TW01R	02/18/10
Volatile Organic Compounds (µg/L)	
1,1,2,2-Tetrachloroethane	**1.54**
1,1,2-Trichloroethane	**1.35**
Benzene	**0.543 J**
cis-1,2-Dichloroethene	**76.5**
1,2-Dichloroethane	**0.405**
Tetrachloroethene	**0.504**
trans-1,2-Dichloroethene	**80.7**
Trichloroethene	**54.7**
Vinyl Chloride	**3.51**

IR49-TW06	02/18/10
Volatile Organic Compounds (µg/L)	
1,1,2,2-Tetrachloroethane	**1.96**
1,1,2-Trichloroethane	**1.72**
1,2-Dichloroethane	**0.62 J**
Tetrachloroethene	**1.23**
trans-1,2-Dichloroethene	**22.3**
Trichloroethene	**8.81**
Vinyl chloride	**22.1**

IR49-TW05	02/18/10
Volatile Organic Compounds (µg/L)	
Vinyl Chloride	**1.05**

IR49-TW04	02/18/10
Volatile Organic Compounds (µg/L)	
1,2-Dichloroethane	**0.345 J**

IR49-TW02	07/12/09
Total Metals (µg/L)	
Aluminum	**3,810**
Arsenic	**3.4 J**
Chromium	**6.3 J**
Iron	**10,300**
Manganese	**287**

IR49-TW01	07/12/09
Volatile Organic Compounds (µg/L)	
1,1,2,2-Tetrachloroethane	**0.86 J**
1,1,2-Trichloroethane	**0.37 J**
Vinyl chloride	**0.93 J**
Total Metals (µg/L)	
Chromium	**2.5 J**
Iron	**4,040**
Manganese	51.7

IR49-TW07	02/18/10
Volatile Organic Compounds (µg/L)	
1,1,2,2-Tetrachloroethane	**78.5**
1,1,2-Trichloroethane	**6.02**
1,2-Dichloroethane	**0.56 J**
Benzene	**2.47**
cis-1,2-Dichloroethene	**155**
Tetrachloroethene	**1.33**
trans-1,2-Dichloroethene	**108**
Trichloroethene	**276**
Vinyl chloride	**16.8**

IR49-TW03	07/12/09
Total Metals (µg/L)	
Aluminum	**39,400**
Arsenic	**6.8 J**
Cobalt	**44.2**
Iron	**172,000**
Manganese	**305**
Nickel	**98.6**

Analyte	2 X the Mean Base Background	NCGWQS (2010)	Adjusted Tap Water RSL
Volatile Organic Compounds (µg/L)			
1,1,2,2-Tetrachloroethane	--	0.2	0.067
1,1,2-Trichloroethane	--	5*	0.24
1,2-Dichloroethane	--	0.4	0.15
Benzene	--	1	0
cis-1,2-Dichloroethene	--	70	37
Tetrachloroethene	--	0.7	0.11
trans-1,2-Dichloroethene	--	100	11
Trichloroethene	--	3	2
Vinyl chloride	--	0.03	0.016
Metals (µg/L)			
Aluminum	1,886	--	3,700
Arsenic	5.77	10	0.045
Chromium	3.13	10	0.043
Cobalt	3.4	--	1.1
Iron	5,999	300	2,600
Manganese	214	50	88
Nickel	7.97	100	73

Legend

- Groundwater Sample Location
- Site 49 Boundary

Notes:

Shading indicates exceedance of 2 X the Mean Base Background concentration for Groundwater

Bold box indicates exceedance of NCGWQS or the more conservative MCL

Bold text indicates exceedance of Adjusted Tap Water RSL

* – MCL

-- – No Standard

J – Analyte present, value may or may not be accurate or precise

N

0 100 200 Feet

1 inch = 200 feet

Figure 4-2
Groundwater Exceedance Map
Site 49 PA/SI Report
MCB CamLej
North Carolina

CH2MHILL

Generated by: *Jeff Albano* Checked by: *Dave Lubell*

SECTION 5

Conclusions and Recommendations

A PA/SI was conducted at Site 49 to evaluate the potential presence and nature of environmental contamination that may have resulted from historical waste disposal activities, and to determine if additional investigation or remediation was warranted.

Subsurface soil and groundwater samples were collected from Site 49 and analyzed for VOCs, SVOCs, and metals. Metals were detected above Base Background in soil and groundwater at the site, but can be attributed to site geology and not historical disposal practices at Site 49. SVOCs were detected in one soil sample, collected from a stratum of fill where asphalt was observed and likely attributed to the asphalt found in the fill near the sample location. SVOCs were not detected above regulatory criteria in groundwater collected from the site. VOCs were detected in groundwater above regulatory standards and included; 1,1,2,2-PCA , 1,1,2-TCA , 1,2-DCA , benzene , cis-1,2-DCE , PCE , TCE, trans-1,2-DCE , and vinyl chloride. VOCs in groundwater appear to be limited to the northwest portion of the site, however the complete extent of contamination is not defined. One VOC (1,1,2,2-PCA) was detected in a soil sample collected in the vicinity of the VOC impacted groundwater.

Based on the potential risks to human health and the environment from VOCs in groundwater at Site 49, a Remedial Investigation (RI) under the Installation Restoration Program (IRP) is recommended to identify the potential source of contamination, define the nature and extent of contamination, evaluate fate and transport mechanisms, and assess potential human health and ecological risks.

SECTION 6

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Appendix A
Soil Boring Logs

Boring Number: IR49-IS01

Client: NAVFAC
Project: CTO-040 LSA Sites/Site-49
Location: MCB Camp Lejeune, Jacksonville, NC
Project Number: 380666

Driller: ARM Environmental Services
Drilling Method: Geoprobe 7720 DT
Sampling Method: 60" macrocore
Logged by: D. Miller/KNV
Start/Finish Date: 7/8/09

Depth (ft)	Sample Information: Sample #	Sample Type	Recovery (%)	SPT (6"-6"-6")	Soil Log	Soil Description	Depth / Elev (ft)	Comments
						Ground Surface	0	
0						**Sand (SP)** light brown, dry, loose, poorly graded	0 -1	FID (ppm) w/o charcoal 0.0
						Clay (CL) light brown to grey, slightly moist, stiff	1	0.0
	0-5	HA	60	NA				0.0
5								0.0
	5-10	DP-1	54	NA				
							-9	
						Silty Sand (SM) brown to grey, wet, medium dense to dense	9 -10	
10						End of Log	10	Collected sample IR49-IS01-7-8-09C from 7-8' bgs.
15								
20								

Boring Number: IR49-IS02

Client: NAVFAC
Project: CTO-040 LSA Sites/Site-49
Location: MCB Camp Lejeune, Jacksonville, NC
Project Number: 380666

Driller: ARM Environmental Services
Drilling Method: Geoprobe 7720 DT
Sampling Method: 60" macrocore
Logged by: D. Miller/KNV
Start/Finish Date: 7/9/09

Depth (ft)	Sample Information: Sample #	Sample Type	Recovery (%)	SPT (6"-6"-6")	Soil Log	Soil Description	Depth / Elev (ft)	Comments
						Ground Surface	0	
0						**Sand (SP)** light brown, dry, loose, poorly graded	0 -1	FID (ppm) w/o charcoal 0.0
						Gravel and Brick Fragments (GP) light brown to pale red, dry, loose	1	
	0-5	HA	60	NA		**Clay (CL)** light brown to grey, slightly moist, stiff		0.0 0.0
5								0.0
	5-10	DP-1	60	NA		**Silty Sand (SM)** light grey, wet, dense, very fine grained	-7 7 -8	0.0
						Clay (CL) light brown to grey, wet, stiff	8	0.0
10						End of Log	-10 10	Collected sample IR49-IS02-6-7-09C from 6-7' bgs.
15								
20								

Boring Number: IR49-IS03

Client: NAVFAC
Project: CTO-040 LSA Sites/Site-49
Location: MCB Camp Lejeune, Jacksonville, NC
Project Number: 380666

Driller: ARM Environmental Services
Drilling Method: Geoprobe 7720 DT
Sampling Method: 60" macrocore
Logged by: D. Miller/KNV
Start/Finish Date: 7/9/09

Depth (ft)	Sample Information: Sample #	Sample Type	Recovery (%)	SPT (6"-6"-6")	Soil Log	Soil Description	Depth / Elev (ft)	Comments
						Ground Surface	0	
0						**Sand (SP)** brown, dry, loose, poorly graded	0	FID (ppm) w/o charcoal 0.0
						Concrete/Asphalt fragments	-2 2	0.0
	0-5	HA	60	NA		**Clay (CL)** light brown to grey, slightly moist, stiff		0.0
5								0.0
	5-10	DP-1	60	NA		moist		0.0
10								
	10-15	DP-2	60	NA		**Silty Sand (SM)** brownish yellow to grey, wet, dense	-12 12	0.0
15						**Clay (CL)** brown to grey, wet, soft	-15 15	0.0
	15-20	DP-3	60	NA				
20						End of Log	-20 20	Collected sample IR49-IS03-8-9-09C from 8-9' bgs.
25								

Boring Number: IR49-IS04

Client: NAVFAC
Project: CTO-040 LSA Sites/Site-49
Location: MCB Camp Lejeune, Jacksonville, NC
Project Number: 380666

Driller: ARM Environmental Services
Drilling Method: Geoprobe 7720 DT
Sampling Method: 60" macrocore
Logged by: D. Miller/KNV
Start/Finish Date: 7/9/09

Depth (ft)	Sample Information: Sample #	Sample Type	Recovery (%)	SPT (6"-6"-6")	Soil Log	Soil Description	Depth / Elev (ft)	Comments
						Ground Surface	0	
0						**Sand (SP)** light brown, dry, loose, poorly graded	0	FID (ppm) w/o charcoal 0.0
						Clay (CL) light brown to grey, slightly moist, stiff		0.0
	0-5	HA	60	NA				
5								0.0
								0.0
	5-10	DP-1	60	NA			-8	
						Silty Sand (SM) light grey to pale yellow, wet, dense, very fine grained	8	0.0
						Clay (CL) light brown to grey, wet, stiff	-10	
10						End of Log	10	Collected sample IR49-IS04-6.5-7.5-09C from 6.5-7.5' bgs.
15								
20								

Boring Number: IR49-IS05

Client: NAVFAC
Project: CTO-040 LSA Sites/Site-49
Location: MCB Camp Lejeune, Jacksonville, NC
Project Number: 380666

Driller: ARM Environmental Services
Drilling Method: Geoprobe 7720 DT
Sampling Method: 60" macrocore
Logged by: D. Miller/KNV
Start/Finish Date: 7/9/09

Depth (ft)	Sample Information: Sample #	Sample Type	Recovery (%)	SPT (6"-6"-6")	Soil Log	Soil Description	Depth / Elev (ft)	Comments
						Ground Surface	0	
0						**Concrete/Gravel** concrete fragments and gravel	0 -1	FID (ppm) w/o charcoal 0.0
						Asphalt and Sand (SW) black, dry, loose	1	
	0-5	DP-1	60	NA				0.0
5						wet		0.0
						Clay (CL) brown to grey, moist, firm	-6 6	
	5-10	DP-2	60	NA				
10						End of Log	-10 10	Collected sample IR49-IS05-4-5-09C from 4-5' bgs.
15								
20								

Boring Number: IR49-IS06

Client: NAVFAC
Project: CTO-040 LSA Sites/Site-49
Location: MCB Camp Lejeune, Jacksonville, NC
Project Number: 380666

Driller: ARM Environmental Services
Drilling Method: Geoprobe 7720 DT
Sampling Method: 60" macrocore
Logged by: D. Miller/KNV
Start/Finish Date: 7/9/09

Depth (ft)	Sample Information: Sample #	Sample Type	Recovery (%)	SPT (6"-6"-6")	Soil Log	Soil Description	Depth / Elev (ft)	Comments
						Ground Surface	0	
0						**Sand (SP)** brown, dry, loose, poorly graded	0	FID (ppm) w/o charcoal 0.0
						Clay (CL) light brown to grey, slightly moist, stiff	-2 2	0.0
	0-5	HA	60	NA				
5								0.0
	5-10	DP-1	60	NA				
						Silty Sand (SM) light grey to brownish yellow, wet, dense, very fine grained	-9 9	0.0
10						End of Log	-10 10	Collected sample IR49-IS06-7-8-09C from 7-8' bgs.
15								
20								

Boring Number: IR49-IS07

Client: NAVFAC
Project: CTO-040 LSA Sites/Site-49
Location: MCB Camp Lejeune, Jacksonville, NC
Project Number: 380666

Driller: ARM Environmental Services
Drilling Method: Geoprobe 7720 DT
Sampling Method: 60" macrocore
Logged by: D. Miller/KNV
Start/Finish Date: 7/9/09

Depth (ft)	Sample Information: Sample #	Sample Type	Recovery (%)	SPT (6"-6"-6")	Soil Log	Soil Description	Depth / Elev (ft)	Comments
						Ground Surface	0	
0						**Sand (SP)** brown, dry, loose, poorly graded	0	FID (ppm) w/o charcoal 0.0 0.0
						Clay (CL) light brown to grey, slightly moist, medium stiff	-2 2	
	0-5	HA	60	NA				0.0 0.0 0.0
5								
	5-10	DP-1	60	NA				0.0
10								0.0 Collected sample IR49-IS07-9-10-09C from 9-10' bgs.
	10-15	DP-2	60	NA		**Silty Sand (SM)** brownish yellow to grey, wet, dense	-13 13	
15						End of Log	-15 15	
20								

Boring Number: IR49-IS08

Client: NAVFAC
Project: CTO-040 LSA Sites/Site-49
Location: MCB Camp Lejeune, Jacksonville, NC
Project Number: 380666

Driller: ARM Environmental Services
Drilling Method: Geoprobe 7720 DT
Sampling Method: 60" macrocore
Logged by: D. Miller/KNV
Start/Finish Date: 7/9/09

Depth (ft)	Sample Information: Sample #	Sample Type	Recovery (%)	SPT (6"-6"-6")	Soil Log	Soil Description	Depth / Elev (ft)	Comments
						Ground Surface	0	
0						**Sand (SP)** brown, dry, loose, poorly graded	0	FID (ppm) w/o charcoal 0.0
						Clay (CL) light brown to grey, slightly moist, stiff	-2 2	0.0 0.0
	0-5	HA	60	NA				0.0 0.0 0.0
5								0.0
	5-10	DP-1	60	NA				Collected sample IR49-IS08-8-9-09C from 8-9' bgs.
10						**Silty Sand (SM)** brownish yellow, wet, dense	-10 10	
						End of Log		
15								
20								

Boring Number: IR49-TW01

Client: NAVFAC
Project: CTO-040 LSA Sites/Site-49
Location: MCB Camp Lejeune, Jacksonville, NC
Project Number: 380666

Driller: ARM Environmental Services
Drilling Method: Geoprobe 7720 DT
Sampling Method: 60" macrocore
Logged by: D. Miller/KNV
Start/Finish Date: 7/8/09

Depth (ft)	Sample Information: Sample #	Sample Type	Recovery (%)	SPT (6"-6"-6")	Soil Log	Soil Description	Depth / Elev (ft)	Comments
						Ground Surface	0	
0						**Sand (SP)** light brown, dry, loose, poorly graded	0	FID (ppm) w/o charcoal 0.0
						Clay (CL) light brown to grey, slightly moist, stiff	-2 2	0.0
	0-5	HA	60	NA				0.0 0.0 0.0
5								
	5-10	DP-1	60	NA		**Silty Sand (SM)** brown to grey, wet, medium dense to dense	-8 8	0.0
10								0.0
	10-15	DP-2	60	NA		dark brown grey		
15						End of Log	-15 15	Set IR49-TW01 set to 15' bgs Screen: 5-15' Sand: 3-15'
20								

Boring Number: IR49-TW02/IR49-TW-S02

Client: NAVFAC
Project: CTO-040 LSA Sites/Site-49
Location: MCB Camp Lejeune, Jacksonville, NC
Project Number: 380666

Driller: ARM Environmental Services
Drilling Method: Geoprobe 7720 DT
Sampling Method: 60" macrocore
Logged by: D. Miller/KNV
Start/Finish Date: 7/9/09

Depth (ft)	Sample #	Sample Type	Recovery (%)	SPT (6"-6"-6")	Soil Log	Soil Description	Depth / Elev (ft)	Comments
						Ground Surface	0	
0						**Sand (SP)** brown, dry, loose, poorly graded	0	FID (ppm) w/o charcoal NA
						Concrete/Asphalt Fragments	-2 2	
	0-5	HA	NA	NA		**Clay (CL)** light brown to grey, slightly moist, stiff		
5								
	5-10	DP-1	NA	NA		moist		
10								
	10-15	DP-2	NA	NA		**Silty Sand (SM)** brownish yellow to grey, wet, dense	-12 12	
15						**Clay (CL)** brown to grey, wet, soft	-15 15	
	15-20	DP-3	NA	NA				Set IR49-TW02/IR49-TW-S02 to 20' bgs Screen: 10-20' Sand: 8-20'
20						End of Log	-20 20	
25								

Boring Number: IR49-TW03

Client: NAVFAC
Project: CTO-040 LSA Sites/Site-49
Location: MCB Camp Lejeune, Jacksonville, NC
Project Number: 380666

Driller: ARM Environmental Services
Drilling Method: Geoprobe 7720 DT
Sampling Method: 60" macrocore
Logged by: D. Miller/KNV
Start/Finish Date: 7/9/09

Depth (ft)	Sample Information: Sample #	Sample Type	Recovery (%)	SPT (6"-6"-6")	Soil Log	Soil Description	Depth / Elev (ft)	Comments
						Ground Surface	0	
0						**Sand (SP)** olive brown, dry, loose, poorly graded	0	FID (ppm) w/o charcoal 0.0
	0-5	HA	60	NA		**Clay (CL)** light brown to grey, slightly moist, stiff	-2 2	0.0
5								0.0
	5-10	DP-1	60	NA				
10								0.0
						Silty Sand (SM) dark green, wet, dense	-11 11	0.0
	10-15	DP-2	60	NA				0.0
						Clay (CL) dark grey, wet, soft to medium stiff	-14 14	
15						**Silty Sand (SM)** grey, wet, dense, very fine grained	-15 15	0.0
	15-20	DP-3	60	NA				Set IR49-TW03 to 18.5' bgs Screen: 8.5'-18.5' Sand: 6.5-18.5'
20						End of Log	-20 20	
25								

Appendix B
Analytical Results and Chain-of-Custody Forms

CTO-40, LSA
Camp Lejeune - Site 49
Validated Groundwater Detected Analytical Results
July 2009

Station ID	IR49-TW01		IR49-TW02	IR49-TW03
Sample ID	IR49-TW01-09C	IR49-TW01D-09C	IR49-TW02-09C	IR49-TW03-09C
Sample Date	07/12/09	07/12/09	07/12/09	07/12/09
Chemical Name				
Volatile Organic Compounds (µg/l)				
1,1,2,2-Tetrachloroethane	0.71 J	0.86 J	1 U	1 U
1,1,2-Trichloroethane	0.34 J	0.37 J	1 U	1 U
Carbon disulfide	1 U	0.21 J	1 U	1 U
cis-1,2-Dichloroethene	6.8	6.9	1 U	3.4
trans-1,2-Dichloroethene	0.47 J	1.3	1 U	1 U
Trichloroethene	1.6	1.6	1 U	1 U
Vinyl chloride	0.93 J	0.89 J	1 U	1 U
Semivolatile Organic Compounds (µg/l)				
No Detections	NA	NA	NA	NA
Total Metals (µg/l)				
Aluminum	1,130 J	755 J	3,810	39,400
Arsenic	10 U	10 U	3.4 J	6.8 J
Barium	30.5 J	38.8 J	76	182
Beryllium	5 U	5 U	5 U	6.1
Cadmium	5 U	5 U	5 U	1.1 J
Calcium	12,200 J	12,300 J	96,900	71,800
Chromium	2.5 J	10 U	6.3 J	10 U
Cobalt	15 U	15 U	15 U	44.2
Iron	4,040	3,000	10,300	172,000
Lead	3 U	3 U	2.9 J	1.8 J
Magnesium	2,040 J	2,040 J	7,880	129,000
Manganese	33.2	51.7	287	305
Nickel	8.3 J	14.2	9.4 J	98.6
Potassium	1,060 J	1,070 J	1,630 J	8,800
Sodium	27,700 J	31,500 J	75,800	1,150,000
Vanadium	15 U	15 U	5.8 J	6.1 J
Zinc	6.7 J	11 J	19.8 J	212

Notes:

Shading indicates detections
NA - Not analyzed
J - Analyte present, value may or may not be accurate or precise
U - The material was analyzed for, but not detected
µg/l - Micrograms per liter

CTO-40, LSA
Camp Lejeune - Site 49
Validated Groundwater Exceedance Results
July 2009

Station ID	**Camp Lejeune Background GW 2X Mean**	**NCGWQS (December 2006) ***	**Adjusted Tap Water RSLs**	IR49-TW01		IR49-TW02	IR49-TW03
Sample ID				IR49-TW01-09C	IR49-TW01D-09C	IR49-TW02-09C	IR49-TW03-09C
Sample Date				07/12/09	07/12/09	07/12/09	07/12/09
Chemical Name							
Volatile Organic Compounds (µg/l)							
1,1,2,2-Tetrachloroethane	--	0.2	0.067	**0.71 J**	**0.86 J**	1 U	1 U
1,1,2-Trichloroethane	--	--	0.24	**0.34 J**	**0.37 J**	1 U	1 U
Carbon disulfide	--	700	100	1 U	0.21 J	1 U	1 U
cis-1,2-Dichloroethene	--	70	37	6.8	6.9	1 U	3.4
trans-1,2-Dichloroethene	--	100	11	0.47 J	1.3	1 U	1 U
Trichloroethene	--	3	2	1.6	1.6	1 U	1 U
Vinyl chloride	--	0.03	0.016	**0.93 J**	**0.89 J**	1 U	1 U
Semivolatile Organic Compounds (µg/l)							
No Detections				NA	NA	NA	NA
Total Metals (µg/l)							
Aluminum	1,886	--	3,700	1,130 J	755 J	**3,810**	**39,400**
Arsenic	5.77	10	0.045	10 U	10 U	**3.4 J**	**6.8 J**
Barium	86.2	700	730	30.5 J	38.8 J	76	182
Beryllium	0.308	--	7.3	5 U	5 U	5 U	6.1
Cadmium	0.358	2	1.8	5 U	5 U	5 U	1.1 J
Calcium	69,078	--	--	12,200 J	12,300 J	96,900	71,800
Chromium	3.13	10	0.043	**2.5 J**	10 U	**6.3 J**	10 U
Cobalt	3.4	--	1.1	15 U	15 U	15 U	**44.2**
Iron	5,999	300	2,600	**4,040**	**3,000**	**10,300**	**172,000**
Lead	2.8	15	--	3 U	3 U	2.9 J	1.8 J
Magnesium	6,363	--	--	2,040 J	2,040 J	7,880	129,000
Manganese	214	50	88	33.2	51.7	**287**	**305**
Nickel	7.97	100	73	8.3 J	14.2	9.4 J	**98.6**
Potassium	3,277	--	--	1,060 J	1,070 J	1,630 J	8,800
Sodium	22,508	--	--	27,700 J	31,500 J	75,800	1,150,000
Vanadium	4.72	--	18	15 U	15 U	5.8 J	6.1 J
Zinc	42.1	1,000	1,100	6.7 J	11 J	19.8 J	212

Notes:

Shading indicates exceedance of two times the mean base background concentration for Groundwater

Bold box indicates exceedance of NCGWQS or the more conservative MCL

Bold text indicates exceedance of Adjusted Tap Water RSLs

RSLs were adjusted for noncarcinogens to account for exposure to multiple constituents

* - The MCL-Groundwater value is reported in place of the NC2LGW where the MCL value is more conservative

NA - Not analyzed

J - Analyte present, value may or may not be accurate or precise

R - Unreliable Result

U - The material was analyzed for, but not detected

UJ - Analyte not detected, quantitation limit may be inaccurate

µg/l - Micrograms per liter

CTO-40, LSA
Camp Lejeune - Site 49
Validated Groundwater Raw Analytical Results
July 2009

Station ID	IR49-TW01		IR49-TW02	IR49-TW03
Sample ID	IR49-TW01-09C	IR49-TW01D-09C	IR49-TW02-09C	IR49-TW03-09C
Sample Date	07/12/09	07/12/09	07/12/09	07/12/09
Chemical Name				
Volatile Organic Compounds (µg/l)				
1,1,1-Trichloroethane	1 U	1 U	1 U	1 U
1,1,2,2-Tetrachloroethane	0.71 J	0.86 J	1 U	1 U
1,1,2-Trichloro-1,2,2-trifluoroethane(Freon-113)	1 U	1 U	1 U	1 U
1,1,2-Trichloroethane	0.34 J	0.37 J	1 U	1 U
1,1-Dichloroethane	1 U	1 U	1 U	1 U
1,1-Dichloroethene	1 U	1 U	1 U	1 U
1,2,4-Trichlorobenzene	1 U	1 U	1 U	1 U
1,2-Dibromo-3-chloropropane	1 U	1 U	1 U	1 U
1,2-Dibromoethane	1 U	1 U	1 U	1 U
1,2-Dichlorobenzene	1 U	1 U	1 U	1 U
1,2-Dichloroethane	1 U	1 U	1 U	1 U
1,2-Dichloropropane	1 U	1 U	1 U	1 U
1,3-Dichlorobenzene	1 U	1 U	1 U	1 U
1,4-Dichlorobenzene	1 U	1 U	1 U	1 U
2-Butanone	3 U	3 U	3 U	3 U
2-Hexanone	1 U	1 U	1 U	1 U
4-Methyl-2-pentanone	1 U	1 U	1 U	1 U
Acetone	2.5 U	2.5 U	4.6 U	2.5 U
Benzene	1 U	1 U	1 U	1 U
Bromodichloromethane	1 U	1 U	1 U	1 U
Bromoform	1 UJ	1 UJ	1 U	1 UJ
Bromomethane	1 U	1 U	1 U	1 U
Carbon disulfide	1 U	0.21 J	1 U	1 U
Carbon tetrachloride	1 U	1 U	1 U	1 U
Chlorobenzene	1 U	1 U	1 U	1 U
Chloroethane	1 U	1 U	1 U	1 U
Chloroform	1 U	1 U	1 U	1 U
Chloromethane	1 U	1 U	1 U	1 UJ
cis-1,2-Dichloroethene	6.8	6.9	1 U	3.4
cis-1,3-Dichloropropene	1 U	1 U	1 U	1 U
Cyclohexane	1 U	1 U	1 U	1 U
Dibromochloromethane	1 U	1 U	1 U	1 U
Dichlorodifluoromethane (Freon-12)	1 U	1 U	1 U	1 U
Ethylbenzene	1 U	1 U	1 U	1 U
Isopropylbenzene	1 UJ	1 UJ	1 U	1 UJ
Methyl acetate	1 U	1 U	1 U	1 U
Methylcyclohexane	1 U	1 U	1 U	1 U
Methylene chloride	1 U	1 U	1 U	1 U
Methyl-tert-butyl ether (MTBE)	1 U	1 U	1 U	1 U
Styrene	1 U	1 U	1 U	1 U
Tetrachloroethene	1 U	1 U	1 U	1 U
Toluene	1 U	1 U	1 U	1 U
trans-1,2-Dichloroethene	0.47 J	1.3	1 U	1 U
trans-1,3-Dichloropropene	1 U	1 U	1 U	1 U
Trichloroethene	1.6	1.6	1 U	1 U
Trichlorofluoromethane(Freon-11)	1 U	1 U	1 U	1 U
Vinyl chloride	0.93 J	0.89 J	1 U	1 U
Xylene, total	1 U	1 U	1 U	1 U

CTO-40, LSA
Camp Lejeune - Site 49
Validated Groundwater Raw Analytical Results
July 2009

Station ID	IR49-TW01		IR49-TW02	IR49-TW03
Sample ID	IR49-TW01-09C	IR49-TW01D-09C	IR49-TW02-09C	IR49-TW03-09C
Sample Date	07/12/09	07/12/09	07/12/09	07/12/09
Chemical Name				
Semivolatile Organic Compounds (µg/l)				
1,1-Biphenyl	9.4 U	9.8 U	9.6 U	10 U
2,2'-Oxybis(1-chloropropane)	9.4 U	9.8 U	9.6 U	10 U
2,4,5-Trichlorophenol	23 U	24 U	24 U	25 U
2,4,6-Trichlorophenol	9.4 U	9.8 U	9.6 U	10 U
2,4-Dichlorophenol	9.4 U	9.8 U	9.6 U	10 U
2,4-Dimethylphenol	9.4 U	9.8 U	9.6 U	10 U
2,4-Dinitrophenol	23 U	24 U	24 U	25 U
2,4-Dinitrotoluene	9.4 U	9.8 U	9.6 U	10 U
2,6-Dinitrotoluene	9.4 U	9.8 U	9.6 U	10 U
2-Chloronaphthalene	9.4 U	9.8 U	9.6 U	10 U
2-Chlorophenol	9.4 U	9.8 U	9.6 U	10 U
2-Methylnaphthalene	9.4 U	9.8 U	9.6 U	10 U
2-Methylphenol	9.4 U	9.8 U	9.6 U	10 U
2-Nitroaniline	23 U	24 U	24 U	25 U
2-Nitrophenol	9.4 U	9.8 U	9.6 U	10 U
3,3'-Dichlorobenzidine	9.4 UJ	9.8 UJ	9.6 U	10 UJ
3-Nitroaniline	23 U	24 U	24 U	25 U
4,6-Dinitro-2-methylphenol	23 U	24 U	24 U	25 U
4-Bromophenyl-phenylether	9.4 U	9.8 U	9.6 U	10 U
4-Chloro-3-methylphenol	9.4 U	9.8 U	9.6 U	10 U
4-Chloroaniline	9.4 U	9.8 U	9.6 U	10 U
4-Chlorophenyl-phenylether	9.4 U	9.8 U	9.6 U	10 U
4-Methylphenol	9.4 U	9.8 U	9.6 U	10 U
4-Nitroaniline	23 U	24 U	24 U	25 U
4-Nitrophenol	23 U	24 U	24 U	25 U
Acenaphthene	9.4 U	9.8 U	9.6 U	10 U
Acenaphthylene	9.4 U	9.8 U	9.6 U	10 U
Acetophenone	9.4 U	9.8 U	9.6 U	10 U
Anthracene	9.4 U	9.8 U	9.6 U	10 U
Atrazine	9.4 U	9.8 U	9.6 U	10 U
Benzaldehyde	9.4 U	9.8 U	9.6 U	10 U
Benzo(a)anthracene	9.4 U	9.8 U	9.6 U	10 U
Benzo(a)pyrene	9.4 U	9.8 U	9.6 U	10 U
Benzo(b)fluoranthene	9.4 U	9.8 U	9.6 U	10 U
Benzo(g,h,i)perylene	9.4 U	9.8 U	9.6 U	10 U
Benzo(k)fluoranthene	9.4 U	9.8 U	9.6 U	10 U
bis(2-Chloroethoxy)methane	9.4 U	9.8 U	9.6 U	10 U
bis(2-Chloroethyl)ether	9.4 U	9.8 U	9.6 U	10 U
bis(2-Ethylhexyl)phthalate	9.4 U	9.8 U	9.6 U	10 U
Butylbenzylphthalate	9.4 U	9.8 U	9.6 U	10 U
Caprolactam	9.4 UJ	9.8 UJ	9.6 UJ	10 R
Carbazole	9.4 U	9.8 U	9.6 U	10 U
Chrysene	9.4 U	9.8 U	9.6 U	10 U
Dibenz(a,h)anthracene	9.4 U	9.8 U	9.6 U	10 U
Dibenzofuran	9.4 U	9.8 U	9.6 U	10 U
Diethylphthalate	9.4 U	9.8 U	9.6 U	10 U
Dimethyl phthalate	9.4 U	9.8 U	9.6 U	10 U
Di-n-butylphthalate	9.4 U	9.8 U	9.6 U	10 U
Di-n-octylphthalate	9.4 U	9.8 U	9.6 UJ	10 UJ
Fluoranthene	9.4 U	9.8 U	9.6 U	10 U
Fluorene	9.4 U	9.8 U	9.6 U	10 U
Hexachlorobenzene	9.4 U	9.8 U	9.6 U	10 U
Hexachlorobutadiene	9.4 U	9.8 U	9.6 U	10 U
Hexachlorocyclopentadiene	9.4 U	9.8 U	9.6 U	10 U
Hexachloroethane	9.4 U	9.8 U	9.6 U	10 U
Indeno(1,2,3-cd)pyrene	9.4 U	9.8 U	9.6 U	10 U
Isophorone	9.4 U	9.8 U	9.6 U	10 U
Naphthalene	9.4 U	9.8 U	9.6 U	10 U
n-Nitroso-di-n-propylamine	9.4 U	9.8 U	9.6 U	10 U
n-Nitrosodiphenylamine	9.4 U	9.8 U	9.6 U	10 U
Nitrobenzene	9.4 U	9.8 U	9.6 U	10 U
Pentachlorophenol	23 U	24 U	24 U	25 U
Phenanthrene	9.4 U	9.8 U	9.6 U	10 U
Phenol	9.4 U	9.8 U	9.6 U	10 U
Pyrene	9.4 U	9.8 U	9.6 U	10 U

CTO-40, LSA
Camp Lejeune - Site 49
Validated Groundwater Raw Analytical Results
July 2009

Station ID	IR49-TW01		IR49-TW02	IR49-TW03
Sample ID	IR49-TW01-09C	IR49-TW01D-09C	IR49-TW02-09C	IR49-TW03-09C
Sample Date	07/12/09	07/12/09	07/12/09	07/12/09
Chemical Name				
Total Metals (µg/l)				
Aluminum	1,130 J	755 J	3,810	39,400
Antimony	15 U	15 U	15 U	15 U
Arsenic	10 U	10 U	3.4 J	6.8 J
Barium	30.5 J	38.8 J	76	182
Beryllium	5 U	5 U	5 U	6.1
Cadmium	5 U	5 U	5 U	1.1 J
Calcium	12,200 J	12,300 J	96,900	71,800
Chromium	2.5 J	10 U	6.3 J	10 U
Cobalt	15 U	15 U	15 U	44.2
Copper	10 U	10 U	10 U	10 U
Iron	4,040	3,000	10,300	172,000
Lead	3 U	3 U	2.9 J	1.8 J
Magnesium	2,040 J	2,040 J	7,880	129,000
Manganese	33.2	51.7	287	305
Mercury	0.2 UJ	0.2 UJ	0.2 U	0.2 UJ
Nickel	8.3 J	14.2	9.4 J	98.6
Potassium	1,060 J	1,070 J	1,630 J	8,800
Selenium	5 U	5 U	5 U	25 U
Silver	10 U	10 U	10 U	10 U
Sodium	27,700 J	31,500 J	75,800	1,150,000
Thallium	2 U	2 U	2 U	10 U
Vanadium	15 U	15 U	5.8 J	6.1 J
Zinc	6.7 J	11 J	19.8 J	212

Notes:

Shading indicates detections

NA - Not analyzed

J - Analyte present, value may or may not be accurate or precise

R - Unreliable Result

U - The material was analyzed for, but not detected

UJ - Analyte not detected, quantitation limit may be inaccurate

µg/l - Micrograms per liter

CTO-40, LSA
Camp Lejeune - Site 49
Validated Subsurface Soil Detected Analytical Results
July 2009

Station ID	IR49-IS01		IR49-IS02	IR49-IS04	IR49-IS05	IR49-IS06	IR49-IS07	IR49-IS08	IR49-TW02
Sample ID	IR49-IS01-7-8-09C	IR49-IS01D-7-8-09C	IR49-IS02-6-7-09C	IR49-IS04-6.5-7.5-09C	IR49-IS05-4-5-09C	IR49-IS06-7-8-09C	IR49-IS07-9-10-09C	IR49-IS08-8-9-09C	IR49-TW-S02-8-9-09C
Sample Date	07/08/09	07/08/09	07/09/09	07/09/09	07/09/09	07/09/09	07/09/09	07/09/09	07/09/09
Chemical Name									
Volatile Organic Compounds (µg/kg)									
1,1,2,2-Tetrachloroethane	9.4 U	10 U	2.4 J	9.7 U	14 U	10 U	10 U	9.7 U	9.8 U
cis-1,2-Dichloroethene	9.4 U	10 U	1.2 J	9.7 U	14 U	10 U	10 U	9.7 U	9.8 U
Cyclohexane	9.4 U	10 U	0.75 J	9.7 U	14 U	10 U	10 U	9.7 U	9.8 U
Ethylbenzene	0.78 J	10 U	9.6 U	9.7 U	1.3 J	10 U	0.79 J	0.77 J	9.8 U
Methylcyclohexane	9.4 U	10 U	0.69 J	9.7 U	14 U	10 U	10 U	9.7 U	9.8 U
Methylene chloride	10	4.4 J	5.3 J	3 J	14 U	10 U	10 U	9.7 U	2.3 J
Toluene	0.93 J	10 U	9.6 U	9.7 U	14 U	10 U	10 U	9.7 U	9.8 U
Trichloroethene	9.4 U	10 U	1.5 J	9.7 U	14 U	10 U	10 U	9.7 U	9.8 U
Xylene, total	3.2 J	10 U	9.6 U	9.7 U	14 U	10 U	10 U	9.7 U	1.5 J
Semivolatile Organic Compounds (µg/kg)									
Benzo(a)pyrene	6.6 U	6.9 U	1.5 J	6.7 U	500 J	6.5 U	1.4 J	1.5 J	1.3 J
Benzo(b)fluoranthene	62 U	64 U	2.3 J	63 U	430 J	61 U	65 U	63 U	2.1 J
Benzo(g,h,i)perylene	250 U	260 U	260 U	250 U	3,000	240 U	260 U	250 U	260 U
Caprolactam	200 J	190 J	160 J	150 J	2,100 UJ	150 J	260 U	150 J	230 J
Pyrene	250 U	260 U	260 U	250 U	410 J	240 U	260 U	250 U	260 U
Total Metals (mg/kg)									
Aluminum	14,900	17,000	15,200	14,700	1,540	13,300	12,700	13,000	14,200
Arsenic	2.1 J	1.5 J	6.8 J	2.1 J	1.2 J	2.9 J	2.9 J	4.4 J	1.3 J
Barium	21.9	26.2	18.5	17.8	14.1	21.2	24.1	23.1	16.5
Beryllium	0.167 J	0.192 J	0.18 J	0.155 J	0.114 J	0.164 J	0.185 J	0.192 J	0.179 J
Cadmium	0.299 U	0.315 U	0.315 U	0.311 U	0.116 J	0.301 U	0.314 U	0.304 U	0.314 U
Calcium	103 J	106 J	336	331	31,700	301 U	314 U	304 U	163 J
Chromium	19.8 J	21.3 J	27.8 J	18.1 J	2.5 J	19.2 J	19.4 J	19.7 J	20.6 J
Cobalt	0.63 J	0.79 J	0.43 J	0.53 J	0.59 J	0.62 J	0.57 J	0.55 J	0.68 J
Copper	3	4.3	4.2	2.6	2	3.2	2.9	2.9	3.3
Iron	6,430 J	4,020 J	18,400 J	6,130 J	2,050 J	6,710 J	7,880 J	11,800 J	4,200 J
Lead	14.5	16.4	13.5	13.7	6.2	12.8	12.2	13.7	19.7
Magnesium	489 J	577 J	704 J	460 J	4,710 J	498 J	567 J	512 J	542 J
Manganese	7	9.3	6.9	6.8	51.1	7	7.4	7.1	10.7
Mercury	0.041 U	0.025 J	0.043 U	0.039 U	0.031 U	0.021 J	0.047	0.036 J	0.02 J
Nickel	1.9	2.1 J	1.7	1.8	4.2	1.7	1.7	1.7	1.9
Potassium	491 J	568 J	663 J	425 J	228 J	527 J	576 J	552 J	609 J
Selenium	0.24 J	0.21 J	0.61	0.34	0.17 J	0.3 U	0.2 J	0.54	0.23 J
Sodium	299 UJ	315 UJ	277 J	224 J	257 UJ	142 J	232 J	92.4 J	232 J
Vanadium	30.9 J	15.6 J	40.6 J	23.9 J	22.6 J	25.9 J	20.2 J	38 J	16.4 J
Zinc	6.5	7.2	6.7	5.5	11	5.9	5.9	6.2	7

Notes:

Shading indicates detections
NA - Not analyzed
J - Analyte present, value may or may not be accurate or precise
U - The material was analyzed for, but not detected
UJ - Analyte not detected, quantitation limit may be inaccurate
mg/kg - Milligrams per kilogram
µg/kg - Micrograms per kilogram

CTO-40, LSA
Camp Lejeune - Site 49
Validated Subsurface Soil Exceedance Results
July 2009

Station ID	Camp Lejeune Background SB 2X Mean	CLEAN NC SSLs Oct 2009	Adjusted Industrial Soil RSLs	Adjusted Residential Soil RSLs	IR49-IS01		IR49-IS02	IR49-IS04	IR49-IS05	IR49-IS06	IR49-IS07	IR49-IS08	IR49-TW02
Sample ID					IR49-IS01-7-8-09C	IR49-IS01D-7-8-09C	IR49-IS02-6-7-09C	IR49-IS04-6.5-7.5-09C	IR49-IS05-4-5-09C	IR49-IS06-7-8-09C	IR49-IS07-9-10-09C	IR49-IS08-8-9-09C	IR49-TW-S02-8-9-09C
Sample Date					07/08/09	07/08/09	07/09/09	07/09/09	07/09/09	07/09/09	07/09/09	07/09/09	07/09/09
Chemical Name													
Volatile Organic Compounds (µg/kg)													
1,1,2,2-Tetrachloroethane	--	1	2800	560	9.4 U	10 U	2.4 J	9.7 U	14 U	10 U	10 U	9.7 U	9.8 U
cis-1,2-Dichloroethene	--	362	1000000	78,000	9.4 U	10 U	1.2 J	9.7 U	14 U	10 U	10 U	9.7 U	9.8 U
Cyclohexane	--	--	120000	120,000	9.4 U	10 U	0.75 J	9.7 U	14 U	10 U	10 U	9.7 U	9.8 U
Ethylbenzene	--	8,200	27000	5,400	0.78 J	10 U	9.6 U	9.7 U	1.3 J	10 U	0.79 J	0.77 J	9.8 U
Methylcyclohexane	--	--	--	--	9.4 U	10 U	0.69 J	9.7 U	14 U	10 U	10 U	9.7 U	9.8 U
Methylene chloride	--	22	53000	11,000	10	4.4 J	5.3 J	3 J	14 U	10 U	10 U	9.7 U	2.3 J
Toluene	--	9,800	820000	500,000	0.93 J	10 U	9.6 U	9.7 U	14 U	10 U	10 U	9.7 U	9.8 U
Trichloroethene	--	17	14000	2,800	9.4 U	10 U	1.5 J	9.7 U	14 U	10 U	10 U	9.7 U	9.8 U
Xylene, total	--	7,070	260,000	63,000	3.2 J	10 U	9.6 U	9.7 U	14 U	10 U	10 U	9.7 U	1.5 J
Semivolatile Organic Compounds (µg/kg)													
Benzo(a)pyrene	--	75	210	15	6.6 U	6.9 U	1.5 J	6.7 U	**500 J**	6.5 U	1.4 J	1.5 J	1.3 J
Benzo(b)fluoranthene	--	770	2,100	150	62 U	64 U	2.3 J	63 U	430 J	61 U	65 U	63 U	2.1 J
Benzo(g,h,i)perylene	--	--	1,700,000	170,000	250 U	260 U	260 U	250 U	3,000	240 U	260 U	250 U	260 U
Caprolactam	--	18,000	31,000,000	3,100,000	200 J	190 J	160 J	150 J	2,100 UJ	150 J	260 U	150 J	230 J
Pyrene	--	292,000	1,700,000	170,000	250 U	260 U	260 U	250 U	410 J	240 U	260 U	250 U	260 U
Total Metals (mg/kg)													
Aluminum	10,369	--	99,000	7,700	14,900	17,000	15,200	14,700	1,540	13,300	12,700	13,000	14,200
Arsenic	2.12	5.44	1.6	0.39	**2.1 J**	1.5 J	**6.8 J**	**2.1 J**	1.2 J	**2.9 J**	**2.9 J**	**4.4 J**	1.3 J
Barium	16.6	1,648	19,000	1,500	21.9	26.2	18.5	17.8	14.1	21.2	24.1	23.1	16.5
Beryllium	0.165	--	200	16	0.167 J	0.192 J	0.18 J	0.155 J	0.114 J	0.164 J	0.185 J	0.192 J	0.179 J
Cadmium	0.023	2.63	80	7	0.299 U	0.315 U	0.315 U	0.311 U	0.116 J	0.301 U	0.314 U	0.304 U	0.314 U
Calcium	441	--	--	--	103 J	106 J	336	331	31,700	301 U	314 U	304 U	163 J
Chromium	14.5	--	5.6	0.29	**19.8 J**	**21.3 J**	**27.8 J**	**18.1 J**	2.5 J	**19.2 J**	**19.4 J**	**19.7 J**	**20.6 J**
Cobalt	0.822	--	30	2.3	0.63 J	0.79 J	0.43 J	0.53 J	0.59 J	0.62 J	0.57 J	0.55 J	0.68 J
Copper	2.56	704	4,100	310	3	4.3	4.2	2.6	2	3.2	2.9	2.9	3.3
Iron	5,439	151	72,000	5,500	6,430 J	4,020 J	18,400 J	6,130 J	2,050 J	6,710 J	7,880 J	11,800 J	4,200 J
Lead	8.49	270	800	400	14.5	16.4	13.5	13.7	6.2	12.8	12.2	13.7	19.7
Magnesium	363	--	--	--	489 J	577 J	704 J	460 J	4,710 J	498 J	567 J	512 J	542 J
Manganese	9.25	65.2	2,300	180	7	9.3	6.9	6.8	51.1	7	7.4	7.1	10.7
Mercury	0.071	1.1	31	2.4	0.041 U	0.025 J	0.043 U	0.039 U	0.031 U	0.021 J	0.047	0.036 J	0.02 J
Nickel	2.27	130	2,000	160	1.9	2.1 J	1.7	1.8	4.2	1.7	1.7	1.7	1.9
Potassium	361	--	--	--	491 J	568 J	663 J	425 J	228 J	527 J	576 J	552 J	609 J
Selenium	0.505	5.2	510	39	0.24 J	0.21 J	0.61	0.34	0.17 J	0.3 U	0.2 J	0.54	0.23 J
Sodium	68.3	--	--	--	299 UJ	315 UJ	277 J	224 J	257 UJ	142 J	232 J	92.4 J	232 J
Vanadium	17.2	--	520	39	30.9 J	15.6 J	40.6 J	23.9 J	22.6 J	25.9 J	20.2 J	38 J	16.4 J
Zinc	6.59	13,060	31,000	2,400	6.5	7.2	6.7	5.5	11	5.9	5.9	6.2	7

Notes:

Shading indicates exceedance of two times the mean base background concentration for subsurface soil

Bold box indicates exceedance of NC SSLs

Bold text indicates exceedance of Adjusted Industrial Soil RSLs

Underline indicates exceedance of Adjusted Residential Soil RSLs

RSLs were adjusted for noncarcinogens to account for exposure to multiple constituents

NA - Not analyzed

J - Analyte present, value may or may not be accurate or precise

R - Unreliable Result

U - The material was analyzed for, but not detected

UJ - Analyte not detected, quantitation limit may be inaccurate

mg/kg - Milligrams per kilogram

µg/kg - Micrograms per kilogram

CTO-40, LSA
Camp Lejeune - Site 49
Validated Subsurface Soil Raw Analytical Results
July 2009

Station ID	IR49-IS01		IR49-IS02	IR49-IS04	IR49-IS05	IR49-IS06	IR49-IS07	IR49-IS08	IR49-TW02
Sample ID	IR49-IS01-7-8-09C	IR49-IS01D-7-8-09C	IR49-IS02-6-7-09C	IR49-IS04-6.5-7.5-09C	IR49-IS05-4-5-09C	IR49-IS06-7-8-09C	IR49-IS07-9-10-09C	IR49-IS08-8-9-09C	IR49-TW-S02-8-9-09C
Sample Date	07/08/09	07/08/09	07/09/09	07/09/09	07/09/09	07/09/09	07/09/09	07/09/09	07/09/09
Chemical Name									
Volatile Organic Compounds (µg/kg)									
1,1,1-Trichloroethane	9.4 U	10 U	9.6 U	9.7 U	14 U	10 U	10 U	9.7 U	9.8 U
1,1,2,2-Tetrachloroethane	9.4 U	10 U	2.4 J	9.7 U	14 U	10 U	10 U	9.7 U	9.8 U
1,1,2-Trichloro-1,2,2-trifluoroethane(Freon-113)	9.4 U	10 U	9.6 U	9.7 U	14 U	10 U	10 U	9.7 U	9.8 U
1,1,2-Trichloroethane	9.4 U	10 U	9.6 U	9.7 U	14 U	10 U	10 U	9.7 U	9.8 U
1,1-Dichloroethane	9.4 U	10 U	9.6 U	9.7 U	14 U	10 U	10 U	9.7 U	9.8 U
1,1-Dichloroethene	9.4 U	10 U	9.6 U	9.7 U	14 U	10 U	10 U	9.7 U	9.8 U
1,2,4-Trichlorobenzene	9.4 U	10 U	9.6 UJ	9.7 U	14 U	10 U	10 U	9.7 U	9.8 U
1,2-Dibromo-3-chloropropane	4.7 U	5.1 U	4.8 U	4.8 U	6.9 U	5 U	5.2 U	4.8 U	4.9 U
1,2-Dibromoethane	9.4 U	10 U	9.6 U	9.7 U	14 U	10 U	10 U	9.7 U	9.8 U
1,2-Dichlorobenzene	9.4 U	10 U	9.6 UJ	9.7 U	14 U	10 U	10 U	9.7 U	9.8 U
1,2-Dichloroethane	9.4 U	10 U	9.6 U	9.7 U	14 U	10 U	10 U	9.7 U	9.8 U
1,2-Dichloropropane	9.4 U	10 U	9.6 U	9.7 U	14 U	10 U	10 U	9.7 U	9.8 U
1,3-Dichlorobenzene	9.4 U	10 U	9.6 U	9.7 U	14 U	10 U	10 U	9.7 U	9.8 U
1,4-Dichlorobenzene	9.4 U	10 U	9.6 U	9.7 U	14 U	10 U	10 U	9.7 U	9.8 U
2-Butanone	9.4 U	10 U	9.6 U	9.7 U	14 U	10 U	10 U	9.7 U	9.8 U
2-Hexanone	9.4 U	10 U	9.6 U	9.7 U	14 U	10 U	10 U	9.7 U	9.8 U
4-Methyl-2-pentanone	9.4 U	10 U	9.6 U	9.7 U	14 U	10 U	10 U	9.7 U	9.8 U
Acetone	11 U	10 U	18 U	11 U	39 R	24 U	4.5 R	9.7 R	9.8 U
Benzene	9.4 U	10 U	9.6 U	9.7 U	14 U	10 U	10 U	9.7 U	9.8 U
Bromodichloromethane	9.4 U	10 U	9.6 U	9.7 U	14 U	10 U	10 U	9.7 U	9.8 U
Bromoform	9.4 U	10 U	9.6 U	9.7 U	14 U	10 U	10 U	9.7 U	9.8 U
Bromomethane	9.4 U	10 U	9.6 U	9.7 U	14 U	10 U	10 U	9.7 U	9.8 U
Carbon disulfide	9.4 U	10 U	9.6 U	9.7 U	14 U	10 U	10 U	9.7 U	9.8 U
Carbon tetrachloride	9.4 U	10 U	9.6 U	9.7 U	14 U	10 U	10 U	9.7 U	9.8 U
Chlorobenzene	9.4 U	10 U	9.6 U	9.7 U	14 U	10 U	10 U	9.7 U	9.8 U
Chloroethane	9.4 U	10 U	9.6 U	9.7 U	14 U	10 U	10 U	9.7 U	9.8 U
Chloroform	9.4 U	10 U	9.6 U	9.7 U	14 U	10 U	10 U	9.7 U	9.8 U
Chloromethane	9.4 U	10 U	9.6 U	9.7 U	14 U	10 U	10 U	9.7 U	9.8 U
cis-1,2-Dichloroethene	9.4 U	10 U	1.2 J	9.7 U	14 U	10 U	10 U	9.7 U	9.8 U
cis-1,3-Dichloropropene	9.4 U	10 U	9.6 U	9.7 U	14 U	10 U	10 U	9.7 U	9.8 U
Cyclohexane	9.4 U	10 U	0.75 J	9.7 U	14 U	10 U	10 U	9.7 U	9.8 U
Dibromochloromethane	9.4 U	10 U	9.6 U	9.7 U	14 U	10 U	10 U	9.7 U	9.8 U
Dichlorodifluoromethane (Freon-12)	9.4 U	10 U	9.6 U	9.7 U	14 U	10 U	10 U	9.7 U	9.8 U
Ethylbenzene	0.78 J	10 U	9.6 U	9.7 U	1.3 J	10 U	0.79 J	0.77 J	9.8 U
Isopropylbenzene	9.4 U	10 U	9.6 UJ	9.7 U	14 U	10 U	10 U	9.7 U	9.8 U
Methyl acetate	9.4 U	10 U	9.6 UJ	9.7 U	14 U	10 U	10 U	9.7 U	9.8 U
Methylcyclohexane	9.4 U	10 U	0.69 J	9.7 U	14 U	10 U	10 U	9.7 U	9.8 U
Methylene chloride	10	4.4 J	5.3 J	3 J	14 U	10 U	10 U	9.7 U	2.3 J
Methyl-tert-butyl ether (MTBE)	9.4 U	10 U	9.6 U	9.7 U	14 U	10 U	10 U	9.7 U	9.8 U
Styrene	9.4 U	10 U	9.6 UJ	9.7 U	14 U	10 U	10 U	9.7 U	9.8 U
Tetrachloroethene	9.4 U	10 U	9.6 U	9.7 U	14 U	10 U	10 U	9.7 U	9.8 U
Toluene	0.93 J	10 U	9.6 U	9.7 U	14 U	10 U	10 U	9.7 U	9.8 U
trans-1,2-Dichloroethene	9.4 U	10 U	9.6 U	9.7 U	14 U	10 U	10 U	9.7 U	9.8 U
trans-1,3-Dichloropropene	9.4 U	10 U	9.6 U	9.7 U	14 U	10 U	10 U	9.7 U	9.8 U
Trichloroethene	9.4 U	10 U	1.5 J	9.7 U	14 U	10 U	10 U	9.7 U	9.8 U
Trichlorofluoromethane(Freon-11)	9.4 U	10 U	9.6 U	9.7 U	14 U	10 U	10 U	9.7 U	9.8 U
Vinyl chloride	9.4 U	10 U	9.6 U	9.7 U	14 U	10 U	10 U	9.7 U	9.8 U
Xylene, total	3.2 J	10 U	9.6 U	9.7 U	14 U	10 U	10 U	9.7 U	1.5 J

CTO-40, LSA
Camp Lejeune - Site 49
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July 2009

Station ID	IR49-IS01		IR49-IS02	IR49-IS04	IR49-IS05	IR49-IS06	IR49-IS07	IR49-IS08	IR49-TW02
Sample ID	IR49-IS01-7-8-09C	IR49-IS01D-7-8-09C	IR49-IS02-6-7-09C	IR49-IS04-6.5-7.5-09C	IR49-IS05-4-5-09C	IR49-IS06-7-8-09C	IR49-IS07-9-10-09C	IR49-IS08-8-9-09C	IR49-TW-S02-8-9-09C
Sample Date	07/08/09	07/08/09	07/09/09	07/09/09	07/09/09	07/09/09	07/09/09	07/09/09	07/09/09
Chemical Name									
Semivolatile Organic Compounds (µg/kg)									
1,1-Biphenyl	250 U	260 U	260 U	250 U	2,100 U	240 U	260 U	250 U	260 U
2,2'-Oxybis(1-chloropropane)	250 UJ	260 UJ	260 U	250 UJ	2,100 U	240 UJ	260 U	250 U	260 U
2,4,5-Trichlorophenol	490 U	520 U	510 U	500 U	4,100 U	490 U	520 U	500 U	520 U
2,4,6-Trichlorophenol	250 U	260 U	260 U	250 U	2,100 U	240 U	260 U	250 U	260 U
2,4-Dichlorophenol	250 U	260 U	260 U	250 U	2,100 U	240 U	260 U	250 U	260 U
2,4-Dimethylphenol	250 U	260 U	260 U	250 U	2,100 U	240 U	260 U	250 U	260 U
2,4-Dinitrophenol	490 U	520 U	510 U	500 U	4,100 U	490 U	520 U	500 U	520 U
2,4-Dinitrotoluene	250 U	260 U	260 U	250 U	2,100 U	240 U	260 U	250 U	260 U
2,6-Dinitrotoluene	250 U	260 U	260 U	250 U	2,100 U	240 U	260 U	250 U	260 U
2-Chloronaphthalene	250 U	260 U	260 U	250 U	2,100 U	240 U	260 U	250 U	260 U
2-Chlorophenol	250 U	260 U	260 U	250 U	2,100 U	240 U	260 U	250 U	260 U
2-Methylnaphthalene	250 U	260 U	260 U	250 U	2,100 U	240 U	260 U	250 U	260 U
2-Methylphenol	250 UJ	260 UJ	260 U	250 UJ	2,100 U	240 UJ	260 U	250 U	260 U
2-Nitroaniline	490 U	520 U	510 U	500 U	4,100 U	490 U	520 U	500 U	520 U
2-Nitrophenol	250 U	260 U	260 U	250 U	2,100 U	240 U	260 U	250 U	260 U
3,3'-Dichlorobenzidine	250 UJ	260 UJ	260 UJ	250 UJ	2,100 U	240 UJ	260 UJ	250 UJ	260 UJ
3-Nitroaniline	490 U	520 U	510 U	500 U	4,100 U	490 U	520 U	500 U	520 U
4,6-Dinitro-2-methylphenol	490 U	520 U	510 U	500 U	4,100 U	490 U	520 U	500 U	520 U
4-Bromophenyl-phenylether	250 U	260 U	260 U	250 U	2,100 U	240 U	260 U	250 U	260 U
4-Chloro-3-methylphenol	250 U	260 U	260 U	250 U	2,100 UJ	240 U	260 U	250 U	260 U
4-Chloroaniline	250 U	260 U	260 U	250 U	2,100 U	240 U	260 U	250 U	260 U
4-Chlorophenyl-phenylether	250 U	260 U	260 U	250 U	2,100 U	240 U	260 U	250 U	260 U
4-Methylphenol	250 U	260 U	260 UJ	250 U	2,100 U	240 U	260 UJ	250 UJ	260 UJ
4-Nitroaniline	490 U	520 U	510 U	500 U	4,100 U	490 U	520 U	500 U	520 U
4-Nitrophenol	490 U	520 U	510 U	500 U	4,100 U	490 U	520 U	500 U	520 U
Acenaphthene	250 U	260 U	260 U	250 U	2,100 U	240 U	260 U	250 U	260 U
Acenaphthylene	250 U	260 U	260 U	250 U	2,100 U	240 U	260 U	250 U	260 U
Acetophenone	250 UJ	260 UJ	260 U	250 UJ	2,100 U	240 UJ	260 U	250 U	260 U
Anthracene	250 U	260 U	260 UJ	250 U	2,100 U	240 U	260 UJ	250 UJ	260 UJ
Atrazine	250 U	260 U	260 U	250 U	2,100 U	240 U	260 U	250 U	260 U
Benzaldehyde	250 UJ	260 UJ	260 U	250 UJ	2,100 U	240 UJ	260 U	250 U	260 U
Benzo(a)anthracene	62 U	64 U	64 U	63 U	390 U	61 U	65 U	63 U	64 U
Benzo(a)pyrene	6.6 U	6.9 U	1.5 J	6.7 U	500 J	6.5 U	1.4 J	1.5 J	1.3 J
Benzo(b)fluoranthene	62 U	64 U	2.3 J	63 U	430 J	61 U	65 U	63 U	2.1 J
Benzo(g,h,i)perylene	250 U	260 U	260 U	250 U	3,000	240 U	260 U	250 U	260 U
Benzo(k)fluoranthene	250 U	260 U	260 U	250 U	2,100 U	240 U	260 U	250 U	260 U
bis(2-Chloroethoxy)methane	250 UJ	260 UJ	260 U	250 UJ	2,100 U	240 UJ	260 U	250 U	260 U
bis(2-Chloroethyl)ether	250 UJ	260 UJ	260 U	250 UJ	2,100 U	240 UJ	260 U	250 U	260 U
bis(2-Ethylhexyl)phthalate	250 U	260 U	260 U	250 U	2,100 U	240 U	260 U	250 U	260 U
Butylbenzylphthalate	250 U	260 U	260 U	250 U	2,100 U	240 U	260 U	250 U	260 U
Caprolactam	200 J	190 J	160 J	150 J	2,100 UJ	150 J	260 U	150 J	230 J
Carbazole	250 U	260 U	260 U	250 U	2,100 U	240 U	260 U	250 U	260 U
Chrysene	250 U	260 U	260 U	250 U	2,100 U	240 U	260 U	250 U	260 U
Dibenz(a,h)anthracene	15 U	16 U	16 U	15 U	280 U	15 U	16 U	15 U	16 U
Dibenzofuran	250 U	260 U	260 U	250 U	2,100 U	240 U	260 U	250 U	260 U
Diethylphthalate	250 U	260 U	260 U	250 U	2,100 U	240 U	260 U	250 U	260 U
Dimethyl phthalate	250 U	260 U	260 U	250 U	2,100 U	240 U	260 U	250 U	260 U
Di-n-butylphthalate	250 U	260 U	260 U	250 U	2,100 U	240 U	260 U	250 U	260 U
Di-n-octylphthalate	410 U	430 U	430 U	420 U	3,400 U	410 U	430 U	420 U	430 U
Fluoranthene	250 U	260 U	260 U	250 U	2,100 U	240 U	260 U	250 U	260 U
Fluorene	250 U	260 U	260 U	250 U	2,100 U	240 U	260 U	250 U	260 U

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Station ID	IR49-IS01		IR49-IS02	IR49-IS04	IR49-IS05	IR49-IS06	IR49-IS07	IR49-IS08	IR49-TW02
Sample ID	IR49-IS01-7-8-09C	IR49-IS01D-7-8-09C	IR49-IS02-6-7-09C	IR49-IS04-6.5-7.5-09C	IR49-IS05-4-5-09C	IR49-IS06-7-8-09C	IR49-IS07-9-10-09C	IR49-IS08-8-9-09C	IR49-TW-S02-8-9-09C
Sample Date	07/08/09	07/08/09	07/09/09	07/09/09	07/09/09	07/09/09	07/09/09	07/09/09	07/09/09
Chemical Name									
Hexachlorobenzene	250 U	260 U	260 U	250 U	2,100 U	240 U	260 U	250 U	260 U
Hexachlorobutadiene	250 U	260 U	260 U	250 U	2,100 U	240 U	260 U	250 U	260 U
Hexachlorocyclopentadiene	250 U	260 U	260 UJ	250 U	2,100 U	240 U	260 UJ	250 UJ	260 UJ
Hexachloroethane	250 U	260 U	260 U	250 U	2,100 U	240 U	260 U	250 U	260 U
Indeno(1,2,3-cd)pyrene	62 U	64 U	64 U	63 U	740 U	61 U	65 U	63 U	64 U
Isophorone	62 U	64 U	64 U	63 U	520 UJ	61 U	65 U	63 U	64 U
Naphthalene	250 U	260 U	260 U	250 U	2,100 U	240 U	260 U	250 U	260 U
n-Nitroso-di-n-propylamine	31 UJ	33 UJ	33 U	32 UJ	260 UJ	31 UJ	33 UJ	32 UJ	33 UJ
n-Nitrosodiphenylamine	250 U	260 U	260 U	250 U	2,100 U	240 U	260 U	250 U	260 U
Nitrobenzene	250 U	260 U	260 UJ	250 U	2,100 U	240 U	260 UJ	250 UJ	260 UJ
Pentachlorophenol	65 UJ	72 UJ	70 UJ	70 UJ	170 U	65 UJ	69 U	66 U	69 U
Phenanthrene	250 U	260 U	260 UJ	250 U	2,100 U	240 U	260 UJ	250 UJ	260 UJ
Phenol	250 U	260 U	260 U	250 U	2,100 UJ	240 U	260 U	250 U	260 U
Pyrene	250 U	260 U	260 U	250 U	410 J	240 U	260 U	250 U	260 U
Total Metals (mg/kg)									
Aluminum	14,900	17,000	15,200	14,700	1,540	13,300	12,700	13,000	14,200
Antimony	0.9 R	0.94 R	0.95 R	0.93 R	0.77 R	0.9 R	0.94 R	0.91 R	0.94 R
Arsenic	2.1 J	1.5 J	6.8 J	2.1 J	1.2 J	2.9 J	2.9 J	4.4 J	1.3 J
Barium	21.9	26.2	18.5	17.8	14.1	21.2	24.1	23.1	16.5
Beryllium	0.167 J	0.192 J	0.18 J	0.155 J	0.114 J	0.164 J	0.185 J	0.192 J	0.179 J
Cadmium	0.299 U	0.315 U	0.315 U	0.311 U	0.116 J	0.301 U	0.314 U	0.304 U	0.314 U
Calcium	103 J	106 J	336	331	31,700	301 U	314 U	304 U	163 J
Chromium	19.8 J	21.3 J	27.8 J	18.1 J	2.5 J	19.2 J	19.4 J	19.7 J	20.6 J
Cobalt	0.63 J	0.79 J	0.43 J	0.53 J	0.59 J	0.62 J	0.57 J	0.55 J	0.68 J
Copper	3	4.3	4.2	2.6	2	3.2	2.9	2.9	3.3
Iron	6,430 J	4,020 J	18,400 J	6,130 J	2,050 J	6,710 J	7,880 J	11,800 J	4,200 J
Lead	14.5	16.4	13.5	13.7	6.2	12.8	12.2	13.7	19.7
Magnesium	489 J	577 J	704 J	460 J	4,710 J	498 J	567 J	512 J	542 J
Manganese	7	9.3	6.9	6.8	51.1	7	7.4	7.1	10.7
Mercury	0.041 U	0.025 J	0.043 U	0.039 U	0.031 U	0.021 J	0.047	0.036 J	0.02 J
Nickel	1.9	2.1 J	1.7	1.8	4.2	1.7	1.7	1.7	1.9
Potassium	491 J	568 J	663 J	425 J	228 J	527 J	576 J	552 J	609 J
Selenium	0.24 J	0.21 J	0.61	0.34	0.17 J	0.3 U	0.2 J	0.54	0.23 J
Silver	0.597 U	0.629 U	0.631 U	0.621 U	0.514 U	0.602 U	0.627 U	0.608 U	0.627 U
Sodium	299 UJ	315 UJ	277 J	224 J	257 UJ	142 J	232 J	92.4 J	232 J
Thallium	0.48 U	0.5 U	0.5 U	0.5 U	0.41 U	0.48 U	0.5 U	0.49 U	0.5 U
Vanadium	30.9 J	15.6 J	40.6 J	23.9 J	22.6 J	25.9 J	20.2 J	38 J	16.4 J
Zinc	6.5	7.2	6.7	5.5	11	5.9	5.9	6.2	7

Notes:

Shading indicates detections
NA - Not analyzed
J - Analyte present, value may or may not be accurate or precise
R - Unreliable Result
U - The material was analyzed for, but not detected
UJ - Analyte not detected, quantitation limit may be inaccurate
mg/kg - Milligrams per kilogram
µg/kg - Micrograms per kilogram

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9285

Send Results to:	Send Invoice to:	Analysis Requirements:	Lab Use Only:
Name Rebekka Shaw	Name David Lubell		VOA Headspace Y N NA
Company CH2M HILL	Company CH2M HILL		Field Filtered Y N NA
Address 5700 Cleveland St	Address 3201 Beechleaf Ct Ste 300		Correct Containers Y N NA
City Virginia Beach	City Raleigh		Discrepancies Y N NA
State, Zip VA 23462	State, Zip NC 27604		Cust. Seals Intact Y N NA
Phone 757-671-6279	Phone 919-760-1788		Containers Intact Y N NA
Fax 757-497-6885	Fax 919-875-8991		Airbill #:
E-mail Rebekka.shaw@ch2m.com	E-mail David.Lubell@ch2m.com		CAR #:
Project No./Name:	Sampler's (Signature):		

Lab Use Only Lab #	Date/Time Sampled	Sample Description	Sample Matrix	VOCs 8260B	Comments	No. of Bottles	Lab Use Only Containers/Pres.
	2/18/2010 0900	IR49-FB02182010	GW	X			
	2-18-10 1115	IR49-TW06-10A					
	2-18-10 1245	IR49-TW07-10A					
	2-18-10 1345	IR49-TW01R-10A					
	2-18-10 1445	IR49-TW05-10A					
	2-18-10 1450	IR49-TW05-10A-MS					
	2-18-10 1500	IR49-TW05-10A-SD					
	2-18-10 1725	IR49-EB1-021810-GW					
	2-18-10 1740	IR49-TW08-10A					
	2-18-10 1745	IR49-TW08D-10A					
	2-19-10 0825	IR49-EB2-021910-GW					
	2-19-10 1400	IR49-TW04-10A					

Sample Kit Prep'd by: (Signature)	Date/Time 2/19/2010 1500	Received By: (Signature)
Relinquished by: (Signature)	Date/Time	Received By: (Signature)
Relinquished by: (Signature)	Date/Time	Received By: (Signature)
Received for Laboratory by: (Signature)	Date/Time	*Temperature*

REMARKS:

Details:

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Send Results to:	Send Invoice to:
Name Rebekka Strand	Name
Company CH2M HILL	Company SAME
Address 5700 Cleveland St	Address
City VA Beach	City
State, Zip VA	State, Zip
Phone 757-671-6284	Phone
Fax	Fax
E-mail rebekka.strand@ch2m.com	E-mail
Project No./Name: CTO-40 / 350 Wide Flex	Sampler's (Signature):

Analysis Requirements: 8260B - VOCs; 8270C - SVOCs; 6010B - TAL METALS

Lab Use Only:

VOA Headspace	Y	N	NA
Field Filtered	Y	N	NA
Correct Containers	Y	N	NA
Discrepancies	Y	N	NA
Cust. Seals Intact	Y	N	NA
Containers Intact	Y	N	NA

Airbill #:

CAR #:

Lab Use Only Lab #	Date/Time Sampled	Sample Description	Sample Matrix	8260B - VOCs	8270C - SVOCs	6010B - TAL METALS	Comments	No. of Bottles	Lab Use Only Containers/Pres.
	7/9/09/1240	IR49-IS01-7-7-09C	SO	X	X	X		6	
	7/9/09 1250	IR49-IS01D-7-8-09C	SO	X	X	X		6	
	7/9/09 0810	IR49-IS02-6-7-09C	SO	X	X	X		6	
	7/9/09 0810	IR49-IS02-6-7-09C-MS	SO	X	X	X	Matrix Spike	6	
	7/9/09 0810	IR49-IS02-6-7-09C-SD	SO	X	X	X	Matrix Spike Dup	6	
	7/9/09 1030	IR49-IS04-6.5-7.5-09C	SO	X	X	X		6	
	7/9/09 1100	IR49-IS06-7-8-09C	SO	X	X	X		6	
	7/9/09 1245	IR49-TW-S02-8-9-09C	SO	X	X	X		6	
	7/9/09 1320	IR49-IS05-4-5-09C	SO	X	X	X		6	
	7/9/09 1400	IR49-IS08-8-9-09C	SO	X	X	X		6	
	7/9/09 1430	IR49-IS07-9-10-09C	SO	X	X	X		6	
	7/9/09 1545	IR49-TB-070909	W	X	X	X	~~Field Blank~~ Trip Blank	6	

Sample Kit Prep'd by: (Signature)	Date/Time 7/8/09 1630	Received By: (Signature)
Relinquished by: (Signature)	Date/Time 7/9/09 1630	Received By: (Signature) FEDEX
Relinquished by: (Signature)	Date/Time	Received By: (Signature)
Received for Laboratory by: (Signature)	Date/Time	*Temperature*

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FEDEX AIRBILL #
8645 0788 1040

Details:

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Send Results to:	Send Invoice to:
Name [illegible]	Name
Company [illegible]	Company
Address 5400 Cleveland St	Address SAME
City Virginia Beach	City
State, Zip VA	State, Zip
Phone 757-671-6079	Phone
Fax	Fax
E-mail [illegible]	E-mail
Project No./Name: [illegible]	**Sampler's (Signature):**

Analysis Requirements: 8260B - VOCs; 8270C - SVOCs; 6010B - TAL Metals

Lab Use Only:

VOA Headspace	Y	N	NA
Field Filtered	Y	N	NA
Correct Containers	Y	N	NA
Discrepancies	Y	N	NA
Cust. Seals Intact	Y	N	NA
Containers Intact	Y	N	NA

Airbill #:

CAR #:

Lab Use Only Lab #	Date/Time Sampled	Sample Description	Sample Matrix	8260B - VOCs	8270C - SVOCs	6010B - TAL Metals	Comments	No. of Bottles	*Lab Use Only* Containers/Pres.
	7/9/09 1600	IR49-EB-070909-DP	W	X	X	X	Equip. Blk.	6	
	7/9/09 1545	IR4-FB-070909	W	X	X	X	Field Blk.	6	
	7/9/09 1620	IR49-TB-070909	W	X			Trip Blank	2	

Sample Kit Prep'd by: (Signature)	Date/Time 7/10/09 1:30	Received By: (Signature)
Relinquished by: (Signature)	Date/Time 7/10/09 1:47	Received By: (Signature) FEDEX
Relinquished by: (Signature)	Date/Time	Received By: (Signature)
Received for Laboratory by: (Signature)	Date/Time	*Temperature*

REMARKS:
FEDEX AIRBILL #

Details:
Page 1 of 1
Cooler No. 1 of 1
Date Shipped 7/9/09
Shipped By FEDEX
Turnaround CONTRACT

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Appendix C
Human Health Risk Screening

APPENDIX C

Human Health Risk Evaluation

A conservative preliminary human health risk screening was performed to assess the potential for human health risks associated with exposure to site media (soil and groundwater). The results of the human health risk screening provide a preliminary indication of potential risks from constituents of potential concern (COPCs), and are used to help evaluate whether future unrestricted (i.e., residential) use of the site is acceptable based on human health risks or if the site requires further evaluation (e.g., a baseline risk assessment, additional data collection and evaluation).

The data included in the risk evaluation were all validated. The validated data were evaluated to determine the reliability of the data for use in the HHRA. A review of the data identified the following criteria for data usability:

- Data qualified with an R (rejected) were not used in the HHRS.
- Estimated values flagged with a J qualifier were treated as detected concentrations.
- For duplicate samples, the maximum concentration between the two samples was used as the sample concentration.
- Unfiltered groundwater samples were analyzed in the risk evaluations following USEPA Region IV guidance (USEPA, 2000).

Human Health Conceptual Site Model

The human health conceptual site model (CSM) presents an overview of site conditions, potential contaminant migration pathways, and exposure pathways to potential receptors. The human health CSM for subsurface soil and groundwater is presented in Figure C-1. Surface contamination was not expected at the site based on past site activities, and surface soil samples were not collected. Therefore, surface soil was not evaluated in this HHRS. In addition, surface water and sediment are not included and will be addressed in the future remedial investigation

Site 49, the MCAS Suspected Minor Dump, consists of approximately 2 acres of wooded land along 800 feet of the New River shoreline. The site is undeveloped with thick underbrush and trees. Reportedly, the site contains minor quantities of paint related waste. Access to the Site can be obtained from adjacent roads. A steel building (AS810) is located approximately 50 feet (ft) from the northeast boundary of the site and is currently used for storage of miscellaneous industrial materials.

Potential current receptors at the site include visitors and trespassers who may come in contact with subsurface soil. Exposure routes may include incidental ingestion of and dermal contact with the subsurface soil, and inhalation of volatile and particulate emissions from the subsurface soil.

Potential future receptors include the current receptors, and future residents, industrial workers, and construction workers. Future receptors could be exposed to subsurface soil if future residential houses or additional industrial buildings or piping/utilities are constructed at the site and the soil is re-worked, mixing the subsurface soil with the surface soil. Exposure routes for future exposure to the subsurface soil are the same as those for current subsurface soil, incidental ingestion of and dermal contact with the soil, and inhalation of volatile and particulate emissions from the soil.

Potable water supplies for MCB Camp Lejeune and the surrounding residential area are provided by water supply wells that pump groundwater from the Castle Hayne aquifer. Although freshwater is present within the surficial, Castle Hayne, Beaufort, and Peedee aquifers, all of which are located below MCB Camp Lejeune, only the Castle Hayne aquifer is used by MCB Camp Lejeune as a water supply source (Cardinell, Berg, and Lloyd, 1993). Twenty of the 30 wells are known to be active water supply wells serving the Camp Geiger, Holcomb Boulevard, MCAS, Verona Loop well fields with eight of the 30 wells known to be inactive (AHEC, 2002).

The groundwater use patterns are already established for the Base and area around Site 49, thus use of site groundwater for industrial or residential purposes is unlikely. In addition, part of Site 49 is located in jurisdictional wetlands, which further limits future industrial or residential land use. However, state and federal governing policies assume that underground fresh water resources are potable, and should be aimed to be maintained as such. Therefore, a potable use scenario was evaluated in this risk assessment. It was assumed that if future residential development of the site occurs, the residents could use the groundwater as a potable water supply. The residents would be exposed through ingestion, and dermal contact and inhalation while bathing. It was also assumed that the groundwater could be used as a future potable water supply for industrial workers, and the industrial workers would be exposed through ingestion. Additionally, due to the groundwater depth (from 4 to 11 feet bgs), construction workers could be exposed to the groundwater through inhalation of volatiles and dermal contact in an excavation during construction activities.

There were VOCs detected in groundwater at the site; therefore, vapor intrusion into future buildings was considered a potentially complete exposure pathway and was evaluated in the risk assessment.

Human Health Risk-Based Screening and Risk Ratio Evaluation Methodology

The human health risk screening was conducted in three steps using a risk ratio technique (Navy, 2000). If chemicals of potential concern (COPCs) were identified after Step 1, the COPCs were evaluated in Step 2. If COPCs were identified after Step 2, the COPCs were evaluated in Step 3. In addition, vapor intrusion into indoor air was evaluated in the HHRS. Results of the risk-based screening and risk ratio evaluation for Site 49 are presented in the Table 2 series. A detailed description of the three-step screening process is described below:

Step 1

The maximum detected analyte concentrations for each medium were compared to USEPA Regional Screening Levels (RSLs; USEPA, 2010) and other human health risk screening levels (if appropriate). The soil and groundwater data were also compared to the MCB Camp Lejeune background data from the Final Base Background Soil Study Report and

Draft Base Background Groundwater Study Report, respectively (Baker, 2001 and Baker, 2002). Background values used were two times the mean background concentration. RSLs based on noncarcinogenic effects were divided by 10 to account for exposure to multiple constituents (i.e., were adjusted to a hazard quotient [HQ] of 0.1, from the HQ of 1.0 used on the RSL table). RSLs based on carcinogenic endpoints were used as presented in the RSL table and are based on a carcinogenic risk of 1×10^{-6}.

The soil data were compared to residential soil RSLs. Residential soil RSLs are more conservative (i.e., lower) than industrial soil RSLs and are therefore protective of all potential receptors (e.g., residents, industrial workers, construction workers). North Carolina Soil Screening Levels (NCSSL) are also shown on the Step 1 screening tables for comparison. The groundwater data were compared to tap water RSLs. Groundwater data were also compared to MCLs (USEPA, 2010) and the North Carolina Groundwater Quality Standards (NCGWQS), however, these comparisons were not used to identify the groundwater COPCs to carry forward to Step 2.

If the maximum detected concentration in soil or groundwater exceeded the appropriate screening value and background concentration, the screening level risk evaluation proceeded to Step 2.

In addition to comparing the detected concentrations to the screening levels, the detection limits for non-detected analytes were compared to the screening levels. Non-detected analytes with detection limits exceeding the screening level were not identified as COPCs to carry forward to Step 2, but were discussed to evaluate the potential for underestimating the total risks.

Step 2

For analytes identified as COPCs in Step 1, a corresponding risk level was calculated using the following equation:

$$\textit{corresponding risk level} = \frac{\textit{concentration} \times \textit{acceptable risk level}}{\textit{RSL}}$$

The concentration is the maximum detected concentration (the same concentration that was used in Step 1). The acceptable risk level is 1 for noncarcinogens and 10^{-6} for carcinogens. RSLs for noncarcinogenic effects were not adjusted by 10 as was done in Step 1, they are used as presented in the RSL table.

All of the corresponding risk levels for each analyte within a media were summed to calculate the cumulative corresponding HI (for noncarcinogens) and cumulative corresponding carcinogenic risk (for carcinogens). A cumulative corresponding HI was also calculated for each target organ/effect. If the cumulative corresponding HI for a target organ/effect is greater than 0.5, or the cumulative corresponding carcinogenic risk is greater than 5×10^{-5}, the anayltes contributing to these values are retained as COPCs and carried forward to Step 3.

Step 3

A corresponding risk level was calculated as discussed above for Step 2; however, the 95 percent upper confidence limit (UCL) was used in place of the maximum detected concentration, if more than five samples were available for that media, to obtain a more site-specific risk ratio. If the cumulative corresponding HI by target organ/effect is greater than 0.5, or the cumulative corresponding carcinogenic risk is greater than 5×10^{-5}, then constituents contributing to these values are considered COPCs.

ProUCL Version 4.00.04 (USEPA, 2009) was used to test the data distribution and calculate 95 percent UCL used for the Step 3 risk ratio calculations.

Vapor Intrusion from Groundwater to Indoor Air

Groundwater risk-based screening levels protective of the vapor intrusion exposure pathway were calculated using the methodology described in **Appendix D** of the *OSWER Draft Guidance for Evaluating the Vapor Intrusion to Indoor Air Pathway from Groundwater and Soils (Subsurface Vapor Intrusion Guidance)* (USEPA, 2002). The target groundwater concentration was calculated by dividing the target indoor air concentration by an attenuation factor (AF) that accounts for the diffusion resistance across the capillary fringe, and then converting the vapor concentration to an equivalent groundwater concentration, assuming the equilibrium partitioning obeys Henry's Law. The equation is as follows (USEPA, 2002):

$$C_{gw}\ [\mu g/L] = C_{target,ia}\ (\mu g/m^3) * 10^{-3}\ m^3/L * 1/H'_{TS} * 1/\alpha$$

where,

Cgw = target groundwater concentration (i.e., GWSL),
$C_{target,ia}$ = target indoor air concentration (i.e., RSLs for residential air),
MW = molecular weight (g/mole)
α = AF (default ratio of indoor air concentration to source vapor concentration; 1E-03), and
H'_{TS} = Henry's Law Constant at system (groundwater) temperature (dimensionless)

The dimensionless form of the Henry's law constant at the system temperature (i.e., at the average groundwater temperature) was estimated using the following equation:

$$H'_{TS} = \frac{\exp\left[-\frac{\Delta H_{v,TS}}{RT_s}\left(\frac{1}{T_S} - \frac{1}{T_R}\right)\right] H_R}{RT_S}$$

where,

H'_{TS} = Henry's law constant at the system temperature (dimensionless)

$\Delta H_{v,TS}$ = Enthalpy of vaporization at the system temperature (cal/mol)
T_S = System temperature (°K)
T_R = Henry's law constant reference temperature (°K)
H_R = Henry's law constant at the reference temperature (atm-m3/mol)
R_C = Gas constant (= 1.9872 cal/mol - °K)
R = Gas constant (= 8.205 E-05 atm-m3/mol-°K)

The enthalpy of vaporization at the system temperature is calculated using the following equation:

$$\Delta H_{v,TS} = \Delta H_{v,b}\left[\frac{(1-T_S/T_C)}{(1-T_B/T_C)}\right]^n$$

where,

$\Delta H_{v,TS}$ = Enthalpy of vaporization at the system temperature (cal/mol)
$\Delta H_{v,b}$ = Enthalpy of vaporization at the normal boiling point (cal/mol)
T_S = System temperature (°K)
T_C = Critical temperature (°K)
T_B = Normal boiling point (°K)
n = Constant (unitless) (The value of n is a function of the ratio of T_B /T_C.)

The groundwater risk-based screening levels were calculated for noncarcinogenic and carcinogenic endpoints. Only volatile chemicals that were detected in groundwater were screened for the vapor intrusion exposure pathway.

Human Health Risk Screening Results

The human health risk-based screening (comparison to risk-based criteria and background levels, Step 1) and risk ratio evaluation (Steps 2 and 3) were performed for soil and groundwater.

Subsurface Soil

Tables 2.1 through 2.1b, **Appendix C**, present the risk-based screening and risk ratio evaluation for subsurface soil at Site 49. As shown on Table 2.1, **Appendix C**, two SVOCs (benzo(a)pyrene and benzo(b)fluoranthene) and five metals (aluminum, arsenic, chromium, iron, and vanadium) exceeded the first step of the screening and were identified as COPCs for evaluation in Step 2. Based on Step 2 of the screening process (Table 2.1a, **Appendix C**), the two SVOCs and two of the metals (arsenic and chromium) were carried forward to Step 3, where the 95% UCL concentration resulted in a cumulative carcinogenic risk above the screening criteria , Table 2.1b, **Appendix C**.

Chromium is the main contributor to the carcinogenic risk associated with the subsurface soil. The analytical data for chromium is for total chromium, however, the RSL used for the

screening is for hexavalent chromium, the more toxic (and carcinogenic) valence state of chromium. In the past, prior to including the New Jersey EPA oral cancer slope factor for hexavalent chromium in the table, EPA's RSL table presented a residential soil RSL for total chromium assuming a one to six ratio of hexavalent chromium to trivalent chromium. Assuming this ratio applies for subsurface soil at Site 49, the maximum concentration of hexavalent chromium (the total measured chromium concentration multiplied by 1/6) would not result in an unacceptable risk associated with exposure to the chromium. It also needs to be noted that there is some uncertainty associated with the hexavalent chromium oral cancer slope factor, and RSL, as the value is from New Jersey EPA, and has not been included in EPA's IRIS database. Elimination of chromium as a COPC in subsurface soil would also result in elimination of all other COPCs in Step 3 as they do not contribute significantly (above $5x10^{-5}$) to the cumulative calculated risk.

Therefore, exposure to Site 49 subsurface soil would not result in an unacceptable risk to human receptors and further evaluation of subsurface soil at Site 49 based on human health is not necessary.

Groundwater

Tables 2.2 through 2.2b, **Appendix C** present the risk-based screening and risk ratio evaluation for groundwater. As shown on Table 2.2, **Appendix C**, nine VOCs (1,1,2,2-tetrachloroethane; 1,1,2-trichloroethane; 1,2-dichloroethane; benzene; tetrachloroethene; trichloroethene; vinyl chloride; cis-1,2-dichloroethene; and trans-1,2-dichloroethene) and seven metals (aluminum, arsenic, chromium, cobalt, iron, manganese, and nickel) exceeded the first step of the screening and were identified as COPCs for evaluation in Step 2. Based on Step 2 (risk ratio using maximum detected concentrations, Table 2.2a, **Appendix C**), eight of the VOCs and six of the metals were carried forward to Step 3, where the 95% UCL concentration resulted in a cumulative carcinogenic risk above the screening criteria , Table 2.2b, **Appendix C**).

Clays are secondary minerals that form through the weathering of primary minerals (i.e. Feldspars) and belong to 5 mineral groups including; Kaolinite, Illite, Vermiculite, Smectite, and Chlorite. This type of soil contains significant amounts of aluminum, iron, and magnesium and is typically found in conjunction with secondary oxide minerals including iron oxides (i.e. Goethite) and manganese oxides (i.e. Birnessite). Cations (positively charged atoms in a molecule) found within clays generally consist of metals such as iron oxides (i.e. iron as Fe^{2+}) and can dissolve in groundwater. Additionally, due to the proximity of Site 49 to the New River, and the evidence of tidally influenced groundwater levels, the groundwater in the surficial aquifer in the vicinity of the temporary wells at Site 49 may contain brackish water with an additional supplement of dissolved metals. The elevated concentrations of aluminum, iron, and manganese groundwater appear to be a product of the natural chemical composition of the constituents in the soil rather than historical land use practices at Site 49. Based on this, metals can be eliminated as COPCs for groundwater.

All eight VOCs are retained as COPCs for groundwater. Future exposure to groundwater could potentially result in risks above acceptable levels, therefore further investigation of groundwater at Site 49 is recommended.

Tables 2.3 and 2.3a, **Appendix C**, present the vapor intrusion from groundwater into indoor air evaluation. Six of the seventeen volatile chemicals detected in groundwater were above the vapor intrusion screening levels. Currently, there are no buildings on Site 49. The only building near the site is a storage building located approximately 50 feet northeast from the site. Therefore, vapor intrusion is currently incomplete and potential risks from groundwater to indoor air were not carried forward past Step 1 in this assessment. If buildings are constructed at the site over the underlying VOC contamination in groundwater, an evaluation of potential exposures to building inhabitants should be considered. It is important to note that the vapor intrusion screening levels used in this assessment are very conservative and assume the site will be developed for residential use and residents would be living on-site. Additionally, these residences would need to be constructed within 100 feet of any of the exceedances of screening values for potentially unacceptable risks.

Comparison of Detection Limits for Non-Detected Analytes to Screening Levels

For soil, there was one VOC and ten SVOCs with detection limits that exceeded the screening level, however, the detection limits were generally within an order of magnitude of the screening value. For groundwater, there were a number of VOCs, SVOCs, and two metals with detection limits that exceeded the screening level, however, the detection limits were generally within an order of magnitude of the screening value or MCL. Therefore, there is some uncertainty associated with constituents that were not detected with detection limits above the screening levels, however based on past site use, and results of those constituents detected in the site media, this is not expected to effect the results of this risk evaluation.

Human Health Risk Screening Summary

The human health risk screening at Site 49 indicates that exposure to the analytes in subsurface soil would not result in any COPCs, or any potentially unacceptable risks to human health. However, exposure to groundwater, and vapor intrusion from groundwater, does indicate the potential for unacceptable risks to human health. Therefore, based on the human health risk screening, further evaluation of groundwater at Site 49 is suggested.

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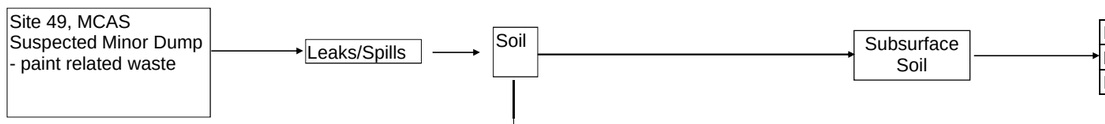

Exposure Route	Current/Future		Future			
	Trespasser/Visitor Adult	Trespasser/Visitor Youth	Residential Adult	Residential Child	Industrial Worker	Construction Worker
Ingestion	X	X	X	X	X	X
Dermal Contact	X	X	X	X	X	X
Inhalation	X	X	X	X	X	X
Ingestion	NA	NA	X	X	X	NA
Dermal Contact	NA	NA	X	X	NA	X
Inhalation - ambient air	NA	NA	X	X	NA	X
Inhalation - vapor intrusion from groundwater to indoor air	NA	NA	X	X	X	NA

NA = Not Applicable or pathway is incomplete
X = Potentially complete exposure pathways

FIGURE C-1
Conceptual Site Model for HHRA
Site 39
MCB CamLej, North Carolina

APPENDIX C

TABLE 2.1

OCCURRENCE, DISTRIBUTION AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN

PA./SI, MCB Camp Lejeune, North Carolina

Site 49

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

Exposure Point	CAS Number	Chemical	Minimum [1] Concentration Qualifier		Maximum [1] Concentration Qualifier		Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits	Concentration [2] Used for Screening	Background [3] Value	Screening [4] Toxicity Value		Potential ARAR/TBC Value	Potential ARAR/TBC Source	COPC Flag	Rationale for [5] Contaminant Deletion or Selection
Subsurface Soil Site 49	71-55-6	1,1,1-Trichloroethane	ND		ND		MG/KG		0/8	0.0094 - 0.014	1.4E-02	N/A	6.4E+02	NS	1.2E+00	NCSSL	NO	DLBSL
	79-34-5	1,1,2,2-Tetrachloroethane	2.4E-03	J	2.4E-03	J	MG/KG	IR49-IS02-6-7-09C	1/8	0.0094 - 0.014	2.4E-03	N/A	5.6E-01	C	1.2E-03	NCSSL	NO	BSL
	76-13-1	1,1,2-Trichloro-1,2,2-trifluoroethane(Freon-113)	ND		ND		MG/KG		0/8	0.0094 - 0.014	1.4E-02	N/A	9.1E+02	NS	9.2E+03	NCSSL	NO	DLBSL
	79-00-5	1,1,2-Trichloroethane	ND		ND		MG/KG		0/8	0.0094 - 0.014	1.4E-02	N/A	1.1E+00	C	N/A	N/A	NO	DLBSL
	75-34-3	1,1-Dichloroethane	ND		ND		MG/KG		0/8	0.0094 - 0.014	1.4E-02	N/A	3.3E+00	C	3.0E-02	NCSSL	NO	DLBSL
	75-35-4	1,1-Dichloroethene	ND		ND		MG/KG		0/8	0.0094 - 0.014	1.4E-02	N/A	2.4E+01	N	4.6E-02	NCSSL	NO	DLBSL
	120-82-1	1,2,4-Trichlorobenzene	ND		ND		MG/KG		0/8	0.0094 - 0.014	1.4E-02	N/A	6.2E+00	C**	2.2E+00	NCSSL	NO	DLBSL
	96-12-8	1,2-Dibromo-3-chloropropane	ND		ND		MG/KG		0/8	0.0047 - 0.0069	6.9E-03	N/A	5.4E-03	C	2.5E-04	NCSSL	YES	DLASL
	106-93-4	1,2-Dibromoethane	ND		ND		MG/KG		0/8	0.0094 - 0.014	1.4E-02	N/A	3.4E-02	C	9.7E-05	NCSSL	NO	DLBSL
	95-50-1	1,2-Dichlorobenzene	ND		ND		MG/KG		0/8	0.0094 - 0.014	1.4E-02	N/A	1.9E+02	NS	2.4E-01	NCSSL	NO	DLBSL
	107-06-2	1,2-Dichloroethane	ND		ND		MG/KG		0/8	0.0094 - 0.014	1.4E-02	N/A	4.3E-01	C	2.0E-03	NCSSL	NO	DLBSL
	78-87-5	1,2-Dichloropropane	ND		ND		MG/KG		0/8	0.0094 - 0.014	1.4E-02	N/A	8.9E-01	C*	3.3E-03	NCSSL	NO	DLBSL
	541-73-1	1,3-Dichlorobenzene	ND		ND		MG/KG		0/8	0.0094 - 0.014	1.4E-02	N/A	2.4E+00	C	7.6E+00	NCSSL	NO	DLBSL
	106-46-7	1,4-Dichlorobenzene	ND		ND		MG/KG		0/8	0.0094 - 0.014	1.4E-02	N/A	2.4E+00	C	7.0E-02	NCSSL	NO	DLBSL
	78-93-3	2-Butanone	ND		ND		MG/KG		0/8	0.0094 - 0.014	1.4E-02	N/A	2.8E+03	N	1.6E+01	NCSSL	NO	DLBSL
	591-78-6	2-Hexanone	ND		ND		MG/KG		0/8	0.0094 - 0.014	1.4E-02	N/A	2.1E+01	NS	1.2E+00	NCSSL	NO	DLBSL
	108-10-1	4-Methyl-2-pentanone	ND		ND		MG/KG		0/8	0.0094 - 0.014	1.4E-02	N/A	5.3E+02	NS	N/A	N/A	NO	DLBSL
	67-64-1	Acetone	ND		ND		MG/KG		0/5	0.0094 - 0.01	1.0E-02	N/A	6.1E+03	N	2.4E+01	NCSSL	NO	DLBSL
	71-43-2	Benzene	ND		ND		MG/KG		0/8	0.0094 - 0.014	1.4E-02	N/A	1.1E+00	C*	7.3E-03	NCSSL	NO	DLBSL
	75-27-4	Bromodichloromethane	ND		ND		MG/KG		0/8	0.0094 - 0.014	1.4E-02	N/A	2.7E-01	C	2.9E-03	NCSSL	NO	DLBSL
	75-25-2	Bromoform	ND		ND		MG/KG		0/8	0.0094 - 0.014	1.4E-02	N/A	6.1E+01	C*	1.9E-02	NCSSL	NO	DLBSL
	74-83-9	Bromomethane	ND		ND		MG/KG		0/8	0.0094 - 0.014	1.4E-02	N/A	7.3E-01	N	N/A	N/A	NO	DLBSL
	75-15-0	Carbon disulfide	ND		ND		MG/KG		0/8	0.0094 - 0.014	1.4E-02	N/A	8.2E+01	NS	3.8E+00	NCSSL	NO	DLBSL
	56-23-5	Carbon tetrachloride	ND		ND		MG/KG		0/8	0.0094 - 0.014	1.4E-02	N/A	6.1E-01	C	2.0E-03	NCSSL	NO	DLBSL
	108-90-7	Chlorobenzene	ND		ND		MG/KG		0/8	0.0094 - 0.014	1.4E-02	N/A	2.9E+01	N	4.5E-01	NCSSL	NO	DLBSL
	75-00-3	Chloroethane	ND		ND		MG/KG		0/8	0.0094 - 0.014	1.4E-02	N/A	1.5E+03	NS	1.6E+01	NCSSL	NO	DLBSL
	67-66-3	Chloroform	ND		ND		MG/KG		0/8	0.0094 - 0.014	1.4E-02	N/A	2.9E-01	C	3.4E-01	NCSSL	NO	DLBSL
	74-87-3	Chloromethane	ND		ND		MG/KG		0/8	0.0094 - 0.014	1.4E-02	N/A	1.2E+01	N	1.5E-02	NCSSL	NO	DLBSL
	156-59-2	cis-1,2-Dichloroethene	1.2E-03	J	1.2E-03	J	MG/KG	IR49-IS02-6-7-09C	1/8	0.0094 - 0.014	1.2E-03	N/A	7.8E+01	N	3.6E-01	NCSSL	NO	BSL
	10061-01-5	cis-1,3-Dichloropropene	ND		ND		MG/KG		0/8	0.0094 - 0.014	1.4E-02	N/A	1.7E+00	C*	2.3E-03	NCSSL	NO	DLBSL
	110-82-7	Cyclohexane	7.5E-04	J	7.5E-04	J	MG/KG	IR49-IS02-6-7-09C	1/8	0.0094 - 0.014	7.5E-04	N/A	1.2E+02	NS	N/A	N/A	NO	BSL
	124-48-1	Dibromochloromethane	ND		ND		MG/KG		0/8	0.0094 - 0.014	1.4E-02	N/A	6.8E-01	C	1.9E-03	NCSSL	NO	DLBSL
	75-71-8	Dichlorodifluoromethane (Freon-12)	ND		ND		MG/KG		0/8	0.0094 - 0.014	1.4E-02	N/A	1.8E+01	N	2.9E+01	NCSSL	NO	DLBSL
	100-41-4	Ethylbenzene	7.7E-04	J	1.3E-03	J	MG/KG	IR49-IS05-4-5-09C	4/8	0.0094 - 0.014	1.3E-03	N/A	5.4E+00	C	8.1E+00	NCSSL	NO	BSL
	98-82-8	Isopropylbenzene	ND		ND		MG/KG		0/8	0.0094 - 0.014	1.4E-02	N/A	2.1E+02	NS	1.3E+00	NCSSL	NO	DLBSL
	79-20-9	Methyl acetate	ND		ND		MG/KG		0/8	0.0094 - 0.014	1.4E-02	N/A	7.8E+03	NS	N/A	N/A	NO	DLBSL
	108-87-2	Methylcyclohexane	6.9E-04	J	6.9E-04	J	MG/KG	IR49-IS02-6-7-09C	1/8	0.0094 - 0.014	6.9E-04	N/A	5.7E+01	NS	N/A	N/A	NO	BSL
	75-09-2	Methylene chloride	2.3E-03	J	1.0E-02		MG/KG	IR49-IS01-7-8-09C	4/8	0.0094 - 0.014	1.0E-02	N/A	1.1E+01	C	2.3E-02	NCSSL	NO	BSL

APPENDIX C

TABLE 2.1

OCCURRENCE, DISTRIBUTION AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN

PA./SI, MCB Camp Lejeune, North Carolina

Site 49

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

Exposure Point	CAS Number	Chemical	Minimum [1] Concentration Qualifier		Maximum [1] Concentration Qualifier		Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits	Concentration [2] Used for Screening	Background [3] Value	Screening [4] Toxicity Value		Potential ARAR/TBC Value	Potential ARAR/TBC Source	COPC Flag	Rationale for [5] Contaminant Deletion or Selection
	1634-04-4	Methyl-tert-butyl ether (MTBE)	ND		ND		MG/KG		0/8	0.0094 - 0.014	1.4E-02	N/A	4.3E+01	C	8.5E-02	NCSSL	NO	DLBSL
	100-42-5	Styrene	ND		ND		MG/KG		0/8	0.0094 - 0.014	1.4E-02	N/A	6.3E+02	NS	9.2E-01	NCSSL	NO	DLBSL
	127-18-4	Tetrachloroethene	ND		ND		MG/KG		0/8	0.0094 - 0.014	1.4E-02	N/A	5.5E-01	C	5.0E-03	NCSSL	NO	DLBSL
	108-88-3	Toluene	9.3E-04	J	9.3E-04	J	MG/KG	IR49-IS01-7-8-09C	1/8	0.0094 - 0.014	9.3E-04	N/A	5.0E+02	NS	5.5E+00	NCSSL	NO	BSL
	156-60-5	trans-1,2-Dichloroethene	ND		ND		MG/KG		0/8	0.0094 - 0.014	1.4E-02	N/A	1.5E+01	N	5.1E-01	NCSSL	NO	DLBSL
	10061-02-6	trans-1,3-Dichloropropene	ND		ND		MG/KG		0/8	0.0094 - 0.014	1.4E-02	N/A	1.7E+00	C*	2.3E-03	NCSSL	NO	DLBSL
	79-01-6	Trichloroethene	1.5E-03	J	1.5E-03	J	MG/KG	IR49-IS02-6-7-09C	1/8	0.0094 - 0.014	1.5E-03	N/A	2.8E+00	C	1.8E-02	NCSSL	NO	BSL
	75-69-4	Trichlorofluoromethane(Freon-11)	ND		ND		MG/KG		0/8	0.0094 - 0.014	1.4E-02	N/A	7.9E+01	N	2.4E+01	NCSSL	NO	DLBSL
	75-01-4	Vinyl chloride	ND		ND		MG/KG		0/8	0.0094 - 0.014	1.4E-02	N/A	6.0E-02	C	1.9E-04	NCSSL	NO	DLBSL
	1330-20-7	Xylene, total	1.5E-03	J	3.2E-03	J	MG/KG	IR49-IS01-7-8-09C	2/8	0.0094 - 0.014	3.2E-03	N/A	6.3E+01	NS	6.0E+00	NCSSL	NO	BSL
	92-52-4	1,1-Biphenyl	ND		ND		MG/KG		0/8	0.24 - 2.1	2.1E+00	N/A	2.1E+02	NS	4.3E+01	NCSSL	NO	DLBSL
	108-60-1	2,2'-Oxybis(1-chloropropane)	ND		ND		MG/KG		0/8	0.24 - 2.1	2.1E+00	N/A	4.6E+00	C	N/A	N/A	NO	DLBSL
	95-95-4	2,4,5-Trichlorophenol	ND		ND		MG/KG		0/8	0.49 - 4.1	4.1E+00	N/A	6.1E+02	N	N/A	N/A	NO	DLBSL
	88-06-2	2,4,6-Trichlorophenol	ND		ND		MG/KG		0/8	0.24 - 2.1	2.1E+00	N/A	6.1E+00	C**	N/A	N/A	NO	DLBSL
	120-83-2	2,4-Dichlorophenol	ND		ND		MG/KG		0/8	0.24 - 2.1	2.1E+00	N/A	1.8E+01	N	N/A	N/A	NO	DLBSL
	105-67-9	2,4-Dimethylphenol	ND		ND		MG/KG		0/8	0.24 - 2.1	2.1E+00	N/A	1.2E+02	N	1.4E+00	NCSSL	NO	DLBSL
	51-28-5	2,4-Dinitrophenol	ND		ND		MG/KG		0/8	0.49 - 4.1	4.1E+00	N/A	1.2E+01	N	N/A	N/A	NO	DLBSL
	121-14-2	2,4-Dinitrotoluene	ND		ND		MG/KG		0/8	0.24 - 2.1	2.1E+00	N/A	1.6E+00	C*	N/A	N/A	YES	DLASL
	606-20-2	2,6-Dinitrotoluene	ND		ND		MG/KG		0/8	0.24 - 2.1	2.1E+00	N/A	6.1E+00	N	N/A	N/A	NO	DLBSL
	91-58-7	2-Chloronaphthalene	ND		ND		MG/KG		0/8	0.24 - 2.1	2.1E+00	N/A	1.8E+02	NS	N/A	N/A	NO	DLBSL
	95-57-8	2-Chlorophenol	ND		ND		MG/KG		0/8	0.24 - 2.1	2.1E+00	N/A	3.9E+01	N	4.1E-03	NCSSL	NO	DLBSL
	91-57-6	2-Methylnaphthalene	ND		ND		MG/KG		0/8	0.24 - 2.1	2.1E+00	N/A	3.1E+01	N	1.6E+00	NCSSL	NO	DLBSL
	95-48-7	2-Methylphenol	ND		ND		MG/KG		0/8	0.24 - 2.1	2.1E+00	N/A	3.1E+02	N	N/A	N/A	NO	DLBSL
	88-74-4	2-Nitroaniline	ND		ND		MG/KG		0/8	0.49 - 4.1	4.1E+00	N/A	6.1E+01	N	N/A	N/A	NO	DLBSL
	88-75-5	2-Nitrophenol	ND		ND		MG/KG		0/8	0.24 - 2.1	2.1E+00	N/A	3.9E+01	N	N/A	N/A	NO	DLBSL
	91-94-1	3,3'-Dichlorobenzidine	ND		ND		MG/KG		0/8	0.24 - 2.1	2.1E+00	N/A	1.1E+00	C	N/A	N/A	YES	DLASL
	99-09-2	3-Nitroaniline	ND		ND		MG/KG		0/8	0.49 - 4.1	4.1E+00	N/A	6.1E+01	N	N/A	N/A	NO	DLBSL
	534-52-1	4,6-Dinitro-2-methylphenol	ND		ND		MG/KG		0/8	0.49 - 4.1	4.1E+00	N/A	4.9E-01	N	N/A	N/A	YES	DLASL
	101-55-3	4-Bromophenyl-phenylether	ND		ND		MG/KG		0/8	0.24 - 2.1	2.1E+00	N/A	N/A		N/A	N/A	NO	NTX
	59-50-7	4-Chloro-3-methylphenol	ND		ND		MG/KG		0/8	0.24 - 2.1	2.1E+00	N/A	6.1E+02	N	N/A	N/A	NO	DLBSL
	106-47-8	4-Chloroaniline	ND		ND		MG/KG		0/8	0.24 - 2.1	2.1E+00	N/A	2.4E+00	C	N/A	N/A	NO	DLBSL
	7005-72-3	4-Chlorophenyl-phenylether	ND		ND		MG/KG		0/8	0.24 - 2.1	2.1E+00	N/A	3.1E+01	N	N/A	N/A	NO	DLBSL
	106-44-5	4-Methylphenol	ND		ND		MG/KG		0/8	0.24 - 2.1	2.1E+00	N/A	3.1E+01	N	4.0E-01	NCSSL	NO	DLBSL
	100-01-6	4-Nitroaniline	ND		ND		MG/KG		0/8	0.49 - 4.1	4.1E+00	N/A	2.4E+01	C*	N/A	N/A	NO	DLBSL
	100-02-7	4-Nitrophenol	ND		ND		MG/KG		0/8	0.49 - 4.1	4.1E+00	N/A	4.8E+00	C*	N/A	N/A	NO	DLBSL
	83-32-9	Acenaphthene	ND		ND		MG/KG		0/8	0.24 - 2.1	2.1E+00	N/A	3.4E+02	N	8.4E+00	NCSSL	NO	DLBSL
	208-96-8	Acenaphthylene	ND		ND		MG/KG		0/8	0.24 - 2.1	2.1E+00	N/A	3.4E+02	N	1.1E+01	NCSSL	NO	DLBSL
	98-86-2	Acetophenone	ND		ND		MG/KG		0/8	0.24 - 2.1	2.1E+00	N/A	7.8E+02	NS	N/A	N/A	NO	DLBSL
	120-12-7	Anthracene	ND		ND		MG/KG		0/8	0.24 - 2.1	2.1E+00	N/A	1.7E+03	N	6.6E+02	NCSSL	NO	DLBSL

APPENDIX C

TABLE 2.1

OCCURRENCE, DISTRIBUTION AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN

PA./SI, MCB Camp Lejeune, North Carolina

Site 49

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

Exposure Point	CAS Number	Chemical	Minimum [1] Concentration Qualifier		Maximum [1] Concentration Qualifier		Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits	Concentration [2] Used for Screening	Background [3] Value	Screening [4] Toxicity Value		Potential ARAR/TBC Value	Potential ARAR/TBC Source	COPC Flag	Rationale for [5] Contaminant Deletion or Selection
	1912-24-9	Atrazine	ND		ND		MG/KG		0/8	0.24 - 2.1	2.1E+00	N/A	2.1E+00	C	2.5E-02	NCSSL	NO	DLBSL
	100-52-7	Benzaldehyde	ND		ND		MG/KG		0/8	0.24 - 2.1	2.1E+00	N/A	7.8E+02	NS	N/A	N/A	NO	DLBSL
	56-55-3	Benzo(a)anthracene	ND		ND		MG/KG		0/8	0.061 - 0.52	5.2E-01	N/A	1.5E-01	C	1.8E-01	NCSSL	YES	DLASL
	50-32-8	**Benzo(a)pyrene**	**1.3E-03**	**J**	**5.0E-01**	**J**	**MG/KG**	**IR49-IS05-4-5-09C**	**5/8**	**0.0065 - 0.055**	**5.0E-01**	**N/A**	**1.5E-02**	**C**	**5.9E-02**	**NCSSL**	**YES**	**ASL**
	205-99-2	**Benzo(b)fluoranthene**	**2.1E-03**	**J**	**4.3E-01**	**J**	**MG/KG**	**IR49-IS05-4-5-09C**	**3/8**	**0.061 - 0.52**	**4.3E-01**	**N/A**	**1.5E-01**	**C**	**6.0E-01**	**NCSSL**	**YES**	**ASL**
	191-24-2	Benzo(g,h,i)perylene	3.0E+00		3.0E+00		MG/KG	IR49-IS05-4-5-09C	1/8	0.24 - 2.1	3.0E+00	N/A	1.7E+02	N	3.6E+02	NCSSL	NO	BSL
	207-08-9	Benzo(k)fluoranthene	ND		ND		MG/KG		0/8	0.24 - 2.1	2.1E+00	N/A	1.5E+00	C	5.9E+00	NCSSL	YES	DLASL
	111-91-1	bis(2-Chloroethoxy)methane	ND		ND		MG/KG		0/8	0.24 - 2.1	2.1E+00	N/A	1.8E+01	N	N/A	N/A	NO	DLBSL
	111-44-4	bis(2-Chloroethyl)ether	ND		ND		MG/KG		0/8	0.24 - 2.1	2.1E+00	N/A	2.1E-01	C	1.4E-04	NCSSL	YES	DLASL
	117-81-7	bis(2-Ethylhexyl)phthalate	ND		ND		MG/KG		0/8	0.24 - 2.1	2.1E+00	N/A	3.5E+01	C*	7.2E+00	NCSSL	NO	DLBSL
	85-68-7	Butylbenzylphthalate	ND		ND		MG/KG		0/8	0.24 - 2.1	2.1E+00	N/A	2.6E+02	C*	1.5E+02	NCSSL	NO	DLBSL
	105-60-2	Caprolactam	1.5E-01	J	2.3E-01	J	MG/KG	IR49-TW-S02-8-9-09C	6/8	0.24 - 2.1	2.3E-01	N/A	3.1E+03	N	1.8E+01	NCSSL	NO	BSL
	86-74-8	Carbazole	ND		ND		MG/KG		0/8	0.24 - 2.1	2.1E+00	N/A	N/A		N/A	N/A	NO	NTX
	218-01-9	Chrysene	ND		ND		MG/KG		0/8	0.24 - 2.1	2.1E+00	N/A	1.5E+01	C	1.8E+01	NCSSL	NO	DLBSL
	53-70-3	Dibenz(a,h)anthracene	ND		ND		MG/KG		0/8	0.0065 - 0.055	5.5E-02	N/A	1.5E-02	C	1.9E-01	NCSSL	YES	DLASL
	132-64-9	Dibenzofuran	ND		ND		MG/KG		0/8	0.24 - 2.1	2.1E+00	N/A	7.8E+00	N	4.7E+00	NCSSL	NO	DLBSL
	84-66-2	Diethylphthalate	ND		ND		MG/KG		0/8	0.24 - 2.1	2.1E+00	N/A	4.9E+03	N	3.7E+01	NCSSL	NO	DLBSL
	131-11-3	Dimethyl phthalate	ND		ND		MG/KG		0/8	0.24 - 2.1	2.1E+00	N/A	N/A		N/A	N/A	NO	NTX
	84-74-2	Di-n-butylphthalate	ND		ND		MG/KG		0/8	0.24 - 2.1	2.1E+00	N/A	6.1E+02	N	1.9E+01	NCSSL	NO	DLBSL
	117-84-0	Di-n-octylphthalate	ND		ND		MG/KG		0/8	0.41 - 3.4	3.4E+00	N/A	3.5E+01	C*	3.8E+01	NCSSL	NO	DLBSL
	206-44-0	Fluoranthene	ND		ND		MG/KG		0/8	0.24 - 2.1	2.1E+00	N/A	2.3E+02	N	3.3E+02	NCSSL	NO	DLBSL
	86-73-7	Fluorene	ND		ND		MG/KG		0/8	0.24 - 2.1	2.1E+00	N/A	2.3E+02	N	5.6E+01	NCSSL	NO	DLBSL
	118-74-1	Hexachlorobenzene	ND		ND		MG/KG		0/8	0.24 - 2.1	2.1E+00	N/A	3.0E-01	C	2.6E-03	NCSSL	YES	DLASL
	87-68-3	Hexachlorobutadiene	ND		ND		MG/KG		0/8	0.24 - 2.1	2.1E+00	N/A	6.1E+00	C**	8.7E-03	NCSSL	NO	DLBSL
	77-47-4	Hexachlorocyclopentadiene	ND		ND		MG/KG		0/8	0.24 - 2.1	2.1E+00	N/A	3.7E+01	N	N/A	N/A	NO	DLBSL
	67-72-1	Hexachloroethane	ND		ND		MG/KG		0/8	0.24 - 2.1	2.1E+00	N/A	6.1E+00	C**	N/A	N/A	NO	DLBSL
	193-39-5	Indeno(1,2,3-cd)pyrene	ND		ND		MG/KG		0/8	0.061 - 0.52	5.2E-01	N/A	1.5E-01	C	2.0E+00	NCSSL	YES	DLASL
	78-59-1	Isophorone	ND		ND		MG/KG		0/8	0.061 - 0.52	5.2E-01	N/A	5.1E+02	C*	2.1E-01	NCSSL	NO	DLBSL
	91-20-3	Naphthalene	ND		ND		MG/KG		0/8	0.24 - 2.1	2.1E+00	N/A	3.6E+00	C*	2.1E-01	NCSSL	NO	DLBSL
	621-64-7	n-Nitroso-di-n-propylamine	ND		ND		MG/KG		0/8	0.031 - 0.26	2.6E-01	N/A	6.9E-02	C	N/A	N/A	YES	DLASL
	86-30-6	n-Nitrosodiphenylamine	ND		ND		MG/KG		0/8	0.24 - 2.1	2.1E+00	N/A	9.9E+01	C	N/A	N/A	NO	DLBSL
	98-95-3	Nitrobenzene	ND		ND		MG/KG		0/8	0.24 - 2.1	2.1E+00	N/A	4.8E+00	C*	N/A	N/A	NO	DLBSL
	87-86-5	Pentachlorophenol	ND		ND		MG/KG		0/8	0.02 - 0.17	1.7E-01	N/A	3.0E+00	C	3.1E-02	NCSSL	NO	DLBSL
	85-01-8	Phenanthrene	ND		ND		MG/KG		0/8	0.24 - 2.1	2.1E+00	N/A	1.7E+03	N	5.7E+01	NCSSL	NO	DLBSL
	108-95-2	Phenol	ND		ND		MG/KG		0/8	0.24 - 2.1	2.1E+00	N/A	1.8E+03	N	2.3E-01	NCSSL	NO	DLBSL
	129-00-0	Pyrene	4.1E-01	J	4.1E-01	J	MG/KG	IR49-IS05-4-5-09C	1/8	0.24 - 2.1	4.1E-01	N/A	1.7E+02	N	2.2E+02	NCSSL	NO	BSL
	7429-90-5	**Aluminum**	**1.5E+03**		**1.7E+04**		**MG/KG**	**IR49-IS01D-7-8-09C**	**8/8**	**10.3 - 12.6**	**1.7E+04**	**1.0E+04**	**7.7E+03**	**N**	**N/A**	**N/A**	**YES**	**ASL**
	7440-36-0	Antimony [1]	N/A		N/A		MG/KG		N/A	N/A	N/A	3.6E-01	3.1E+00	N	N/A	N/A	NO	DLBSL
	7440-38-2	**Arsenic**	**1.2E+00**	**J**	**6.8E+00**	**J**	**MG/KG**	**IR49-IS02-6-7-09C**	**8/8**	**0.51 - 0.63**	**6.8E+00**	**2.1E+00**	**3.9E-01**	**C***	**5.8E+00**	**NCSSL**	**YES**	**ASL**

APPENDIX C

TABLE 2.1

OCCURRENCE, DISTRIBUTION AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN

PA./SI, MCB Camp Lejeune, North Carolina

Site 49

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

Exposure Point	CAS Number	Chemical	Minimum [1] Concentration	Qualifier	Maximum [1] Concentration	Qualifier	Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits	Concentration [2] Used for Screening	Background [3] Value	Screening [4] Toxicity Value		Potential ARAR/TBC Value	Potential ARAR/TBC Source	COPC Flag	Rationale for [5] Contaminant Deletion or Selection
	7440-39-3	Barium	1.4E+01		2.6E+01		MG/KG	IR49-IS01D-7-8-09C	8/8	2.1 - 2.5	2.6E+01	1.7E+01	1.5E+03	N	5.8E+02	NCSSL	NO	BSL
	7440-41-7	Beryllium	1.1E-01	J	1.9E-01	J	MG/KG	IR49-IS01D-7-8-09C: IR49-IS08-8-9-09C	8/8	0.257 - 0.315	1.9E-01	1.7E-01	1.6E+01	N	N/A	N/A	NO	BSL
	7440-43-9	Cadmium	1.2E-01	J	1.2E-01	J	MG/KG	IR49-IS05-4-5-09C	1/8	0.257 - 0.315	1.2E-01	2.3E-02	7.0E+00	N	3.0E+00	NCSSL	NO	BSL
	7440-70-2	Calcium	1.1E+02	J	3.2E+04		MG/KG	IR49-IS05-4-5-09C	5/8	299 - 514	3.2E+04	4.4E+02	N/A		N/A	N/A	NO	NUT
	7440-47-3	**Chromium**	**2.5E+00**	**J**	**2.8E+01**	**J**	**MG/KG**	**IR49-IS02-6-7-09C**	**8/8**	**0.51 - 0.63**	**2.8E+01**	**1.5E+01**	**2.9E-01**	**C**	**3.8E+00**	**NCSSL**	**YES**	**ASL**
	7440-48-4	Cobalt	4.3E-01	J	7.9E-01	J	MG/KG	IR49-IS01D-7-8-09C	8/8	0.77 - 0.95	7.9E-01	8.2E-01	2.3E+00	N	N/A	N/A	NO	BSL
	7440-50-8	Copper	2.0E+00		4.3E+00		MG/KG	IR49-IS01D-7-8-09C	8/8	0.51 - 0.63	4.3E+00	2.6E+00	3.1E+02	N	7.0E+02	NCSSL	NO	BSL
	7439-89-6	**Iron**	**2.1E+03**	**J**	**1.8E+04**	**J**	**MG/KG**	**IR49-IS02-6-7-09C**	**8/8**	**5.1 - 6.3**	**1.8E+04**	**5.4E+03**	**5.5E+03**	**N**	**1.5E+02**	**NCSSL**	**YES**	**ASL**
	7439-92-1	Lead	6.2E+00		2.0E+01		MG/KG	IR49-TW-S02-8-9-09C	8/8	0.154 - 0.189	2.0E+01	8.5E+00	4.0E+02		2.7E+02	NCSSL	NO	BSL
	7439-95-4	Magnesium	4.6E+02	J	4.7E+03	J	MG/KG	IR49-IS05-4-5-09C	8/8	257 - 315	4.7E+03	3.6E+02	N/A		N/A	N/A	NO	NUT
	7439-96-5	Manganese	6.8E+00		5.1E+01		MG/KG	IR49-IS05-4-5-09C	8/8	0.77 - 0.95	5.1E+01	9.3E+00	1.8E+02	N	6.5E+01	NCSSL	NO	BSL
	7439-97-6	Mercury	2.0E-02	J	4.7E-02		MG/KG	IR49-IS07-9-10-09C	5/8	0.031 - 0.043	4.7E-02	7.1E-02	2.3E+00	N	1.0E+00	NCSSL	NO	BSL
	7440-02-0	Nickel	1.7E+00		4.2E+00		MG/KG	IR49-IS05-4-5-09C	8/8	0.51 - 0.63	4.2E+00	2.3E+00	1.5E+02	N	1.3E+02	NCSSL	NO	BSL
	7440-09-7	Potassium	2.3E+02	J	6.6E+02	J	MG/KG	IR49-IS02-6-7-09C	8/8	257 - 315	6.6E+02	3.6E+02	N/A		N/A	N/A	NO	NUT
	7782-49-2	Selenium	1.7E-01	J	6.1E-01		MG/KG	IR49-IS02-6-7-09C	7/8	0.26 - 0.32	6.1E-01	5.1E-01	3.9E+01	N	2.1E+00	NCSSL	NO	BSL
	7440-22-4	Silver	ND		ND		MG/KG		0/8	0.514 - 0.631	6.3E-01	1.3E-01	3.9E+01	N	3.4E+00	NCSSL	NO	DLBSL
	7440-23-5	Sodium	9.2E+01	J	2.8E+02	J	MG/KG	IR49-IS02-6-7-09C	6/8	257 - 315	2.8E+02	6.8E+01	N/A		N/A	N/A	NO	NUT
	7440-28-0	Thallium	ND		ND		MG/KG		0/8	0.41 - 0.5	5.0E-01	3.8E-01	N/A		N/A	N/A	NO	DLBSL
	7440-62-2	**Vanadium**	**1.6E+01**	**J**	**4.1E+01**	**J**	**MG/KG**	**IR49-IS02-6-7-09C**	**8/8**	**0.77 - 0.95**	**4.1E+01**	**1.7E+01**	**3.9E+01**	**N**	**N/A**	**N/A**	**YES**	**ASL**
	7440-66-6	Zinc	5.5E+00		1.1E+01		MG/KG	IR49-IS05-4-5-09C	8/8	1 - 1.3	1.1E+01	6.6E+00	2.3E+03	N	1.2E+03	NCSSL	NO	BSL

[1] Minimum/Maximum detected concentrations.

[2] Maximum concentration is used for screening. If not detected (ND), used maximum detection limit.

[3] Background values are two times the arithmetic mean basewide background subsurface soil concentrations.

[4] Oak Ridge National Laboratory (ORNL). May 2010. Regional Screening Levels for Chemical Contaminants at Superfund Sites for residential soil (based on 10^{-6} for carcinogens and HQ of 0.1 for noncarcinogens). [Online]. Available: http://epa-prgs.ornl.gov/chemicals/index.shtml

RSL value for 1,3-dichloropropene used as a surrogate for cis-1,3-dichloropropene and trans-1,3-dichloropropene.
RSL value for 1,4-dichlorobenzene used as surrogate for 1,3-dichlorobenzene.
RSL value for 2-chlorophenol used as surrogate for 4-chloro-3-methylphenol and 2-nitrophenol.
RSL value for 2-nitroaniline used as surrogate for 3-nitroaniline.
RSL value for Acenaphthene used as surrogate for Acenaphthylene.
RSL value for Anthracene used as surrogate for Phenanthrene.
RSL value for bis(2-ethylhexyl)phthalate used as a surrogate for di-n-octylphthalate.
RSL value for Cadmium (diet) used as surrogate for cadmium.
RSL value for hexavalent chromium (chromium VI) used as surrogate for chromium.
RSL value for Manganese (water) used as surrogate for manganese.
RSL value for Mercury (inorganic salts) used as surrogate for mercury.

COPC = Chemical of Potential Concern
ARAR/TBC = Applicable or Relevant and Appropriate Requirement/ To Be Considered

J = Estimated Value
C = Carcinogenic
C* = N screening level < 100x C screening level, therefore N screening value/10 used as screening level
C** = N screening level < 10x C screening level, therefore N screening value/10 used as screening level
N = Noncarcinogenic
S = saturation concentration higher than noncarcinogenic based RSL, therefore Csat used as screening level
NCSSL = North Carolina Soil Screening Levels (NCDENR, 2010)
N/A = Not available
ND = Not Detected
mg/kg = milligram per kilogram

APPENDIX C

TABLE 2.1

OCCURRENCE, DISTRIBUTION AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN

PA./SI, MCB Camp Lejeune, North Carolina

Site 49

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

Exposure Point	CAS Number	Chemical	Minimum [1] Concentration Qualifier	Maximum [1] Concentration Qualifier	Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits	Concentration [2] Used for Screening	Background [3] Value	Screening [4] Toxicity Value	Potential ARAR/TBC Value	Potential ARAR/TBC Source	COPC Flag	Rationale for [5] Contaminant Deletion or Selection

RSL value for Methoxychlor used as surrogate for 4-Chlorophenyl-phenylether.

RSL value for n-hexane used as surrogate for methylcyclohexane.

RSL value for Nitrobenzene used as surrogate for 4-Nitrophenol.

RSL value for Pyrene used as surrogate for Benzo(g,h,i)perylene.

[1] = Antimony had all R (rejected) qualifiers associated with data. Data could not be used in risk assessment.

[5] Rationale Codes

Selection Reason:
- Above Screening Levels (ASL)
- Detection Limit Above Screening Level (DLASL), not quantitatively evaluated in HHRA
- Chemical from same class (carcinogenic PAH) identified as a COPC (CPAH)

Deletion Reason:
- No Toxicity Information (NTX)
- Essential Nutrient (NUT)
- Below Screening Level (BSL)
- Below Background (BBK)
- Detection Limit Below Screening Level (DLBSL)

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APPENDIX C

TABLE 2.1a

Step 2 Soil Screening - Risk Ratio, Maximum Detected Concentration

PA/SI, MCB Camp Lejeune, North Carolina

Site 49 - Subsurface Soil

Analyte	Detection Frequency	Maximum Detected Concentration (Qualifier)	Sample	Residential Soil RSL	Acceptable Risk/HI Level	Corresponding Hazard Index[a]	Corresponding Cancer Risk[b]	Target Organ[c]
SVOCs (mg/kg)								
Benzo(a)pyrene	5 / 8	5.0E-01 J	IR49-IS05-4-5-09C	1.5E-02	1E-06		3E-05	
Benzo(b)fluoranthene	3 / 8	4.3E-01 J	IR49-IS05-4-5-09C	1.5E-01	1E-06		3E-06	
Metals (mg/kg)								
Aluminum	8 / 8	1.7E+04	IR49-IS01D-7-8-09C	7.7E+04	1	0.2		Nervous System
Arsenic	8 / 8	6.8E+00 J	IR49-IS02-6-7-09C	3.9E-01	1E-06		2E-05	
Chromium	8 / 8	2.8E+01 J	IR49-IS02-6-7-09C	2.9E-01	1E-06		1E-04	
Iron	8 / 8	1.8E+04 J	IR49-IS02-6-7-09C	5.5E+04	1	0.3		Gastrointestinal
Vanadium	8 / 8	4.1E+01 J	IR49-IS02-6-7-09C	3.9E+02	1	0.1		Kidney
Cumulative Corresponding Hazard Index[d]						**0.7**		
Cumulative Corresponding Cancer Risk[e]							**1E-04**	

Total Nervous System HI =	0.2
Total Gastrointestinal HI =	0.3
Total Kidney HI =	0.1

[a] Corresponding Hazard Index equals maximum detected concentration divided by the RSL divided by the acceptable HI level.

[b] Corresponding Cancer Risk equals maximum detected concentration divided by the RSL divided by the acceptable risk level.

[c] Target organs were obtained from Oak Ridge National Laboratory's (ORNL, 2010) Risk Assessment Information System (RAIS), available online at http://rais.ornl.gov and from EPA's (2010) Integrated Risk Information (IRIS).

[d] Cumulative Corresponding Hazard Index equals sum of Corresponding Hazard Indices for each constituent.

[e] Cumulative Corresponding Cancer Risk equals sum of Corresponding Cancer Risks for each constituent.

Constituent selected as COPC if it contributes to an overall Hazard Index by target organ greater than 0.5 or Cumulative Corresponding Cancer Risk greater than 5E-05, otherwise, constituent not selected as COPC.

Constituents selected as COPCs are indicated by shading.

COPC = Constituent of Potential Concern

J = Estimated Value

mg/kg = milligrams per kilogram

NA = Not available/not applicable

HI = Hazard Index

RSL = Oak Ridge National Laboratory (ORNL). May 2010. Regional Screening Levels (RSLs) for Chemical Contaminants at Superfund Sites. [Online]. Available: http://epa-prgs.ornl.gov/chemicals/index.shtml

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APPENDIX C

TABLE 2.1b

Step 3 Soil Screening - Risk Ratio, 95% UCL

PA/SI, MCB Camp Lejeune, North Carolina

Site 49 - Subsurface Soil

Analyte	Detection Frequency	95% UCL		95% UCL Rationale	Residential Soil RSL	Acceptable Risk Level	Corresponding Hazard Index[a]	Corresponding Cancer Risk[b]	Target Organ[c]
PAHs (mg/kg)									
Benzo(a)pyrene	5 / 8	5.0E-01	Max	6	1.5E-02	1E-06		3E-05	
Benzo(b)fluoranthene	3 / 8	4.3E-01	Max	6	1.5E-01	1E-06		3E-06	
Metals (mg/kg)									
Arsenic	8 / 8	4.2E+00	95% Stud-t	1,2,3,4	3.9E-01	1E-06		1E-05	
Chromium	8 / 8	2.8E+01	Max	6	2.9E-01	1E-06		1E-04	
Cumulative Corresponding Hazard Index[d]							**NA**		
Cumulative Corresponding Cancer Risk[e]								**1E-04**	

[a] Corresponding Hazard Index equals maximum detected concentration divided by the RSL divided by the acceptable HI level.

[b] Corresponding Cancer Risk equals maximum detected concentration divided by the RSL divided by the acceptable risk level.

[c] Target organs were obtained from Oak Ridge National Laboratory's (ORNL, 2010) Risk Assessment Information System (RAIS), available online at http://rais.ornl.gov and from EPA's (2010) Integrated Risk Information (IRIS).

[d] Cumulative Corresponding Hazard Index equals sum of Corresponding Hazard Indices for each constituent.

[e] Cumulative Corresponding Cancer Risk equals sum of Corresponding Cancer Risks for each constituent.

Constituent selected as COPC if it contributes to an overall Hazard Index by target organ greater than 0.5 or Cumulative Corresponding Cancer Risk greater than 5E-05,

Constituents selected as COPCs are indicated by shading.

mg/kg = milligrams per kilogram

HI = Hazard Index

ProUCL, Version 4.00.04 used to determine distribution of data and calculate UCL, following recommendations

in users guide (USEPA.February 2009. ProUCL, Version 4.0. Prepared by Lockheed Martin Environmental Services).

Options: Maximum Detected Value (Max); 95% Student's-T test UCL (95% Stud-t); 95% Kaplan-Meier (t) UCL (95% KM-t); 95% Chebyshev (Mean, Sd) UCL (95% Cheb-m)

UCL Rationale:

(1) Shapiro-Wilk W Test/Lilliefors test indicates data are log-normally distributed.

(2) Shapiro-Wilk W Test/Lilliefors indicates data are normally distributed.

(3) Anderson-Darling Test indicates data are gamma distributed.

(4) Kolmogorov-Smirnov Test indicates data are gamma distributed.

(5) Distribution tests are inconclusive (data are not normal, log-normal, or gamma-distributed).

(6) Maximum value used because calculated UCL exceeds maximum concentration.

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APPENDIX C
TABLE 2.2
OCCURRENCE, DISTRIBUTION AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN
PA/SI, MCB Camp Lejeune, North Carolina
Site 49

Scenario Timeframe: Future
Medium: Groundwater
Exposure Medium: Groundwater

Exposure Point	CAS Number	Chemical	Minimum [1] Concentration	Qualifier	Maximum [1] Concentration	Qualifier	Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits	Concentration [2] Used for Screening	Background [3] Value	Screening [4] Toxicity Value		Potential ARAR/TBC Value	Potential ARAR/TBC Source	COPC Flag	Rationale for [5] Contaminant Deletion or Selection
Groundwater	71-55-6	1,1,1-Trichloroethane	ND		ND		UG/L		0/9	1 - 1	1.0E+00	N/A	9.1E+02	N	2.0E+02	MCL, 15A NCAC 2L	NO	DLBSL
Site 49	**79-34-5**	**1,1,2,2-Tetrachloroethane**	**8.6E-01**	**J**	**7.9E+01**		**UG/L**	**IR49-TW07-10A**	**4/9**	**1 - 1**	**7.9E+01**	**N/A**	**6.7E-02**	**C**	**2.0E-01**	**15A NCAC 2L**	**YES**	**ASL**
	76-13-1	1,1,2-Trichloro-1,2,2-trifluoroethane(Freon-113)	ND		ND		UG/L		0/9	1 - 1	1.0E+00	N/A	5.9E+03	N	2.0E+05	15A NCAC 2L	NO	DLBSL
	79-00-5	**1,1,2-Trichloroethane**	**3.7E-01**	**J**	**6.0E+00**		**UG/L**	**IR49-TW07-10A**	**4/9**	**1 - 1**	**6.0E+00**	**N/A**	**2.4E-01**	**C**	**5.0E+00**	**MCL**	**YES**	**ASL**
	75-34-3	1,1-Dichloroethane	ND		ND		UG/L		0/9	1 - 1	1.0E+00	N/A	2.4E+00	C	6.0E+00	15A NCAC 2L	NO	DLBSL
	75-35-4	1,1-Dichloroethene	3.9E-01	J	9.9E-01	J	UG/L	IR49-TW07-10A	3/9	1 - 1	9.9E-01	N/A	3.4E+01	N	7.0E+00	MCL, 15A NCAC 2L	NO	BSL
	120-82-1	1,2,4-Trichlorobenzene	ND		ND		UG/L		0/9	1 - 1	1.0E+00	N/A	4.1E-01	C**	7.0E+01	MCL, 15A NCAC 2L	YES	DLASL
	96-12-8	1,2-Dibromo-3-chloropropane	ND		ND		UG/L		0/9	1 - 1.5	1.5E+00	N/A	3.2E-04	C	2.0E-01	MCL	YES	DLASL
															4.0E-02	15A NCAC 2L		
	106-93-4	1,2-Dibromoethane	ND		ND		UG/L		0/9	1 - 1	1.0E+00	N/A	6.5E-03	C	5.0E-02	MCL	YES	DLASL
															2.0E-02	15A NCAC 2L		
	95-50-1	1,2-Dichlorobenzene	ND		ND		UG/L		0/9	1 - 1	1.0E+00	N/A	3.7E+01	N	6.0E+02	MCL	NO	DLBSL
															2.0E+01	15A NCAC 2L		
	107-06-2	**1,2-Dichloroethane**	**3.5E-01**	**J**	**6.2E-01**	**J**	**UG/L**	**IR49-TW06-10A**	**4/9**	**1 - 1**	**6.2E-01**	**N/A**	**1.5E-01**	**C**	**5.0E+00**	**MCL**	**YES**	**ASL**
															4.0E-01	15A NCAC 2L		
	78-87-5	1,2-Dichloropropane	ND		ND		UG/L		0/9	1 - 1	1.0E+00	N/A	3.9E-01	C*	5.0E+00	MCL	YES	DLASL
															6.0E-01	15A NCAC 2L		
	541-73-1	1,3-Dichlorobenzene	ND		ND		UG/L		0/9	1 - 1	1.0E+00	N/A	4.3E-01	C	2.0E+02	15A NCAC 2L	YES	DLASL
	106-46-7	1,4-Dichlorobenzene	2.6E-01	J	3.0E-01	J	UG/L	IR49-TW05-10A	3/9	1 - 1	3.0E-01	N/A	4.3E-01	C	7.5E+01	MCL	NO	BSL
															6.0E+00	15A NCAC 2L		
	78-93-3	2-Butanone	ND		ND		UG/L		0/9	3 - 5	3.0E+00	N/A	7.1E+02	N	4.2E+03	15A NCAC 2L	NO	DLBSL
	591-78-6	2-Hexanone	ND		ND		UG/L		0/9	1 - 5	1.0E+00	N/A	4.7E+00	N	N/A	N/A	NO	DLBSL
	108-10-1	4-Methyl-2-pentanone	ND		ND		UG/L		0/9	1 - 5	1.0E+00	N/A	2.0E+02	N	N/A	N/A	NO	DLBSL
	67-64-1	Acetone	2.6E+00	J	6.1E+00		UG/L	IR49-TW08-10A	3/9	2.5 - 5.5	6.1E+00	N/A	2.2E+03	N	6.0E+03	15A NCAC 2L	NO	BSL
	71-43-2	**Benzene**	**1.9E-01**	**J**	**2.5E+00**		**UG/L**	**IR49-TW07-10A**	**3/9**	**1 - 1**	**2.5E+00**	**N/A**	**4.1E-01**	**C**	**1.0E+00**	**15A NCAC 2L**	**YES**	**ASL**
															5.0E+00	MCL		
	75-27-4	Bromodichloromethane	ND		ND		UG/L		0/9	1 - 1	1.0E+00	N/A	1.2E-01	C	6.0E-01	15A NCAC 2L	YES	DLASL
															8.0E+01	MCL		
	75-25-2	Bromoform	ND		ND		UG/L		0/9	1 - 1.5	1.5E+00	N/A	8.5E+00	C*	4.0E+00	15A NCAC 2L	NO	DLBSL
															8.0E+01	MCL		
	74-83-9	Bromomethane	ND		ND		UG/L		0/9	1 - 1	1.0E+00	N/A	8.7E-01	N	N/A	N/A	YES	DLASL
	75-15-0	Carbon disulfide	2.1E-01	J	2.1E-01	J	UG/L	IR49-TW01D-09C	1/9	1 - 1	2.1E-01	N/A	1.0E+02	N	7.0E+02	15A NCAC 2L	NO	BSL
	56-23-5	Carbon tetrachloride	ND		ND		UG/L		0/9	1 - 1	1.0E+00	N/A	4.4E-01	C	5.0E+00	MCL	YES	DLASL
															3.0E-01	15A NCAC 2L		
	108-90-7	Chlorobenzene	ND		ND		UG/L		0/9	1 - 1	1.0E+00	N/A	9.1E+00	N	1.0E+02	MCL	NO	DLBSL
															5.0E+01	15A NCAC 2L		
	75-00-3	Chloroethane	ND		ND		UG/L		0/9	1 - 1	1.0E+00	N/A	2.1E+03	N	3.0E+03	15A NCAC 2L	NO	DLBSL

APPENDIX C
TABLE 2.2
OCCURRENCE, DISTRIBUTION AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN
PA/SI, MCB Camp Lejeune, North Carolina
Site 49

Scenario Timeframe: Future
Medium: Groundwater
Exposure Medium: Groundwater

Exposure Point	CAS Number	Chemical	Minimum [1] Concentration	Qualifier	Maximum [1] Concentration	Qualifier	Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits	Concentration [2] Used for Screening	Background [3] Value	Screening Toxicity Value	[4]	Potential ARAR/TBC Value	Potential ARAR/TBC Source	COPC Flag	Rationale for [5] Contaminant Deletion or Selection
	67-66-3	Chloroform	ND		ND		UG/L		0/9	1 - 1	1.0E+00	N/A	1.9E-01	C	8.0E+01	MCL	YES	DLASL
															7.0E+01	15A NCAC 2L		
	74-87-3	Chloromethane	ND		ND		UG/L		0/9	1 - 1	1.0E+00	N/A	1.9E+01	N	3.0E+00	15A NCAC 2L	NO	DLBSL
	110-82-7	Cyclohexane	2.8E+00		3.5E+00		UG/L	IR49-TW07-10A	2/9	1 - 1	3.5E+00	N/A	1.3E+03	N	N/A	N/A	NO	BSL
	124-48-1	Dibromochloromethane	ND		ND		UG/L		0/9	1 - 1	1.0E+00	N/A	1.5E-01	C	8.0E+01	MCL	YES	DLASL
															4.0E-01	15A NCAC 2L		
	75-71-8	Dichlorodifluoromethane (Freon-12)	ND		ND		UG/L		0/9	1 - 1	1.0E+00	N/A	3.9E+01	N	1.0E+03	15A NCAC 2L	NO	DLBSL
	100-41-4	Ethylbenzene	1.8E-01	J	1.8E-01	J	UG/L	IR49-TW07-10A	2/9	1 - 1	1.8E-01	N/A	1.5E+00	C	7.0E+02	MCL	NO	BSL
															6.0E+02	15A NCAC 2L		
	98-82-8	Isopropylbenzene	2.7E-01	J	5.2E-01	J	UG/L	IR49-TW07-10A	3/9	1 - 1	5.2E-01	N/A	6.8E+01	N	7.0E+01	15A NCAC 2L	NO	BSL
	79-20-9	Methyl acetate	ND		ND		UG/L		0/9	1 - 2	2.0E+00	N/A	3.7E+03	N	N/A	N/A	NO	DLBSL
	1634-04-4	Methyl-tert-butyl ether (MTBE)	ND		ND		UG/L		0/9	1 - 1	1.0E+00	N/A	1.2E+01	C	2.0E+01	15A NCAC 2L	NO	DLBSL
	108-87-2	Methylcyclohexane	2.7E+00		5.9E+00		UG/L	IR49-TW07-10A	3/9	1 - 1	5.9E+00	N/A	8.8E+01	N	N/A	N/A	NO	BSL
	75-09-2	Methylene chloride	ND		ND		UG/L		0/9	1 - 1	1.0E+00	N/A	4.8E+00	C	5.0E+00	MCL, 15A NCAC 2L	NO	DLBSL
	100-42-5	Styrene	ND		ND		UG/L		0/9	1 - 1	1.0E+00	N/A	1.6E+02	N	1.0E+02	MCL	NO	DLBSL
															7.0E+01	15A NCAC 2L		
	127-18-4	**Tetrachloroethene**	**5.0E-01**	**J**	**1.3E+00**		**UG/L**	**IR49-TW07-10A**	**3/9**	**1 - 1**	**1.3E+00**	**N/A**	**1.1E-01**	**C**	**5.0E+00**	**MCL**	**YES**	**ASL**
															7.0E-01	15A NCAC 2L		
	108-88-3	Toluene	ND		ND		UG/L		0/9	1 - 1	1.0E+00	N/A	2.3E+02	N	1.0E+03	MCL	NO	DLBSL
															6.0E+02	15A NCAC 2L		
	79-01-6	**Trichloroethene**	**1.6E+00**		**2.8E+02**		**UG/L**	**IR49-TW07-10A**	**4/9**	**1 - 3**	**2.8E+02**	**N/A**	**2.0E+00**	**C**	**5.0E+00**	**MCL**	**YES**	**ASL**
															3.0E+00	15A NCAC 2L		
	75-69-4	Trichlorofluoromethane(Freon-11)	ND		ND		UG/L		0/9	1 - 1	1.0E+00	N/A	1.3E+02	N	2.0E+03	15A NCAC 2L	NO	DLBSL
	75-01-4	**Vinyl chloride**	**9.3E-01**	**J**	**2.2E+01**		**UG/L**	**IR49-TW06-10A**	**5/9**	**1 - 1**	**2.2E+01**	**N/A**	**1.6E-02**	**C**	**2.0E+00**	**MCL**	**YES**	**ASL**
															3.0E-02	15A NCAC 2L		
	1330-20-7	Xylene, total	ND		ND		UG/L		0/9	1 - 1	1.0E+00	N/A	2.0E+01	N	1.0E+04	MCL	NO	DLBSL
															5.0E+02	15A NCAC 2L		
	156-59-2	**cis-1,2-Dichloroethene**	**2.5E+00**		**1.6E+02**		**UG/L**	**IR49-TW07-10A**	**8/9**	**1 - 1.5**	**1.6E+02**	**N/A**	**3.7E+01**	**N**	**7.0E+01**	**MCL, 15A NCAC 2L**	**YES**	**ASL**
	10061-01-5	cis-1,3-Dichloropropene	ND		ND		UG/L		0/9	1 - 1	1.0E+00	N/A	4.3E-01	C*	4.0E-01	15A NCAC 2L	YES	DLASL
	156-60-5	**trans-1,2-Dichloroethene**	**6.6E-01**	**J**	**1.1E+02**		**UG/L**	**IR49-TW07-10A**	**7/9**	**1 - 1.5**	**1.1E+02**	**N/A**	**1.1E+01**	**N**	**1.0E+02**	**MCL, 15A NCAC 2L**	**YES**	**ASL**
	10061-02-6	trans-1,3-Dichloropropene	ND		ND		UG/L		0/9	1 - 1	1.0E+00	N/A	4.3E-01	C*	4.0E-01	15A NCAC 2L	YES	DLASL
	92-52-4	1,1-Biphenyl	ND		ND		UG/L		0/3	9.4 - 10	1.0E+01	N/A	1.8E+02	N	4.0E+02	15A NCAC 2L	NO	DLBSL
	108-60-1	2,2'-Oxybis(1-chloropropane)	ND		ND		UG/L		0/3	9.4 - 10	1.0E+01	N/A	3.2E-01	C	N/A	N/A	YES	DLASL
	95-95-4	2,4,5-Trichlorophenol	ND		ND		UG/L		0/3	23 - 25	2.5E+01	N/A	3.7E+02	N	N/A	N/A	NO	DLBSL
	88-06-2	2,4,6-Trichlorophenol	ND		ND		UG/L		0/3	9.4 - 10	1.0E+01	N/A	3.7E+00	C**	N/A	N/A	YES	DLASL
	120-83-2	2,4-Dichlorophenol	ND		ND		UG/L		0/3	9.4 - 10	1.0E+01	N/A	1.1E+01	N	N/A	N/A	NO	DLBSL
	105-67-9	2,4-Dimethylphenol	ND		ND		UG/L		0/3	9.4 - 10	1.0E+01	N/A	7.3E+01	N	1.0E+02	15A NCAC 2L	NO	DLBSL
	51-28-5	2,4-Dinitrophenol	ND		ND		UG/L		0/3	23 - 25	2.5E+01	N/A	7.3E+00	N	N/A	N/A	YES	DLASL
	121-14-2	2,4-Dinitrotoluene	ND		ND		UG/L		0/3	9.4 - 10	1.0E+01	N/A	2.2E-01	C	N/A	N/A	YES	DLASL
	606-20-2	2,6-Dinitrotoluene	ND		ND		UG/L		0/3	9.4 - 10	1.0E+01	N/A	3.7E+00	N	N/A	N/A	YES	DLASL

APPENDIX C
TABLE 2.2
OCCURRENCE, DISTRIBUTION AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN
PA/SI, MCB Camp Lejeune, North Carolina
Site 49

Scenario Timeframe: Future
Medium: Groundwater
Exposure Medium: Groundwater

Exposure Point	CAS Number	Chemical	Minimum [1] Concentration Qualifier	Maximum [1] Concentration Qualifier	Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits	Concentration [2] Used for Screening	Background [3] Value	Screening [4] Toxicity Value		Potential ARAR/TBC Value	Potential ARAR/TBC Source	COPC Flag	Rationale for [5] Contaminant Deletion or Selection
	91-58-7	2-Chloronaphthalene	ND	ND	UG/L		0/3	9.4 - 10	1.0E+01	N/A	2.9E+02	N	N/A	N/A	NO	DLBSL
	95-57-8	2-Chlorophenol	ND	ND	UG/L		0/3	9.4 - 10	1.0E+01	N/A	1.8E+01	N	4.0E-01	15A NCAC 2L	NO	DLBSL
	91-57-6	2-Methylnaphthalene	ND	ND	UG/L		0/3	9.4 - 10	1.0E+01	N/A	1.5E+01	N	3.0E+01	15A NCAC 2L	NO	DLBSL
	95-48-7	2-Methylphenol	ND	ND	UG/L		0/3	9.4 - 10	1.0E+01	N/A	1.8E+02	N	N/A	N/A	NO	DLBSL
	88-74-4	2-Nitroaniline	ND	ND	UG/L		0/3	23 - 25	2.5E+01	N/A	3.7E+01	N	N/A	N/A	NO	DLBSL
	88-75-5	2-Nitrophenol	ND	ND	UG/L		0/3	9.4 - 10	1.0E+01	N/A	1.8E+01	N	N/A	N/A	NO	DLBSL
	91-94-1	3,3'-Dichlorobenzidine	ND	ND	UG/L		0/3	9.4 - 10	1.0E+01	N/A	1.5E-01	C	N/A	N/A	YES	DLASL
	99-09-2	3-Nitroaniline	ND	ND	UG/L		0/3	23 - 25	2.5E+01	N/A	3.7E+01	N	N/A	N/A	NO	DLBSL
	534-52-1	4,6-Dinitro-2-methylphenol	ND	ND	UG/L		0/3	23 - 25	2.5E+01	N/A	2.9E-01	N	N/A	N/A	YES	DLASL
	101-55-3	4-Bromophenyl-phenylether	ND	ND	UG/L		0/3	9.4 - 10	1.0E+01	N/A	N/A		N/A	N/A	NO	NTX
	59-50-7	4-Chloro-3-methylphenol	ND	ND	UG/L		0/3	9.4 - 10	1.0E+01	N/A	3.7E+02	N	N/A	N/A	NO	DLBSL
	106-47-8	4-Chloroaniline	ND	ND	UG/L		0/3	9.4 - 10	1.0E+01	N/A	3.4E-01	C	N/A	N/A	YES	DLASL
	7005-72-3	4-Chlorophenyl-phenylether	ND	ND	UG/L		0/3	9.4 - 10	1.0E+01	N/A	1.8E+01	N	N/A	N/A	NO	DLBSL
	106-44-5	4-Methylphenol	ND	ND	UG/L		0/3	9.4 - 10	1.0E+01	N/A	1.8E+01	N	4.0E+01	15A NCAC 2L	NO	DLBSL
	100-01-6	4-Nitroaniline	ND	ND	UG/L		0/3	23 - 25	2.5E+01	N/A	3.4E+00	C*	N/A	N/A	YES	DLASL
	100-02-7	4-Nitrophenol	ND	ND	UG/L		0/3	23 - 25	2.5E+01	N/A	1.2E-01	C	N/A	N/A	YES	DLASL
	83-32-9	Acenaphthene	ND	ND	UG/L		0/3	9.4 - 10	1.0E+01	N/A	2.2E+02	N	8.0E+01	15A NCAC 2L	NO	DLBSL
	208-96-8	Acenaphthylene	ND	ND	UG/L		0/3	9.4 - 10	1.0E+01	N/A	2.2E+02	N	2.0E+02	15A NCAC 2L	NO	DLBSL
	98-86-2	Acetophenone	ND	ND	UG/L		0/3	9.4 - 10	1.0E+01	N/A	3.7E+02	N	N/A	N/A	NO	DLBSL
	120-12-7	Anthracene	ND	ND	UG/L		0/3	9.4 - 10	1.0E+01	N/A	1.1E+03	N	2.0E+03	15A NCAC 2L	NO	DLBSL
	1912-24-9	Atrazine	ND	ND	UG/L		0/3	9.4 - 10	1.0E+01	N/A	2.9E-01	C	3.0E+00	MCL, 15A NCAC 2L	YES	DLASL
	100-52-7	Benzaldehyde	ND	ND	UG/L		0/3	9.4 - 10	1.0E+01	N/A	3.7E+02	N	N/A	N/A	NO	DLBSL
	56-55-3	Benzo(a)anthracene	ND	ND	UG/L		0/3	9.4 - 10	1.0E+01	N/A	2.9E-02	C	5.0E-02	15A NCAC 2L	YES	DLASL
	50-32-8	Benzo(a)pyrene	ND	ND	UG/L		0/3	9.4 - 10	1.0E+01	N/A	2.9E-03	C	2.0E-01	MCL	YES	DLASL
													5.0E-03	15A NCAC 2L		
	205-99-2	Benzo(b)fluoranthene	ND	ND	UG/L		0/3	9.4 - 10	1.0E+01	N/A	2.9E-02	C	5.0E-02	15A NCAC 2L	YES	DLASL
	191-24-2	Benzo(g,h,i)perylene	ND	ND	UG/L		0/3	9.4 - 10	1.0E+01	N/A	1.1E+02	N	2.0E+02	15A NCAC 2L	NO	DLBSL
	207-08-9	Benzo(k)fluoranthene	ND	ND	UG/L		0/3	9.4 - 10	1.0E+01	N/A	2.9E-01	C	5.0E-01	15A NCAC 2L	YES	DLASL
	85-68-7	Butylbenzylphthalate	ND	ND	UG/L		0/3	9.4 - 10	1.0E+01	N/A	3.5E+01	C	1.0E+03	15A NCAC 2L	NO	DLBSL
	105-60-2	Caprolactam	ND	ND	UG/L		0/2	9.4 - 9.8	9.8E+00	N/A	1.8E+03	N	4.0E+03	15A NCAC 2L	NO	DLBSL
	86-74-8	Carbazole	ND	ND	UG/L		0/3	9.4 - 10	1.0E+01	N/A	N/A		N/A	N/A	NO	NTX
	218-01-9	Chrysene	ND	ND	UG/L		0/3	9.4 - 10	1.0E+01	N/A	2.9E+00	C	5.0E+00	15A NCAC 2L	YES	DLASL
	84-74-2	Di-n-butylphthalate	ND	ND	UG/L		0/3	9.4 - 10	1.0E+01	N/A	3.7E+02	N	7.0E+02	15A NCAC 2L	NO	DLBSL
	117-84-0	Di-n-octylphthalate	ND	ND	UG/L		0/3	9.4 - 10	1.0E+01	N/A	4.8E+00	C	N/A	N/A	YES	DLASL
	53-70-3	Dibenz(a,h)anthracene	ND	ND	UG/L		0/3	9.4 - 10	1.0E+01	N/A	2.9E-03	C	5.0E-03	15A NCAC 2L	YES	DLASL
	132-64-9	Dibenzofuran	ND	ND	UG/L		0/3	9.4 - 10	1.0E+01	N/A	3.7E+00	NC	N/A	N/A	YES	DLASL
	84-66-2	Diethylphthalate	ND	ND	UG/L		0/3	9.4 - 10	1.0E+01	N/A	2.9E+03	N	5.0E+03	15A NCAC 2L	NO	DLBSL
	131-11-3	Dimethyl phthalate	ND	ND	UG/L		0/3	9.4 - 10	1.0E+01	N/A	N/A		N/A	N/A	NO	NTX
	206-44-0	Fluoranthene	ND	ND	UG/L		0/3	9.4 - 10	1.0E+01	N/A	1.5E+02	N	3.0E+02	15A NCAC 2L	NO	DLBSL
	86-73-7	Fluorene	ND	ND	UG/L		0/3	9.4 - 10	1.0E+01	N/A	1.5E+02	N	3.0E+02	15A NCAC 2L	NO	DLBSL

APPENDIX C
TABLE 2.2
OCCURRENCE, DISTRIBUTION AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN
PA/SI, MCB Camp Lejeune, North Carolina
Site 49

Scenario Timeframe: Future
Medium: Groundwater
Exposure Medium: Groundwater

Exposure Point	CAS Number	Chemical	Minimum [1] Concentration Qualifier		Maximum [1] Concentration Qualifier		Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits	Concentration [2] Used for Screening	Background [3] Value	Screening Toxicity Value [4]		Potential ARAR/TBC Value	Potential ARAR/TBC Source	COPC Flag	Rationale for [5] Contaminant Deletion or Selection
	118-74-1	Hexachlorobenzene	ND		ND		UG/L		0/3	9.4 - 10	1.0E+01	N/A	4.2E-02	C	1.0E+00	MCL	YES	DLASL
															2.0E-02	15A NCAC 2L		
	87-68-3	Hexachlorobutadiene	ND		ND		UG/L		0/3	9.4 - 10	1.0E+01	N/A	8.6E-01	C*	4.0E-01	15A NCAC 2L	YES	DLASL
	77-47-4	Hexachlorocyclopentadiene	ND		ND		UG/L		0/3	9.4 - 10	1.0E+01	N/A	2.2E+01	N	5.0E+01	MCL	NO	DLBSL
	67-72-1	Hexachloroethane	ND		ND		UG/L		0/3	9.4 - 10	1.0E+01	N/A	3.7E+00	C**	N/A	N/A	YES	DLASL
	193-39-5	Indeno(1,2,3-cd)pyrene	ND		ND		UG/L		0/3	9.4 - 10	1.0E+01	N/A	2.9E-02	C	5.0E-02	15A NCAC 2L	YES	DLASL
	78-59-1	Isophorone	ND		ND		UG/L		0/3	9.4 - 10	1.0E+01	N/A	7.1E+01	C	4.0E+01	15A NCAC 2L	NO	DLBSL
	91-20-3	Naphthalene	ND		ND		UG/L		0/3	9.4 - 10	1.0E+01	N/A	1.4E-01	C*	6.0E+00	15A NCAC 2L	YES	DLASL
	98-95-3	Nitrobenzene	ND		ND		UG/L		0/3	9.4 - 10	1.0E+01	N/A	1.2E-01	C	N/A	N/A	YES	DLASL
	87-86-5	Pentachlorophenol	ND		ND		UG/L		0/3	23 - 25	2.5E+01	N/A	5.6E-01	C	1.0E+00	MCL	YES	DLASL
															3.0E-01	15A NCAC 2L		
	85-01-8	Phenanthrene	ND		ND		UG/L		0/3	9.4 - 10	1.0E+01	N/A	1.1E+03	N	2.0E+02	15A NCAC 2L	NO	DLBSL
	108-95-2	Phenol	ND		ND		UG/L		0/3	9.4 - 10	1.0E+01	N/A	1.1E+03	N	3.0E+01	15A NCAC 2L	NO	DLBSL
	129-00-0	Pyrene	ND		ND		UG/L		0/3	9.4 - 10	1.0E+01	N/A	1.1E+02	N	2.0E+02	15A NCAC 2L	NO	DLBSL
	111-91-1	bis(2-Chloroethoxy)methane	ND		ND		UG/L		0/3	9.4 - 10	1.0E+01	N/A	1.1E+01	N	N/A	N/A	NO	DLBSL
	111-44-4	bis(2-Chloroethyl)ether	ND		ND		UG/L		0/3	9.4 - 10	1.0E+01	N/A	1.2E-02	C	3.0E-02	15A NCAC 2L	YES	DLASL
	117-81-7	bis(2-Ethylhexyl)phthalate	ND		ND		UG/L		0/3	9.4 - 10	1.0E+01	N/A	4.8E+00	C	6.0E+00	MCL	YES	DLASL
															3.0E+00	15A NCAC 2L		
	621-64-7	n-Nitroso-di-n-propylamine	ND		ND		UG/L		0/3	9.4 - 10	1.0E+01	N/A	9.6E-03	C	N/A	N/A	YES	DLASL
	86-30-6	n-Nitrosodiphenylamine	ND		ND		UG/L		0/3	9.4 - 10	1.0E+01	N/A	1.4E+01	C	N/A	N/A	NO	DLBSL
	7429-90-5	**Aluminum**	**1.1E+03**	**J**	**3.9E+04**		**UG/L**	**IR49-TW03-09C**	**3/3**	**200 - 200**	**3.9E+04**	**1.9E+03**	**3.7E+03**	**N**	**50 - 200**	**SMCL**	**YES**	**ASL**
	7440-36-0	Antimony	ND		ND		UG/L		0/3	15 - 15	1.5E+01	3.3E+00	1.5E+00	N	6.0E+00	MCL	YES	DLASL
	7440-38-2	**Arsenic**	**3.4E+00**	**J**	**6.8E+00**	**J**	**UG/L**	**IR49-TW03-09C**	**2/3**	**10 - 10**	**6.8E+00**	**5.8E+00**	**4.5E-02**	**C**	**1.0E+01**	**MCL, 15A NCAC 2L**	**YES**	**ASL**
	7440-39-3	Barium	3.9E+01	J	1.8E+02		UG/L	IR49-TW03-09C	3/3	40 - 40	1.8E+02	8.6E+01	7.3E+02	N	2.0E+03	MCL	NO	BSL
															7.0E+02	15A NCAC 2L		
	7440-41-7	Beryllium	6.1E+00		6.1E+00		UG/L	IR49-TW03-09C	1/3	5 - 5	6.1E+00	3.1E-01	7.3E+00	N	4.0E+00	MCL	NO	BSL
	7440-43-9	Cadmium	1.1E+00	J	1.1E+00	J	UG/L	IR49-TW03-09C	1/3	5 - 5	1.1E+00	3.6E-01	1.8E+00	N	5.0E+00	MCL	NO	BSL
															2.0E+00	15A NCAC 2L		
	7440-70-2	Calcium	1.2E+04	J	9.7E+04		UG/L	IR49-TW02-09C	3/3	5000 - 5000	9.7E+04	6.9E+04	N/A		N/A	N/A	NO	NUT
	7440-47-3	**Chromium**	2.5E+00	J	6.3E+00	J	UG/L	IR49-TW02-09C	2/3	10 - 10	6.3E+00	**3.1E+00**	**4.3E-02**	**C**	**1.0E+02**	**MCL**	**YES**	**ASL**
															1.0E+01	15A NCAC 2L		
	7440-48-4	**Cobalt**	**4.4E+01**		**4.4E+01**		**UG/L**	**IR49-TW03-09C**	**1/3**	**15 - 15**	**4.4E+01**	**3.4E+00**	**1.1E+00**	**N**	**N/A**	N/A	**YES**	**ASL**
	7440-50-8	Copper	ND		ND		UG/L		0/3	10 - 10	1.0E+01	2.8E+00	1.5E+02	N	1.3E+03	MCL	NO	DLBSL
															1.0E+03	15A NCAC 2L		
	7439-89-6	**Iron**	**4.0E+03**		**1.7E+05**		**UG/L**	**IR49-TW03-09C**	**3/3**	**100 - 100**	**1.7E+05**	**6.0E+03**	**2.6E+03**	**N**	**3.0E+02**	**15A NCAC 2L**	**YES**	**ASL**
	7439-92-1	Lead	1.8E+00	J	2.9E+00	J	UG/L	IR49-TW02-09C	2/3	3 - 3	2.9E+00	2.8E+00	1.5E+01		1.5E+01	MCL, 15A NCAC 2L	NO	BSL
	7439-95-4	Magnesium	2.0E+03	J	1.3E+05		UG/L	IR49-TW03-09C	3/3	5000 - 5000	1.3E+05	6.4E+03	N/A		N/A	N/A	NO	NUT
	7439-96-5	**Manganese**	**5.2E+01**		**3.1E+02**		**UG/L**	**IR49-TW03-09C**	**3/3**	**15 - 15**	**3.1E+02**	**2.1E+02**	**8.8E+01**	**N**	**5.0E+01**	**15A NCAC 2L**	**YES**	**ASL**

APPENDIX C
TABLE 2.2
OCCURRENCE, DISTRIBUTION AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN
PA/SI, MCB Camp Lejeune, North Carolina
Site 49

Scenario Timeframe: Future
Medium: Groundwater
Exposure Medium: Groundwater

Exposure Point	CAS Number	Chemical	Minimum [1] Concentration Qualifier		Maximum [1] Concentration Qualifier		Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits	Concentration [2] Used for Screening	Background [3] Value	Screening Toxicity Value [4]		Potential ARAR/TBC Value	Potential ARAR/TBC Source	COPC Flag	Rationale for Contaminant Deletion or Selection [5]
	7439-97-6	Mercury	ND		ND		UG/L		0/3	0.2 - 0.2	2.0E-01	1.0E-01	1.1E+00	N	2.0E+00	MCL	NO	DLBSL
															1.0E+00	15A NCAC 2L		
	7440-02-0	**Nickel**	**9.4E+00**	**J**	**9.9E+01**		**UG/L**	**IR49-TW03-09C**	**3/3**	**10 - 10**	**9.9E+01**	**8.0E+00**	**7.3E+01**	**N**	**1.0E+02**	**15A NCAC 2L**	**YES**	**ASL**
	7440-09-7	Potassium	1.1E+03	J	8.8E+03		UG/L	IR49-TW03-09C	3/3	5000 - 5000	8.8E+03	3.3E+03	N/A		N/A	N/A	NO	NUT
	7782-49-2	Selenium	ND		ND		UG/L		0/3	5 - 25	2.5E+01	3.1E+00	1.8E+01	N	5.0E+01	MCL	YES	DLASL
															2.0E+01	15A NCAC 2L		
	7440-22-4	Silver	ND		ND		UG/L		0/3	10 - 10	1.0E+01	7.7E-01	1.8E+01	N	2.0E+01	15A NCAC 2L	NO	DLBSL
	7440-23-5	Sodium	3.2E+04	J	1.2E+06		UG/L	IR49-TW03-09C	3/3	5000 - 25000	1.2E+06	2.3E+04	N/A		N/A	N/A	NO	NUT
	7440-28-0	Thallium	ND		ND		UG/L		0/3	2 - 10	1.0E+01	3.8E+00	N/A		2.0E+00	MCL	NO	NTX
	7440-62-2	Vanadium	5.8E+00	J	6.1E+00	J	UG/L	IR49-TW03-09C	2/3	15 - 15	6.1E+00	4.7E+00	1.8E+01	N	N/A	N/A	NO	BSL
	7440-66-6	Zinc	1.1E+01	J	2.1E+02		UG/L	IR49-TW03-09C	3/3	25 - 25	2.1E+02	4.2E+01	1.1E+03	N	1.0E+03	15A NCAC 2L	NO	BSL

[1] Minimum/Maximum detected concentrations.
[2] Maximum concentration is used for screening. If not detected (ND), used maximum detection limit.
[3] Background values are two times the arithmetic mean basewide background shallow groundwater concentrations.
[4] Oak Ridge National Laboratory (ORNL). May 2010. Regional Screening Levels for Chemical Contaminants at Superfund Sites for tapwater (based on 1ô for carcinogens and HQ of 0.1 for noncarcinogens). [Online]. Available: http://epa-prgs.ornl.gov/chemicals/index.shtml

RSL value for 1,3-dichloropropene used as a surrogate for cis-1,3-dichloropropene and trans-1,3-dichloropropene.
RSL value for 1,4-dichlorobenzene used as surrogate for 1,3-dichlorobenzene.
RSL value for 2-chlorophenol used as surrogate for 2-nitrophenol.
RSL value for 2-nitroaniline used as surrogate for 3-nitroaniline.
RSL value for Acenaphthene used as surrogate for Acenaphthylene.
RSL value for Anthracene used as surrogate for Phenanthrene.
RSL value for Manganese (water) used as surrogate for manganese.
RSL value for Mercury (inorganic salts) used as surrogate for mercury.
RSL value for Methoxychlor used as surrogate for 4-Chlorophenyl-phenylether.
RSL value for n-hexane used as surrogate for methylcyclohexane.
RSL value for Nitrobenzene used as surrogate for 4-Nitrophenol.
RSL value for Pyrene used as surrogate for Benzo(g,h,i)perylene.

[5] Rationale Codes

Selection Reason:
- Above Screening Levels (ASL)
- Detection Limit Above Screening Level (DLASL), not quantitatively evaluated in HHRA
- Chemical from same class (carcinogenic PAH) identified as a COPC (CPAH)

Deletion Reason:
- No Toxicity Information (NTX)
- Essential Nutrient (NUT)
- Below Screening Level (BSL)
- Below Background (BBK)
- Detection Limit Below Screening Level (DLBSL)

MCL = Maximum Contaminant Level from EPA's National Primary Drinking Water Standards
15A NCAC 2L = North Carolina Classifications and Groundwater Quality Standards, Amended January 2010.

COPC = Chemical of Potential Concern
ARAR/TBC = Applicable or Relevant and Appropriate Requirement/ To Be Considered
J = Estimated Value
C = Carcinogenic
C* = Carcinogenic (where nc PRG<100 x ca PRG)
C**= Carcinogenic (where nc PRG < 10 X ca PRG, therefore, nc PRG used)
N = Noncarcinogenic
N/A = Not available
ND = Not Detected
ug/L = microgram per liter

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APPENDIX C

TABLE 2.2a

Step 2 Groundwater Screening - Risk Ratio, Maximum Detected Concentration

PA/SI, MCB Camp Lejeune, North Carolina

Site 49 - Groundwater

Analyte	Detection Frequency	Maximum Detected Concentration (Qualifier)	Sample	Tap Water RSL	Acceptable Risk/HI Level	Corresponding Hazard Index[a]	Corresponding Cancer Risk[b]	Target Organ[c]
Volatile Organic Compounds (ug/L)								
1,1,2,2-Tetrachloroethane	4 / 9	78.5	IR49-TW07-10A	6.7E-02	1E-06		1E-03	
1,1,2-Trichloroethane	4 / 9	6.02	IR49-TW07-10A	2.4E-01	1E-06		3E-05	
1,2-Dichloroethane	4 / 9	0.62 J	IR49-TW06-10A	1.5E-01	1E-06		4E-06	
Benzene	3 / 9	2.47	IR49-TW07-10A	4.1E-01	1E-06		6E-06	
Tetrachloroethene	3 / 9	1.33	IR49-TW07-10A	1.1E-01	1E-06		1E-05	
Trichloroethene	4 / 9	276	IR49-TW07-10A	2.0E+00	1E-06		1E-04	
Vinyl chloride	5 / 9	22.1	IR49-TW06-10A	1.6E-02	1E-06		1E-03	
cis-1,2-Dichloroethene	8 / 9	155	IR49-TW07-10A	3.7E+02	1	0.4		Blood
trans-1,2-Dichloroethene	7 / 9	108	IR49-TW07-10A	1.1E+02	1	1		Respiratory
Metals (ug/L)								
Aluminum	3 / 3	3.9E+04	IR49-TW03-09C	3.7E+04	1	1		Nervous System
Arsenic	2 / 3	6.8E+00 J	IR49-TW03-09C	4.5E-02	1E-06		2E-04	
Chromium	2 / 3	6.3E+00 J	IR49-TW02-09C	4.3E-02	1E-06		1E-04	
Cobalt	1 / 3	4.4E+01	IR49-TW03-09C	1.1E+01	1	4		Thyroid
Iron	3 / 3	1.7E+05	IR49-TW03-09C	2.6E+04	1	7		Gastrointestinal
Manganese	3 / 3	3.1E+02	IR49-TW03-09C	8.8E+02	1	0.3		CNS
Nickel	3 / 3	9.9E+01	IR49-TW03-09C	7.3E+02	1	0.1		Body Weight
Cumulative Corresponding Hazard Index[d]						**14**		
Cumulative Corresponding Cancer Risk[e]							**3E-03**	

Total Nervous System/CNS HI =	**1**
Total Thyroid HI =	**4**
Total Gastrointestinal HI =	**7**
Total Body Weight HI =	0.1
Total Blood HI =	0.4
Total Respiratory HI =	**1**

[a] Corresponding Hazard Index equals maximum detected concentration divided by the RSL divided by the acceptable HI level.

[b] Corresponding Cancer Risk equals maximum detected concentration divided by the RSL divided by the acceptable risk level.

[c] Target organs were obtained from Oak Ridge National Laboratory's (ORNL, 2010) Risk Assessment Information System (RAIS), available online at http://rais.ornl.gov and from EPA's (2010) Integrated Risk Information (IRIS).

[d] Cumulative Corresponding Hazard Index equals sum of Corresponding Hazard Indices for each constituent.

[e] Cumulative Corresponding Cancer Risk equals sum of Corresponding Cancer Risks for each constituent.

Constituent selected as COPC if it contributes to an overall Hazard Index by target organ greater than 0.5 or Cumulative Corresponding Cancer Risk greater than 5E-05, otherwise, constituent not selected as COPC.

COPC = Constituent of Potential Concern

HI = Hazard Index

ug/L = microgram per liter

CNS = Central Nervous System

RSL = Oak Ridge National Laboratory (ORNL). May 2010. Regional Screening Levels (RSLs) for Chemical Contaminants at Superfund Sites. [Online]. Available: http://epa-prgs.ornl.gov/chemicals/index.shtml

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APPENDIX C
TABLE 2.2b
Step 3 Risk Ratio Screening for Groundwater, Maximum Detected Concentration
PA/SI, MCB Camp Lejeune, North Carolina
Site 49 - Groundwater

Analyte	Detection Frequency	95% UCL		95% UCL Rationale	Tap Water RSL	Acceptable Risk Level	Corresponding Hazard Index[a]	Corresponding Cancer Risk[b]	Target Organ
Volatile Organic Compounds (ug/L)									
1,1,2,2-Tetrachloroethane	4 / 9	78.5	Max	5	6.7E-02	1E-06		1E-03	
1,1,2-Trichloroethane	4 / 9	2.511	95% KM-t	1,2,3	2.4E-01	1E-06		1E-05	
1,2-Dichloroethane	4 / 9	0.604	95% KM-t	1,2,3	1.5E-01	1E-06		4E-06	
Benzene	3 / 9	1.162	95% KM-t	1,2	4.1E-01	1E-06		3E-06	
Tetrachloroethene	3 / 9	0.922	95% KM-t	1,2	1.1E-01	1E-06		8E-06	
Trichloroethene	4 / 9	99.95	95% KM-t	1,2,3	2.0E+00	1E-06		5E-05	
Vinyl chloride	5 / 9	10.67	95% KM-t	1,2,3	1.6E-02	1E-06		7E-04	
trans-1,2-Dichloroethene	7 / 9	84.78	95% KM	1,3,4	1.1E+02	1	1		Respiratory
Metals (ug/L)									
Aluminum	3 / 3	3.9E+04	Max	6	3.7E+04	1	1		Nervous System
Arsenic	2 / 3	6.8E+00	Max	6	4.5E-02	1E-06		2E-04	
Chromium	2 / 3	6.3E+00	Max	6	4.3E-02	1E-06		1E-04	
Cobalt	1 / 3	4.4E+01	Max	6	1.1E+01	1	4		Thyroid
Iron	3 / 3	1.7E+05	Max	6	2.6E+04	1	7		Gastrointestinal
Manganese	3 / 3	3.1E+02	Max	6	8.8E+02	1	0.3		CNS
Cumulative Corresponding Hazard Index[c]							**12.8**		
Cumulative Corresponding Cancer Risk[d]								**2E-03**	

Total Nervous System/CNS HI =	**1**
Total Thyroid HI =	**4**
Total Gastrointestinal HI =	**7**
Total Respiratory HI =	**0.8**

[a] Corresponding Hazard Index equals maximum detected concentration divided by the RSL divided by the acceptable HI lev
[b] Corresponding Cancer Risk equals maximum detected concentration divided by the RSL divided by the acceptable risk lev
[c] Target organs were obtained from Oak Ridge National Laboratory's (ORNL, 2010) Risk Assessment Information System (RAIS), available online at http://rais.ornl.gov and from EPA's (2010) Integrated Risk Information (IRIS).
[d] Cumulative Corresponding Hazard Index equals sum of Corresponding Hazard Indices for each constituent.
[e] Cumulative Corresponding Cancer Risk equals sum of Corresponding Cancer Risks for each constituent.

Constituent selected as COPC if it contributes to an overall Hazard Index by target organ greater than 0.5 or Cumulative Corresponding Cancer Risk greater than 5E-05, otherwise, constituent not selected as COPC.
ug/L = micrograms per liter
HI = Hazard Index

For duplicate sample results, the maximum value was used in the calculation. When only 1 detect was present for a COPC, 1/2 sample quantitation limit was used as a proxy concentration for the non-detects.
ProUCL, Version 4.00.04 used to determine distribution of data and calculate UCL, following recommendations in users guide (USEPA. February 2009. ProUCL, Version 4.0. Prepared by Lockheed Martin Environmental Services).
Options: Maximum Detected Value (M); 97.5% Kaplan-Meier Chebyshev (97.5% KM); 95% Kaplan-Meier (t) UCL (95% KM-t); 95% Kaplan-Meier (percentile Bootstrap) (95% KM-b); 95% Kaplan-Meier (BCA) UCL (95% KM-BCA); 95% Kaplan-Meier Chebyshev (95% KM); 95% Chebyshev (mean, std) UCL (95% Cheb-m); Approximate Gamma UCL (G-App); 95% Student's-T test UCL (95% Stud-t);

UCL Rationale:
(1) Shapiro-Wilk W Test/Lilliefors test indicates data are log-normally distributed.
(2) Shapiro-Wilk W Test/Lilliefors indicates data are normally distributed.
(3) Test indicates data are gamma distributed.
(4) Distribution tests are inconclusive
(5) Max value used because UCL greater than max.
(6) Max value used because data set too small to compute results.
RSL = Oak Ridge National Laboratory (ORNL). May 2010. Regional Screening Levels (RSLs) for Chemical Contaminants at Superfund Sites. [Online]. Available: http://epa-prgs.ornl.gov/chemicals/index.shtml

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APPENDIX C

TABLE 2.3

OCCURRENCE, DISTRIBUTION AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN

PA/SI, MCB Camp Lejeune, North Carolina

Site 49

Scenario Timeframe: Future
Medium: Groundwater
Exposure Medium: Indoor Air

Exposure Point	CAS Number	Chemical	Minimum [1] Concentration	Qualifier	Maximum [1] Concentration	Qualifier	Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits	Concentration [2] Used for Screening	Background [3] Value	Screening Toxicity Value [4]		Potential ARAR/TBC Value	Potential ARAR/TBC Source	COPC Flag	Rationale for [5] Contaminant Deletion or Selection
Indoor Air	**79-34-5**	**1,1,2,2-Tetrachloroethane**	**8.6E-01**	**J**	**7.9E+01**		**UG/L**	**IR49-TW07-10A**	**4/9**	**1 - 1**	**7.9E+01**	**NA**	**4.9E+00**	**C**	**NA**	**NA**	**YES**	**ASL**
Site 49	79-00-5	1,1,2-Trichloroethane	3.7E-01	J	6.0E+00		UG/L	IR49-TW07-10A	4/9	1 - 1	6.0E+00	NA	7.4E+00	C	NA	NA	NO	BSL
	75-35-4	1,1-Dichloroethene	3.9E-01	J	9.9E-01	J	UG/L	IR49-TW07-10A	3/9	1 - 1	9.9E-01	NA	2.6E+01	N	NA	NA	NO	BSL
	107-06-2	1,2-Dichloroethane	3.5E-01	J	6.2E-01	J	UG/L	IR49-TW06-10A	4/9	1 - 1	6.2E-01	NA	5.0E+00	M	NA	NA	NO	BSL
	106-46-7	1,4-Dichlorobenzene	2.6E-01	J	3.0E-01	J	UG/L	IR49-TW05-10A	3/9	1 - 1	3.0E-01	NA	7.5E+01	M	NA	NA	NO	BSL
	67-64-1	Acetone	2.6E+00	J	6.1E+00		UG/L	IR49-TW08-10A	3/9	2.5 - 5.5	6.1E+00	NA	3.3E+06	N	NA	NA	NO	BSL
	71-43-2	Benzene	1.9E-01	J	2.5E+00		UG/L	IR49-TW07-10A	3/9	1 - 1	2.5E+00	NA	5.0E+00	M	NA	NA	NO	BSL
	75-15-0	Carbon disulfide	2.1E-01	J	2.1E-01	J	UG/L	IR49-TW01D-09C	1/9	1 - 1	2.1E-01	NA	1.7E+02	N	NA	NA	NO	BSL
	110-82-7	Cyclohexane	2.8E+00		3.5E+00		UG/L	IR49-TW07-10A	2/9	1 - 1	3.5E+00	NA	4.2E+03	N	NA	NA	NO	BSL
	100-41-4	Ethylbenzene	1.8E-01	J	1.8E-01	J	UG/L	IR49-TW07-10A	2/9	1 - 1	1.8E-01	NA	7.0E+02	M	NA	NA	NO	BSL
	98-82-8	Isopropylbenzene	2.7E-01	J	5.2E-01	J	UG/L	IR49-TW07-10A	3/9	1 - 1	5.2E-01	NA	1.8E+02	N	NA	NA	NO	BSL
	108-87-2	**Methylcyclohexane**	**2.7E+00**		**5.9E+00**		**UG/L**	**IR49-TW07-10A**	**3/9**	**1 - 1**	**5.9E+00**	**NA**	**1.4E+00**	**N**	**NA**	**NA**	**YES**	**ASL**
	127-18-4	Tetrachloroethene	5.0E-01	J	1.3E+00		UG/L	IR49-TW07-10A	3/9	1 - 1	1.3E+00	NA	5.0E+00	M	NA	NA	NO	BSL
	79-01-6	**Trichloroethene**	**1.6E+00**		**2.8E+02**		**UG/L**	**IR49-TW07-10A**	**4/9**	**1 - 3**	**2.8E+02**	**NA**	**5.0E+00**	**M**	**NA**	**NA**	**YES**	**ASL**
	75-01-4	**Vinyl chloride**	**9.3E-01**	**J**	**2.2E+01**		**UG/L**	**IR49-TW06-10A**	**5/9**	**1 - 1**	**2.2E+01**	**NA**	**2.0E+00**	**M**	**NA**	**NA**	**YES**	**ASL**
	156-59-2	**cis-1,2-Dichloroethene**	**2.5E+00**		**1.6E+02**		**UG/L**	**IR49-TW07-10A**	**8/9**	**1 - 1.5**	**1.6E+02**	**NA**	**7.0E+01**	**M**	**NA**	**NA**	**YES**	**ASL**
	156-60-5	**trans-1,2-Dichloroethene**	**6.6E-01**	**J**	**1.1E+02**		**UG/L**	**IR49-TW07-10A**	**7/9**	**1 - 1.5**	**1.1E+02**	**NA**	**1.0E+02**	**M**	**NA**	**NA**	**YES**	**ASL**

[1] Minimum/Maximum detected concentrations.
[2] Maximum concentration is used for screening.
[3] Background values not available.
[4] Generic groundwater vapor intrusion screening levels (USEPA, 2002); see Table 2.3a.
[5] Rationale Codes

Selection Reason: Above Screening Levels (ASL)
Deletion Reason: No Toxicity Information (NTX)
Below Screening Level (BSL)

COPC = Chemical of Potential Concern
ARAR/TBC = Applicable or Relevant and Appropriate Requirement/ To Be Considered
J = Estimated Value
C = Carcinogenic
N = Noncarcinogenic
N/A = Not available
ug/L = microgram per liter
M = Maximum Contaminant Level from EPA's National Primary Drinking Water Standards

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APPENDIX C
TABLE 2.3a
Calculation of Target Groundwater Concentrations for Vapor Intrusion Screening [1]
PA/SI, MCB Camp Lejeune, North Carolina

Site 49

CAS Number	Constituent	Target Indoor Air Concentration[2], carcinogen (C_{Cancer}) ug/m^3	Target Indoor Air Concentration[2], non-carcinogen ($C_{non-Cancer}$) ug/m^3	Target Indoor Air Concentration ($C_{target,ia}$) ug/m^3	System Temperature Henry's Law Constant (H'TS)[3] Dimensionless	MCL ug/L	Final Target Groundwater Concentration[4] (C_{gw}) ug/L
79-34-5	1,1,2,2-Tetrachloroethane	4.2E-02	N/A	4.2E-02	8.5E-03	N/A	4.9E+00
79-00-5	1,1,2-Trichloroethane	1.5E-01	N/A	1.5E-01	2.0E-02	5.0E+00	7.4E+00
75-35-4	1,1-Dichloroethene	N/A	2.1E+01	2.1E+01	7.9E-01	7.0E+00	2.6E+01
107-06-2	1,2-Dichloroethane	9.4E-02	2.5E+02	9.4E-02	3.1E-02	5.0E+00	5.0E+00
106-46-7	1,4-Dichlorobenzene	2.2E-01	8.3E+01	2.2E-01	5.4E-02	7.5E+01	7.5E+01
67-64-1	Acetone	N/A	3.2E+03	3.2E+03	9.6E-04	N/A	3.3E+06
71-43-2	Benzene	3.1E-01	3.1E+00	3.1E-01	1.5E-01	5.0E+00	5.0E+00
75-15-0	Carbon disulfide	N/A	7.3E+01	7.3E+01	4.3E-01	N/A	1.7E+02
110-82-7	Cyclohexane	N/A	6.3E+02	6.3E+02	1.5E-01	N/A	4.2E+03
100-41-4	Ethylbenzene	9.7E-01	1.0E+02	9.7E-01	1.9E-01	7.0E+02	7.0E+02
98-82-8	Isopropylbenzene	N/A	4.2E+01	4.2E+01	2.4E-01	N/A	1.8E+02
108-87-2	Methylcyclohexane	N/A	7.3E+02	7.3E+02	5.3E+02	N/A	1.4E+00
127-18-4	Tetrachloroethene	4.1E-01	2.8E+01	4.1E-01	4.6E-01	5.0E+00	5.0E+00
79-01-6	Trichloroethene	1.2E+00	N/A	1.2E+00	2.6E-01	5.0E+00	5.0E+00
75-01-4	Vinyl chloride	1.6E-01	1.0E+01	1.6E-01	9.1E-01	2.0E+00	2.0E+00
156-59-2	cis-1,2-Dichloroethene	N/A	6.3E+00	6.3E+00	1.2E-01	7.0E+01	7.0E+01
156-60-5	trans-1,2-Dichloroethene	N/A	6.3E+00	6.3E+00	1.2E-01	1.0E+02	1.0E+02

Notes:
[1] The vapor intrusion screening levels [i.e., target groundwater concentration from Table 2c, Subsurface Vapor Intrusion Guidance (EPA, 2002)] were updated using the methodology presented in Appendix D of Subsurface Vapor Intrusion Guidance (EPA, 2002).
[2] Values are Regional Screening Levels (RSL) for residential air (based on 10^{-6} for carcinogens and HQ of 0.1 for noncarcinogens). [Oak Ridge National Laboratory (ORNL), May 2010].
[3] H'TS = Henry's Law Constant (dimensionless) at system (i.e., groundwater) temperature. Calculated using equation 3 from USEPA, 2004. The H'TS for cyclohexane is the Henry's Law Constant (dimensionless) (H') at reference temperature due to the lack of chemical specific data available to calculate the H'TS.
Average groundwater temperature of 15.19°C used in calculations.
[4] If the calculated groundwater target concentration is less than the Maximum Contaminant Level (MCL) for the compound, the target concentration is set at the MCL (EPA, 2002).

RSL values for trans-1,2-Dichloroethene used as surrogate for cis-1,2-Dichloroethene.
RSL value for n-hexane used as surrogate for methylcyclohexane.

MCL = maximum contaminant level (EPA, 2009).
N/A = Not available
ug/L = microgram per liter
ug/m^3 = microgram per cubic meter

Variables	Units	Value
$C_{target,ia}$ = Target indoor air conc., minimum	ug/m^3	Solved by Eq. 1
C_{gw} = Target groundwater conc.	ug/L	Solved by Eq. 2
TCR = Target Cancer Risk	unitless	1.00E-06
THQ = Target Hazard Quotient	unitless	1
H'TS = Dimensionless Henry's Law Constant	unitless	Chemical-specific
alpha (α) = Attenuation Factor	unitless	0.001

Equation 1: $C_{target,ia}$ = Minimum(C_{cancer}, $C_{non-cancer}$)
Equation 2: Cgw = $C_{target,ia}$ x 10^{-3} m^3/L * 1/H'TS * 1/α

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Appendix D
Ecological Risk Screening

APPENDIX D

Ecological Risk Screening

Introduction

An ecological risk screening (ERS) was conducted for Installation Restoration (IR) Site 49. Results for constituents in soil and groundwater were screened against benchmarks intended to be protective of ecological receptors. All data considered in the screen were collected in 2009.

Environmental Description

Site 49, the MCAS Suspected Minor Dump, consists of approximately 800 feet of shoreline along the New River. According to the IAS report (WAR, 1983), Site 49 was reported to contain minor quantities of paint-related waste. The land slopes northwest toward the New River. Surface water in the New River is considered marine. The site is undeveloped with thick underbrush and trees. A jurisdiction wetland and small drainage area is present in the central portion of the site though no samples were collected from within this area. During a December 2008 reconnaissance by CH2M HILL staff, red bricks were observed along the shoreline but no other wastes. Figure 3-1 of the main text presents aerial photos and sampling locations.

Screening Methodology

An ecological checklist, as required by North Carolina Department of Environment and Natural Resources (NCDENR, 2003), was completed for the site and is presented in Attachment 1.

Soil samples collected between 0 and 5 feet bgs were used in this ERS. If a sample was collected beneath pavement, it was not included in the dataset. It should be noted that surface soil data (0-1 foot bgs) were not collected at Site 49. Estimated risk in subsurface soil was assumed to be representative of risk based on exposure to surface soil.

All available groundwater data for Site 49 were included in the ERS. Groundwater samples were not filtered.

For each medium (subsurface soil and groundwater), the maximum and arithmetic mean concentrations are presented along with representative Ecological Screening Values (ESVs) intended to be protective of ecological receptors. Hazard Quotients (HQs) were calculated by dividing these statistics by the ESVs. It should be noted that ESVs for inorganics in water are generally based on dissolved concentrations and comparing them to total metals concentrations is conservative and may over-represent risk.

For locations with multiple data points (i.e., a parent and duplicate sample were available), data were reduced to the value of the greatest detected concentration or highest detection limit if there was no detection. One half of the detection limit was used for nondetects as the representative concentration when determining means.

For soil, the EPA Ecological Soil Screening Levels (EcoSSL) (EPA, 2009) were preferentially selected over Region 4 values (EPA, 2001). When no EcoSSL was available for a constituent, the Region 4 value was selected.

A selection hierarchy was also applied to surface water. The NRWQC was preferentially selected over the Region 4 value. However, when no NRWQC was available for a constituent, the Region 4 value was selected as the ESV for that constituent. Marine ESVs were used to screen groundwater concentrations assuming that groundwater discharges to the New River.

When ESVs were not available using the selected hierarchy above, supplemental ESVs were identified as available.

A base background study was conducted at MCB Camp Lejeune in June and July 2000 (Baker, 2001). As part of the ERS, subsurface soil and groundwater background concentrations were compared to site-specific media concentrations. Additional lines of evidence in the evaluation include the frequency of detection, frequency of exceedance, magnitude of exceedance, and identification of potential laboratory contaminants.

Screening Results

One subsurface sample and three groundwater samples were used in the ERS for Site 49. Analyses performed included VOCs, SVOCs, and metals. While the lack of surface soil data does create some uncertainty related to ecological exposures, this site was used from 1950 to 1960 and reportedly contains landscape and construction debris which is unlikely to contain significant contamination. Table C-1 presents the subsurface soil screen while Table C-2 presents the groundwater screen.

Subsurface Soil

Three inorganics (aluminum, iron, and vanadium) and benzo(g,h,i)perylene had HQs greater than one. Aluminum and iron were consistent with background while the maximum vanadium concentration was within the background range. Benzo(g,h,i)perylene had a low magnitude of exceedance (maximum-based HQ = 2.73) and is considered to have a low risk. Additionally, only three other PAHs were detected, all of which had HQs less than one.

All other analytes had HQs less than one, were not detected, lacked screening values, or were consistent with background. While several analytes lacked screening values and had resulting HQs above 1 based on the detection limit, it is unlikely that an a significant risk exists based on the fact that very few organic analytes were detected, most inorganics were found to be within the background range, and none of the detected analytes were identified as risk drivers. Consequently, significant risks to populations of ecological receptors exposed to soils at Site 49 are unlikely.

Groundwater

Cobalt, iron, nickel and zinc were the only analytes with HQs greater than one. Cobalt had a maximum-based HQ of 44 and a mean-based HQ of 19 but was only detected in one of three samples. While iron had very elevated HQs, the supplemental ESV (50 ug/L) was orders of magnitude less than the maximum background value (32,700 ug/L) suggesting that the ESV is overly conservative. Nickel exceeded the ESV in all three samples and had a maximum-

based HQ of 12 and a mean-based HQ of 5. Zinc exceeded the ESV in only one of three samples and had a low magnitude of exceedance (maximum-based HQ = 2.62). It's unlikely that these analytes are site-related because cobalt and iron were consistent with background in soils while nickel and zinc were both found to be within the background range. Because inorganic concentrations are based on total metals and ESVs are based on dissolved criteria, estimated risks are conservative and likely overestimated. Consequently, risk associated with groundwater at Site 49 is considered low.

Uncertainty

The only chemicals detected without ESVs were essential nutrients (e.g., calcium and potassium) and several VOCs. The nutrients occur naturally. Limited toxicological data are available for the effects of VOCs on ecological receptors because these chemicals typically are not ecological risk drivers. In some cases, such as with 2-butanone, acetone, and bis(2-ethylhexyl)phthalate, the chemicals may be laboratory artifacts (CDTSC, 2008). For TCE, the Region 4 ESV is the target value reported in MHSPE (1994). However, this value has been revised to 2.5 mg/kg (MHSPE, 2001). Using this value as a surrogate for the other detected VOCs suggests they pose no risk.

Undetected chemicals were identified as posing no risk. Although some uncertainty is associated with this approach, it was assumed that if chemicals were present at ecologically relevant levels, they would be detected in some samples.

Summary

Based on the results of this screening, additional ecological investigation of soil and groundwater at Site 49 is not recommended. However, because this site is recommended for additional evaluation (for reasons other than ecological risk) under a remedial investigation, additional groundwater data are likely to be collected. The ecological risk evaluation for groundwater will be reevaluated using all current and new data as part of the remedial investigation effort.

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Table D-1

Site 49 Subsurface Soil Screen

MCB Camp Lejeune, North Carolina

Chemical	Range of Non-Detect Values	Frequency of Detection	Minimum Concentration Detected	Maximum Concentration Detected	Sample ID of Maximum Detected Concentration	Arithmetic Mean	Standard Deviation of Mean	95% UCL (Norm)	Screening Value	Frequency of Exceedance[1]	Maximum Hazard Quotient[2]	Mean Hazard Quotient	2x Mean Background	Maximum Greater than Background?	Retain?	Rationale
Volatile Organic Compounds (UG/KG)																
1,1,1-Trichloroethane	14.0 - 14.0	0 / 1	--	--	--	7.00	--	--	100	-- / --	0.14	0.070	--	--	NO	HQs less than one, not detected
1,1,2,2-Tetrachloroethane	14.0 - 14.0	0 / 1	--	--	--	7.00	--	--	100	-- / --	0.14	0.070	--	--	NO	HQs less than one, not detected
1,1,2-Trichloro-1,2,2-trifluoroethane(Freon-113)	14.0 - 14.0	0 / 1	--	--	--	7.00	--	--	NSV	-- / --	NSV	NSV	--	--	NO	No screening value, not detected
1,1,2-Trichloroethane	14.0 - 14.0	0 / 1	--	--	--	7.00	--	--	100	-- / --	0.14	0.070	--	--	NO	HQs less than one, not detected
1,1-Dichloroethane	14.0 - 14.0	0 / 1	--	--	--	7.00	--	--	100	-- / --	0.14	0.070	--	--	NO	HQs less than one, not detected
1,1-Dichloroethene	14.0 - 14.0	0 / 1	--	--	--	7.00	--	--	100	-- / --	0.14	0.070	--	--	NO	HQs less than one, not detected
1,2,4-Trichlorobenzene	14.0 - 14.0	0 / 1	--	--	--	7.00	--	--	10.0	-- / --	1.40	0.70	--	--	NO	Not detected
1,2-Dibromo-3-chloropropane	6.90 - 6.90	0 / 1	--	--	--	3.45	--	--	NSV	-- / --	NSV	NSV	--	--	NO	No screening value, not detected
1,2-Dibromoethane	14.0 - 14.0	0 / 1	--	--	--	7.00	--	--	NSV	-- / --	NSV	NSV	--	--	NO	No screening value, not detected
1,2-Dichlorobenzene	14.0 - 14.0	0 / 1	--	--	--	7.00	--	--	10.0	-- / --	1.40	0.70	--	--	NO	Not detected
1,2-Dichloroethane	14.0 - 14.0	0 / 1	--	--	--	7.00	--	--	400	-- / --	0.035	0.018	--	--	NO	HQs less than one, not detected
1,2-Dichloropropane	14.0 - 14.0	0 / 1	--	--	--	7.00	--	--	700,000	-- / --	2.00E-05	1.00E-05	--	--	NO	HQs less than one, not detected
1,3-Dichlorobenzene	14.0 - 14.0	0 / 1	--	--	--	7.00	--	--	10.0	-- / --	1.40	0.70	--	--	NO	Not detected
1,4-Dichlorobenzene	14.0 - 14.0	0 / 1	--	--	--	7.00	--	--	10.0	-- / --	1.40	0.70	--	--	NO	Not detected
2-Butanone	14.0 - 14.0	0 / 1	--	--	--	7.00	--	--	NSV	-- / --	NSV	NSV	--	--	NO	No screening value, not detected
2-Hexanone	14.0 - 14.0	0 / 1	--	--	--	7.00	--	--	NSV	-- / --	NSV	NSV	--	--	NO	No screening value, not detected
4-Methyl-2-pentanone	14.0 - 14.0	0 / 1	--	--	--	7.00	--	--	NSV	-- / --	NSV	NSV	--	--	NO	No screening value, not detected
Acetone									NSV	-- --	NSV	NSV	--	--	NO	No screening value, not detected
Benzene	14.0 - 14.0	0 / 1	--	--	--	7.00	--	--	50.0	-- / --	0.28	0.14	--	--	NO	HQs less than one, not detected
Bromodichloromethane	14.0 - 14.0	0 / 1	--	--	--	7.00	--	--	NSV	-- / --	NSV	NSV	--	--	NO	No screening value, not detected
Bromoform	14.0 - 14.0	0 / 1	--	--	--	7.00	--	--	NSV	-- / --	NSV	NSV	--	--	NO	No screening value, not detected
Bromomethane	14.0 - 14.0	0 / 1	--	--	--	7.00	--	--	NSV	-- / --	NSV	NSV	--	--	NO	No screening value, not detected
Carbon disulfide	14.0 - 14.0	0 / 1	--	--	--	7.00	--	--	NSV	-- / --	NSV	NSV	--	--	NO	No screening value, not detected
Carbon tetrachloride	14.0 - 14.0	0 / 1	--	--	--	7.00	--	--	1,000,000	-- / --	1.40E-05	7.00E-06	--	--	NO	HQs less than one, not detected
Chlorobenzene	14.0 - 14.0	0 / 1	--	--	--	7.00	--	--	50.0	-- / --	0.28	0.14	--	--	NO	HQs less than one, not detected
Chloroethane	14.0 - 14.0	0 / 1	--	--	--	7.00	--	--	100	-- / --	0.14	0.070	--	--	NO	HQs less than one, not detected
Chloroform	14.0 - 14.0	0 / 1	--	--	--	7.00	--	--	1.00	-- / --	14.0	7.00	--	--	NO	Not detected
Chloromethane	14.0 - 14.0	0 / 1	--	--	--	7.00	--	--	NSV	-- / --	NSV	NSV	--	--	NO	No screening value, not detected
cis-1,2-Dichloroethene	14.0 - 14.0	0 / 1	--	--	--	7.00	--	--	NSV	-- / --	NSV	NSV	--	--	NO	No screening value, not detected
cis-1,3-Dichloropropene	14.0 - 14.0	0 / 1	--	--	--	7.00	--	--	NSV	-- / --	NSV	NSV	--	--	NO	No screening value, not detected
Cyclohexane	14.0 - 14.0	0 / 1	--	--	--	7.00	--	--	100	-- / --	0.14	0.070	--	--	NO	HQs less than one, not detected
Dibromochloromethane	14.0 - 14.0	0 / 1	--	--	--	7.00	--	--	NSV	-- / --	NSV	NSV	--	--	NO	No screening value, not detected
Dichlorodifluoromethane (Freon-12)	14.0 - 14.0	0 / 1	--	--	--	7.00	--	--	NSV	-- / --	NSV	NSV	--	--	NO	No screening value, not detected
Ethylbenzene	-- - --	1 / 1	1.30	1.30	IR49-IS05-4-5-09C	1.30	--	--	50.0	0 / 1	0.026	0.026	--	--	NO	HQs less than one
Isopropylbenzene	14.0 - 14.0	0 / 1	--	--	--	7.00	--	--	NSV	-- / --	NSV	NSV	--	--	NO	No screening value, not detected
Methyl acetate	14.0 - 14.0	0 / 1	--	--	--	7.00	--	--	NSV	-- / --	NSV	NSV	--	--	NO	No screening value, not detected
Methylcyclohexane	14.0 - 14.0	0 / 1	--	--	--	7.00	--	--	NSV	-- / --	NSV	NSV	--	--	NO	No screening value, not detected
Methylene chloride	14.0 - 14.0	0 / 1	--	--	--	7.00	--	--	2,000	-- / --	0.0070	0.0035	--	--	NO	HQs less than one, not detected
Methyl-tert-butyl ether (MTBE)	14.0 - 14.0	0 / 1	--	--	--	7.00	--	--	NSV	-- / --	NSV	NSV	--	--	NO	No screening value, not detected
Styrene	14.0 - 14.0	0 / 1	--	--	--	7.00	--	--	100	-- / --	0.14	0.070	--	--	NO	HQs less than one, not detected
Tetrachloroethene	14.0 - 14.0	0 / 1	--	--	--	7.00	--	--	10.0	-- / --	1.40	0.70	--	--	NO	Not detected
Toluene	14.0 - 14.0	0 / 1	--	--	--	7.00	--	--	50.0	-- / --	0.28	0.14	--	--	NO	HQs less than one, not detected
trans-1,2-Dichloroethene	14.0 - 14.0	0 / 1	--	--	--	7.00	--	--	100	-- / --	0.14	0.070	--	--	NO	HQs less than one, not detected
trans-1,3-Dichloropropene	14.0 - 14.0	0 / 1	--	--	--	7.00	--	--	NSV	-- / --	NSV	NSV	--	--	NO	No screening value, not detected
Trichloroethene	14.0 - 14.0	0 / 1	--	--	--	7.00	--	--	1.00	-- / --	14.0	7.00	--	--	NO	Not detected
Trichlorofluoromethane(Freon-11)	14.0 - 14.0	0 / 1	--	--	--	7.00	--	--	NSV	-- / --	NSV	NSV	--	--	NO	No screening value, not detected
Vinyl chloride	14.0 - 14.0	0 / 1	--	--	--	7.00	--	--	10.0	-- / --	1.40	0.70	--	--	NO	Not detected
Xylene, total	14.0 - 14.0	0 / 1	--	--	--	7.00	--	--	50.0	-- / --	0.28	0.14	--	--	NO	HQs less than one, not detected
Semivolatile Organic Compounds (UG/KG)																
1,1-Biphenyl	2,100 - 2,100	0 / 1	--	--	--	1,050	--	--	60,000	-- / --	0.035	0.018	--	--	NO	HQs less than one, not detected
2,2'-Oxybis(1-chloropropane)	2,100 - 2,100	0 / 1	--	--	--	1,050	--	--	NSV	-- / --	NSV	NSV	--	--	NO	No screening value, not detected

Table D-1

Site 49 Subsurface Soil Screen

MCB Camp Lejeune, North Carolina

Chemical	Range of Non-Detect Values	Frequency of Detection	Minimum Concentration Detected	Maximum Concentration Detected	Sample ID of Maximum Detected Concentration	Arithmetic Mean	Standard Deviation of Mean	95% UCL (Norm)	Screening Value	Frequency of Exceedance[1]	Maximum Hazard Quotient[2]	Mean Hazard Quotient	2x Mean Background	Maximum Greater than Background?	Retain?	Rationale
2,4,5-Trichlorophenol	4,100 - 4,100	0 / 1	--	--	--	2,050	--	--	4,000	-- / --	1.03	0.51	--	--	NO	Not detected
2,4,6-Trichlorophenol	2,100 - 2,100	0 / 1	--	--	--	1,050	--	--	10,000	-- / --	0.21	0.11	--	--	NO	HQs less than one, not detected
2,4-Dichlorophenol	2,100 - 2,100	0 / 1	--	--	--	1,050	--	--	3.00	-- / --	700	350	--	--	NO	Not detected
2,4-Dimethylphenol	2,100 - 2,100	0 / 1	--	--	--	1,050	--	--	NSV	-- / --	NSV	NSV	--	--	NO	No screening value, not detected
2,4-Dinitrophenol	4,100 - 4,100	0 / 1	--	--	--	2,050	--	--	20,000	-- / --	0.21	0.10	--	--	NO	HQs less than one, not detected
2,4-Dinitrotoluene	2,100 - 2,100	0 / 1	--	--	--	1,050	--	--	NSV	-- / --	NSV	NSV	--	--	NO	No screening value, not detected
2,6-Dinitrotoluene	2,100 - 2,100	0 / 1	--	--	--	1,050	--	--	NSV	-- / --	NSV	NSV	--	--	NO	No screening value, not detected
2-Chloronaphthalene	2,100 - 2,100	0 / 1	--	--	--	1,050	--	--	1,000	-- / --	2.10	1.05	--	--	NO	Not detected
2-Chlorophenol	2,100 - 2,100	0 / 1	--	--	--	1,050	--	--	10.0	-- / --	210	105	--	--	NO	Not detected
2-Methylnaphthalene	2,100 - 2,100	0 / 1	--	--	--	1,050	--	--	29,000	-- / --	0.072	0.036	--	--	NO	HQs less than one, not detected
2-Methylphenol	2,100 - 2,100	0 / 1	--	--	--	1,050	--	--	500	-- / --	4.20	2.10	--	--	NO	Not detected
2-Nitroaniline	4,100 - 4,100	0 / 1	--	--	--	2,050	--	--	NSV	-- / --	NSV	NSV	--	--	NO	No screening value, not detected
2-Nitrophenol	2,100 - 2,100	0 / 1	--	--	--	1,050	--	--	NSV	-- / --	NSV	NSV	--	--	NO	No screening value, not detected
3,3'-Dichlorobenzidine	2,100 - 2,100	0 / 1	--	--	--	1,050	--	--	NSV	-- / --	NSV	NSV	--	--	NO	No screening value, not detected
3-Nitroaniline	4,100 - 4,100	0 / 1	--	--	--	2,050	--	--	NSV	-- / --	NSV	NSV	--	--	NO	No screening value, not detected
4,6-Dinitro-2-methylphenol	4,100 - 4,100	0 / 1	--	--	--	2,050	--	--	NSV	-- / --	NSV	NSV	--	--	NO	No screening value, not detected
4-Bromophenyl-phenylether	2,100 - 2,100	0 / 1	--	--	--	1,050	--	--	NSV	-- / --	NSV	NSV	--	--	NO	No screening value, not detected
4-Chloro-3-methylphenol	2,100 - 2,100	0 / 1	--	--	--	1,050	--	--	NSV	-- / --	NSV	NSV	--	--	NO	No screening value, not detected
4-Chloroaniline	2,100 - 2,100	0 / 1	--	--	--	1,050	--	--	20,000	-- / --	0.11	0.053	--	--	NO	HQs less than one, not detected
4-Chlorophenyl-phenylether	2,100 - 2,100	0 / 1	--	--	--	1,050	--	--	NSV	-- / --	NSV	NSV	--	--	NO	No screening value, not detected
4-Methylphenol	2,100 - 2,100	0 / 1	--	--	--	1,050	--	--	500	-- / --	4.20	2.10	--	--	NO	Not detected
4-Nitroaniline	4,100 - 4,100	0 / 1	--	--	--	2,050	--	--	NSV	-- / --	NSV	NSV	--	--	NO	No screening value, not detected
4-Nitrophenol	4,100 - 4,100	0 / 1	--	--	--	2,050	--	--	7,000	-- / --	0.59	0.29	--	--	NO	HQs less than one, not detected
Acenaphthene	2,100 - 2,100	0 / 1	--	--	--	1,050	--	--	29,000	-- / --	0.072	0.036	--	--	NO	HQs less than one, not detected
Acenaphthylene	2,100 - 2,100	0 / 1	--	--	--	1,050	--	--	29,000	-- / --	0.072	0.036	--	--	NO	HQs less than one, not detected
Acetophenone	2,100 - 2,100	0 / 1	--	--	--	1,050	--	--	NSV	-- / --	NSV	NSV	--	--	NO	No screening value, not detected
Anthracene	2,100 - 2,100	0 / 1	--	--	--	1,050	--	--	29,000	-- / --	0.072	0.036	--	--	NO	HQs less than one, not detected
Atrazine	2,100 - 2,100	0 / 1	--	--	--	1,050	--	--	0.050	-- / --	42,000	21,000	--	--	NO	Not detected
Benzaldehyde	2,100 - 2,100	0 / 1	--	--	--	1,050	--	--	NSV	-- / --	NSV	NSV	--	--	NO	No screening value, not detected
Benzo(a)anthracene	390 - 390	0 / 1	--	--	--	195	--	--	1,100	-- / --	0.35	0.18	--	--	NO	HQs less than one, not detected
Benzo(a)pyrene	-- - --	1 / 1	500	500	IR49-IS05-4-5-09C	500	--	--	1,100	0 / 1	0.45	0.45	--	--	NO	HQs less than one
Benzo(b)fluoranthene	-- - --	1 / 1	430	430	IR49-IS05-4-5-09C	430	--	--	1,100	0 / 1	0.39	0.39	--	--	NO	HQs less than one
Benzo(g,h,i)perylene	-- - --	1 / 1	3,000	3,000	IR49-IS05-4-5-09C	3,000	--	--	1,100	1 / 1	2.73	2.73	--	--	NO	Low magnitude of exceedance
Benzo(k)fluoranthene	2,100 - 2,100	0 / 1	--	--	--	1,050	--	--	1,100	-- / --	1.91	0.95	--	--	NO	Not detected
bis(2-Chloroethoxy)methane	2,100 - 2,100	0 / 1	--	--	--	1,050	--	--	NSV	-- / --	NSV	NSV	--	--	NO	No screening value, not detected
bis(2-Chloroethyl)ether	2,100 - 2,100	0 / 1	--	--	--	1,050	--	--	NSV	-- / --	NSV	NSV	--	--	NO	No screening value, not detected
bis(2-Ethylhexyl)phthalate	2,100 - 2,100	0 / 1	--	--	--	1,050	--	--	100	-- / --	21.0	10.5	--	--	NO	Not detected
Butylbenzylphthalate	2,100 - 2,100	0 / 1	--	--	--	1,050	--	--	100	-- / --	21.0	10.5	--	--	NO	Not detected
Caprolactam	2,100 - 2,100	0 / 1	--	--	--	1,050	--	--	NSV	-- / --	NSV	NSV	--	--	NO	No screening value, not detected
Carbazole	2,100 - 2,100	0 / 1	--	--	--	1,050	--	--	NSV	-- / --	NSV	NSV	--	--	NO	No screening value, not detected
Chrysene	2,100 - 2,100	0 / 1	--	--	--	1,050	--	--	1,100	-- / --	1.91	0.95	--	--	NO	Not detected
Dibenz(a,h)anthracene	280 - 280	0 / 1	--	--	--	140	--	--	1,100	-- / --	0.25	0.13	--	--	NO	HQs less than one, not detected
Dibenzofuran	2,100 - 2,100	0 / 1	--	--	--	1,050	--	--	NSV	-- / --	NSV	NSV	--	--	NO	No screening value, not detected
Diethylphthalate	2,100 - 2,100	0 / 1	--	--	--	1,050	--	--	100,000	-- / --	0.021	0.011	--	--	NO	HQs less than one, not detected
Dimethyl phthalate	2,100 - 2,100	0 / 1	--	--	--	1,050	--	--	200,000	-- / --	0.011	0.0053	--	--	NO	HQs less than one, not detected
Di-n-butylphthalate	2,100 - 2,100	0 / 1	--	--	--	1,050	--	--	200,000	-- / --	0.011	0.0053	--	--	NO	HQs less than one, not detected
Di-n-octylphthalate	3,400 - 3,400	0 / 1	--	--	--	1,700	--	--	100	-- / --	34.0	17.0	--	--	NO	Not detected
Fluoranthene	2,100 - 2,100	0 / 1	--	--	--	1,050	--	--	1,100	-- / --	1.91	0.95	--	--	NO	Not detected
Fluorene	2,100 - 2,100	0 / 1	--	--	--	1,050	--	--	29,000	-- / --	0.072	0.036	--	--	NO	HQs less than one, not detected
Hexachlorobenzene	2,100 - 2,100	0 / 1	--	--	--	1,050	--	--	2.50	-- / --	840	420	--	--	NO	Not detected
Hexachlorobutadiene	2,100 - 2,100	0 / 1	--	--	--	1,050	--	--	NSV	-- / --	NSV	NSV	--	--	NO	No screening value, not detected
Hexachlorocyclopentadiene	2,100 - 2,100	0 / 1	--	--	--	1,050	--	--	10,000	-- / --	0.21	0.11	--	--	NO	HQs less than one, not detected

Table D-1

Site 49 Subsurface Soil Screen

MCB Camp Lejeune, North Carolina

Chemical	Range of Non-Detect Values	Frequency of Detection	Minimum Concentration Detected	Maximum Concentration Detected	Sample ID of Maximum Detected Concentration	Arithmetic Mean	Standard Deviation of Mean	95% UCL (Norm)	Screening Value	Frequency of Exceedance[1]	Maximum Hazard Quotient[2]	Mean Hazard Quotient	2x Mean Background	Maximum Greater than Background?	Retain?	Rationale
Hexachloroethane	2,100 - 2,100	0 / 1	--	--	--	1,050	--	--	100	-- / --	21.0	10.5	--	--	NO	Not detected
Indeno(1,2,3-cd)pyrene	740 - 740	0 / 1	--	--	--	370	--	--	1,100	-- / --	0.67	0.34	--	--	NO	HQs less than one, not detected
Isophorone	520 - 520	0 / 1	--	--	--	260	--	--	NSV	-- / --	NSV	NSV	--	--	NO	No screening value, not detected
Naphthalene	2,100 - 2,100	0 / 1	--	--	--	1,050	--	--	29,000	-- / --	0.072	0.036	--	--	NO	HQs less than one, not detected
n-Nitroso-di-n-propylamine	260 - 260	0 / 1	--	--	--	130	--	--	NSV	-- / --	NSV	NSV	--	--	NO	No screening value, not detected
n-Nitrosodiphenylamine	2,100 - 2,100	0 / 1	--	--	--	1,050	--	--	20,000	-- / --	0.11	0.053	--	--	NO	HQs less than one, not detected
Nitrobenzene	2,100 - 2,100	0 / 1	--	--	--	1,050	--	--	40,000	-- / --	0.053	0.026	--	--	NO	HQs less than one, not detected
Pentachlorophenol	170 - 170	0 / 1	--	--	--	85.0	--	--	2,100	-- / --	0.081	0.040	--	--	NO	HQs less than one, not detected
Phenanthrene	2,100 - 2,100	0 / 1	--	--	--	1,050	--	--	29,000	-- / --	0.072	0.036	--	--	NO	HQs less than one, not detected
Phenol	2,100 - 2,100	0 / 1	--	--	--	1,050	--	--	50.0	-- / --	42.0	21.0	--	--	NO	Not detected
Pyrene	-- - --	1 / 1	410	410	IR49-IS05-4-5-09C	410	--	--	1,100	0 / 1	0.37	0.37	--	--	NO	HQs less than one
Inorganics (MG/KG)																
Aluminum	-- - --	1 / 1	1,540	1,540	IR49-IS05-4-5-09C	1,540	--	--	50.0	1 / 1	30.8	30.8	10369	NO	NO	Consistent with background
Arsenic	-- - --	1 / 1	1.20	1.20	IR49-IS05-4-5-09C	1.20	--	--	18.0	0 / 1	0.067	0.067	2.12	NO	NO	Consistent with background, HQs less than one
Barium	-- - --	1 / 1	14.1	14.1	IR49-IS05-4-5-09C	14.1	--	--	330	0 / 1	0.043	0.043	16.6	NO	NO	Consistent with background, HQs less than one
Beryllium	-- - --	1 / 1	0.11	0.11	IR49-IS05-4-5-09C	0.11	--	--	21.0	0 / 1	0.0054	0.0054	0.165	NO	NO	Consistent with background, HQs less than one
Cadmium	-- - --	1 / 1	0.12	0.12	IR49-IS05-4-5-09C	0.12	--	--	0.36	0 / 1	0.32	0.32	0.023	YES	NO	HQs less than one
Calcium [3]	-- - --	1 / 1	31,700	31,700	IR49-IS05-4-5-09C	31,700	--	--	NSV	-- / --	NSV	NSV	441	YES	NO	Macronutrieint
Chromium	-- - --	1 / 1	2.50	2.50	IR49-IS05-4-5-09C	2.50	--	--	26.0	0 / 1	0.096	0.096	14.5	NO	NO	Consistent with background, HQs less than one
Cobalt	-- - --	1 / 1	0.59	0.59	IR49-IS05-4-5-09C	0.59	--	--	13.0	0 / 1	0.045	0.045	0.822	NO	NO	Consistent with background, HQs less than one
Copper	-- - --	1 / 1	2.00	2.00	IR49-IS05-4-5-09C	2.00	--	--	28.0	0 / 1	0.071	0.071	2.56	NO	NO	Consistent with background, HQs less than one
Iron	-- - --	1 / 1	2,050	2,050	IR49-IS05-4-5-09C	2,050	--	--	200	1 / 1	10.3	10.3	5439	NO	NO	Consistent with background
Lead	-- - --	1 / 1	6.20	6.20	IR49-IS05-4-5-09C	6.20	--	--	11.0	0 / 1	0.56	0.56	8.49	NO	NO	Consistent with background, HQs less than one
Magnesium [3]	-- - --	1 / 1	4,710	4,710	IR49-IS05-4-5-09C	4,710	--	--	NSV	-- / --	NSV	NSV	363	YES	NO	Macronutrient
Manganese	-- - --	1 / 1	51.1	51.1	IR49-IS05-4-5-09C	51.1	--	--	220	0 / 1	0.23	0.23	9.25	YES	NO	Within background range, HQs less than one
Mercury	0.031 - 0.031	0 / 1	--	--	--	0.016	--	--	0.10	-- / --	0.31	0.16	0.071	--	NO	HQs less than one, not detected
Nickel	-- - --	1 / 1	4.20	4.20	IR49-IS05-4-5-09C	4.20	--	--	38.0	0 / 1	0.11	0.11	2.27	YES	NO	Within background range, HQs less than one
Potassium [3]	-- - --	1 / 1	228	228	IR49-IS05-4-5-09C	228	--	--	NSV	-- / --	NSV	NSV	361	NO	NO	Consistent with background, macronutrient
Selenium	-- - --	1 / 1	0.17	0.17	IR49-IS05-4-5-09C	0.17	--	--	0.52	0 / 1	0.33	0.33	0.505	NO	NO	Consistent with background, HQs less than one
Silver	0.51 - 0.51	0 / 1	--	--	--	0.26	--	--	4.20	-- / --	0.12	0.061	0.129	--	NO	HQs less than one, not detected
Sodium [3]	257 - 257	0 / 1	--	--	--	129	--	--	NSV	-- / --	NSV	NSV	68.3	--	NO	Macronutrient
Thallium	0.41 - 0.41	0 / 1	--	--	--	0.21	--	--	1.00	-- / --	0.41	0.21	0.38	--	NO	HQs less than one, not detected
Vanadium	-- - --	1 / 1	22.6	22.6	IR49-IS05-4-5-09C	22.6	--	--	7.80	1 / 1	2.90	2.90	17.2	YES	NO	Within background range
Zinc	-- - --	1 / 1	11.0	11.0	IR49-IS05-4-5-09C	11.0	--	--	46.0	0 / 1	0.24	0.24	6.59	YES	NO	Within background range, HQs less than one

NOTES

1 - Count of detected samples exceeding or equaling Screening Value

2 - Shaded cells indicate hazard quotient based on reporting limits

3 - Macronutrient - Not considered to be a COPC

HQs - Hazard Quotients

MG/KG - Milligrams per kilogram

NSV - No Screening Value

Table D-2
Site 49 Groundwater Screen
MCB Camp Lejeune, North Carolina

Chemical	Range of Non-Detect Values	Frequency of Detection	Minimum Concentration Detected	Maximum Concentration Detected	Sample ID of Maximum Detected Concentration	Arithmetic Mean	Standard Deviation of Mean	95% UCL (Norm)	Screening Value	Frequency of Exceedance[1]	Supplemental ESV	Source	Maximum Hazard Quotient[2]	Mean Hazard Quotient	2x Mean Background	Maximum Greater than Background?	Retain?	Rationale
Volatile Organic Compounds (UG/L)																		
1,1,1-Trichloroethane	1.00 - 1.00	0 / 3	--	--	--	0.50	0.0	0.50	312	-- / --	--	--	0.0032	0.0016	--	--	NO	HQs less than one, not detected
1,1,2,2-Tetrachloroethane	1.00 - 1.00	1 / 3	0.86	0.86	IR49-TW01-09C	0.62	0.21	0.97	90.2	0 / 3	--	--	0.0095	0.0069	--	--	NO	HQs less than one
1,1,2-Trichloro-1,2,2-trifluoroethane(Freon-113)	1.00 - 1.00	0 / 3	--	--	--	0.50	0.0	0.50	NSV	-- / --	--	--	NSV	NSV	--	--	NO	No screening value, not detected
1,1,2-Trichloroethane	1.00 - 1.00	1 / 3	0.37	0.37	IR49-TW01-09C	0.46	0.075	0.58	NSV	-- / --	1,900	Buchman, 2008	0.0002	0.0002	--	--	NO	HQs less than one
1,1-Dichloroethane	1.00 - 1.00	0 / 3	--	--	--	0.50	0.0	0.50	NSV	-- / --	--	--	NSV	NSV	--	--	NO	No screening value, not detected
1,1-Dichloroethene	1.00 - 1.00	0 / 3	--	--	--	0.50	0.0	0.50	2,240	-- / --	--	--	4.46E-04	2.23E-04	--	--	NO	HQs less than one, not detected
1,2,4-Trichlorobenzene	1.00 - 1.00	0 / 3	--	--	--	0.50	0.0	0.50	4.50	-- / --	--	--	0.22	0.11	--	--	NO	HQs less than one, not detected
1,2-Dibromo-3-chloropropane	1.00 - 1.00	0 / 3	--	--	--	0.50	0.0	0.50	NSV	-- / --	--	--	NSV	NSV	--	--	NO	No screening value, not detected
1,2-Dibromoethane	1.00 - 1.00	0 / 3	--	--	--	0.50	0.0	0.50	NSV	-- / --	--	--	NSV	NSV	--	--	NO	No screening value, not detected
1,2-Dichlorobenzene	1.00 - 1.00	0 / 3	--	--	--	0.50	0.0	0.50	19.7	-- / --	--	--	0.051	0.025	--	--	NO	HQs less than one, not detected
1,2-Dichloroethane	1.00 - 1.00	0 / 3	--	--	--	0.50	0.0	0.50	1,130	-- / --	--	--	8.85E-04	4.42E-04	--	--	NO	HQs less than one, not detected
1,2-Dichloropropane	1.00 - 1.00	0 / 3	--	--	--	0.50	0.0	0.50	2,400	-- / --	--	--	4.17E-04	2.08E-04	--	--	NO	HQs less than one, not detected
1,3-Dichlorobenzene	1.00 - 1.00	0 / 3	--	--	--	0.50	0.0	0.50	28.5	-- / --	--	--	0.035	0.018	--	--	NO	HQs less than one, not detected
1,4-Dichlorobenzene	1.00 - 1.00	0 / 3	--	--	--	0.50	0.0	0.50	19.9	-- / --	--	--	0.050	0.025	--	--	NO	HQs less than one, not detected
2-Butanone	3.00 - 3.00	0 / 3	--	--	--	1.50	0.0	1.50	NSV	-- / --	--	--	NSV	NSV	--	--	NO	No screening value, not detected
2-Hexanone	1.00 - 1.00	0 / 3	--	--	--	0.50	0.0	0.50	NSV	-- / --	--	--	NSV	NSV	--	--	NO	No screening value, not detected
4-Methyl-2-pentanone	1.00 - 1.00	0 / 3	--	--	--	0.50	0.0	0.50	NSV	-- / --	--	--	NSV	NSV	--	--	NO	No screening value, not detected
Acetone	2.50 - 4.60	0 / 3	--	--	--	1.60	0.61	2.62	NSV	-- / --	--	--	NSV	NSV	--	--	NO	No screening value, not detected
Benzene	1.00 - 1.00	0 / 3	--	--	--	0.50	0.0	0.50	109	-- / --	--	--	0.0092	0.0046	--	--	NO	HQs less than one, not detected
Bromodichloromethane	1.00 - 1.00	0 / 3	--	--	--	0.50	0.0	0.50	NSV	-- / --	--	--	NSV	NSV	--	--	NO	No screening value, not detected
Bromoform	1.00 - 1.00	0 / 3	--	--	--	0.50	0.0	0.50	640	-- / --	--	--	0.0016	7.81E-04	--	--	NO	HQs less than one, not detected
Bromomethane	1.00 - 1.00	0 / 3	--	--	--	0.50	0.0	0.50	120	-- / --	--	--	0.0083	0.0042	--	--	NO	HQs less than one, not detected
Carbon disulfide	1.00 - 1.00	1 / 3	0.21	0.21	IR49-TW01-09C	0.40	0.17	0.69	NSV	-- / --	--	--	NSV	NSV	--	--	NO	No screening value
Carbon tetrachloride	1.00 - 1.00	0 / 3	--	--	--	0.50	0.0	0.50	1,500	-- / --	--	--	6.67E-04	3.33E-04	--	--	NO	HQs less than one, not detected
Chlorobenzene	1.00 - 1.00	0 / 3	--	--	--	0.50	0.0	0.50	105	-- / --	--	--	0.0095	0.0048	--	--	NO	HQs less than one, not detected
Chloroethane	1.00 - 1.00	0 / 3	--	--	--	0.50	0.0	0.50	NSV	-- / --	--	--	NSV	NSV	--	--	NO	No screening value, not detected
Chloroform	1.00 - 1.00	0 / 3	--	--	--	0.50	0.0	0.50	815	-- / --	--	--	0.0012	6.13E-04	--	--	NO	HQs less than one, not detected
Chloromethane	1.00 - 1.00	0 / 3	--	--	--	0.50	0.0	0.50	2,700	-- / --	--	--	3.70E-04	1.85E-04	--	--	NO	HQs less than one, not detected
cis-1,2-Dichloroethene	1.00 - 1.00	2 / 3	3.40	6.90	IR49-TW01-09C	3.60	3.20	9.00	NSV	-- / --	--	--	NSV	NSV	--	--	NO	No screening value
cis-1,3-Dichloropropene	1.00 - 1.00	0 / 3	--	--	--	0.50	0.0	0.50	7.90	-- / --	--	--	0.13	0.063	--	--	NO	HQs less than one, not detected
Cyclohexane	1.00 - 1.00	0 / 3	--	--	--	0.50	0.0	0.50	NSV	-- / --	--	--	NSV	NSV	--	--	NO	No screening value, not detected
Dibromochloromethane	1.00 - 1.00	0 / 3	--	--	--	0.50	0.0	0.50	NSV	-- / --	--	--	NSV	NSV	--	--	NO	No screening value, not detected
Dichlorodifluoromethane (Freon-12)	1.00 - 1.00	0 / 3	--	--	--	0.50	0.0	0.50	NSV	-- / --	--	--	NSV	NSV	--	--	NO	No screening value, not detected
Ethylbenzene	1.00 - 1.00	0 / 3	--	--	--	0.50	0.0	0.50	4.30	-- / --	--	--	0.23	0.12	--	--	NO	HQs less than one, not detected
Isopropylbenzene	1.00 - 1.00	0 / 3	--	--	--	0.50	0.0	0.50	NSV	-- / --	--	--	NSV	NSV	--	--	NO	No screening value, not detected
Methyl acetate	1.00 - 1.00	0 / 3	--	--	--	0.50	0.0	0.50	NSV	-- / --	--	--	NSV	NSV	--	--	NO	No screening value, not detected
Methylcyclohexane	1.00 - 1.00	0 / 3	--	--	--	0.50	0.0	0.50	NSV	-- / --	--	--	NSV	NSV	--	--	NO	No screening value, not detected
Methylene chloride	1.00 - 1.00	0 / 3	--	--	--	0.50	0.0	0.50	2,560	-- / --	--	--	3.91E-04	1.95E-04	--	--	NO	HQs less than one, not detected
Methyl-tert-butyl ether (MTBE)	1.00 - 1.00	0 / 3	--	--	--	0.50	0.0	0.50	NSV	-- / --	--	--	NSV	NSV	--	--	NO	No screening value, not detected
Styrene	1.00 - 1.00	0 / 3	--	--	--	0.50	0.0	0.50	NSV	-- / --	--	--	NSV	NSV	--	--	NO	No screening value, not detected
Tetrachloroethene	1.00 - 1.00	0 / 3	--	--	--	0.50	0.0	0.50	45.0	-- / --	--	--	0.022	0.011	--	--	NO	HQs less than one, not detected
Toluene	1.00 - 1.00	0 / 3	--	--	--	0.50	0.0	0.50	37.0	-- / --	--	--	0.027	0.014	--	--	NO	HQs less than one, not detected
trans-1,2-Dichloroethene	1.00 - 1.00	1 / 3	1.30	1.30	IR49-TW01-09C	0.77	0.46	1.55	NSV	-- / --	--	--	NSV	NSV	--	--	NO	No screening value
trans-1,3-Dichloropropene	1.00 - 1.00	0 / 3	--	--	--	0.50	0.0	0.50	7.90	-- / --	--	--	0.13	0.063	--	--	NO	HQs less than one, not detected
Trichloroethene	1.00 - 1.00	1 / 3	1.60	1.60	IR49-TW01-09C	0.87	0.64	1.94	NSV	-- / --	20	Buchman, 2008	0.08	0.04	--	--	NO	HQs less than one
Trichlorofluoromethane(Freon-11)	1.00 - 1.00	0 / 3	--	--	--	0.50	0.0	0.50	NSV	-- / --	--	--	NSV	NSV	--	--	NO	No screening value, not detected
Vinyl chloride	1.00 - 1.00	1 / 3	0.93	0.93	IR49-TW01-09C	0.64	0.25	1.06	NSV	-- / --	--	--	NSV	NSV	--	--	NO	No screening value
Xylene, total	1.00 - 1.00	0 / 3	--	--	--	0.50	0.0	0.50	NSV	-- / --	--	--	NSV	NSV	--	--	NO	No screening value, not detected
Semivolatile Organic Compounds (UG/L)																		
1,1-Biphenyl	9.60 - 10.0	0 / 3	--	--	--	4.90	0.10	5.07	NSV	-- / --	--	--	NSV	NSV	--	--	NO	No screening value, not detected
2,2'-Oxybis(1-chloropropane)	9.60 - 10.0	0 / 3	--	--	--	4.90	0.10	5.07	NSV	-- / --	--	--	NSV	NSV	--	--	NO	No screening value, not detected
2,4,5-Trichlorophenol	24.0 - 25.0	0 / 3	--	--	--	12.2	0.29	12.7	NSV	-- / --	--	--	NSV	NSV	--	--	NO	No screening value, not detected
2,4,6-Trichlorophenol	9.60 - 10.0	0 / 3	--	--	--	4.90	0.10	5.07	NSV	-- / --	--	--	NSV	NSV	--	--	NO	No screening value, not detected
2,4-Dichlorophenol	9.60 - 10.0	0 / 3	--	--	--	4.90	0.10	5.07	NSV	-- / --	--	--	NSV	NSV	--	--	NO	No screening value, not detected
2,4-Dimethylphenol	9.60 - 10.0	0 / 3	--	--	--	4.90	0.10	5.07	NSV	-- / --	--	--	NSV	NSV	--	--	NO	No screening value, not detected
2,4-Dinitrophenol	24.0 - 25.0	0 / 3	--	--	--	12.2	0.29	12.7	48.5	-- / --	--	--	0.52	0.25	--	--	NO	HQs less than one, not detected
2,4-Dinitrotoluene	9.60 - 10.0	0 / 3	--	--	--	4.90	0.10	5.07	NSV	-- / --	--	--	NSV	NSV	--	--	NO	No screening value, not detected
2,6-Dinitrotoluene	9.60 - 10.0	0 / 3	--	--	--	4.90	0.10	5.07	NSV	-- / --	--	--	NSV	NSV	--	--	NO	No screening value, not detected
2-Chloronaphthalene	9.60 - 10.0	0 / 3	--	--	--	4.90	0.10	5.07	NSV	-- / --	--	--	NSV	NSV	--	--	NO	No screening value, not detected
2-Chlorophenol	9.60 - 10.0	0 / 3	--	--	--	4.90	0.10	5.07	NSV	-- / --	--	--	NSV	NSV	--	--	NO	No screening value, not detected
2-Methylnaphthalene	9.60 - 10.0	0 / 3	--	--	--	4.90	0.10	5.07	NSV	-- / --	--	--	NSV	NSV	--	--	NO	No screening value, not detected

Table D-2
Site 49 Groundwater Screen
MCB Camp Lejeune, North Carolina

Chemical	Range of Non-Detect Values	Frequency of Detection	Minimum Concentration Detected	Maximum Concentration Detected	Sample ID of Maximum Detected Concentration	Arithmetic Mean	Standard Deviation of Mean	95% UCL (Norm)	Screening Value	Frequency of Exceedance[1]	Supplemental ESV	Source	Maximum Hazard Quotient[2]	Mean Hazard Quotient	2x Mean Background	Maximum Greater than Background?	Retain?	Rationale
2-Methylphenol	9.60 - 10.0	0 / 3	--	--	--	4.90	0.10	5.07	NSV	-- / --	--	--	NSV	NSV	--	--	NO	No screening value, not detected
2-Nitroaniline	24.0 - 25.0	0 / 3	--	--	--	12.2	0.29	12.7	NSV	-- / --	--	--	NSV	NSV	--	--	NO	No screening value, not detected
2-Nitrophenol	9.60 - 10.0	0 / 3	--	--	--	4.90	0.10	5.07	NSV	-- / --	--	--	NSV	NSV	--	--	NO	No screening value, not detected
3,3'-Dichlorobenzidine	9.60 - 10.0	0 / 3	--	--	--	4.90	0.10	5.07	NSV	-- / --	--	--	NSV	NSV	--	--	NO	No screening value, not detected
3-Nitroaniline	24.0 - 25.0	0 / 3	--	--	--	12.2	0.29	12.7	NSV	-- / --	--	--	NSV	NSV	--	--	NO	No screening value, not detected
4,6-Dinitro-2-methylphenol	24.0 - 25.0	0 / 3	--	--	--	12.2	0.29	12.7	NSV	-- / --	--	--	NSV	NSV	--	--	NO	No screening value, not detected
4-Bromophenyl-phenylether	9.60 - 10.0	0 / 3	--	--	--	4.90	0.10	5.07	NSV	-- / --	--	--	NSV	NSV	--	--	NO	No screening value, not detected
4-Chloro-3-methylphenol	9.60 - 10.0	0 / 3	--	--	--	4.90	0.10	5.07	NSV	-- / --	--	--	NSV	NSV	--	--	NO	No screening value, not detected
4-Chloroaniline	9.60 - 10.0	0 / 3	--	--	--	4.90	0.10	5.07	NSV	-- / --	--	--	NSV	NSV	--	--	NO	No screening value, not detected
4-Chlorophenyl-phenylether	9.60 - 10.0	0 / 3	--	--	--	4.90	0.10	5.07	NSV	-- / --	--	--	NSV	NSV	--	--	NO	No screening value, not detected
4-Methylphenol	9.60 - 10.0	0 / 3	--	--	--	4.90	0.10	5.07	NSV	-- / --	--	--	NSV	NSV	--	--	NO	No screening value, not detected
4-Nitroaniline	24.0 - 25.0	0 / 3	--	--	--	12.2	0.29	12.7	NSV	-- / --	--	--	NSV	NSV	--	--	NO	No screening value, not detected
4-Nitrophenol	24.0 - 25.0	0 / 3	--	--	--	12.2	0.29	12.7	71.7	-- / --	--	--	0.35	0.17	--	--	NO	HQs less than one, not detected
Acenaphthene	9.60 - 10.0	0 / 3	--	--	--	4.90	0.10	5.07	9.70	-- / --	--	--	1.03	0.51	--	--	NO	Not detected
Acenaphthylene	9.60 - 10.0	0 / 3	--	--	--	4.90	0.10	5.07	NSV	-- / --	--	--	NSV	NSV	--	--	NO	No screening value, not detected
Acetophenone	9.60 - 10.0	0 / 3	--	--	--	4.90	0.10	5.07	NSV	-- / --	--	--	NSV	NSV	--	--	NO	No screening value, not detected
Anthracene	9.60 - 10.0	0 / 3	--	--	--	4.90	0.10	5.07	NSV	-- / --	--	--	NSV	NSV	--	--	NO	No screening value, not detected
Atrazine	9.60 - 10.0	0 / 3	--	--	--	4.90	0.10	5.07	NSV	-- / --	--	--	NSV	NSV	--	--	NO	No screening value, not detected
Benzaldehyde	9.60 - 10.0	0 / 3	--	--	--	4.90	0.10	5.07	NSV	-- / --	--	--	NSV	NSV	--	--	NO	No screening value, not detected
Benzo(a)anthracene	9.60 - 10.0	0 / 3	--	--	--	4.90	0.10	5.07	NSV	-- / --	--	--	NSV	NSV	--	--	NO	No screening value, not detected
Benzo(a)pyrene	9.60 - 10.0	0 / 3	--	--	--	4.90	0.10	5.07	NSV	-- / --	--	--	NSV	NSV	--	--	NO	No screening value, not detected
Benzo(b)fluoranthene	9.60 - 10.0	0 / 3	--	--	--	4.90	0.10	5.07	NSV	-- / --	--	--	NSV	NSV	--	--	NO	No screening value, not detected
Benzo(g,h,i)perylene	9.60 - 10.0	0 / 3	--	--	--	4.90	0.10	5.07	NSV	-- / --	--	--	NSV	NSV	--	--	NO	No screening value, not detected
Benzo(k)fluoranthene	9.60 - 10.0	0 / 3	--	--	--	4.90	0.10	5.07	NSV	-- / --	--	--	NSV	NSV	--	--	NO	No screening value, not detected
bis(2-Chloroethoxy)methane	9.60 - 10.0	0 / 3	--	--	--	4.90	0.10	5.07	NSV	-- / --	--	--	NSV	NSV	--	--	NO	No screening value, not detected
bis(2-Chloroethyl)ether	9.60 - 10.0	0 / 3	--	--	--	4.90	0.10	5.07	NSV	-- / --	--	--	NSV	NSV	--	--	NO	No screening value, not detected
bis(2-Ethylhexyl)phthalate	9.60 - 10.0	0 / 3	--	--	--	4.90	0.10	5.07	NSV	-- / --	--	--	NSV	NSV	--	--	NO	No screening value, not detected
Butylbenzylphthalate	9.60 - 10.0	0 / 3	--	--	--	4.90	0.10	5.07	29.4	-- / --	--	--	0.34	0.17	--	--	NO	HQs less than one, not detected
Caprolactam	9.60 - 9.80	0 / 2	--	--	--	4.85	0.071	5.17	NSV	-- / --	--	--	NSV	NSV	--	--	NO	No screening value, not detected
Carbazole	9.60 - 10.0	0 / 3	--	--	--	4.90	0.10	5.07	NSV	-- / --	--	--	NSV	NSV	--	--	NO	No screening value, not detected
Chrysene	9.60 - 10.0	0 / 3	--	--	--	4.90	0.10	5.07	NSV	-- / --	--	--	NSV	NSV	--	--	NO	No screening value, not detected
Dibenz(a,h)anthracene	9.60 - 10.0	0 / 3	--	--	--	4.90	0.10	5.07	NSV	-- / --	--	--	NSV	NSV	--	--	NO	No screening value, not detected
Dibenzofuran	9.60 - 10.0	0 / 3	--	--	--	4.90	0.10	5.07	NSV	-- / --	--	--	NSV	NSV	--	--	NO	No screening value, not detected
Diethylphthalate	9.60 - 10.0	0 / 3	--	--	--	4.90	0.10	5.07	759	-- / --	--	--	0.013	0.0065	--	--	NO	HQs less than one, not detected
Dimethyl phthalate	9.60 - 10.0	0 / 3	--	--	--	4.90	0.10	5.07	580	-- / --	--	--	0.017	0.0084	--	--	NO	HQs less than one, not detected
Di-n-butylphthalate	9.60 - 10.0	0 / 3	--	--	--	4.90	0.10	5.07	3.40	-- / --	--	--	2.94	1.44	--	--	NO	Not detected
Di-n-octylphthalate	9.60 - 10.0	0 / 3	--	--	--	4.90	0.10	5.07	NSV	-- / --	--	--	NSV	NSV	--	--	NO	No screening value, not detected
Fluoranthene	9.60 - 10.0	0 / 3	--	--	--	4.90	0.10	5.07	1.60	-- / --	--	--	6.25	3.06	--	--	NO	Not detected
Fluorene	9.60 - 10.0	0 / 3	--	--	--	4.90	0.10	5.07	NSV	-- / --	--	--	NSV	NSV	--	--	NO	No screening value, not detected
Hexachlorobenzene	9.60 - 10.0	0 / 3	--	--	--	4.90	0.10	5.07	NSV	-- / --	--	--	NSV	NSV	--	--	NO	No screening value, not detected
Hexachlorobutadiene	9.60 - 10.0	0 / 3	--	--	--	4.90	0.10	5.07	0.32	-- / --	--	--	31.3	15.3	--	--	NO	Not detected
Hexachlorocyclopentadiene	9.60 - 10.0	0 / 3	--	--	--	4.90	0.10	5.07	0.070	-- / --	--	--	143	70.0	--	--	NO	Not detected
Hexachloroethane	9.60 - 10.0	0 / 3	--	--	--	4.90	0.10	5.07	9.40	-- / --	--	--	1.06	0.52	--	--	NO	Not detected
Indeno(1,2,3-cd)pyrene	9.60 - 10.0	0 / 3	--	--	--	4.90	0.10	5.07	NSV	-- / --	--	--	NSV	NSV	--	--	NO	No screening value, not detected
Isophorone	9.60 - 10.0	0 / 3	--	--	--	4.90	0.10	5.07	129	-- / --	--	--	0.078	0.038	--	--	NO	HQs less than one, not detected
Naphthalene	9.60 - 10.0	0 / 3	--	--	--	4.90	0.10	5.07	23.5	-- / --	--	--	0.43	0.21	--	--	NO	HQs less than one, not detected
n-Nitroso-di-n-propylamine	9.60 - 10.0	0 / 3	--	--	--	4.90	0.10	5.07	NSV	-- / --	--	--	NSV	NSV	--	--	NO	No screening value, not detected
n-Nitrosodiphenylamine	9.60 - 10.0	0 / 3	--	--	--	4.90	0.10	5.07	33,000	-- / --	--	--	3.03E-04	1.48E-04	--	--	NO	HQs less than one, not detected
Nitrobenzene	9.60 - 10.0	0 / 3	--	--	--	4.90	0.10	5.07	30.0	-- / --	--	--	0.33	0.16	--	--	NO	HQs less than one, not detected
Pentachlorophenol	24.0 - 25.0	0 / 3	--	--	--	12.2	0.29	12.7	7.90	-- / --	--	--	3.16	1.54	--	--	NO	Not detected
Phenanthrene	9.60 - 10.0	0 / 3	--	--	--	4.90	0.10	5.07	NSV	-- / --	--	--	NSV	NSV	--	--	NO	No screening value, not detected
Phenol	9.60 - 10.0	0 / 3	--	--	--	4.90	0.10	5.07	58.0	-- / --	--	--	0.17	0.084	--	--	NO	HQs less than one, not detected
Pyrene	9.60 - 10.0	0 / 3	--	--	--	4.90	0.10	5.07	NSV	-- / --	--	--	NSV	NSV	--	--	NO	No screening value, not detected
Inorganics (UG/L)																		
Aluminum	-- - --	3 / 3	1,130	39,400	IR49-TW03-09C	14,780	21,364	50,796	NSV	-- / --	--	--	NSV	NSV	1886	YES	NO	No screening value
Antimony	15.0 - 15.0	0 / 3	--	--	--	7.50	0.0	7.50	NSV	-- / --	--	--	NSV	NSV	3.28	--	NO	No screening value, not detected
Arsenic	10.0 - 10.0	2 / 3	3.40	6.80	IR49-TW03-09C	5.07	1.70	7.93	36.0	0 / 3	--	--	0.19	0.14	5.77	YES	NO	Within background range, HQs less than one
Barium	-- - --	3 / 3	38.8	182	IR49-TW03-09C	98.9	74.3	224	NSV	-- / --	200	Buchman, 2008	0.91	0.49	86.2	YES	NO	HQs less than one
Beryllium	5.00 - 5.00	1 / 3	6.10	6.10	IR49-TW03-09C	3.70	2.08	7.20	NSV	-- / --	100	Buchman, 2008	0.061	0.04	0.308	YES	NO	HQs less than one
Cadmium	5.00 - 5.00	1 / 3	1.10	1.10	IR49-TW03-09C	2.03	0.81	3.40	8.80	0 / 3	--	--	0.13	0.23	0.358	YES	NO	HQs less than one
Calcium [3]	-- - --	3 / 3	12,300	96,900	IR49-TW02-09C	60,333	43,450	133,584	NSV	-- / --	--	--	NSV	NSV	69078	YES	NO	Macronutrient
Chromium	10.0 - 10.0	2 / 3	2.50	6.30	IR49-TW02-09C	4.60	1.93	7.86	50.0	0 / 3	--	--	0.13	0.092	3.13	YES	NO	Within background range, HQs less than one

Table D-2
Site 49 Groundwater Screen
MCB Camp Lejeune, North Carolina

Chemical	Range of Non-Detect Values	Frequency of Detection	Minimum Concentration Detected	Maximum Concentration Detected	Sample ID of Maximum Detected Concentration	Arithmetic Mean	Standard Deviation of Mean	95% UCL (Norm)	Screening Value	Frequency of Exceedance[1]	Supplemental ESV	Source	Maximum Hazard Quotient[2]	Mean Hazard Quotient	2x Mean Background	Maximum Greater than Background?	Retain?	Rationale
Cobalt	15.0 - 15.0	1 / 3	44.2	44.2	IR49-TW03-09C	19.7	21.2	55.5	NSV	-- / --	1	Buchman, 2008	44.2	19.7	3.4	YES	NO	See text discussion
Copper	10.0 - 10.0	0 / 3	--	--	--	5.00	0.0	5.00	3.10	-- / --	--	--	3.23	1.61	2.76	--	NO	Not detected
Iron	-- - --	3 / 3	4,040	172,000	IR49-TW03-09C	62,113	95,216	222,634	NSV	-- / --	50	Buchman, 2008	3440	1242	5999	YES	NO	See text discussion
Lead	3.00 - 3.00	2 / 3	1.80	2.90	IR49-TW02-09C	2.07	0.74	3.31	8.10	0 / 3	--	--	0.36	0.26	2.8	YES	NO	Within background range, HQs less than one
Magnesium [3]	-- - --	3 / 3	2,040	129,000	IR49-TW03-09C	46,307	71,674	167,139	NSV	-- / --	--	--	NSV	NSV	6363	YES	NO	Macronutrient
Manganese	-- - --	3 / 3	51.7	305	IR49-TW03-09C	215	141	453	NSV	-- / --	--	--	NSV	NSV	214	YES	NO	Within background range, no screening value
Mercury	0.20 - 0.20	0 / 3	--	--	--	0.10	1.70E-17	0.10	0.94	-- / --	--	--	0.21	0.11	0.1	--	NO	HQs less than one, not detected
Nickel	-- - --	3 / 3	9.40	98.6	IR49-TW03-09C	40.7	50.2	125	8.20	3 / 3	--	--	12.0	4.97	7.97	YES	NO	ESV based on dissolved nickel
Potassium [3]	-- - --	3 / 3	1,070	8,800	IR49-TW03-09C	3,833	4,310	11,100	NSV	-- / --	--	--	NSV	NSV	3277	YES	NO	Macronutrient
Selenium	5.00 - 25.0	0 / 3	--	--	--	5.83	5.77	15.6	71.0	-- / --	--	--	0.35	0.082	3.14	--	NO	HQs less than one, not detected.
Silver	10.0 - 10.0	0 / 3	--	--	--	5.00	0.0	5.00	0.23	-- / --	--	--	43.5	21.7	0.77	--	NO	Not detected
Sodium [3]	-- - --	3 / 3	31,500	1,150,000	IR49-TW03-09C	419,100	633,365	1,486,862	NSV	-- / --	--	--	NSV	NSV	22508	YES	NO	Macronutrient
Thallium	2.00 - 10.0	0 / 3	--	--	--	2.33	2.31	6.23	21.3	-- / --	--	--	0.47	0.11	3.78	--	NO	HQs less than one, not detected.
Vanadium	15.0 - 15.0	2 / 3	5.80	6.10	IR49-TW03-09C	6.47	0.91	8.00	NSV	-- / --	--	--	NSV	NSV	4.72	YES	NO	Within background range, no screening value
Zinc	-- - --	3 / 3	11.0	212	IR49-TW03-09C	80.9	114	272	81.0	1 / 3	--	--	2.62	1.00	42.1	YES	NO	Low magnitude of exceedance

NOTES
1 - Count of detected samples exceeding or equaling Screening Value
2 - Shaded cells indicate hazard quotient based on reporting limits
3 - Macronutrient - Not considered to be a COPC
ESV - ecological screening value
HQs - Hazard Quotients
NSV - No Screening Value
UCL - Upper Confidence Level
UG/L - Micrograms per liter

CHECKLIST FOR ECOLOGICAL ASSESSMENTS/SAMPLING

I. SITE LOCATION

1. Site Name Site 49 – MCAS Suspected Minor Dump
   US EPA ID Number _____
   Location United States Marine Corps Base (MCB), Camp Lejeune
   County Onslow_____ City Jacksonville_ _____ State NC_____

2. Latitude___34°42'42.14" N_____ Longitude__77°25'49.36" W_____

3. Attach site maps, including a topographical map, a diagram which illustrates the layout of the facility (e.g., site boundaries, structures, etc.), and maps showing all habitat areas identified in Section III of the checklist. Also, include maps which illustrate known and suspected release areas, sampling locations and any other important features, if available. Figure 1-1 of this report presents topography and site boundaries. Figure 2-4 is an aerial figure showing habitat and sample locations.

II. SITE CHARACTERIZATION

1. Indicate the approximate area of the site (i.e., acres or sq. ft.) Approximately 800 feet of shoreline.

2. Is this the first site visit? ☐ Yes X No
   If no, attach trip report of previous site visit(s), if available.
   Trip report is not available.

   Dates(s) of previous site visit(s) Visits to the site were conducted one time in 2008 for reconnaissance and on several dates in July 2009, during sampling events.

3. Are aerial or other site photographs available? X Yes ☐ No
   If yes, please attach any available photo(s) to the site map to the report.
   Figure 2-4 of this report.

4. Provide an approximate breakdown of the land uses on the site:

_____% Heavy Industrial	_2___% Light Industrial	_____% Urban
_____% Residential	_____% Rural	_____% Agricultural[b]
_____% Recreational[a]	_98__% Undisturbed	_____% Other[c]

[a]For recreational areas, please describe the use of the area (e.g., park, playing field, etc).
_____

[b]For agricultural areas, please list the crops and/or livestock which are present.
_____

[c]For areas designated as "other," please describe the use of the area.
_____

5. Provide an approximate breakdown of the land uses in the area surrounding the site. Indicate the radius (in miles) of the area described: _____0.5 mile radius_____

_____% Heavy Industrial	__20___% Light Industrial	_____% Urban
_____% Residential	_____% Rural	____% Agricultural[b]
_____% Recreational[a]	_____% Undisturbed	__80__% Other [c]

[a]For recreational areas, please describe the use of the area (e.g., park, playing field, golf course, etc).
_____

[b]For agricultural areas, please list the crops and/or livestock which are present.
_____

[c]For areas designated as "other," please describe the use of the area.
___McCutcheon Air Field and associated runways_____

6. Has any movement of soil taken place at the site? ☐ Yes X No
If yes, indicate the likely source of the disturbance, (e.g., erosion, agricultural, mining, industrial activities, removals, etc.) degree of disturbance, and estimate when these events occurred.

7. Do any sensitive environmental areas exist adjacent to or in proximity to the site, (e.g. Federal and State parks, National and State monuments, wetlands)? *Remember, flood plains and wetlands are not always obvious; do not answer "no" without confirming information. See Table 1 for a list of contacts.* No
Wetlands are found within and directly adjacent to the Site 49 boundaries. Site 49 is relatively small and undisturbed, but the surrounding area is largely developed. Consequently, the area does not provided adequate habitat for the red-cockaded woodpecker.

Please provide the source(s) of information used to identify these sensitive areas, and indicate their general location on the site map.
United States Marine Corps (USMC). 2006. Integrated Natural Resource Management Plan (INRMP) 2007-2011, Marine Corps Base Camp Lejeune, Onslow County, North Carolina. November.

8. What type of facility is located at the site?

☐ Chemical ☐ Manufacturing ☐ Mixing

X Waste Disposal ☐ Other (specify)

Site 49 was reported to contain minor quantities of paint related waste. Currently, the site is forested.

9. Identify the contaminants of potential concern (COPCs) at the site. If known, include the maximum contaminant levels. Please indicate the source of data cited (e.g., RFI, confirmatory sampling, etc).
Site 49 was originally identified during the 1983 Initial Assessment Study (IAS) conducted by Water and Air Research, Inc (WAR). Based upon limited historical information, the IAS concluded that 10 sites, including Site 49, did not require further assessment. This decision was primarily due to the lack of specific evidence to suggest the presence of hazardous or toxic substances. To confirm the validity of the original determinations for no further assessment, metals, VOCs and SVOCs were sampled from soil and groundwater at Site 49. Please see the Ecological Risk Screening for concentration information.

10. Check any potential routes of off-site migration of contaminants observed at the site:

☐ Swales ☐ Depressions X Drainage Ditches

X Runoff ☐ Windblown Particulates ☐ Vehicular Traffic

X Other (specify): Groundwater

11. Indicate the approximate depth to groundwater (in feet below ground surface [(bgs)].
The water table was encountered at depths ranging from approximately 4.2 to 6.8 feet bgs.

12. Indicate the direction of groundwater flow (e.g., north, southeast, etc.)
Groundwater at Site 49 generally flows towards the New River, but is tidally influenced.

13. Is the direction of surface runoff apparent from site observations? X Yes ☐ No
If yes, to which of the following does the surface runoff discharge? Indicate all that apply.

X Surface water X Groundwater ☐ Sewer

☐ Collection Impoundment

14. Is there a navigable water body or tributary to a navigable water body?
X Yes ☐ No

15. Is there a water body anywhere on or in the vicinity of the site? If yes, also complete Section III.B.1: Aquatic Habitat Checklist -- Non-Flowing Systems and/or Section III.B.2: Aquatic Habitat Checklist -- Flowing Systems.

X Yes (approx. distance: borders site) ☐ No

16. Is there evidence of flooding? ☐ Yes X No
Wetlands and flood plains are not always obvious. Do not answer "no" without confirming information. If yes, complete Section III.C: Wetland Habitat Checklist.

17. If a field guide was used to aid any of the identifications, please provide a reference. Also, estimate the time spent identifying fauna. (Use a blank sheet if additional space is needed for text.)

18. Are any threatened and/or endangered species (plant or animal) known to inhabit the area of the site? ☐ Yes X No
If yes, you are required to verify this information with the U.S. Fish and Wildlife Service or other appropriate agencies (see Table 1 for a list of contacts). If species' identities are known, please list them next.

19. Record weather conditions at the site at the time of the site visit when information for completion of this checklist was prepared:

DATE July 2009

Warm Temperature (°C/°F)

Wind (direction/speed):

Cloud Cover: Cloudy

Normal daily high temperature (°C/°F):

Precipitation (rain, snow):

20. Describe reasonable and likely future land and/or water use(s) at the site.
Land and water use will likely remain the same.

21. Describe the historical uses of the site. Include information on chemical releases that may have occurred as a result of previous land uses. For each chemical release, provide information on the form of the chemical released (i.e., solid, liquid, vapor) and the known or suspected causes or mechanism of the release (i.e., spills, leaks, material disposal, dumping, explosion, etc.).
The Site is undeveloped with thick underbrush and trees. According to the IAS report (WAR, 1983), Site 49 was reported to contain minor quantities of paint related waste. During a December 2008 reconnaissance by CH2M HILL staff, red bricks were observed along the shoreline but no other wastes.

22. Identify the media (e.g., soil [surface or subsurface], surface water, air, groundwater) which are known or suspected to contain COCs.

Soil and groundwater may contain COPCs, based on reconnaissance.

II.A. SUMMARY OF OBSERVATIONS AND SITE SETTING

Include information on significant source areas and migration pathways that are likely to constitute complete exposure pathways.

Several VOCs, SVOCs, and metals were detected in the soils and VOCs and metals were detected in groundwater. Soil exposure and surface water exposure may be complete pathways.

Checklist Completed by__Demitria Wright Updated by Sara Kent_____

Affiliation__CH2M HILL_____

Author Assisted by____ _____

Date__11/12/2009____Updated: 07/06/2010_____

III. HABITAT EVALUATION

III.A Terrestrial Habitat Checklist

III.A.1 Wooded

Are any wooded areas on or adjacent to the site? X Yes ☐ No

If yes, indicate the wooded area on the attached site map and answer the following questions. If more than one wooded area is present on or adjacent to the site, make additional copies of the following questions and fill out for each individual wooded area. Distinguish between wooded areas by using names or other designations, and clearly identify each area on the site map.

If no, proceed to Section III.A.2: Shrub/Scrub

Wooded Area Questions

X On-site ☐ Off-site

Name or Designation: Site 49 – MCAS Suspected Minor Dump area

1. Estimate the approximate size of the wooded area (_98% of site; approximately 800 feet of shoreline)
   Please identify what information was used to determine the wooded area of the site (e.g., direct observation, photos, etc).
   Aerial imagery available on Google Earth

2. Indicate the dominant type of vegetation in the wooded area. Provide photographs, if available.

   X Evergreen
   - ❑ Deciduous
   - ❑ Mixed

   Dominant plant species, if known: Pine

3. Estimate the vegetation density of the wooded area.

   X Dense (i.e., greater than 75% vegetation)
   - ❑ Moderate (i.e., 25% to 75% vegetation)
   - ❑ Sparse (i.e., less than 25% vegetation)

4. Indicate the predominant size of the trees at the site. Use diameter at breast height.

   X 0-6 inches
   - ❑ 6-12 inches
   - ❑ >12 inches
   - ❑ No single size range is predominant

5. Specify type of understory present, if known. Provide a photograph, if available.

III.A.2 Shrub/Scrub

Are any shrub/scrub areas on or adjacent to the site? ☐ Yes X No

If yes, indicate the shrub/scrub area on the attached site map and answer the following questions. If more than one shrub/scrub area is present on or adjacent to the site, make additional copies of the following questions and fill out for each individual shrub/scrub area. Distinguish between shrub/scrub areas, using names or other designations, and clearly identify each area on the site map.

If no, proceed to Section III.A.3: Open Field

III.A.3 Open Field

Are any open field areas on or adjacent to the site? ☐ Yes X No

If yes, indicate the open field area on the attached site map and answer the following questions. If more than one open field area is present on or adjacent to the site, make additional copies of the following questions and fill out for each individual open field area. Distinguish between open field areas, using names or other designations, and clearly identify each area on the site map.

If no, proceed to Section III.A.4: Miscellaneous

III.A.4 Miscellaneous

Are other types of terrestrial habitats present at the site, other than woods, scrub/shrub and open field? ☐ Yes X No

If yes, indicate the area on the attached site map and answer the following questions. If more than one of these areas are present on or adjacent to the site, make additional copies of the following questions and fill out for each individual area. Distinguish between areas by using names or other designations. Clearly identify each area on the site map.

If no, proceed to Section III.B: Aquatic Habitats.

III.B Aquatic Habitats

Note: Aquatic systems are often associated with wetland habitats. Please refer to Section III.C, Wetland Habitat Checklist.

III.B.1 Non-Flowing Systems

Are any non-flowing aquatic features (such as ponds or lakes) located at or adjacent to the site?

☐ Yes X No

If yes, indicate the aquatic feature on the attached site map and answer the following questions regarding the non-flowing aquatic features. If more than one non-flowing aquatic feature is present on or adjacent to the site, make additional copies of the following questions and fill out for each individual aquatic feature. Distinguish between aquatic features by using names or other designations. Clearly identify each area on the site map.

If no, proceed to Section III.B.2: Flowing Systems

III.B.2 Flowing Systems

Note: Aquatic systems are often associated with wetland habitats. Please refer to Section III.C, Wetland Habitat Checklist.

Are any flowing aquatic features (such as streams or rivers) located at or adjacent to the site?

X Yes ☐ No

If yes, indicate the system on the attached site map and answer the following questions regarding the flowing system. If more than one flowing system is present on or adjacent to the site, make additional copies of the following questions and complete one set for each individual aquatic feature. Distinguish between flowing systems by using names or other designation. Clearly identify each area on the site map

If no, proceed to Section III.C: Wetlands Habitats.

Flowing Aquatic Systems Questions

☐ On-site X Off-site

Name or Designation: New River

1. Indicate the type of flowing aquatic feature present.

   X River
   - ☐ Stream/Creek/Brook
   - ☐ Intermittent stream
   - ☐ Artificially created (ditch, etc.)
   - ☐ Channeling
   - ☐ Other (specify)

2. For natural systems, are there any indicators of physical alteration (e.g., channeling, debris, etc.)? ☐ Yes X No
   If yes, please describe the indicators observed.

3. Indicate the general composition of the bottom substrate.

☐ Bedrock	X Sand (course)	☐ Concrete
☐ Boulder (>10 in.)	X Silt (fine)	X Debris
☐ Cobble (2.5 - 10 in.)	X Clay (slick)	X Detritus
☐ Gravel (0.1 - 2.5 in.)	X Muck (fine/black)	☐ Marl (Shells)

   ☐ Other (please specify):_____

4. Describe the condition of the bank (e.g., height, slope, extent of vegetative cover).
   Trees occur along the bank. Along the edge of the site, the bank gradually slopes to the water.

5. Is the system influenced by tides? X Yes ☐ No
   What information was used to make this determination?
   Visual observations and tide charts (http://www.tides.info/?command=view&location=New+River+Inlet%2C+North+Carolina); based on observations, tide seems to fluctuate approximately <1 ft in either direction.

6. Is the flow intermittent? ☐ Yes X No
   If yes, please note the information used to make this determination.

Flowing System Questions (Continued)

7. Is there a discharge from the site to the water body? X Yes ☐ No
   If yes, describe the origin of each discharge and its migration path.
   Groundwater discharges to the river.

8. Indicate the discharge point of the water body. Specify name of the discharge, if known.
   The groundwater discharges along the New River shoreline, which then flows to the Atlantic Ocean.

9. Identify any field measurements and observations of water quality that were made. Provide the measurement and the units of measure in the appropriate space below:

   _____ Width (ft.)

   _____ Depth (average)

   _____ Velocity (specify units):_____

   _____ Temperature (depth of water where the reading was taken)_____

   _____ pH

   _____ Dissolved oxygen

   _____ Salinity

   _____ Turbidity (clear, slightly turbid, turbid, opaque)
   (Secchi disk depth_____)

   _____ Other (specify)

10. Describe observed color and area of coloration.

11. Is any aquatic vegetation present? X Yes ☐ No
    If yes, please identify the type of vegetation present, if known.

    ☐ Emergent X Submergent ☐ Floating

Flowing System Questions (Continued)

12. Mark the flowing water system on the attached site map.

13. What observations were made at the water body regarding the presence and/or absence of benthic macroinvertebrates, fish, birds, mammals, etc?

None at the site.

Flowing Aquatic Systems Questions

X On-site ☐ Off-site

Name or Designation: Unnamed drainage feature

14. Indicate the type of flowing aquatic feature present.

- ☐ River
- ☐ Stream/Creek/Brook
- X Intermittent stream
- ☐ Artificially created (ditch, etc.)
- ☐ Channeling
- ☐ Other (specify)

15. For natural systems, are there any indicators of physical alteration (e.g., channeling, debris, etc.)? ☐ Yes X No
If yes, please describe the indicators observed.

16. Indicate the general composition of the bottom substrate. No observation recorded.

☐ Bedrock	☐ Sand (course)	☐ Concrete
☐ Boulder (>10 in.)	☐ Silt (fine)	☐ Debris
☐ Cobble (2.5 - 10 in.)	☐ Clay (slick)	☐ Detritus
☐ Gravel (0.1 - 2.5 in.)	☐ Muck (fine/black)	☐ Marl (Shells)

☐ Other (please specify):_____

17. Describe the condition of the bank (e.g., height, slope, extent of vegetative cover).
Trees occur along the bank. The bank gradually slopes to the water.

18. Is the system influenced by tides? X Yes ☐ No
What information was used to make this determination?
Proximity to New River.

19. Is the flow intermittent? X Yes ☐ No
If yes, please note the information used to make this determination.

Flowing System Questions (Continued)

20. Is there a discharge from the site to the water body? X Yes ☐ No
    If yes, describe the origin of each discharge and its migration path.
    Stormwater runoff potentially flows to this drainage feature and the associated wetland, during heavy rain.

21. Indicate the discharge point of the water body. Specify name of the discharge, if known.
    The drainage flows into the New River.

22. Identify any field measurements and observations of water quality that were made.
    Provide the measurement and the units of measure in the appropriate space below:

    _____ Width (ft.)

    _____ Depth (average)

    _____ Velocity (specify units):_____

    _____ Temperature (depth of water where the reading was taken)_____

    _____ pH

    _____ Dissolved oxygen

    _____ Salinity

    _____ Turbidity (clear, slightly turbid, turbid, opaque)
    (Secchi disk depth_____)

    _____ Other (specify)

23. Describe observed color and area of coloration.

24. Is any aquatic vegetation present? X Yes ☐ No
    If yes, please identify the type of vegetation present, if known.

    X Emergent X Submergent ☐ Floating
    Cattails (sp.) and herbaceous vegetation were observed growing in creek during the 2008 reconnaissance.

Flowing System Questions (Continued)

25. Mark the flowing water system on the attached site map. Drainage is within the wetland denoted in Figure 2.4

26. What observations were made at the water body regarding the presence and/or absence of benthic macroinvertebrates, fish, birds, mammals, etc? Small fish and snakes

III.C Wetland Habitats

Are any wetland[1] areas such as marshes or swamps on or adjacent to the site?

X Yes ☐ No

If yes, indicate the wetland area on the attached site map and answer the following questions regarding the wetland area. If more than one wetland area is present on or adjacent to the site, make additional copies of the following questions and fill out one for each individual wetland area. Distinguish between wetland areas by using names or other designations (such as location). Clearly identify each area on the site map. Also, obtain and attach a National Wetlands Inventory Map (or maps) to illustrate each wetland area.

Identify the sources of the observations and information (e.g., National Wetland Inventory, Federal or State Agency, USGS topographic maps) used to make the determination whether or not wetland areas are present.
MCB, Camp Lejeune, North Carolina 2007-2011 Integrated Natural Resource Management Plan (INRMP), 2006.

MCB Camp Lejeune GIS Layer for Wetlands

If no wetland areas are present, proceed to Section III.D: Sensitive Environments and Receptors.

[1]Wetlands are defined in 40 CFR §232.2 as " Areas inundated or saturated by surface or groundwater at a frequency and duration sufficient to support, and that under normal circumstances does support, a prevalence of vegetation typically adapted for life in saturated soil conditions." Examples of typical wetlands plants include: cattails, cordgrass, willows and cypress trees. National wetland inventory maps may be available at http:\\nwi.fws.gov. Additional information on wetland delineation criteria is also available from the Army Corps of Engineers.

Wetland Area Questions

X On-site X Off-site

Name or Designation: Wetlands associated with the intermittent drainage

1. Indicate the approximate area of the wetland (acres or ft.^{2}) Based on available mapping, the wetland is approximately 1.3 acres. However, a wetland delineation has not been conducted by CH2M HILL personnel for this area.

2. Identify the type(s) of vegetation present in the wetland.

- ❑ Submergent (i.e., underwater) vegetation
- ❑ Emergent (i.e., rooted in the water, but rising above it) vegetation
- ❑ Floating vegetation
- ❑ Scrub/shrub
- X Wooded
- ❑ Other (Please describe):_____

3. Provide a general description of the vegetation present in and around the wetland (height, color, etc). Provide a photograph of the known or suspected wetlands, if available. Vegetation descriptions are not available from aerial photo.

4. Estimate the vegetation density of the wetland area.

- ❑ Dense (i.e., greater than 75% vegetation)
- X Moderate (i.e., 25% to 75% vegetation)
- ❑ Sparse (i.e., less than 25% vegetation)

5. Is standing water present? X Yes ☐ No
If yes, is the water primarily: X Fresh ☐ Brackish
Indicate the approximate area of the standing water (ft.^{2}):
Indicate the approximate depth of the standing water, if known (ft. or in.)_____

Wetland Area Questions (Continued)

6. Identify any field measurements and observations of water quality that were made. Provide the measurement and the units of measure in the appropriate space below:

Depth (average)

Temperature

pH

Dissolved oxygen

Salinity

Turbidity (clear, slightly turbid, turbid, opaque) (Secchi disk depth_____)

Other (specify)

Other(specify)

7. Describe observed color and area of coloration.

8. If known, indicate the source of the water in the wetland.

- ❑ Stream/River/Creek/Lake/Pond
- X Flooding (Potentially)
- ❑ Groundwater
- X Surface runoff

9. Is there a discharge from the site to the wetland? X Yes ☐ No

If yes, please describe:

The wetland surrounds the intermittent drainage area. Runoff from the site may flow into or through the wetland to the creek onsite.

Wetland Area Questions (Continued)

10. Is there a discharge from the wetland? X Yes ☐ No
If yes, to what water body is discharge released?

- ❑ Marine (Name:_____)
- X Surface stream/River (Name:_New River_)
- ❑ Lake/Pond (Name:_____)
- ❑ Groundwater
- ❑ Not sure

11. Does the area show evidence of flooding? X Yes ☐ No
If yes, indicate which of the following are present (mark all that apply).

- X Standing water
- ❑ Water-saturated soils
- ❑ Water marks
- ❑ Buttressing
- ❑ Debris lines
- ❑ Mud cracks
- ❑ Other (please describe)

11. If a soil sample was collected, describe the appearance of the soil in the wetland area. Circle or write in the best response. None collected.

Color (blue/gray, brown, black, mottled) _____

Water content (dry, wet, saturated/unsaturated)_____

12. Mark the observed wetland area(s) on the attached site map.
See Figure 2-4.

III.D Sensitive Environments and Receptors

1. Do any other potentially sensitive environmental areas[2] exist adjacent to or within one-half mile of the site? If yes, list these areas and provide the source(s) of information used to identify sensitive areas. *Do not answer "no" without confirmation from the U.S. Fish and Wildlife Service and other appropriate agencies. See Table 1 for a list of contacts.*
   Jurisdictional wetlands are located within and directly adjacent to the site boundary.

3. Are any areas on or near (i.e., within one-half mile) the site owned or used by local tribes? If yes, describe. No

3. Does the site serve or potentially serve as a habitat, foraging area or refuge by rare, threatened, endangered, candidate and/or proposed species (plants or animals), or any otherwise protected species? If yes, identify species. *This information should be obtained from the U.S. Fish and Wildlife Service and other appropriate agencies. See Table 1 for a list of contacts.*
   No

4. Is the site potentially used as a breeding, roosting or feeding area by migratory bird species? If yes, identify which species.
   Unknown

5. Is the site used by any ecologically[3], recreationally or commercially important species? If yes, explain.
   No

---

[3] Areas that provide unique and often protected habitat for wildlife species. These areas are typically used during critical life stages such as breeding, hatching, rearing of young and overwintering. Refer to Table 2 at the end of this document for examples of sensitive environments.

[3] Ecologically important species include populations of species which provide a critical (i.e., not replaceable) food resource for higher organisms. These species' functions would not be replaced by more tolerant species or perform a critical ecological function (such as organic matter decomposition) and will not be replaced by other species. Ecologically important species include pest and opportunistic species that populate an area if they serve as a food source for other species, but do not include domesticated animals (e.g., pets and livestock) or plants/animals whose existence is maintained by continuous human interventions (e.g., fish hatcheries, agricultural crops, etc).

IV. EXPOSURE PATHWAY EVALUATION

1. Do existing data provide sufficient information on the nature, rate and extent of contamination at the site?

   - ❑ Yes
   - X No
   - ❑ Uncertain

   Please provide an explanation for your answer.
   Data were collected from groundwater and subsurface soil. Surface water and sediment samples were not collected from the wetlands and intermittent drainage onsite.

2. Do existing data provide sufficient information on the nature, rate and extent of contamination in offsite affected areas?

   - ❑ Yes
   - X No
   - ❑ Uncertain
   - ❑ No offsite contamination

   Please provide an explanation for your answer.

   See #1 of this section.

3. Do existing data address potential migration pathways of contaminants at the site?

   - ❑ Yes
   - ❑ No
   - X Uncertain

   Please provide an explanation for your answer.

   Data were collected based on potential migration pathways (i.e. leaching). However, data was not collected from the intermittent drainage or wetland onsite to evaluate overland flow pathways.

4. Do existing data address potential migration pathways of contaminants in offsite affected areas?

- ❑ Yes
- ❑ No
- X Uncertain
- ❑ No offsite contamination

Please provide an explanation for your answer. See response #2 of this section.

5. Are there visible indications of stressed habitats or receptors on or near (i.e., within one-half mile) the site that may be the result of a chemical release? If yes, explain. Attach photographs if available.

No

6. Is the location of the contamination such that receptors might be reasonably expected to come into contact with it? For soil, this means contamination in the soil 0 to 1 foot below ground surface (bgs). If yes, explain.

Yes. The site is in close proximity to the water body. If contamination is present in ground water, it may migrate into the adjacent water body or wetland via the groundwater-to-surface water pathway. VOCs, SVOCs, and metals were detected in areas where plant and invertebrate receptors may be exposed in soil (greater than 1 foot).

7. Are receptors located in or using habitats where chemicals exist in air, soil, sediment or surface water? If yes, explain.

Yes. Aquatic receptors are present in the New River. Birds and other transient receptors maybe observed onsite, but due to the development surrounding the area and limited available terrestrial habitat onsite, exposure would be limited.

8. Could chemicals reach receptors via groundwater? Can chemicals leach or dissolve to groundwater? Are chemicals mobile in groundwater? Does groundwater discharge into receptor habitats? If yes, explain.

   Yes. See #6 of this section.

9. Could chemicals reach receptors through runoff or erosion? Answer the following questions.

   If contamination is present in soil, chemicals from within the top six inches of soil could reach receptors via runoff from the site; however, this is unlikely due to the relatively flat topography of the site.

   What is the approximate distance from the contaminated area to the nearest watercourse?

   - ❑ 0 feet (i.e., contamination has reached a watercourse)
   - X 1-10 feet
   - ❑ 11-20 feet
   - ❑ 21-50 feet
   - ❑ 51-100 feet
   - ❑ 101-200 feet
   - ❑ > 200 feet
   - ❑ > 500 feet
   - ❑ > 1000 feet

   What is the slope of the ground in the contaminated area?

   - X 0-10%
   - ❑ 10-30%
   - ❑ > 30%

   What is the approximate amount of ground and canopy vegetative cover in the contaminated area?

   - ❑ < 25%
   - X 25-75%
   - ❑ > 75%

   Is there visible evidence of erosion (e.g., a rill or gully) in or near the contaminated area?

   - ❑ Yes
   - X No
   - ❑ Do not know

Do any structures, pavement or natural drainage features direct run-on flow (i.e., surface flows originating upstream or uphill from the area of concern) into the contaminated area?

X Yes
❑ No
❑ Do not know

Although the drainage area is not expected to be contaminated based on low levels of groundwater concentrations, at least two drainage ditches up-gradient of the site flow under the Longstaff Street and into the creek.

Could chemicals reach receptors through the dispersion of contaminants in air (e.g., volatilization, vapors, fugitive dust)? If yes, explain.

No. See #6 of this section.

Could chemicals reach receptors through migration of non-aqueous phase liquids (NAPLs)? Is a NAPL present at the site that might be migrating towards receptors or habitats? Could NAPL discharge contact receptors or their habitat?

No