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FINAL TREATABILITY STUDY IMPLEMENTATION PLAN FOR SITE 78 MCB CAMP LEJEUNE
NC
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CH2M HILL

Final

**Treatability Study Implementation Plan
Site 78, Operable Unit No. 1**

**Marine Corps Installations East – Marine Corps Base Camp Lejeune
North Carolina**

Contract Task Order 71

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Acronyms and Abbreviations

°C	degree Celsius
µg/L	microgram per liter
ASL	Applied Sciences Laboratory
bgs	below ground surface
BTEX	benzene, toluene, ethylbenzene, and xylene
cells/L	cells per liter
CLEAN	Comprehensive Long-term Environmental Action—Navy
COC	constituent of concern
CVOC	chlorinated volatile organic compound
DCA	dichloroethane
DCE	dichloroethene
DO	dissolved oxygen
EDTA	ethylenediaminetetraacetic acid
ERD	enhanced reductive dechlorination
ft	feet
ft bgs	feet below ground surface
FTL	Field Team Leader
ft/day	feet per day
gpm	gallon per minute
g/kg	gram per kilogram
g/L	gram per liter
HPFF	Hadnot Point Fuel Farm
HPIA	Hadnot Point Industrial Area
HSP	Health and Safety Plan
ID	inner diameter
IDW	investigation-derived waste
ISCO	<i>in situ</i> chemical oxidation
LEL	lower explosive limit
MCIEAST-MCB CAMLEJ	Marine Corps Installations East- Marine Corps Base Camp Lejeune
mg/L	milligram per liter
mL	milliliter
mV	millivolt
NAVFAC	Naval Facilities Engineering Command
NCDENR	North Carolina Department of Environment and Natural Resources
NCGWQS	North Carolina Groundwater Quality Standard
ORP	oxidation-reduction potential
OU	Operable Unit
PCE	tetrachloroethene
PID	photoionization detector
PPE	personal protective equipment
PVC	polyvinyl chloride

ROD	Record of Decision
ROI	radius of influence
SAP	Sampling and Analysis Plan
SU	standard unit
TCE	trichloroethene
TTZ	target treatment zone
UIC	underground injection control
USEPA	United States Environmental Protection Agency
VC	vinyl chloride
VI	vapor intrusion
VOA	volatile organic analysis
VOC	volatile organic compound

SECTION 1

Introduction

This document presents the Treatability Study Implementation Plan for Operable Unit (OU) No. 1, Site 78, Marine Corps Installations East - Marine Corps Base Camp Lejeune (MCIEAST-MCB CAMLEJ), North Carolina (**Figure 1-1**). This Implementation Plan is prepared under the Naval Facilities Engineering Command (NAVFAC)—Mid-Atlantic, Comprehensive Long-term Environmental Action—Navy (CLEAN) 1000 Contract N62470-08-D-1000, Contract Task Order 71.

As specified in the Final Record of Decision (ROD) for OU No. 1 (Baker, 1994b), two separate groundwater pump and treat systems operate at Site 78 to contain groundwater impacted by chlorinated volatile organic compounds (CVOCs) and petroleum-related hydrocarbons. The Five-Year Review (CH2M HILL, 2010) indicated that contaminant concentration trends have asymptotically leveled over time, demonstrating a decrease in the system's effectiveness to remove contaminant mass from the impacted groundwater. The Five-Year Review recommended evaluation of alternative treatment technologies. As a result, a treatability study will be conducted at Site 78 to evaluate the effectiveness of *in situ* treatment as a potential method to accelerate site closure, as described herein.

This Treatability Study Implementation Plan is organized as follows:

- Section 1—Introduction
- Section 2—Site Background
- Section 3—Bench-Scale Testing
- Section 4—Treatability Study Implementation
- Section 5—Health and Safety and Residuals Management
- Section 6—Reporting
- Section 7—References



Legend

- Highways
- Installation Boundary

Land Use Control Boundaries

- Aquifer Use Control Boundary
- Intrusive Activities Control Boundary (Groundwater)
- Non-Industrial Use Control Boundary

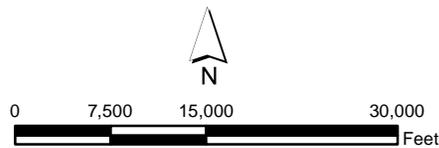


Figure 1-1
Base Location Map
Site 78 Treatability Study Implementation Plan
MCIEAST-MCB CAMLEJ
North Carolina



SECTION 2

Site Background

Site 78, located within the 'Mainside' of MCIEAST-MCB CAMLEJ, is bordered by Holcomb Boulevard to the north, Sneads Ferry Road to the east, Louis Road and Duncan Street to the south, and McHugh Boulevard to the west (**Figure 2-1**). The site covers approximately 590 acres in the Hadnot Point Industrial Area (HPIA).

The majority of the site area is paved (roadways, parking lots, loading dock areas, and storage lots); however, there are many small lawn areas associated with individual buildings within the site and along lengthy stretches of roadways. Recreational ball fields and parade grounds are located in the southwest corner of the site.

The HPIA, constructed in the late 1930s, was the first area developed at MCIEAST-MCB CAMLEJ and has historically included maintenance, warehouses, painting, printing, and auto body shops, as well as small industrial facilities that are currently in use throughout the area. The Hadnot Point Fuel Farm (HPFF) and several other petroleum-contaminated sites being managed under separate programs are located within the HPIA and vicinity of Site 78.

Previous investigations have identified three distinct areas of impacted groundwater within Site 78:

- The northern area in the vicinity of Buildings 901, 902, and 903 (Site 78 North) is impacted primarily with CVOCs and petroleum-related hydrocarbons;
- The central area is impacted with petroleum-related hydrocarbons associated with the former HPFF; and
- The southern area in the vicinity of Buildings 1601 and 1603 (Site 78 South) is impacted primarily with CVOCs and petroleum-related hydrocarbons.

The volatile organic carbon (VOC) constituents of concern (COCs) at Site 78 include VOCs identified in the ROD, others that have exceeded North Carolina Groundwater Quality Standards (NCGWQS) during the previous four quarters of long term monitoring, and any associated daughter products. The petroleum-related COCs for Site 78 currently include benzene, toluene, ethylbenzene, and xylene (BTEX), isopropylbenzene, and 1,2-dichloroethane (DCA). The CVOC COCs currently include tetrachloroethene (PCE), trichloroethene (TCE), cis-1,2-dichloroethene (DCE), vinyl chloride (VC), trans 1,2-DCE, 1,1-DCA, 1,1-DCE, 1,2-dibromo-3-chloropropane, and methylene chloride.

Additional detail on site history, contaminant concentrations, plume geometry, and subsurface geology and hydrogeology for Site 78 are provided in the Remedial Investigation (Baker, 1994a) and will be updated in the Supplemental Groundwater Investigation Technical Memorandum planned for completion in 2013 (CH2M HILL, 2013b). Site characteristics specific to the treatability study area are discussed below.

2.1 Treatability Study Location

The treatability study was initially planned for the areas of highest COC concentrations within Site 78 North and South. However, construction is currently underway to expand Holcomb Boulevard, which overlaps the western portion of Site 78 North. As a result, no treatability study activities will be conducted in the Site 78 North area at this time. Therefore, this treatability study will be conducted only in Site 78 South.

Based on previous investigations, the highest concentrations of CVOCs at Site 78 South are detected near the intersection of Gum Street and Hammond Road (**Figure 2-2**) within the upper Castle Hayne aquifer from a depth of 50 to 60 feet below ground surface (ft bgs). The treatability study target treatment zone (TTZ) is located slightly upgradient from the intersection of Gum Street and Hammond Road, to minimize interference with Base operations and to facilitate the execution of field activities, while still targeting elevated CVOC concentrations (greater than 1,000 µg/L).

2.2 Geology

The lithologic units that are present at Site 78 include the undifferentiated formation, Belgrade Formation, River Bend Formation, and the Castle Hayne Formation. A geologic cross-section of the treatability study area is presented on **Figure 2-3**. Within the treatability study area, shallow soils of the undifferentiated formation consist of fine-grained silty sand and sandy clay that extend to approximately 20 ft bgs. These fine-grained sediments are underlain by the River Bend formation, which is composed of well-graded sand and silt with partially cemented sand and shell fragments to 150 ft bgs. The Castle Hayne Formation consists of poorly indurated and well-indurated micrite and biomicrudite limestone at approximate depths of 150 to at least 450 feet bgs at Site 78. A fine-grained sandy clay layer of the Belgrade Formation was observed at 49 to 53 ft bgs in the boring at the location of monitoring well IR78-GW109UCH. However, this clay layer was not observed in the borings at the locations of monitoring wells installed to the same depth in the vicinity of IR78-GW109UCH, indicating the semi-confining layer is discontinuous.

2.3 Hydrogeology

Groundwater monitoring wells have been installed in the surficial aquifer and the Castle Hayne aquifer, which is divided into the upper, middle, and lower Castle Hayne. The surficial aquifer at Site 78 extends to a depth of approximately 30 ft bgs, the upper Castle Hayne aquifer extends from approximately 30 to 60 ft bgs, the middle Castle Hayne aquifer extends from approximately 60 to 125 ft bgs, and the lower Castle Hayne aquifer extends from approximately 125 to 150 ft bgs. This treatability study will be conducted entirely within the upper Castle Hayne aquifer. Groundwater flow in the upper Castle Hayne aquifer is to the southwest (**Figure 2-2**). Based on slug testing conducted within the treatability study area, the hydraulic conductivity is approximately 29 feet per day (ft/day).

2.4 Groundwater Quality

Laboratory analytical data from the groundwater investigations conducted between 2011 and 2012 indicate that TCE is the primary contaminant within the treatability study area. TCE was detected in samples collected from Site 78 South at concentrations ranging from 4,300 (IR78-GW124UCH) to 12,000 (IR78-GW109UCH) micrograms per liter ($\mu\text{g/L}$), as summarized in **Table 2-1**.

Geochemical data from groundwater samples collected from Site 78 South indicate favorable conditions for reductive dechlorination. These conditions include low dissolved oxygen (DO), neutral pH, low oxidation-reduction potential (ORP) values, and moderate groundwater temperatures (**Table 2-2**).

TABLE 2-1
CVOC Concentrations
Site 78 South Treatability Study Area

Monitoring Well	Sample Date	TCE ($\mu\text{g/L}$)	Cis-1, 2-DCE ($\mu\text{g/L}$)	VC ($\mu\text{g/L}$)
IR78-GW109UCH*	9/15/2011	12,000	360	2.5 J
IR78-GW121UCH	4/5/2012	11,000	430	40 U
IR78-GW122UCH	5/22/2012	5,400	170	1 U
IR78-GW123UCH	5/22/2012	5,100	160	1 U
IR78-GW124UCH	5/22/2012	4,300	140	1 U

Notes:

U - Not detected

*IR78-GW109UCH was abandoned in April 2012

TABLE 2-2
 Summary of Attenuation Indicator Parameters
Site 78 South Treatability Study Area

Attenuation Indicator Parameter	Range of Results	Condition Suitable for Reductive Dechlorination	Favorable / Unfavorable
ORP (mV)	-182.2 to 32	Less than +50 (favorable) Less than -100 (ideal)	Favorable
pH (SU)	7.03 to 7.34	Greater than 6.0 and less than 8.0	Favorable
DO (mg/L)	0.05 to 0.84	Less than 1.0	Favorable
Temperature (°C)	21.23 to 21.80	Greater than 20	Favorable

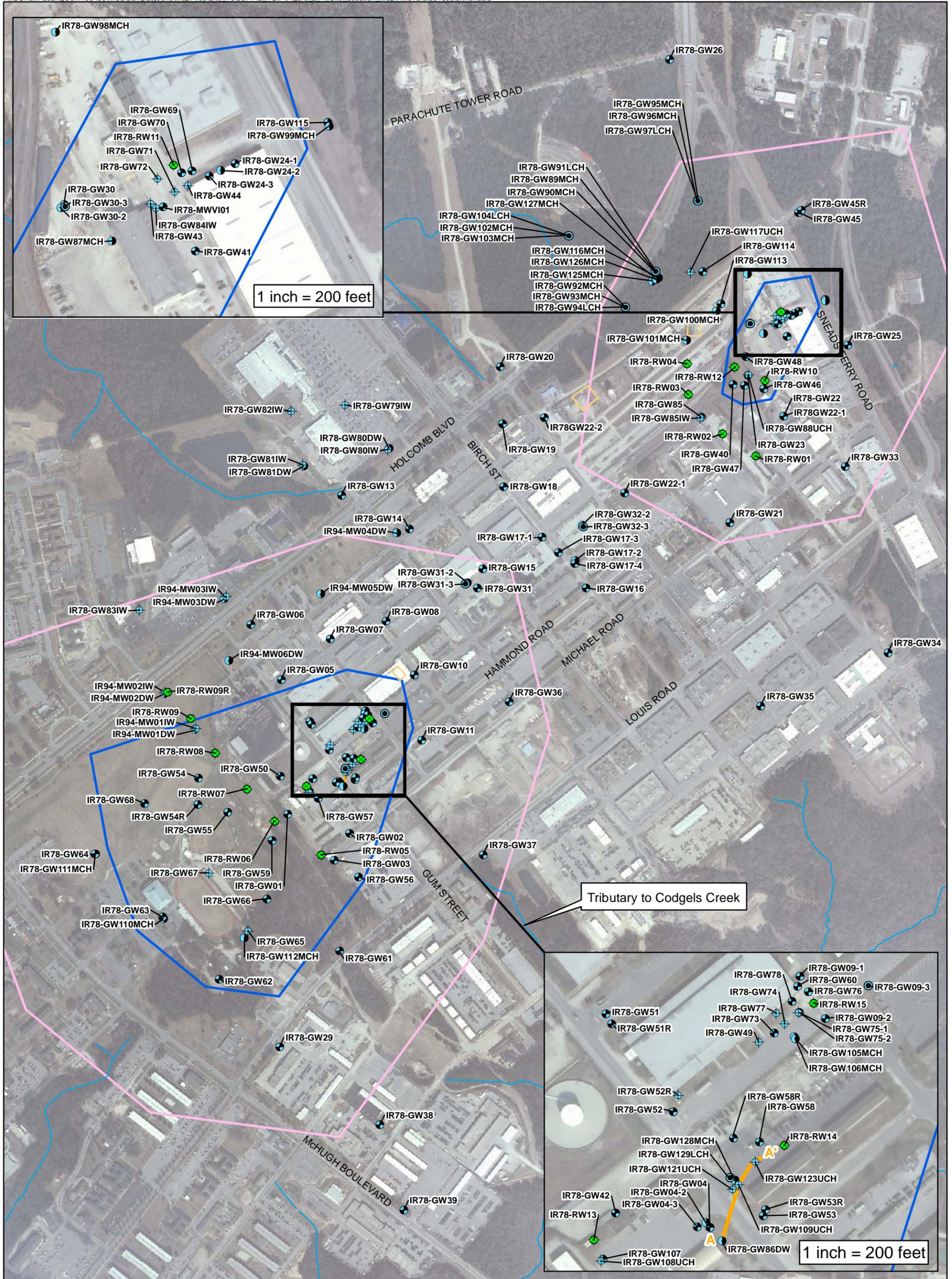
Notes:

°C – degrees Celsius

mg/L – milligram per liter

mV – millivolt

SU – standard unit

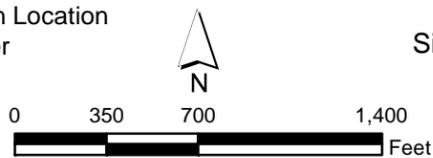


Legend

Monitoring Wells

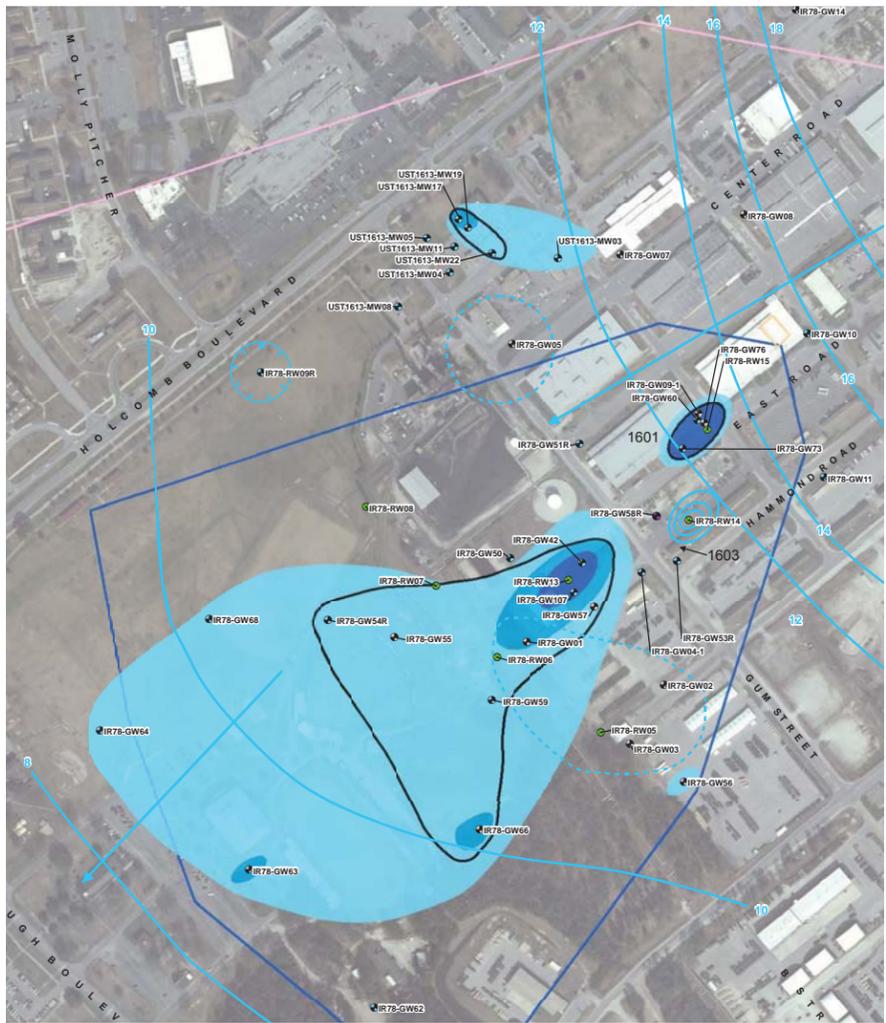
- Surficial Aquifer
- ⊕ Upper Castle Hayne Aquifer
- Middle Castle Hayne Aquifer
- Lower Castle Hayne Aquifer
- Recovery Wells
- Aquifer Use Control Boundary
- Intrusive Activities Control Boundary (Groundwater)
- Non-Industrial Use Control Boundary

- Cross Section Location
- Surface Water

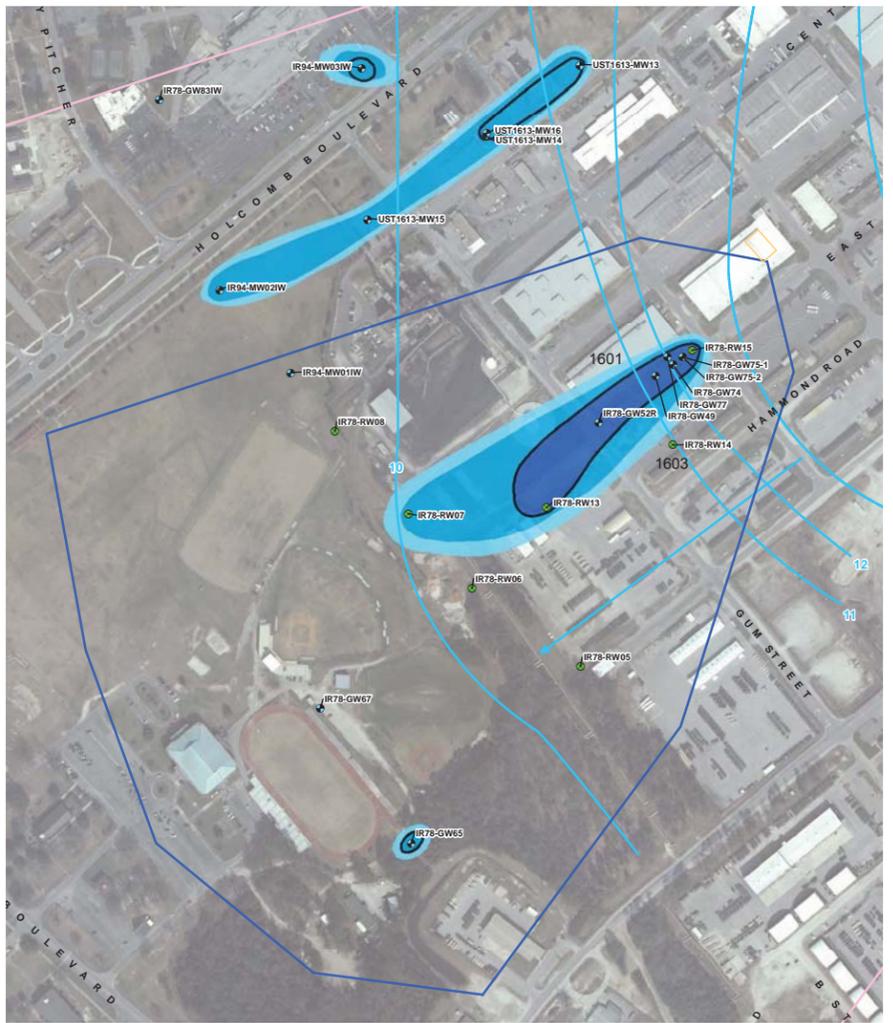


1 inch = 700 feet

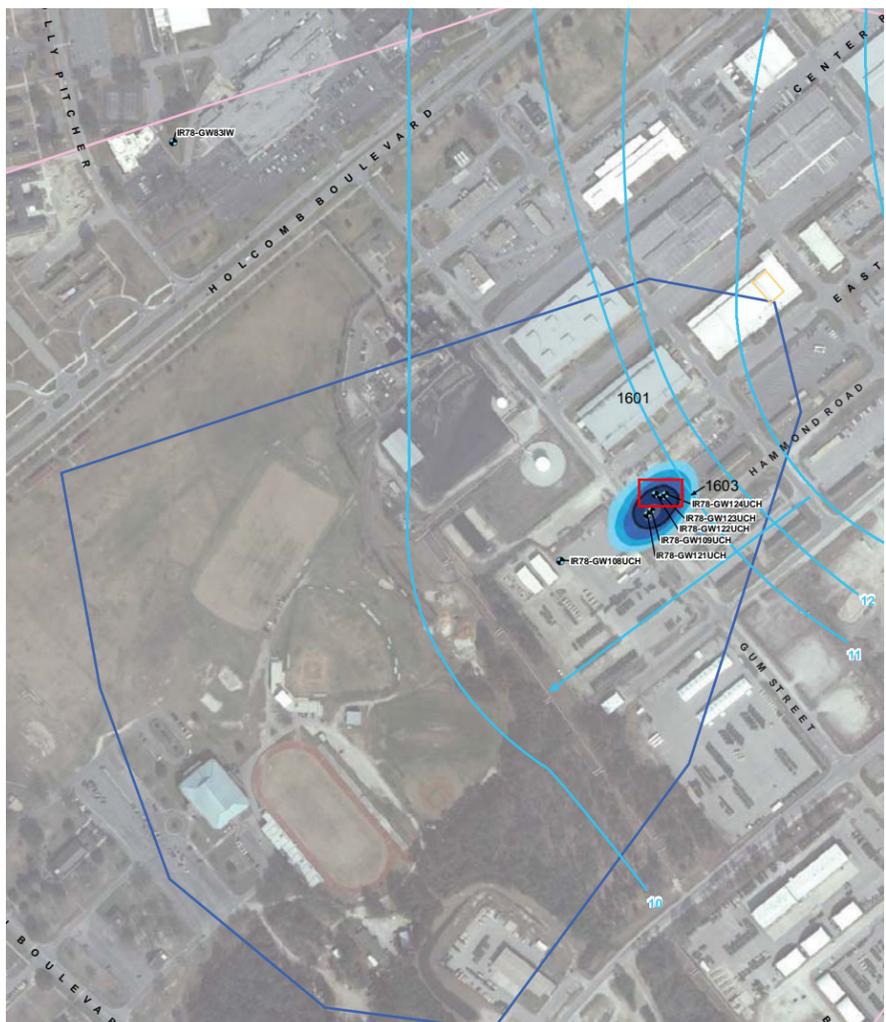
Figure 2-1
Site Map
Site 78 Treatability Study Implementation Plan
MCIEAST - MCB CAMLEJ
North Carolina



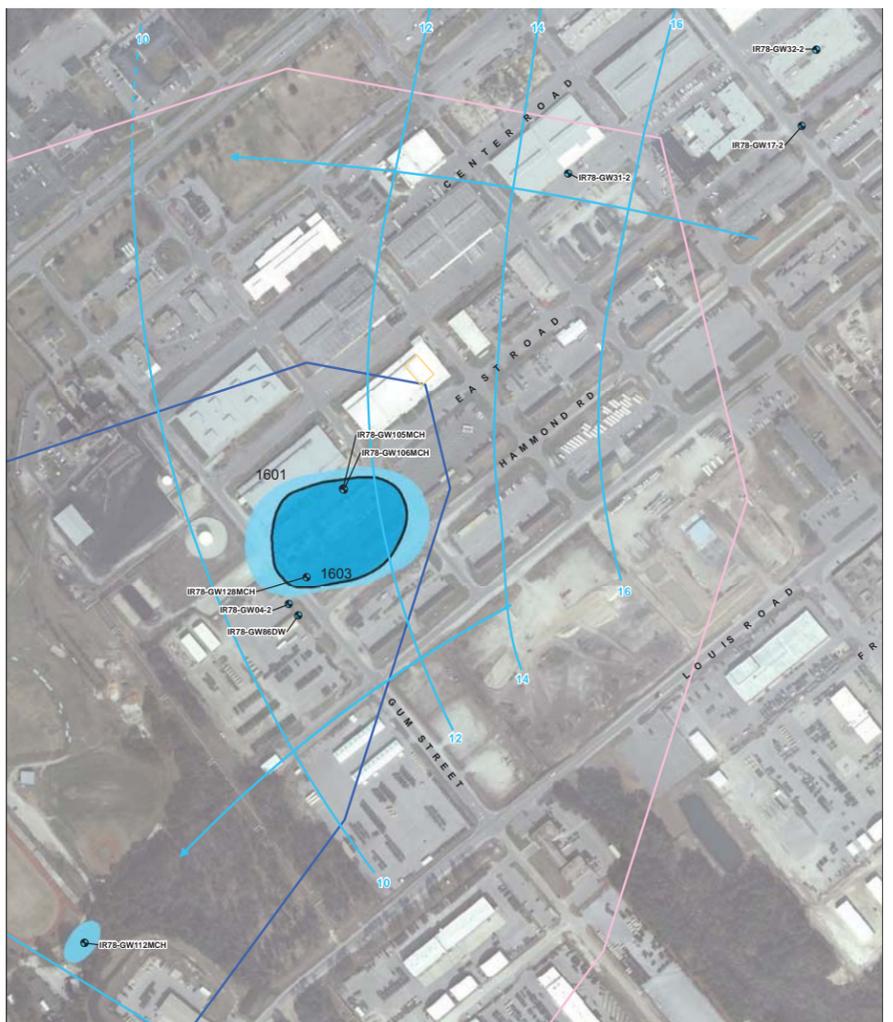
Surficial Aquifer 0'-30' bgs



Upper Castle Hayne Aquifer 30'-50' bgs



Upper Castle Hayne Aquifer 50'-60' bgs



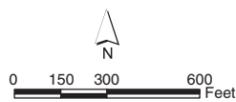
Middle Castle Hayne Aquifer 60'-125' bgs

Legend

- Monitoring Well
- Monitoring Well - Not in LTM
- Monitoring Well Measured LNAPL
- Recovery Wells
- Estimated direction of groundwater flow
- Potentiometric surface contour
- Area of perched groundwater
- Groundwater depression
- Target Treatment Zone

Land Use Control Boundaries

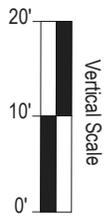
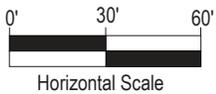
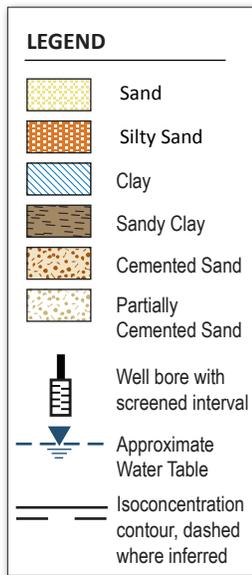
- Aquifer Use Control Boundary
- Non-Industrial Use Control Boundary
- Intrusive Activities Control Boundary (Groundwater)



Total CVOC Concentration Plumes

- 0-10 µg/L
- 10-100 µg/L
- 100-1,000 µg/L
- 1,000-10,000 µg/L
- >10,000 µg/L plume color swatch"/> >10,000 µg/L
- Exceeds NCGWQS

FIGURE 2-2
CVOC Plume Maps – South
Site 78 Treatability Study Implementation Plan
MCIEAST-MCB CAMLEJ
North Carolina



Notes:

- The depth and thickness of the subsurface strata indicated on this section (profile) were generalized from and interpolated between test locations. Information on actual subsurface conditions applies only to the specific locations and dates indicated. Subsurface conditions at other locations may differ from conditions occurring at the indicated location.

- Total volatile organic compound (VOC) data from 9/2011, 4/2012, and 5/2012. MIP data collected 6/2012.
- $\mu\text{g/L}$ - micrograms per liter
- ND - VOCs not detected
- ft msl - feet above mean sea level

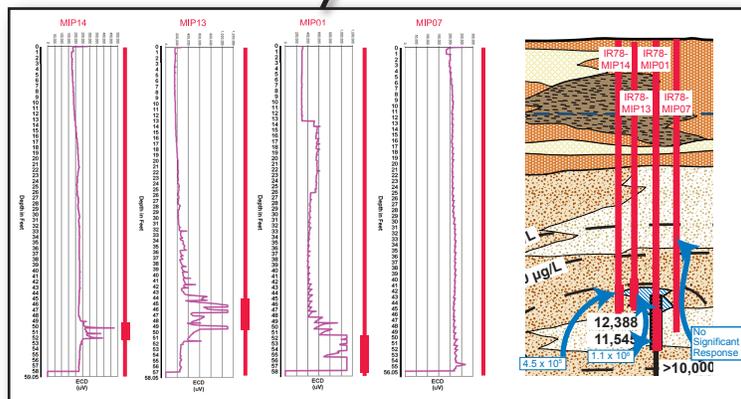
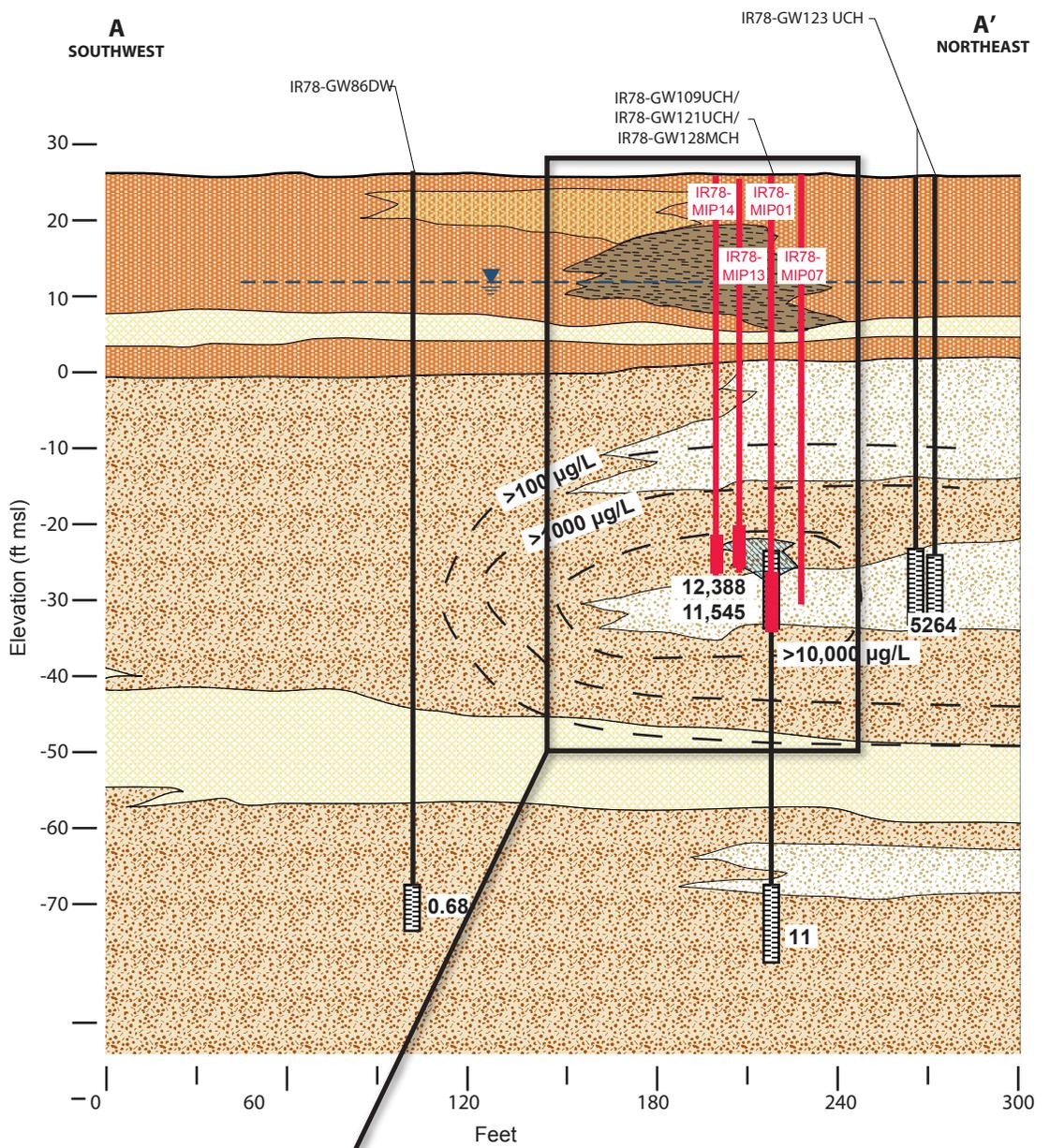


FIGURE 2-3
 Cross-Section A-A'
 Site 78 Treatability Study Implementation Plan
 MCIEAST-MCB CAMLEJ
 North Carolina

SECTION 3

Bench-Scale Testing

Prior to implementation of the treatability study, *in situ* chemical oxidation (ISCO) and enhanced reductive dechlorination (ERD) bench-scale tests were conducted to evaluate the effectiveness of select amendments in reducing COC concentrations in groundwater. The bench-scale study summary reports are provided in **Appendix A** and summarized below. The bench-scale test findings were incorporated into the design of the treatability study.

3.1 ISCO

Washington State University performed a bench-scale test to examine the effectiveness of iron-ethylenediaminetetraacetic acid (EDTA)-activated and base-activated persulfate in reducing both CVOCs and petroleum-related hydrocarbons in groundwater at Site 78 North and Site 78 South. In April 2012, soil and groundwater samples were collected from Site 78 North and Site 78 South for use in the bench-scale test and shipped to the Chemical Oxidation Laboratory at Washington State University in Pullman, Washington.

The soil was first homogenized in a 1-liter jar and characterized for site-specific contaminants. The groundwater samples were also analyzed for site-specific contaminants. The bench tests were conducted using 40-milliliter (mL) volatile organic analysis (VOA) vials containing 30 grams of soil and 9 mL of groundwater from the study area. The samples were dosed at 1.5, 2.5, and 4 grams per kilogram (g/kg) persulfate. The reactors were analyzed for contaminant concentrations at 7, 14, 21, and 28 days following the amendment application.

At Site 78 North, a maximum TCE reduction of 75 percent was achieved in the reactor containing the highest persulfate dose. At Site 78 South, no significant destruction of CVOCs or petroleum-related hydrocarbons was observed in any reactor. Under laboratory conditions, COC reductions greater than 90 percent are generally considered favorable for field implementation. Because neither test achieved this criterion, field implementation of ISCO via persulfate at Site 78 was not recommended.

3.2 Enhanced Reductive Dechlorination Bench-Scale Test

A second bench-scale test was conducted by the CH2M HILL Applied Sciences Laboratory (ASL) in Corvallis, Oregon to evaluate the effectiveness of ERD substrates with and without bioaugmentation. In November 2012, soil and groundwater samples were collected from two areas within Site 78 South (Area A and Area B) for use in the bench-scale test and shipped to the CH2M HILL ASL in Corvallis, Oregon. Area A consists of soil and groundwater collected from the surficial aquifer in the vicinity of Building 1601 and contains elevated concentrations of both BTEX and CVOC constituents. Area B consists of soil and groundwater collected from the upper Castle Hayne aquifer in the vicinity of Building 1603 and primarily contains elevated concentrations of CVOC constituents. Bench-scale testing was performed in two phases as described below.

Phase 1

In Phase 1, sulfate was evaluated for Area A as a terminal electron acceptor to drive oxidative remediation of BTEX in anaerobic environments and EHC-L¹ was evaluated for Area B for promotion of reductive dechlorination of CVOCs. For each amendment (sulfate and EHC-L), one control and one treatment reactor was prepared and composed of a 1-liter glass bottle, 400 grams of soil, and 760 mL of groundwater. Treatment reactors were dosed with 0.23 grams of sulfate (in the form of Epsom salt, MgSO₄·7H₂O) and 1.52 grams of EHC-L, respectively. The reactors were analyzed for contaminant concentrations immediately after preparation and after 7, 14, and 33 days of incubation.

¹ EHC-L is a chemical reduction reagent produced by FMC Corporation to promote biological degradation of CVOCs. It is a concentrated, buffered, microemulsion of a controlled-release, food-grade carbon, nutrients, and iron. It is composed of a slow-release carbon source (lecithin) and an organo-iron compound with amino acids. Lecithin is provided as a 25 percent emulsified liquid, and the organo-iron compound is supplied as a powder. The addition of EHC-L promotes anaerobic bioremediation processes and abiotic dechlorination reactions to reduce CVOC concentrations.

The reactors progressively became more anaerobic over the 33-day incubation and the aqueous contaminant concentrations in both the controls and treatment reactors decreased slightly over time. Within the sulfate reactor, the presence of sulfate appeared to accelerate the transition to a more reductive environment as indicated by lower DO and elevated dissolved iron concentrations; however, the sulfate concentration did not change significantly. Over 33 days, the sulfate reactor had only 13 percent less BTEX and 22 percent less CVOCs than measured in the control. The slow degradation rate was attributed to low biological activity. Within the EHC-L reactor, the addition of EHC-L increased the concentration of dissolved iron and total organic carbon, and more substrate became available from the slow-release reagent over time. However, reductive dechlorination of CVOCs was not promoted, as indicated by relatively stable TCE and cis-1,2-DCE concentrations. Similar to the sulfate reactor, the low CVOC reduction was attributed to lack of a healthy dechlorinating culture in the site media. No meaningful change in BTEX concentrations was observed in the EHC-L reactor during Phase 1.

Phase 2

In Phase 2, the microcosms were amended with sodium lactate or a dechlorinating culture to stimulate the sulfate-reducing and dechlorinating reactions, respectively. The sulfate reactor was dosed with 500 mg/L of sodium lactate to increase the electron donor concentration with the goal of stimulating the activity of sulfate-reducing culture. The EHC-L reactor was inoculated with a 1 percent dose (by volume) of Terra System's TSI-DC culture² to stimulate microbial activity. The EHC-L control reactor (without the addition of EHC-L) was also inoculated with a 1 percent dose (by volume) of TSI-DC culture to evaluate effectiveness of bioaugmentation in treating CVOCs without biostimulation. The amended reactors were analyzed for contaminant concentrations immediately after preparation and after 1 and 2 months of incubation.

The reactors remained at low DO concentrations over the 2-month incubation period. In the sulfate/sodium lactate reactors, treatment effectiveness was based on toluene and TCE concentration changes; the other BTEX and CVOC compounds were below detection limits during Phase 2. The results indicated a slight improvement in toluene degradation in the presence of sulfate, but degradation was slow and not considerably improved by the addition of lactate. There was no significant difference in the TCE concentrations between the reactors.

Rapid dechlorination of TCE and its daughter products was observed in both of the reactors inoculated with the TSI-DC culture (with and without EHC-L). Within 1 month, all TCE and cis-1,2-DCE had been transformed to VC, ethene, or other products in both the EHC-L/TSI-DC and the TSI-DC-only reactors. The EHC-L/TSI-DC reactor exhibited complete degradation of TCE and its daughter products within 1 month, as all COCs had been transformed to ethene or other products. After 2 months, no chlorinated compounds remained in either the EHC-L/TSI-DC or TSI-DC-only reactor. These results confirmed that dechlorination could be substantially accelerated at the site with the addition of a dechlorinating culture. No meaningful change in BTEX concentrations was observed in the TSI-DC reactors during Phase 2.

3.3 Treatability Study Implications

Based on the results of the bench-scale test, the MCIEAST-MCB CAMLEJ Partnering Team, composed of representatives from NAVFAC, MCIEAST-MCB CAMLEJ, United States Environmental Protection Agency (USEPA), and North Carolina Department of Environment and Natural Resources (NCDENR) agreed to proceed with field implementation of an ERD treatability study through the injection of EHC-L, supplemented by bioaugmentation with TSI-DC culture. EHC-L and TSI-DC will be injected into two existing, permanent injection wells located within the treatability study area at Site 78 South.

² TSI-DC, provided by Terra Systems, Inc., is an enriched natural bacteria culture that contains *Dehalococcoides* species. The TSI-DC culture contains more than 10^{10} *Dehalococcoides* cells per liter (cells/L), which will promote the complete dechlorination of TCE to ethene.

SECTION 4

Treatability Study Implementation

This section presents the implementation element of the treatability study including the installation of monitoring and injection wells and soil gas probes, baseline groundwater and soil gas monitoring, amendment injection, and performance monitoring of groundwater and soil gas. The field activities will be conducted in accordance with the Groundwater Sampling and Analysis Plan (SAP) (CH2M HILL, 2011a).

The primary objectives of the treatability study are:

- To evaluate the overall effectiveness of ERD with bioaugmentation for reducing CVOC mass at Site 78 South.
- To obtain information on design parameters for site-wide implementation of ERD with bioaugmentation as a potential alternative to accelerate site closure.

4.1 Well and Soil Gas Probe Installation

4.1.1 Injection and Monitoring Well Installation

Two injection wells (IR78-IW01 and IR78-IW02) and three monitoring wells (IR78-GW122UCH through IR78-GW124UCH) were installed in the TTZ in April 2012 (**Figure 4-1**). The wells were installed by Groundwater Protection, a North Carolina-licensed well driller, using rotosonic drilling techniques, and completed in accordance with North Carolina regulations. Injection and monitoring well construction details are provided in **Table 4-1**.

TABLE 4-1
Well Construction Details

Well Identification	Installation Date	Total Depth (ft bgs)	Well Diameter (inches)	Screened Interval (ft bgs)	Distance from Injection Well (ft)
IR78-IW01	4/12/12	60	4	50-60	-
IR78-IW02	4/13/12	60	4	50-60	-
IR78-GW122UCH	4/14/12	60	2	50-60	18
IR78-GW123UCH	4/13/12	60	2	50-60	13
IR78-GW124UCH	4/14/12	60	2	50-60	5

The injection wells were installed to 60 ft bgs and constructed using a 10-foot section of 4-inch inner diameter (ID), 0.020-inch machine-slotted Schedule 40 polyvinyl chloride (PVC) screen. The monitoring wells in the TTZ were installed at distances of 5 to 18 feet from the injection wells to monitor the radius of influence (ROI) of the injections and the effectiveness of the treatment (**Table 4-1**). The monitoring wells were installed to 60 ft bgs and constructed using a 10-foot section of 2-inch ID, 0.010-inch machine-slotted Schedule 40 PVC screen.

4.1.2 Soil Gas Probe Installation

As documented in the Basewide Vapor Intrusion (VI) Evaluation Report (CH2M HILL, 2011b), the potential for VI has been monitored in several buildings in the vicinity of the treatability study area. Because the proposed injections may generate biogas (primarily methane) in this area as the carbon substrate is degraded and the VOCs are reduced, an existing sub-slab soil gas probe (IR78-SG24) and a new sub-slab soil gas probe (IR78-SG73), both located inside Building 1603 (**Figure 4-1**), will be monitored during the study to confirm that methane and VOCs do not accumulate beneath Building 1603. Prior to installation of the sub-slab soil gas probe IR78-SG73, CH2M HILL will coordinate with a utilities locating subcontractor to define all subsurface structures that could be impacted by the installation activities.

4.2 Baseline Groundwater and Soil Gas Monitoring

Monitoring wells within the treatability study area were gauged and samples were collected for laboratory analysis of VOCs in April and May 2012. The resulting analytical data, presented in **Table 4-2**, were used to establish baseline conditions.

Prior to commencement of injections, baseline methane and VOC concentrations will be screened at sub-slab soil gas probes IR78-SG24 and IR78-SG73. A landfill gas meter, such as a GEM2000 equipped with a carbon filter, will then be used to measure the methane readings. A photoionization detector (PID) will be used to screen VOC concentrations.

Subsequent data collected following the injections will be compared to baseline conditions to evaluate performance during the treatability study.

4.3 Amendment Injection

4.3.1 Notifications

A Notice of Intent to Construct or Operate Injection Wells is included in **Appendix B** for submittal to the NCDENR Division of Water Quality Underground Injection Control (UIC) Program.

4.3.2 Injection Equipment and Logistics

The treatability study will be conducted within a congested area of MCIEAST-MCB CAMLEJ in Site 78 South. Care will be taken to minimize disturbance of surrounding operations. The treatability study area is located within a gated parking lot, which will be secured during non-working hours.

A process flow diagram for the treatment study area is shown on **Figure 4-2**. EHC-L will be supplied in two 55-gallon drums for the lecithin (a liquid) and two 25-pound buckets of the organo-iron compound (a solid powder). TSI-DC will be supplied in a 6-liter keg that has been pressurized to 10 to 15 pounds per square inch. All materials will be staged onsite in the location shown on **Figure 4-1** within aboveground secondary containment. Water will be obtained from a fire hydrant located approximately 150 feet west of the injection area, at the corner of Gum Street and East Road (**Figure 4-1**). The fire hydrant will either be equipped with a backflow preventer that has been certified for use at MCIEAST-MCB CAMLEJ or the mixing tank will be equipped with an air gap equal to 2.5 times the diameter of the fill pipe. The lecithin will be pumped from the drums into a 5,000-gallon mixing tank, while the organo-iron compound will be manually added into the mixing tank. Water will then be pumped from the hydrant to the mixing tank to promote mixing of the solution. The solution will then be pumped into the injection wells through hoses equipped with a flow meter, totalizer, and pressure gauge.

Prior to initiation of the injections, recovery well IR78-RW14 will be turned off and remain so for the duration of the study.

4.3.3 Injection Monitoring

The three monitoring wells in the vicinity of the injections will be monitored continuously for water levels and water quality parameters such as DO, pH, conductivity, and ORP to monitor injections and confirm the ROI of the injection. Down-hole pressure transducers and data loggers will be placed in each monitoring well prior to the injection event, and will be left in place to collect data until the injection event is complete.

4.3.4 Biostimulation

Based on the results of the bench-scale study, 8,000 gallons of an EHC-L solution will be injected into each injection well. The total volume was calculated assuming a 15-ft ROI and an assumed effective porosity of 15 percent. A total of 420 pounds of EHC-L will be mixed with 8,000 gallons of water to create a 6 gram-per-liter (g/L) solution of EHC-L. Because of tank size limitations, two batches of solution will be pumped into each well, with each batch consisting of 210 pounds of EHC-L and 4,000 gallons of water. At an expected injection rate of 10 gallons per minute (gpm), the injections can be completed in about 5 days.

It is expected that the EHC-L solution will quickly yield anaerobic conditions and low DO within the mix tank. To confirm, the DO and ORP will be measured in each EHC-L batch prior to injection. If DO is greater than 0.5 mg/L or the ORP measures greater than -50mV, then a reducing agent (such as sodium thiosulfate or sodium sulfite) will be added to the solution to induce anaerobic conditions.

4.3.5 Bioaugmentation

Bioaugmentation following substrate injections are often delayed to allow for reducing conditions to be established in the treatment zone. However, the conditions at the site are currently suitable for ERD (as discussed in Section 2.4) and the introduction of the EHC-L is expected to further reduce DO and ORP. Therefore, the bioaugmentation culture can be injected during the same mobilization as the EHC-L injections.

Following the injection of the first batch of EHC-L at each injection well, three (3) liters of TSI-DC will be injected into the treatment zone. Nitrogen gas will be used to transfer the TSI-DC from the keg into the measuring cylinder attached to the keg. The culture will then be gravity-fed into the injection well. The second batch of EHC-L will then be injected and will facilitate the distribution of the bioaugmentation culture. This process will be conducted at each injection well.

4.4 Performance Monitoring

4.4.1 Groundwater Monitoring

Three post-injection monitoring events will be conducted at 1, 3, and 6 months to monitor the effectiveness of the injections. Groundwater samples will be collected from downgradient well IR78-GW121UCH and the three TTZ wells, IR78-GW122UCH, IR78-GW123UCH, and IR78-GW124UCH, using low-flow groundwater sampling methods in accordance with the SAP (CH2M HILL, 2011a). All groundwater samples will be submitted for laboratory analysis for select VOCs (benzene, 1,2-DCE [total], ethylbenzene, PCE, toluene, TCE, VC, xylene, 1,1-DCA, 1,1-DCE, 1,2-dibromo-3-dichloropropane, 1,2-DCA, isopropylbenzene, cis-1,2-DCE, methylene chloride, and trans-1,2-DCE).

4.4.2 Soil Gas Monitoring

As part of each post-injection monitoring event (1, 3, and 6 months following injections), the sub-slab soil gas probes in Building 1603 will be screened for methane and VOCs using a landfill gas meter and PID. The results will be used to confirm that methane and VOCs do not accumulate beneath Building 1603. The frequency of post-injection soil gas monitoring may be increased if elevated concentrations of VOCs or methane are detected.

The lower explosive limit (LEL) for methane is five percent. Triggers for evaluating potential corrective actions/mitigation measures exist at concentrations as low as 10 percent of the LEL (0.5 percent). If methane is detected at concentrations exceeding 0.5 percent, then sub-slab soil gas samples will be collected for laboratory analysis of methane to confirm the field measurements and the Base and Navy will be notified.

If VOCs are detected in sub-slab soil gas at concentrations more than ten times the baseline concentrations, then confirmatory sub-slab soil gas samples will be collected for laboratory analysis of VOCs and the Base and Navy will be notified.

TABLE 4-2

Baseline Analytical Results

Site 78 Treatability Study Implementation Plan

Station ID	NCGWQS/MCL (April, 2013)	IR78-GW109UCH	IR78-GW121UCH	IR78-GW122UCH		IR78-GW123UCH	IR78-GW124UCH
Sample ID		IR78-GW109UCH-11C	IR78-GW121UCH-12B	IR78-GW122UCH-12B	IR78-GW122UCHD-12B	IR78-GW123UCH-12B	IR78-GW124UCH-12B
Sample Date		09/15/11	04/05/12	05/22/12	05/22/12	05/22/12	05/22/12
Chemical Name							
Volatile Organic Compounds (µg/l)							
1,1-Dichloroethane	6	1 U	40 U	1 U	1 U	1 U	1 U
1,1-Dichloroethene*	7	23 J	40 U	3.8	3.5	3.5	3
1,2-Dichloroethane	0.4	1 U	40 U	1 U	1 U	1 U	1 U
1,2-Dichloroethene (total)**	70	360	430	170	170	160	140
Benzene	1	0.64 J	40 U	1 U	1 U	1 U	1 U
cis-1,2-Dichloroethene	70	360	430	170	170	160	140
Ethylbenzene	600	1 U	40 U	1 U	1 U	1 U	1 U
Isopropylbenzene	70	1 U	40 U	1 U	1 U	1 U	1 U
m- and p-Xylene	500	2 U	80 U	2 U	2 U	2 U	2 U
Methylene chloride	5	5 U	69 U	5 U	5 U	5 U	5 U
o-Xylene	500	1 U	40 U	1 U	1 U	1 U	1 U
Tetrachloroethene	0.7	1 U	40 U	1 U	1 U	1 U	1 U
Toluene	600	1 U	46 U	1 U	1 U	1 U	1.3 J
trans-1,2-Dichloroethene	100	1.4 J	40 U	1.2 J	1.2 J	0.76 J	0.82 J
Trichloroethene	3	12,000	11,000	5,400 D	4,900 D	5,100 D	4,300 D
Vinyl chloride	0.03	2.5 J	40 U	1 U	1 U	1 U	1 U
Xylene, total	500	3 U	40 U	3 U	3 U	3 U	3 U

Notes:

Bold box indicates exceedance of NCGWQS or the more conservative MCL

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

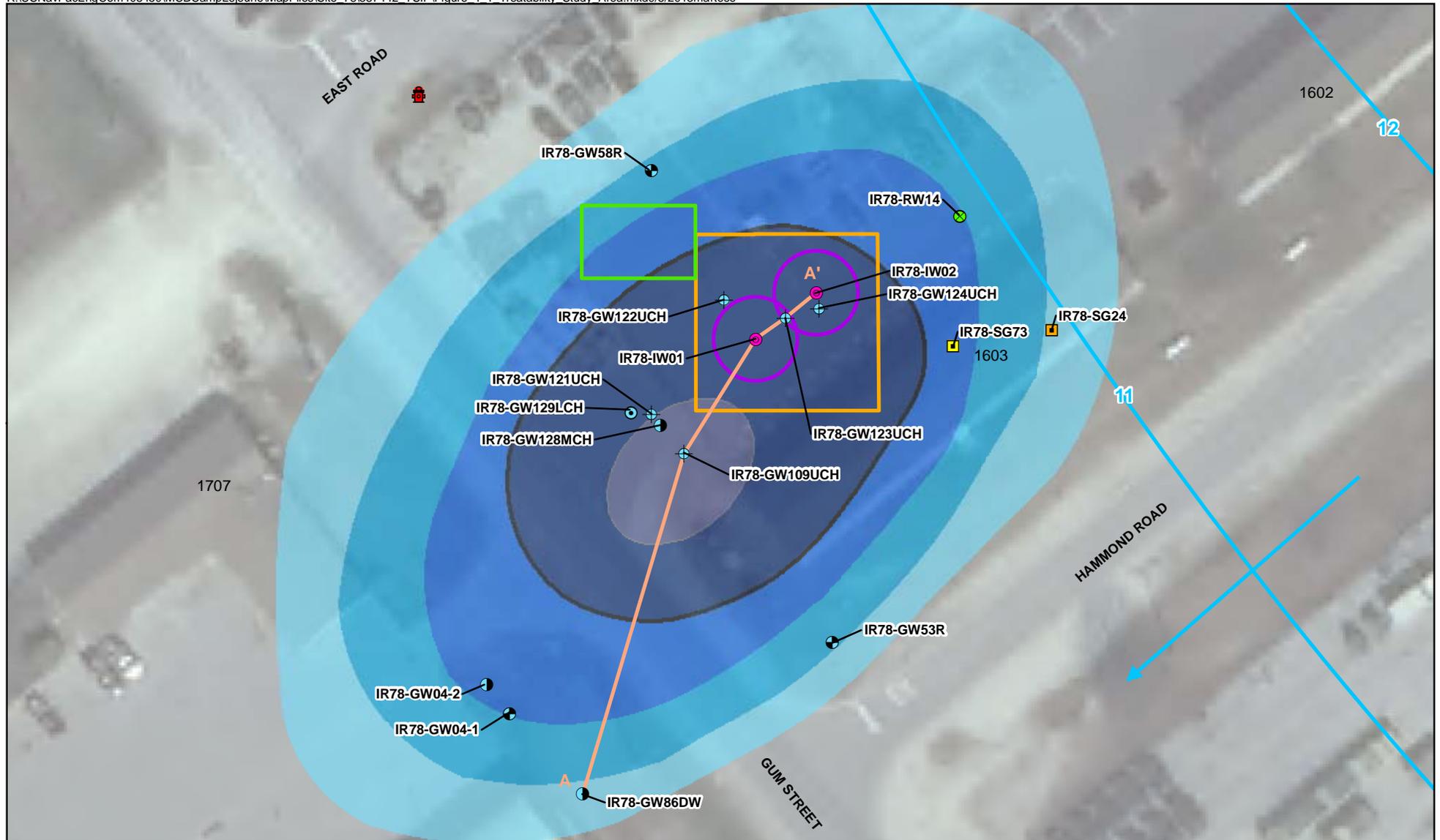
**No NCGWQS or MCL, value reported is Cleanup Level

D - Compound identified in an analysis at a secondary dilution factor

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

U - Not detected

µg/l - micrograms per liter



Legend

Monitoring Well

- Shallow Monitoring Wells
- Upper Castle Hayne Monitoring Well
- Middle Castle Hayne Monitoring Wells
- Lower Castle Hayne Aquifer
- Recovery Well
- Injection Well

- Soil Gas Probe Location
- Proposed Soil Gas Probe
- Fire Hydrants
- Cross Section Location
- Radius of Influence - 15 feet
- Staging Area
- Target Treatment Zone

Total CVOC Concentration Plumes

- 0-10 µg/L
- 10-100 µg/L
- 100-1,000 µg/L
- 1,000-10,000 µg/L
- >10,000 µg/L plume color swatch"/> >10,000 µg/L
- Exceeds NCGWQS

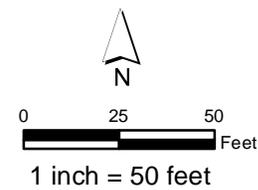
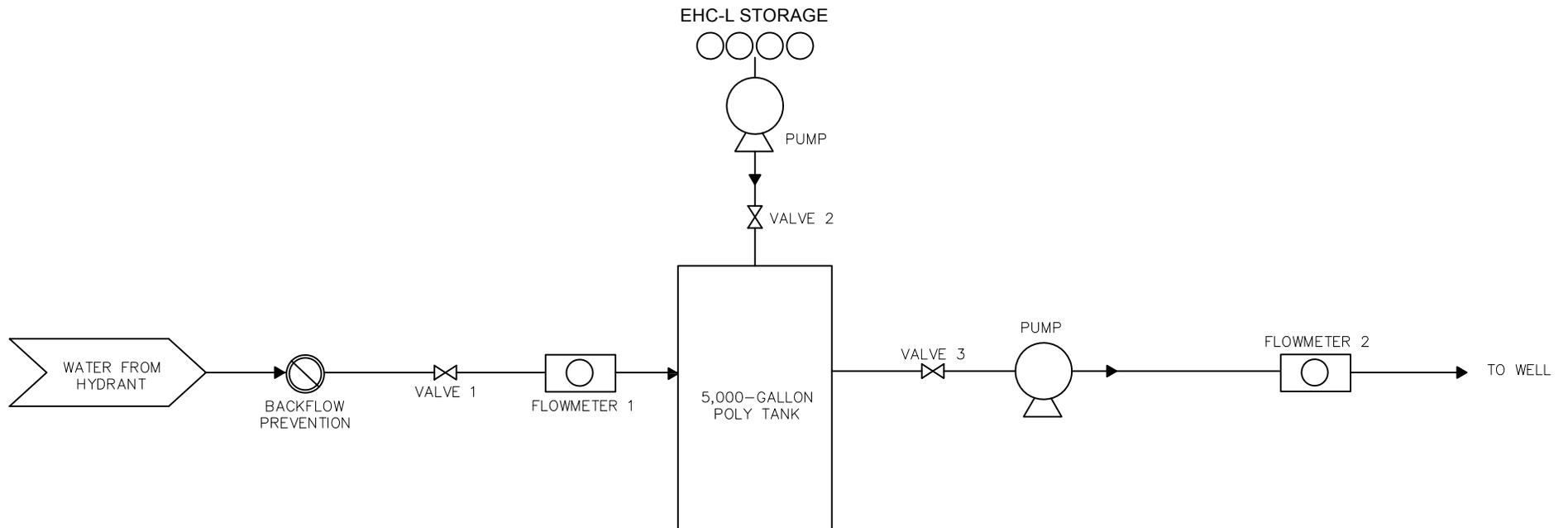


Figure 4-1
Treatability Study Area
Site 78 Treatability Study Implementation Plan
MCIEAST-MCB CAMLEJ
North Carolina



NOTES:

1. TWO BATCHES OF EHC-L WILL BE REQUIRED TO COMPLETE ONE INJECTION WELL.
2. A BATCH WILL INCLUDE THE FOLLOWING:
 - 210 pounds of EHC-L
 - 12.5 POUNDS OF ORGANO-IRON COMPOUND (1/2 BUCKET)
 - 27.5 GALLONS OF LECITHIN (1/2 DRUM)
 - 4,000 GALLONS OF WATER
3. BIOAUGMENTATION WILL BE CONDUCTED BETWEEN EACH EHC-L BATCH.
 - 3 LITERS TSI-DC VIA GRAVITY FEED

FIGURE 4-2
 Process Flow Diagram
 Site 78 Treatability Study Implementation Plan
 MCIEAST-MCB CAMLEJ
 North Carolina



Health and Safety and Residuals Management

5.1 Health and Safety

A Health and Safety Plan (HSP) will be prepared to address the potential hazards associated with implementation of the treatability study. Subcontractors are responsible for health and safety procedures specific to their particular work components and are required to develop and submit an Activity Hazard Analysis to CH2M HILL for review prior to the start of field work. Subcontractors must comply with the established HSP and CH2M HILL must monitor and enforce compliance with the established HSP.

5.2 Residuals Management

Wastes generated during the treatability study will be managed in accordance with the most current *Investigation and Remediation Waste Management Plan* (CH2M HILL, 2013a).

5.2.1 Waste Streams

The waste streams associated with this scope of work may include:

- Empty amendment containers
- Equipment and personnel decontamination fluid
- Purge water from the monitoring wells
- Personal protective equipment (PPE)
- Used sampling supplies
- Uncontaminated general debris

5.2.2 Waste Management

Amendment Containers

Drums and buckets containing EHC-L will be rinsed once emptied, and the rinse water will be collected and injected. The EHC-L containers will be removed by a third-party investigation-derived waste (IDW) transportation and disposal subcontractor for offsite disposal, while the TSI-DC canisters will be returned to the vendor.

Decontamination Fluids and Purge Water

Decontamination fluids and purge water from the monitoring wells will be containerized in bulk containers that will be provided by CH2M HILL. The CH2M HILL Field Team Leader (FTL) will coordinate the transportation of all IDW fluids to the wet well located at Lot 203 on Piney Green Road for disposal. A CH2M HILL representative will provide oversight when transferring IDW fluids to Lot 203. Adequate time will be allotted to allow for any solids to settle from the fluids prior to discharging to the wet well. Decontamination fluids or purge water that are turbid due to sediment in the water will be drummed and disposed of offsite.

Personal Protective Equipment, Used Sampling Supplies, and General Debris

PPE and used sampling supplies associated with the generation of non-hazardous wastes and general debris will be collected in black, non-translucent trash bags and disposed of in a dumpster aboard MCIEAST-MCB CAMLEJ. PPE and used sampling supplies associated with the generation of hazardous waste will be properly contained and disposed of at an offsite, permitted Resource Conservation and Recovery Act Subtitle C treatment, storage, or disposal facility.

SECTION 6

Reporting

At the conclusion of the monitoring activities, a draft Treatability Study Report will be prepared to summarize the field activities and to present the results and conclusions. After a comment period, any comments received will be addressed in the final report. The results of the treatability study will be used to re-evaluate the site closure strategy.

SECTION 7

References

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Appendix A
Bench-Scale Study Summary Reports

Final Report

Chemical Oxidation Bench-Scale Treatability Study Services

Site 78—Marine Corps Base Camp Lejeune
Jacksonville, North Carolina

Prepared for

CH2M HILL

by

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Executive Summary

Two subsurface soils and two corresponding groundwater samples were collected by CH2M HILL from Site 78 at Marine Corps Base Camp Lejeune and sent to the Chemical Oxidations Laboratory at Washington State University for bench scale treatability testing. The samples from Site 78 North and Site 78 South were evaluated for potential field in situ chemical oxidation (ISCO) treatment using iron-ethylenediamine tetraacetic acid (EDTA) activated and base activated persulfate. The Site 78 South sample is contaminated primarily with nonhalogenated hydrocarbons, such as benzene, toluene, and xylenes. The Site 78 North sample is contaminated with chlorinated hydrocarbons including isomers of 1,2-dichloroethylene (1,2-DCE), trichloroethylene (TCE), and perchloroethylene (PCE). Total oxidant demand (TOD) analysis showed moderate TOD of 2.5 g/kg of soil in the Site 78 south sample, and high TOD of 5.5 g/kg of soil in the Site 78 North sample. Based on these TOD levels, Site 78 South samples were dosed at 1.5 g/kg, 2.5 g/kg, and 4 g/kg persulfate and Site 78 North samples were dosed at 3 g/kg, 6 g/kg, and 9 g/kg persulfate. Sampling times for contaminant destruction studies were established at 7 days, 14 days, 21 days, and 28 days. In the Site 78 South sample, destruction of the nonchlorinated hydrocarbons benzene, toluene, and xylenes was negligible over 28 days. In the Site 78 North sample, destruction of 1,2-DCE and TCE was moderate, but PCE destruction was negligible. The results of the study suggest that activated persulfate treatment, at the dosages applied, is not effective, and other remediation strategies should be considered.

Introduction

In situ chemical oxidation (ISCO) reactions using iron chelate-activated persulfate and base-activated persulfate represent robust chemistries that may achieve significant mass reduction at the Site 78, Marine Corps Base Camp Lejeune. This report provides descriptions of procedures and results of the completed treatability study.

Methods

Sample Characterization

Soils/subsurface solids. CH2M HILL provided soil samples from each of two study areas (Sites 78 North and Site 78 South). Samples received from CH2M HILL were immediately placed under refrigeration. The soil samples were cooled to near-freezing in a freezer and then placed in 1 L glass jars. While maintaining the temperature at $< 4^{\circ}\text{C}$, each of the two soils from the study areas was thoroughly mixed in the 1 L jars prior to characterization and treatability studies. Each of the soil samples were characterized for site-specific contaminants prior to conducting the treatability studies. Initial concentrations of contaminants of concern (CoCs) were analyzed by gas chromatography after shake extraction with decane.

Groundwater. CH2M HILL provided groundwater samples from each of two study areas (Sites 78 North and Site 78 South). The groundwater samples were extracted with decane, and the decane extracts were analyzed for CoCs by gas chromatography.

Treatability Study Procedures

Soil buffering titration. The procedure documented by FMC was used to determine the buffering capacity of each of the two soils. Soil-groundwater slurries (30 g soil + 9 mL of groundwater) were titrated with 5% NaOH until the pH was maintained at 11 for at least 4 hr. The dose of NaOH used in alkaline persulfate reactions was the NaOH required to overcome the soil buffering capacity + a 2:1 molar ratio of NaOH:persulfate to account for the sulfuric acid generated as persulfate decomposes.

Total oxidant demand (TOD) determination. Soil samples of 50 g each were weighed into 100 mL wide mouth glass jars with Teflon-lined tops. Persulfate solutions of 50 mL were prepared in site groundwater using base and iron-EDTA in separate solutions. The base dosage was sufficient to overcome the buffering capacity of the soil + a 2:1 molar ratio of base:persulfate to account for the generation of sulfuric acid during the decomposition of persulfate. The iron-EDTA dose was 400 mg/L as iron. The reactors were dosed with persulfate at 3 g/kg soil and 6 g/kg soil. The jars were placed in the dark, and inverted once per day. Aliquots were collected at time = 2 days and 5 days to determine slow and long-term TOD. TOD was reported as g of persulfate consumed/kg of soil.

Contaminant destruction. The treatability study was conducted in 40 mL volatile organic analysis (VOA) vials containing 30 g of soil. Persulfate solutions were prepared in site groundwater from each of the two areas. The total volume of solution added to the soils was 9 mL, which saturated the soils and provided sufficient volume for sampling. The persulfate dosages and sampling times were confirmed in a conference call; Site 78 North samples were dosed at 3 g/kg, 6 g/kg, and 9 g/kg persulfate, and Site 78 South samples were dosed at 1.5 g/kg, 2.5 g/kg, and 4 g/kg persulfate. Sampling times were established at 7 days, 14 days, 21 days, and 28 days.

Separate sets of duplicate VOA vials were prepared for each time point. At each of the sampling times, a set of vials was extracted with decane and analyzed for CoCs by gas chromatography. A separate set of non-duplicate vials (termed *monitoring reactors*) was prepared and monitored for persulfate residuals, pH, oxidation-reduction potential (ORP), and dissolved oxygen at the same time points. Another set of non-duplicate monitoring vials was monitored for volume of off gas and heat. The volume of off gas was monitored by attaching a manometer to a port embedded in the Teflon-lined cap. Temperature was measured using a mercury thermometer.

Analyses. Decane extracts containing hydrocarbons were analyzed by gas chromatograph/flame ionization detection (GC/FID). The GC/FID was fitted with a 30 m Equity-1 capillary column, and conditions included an injector temperature of 140°C, detector temperature of 200°C, initial oven temperature of 40°C, and program rate of 10°C/min. Site-specific chlorinated volatile organic compounds (VOCs) were analyzed by GC/electron capture detection (GC/ECD) of the decane extracts. A Hewlett Packard 5890A GC fitted with an Equity (30 m × 0.53 mm) column was used to analyze the samples. An injector temperature of 140°C was used with an initial oven temperature of 40°C ramped at 10°C/min to 200°C. Persulfate was analyzed by iodometric titration with 0.01 N sodium thiosulfate. Determination of pH and ORP was conducted using a Fisher Accumet pH/mv meter. Dissolved oxygen was quantified using Yellow Springs Instruments dissolved oxygen meter.

Results

Base Titration

Titration of soil slurries resulted in a base requirement of 4.7×10^{-5} g of NaOH/g of Site 78 South soil to maintain the pH at 11 for at least 4 hours. The base requirement for the Site 78 North soil was 1.2×10^{-4} g of NaOH/g of soil.

Total Oxidant Demand

TOD was quantified based on the relationship developed by Haselow et al. (2003):

$$TOD_T = V * (C_0 - C_T) / M_s$$

where TOD_T = Total oxidant demand at time T
V = volume of the groundwater used in the sample
 C_0 = initial concentration of persulfate at time 0
 C_T = concentration of persulfate at time T
 M_s = mass of subsurface solids used in the sample

The results of TOD testing for the Site 78 South soil and the Site 78 North Soil are listed in Tables 1 and 2, respectively. These results demonstrate that the TOD of the South Soil is moderate, with TOD of approximately 2.5 g persulfate consumed/kg of soil (actual TOD ranged from 1.7 to 2.7 g/kg). However, TOD of the Site 78 North soil was higher, with a TOD of approximately 5.4 g/kg of soil. The actual range of TOD was from >3 to 5.4 g/kg. Based on a conference call between WSU and CH2M HILL project management and technical advisors, contaminant destruction studies were recommended using persulfate loadings of 1.5 g/kg, 2.5 g/kg, and 4 g/kg for the Site 78 South sample, and 3 g/kg, 6 g/kg, and 9 g/kg for the Site 78 North sample.

Initial Sample Characterization

Initial CoC concentrations for the Site 78 South sample and the Site 78 North sample are listed in Tables 3 and 4, respectively. These results are similar to the split sample analyses sent to a commercial laboratory by CH2M HILL (Table 5). The South sample contains primarily hydrocarbons with toluene and xylenes predominating. In contrast, the North sample is dominated by chlorinated solvents and their degradation products with 1,2-DCE, TCE, and PCE as the primary CoCs. The results of Table 5 are in general agreement with the data listed in Tables 3 and 4.

Persulfate, pH, Oxidation-Reduction Potential, and Dissolved Oxygen Measurements

The parameters pH, oxidation-reduction potential (ORP), dissolved oxygen, and persulfate concentration for iron-EDTA and base activated persulfate treatments for the Site 78 South sample are listed in Tables 6 and 7, respectively. Parallel data for the Site 78 North sample are listed in Tables 8 and 9 respectively. Control data are shown in Table 10. Results for pH, ORC, and dissolved oxygen are as expected. The pH in iron-EDTA activated systems started as acidic and increased as the reactions proceeded. The ORC started high and decreased as the persulfate was consumed. Dissolved oxygen concentrations were near saturation for the duration of the study. Persulfate residuals in the Site 78 South sample were maintained through 21 days. However, persulfate was consumed before 14 days in the Site 78 North sample, which likely affected treatment effectiveness.

Gas Evolution and Heat Generation

Cumulative gas evolution over 28 days in the Site 78 South samples and the Site 78 North samples is listed in Table 12. Gas evolution was undetectable in the iron-EDTA activated persulfate systems, and minimal in the two higher dosages of base activated persulfate. Furman

et al. (2010) documented that gas evolution is minimal in activated persulfate systems. Only high persulfate dosages with excess base (e.g., > 4:1 molar ratio of base:persulfate) generate appreciable gas volumes (Furman et al, 2011).

Temperature measurements over the first two weeks of the reactions document no change in temperature in any of the activated persulfate systems.

CoC Destruction

Contaminant concentrations were determined using a standard curve developed from analytical standards of each of the CoCs. Because the entire reactor contents (30 g of soil and 9 mL of groundwater) were extracted and analyzed, the CoC extract concentrations were converted to total contaminant mass (of both the soil and groundwater fractions) by multiplying the CoC extract concentration by the volume of the decane extract. CoC masses after treatment were then compared to CoC control masses to determine percent CoC destruction. For example, if the 1,2-DCE mass after 7 days of treatment was 0.00040 mg, and the corresponding control mass was 0.00042 mg, percent destruction was $1 - (0.00040/0.00042) = 4.82\%$.

The results of CoC destruction for iron-EDTA activated persulfate and base activated persulfate treatment for Site 78 South are listed in Tables 12 through 19. Two successive tables show oxidation effectiveness results for each of the activation method, and the set of two tables are then depicted to show the effectiveness at Day 7, 14, 21, and 28. Destruction of the hydrocarbons was minimal using all three persulfate dosages with both iron-EDTA activation and base activation. Toluene mass was lower in one reactor at Day 14 (Table 15), which was likely due to experimental error. Sulfate radical and hydroxyl radical are scavenged by carbonate, chloride, and soil organic matter, which can lead to ineffective contaminant

destruction (Watts, 1998); furthermore, Teel et al. (2011) documented that some naturally occurring trace minerals found in soils can render persulfate activation ineffective.

The results of CoC destruction in the Site 78 North sample using iron-EDTA activated persulfate and base activated persulfate are listed in Tables 20 through 27. Vinyl chloride was partially destroyed over the first week of treatment; however, vinyl chloride was lost from the control reactors before 14 days, likely from volatilization. Previous studies conducted at the WSU Chemical Oxidations Laboratory have shown that ISCO treatment of vinyl chloride is difficult to evaluate at the bench level due to volatilization. Destruction of 1,2-DCE was significant with 89.9% loss; however, TCE destruction was moderate with only 60.5% loss relative to control reactors over the 28-day study period. In contrast, PCE destruction was negligible even with a persulfate dosage of 9 g/kg. These results strongly suggest that activated persulfate is not the most effective process for remediation of the Site 78 South and North subsurface systems.

Summary and Recommendation

Treatment of samples collected from Site 78 South and Site 78 North at Marine Corps Base Camp Lejeune was evaluated at the bench level using iron EDTA activated persulfate and base activated persulfate. Based on TOD results, the samples were each dosed with three persulfate concentrations. In the Site 78 South sample, destruction of CoCs, including benzene, toluene, and xylenes, was negligible over 28 days. In the Site 78 North sample, 1,2-DCE and TCE destruction were moderate, but PCE destruction was negligible. The results of the study demonstrate that activated persulfate treatment, at the dosages applied, is not effective, and other remediation strategies should be considered.

References

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Table 1. TOD Results: Site 78 South

Persulfate Dose	Measured Dose	2-Day TOD (g/kg)	5-Day TOD (g/kg)
3 g/kg + 400 mg/L Fe-EDTA	2.9 g/kg	1.3	1.7
6 g/kg + 400 mg/L Fe-EDTA	5.2 g/kg	1.4	2.0
3 g/kg + Base	2.9 g/kg	1.2	2.3
6 g/kg+ Base	5.4 g/kg	1.8	2.7

Table 2. TOD Results: Site 78 North

Persulfate Dose	Measured Dose	2-Day TOD (g/kg)	5-Day TOD
3 g/kg + 400 mg/L Fe-EDTA (as Fe)	2.6 g/kg	1.3	>3
6 g/kg + 400 mg/L Fe-EDTA (as Fe)	5.5 g/kg	3.2	5.3
3 g/kg + Base	2.6 g/kg	>3	>3
6 g/kg+ Base	5.6 g/kg	5.4	5.4

Notes:

Persulfate dose was the concentration prepared in groundwater normalized to the mass of soil treated.

Measured dose was based on the concentration of persulfate analyzed within 15 minutes after addition to the soil. This concentration is almost always less than the concentration prepared because of dilution with soil water or initial reaction within the first 15 minutes after addition to the soil.

Table 3. Initial Contaminant Concentrations: Site 78 South

Contaminant	Groundwater Concentration (µg/L)	Soil Concentration (µg/kg)
Benzene	122	230
Ethylbenzene	684	470
Toluene	6100	5520
Xylenes	2830	2860
Isopropylbenzene	43	
1,2-DCE (total)	48	

Table 4. Initial Contaminant Concentrations: Site 78 North

Contaminant	Groundwater Concentration (µg/L)	Soil Concentration (µg/kg)
Benzene	3	
Toluene	5	
Xylenes	3	
Vinyl chloride	11	
1,2-DCE (total)	554	50
TCE	1880	215
PCE	133	61

Note: The gas chromatographs in the Chemical Oxidations Lab at WSU can only detect total 1,2-DCE and total xylenes.

Table 5. Split Sample Analyses of Initial Contaminant Concentrations

Compound	Soil (mg/kg)		Groundwater (µg/L)	
	(Site 78 South) IR78-SB138- 20-40-12B	(Site 78 North) IR78-IW04-80- 90-12B	(Site 78 South) IR78-GW75- 12B	(Site 78 North) IR78-IW04- 12B
1,1-Dichloroethene				1.7
1,2-Dichloroethane				0.81 J
1,2-Dichloroethene (Total)		0.054	52	610
Benzene	0.13 D		140	2.0
cis-1,2-Dichloroethene		0.041	52	500 D
Ethylbenzene	0.59 D		740 D	
Isopropylbenzene			54	
m,p-Xylenes	1.8 D		2000 D	2.0
o-Xylene	0.75 D	0.0005 J	950 D	1.4
Tetrachloroethene		0.043		120
Toluene	5.7 D		6300 D	5.3
trans-1,2- Dichloroethene		0.013		150
Trichloroethene		0.18		2000 D
Vinyl chloride		0.0008 J	0.76 J	16
Xylenes (Total)	2.5 D	0.0010 J	3000 D	3.4

D - indicates the sample was diluted

J - indicates an estimated value

Table 6. Persulfate Residual, pH, Oxidation-Reduction Potential (ORP), and Dissolved Oxygen (D.O.) for Iron-EDTA Activated Persulfate Treatment of Site 78 South

Treatment	Parameter	Time (days)				
		0	7	14	21	28
1.5 g/kg Persulfate + Iron- EDTA	Persulfate (%)	0.48	0.32	0.18	0.1	nd
	pH	4.5	4.5	4.6	4.6	4.9
	ORP (mV)	+360	+348	+292	+238	+122
	D.O. (mg/L)	4.2	9.5	9.5	9.6	7.8
2.5 g/kg Persulfate + Iron- EDTA	Persulfate (%)	0.81	0.40	0.35	0.18	nd
	pH	3.0	3.2	3.5	3.6	4.7
	ORP (mV)	+522	+498	+380	+319	+227
	D.O. (mg/L)	5.1	9.8	10.0	10.1	8.0
4 g/kg Persulfate + Iron- EDTA	Persulfate (%)	1.28	0.86	0.48	0.28	nd
	pH	2.2	2.4	2.8	3.0	4.7
	ORP (mV)	+588	+560	+410	+378	+278
	D.O. (mg/L)	5.8	9.9	10.2	10.0	8.0

Note: Time zero dissolved oxygen concentrations were higher than typical, which was likely due to the lag time in its measurement after the reaction started.

Table 7. Persulfate Residual, pH, Oxidation-Reduction Potential (ORP), and Dissolved Oxygen (D.O.) for Base Activated Persulfate Treatment of Site 78 South

Treatment	Parameter	Time (days)				
		0	7	14	21	28
1.5 g/kg Persulfate + Base	Persulfate (%)	0.47	0.28	0.15	nd	nd
	pH	11.8	8.2	7.9	8.7	8.9
	ORP (mV)	+340	+278	+240	+202	+120
	D.O. (mg/L)	6.5	9.8	10.0	9.9	9.8
2.5 g/kg Persulfate + Base	Persulfate (%)	0.79	0.41	0.22	0.10	nd
	pH	12.1	11.6	11.2	10.8	9.6
	ORP (mV)	+310	+288	+288	+278	+108
	D.O. (mg/L)	6.8	9.5	9.4	10.0	9.2
4 g/kg Persulfate + Base	Persulfate (%)	1.27	0.68	0.41	0.22	nd
	pH	12.8	12.6	12.6	12.6	12.4
	ORP (mV)	+288	+248	+208	+190	+160
	D.O. (mg/L)	7.2	10.0	10.1	10.0	10.1

Note: Time zero dissolved oxygen concentrations were higher than typical, which was likely due to the lag time in its measurement after the reaction started.

Table 8. Persulfate Residual, pH, Oxidation-Reduction Potential (ORP), and Dissolved Oxygen (D.O.) for Iron-EDTA Activated Persulfate Treatment of Site 78 North

Treatment	Parameter	Time (days)				
		0	7	14	21	28
3 g/kg Persulfate + Iron- EDTA	Persulfate (%)	0.96	0.38	nd	nd	nd
	pH	4.8	6.9	7.0	7.0	6.6
	ORP (mV)	+380	+244	+252	+264	+151
	D.O. (mg/L)	5.2	9.8	10.1	10.2	10.3
6 g/kg Persulfate + Iron- EDTA	Persulfate (%)	1.94	0.82	nd	nd	nd
	pH	4.1	6.6	7.2	7.4	7.6
	ORP (mV)	+360	+230	+222	+222	+130
	D.O. (mg/L)	5.8	9.8	10.0	10.5	10.3
9 g/kg Persulfate + Iron- EDTA	Persulfate (%)	2.98	1.10	nd	nd	nd
	pH	2.4	5.4	7.2	7.2	7.9
	ORP (mV)	+378	+238	+224	+204	+180
	D.O. (mg/L)	6.1	9.9	10.0	10.4	10.4

Table 9. Persulfate Residual, pH, Oxidation-Reduction Potential (ORP), and Dissolved Oxygen (D.O.) for Base Activated Persulfate Treatment of Site 78 North

Treatment	Parameter	Time (days)				
		0	7	14	21	28
3 g/kg Persulfate + Base	Persulfate (%)	0.95	0.18	nd	nd	nd
	pH	11.9	7.6	7.6	7.6	7.8
	ORP (mV)	+320	+212	+208	+210	+188
	D.O. (mg/L)	6.4	10.0	10.1	10.0	10.1
6 g/kg Persulfate + Base	Persulfate (%)	1.92	0.50	nd	nd	nd
	pH	12.2	7.4	7.6	7.3	7.9
	ORP (mV)	+362	+220	+192	+188	+177
	D.O. (mg/L)	6.5	10.0	10.1	10.2	10.2
9 g/kg Persulfate + Base	Persulfate (%)	2.96	0.71	nd	nd	nd
	pH	12.8	7.5	7.6	7.5	7.8
	ORP (mV)	+366	+288	+202	+184	+181
	D.O. (mg/L)	6.3	10.1	10.2	10.3	10.1

Table 10. Persulfate Residual, pH, Oxidation-Reduction Potential (ORP), and Dissolved Oxygen (D.O.) for Control Systems of Site 78 South and Site 78 North

Treatment	Parameter	Time (days)				
		0	7	14	21	28
South Control	Persulfate (%)	na	na	na	na	na
	pH	8.5	8.4	8.3	8.4	8.5
	ORP (mV)	+160	+164	+158	+164	+159
	D.O. (mg/L)	4.2	4.4	4.5	4.4	4.6
North Control	Persulfate (%)	na	na	na	na	na
	pH	8.2	8.1	8.2	8.3	8.2
	ORP (mV)	+174	+184	+180	+178	+180
	D.O. (mg/L)	4.5	4.8	4.9	4.3	4.5

Table 11. Gas Evolution in All Reactors for Site 78 South and Site 78 North

Site	Treatment	Cumulative Gas Evolution (mL)			
		T = 7 Days	T = 7 Days	T = 14 Days	T = 28 Days
South Sample	1.5 g/kg Persulfate + Iron-EDTA	nd	nd	nd	nd
	2.5 g/kg Persulfate + Iron-EDTA	nd	nd	nd	nd
	4 g/kg Persulfate + Iron-EDTA	nd	nd	nd	nd
	1.5 g/kg Persulfate + Base	nd	nd	nd	nd
	2.5 g/kg Persulfate + Base	nd	nd	0.4	0.6
	4 g/kg Persulfate + Base	nd	0.2	0.3	0.8
	North Sample	3 g/kg Persulfate + Iron-EDTA	nd	nd	nd
6 g/kg Persulfate + Iron-EDTA		nd	nd	nd	nd
9 g/kg Persulfate + Iron-EDTA		nd	nd	nd	nd
3 g/kg Persulfate + Base		nd	nd	nd	nd
6 g/kg Persulfate + Base		nd	0.9	0.9	0.9
9 g/kg Persulfate + Base		nd	1.2	1.2	1.2

Table 12. Treatment Results for South Samples Treated with Iron-EDTA Activated Persulfate at Day 7

Treatment		Compound residual (mg)					
		Benzene	Ethyl- benzene	Toluene	Xylenes	Isopropy- lbenzene	1,2-DCE
Day 7 Control	Rep. 1	0.0085	0.0021	0.171	0.102	0.00038	0.00040
	Rep. 2	0.0081	0.0023	0.174	0.101	0.00042	0.00043
	Ave.	0.0083	0.0022	0.173	0.102	0.00040	0.00042
1.5 g/kg Persulfate + Iron- EDTA	Rep. 1	0.0085	0.0020	0.170	0.103	0.00050	0.00041
	Rep. 2	0.0087	0.0025	0.175	0.101	0.00041	0.00038
	Ave. %	0.0086	0.0023	0.173	0.102	0.00046	0.00040
	Destruction	0%	0%	0%	0%	0%	4.82%
2.5 g/kg Persulfate + Iron- EDTA	Rep. 1	0.0081	0.0021	0.176	0.099	0.00047	0.00036
	Rep. 2	0.0086	0.0022	0.168	0.105	0.00041	0.00038
	Ave. %	0.0084	0.0022	0.172	0.102	0.00044	0.00037
	Destruction	0%	2.27%	0.29%	0%	0%	10.8%
4 g/kg Persulfate + Iron- EDTA	Rep. 1	0.0080	0.0024	0.168	0.105	0.00039	0.00041
	Rep. 2	0.0080	0.0020	0.169	0.097	0.00035	0.00035
	Ave. %	0.0080	0.0022	0.169	0.101	0.00037	0.00038
	Destruction	3.61%	0.00%	2.32%	0.49%	7.50%	8.43%

Table 13. Treatment Results for South Samples Treated with Base Activated Persulfate at Day 7

Treatment		Compound residual (mg)					
		Benzene	Ethyl- benzene	Toluene	Xylenes	Isopropyl- benzene	1,2-DCE
Day 7 Control	Rep. 1	0.0085	0.0021	0.171	0.102	0.00038	0.00040
	Rep. 2	0.0081	0.0023	0.174	0.101	0.00042	0.00043
	Ave.	0.0083	0.0022	0.173	0.102	0.00040	0.00042
1.5 g/kg Persulfate + Base	Rep. 1	0.0091	0.0023	0.175	0.098	0.00037	0.00041
	Rep. 2	0.0084	0.0025	0.172	0.103	0.00043	0.00038
	Ave. %	0.00875	0.0024	0.174	0.101	0.00040	0.00040
	Destruction	0%	0%	0%	0.99%	0%	4.82%
2.5 g/kg Persulfate + Base	Rep. 1	0.0081	0.0026	0.170	0.104	0.00041	0.00039
	Rep. 2	0.0079	0.0026	0.172	0.106	0.00047	0.00040
	Ave. %	0.0080	0.0026	0.171	0.105	0.00044	0.00040
	Destruction	3.61%	0%	0.87%	0%	0%	4.82%
4 g/kg Persulfate + Base	Rep. 1	0.0080	0.0021	0.170	0.099	0.00039	0.00041
	Rep. 2	0.0083	0.0024	0.171	0.097	0.00039	0.00038
	Ave. %	0.0088	0.0024	0.174	0.101	0.00040	0.00040
	Destruction	3.85%	0%	0.57%	0%	0%	2.44%

Table 14. Treatment Results for South Samples Treated with Iron-EDTA Activated Persulfate at Day 14

Treatment		Compound residual (mg)					
		Benzene	Ethyl- benzene	Toluene	Xylenes	Isopropyl- benzene	1,2-DCE
Day 14 Control	Rep. 1	0.0079	0.0020	0.168	0.099	0.00035	0.00040
	Rep. 2	0.0080	0.0021	0.171	0.100	0.00040	0.00042
	Ave.	0.0080	0.0021	0.170	0.100	0.00038	0.00041
1.5 g/kg Persulfate + Iron- EDTA	Rep. 1	0.0083	0.0021	0.170	0.096	0.00041	0.00038
	Rep. 2	0.0080	0.0020	0.171	0.099	0.00040	0.00039
	Ave. %	0.00815	0.00205	0.171	0.098	0.00041	0.00039
	Destruction	0%	0%	0%	2.01%	0%	6.10%
2.5 g/kg Persulfate + Iron- EDTA	Rep. 1	0.0074	0.0026	0.172	0.107	0.00034	0.00038
	Rep. 2	0.0081	0.0021	0.166	0.101	0.00038	0.00038
	Ave. %	0.00775	0.0024	0.169	0.104	0.00036	0.00038
	Destruction	2.52%	0%	0.29%	0%	4.00%	7.32%
4 g/kg Persulfate + Iron- EDTA	Rep. 1	0.0078	0.0019	0.167	0.097	0.00035	0.00036
	Rep. 2	0.0084	0.0019	0.175	0.099	0.00038	0.00037
	Ave. %	0.0081	0.0019	0.171	0.098	0.00037	0.00037
	Destruction	0%	7.32%	0%	1.51%	2.67%	11.0%

Table 15. Treatment Results for South Samples Treated with Base Activated Persulfate at Day 14

Treatment		Compound residual (mg)					
		Benzene	Ethyl- benzene	Toluene	Xylenes	Isopropyl- benzene	1,2-DCE
Day 14 Control	Rep. 1	0.0079	0.0020	0.198	0.099	0.00035	0.00040
	Rep. 2	0.0080	0.0021	0.171	0.100	0.00040	0.00042
	Ave.	0.0080	0.0021	0.185	0.100	0.00038	0.00041
1.5 g/kg Persulfate + Base	Rep. 1	0.0088	0.0019	0.164	0.100	0.00033	0.00039
	Rep. 2	0.0079	0.0025	0.078	0.106	0.00039	0.00041
	Ave. %	0.0084	0.0022	0.121	0.103	0.00036	0.00040
	Destruction	0%	0%	34.4%	0%	4.00%	2.44%
2.5 g/kg Persulfate + Base	Rep. 1	0.0077	0.0021	0.177	0.100	0.00042	0.00036
	Rep. 2	0.0086	0.0023	0.168	0.097	0.00038	0.00039
	Ave. %	0.0082	0.0022	0.173	0.099	0.00040	0.00038
	Destruction	0%	0%	6.50%	1.01%	0%	8.54%
4 g/kg Persulfate + Base	Rep. 1	0.0079	0.0020	0.172	0.110	0.00040	0.00035
	Rep. 2	0.0082	0.0020	0.172	0.102	0.00035	0.00034
	Ave. %	0.0081	0.0020	0.172	0.106	0.00038	0.00035
	Destruction	0%	2.44%	6.78%	0%	0%	15.9%

Table 16. Treatment Results for South Samples Treated with Iron-EDTA Activated Persulfate at Day 21

Treatment		Compound residual (mg)					
		Benzene	Ethyl- benzene	Toluene	Xylenes	Isopropyl- benzene	1,2-DCE
Day 21 Control	Rep. 1	0.0079	0.0020	0.166	0.098	0.00036	0.00041
	Rep. 2	0.0078	0.0020	0.171	0.100	0.00039	0.00040
	Ave.	0.0079	0.0020	0.169	0.099	0.00038	0.00041
1.5 g/kg Persulfate + Iron- EDTA	Rep. 1	0.0077	0.0017	0.159	0.101	0.00039	0.00040
	Rep. 2	0.0081	0.0019	0.175	0.099	0.00034	0.00040
	Ave. %	0.0079	0.0018	0.167	0.100	0.00037	0.00040
	Destruction	0%	10.0%	0.89%	0%	2.67%	1.23%
2.5 g/kg Persulfate + Iron- EDTA	Rep. 1	0.0077	0.0023	0.171	0.107	0.00036	0.00041
	Rep. 2	0.0080	0.0019	0.170	0.100	0.00035	0.00035
	Ave. %	0.0079	0.0021	0.171	0.104	0.00036	0.00038
	Destruction	0%	0%	0%	0%	5.33%	6.17%
4 g/kg Persulfate + Iron- EDTA	Rep. 1	0.0077	0.0020	0.198	0.102	0.00041	0.00036
	Rep. 2	0.0079	0.0018	0.170	0.096	0.00034	0.00038
	Ave. %	0.0078	0.0019	0.184	0.099	0.00038	0.00037
	Destruction	0.64%	5.00%	0%	0%	0%	8.64%

Table 17. Treatment Results for South Samples Treated with Base Activated Persulfate at Day 21

Treatment		Compound residual (mg)					
		Benzene	Ethyl- benzene	Toluene	Xylenes	Isopropyl- benzene	1,2-DCE
Day 21 Control	Rep. 1	0.0079	0.0020	0.166	0.098	0.00036	0.00041
	Rep. 2	0.0078	0.0020	0.171	0.100	0.00039	0.00040
	Ave.	0.0079	0.0020	0.169	0.099	0.00038	0.00041
1.5 g/kg Persulfate + Base	Rep. 1	0.0081	0.0023	0.161	0.098	0.00039	0.00041
	Rep. 2	0.0085	0.0018	0.173	0.099	0.00035	0.00044
	Ave. %	0.0083	0.0021	0.167	0.099	0.00037	0.00043
	Destruction	0%	0%	0.89%	0.51%	1.33%	0%
2.5 g/kg Persulfate + Base	Rep. 1	0.0078	0.0020	0.170	0.103	0.00037	0.00037
	Rep. 2	0.0079	0.0023	0.166	0.099	0.00040	0.00041
	Ave. %	0.0079	0.0022	0.168	0.101	0.00039	0.00039
	Destruction	0%	0%	0.30%	0%	0%	3.70%
4 g/kg Persulfate + Base	Rep. 1	0.0076	0.0024	0.162	0.098	0.00041	0.00036
	Rep. 2	0.0082	0.0019	0.169	0.104	0.00033	0.00039
	Ave. %	0.0079	0.0022	0.166	0.101	0.00037	0.00038
	Destruction	0%	0%	1.78%	0%	1.33%	7.41%

Table 18. Treatment Results for South Samples Treated with Iron-EDTA Activated Persulfate at Day 28

Treatment		Compound residual (mg)					
		Benzene	Ethyl- benzene	Toluene	Xylenes	Isopropyl- benzene	1,2-DCE
Day 28 Control	Rep. 1	0.0075	0.0021	0.164	0.100	0.00036	0.00040
	Rep. 2	0.0075	0.0020	0.170	0.096	0.00036	0.00038
	Ave.	0.0075	0.0021	0.167	0.098	0.00036	0.00039
1.5 g/kg Persulfate + Iron- EDTA	Rep. 1	0.0071	0.0025	0.169	0.010	0.00038	0.00039
	Rep. 2	0.0075	0.0021	0.171	0.099	0.00033	0.00039
	Ave. %	0.0073	0.0023	0.170	0.054	0.00036	0.00039
	Destruction	2.67%	0%	0%	44.5%	1.39%	0%
2.5 g/kg Persulfate + Iron- EDTA	Rep. 1	0.0070	0.0018	0.170	0.096	0.00039	0.00038
	Rep. 2	0.0077	0.0021	0.168	0.102	0.00034	0.00034
	Ave. %	0.0074	0.0020	0.169	0.099	0.00037	0.00036
	Destruction	2.00%	4.88%	0%	0%	0%	7.69%
4 g/kg Persulfate + Iron- EDTA	Rep. 1	0.0072	0.0017	0.164	0.094	0.00041	0.00035
	Rep. 2	0.0074	0.0019	0.165	0.099	0.00030	0.00036
	Ave. %	0.0073	0.0018	0.165	0.097	0.00036	0.00036
	Destruction	2.67%	12.2%	1.50%	1.53%	1.39%	8.97%

Table 19. Treatment Results for South Samples Treated with Base Activated Persulfate at Day 28

Treatment		Compound residual (mg)					
		Benzene	Ethyl- benzene	Toluene	Xylenes	Isopropyl- benzene	1,2-DCE
Day 28 Control	Rep. 1	0.0075	0.0021	0.164	0.100	0.00036	0.00040
	Rep. 2	0.0075	0.0020	0.170	0.096	0.00036	0.00038
	Ave.	0.0075	0.0021	0.167	0.098	0.00036	0.00039
1.5 g/kg Persulfate + Base	Rep. 1	0.0078	0.0018	0.166	0.098	0.00039	0.00039
	Rep. 2	0.0077	0.0017	0.168	0.095	0.00034	0.00037
	Ave. %	0.0078	0.0018	0.167	0.097	0.00037	0.00038
	Destruction	0%	14.6%	0%	1.53%	0%	2.56%
2.5 g/kg Persulfate + Base	Rep. 1	0.0075	0.0021	0.167	0.097	0.00032	0.00037
	Rep. 2	0.0076	0.0024	0.171	0.099	0.00037	0.00036
	Ave. %	0.0076	0.0023	0.169	0.098	0.00035	0.00037
	Destruction	0%	0%	0%	0%	4.17%	6.41%
4 g/kg Persulfate + Base	Rep. 1	0.0074	0.0018	0.172	0.101	0.00039	0.00035
	Rep. 2	0.0071	0.0020	0.170	0.095	0.00031	0.00038
	Ave. %	0.0073	0.0019	0.171	0.098	0.00035	0.00037
	Destruction	3.33%	7.32%	0%	0%	2.78%	6.41%

Table 20. Treatment Results for North Samples Treated with Iron-EDTA Activated Persulfate at Day 7

Treatment		Compound residual (mg)						
		Vinyl Chloride	1,2-DCE	TCE	PCE	Benzene	Toluene	Xylenes
Day 7 Control	Rep. 1	0.00011	0.0064	0.023	0.0030	nd	nd	nd
	Rep. 2	0.00010	0.0062	0.022	0.0034	nd	nd	nd
	Ave.	0.00011	0.0063	0.023	0.0032	nd	nd	nd
3 g/kg Persulfate + Iron-EDTA	Rep. 1	0.00004	0.0051	0.024	0.0032	nd	nd	nd
	Rep. 2	0.00003	0.0054	0.023	0.0033	nd	nd	nd
	Ave.	0.00004	0.0053	0.0235	0.0033	nd	nd	nd
	Destruction %	66.7%	16.7%	0%	0%	nd	nd	nd
6 g/kg Persulfate + Iron-EDTA	Rep. 1	0.00003	0.0047	0.015	0.0034	nd	nd	nd
	Rep. 2	0.00003	0.0045	0.017	0.0031	nd	nd	nd
	Ave.	0.00003	0.0046	0.016	0.0033	nd	nd	nd
	Destruction %	71.4%	27.0%	28.9%	0%	nd	nd	nd
9 g/kg Persulfate + Iron-EDTA	Rep. 1	0.00003	0.0031	0.007	0.0033	nd	nd	nd
	Rep. 2	0.00002	0.0028	0.006	0.0036	nd	nd	nd
	Ave.	0.00003	0.0030	0.007	0.0035	nd	nd	nd
	Destruction %	76.2%	53.2%	71.1%	0%	nd	nd	nd

Table 21. Treatment Results for North Samples Treated with Base Activated Persulfate at Day 7

Treatment		Compound residual (mg)						
		Vinyl Chloride	1,2-DCE	TCE	PCE	Benzene	Toluene	Xylenes
Day 7 Control	Rep. 1	0.00011	0.0064	0.023	0.0030	nd	nd	nd
	Rep. 2	0.00010	0.0062	0.022	0.0034	nd	nd	nd
	Ave.	0.00011	0.0063	0.023	0.0032	nd	nd	nd
3 g/kg Persulfate + Base	Rep. 1	0.00004	0.0049	0.011	0.0034	nd	nd	nd
	Rep. 2	0.00004	0.0044	0.013	0.0034	nd	nd	nd
	Ave.	0.00004	0.0047	0.012	0.0034	nd	nd	nd
	Destruction %	61.9%	26.2%	46.7%	0%	nd	nd	nd
6 g/kg Persulfate + Base	Rep. 1	0.00002	0.0042	0.010	0.0035	nd	nd	nd
	Rep. 2	0.00002	0.0040	0.014	0.0034	nd	nd	nd
	Ave.	0.00002	0.0041	0.012	0.0035	nd	nd	nd
	Destruction %	81.0%	34.9%	46.7%	0%	nd	nd	nd
9 g/kg Persulfate + Base	Rep. 1	0.00002	0.0037	0.008	0.0032	nd	nd	nd
	Rep. 2	0.00002	0.0033	0.009	0.0033	nd	nd	nd
	Ave.	0.00002	0.0035	0.009	0.0033	nd	nd	nd
	Destruction %	81.0%	44.4%	62.2%	0%	nd	nd	nd

Table 22. Treatment Results for North Samples Treated with Iron-EDTA Activated Persulfate at Day 14

Treatment		Compound residual (mg)						
		Vinyl Chloride	1,2-DCE	TCE	PCE	Benzene	Toluene	Xylenes
Day 14 Control	Rep. 1	nd	0.0061	0.022	0.0030	nd	nd	nd
	Rep. 2	nd	0.0058	0.022	0.0031	nd	nd	nd
	Ave.	nd	0.0060	0.022	0.0031	nd	nd	nd
3 g/kg Persulfate + Iron-EDTA	Rep. 1	nd	0.0027	0.023	0.0034	nd	nd	nd
	Rep. 2	nd	0.0029	0.022	0.0030	nd	nd	nd
	Ave.	nd	0.0028	0.023	0.0032	nd	nd	nd
	Destruction %	nd	52.9%	0%	0%	nd	nd	nd
6 g/kg Persulfate + Iron-EDTA	Rep. 1	nd	0.0020	0.014	0.0031	nd	nd	nd
	Rep. 2	nd	0.0022	0.014	0.0032	nd	nd	nd
	Ave.	nd	0.0021	0.014	0.0032	nd	nd	nd
	Destruction %	nd	64.7%	36.4%	0%	nd	nd	nd
9 g/kg Persulfate + Iron-EDTA	Rep. 1	nd	0.0012	0.006	0.0030	nd	nd	nd
	Rep. 2	nd	0.0008	0.005	0.0031	nd	nd	nd
	Ave.	nd	0.0010	0.006	0.0031	nd	nd	nd
	Destruction %	nd	83.2%	75.0%	0%	nd	nd	nd

Table 23. Treatment Results for North Samples Treated with Base Activated Persulfate at Day 14

Treatment		Compound residual (mg)						
		Vinyl Chloride	1,2-DCE	TCE	PCE	Benzene	Toluene	Xylenes
Day 14 Control	Rep. 1	nd	0.0061	0.022	0.0030	nd	nd	nd
	Rep. 2	nd	0.0058	0.022	0.0031	nd	nd	nd
	Ave.	nd	0.0060	0.022	0.0031	nd	nd	nd
3 g/kg Persulfate + Base	Rep. 1	nd	0.0020	0.010	0.0035	nd	nd	nd
	Rep. 2	nd	0.0018	0.012	0.0030	nd	nd	nd
	Ave.	nd	0.0019	0.0110	0.0033	nd	nd	nd
	% Destruction	nd	68.1%	50.0%	0%	nd	nd	nd
6 g/kg Persulfate + Base	Rep. 1	nd	0.0011	0.009	0.0032	nd	nd	nd
	Rep. 2	nd	0.0007	0.012	0.0031	nd	nd	nd
	Ave.	nd	0.0009	0.011	0.0032	nd	nd	nd
	% Destruction	nd	84.9%	52.3%	0%	nd	nd	nd
9 g/kg Persulfate + Base	Rep. 1	nd	0.0005	0.009	0.0029	nd	nd	nd
	Rep. 2	nd	0.0006	0.007	0.0033	nd	nd	nd
	Ave.	nd	0.0006	0.008	0.0031	nd	nd	nd
	% Destruction	nd	90.8%	63.6%	0%	nd	nd	nd

Table 24. Treatment Results for North Samples Treated with Iron-EDTA Activated Persulfate at Day 21

Treatment		Compound residual (mg)						
		Vinyl Chloride	1,2-DCE	TCE	PCE	Benzene	Toluene	Xylenes
Day 21 Control	Rep. 1	nd	0.0060	0.021	0.0030	nd	nd	nd
	Rep. 2	nd	0.0059	0.022	0.0030	nd	nd	nd
	Ave.	nd	0.0060	0.022	0.0030	nd	nd	nd
3 g/kg Persulfate + Iron-EDTA	Rep. 1	nd	0.0029	0.022	0.0028	nd	nd	nd
	Rep. 2	nd	0.0028	0.022	0.0034	nd	nd	nd
	Ave.	nd	0.0029	0.022	0.0031	nd	nd	nd
	Destruction %	nd	52.1%	0%	0%	nd	nd	nd
6 g/kg Persulfate + Iron-EDTA	Rep. 1	nd	0.0019	0.014	0.0031	nd	nd	nd
	Rep. 2	nd	0.0023	0.015	0.0031	nd	nd	nd
	Ave.	nd	0.0021	0.015	0.0031	nd	nd	nd
	Destruction %	nd	64.7%	32.6%	0%	nd	nd	nd
9 g/kg Persulfate + Iron-EDTA	Rep. 1	nd	0.0014	0.007	0.0032	nd	nd	nd
	Rep. 2	nd	0.0008	0.004	0.0028	nd	nd	nd
	Ave.	nd	0.0011	0.006	0.0030	nd	nd	nd
	Destruction %	nd	81.5%	74.4%	0%	nd	nd	nd

Table 25. Treatment Results for North Samples Treated with Base Activated Persulfate at Day 21

Treatment		Compound residual (mg)						
		Vinyl Chloride	1,2-DCE	TCE	PCE	Benzene	Toluene	Xylenes
Day 21 Control	Rep. 1	nd	0.0060	0.021	0.0030	nd	nd	nd
	Rep. 2	nd	0.0059	0.022	0.0030	nd	nd	nd
	Ave.	nd	0.0060	0.022	0.0030	nd	nd	nd
3 g/kg Persulfate + Base	Rep. 1	nd	0.0019	0.011	0.0030	nd	nd	nd
	Rep. 2	nd	0.0019	0.0100	0.0031	nd	nd	nd
	Ave. %	nd	0.0019	0.011	0.0031	nd	nd	nd
	Destruction	nd	68.1%	51.2%	0%	nd	nd	nd
6 g/kg Persulfate + Base	Rep. 1	nd	0.0010	0.009	0.0030	nd	nd	nd
	Rep. 2	nd	0.0009	0.011	0.0030	nd	nd	nd
	Ave. %	nd	0.0010	0.010	0.0030	nd	nd	nd
	Destruction	nd	84.0%	53.5%	0%	nd	nd	nd
9 g/kg Persulfate + Base	Rep. 1	nd	0.0005	0.008	0.0034	nd	nd	nd
	Rep. 2	nd	0.0007	0.009	0.0028	nd	nd	nd
	Ave. %	nd	0.0006	0.009	0.0031	nd	nd	nd
	Destruction	nd	89.9%	60.5%	0%	nd	nd	nd

Table 26. Treatment Results for North Samples Treated with Iron-EDTA Activated Persulfate at Day 28

Treatment		Compound residual (mg)						
		Vinyl Chloride	1,2-DCE	TCE	PCE	Benzene	Toluene	Xylenes
Day 28 Control	Rep. 1	nd	0.0058	0.02	0.0030	nd	nd	nd
	Rep. 2	nd	0.0057	0.022	0.0028	nd	nd	nd
	Ave.	nd	0.0058	0.021	0.0029	nd	nd	nd
3 g/kg Persulfate + Iron-EDTA	Rep. 1	nd	0.0026	0.021	0.0031	nd	nd	nd
	Rep. 2	nd	0.0028	0.022	0.0029	nd	nd	nd
	Ave.	nd	0.0027	0.022	0.0030	nd	nd	nd
	Destruction %	nd	53.0%	0%	0%	nd	nd	nd
6 g/kg Persulfate + Iron-EDTA	Rep. 1	nd	0.0021	0.013	0.0030	nd	nd	nd
	Rep. 2	nd	0.0022	0.015	0.0031	nd	nd	nd
	Ave.	nd	0.0022	0.014	0.0031	nd	nd	nd
	Destruction %	nd	62.6%	33.3%	0%	nd	nd	nd
9 g/kg Persulfate + Iron-EDTA	Rep. 1	nd	0.0013	0.006	0.0033	nd	nd	nd
	Rep. 2	nd	0.0007	0.005	0.0030	nd	nd	nd
	Ave.	nd	0.0010	0.006	0.0032	nd	nd	nd
	Destruction %	nd	82.6%	73.8%	0%	nd	nd	nd

Table 27. Treatment Results for North Samples Treated with Base Activated Persulfate at Day 28

Treatment		Compound residual (mg)						
		Vinyl Chloride	1,2-DCE	TCE	PCE	Benzene	Toluene	Xylenes
Day 28 Control	Rep. 1	nd	0.0058	0.020	0.0030	nd	nd	nd
	Rep. 2	nd	0.0057	0.022	0.0028	nd	nd	nd
	Ave.	nd	0.0058	0.021	0.0029	nd	nd	nd
3 g/kg Persulfate + Base	Rep. 1	nd	0.0020	0.010	0.0028	nd	nd	nd
	Rep. 2	nd	0.0017	0.010	0.0030	nd	nd	nd
	Ave.	nd	0.0019	0.010	0.0029	nd	nd	nd
	% Destruction	nd	67.8%	52.4%	0%	nd	nd	nd
6 g/kg Persulfate + Base	Rep. 1	nd	0.0010	0.009	0.0031	nd	nd	nd
	Rep. 2	nd	0.0008	0.011	0.0031	nd	nd	nd
	Ave.	nd	0.0009	0.010	0.0031	nd	nd	nd
	% Destruction	nd	84.3%	52.4%	0%	nd	nd	nd
9 g/kg Persulfate + Base	Rep. 1	nd	0.0004	0.009	0.0031	nd	nd	nd
	Rep. 2	nd	0.0006	0.009	0.0032	nd	nd	nd
	Ave.	nd	0.0005	0.009	0.0032	nd	nd	nd
	% Destruction	nd	91.3%	57.1%	0%	nd	nd	nd

Installation Restoration Site 78, Marine Corps Installations East – Marine Corps Base Camp Lejeune

BTEX and CVOC Reduction Treatability Test Results

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Introduction

This technical memorandum reports the results of bench testing conducted at the CH2M HILL Applied Sciences Laboratory (ASL) to demonstrate the effectiveness of select reducing reagents that are being considered to support remediation of volatile organic compound (VOC) plumes at Installation Restoration (IR) Site 78 of the Marine Corps Installations East - Marine Corps Base Camp Lejeune (MCIEAST – MCB CAMLEJ), North Carolina. Soil and groundwater samples were collected for use in batch microcosm studies from two treatment areas at Site 78, designated Area A and Area B. Materials from Area A, which are primarily contaminated with benzene, toluene, ethylbenzene, and xylene (BTEX), were treated with sulfate. Chlorinated volatile organic compounds (CVOCs), such as trichloroethene (TCE) and cis-1,2-dichloroethene (cis-DCE), are the primary contaminants of Area B, and EHC-L[®] was applied to materials from this location to promote biological dechlorination.

Testing was performed in two phases. In Phase 1, the reagents under consideration were applied to the microcosms without any supplements. No significant treatment was observed over a 33-day incubation period. The reactors were spiked with site-representative concentrations of toluene (Area A) and TCE (Areas A and B) in Phase 2, then amended with sodium lactate or a dechlorinating culture to stimulate the sulfate-reducing and dechlorinating reactions in Areas A and B, respectively. Reactor preparation and the results of these two phases are discussed below.

Phase 1 Reactor Preparation

Soil sample homogenization, sampling for baseline characterization, and Phase 1 reactor preparation were performed in an anaerobic glovebox as described in *IR Site 78, MCIEAST – MCB CAMLEJ: BTEX and CVOC Reduction Treatability Test Plan* (“Test Plan”, dated October 31, 2012). Soil core samples were provided in sealed 1.5-inch diameter Geoprobe Macrocore tubes (Photo 1) and were segregated by treatment area. Twenty 1-foot cores were provided for Area A, and 7 1-foot cores for Area B. Soil from each treatment area was pushed out of the sample tubes into a plastic bag for homogenization by shaking and kneading materials together (Photo 2). Groundwater samples were provided in zero-headspace cubitainers from IR78-GW75-1-12D for Area A and IR78-IW01-12D for Area B (Photo 3). Aliquots of groundwater and homogenized soil from treatment areas A and B were collected and submitted for baseline characterization. Results of this characterization are presented in Table 1, and full analytical reports are included as Attachment 1. The concentrations of site-specific VOCs were lower than those measured in the field, but were deemed sufficiently representative of field conditions to proceed as planned.

One control and one treatment reactor were prepared in duplicate for each sample area (Photo 3). Each reactor was composed of a 1 L glass bottle with a rubber butyl septum in the cap, and 400 grams of soil (as-received), and 760 mL of the corresponding groundwater were added (Photo 4). Taking into account the measured moisture

content of the two soil samples, the final groundwater volume and dry soil mass of the Area A reactors were 837 mL and 323 g, respectively, and 810 mL to 350 g dry soil for the Area B reactors.

Area A reactors (Control A and Sulfate) evaluated the use of sulfate as a terminal electron acceptor to drive oxidative remediation of BTEX in anaerobic environments. A dose of 4 pounds of sulfate (in the form of Epsom salt, $MgSO_4 \cdot 7H_2O$) per pound of hydrocarbon with a safety factor of 3 was selected for this test (roughly based on Wiedemier et al., 1995). Total BTEX concentrations of 7,441 $\mu g/L$ and 4.52 mg/kg were measured in the Area A groundwater and homogenized soil sample, respectively (Table 1), which dictated the application of 0.23 grams of Epsom salt (100% technical grade, Giles Chemical) to the Sulfate reactor.

Area B reactors (Control B and EHC-L) evaluated the use of EHC-L[®], a reagent produced by FMC corporation to promote biological degradation of CVOCs. It is composed of a slow release carbon source (lecithin) and an organo-iron compound with amino acids. Lecithin is provided as a 25% emulsified liquid, and the organo-iron compound with amino acids is supplied as a powder. The vendor (FMC Corporation) recommended dosing approximately 2 grams of a 17:1 mixture (by weight) of lecithin and the organo-iron powder per liter of groundwater with CVOC concentrations similar to that observed in Area B.¹ After preparation, 1.52 g of the mixture was added to the EHC-L reactors.

Reactors were setup, sampled, and incubated as specified in the Test Plan. Sampling events occurred immediately after preparation and after 7, 14, and 33 days of incubation. The results from these events are displayed in Table 2 and discussed in the following section.

Phase 1 Results

Over the 33-day incubation, the reactors progressively became more anaerobic as indicated by the decreasing DO and increasing dissolved iron (Table 2). To compare degradation of contaminants over the 33-day incubation between the two reactors, the sum of the BTEX concentrations and the CVOC (TCE and cis-DCE) concentrations were plotted over time, as displayed in Figures 1 and 2. Only TCE and cis-DCE were included as all other chlorinated compounds remained below reporting limits (0.5-10 $\mu g/L$) throughout Phase 1. Overall, the aqueous contaminant concentrations in both the controls and the treatment reactors decreased slightly over time, likely due to gas/liquid partitioning as the headspace volume increased with subsequent sampling events.

Within Area A reactors, the presence of sulfate appeared to accelerate the transition to a more reductive environment as indicated by lower dissolved oxygen and elevated dissolved iron concentrations; however, the sulfate concentration itself did not change significantly. Contaminant reduction in the Sulfate reactor was also consistently better than Control A, but by only a small margin. Over 33 days, the Sulfate reactor had 13% less BTEX (at 968 $\mu g/L$) and 21.6% less CVOCs (at 26.8 $\mu g/L$) than measured in Control A. Both reactors showed elevated contaminant concentrations after one week of incubation due to desorption from the solid phase. The slow degradation rate was attributed to low biological activity.

In the Area B reactor set, addition of EHC-L increased the concentration of dissolved iron and total organic carbon (TOC) as expected, and more substrate became available from this slow-release reagent over time. This addition did not promote degradation of CVOCs, as indicated by nearly constant TCE and cis-DCE concentrations (Table 2 and Figure 2), but did appear to promote sulfate reduction from 34 mg/L sulfate to less than 0.1 mg/L within the 33-day incubation. The low CVOC reduction was attributed to lack of a healthy dechlorinating culture in the Area B materials.

Phase 2 Reactor Preparation

After limited success in the first phase of testing, additions were made to the reactors to stimulate degradation of the contaminants. Area A reactors (Control A_2 and Sulfate_2) received 500 mg/L sodium lactate to increase the activity of the sulfate-reducing culture. These reactors were freshly prepared at the initiation of Phase 2 per the specifications described in the previous phase. The duplicate Area B reactors from Phase 1 (Control B_2 and EHC-

¹ Fayaz Lakhwala, FMC Corporation, personal communication on 10/12/12.

L_2) were inoculated with TerraSystem's TSI-DC culture following 68 days of incubation under the Phase 1 setup. This culture contains *Dehalococcoides mccartyi*, which are capable of degrading CVOCs to ethene. Vendor recommendations specify a 0.001% dose (by volume) for field application, and up to a 1% addition for bench scale tests. The 1% dose (7.6 mL per reactor) was used for this test.

To better evaluate the effect of the additions, the Phase 2 reactors were also spiked with contaminants, elevating them to more field-representative conditions. Both TCE (ACS Grade >99.5%) and toluene (ACS Grade >99.9%) were spiked into Area A reactors using a microsyringe, with target concentrations of 800 µg/L and 14,000 µg/L, respectively (a dose of 0.4 µL and 12.4 µL of neat liquid per reactor). A TCE concentration of 3,000 µg/L (1.6 µL per reactor) was targeted in the Area B reactors. These contaminants were spiked one day after the dechlorinating culture had been introduced to the Area B reactors, allowing the bacterial community time to adjust to the new conditions before being exposed to high contaminant concentrations.

The Phase 2 reactors were incubated for 2 months before the test was concluded. Reactors were incubated and sampled as described in the Test Plan for Phase 1, except sample events occurred at set-up and after 1 and 2 months of incubation, and only a limited suite of chemical analyses were performed on the 1-month samples. The results of these analyses are shown in Table 3 and discussed in the following section.

Phase 2 Results

The reactors remained at low DO concentrations of approximately 1.3 mg/L over the 2 month incubation (Table 3). In the Area A reactors, degradation was evaluated based on toluene and TCE concentrations as the other BTEX and CVOC compounds were below detection limits. The results are presented graphically in Figures 3 and 4. Iron sulfide was formed in the Sulfate reactor, and was visible in the solids (Photo 5). The toluene dose in the Sulfate reactor appears to have been slightly lower than that of the Control A reactor; however, the decreasing trends in the toluene concentration are very similar. A mass balance of material was performed and summarized in Table 4. All of the contaminant mass was assumed to be in the liquid phase at the initial sampling event, and the mass extracted during each sampling event was accounted for. Approximately 1,420 µg (13.5%) of toluene are unaccounted for in the liquid and solid phases of Control A at the end of the test, and 1,770 µg (20.1%) are unaccounted for in the Sulfate reactor. Therefore, there may be a slight advantage of toluene degradation in the presence of sulfate, but degradation is slow and was not considerably improved by the addition of lactate. There was no significant difference between the changes observed in the TCE concentration between the reactors (Figure 4). Decreasing TCE concentrations in the liquid phase were accounted for in the solids at the conclusion of the test.

Rapid dechlorination of TCE and its daughter products was observed in the Area B reactors inoculated with the TSI-DC culture (Figure 5). Within one month, all TCE and cis-DCE had been transformed to VC, ethene, or other products in both the Control B and EHC-L reactors. There was a slight advantage in the EHC-L containing reactors, as all VC had also been transformed to ethene or other products within 1 month. At 2 months, no chlorinated compounds remained in either reactor. These results confirmed that dechlorination could be substantially accelerated in the site materials with the addition of a dechlorinating culture. It appeared that sufficient degradable organic carbon was present within the TSI-DC culture to complete TCE biotransformation process in these batch systems. However, target contaminant removal and the potential for rebound over the long term would need to be considered to optimize the required substrate dosing for field applications.

References

Wiedemeier, T.H., Kampbell, D.H., Miller, R.N., and J.T. Wilson, 1995. Significance of anaerobic processes for the intrinsic bioremediation of fuel hydrocarbons, In Proceedings of Petroleum Hydrocarbons and Organic Chemicals in Ground Water: Prevention, Detection and Restoration. Houston, Texas Nov 29-Dec 1, NGWA., pp. 49-61.

Photos



Photo 1: Soil samples were provided in sealed cores to help preserve anaerobic conditions

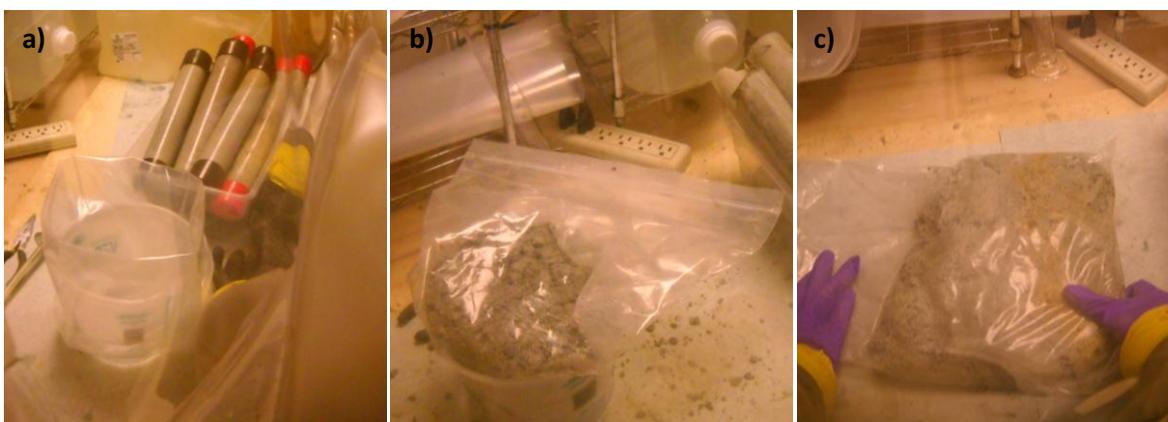


Photo 2: Soil was pushed out of the cores into a bag (a) within an anaerobic glovebox. Once all soil had been deposited, the bag was sealed (b) and the soil was shaken and kneaded together (c) to homogenize.



Photo 3: One-liter amber glass bottles with septa caps were used as reactors (left). A contingency reactor was prepared for each of the four treatments. Each reactor received 400 grams of wet homogenized soil (right) and 760 mL of groundwater (contained in the cubitainers) from the treatment area (Area A or Area B).



Photo 4: Prepared reactor with septa cap. Soil depth marked with black line.

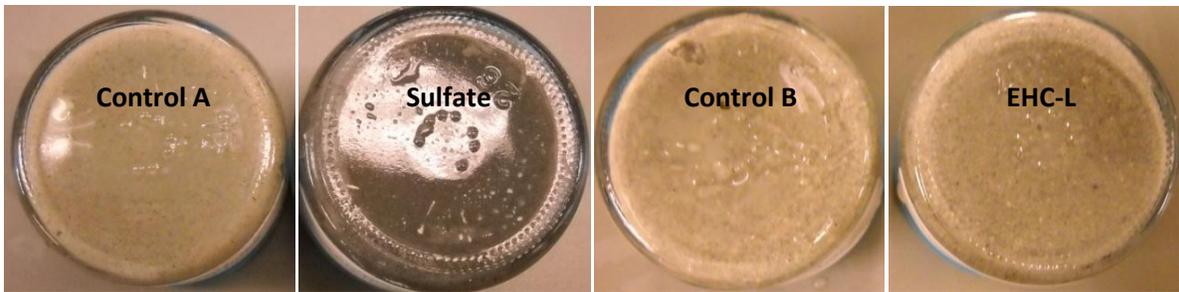


Photo 5: Solid samples at the end of treatment from the reactors. Note the dark color of the solids from the Sulfate reactor due to iron sulfide production.

Tables

Table 1

Baseline Characterization of Soil and Groundwater*Installation Restoration Site 78, Marine Corps Installations East – Marine Corps Base Camp Lejeune*

	Area A Groundwater	Area A Soil	Area B Groundwater	Area B Soil
General Chemistry, Soil				
Percent Moisture	-	19.3	-	12.4
Total Iron (mg/kg)	-	1120	-	1940.0
General Chemistry, Groundwater				
pH	6.80	-	7.22	-
ORP (mV)	-293	-	-296	-
DO (mg/L)	3.85	-	3.74	-
Dissolved Iron (µg/L)	518	-	100 U	-
Sulfide (µg/L)	25.0 U	-	25.0 U	-
Sulfate (mg/L)	1.24	-	33.7	-
Nitrate (mg/L)	0.10 U	-	0.10 U	-
TOC (mg/L)	17.8	-	1.78	-
Volatile Organic Compounds (VOCs) (Groundwater in ug/L, Soil in mg/kg)				
1,1-Dichloroethene	10.0 U	0.0551 U	5.00 U	0.0364 U
1,1-Dichloroethane	10.0 U	0.0551 U	5.00 U	0.0364 U
1,2-Dichloroethane	10.0 U	0.0551 U	5.00 U	0.0364 U
1,2-Dibromo-3-chloropropane	10.0 U	0.0551 U	5.00 U	0.0364 U
Benzene	235	0.0551 U	5.00 U	0.0364 U
cis-1,2-Dichloroethene	10.0 U	0.0551 U	229	0.0364 U
Ethylbenzene	280	0.650	5.00 U	0.0364 U
Isopropylbenzene	10.0 U	0.260	5.00 U	0.0364 U
m,p-Xylene	697	3.33	10.0 U	0.0729 U
Methylene Chloride	10.0 U	0.0551 U	5.00 U	0.0364 U
o-Xylene	469	0.989	5.00 U	0.0364 U
Tetrachloroethene (PCE)	10.0 U	0.0551 U	5.00 U	0.0364 U
Toluene	5760	0.0551 U	18.5	0.0364 U
trans-1,2-Dichloroethene	10.0 U	0.0551 U	5.00 U	0.0364 U
Trichloroethene (TCE)	10.0 U	0.244	3260	0.0571
Vinyl Chloride	10.0 U	0.0551 U	5.00 U	0.0364 U

Notes:

U = The analyte was analyzed for, but was not detected above the reported sample quantitation limit.

Table 2

Phase 1 Analytical Results

Installation Restoration Site 78, Marine Corps Installations East – Marine Corps Base Camp Lejeune

General Chemistry	Control (Area A)				Sulfate (Area A)				Control (Area B)				EHC-L (Area B)			
	Day 0	Day 7	Day 14	Day 33	Day 0	Day 7	Day 14	Day 33	Day 0	Day 7	Day 14	Day 33	Day 0	Day 7	Day 14	Day 33
pH	7.17	6.94	6.95	6.50	7.07	6.85	6.78	6.53	7.76	7.56	7.40	7.21	7.62	7.42	7.25	7.20
ORP (mV)*	-146	-130.7	-219.6	-214.1	-213	-250	-237.5	-240.9	-220	-202.3	-237.8	-239.7	-218	-180.5	-245.7	-273.2
DO (mg/L)	4.60	3.23	1.50	0.09	3.78	1.96	1.35	0.08	3.42	1.66	1.43	0.04	2.50	1.79	1.28	0.10
Dissolved Iron (µg/L)	6010	9030	9990	10700	6830	10900	10000	15100	111	331	386	457	2110	2140	3540	9690
Sulfide (µg/L)	117	88	331	154	50.4	79.5	2500 [†]	127	28.1	49.8	84.9	25.0 U	158	776	216	141
Sulfate (mg/L)	4.55	8.37	2.38	2.48	92.4	91.9	98.2	94.4	33.7	31.7	35.5	32.4	34.1	16.7	0.14	0.1 U
Nitrate (mg/L)	0.1 U	0.1 U	0.1 U*	0.1 U	0.1 U	0.1 U	0.1 U*	0.1 U	0.1 U	0.1 U	0.1 U*	0.1 U	0.1 U	0.1 U	0.97 *	0.1 U
TOC (mg/L)	16.3	16.2	18.1	31.4	17.2	17.6	109 [†]	26.6	1.48	2.08	2.53	12.6	44.8	41.7	50.6	63.0
Volatiles Organic Compounds (VOCs), µg/L																
1,1-Dichloroethene	10.0 U	1.10 U	1.10 U	1.10 U	10 U	0.50 U	1.10 U	1.10 U	5.00 U	1.10 U	0.50 U	0.50 U	5.00 U	1.10 U	0.50 U	0.50 U
1,1-Dichloroethane	10.0 U	1.10 U	1.10 U	1.10 U	10 U	0.50 U	1.10 U	1.10 U	5.00 U	1.10 U	0.50 U	0.50 U	5.00 U	1.10 U	0.50 U	0.50 U
1,2-Dichloroethane	10.0 U	1.10 U	1.10 U	1.10 U	10 U	0.50 U	1.10 U	1.10 U	5.00 U	1.10 U	0.50 U	0.50 U	5.00 U	1.10 U	0.50 U	0.50 U
1,2-Dibromo-3-chloropropane	10.0 U	1.10 U	1.10 U	1.10 U	10 U	0.50 U	1.10 U	1.10 U	5.00 U	1.10 U	0.50 U	0.50 U	5.00 U	1.10 U	0.50 U	0.50 U
Benzene	22.7	19.2	17.7	16.4	20.3	16.4	15.5	13.8	5.00 U	1.33	1.19	1.10	5.00 U	1.34	1.14	1.08
cis-1,2-Dichloroethene	10.0 U	2.27	2.20	1.99	10 U	1.82	1.90	1.62	54.3	46.3	45.3	43.7	54.3	46.9	45.0	43.0
Ethylbenzene	105	153	139	132	107	139	129	111	5.00 U	2.37	2.03	1.67	5.00 U	1.75	1.48	1.38
Isopropylbenzene	31.1	43.0	37.6	40.3	33.6	40.8	41.2	34.1	5.00 U	1.10 U	0.50 U	0.50 U	5.00 U	1.10 U	0.50 U	0.50 U
m,p-Xylene	534	809	704	657	545	697	665	581	10.0 U	9.32	2.83	1.71	10.0 U	6.32	5.28	5.32
Methylene Chloride	10.0 U	1.10 U	1.10 U	1.10 U	10 U	0.50 U	1.10 U	1.10 U	5.00 U	1.10 U	0.50 U	0.50 U	5.00 U	1.10 U	0.50 U	0.50 U
o-Xylene	180	278	250	234	180	239	234	199	5.00 U	4.51	3.44	3.27	5.00 U	3.26	2.90	2.94
Tetrachloroethene (PCE)	10.0 U	1.10 U	1.10 U	1.10 U	10 U	0.50 U	1.10 U	1.10 U	5.00 U	1.10 U	0.50 U	0.50 U	5.00 U	1.10 U	0.50 U	0.50 U
Toluene	107	88.6	80.4	74.0	95.8	77.2	74.4	62.7	29.7	23.0	14.2	2.51	27.3	22.4	20.1	18.9
trans-1,2-Dichloroethene	10.0 U	1.10 U	1.10 U	1.10 U	10 U	0.50 U	1.10 U	1.10 U	5.00 U	1.10 U	0.50 U	0.50 U	5.00 U	1.10 U	0.50 U	0.50 U
Trichloroethene (TCE)	26.5	41.2	36.1	32.2	24.3	32.9	30.8	25.2	49.2	41.0	35.3	31.3	45.9	39.5	35.1	29.6
Vinyl Chloride	10.0 U	1.10 U	1.10 U	1.10 U	10 U	0.50 U	1.10 U	1.10 U	5.00 U	1.10 U	0.50 U	0.50 U	5.00 U	1.10 U	0.50 U	0.50 U

Notes:

U = The analyte was analyzed for, but was not detected above the reported sample quantitation limit.

* Sample was analyzed outside of holding time.

† Sediment was stirred up into the sample collected for these analyses.

Table 3

Phase 2 Analytical Results

Installation Restoration Site 78, Marine Corps Installations East – Marine Corps Base Camp Lejeune

General Chemistry	Control (Area A)			Sulfate (Area A)			Control (Area B)			EHC-L (Area B)		
	Day 0	1 month	2 months	Day 0	1 month	2 months	Day 0	1 month	2 months	Day 0	1 month	2 months
pH	6.80	6.55	6.66	6.77	6.44	6.82	7.37	7.13*	7.50	7.21	6.64	7.12
ORP (mV)*	-113	-138	-61.2	-112	-115.6	-66.8	-172	-188*	-109	-188	-162.6	-140.1
DO (mg/L)	1.18	1.25	1.23	1.17	1.21	1.31	1.46	2.13*	2.30	1.46	1.21	1.17
Dissolved Iron (µg/L)	185	14400	17100	556	6240	5380	1340	-	1490	10400	-	6710
Sulfide (µg/L)	32.4	-	25.0 U	41.9	-	47.7	25.0 U	-	25.0 U	65.7	-	40.8
Sulfate (mg/L)	12.5	0.10 U	0.11	219	43.5 U	38.1	38.9	-	0.10 U	0.15	-	0.10 U
Nitrate (mg/L)	0.10 U	-	0.10 U	0.10 U	-	0.10 U	0.10 U	-	0.10 U	0.10 U	-	0.10 U
TOC (mg/L)	139	-	120	183	-	120	31.1	-	17	55.4	-	18.8
Groundwater Volatile Organic Compounds (VOCs), µg/L												
1,1-Dichloroethene	5.00 U	25.0 U	25.0 U	5.00 U	25.0 U	25.0 U	0.50 U	2.50 U	1.10 U	1.59	2.50 U	1.10 U
1,1-Dichloroethane	5.00 U	25.0 U	25.0 U	5.00 U	25.0 U	25.0 U	0.50 U	2.50 U	1.10 U	0.50 U	2.50 U	1.10 U
1,2-Dichloroethane	5.00 U	25.0 U	25.0 U	5.00 U	25.0 U	25.0 U	0.50 U	2.50 U	1.10 U	0.50 U	2.50 U	1.10 U
1,2-Dibromo-3-chloropropane	5.00 U	25.0 U	25.0 U	5.00 U	25.0 U	25.0 U	0.50 U	2.50 U	1.10 U	0.50 U	2.50 U	1.10 U
Benzene	5.00 U	25.0 U	25.0 U	5.00 U	25.0 U	25.0 U	1.35	2.50 U	1.10 U	1.33	2.50 U	1.32
cis-1,2-Dichloroethene	5.00 U	25.0 U	25.0 U	5.00 U	25.0 U	25.0 U	8.31	7.10	1.10 U	81.5	2.50 U	1.10 U
Ethylbenzene	7.51	25.0 U	25.0 U	11.5	25.0 U	25.0 U	1.94	2.50 U	1.17	1.57	2.50 U	1.62
Isopropylbenzene	6.25	25.0 U	25.0 U	9.97	25.0 U	25.0 U	0.50 U	2.50 U	1.10 U	0.50 U	2.50 U	1.10 U
m,p-Xylene	39.6	50.0 U	50.0 U	62.9	50.0 U	50.0 U	1.63	5.00 U	2.20 U	5.68	5.07	5.04
Methylene Chloride	5.00 U	25.0 U	25.0 U	5.00 U	25.0 U	25.0 U	0.50 U	2.50 U	1.10 U	0.50 U	2.50 U	1.10 U
o-Xylene	11.5	25.0 U	25.0 U	18.5	25.0 U	25.0 U	0.50 U	2.50 U	1.10 U	3.07	2.74	2.87
Tetrachloroethene (PCE)	5.00 U	25.0 U	25.0 U	5.00 U	25.0 U	25.0 U	0.50 U	2.50 U	1.10 U	0.50 U	2.50 U	1.10 U
Toluene	12600 E	9370	9060	10500 E	7750	7160	1.31	4.52	2.94	23.8	23.3	23.3
trans-1,2-Dichloroethene	5.00 U	25.0 U	25.0 U	5.00 U	25.0 U	25.0 U	0.50 U	2.50 U	1.10 U	0.50 U	2.50 U	1.10 U
Trichloroethene (TCE)	661	645	611	551	589	512	1650	2.50 U	1.10 U	1500	2.50 U	1.10 U
Vinyl Chloride	5.00 U	25.0 U	25.0 U	5.00 U	25.0 U	25.0 U	51.8	282	2.55	25.40	2.50 U	1.10 U
Soil General Chemistry												
Total Iron (mg/kg)	NT	NT	2060	NT	NT	737	NT	NT	1610	NT	NT	2110
Soil Volatile Organic Compounds (VOCs), µg/kg												
Non-detects	NT	NT	61.0 U	NT	NT	47.7 U	NT	NT	36.8 U	NT	NT	33.3 U
Toluene	NT	NT	2870	NT	NT	1310	NT	NT	36.8 U	NT	NT	33.3 U
Trichloroethene (TCE)	NT	NT	168	NT	NT	89.6	NT	NT	36.8 U	NT	NT	33.3 U

Notes:

U = The analyte was analyzed for, but was not detected above the reported sample quantitation limit.

E = The analyte was measured at a value above the calibration limit. The provided value is an estimate.

NT = Not Tested

*Reactor broke during sample event. Conternts were transferred to another anaerobic reactor. pH, ORP, and DO samples were measured approximately 1/2 hour after collection.

Table 4

Area A Mass Balance Calculations for Phase 2

Installation Restoration Site 78, Marine Corps Installations East – Marine Corps Base Camp Lejeune

Toluene										
Control A					Sulfate					
	Liquid	Soil	Groundwater	Contaminant		Liquid	Soil	Groundwater	Contaminant	
	Concentration	Concentration	Volume	Soil Mass	Mass	Concentration	Concentration	Volume	Soil Mass	Mass
	µg/L	µg/kg	L	kg-dry	µg	µg/L	µg/kg	L	kg-dry	µg
Initial Mass	12600	Assume 0	0.837	-	10546	10500	Assume 0	0.837	-	8789
Mass Extracted, t=0	12600	-	0.165	-	2079	10500	-	0.165	-	1733
Mass Extracted, t=1	9370	-	0.095	-	890	7750	-	0.095	-	736
Final Mass	9060	2870	0.577	0.323	6154	7160	1310	0.577	0.323	4554
Mass Accounted For					9123					7023
Mass Unaccounted For					1423					1766

TCE										
Control A					Sulfate					
	Liquid	Soil	Groundwater	Contaminant		Liquid	Soil	Groundwater	Contaminant	
	Concentration	Concentration	Volume	Soil Mass	Mass	Concentration	Concentration	Volume	Soil Mass	Mass
	µg/L	µg/kg	L	kg-dry	µg	µg/L	µg/kg	L	kg-dry	µg
Initial Mass	661	Assume 0	0.837	-	553	551	Assume 0	0.837	-	461
Mass Extracted, t=0	661	-	0.165	-	109	551	-	0.165	-	91
Mass Extracted, t=1	645	-	0.095	-	61	589	-	0.095	-	56
Final Mass	611	168	0.577	0.323	407	512	90	0.577	0.323	324
Mass Accounted For					577					471
Mass Unaccounted For					-24					-10

Figures

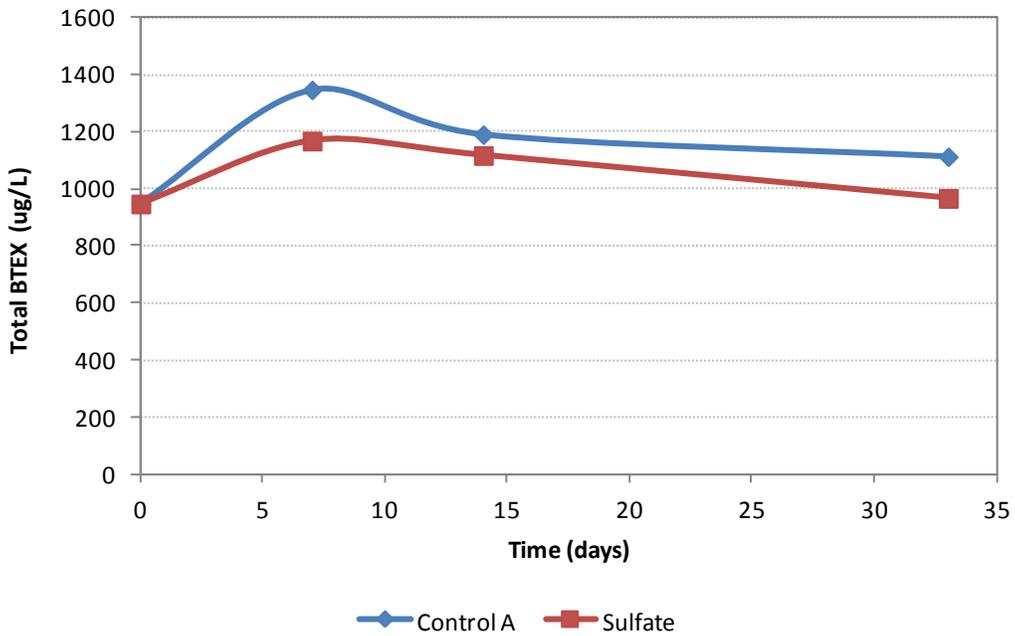


Figure 1: Total BTEX concentration over time during Phase 1. Elevated concentrations on day 7 in the Area A reactors are due to contaminant desorption from soils.

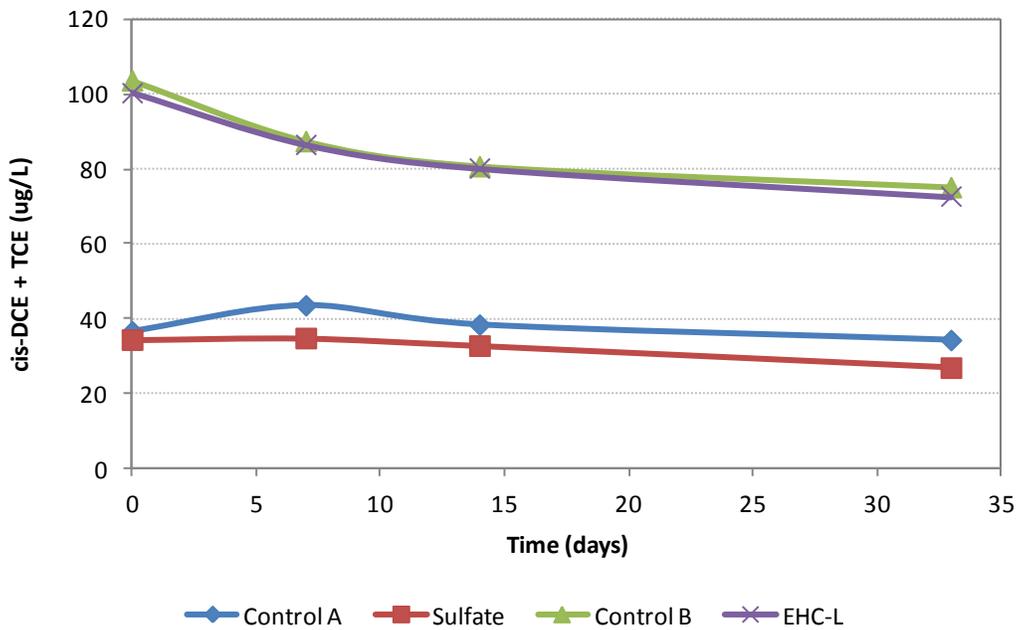


Figure 2: Total CVOC concentration over time during Phase 1. Total CVOCs are represented by cis-DCE and TCE as all other chlorinated compounds were below detection limits (0.5-10 µg/L).

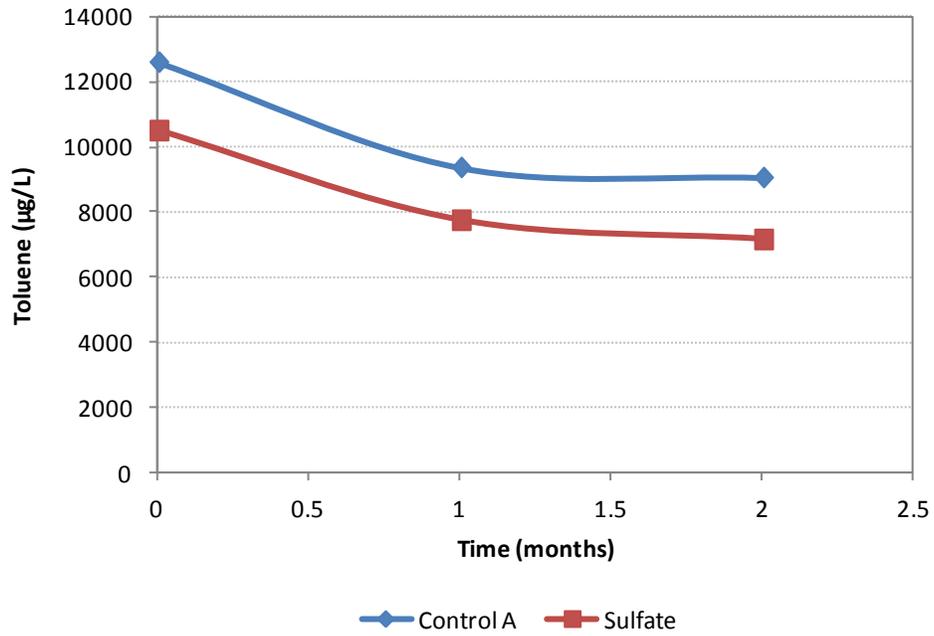


Figure 3: Toluene concentration over time in Area A reactors during Phase 2.

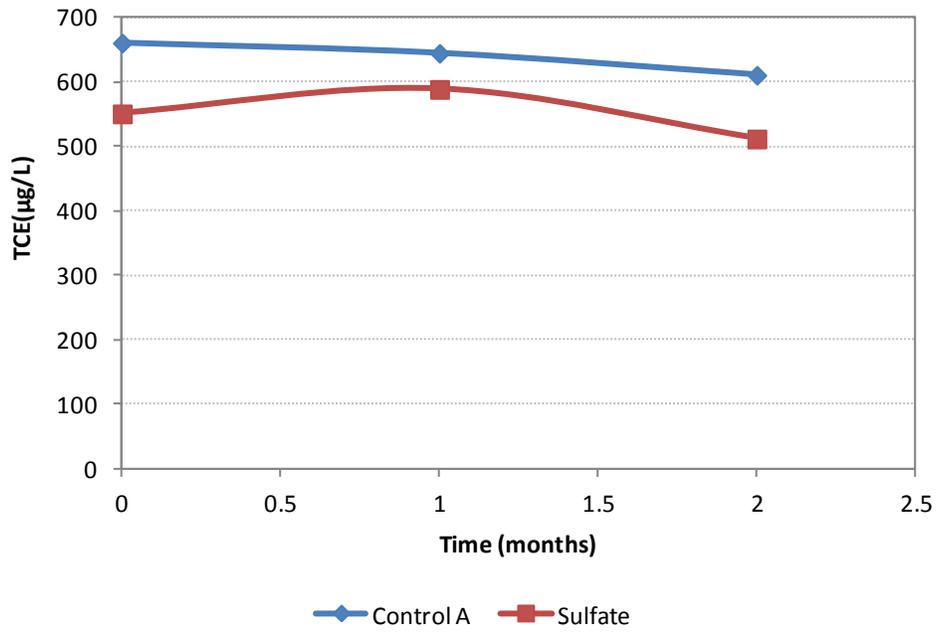


Figure 4: TCE concentration over time in Area A reactors during Phase 2.

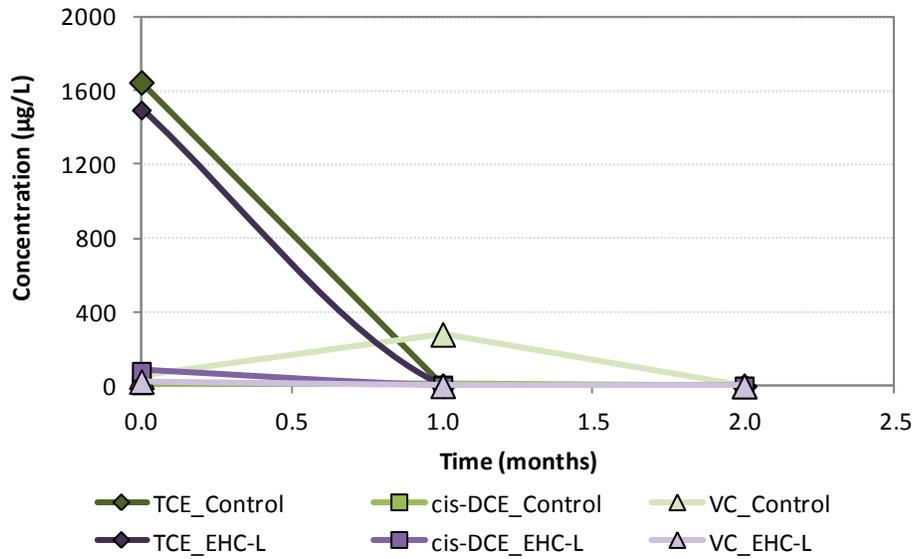


Figure 5: Sequential degradation of TCE and daughter products in the TSI-DC bioaugmented Area B reactors during Phase 2. The EHC-L containing reactor (purple) successfully completed the dechlorination process before the 1-month sampling event, while the control (green, without EHC-L) was on the final step, transforming vinyl chloride to ethene.

**Attachment 1:
Analytical Reports**



ANALYTICAL REPORT

For:
Camp Lejeune - Site 78

ASL Report #: L2861
Project ID: 387442.78.WP
Attn: Dusty Berggren/CH2M HILL
cc:
Mike Niemet/mike.niemet@ch2m.com

Authorized and Released By:

Laboratory Project Manager
Ben Thompson
(541) 758-0235 ext.23132
December 04, 2012

This data package meets standards requested by client and is not intended or implied to meet any other standard.

All analyses performed by CH2M HILL are clearly indicated. Any subcontracted analyses are included as appended reports as received from the subcontracted laboratory. The results included in this report only relate to the samples listed on the following Sample Cross-Reference page. This report shall not be reproduced except in full, without the written approval of the laboratory.

Any unusual difficulties encountered during the analysis of your samples are discussed in the attached case narratives.

ASL Report #: L2861

Sample Receipt Comments

We certify that the test results meet all standard ASL requirements.

Sample Cross-Reference

ASL Sample ID	Client Sample ID	Date/Time Collected	Date Received
L286101	AA_gw	11/16/12 13:10	11/16/12
L286102	AB_gw	11/16/12 13:20	11/16/12
L286103	AA_so	11/16/12 13:00	11/16/12
L286104	AB_so	11/16/12 13:30	11/16/12

CASE NARRATIVE
GC/MS VOLATILES ANALYSIS

Lab Name: CH2M HILL/LAB/CVO

ASL SDG#: L2861

Project: Camp Lejeune

Project #: 387442.78.WP

I. Method(s):

Analysis: SW8260B
Preparation: SW5030/SW5035

II. Receipt/Holding Times:

All acceptance criteria were met.

III. Analysis:

A. Initial Calibration(s):

All acceptance criteria were met.

B. Calibration Verification(s):

All acceptance criteria were met.

C. Blank(s):

All acceptance criteria were met.

D. Laboratory Control Sample(s):

All acceptance criteria were met.

E. Matrix Spike/Matrix Spike Duplicate Sample(s):

Analyzed in accordance with standard operating procedure.

F. Surrogate Standard(s):

All acceptance criteria were met.

G. BFB Tune Verification(s):

All acceptance criteria were met.

H. Internal Standard(s):

All acceptance criteria were met.

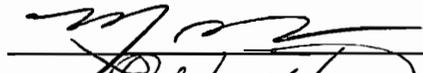
I. Analytical Exception(s):

Due to instrumental contamination concerns, some samples within this SDG could not be analyzed at 1x dilution.

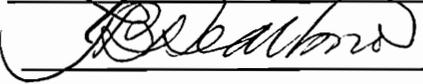
IV. Documentation Exception(s):

None.

V. I certify that this data package is in compliance with the terms and conditions agreed to by the client and CH2M HILL, both technically and for completeness, except for the conditions detailed above. Release of the data contained in this hardcopy data package has been authorized by the Laboratory Manager or designee, as verified by the following signatures.

Prepared by: 

Date: 11/29/12

Reviewed by: 

Date: 12/4/12

CH2M HILL Applied Sciences Laboratory (ASL)

Client Information				Lab Information			
Client Sample ID: AA_gw				Lab Sample ID: L286101			
Project Name: Camp Lejeune				Date Received: 11/16/12			
Sample Date: 11/16/12				Dilution Factor: 20			
Sample Time: 13:10				Report Revision No.: 0			
Type: Grab							
Matrix: Water							

Analyte	CAS#	DL	RL	Sample Result	Qualifier	Units	Analysis Method	Date Analyzed
GC/MS Volatiles								
Vinyl Chloride	75-01-4	4.00	10.0	10.0	U	ug/L	SW8260B	11/19/12
1,1-Dichloroethene	75-35-4	4.00	10.0	10.0	U	ug/L	SW8260B	11/19/12
Methylene chloride	75-09-2	4.00	10.0	10.0	U	ug/L	SW8260B	11/19/12
trans-1,2-Dichloroethene	156-60-5	4.00	10.0	10.0	U	ug/L	SW8260B	11/19/12
1,1-Dichloroethane	75-34-3	4.00	10.0	10.0	U	ug/L	SW8260B	11/19/12
cis-1,2-Dichloroethene	156-59-2	4.00	10.0	10.0	U	ug/L	SW8260B	11/19/12
1,2-Dichloroethane	107-06-2	4.00	10.0	10.0	U	ug/L	SW8260B	11/19/12
Benzene	71-43-2	4.00	10.0	235		ug/L	SW8260B	11/19/12
Trichloroethene (TCE)	79-01-6	4.00	10.0	10.0	U	ug/L	SW8260B	11/19/12
Toluene	108-88-3	4.00	10.0	5270	E	ug/L	SW8260B	11/19/12
Tetrachloroethene (PCE)	127-18-4	4.00	10.0	10.0	U	ug/L	SW8260B	11/19/12
Ethylbenzene	100-41-4	4.00	10.0	280		ug/L	SW8260B	11/19/12
m,p-Xylene	108-38-3/1	8.00	20.0	697		ug/L	SW8260B	11/19/12
o-Xylene	95-47-6	4.00	10.0	469		ug/L	SW8260B	11/19/12
Isopropylbenzene	98-82-8	4.00	10.0	10.0	U	ug/L	SW8260B	11/19/12
1,2-Dibromo-3-chloropropane	96-12-8	4.00	10.0	10.0	U	ug/L	SW8260B	11/19/12

Surrogate	% Recovery	Control Limits	Qualifier
Dibromofluoromethane	95	75-125	
1,2-Dichloroethane-d4	94	75-125	
Toluene-d8	97	75-125	
4-Bromofluorobenzene	97	75-125	

U=Not detected at specified reporting limit
 J=Estimated value below reporting limit
 E=Estimated value above calibration range
 *=See case narrative

CH2M HILL Applied Sciences Laboratory (ASL)

<u>Client Information</u>	<u>Lab Information</u>
Client Sample ID: AA_gwDL	Lab Sample ID: L286101DL
Project Name: Camp Lejeune	Date Received: 11/16/12
Sample Date: 11/16/12	Dilution Factor: 200
Sample Time: 13:10	Report Revision No.: 0
Type: Grab	
Matrix: Water	

Analyte	CAS#	DL	RL	Sample Result	Qualifier	Units	Analysis Method	Date Analyzed
GC/MS Volatiles								
Vinyl Chloride	75-01-4	40.0	100	100	U	ug/L	SW8260B	11/19/12
1,1-Dichloroethene	75-35-4	40.0	100	100	U	ug/L	SW8260B	11/19/12
Methylene chloride	75-09-2	40.0	100	100	U	ug/L	SW8260B	11/19/12
trans-1,2-Dichloroethene	156-60-5	40.0	100	100	U	ug/L	SW8260B	11/19/12
1,1-Dichloroethane	75-34-3	40.0	100	100	U	ug/L	SW8260B	11/19/12
cis-1,2-Dichloroethene	156-59-2	40.0	100	100	U	ug/L	SW8260B	11/19/12
1,2-Dichloroethane	107-06-2	40.0	100	100	U	ug/L	SW8260B	11/19/12
Benzene	71-43-2	40.0	100	228		ug/L	SW8260B	11/19/12
Trichloroethene (TCE)	79-01-6	40.0	100	100	U	ug/L	SW8260B	11/19/12
Toluene	108-88-3	40.0	100	5760		ug/L	SW8260B	11/19/12
Tetrachloroethene (PCE)	127-18-4	40.0	100	100	U	ug/L	SW8260B	11/19/12
Ethylbenzene	100-41-4	40.0	100	246		ug/L	SW8260B	11/19/12
m,p-Xylene	108-38-3/1	80.0	200	607		ug/L	SW8260B	11/19/12
o-Xylene	95-47-6	40.0	100	404		ug/L	SW8260B	11/19/12
Isopropylbenzene	98-82-8	40.0	100	100	U	ug/L	SW8260B	11/19/12
1,2-Dibromo-3-chloropropane	96-12-8	40.0	100	100	U	ug/L	SW8260B	11/19/12

<u>Surrogate</u>	<u>% Recovery</u>	<u>Control Limits</u>	<u>Qualifier</u>
Dibromofluoromethane	98	75-125	
1,2-Dichloroethane-d4	96	75-125	
Toluene-d8	97	75-125	
4-Bromofluorobenzene	94	75-125	

U=Not detected at specified reporting limit
 J=Estimated value below reporting limit
 E=Estimated value above calibration range
 *=See case narrative

CH2M HILL Applied Sciences Laboratory (ASL)

Client Information				Lab Information			
Client Sample ID: AB_gw				Lab Sample ID: L286102			
Project Name: Camp Lejeune				Date Received: 11/16/12			
Sample Date: 11/16/12				Dilution Factor: 10			
Sample Time: 13:20				Report Revision No.: 0			
Type: Grab							
Matrix: Water							

Analyte	CAS#	DL	RL	Sample Result	Qualifier	Units	Analysis Method	Date Analyzed
GC/MS Volatiles								
Vinyl Chloride	75-01-4	2.00	5.00	5.00	U	ug/L	SW8260B	11/19/12
1,1-Dichloroethene	75-35-4	2.00	5.00	5.00	U	ug/L	SW8260B	11/19/12
Methylene chloride	75-09-2	2.00	5.00	5.00	U	ug/L	SW8260B	11/19/12
trans-1,2-Dichloroethene	156-60-5	2.00	5.00	5.00	U	ug/L	SW8260B	11/19/12
1,1-Dichloroethane	75-34-3	2.00	5.00	5.00	U	ug/L	SW8260B	11/19/12
cis-1,2-Dichloroethane	156-59-2	2.00	5.00	229		ug/L	SW8260B	11/19/12
1,2-Dichloroethane	107-06-2	2.00	5.00	5.00	U	ug/L	SW8260B	11/19/12
Benzene	71-43-2	2.00	5.00	5.00	U	ug/L	SW8260B	11/19/12
Trichloroethene (TCE)	79-01-6	2.00	5.00	3450	E	ug/L	SW8260B	11/19/12
Toluene	108-88-3	2.00	5.00	18.5		ug/L	SW8260B	11/19/12
Tetrachloroethene (PCE)	127-18-4	2.00	5.00	5.00	U	ug/L	SW8260B	11/19/12
Ethylbenzene	100-41-4	2.00	5.00	5.00	U	ug/L	SW8260B	11/19/12
m,p-Xylene	108-38-3/1	4.00	10.0	10.0	U	ug/L	SW8260B	11/19/12
o-Xylene	95-47-6	2.00	5.00	5.00	U	ug/L	SW8260B	11/19/12
Isopropylbenzene	98-82-8	2.00	5.00	5.00	U	ug/L	SW8260B	11/19/12
1,2-Dibromo-3-chloropropane	96-12-8	2.00	5.00	5.00	U	ug/L	SW8260B	11/19/12

Surrogate	% Recovery	Control Limits	Qualifier
Dibromofluoromethane	96	75-125	
1,2-Dichloroethane-d4	94	75-125	
Toluene-d8	96	75-125	
4-Bromofluorobenzene	95	75-125	

U=Not detected at specified reporting limit
 J=Estimated value below reporting limit
 E=Estimated value above calibration range
 *=See case narrative

CH2M HILL Applied Sciences Laboratory (ASL)

Client Information				Lab Information			
Client Sample ID: AB_gwDL				Lab Sample ID: L286102DL			
Project Name: Camp Lejeune				Date Received: 11/16/12			
Sample Date: 11/16/12				Dilution Factor: 200			
Sample Time: 13:20				Report Revision No.: 0			
Type: Grab							
Matrix: Water							

Analyte	CAS#	DL	RL	Sample Result	Qualifier	Units	Analysis Method	Date Analyzed
GC/MS Volatiles								
Vinyl Chloride	75-01-4	40.0	100	100	U	ug/L	SW8260B	11/19/12
1,1-Dichloroethene	75-35-4	40.0	100	100	U	ug/L	SW8260B	11/19/12
Methylene chloride	75-09-2	40.0	100	100	U	ug/L	SW8260B	11/19/12
trans-1,2-Dichloroethene	156-60-5	40.0	100	100	U	ug/L	SW8260B	11/19/12
1,1-Dichloroethane	75-34-3	40.0	100	100	U	ug/L	SW8260B	11/19/12
cis-1,2-Dichloroethane	156-59-2	40.0	100	207		ug/L	SW8260B	11/19/12
1,2-Dichloroethane	107-06-2	40.0	100	100	U	ug/L	SW8260B	11/19/12
Benzene	71-43-2	40.0	100	100	U	ug/L	SW8260B	11/19/12
Trichloroethene (TCE)	79-01-6	40.0	100	3260		ug/L	SW8260B	11/19/12
Toluene	108-88-3	40.0	100	100	U	ug/L	SW8260B	11/19/12
Tetrachloroethene (PCE)	127-18-4	40.0	100	100	U	ug/L	SW8260B	11/19/12
Ethylbenzene	100-41-4	40.0	100	100	U	ug/L	SW8260B	11/19/12
m,p-Xylene	108-38-3/1	80.0	200	200	U	ug/L	SW8260B	11/19/12
o-Xylene	95-47-6	40.0	100	100	U	ug/L	SW8260B	11/19/12
Isopropylbenzene	98-82-8	40.0	100	100	U	ug/L	SW8260B	11/19/12
1,2-Dibromo-3-chloropropane	96-12-8	40.0	100	100	U	ug/L	SW8260B	11/19/12

Surrogate	% Recovery	Control Limits	Qualifier
Dibromofluoromethane	98	75-125	
1,2-Dichloroethane-d4	96	75-125	
Toluene-d8	95	75-125	
4-Bromofluorobenzene	94	75-125	

U=Not detected at specified reporting limit
 J=Estimated value below reporting limit
 E=Estimated value above calibration range
 *=See case narrative

CH2M HILL Applied Sciences Laboratory (ASL)

Client Information				Lab Information			
Client Sample ID: AA_so				Lab Sample ID: L286103			
Project Name: Camp Lejeune				Date Received: 11/16/12			
Sample Date: 11/16/12				Dilution Factor: 100			
Sample Time: 13:00				Report Revision No.: 0			
Type: Grab							
Matrix: Soil							
Basis: Dry Weight							

Analyte	CAS#	DL	RL	Sample Result	Qualifier	Units	Analysis Method	Date Analyzed
GC/MS Volatiles								
Vinyl Chloride	75-01-4	22.0	55.1	55.1	U	ug/Kg	SW8260B	11/19/12
1,1-Dichloroethene	75-35-4	22.0	55.1	55.1	U	ug/Kg	SW8260B	11/19/12
Methylene chloride	75-09-2	22.0	55.1	55.1	U	ug/Kg	SW8260B	11/19/12
trans-1,2-Dichloroethene	156-60-5	22.0	55.1	55.1	U	ug/Kg	SW8260B	11/19/12
1,1-Dichloroethane	75-34-3	22.0	55.1	55.1	U	ug/Kg	SW8260B	11/19/12
cis-1,2-Dichloroethene	156-59-2	22.0	55.1	55.1	U	ug/Kg	SW8260B	11/19/12
1,2-Dichloroethane	107-06-2	22.0	55.1	55.1	U	ug/Kg	SW8260B	11/19/12
Benzene	71-43-2	22.0	55.1	55.1	U	ug/Kg	SW8260B	11/19/12
Trichloroethene (TCE)	79-01-6	22.0	55.1	244		ug/Kg	SW8260B	11/19/12
Toluene	108-88-3	22.0	55.1	55.1	U	ug/Kg	SW8260B	11/19/12
Tetrachloroethene (PCE)	127-18-4	22.0	55.1	55.1	U	ug/Kg	SW8260B	11/19/12
Ethylbenzene	100-41-4	22.0	55.1	650		ug/Kg	SW8260B	11/19/12
m,p-Xylene	108-38-3/1	44.1	110	3330		ug/Kg	SW8260B	11/19/12
o-Xylene	95-47-6	22.0	55.1	989		ug/Kg	SW8260B	11/19/12
Isopropylbenzene	98-82-8	22.0	55.1	260		ug/Kg	SW8260B	11/19/12
1,2-Dibromo-3-chloropropane	96-12-8	22.0	55.1	55.1	U	ug/Kg	SW8260B	11/19/12

Surrogate	% Recovery	Control Limits	Qualifier
Dibromofluoromethane	93	65-135	
1,2-Dichloroethane-d4	93	65-135	
Toluene-d8	98	65-135	
4-Bromofluorobenzene	92	65-135	

U=Not detected at specified reporting limit
 J=Estimated value below reporting limit
 E=Estimated value above calibration range
 *=See case narrative

CH2M HILL Applied Sciences Laboratory (ASL)

Client Information				Lab Information			
Client Sample ID: AB_so				Lab Sample ID: L286104			
Project Name: Camp Lejeune				Date Received: 11/16/12			
Sample Date: 11/16/12				Dilution Factor: 100			
Sample Time: 13:30				Report Revision No.: 0			
Type: Grab							
Matrix: Soil							
Basis: Dry Weight							

Analyte	CAS#	DL	RL	Sample Result	Qualifier	Units	Analysis Method	Date Analyzed
GC/MS Volatiles								
Vinyl Chloride	75-01-4	14.6	36.4	36.4	U	ug/Kg	SW8260B	11/19/12
1,1-Dichloroethene	75-35-4	14.6	36.4	36.4	U	ug/Kg	SW8260B	11/19/12
Methylene chloride	75-09-2	14.6	36.4	36.4	U	ug/Kg	SW8260B	11/19/12
trans-1,2-Dichloroethene	156-60-5	14.6	36.4	36.4	U	ug/Kg	SW8260B	11/19/12
1,1-Dichloroethane	75-34-3	14.6	36.4	36.4	U	ug/Kg	SW8260B	11/19/12
cis-1,2-Dichloroethene	156-59-2	14.6	36.4	36.4	U	ug/Kg	SW8260B	11/19/12
1,2-Dichloroethane	107-06-2	14.6	36.4	36.4	U	ug/Kg	SW8260B	11/19/12
Benzene	71-43-2	14.6	36.4	36.4	U	ug/Kg	SW8260B	11/19/12
Trichloroethene (TCE)	79-01-6	14.6	36.4	57.1		ug/Kg	SW8260B	11/19/12
Toluene	108-88-3	14.6	36.4	36.4	U	ug/Kg	SW8260B	11/19/12
Tetrachloroethene (PCE)	127-18-4	14.6	36.4	36.4	U	ug/Kg	SW8260B	11/19/12
Ethylbenzene	100-41-4	14.6	36.4	36.4	U	ug/Kg	SW8260B	11/19/12
m,p-Xylene	108-38-3/1	29.2	72.9	72.9	U	ug/Kg	SW8260B	11/19/12
o-Xylene	95-47-6	14.6	36.4	36.4	U	ug/Kg	SW8260B	11/19/12
Isopropylbenzene	98-82-8	14.6	36.4	36.4	U	ug/Kg	SW8260B	11/19/12
1,2-Dibromo-3-chloropropane	96-12-8	14.6	36.4	36.4	U	ug/Kg	SW8260B	11/19/12

Surrogate	% Recovery	Control Limits	Qualifier
Dibromofluoromethane	93	65-135	
1,2-Dichloroethane-d4	92	65-135	
Toluene-d8	95	65-135	
4-Bromofluorobenzene	94	65-135	

U=Not detected at specified reporting limit
 J=Estimated value below reporting limit
 E=Estimated value above calibration range
 *=See case narrative

CH2M HILL Applied Sciences Laboratory (ASL)

Client Information				Lab Information			
Client Sample ID: WB1-1119				Lab Sample ID: WB1-1119			
Project Name: Camp Lejeune				Date Received: N/A			
Sample Date: N/A				Dilution Factor: 1			
Sample Time: N/A				Report Revision No.: 0			
Type: QC							
Matrix: Water							

Analyte	CAS#	DL	RL	Sample Result	Qualifier	Units	Analysis Method	Date Analyzed
GC/MS Volatiles								
Vinyl Chloride	75-01-4	0.20	0.50	0.50	U	ug/L	SW8260B	11/19/12
1,1-Dichloroethene	75-35-4	0.20	0.50	0.50	U	ug/L	SW8260B	11/19/12
Methylene chloride	75-09-2	0.20	0.50	0.50	U	ug/L	SW8260B	11/19/12
trans-1,2-Dichloroethene	156-60-5	0.20	0.50	0.50	U	ug/L	SW8260B	11/19/12
1,1-Dichloroethane	75-34-3	0.20	0.50	0.50	U	ug/L	SW8260B	11/19/12
cis-1,2-Dichloroethene	156-59-2	0.20	0.50	0.50	U	ug/L	SW8260B	11/19/12
1,2-Dichloroethane	107-06-2	0.20	0.50	0.50	U	ug/L	SW8260B	11/19/12
Benzene	71-43-2	0.20	0.50	0.50	U	ug/L	SW8260B	11/19/12
Trichloroethene (TCE)	79-01-6	0.20	0.50	0.50	U	ug/L	SW8260B	11/19/12
Toluene	108-88-3	0.20	0.50	0.50	U	ug/L	SW8260B	11/19/12
Tetrachloroethene (PCE)	127-18-4	0.20	0.50	0.50	U	ug/L	SW8260B	11/19/12
Ethylbenzene	100-41-4	0.20	0.50	0.50	U	ug/L	SW8260B	11/19/12
m,p-Xylene	108-38-3/1	0.40	1.00	1.00	U	ug/L	SW8260B	11/19/12
o-Xylene	95-47-6	0.20	0.50	0.50	U	ug/L	SW8260B	11/19/12
Isopropylbenzene	98-82-8	0.20	0.50	0.50	U	ug/L	SW8260B	11/19/12
1,2-Dibromo-3-chloropropane	96-12-8	0.20	0.50	0.50	U	ug/L	SW8260B	11/19/12

Surrogate	% Recovery	Control Limits	Qualifier
Dibromofluoromethane	99	75-125	
1,2-Dichloroethane-d4	96	75-125	
Toluene-d8	97	75-125	
4-Bromofluorobenzene	98	75-125	

U=Not detected at specified reporting limit
 J=Estimated value below reporting limit
 E=Estimated value above calibration range
 *=See case narrative

CH2M HILL Applied Sciences Laboratory (ASL)

Client Information				Lab Information			
Client Sample ID: SB1-1119				Lab Sample ID: SB1-1119			
Project Name: Camp Lejeune				Date Received: N/A			
Sample Date: N/A				Dilution Factor: 100			
Sample Time: N/A				Report Revision No.: 0			
Type: QC							
Matrix: Soil							
Basis: Dry Weight							

Analyte	CAS#	DL	RL	Sample Result	Qualifier	Units	Analysis Method	Date Analyzed
GC/MS Volatiles								
Vinyl Chloride	75-01-4	20.0	50.0	50.0	U	ug/Kg	SW8260B	11/19/12
1,1-Dichloroethene	75-35-4	20.0	50.0	50.0	U	ug/Kg	SW8260B	11/19/12
Methylene chloride	75-09-2	20.0	50.0	50.0	U	ug/Kg	SW8260B	11/19/12
trans-1,2-Dichloroethene	156-60-5	20.0	50.0	50.0	U	ug/Kg	SW8260B	11/19/12
1,1-Dichloroethane	75-34-3	20.0	50.0	50.0	U	ug/Kg	SW8260B	11/19/12
cis-1,2-Dichloroethene	156-59-2	20.0	50.0	50.0	U	ug/Kg	SW8260B	11/19/12
1,2-Dichloroethane	107-06-2	20.0	50.0	50.0	U	ug/Kg	SW8260B	11/19/12
Benzene	71-43-2	20.0	50.0	50.0	U	ug/Kg	SW8260B	11/19/12
Trichloroethene (TCE)	79-01-6	20.0	50.0	50.0	U	ug/Kg	SW8260B	11/19/12
Toluene	108-88-3	20.0	50.0	50.0	U	ug/Kg	SW8260B	11/19/12
Tetrachloroethene (PCE)	127-18-4	20.0	50.0	50.0	U	ug/Kg	SW8260B	11/19/12
Ethylbenzene	100-41-4	20.0	50.0	50.0	U	ug/Kg	SW8260B	11/19/12
m,p-Xylene	108-38-3/1	40.0	100	100	U	ug/Kg	SW8260B	11/19/12
o-Xylene	95-47-6	20.0	50.0	50.0	U	ug/Kg	SW8260B	11/19/12
Isopropylbenzene	98-82-8	20.0	50.0	50.0	U	ug/Kg	SW8260B	11/19/12
1,2-Dibromo-3-chloropropane	96-12-8	20.0	50.0	50.0	U	ug/Kg	SW8260B	11/19/12

Surrogate	% Recovery	Control Limits	Qualifier
Dibromofluoromethane	95	65-135	
1,2-Dichloroethane-d4	96	65-135	
Toluene-d8	97	65-135	
4-Bromofluorobenzene	94	65-135	

U=Not detected at specified reporting limit
 J=Estimated value below reporting limit
 E=Estimated value above calibration range
 *=See case narrative

CH2M HILL Applied Sciences Laboratory (ASL)

<u>Client Information</u>		<u>Lab Information</u>	
Project Name: Camp Lejeune		LCS ID: BS1W1119	
Type: QC		Report Revision No.: 0	
Matrix: Water		Dilution Factor: 1	

Analyte	CAS#	Spike Amount	Sample Result	Units	%Recovery	Analysis Method	Date Analyzed
GC/MS Volatiles							
Vinyl Chloride	75-01-4	20.0	19.6	ug/L	98	SW8260B	11/19/12
1,1-Dichloroethene	75-35-4	20.0	19.0	ug/L	95	SW8260B	11/19/12
Methylene chloride	75-09-2	20.0	19.8	ug/L	99	SW8260B	11/19/12
trans-1,2-Dichloroethene	156-60-5	20.0	19.4	ug/L	97	SW8260B	11/19/12
1,1-Dichloroethane	75-34-3	20.0	19.5	ug/L	97	SW8260B	11/19/12
cis-1,2-Dichloroethene	156-59-2	20.0	19.4	ug/L	97	SW8260B	11/19/12
1,2-Dichloroethane	107-06-2	20.0	19.2	ug/L	96	SW8260B	11/19/12
Benzene	71-43-2	20.0	19.8	ug/L	99	SW8260B	11/19/12
Trichloroethene (TCE)	79-01-6	20.0	19.9	ug/L	100	SW8260B	11/19/12
Toluene	108-88-3	20.0	19.5	ug/L	98	SW8260B	11/19/12
Tetrachloroethene (PCE)	127-18-4	20.0	19.3	ug/L	96	SW8260B	11/19/12
Ethylbenzene	100-41-4	20.0	19.3	ug/L	96	SW8260B	11/19/12
m,p-Xylene	108-38-3/1	40.0	38.8	ug/L	97	SW8260B	11/19/12
o-Xylene	95-47-6	20.0	19.4	ug/L	97	SW8260B	11/19/12
Isopropylbenzene	98-82-8	20.0	17.9	ug/L	89	SW8260B	11/19/12
1,2-Dibromo-3-chloropropane	96-12-8	20.0	21.1	ug/L	105	SW8260B	11/19/12

Surrogate	% Recovery	Control Limits	Qualifier
Dibromofluoromethane	96	75-125	
1,2-Dichloroethane-d4	94	75-125	
Toluene-d8	96	75-125	
4-Bromofluorobenzene	97	75-125	

U=Not detected at specified reporting limit
 J=Estimated value below reporting limit
 E=Estimated value above calibration range
 *=See case narrative

CH2M HILL Applied Sciences Laboratory (ASL)

<u>Client Information</u>	<u>Lab Information</u>
Project Name: Camp Lejeune Type: QC Matrix: Soil	LCS ID: BS1S1119 Report Revision No.: 0 Dilution Factor: 100

Analyte	CAS#	Spike Amount	Sample Result	Units	%Recovery	Analysis Method	Date Analyzed
GC/MS Volatiles							
Vinyl Chloride	75-01-4	2000	1960	ug/Kg	98	SW8260B	11/19/12
1,1-Dichloroethene	75-35-4	2000	1900	ug/Kg	95	SW8260B	11/19/12
Methylene chloride	75-09-2	2000	1980	ug/Kg	99	SW8260B	11/19/12
trans-1,2-Dichloroethene	156-60-5	2000	1940	ug/Kg	97	SW8260B	11/19/12
1,1-Dichloroethane	75-34-3	2000	1950	ug/Kg	97	SW8260B	11/19/12
cis-1,2-Dichloroethene	156-59-2	2000	1940	ug/Kg	97	SW8260B	11/19/12
1,2-Dichloroethane	107-06-2	2000	1920	ug/Kg	96	SW8260B	11/19/12
Benzene	71-43-2	2000	1980	ug/Kg	99	SW8260B	11/19/12
Trichloroethene (TCE)	79-01-6	2000	1990	ug/Kg	100	SW8260B	11/19/12
Toluene	108-88-3	2000	1950	ug/Kg	98	SW8260B	11/19/12
Tetrachloroethene (PCE)	127-18-4	2000	1930	ug/Kg	96	SW8260B	11/19/12
Ethylbenzene	100-41-4	2000	1930	ug/Kg	96	SW8260B	11/19/12
m,p-Xylene	108-38-3/1	4000	3880	ug/Kg	97	SW8260B	11/19/12
o-Xylene	95-47-6	2000	1940	ug/Kg	97	SW8260B	11/19/12
Isopropylbenzene	98-82-8	2000	1790	ug/Kg	89	SW8260B	11/19/12
1,2-Dibromo-3-chloropropane	96-12-8	2000	2110	ug/Kg	105	SW8260B	11/19/12

Surrogate	% Recovery	Control Limits	Qualifier
Dibromofluoromethane	96	65-135	
1,2-Dichloroethane-d4	94	65-135	
Toluene-d8	96	65-135	
4-Bromofluorobenzene	97	65-135	

U=Not detected at specified reporting limit
 J=Estimated value below reporting limit
 E=Estimated value above calibration range
 *=See case narrative

CASE NARRATIVE
METALS ANALYSIS

Lab Name: CH2M HILL/LAB/CVO

ASL SDG#: L2861

Project: Camp Lejeune

Project #: 387442.78.WP

I. Method(s):

Analysis: SW6010B, E200.7
Preparation: SW3050, E200.2

II. Receipt/Holding Times:

All acceptance criteria were met.

III. Analysis:

A. Initial Calibration(s):

All acceptance criteria were met.

B. Calibration Verification(s):

All acceptance criteria were met.

C. Blanks:

All acceptance criteria were met.

D. Laboratory Control Sample(s):

All acceptance criteria were met.

E. Matrix Spike/Matrix Spike Duplicate Sample(s):

Analyzed in accordance with standard operating procedure.

F. Interference Check Sample(s):

All acceptance criteria were met.

G. Serial Dilution(s):

Analyzed in accordance with standard operating procedure.

H. Digestion Exception(s):

None.

I. Analytical Exception(s):

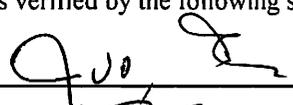
None.

IV. Documentation Exception(s):

None.

V. I certify that this data package is in compliance with the terms and conditions agreed to by the client and CH2M HILL, both technically and for completeness, except for the conditions detailed above. Release of the data contained in this hardcopy data package has been authorized by the Laboratory Manager or designee, as verified by the following signatures.

Prepared by: _____



Date: _____

12-3-12

Reviewed by: _____



Date: _____

2 Dec 2012

CH2M HILL Applied Sciences Laboratory (ASL)

<u>Client Information</u>				<u>Lab Information</u>			
Project Name: Camp Lejeune				Lab Batch ID: L2861			
Date Received: 11/16/12				Report Revision No.: 0			
Type: See C.O.C.							
Matrix: Water							

Client Sample ID	Lab Sample ID	Dilution Factor	RL	Result	Qual	Units	Date Analyzed
<i>Metals</i>							
Iron: E200.7							
<i>Dissolved</i>							
AA_gw	L286101F	1	100	518		ug/L	11/30/12
AB_gw	L286102F	1	100	100	U	ug/L	11/30/12
<i>Total</i>							
WB2-1127	WB2-1127	1	100	100	U	ug/L	11/30/12

U=Not detected at specified reporting limit
 J=Estimated value below reporting limit
 E=Estimated value above calibration range
 *=See case narrative

CH2M HILL Applied Sciences Laboratory (ASL)

Client Information		Lab Information	
Project Name: Camp Lejeune		Lab Batch ID: L2861	
Date Received: 11/16/12		Report Revision No.: 0	
Type: See C.O.C.			
Matrix: Soil			
Basis: Dry Weight			

Client Sample ID	Lab Sample ID	Dilution Factor	RL	Result	Qual	Units	Date Analyzed
Metals							
Iron: SW6010B							
<i>Total</i>							
AA_so	L286103	1	7.31	1120		mg/Kg	11/30/12
AB_so	L286104	1	6.19	1940		mg/Kg	11/30/12
SB1-1128	SB1-1128	1	10.0	10.0	U	mg/Kg	11/30/12

U=Not detected at specified reporting limit
 J=Estimated value below reporting limit
 E=Estimated value above calibration range
 *=See case narrative

CH2M HILL Applied Sciences Laboratory (ASL)

<u>Client Information</u>	<u>Lab Information</u>
Project Name: Camp Lejeune Type: QC Matrix: Water	LCS ID: BS2W1127 Report Revision No.: 0 Dilution Factor: 1

Analyte	CAS#	Spike Amount	Sample Result	Units	%Recovery	Analysis Method	Date Analyzed
Metals							
Iron	7439-89-6	500	491	ug/L	98	E200.7	11/30/12

U=Not detected at specified reporting limit
 J=Estimated value below reporting limit
 E=Estimated value above calibration range
 *=See case narrative

CH2M HILL Applied Sciences Laboratory (ASL)

<u>Client Information</u>	<u>Lab Information</u>
Project Name: Camp Lejeune Type: QC Matrix: Soil	LCS ID: BS1S1128 Report Revision No.: 0 Dilution Factor: 1

Analyte	CAS#	Spike Amount	Sample Result	Units	%Recovery	Analysis Method	Date Analyzed
Metals							
Iron	7439-89-6	50.0	50.7	mg/Kg	101	SW6010B	11/30/12

U=Not detected at specified reporting limit
 J=Estimated value below reporting limit
 E=Estimated value above calibration range
 *=See case narrative

**CASE NARRATIVE
ION CHROMATOGRAPHY ANALYSIS**

Lab Name: CH2M HILL/LAB/CVO

ASL SDG#: L2861

Project: Camp Lejeune

Project #: 387442.78.WP

I. Method(s):

Analysis: E300.0A

II. Receipt/Holding Times:

All acceptance criteria were met.

III. Analysis:

A. Initial Calibration(s):

All acceptance criteria were met.

B. Calibration Verification(s):

All acceptance criteria were met.

C. Blanks:

All acceptance criteria were met.

D. Laboratory Control Sample(s):

All acceptance criteria were met.

E. Matrix Spike/Matrix Spike Duplicate Sample(s):

Analyzed in accordance with standard operating procedure.

F. Analytical Exception(s):

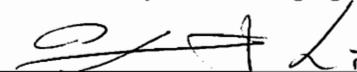
None.

IV. Documentation Exception(s):

None.

V. I certify that this data package is in compliance with the terms and conditions agreed to by the client and CH2M HILL, both technically and for completeness, except for the conditions detailed above. Release of the data contained in this hardcopy data package has been authorized by the Laboratory Manager or designee, as verified by the following signatures.

Prepared by:



Date:

11/28/2012

Reviewed by:



Date:

12/4/12

CH2M HILL Applied Sciences Laboratory (ASL)

<u>Client Information</u>	<u>Lab Information</u>
Client Sample ID: AA_gw	Lab Sample ID: L286101
Project Name: Camp Lejeune	Date Received: 11/16/12
Sample Date: 11/16/12	Report Revision No.: 0
Sample Time: 13:10	
Type: Grab	
Matrix: Water	

Analyte	Dilution Factor	RL	Sample Result	Qual	Units	Analysis Method	Date Analyzed
General Chemistry							
Nitrate-N	1	0.10	0.10	U	mg/L	E300.0A	11/16/12 23:01
Sulfate	1	0.10	1.24		mg/L	E300.0A	11/16/12

U=Not detected at specified reporting limit
 J=Estimated value below reporting limit
 E=Estimated value above calibration range
 *=See case narrative

CH2M HILL Applied Sciences Laboratory (ASL)

<u>Client Information</u>				<u>Lab Information</u>			
Client Sample ID: AB_gw				Lab Sample ID: L286102			
Project Name: Camp Lejeune				Date Received: 11/16/12			
Sample Date: 11/16/12				Report Revision No.: 0			
Sample Time: 13:20							
Type: Grab							
Matrix: Water							

Analyte	Dilution Factor	RL	Sample Result	Qual	Units	Analysis Method	Date Analyzed
General Chemistry							
Nitrate-N	1	0.10	0.10	U	mg/L	E300.0A	11/16/12 23:22
Sulfate	2	0.20	33.7		mg/L	E300.0A	11/19/12

U=Not detected at specified reporting limit
 J=Estimated value below reporting limit
 E=Estimated value above calibration range
 *=See case narrative

CH2M HILL Applied Sciences Laboratory (ASL)

<u>Client Information</u>	<u>Lab Information</u>
Project Name: Camp Lejeune	Lab Batch ID: L2861
Type: QC	Date Received: N/A
Matrix: Water	Report Revision No.: 0

Blank ID	Analyte	RL	Sample Result	Qualifier	Units	Analysis Method	Date Analyzed
General Chemistry							
WB1-1116	Nitrate-N	0.10	0.10	U	mg/L	E300.0A	11/16/12 16:22
WB1-1116	Sulfate	0.10	0.10	U	mg/L	E300.0A	11/16/12
WB1-1119	Sulfate	0.10	0.10	U	mg/L	E300.0A	11/19/12

U=Not detected at specified reporting limit
 J=Estimated value below reporting limit
 E=Estimated value above calibration range
 *=See case narrative

CH2M HILL Applied Sciences Laboratory (ASL)

<u>Client Information</u>	<u>Lab Information</u>
Project Name: Camp Lejeune Type: QC Matrix: Water	Lab Batch ID: L2861 Report Revision No.: 0

LCS ID	Analyte	Spike Amount	Sample Result	Units	% Recovery	Analysis Method	Date Analyzed
General Chemistry							
BS1W1116	Nitrate-N	3.00	2.82	mg/L	94	E300.0A	11/16/12
BS1W1116	Sulfate	15.0	14.1	mg/L	94	E300.0A	11/16/12
BS1W1119	Sulfate	15.0	13.7	mg/L	91	E300.0A	11/19/12

U=Not detected at specified reporting limit
 J=Estimated value below reporting limit
 E=Estimated value above calibration range
 *=See case narrative

**CASE NARRATIVE
WET CHEMISTRY ANALYSIS**

Lab Name: CH2M HILL/LAB/CVO

ASL SDG#: L2861

Project: Camp Lejeune

Project #: 387442.78.WP

I. Method(s):

Analysis: SM5310B

II. Receipt/Holding Times:

All acceptance criteria were met.

III. Analysis:

A. Initial Calibration(s):

All acceptance criteria were met.

B. Calibration Verification(s):

All acceptance criteria were met.

C. Blanks:

All acceptance criteria were met.

D. Laboratory Control Sample(s):

All acceptance criteria were met.

E. Matrix Spike/Matrix Spike Duplicate Sample(s):

Analyzed in accordance with standard operating procedure.

F. Analytical Exception(s):

None.

IV. Documentation Exception(s):

None.

V. I certify that this data package is in compliance with the terms and conditions agreed to by the client and CH2M HILL, both technically and for completeness, except for the conditions detailed above. Release of the data contained in this hardcopy data package has been authorized by the Laboratory Manager or designee, as verified by the following signatures.

Prepared by: _____

Date: _____

12/3/2012

Reviewed by: _____

Date: _____

12/4/12

CH2M HILL Applied Sciences Laboratory (ASL)

<u>Client Information</u>	<u>Lab Information</u>
Project Name: Camp Lejeune	Lab Batch ID: L2861
Date Received: 11/16/12	Analysis Method: SM5310B
Type: See C.O.C.	Units: mg/L
Matrix: Water	Report Revision No.: 0

Client Sample ID	Lab Sample ID	Dilution Factor	Total Organic Carbon		Qualifier	Date Analyzed
			RL	Result		
General Chemistry						
AA_gw	L286101	10	5.00	17.8		11/28/12
AB_gw	L286102	1	0.50	1.78		11/21/12
WB1-1121	WB1-1121	1	0.50	0.50	U	11/21/12
WB1-1128	WB1-1128	1	0.50	0.50	U	11/28/12

U=Not detected at specified reporting limit
 J=Estimated value below reporting limit
 E=Estimated value above calibration range
 *=See case narrative

CH2M HILL Applied Sciences Laboratory (ASL)

<u>Client Information</u>	<u>Lab Information</u>
Project Name: Camp Lejeune Type: QC Matrix: Water	Lab Batch ID: L2861 Report Revision No.: 0

LCS ID	Analyte	Spike Amount	Sample Result	Units	% Recovery	Analysis Method	Date Analyzed
General Chemistry							
BS1W121	Total Organic Carbon	2.50	2.87	mg/L	115	SM5310B	11/21/12
BS1W1128	Total Organic Carbon	2.50	2.24	mg/L	89	SM5310B	11/28/12

U=Not detected at specified reporting limit
 J=Estimated value below reporting limit
 E=Estimated value above calibration range
 *=See case narrative

**CASE NARRATIVE
WET CHEMISTRY ANALYSIS**

Lab Name: CH2M HILL/LAB/CVO

ASL SDG#: L2861

Project: Camp Lejeune

Project #: 387442.78.WP

I. Method(s):

Analysis: E376.2

II. Receipt/Holding Times:

All acceptance criteria were met.

III. Analysis:

A. Initial Calibration(s):

All acceptance criteria were met.

B. Calibration Verification(s):

All acceptance criteria were met.

C. Blanks:

All acceptance criteria were met.

D. Laboratory Control Sample(s):

All acceptance criteria were met.

E. Matrix Spike/Matrix Spike Duplicate Sample(s):

Analyzed in accordance with standard operating procedure.

F. Analytical Exception(s):

None.

IV. Documentation Exception(s):

None.

V. I certify that this data package is in compliance with the terms and conditions agreed to by the client and CH2M HILL, both technically and for completeness, except for the conditions detailed above. Release of the data contained in this hardcopy data package has been authorized by the Laboratory Manager or designee, as verified by the following signatures.

Prepared by: Janet McBeary

Date: 12/2/12

Reviewed by: Kathey McKinley

Date: 12/4/12

CH2M HILL Applied Sciences Laboratory (ASL)

<u>Client Information</u>		<u>Lab Information</u>	
Project Name: Camp Lejeune		Lab Batch ID: L2861	
Date Received: 11/16/2012		Analysis Method: E376.2	
Type: See C.O.C.		Units: ug/L	
Matrix: Water		Report Revision No.: 0	

Client Sample ID	Lab Sample ID	Dilution Factor	RL	Sulfide Result	Qualifier	Date Analyzed
General Chemistry						
AA_gw	L286101	1	25.0	25.0	U	11/19/2012
AB_gw	L286102	1	25.0	25.0	U	11/19/2012
WB1-1119	WB1-1119	1	25.0	25.0	U	11/19/2012

U=Not detected at specified reporting limit
 J=Estimated value below reporting limit
 E=Estimated value above calibration range
 *=See case narrative

CH2M HILL Applied Sciences Laboratory (ASL)

Client Information

Project Name: Camp Lèjeune
Type: QC
Matrix: Water

Lab Information

Lab Batch ID: L2861
Report Revision No.: 0

LCS ID	Analyte	Spike Amount	Sample Result	Units	% Recovery	Analysis Method	Date Analyzed
General Chemistry							
BS1W1119	Sulfide	333	324	ug/L	97	E376.2	11/19/2012

U=Not detected at specified reporting limit
J=Estimated value below reporting limit
E=Estimated value above calibration range
*=See case narrative

CH2MHILL Applied Sciences Lab
CHAIN OF CUSTODY RECORD
AND AGREEMENT TO PERFORM SERVICES

1000 NE Circle Blvd., Suite 10350
 Corvallis, OR 97330
 (541) 768-3120 FAX (541) 752-0276

COC #

Project # or Purchase Order # 387442.78.WP							Requested Analytical Method #										THIS AREA FOR LAB USE ONLY										
Project Name Camp Lejeune Site 78							TOTAL # OF CONTAINERS	Sulfate & Nitrate (E300.0)	VOCs (SW8260B)*	Dissolved Iron (200.7) **PRE-FILTERED**	TOC	Sulfide	Asbestos - Total (E200.7) Asbestos - Total Iron (E200.7)	VOCs (SW8260B)*	Lab #	Page	of										
Company Name or Home Address/Phone Number CH2M HILL															2861 2 3												
Email Address for Reporting Dusty Berggren/CVO				Report Copy to: Mike Niemet/CVO											20.3°C H.D.												
Turnaround Time <input type="checkbox"/> 24 hours <input type="checkbox"/> 48 hours <input type="checkbox"/> 72 hours <input checked="" type="checkbox"/> 7 days <input type="checkbox"/> 14 days <input type="checkbox"/> 21 days (STD)				Drinking Water? Yes <input type="checkbox"/> No <input checked="" type="checkbox"/>		Sample Disposal: Dispose <input checked="" type="checkbox"/> Return <input type="checkbox"/>																					
Sampling		Type		Matrix											Preservative										EPA Tier QC Level		
Date	Time	COMP	GRAB	WATER	SOIL	AIR									CLIENT SAMPLE ID	UNPRES	HCl	HNO ₃	H ₂ SO ₄	ZnAc	UNPRES	UNPRES	1 (Screening) 2 3 4				
11/16	1310		x	x											AA_gw	8	1	3	1	2	1			Canister ID Lab ID			
11/16	1320		x	x											AB_gw	8	1	3	1	2	1			-1			
11/16	1300		X		x										AA_so	2					1	1	-2				
11/16	1330		X		x										AB_so	2					1	1	-3				
11/16															-4												

Possible Hazard Identification: Non-Hazard Flammable Skin Irritant Poison B Unknown Volatile Contaminants/Odorous Biohazard Other _____

Relinquished By _____ Date/Time _____				Received By: _____ Date/Time _____			
Sampled By and Title (Please sign and print name) _____ Date/Time _____				Relinquished By (Please sign and print name) _____ Date/Time _____			
Received By (Please sign and print name) _____ Date/Time _____				Relinquished By (Please sign and print name) _____ Date/Time _____			
Received By (Please sign and print name) _____ Date/Time _____				Shipped Via _____ Tracking # _____			

Special Instructions
 Please provide preliminary VOC results when available.
 *Only report the following VOCs: benzene, ethylbenzene, toluene, xylenes, tetrachloroethene (PCE), trichloroethene (TCE), 1,1-dichloroethene (DCE), cis-1,2-DCE, trans-1,2-DCE, vinyl chloride (VC), 1,1-dichloroethane (DCA), 1,2-DCA, 1,2-dibromo-3-chloropropane, isopropylbenzene, and methylene chloride.

Instructions and Agreement Provisions on Reverse Side



ANALYTICAL REPORT

For:
Camp Lejeune

ASL Report #: L2953
Project ID: 387442.78.WP
Attn: Dusty Berggren/CH2M HILL
cc:
Mike Niemet/mike.niemet@ch2m.com

Authorized and Released By:

Laboratory Project Manager
Ben Thompson
(541) 758-0235 ext.23132
December 13, 2012

This data package meets standards requested by client and is not intended or implied to meet any other standard.

All analyses performed by CH2M HILL are clearly indicated. Any subcontracted analyses are included as appended reports as received from the subcontracted laboratory. The results included in this report only relate to the samples listed on the following Sample Cross-Reference page. This report shall not be reproduced except in full, without the written approval of the laboratory.

Any unusual difficulties encountered during the analysis of your samples are discussed in the attached case narratives.

ASL Report #: L2953

Sample Receipt Comments

We certify that the test results meet all standard ASL requirements.

Sample Cross-Reference

ASL Sample ID	Client Sample ID	Date/Time Collected	Date Received
L295301	Control A_t0	11/30/12 19:00	12/03/12
L295302	Sulfate_t0	11/30/12 19:20	12/03/12
L295303	Control B_t0	11/30/12 19:35	12/03/12
L295304	EHC-L_t0	11/30/12 19:50	12/03/12

**CASE NARRATIVE
GC/MS VOLATILES ANALYSIS**

Lab Name: CH2M HILL/LAB/CVO

ASL SDG#: L2953

Project: Camp Lejeune

Project #: 387442.78.WP

I. Method(s):

Analysis: SW8260B

Preparation: SW5030

II. Receipt/Holding Times:

All acceptance criteria were met.

III. Analysis:

A. Initial Calibration(s):

All acceptance criteria were met.

B. Calibration Verification(s):

All acceptance criteria were met.

C. Blank(s):

All acceptance criteria were met.

D. Laboratory Control Sample(s):

All acceptance criteria were met.

E. Matrix Spike/Matrix Spike Duplicate Sample(s):

Analyzed in accordance with standard operating procedure.

F. Surrogate Standard(s):

All acceptance criteria were met.

G. BFB Tune Verification(s):

All acceptance criteria were met.

H. Internal Standard(s):

All acceptance criteria were met.

I. Analytical Exception(s):

Due to instrumental contamination concerns, some samples within this SDG could not be analyzed at 1x dilution. Only one vial provided for analysis.

IV. Documentation Exception(s):

None.

V. I certify that this data package is in compliance with the terms and conditions agreed to by the client and CH2M HILL, both technically and for completeness, except for the conditions detailed above. Release of the data contained in this hardcopy data package has been authorized by the Laboratory Manager or designee, as verified by the following signatures.

Prepared by: _____

Date: _____

12/12/12

Reviewed by: _____

Date: _____

12/13/12

CH2M HILL Applied Sciences Laboratory (ASL)

Client Information				Lab Information			
Client Sample ID: Control A_t0				Lab Sample ID: L295301			
Project Name: Camp Lejeune				Date Received: 12/03/12			
Sample Date: 11/30/12				Dilution Factor: 20			
Sample Time: 19:00				Report Revision No.: 0			
Type: Grab							
Matrix: Water							

Analyte	CAS#	DL	RL	Sample Result	Qualifier	Units	Analysis Method	Date Analyzed
GC/MS Volatiles								
Vinyl Chloride	75-01-4	4.00	10.0	10.0	U	ug/L	SW8260B	12/05/12
1,1-Dichloroethene	75-35-4	4.00	10.0	10.0	U	ug/L	SW8260B	12/05/12
Methylene chloride	75-09-2	4.00	10.0	10.0	U	ug/L	SW8260B	12/05/12
trans-1,2-Dichloroethene	156-60-5	4.00	10.0	10.0	U	ug/L	SW8260B	12/05/12
1,1-Dichloroethane	75-34-3	4.00	10.0	10.0	U	ug/L	SW8260B	12/05/12
cis-1,2-Dichloroethene	156-59-2	4.00	10.0	10.0	U	ug/L	SW8260B	12/05/12
1,2-Dichloroethane	107-06-2	4.00	10.0	10.0	U	ug/L	SW8260B	12/05/12
Benzene	71-43-2	4.00	10.0	22.7		ug/L	SW8260B	12/05/12
Trichloroethene (TCE)	79-01-6	4.00	10.0	26.5		ug/L	SW8260B	12/05/12
Toluene	108-88-3	4.00	10.0	107		ug/L	SW8260B	12/05/12
Tetrachloroethene (PCE)	127-18-4	4.00	10.0	10.0	U	ug/L	SW8260B	12/05/12
Ethylbenzene	100-41-4	4.00	10.0	105		ug/L	SW8260B	12/05/12
m,p-Xylene	108-38-3/1	8.00	20.0	534		ug/L	SW8260B	12/05/12
o-Xylene	95-47-6	4.00	10.0	180		ug/L	SW8260B	12/05/12
Isopropylbenzene	98-82-8	4.00	10.0	31.1		ug/L	SW8260B	12/05/12
1,2-Dibromo-3-chloropropane	96-12-8	4.00	10.0	10.0	U	ug/L	SW8260B	12/05/12

Surrogate	% Recovery	Control Limits	Qualifier
Dibromofluoromethane	94	75-125	
1,2-Dichloroethane-d4	90	75-125	
Toluene-d8	97	75-125	
4-Bromofluorobenzene	93	75-125	

U=Not detected at specified reporting limit
 J=Estimated value below reporting limit
 E=Estimated value above calibration range
 *=See case narrative

CH2M HILL Applied Sciences Laboratory (ASL)

Client Information				Lab Information			
Client Sample ID: Sulfate_t0				Lab Sample ID: L295302			
Project Name: Camp Lejeune				Date Received: 12/03/12			
Sample Date: 11/30/12				Dilution Factor: 20			
Sample Time: 19:20				Report Revision No.: 0			
Type: Grab							
Matrix: Water							

Analyte	CAS#	DL	RL	Sample Result	Qualifier	Units	Analysis Method	Date Analyzed
GC/MS Volatiles								
Vinyl Chloride	75-01-4	4.00	10.0	10.0	U	ug/L	SW8260B	12/05/12
1,1-Dichloroethene	75-35-4	4.00	10.0	10.0	U	ug/L	SW8260B	12/05/12
Methylene chloride	75-09-2	4.00	10.0	10.0	U	ug/L	SW8260B	12/05/12
trans-1,2-Dichloroethene	156-60-5	4.00	10.0	10.0	U	ug/L	SW8260B	12/05/12
1,1-Dichloroethane	75-34-3	4.00	10.0	10.0	U	ug/L	SW8260B	12/05/12
cis-1,2-Dichloroethene	156-59-2	4.00	10.0	10.0	U	ug/L	SW8260B	12/05/12
1,2-Dichloroethane	107-06-2	4.00	10.0	10.0	U	ug/L	SW8260B	12/05/12
Benzene	71-43-2	4.00	10.0	20.3		ug/L	SW8260B	12/05/12
Trichloroethene (TCE)	79-01-6	4.00	10.0	24.3		ug/L	SW8260B	12/05/12
Toluene	108-88-3	4.00	10.0	95.8		ug/L	SW8260B	12/05/12
Tetrachloroethene (PCE)	127-18-4	4.00	10.0	10.0	U	ug/L	SW8260B	12/05/12
Ethylbenzene	100-41-4	4.00	10.0	107		ug/L	SW8260B	12/05/12
m,p-Xylene	108-38-3/1	8.00	20.0	545		ug/L	SW8260B	12/05/12
o-Xylene	95-47-6	4.00	10.0	180		ug/L	SW8260B	12/05/12
Isopropylbenzene	98-82-8	4.00	10.0	33.6		ug/L	SW8260B	12/05/12
1,2-Dibromo-3-chloropropane	96-12-8	4.00	10.0	10.0	U	ug/L	SW8260B	12/05/12

Surrogate	% Recovery	Control Limits	Qualifier
Dibromofluoromethane	94	75-125	
1,2-Dichloroethane-d4	89	75-125	
Toluene-d8	97	75-125	
4-Bromofluorobenzene	95	75-125	

U=Not detected at specified reporting limit
 J=Estimated value below reporting limit
 E=Estimated value above calibration range
 *=See case narrative

CH2M HILL Applied Sciences Laboratory (ASL)

Client Information				Lab Information			
Client Sample ID: Control B_t0				Lab Sample ID: L295303			
Project Name: Camp Lejeune				Date Received: 12/03/12			
Sample Date: 11/30/12				Dilution Factor: 10			
Sample Time: 19:35				Report Revision No.: 0			
Type: Grab							
Matrix: Water							

Analyte	CAS#	DL	RL	Sample Result	Qualifier	Units	Analysis Method	Date Analyzed
GC/MS Volatiles								
Vinyl Chloride	75-01-4	2.00	5.00	5.00	U	ug/L	SW8260B	12/05/12
1,1-Dichloroethene	75-35-4	2.00	5.00	5.00	U	ug/L	SW8260B	12/05/12
Methylene chloride	75-09-2	2.00	5.00	5.00	U	ug/L	SW8260B	12/05/12
trans-1,2-Dichloroethene	156-60-5	2.00	5.00	5.00	U	ug/L	SW8260B	12/05/12
1,1-Dichloroethane	75-34-3	2.00	5.00	5.00	U	ug/L	SW8260B	12/05/12
cis-1,2-Dichloroethene	156-59-2	2.00	5.00	54.3		ug/L	SW8260B	12/05/12
1,2-Dichloroethane	107-06-2	2.00	5.00	5.00	U	ug/L	SW8260B	12/05/12
Benzene	71-43-2	2.00	5.00	5.00	U	ug/L	SW8260B	12/05/12
Trichloroethene (TCE)	79-01-6	2.00	5.00	49.2		ug/L	SW8260B	12/05/12
Toluene	108-88-3	2.00	5.00	29.7		ug/L	SW8260B	12/05/12
Tetrachloroethene (PCE)	127-18-4	2.00	5.00	5.00	U	ug/L	SW8260B	12/05/12
Ethylbenzene	100-41-4	2.00	5.00	5.00	U	ug/L	SW8260B	12/05/12
m,p-Xylene	108-38-3/1	4.00	10.0	10.0	U	ug/L	SW8260B	12/05/12
o-Xylene	95-47-6	2.00	5.00	5.00	U	ug/L	SW8260B	12/05/12
Isopropylbenzene	98-82-8	2.00	5.00	5.00	U	ug/L	SW8260B	12/05/12
1,2-Dibromo-3-chloropropane	96-12-8	2.00	5.00	5.00	U	ug/L	SW8260B	12/05/12

Surrogate	% Recovery	Control Limits	Qualifier
Dibromofluoromethane	94	75-125	
1,2-Dichloroethane-d4	89	75-125	
Toluene-d8	96	75-125	
4-Bromofluorobenzene	93	75-125	

U=Not detected at specified reporting limit
 J=Estimated value below reporting limit
 E=Estimated value above calibration range
 *=See case narrative

CH2M HILL Applied Sciences Laboratory (ASL)

<u>Client Information</u>	<u>Lab Information</u>
Client Sample ID: EHC-L_t0	Lab Sample ID: L295304
Project Name: Camp Lejeune	Date Received: 12/03/12
Sample Date: 11/30/12	Dilution Factor: 10
Sample Time: 19:50	Report Revision No.: 0
Type: Grab	
Matrix: Water	

Analyte	CAS#	DL	RL	Sample Result	Qualifier	Units	Analysis Method	Date Analyzed
GC/MS Volatiles								
Vinyl Chloride	75-01-4	2.00	5.00	5.00	U	ug/L	SW8260B	12/05/12
1,1-Dichloroethene	75-35-4	2.00	5.00	5.00	U	ug/L	SW8260B	12/05/12
Methylene chloride	75-09-2	2.00	5.00	5.00	U	ug/L	SW8260B	12/05/12
trans-1,2-Dichloroethene	156-60-5	2.00	5.00	5.00	U	ug/L	SW8260B	12/05/12
1,1-Dichloroethane	75-34-3	2.00	5.00	5.00	U	ug/L	SW8260B	12/05/12
cis-1,2-Dichloroethene	156-59-2	2.00	5.00	54.3		ug/L	SW8260B	12/05/12
1,2-Dichloroethane	107-06-2	2.00	5.00	5.00	U	ug/L	SW8260B	12/05/12
Benzene	71-43-2	2.00	5.00	5.00	U	ug/L	SW8260B	12/05/12
Trichloroethene (TCE)	79-01-6	2.00	5.00	45.9		ug/L	SW8260B	12/05/12
Toluene	108-88-3	2.00	5.00	27.3		ug/L	SW8260B	12/05/12
Tetrachloroethene (PCE)	127-18-4	2.00	5.00	5.00	U	ug/L	SW8260B	12/05/12
Ethylbenzene	100-41-4	2.00	5.00	5.00	U	ug/L	SW8260B	12/05/12
m,p-Xylene	108-38-3/1	4.00	10.0	10.0	U	ug/L	SW8260B	12/05/12
o-Xylene	95-47-6	2.00	5.00	5.00	U	ug/L	SW8260B	12/05/12
Isopropylbenzene	98-82-8	2.00	5.00	5.00	U	ug/L	SW8260B	12/05/12
1,2-Dibromo-3-chloropropane	96-12-8	2.00	5.00	5.00	U	ug/L	SW8260B	12/05/12

<u>Surrogate</u>	<u>% Recovery</u>	<u>Control Limits</u>	<u>Qualifier</u>
Dibromofluoromethane	96	75-125	
1,2-Dichloroethane-d4	90	75-125	
Toluene-d8	96	75-125	
4-Bromofluorobenzene	92	75-125	

U=Not detected at specified reporting limit
 J=Estimated value below reporting limit
 E=Estimated value above calibration range
 *=See case narrative

CH2M HILL Applied Sciences Laboratory (ASL)

<u>Client Information</u>	<u>Lab Information</u>
Client Sample ID: WB1-1205	Lab Sample ID: WB1-1205
Project Name: Camp Lejeune	Date Received: N/A
Sample Date: N/A	Dilution Factor: 1
Sample Time: N/A	Report Revision No.: 0
Type: QC	
Matrix: Water	

Analyte	CAS#	DL	RL	Sample Result	Qualifier	Units	Analysis Method	Date Analyzed
GC/MS Volatiles								
Vinyl Chloride	75-01-4	0.20	0.50	0.50	U	ug/L	SW8260B	12/05/12
1,1-Dichloroethene	75-35-4	0.20	0.50	0.50	U	ug/L	SW8260B	12/05/12
Methylene chloride	75-09-2	0.20	0.50	0.50	U	ug/L	SW8260B	12/05/12
trans-1,2-Dichloroethene	156-60-5	0.20	0.50	0.50	U	ug/L	SW8260B	12/05/12
1,1-Dichloroethane	75-34-3	0.20	0.50	0.50	U	ug/L	SW8260B	12/05/12
cis-1,2-Dichloroethene	156-59-2	0.20	0.50	0.50	U	ug/L	SW8260B	12/05/12
1,2-Dichloroethane	107-06-2	0.20	0.50	0.50	U	ug/L	SW8260B	12/05/12
Benzene	71-43-2	0.20	0.50	0.50	U	ug/L	SW8260B	12/05/12
Trichloroethene (TCE)	79-01-6	0.20	0.50	0.50	U	ug/L	SW8260B	12/05/12
Toluene	108-88-3	0.20	0.50	0.50	U	ug/L	SW8260B	12/05/12
Tetrachloroethene (PCE)	127-18-4	0.20	0.50	0.50	U	ug/L	SW8260B	12/05/12
Ethylbenzene	100-41-4	0.20	0.50	0.50	U	ug/L	SW8260B	12/05/12
m,p-Xylene	108-38-3/1	0.40	1.00	1.00	U	ug/L	SW8260B	12/05/12
o-Xylene	95-47-6	0.20	0.50	0.50	U	ug/L	SW8260B	12/05/12
Isopropylbenzene	98-82-8	0.20	0.50	0.50	U	ug/L	SW8260B	12/05/12
1,2-Dibromo-3-chloropropane	96-12-8	0.20	0.50	0.50	U	ug/L	SW8260B	12/05/12

<u>Surrogate</u>	<u>% Recovery</u>	<u>Control Limits</u>	<u>Qualifier</u>
Dibromofluoromethane	98	75-125	
1,2-Dichloroethane-d4	95	75-125	
Toluene-d8	95	75-125	
4-Bromofluorobenzene	94	75-125	

U=Not detected at specified reporting limit
 J=Estimated value below reporting limit
 E=Estimated value above calibration range
 *=See case narrative

CH2M HILL Applied Sciences Laboratory (ASL)

<u>Client Information</u>	<u>Lab Information</u>
Project Name: Camp Lejeune	LCS ID: BS1W1205
Type: QC	Report Revision No.: 0
Matrix: Water	Dilution Factor: 1

Analyte	CAS#	Spike Amount	Sample Result	Units	%Recovery	Analysis Method	Date Analyzed
GC/MS Volatiles							
Vinyl Chloride	75-01-4	20.0	17.8	ug/L	89	SW8260B	12/05/12
1,1-Dichloroethene	75-35-4	20.0	17.3	ug/L	87	SW8260B	12/05/12
Methylene chloride	75-09-2	20.0	19.2	ug/L	96	SW8260B	12/05/12
trans-1,2-Dichloroethene	156-60-5	20.0	18.2	ug/L	91	SW8260B	12/05/12
1,1-Dichloroethane	75-34-3	20.0	18.4	ug/L	92	SW8260B	12/05/12
cis-1,2-Dichloroethene	156-59-2	20.0	18.4	ug/L	92	SW8260B	12/05/12
1,2-Dichloroethane	107-06-2	20.0	17.9	ug/L	89	SW8260B	12/05/12
Benzene	71-43-2	20.0	19.1	ug/L	96	SW8260B	12/05/12
Trichloroethene (TCE)	79-01-6	20.0	19.1	ug/L	96	SW8260B	12/05/12
Toluene	108-88-3	20.0	18.9	ug/L	95	SW8260B	12/05/12
Tetrachloroethene (PCE)	127-18-4	20.0	18.4	ug/L	92	SW8260B	12/05/12
Ethylbenzene	100-41-4	20.0	18.1	ug/L	91	SW8260B	12/05/12
m,p-Xylene	108-38-3/1	40.0	36.6	ug/L	92	SW8260B	12/05/12
o-Xylene	95-47-6	20.0	18.4	ug/L	92	SW8260B	12/05/12
Isopropylbenzene	98-82-8	20.0	16.6	ug/L	83	SW8260B	12/05/12
1,2-Dibromo-3-chloropropane	96-12-8	20.0	18.7	ug/L	94	SW8260B	12/05/12

Surrogate	% Recovery	Control Limits	Qualifier
Dibromofluoromethane	99	75-125	
1,2-Dichloroethane-d4	91	75-125	
Toluene-d8	96	75-125	
4-Bromofluorobenzene	94	75-125	

U=Not detected at specified reporting limit
 J=Estimated value below reporting limit
 E=Estimated value above calibration range
 *=See case narrative

CASE NARRATIVE
METALS ANALYSIS

Lab Name: CH2M HILL/LAB/CVO

ASL SDG#: L2953

Project: Camp Lejeune

Project #: 387442.78.WP

I. Method(s):

Analysis: E200.7

Preparation: E200.2, FLDFLT

II. Receipt/Holding Times:

All acceptance criteria were met.

III. Analysis:

A. Initial Calibration(s):

All acceptance criteria were met.

B. Calibration Verification(s):

All acceptance criteria were met.

C. Blanks:

All acceptance criteria were met.

D. Laboratory Control Sample(s):

All acceptance criteria were met.

E. Matrix Spike/Matrix Spike Duplicate Sample(s):

Analyzed in accordance with standard operating procedure.

F. Interference Check Sample(s):

All acceptance criteria were met.

G. Serial Dilution(s):

Analyzed in accordance with standard operating procedure.

H. Digestion Exception(s):

None.

I. Analytical Exception(s):

None.

IV. Documentation Exception(s):

None.

V. I certify that this data package is in compliance with the terms and conditions agreed to by the client and CH2M HILL, both technically and for completeness, except for the conditions detailed above. Release of the data contained in this hardcopy data package has been authorized by the Laboratory Manager or designee, as verified by the following signatures.

Prepared by: 

Date: 12-7-12

Reviewed by: 

Date: 12/10/12

CH2M HILL Applied Sciences Laboratory (ASL)

<u>Client Information</u>		<u>Lab Information</u>	
Project Name: Camp Lejeune		Lab Batch ID: L2953	
Date Received: 12/03/12		Report Revision No.: 0	
Type: See C.O.C.			
Matrix: Water			

Client Sample ID	Lab Sample ID	Dilution Factor	RL	Result	Qual	Units	Date Analyzed
Metals							
Iron: E200.7							
Dissolved							
Control A_t0	L295301F	1	100	6010		ug/L	12/04/12
Sulfate_t0	L295302F	1	100	6830		ug/L	12/04/12
Control B_t0	L295303F	1	100	111		ug/L	12/04/12
EHC-L_t0	L295304F	1	100	2110		ug/L	12/04/12
Total							
WB1-1130	WB1-1130	1	100	100	U	ug/L	12/04/12

U=Not detected at specified reporting limit
 J=Estimated value below reporting limit
 E=Estimated value above calibration range
 *=See case narrative

CH2M HILL Applied Sciences Laboratory (ASL)

<u>Client Information</u>	<u>Lab Information</u>
Project Name: Camp Lejeune Type: QC Matrix: Water	LCS ID: BS1W1130 Report Revision No.: 0 Dilution Factor: 1

Analyte	CAS#	Spike Amount	Sample Result	Units	%Recovery	Analysis Method	Date Analyzed
Metals							
Iron	7439-89-6	500	536	ug/L	107	E200.7	12/04/12

U=Not detected at specified reporting limit
 J=Estimated value below reporting limit
 E=Estimated value above calibration range
 *=See case narrative

**CASE NARRATIVE
ION CHROMATOGRAPHY ANALYSIS**

Lab Name: CH2M HILL/LAB/CVO

ASL SDG#: L2953

Project: Camp Lejeune

Project #: 387442.78.WP

I. Method(s):

Analysis: E300.0A

II. Receipt/Holding Times:

Samples for Nitrate-N were analyzed outside of holding time.

III. Analysis:

A. Initial Calibration(s):

All acceptance criteria were met.

B. Calibration Verification(s):

All acceptance criteria were met.

C. Blanks:

All acceptance criteria were met.

D. Laboratory Control Sample(s):

All acceptance criteria were met.

E. Matrix Spike/Matrix Spike Duplicate Sample(s):

Analyzed in accordance with standard operating procedure.

F. Analytical Exception(s):

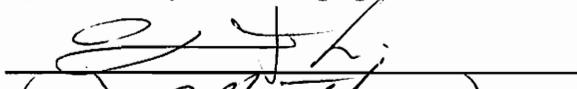
None.

IV. Documentation Exception(s):

None.

V. I certify that this data package is in compliance with the terms and conditions agreed to by the client and CH2M HILL, both technically and for completeness, except for the conditions detailed above. Release of the data contained in this hardcopy data package has been authorized by the Laboratory Manager or designee, as verified by the following signatures.

Prepared by:



Date:

12/7/2012

Reviewed by:



Date:

12/13/12

CH2M HILL Applied Sciences Laboratory (ASL)

<u>Client Information</u>	<u>Lab Information</u>
Client Sample ID: Control A_t0	Lab Sample ID: L295301
Project Name: Camp Lejeune	Date Received: 12/03/12
Sample Date: 11/30/12	Report Revision No.: 0
Sample Time: 19:00	
Type: Grab	
Matrix: Water	

Analyte	Dilution Factor	RL	Sample Result	Qual	Units	Analysis Method	Date Analyzed
General Chemistry							
Nitrate-N	1	0.10	0.10	U*	mg/L	E300.0A	12/03/12 16:23
Sulfate	1	0.10	4.55		mg/L	E300.0A	12/03/12

U=Not detected at specified reporting limit
 J=Estimated value below reporting limit
 E=Estimated value above calibration range
 *=See case narrative

CH2M HILL Applied Sciences Laboratory (ASL)

<u>Client Information</u>	<u>Lab Information</u>
Client Sample ID: Sulfate_t0	Lab Sample ID: L295302
Project Name: Camp Lejeune	Date Received: 12/03/12
Sample Date: 11/30/12	Report Revision No.: 0
Sample Time: 19:20	
Type: Grab	
Matrix: Water	

Analyte	Dilution Factor	RL	Sample Result	Qual	Units	Analysis Method	Date Analyzed
General Chemistry							
Nitrate-N	1	0.10	0.10	U*	mg/L	E300.0A	12/03/12 16:44
Sulfate	5	0.50	92.4		mg/L	E300.0A	12/04/12

U=Not detected at specified reporting limit
 J=Estimated value below reporting limit
 E=Estimated value above calibration range
 *=See case narrative

CH2M HILL Applied Sciences Laboratory (ASL)

Client Information

Client Sample ID: Control B_t0

Project Name: Camp Lejeune

Sample Date: 11/30/12

Sample Time: 19:35

Type: Grab

Matrix: Water

Lab Information

Lab Sample ID: L295303

Date Received: 12/03/12

Report Revision No.: 0

Analyte	Dilution Factor	RL	Sample Result	Qual	Units	Analysis Method	Date Analyzed
General Chemistry							
Nitrate-N	1	0.10	0.10	U*	mg/L	E300.0A	12/03/12 17:04
Sulfate	3	0.30	33.7		mg/L	E300.0A	12/04/12

U=Not detected at specified reporting limit
 J=Estimated value below reporting limit
 E=Estimated value above calibration range
 *=See case narrative

CH2M HILL Applied Sciences Laboratory (ASL)

<u>Client Information</u>	<u>Lab Information</u>
Client Sample ID: EHC-L_t0	Lab Sample ID: L295304
Project Name: Camp Lejeune	Date Received: 12/03/12
Sample Date: 11/30/12	Report Revision No.: 0
Sample Time: 19:50	
Type: Grab	
Matrix: Water	

Analyte	Dilution Factor	RL	Sample Result	Qual	Units	Analysis Method	Date Analyzed
General Chemistry							
Nitrate-N	1	0.10	0.10	U*	mg/L	E300.0A	12/03/12 17:25
Sulfate	3	0.30	34.1		mg/L	E300.0A	12/04/12

U=Not detected at specified reporting limit
 J=Estimated value below reporting limit
 E=Estimated value above calibration range
 *=See case narrative

CH2M HILL Applied Sciences Laboratory (ASL)

<u>Client Information</u>	<u>Lab Information</u>
Project Name: Camp Lejeune	Lab Batch ID: L2953
Type: QC	Date Received: N/A
Matrix: Water	Report Revision No.: 0

Blank ID	Analyte	RL	Sample Result	Qualifier	Units	Analysis Method	Date Analyzed
General Chemistry							
WB1-1203	Nitrate-N	0.10	0.10	U	mg/L	E300.0A	12/03/12 15:21
WB1-1203	Sulfate	0.10	0.10	U	mg/L	E300.0A	12/03/12
WB2-1203	Sulfate	0.10	0.10	U	mg/L	E300.0A	12/04/12

U=Not detected at specified reporting limit
 J=Estimated value below reporting limit
 E=Estimated value above calibration range
 *=See case narrative

CH2M HILL Applied Sciences Laboratory (ASL)

<u>Client Information</u>	<u>Lab Information</u>
Project Name: Camp Lejeune Type: QC Matrix: Water	Lab Batch ID: L2953 Report Revision No.: 0

LCS ID	Analyte	Spike Amount	Sample Result	Units	% Recovery	Analysis Method	Date Analyzed
General Chemistry							
BS1W1203	Nitrate-N	3.00	2.89	mg/L	96	E300.0A	12/03/12
BS1W1203	Sulfate	15.0	13.9	mg/L	93	E300.0A	12/03/12
BS2W1203	Sulfate	15.0	13.9	mg/L	93	E300.0A	12/04/12

U=Not detected at specified reporting limit
 J=Estimated value below reporting limit
 E=Estimated value above calibration range
 *=See case narrative

**CASE NARRATIVE
WET CHEMISTRY ANALYSIS**

Lab Name: CH2M HILL/LAB/CVO

ASL SDG#: L2953

Project: Camp Lejeune

Project #: 387442.78.WP

I. Method(s):

Analysis: SM5310B

II. Receipt/Holding Times:

All acceptance criteria were met.

III. Analysis:

A. Initial Calibration(s):

All acceptance criteria were met.

B. Calibration Verification(s):

All acceptance criteria were met.

C. Blanks:

All acceptance criteria were met.

D. Laboratory Control Sample(s):

All acceptance criteria were met.

E. Matrix Spike/Matrix Spike Duplicate Sample(s):

Analyzed in accordance with standard operating procedure.

F. Analytical Exception(s):

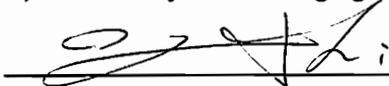
None.

IV. Documentation Exception(s):

None.

V. I certify that this data package is in compliance with the terms and conditions agreed to by the client and CH2M HILL, both technically and for completeness, except for the conditions detailed above. Release of the data contained in this hardcopy data package has been authorized by the Laboratory Manager or designee, as verified by the following signatures.

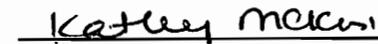
Prepared by: _____



Date: _____

12/10/2012

Reviewed by: _____



Date: _____

12/11/12

CH2M HILL Applied Sciences Laboratory (ASL)

<u>Client Information</u>	<u>Lab Information</u>
Project Name: Camp Lejeune	Lab Batch ID: L2953
Date Received: 12/03/12	Analysis Method: SM5310B
Type: See C.O.C.	Units: mg/L
Matrix: Water	Report Revision No.: 0

Client Sample ID	Lab Sample ID	Dilution Factor	Total Organic Carbon RL	Result	Qualifier	Date Analyzed
General Chemistry						
Control A_t0	L295301	10	5.00	16.3		12/07/12
Sulfate_t0	L295302	10	5.00	17.2		12/07/12
Control B_t0	L295303	1	0.50	1.48		12/05/12
EHC-L_t0	L295304	20	10.0	44.8		12/07/12
WB1-1205	WB1-1205	1	0.50	0.50	U	12/05/12
WB1-1207	WB1-1207	1	0.50	0.50	U	12/07/12

U=Not detected at specified reporting limit
 J=Estimated value below reporting limit
 E=Estimated value above calibration range
 *=See case narrative

CH2M HILL Applied Sciences Laboratory (ASL)

Client Information

Project Name: Camp Lejeune
 Type: QC
 Matrix: Water

Lab Information

Lab Batch ID: L2953
 Report Revision No.: 0

LCS ID	Analyte	Spike Amount	Sample Result	Units	% Recovery	Analysis Method	Date Analyzed
General Chemistry							
BS1W1205	Total Organic Carbon	2.50	2.20	mg/L	88	SM5310B	12/05/12
BS1W1207	Total Organic Carbon	2.50	2.24	mg/L	90	SM5310B	12/07/12

U=Not detected at specified reporting limit
 J=Estimated value below reporting limit
 E=Estimated value above calibration range
 *=See case narrative

**CASE NARRATIVE
WET CHEMISTRY ANALYSIS**

Lab Name: CH2M HILL/LAB/CVO

ASL SDG#: L2953

Project: Camp Lejeune

Project #: 387442.78.WP

I. Method(s):

Analysis: E376.2

II. Receipt/Holding Times:

All acceptance criteria were met.

III. Analysis:

A. Initial Calibration(s):

All acceptance criteria were met.

B. Calibration Verification(s):

All acceptance criteria were met.

C. Blanks:

All acceptance criteria were met.

D. Laboratory Control Sample(s):

All acceptance criteria were met.

E. Matrix Spike/Matrix Spike Duplicate Sample(s):

Analyzed in accordance with standard operating procedure.

F. Analytical Exception(s):

None.

IV. Documentation Exception(s):

None.

V. I certify that this data package is in compliance with the terms and conditions agreed to by the client and CH2M HILL, both technically and for completeness, except for the conditions detailed above. Release of the data contained in this hardcopy data package has been authorized by the Laboratory Manager or designee, as verified by the following signatures.

Prepared by: *Jamul McGeary*

Date: 12/9/12

Reviewed by: *Kathy McKinley*

Date: 12/10/12

CH2M HILL Applied Sciences Laboratory (ASL)

<u>Client Information</u>	<u>Lab Information</u>
Project Name: Camp Lejeune	Lab Batch ID: L2953
Date Received: 12/03/2012	Analysis Method: E376.2
Type: See C.O.C.	Units: ug/L
Matrix: Water	Report Revision No.: 0

Client Sample ID	Lab Sample ID	Dilution Factor	RL	Sulfide Result	Qualifier	Date Analyzed
General Chemistry						
Control A_t0	L295301	1	25.0	117		12/05/2012
Sulfate_t0	L295302	1	25.0	50.4		12/05/2012
Control B_t0	L295303	1	25.0	28.1		12/05/2012
EHC-L_t0	L295304	1	25.0	158		12/05/2012
WB1-1205	WB1-1205	1	25.0	25.0	U	12/05/2012

U=Not detected at specified reporting limit
 J=Estimated value below reporting limit
 E=Estimated value above calibration range
 *=See case narrative

CH2M HILL Applied Sciences Laboratory (ASL)

Client Information

Project Name: Camp Lejeune
Type: QC
Matrix: Water

Lab Information

Lab Batch ID: L2953
Report Revision No.: 0

LCS ID	Analyte	Spike Amount	Sample Result	Units	% Recovery	Analysis Method	Date Analyzed
General Chemistry							
BS1W1205	Sulfide	383	408	ug/L	106	E376.2	12/05/2012

U=Not detected at specified reporting limit
J=Estimated value below reporting limit
E=Estimated value above calibration range
*=See case narrative



Sample Receipt Exception Report

Sample Batch Number: L2953 Client/Project Camp Lejeune

The following exceptions were noted:	
	Comments (write number of exception description and the impacted sample numbers)
1. No custody seal as required by project	Nitrate past holding time. pH not checked on UAC. only one vial submitted
2. No chain-of-custody provided	
3. Analysis, description, date of collection not provided	
4. Samples broken or leaking on receipt.	
5. Temperature of samples inappropriate for analysis requested	
6. Container inappropriate for analysis requested	
7. Inadequate sample volume.	
8. Preservation inappropriate for analysis requested	
9. Samples received out of holding time for analysis requested	
10. Discrepancies between COC form and container labels.	
11. Other.	

ACTION TAKEN:

Originator Carmen Bell Date: 12/3/12
Client was notified on: _____ Client Contact: _____
(Date/Time)

Client Services:



ANALYTICAL REPORT

For:
Camp Lejeune - Site 78

ASL Report #: L3043
Project ID: 387442.78.WP
Attn: Dusty Berggren/CH2M HILL
cc:
Mike Niemet/mike.niemet@ch2m.com

Authorized and Released By:

Laboratory Project Manager
Ben Thompson
(541) 758-0235 ext.23132
January 14, 2013

This data package meets standards requested by client and is not intended or implied to meet any other standard.

All analyses performed by CH2M HILL are clearly indicated. Any subcontracted analyses are included as appended reports as received from the subcontracted laboratory. The results included in this report only relate to the samples listed on the following Sample Cross-Reference page. This report shall not be reproduced except in full, without the written approval of the laboratory.

Any unusual difficulties encountered during the analysis of your samples are discussed in the attached case narratives.

ASL Report #: L3043

Sample Receipt Comments

We certify that the test results meet all standard ASL requirements.

Sample Cross-Reference

ASL Sample ID	Client Sample ID	Date/Time Collected	Date Received
L304301	Control A_t14	12/14/12 09:45	12/14/12
L304302	Sulfate_t14	12/14/12 09:55	12/14/12
L304303	Control B_t14	12/14/12 09:35	12/14/12
L304304	EHC-L_t14	12/14/12 09:57	12/14/12

**CASE NARRATIVE
GC/MS VOLATILES ANALYSIS**

Lab Name: CH2M HILL/LAB/CVO

ASL SDG#: L3043

Project: Camp Lejeune

Project #: 387442.78.WP

I. Method(s):

Analysis: SW8260B
Preparation: SW5030

II. Receipt/Holding Times:

All acceptance criteria were met.

III. Analysis:

A. Initial Calibration(s):

All acceptance criteria were met.

B. Calibration Verification(s):

All acceptance criteria were met.

C. Blank(s):

All acceptance criteria were met.

D. Laboratory Control Sample(s):

All acceptance criteria were met.

E. Matrix Spike/Matrix Spike Duplicate Sample(s):

Analyzed in accordance with standard operating procedure.

F. Surrogate Standard(s):

All acceptance criteria were met.

G. BFB Tune Verification(s):

All acceptance criteria were met.

H. Internal Standard(s):

All acceptance criteria were met.

I. Analytical Exception(s):

None.

IV. Documentation Exception(s):

None.

V. I certify that this data package is in compliance with the terms and conditions agreed to by the client and CH2M HILL, both technically and for completeness, except for the conditions detailed above. Release of the data contained in this hardcopy data package has been authorized by the Laboratory Manager or designee, as verified by the following signatures.

Prepared by: _____

Date: _____

Reviewed by: _____

Date: _____

CH2M HILL Applied Sciences Laboratory (ASL)

Client Information				Lab Information			
Client Sample ID: Control A_t14				Lab Sample ID: L304301			
Project Name: Camp Lejeune				Date Received: 12/14/12			
Sample Date: 12/14/12				Dilution Factor: 2.2			
Sample Time: 09:45				Report Revision No.: 0			
Type: Grab							
Matrix: Water							

Analyte	CAS#	DL	RL	Sample Result	Qualifier	Units	Analysis Method	Date Analyzed
GC/MS Volatiles								
Vinyl Chloride	75-01-4	0.44	1.10	1.10	U	ug/L	SW8260B	12/17/12
1,1-Dichloroethene	75-35-4	0.44	1.10	1.10	U	ug/L	SW8260B	12/17/12
Methylene chloride	75-09-2	0.44	1.10	1.10	U	ug/L	SW8260B	12/17/12
trans-1,2-Dichloroethene	156-60-5	0.44	1.10	1.10	U	ug/L	SW8260B	12/17/12
1,1-Dichloroethane	75-34-3	0.44	1.10	1.10	U	ug/L	SW8260B	12/17/12
cis-1,2-Dichloroethane	156-59-2	0.44	1.10	2.20		ug/L	SW8260B	12/17/12
1,2-Dichloroethane	107-06-2	0.44	1.10	1.10	U	ug/L	SW8260B	12/17/12
Benzene	71-43-2	0.44	1.10	17.7		ug/L	SW8260B	12/17/12
Trichloroethene (TCE)	79-01-6	0.44	1.10	36.1		ug/L	SW8260B	12/17/12
Toluene	108-88-3	0.44	1.10	80.4		ug/L	SW8260B	12/17/12
Tetrachloroethene (PCE)	127-18-4	0.44	1.10	1.10	U	ug/L	SW8260B	12/17/12
Ethylbenzene	100-41-4	0.44	1.10	139		ug/L	SW8260B	12/17/12
m,p-Xylene	108-38-3/1	0.88	2.20	618	E	ug/L	SW8260B	12/17/12
o-Xylene	95-47-6	0.44	1.10	240	E	ug/L	SW8260B	12/17/12
Isopropylbenzene	98-82-8	0.44	1.10	37.6		ug/L	SW8260B	12/17/12
1,2-Dibromo-3-chloropropane	96-12-8	0.44	1.10	1.10	U	ug/L	SW8260B	12/17/12

Surrogate	% Recovery	Control Limits	Qualifier
Dibromofluoromethane	94	75-125	
1,2-Dichloroethane-d4	90	75-125	
Toluene-d8	96	75-125	
4-Bromofluorobenzene	95	75-125	

U=Not detected at specified reporting limit
 J=Estimated value below reporting limit
 E=Estimated value above calibration range
 *=See case narrative

CH2M HILL Applied Sciences Laboratory (ASL)

Client Information				Lab Information			
Client Sample ID: Control A_t14DL				Lab Sample ID: L304301DL			
Project Name: Camp Lejeune				Date Received: 12/14/12			
Sample Date: 12/14/12				Dilution Factor: 10			
Sample Time: 09:45				Report Revision No.: 0			
Type: Grab							
Matrix: Water							

Analyte	CAS#	DL	RL	Sample Result	Qualifier	Units	Analysis Method	Date Analyzed
GC/MS Volatiles								
Vinyl Chloride	75-01-4	2.00	5.00	5.00	U	ug/L	SW8260B	12/17/12
1,1-Dichloroethene	75-35-4	2.00	5.00	5.00	U	ug/L	SW8260B	12/17/12
Methylene chloride	75-09-2	2.00	5.00	5.00	U	ug/L	SW8260B	12/17/12
trans-1,2-Dichloroethene	156-60-5	2.00	5.00	5.00	U	ug/L	SW8260B	12/17/12
1,1-Dichloroethane	75-34-3	2.00	5.00	5.00	U	ug/L	SW8260B	12/17/12
cis-1,2-Dichloroethene	156-59-2	2.00	5.00	5.00	U	ug/L	SW8260B	12/17/12
1,2-Dichloroethane	107-06-2	2.00	5.00	5.00	U	ug/L	SW8260B	12/17/12
Benzene	71-43-2	2.00	5.00	18.3		ug/L	SW8260B	12/17/12
Trichloroethene (TCE)	79-01-6	2.00	5.00	37.3		ug/L	SW8260B	12/17/12
Toluene	108-88-3	2.00	5.00	82.1		ug/L	SW8260B	12/17/12
Tetrachloroethene (PCE)	127-18-4	2.00	5.00	5.00	U	ug/L	SW8260B	12/17/12
Ethylbenzene	100-41-4	2.00	5.00	141		ug/L	SW8260B	12/17/12
m,p-Xylene	108-38-3/1	4.00	10.0	704		ug/L	SW8260B	12/17/12
o-Xylene	95-47-6	2.00	5.00	250		ug/L	SW8260B	12/17/12
Isopropylbenzene	98-82-8	2.00	5.00	37.1		ug/L	SW8260B	12/17/12
1,2-Dibromo-3-chloropropane	96-12-8	2.00	5.00	5.00	U	ug/L	SW8260B	12/17/12

Surrogate	% Recovery	Control Limits	Qualifier
Dibromofluoromethane	95	75-125	
1,2-Dichloroethane-d4	93	75-125	
Toluene-d8	95	75-125	
4-Bromofluorobenzene	93	75-125	

U=Not detected at specified reporting limit
 J=Estimated value below reporting limit
 E=Estimated value above calibration range
 *=See case narrative

CH2M HILL Applied Sciences Laboratory (ASL)

Client Information				Lab Information			
Client Sample ID: Sulfate_t14				Lab Sample ID: L304302			
Project Name: Camp Lejeune				Date Received: 12/14/12			
Sample Date: 12/14/12				Dilution Factor: 2.2			
Sample Time: 09:55				Report Revision No.: 0			
Type: Grab							
Matrix: Water							

Analyte	CAS#	DL	RL	Sample Result	Qualifier	Units	Analysis Method	Date Analyzed
GC/MS Volatiles								
Vinyl Chloride	75-01-4	0.44	1.10	1.10	U	ug/L	SW8260B	12/17/12
1,1-Dichloroethene	75-35-4	0.44	1.10	1.10	U	ug/L	SW8260B	12/17/12
Methylene chloride	75-09-2	0.44	1.10	1.10	U	ug/L	SW8260B	12/17/12
trans-1,2-Dichloroethene	156-60-5	0.44	1.10	1.10	U	ug/L	SW8260B	12/17/12
1,1-Dichloroethane	75-34-3	0.44	1.10	1.10	U	ug/L	SW8260B	12/17/12
cis-1,2-Dichloroethene	156-59-2	0.44	1.10	1.90		ug/L	SW8260B	12/17/12
1,2-Dichloroethane	107-06-2	0.44	1.10	1.10	U	ug/L	SW8260B	12/17/12
Benzene	71-43-2	0.44	1.10	15.5		ug/L	SW8260B	12/17/12
Trichloroethene (TCE)	79-01-6	0.44	1.10	30.8		ug/L	SW8260B	12/17/12
Toluene	108-88-3	0.44	1.10	74.4		ug/L	SW8260B	12/17/12
Tetrachloroethene (PCE)	127-18-4	0.44	1.10	1.10	U	ug/L	SW8260B	12/17/12
Ethylbenzene	100-41-4	0.44	1.10	129		ug/L	SW8260B	12/17/12
m,p-Xylene	108-38-3/1	0.88	2.20	579	E	ug/L	SW8260B	12/17/12
o-Xylene	95-47-6	0.44	1.10	221	E	ug/L	SW8260B	12/17/12
Isopropylbenzene	98-82-8	0.44	1.10	41.2		ug/L	SW8260B	12/17/12
1,2-Dibromo-3-chloropropane	96-12-8	0.44	1.10	1.10	U	ug/L	SW8260B	12/17/12

Surrogate	% Recovery	Control Limits	Qualifier
Dibromofluoromethane	94	75-125	
1,2-Dichloroethane-d4	90	75-125	
Toluene-d8	97	75-125	
4-Bromofluorobenzene	98	75-125	

U=Not detected at specified reporting limit
 J=Estimated value below reporting limit
 E=Estimated value above calibration range
 *=See case narrative

CH2M HILL Applied Sciences Laboratory (ASL)

<u>Client Information</u>				<u>Lab Information</u>			
Client Sample ID: Sulfate_t14DL				Lab Sample ID: L304302DL			
Project Name: Camp Lejeune				Date Received: 12/14/12			
Sample Date: 12/14/12				Dilution Factor: 10			
Sample Time: 09:55				Report Revision No.: 0			
Type: Grab							
Matrix: Water							

Analyte	CAS#	DL	RL	Sample Result	Qualifier	Units	Analysis Method	Date Analyzed
GC/MS Volatiles								
Vinyl Chloride	75-01-4	2.00	5.00	5.00	U	ug/L	SW8260B	12/17/12
1,1-Dichloroethene	75-35-4	2.00	5.00	5.00	U	ug/L	SW8260B	12/17/12
Methylene chloride	75-09-2	2.00	5.00	5.00	U	ug/L	SW8260B	12/17/12
trans-1,2-Dichloroethene	156-60-5	2.00	5.00	5.00	U	ug/L	SW8260B	12/17/12
1,1-Dichloroethane	75-34-3	2.00	5.00	5.00	U	ug/L	SW8260B	12/17/12
cis-1,2-Dichloroethane	156-59-2	2.00	5.00	5.00	U	ug/L	SW8260B	12/17/12
1,2-Dichloroethane	107-06-2	2.00	5.00	5.00	U	ug/L	SW8260B	12/17/12
Benzene	71-43-2	2.00	5.00	16.3		ug/L	SW8260B	12/17/12
Trichloroethene (TCE)	79-01-6	2.00	5.00	32.0		ug/L	SW8260B	12/17/12
Toluene	108-88-3	2.00	5.00	76.3		ug/L	SW8260B	12/17/12
Tetrachloroethene (PCE)	127-18-4	2.00	5.00	5.00	U	ug/L	SW8260B	12/17/12
Ethylbenzene	100-41-4	2.00	5.00	132		ug/L	SW8260B	12/17/12
m,p-Xylene	108-38-3/1	4.00	10.0	665		ug/L	SW8260B	12/17/12
o-Xylene	95-47-6	2.00	5.00	234		ug/L	SW8260B	12/17/12
Isopropylbenzene	98-82-8	2.00	5.00	39.9		ug/L	SW8260B	12/17/12
1,2-Dibromo-3-chloropropane	96-12-8	2.00	5.00	5.00	U	ug/L	SW8260B	12/17/12

<u>Surrogate</u>	<u>% Recovery</u>	<u>Control Limits</u>	<u>Qualifier</u>
Dibromofluoromethane	95	75-125	
1,2-Dichloroethane-d4	92	75-125	
Toluene-d8	95	75-125	
4-Bromofluorobenzene	96	75-125	

U=Not detected at specified reporting limit
 J=Estimated value below reporting limit
 E=Estimated value above calibration range
 *=See case narrative

CH2M HILL Applied Sciences Laboratory (ASL)

Client Information				Lab Information			
Client Sample ID: Control B_t14				Lab Sample ID: L304303			
Project Name: Camp Lejeune				Date Received: 12/14/12			
Sample Date: 12/14/12				Dilution Factor: 1			
Sample Time: 09:35				Report Revision No.: 0			
Type: Grab							
Matrix: Water							

Analyte	CAS#	DL	RL	Sample Result	Qualifier	Units	Analysis Method	Date Analyzed
GC/MS Volatiles								
Vinyl Chloride	75-01-4	0.20	0.50	0.50	U	ug/L	SW8260B	12/17/12
1,1-Dichloroethene	75-35-4	0.20	0.50	0.50	U	ug/L	SW8260B	12/17/12
Methylene chloride	75-09-2	0.20	0.50	0.50	U	ug/L	SW8260B	12/17/12
trans-1,2-Dichloroethene	156-60-5	0.20	0.50	0.50	U	ug/L	SW8260B	12/17/12
1,1-Dichloroethane	75-34-3	0.20	0.50	0.50	U	ug/L	SW8260B	12/17/12
cis-1,2-Dichloroethene	156-59-2	0.20	0.50	45.3		ug/L	SW8260B	12/17/12
1,2-Dichloroethane	107-06-2	0.20	0.50	0.50	U	ug/L	SW8260B	12/17/12
Benzene	71-43-2	0.20	0.50	1.19		ug/L	SW8260B	12/17/12
Trichloroethene (TCE)	79-01-6	0.20	0.50	35.3		ug/L	SW8260B	12/17/12
Toluene	108-88-3	0.20	0.50	14.2		ug/L	SW8260B	12/17/12
Tetrachloroethene (PCE)	127-18-4	0.20	0.50	0.50	U	ug/L	SW8260B	12/17/12
Ethylbenzene	100-41-4	0.20	0.50	2.03		ug/L	SW8260B	12/17/12
m,p-Xylene	108-38-3/1	0.40	1.00	2.83		ug/L	SW8260B	12/17/12
o-Xylene	95-47-6	0.20	0.50	3.44		ug/L	SW8260B	12/17/12
Isopropylbenzene	98-82-8	0.20	0.50	0.50	U	ug/L	SW8260B	12/17/12
1,2-Dibromo-3-chloropropane	96-12-8	0.20	0.50	0.50	U	ug/L	SW8260B	12/17/12

Surrogate	% Recovery	Control Limits	Qualifier
Dibromofluoromethane	95	75-125	
1,2-Dichloroethane-d4	92	75-125	
Toluene-d8	91	75-125	
4-Bromofluorobenzene	94	75-125	

U=Not detected at specified reporting limit
 J=Estimated value below reporting limit
 E=Estimated value above calibration range
 *=See case narrative

CH2M HILL Applied Sciences Laboratory (ASL)

Client Information				Lab Information			
Client Sample ID: EHC-L_t14				Lab Sample ID: L304304			
Project Name: Camp Lejeune				Date Received: 12/14/12			
Sample Date: 12/14/12				Dilution Factor: 1			
Sample Time: 09:57				Report Revision No.: 0			
Type: Grab							
Matrix: Water							

Analyte	CAS#	DL	RL	Sample Result	Qualifier	Units	Analysis Method	Date Analyzed
GC/MS Volatiles								
Vinyl Chloride	75-01-4	0.20	0.50	0.50	U	ug/L	SW8260B	12/17/12
1,1-Dichloroethene	75-35-4	0.20	0.50	0.50	U	ug/L	SW8260B	12/17/12
Methylene chloride	75-09-2	0.20	0.50	0.50	U	ug/L	SW8260B	12/17/12
trans-1,2-Dichloroethene	156-60-5	0.20	0.50	0.50	U	ug/L	SW8260B	12/17/12
1,1-Dichloroethane	75-34-3	0.20	0.50	0.50	U	ug/L	SW8260B	12/17/12
cis-1,2-Dichloroethane	156-59-2	0.20	0.50	45.0		ug/L	SW8260B	12/17/12
1,2-Dichloroethane	107-06-2	0.20	0.50	0.50	U	ug/L	SW8260B	12/17/12
Benzene	71-43-2	0.20	0.50	1.14		ug/L	SW8260B	12/17/12
Trichloroethene (TCE)	79-01-6	0.20	0.50	35.1		ug/L	SW8260B	12/17/12
Toluene	108-88-3	0.20	0.50	20.1		ug/L	SW8260B	12/17/12
Tetrachloroethene (PCE)	127-18-4	0.20	0.50	0.50	U	ug/L	SW8260B	12/17/12
Ethylbenzene	100-41-4	0.20	0.50	1.48		ug/L	SW8260B	12/17/12
m,p-Xylene	108-38-3/1	0.40	1.00	5.28		ug/L	SW8260B	12/17/12
o-Xylene	95-47-6	0.20	0.50	2.90		ug/L	SW8260B	12/17/12
Isopropylbenzene	98-82-8	0.20	0.50	0.50	U	ug/L	SW8260B	12/17/12
1,2-Dibromo-3-chloropropane	96-12-8	0.20	0.50	0.50	U	ug/L	SW8260B	12/17/12

Surrogate	% Recovery	Control Limits	Qualifier
Dibromofluoromethane	94	75-125	
1,2-Dichloroethane-d4	89	75-125	
Toluene-d8	90	75-125	
4-Bromofluorobenzene	93	75-125	

U=Not detected at specified reporting limit
 J=Estimated value below reporting limit
 E=Estimated value above calibration range
 *=See case narrative

CH2M HILL Applied Sciences Laboratory (ASL)

Client Information				Lab Information			
Client Sample ID: WB1-1217				Lab Sample ID: WB1-1217			
Project Name: Camp Lejeune				Date Received: N/A			
Sample Date: N/A				Dilution Factor: 1			
Sample Time: N/A				Report Revision No.: 0			
Type: QC							
Matrix: Water							

Analyte	CAS#	DL	RL	Sample Result	Qualifier	Units	Analysis Method	Date Analyzed
GC/MS Volatiles								
Vinyl Chloride	75-01-4	0.20	0.50	0.50	U	ug/L	SW8260B	12/17/12
1,1-Dichloroethene	75-35-4	0.20	0.50	0.50	U	ug/L	SW8260B	12/17/12
Methylene chloride	75-09-2	0.20	0.50	0.50	U	ug/L	SW8260B	12/17/12
trans-1,2-Dichloroethene	156-60-5	0.20	0.50	0.50	U	ug/L	SW8260B	12/17/12
1,1-Dichloroethane	75-34-3	0.20	0.50	0.50	U	ug/L	SW8260B	12/17/12
cis-1,2-Dichloroethene	156-59-2	0.20	0.50	0.50	U	ug/L	SW8260B	12/17/12
1,2-Dichloroethane	107-06-2	0.20	0.50	0.50	U	ug/L	SW8260B	12/17/12
Benzene	71-43-2	0.20	0.50	0.50	U	ug/L	SW8260B	12/17/12
Trichloroethene (TCE)	79-01-6	0.20	0.50	0.50	U	ug/L	SW8260B	12/17/12
Toluene	108-88-3	0.20	0.50	0.50	U	ug/L	SW8260B	12/17/12
Tetrachloroethene (PCE)	127-18-4	0.20	0.50	0.50	U	ug/L	SW8260B	12/17/12
Ethylbenzene	100-41-4	0.20	0.50	0.50	U	ug/L	SW8260B	12/17/12
m,p-Xylene	108-38-3/1	0.40	1.00	1.00	U	ug/L	SW8260B	12/17/12
o-Xylene	95-47-6	0.20	0.50	0.50	U	ug/L	SW8260B	12/17/12
Isopropylbenzene	98-82-8	0.20	0.50	0.50	U	ug/L	SW8260B	12/17/12
1,2-Dibromo-3-chloropropane	96-12-8	0.20	0.50	0.50	U	ug/L	SW8260B	12/17/12

Surrogate	% Recovery	Control Limits	Qualifier
Dibromofluoromethane	102	75-125	
1,2-Dichloroethane-d4	100	75-125	
Toluene-d8	98	75-125	
4-Bromofluorobenzene	101	75-125	

U=Not detected at specified reporting limit
 J=Estimated value below reporting limit
 E=Estimated value above calibration range
 *=See case narrative

CH2M HILL Applied Sciences Laboratory (ASL)

<u>Client Information</u>	<u>Lab Information</u>
Project Name: Camp Lejeune Type: QC Matrix: Water	LCS ID: BS1W1217 Report Revision No.: 0 Dilution Factor: 1

Analyte	CAS#	Spike Amount	Sample Result	Units	%Recovery	Analysis Method	Date Analyzed
GC/MS Volatiles							
Vinyl Chloride	75-01-4	20.0	18.4	ug/L	92	SW8260B	12/17/12
1,1-Dichloroethene	75-35-4	20.0	17.1	ug/L	85	SW8260B	12/17/12
Methylene chloride	75-09-2	20.0	19.1	ug/L	96	SW8260B	12/17/12
trans-1,2-Dichloroethene	156-60-5	20.0	18.2	ug/L	91	SW8260B	12/17/12
1,1-Dichloroethane	75-34-3	20.0	18.6	ug/L	93	SW8260B	12/17/12
cis-1,2-Dichloroethene	156-59-2	20.0	18.4	ug/L	92	SW8260B	12/17/12
1,2-Dichloroethane	107-06-2	20.0	18.2	ug/L	91	SW8260B	12/17/12
Benzene	71-43-2	20.0	18.6	ug/L	93	SW8260B	12/17/12
Trichloroethene (TCE)	79-01-6	20.0	18.8	ug/L	94	SW8260B	12/17/12
Toluene	108-88-3	20.0	18.4	ug/L	92	SW8260B	12/17/12
Tetrachloroethene (PCE)	127-18-4	20.0	18.3	ug/L	91	SW8260B	12/17/12
Ethylbenzene	100-41-4	20.0	17.5	ug/L	88	SW8260B	12/17/12
m,p-Xylene	108-38-3/1	40.0	35.2	ug/L	88	SW8260B	12/17/12
o-Xylene	95-47-6	20.0	17.7	ug/L	89	SW8260B	12/17/12
Isopropylbenzene	98-82-8	20.0	16.3	ug/L	82	SW8260B	12/17/12
1,2-Dibromo-3-chloropropane	96-12-8	20.0	18.3	ug/L	92	SW8260B	12/17/12

Surrogate	% Recovery	Control Limits	Qualifier
Dibromofluoromethane	97	75-125	
1,2-Dichloroethane-d4	93	75-125	
Toluene-d8	93	75-125	
4-Bromofluorobenzene	96	75-125	

U=Not detected at specified reporting limit
 J=Estimated value below reporting limit
 E=Estimated value above calibration range
 *=See case narrative

CASE NARRATIVE
METALS ANALYSIS

Lab Name: CH2M HILL/LAB/CVO

ASL SDG#: L3043

Project: Camp Lejeune

Project #: 387442.78.WP

I. Method(s):

Analysis: E200.7

Preparation: FLDFLT

II. Receipt/Holding Times:

All acceptance criteria were met.

III. Analysis:

A. Initial Calibration(s):

All acceptance criteria were met.

B. Calibration Verification(s):

All acceptance criteria were met.

C. Blanks:

All acceptance criteria were met.

D. Laboratory Control Sample(s):

All acceptance criteria were met.

E. Matrix Spike/Matrix Spike Duplicate Sample(s):

Analyzed in accordance with standard operating procedure.

F. Interference Check Sample(s):

All acceptance criteria were met.

G. Serial Dilution(s):

Analyzed in accordance with standard operating procedure.

H. Digestion Exception(s):

None.

I. Analytical Exception(s):

None.

IV. Documentation Exception(s):

None.

V. I certify that this data package is in compliance with the terms and conditions agreed to by the client and CH2M HILL, both technically and for completeness, except for the conditions detailed above. Release of the data contained in this hardcopy data package has been authorized by the Laboratory Manager or designee, as verified by the following signatures.

Prepared by: Judy D

Date: 1-2-13

Reviewed by: Joseph A. Hanel

Date: 1/14/13

CH2M HILL Applied Sciences Laboratory (ASL)

Client Information

Project Name: Camp Lejeune

Date Received: 12/14/12

Type: See C.O.C.

Matrix: Water

Lab Information

Lab Batch ID: L3043

Report Revision No.: 0

Client Sample ID	Lab Sample ID	Dilution Factor	RL	Result	Qual	Units	Date Analyzed
Iron: E200.7							
<i>Dissolved Metals</i>							
Control A_t14	L304301F	1	100	9990		ug/L	12/31/12
Sulfate_t14	L304302F	1	100	10000		ug/L	12/31/12
Control B_t14	L304303F	1	100	386		ug/L	12/31/12
EHC-L_t14	L304304F	1	100	3540		ug/L	12/31/12
<i>Total Metals</i>							
WB1-1231	WB1-1231	1	100	100	U	ug/L	12/31/12

U=Not detected at specified reporting limit

J=Estimated value below reporting limit

E=Estimated value above calibration range

*=See case narrative

CH2M HILL Applied Sciences Laboratory (ASL)

Client Information

Project Name: Camp Lejeune
Type: QC
Matrix: Water

Lab Information

LCS ID: BS1W1231
Report Revision No.: 0
Dilution Factor: 1

Analyte	CAS#	Spike Amount	Sample Result	Units	%Recovery	Analysis Method	Date Analyzed
Metals							
Iron	7439-89-6	500	518	ug/L	104	E200.7	12/31/12

U=Not detected at specified reporting limit
J=Estimated value below reporting limit
E=Estimated value above calibration range
*=See case narrative

CASE NARRATIVE
WET CHEMISTRY ANALYSIS

Lab Name: CH2M HILL/LAB/CVO

ASL SDG#: L3043

Project: Camp Lejeune

Project #: 387442.78.WP

I. Method(s):

Analysis: E376.2

II. Receipt/Holding Times:

All acceptance criteria were met.

III. Analysis:

A. Initial Calibration(s):

All acceptance criteria were met.

B. Calibration Verification(s):

All acceptance criteria were met.

C. Blanks:

All acceptance criteria were met.

D. Laboratory Control Sample(s):

All acceptance criteria were met.

E. Matrix Spike/Matrix Spike Duplicate Sample(s):

Analyzed in accordance with standard operating procedure.

F. Analytical Exception(s):

The turbidity in sample "Control A_t14" did not clear with the addition of reagents. Not enough sample available to reanalyze with a turbidity blank.

Sample "Sulfate_t14" was very turbid. Dilution was necessary in order to measure absorbance.

IV. Documentation Exception(s):

None.

V. I certify that this data package is in compliance with the terms and conditions agreed to by the client and CH2M HILL, both technically and for completeness, except for the conditions detailed above. Release of the data contained in this hardcopy data package has been authorized by the Laboratory Manager or designee, as verified by the following signatures.

Prepared by: 

Date: 12/26/12

Reviewed by: 

Date: 12/27/12

CH2M HILL Applied Sciences Laboratory (ASL)

<u>Client Information</u>			<u>Lab Information</u>		
Project Name: Camp Lejeune			Lab Batch ID: L3043		
Date Received: 12/14/2012			Analysis Method: E376.2		
Type: See C.O.C.			Units: ug/L		
Matrix: Water			Report Revision No.: 0		

Client Sample ID	Lab Sample ID	Dilution Factor	RL	Sulfide Result	Qualifier	Date Analyzed
General Chemistry						
Control A_t14	L304301	5	125	331		12/20/2012
Sulfate_t14	L304302	100	2500	2500	U	12/20/2012
Control B_t14	L304303	2	50.0	84.9		12/20/2012
EHC-L_t14	L304304	1	25.0	216		12/20/2012
WB1-1220	WB1-1220	1	25.0	25.0	U	12/20/2012

U=Not detected at specified reporting limit
 J=Estimated value below reporting limit
 E=Estimated value above calibration range
 *=See case narrative

CH2M HILL Applied Sciences Laboratory (ASL)

<u>Client Information</u>	<u>Lab Information</u>
Project Name: Camp Lejeune Type: QC Matrix: Water	Lab Batch ID: L3043 Report Revision No.: 0

LCS ID	Analyte	Spike Amount	Sample Result	Units	% Recovery	Analysis Method	Date Analyzed
General Chemistry							
BS1W1220	Sulfide	343	364	ug/L	106	E376.2	12/20/2012

U=Not detected at specified reporting limit
 J=Estimated value below reporting limit
 E=Estimated value above calibration range
 *=See case narrative

CASE NARRATIVE
ION CHROMATOGRAPHY ANALYSIS

Lab Name: CH2M HILL/LAB/CVO

ASL SDG#: L3043

Project: Camp Lejeune

Project #: 387442.78.WP

I. Method(s):

Analysis: E300.0A

II. Receipt/Holding Times:

Samples for Nitrate-N were analyzed outside holding time.

III. Analysis:

A. Initial Calibration(s):

All acceptance criteria were met.

B. Calibration Verification(s):

All acceptance criteria were met.

C. Blanks:

All acceptance criteria were met.

D. Laboratory Control Sample(s):

All acceptance criteria were met.

E. Matrix Spike/Matrix Spike Duplicate Sample(s):

Analyzed in accordance with standard operating procedure.

F. Analytical Exception(s):

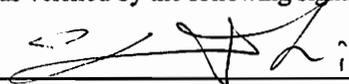
None.

IV. Documentation Exception(s):

None.

V. I certify that this data package is in compliance with the terms and conditions agreed to by the client and CH2M HILL, both technically and for completeness, except for the conditions detailed above. Release of the data contained in this hardcopy data package has been authorized by the Laboratory Manager or designee, as verified by the following signatures.

Prepared by: _____



Date: _____

01/02/2013

Reviewed by: _____



Date: _____

4/3/13

CH2M HILL Applied Sciences Laboratory (ASL)

<u>Client Information</u>		<u>Lab Information</u>	
Project Name: Camp Lejeune		Lab Batch ID: L3043	
Date Received: 12/14/12		Analysis Method: E300.0A	
Type: See C.O.C.		Units: mg/L	
Matrix: Water		Report Revision No.: 0	

Client Sample ID	Lab Sample ID	Dilution Factor	RL	Nitrate-N Result	Qualifier	Date Analyzed
General Chemistry						
Control A_t14	L304301	1	0.10	0.10	U*	12/30/12 01:21
Sulfate_t14	L304302	1	0.10	0.10	U*	12/30/12 01:42
Control B_t14	L304303	1	0.10	0.10	U*	12/30/12 02:02
EHC-L_t14	L304304	1	0.10	0.97	*	12/30/12 02:23
WB1-1230	WB1-1230	1	0.10	0.10	U	12/30/12 01:02

U=Not detected at specified reporting limit
 J=Estimated value below reporting limit
 E=Estimated value above calibration range
 *=See case narrative

CH2M HILL Applied Sciences Laboratory (ASL)

<u>Client Information</u>		<u>Lab Information</u>	
Project Name: Camp Lejeune		Lab Batch ID: L3043	
Date Received: 12/14/12		Analysis Method: E300.0A	
Type: See C.O.C.		Units: mg/L	
Matrix: Water		Report Revision No.: 0	

Client Sample ID	Lab Sample ID	Dilution Factor	RL	Sulfate Result	Qualifier	Date Analyzed
General Chemistry						
Control A_t14	L304301	1	0.10	2.38		12/30/12
Sulfate_t14	L304302	5	0.50	98.2		12/30/12
Control B_t14	L304303	2	0.20	35.5		12/30/12
EHC-L_t14	L304304	1	0.10	0.14		12/30/12
WB1-1230	WB1-1230	1	0.10	0.10	U	12/30/12

U=Not detected at specified reporting limit
 J=Estimated value below reporting limit
 E=Estimated value above calibration range
 *=See case narrative

CH2M HILL Applied Sciences Laboratory (ASL)

<u>Client Information</u>		<u>Lab Information</u>	
Project Name: Camp Lejeune Type: QC Matrix: Water		Lab Batch ID: L3043 Report Revision No.: 0	

LCS ID	Analyte	Spike Amount	Sample Result	Units	% Recovery	Analysis Method	Date Analyzed
General Chemistry							
BS1W1230	Nitrate-N	3.00	3.05	mg/L	102	E300.0A	12/30/12
BS1W1230	Sulfate	15.0	13.9	mg/L	92	E300.0A	12/30/12

U=Not detected at specified reporting limit
 J=Estimated value below reporting limit
 E=Estimated value above calibration range
 *=See case narrative

**CASE NARRATIVE
WET CHEMISTRY ANALYSIS**

Lab Name: CH2M HILL/LAB/CVO

ASL SDG#: L3043

Project: Camp Lejeune

Project #: 387442.78.WP

I. Method(s):

Analysis: SM5310B

II. Receipt/Holding Times:

All acceptance criteria were met.

III. Analysis:

A. Initial Calibration(s):

All acceptance criteria were met.

B. Calibration Verification(s):

All acceptance criteria were met.

C. Blanks:

All acceptance criteria were met.

D. Laboratory Control Sample(s):

All acceptance criteria were met.

E. Matrix Spike/Matrix Spike Duplicate Sample(s):

Analyzed in accordance with standard operating procedure.

F. Analytical Exception(s):

None.

IV. Documentation Exception(s):

None.

V. I certify that this data package is in compliance with the terms and conditions agreed to by the client and CH2M HILL, both technically and for completeness, except for the conditions detailed above. Release of the data contained in this hardcopy data package has been authorized by the Laboratory Manager or designee, as verified by the following signatures.

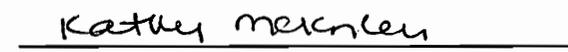
Prepared by: _____



Date: _____

12/30/2012

Reviewed by: _____



Date: _____

1/2/13

CH2M HILL Applied Sciences Laboratory (ASL)

<u>Client Information</u>	<u>Lab Information</u>
Project Name: Camp Lejeune	Lab Batch ID: L3043
Date Received: 12/14/12	Analysis Method: SM5310B
Type: See C.O.C.	Units: mg/L
Matrix: Water	Report Revision No.: 0

Client Sample ID	Lab Sample ID	Dilution Factor	Total Organic Carbon		Qualifier	Date Analyzed
			RL	Result		
General Chemistry						
Control A_t14	L304301	6.25	3.13	18.1		12/20/12
Sulfate_t14	L304302	20	10.0	109		12/20/12
Control B_t14	L304303	1	0.50	2.53		12/20/12
EHC-L_t14	L304304	15	7.50	50.6		12/20/12
WB1-1220	WB1-1220	1	0.50	0.50	U	12/20/12

U=Not detected at specified reporting limit
 J=Estimated value below reporting limit
 E=Estimated value above calibration range
 *=See case narrative

CH2M HILL Applied Sciences Laboratory (ASL)

<u>Client Information</u>	<u>Lab Information</u>
Project Name: Camp Lejeune Type: QC Matrix: Water	Lab Batch ID: L3043 Report Revision No.: 0

LCS ID	Analyte	Spike Amount	Sample Result	Units	% Recovery	Analysis Method	Date Analyzed
General Chemistry							
BS1W1220	Total Organic Carbon	2.50	2.81	mg/L	112	SM5310B	12/20/12

U=Not detected at specified reporting limit
J=Estimated value below reporting limit
E=Estimated value above calibration range
*=See case narrative

CH2MHILL Applied Sciences Lab
CHAIN OF CUSTODY RECORD
AND AGREEMENT TO PERFORM SERVICES

1000 NE Circle Blvd., Suite 10350
 Corvallis, OR 97330
 (541) 768-3120 FAX (541) 752-0276

COC #

Project # or Purchase Order # 387442.78.WP							TOTAL # OF CONTAINERS	Requested Analytical Method #							THIS AREA FOR LAB USE ONLY																
Project Name Camp Lejeune Site 78								Sulfate & Nitrate (E300.0)	VOCs (SW8260B)*	Dissolved Iron (200.7) **PRE-FILTERED**	TOC	Sulfide				Lab #	Page	of													
Company Name or Home Address/Phone Number CH2M HILL																L3043															
Email Address for Reporting Dusty Berggren/CVO				Report Copy to: Mike Nieme/CVO																											
Turnaround Time <input type="checkbox"/> 24 hours <input type="checkbox"/> 48 hours <input type="checkbox"/> 72 hours <input checked="" type="checkbox"/> 7 days <input type="checkbox"/> 14 days <input type="checkbox"/> 21 days (STD)				Drinking Water? Yes <input type="checkbox"/> No <input checked="" type="checkbox"/>		Sample Disposal: Dispose <input checked="" type="checkbox"/> Return <input type="checkbox"/>																									
Sampling		Type		Matrix												Preservative							EPA Tier QC Level								
Date	Time	COMP	GRAB	WATER	SOIL	AIR										CLIENT SAMPLE ID	UNPRES	HCl	HNO ₃	H ₂ SO ₄	ZnAc	UNPRES	UNPRES	1 (Screening)	2	3	4				
12/14/12	945		x	x												Control A_t14	1	1	1	1	1			Canister ID				Lab ID			
12/14/12	955		x	x												Sulfate_t14	1	1	1	1	1										
12/14/12	935		X	X												Control B_t14	1	1	1	1	1										
12/14/12	957		X	X			EHC-L_t14									1	1	1	1	1											

Possible Hazard Identification: Non-Hazard Flammable Skin Irritant Poison B Unknown Volatile Contaminants/Odorous Biohazard Other _____

Relinquished By _____ Date/Time _____				Received By: _____ Date/Time _____			
Sampled By and Title (Please sign and print name) <i>Dusty RV Berggren</i> Date/Time <i>12/14/12 10:00</i>				Relinquished By (Please sign and print name) <i>Dusty RV Berggren</i> Date/Time <i>12/14/12 10:00</i>			
Received By (Please sign and print name) _____ Date/Time _____				Relinquished By (Please sign and print name) _____ Date/Time _____			
Received By (Please sign and print name) _____ Date/Time _____				Shipped Via _____ Tracking # _____ UPS Fed-Ex Other _____			

Special Instructions
 Please provide preliminary VOC results when available. NOTE LIMITED VOLUME. See t=0 & t=7 results (L2953 and L_____) for dilutions guidance. This batch should have slightly lower VOCs & sulfate.
 *Only report the following VOCs: benzene, ethylbenzene, toluene, xylenes, tetrachloroethene (PCE), trichloroethene (TCE), 1,1-dichloroethene (DCE), cis-1,2-DCE, trans-1,2-DCE, vinyl chloride (VC), 1,1-dichloroethane (DCA), 1,2-DCA, 1,2-dibromo-3-chloropropane, isopropylbenzene, and methylene chloride.

Instructions and Agreement Provisions on Reverse Side

DISTRIBUTION: Original – LAB, Yellow – LAB, Pink – Client
 Rev 09/2010 LAB FORM 340



ANALYTICAL REPORT

For:
Camp Lejeune

ASL Report #: M1009
Project ID: 387442.78.WP
Attn: Dusty Berggren/CH2M HILL
cc:
Mike Niemet/mike.niemet@ch2m.com

Authorized and Released By:

Laboratory Project Manager
Ben Thompson
(541) 758-0235 ext.23132
January 23, 2013

This data package meets standards requested by client and is not intended or implied to meet any other standard.

All analyses performed by CH2M HILL are clearly indicated. Any subcontracted analyses are included as appended reports as received from the subcontracted laboratory. The results included in this report only relate to the samples listed on the following Sample Cross-Reference page. This report shall not be reproduced except in full, without the written approval of the laboratory.

Any unusual difficulties encountered during the analysis of your samples are discussed in the attached case narratives.

ASL Report #: M1009

Sample Receipt Comments

We certify that the test results meet all standard ASL requirements.

Sample Cross-Reference

ASL Sample ID	Client Sample ID	Date/Time Collected	Date Received
M100901	Control A (t32)	01/02/13 17:45	01/03/13
M100902	Sulfate (t32)	01/02/13 18:00	01/03/13
M100903	Control B (t32)	01/02/13 18:15	01/03/13
M100904	EHC-L (t32)	01/02/13 18:30	01/03/13

**CASE NARRATIVE
GC/MS VOLATILES ANALYSIS**

Lab Name: CH2M HILL/LAB/CVO

ASL SDG#: M1009

Project: Camp Lejeune

Project #: 387442.78.WP

I. Method(s):

Analysis: SW8260B

Preparation: SW5030

II. Receipt/Holding Times:

All acceptance criteria were met.

III. Analysis:

A. Initial Calibration(s):

All acceptance criteria were met.

B. Calibration Verification(s):

All acceptance criteria were met.

C. Blank(s):

All acceptance criteria were met.

D. Laboratory Control Sample(s):

All acceptance criteria were met.

E. Matrix Spike/Matrix Spike Duplicate Sample(s):

Analyzed in accordance with standard operating procedure.

F. Surrogate Standard(s):

All acceptance criteria were met.

G. BFB Tune Verification(s):

All acceptance criteria were met.

H. Internal Standard(s):

All acceptance criteria were met.

I. Analytical Exception(s):

None.

IV. Documentation Exception(s):

None.

V. I certify that this data package is in compliance with the terms and conditions agreed to by the client and CH2M HILL, both technically and for completeness, except for the conditions detailed above. Release of the data contained in this hardcopy data package has been authorized by the Laboratory Manager or designee, as verified by the following signatures.

Prepared by: _____

Date: _____

Reviewed by: _____

Date: _____

CH2M HILL Applied Sciences Laboratory (ASL)

Client Information

Client Sample ID: Control A (t32)

Project Name: Camp Lejeune

Sample Date: 01/02/13

Sample Time: 17:45

Type: Grab

Matrix: Water

Lab Information

Lab Sample ID: M100901

Date Received: 01/03/13

Dilution Factor: 2.2

Report Revision No.: 0

Analyte	CAS#	DL	RL	Sample Result	Qualifier	Units	Analysis Method	Date Analyzed
GC/MS Volatiles								
Vinyl Chloride	75-01-4	0.44	1.10	1.10	U	ug/L	SW8260B	01/09/13
1,1-Dichloroethene	75-35-4	0.44	1.10	1.10	U	ug/L	SW8260B	01/09/13
Methylene chloride	75-09-2	0.44	1.10	1.10	U	ug/L	SW8260B	01/09/13
trans-1,2-Dichloroethene	156-60-5	0.44	1.10	1.10	U	ug/L	SW8260B	01/09/13
1,1-Dichloroethane	75-34-3	0.44	1.10	1.10	U	ug/L	SW8260B	01/09/13
cis-1,2-Dichloroethene	156-59-2	0.44	1.10	1.99		ug/L	SW8260B	01/09/13
1,2-Dichloroethane	107-06-2	0.44	1.10	1.10	U	ug/L	SW8260B	01/09/13
Benzene	71-43-2	0.44	1.10	16.4		ug/L	SW8260B	01/09/13
Trichloroethene (TCE)	79-01-6	0.44	1.10	32.2		ug/L	SW8260B	01/09/13
Toluene	108-88-3	0.44	1.10	74.0		ug/L	SW8260B	01/09/13
Tetrachloroethene (PCE)	127-18-4	0.44	1.10	1.10	U	ug/L	SW8260B	01/09/13
Ethylbenzene	100-41-4	0.44	1.10	132		ug/L	SW8260B	01/09/13
m,p-Xylene	108-38-3/1	0.88	2.20	602	E	ug/L	SW8260B	01/09/13
o-Xylene	95-47-6	0.44	1.10	235	E	ug/L	SW8260B	01/09/13
Isopropylbenzene	98-82-8	0.44	1.10	40.3		ug/L	SW8260B	01/09/13
1,2-Dibromo-3-chloropropane	96-12-8	0.44	1.10	1.10	U	ug/L	SW8260B	01/09/13

Surrogate	% Recovery	Control Limits	Qualifier
Dibromofluoromethane	104	75-125	
1,2-Dichloroethane-d4	105	75-125	
Toluene-d8	100	75-125	
4-Bromofluorobenzene	104	75-125	

U=Not detected at specified reporting limit
 J=Estimated value below reporting limit
 E=Estimated value above calibration range
 *=See case narrative

CH2M HILL Applied Sciences Laboratory (ASL)

Client Information				Lab Information			
Client Sample ID: Control A (t32)DL				Lab Sample ID: M100901DL			
Project Name: Camp Lejeune				Date Received: 01/03/13			
Sample Date: 01/02/13				Dilution Factor: 10			
Sample Time: 17:45				Report Revision No.: 0			
Type: Grab							
Matrix: Water							

Analyte	CAS#	DL	RL	Sample Result	Qualifier	Units	Analysis Method	Date Analyzed
GC/MS Volatiles								
Vinyl Chloride	75-01-4	2.00	5.00	5.00	U	ug/L	SW8260B	01/09/13
1,1-Dichloroethene	75-35-4	2.00	5.00	5.00	U	ug/L	SW8260B	01/09/13
Methylene chloride	75-09-2	2.00	5.00	5.00	U	ug/L	SW8260B	01/09/13
trans-1,2-Dichloroethene	156-60-5	2.00	5.00	5.00	U	ug/L	SW8260B	01/09/13
1,1-Dichloroethane	75-34-3	2.00	5.00	5.00	U	ug/L	SW8260B	01/09/13
cis-1,2-Dichloroethene	156-59-2	2.00	5.00	5.00	U	ug/L	SW8260B	01/09/13
1,2-Dichloroethane	107-06-2	2.00	5.00	5.00	U	ug/L	SW8260B	01/09/13
Benzene	71-43-2	2.00	5.00	16.4		ug/L	SW8260B	01/09/13
Trichloroethene (TCE)	79-01-6	2.00	5.00	32.2		ug/L	SW8260B	01/09/13
Toluene	108-88-3	2.00	5.00	74.0		ug/L	SW8260B	01/09/13
Tetrachloroethene (PCE)	127-18-4	2.00	5.00	5.00	U	ug/L	SW8260B	01/09/13
Ethylbenzene	100-41-4	2.00	5.00	130		ug/L	SW8260B	01/09/13
m,p-Xylene	108-38-3/1	4.00	10.0	657		ug/L	SW8260B	01/09/13
o-Xylene	95-47-6	2.00	5.00	234		ug/L	SW8260B	01/09/13
Isopropylbenzene	98-82-8	2.00	5.00	36.9		ug/L	SW8260B	01/09/13
1,2-Dibromo-3-chloropropane	96-12-8	2.00	5.00	5.00	U	ug/L	SW8260B	01/09/13

Surrogate	% Recovery	Control Limits	Qualifier
Dibromofluoromethane	106	75-125	
1,2-Dichloroethane-d4	109	75-125	
Toluene-d8	102	75-125	
4-Bromofluorobenzene	102	75-125	

U=Not detected at specified reporting limit
 J=Estimated value below reporting limit
 E=Estimated value above calibration range
 *=See case narrative

CH2M HILL Applied Sciences Laboratory (ASL)

Client Information

Client Sample ID: Sulfate (t32)
 Project Name: Camp Lejeune
 Sample Date: 01/02/13
 Sample Time: 18:00
 Type: Grab
 Matrix: Water

Lab Information

Lab Sample ID: M100902
 Date Received: 01/03/13
 Dilution Factor: 2.2
 Report Revision No.: 0

Analyte	CAS#	DL	RL	Sample Result	Qualifier	Units	Analysis Method	Date Analyzed
GC/MS Volatiles								
Vinyl Chloride	75-01-4	0.44	1.10	1.10	U	ug/L	SW8260B	01/09/13
1,1-Dichloroethene	75-35-4	0.44	1.10	1.10	U	ug/L	SW8260B	01/09/13
Methylene chloride	75-09-2	0.44	1.10	1.10	U	ug/L	SW8260B	01/09/13
trans-1,2-Dichloroethene	156-60-5	0.44	1.10	1.10	U	ug/L	SW8260B	01/09/13
1,1-Dichloroethane	75-34-3	0.44	1.10	1.10	U	ug/L	SW8260B	01/09/13
cis-1,2-Dichloroethene	156-59-2	0.44	1.10	1.62		ug/L	SW8260B	01/09/13
1,2-Dichloroethane	107-06-2	0.44	1.10	1.10	U	ug/L	SW8260B	01/09/13
Benzene	71-43-2	0.44	1.10	13.8		ug/L	SW8260B	01/09/13
Trichloroethene (TCE)	79-01-6	0.44	1.10	25.2		ug/L	SW8260B	01/09/13
Toluene	108-88-3	0.44	1.10	62.7		ug/L	SW8260B	01/09/13
Tetrachloroethene (PCE)	127-18-4	0.44	1.10	1.10	U	ug/L	SW8260B	01/09/13
Ethylbenzene	100-41-4	0.44	1.10	111		ug/L	SW8260B	01/09/13
m,p-Xylene	108-38-3/1	0.88	2.20	512	E	ug/L	SW8260B	01/09/13
o-Xylene	95-47-6	0.44	1.10	199		ug/L	SW8260B	01/09/13
Isopropylbenzene	98-82-8	0.44	1.10	34.1		ug/L	SW8260B	01/09/13
1,2-Dibromo-3-chloropropane	96-12-8	0.44	1.10	1.10	U	ug/L	SW8260B	01/09/13

Surrogate	% Recovery	Control Limits	Qualifier
Dibromofluoromethane	98	75-125	
1,2-Dichloroethane-d4	99	75-125	
Toluene-d8	96	75-125	
4-Bromofluorobenzene	98	75-125	

U=Not detected at specified reporting limit
 J=Estimated value below reporting limit
 E=Estimated value above calibration range
 *=See case narrative

CH2M HILL Applied Sciences Laboratory (ASL)

Client Information		Lab Information	
Client Sample ID: Sulfate (t32)DL		Lab Sample ID: M100902DL	
Project Name: Camp Lejeune		Date Received: 01/03/13	
Sample Date: 01/02/13		Dilution Factor: 10	
Sample Time: 18:00		Report Revision No.: 0	
Type: Grab			
Matrix: Water			

Analyte	CAS#	DL	RL	Sample Result	Qualifier	Units	Analysis Method	Date Analyzed
GC/MS Volatiles								
Vinyl Chloride	75-01-4	2.00	5.00	5.00	U	ug/L	SW8260B	01/09/13
1,1-Dichloroethene	75-35-4	2.00	5.00	5.00	U	ug/L	SW8260B	01/09/13
Methylene chloride	75-09-2	2.00	5.00	5.00	U	ug/L	SW8260B	01/09/13
trans-1,2-Dichloroethene	156-60-5	2.00	5.00	5.00	U	ug/L	SW8260B	01/09/13
1,1-Dichloroethane	75-34-3	2.00	5.00	5.00	U	ug/L	SW8260B	01/09/13
cis-1,2-Dichloroethene	156-59-2	2.00	5.00	5.00	U	ug/L	SW8260B	01/09/13
1,2-Dichloroethane	107-06-2	2.00	5.00	5.00	U	ug/L	SW8260B	01/09/13
Benzene	71-43-2	2.00	5.00	14.7		ug/L	SW8260B	01/09/13
Trichloroethene (TCE)	79-01-6	2.00	5.00	26.5		ug/L	SW8260B	01/09/13
Toluene	108-88-3	2.00	5.00	66.9		ug/L	SW8260B	01/09/13
Tetrachloroethene (PCE)	127-18-4	2.00	5.00	5.00	U	ug/L	SW8260B	01/09/13
Ethylbenzene	100-41-4	2.00	5.00	115		ug/L	SW8260B	01/09/13
m,p-Xylene	108-38-3/1	4.00	10.0	581		ug/L	SW8260B	01/09/13
o-Xylene	95-47-6	2.00	5.00	210		ug/L	SW8260B	01/09/13
Isopropylbenzene	98-82-8	2.00	5.00	33.3		ug/L	SW8260B	01/09/13
1,2-Dibromo-3-chloropropane	96-12-8	2.00	5.00	5.00	U	ug/L	SW8260B	01/09/13

Surrogate	% Recovery	Control Limits	Qualifier
Dibromofluoromethane	102	75-125	
1,2-Dichloroethane-d4	104	75-125	
Toluene-d8	100	75-125	
4-Bromofluorobenzene	100	75-125	

U=Not detected at specified reporting limit
 J=Estimated value below reporting limit
 E=Estimated value above calibration range
 *=See case narrative

CH2M HILL Applied Sciences Laboratory (ASL)

Client Information

Client Sample ID: Control B (t32)
 Project Name: Camp Lejeune
 Sample Date: 01/02/13
 Sample Time: 18:15
 Type: Grab
 Matrix: Water

Lab Information

Lab Sample ID: M100903
 Date Received: 01/03/13
 Dilution Factor: 1
 Report Revision No.: 0

Analyte	CAS#	DL	RL	Sample Result	Qualifier	Units	Analysis Method	Date Analyzed
GC/MS Volatiles								
Vinyl Chloride	75-01-4	0.20	0.50	0.50	U	ug/L	SW8260B	01/09/13
1,1-Dichloroethene	75-35-4	0.20	0.50	0.50	U	ug/L	SW8260B	01/09/13
Methylene chloride	75-09-2	0.20	0.50	0.50	U	ug/L	SW8260B	01/09/13
trans-1,2-Dichloroethene	156-60-5	0.20	0.50	0.50	U	ug/L	SW8260B	01/09/13
1,1-Dichloroethane	75-34-3	0.20	0.50	0.50	U	ug/L	SW8260B	01/09/13
cis-1,2-Dichloroethene	156-59-2	0.20	0.50	43.7		ug/L	SW8260B	01/09/13
1,2-Dichloroethane	107-06-2	0.20	0.50	0.50	U	ug/L	SW8260B	01/09/13
Benzene	71-43-2	0.20	0.50	1.10		ug/L	SW8260B	01/09/13
Trichloroethene (TCE)	79-01-6	0.20	0.50	31.3		ug/L	SW8260B	01/09/13
Toluene	108-88-3	0.20	0.50	2.51		ug/L	SW8260B	01/09/13
Tetrachloroethene (PCE)	127-18-4	0.20	0.50	0.50	U	ug/L	SW8260B	01/09/13
Ethylbenzene	100-41-4	0.20	0.50	1.67		ug/L	SW8260B	01/09/13
m,p-Xylene	108-38-3/1	0.40	1.00	1.71		ug/L	SW8260B	01/09/13
o-Xylene	95-47-6	0.20	0.50	3.27		ug/L	SW8260B	01/09/13
Isopropylbenzene	98-82-8	0.20	0.50	0.50	U	ug/L	SW8260B	01/09/13
1,2-Dibromo-3-chloropropane	96-12-8	0.20	0.50	0.50	U	ug/L	SW8260B	01/09/13

Surrogate	% Recovery	Control Limits	Qualifier
Dibromofluoromethane	103	75-125	
1,2-Dichloroethane-d4	104	75-125	
Toluene-d8	99	75-125	
4-Bromofluorobenzene	99	75-125	

U=Not detected at specified reporting limit
 J=Estimated value below reporting limit
 E=Estimated value above calibration range
 *=See case narrative

CH2M HILL Applied Sciences Laboratory (ASL)

Client Information				Lab Information			
Client Sample ID: EHC-L (t32)				Lab Sample ID: M100904			
Project Name: Camp Lejeune				Date Received: 01/03/13			
Sample Date: 01/02/13				Dilution Factor: 1			
Sample Time: 18:30				Report Revision No.: 0			
Type: Grab							
Matrix: Water							

Analyte	CAS#	DL	RL	Sample Result	Qualifier	Units	Analysis Method	Date Analyzed
GC/MS Volatiles								
Vinyl Chloride	75-01-4	0.20	0.50	0.50	U	ug/L	SW8260B	01/09/13
1,1-Dichloroethene	75-35-4	0.20	0.50	0.50	U	ug/L	SW8260B	01/09/13
Methylene chloride	75-09-2	0.20	0.50	0.50	U	ug/L	SW8260B	01/09/13
trans-1,2-Dichloroethene	156-60-5	0.20	0.50	0.50	U	ug/L	SW8260B	01/09/13
1,1-Dichloroethane	75-34-3	0.20	0.50	0.50	U	ug/L	SW8260B	01/09/13
cis-1,2-Dichloroethene	156-59-2	0.20	0.50	43.0		ug/L	SW8260B	01/09/13
1,2-Dichloroethane	107-06-2	0.20	0.50	0.50	U	ug/L	SW8260B	01/09/13
Benzene	71-43-2	0.20	0.50	1.08		ug/L	SW8260B	01/09/13
Trichloroethene (TCE)	79-01-6	0.20	0.50	29.6		ug/L	SW8260B	01/09/13
Toluene	108-88-3	0.20	0.50	18.9		ug/L	SW8260B	01/09/13
Tetrachloroethene (PCE)	127-18-4	0.20	0.50	0.50	U	ug/L	SW8260B	01/09/13
Ethylbenzene	100-41-4	0.20	0.50	1.38		ug/L	SW8260B	01/09/13
m,p-Xylene	108-38-3/1	0.40	1.00	5.32		ug/L	SW8260B	01/09/13
o-Xylene	95-47-6	0.20	0.50	2.94		ug/L	SW8260B	01/09/13
Isopropylbenzene	98-82-8	0.20	0.50	0.50	U	ug/L	SW8260B	01/09/13
1,2-Dibromo-3-chloropropane	96-12-8	0.20	0.50	0.50	U	ug/L	SW8260B	01/09/13

Surrogate	% Recovery	Control Limits	Qualifier
Dibromofluoromethane	101	75-125	
1,2-Dichloroethane-d4	103	75-125	
Toluene-d8	97	75-125	
4-Bromofluorobenzene	97	75-125	

U=Not detected at specified reporting limit
 J=Estimated value below reporting limit
 E=Estimated value above calibration range
 *=See case narrative

CH2M HILL Applied Sciences Laboratory (ASL)

Client Information

Client Sample ID: WB1-0109
 Project Name: Camp Lejeune
 Sample Date: N/A
 Sample Time: N/A
 Type: QC
 Matrix: Water

Lab Information

Lab Sample ID: WB1-0109
 Date Received: N/A
 Dilution Factor: 1
 Report Revision No.: 0

Analyte	CAS#	DL	RL	Sample Result	Qualifier	Units	Analysis Method	Date Analyzed
GC/MS Volatiles								
Vinyl Chloride	75-01-4	0.20	0.50	0.50	U	ug/L	SW8260B	01/09/13
1,1-Dichloroethene	75-35-4	0.20	0.50	0.50	U	ug/L	SW8260B	01/09/13
Methylene chloride	75-09-2	0.20	0.50	0.50	U	ug/L	SW8260B	01/09/13
trans-1,2-Dichloroethene	156-60-5	0.20	0.50	0.50	U	ug/L	SW8260B	01/09/13
1,1-Dichloroethane	75-34-3	0.20	0.50	0.50	U	ug/L	SW8260B	01/09/13
cis-1,2-Dichloroethene	156-59-2	0.20	0.50	0.50	U	ug/L	SW8260B	01/09/13
1,2-Dichloroethane	107-06-2	0.20	0.50	0.50	U	ug/L	SW8260B	01/09/13
Benzene	71-43-2	0.20	0.50	0.50	U	ug/L	SW8260B	01/09/13
Trichloroethene (TCE)	79-01-6	0.20	0.50	0.50	U	ug/L	SW8260B	01/09/13
Toluene	108-88-3	0.20	0.50	0.50	U	ug/L	SW8260B	01/09/13
Tetrachloroethene (PCE)	127-18-4	0.20	0.50	0.50	U	ug/L	SW8260B	01/09/13
Ethylbenzene	100-41-4	0.20	0.50	0.50	U	ug/L	SW8260B	01/09/13
m,p-Xylene	108-38-3/1	0.40	1.00	1.00	U	ug/L	SW8260B	01/09/13
o-Xylene	95-47-6	0.20	0.50	0.50	U	ug/L	SW8260B	01/09/13
Isopropylbenzene	98-82-8	0.20	0.50	0.50	U	ug/L	SW8260B	01/09/13
1,2-Dibromo-3-chloropropane	96-12-8	0.20	0.50	0.50	U	ug/L	SW8260B	01/09/13

<u>Surrogate</u>	<u>% Recovery</u>	<u>Control Limits</u>	<u>Qualifier</u>
Dibromofluoromethane	111	75-125	
1,2-Dichloroethane-d4	115	75-125	
Toluene-d8	100	75-125	
4-Bromofluorobenzene	92	75-125	

U=Not detected at specified reporting limit
 J=Estimated value below reporting limit
 E=Estimated value above calibration range
 *=See case narrative

CH2M HILL Applied Sciences Laboratory (ASL)

Client Information

Project Name: Camp Lejeune
 Type: QC
 Matrix: Water

Lab Information

LCS ID: BS1W0109
 Report Revision No.: 0
 Dilution Factor: 1

Analyte	CAS#	Spike Amount	Sample Result	Units	%Recovery	Analysis Method	Date Analyzed
GC/MS Volatiles							
Vinyl Chloride	75-01-4	20.0	20.2	ug/L	101	SW8260B	01/09/13
1,1-Dichloroethene	75-35-4	20.0	17.0	ug/L	85	SW8260B	01/09/13
Methylene chloride	75-09-2	20.0	19.4	ug/L	97	SW8260B	01/09/13
trans-1,2-Dichloroethene	156-60-5	20.0	18.0	ug/L	90	SW8260B	01/09/13
1,1-Dichloroethane	75-34-3	20.0	19.0	ug/L	95	SW8260B	01/09/13
cis-1,2-Dichloroethene	156-59-2	20.0	18.9	ug/L	95	SW8260B	01/09/13
1,2-Dichloroethane	107-06-2	20.0	19.7	ug/L	98	SW8260B	01/09/13
Benzene	71-43-2	20.0	18.8	ug/L	94	SW8260B	01/09/13
Trichloroethene (TCE)	79-01-6	20.0	19.0	ug/L	95	SW8260B	01/09/13
Toluene	108-88-3	20.0	18.9	ug/L	95	SW8260B	01/09/13
Tetrachloroethene (PCE)	127-18-4	20.0	19.0	ug/L	95	SW8260B	01/09/13
Ethylbenzene	100-41-4	20.0	18.7	ug/L	94	SW8260B	01/09/13
m,p-Xylene	108-38-3/1	40.0	38.0	ug/L	95	SW8260B	01/09/13
o-Xylene	95-47-6	20.0	19.0	ug/L	95	SW8260B	01/09/13
Isopropylbenzene	98-82-8	20.0	16.8	ug/L	84	SW8260B	01/09/13
1,2-Dibromo-3-chloropropane	96-12-8	20.0	18.0	ug/L	90	SW8260B	01/09/13

Surrogate	% Recovery	Control Limits	Qualifier
Dibromofluoromethane	106	75-125	
1,2-Dichloroethane-d4	105	75-125	
Toluene-d8	97	75-125	
4-Bromofluorobenzene	100	75-125	

U=Not detected at specified reporting limit
 J=Estimated value below reporting limit
 E=Estimated value above calibration range
 *=See case narrative

CASE NARRATIVE
METALS ANALYSIS

Lab Name: CH2M HILL/LAB/CVO

ASL SDG#: M1009

Project: Camp Lejeune

Project #: 387442.78.WP

I. Method(s):

Analysis: E200.7
Preparation: FLDFLT

II. Receipt/Holding Times:

All acceptance criteria were met.

III. Analysis:

A. Initial Calibration(s):

All acceptance criteria were met.

B. Calibration Verification(s):

All acceptance criteria were met.

C. Blanks:

All acceptance criteria were met.

D. Laboratory Control Sample(s):

All acceptance criteria were met.

E. Matrix Spike/Matrix Spike Duplicate Sample(s):

Analyzed in accordance with standard operating procedure.

F. Interference Check Sample(s):

All acceptance criteria were met.

G. Serial Dilution(s):

Analyzed in accordance with standard operating procedure.

H. Digestion Exception(s):

None.

I. Analytical Exception(s):

None.

IV. Documentation Exception(s):

None.

V. I certify that this data package is in compliance with the terms and conditions agreed to by the client and CH2M HILL, both technically and for completeness, except for the conditions detailed above. Release of the data contained in this hardcopy data package has been authorized by the Laboratory Manager or designee, as verified by the following signatures.

Prepared by:  Date: 1-7-13
Reviewed by:  Date: 1/14/13

CH2M HILL Applied Sciences Laboratory (ASL)

<u>Client Information</u>	<u>Lab Information</u>
Project Name: Camp Lejeune	Lab Batch ID: M1009
Date Received: 01/03/13	Report Revision No.: 0
Type: See C.O.C.	
Matrix: Water	

Client Sample ID	Lab Sample ID	Dilution Factor	RL	Result	Qual	Units	Date Analyzed
Iron: E200.7							
<i>Dissoived Metals</i>							
Control A (t32)	M100901F	1	100	10700		ug/L	01/04/13
Sulfate (t32)	M100902F	1	100	15100		ug/L	01/04/13
Control B (t32)	M100903F	1	100	457		ug/L	01/04/13
EHC-L (t32)	M100904F	1	100	9690		ug/L	01/04/13
<i>Total Metals</i>							
WB1-0102	WB1-0102	1	100	100	U	ug/L	01/04/13

U=Not detected at specified reporting limit
 J=Estimated value below reporting limit
 E=Estimated value above calibration range
 *=See case narrative

CH2M HILL Applied Sciences Laboratory (ASL)

Client Information

Project Name: Camp Lejeune
Type: QC
Matrix: Water

Lab Information

LCS ID: BS1W0102
Report Revision No.: 0
Dilution Factor: 1

Analyte	CAS#	Spike Amount	Sample Result	Units	%Recovery	Analysis Method	Date Analyzed
Metals							
Iron	7439-89-6	500	506	ug/L	101	E200.7	01/04/13

U=Not detected at specified reporting limit
J=Estimated value below reporting limit
E=Estimated value above calibration range
*=See case narrative

**CASE NARRATIVE
ION CHROMATOGRAPHY ANALYSIS**

Lab Name: CH2M HILL/LAB/CVO

ASL SDG#: M1009

Project: Camp Lejeune

Project #: 387442.78.WP

I. Method(s):

Analysis: E300.0A

II. Receipt/Holding Times:

All acceptance criteria were met.

III. Analysis:

A. Initial Calibration(s):

All acceptance criteria were met.

B. Calibration Verification(s):

All acceptance criteria were met.

C. Blanks:

All acceptance criteria were met.

D. Laboratory Control Sample(s):

All acceptance criteria were met.

E. Matrix Spike/Matrix Spike Duplicate Sample(s):

Analyzed in accordance with standard operating procedure.

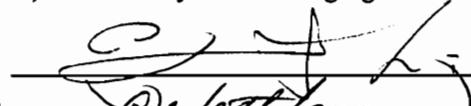
F. Analytical Exception(s):

None.

IV. Documentation Exception(s):

None.

V. I certify that this data package is in compliance with the terms and conditions agreed to by the client and CH2M HILL, both technically and for completeness, except for the conditions detailed above. Release of the data contained in this hardcopy data package has been authorized by the Laboratory Manager or designee, as verified by the following signatures.

Prepared by: 
Reviewed by: 

Date: 1/18/2013

Date: 01/21/13

CH2M HILL Applied Sciences Laboratory (ASL)

<u>Client Information</u>	<u>Lab Information</u>
Project Name: Camp Lejeune	Lab Batch ID: M1009
Date Received: 01/03/13	Analysis Method: E300.0A
Type: See C.O.C.	Units: mg/L
Matrix: Water	Report Revision No.: 0

Client Sample ID	Lab Sample ID	Dilution Factor	RL	Nitrate-N Result	Qualifier	Date Analyzed
General Chemistry						
Control A (t32)	M100901	1	0.10	0.10	U	01/03/13 17:46
Sulfate (t32)	M100902	1	0.10	0.10	U	01/03/13 18:06
Control B (t32)	M100903	1	0.10	0.10	U	01/03/13 18:27
EHC-L (t32)	M100904	1	0.10	0.10	U	01/03/13 18:47
WB1-0103	WB1-0103	1	0.10	0.10	U	01/03/13 17:26

U=Not detected at specified reporting limit
 J=Estimated value below reporting limit
 E=Estimated value above calibration range
 *=See case narrative

CH2M HILL Applied Sciences Laboratory (ASL)

<u>Client Information</u>		<u>Lab Information</u>	
Project Name: Camp Lejeune		Lab Batch ID: M1009	
Date Received: 01/03/13		Analysis Method: E300.0A	
Type: See C.O.C.		Units: mg/L	
Matrix: Water		Report Revision No.: 0	

Client Sample ID	Lab Sample ID	Dilution Factor	RL	Sulfate Result	Qualifier	Date Analyzed
General Chemistry						
Control A (t32)	M100901	1	0.10	2.48		01/03/13
Sulfate (t32)	M100902	5	0.50	94.4		01/04/13
Control B (t32)	M100903	2	0.20	32.4		01/04/13
EHC-L (t32)	M100904	1	0.10	0.10	U	01/03/13
WB1-0103	WB1-0103	1	0.10	0.10	U	01/03/13

U=Not detected at specified reporting limit
 J=Estimated value below reporting limit
 E=Estimated value above calibration range
 *=See case narrative

CH2M HILL Applied Sciences Laboratory (ASL)

<u>Client Information</u>	<u>Lab Information</u>
Project Name: Camp Lejeune Type: QC Matrix: Water	Lab Batch ID: M1009 Report Revision No.: 0

LCS ID	Analyte	Spike Amount	Sample Result	Units	% Recovery	Analysis Method	Date Analyzed
General Chemistry							
BS1W0103	Nitrate-N	3.00	2.82	mg/L	94	E300.0A	01/03/13
BS1W0103	Sulfate	15.0	13.8	mg/L	92	E300.0A	01/03/13

U=Not detected at specified reporting limit
 J=Estimated value below reporting limit
 E=Estimated value above calibration range
 *=See case narrative

**CASE NARRATIVE
WET CHEMISTRY ANALYSIS**

Lab Name: CH2M HILL/LAB/CVO

ASL SDG#: M1009

Project: Camp Lejeune

Project #: 387442.78.WP

I. Method(s):

Analysis: M5310B

II. Receipt/Holding Times:

All acceptance criteria were met.

III. Analysis:

A. Initial Calibration(s):

All acceptance criteria were met.

B. Calibration Verification(s):

All acceptance criteria were met.

C. Blanks:

All acceptance criteria were met.

D. Laboratory Control Sample(s):

All acceptance criteria were met.

E. Matrix Spike/Matrix Spike Duplicate Sample(s):

Analyzed in accordance with standard operating procedure.

F. Analytical Exception(s):

None.

IV. Documentation Exception(s):

None.

V. I certify that this data package is in compliance with the terms and conditions agreed to by the client and CH2M HILL, both technically and for completeness, except for the conditions detailed above. Release of the data contained in this hardcopy data package has been authorized by the Laboratory Manager or designee, as verified by the following signatures.

Prepared by: 

Date: 1/17/2013

Reviewed by: Katley mace

Date: 1/17/13

CH2M HILL Applied Sciences Laboratory (ASL)

<u>Client Information</u>	<u>Lab Information</u>
Project Name: Camp Lejeune	Lab Batch ID: M1009
Date Received: 01/03/13	Analysis Method: SM5310B
Type: See C.O.C.	Units: mg/L
Matrix: Water	Report Revision No.: 0

Client Sample ID	Lab Sample ID	Dilution Factor	Total Organic Carbon RL	Result	Qualifier	Date Analyzed
General Chemistry						
Control A (t32)	M100901	12	6.00	31.4		01/08/13
Sulfate (t32)	M100902	10	5.00	26.6		01/08/13
Control B (t32)	M100903	5	2.50	12.6		01/08/13
EHC-L (t32)	M100904	20	10.0	63.0		01/08/13
WB2-0107	WB2-0107	1	0.50	0.50	U	01/08/13

U=Not detected at specified reporting limit
 J=Estimated value below reporting limit
 E=Estimated value above calibration range
 *=See case narrative

CH2M HILL Applied Sciences Laboratory (ASL)

Client Information

Project Name: Camp Lejeune
Type: QC
Matrix: Water

Lab Information

Lab Batch ID: M1009
Report Revision No.: 0

LCS ID	Analyte	Spike Amount	Sample Result	Units	% Recovery	Analysis Method	Date Analyzed
General Chemistry							
BS2W0107	Total Organic Carbon	5.00	5.02	mg/L	100	SM5310B	01/08/13

U=Not detected at specified reporting limit
J=Estimated value below reporting limit
E=Estimated value above calibration range
*=See case narrative

**CASE NARRATIVE
WET CHEMISTRY ANALYSIS**

Lab Name: CH2M HILL/LAB/CVO

ASL SDG#: M1009

Project: Camp Lejeune

Project #: 387442.78.WP

I. Method(s):

Analysis: E376.2

II. Receipt/Holding Times:

All acceptance criteria were met.

III. Analysis:

A. Initial Calibration(s):

All acceptance criteria were met.

B. Calibration Verification(s):

All acceptance criteria were met.

C. Blanks:

All acceptance criteria were met.

D. Laboratory Control Sample(s):

All acceptance criteria were met.

E. Matrix Spike/Matrix Spike Duplicate Sample(s):

Analyzed in accordance with standard operating procedure.

F. Analytical Exception(s):

None.

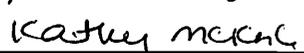
IV. Documentation Exception(s):

None.

V. I certify that this data package is in compliance with the terms and conditions agreed to by the client and CH2M HILL, both technically and for completeness, except for the conditions detailed above. Release of the data contained in this hardcopy data package has been authorized by the Laboratory Manager or designee, as verified by the following signatures.

Prepared by: 

Date: 1/15/13

Reviewed by: 

Date: 1/16/13

CH2M HILL Applied Sciences Laboratory (ASL)

Client Information

Project Name: Camp Lejeune
 Date Received: 01/03/13
 Type: See C.O.C.
 Matrix: Water

Lab Information

Lab Batch ID: M1009
 Analysis Method: E376.2
 Units: ug/L
 Report Revision No.: 0

Client Sample ID	Lab Sample ID	Dilution Factor	RL	Sulfide Result	Qualifier	Date Analyzed
General Chemistry						
Control A (t32)	M100901	5	125	154		01/09/13
Sulfate (t32)	M100902	5	125	127		01/09/13
Control B (t32)	M100903	1	25.0	25.0	U	01/09/13
EHC-L (t32)	M100904	1	25.0	141		01/09/13
WB1-0109	WB1-0109	1	25.0	25.0	U	01/09/13

U=Not detected at specified reporting limit
 J=Estimated value below reporting limit
 E=Estimated value above calibration range
 *=See case narrative

CH2M HILL Applied Sciences Laboratory (ASL)

Client Information

Project Name: Camp Lejeune
Type: QC
Matrix: Water

Lab Information

Lab Batch ID: M1009
Report Revision No.: 0

LCS ID	Analyte	Spike Amount	Sample Result	Units	% Recovery	Analysis Method	Date Analyzed
General Chemistry							
BS1W0109	Sulfide	295	325	ug/L	110	E376.2	01/09/13

U=Not detected at specified reporting limit
J=Estimated value below reporting limit
E=Estimated value above calibration range
*=See case narrative



Sample Receipt Exception Report

Sample Batch Number: M1009

Client/Project Camp Lejeune

The following exceptions were noted:

	Comments (write number of exception description and the impacted sample numbers)
1. No custody seal as required by project	1) Two VOCs are composed of 50% sediment or more
2. No chain-of-custody provided	
3. Analysis, description, date of collection not provided	4) Cap to Control B's TOC is cracked and has been taped over. I will not check PH on this sample.
X 4. Samples broken or leaking on receipt.	
5. Temperature of samples inappropriate for analysis requested	
6. Container inappropriate for analysis requested	
7. Inadequate sample volume.	
8. Preservation inappropriate for analysis requested	
9. Samples received out of holding time for analysis requested	
10. Discrepancies between COC form and container labels.	
X 11. Other.	

ACTION TAKEN:

Originator: Mikio Quinn

Date: 1/3/13

Client was notified on:
(Date/Time)

Client Contact:

Client Services:



ANALYTICAL REPORT

For:
Camp Lejeune

ASL Report #: L3001
Project ID: 387442.78.WP
Attn: Dusty Berggren/CH2M HILL
cc:
Mike Niemet/mike.niemet@ch2m.com

Authorized and Released By:

Laboratory Project Manager
Ben Thompson
(541) 758-0235 ext.23132
December 24, 2012

This data package meets standards requested by client and is not intended or implied to meet any other standard.

All analyses performed by CH2M HILL are clearly indicated. Any subcontracted analyses are included as appended reports as received from the subcontracted laboratory. The results included in this report only relate to the samples listed on the following Sample Cross-Reference page. This report shall not be reproduced except in full, without the written approval of the laboratory.

Any unusual difficulties encountered during the analysis of your samples are discussed in the attached case narratives.

ASL Report #: L3001

Sample Receipt Comments

We certify that the test results meet all standard ASL requirements.

Sample Cross-Reference

ASL Sample ID	Client Sample ID	Date/Time Collected	Date Received
L300101	Control A_t7	12/07/12 15:15	12/07/12
L300102	Sulfate_t7	12/07/12 15:25	12/07/12
L300103	Control B_t7	12/07/12 15:35	12/07/12
L300104	EHC-L_t7	12/07/12 15:45	12/07/12

**CASE NARRATIVE
WET CHEMISTRY ANALYSIS**

Lab Name: CH2M HILL/LAB/CVO

ASL SDG#: L3001

Project: Camp Lejeune

Project #: 387442.78.WP

I. Method(s):

Analysis: SM5310B

II. Receipt/Holding Times:

All acceptance criteria were met.

III. Analysis:

A. Initial Calibration(s):

All acceptance criteria were met.

B. Calibration Verification(s):

All acceptance criteria were met.

C. Blanks:

All acceptance criteria were met.

D. Laboratory Control Sample(s):

All acceptance criteria were met.

E. Matrix Spike/Matrix Spike Duplicate Sample(s):

Analyzed in accordance with standard operating procedure.

F. Analytical Exception(s):

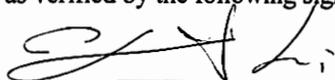
None.

IV. Documentation Exception(s):

None.

V. I certify that this data package is in compliance with the terms and conditions agreed to by the client and CH2M HILL, both technically and for completeness, except for the conditions detailed above. Release of the data contained in this hardcopy data package has been authorized by the Laboratory Manager or designee, as verified by the following signatures.

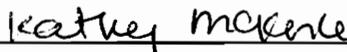
Prepared by: _____



Date: _____

12/20/2012

Reviewed by: _____



Date: _____

12/22/12

CH2M HILL Applied Sciences Laboratory (ASL)

<u>Client Information</u>	<u>Lab Information</u>
Client Sample ID: Control A_t7	Lab Sample ID: L300101
Project Name: Camp Lejeune	Date Received: 12/07/12
Sample Date: 12/07/12	Report Revision No.: 0
Sample Time: 15:15	
Type: Grab	
Matrix: Water	

Analyte	Dilution Factor	RL	Sample Result	Qual	Units	Analysis Method	Date Analyzed
General Chemistry							
Total Organic Carbon	10	5.00	16.2		mg/L	SM5310B	12/14/12

U=Not detected at specified reporting limit
 J=Estimated value below reporting limit
 E=Estimated value above calibration range
 *=See case narrative

CH2M HILL Applied Sciences Laboratory (ASL)

<u>Client Information</u>				<u>Lab Information</u>			
Client Sample ID: Sulfate_t7				Lab Sample ID: L300102			
Project Name: Camp Lejeune				Date Received: 12/07/12			
Sample Date: 12/07/12				Report Revision No.: 0			
Sample Time: 15:25							
Type: Grab							
Matrix: Water							

Analyte	Dilution Factor	RL	Sample Result	Qual	Units	Analysis Method	Date Analyzed
General Chemistry							
Total Organic Carbon	10	5.00	17.6		mg/L	SM5310B	12/14/12

U=Not detected at specified reporting limit
 J=Estimated value below reporting limit
 E=Estimated value above calibration range
 *=See case narrative

CH2M HILL Applied Sciences Laboratory (ASL)

<u>Client Information</u>				<u>Lab Information</u>			
Client Sample ID: Control B_t7				Lab Sample ID: L300103			
Project Name: Camp Lejeune				Date Received: 12/07/12			
Sample Date: 12/07/12				Report Revision No.: 0			
Sample Time: 15:35							
Type: Grab							
Matrix: Water							

Analyte	Dilution Factor	RL	Sample Result	Qual	Units	Analysis Method	Date Analyzed
General Chemistry							
Total Organic Carbon	1	0.50	2.08		mg/L	SM5310B	12/14/12

U=Not detected at specified reporting limit
 J=Estimated value below reporting limit
 E=Estimated value above calibration range
 *=See case narrative

CH2M HILL Applied Sciences Laboratory (ASL)

<u>Client Information</u>		<u>Lab Information</u>	
Client Sample ID: EHC-L_t7		Lab Sample ID: L300104	
Project Name: Camp Lejeune		Date Received: 12/07/12	
Sample Date: 12/07/12		Report Revision No.: 0	
Sample Time: 15:45			
Type: Grab			
Matrix: Water			

Analyte	Dilution Factor	RL	Sample Result	Qual	Units	Analysis Method	Date Analyzed
General Chemistry							
Total Organic Carbon	20	10.0	41.7		mg/L	SM5310B	12/14/12

U=Not detected at specified reporting limit
 J=Estimated value below reporting limit
 E=Estimated value above calibration range
 *=See case narrative

CH2M HILL Applied Sciences Laboratory (ASL)

Client Information

Project Name: Camp Lejeune

Type: QC
Matrix: Water

Lab Information

Lab Batch ID: L3001

Date Received: N/A
Report Revision No.: 0

Blank ID	Analyte	RL	Sample Result	Qualifier	Units	Analysis Method	Date Analyzed
General Chemistry							
WB1-1214	Total Organic Carbon	0.50	0.50	U	mg/L	SM5310B	12/14/12

U=Not detected at specified reporting limit
J=Estimated value below reporting limit
E=Estimated value above calibration range
*=See case narrative

CH2M HILL Applied Sciences Laboratory (ASL)

Client Information

Project Name: Camp Lejeune
Type: QC
Matrix: Water

Lab Information

Lab Batch ID: L3001
Report Revision No.: 0

LCS ID	Analyte	Spike Amount	Sample Result	Units	% Recovery	Analysis Method	Date Analyzed
General Chemistry							
BS1W1214	Total Organic Carbon	2.50	2.28	mg/L	91	SM5310B	12/14/12

U=Not detected at specified reporting limit
J=Estimated value below reporting limit
E=Estimated value above calibration range
*=See case narrative

**CASE NARRATIVE
WET CHEMISTRY ANALYSIS**

Lab Name: CH2M HILL/LAB/CVO

ASL SDG#: L3001

Project: Camp Lejeune

Project #: 387442.78.WP

I. Method(s):

Analysis: E376.2

II. Receipt/Holding Times:

All acceptance criteria were met.

III. Analysis:

A. Initial Calibration(s):

All acceptance criteria were met.

B. Calibration Verification(s):

All acceptance criteria were met.

C. Blanks:

All acceptance criteria were met.

D. Laboratory Control Sample(s):

All acceptance criteria were met.

E. Matrix Spike/Matrix Spike Duplicate Sample(s):

All acceptance criteria were met.

F. Analytical Exception(s):

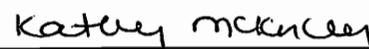
None.

IV. Documentation Exception(s):

None.

V. I certify that this data package is in compliance with the terms and conditions agreed to by the client and CH2M HILL, both technically and for completeness, except for the conditions detailed above. Release of the data contained in this hardcopy data package has been authorized by the Laboratory Manager or designee, as verified by the following signatures.

Prepared by:  Date: 12/19/12

Reviewed by:  Date: 12/20/12

CH2M HILL Applied Sciences Laboratory (ASL)

<u>Client Information</u>	<u>Lab Information</u>
Project Name: Camp Lejeune	Lab Batch ID: L3001
Date Received: 12/07/12	Analysis Method: E376.2
Type: See C.O.C.	Units: ug/L
Matrix: Water	Report Revision No.: 0

Client Sample ID	Lab Sample ID	Dilution Factor	RL	Sulfide Result	Qualifier	Date Analyzed
General Chemistry						
Control A_t7	L300101	1	25.0	88.0		12/14/12
Sulfate_t7	L300102	1	25.0	79.5		12/14/12
Control B_t7	L300103	1	25.0	49.8		12/14/12
EHC-L_t7	L300104	1	25.0	776		12/14/12
WB1-1214	WB1-1214	1	25.0	25.0	U	12/14/12

U=Not detected at specified reporting limit
 J=Estimated value below reporting limit
 E=Estimated value above calibration range
 *=See case narrative

CH2M HILL Applied Sciences Laboratory (ASL)

<u>Client Information</u>	<u>Lab Information</u>
Project Name: Camp Lejeune Type: QC Matrix: Water	Lab Batch ID: L3001 Report Revision No.: 0

LCS ID	Analyte	Spike Amount	Sample Result	Units	% Recovery	Analysis Method	Date Analyzed
General Chemistry							
BS1W1214	Sulfide	324	319	ug/L	99	E376.2	12/14/12

U=Not detected at specified reporting limit
 J=Estimated value below reporting limit
 E=Estimated value above calibration range
 *=See case narrative

CASE NARRATIVE
GC/MS VOLATILES ANALYSIS

Lab Name: CH2M HILL/LAB/CVO

ASL SDG#: L3001

Project: Camp Lejeune

Project #: 387442.78.WP

- I. Method(s):
Analysis: SW8260B
Preparation: SW5030
- II. Receipt/Holding Times:
All acceptance criteria were met.
- III. Analysis:
- A. Initial Calibration(s):
All acceptance criteria were met.
- B. Calibration Verification(s):
All acceptance criteria were met.
- C. Blank(s):
All acceptance criteria were met.
- D. Laboratory Control Sample(s):
All acceptance criteria were met.
- E. Matrix Spike/Matrix Spike Duplicate Sample(s):
Analyzed in accordance with standard operating procedure.
- F. Surrogate Standard(s):
All acceptance criteria were met.
- G. BFB Tune Verification(s):
All acceptance criteria were met.
- H. Internal Standard(s):
All acceptance criteria were met.
- I. Analytical Exception(s):
Due to instrumental contamination concerns, some samples within this SDG could not be analyzed at 1x dilution. Only one vial provided for analysis.
- IV. Documentation Exception(s):
None.
- V. I certify that this data package is in compliance with the terms and conditions agreed to by the client and CH2M HILL, both technically and for completeness, except for the conditions detailed above. Release of the data contained in this hardcopy data package has been authorized by the Laboratory Manager or designee, as verified by the following signatures.

Prepared by: _____

Date: 12/13/12

Reviewed by: _____

Date: 12/14/12

CH2M HILL Applied Sciences Laboratory (ASL)

<u>Client Information</u>				<u>Lab Information</u>			
Client Sample ID: Control A_t7				Lab Sample ID: L300101			
Project Name: Camp Lejeune				Date Received: 12/07/12			
Sample Date: 12/07/12				Dilution Factor: 2.2			
Sample Time: 15:15				Report Revision No.: 0			
Type: Grab							
Matrix: Water							

Analyte	CAS#	DL	RL	Sample Result	Qualifier	Units	Analysis Method	Date Analyzed
GC/MS Volatiles								
Vinyl Chloride	75-01-4	0.44	1.10	1.10	U	ug/L	SW8260B	12/10/12
1,1-Dichloroethene	75-35-4	0.44	1.10	1.10	U	ug/L	SW8260B	12/10/12
Methylene chloride	75-09-2	0.44	1.10	1.10	U	ug/L	SW8260B	12/10/12
trans-1,2-Dichloroethene	156-60-5	0.44	1.10	1.10	U	ug/L	SW8260B	12/10/12
1,1-Dichloroethane	75-34-3	0.44	1.10	1.10	U	ug/L	SW8260B	12/10/12
cis-1,2-Dichloroethene	156-59-2	0.44	1.10	2.27		ug/L	SW8260B	12/10/12
1,2-Dichloroethane	107-06-2	0.44	1.10	1.10	U	ug/L	SW8260B	12/10/12
Benzene	71-43-2	0.44	1.10	19.2		ug/L	SW8260B	12/10/12
Trichloroethene (TCE)	79-01-6	0.44	1.10	41.2		ug/L	SW8260B	12/10/12
Toluene	108-88-3	0.44	1.10	88.6		ug/L	SW8260B	12/10/12
Tetrachloroethene (PCE)	127-18-4	0.44	1.10	1.10	U	ug/L	SW8260B	12/10/12
Ethylbenzene	100-41-4	0.44	1.10	153		ug/L	SW8260B	12/10/12
m,p-Xylene	108-38-3/1	0.88	2.20	652	E	ug/L	SW8260B	12/10/12
o-Xylene	95-47-6	0.44	1.10	256	E	ug/L	SW8260B	12/10/12
Isopropylbenzene	98-82-8	0.44	1.10	43.0		ug/L	SW8260B	12/10/12
1,2-Dibromo-3-chloropropane	96-12-8	0.44	1.10	1.10	U	ug/L	SW8260B	12/10/12

<u>Surrogate</u>	<u>% Recovery</u>	<u>Control Limits</u>	<u>Qualifier</u>
Dibromofluoromethane	94	75-125	
1,2-Dichloroethane-d4	88	75-125	
Toluene-d8	97	75-125	
4-Bromofluorobenzene	93	75-125	

U=Not detected at specified reporting limit
 J=Estimated value below reporting limit
 E=Estimated value above calibration range
 *=See case narrative

CH2M HILL Applied Sciences Laboratory (ASL)

Client Information				Lab Information			
Client Sample ID: Control A_t7DL				Lab Sample ID: L300101DL			
Project Name: Camp Lejeune				Date Received: 12/07/12			
Sample Date: 12/07/12				Dilution Factor: 10			
Sample Time: 15:15				Report Revision No.: 0			
Type: Grab							
Matrix: Water							

Analyte	CAS#	DL	RL	Sample Result	Qualifier	Units	Analysis Method	Date Analyzed
GC/MS Volatiles								
Vinyl Chloride	75-01-4	2.00	5.00	5.00	U	ug/L	SW8260B	12/10/12
1,1-Dichloroethene	75-35-4	2.00	5.00	5.00	U	ug/L	SW8260B	12/10/12
Methylene chloride	75-09-2	2.00	5.00	5.00	U	ug/L	SW8260B	12/10/12
trans-1,2-Dichloroethene	156-60-5	2.00	5.00	5.00	U	ug/L	SW8260B	12/10/12
1,1-Dichloroethane	75-34-3	2.00	5.00	5.00	U	ug/L	SW8260B	12/10/12
cis-1,2-Dichloroethene	156-59-2	2.00	5.00	5.00	U	ug/L	SW8260B	12/10/12
1,2-Dichloroethane	107-06-2	2.00	5.00	5.00	U	ug/L	SW8260B	12/10/12
Benzene	71-43-2	2.00	5.00	20.2		ug/L	SW8260B	12/10/12
Trichloroethene (TCE)	79-01-6	2.00	5.00	42.4		ug/L	SW8260B	12/10/12
Toluene	108-88-3	2.00	5.00	92.5		ug/L	SW8260B	12/10/12
Tetrachloroethene (PCE)	127-18-4	2.00	5.00	5.00	U	ug/L	SW8260B	12/10/12
Ethylbenzene	100-41-4	2.00	5.00	163		ug/L	SW8260B	12/10/12
m,p-Xylene	108-38-3/1	4.00	10.0	809		ug/L	SW8260B	12/10/12
o-Xylene	95-47-6	2.00	5.00	278		ug/L	SW8260B	12/10/12
Isopropylbenzene	98-82-8	2.00	5.00	43.0		ug/L	SW8260B	12/10/12
1,2-Dibromo-3-chloropropane	96-12-8	2.00	5.00	5.00	U	ug/L	SW8260B	12/10/12

Surrogate	% Recovery	Control Limits	Qualifier
Dibromofluoromethane	97	75-125	
1,2-Dichloroethane-d4	92	75-125	
Toluene-d8	101	75-125	
4-Bromofluorobenzene	97	75-125	

U=Not detected at specified reporting limit
 J=Estimated value below reporting limit
 E=Estimated value above calibration range
 *=See case narrative

CH2M HILL Applied Sciences Laboratory (ASL)

Client Information				Lab Information			
Client Sample ID: Sulfate_t7				Lab Sample ID: L300102			
Project Name: Camp Lejeune				Date Received: 12/07/12			
Sample Date: 12/07/12				Dilution Factor: 1			
Sample Time: 15:25				Report Revision No.: 0			
Type: Grab							
Matrix: Water							

Analyte	CAS#	DL	RL	Sample Result	Qualifier	Units	Analysis Method	Date Analyzed
GC/MS Volatiles								
Vinyl Chloride	75-01-4	0.20	0.50	0.50	U	ug/L	SW8260B	12/10/12
1,1-Dichloroethene	75-35-4	0.20	0.50	0.50	U	ug/L	SW8260B	12/10/12
Methylene chloride	75-09-2	0.20	0.50	0.50	U	ug/L	SW8260B	12/10/12
trans-1,2-Dichloroethene	156-60-5	0.20	0.50	0.50	U	ug/L	SW8260B	12/10/12
1,1-Dichloroethane	75-34-3	0.20	0.50	0.50	U	ug/L	SW8260B	12/10/12
cis-1,2-Dichloroethene	156-59-2	0.20	0.50	1.82		ug/L	SW8260B	12/10/12
1,2-Dichloroethane	107-06-2	0.20	0.50	0.50	U	ug/L	SW8260B	12/10/12
Benzene	71-43-2	0.20	0.50	16.4		ug/L	SW8260B	12/10/12
Trichloroethene (TCE)	79-01-6	0.20	0.50	32.9		ug/L	SW8260B	12/10/12
Toluene	108-88-3	0.20	0.50	77.2		ug/L	SW8260B	12/10/12
Tetrachloroethene (PCE)	127-18-4	0.20	0.50	0.50	U	ug/L	SW8260B	12/10/12
Ethylbenzene	100-41-4	0.20	0.50	137	E	ug/L	SW8260B	12/10/12
m,p-Xylene	108-38-3/1	0.40	1.00	603	E	ug/L	SW8260B	12/10/12
o-Xylene	95-47-6	0.20	0.50	231	E	ug/L	SW8260B	12/10/12
Isopropylbenzene	98-82-8	0.20	0.50	40.8		ug/L	SW8260B	12/10/12
1,2-Dibromo-3-chloropropane	96-12-8	0.20	0.50	0.50	U	ug/L	SW8260B	12/10/12

Surrogate	% Recovery	Control Limits	Qualifier
Dibromofluoromethane	93	75-125	
1,2-Dichloroethane-d4	85	75-125	
Toluene-d8	96	75-125	
4-Bromofluorobenzene	96	75-125	

U=Not detected at specified reporting limit
 J=Estimated value below reporting limit
 E=Estimated value above calibration range
 *=See case narrative

CH2M HILL Applied Sciences Laboratory (ASL)

<u>Client Information</u>				<u>Lab Information</u>			
Client Sample ID: Sulfate_t7DL				Lab Sample ID: L300102DL			
Project Name: Camp Lejeune				Date Received: 12/07/12			
Sample Date: 12/07/12				Dilution Factor: 10			
Sample Time: 15:25				Report Revision No.: 0			
Type: Grab							
Matrix: Water							

Analyte	CAS#	DL	RL	Sample Result	Qualifier	Units	Analysis Method	Date Analyzed
GC/MS Volatiles								
Vinyl Chloride	75-01-4	2.00	5.00	5.00	U	ug/L	SW8260B	12/10/12
1,1-Dichloroethene	75-35-4	2.00	5.00	5.00	U	ug/L	SW8260B	12/10/12
Methylene chloride	75-09-2	2.00	5.00	5.00	U	ug/L	SW8260B	12/10/12
trans-1,2-Dichloroethene	156-60-5	2.00	5.00	5.00	U	ug/L	SW8260B	12/10/12
1,1-Dichloroethane	75-34-3	2.00	5.00	5.00	U	ug/L	SW8260B	12/10/12
cis-1,2-Dichloroethene	156-59-2	2.00	5.00	5.00	U	ug/L	SW8260B	12/10/12
1,2-Dichloroethane	107-06-2	2.00	5.00	5.00	U	ug/L	SW8260B	12/10/12
Benzene	71-43-2	2.00	5.00	16.8		ug/L	SW8260B	12/10/12
Trichloroethene (TCE)	79-01-6	2.00	5.00	33.6		ug/L	SW8260B	12/10/12
Toluene	108-88-3	2.00	5.00	79.8		ug/L	SW8260B	12/10/12
Tetrachloroethene (PCE)	127-18-4	2.00	5.00	5.00	U	ug/L	SW8260B	12/10/12
Ethylbenzene	100-41-4	2.00	5.00	139		ug/L	SW8260B	12/10/12
m,p-Xylene	108-38-3/1	4.00	10.0	697		ug/L	SW8260B	12/10/12
o-Xylene	95-47-6	2.00	5.00	239		ug/L	SW8260B	12/10/12
Isopropylbenzene	98-82-8	2.00	5.00	39.8		ug/L	SW8260B	12/10/12
1,2-Dibromo-3-chloropropane	96-12-8	2.00	5.00	5.00	U	ug/L	SW8260B	12/10/12

<u>Surrogate</u>	<u>% Recovery</u>	<u>Control Limits</u>	<u>Qualifier</u>
Dibromofluoromethane	95	75-125	
1,2-Dichloroethane-d4	88	75-125	
Toluene-d8	98	75-125	
4-Bromofluorobenzene	97	75-125	

U=Not detected at specified reporting limit
 J=Estimated value below reporting limit
 E=Estimated value above calibration range
 *=See case narrative

CH2M HILL Applied Sciences Laboratory (ASL)

<u>Client Information</u>				<u>Lab Information</u>			
Client Sample ID: Control B_t7				Lab Sample ID: L300103			
Project Name: Camp Lejeune				Date Received: 12/07/12			
Sample Date: 12/07/12				Dilution Factor: 2.2			
Sample Time: 15:35				Report Revision No.: 0			
Type: Grab							
Matrix: Water							

Analyte	CAS#	DL	RL	Sample Result	Qualifier	Units	Analysis Method	Date Analyzed
GC/MS Volatiles								
Vinyl Chloride	75-01-4	0.44	1.10	1.10	U	ug/L	SW8260B	12/10/12
1,1-Dichloroethene	75-35-4	0.44	1.10	1.10	U	ug/L	SW8260B	12/10/12
Methylene chloride	75-09-2	0.44	1.10	1.10	U	ug/L	SW8260B	12/10/12
trans-1,2-Dichloroethene	156-60-5	0.44	1.10	1.10	U	ug/L	SW8260B	12/10/12
1,1-Dichloroethane	75-34-3	0.44	1.10	1.10	U	ug/L	SW8260B	12/10/12
cis-1,2-Dichloroethene	156-59-2	0.44	1.10	46.3		ug/L	SW8260B	12/10/12
1,2-Dichloroethane	107-06-2	0.44	1.10	1.10	U	ug/L	SW8260B	12/10/12
Benzene	71-43-2	0.44	1.10	1.33		ug/L	SW8260B	12/10/12
Trichloroethene (TCE)	79-01-6	0.44	1.10	41.0		ug/L	SW8260B	12/10/12
Toluene	108-88-3	0.44	1.10	23.0		ug/L	SW8260B	12/10/12
Tetrachloroethene (PCE)	127-18-4	0.44	1.10	1.10	U	ug/L	SW8260B	12/10/12
Ethylbenzene	100-41-4	0.44	1.10	2.37		ug/L	SW8260B	12/10/12
m,p-Xylene	108-38-3/1	0.88	2.20	9.32		ug/L	SW8260B	12/10/12
o-Xylene	95-47-6	0.44	1.10	4.51		ug/L	SW8260B	12/10/12
Isopropylbenzene	98-82-8	0.44	1.10	1.10	U	ug/L	SW8260B	12/10/12
1,2-Dibromo-3-chloropropane	96-12-8	0.44	1.10	1.10	U	ug/L	SW8260B	12/10/12

<u>Surrogate</u>	<u>% Recovery</u>	<u>Control Limits</u>	<u>Qualifier</u>
Dibromofluoromethane	92	75-125	
1,2-Dichloroethane-d4	86	75-125	
Toluene-d8	93	75-125	
4-Bromofluorobenzene	97	75-125	

U=Not detected at specified reporting limit
 J=Estimated value below reporting limit
 E=Estimated value above calibration range
 *=See case narrative

CH2M HILL Applied Sciences Laboratory (ASL)

<u>Client Information</u>				<u>Lab Information</u>			
Client Sample ID: EHC-L_t7				Lab Sample ID: L300104			
Project Name: Camp Lejeune				Date Received: 12/07/12			
Sample Date: 12/07/12				Dilution Factor: 2.2			
Sample Time: 15:45				Report Revision No.: 0			
Type: Grab							
Matrix: Water							

Analyte	CAS#	DL	RL	Sample Result	Qualifier	Units	Analysis Method	Date Analyzed
GC/MS Volatiles								
Vinyl Chloride	75-01-4	0.44	1.10	1.10	U	ug/L	SW8260B	12/10/12
1,1-Dichloroethene	75-35-4	0.44	1.10	1.10	U	ug/L	SW8260B	12/10/12
Methylene chloride	75-09-2	0.44	1.10	1.10	U	ug/L	SW8260B	12/10/12
trans-1,2-Dichloroethene	156-60-5	0.44	1.10	1.10	U	ug/L	SW8260B	12/10/12
1,1-Dichloroethane	75-34-3	0.44	1.10	1.10	U	ug/L	SW8260B	12/10/12
cis-1,2-Dichloroethene	156-59-2	0.44	1.10	46.9		ug/L	SW8260B	12/10/12
1,2-Dichloroethane	107-06-2	0.44	1.10	1.10	U	ug/L	SW8260B	12/10/12
Benzene	71-43-2	0.44	1.10	1.34		ug/L	SW8260B	12/10/12
Trichloroethene (TCE)	79-01-6	0.44	1.10	39.5		ug/L	SW8260B	12/10/12
Toluene	108-88-3	0.44	1.10	22.4		ug/L	SW8260B	12/10/12
Tetrachloroethene (PCE)	127-18-4	0.44	1.10	1.10	U	ug/L	SW8260B	12/10/12
Ethylbenzene	100-41-4	0.44	1.10	1.75		ug/L	SW8260B	12/10/12
m,p-Xylene	108-38-3/1	0.88	2.20	6.32		ug/L	SW8260B	12/10/12
o-Xylene	95-47-6	0.44	1.10	3.26		ug/L	SW8260B	12/10/12
Isopropylbenzene	98-82-8	0.44	1.10	1.10	U	ug/L	SW8260B	12/10/12
1,2-Dibromo-3-chloropropane	96-12-8	0.44	1.10	1.10	U	ug/L	SW8260B	12/10/12

<u>Surrogate</u>	<u>% Recovery</u>	<u>Control Limits</u>	<u>Qualifier</u>
Dibromofluoromethane	92	75-125	
1,2-Dichloroethane-d4	85	75-125	
Toluene-d8	92	75-125	
4-Bromofluorobenzene	94	75-125	

U=Not detected at specified reporting limit
 J=Estimated value below reporting limit
 E=Estimated value above calibration range
 *=See case narrative

CH2M HILL Applied Sciences Laboratory (ASL)

Client Information				Lab Information			
Client Sample ID: WB1-1210				Lab Sample ID: WB1-1210			
Project Name: Camp Lejeune				Date Received: N/A			
Sample Date: N/A				Dilution Factor: 1			
Sample Time: N/A				Report Revision No.: 0			
Type: QC							
Matrix: Water							

Analyte	CAS#	DL	RL	Sample Result	Qualifier	Units	Analysis Method	Date Analyzed
GC/MS Volatiles								
Vinyl Chloride	75-01-4	0.20	0.50	0.50	U	ug/L	SW8260B	12/10/12
1,1-Dichloroethene	75-35-4	0.20	0.50	0.50	U	ug/L	SW8260B	12/10/12
Methylene chloride	75-09-2	0.20	0.50	0.50	U	ug/L	SW8260B	12/10/12
trans-1,2-Dichloroethene	156-60-5	0.20	0.50	0.50	U	ug/L	SW8260B	12/10/12
1,1-Dichloroethane	75-34-3	0.20	0.50	0.50	U	ug/L	SW8260B	12/10/12
cis-1,2-Dichloroethene	156-59-2	0.20	0.50	0.50	U	ug/L	SW8260B	12/10/12
1,2-Dichloroethane	107-06-2	0.20	0.50	0.50	U	ug/L	SW8260B	12/10/12
Benzene	71-43-2	0.20	0.50	0.50	U	ug/L	SW8260B	12/10/12
Trichloroethene (TCE)	79-01-6	0.20	0.50	0.50	U	ug/L	SW8260B	12/10/12
Toluene	108-88-3	0.20	0.50	0.50	U	ug/L	SW8260B	12/10/12
Tetrachloroethene (PCE)	127-18-4	0.20	0.50	0.50	U	ug/L	SW8260B	12/10/12
Ethylbenzene	100-41-4	0.20	0.50	0.50	U	ug/L	SW8260B	12/10/12
m,p-Xylene	108-38-3/1	0.40	1.00	1.00	U	ug/L	SW8260B	12/10/12
o-Xylene	95-47-6	0.20	0.50	0.50	U	ug/L	SW8260B	12/10/12
Isopropylbenzene	98-82-8	0.20	0.50	0.50	U	ug/L	SW8260B	12/10/12
1,2-Dibromo-3-chloropropane	96-12-8	0.20	0.50	0.50	U	ug/L	SW8260B	12/10/12

Surrogate	% Recovery	Control Limits	Qualifier
Dibromofluoromethane	93	75-125	
1,2-Dichloroethane-d4	88	75-125	
Toluene-d8	92	75-125	
4-Bromofluorobenzene	94	75-125	

U=Not detected at specified reporting limit
 J=Estimated value below reporting limit
 E=Estimated value above calibration range
 *=See case narrative

CH2M HILL Applied Sciences Laboratory (ASL)

<u>Client Information</u>	<u>Lab Information</u>
Project Name: Camp Lejeune	LCS ID: BS1W1210
Type: QC	Report Revision No.: 0
Matrix: Water	Dilution Factor: 1

Analyte	CAS#	Spike Amount	Sample Result	Units	%Recovery	Analysis Method	Date Analyzed
GC/MS Volatiles							
Vinyl Chloride	75-01-4	20.0	17.7	ug/L	89	SW8260B	12/10/12
1,1-Dichloroethene	75-35-4	20.0	16.3	ug/L	82	SW8260B	12/10/12
Methylene chloride	75-09-2	20.0	18.3	ug/L	92	SW8260B	12/10/12
trans-1,2-Dichloroethene	156-60-5	20.0	17.6	ug/L	88	SW8260B	12/10/12
1,1-Dichloroethane	75-34-3	20.0	18.0	ug/L	90	SW8260B	12/10/12
cis-1,2-Dichloroethene	156-59-2	20.0	17.9	ug/L	90	SW8260B	12/10/12
1,2-Dichloroethane	107-06-2	20.0	17.0	ug/L	85	SW8260B	12/10/12
Benzene	71-43-2	20.0	18.5	ug/L	92	SW8260B	12/10/12
Trichloroethene (TCE)	79-01-6	20.0	18.6	ug/L	93	SW8260B	12/10/12
Toluene	108-88-3	20.0	18.3	ug/L	92	SW8260B	12/10/12
Tetrachloroethene (PCE)	127-18-4	20.0	18.1	ug/L	90	SW8260B	12/10/12
Ethylbenzene	100-41-4	20.0	18.1	ug/L	91	SW8260B	12/10/12
m,p-Xylene	108-38-3/1	40.0	36.1	ug/L	90	SW8260B	12/10/12
o-Xylene	95-47-6	20.0	18.1	ug/L	91	SW8260B	12/10/12
Isopropylbenzene	98-82-8	20.0	16.9	ug/L	84	SW8260B	12/10/12
1,2-Dibromo-3-chloropropane	96-12-8	20.0	19.2	ug/L	96	SW8260B	12/10/12

Surrogate	% Recovery	Control Limits	Qualifier
Dibromofluoromethane	96	75-125	
1,2-Dichloroethane-d4	88	75-125	
Toluene-d8	95	75-125	
4-Bromofluorobenzene	96	75-125	

U=Not detected at specified reporting limit
 J=Estimated value below reporting limit
 E=Estimated value above calibration range
 *=See case narrative

CASE NARRATIVE
METALS ANALYSIS

Lab Name: CH2M HILL/LAB/CVO

ASL SDG#: L3001

Project: Camp Lejeune

Project #: 387442.78.WP

I. Method(s):

Analysis: E200.7

Preparation: E200.2, FLDFLT

II. Receipt/Holding Times:

All acceptance criteria were met.

III. Analysis:

A. Initial Calibration(s):

All acceptance criteria were met.

B. Calibration Verification(s):

All acceptance criteria were met.

C. Blanks:

All acceptance criteria were met.

D. Laboratory Control Sample(s):

All acceptance criteria were met.

E. Matrix Spike/Matrix Spike Duplicate Sample(s):

Analyzed in accordance with standard operating procedure.

F. Interference Check Sample(s):

All acceptance criteria were met.

G. Serial Dilution(s):

Analyzed in accordance with standard operating procedure.

H. Digestion Exception(s):

None.

I. Analytical Exception(s):

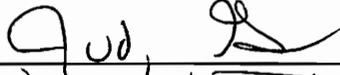
None.

IV. Documentation Exception(s):

None.

V. I certify that this data package is in compliance with the terms and conditions agreed to by the client and CH2M HILL, both technically and for completeness, except for the conditions detailed above. Release of the data contained in this hardcopy data package has been authorized by the Laboratory Manager or designee, as verified by the following signatures.

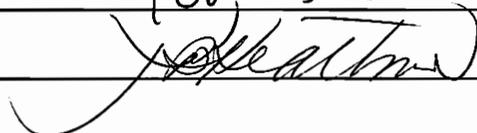
Prepared by: _____



Date: _____

12-14-12

Reviewed by: _____



Date: _____

12-17-12

CH2M HILL Applied Sciences Laboratory (ASL)

Client Information			Lab Information		
Project Name:	Camp Lejeune		Lab Batch ID:	L3001	
Date Received:	12/07/12		Report Revision No.:	0	
Type:	See C.O.C.				
Matrix:	Water				

Client Sample ID	Lab Sample ID	Dilution Factor	RL	Result	Qual	Units	Date Analyzed
Metals							
Iron: E200.7							
<i>Dissolved</i>							
Control A_t7	L300101F	1	100	9030		ug/L	12/11/12
Sulfate_t7	L300102F	1	100	10900		ug/L	12/11/12
Control B_t7	L300103F	1	100	331		ug/L	12/11/12
EHC-L_t7	L300104F	1	100	2140		ug/L	12/11/12
<i>Total</i>							
WB1-1211	WB1-1211	1	100	100	U	ug/L	12/11/12

U=Not detected at specified reporting limit
 J=Estimated value below reporting limit
 E=Estimated value above calibration range
 *=See case narrative

CH2M HILL Applied Sciences Laboratory (ASL)

<u>Client Information</u>	<u>Lab Information</u>
Project Name: Camp Lejeune Type: QC Matrix: Water	LCS ID: BS1W1211 Report Revision No.: 0 Dilution Factor: 1

Analyte	CAS#	Spike Amount	Sample Result	Units	%Recovery	Analysis Method	Date Analyzed
Metals							
Iron	7439-89-6	500	536	ug/L	107	E200.7	12/11/12

U=Not detected at specified reporting limit
 J=Estimated value below reporting limit
 E=Estimated value above calibration range
 *=See case narrative

**CASE NARRATIVE
ION CHROMATOGRAPHY ANALYSIS**

Lab Name: CH2M HILL/LAB/CVO

ASL SDG#: L3001

Project: Camp Lejeune

Project #: 387442.78.WP

I. Method(s):

Analysis: E300.0A

II. Receipt/Holding Times:

All acceptance criteria were met.

III. Analysis:

A. Initial Calibration(s):

All acceptance criteria were met.

B. Calibration Verification(s):

All acceptance criteria were met.

C. Blanks:

All acceptance criteria were met.

D. Laboratory Control Sample(s):

All acceptance criteria were met.

E. Matrix Spike/Matrix Spike Duplicate Sample(s):

Analyzed in accordance with standard operating procedure.

F. Analytical Exception(s):

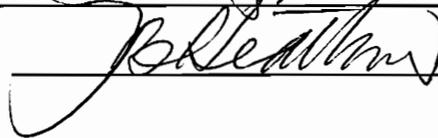
None.

IV. Documentation Exception(s):

None.

V. I certify that this data package is in compliance with the terms and conditions agreed to by the client and CH2M HILL, both technically and for completeness, except for the conditions detailed above. Release of the data contained in this hardcopy data package has been authorized by the Laboratory Manager or designee, as verified by the following signatures.

Prepared by: _____

Date: _____

12/10/2012

Reviewed by: _____

Date: _____

12/13/12

CH2M HILL Applied Sciences Laboratory (ASL)

<u>Client Information</u>	<u>Lab Information</u>
Client Sample ID: Control A_t7	Lab Sample ID: L300101
Project Name: Camp Lejeune	Date Received: 12/07/12
Sample Date: 12/07/12	Report Revision No.: 0
Sample Time: 15:15	
Type: Grab	
Matrix: Water	

Analyte	Dilution Factor	RL	Sample Result	Qual	Units	Analysis Method	Date Analyzed
General Chemistry							
Nitrate-N	1	0.10	0.10	U	mg/L	E300.0A	12/07/12 18:51
Sulfate	1	0.10	8.37		mg/L	E300.0A	12/07/12

U=Not detected at specified reporting limit
 J=Estimated value below reporting limit
 E=Estimated value above calibration range
 *=See case narrative

CH2M HILL Applied Sciences Laboratory (ASL)

<u>Client Information</u>	<u>Lab Information</u>
Client Sample ID: Sulfate_t7	Lab Sample ID: L300102
Project Name: Camp Lejeune	Date Received: 12/07/12
Sample Date: 12/07/12	Report Revision No.: 0
Sample Time: 15:25	
Type: Grab	
Matrix: Water	

Analyte	Dilution Factor	RL	Sample Result	Qual	Units	Analysis Method	Date Analyzed
General Chemistry							
Nitrate-N	1	0.10	0.10	U	mg/L	E300.0A	12/07/12 19:11
Sulfate	5	0.50	91.9		mg/L	E300.0A	12/07/12

U=Not detected at specified reporting limit
 J=Estimated value below reporting limit
 E=Estimated value above calibration range
 *=See case narrative

CH2M HILL Applied Sciences Laboratory (ASL)

<u>Client Information</u>	<u>Lab Information</u>
Client Sample ID: Control B_t7	Lab Sample ID: L300103
Project Name: Camp Lejeune	Date Received: 12/07/12
Sample Date: 12/07/12	Report Revision No.: 0
Sample Time: 15:35	
Type: Grab	
Matrix: Water	

Analyte	Dilution Factor	RL	Sample Result	Qual	Units	Analysis Method	Date Analyzed
General Chemistry							
Nitrate-N	1	0.10	0.10	U	mg/L	E300.0A	12/07/12 19:32
Sulfate	5	0.50	31.7		mg/L	E300.0A	12/07/12

U=Not detected at specified reporting limit
 J=Estimated value below reporting limit
 E=Estimated value above calibration range
 *=See case narrative

CH2M HILL Applied Sciences Laboratory (ASL)

<u>Client Information</u>	<u>Lab Information</u>
Client Sample ID: EHC-L_t7	Lab Sample ID: L300104
Project Name: Camp Lejeune	Date Received: 12/07/12
Sample Date: 12/07/12	Report Revision No.: 0
Sample Time: 15:45	
Type: Grab	
Matrix: Water	

Analyte	Dilution Factor	RL	Sample Result	Qual	Units	Analysis Method	Date Analyzed
General Chemistry							
Nitrate-N	1	0.10	0.10	U	mg/L	E300.0A	12/07/12 19:52
Sulfate	1	0.10	16.7		mg/L	E300.0A	12/07/12

U=Not detected at specified reporting limit
 J=Estimated value below reporting limit
 E=Estimated value above calibration range
 *=See case narrative

CH2M HILL Applied Sciences Laboratory (ASL)

<u>Client Information</u>	<u>Lab Information</u>
Project Name: Camp Lejeune	Lab Batch ID: L3001
Type: QC	Date Received: N/A
Matrix: Water	Report Revision No.: 0

Blank ID	Analyte	RL	Sample Result	Qualifier	Units	Analysis Method	Date Analyzed
General Chemistry							
WB1-1207	Nitrate-N	0.10	0.10	U	mg/L	E300.0A	12/07/12 18:30
WB1-1207	Sulfate	0.10	0.10	U	mg/L	E300.0A	12/07/12

U=Not detected at specified reporting limit
 J=Estimated value below reporting limit
 E=Estimated value above calibration range
 *=See case narrative

CH2M HILL Applied Sciences Laboratory (ASL)

<u>Client Information</u>	<u>Lab Information</u>
Project Name: Camp Lejeune Type: QC Matrix: Water	Lab Batch ID: L3001 Report Revision No.: 0

LCS ID	Analyte	Spike Amount	Sample Result	Units	% Recovery	Analysis Method	Date Analyzed
General Chemistry							
BS1W1207	Nitrate-N	3.00	2.95	mg/L	98	E300.0A	12/07/12
BS1W1207	Sulfate	15.0	13.7	mg/L	91	E300.0A	12/07/12

U=Not detected at specified reporting limit
 J=Estimated value below reporting limit
 E=Estimated value above calibration range
 *=See case narrative

CH2MHILL Applied Sciences Lab
CHAIN OF CUSTODY RECORD
AND AGREEMENT TO PERFORM SERVICES

1000 NE Circle Blvd., Suite 10350
 Corvallis, OR 97330
 (541) 768-3120 FAX (541) 752-0276

COC #

Project # or Purchase Order # 387442.78.WP		Requested Analytical Method #										THIS AREA FOR LAB USE ONLY																																																																																													
Project Name Camp Lejeune Site 78												Sulfate & Nitrate (E300.0) VOCs (SW8260B)* Dissolved Iron (200.7) **PRE-FILTERED** TOC Sulfide										Lab # 23001	Page	of																																																																																	
Company Name or Home Address/Phone Number CH2M HILL		PRESERVATIVE UNPRES HCl HNO3 H2SO4 ZnAc UNPRES UNPRES																				EPA Tier QC Level 1 (Screening) 2 3 4																																																																																			
Email Address for Reporting Dusty Berggren/CVO												Report Copy to: Mike Niemet/CVO		CLIENT SAMPLE ID										Canister ID		Lab ID																																																																															
Turnaround Time <input type="checkbox"/> 24 hours <input type="checkbox"/> 48 hours <input type="checkbox"/> 72 hours <input checked="" type="checkbox"/> 7 days <input type="checkbox"/> 14 days <input type="checkbox"/> 21 days (STD)		Drinking Water? Yes <input type="checkbox"/> No <input checked="" type="checkbox"/>		Sample Disposal: Dispose <input checked="" type="checkbox"/> Return <input type="checkbox"/>		<table border="1"> <thead> <tr> <th>Sampling</th> <th>Type</th> <th colspan="5">Matrix</th> <th rowspan="2">CLIENT SAMPLE ID</th> <th rowspan="2">TOTAL # OF CONTAINERS</th> <th rowspan="2">UNPRES</th> <th rowspan="2">HCl</th> <th rowspan="2">HNO3</th> <th rowspan="2">H2SO4</th> <th rowspan="2">ZnAc</th> <th rowspan="2">UNPRES</th> <th rowspan="2">UNPRES</th> </tr> <tr> <th>Date</th> <th>Time</th> <th>COMP</th> <th>GRAB</th> <th>WATER</th> <th>SOIL</th> <th>AIR</th> </tr> </thead> <tbody> <tr> <td>12/7/12</td> <td>1515</td> <td></td> <td>x</td> <td>x</td> <td></td> <td></td> <td>Control A_t7</td> <td>5</td> <td>1</td> <td>1</td> <td>1</td> <td>1</td> <td>1</td> <td></td> <td></td> </tr> <tr> <td>12/7/12</td> <td>1525</td> <td></td> <td>x</td> <td>x</td> <td></td> <td></td> <td>Sulfate_t7</td> <td>5</td> <td>1</td> <td>1</td> <td>1</td> <td>1</td> <td>1</td> <td></td> <td></td> </tr> <tr> <td>12/7/12</td> <td>1535</td> <td></td> <td>X</td> <td>X</td> <td></td> <td></td> <td>Control B_t7</td> <td>5</td> <td>1</td> <td>1</td> <td>1</td> <td>1</td> <td>1</td> <td></td> <td></td> </tr> <tr> <td>12/7/12</td> <td>1545</td> <td></td> <td>X</td> <td>X</td> <td></td> <td></td> <td>EHC-L_t7</td> <td>5</td> <td>1</td> <td>1</td> <td>1</td> <td>1</td> <td>1</td> <td></td> <td></td> </tr> </tbody> </table>																		Sampling	Type	Matrix					CLIENT SAMPLE ID	TOTAL # OF CONTAINERS	UNPRES	HCl	HNO3	H2SO4	ZnAc	UNPRES	UNPRES	Date	Time	COMP	GRAB	WATER	SOIL	AIR	12/7/12	1515		x	x			Control A_t7	5	1	1	1	1	1			12/7/12	1525		x	x			Sulfate_t7	5	1	1	1	1	1			12/7/12	1535		X	X			Control B_t7	5	1	1	1	1	1			12/7/12	1545		X	X			EHC-L_t7	5	1	1
Sampling	Type	Matrix														CLIENT SAMPLE ID	TOTAL # OF CONTAINERS	UNPRES	HCl	HNO3	H2SO4	ZnAc	UNPRES	UNPRES																																																																																	
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12/7/12	1515		x	x			Control A_t7	5	1	1	1	1	1																																																																																												
12/7/12	1525		x	x			Sulfate_t7	5	1	1	1	1	1																																																																																												
12/7/12	1535		X	X			Control B_t7	5	1	1	1	1	1																																																																																												
12/7/12	1545		X	X			EHC-L_t7	5	1	1	1	1	1																																																																																												

Possible Hazard Identification: Non-Hazard Flammable Skin Irritant Poison B Unknown Volatile Contaminants/Odororous Biohazard Other _____

Relinquished By _____ Date/Time _____		Received By: <i>Carmen Bell</i> 12/7/12 1600	
Sampled By and Title <i>Dusty RV Berggren</i> (Please sign and print name) Date/Time <i>15:45 12/7/12</i>		Relinquished By <i>Dusty RV Berggren</i> (Please sign and print name) Date/Time <i>1550 12/7/12</i>	
Received By _____ (Please sign and print name) Date/Time _____		Relinquished By _____ (Please sign and print name) Date/Time _____	
Received By _____ (Please sign and print name) Date/Time _____		Shipped Via _____ Tracking # _____ UPS Fed-Ex Other _____	

Special Instructions
 Please provide preliminary VOC results when available. NOTE LIMITED VOLUME. See t=0 results (L2953) for dilutions guidance. This batch should have slightly lower VOCs & sulfate.
 *Only report the following VOCs: benzene, ethylbenzene, toluene, xylenes, tetrachloroethene (PCE), trichloroethene (TCE), 1,1-dichloroethene (DCE), cis-1,2-DCE, trans-1,2-DCE, vinyl chloride (VC), 1,1-dichloroethane (DCA), 1,2-DCA, 1,2-dibromo-3-chloropropane, isopropylbenzene, and methylbenzene chloride.

Instructions and Agreement Provisions on Reverse Side

DISTRIBUTION: Original – LAB, Yellow – LAB, Pink – Client
 Rev 09/2010 LAB FORM 340



ANALYTICAL REPORT

For:
Camp Lejeune

ASL Report #: M1252

Project ID: 387442.78.WP

Attn: Dusty Berggren/CVO

cc:
Mike Niemet/CVO

Authorized and Released By:

Laboratory Project Manager

Ben Thompson

(541) 758-0235 ext.23132

March 11, 2013

This data package meets standards requested by client and is not intended or implied to meet any other standard.

All analyses performed by CH2M HILL are clearly indicated. Any subcontracted analyses are included as appended reports as received from the subcontracted laboratory. The results included in this report only relate to the samples listed on the following Sample Cross-Reference page. This report shall not be reproduced except in full, without the written approval of the laboratory.

Any unusual difficulties encountered during the analysis of your samples are discussed in the attached case narratives.

ASL Report #: M1252

Sample Receipt Comments

We certify that the test results meet all standard ASL requirements.

Sample Cross-Reference

ASL Sample ID	Client Sample ID	Date/Time Collected	Date Received
M125201	ContA_aug_t0	02/20/13 13:45	02/20/13
M125202	Sulf_aug_t0	02/20/13 13:55	02/20/13
M125203	ContB_bio_t0	02/20/13 13:15	02/20/13
M125204	EHCL_bio_t0	02/20/13 13:30	02/20/13
M125205	ContA_old_t0	02/20/13 14:30	02/20/13
M125206	Sulf_old_t0	02/20/13 14:45	02/20/13

**CASE NARRATIVE
GC/MS VOLATILES ANALYSIS**

Lab Name: CH2M HILL/LAB/CVO

ASL SDG#: M1252

Project: Camp Lejeune

Project #: 387442.78.WP

I. Method(s):

Analysis: SW8260B

Preparation: SW5030

II. Receipt/Holding Times:

All acceptance criteria were met.

III. Analysis:

A. Initial Calibration(s):

All acceptance criteria were met.

B. Calibration Verification(s):

All acceptance criteria were met.

C. Blank(s):

All acceptance criteria were met.

D. Laboratory Control Sample(s):

All acceptance criteria were met.

E. Matrix Spike/Matrix Spike Duplicate Sample(s):

Analyzed in accordance with standard operating procedure.

F. Surrogate Standard(s):

All acceptance criteria were met.

G. BFB Tune Verification(s):

All acceptance criteria were met.

H. Internal Standard(s):

All acceptance criteria were met.

I. Analytical Exception(s):

Only one vial provided for analysis. Multiple dilutions were taken from this single vial. Dilution estimates were necessary and may have not been adequate to ensure all compounds were within the range of calibration.

IV. Documentation Exception(s):

None.

V. I certify that this data package is in compliance with the terms and conditions agreed to by the client and CH2M HILL, both technically and for completeness, except for the conditions detailed above. Release of the data contained in this hardcopy data package has been authorized by the Laboratory Manager or designee, as verified by the following signatures.

Prepared by:



Date:

3/7/13

Reviewed by:



Date:

3/8/13

CH2M HILL Applied Sciences Laboratory (ASL)

<u>Client Information</u>				<u>Lab Information</u>			
Client Sample ID: ContA_aug_t0				Lab Sample ID: M125201			
Project Name: Camp Lejeune				Date Received: 02/20/13			
Sample Date: 02/20/13				Dilution Factor: 10			
Sample Time: 13:45				Report Revision No.: 0			
Type: Grab							
Matrix: Water							

Analyte	CAS#	DL	RL	Sample Result	Qualifier	Units	Analysis Method	Date Analyzed
GC/MS Volatiles								
Vinyl Chloride	75-01-4	2.00	5.00	5.00	U	ug/L	SW8260B	02/22/13
1,1-Dichloroethene	75-35-4	2.00	5.00	5.00	U	ug/L	SW8260B	02/22/13
Methylene chloride	75-09-2	2.00	5.00	5.00	U	ug/L	SW8260B	02/22/13
trans-1,2-Dichloroethene	156-60-5	2.00	5.00	5.00	U	ug/L	SW8260B	02/22/13
1,1-Dichloroethane	75-34-3	2.00	5.00	5.00	U	ug/L	SW8260B	02/22/13
cis-1,2-Dichloroethene	156-59-2	2.00	5.00	5.00	U	ug/L	SW8260B	02/22/13
1,2-Dichloroethane	107-06-2	2.00	5.00	5.00	U	ug/L	SW8260B	02/22/13
Benzene	71-43-2	2.00	5.00	5.00	U	ug/L	SW8260B	02/22/13
Trichloroethene (TCE)	79-01-6	2.00	5.00	661		ug/L	SW8260B	02/22/13
Toluene	108-88-3	2.00	5.00	6870	E	ug/L	SW8260B	02/22/13
Tetrachloroethene (PCE)	127-18-4	2.00	5.00	5.00	U	ug/L	SW8260B	02/22/13
Ethylbenzene	100-41-4	2.00	5.00	7.51		ug/L	SW8260B	02/22/13
m,p-Xylene	108-38-3/1	4.00	10.0	39.6		ug/L	SW8260B	02/22/13
o-Xylene	95-47-6	2.00	5.00	11.5		ug/L	SW8260B	02/22/13
Isopropylbenzene	98-82-8	2.00	5.00	6.25		ug/L	SW8260B	02/22/13
1,2-Dibromo-3-chloropropane	96-12-8	2.00	5.00	5.00	U	ug/L	SW8260B	02/22/13

<u>Surrogate</u>	<u>% Recovery</u>	<u>Control Limits</u>	<u>Qualifier</u>
Dibromofluoromethane	100	75-125	
1,2-Dichloroethane-d4	110	75-125	
Toluene-d8	100	75-125	
4-Bromofluorobenzene	90	75-125	

U=Not detected at specified reporting limit
 J=Estimated value below reporting limit
 E=Estimated value above calibration range
 *=See case narrative

CH2M HILL Applied Sciences Laboratory (ASL)

Client Information				Lab Information			
Client Sample ID: ContA_aug_t0DL				Lab Sample ID: M125201DL			
Project Name: Camp Lejeune				Date Received: 02/20/13			
Sample Date: 02/20/13				Dilution Factor: 50			
Sample Time: 13:45				Report Revision No.: 0			
Type: Grab							
Matrix: Water							

Analyte	CAS#	DL	RL	Sample Result	Qualifier	Units	Analysis Method	Date Analyzed
GC/MS Volatiles								
Vinyl Chloride	75-01-4	10.0	25.0	25.0	U	ug/L	SW8260B	02/22/13
1,1-Dichloroethene	75-35-4	10.0	25.0	25.0	U	ug/L	SW8260B	02/22/13
Methylene chloride	75-09-2	10.0	25.0	25.0	U	ug/L	SW8260B	02/22/13
trans-1,2-Dichloroethene	156-60-5	10.0	25.0	25.0	U	ug/L	SW8260B	02/22/13
1,1-Dichloroethane	75-34-3	10.0	25.0	25.0	U	ug/L	SW8260B	02/22/13
cis-1,2-Dichloroethene	156-59-2	10.0	25.0	25.0	U	ug/L	SW8260B	02/22/13
1,2-Dichloroethane	107-06-2	10.0	25.0	25.0	U	ug/L	SW8260B	02/22/13
Benzene	71-43-2	10.0	25.0	25.0	U	ug/L	SW8260B	02/22/13
Trichloroethene (TCE)	79-01-6	10.0	25.0	568		ug/L	SW8260B	02/22/13
Toluene	108-88-3	10.0	25.0	12600	E	ug/L	SW8260B	02/22/13
Tetrachloroethene (PCE)	127-18-4	10.0	25.0	25.0	U	ug/L	SW8260B	02/22/13
Ethylbenzene	100-41-4	10.0	25.0	25.0	U	ug/L	SW8260B	02/22/13
m,p-Xylene	108-38-3/1	20.0	50.0	50.0	U	ug/L	SW8260B	02/22/13
o-Xylene	95-47-6	10.0	25.0	25.0	U	ug/L	SW8260B	02/22/13
Isopropylbenzene	98-82-8	10.0	25.0	25.0	U	ug/L	SW8260B	02/22/13
1,2-Dibromo-3-chloropropane	96-12-8	10.0	25.0	25.0	U	ug/L	SW8260B	02/22/13

Surrogate	% Recovery	Control Limits	Qualifier
Dibromofluoromethane	102	75-125	
1,2-Dichloroethane-d4	115	75-125	
Toluene-d8	98	75-125	
4-Bromofluorobenzene	85	75-125	

U=Not detected at specified reporting limit
 J=Estimated value below reporting limit
 E=Estimated value above calibration range
 *=See case narrative

CH2M HILL Applied Sciences Laboratory (ASL)

Client Information				Lab Information			
Client Sample ID: Sulf_aug_t0				Lab Sample ID: M125202			
Project Name: Camp Lejeune				Date Received: 02/20/13			
Sample Date: 02/20/13				Dilution Factor: 10			
Sample Time: 13:55				Report Revision No.: 0			
Type: Grab							
Matrix: Water							

Analyte	CAS#	DL	RL	Sample Result	Qualifier	Units	Analysis Method	Date Analyzed
GC/MS Volatiles								
Vinyl Chloride	75-01-4	2.00	5.00	5.00	U	ug/L	SW8260B	02/22/13
1,1-Dichloroethene	75-35-4	2.00	5.00	5.00	U	ug/L	SW8260B	02/22/13
Methylene chloride	75-09-2	2.00	5.00	5.00	U	ug/L	SW8260B	02/22/13
trans-1,2-Dichloroethene	156-60-5	2.00	5.00	5.00	U	ug/L	SW8260B	02/22/13
1,1-Dichloroethane	75-34-3	2.00	5.00	5.00	U	ug/L	SW8260B	02/22/13
cis-1,2-Dichloroethene	156-59-2	2.00	5.00	5.00	U	ug/L	SW8260B	02/22/13
1,2-Dichloroethane	107-06-2	2.00	5.00	5.00	U	ug/L	SW8260B	02/22/13
Benzene	71-43-2	2.00	5.00	5.00	U	ug/L	SW8260B	02/22/13
Trichloroethene (TCE)	79-01-6	2.00	5.00	551		ug/L	SW8260B	02/22/13
Toluene	108-88-3	2.00	5.00	6560	E	ug/L	SW8260B	02/22/13
Tetrachloroethene (PCE)	127-18-4	2.00	5.00	5.00	U	ug/L	SW8260B	02/22/13
Ethylbenzene	100-41-4	2.00	5.00	11.5		ug/L	SW8260B	02/22/13
m,p-Xylene	108-38-3/1	4.00	10.0	62.9		ug/L	SW8260B	02/22/13
o-Xylene	95-47-6	2.00	5.00	18.5		ug/L	SW8260B	02/22/13
Isopropylbenzene	98-82-8	2.00	5.00	9.97		ug/L	SW8260B	02/22/13
1,2-Dibromo-3-chloropropane	96-12-8	2.00	5.00	5.00	U	ug/L	SW8260B	02/22/13

Surrogate	% Recovery	Control Limits	Qualifier
Dibromofluoromethane	97	75-125	
1,2-Dichloroethane-d4	107	75-125	
Toluene-d8	98	75-125	
4-Bromofluorobenzene	91	75-125	

U=Not detected at specified reporting limit
 J=Estimated value below reporting limit
 E=Estimated value above calibration range
 *=See case narrative

CH2M HILL Applied Sciences Laboratory (ASL)

Client Information				Lab Information			
Client Sample ID: Sulf_aug_t0DL				Lab Sample ID: M125202DL			
Project Name: Camp Lejeune				Date Received: 02/20/13			
Sample Date: 02/20/13				Dilution Factor: 50			
Sample Time: 13:55				Report Revision No.: 0			
Type: Grab							
Matrix: Water							

Analyte	CAS#	DL	RL	Sample Result	Qualifier	Units	Analysis Method	Date Analyzed
GC/MS Volatiles								
Vinyl Chloride	75-01-4	10.0	25.0	25.0	U	ug/L	SW8260B	02/22/13
1,1-Dichloroethene	75-35-4	10.0	25.0	25.0	U	ug/L	SW8260B	02/22/13
Methylene chloride	75-09-2	10.0	25.0	25.0	U	ug/L	SW8260B	02/22/13
trans-1,2-Dichloroethene	156-60-5	10.0	25.0	25.0	U	ug/L	SW8260B	02/22/13
1,1-Dichloroethane	75-34-3	10.0	25.0	25.0	U	ug/L	SW8260B	02/22/13
cis-1,2-Dichloroethene	156-59-2	10.0	25.0	25.0	U	ug/L	SW8260B	02/22/13
1,2-Dichloroethane	107-06-2	10.0	25.0	25.0	U	ug/L	SW8260B	02/22/13
Benzene	71-43-2	10.0	25.0	25.0	U	ug/L	SW8260B	02/22/13
Trichloroethene (TCE)	79-01-6	10.0	25.0	462		ug/L	SW8260B	02/22/13
Toluene	108-88-3	10.0	25.0	10500	E	ug/L	SW8260B	02/22/13
Tetrachloroethene (PCE)	127-18-4	10.0	25.0	25.0	U	ug/L	SW8260B	02/22/13
Ethylbenzene	100-41-4	10.0	25.0	25.0	U	ug/L	SW8260B	02/22/13
m,p-Xylene	108-38-3/1	20.0	50.0	50.0	U	ug/L	SW8260B	02/22/13
o-Xylene	95-47-6	10.0	25.0	25.0	U	ug/L	SW8260B	02/22/13
Isopropylbenzene	98-82-8	10.0	25.0	25.0	U	ug/L	SW8260B	02/22/13
1,2-Dibromo-3-chloropropane	96-12-8	10.0	25.0	25.0	U	ug/L	SW8260B	02/22/13

Surrogate	% Recovery	Control Limits	Qualifier
Dibromofluoromethane	101	75-125	
1,2-Dichloroethane-d4	112	75-125	
Toluene-d8	97	75-125	
4-Bromofluorobenzene	87	75-125	

U=Not detected at specified reporting limit
 J=Estimated value below reporting limit
 E=Estimated value above calibration range
 *=See case narrative

CH2M HILL Applied Sciences Laboratory (ASL)

Client Information				Lab Information			
Client Sample ID: ContB_bio_t0				Lab Sample ID: M125203			
Project Name: Camp Lejeune				Date Received: 02/20/13			
Sample Date: 02/20/13				Dilution Factor: 1			
Sample Time: 13:15				Report Revision No.: 0			
Type: Grab							
Matrix: Water							

Analyte	CAS#	DL	RL	Sample Result	Qualifier	Units	Analysis Method	Date Analyzed
GC/MS Volatiles								
Vinyl Chloride	75-01-4	0.20	0.50	51.8		ug/L	SW8260B	02/22/13
1,1-Dichloroethene	75-35-4	0.20	0.50	0.50	U	ug/L	SW8260B	02/22/13
Methylene chloride	75-09-2	0.20	0.50	0.50	U	ug/L	SW8260B	02/22/13
trans-1,2-Dichloroethene	156-60-5	0.20	0.50	0.50	U	ug/L	SW8260B	02/22/13
1,1-Dichloroethane	75-34-3	0.20	0.50	0.50	U	ug/L	SW8260B	02/22/13
cis-1,2-Dichloroethene	156-59-2	0.20	0.50	8.31		ug/L	SW8260B	02/22/13
1,2-Dichloroethane	107-06-2	0.20	0.50	0.50	U	ug/L	SW8260B	02/22/13
Benzene	71-43-2	0.20	0.50	1.35		ug/L	SW8260B	02/22/13
Trichloroethene (TCE)	79-01-6	0.20	0.50	1270	E	ug/L	SW8260B	02/22/13
Toluene	108-88-3	0.20	0.50	1.31		ug/L	SW8260B	02/22/13
Tetrachloroethene (PCE)	127-18-4	0.20	0.50	0.50	U	ug/L	SW8260B	02/22/13
Ethylbenzene	100-41-4	0.20	0.50	1.94		ug/L	SW8260B	02/22/13
m,p-Xylene	108-38-3/1	0.40	1.00	1.63		ug/L	SW8260B	02/22/13
o-Xylene	95-47-6	0.20	0.50	0.50	U	ug/L	SW8260B	02/22/13
Isopropylbenzene	98-82-8	0.20	0.50	0.50	U	ug/L	SW8260B	02/22/13
1,2-Dibromo-3-chloropropane	96-12-8	0.20	0.50	0.50	U	ug/L	SW8260B	02/22/13

Surrogate	% Recovery	Control Limits	Qualifier
Dibromofluoromethane	102	75-125	
1,2-Dichloroethane-d4	114	75-125	
Toluene-d8	98	75-125	
4-Bromofluorobenzene	91	75-125	

U=Not detected at specified reporting limit
 J=Estimated value below reporting limit
 E=Estimated value above calibration range
 *=See case narrative

CH2M HILL Applied Sciences Laboratory (ASL)

Client Information				Lab Information			
Client Sample ID: ContB_bio_t0DL				Lab Sample ID: M125203DL			
Project Name: Camp Lejeune				Date Received: 02/20/13			
Sample Date: 02/20/13				Dilution Factor: 100			
Sample Time: 13:15				Report Revision No.: 0			
Type: Grab							
Matrix: Water							

Analyte	CAS#	DL	RL	Sample Result	Qualifier	Units	Analysis Method	Date Analyzed
GC/MS Volatiles								
Vinyl Chloride	75-01-4	20.0	50.0	50.0	U	ug/L	SW8260B	02/22/13
1,1-Dichloroethene	75-35-4	20.0	50.0	50.0	U	ug/L	SW8260B	02/22/13
Methylene chloride	75-09-2	20.0	50.0	50.0	U	ug/L	SW8260B	02/22/13
trans-1,2-Dichloroethene	156-60-5	20.0	50.0	50.0	U	ug/L	SW8260B	02/22/13
1,1-Dichloroethane	75-34-3	20.0	50.0	50.0	U	ug/L	SW8260B	02/22/13
cis-1,2-Dichloroethene	156-59-2	20.0	50.0	50.0	U	ug/L	SW8260B	02/22/13
1,2-Dichloroethane	107-06-2	20.0	50.0	50.0	U	ug/L	SW8260B	02/22/13
Benzene	71-43-2	20.0	50.0	50.0	U	ug/L	SW8260B	02/22/13
Trichloroethene (TCE)	79-01-6	20.0	50.0	1650		ug/L	SW8260B	02/22/13
Toluene	108-88-3	20.0	50.0	50.0	U	ug/L	SW8260B	02/22/13
Tetrachloroethene (PCE)	127-18-4	20.0	50.0	50.0	U	ug/L	SW8260B	02/22/13
Ethylbenzene	100-41-4	20.0	50.0	50.0	U	ug/L	SW8260B	02/22/13
m,p-Xylene	108-38-3/1	40.0	100	100	U	ug/L	SW8260B	02/22/13
o-Xylene	95-47-6	20.0	50.0	50.0	U	ug/L	SW8260B	02/22/13
Isopropylbenzene	98-82-8	20.0	50.0	50.0	U	ug/L	SW8260B	02/22/13
1,2-Dibromo-3-chloropropane	96-12-8	20.0	50.0	50.0	U	ug/L	SW8260B	02/22/13

Surrogate	% Recovery	Control Limits	Qualifier
Dibromofluoromethane	104	75-125	
1,2-Dichloroethane-d4	117	75-125	
Toluene-d8	98	75-125	
4-Bromofluorobenzene	88	75-125	

U=Not detected at specified reporting limit
 J=Estimated value below reporting limit
 E=Estimated value above calibration range
 *=See case narrative

CH2M HILL Applied Sciences Laboratory (ASL)

Client Information				Lab Information			
Client Sample ID: EHCL_bio_t0				Lab Sample ID: M125204			
Project Name: Camp Lejeune				Date Received: 02/20/13			
Sample Date: 02/20/13				Dilution Factor: 1			
Sample Time: 13:30				Report Revision No.: 0			
Type: Grab							
Matrix: Water							

Analyte	CAS#	DL	RL	Sample Result	Qualifier	Units	Analysis Method	Date Analyzed
GC/MS Volatiles								
Vinyl Chloride	75-01-4	0.20	0.50	25.4		ug/L	SW8260B	02/22/13
1,1-Dichloroethene	75-35-4	0.20	0.50	1.59		ug/L	SW8260B	02/22/13
Methylene chloride	75-09-2	0.20	0.50	0.50	U	ug/L	SW8260B	02/22/13
trans-1,2-Dichloroethene	156-60-5	0.20	0.50	0.50	U	ug/L	SW8260B	02/22/13
1,1-Dichloroethane	75-34-3	0.20	0.50	0.50	U	ug/L	SW8260B	02/22/13
cis-1,2-Dichloroethene	156-59-2	0.20	0.50	81.5		ug/L	SW8260B	02/22/13
1,2-Dichloroethane	107-06-2	0.20	0.50	0.50	U	ug/L	SW8260B	02/22/13
Benzene	71-43-2	0.20	0.50	1.33		ug/L	SW8260B	02/22/13
Trichloroethene (TCE)	79-01-6	0.20	0.50	1140	E	ug/L	SW8260B	02/22/13
Toluene	108-88-3	0.20	0.50	23.8		ug/L	SW8260B	02/22/13
Tetrachloroethene (PCE)	127-18-4	0.20	0.50	0.50	U	ug/L	SW8260B	02/22/13
Ethylbenzene	100-41-4	0.20	0.50	1.57		ug/L	SW8260B	02/22/13
m,p-Xylene	108-38-3/1	0.40	1.00	5.68		ug/L	SW8260B	02/22/13
o-Xylene	95-47-6	0.20	0.50	3.07		ug/L	SW8260B	02/22/13
Isopropylbenzene	98-82-8	0.20	0.50	0.50	U	ug/L	SW8260B	02/22/13
1,2-Dibromo-3-chloropropane	96-12-8	0.20	0.50	0.50	U	ug/L	SW8260B	02/22/13

Surrogate	% Recovery	Control Limits	Qualifier
Dibromofluoromethane	103	75-125	
1,2-Dichloroethane-d4	115	75-125	
Toluene-d8	98	75-125	
4-Bromofluorobenzene	86	75-125	

U=Not detected at specified reporting limit
 J=Estimated value below reporting limit
 E=Estimated value above calibration range
 *=See case narrative

CH2M HILL Applied Sciences Laboratory (ASL)

Client Information				Lab Information			
Client Sample ID: EHCL_bio_t0DL				Lab Sample ID: M125204DL			
Project Name: Camp Lejeune				Date Received: 02/20/13			
Sample Date: 02/20/13				Dilution Factor: 100			
Sample Time: 13:30				Report Revision No.: 0			
Type: Grab							
Matrix: Water							

Analyte	CAS#	DL	RL	Sample Result	Qualifier	Units	Analysis Method	Date Analyzed
GC/MS Volatiles								
Vinyl Chloride	75-01-4	20.0	50.0	50.0	U	ug/L	SW8260B	02/22/13
1,1-Dichloroethene	75-35-4	20.0	50.0	50.0	U	ug/L	SW8260B	02/22/13
Methylene chloride	75-09-2	20.0	50.0	50.0	U	ug/L	SW8260B	02/22/13
trans-1,2-Dichloroethene	156-60-5	20.0	50.0	50.0	U	ug/L	SW8260B	02/22/13
1,1-Dichloroethane	75-34-3	20.0	50.0	50.0	U	ug/L	SW8260B	02/22/13
cis-1,2-Dichloroethene	156-59-2	20.0	50.0	77.8		ug/L	SW8260B	02/22/13
1,2-Dichloroethane	107-06-2	20.0	50.0	50.0	U	ug/L	SW8260B	02/22/13
Benzene	71-43-2	20.0	50.0	50.0	U	ug/L	SW8260B	02/22/13
Trichloroethene (TCE)	79-01-6	20.0	50.0	1500		ug/L	SW8260B	02/22/13
Toluene	108-88-3	20.0	50.0	50.0	U	ug/L	SW8260B	02/22/13
Tetrachloroethene (PCE)	127-18-4	20.0	50.0	50.0	U	ug/L	SW8260B	02/22/13
Ethylbenzene	100-41-4	20.0	50.0	50.0	U	ug/L	SW8260B	02/22/13
m,p-Xylene	108-38-3/1	40.0	100	100	U	ug/L	SW8260B	02/22/13
o-Xylene	95-47-6	20.0	50.0	50.0	U	ug/L	SW8260B	02/22/13
Isopropylbenzene	98-82-8	20.0	50.0	50.0	U	ug/L	SW8260B	02/22/13
1,2-Dibromo-3-chloropropane	96-12-8	20.0	50.0	50.0	U	ug/L	SW8260B	02/22/13

Surrogate	% Recovery	Control Limits	Qualifier
Dibromofluoromethane	105	75-125	
1,2-Dichloroethane-d4	120	75-125	
Toluene-d8	98	75-125	
4-Bromofluorobenzene	88	75-125	

U=Not detected at specified reporting limit
 J=Estimated value below reporting limit
 E=Estimated value above calibration range
 *=See case narrative

CH2M HILL Applied Sciences Laboratory (ASL)

Client Information				Lab Information			
Client Sample ID: WB1-0222				Lab Sample ID: WB1-0222			
Project Name: Camp Lejeune				Date Received: N/A			
Sample Date: N/A				Dilution Factor: 1			
Sample Time: N/A				Report Revision No.: 0			
Type: QC							
Matrix: Water							

Analyte	CAS#	DL	RL	Sample Result	Qualifier	Units	Analysis Method	Date Analyzed
GC/MS Volatiles								
Vinyl Chloride	75-01-4	0.20	0.50	0.50	U	ug/L	SW8260B	02/22/13
1,1-Dichloroethene	75-35-4	0.20	0.50	0.50	U	ug/L	SW8260B	02/22/13
Methylene chloride	75-09-2	0.20	0.50	0.50	U	ug/L	SW8260B	02/22/13
trans-1,2-Dichloroethene	156-60-5	0.20	0.50	0.50	U	ug/L	SW8260B	02/22/13
1,1-Dichloroethane	75-34-3	0.20	0.50	0.50	U	ug/L	SW8260B	02/22/13
cis-1,2-Dichloroethene	156-59-2	0.20	0.50	0.50	U	ug/L	SW8260B	02/22/13
1,2-Dichloroethane	107-06-2	0.20	0.50	0.50	U	ug/L	SW8260B	02/22/13
Benzene	71-43-2	0.20	0.50	0.50	U	ug/L	SW8260B	02/22/13
Trichloroethene (TCE)	79-01-6	0.20	0.50	0.50	U	ug/L	SW8260B	02/22/13
Toluene	108-88-3	0.20	0.50	0.50	U	ug/L	SW8260B	02/22/13
Tetrachloroethene (PCE)	127-18-4	0.20	0.50	0.50	U	ug/L	SW8260B	02/22/13
Ethylbenzene	100-41-4	0.20	0.50	0.50	U	ug/L	SW8260B	02/22/13
m,p-Xylene	108-38-3/1	0.40	1.00	1.00	U	ug/L	SW8260B	02/22/13
o-Xylene	95-47-6	0.20	0.50	0.50	U	ug/L	SW8260B	02/22/13
Isopropylbenzene	98-82-8	0.20	0.50	0.50	U	ug/L	SW8260B	02/22/13
1,2-Dibromo-3-chloropropane	96-12-8	0.20	0.50	0.50	U	ug/L	SW8260B	02/22/13

Surrogate	% Recovery	Control Limits	Qualifier
Dibromofluoromethane	104	75-125	
1,2-Dichloroethane-d4	114	75-125	
Toluene-d8	97	75-125	
4-Bromofluorobenzene	88	75-125	

U=Not detected at specified reporting limit
 J=Estimated value below reporting limit
 E=Estimated value above calibration range
 *=See case narrative

CH2M HILL Applied Sciences Laboratory (ASL)

<u>Client Information</u>	<u>Lab Information</u>
Project Name: Camp Lejeune	LCS ID: BS1W0222
Type: QC	Report Revision No.: 0
Matrix: Water	Dilution Factor: 1

Analyte	CAS#	Spike Amount	Sample Result	Units	%Recovery	Analysis Method	Date Analyzed
GC/MS Volatiles							
Vinyl Chloride	75-01-4	20.0	19.6	ug/L	98	SW8260B	02/22/13
1,1-Dichloroethene	75-35-4	20.0	20.1	ug/L	101	SW8260B	02/22/13
Methylene chloride	75-09-2	20.0	19.8	ug/L	99	SW8260B	02/22/13
trans-1,2-Dichloroethene	156-60-5	20.0	19.0	ug/L	95	SW8260B	02/22/13
1,1-Dichloroethane	75-34-3	20.0	19.5	ug/L	97	SW8260B	02/22/13
cis-1,2-Dichloroethene	156-59-2	20.0	19.3	ug/L	97	SW8260B	02/22/13
1,2-Dichloroethane	107-06-2	20.0	20.9	ug/L	104	SW8260B	02/22/13
Benzene	71-43-2	20.0	18.4	ug/L	92	SW8260B	02/22/13
Trichloroethene (TCE)	79-01-6	20.0	17.7	ug/L	89	SW8260B	02/22/13
Toluene	108-88-3	20.0	18.9	ug/L	95	SW8260B	02/22/13
Tetrachloroethene (PCE)	127-18-4	20.0	17.0	ug/L	85	SW8260B	02/22/13
Ethylbenzene	100-41-4	20.0	18.4	ug/L	92	SW8260B	02/22/13
m,p-Xylene	108-38-3/1	40.0	37.9	ug/L	95	SW8260B	02/22/13
o-Xylene	95-47-6	20.0	18.8	ug/L	94	SW8260B	02/22/13
Isopropylbenzene	98-82-8	20.0	16.3	ug/L	81	SW8260B	02/22/13
1,2-Dibromo-3-chloropropane	96-12-8	20.0	20.9	ug/L	104	SW8260B	02/22/13

Surrogate	% Recovery	Control Limits	Qualifier
Dibromofluoromethane	102	75-125	
1,2-Dichloroethane-d4	111	75-125	
Toluene-d8	97	75-125	
4-Bromofluorobenzene	92	75-125	

U=Not detected at specified reporting limit
 J=Estimated value below reporting limit
 E=Estimated value above calibration range
 *=See case narrative

CASE NARRATIVE
METALS ANALYSIS

Lab Name: CH2M HILL/LAB/CVO

ASL SDG#: M1252

Project: Camp Lejeune

Project #: 387442.78.WP

I. Method(s):

Analysis: E200.7

Preparation: FLDFLT

II. Receipt/Holding Times:

All acceptance criteria were met.

III. Analysis:

A. Initial Calibration(s):

All acceptance criteria were met.

B. Calibration Verification(s):

All acceptance criteria were met.

C. Blanks:

All acceptance criteria were met.

D. Laboratory Control Sample(s):

All acceptance criteria were met.

E. Matrix Spike/Matrix Spike Duplicate Sample(s):

Analyzed in accordance with standard operating procedure.

F. Interference Check Sample(s):

All acceptance criteria were met.

G. Serial Dilution(s):

Analyzed in accordance with standard operating procedure.

H. Digestion Exception(s):

None.

I. Analytical Exception(s):

None.

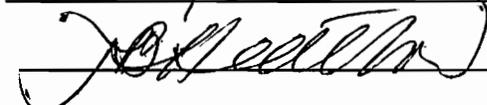
IV. Documentation Exception(s):

None.

V. I certify that this data package is in compliance with the terms and conditions agreed to by the client and CH2M HILL, both technically and for completeness, except for the conditions detailed above. Release of the data contained in this hardcopy data package has been authorized by the Laboratory Manager or designee, as verified by the following signatures.

Prepared by: 

Date: 3/5/13

Reviewed by: 

Date: 3/11/13

CH2M HILL Applied Sciences Laboratory (ASL)

<u>Client Information</u>		<u>Lab Information</u>	
Project Name: Camp Lejeune		Lab Batch ID: M1252	
Date Received: 02/20/13		Report Revision No.: 0	
Type: See C.O.C.			
Matrix: Water			

Client Sample ID	Lab Sample ID	Dilution Factor	RL	Result	Qual	Units	Date Analyzed
Iron: E200.7							
<i>Dissolved Metals</i>							
ContA_aug_t0	M125201F	1	100	185		ug/L	02/21/13
Sulf_aug_t0	M125202F	1	100	556		ug/L	02/21/13
ContB_bio_t0	M125203F	1	100	1340		ug/L	02/21/13
EHCL_bio_t0	M125204F	1	100	10400		ug/L	02/21/13
<i>Total Metals</i>							
WB1-0220	WB1-0220	1	100	100	U	ug/L	02/21/13

U=Not detected at specified reporting limit
 J=Estimated value below reporting limit
 E=Estimated value above calibration range
 *=See case narrative

CH2M HILL Applied Sciences Laboratory (ASL)

<u>Client Information</u>	<u>Lab Information</u>
Project Name: Camp Lejeune Type: QC Matrix: Water	LCS ID: BS1W0220 Report Revision No.: 0 Dilution Factor: 1

Analyte	CAS#	Spike Amount	Sample Result	Units	%Recovery	Analysis Method	Date Analyzed
Metals							
Iron	7439-89-6	500	520	ug/L	104	E200.7	02/21/13

U=Not detected at specified reporting limit
 J=Estimated value below reporting limit
 E=Estimated value above calibration range
 *=See case narrative

CASE NARRATIVE
GENERAL CHEMISTRY ANALYSIS

Lab Name: CH2M HILL/LAB/CVO

ASL SDG#: M1252

Project: Camp Lejeune

Project #: 387442.78.WP

I. Method(s):

Analysis: E300.0A

II. Receipt/Holding Times:

All acceptance criteria were met.

III. Analysis:

A. Initial Calibration(s):

All acceptance criteria were met.

B. Calibration Verification(s):

All acceptance criteria were met.

C. Blanks:

All acceptance criteria were met.

D. Laboratory Control Sample(s):

All acceptance criteria were met.

E. Matrix Spike/Matrix Spike Duplicate Sample(s):

Analyzed in accordance with standard operating procedure.

F. Analytical Exception(s):

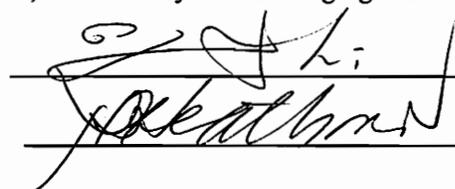
None.

IV. Documentation Exception(s):

None.

V. I certify that this data package is in compliance with the terms and conditions agreed to by the client and CH2M HILL, both technically and for completeness, except for the conditions detailed above. Release of the data contained in this hardcopy data package has been authorized by the Laboratory Manager or designee, as verified by the following signatures.

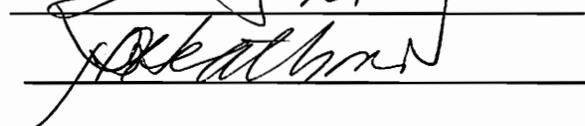
Prepared by: _____



Date: _____

2/25/2013

Reviewed by: _____



Date: _____

02/26/13

CH2M HILL Applied Sciences Laboratory (ASL)

<u>Client Information</u>	<u>Lab Information</u>
Project Name: Camp Lejeune	Lab Batch ID: M1252
Date Received: 02/20/13	Analysis Method: E300.0A
Type: See C.O.C.	Units: mg/L
Matrix: Water	Report Revision No.: 0

Client Sample ID	Lab Sample ID	Dilution Factor	RL	Nitrate-N Result	Qualifier	Date Analyzed
General Chemistry						
ContA_aug_t0	M125201	1	0.10	0.10	U	02/21/13 11:28
Sulf_aug_t0	M125202	1	0.10	0.10	U	02/21/13 11:52
ContB_bio_t0	M125203	1	0.10	0.10	U	02/21/13 12:15
EHCL_bio_t0	M125204	1	0.10	0.10	U	02/21/13 12:39
WB1-0221	WB1-0221	1	0.10	0.10	U	02/21/13 11:04

U=Not detected at specified reporting limit
 J=Estimated value below reporting limit
 E=Estimated value above calibration range
 *=See case narrative

CH2M HILL Applied Sciences Laboratory (ASL)

<u>Client Information</u>	<u>Lab Information</u>
Project Name: Camp Lejeune	Lab Batch ID: M1252
Date Received: 02/20/13	Analysis Method: E300.0A
Type: See C.O.C.	Units: mg/L
Matrix: Water	Report Revision No.: 0

Client Sample ID	Lab Sample ID	Dilution Factor	RL	Sulfate Result	Qualifier	Date Analyzed
General Chemistry						
ContA_aug_t0	M125201	1	0.10	12.5		02/21/13
Sulf_aug_t0	M125202	20	2.00	219		02/21/13
ContB_bio_t0	M125203	2	0.20	38.9		02/21/13
EHCL_bio_t0	M125204	1	0.10	0.15		02/21/13
WB1-0221	WB1-0221	1	0.10	0.10	U	02/21/13

U=Not detected at specified reporting limit
 J=Estimated value below reporting limit
 E=Estimated value above calibration range
 *=See case narrative

CH2M HILL Applied Sciences Laboratory (ASL)

<u>Client Information</u>	<u>Lab Information</u>
Project Name: Camp Lejeune Type: QC Matrix: Water	Lab Batch ID: M1252 Report Revision No.: 0

LCS ID	Analyte	Spike Amount	Sample Result	Units	% Recovery	Analysis Method	Date Analyzed
General Chemistry							
BS1W0221	Nitrate-N	3.00	2.74	mg/L	91	E300.0A	02/21/13
BS1W0221	Sulfate	15.0	15.0	mg/L	100	E300.0A	02/21/13

U=Not detected at specified reporting limit
 J=Estimated value below reporting limit
 E=Estimated value above calibration range
 *=See case narrative

**CASE NARRATIVE
GENERAL CHEMISTRY ANALYSIS**

Lab Name: CH2M HILL/LAB/CVO

ASL SDG#: M1252

Project: Camp Lejeune

Project #: 387442.78.WP

I. Method(s):

Analysis: E376.2

II. Receipt/Holding Times:

All acceptance criteria were met.

III. Analysis:

A. Initial Calibration(s):

All acceptance criteria were met.

B. Calibration Verification(s):

All acceptance criteria were met.

C. Blanks:

All acceptance criteria were met.

D. Laboratory Control Sample(s):

All acceptance criteria were met.

E. Matrix Spike/Matrix Spike Duplicate Sample(s):

Analyzed in accordance with standard operating procedure.

F. Analytical Exception(s):

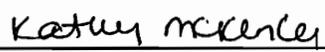
None.

IV. Documentation Exception(s):

None.

V. I certify that this data package is in compliance with the terms and conditions agreed to by the client and CH2M HILL, both technically and for completeness, except for the conditions detailed above. Release of the data contained in this hardcopy data package has been authorized by the Laboratory Manager or designee, as verified by the following signatures.

Prepared by:  Date: 3/2/13

Reviewed by:  Date: 3/4/13

CH2M HILL Applied Sciences Laboratory (ASL)

<u>Client Information</u>	<u>Lab Information</u>
Project Name: Camp Lejeune	Lab Batch ID: M1252
Date Received: 02/20/2013	Analysis Method: E376.2
Type: See C.O.C.	Units: ug/L
Matrix: Water	Report Revision No.: 0

Client Sample ID	Lab Sample ID	Dilution Factor	RL	Sulfide Result	Qualifier	Date Analyzed
General Chemistry						
ContA_aug_t0	M125201	1	25.0	32.4		02/27/2013
Sulf_aug_t0	M125202	1	25.0	41.9		02/27/2013
ContB_bio_t0	M125203	1	25.0	25.0	U	02/27/2013
EHCL_bio_t0	M125204	1	25.0	65.7		02/27/2013
WB1-0227	WB1-0227	1	25.0	25.0	U	02/27/2013

U=Not detected at specified reporting limit
 J=Estimated value below reporting limit
 E=Estimated value above calibration range
 *=See case narrative

CH2M HILL Applied Sciences Laboratory (ASL)

<u>Client Information</u>	<u>Lab Information</u>
Project Name: Camp Lejeune Type: QC Matrix: Water	Lab Batch ID: M1252 Report Revision No.: 0

LCS ID	Analyte	Spike Amount	Sample Result	Units	% Recovery	Analysis Method	Date Analyzed
General Chemistry							
BS1W0227	Sulfide	316	260	ug/L	82	E376.2	02/27/2013

U=Not detected at specified reporting limit
 J=Estimated value below reporting limit
 E=Estimated value above calibration range
 *=See case narrative

**CASE NARRATIVE
GENERAL CHEMISTRY ANALYSIS**

Lab Name: CH2M HILL/LAB/CVO

ASL SDG#: M1252

Project: Camp Lejeune

Project #: 387442.78.WP

I. Method(s):

Analysis: SM5310B

II. Receipt/Holding Times:

All acceptance criteria were met.

III. Analysis:

A. Initial Calibration(s):

All acceptance criteria were met.

B. Calibration Verification(s):

All acceptance criteria were met.

C. Blanks:

All acceptance criteria were met.

D. Laboratory Control Sample(s):

All acceptance criteria were met.

E. Matrix Spike/Matrix Spike Duplicate Sample(s):

Analyzed in accordance with standard operating procedure.

F. Analytical Exception(s):

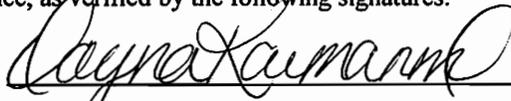
None.

IV. Documentation Exception(s):

None.

V. I certify that this data package is in compliance with the terms and conditions agreed to by the client and CH2M HILL, both technically and for completeness, except for the conditions detailed above. Release of the data contained in this hardcopy data package has been authorized by the Laboratory Manager or designee, as verified by the following signatures.

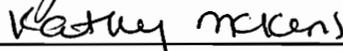
Prepared by:



Date:

2/22/13

Reviewed by:



Date:

2/26/13

CH2M HILL Applied Sciences Laboratory (ASL)

Client Information

Project Name: Camp Lejeune

Date Received: 02/20/13

Type: See C.O.C.

Matrix: Water

Lab Information

Lab Batch ID: M1252

Analysis Method: SM5310B

Units: mg/L

Report Revision No.: 0

Client Sample ID	Lab Sample ID	Dilution Factor	Total Organic Carbon RL	Result	Qualifier	Date Analyzed
General Chemistry						
ContA_aug_t0	M125201	40	20.0	139		02/21/13
Sulf_aug_t0	M125202	40	20.0	183		02/21/13
ContB_bio_t0	M125203	5	2.50	31.1		02/21/13
EHCL_bio_t0	M125204	10	5.00	55.4		02/21/13
WB1-0221	WB1-0221	1	0.50	0.50	U	02/21/13

U=Not detected at specified reporting limit

J=Estimated value below reporting limit

E=Estimated value above calibration range

*=See case narrative

CH2M HILL Applied Sciences Laboratory (ASL)

Client Information

Project Name: Camp Lejeune
Type: QC
Matrix: Water

Lab Information

Lab Batch ID: M1252
Report Revision No.: 0

LCS ID	Analyte	Spike Amount	Sample Result	Units	% Recovery	Analysis Method	Date Analyzed
General Chemistry							
BS1W0221	Total Organic Carbon	5.00	5.17	mg/L	103	SM5310B	02/21/13

U=Not detected at specified reporting limit
J=Estimated value below reporting limit
E=Estimated value above calibration range
*=See case narrative



ANALYTICAL REPORT

For:
Camp Lejeune

ASL Report #: M1455
Project ID: 387442.78.WP
Attn: Dusty Berggren/CVO
cc:
Mike Niemet/CVO

Authorized and Released By:

Laboratory Project Manager
Ben Thompson
(541) 758-0235 ext.23132
April 04, 2013

All analyses performed by CH2M HILL are clearly indicated. Any subcontracted analyses are included as appended reports as received from the subcontracted laboratory. The results included in this report only relate to the samples listed on the following Sample Cross-Reference page. This report shall not be reproduced except in full, without the written approval of the laboratory.

Any unusual difficulties encountered during the analysis of your samples are discussed in the attached case narratives.



Accredited in accordance with NELAP:
Oregon (100022)
Arizona (0771)
Louisiana (05031)

ASL Report #: M1455

Sample Receipt Comments

We certify that the test results meet all NELAP requirements.

Sample Cross-Reference

ASL Sample ID	Client Sample ID	Date/Time Collected	Date Received
M145501	ContA_aug_t0	03/19/13 16:30	03/20/13
M145502	Sulf_aug_10	03/19/13 16:40	03/20/13
M145503	ContB_bio_t0	03/18/13 13:00	03/20/13
M145504	EHCL_bio_t0	03/19/13 16:50	03/20/13

**CASE NARRATIVE
GC/MS VOLATILES ANALYSIS**

Lab Name: CH2M HILL/LAB/CVO

ASL SDG#: M1455

Project: Camp Lejeune

Project #: 387442.78.WP

I. Method(s):

Analysis: SW8260B
Preparation: SW5030

II. Receipt/Holding Times:

All acceptance criteria were met.

III. Analysis:

A. Initial Calibration(s):

All acceptance criteria were met.

B. Calibration Verification(s):

All acceptance criteria were met.

C. Blank(s):

All acceptance criteria were met.

D. Laboratory Control Sample(s):

All acceptance criteria were met.

E. Matrix Spike/Matrix Spike Duplicate Sample(s):

Analyzed in accordance with standard operating procedure.

F. Surrogate Standard(s):

All acceptance criteria were met.

G. BFB Tune Verification(s):

All acceptance criteria were met.

H. Internal Standard(s):

All acceptance criteria were met.

I. Analytical Exception(s):

None.

IV. Documentation Exception(s):

None.

V. I certify that this data package is in compliance with the terms and conditions agreed to by the client and CH2M HILL, both technically and for completeness, except for the conditions detailed above. Release of the data contained in this hardcopy data package has been authorized by the Laboratory Manager or designee, as verified by the following signatures.

Prepared by:  Date: 3/28/13
Reviewed by:  Date: 3/29/13

CH2M HILL Applied Sciences Laboratory (ASL)

Client Information				Lab Information			
Client Sample ID: ContA_aug_t0				Lab Sample ID: M145501			
Project Name: Camp Lejeune				Date Received: 03/20/13			
Sample Date: 03/19/13				Dilution Factor: 50			
Sample Time: 16:30				Report Revision No.: 0			
Type: Grab							
Matrix: Water							

Analyte	CAS#	DL	RL	Sample Result	Qualifier	Units	Analysis Method	Date Analyzed
GC/MS Volatiles								
Vinyl Chloride	75-01-4	10.0	25.0	25.0	U	ug/L	SW8260B	03/21/13
1,1-Dichloroethene	75-35-4	10.0	25.0	25.0	U	ug/L	SW8260B	03/21/13
Methylene chloride	75-09-2	10.0	25.0	25.0	U	ug/L	SW8260B	03/21/13
trans-1,2-Dichloroethene	156-60-5	10.0	25.0	25.0	U	ug/L	SW8260B	03/21/13
1,1-Dichloroethane	75-34-3	10.0	25.0	25.0	U	ug/L	SW8260B	03/21/13
cis-1,2-Dichloroethene	156-59-2	10.0	25.0	25.0	U	ug/L	SW8260B	03/21/13
1,2-Dichloroethane	107-06-2	10.0	25.0	25.0	U	ug/L	SW8260B	03/21/13
Benzene	71-43-2	10.0	25.0	25.0	U	ug/L	SW8260B	03/21/13
Trichloroethene (TCE)	79-01-6	10.0	25.0	645		ug/L	SW8260B	03/21/13
Toluene	108-88-3	10.0	25.0	9070	E	ug/L	SW8260B	03/21/13
Tetrachloroethene (PCE)	127-18-4	10.0	25.0	25.0	U	ug/L	SW8260B	03/21/13
Ethylbenzene	100-41-4	10.0	25.0	25.0	U	ug/L	SW8260B	03/21/13
m,p-Xylene	108-38-3/1	20.0	50.0	50.0	U	ug/L	SW8260B	03/21/13
o-Xylene	95-47-6	10.0	25.0	25.0	U	ug/L	SW8260B	03/21/13
Isopropylbenzene	98-82-8	10.0	25.0	25.0	U	ug/L	SW8260B	03/21/13
1,2-Dibromo-3-chloropropane	96-12-8	10.0	25.0	25.0	U	ug/L	SW8260B	03/21/13

Surrogate	% Recovery	Control Limits	Qualifier
Dibromofluoromethane	99	75-125	
1,2-Dichloroethane-d4	104	75-125	
Toluene-d8	96	75-125	
4-Bromofluorobenzene	90	75-125	

U=Not detected at specified reporting limit
 J=Estimated value below reporting limit
 E=Estimated value above calibration range
 *=See case narrative

CH2M HILL Applied Sciences Laboratory (ASL)

Client Information				Lab Information			
Client Sample ID: ContA_aug_t0DL				Lab Sample ID: M145501DL			
Project Name: Camp Lejeune				Date Received: 03/20/13			
Sample Date: 03/19/13				Dilution Factor: 1000			
Sample Time: 16:30				Report Revision No.: 0			
Type: Grab							
Matrix: Water							

Analyte	CAS#	DL	RL	Sample Result	Qualifier	Units	Analysis Method	Date Analyzed
GC/MS Volatiles								
Vinyl Chloride	75-01-4	200	500	500	U	ug/L	SW8260B	03/21/13
1,1-Dichloroethene	75-35-4	200	500	500	U	ug/L	SW8260B	03/21/13
Methylene chloride	75-09-2	200	500	500	U	ug/L	SW8260B	03/21/13
trans-1,2-Dichloroethene	156-60-5	200	500	500	U	ug/L	SW8260B	03/21/13
1,1-Dichloroethane	75-34-3	200	500	500	U	ug/L	SW8260B	03/21/13
cis-1,2-Dichloroethene	156-59-2	200	500	500	U	ug/L	SW8260B	03/21/13
1,2-Dichloroethane	107-06-2	200	500	500	U	ug/L	SW8260B	03/21/13
Benzene	71-43-2	200	500	500	U	ug/L	SW8260B	03/21/13
Trichloroethene (TCE)	79-01-6	200	500	647		ug/L	SW8260B	03/21/13
Toluene	108-88-3	200	500	9370		ug/L	SW8260B	03/21/13
Tetrachloroethene (PCE)	127-18-4	200	500	500	U	ug/L	SW8260B	03/21/13
Ethylbenzene	100-41-4	200	500	500	U	ug/L	SW8260B	03/21/13
m,p-Xylene	108-38-3/1	400	1000	1000	U	ug/L	SW8260B	03/21/13
o-Xylene	95-47-6	200	500	500	U	ug/L	SW8260B	03/21/13
Isopropylbenzene	98-82-8	200	500	500	U	ug/L	SW8260B	03/21/13
1,2-Dibromo-3-chloropropane	96-12-8	200	500	500	U	ug/L	SW8260B	03/21/13

Surrogate	% Recovery	Control Limits	Qualifier
Dibromofluoromethane	98	75-125	
1,2-Dichloroethane-d4	103	75-125	
Toluene-d8	96	75-125	
4-Bromofluorobenzene	89	75-125	

U=Not detected at specified reporting limit
 J=Estimated value below reporting limit
 E=Estimated value above calibration range
 *=See case narrative

CH2M HILL Applied Sciences Laboratory (ASL)

Client Information				Lab Information			
Client Sample ID: Sulf_aug_10				Lab Sample ID: M145502			
Project Name: Camp Lejeune				Date Received: 03/20/13			
Sample Date: 03/19/13				Dilution Factor: 50			
Sample Time: 16:40				Report Revision No.: 0			
Type: Grab							
Matrix: Water							

Analyte	CAS#	DL	RL	Sample Result	Qualifier	Units	Analysis Method	Date Analyzed
GC/MS Volatiles								
Vinyl Chloride	75-01-4	10.0	25.0	25.0	U	ug/L	SW8260B	03/21/13
1,1-Dichloroethene	75-35-4	10.0	25.0	25.0	U	ug/L	SW8260B	03/21/13
Methylene chloride	75-09-2	10.0	25.0	25.0	U	ug/L	SW8260B	03/21/13
trans-1,2-Dichloroethene	156-60-5	10.0	25.0	25.0	U	ug/L	SW8260B	03/21/13
1,1-Dichloroethane	75-34-3	10.0	25.0	25.0	U	ug/L	SW8260B	03/21/13
cis-1,2-Dichloroethene	156-59-2	10.0	25.0	25.0	U	ug/L	SW8260B	03/21/13
1,2-Dichloroethane	107-06-2	10.0	25.0	25.0	U	ug/L	SW8260B	03/21/13
Benzene	71-43-2	10.0	25.0	25.0	U	ug/L	SW8260B	03/21/13
Trichloroethene (TCE)	79-01-6	10.0	25.0	589		ug/L	SW8260B	03/21/13
Toluene	108-88-3	10.0	25.0	7460	E	ug/L	SW8260B	03/21/13
Tetrachloroethene (PCE)	127-18-4	10.0	25.0	25.0	U	ug/L	SW8260B	03/21/13
Ethylbenzene	100-41-4	10.0	25.0	25.0	U	ug/L	SW8260B	03/21/13
m,p-Xylene	108-38-3/1	20.0	50.0	50.0	U	ug/L	SW8260B	03/21/13
o-Xylene	95-47-6	10.0	25.0	25.0	U	ug/L	SW8260B	03/21/13
Isopropylbenzene	98-82-8	10.0	25.0	25.0	U	ug/L	SW8260B	03/21/13
1,2-Dibromo-3-chloropropane	96-12-8	10.0	25.0	25.0	U	ug/L	SW8260B	03/21/13

Surrogate	% Recovery	Control Limits	Qualifier
Dibromofluoromethane	99	75-125	
1,2-Dichloroethane-d4	104	75-125	
Toluene-d8	96	75-125	
4-Bromofluorobenzene	88	75-125	

U=Not detected at specified reporting limit
 J=Estimated value below reporting limit
 E=Estimated value above calibration range
 *=See case narrative

CH2M HILL Applied Sciences Laboratory (ASL)

Client Information				Lab Information			
Client Sample ID: Sulf_aug_10DL				Lab Sample ID: M145502DL			
Project Name: Camp Lejeune				Date Received: 03/20/13			
Sample Date: 03/19/13				Dilution Factor: 1000			
Sample Time: 16:40				Report Revision No.: 0			
Type: Grab							
Matrix: Water							

Analyte	CAS#	DL	RL	Sample Result	Qualifier	Units	Analysis Method	Date Analyzed
GC/MS Volatiles								
Vinyl Chloride	75-01-4	200	500	500	U	ug/L	SW8260B	03/21/13
1,1-Dichloroethene	75-35-4	200	500	500	U	ug/L	SW8260B	03/21/13
Methylene chloride	75-09-2	200	500	500	U	ug/L	SW8260B	03/21/13
trans-1,2-Dichloroethene	156-60-5	200	500	500	U	ug/L	SW8260B	03/21/13
1,1-Dichloroethane	75-34-3	200	500	500	U	ug/L	SW8260B	03/21/13
cis-1,2-Dichloroethene	156-59-2	200	500	500	U	ug/L	SW8260B	03/21/13
1,2-Dichloroethane	107-06-2	200	500	500	U	ug/L	SW8260B	03/21/13
Benzene	71-43-2	200	500	500	U	ug/L	SW8260B	03/21/13
Trichloroethene (TCE)	79-01-6	200	500	609		ug/L	SW8260B	03/21/13
Toluene	108-88-3	200	500	7750		ug/L	SW8260B	03/21/13
Tetrachloroethene (PCE)	127-18-4	200	500	500	U	ug/L	SW8260B	03/21/13
Ethylbenzene	100-41-4	200	500	500	U	ug/L	SW8260B	03/21/13
m,p-Xylene	108-38-3/1	400	1000	1000	U	ug/L	SW8260B	03/21/13
o-Xylene	95-47-6	200	500	500	U	ug/L	SW8260B	03/21/13
Isopropylbenzene	98-82-8	200	500	500	U	ug/L	SW8260B	03/21/13
1,2-Dibromo-3-chloropropane	96-12-8	200	500	500	U	ug/L	SW8260B	03/21/13

Surrogate	% Recovery	Control Limits	Qualifier
Dibromofluoromethane	100	75-125	
1,2-Dichloroethane-d4	105	75-125	
Toluene-d8	97	75-125	
4-Bromofluorobenzene	92	75-125	

U=Not detected at specified reporting limit
 J=Estimated value below reporting limit
 E=Estimated value above calibration range
 *=See case narrative

CH2M HILL Applied Sciences Laboratory (ASL)

Client Information				Lab Information			
Client Sample ID: ContB_bio_t0				Lab Sample ID: M145503			
Project Name: Camp Lejeune				Date Received: 03/20/13			
Sample Date: 03/18/13				Dilution Factor: 5			
Sample Time: 13:00				Report Revision No.: 0			
Type: Grab							
Matrix: Water							

Analyte	CAS#	DL	RL	Sample Result	Qualifier	Units	Analysis Method	Date Analyzed
GC/MS Volatiles								
Vinyl Chloride	75-01-4	1.00	2.50	282		ug/L	SW8260B	03/21/13
1,1-Dichloroethene	75-35-4	1.00	2.50	2.50	U	ug/L	SW8260B	03/21/13
Methylene chloride	75-09-2	1.00	2.50	2.50	U	ug/L	SW8260B	03/21/13
trans-1,2-Dichloroethene	156-60-5	1.00	2.50	2.50	U	ug/L	SW8260B	03/21/13
1,1-Dichloroethane	75-34-3	1.00	2.50	2.50	U	ug/L	SW8260B	03/21/13
cis-1,2-Dichloroethene	156-59-2	1.00	2.50	7.10		ug/L	SW8260B	03/21/13
1,2-Dichloroethane	107-06-2	1.00	2.50	2.50	U	ug/L	SW8260B	03/21/13
Benzene	71-43-2	1.00	2.50	2.50	U	ug/L	SW8260B	03/21/13
Trichloroethene (TCE)	79-01-6	1.00	2.50	2.50	U	ug/L	SW8260B	03/21/13
Toluene	108-88-3	1.00	2.50	4.52		ug/L	SW8260B	03/21/13
Tetrachloroethene (PCE)	127-18-4	1.00	2.50	2.50	U	ug/L	SW8260B	03/21/13
Ethylbenzene	100-41-4	1.00	2.50	2.50	U	ug/L	SW8260B	03/21/13
m,p-Xylene	108-38-3/1	2.00	5.00	5.00	U	ug/L	SW8260B	03/21/13
o-Xylene	95-47-6	1.00	2.50	2.50	U	ug/L	SW8260B	03/21/13
Isopropylbenzene	98-82-8	1.00	2.50	2.50	U	ug/L	SW8260B	03/21/13
1,2-Dibromo-3-chloropropane	96-12-8	1.00	2.50	2.50	U	ug/L	SW8260B	03/21/13

Surrogate	% Recovery	Control Limits	Qualifier
Dibromofluoromethane	100	75-125	
1,2-Dichloroethane-d4	104	75-125	
Toluene-d8	94	75-125	
4-Bromofluorobenzene	88	75-125	

U=Not detected at specified reporting limit
 J=Estimated value below reporting limit
 E=Estimated value above calibration range
 *=See case narrative

CH2M HILL Applied Sciences Laboratory (ASL)

Client Information				Lab Information			
Client Sample ID: ContB_bio_t0DL				Lab Sample ID: M145503DL			
Project Name: Camp Lejeune				Date Received: 03/20/13			
Sample Date: 03/18/13				Dilution Factor: 100			
Sample Time: 13:00				Report Revision No.: 0			
Type: Grab							
Matrix: Water							

Analyte	CAS#	DL	RL	Sample Result	Qualifier	Units	Analysis Method	Date Analyzed
GC/MS Volatiles								
Vinyl Chloride	75-01-4	20.0	50.0	288		ug/L	SW8260B	03/21/13
1,1-Dichloroethene	75-35-4	20.0	50.0	50.0	U	ug/L	SW8260B	03/21/13
Methylene chloride	75-09-2	20.0	50.0	50.0	U	ug/L	SW8260B	03/21/13
trans-1,2-Dichloroethene	156-60-5	20.0	50.0	50.0	U	ug/L	SW8260B	03/21/13
1,1-Dichloroethane	75-34-3	20.0	50.0	50.0	U	ug/L	SW8260B	03/21/13
cis-1,2-Dichloroethene	156-59-2	20.0	50.0	50.0	U	ug/L	SW8260B	03/21/13
1,2-Dichloroethane	107-06-2	20.0	50.0	50.0	U	ug/L	SW8260B	03/21/13
Benzene	71-43-2	20.0	50.0	50.0	U	ug/L	SW8260B	03/21/13
Trichloroethene (TCE)	79-01-6	20.0	50.0	50.0	U	ug/L	SW8260B	03/21/13
Toluene	108-88-3	20.0	50.0	50.0	U	ug/L	SW8260B	03/21/13
Tetrachloroethene (PCE)	127-18-4	20.0	50.0	50.0	U	ug/L	SW8260B	03/21/13
Ethylbenzene	100-41-4	20.0	50.0	50.0	U	ug/L	SW8260B	03/21/13
m,p-Xylene	108-38-3/1	40.0	100	100	U	ug/L	SW8260B	03/21/13
o-Xylene	95-47-6	20.0	50.0	50.0	U	ug/L	SW8260B	03/21/13
Isopropylbenzene	98-82-8	20.0	50.0	50.0	U	ug/L	SW8260B	03/21/13
1,2-Dibromo-3-chloropropane	96-12-8	20.0	50.0	50.0	U	ug/L	SW8260B	03/21/13

Surrogate	% Recovery	Control Limits	Qualifier
Dibromofluoromethane	100	75-125	
1,2-Dichloroethane-d4	104	75-125	
Toluene-d8	97	75-125	
4-Bromofluorobenzene	91	75-125	

U=Not detected at specified reporting limit
 J=Estimated value below reporting limit
 E=Estimated value above calibration range
 *=See case narrative

CH2M HILL Applied Sciences Laboratory (ASL)

Client Information				Lab Information			
Client Sample ID: EHCL_bio_t0				Lab Sample ID: M145504			
Project Name: Camp Lejeune				Date Received: 03/20/13			
Sample Date: 03/19/13				Dilution Factor: 5			
Sample Time: 16:50				Report Revision No.: 0			
Type: Grab							
Matrix: Water							

Analyte	CAS#	DL	RL	Sample Result	Qualifier	Units	Analysis Method	Date Analyzed
GC/MS Volatiles								
Vinyl Chloride	75-01-4	1.00	2.50	2.50	U	ug/L	SW8260B	03/21/13
1,1-Dichloroethene	75-35-4	1.00	2.50	2.50	U	ug/L	SW8260B	03/21/13
Methylene chloride	75-09-2	1.00	2.50	2.50	U	ug/L	SW8260B	03/21/13
trans-1,2-Dichloroethene	156-60-5	1.00	2.50	2.50	U	ug/L	SW8260B	03/21/13
1,1-Dichloroethane	75-34-3	1.00	2.50	2.50	U	ug/L	SW8260B	03/21/13
cis-1,2-Dichloroethene	156-59-2	1.00	2.50	2.50	U	ug/L	SW8260B	03/21/13
1,2-Dichloroethane	107-06-2	1.00	2.50	2.50	U	ug/L	SW8260B	03/21/13
Benzene	71-43-2	1.00	2.50	2.50	U	ug/L	SW8260B	03/21/13
Trichloroethene (TCE)	79-01-6	1.00	2.50	2.50	U	ug/L	SW8260B	03/21/13
Toluene	108-88-3	1.00	2.50	23.3		ug/L	SW8260B	03/21/13
Tetrachloroethene (PCE)	127-18-4	1.00	2.50	2.50	U	ug/L	SW8260B	03/21/13
Ethylbenzene	100-41-4	1.00	2.50	2.50	U	ug/L	SW8260B	03/21/13
m,p-Xylene	108-38-3/1	2.00	5.00	5.07		ug/L	SW8260B	03/21/13
o-Xylene	95-47-6	1.00	2.50	2.74		ug/L	SW8260B	03/21/13
Isopropylbenzene	98-82-8	1.00	2.50	2.50	U	ug/L	SW8260B	03/21/13
1,2-Dibromo-3-chloropropane	96-12-8	1.00	2.50	2.50	U	ug/L	SW8260B	03/21/13

Surrogate	% Recovery	Control Limits	Qualifier
Dibromofluoromethane	103	75-125	
1,2-Dichloroethane-d4	109	75-125	
Toluene-d8	98	75-125	
4-Bromofluorobenzene	91	75-125	

U=Not detected at specified reporting limit
 J=Estimated value below reporting limit
 E=Estimated value above calibration range
 *=See case narrative

CH2M HILL Applied Sciences Laboratory (ASL)

Client Information				Lab Information			
Client Sample ID: WB1-0321				Lab Sample ID: WB1-0321			
Project Name: Camp Lejeune				Date Received: N/A			
Sample Date: N/A				Dilution Factor: 1			
Sample Time: N/A				Report Revision No.: 0			
Type: QC							
Matrix: Water							

Analyte	CAS#	DL	RL	Sample Result	Qualifier	Units	Analysis Method	Date Analyzed
GC/MS Volatiles								
Vinyl Chloride	75-01-4	0.20	0.50	0.50	U	ug/L	SW8260B	03/21/13
1,1-Dichloroethene	75-35-4	0.20	0.50	0.50	U	ug/L	SW8260B	03/21/13
Methylene chloride	75-09-2	0.20	0.50	0.50	U	ug/L	SW8260B	03/21/13
trans-1,2-Dichloroethene	156-60-5	0.20	0.50	0.50	U	ug/L	SW8260B	03/21/13
1,1-Dichloroethane	75-34-3	0.20	0.50	0.50	U	ug/L	SW8260B	03/21/13
cis-1,2-Dichloroethene	156-59-2	0.20	0.50	0.50	U	ug/L	SW8260B	03/21/13
1,2-Dichloroethane	107-06-2	0.20	0.50	0.50	U	ug/L	SW8260B	03/21/13
Benzene	71-43-2	0.20	0.50	0.50	U	ug/L	SW8260B	03/21/13
Trichloroethene (TCE)	79-01-6	0.20	0.50	0.50	U	ug/L	SW8260B	03/21/13
Toluene	108-88-3	0.20	0.50	0.50	U	ug/L	SW8260B	03/21/13
Tetrachloroethene (PCE)	127-18-4	0.20	0.50	0.50	U	ug/L	SW8260B	03/21/13
Ethylbenzene	100-41-4	0.20	0.50	0.50	U	ug/L	SW8260B	03/21/13
m,p-Xylene	108-38-3/1	0.40	1.00	1.00	U	ug/L	SW8260B	03/21/13
o-Xylene	95-47-6	0.20	0.50	0.50	U	ug/L	SW8260B	03/21/13
Isopropylbenzene	98-82-8	0.20	0.50	0.50	U	ug/L	SW8260B	03/21/13
1,2-Dibromo-3-chloropropane	96-12-8	0.20	0.50	0.50	U	ug/L	SW8260B	03/21/13

Surrogate	% Recovery	Control Limits	Qualifier
Dibromofluoromethane	101	75-125	
1,2-Dichloroethane-d4	104	75-125	
Toluene-d8	98	75-125	
4-Bromofluorobenzene	92	75-125	

U=Not detected at specified reporting limit
 J=Estimated value below reporting limit
 E=Estimated value above calibration range
 *=See case narrative

CH2M HILL Applied Sciences Laboratory (ASL)

<u>Client Information</u>	<u>Lab Information</u>
Project Name: Camp Lejeune	LCS ID: BS1W0321
Type: QC	Report Revision No.: 0
Matrix: Water	Dilution Factor: 1

Analyte	CAS#	Spike Amount	Sample Result	Units	%Recovery	Analysis Method	Date Analyzed
GC/MS Volatiles							
Vinyl Chloride	75-01-4	20.0	18.8	ug/L	94	SW8260B	03/21/13
1,1-Dichloroethene	75-35-4	20.0	20.4	ug/L	102	SW8260B	03/21/13
Methylene chloride	75-09-2	20.0	22.1	ug/L	111	SW8260B	03/21/13
trans-1,2-Dichloroethene	156-60-5	20.0	20.6	ug/L	103	SW8260B	03/21/13
1,1-Dichloroethane	75-34-3	20.0	21.0	ug/L	105	SW8260B	03/21/13
cis-1,2-Dichloroethene	156-59-2	20.0	20.9	ug/L	104	SW8260B	03/21/13
1,2-Dichloroethane	107-06-2	20.0	20.7	ug/L	103	SW8260B	03/21/13
Benzene	71-43-2	20.0	20.6	ug/L	103	SW8260B	03/21/13
Trichloroethene (TCE)	79-01-6	20.0	20.0	ug/L	100	SW8260B	03/21/13
Toluene	108-88-3	20.0	20.5	ug/L	102	SW8260B	03/21/13
Tetrachloroethene (PCE)	127-18-4	20.0	19.6	ug/L	98	SW8260B	03/21/13
Ethylbenzene	100-41-4	20.0	20.7	ug/L	104	SW8260B	03/21/13
m,p-Xylene	108-38-3/1	40.0	41.6	ug/L	104	SW8260B	03/21/13
o-Xylene	95-47-6	20.0	21.0	ug/L	105	SW8260B	03/21/13
Isopropylbenzene	98-82-8	20.0	18.2	ug/L	91	SW8260B	03/21/13
1,2-Dibromo-3-chloropropane	96-12-8	20.0	19.1	ug/L	96	SW8260B	03/21/13

Surrogate	% Recovery	Control Limits	Qualifier
Dibromofluoromethane	101	75-125	
1,2-Dichloroethane-d4	99	75-125	
Toluene-d8	96	75-125	
4-Bromofluorobenzene	96	75-125	

U=Not detected at specified reporting limit
 J=Estimated value below reporting limit
 E=Estimated value above calibration range
 *=See case narrative

**CASE NARRATIVE
METALS ANALYSIS**

Lab Name: CH2M HILL/LAB/CVO

ASL SDG#: M1455

Project: Camp Lejeune

Project #: 387442.78.WP

I. Method(s):

Analysis: E200.7

Preparation: FLDFLT

II. Receipt/Holding Times:

All acceptance criteria were met.

III. Analysis:

A. Initial Calibration(s):

All acceptance criteria were met.

B. Calibration Verification(s):

All acceptance criteria were met.

C. Blanks:

All acceptance criteria were met.

D. Laboratory Control Sample(s):

All acceptance criteria were met.

E. Matrix Spike/Matrix Spike Duplicate Sample(s):

Analyzed in accordance with standard operating procedure.

F. Interference Check Sample(s):

All acceptance criteria were met.

G. Serial Dilution(s):

Analyzed in accordance with standard operating procedure.

H. Digestion Exception(s):

None.

I. Analytical Exception(s):

None.

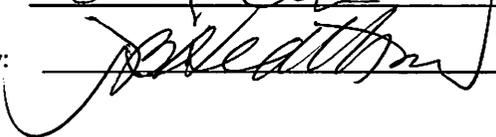
IV. Documentation Exception(s):

None.

V. I certify that this data package is in compliance with the terms and conditions agreed to by the client and CH2M HILL, both technically and for completeness, except for the conditions detailed above. Release of the data contained in this hardcopy data package has been authorized by the Laboratory Manager or designee, as verified by the following signatures.

Prepared by: 

Date: 3/27/13

Reviewed by: 

Date: 4/16/13

CH2M HILL Applied Sciences Laboratory (ASL)

<u>Client Information</u>	<u>Lab Information</u>
Project Name: Camp Lejeune	Lab Batch ID: M1455
Date Received: 03/20/13	Report Revision No.: 0
Type: See C.O.C.	
Matrix: Water	

Client Sample ID	Lab Sample ID	Dilution Factor	RL	Result	Qual	Units	Date Analyzed
Iron: E200.7							
<i>Dissolved Metals</i>							
ContA_aug_10	M145501F	1	100	14400		ug/L	03/27/13
Sulf_aug_10	M145502F	1	100	6240		ug/L	03/27/13
<i>Total Metals</i>							
WB1-0326	WB1-0326	1	100	100	U	ug/L	03/27/13

U=Not detected at specified reporting limit
 J=Estimated value below reporting limit
 E=Estimated value above calibration range
 *=See case narrative

CH2M HILL Applied Sciences Laboratory (ASL)

<u>Client Information</u>	<u>Lab Information</u>
Project Name: Camp Lejeune Type: QC Matrix: Water	LCS ID: BS1W0326 Report Revision No.: 0 Dilution Factor: 1

Analyte	CAS#	Spike Amount	Sample Result	Units	%Recovery	Analysis Method	Date Analyzed
Metals							
Iron	7439-89-6	500	564	ug/L	113	E200.7	03/27/13

U=Not detected at specified reporting limit
J=Estimated value below reporting limit
E=Estimated value above calibration range
*=See case narrative

**CASE NARRATIVE
GENERAL CHEMISTRY ANALYSIS**

Lab Name: CH2M HILL/LAB/CVO

ASL SDG#: M1455

Project: Camp Lejeune

Project #: 387442.78.WP

I. Method(s):

Analysis: E300.0A

II. Receipt/Holding Times:

All acceptance criteria were met.

III. Analysis:

A. Initial Calibration(s):

All acceptance criteria were met.

B. Calibration Verification(s):

All acceptance criteria were met.

C. Blanks:

All acceptance criteria were met.

D. Laboratory Control Sample(s):

All acceptance criteria were met.

E. Matrix Spike/Matrix Spike Duplicate Sample(s):

Analyzed in accordance with standard operating procedure.

F. Analytical Exception(s):

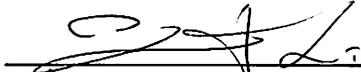
None.

IV. Documentation Exception(s):

None.

V. I certify that this data package is in compliance with the terms and conditions agreed to by the client and CH2M HILL, both technically and for completeness, except for the conditions detailed above. Release of the data contained in this hardcopy data package has been authorized by the Laboratory Manager or designee, as verified by the following signatures.

Prepared by:



Date:

3/22/2013

Reviewed by:



Date:

3/27/13

CH2M HILL Applied Sciences Laboratory (ASL)

<u>Client Information</u>	<u>Lab Information</u>
Project Name: Camp Lejeune	Lab Batch ID: M1455
Date Received: 03/20/13	Analysis Method: E300.0A
Type: See C.O.C.	Units: mg/L
Matrix: Water	Report Revision No.: 0

Client Sample ID	Lab Sample ID	Dilution Factor	RL	Sulfate Result	Qualifier	Date Analyzed
General Chemistry						
ContA_aug_t0	M145501	1	0.10	0.10	U	03/21/13
Sulf_aug_10	M145502	2	0.20	43.5		03/22/13
WB1-0319	WB1-0319	1	0.10	0.10	U	03/21/13

U=Not detected at specified reporting limit
 J=Estimated value below reporting limit
 E=Estimated value above calibration range
 *=See case narrative

CH2M HILL Applied Sciences Laboratory (ASL)

<u>Client Information</u>	<u>Lab Information</u>
Project Name: Camp Lejeune Type: QC Matrix: Water	Lab Batch ID: M1455 Report Revision No.: 0

LCS ID	Analyte	Spike Amount	Sample Result	Units	% Recovery	Analysis Method	Date Analyzed
General Chemistry							
BS1W0321	Sulfate	15.0	14.5	mg/L	97	E300.0A	03/21/13

U=Not detected at specified reporting limit
J=Estimated value below reporting limit
E=Estimated value above calibration range
*=See case narrative

CH2MHILL Applied Sciences Lab
CHAIN OF CUSTODY RECORD
AND AGREEMENT TO PERFORM SERVICES

1000 NE Circle Blvd., Suite 10350
 Corvallis, OR 97330
 (541) 768-3120 FAX (541) 752-0276

12.5°C AD

COC #

Project # or Purchase Order # 387442.78.WP							TOTAL # OF CONTAINERS	Requested Analytical Method #							THIS AREA FOR LAB USE ONLY												
Project Name Camp Lejeune Site 78								Sulfate (E300.0)	VOCs (SW8260B)*	Dissolved Iron (200.7) PRE-FILTERED						Lab #	Page	of									
Company Name or Home Address/Phone Number CH2M HILL																M1455											
Email Address for Reporting Dusty Berggren/CVO				Report Copy to: Mike Niemet/CVO																							
Turnaround Time <input type="checkbox"/> 24 hours <input type="checkbox"/> 48 hours <input type="checkbox"/> 72 hours <input type="checkbox"/> 7 days <input type="checkbox"/> 14 days <input checked="" type="checkbox"/> 21 days (STD)				Drinking Water? Yes <input type="checkbox"/> No <input checked="" type="checkbox"/>		Sample Disposal: Dispose <input checked="" type="checkbox"/> Return <input type="checkbox"/>																					
Sampling		Type		Matrix			Preservative							EPA Tier QC Level													
Date	Time	COMP	GRAB	WATER	SOIL	AIR	CLIENT SAMPLE ID							UNPRES	HCl	HNO ₃	H ₂ SO ₄	ZnAc	UNPRES	UNPRES	1 (Screening)	2	3	4			
3/19/13	16:30		x	x			ContA_aug_t0	3	1	HOLD	1																
3/19/13	16:40		x	x			Sulf_aug_t0	3	1	HOLD	1																
3/19/13	1300		X	X			ContB__bio_t0	1			1																
3/19/13	1650		X	X			EHCL_bio_t0	1			1																

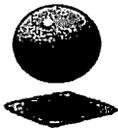
Possible Hazard Identification: Non-Hazard Flammable Skin Irritant Poison B Unknown Volatile Contaminants/Odororous Biohazard Other _____

Relinquished By			Date/Time			Received By:			Date/Time		
Sampled By and Title <i>Dusty R Berggren</i>			Date/Time 3/19/13 1700			Relinquished By <i>Dusty R Berggren</i>			Date/Time 3/20/13 8:15		
Received By <i>Mike Niemet</i>			Date/Time 3/20/13 0900			Relinquished By			Date/Time		
Received By			Date/Time			Shipped Via UPS Fed-Ex Other _____			Tracking #		

Special Instructions
 Please provide preliminary VOC results when available. NOTE LIMITED VOLUME. Reference SDG M1252. VOCs should be slightly lower in parent CAH compounds and higher in daughter products. Expect lower sulfate and dissolved Fe concentrations.
 Only report the following VOCs: benzene, ethylbenzene, toluene, xylenes, tetrachloroethene (PCE), trichloroethene (TCE), 1,1-dichloroethene (DCE), cis-1,2-DCE, trans-1,2-DCE, vinyl chloride (VC), 1,1-dichloroethane (DCA), 1,2-DCA, 1,2-dibromo-3-chloropropane, isopropylbenzene, and methylene chloride.

Instructions and Agreement Provisions on Reverse Side

DISTRIBUTION: Original – LAB, Yellow – LAB, Pink – Client
 Rev 09/2010 LAB FORM 340



Sample Receipt Exception Report

Sample Batch Number: M1455 Client/Project CAMP LESBURG

The following exceptions were noted:	Comments (write number of exception description and the impacted sample numbers)
1. No custody seal as required by project	11. ONLY 1 VOC VIAL PROVIDED. ASSUME UN-PRESERVED.
2. No chain-of-custody provided	
3. Analysis, description, date of collection not provided	
4. Samples broken or leaking on receipt.	
5. Temperature of samples inappropriate for analysis requested	
6. Container inappropriate for analysis requested	
7. Inadequate sample volume.	
8. Preservation inappropriate for analysis requested	
9. Samples received out of holding time for analysis requested	
10. Discrepancies between COC form and container labels.	
X 11. Other.	

ACTION TAKEN: NOTIFY LTM. LOG IN AS UN-PRESERVED.

Originator: P. McMorris Date: 3/20/13
 Client was notified on: _____ Client Contact: _____
 (Date/Time)

Client Services:



ANALYTICAL REPORT

For:
Camp Lejeune

ASL Report #: M1670
Project ID: 387442.78.WP
Attn: Dusty Berggren/CVO
cc:
Mike Niemet/CVO

Authorized and Released By:

Laboratory Project Manager
Ben Thompson
(541) 758-0235 ext.23132
April 29, 2013

This data package meets standards requested by client and is not intended or implied to meet any other standard.

All analyses performed by CH2M HILL are clearly indicated. Any subcontracted analyses are included as appended reports as received from the subcontracted laboratory. The results included in this report only relate to the samples listed on the following Sample Cross-Reference page. This report shall not be reproduced except in full, without the written approval of the laboratory.

Any unusual difficulties encountered during the analysis of your samples are discussed in the attached case narratives.

ASL Report #: M1670

Sample Receipt Comments

We certify that the test results meet all standard ASL requirements.

Sample Cross-Reference

ASL Sample ID	Client Sample ID	Date/Time Collected	Date Received
M167001	ContA_aug_t2	04/17/13	04/17/13
M167002	Sulf_aug_t2	04/17/13	04/17/13
M167003	ContB_bio_t2	04/17/13	04/17/13
M167004	EHCL_bio_t2	04/17/13	04/17/13
M167005	ContA_soil_t2	04/17/13	04/17/13
M167006	Sulf_soil_t2	04/17/13	04/17/13
M167007	ContB_soil_t2	04/17/13	04/17/13
M167008	EHCL_soil_t2	04/17/13	04/17/13

CASE NARRATIVE
GC/MS VOLATILES ANALYSIS

Lab Name: CH2M HILL/LAB/CVO

ASL SDG#: M1670

Project: Camp Lejeune

Project #: 387442.78.WP

I. Method(s):

Analysis: SW8260B

Preparation: SW5030

II. Receipt/Holding Times:

All acceptance criteria were met.

III. Analysis:

A. Initial Calibration(s):

All acceptance criteria were met.

B. Calibration Verification(s):

All acceptance criteria were met.

C. Blank(s):

All acceptance criteria were met.

D. Laboratory Control Sample(s):

All acceptance criteria were met.

E. Matrix Spike/Matrix Spike Duplicate Sample(s):

Analyzed in accordance with standard operating procedure.

F. Surrogate Standard(s):

All acceptance criteria were met.

G. BFB Tune Verification(s):

All acceptance criteria were met.

H. Internal Standard(s):

All acceptance criteria were met.

I. Analytical Exception(s):

None.

IV. Documentation Exception(s):

None.

V. I certify that this data package is in compliance with the terms and conditions agreed to by the client and CH2M HILL, both technically and for completeness, except for the conditions detailed above. Release of the data contained in this hardcopy data package has been authorized by the Laboratory Manager or designee, as verified by the following signatures.

Prepared by: _____

Date: _____

4-26-13

Reviewed by: _____

Date: _____

4/26/13

CH2M HILL Applied Sciences Laboratory (ASL)

<u>Client Information</u>	<u>Lab Information</u>
Client Sample ID: ContA_aug_t2	Lab Sample ID: M167001
Project Name: Camp Lejeune	Date Received: 04/17/13
Sample Date: 04/17/13	Dilution Factor: 50
Sample Time: N/A	Report Revision No.: 0
Type: Grab	
Matrix: Water	

Analyte	CAS#	DL	RL	Sample Result	Qualifier	Units	Analysis Method	Date Analyzed
GC/MS Volatiles								
Vinyl Chloride	75-01-4	10.0	25.0	25.0	U	ug/L	SW8260B	04/19/13
1,1-Dichloroethene	75-35-4	10.0	25.0	25.0	U	ug/L	SW8260B	04/19/13
Methylene chloride	75-09-2	10.0	25.0	25.0	U	ug/L	SW8260B	04/19/13
trans-1,2-Dichloroethene	156-60-5	10.0	25.0	25.0	U	ug/L	SW8260B	04/19/13
1,1-Dichloroethane	75-34-3	10.0	25.0	25.0	U	ug/L	SW8260B	04/19/13
cis-1,2-Dichloroethene	156-59-2	10.0	25.0	25.0	U	ug/L	SW8260B	04/19/13
1,2-Dichloroethane	107-06-2	10.0	25.0	25.0	U	ug/L	SW8260B	04/19/13
Benzene	71-43-2	10.0	25.0	25.0	U	ug/L	SW8260B	04/19/13
Trichloroethene (TCE)	79-01-6	10.0	25.0	611		ug/L	SW8260B	04/19/13
Toluene	108-88-3	10.0	25.0	9120	E	ug/L	SW8260B	04/19/13
Tetrachloroethene (PCE)	127-18-4	10.0	25.0	25.0	U	ug/L	SW8260B	04/19/13
Ethylbenzene	100-41-4	10.0	25.0	25.0	U	ug/L	SW8260B	04/19/13
m,p-Xylene	108-38-3/1	20.0	50.0	50.0	U	ug/L	SW8260B	04/19/13
o-Xylene	95-47-6	10.0	25.0	25.0	U	ug/L	SW8260B	04/19/13
Isopropylbenzene	98-82-8	10.0	25.0	25.0	U	ug/L	SW8260B	04/19/13
1,2-Dibromo-3-chloropropane	96-12-8	10.0	25.0	25.0	U	ug/L	SW8260B	04/19/13

<u>Surrogate</u>	<u>% Recovery</u>	<u>Control Limits</u>	<u>Qualifier</u>
Dibromofluoromethane	97	75-125	
1,2-Dichloroethane-d4	106	75-125	
Toluene-d8	96	75-125	
4-Bromofluorobenzene	86	75-125	

*=See case narrative

U=Not detected at specified reporting limit

E=Estimated value above calibration range

CH2M HILL Applied Sciences Laboratory (ASL)

Client Information				Lab Information			
Client Sample ID: ContA_aug_t2DL				Lab Sample ID: M167001DL			
Project Name: Camp Lejeune				Date Received: 04/17/13			
Sample Date: 04/17/13				Dilution Factor: 200			
Sample Time: N/A				Report Revision No.: 0			
Type: Grab							
Matrix: Water							

Analyte	CAS#	DL	RL	Sample Result	Qualifier	Units	Analysis Method	Date Analyzed
GC/MS Volatiles								
Vinyl Chloride	75-01-4	40.0	100	100	U	ug/L	SW8260B	04/19/13
1,1-Dichloroethene	75-35-4	40.0	100	100	U	ug/L	SW8260B	04/19/13
Methylene chloride	75-09-2	40.0	100	100	U	ug/L	SW8260B	04/19/13
trans-1,2-Dichloroethene	156-60-5	40.0	100	100	U	ug/L	SW8260B	04/19/13
1,1-Dichloroethane	75-34-3	40.0	100	100	U	ug/L	SW8260B	04/19/13
cis-1,2-Dichloroethene	156-59-2	40.0	100	100	U	ug/L	SW8260B	04/19/13
1,2-Dichloroethane	107-06-2	40.0	100	100	U	ug/L	SW8260B	04/19/13
Benzene	71-43-2	40.0	100	100	U	ug/L	SW8260B	04/19/13
Trichloroethene (TCE)	79-01-6	40.0	100	594		ug/L	SW8260B	04/19/13
Toluene	108-88-3	40.0	100	9060		ug/L	SW8260B	04/19/13
Tetrachloroethene (PCE)	127-18-4	40.0	100	100	U	ug/L	SW8260B	04/19/13
Ethylbenzene	100-41-4	40.0	100	100	U	ug/L	SW8260B	04/19/13
m,p-Xylene	108-38-3/1	80.0	200	200	U	ug/L	SW8260B	04/19/13
o-Xylene	95-47-6	40.0	100	100	U	ug/L	SW8260B	04/19/13
Isopropylbenzene	98-82-8	40.0	100	100	U	ug/L	SW8260B	04/19/13
1,2-Dibromo-3-chloropropane	96-12-8	40.0	100	100	U	ug/L	SW8260B	04/19/13

Surrogate	% Recovery	Control Limits	Qualifier
Dibromofluoromethane	101	75-125	
1,2-Dichloroethane-d4	105	75-125	
Toluene-d8	96	75-125	
4-Bromofluorobenzene	88	75-125	

*=See case narrative

U=Not detected at specified reporting limit

E=Estimated value above calibration range

CH2M HILL Applied Sciences Laboratory (ASL)

Client Information				Lab Information			
Client Sample ID: Sulf_aug_t2				Lab Sample ID: M167002			
Project Name: Camp Lejeune				Date Received: 04/17/13			
Sample Date: 04/17/13				Dilution Factor: 50			
Sample Time: N/A				Report Revision No.: 0			
Type: Grab							
Matrix: Water							

Analyte	CAS#	DL	RL	Sample Result	Qualifier	Units	Analysis Method	Date Analyzed
GC/MS Volatiles								
Vinyl Chloride	75-01-4	10.0	25.0	25.0	U	ug/L	SW8260B	04/19/13
1,1-Dichloroethene	75-35-4	10.0	25.0	25.0	U	ug/L	SW8260B	04/19/13
Methylene chloride	75-09-2	10.0	25.0	25.0	U	ug/L	SW8260B	04/19/13
trans-1,2-Dichloroethene	156-60-5	10.0	25.0	25.0	U	ug/L	SW8260B	04/19/13
1,1-Dichloroethane	75-34-3	10.0	25.0	25.0	U	ug/L	SW8260B	04/19/13
cis-1,2-Dichloroethene	156-59-2	10.0	25.0	25.0	U	ug/L	SW8260B	04/19/13
1,2-Dichloroethane	107-06-2	10.0	25.0	25.0	U	ug/L	SW8260B	04/19/13
Benzene	71-43-2	10.0	25.0	25.0	U	ug/L	SW8260B	04/19/13
Trichloroethene (TCE)	79-01-6	10.0	25.0	512		ug/L	SW8260B	04/19/13
Toluene	108-88-3	10.0	25.0	7110	E	ug/L	SW8260B	04/19/13
Tetrachloroethene (PCE)	127-18-4	10.0	25.0	25.0	U	ug/L	SW8260B	04/19/13
Ethylbenzene	100-41-4	10.0	25.0	25.0	U	ug/L	SW8260B	04/19/13
m,p-Xylene	108-38-3/1	20.0	50.0	50.0	U	ug/L	SW8260B	04/19/13
o-Xylene	95-47-6	10.0	25.0	25.0	U	ug/L	SW8260B	04/19/13
Isopropylbenzene	98-82-8	10.0	25.0	25.0	U	ug/L	SW8260B	04/19/13
1,2-Dibromo-3-chloropropane	96-12-8	10.0	25.0	25.0	U	ug/L	SW8260B	04/19/13

Surrogate	% Recovery	Control Limits	Qualifier
Dibromofluoromethane	98	75-125	
1,2-Dichloroethane-d4	106	75-125	
Toluene-d8	95	75-125	
4-Bromofluorobenzene	87	75-125	

*=See case narrative

U=Not detected at specified reporting limit

E=Estimated value above calibration range

CH2M HILL Applied Sciences Laboratory (ASL)

Client Information				Lab Information			
Client Sample ID: Sulf_aug_t2DL				Lab Sample ID: M167002DL			
Project Name: Camp Lejeune				Date Received: 04/17/13			
Sample Date: 04/17/13				Dilution Factor: 200			
Sample Time: N/A				Report Revision No.: 0			
Type: Grab							
Matrix: Water							

Analyte	CAS#	DL	RL	Sample Result	Qualifier	Units	Analysis Method	Date Analyzed
GC/MS Volatiles								
Vinyl Chloride	75-01-4	40.0	100	100	U	ug/L	SW8260B	04/19/13
1,1-Dichloroethene	75-35-4	40.0	100	100	U	ug/L	SW8260B	04/19/13
Methylene chloride	75-09-2	40.0	100	100	U	ug/L	SW8260B	04/19/13
trans-1,2-Dichloroethene	156-60-5	40.0	100	100	U	ug/L	SW8260B	04/19/13
1,1-Dichloroethane	75-34-3	40.0	100	100	U	ug/L	SW8260B	04/19/13
cis-1,2-Dichloroethene	156-59-2	40.0	100	100	U	ug/L	SW8260B	04/19/13
1,2-Dichloroethane	107-06-2	40.0	100	100	U	ug/L	SW8260B	04/19/13
Benzene	71-43-2	40.0	100	100	U	ug/L	SW8260B	04/19/13
Trichloroethene (TCE)	79-01-6	40.0	100	505		ug/L	SW8260B	04/19/13
Toluene	108-88-3	40.0	100	7160		ug/L	SW8260B	04/19/13
Tetrachloroethene (PCE)	127-18-4	40.0	100	100	U	ug/L	SW8260B	04/19/13
Ethylbenzene	100-41-4	40.0	100	100	U	ug/L	SW8260B	04/19/13
m,p-Xylene	108-38-3/1	80.0	200	200	U	ug/L	SW8260B	04/19/13
o-Xylene	95-47-6	40.0	100	100	U	ug/L	SW8260B	04/19/13
Isopropylbenzene	98-82-8	40.0	100	100	U	ug/L	SW8260B	04/19/13
1,2-Dibromo-3-chloropropane	96-12-8	40.0	100	100	U	ug/L	SW8260B	04/19/13

Surrogate	% Recovery	Control Limits	Qualifier
Dibromofluoromethane	100	75-125	
1,2-Dichloroethane-d4	106	75-125	
Toluene-d8	96	75-125	
4-Bromofluorobenzene	88	75-125	

*=See case narrative

U=Not detected at specified reporting limit

E=Estimated value above calibration range

CH2M HILL Applied Sciences Laboratory (ASL)

Client Information				Lab Information			
Client Sample ID: ContB_bio_t2				Lab Sample ID: M167003			
Project Name: Camp Lejeune				Date Received: 04/17/13			
Sample Date: 04/17/13				Dilution Factor: 2.2			
Sample Time: N/A				Report Revision No.: 0			
Type: Grab							
Matrix: Water							

Analyte	CAS#	DL	RL	Sample Result	Qualifier	Units	Analysis Method	Date Analyzed
GC/MS Volatiles								
Vinyl Chloride	75-01-4	0.44	1.10	2.55		ug/L	SW8260B	04/19/13
1,1-Dichloroethene	75-35-4	0.44	1.10	1.10	U	ug/L	SW8260B	04/19/13
Methylene chloride	75-09-2	0.44	1.10	1.10	U	ug/L	SW8260B	04/19/13
trans-1,2-Dichloroethene	156-60-5	0.44	1.10	1.10	U	ug/L	SW8260B	04/19/13
1,1-Dichloroethane	75-34-3	0.44	1.10	1.10	U	ug/L	SW8260B	04/19/13
cis-1,2-Dichloroethene	156-59-2	0.44	1.10	1.10	U	ug/L	SW8260B	04/19/13
1,2-Dichloroethane	107-06-2	0.44	1.10	1.10	U	ug/L	SW8260B	04/19/13
Benzene	71-43-2	0.44	1.10	1.10	U	ug/L	SW8260B	04/19/13
Trichloroethene (TCE)	79-01-6	0.44	1.10	1.10	U	ug/L	SW8260B	04/19/13
Toluene	108-88-3	0.44	1.10	2.94		ug/L	SW8260B	04/19/13
Tetrachloroethene (PCE)	127-18-4	0.44	1.10	1.10	U	ug/L	SW8260B	04/19/13
Ethylbenzene	100-41-4	0.44	1.10	1.17		ug/L	SW8260B	04/19/13
m,p-Xylene	108-38-3/1	0.88	2.20	2.20	U	ug/L	SW8260B	04/19/13
o-Xylene	95-47-6	0.44	1.10	1.10	U	ug/L	SW8260B	04/19/13
Isopropylbenzene	98-82-8	0.44	1.10	1.10	U	ug/L	SW8260B	04/19/13
1,2-Dibromo-3-chloropropane	96-12-8	0.44	1.10	1.10	U	ug/L	SW8260B	04/19/13

<u>Surrogate</u>	<u>% Recovery</u>	<u>Control Limits</u>	<u>Qualifier</u>
Dibromofluoromethane	96	75-125	
1,2-Dichloroethane-d4	105	75-125	
Toluene-d8	91	75-125	
4-Bromofluorobenzene	82	75-125	

*=See case narrative

U=Not detected at specified reporting limit

E=Estimated value above calibration range

CH2M HILL Applied Sciences Laboratory (ASL)

Client Information				Lab Information			
Client Sample ID: EHCL_bio_t2				Lab Sample ID: M167004			
Project Name: Camp Lejeune				Date Received: 04/17/13			
Sample Date: 04/17/13				Dilution Factor: 2.2			
Sample Time: N/A				Report Revision No.: 0			
Type: Grab							
Matrix: Water							

Analyte	CAS#	DL	RL	Sample Result	Qualifier	Units	Analysis Method	Date Analyzed
GC/MS Volatiles								
Vinyl Chloride	75-01-4	0.44	1.10	1.10	U	ug/L	SW8260B	04/19/13
1,1-Dichloroethene	75-35-4	0.44	1.10	1.10	U	ug/L	SW8260B	04/19/13
Methylene chloride	75-09-2	0.44	1.10	1.10	U	ug/L	SW8260B	04/19/13
trans-1,2-Dichloroethene	156-60-5	0.44	1.10	1.10	U	ug/L	SW8260B	04/19/13
1,1-Dichloroethane	75-34-3	0.44	1.10	1.10	U	ug/L	SW8260B	04/19/13
cis-1,2-Dichloroethene	156-59-2	0.44	1.10	1.10	U	ug/L	SW8260B	04/19/13
1,2-Dichloroethane	107-06-2	0.44	1.10	1.10	U	ug/L	SW8260B	04/19/13
Benzene	71-43-2	0.44	1.10	1.32		ug/L	SW8260B	04/19/13
Trichloroethene (TCE)	79-01-6	0.44	1.10	1.10	U	ug/L	SW8260B	04/19/13
Toluene	108-88-3	0.44	1.10	23.3		ug/L	SW8260B	04/19/13
Tetrachloroethene (PCE)	127-18-4	0.44	1.10	1.10	U	ug/L	SW8260B	04/19/13
Ethylbenzene	100-41-4	0.44	1.10	1.62		ug/L	SW8260B	04/19/13
m,p-Xylene	108-38-3/1	0.88	2.20	5.04		ug/L	SW8260B	04/19/13
o-Xylene	95-47-6	0.44	1.10	2.87		ug/L	SW8260B	04/19/13
Isopropylbenzene	98-82-8	0.44	1.10	1.10	U	ug/L	SW8260B	04/19/13
1,2-Dibromo-3-chloropropane	96-12-8	0.44	1.10	1.10	U	ug/L	SW8260B	04/19/13

Surrogate	% Recovery	Control Limits	Qualifier
Dibromofluoromethane	101	75-125	
1,2-Dichloroethane-d4	106	75-125	
Toluene-d8	94	75-125	
4-Bromofluorobenzene	89	75-125	

*=See case narrative

U=Not detected at specified reporting limit

E=Estimated value above calibration range

CH2M HILL Applied Sciences Laboratory (ASL)

Client Information	Lab Information
Client Sample ID: ContA_soil_t2	Lab Sample ID: M167005
Project Name: Camp Lejeune	Date Received: 04/17/13
Sample Date: 04/17/13	Dilution Factor: 100
Sample Time: N/A	Report Revision No.: 0
Type: Grab	
Matrix: Soil	
Basis: Dry Weight	

Analyte	CAS#	DL	RL	Sample Result	Qualifier	Units	Analysis Method	Date Analyzed
GC/MS Volatiles								
Vinyl Chloride	75-01-4	24.4	61.0	61.0	U	ug/Kg	SW8260B	04/19/13
1,1-Dichloroethene	75-35-4	24.4	61.0	61.0	U	ug/Kg	SW8260B	04/19/13
Methylene chloride	75-09-2	24.4	61.0	61.0	U	ug/Kg	SW8260B	04/19/13
trans-1,2-Dichloroethene	156-60-5	24.4	61.0	61.0	U	ug/Kg	SW8260B	04/19/13
1,1-Dichloroethane	75-34-3	24.4	61.0	61.0	U	ug/Kg	SW8260B	04/19/13
cis-1,2-Dichloroethene	156-59-2	24.4	61.0	61.0	U	ug/Kg	SW8260B	04/19/13
1,2-Dichloroethane	107-06-2	24.4	61.0	61.0	U	ug/Kg	SW8260B	04/19/13
Benzene	71-43-2	24.4	61.0	61.0	U	ug/Kg	SW8260B	04/19/13
Trichloroethene (TCE)	79-01-6	24.4	61.0	168		ug/Kg	SW8260B	04/19/13
Toluene	108-88-3	24.4	61.0	2870		ug/Kg	SW8260B	04/19/13
Tetrachloroethene (PCE)	127-18-4	24.4	61.0	61.0	U	ug/Kg	SW8260B	04/19/13
Ethylbenzene	100-41-4	24.4	61.0	61.0	U	ug/Kg	SW8260B	04/19/13
m,p-Xylene	108-38-3/1	48.8	122	122	U	ug/Kg	SW8260B	04/19/13
o-Xylene	95-47-6	24.4	61.0	61.0	U	ug/Kg	SW8260B	04/19/13
Isopropylbenzene	98-82-8	24.4	61.0	61.0	U	ug/Kg	SW8260B	04/19/13
1,2-Dibromo-3-chloropropane	96-12-8	24.4	61.0	61.0	U	ug/Kg	SW8260B	04/19/13

Surrogate	% Recovery	Control Limits	Qualifier
Dibromofluoromethane	96	65-135	
1,2-Dichloroethane-d4	104	65-135	
Toluene-d8	97	65-135	
4-Bromofluorobenzene	91	65-135	

*=See case narrative

U=Not detected at specified reporting limit

E=Estimated value above calibration range

CH2M HILL Applied Sciences Laboratory (ASL)

Client Information				Lab Information			
Client Sample ID: Sulf_soil_t2				Lab Sample ID: M167006			
Project Name: Camp Lejeune				Date Received: 04/17/13			
Sample Date: 04/17/13				Dilution Factor: 100			
Sample Time: N/A				Report Revision No.: 0			
Type: Grab							
Matrix: Soil							
Basis: Dry Weight							

Analyte	CAS#	DL	RL	Sample Result	Qualifier	Units	Analysis Method	Date Analyzed
GC/MS Volatiles								
Vinyl Chloride	75-01-4	19.1	47.7	47.7	U	ug/Kg	SW8260B	04/19/13
1,1-Dichloroethene	75-35-4	19.1	47.7	47.7	U	ug/Kg	SW8260B	04/19/13
Methylene chloride	75-09-2	19.1	47.7	47.7	U	ug/Kg	SW8260B	04/19/13
trans-1,2-Dichloroethene	156-60-5	19.1	47.7	47.7	U	ug/Kg	SW8260B	04/19/13
1,1-Dichloroethane	75-34-3	19.1	47.7	47.7	U	ug/Kg	SW8260B	04/19/13
cis-1,2-Dichloroethene	156-59-2	19.1	47.7	47.7	U	ug/Kg	SW8260B	04/19/13
1,2-Dichloroethane	107-06-2	19.1	47.7	47.7	U	ug/Kg	SW8260B	04/19/13
Benzene	71-43-2	19.1	47.7	47.7	U	ug/Kg	SW8260B	04/19/13
Trichloroethene (TCE)	79-01-6	19.1	47.7	89.6		ug/Kg	SW8260B	04/19/13
Toluene	108-88-3	19.1	47.7	1310		ug/Kg	SW8260B	04/19/13
Tetrachloroethene (PCE)	127-18-4	19.1	47.7	47.7	U	ug/Kg	SW8260B	04/19/13
Ethylbenzene	100-41-4	19.1	47.7	47.7	U	ug/Kg	SW8260B	04/19/13
m,p-Xylene	108-38-3/1	38.1	95.4	95.4	U	ug/Kg	SW8260B	04/19/13
o-Xylene	95-47-6	19.1	47.7	47.7	U	ug/Kg	SW8260B	04/19/13
Isopropylbenzene	98-82-8	19.1	47.7	47.7	U	ug/Kg	SW8260B	04/19/13
1,2-Dibromo-3-chloropropane	96-12-8	19.1	47.7	47.7	U	ug/Kg	SW8260B	04/19/13

Surrogate	% Recovery	Control Limits	Qualifier
Dibromofluoromethane	96	65-135	
1,2-Dichloroethane-d4	107	65-135	
Toluene-d8	99	65-135	
4-Bromofluorobenzene	92	65-135	

*=See case narrative

U=Not detected at specified reporting limit

E=Estimated value above calibration range

CH2M HILL Applied Sciences Laboratory (ASL)

<u>Client Information</u>	<u>Lab Information</u>
Client Sample ID: ContB_soil_t2	Lab Sample ID: M167007
Project Name: Camp Lejeune	Date Received: 04/17/13
Sample Date: 04/17/13	Dilution Factor: 100
Sample Time: N/A	Report Revision No.: 0
Type: Grab	
Matrix: Soil	
Basis: Dry Weight	

Analyte	CAS#	DL	RL	Sample Result	Qualifier	Units	Analysis Method	Date Analyzed
GC/MS Volatiles								
Vinyl Chloride	75-01-4	14.7	36.8	36.8	U	ug/Kg	SW8260B	04/19/13
1,1-Dichloroethene	75-35-4	14.7	36.8	36.8	U	ug/Kg	SW8260B	04/19/13
Methylene chloride	75-09-2	14.7	36.8	36.8	U	ug/Kg	SW8260B	04/19/13
trans-1,2-Dichloroethene	156-60-5	14.7	36.8	36.8	U	ug/Kg	SW8260B	04/19/13
1,1-Dichloroethane	75-34-3	14.7	36.8	36.8	U	ug/Kg	SW8260B	04/19/13
cis-1,2-Dichloroethene	156-59-2	14.7	36.8	36.8	U	ug/Kg	SW8260B	04/19/13
1,2-Dichloroethane	107-06-2	14.7	36.8	36.8	U	ug/Kg	SW8260B	04/19/13
Benzene	71-43-2	14.7	36.8	36.8	U	ug/Kg	SW8260B	04/19/13
Trichloroethene (TCE)	79-01-6	14.7	36.8	36.8	U	ug/Kg	SW8260B	04/19/13
Toluene	108-88-3	14.7	36.8	36.8	U	ug/Kg	SW8260B	04/19/13
Tetrachloroethene (PCE)	127-18-4	14.7	36.8	36.8	U	ug/Kg	SW8260B	04/19/13
Ethylbenzene	100-41-4	14.7	36.8	36.8	U	ug/Kg	SW8260B	04/19/13
m,p-Xylene	108-38-3/1	29.4	73.6	73.6	U	ug/Kg	SW8260B	04/19/13
o-Xylene	95-47-6	14.7	36.8	36.8	U	ug/Kg	SW8260B	04/19/13
Isopropylbenzene	98-82-8	14.7	36.8	36.8	U	ug/Kg	SW8260B	04/19/13
1,2-Dibromo-3-chloropropane	96-12-8	14.7	36.8	36.8	U	ug/Kg	SW8260B	04/19/13

<u>Surrogate</u>	<u>% Recovery</u>	<u>Control Limits</u>	<u>Qualifier</u>
Dibromofluoromethane	92	65-135	
1,2-Dichloroethane-d4	103	65-135	
Toluene-d8	96	65-135	
4-Bromofluorobenzene	89	65-135	

*=See case narrative

U=Not detected at specified reporting limit

E=Estimated value above calibration range

CH2M HILL Applied Sciences Laboratory (ASL)

Client Information				Lab Information			
Client Sample ID: EHCL_soil_t2				Lab Sample ID: M167008			
Project Name: Camp Lejeune				Date Received: 04/17/13			
Sample Date: 04/17/13				Dilution Factor: 100			
Sample Time: N/A				Report Revision No.: 0			
Type: Grab							
Matrix: Soil							
Basis: Dry Weight							

Analyte	CAS#	DL	RL	Sample Result	Qualifier	Units	Analysis Method	Date Analyzed
GC/MS Volatiles								
Vinyl Chloride	75-01-4	13.3	33.3	33.3	U	ug/Kg	SW8260B	04/19/13
1,1-Dichloroethene	75-35-4	13.3	33.3	33.3	U	ug/Kg	SW8260B	04/19/13
Methylene chloride	75-09-2	13.3	33.3	33.3	U	ug/Kg	SW8260B	04/19/13
trans-1,2-Dichloroethene	156-60-5	13.3	33.3	33.3	U	ug/Kg	SW8260B	04/19/13
1,1-Dichloroethane	75-34-3	13.3	33.3	33.3	U	ug/Kg	SW8260B	04/19/13
cis-1,2-Dichloroethene	156-59-2	13.3	33.3	33.3	U	ug/Kg	SW8260B	04/19/13
1,2-Dichloroethane	107-06-2	13.3	33.3	33.3	U	ug/Kg	SW8260B	04/19/13
Benzene	71-43-2	13.3	33.3	33.3	U	ug/Kg	SW8260B	04/19/13
Trichloroethene (TCE)	79-01-6	13.3	33.3	33.3	U	ug/Kg	SW8260B	04/19/13
Toluene	108-88-3	13.3	33.3	33.3	U	ug/Kg	SW8260B	04/19/13
Tetrachloroethene (PCE)	127-18-4	13.3	33.3	33.3	U	ug/Kg	SW8260B	04/19/13
Ethylbenzene	100-41-4	13.3	33.3	33.3	U	ug/Kg	SW8260B	04/19/13
m,p-Xylene	108-38-3/1	26.7	66.7	66.7	U	ug/Kg	SW8260B	04/19/13
o-Xylene	95-47-6	13.3	33.3	33.3	U	ug/Kg	SW8260B	04/19/13
Isopropylbenzene	98-82-8	13.3	33.3	33.3	U	ug/Kg	SW8260B	04/19/13
1,2-Dibromo-3-chloropropane	96-12-8	13.3	33.3	33.3	U	ug/Kg	SW8260B	04/19/13

Surrogate	% Recovery	Control Limits	Qualifier
Dibromofluoromethane	98	65-135	
1,2-Dichloroethane-d4	110	65-135	
Toluene-d8	96	65-135	
4-Bromofluorobenzene	87	65-135	

*=See case narrative

U=Not detected at specified reporting limit

E=Estimated value above calibration range

CH2M HILL Applied Sciences Laboratory (ASL)

Client Information				Lab Information			
Client Sample ID: WB1-0419				Lab Sample ID: WB1-0419			
Project Name: Camp Lejeune				Date Received: N/A			
Sample Date: N/A				Dilution Factor: 1			
Sample Time: N/A				Report Revision No.: 0			
Type: QC							
Matrix: Water							

Analyte	CAS#	DL	RL	Sample Result	Qualifier	Units	Analysis Method	Date Analyzed
GC/MS Volatiles								
Vinyl Chloride	75-01-4	0.20	0.50	0.50	U	ug/L	SW8260B	04/19/13
1,1-Dichloroethene	75-35-4	0.20	0.50	0.50	U	ug/L	SW8260B	04/19/13
Methylene chloride	75-09-2	0.20	0.50	0.50	U	ug/L	SW8260B	04/19/13
trans-1,2-Dichloroethene	156-60-5	0.20	0.50	0.50	U	ug/L	SW8260B	04/19/13
1,1-Dichloroethane	75-34-3	0.20	0.50	0.50	U	ug/L	SW8260B	04/19/13
cis-1,2-Dichloroethene	156-59-2	0.20	0.50	0.50	U	ug/L	SW8260B	04/19/13
1,2-Dichloroethane	107-06-2	0.20	0.50	0.50	U	ug/L	SW8260B	04/19/13
Benzene	71-43-2	0.20	0.50	0.50	U	ug/L	SW8260B	04/19/13
Trichloroethene (TCE)	79-01-6	0.20	0.50	0.50	U	ug/L	SW8260B	04/19/13
Toluene	108-88-3	0.20	0.50	0.50	U	ug/L	SW8260B	04/19/13
Tetrachloroethene (PCE)	127-18-4	0.20	0.50	0.50	U	ug/L	SW8260B	04/19/13
Ethylbenzene	100-41-4	0.20	0.50	0.50	U	ug/L	SW8260B	04/19/13
m,p-Xylene	108-38-3/1	0.40	1.00	1.00	U	ug/L	SW8260B	04/19/13
o-Xylene	95-47-6	0.20	0.50	0.50	U	ug/L	SW8260B	04/19/13
Isopropylbenzene	98-82-8	0.20	0.50	0.50	U	ug/L	SW8260B	04/19/13
1,2-Dibromo-3-chloropropane	96-12-8	0.20	0.50	0.50	U	ug/L	SW8260B	04/19/13

Surrogate	% Recovery	Control Limits	Qualifier
Dibromofluoromethane	102	75-125	
1,2-Dichloroethane-d4	108	75-125	
Toluene-d8	98	75-125	
4-Bromofluorobenzene	89	75-125	

*=See case narrative

U=Not detected at specified reporting limit

E=Estimated value above calibration range

CH2M HILL Applied Sciences Laboratory (ASL)

Client Information				Lab Information			
Client Sample ID: SB1-0419				Lab Sample ID: SB1-0419			
Project Name: Camp Lejeune				Date Received: N/A			
Sample Date: N/A				Dilution Factor: 100			
Sample Time: N/A				Report Revision No.: 0			
Type: QC							
Matrix: Soil							
Basis: Dry Weight							

Analyte	CAS#	DL	RL	Sample Result	Qualifier	Units	Analysis Method	Date Analyzed
GC/MS Volatiles								
Vinyl Chloride	75-01-4	20.0	50.0	50.0	U	ug/Kg	SW8260B	04/19/13
1,1-Dichloroethene	75-35-4	20.0	50.0	50.0	U	ug/Kg	SW8260B	04/19/13
Methylene chloride	75-09-2	20.0	50.0	50.0	U	ug/Kg	SW8260B	04/19/13
trans-1,2-Dichloroethene	156-60-5	20.0	50.0	50.0	U	ug/Kg	SW8260B	04/19/13
1,1-Dichloroethane	75-34-3	20.0	50.0	50.0	U	ug/Kg	SW8260B	04/19/13
cis-1,2-Dichloroethene	156-59-2	20.0	50.0	50.0	U	ug/Kg	SW8260B	04/19/13
1,2-Dichloroethane	107-06-2	20.0	50.0	50.0	U	ug/Kg	SW8260B	04/19/13
Benzene	71-43-2	20.0	50.0	50.0	U	ug/Kg	SW8260B	04/19/13
Trichloroethene (TCE)	79-01-6	20.0	50.0	50.0	U	ug/Kg	SW8260B	04/19/13
Toluene	108-88-3	20.0	50.0	50.0	U	ug/Kg	SW8260B	04/19/13
Tetrachloroethene (PCE)	127-18-4	20.0	50.0	50.0	U	ug/Kg	SW8260B	04/19/13
Ethylbenzene	100-41-4	20.0	50.0	50.0	U	ug/Kg	SW8260B	04/19/13
m,p-Xylene	108-38-3/1	40.0	100	100	U	ug/Kg	SW8260B	04/19/13
o-Xylene	95-47-6	20.0	50.0	50.0	U	ug/Kg	SW8260B	04/19/13
Isopropylbenzene	98-82-8	20.0	50.0	50.0	U	ug/Kg	SW8260B	04/19/13
1,2-Dibromo-3-chloropropane	96-12-8	20.0	50.0	50.0	U	ug/Kg	SW8260B	04/19/13

Surrogate	% Recovery	Control Limits	Qualifier
Dibromofluoromethane	102	65-135	
1,2-Dichloroethane-d4	108	65-135	
Toluene-d8	98	65-135	
4-Bromofluorobenzene	89	65-135	

*=See case narrative

U=Not detected at specified reporting limit

E=Estimated value above calibration range

CH2M HILL Applied Sciences Laboratory (ASL)

<u>Client Information</u>	<u>Lab Information</u>
Project Name: Camp Lejeune Type: QC Matrix: Water	LCS ID: BS1W0419 Report Revision No.: 0 Dilution Factor: 1

Analyte	CAS#	Spike Amount	Sample Result	Units	%Recovery	Analysis Method	Date Analyzed
GC/MS Volatiles							
Vinyl Chloride	75-01-4	20.0	17.5	ug/L	88	SW8260B	04/19/13
1,1-Dichloroethene	75-35-4	20.0	18.9	ug/L	94	SW8260B	04/19/13
Methylene chloride	75-09-2	20.0	21.8	ug/L	109	SW8260B	04/19/13
trans-1,2-Dichloroethene	156-60-5	20.0	20.0	ug/L	100	SW8260B	04/19/13
1,1-Dichloroethane	75-34-3	20.0	20.9	ug/L	104	SW8260B	04/19/13
cis-1,2-Dichloroethene	156-59-2	20.0	21.0	ug/L	105	SW8260B	04/19/13
1,2-Dichloroethane	107-06-2	20.0	21.0	ug/L	105	SW8260B	04/19/13
Benzene	71-43-2	20.0	20.9	ug/L	104	SW8260B	04/19/13
Trichloroethene (TCE)	79-01-6	20.0	20.0	ug/L	100	SW8260B	04/19/13
Toluene	108-88-3	20.0	20.7	ug/L	103	SW8260B	04/19/13
Tetrachloroethene (PCE)	127-18-4	20.0	19.6	ug/L	98	SW8260B	04/19/13
Ethylbenzene	100-41-4	20.0	21.2	ug/L	106	SW8260B	04/19/13
m,p-Xylene	108-38-3/1	40.0	42.3	ug/L	106	SW8260B	04/19/13
o-Xylene	95-47-6	20.0	21.3	ug/L	107	SW8260B	04/19/13
Isopropylbenzene	98-82-8	20.0	18.4	ug/L	92	SW8260B	04/19/13
1,2-Dibromo-3-chloropropane	96-12-8	20.0	20.3	ug/L	102	SW8260B	04/19/13

Surrogate	% Recovery	Control Limits	Qualifier
Dibromofluoromethane	99	75-125	
1,2-Dichloroethane-d4	100	75-125	
Toluene-d8	94	75-125	
4-Bromofluorobenzene	94	75-125	

*=See case narrative

U=Not detected at specified reporting limit

E=Estimated value above calibration range

CH2M HILL Applied Sciences Laboratory (ASL)

<u>Client Information</u>	<u>Lab Information</u>
Project Name: Camp Lejeune Type: QC Matrix: Soil	LCS ID: BS1S0419 Report Revision No.: 0 Dilution Factor: 100

Analyte	CAS#	Spike Amount	Sample Result	Units	%Recovery	Analysis Method	Date Analyzed
GC/MS Volatiles							
Vinyl Chloride	75-01-4	2000	1750	ug/Kg	88	SW8260B	04/19/13
1,1-Dichloroethene	75-35-4	2000	1890	ug/Kg	94	SW8260B	04/19/13
Methylene chloride	75-09-2	2000	2180	ug/Kg	109	SW8260B	04/19/13
trans-1,2-Dichloroethene	156-60-5	2000	2000	ug/Kg	100	SW8260B	04/19/13
1,1-Dichloroethane	75-34-3	2000	2090	ug/Kg	104	SW8260B	04/19/13
cis-1,2-Dichloroethene	156-59-2	2000	2100	ug/Kg	105	SW8260B	04/19/13
1,2-Dichloroethane	107-06-2	2000	2100	ug/Kg	105	SW8260B	04/19/13
Benzene	71-43-2	2000	2090	ug/Kg	104	SW8260B	04/19/13
Trichloroethene (TCE)	79-01-6	2000	2000	ug/Kg	100	SW8260B	04/19/13
Toluene	108-88-3	2000	2070	ug/Kg	103	SW8260B	04/19/13
Tetrachloroethene (PCE)	127-18-4	2000	1960	ug/Kg	98	SW8260B	04/19/13
Ethylbenzene	100-41-4	2000	2120	ug/Kg	106	SW8260B	04/19/13
m,p-Xylene	108-38-3/1	4000	4230	ug/Kg	106	SW8260B	04/19/13
o-Xylene	95-47-6	2000	2130	ug/Kg	107	SW8260B	04/19/13
Isopropylbenzene	98-82-8	2000	1840	ug/Kg	92	SW8260B	04/19/13
1,2-Dibromo-3-chloropropane	96-12-8	2000	2030	ug/Kg	102	SW8260B	04/19/13

Surrogate	% Recovery	Control Limits	Qualifier
Dibromofluoromethane	99	65-135	
1,2-Dichloroethane-d4	100	65-135	
Toluene-d8	94	65-135	
4-Bromofluorobenzene	94	65-135	

*=See case narrative

U=Not detected at specified reporting limit

E=Estimated value above calibration range

CASE NARRATIVE
METALS ANALYSIS

Lab Name: CH2M HILL/LAB/CVO

ASL SDG#: M1670

Project: Camp Lejeune

Project #: 387442.78.WP

I. Method(s):

Analysis: E200.7, SW6010B
Preparation: FLDFLT, SW3050

II. Receipt/Holding Times:

All acceptance criteria were met.

III. Analysis:

A. Initial Calibration(s):

All acceptance criteria were met.

B. Calibration Verification(s):

All acceptance criteria were met.

C. Blanks:

All acceptance criteria were met.

D. Laboratory Control Sample(s):

All acceptance criteria were met.

E. Matrix Spike/Matrix Spike Duplicate Sample(s):

MS adn MSD recovery of iron (0%) in EHCL_soil_t2 did not meet acceptance criteria because the iron concentration in the sample was significantly higher than the added spike concentration.

F. Interference Check Sample(s):

All acceptance criteria were met.

G. Serial Dilution(s):

Analyzed in accordance with standard operating procedure.

H. Digestion Exception(s):

None.

I. Analytical Exception(s):

None.

IV. Documentation Exception(s):

None.

V. I certify that this data package is in compliance with the terms and conditions agreed to by the client and CH2M HILL, both technically and for completeness, except for the conditions detailed above. Release of the data contained in this hardcopy data package has been authorized by the Laboratory Manager or designee, as verified by the following signatures.

Prepared by: _____

Emily Clark

Date: _____

4/29/13

Reviewed by: _____

J. J. [Signature]

Date: _____

4/29/13

CH2M HILL Applied Sciences Laboratory (ASL)

<u>Client Information</u>	<u>Lab Information</u>
Project Name: Camp Lejeune	Lab Batch ID: M1670
Date Received: 04/17/13	Report Revision No.: 0
Type: See C.O.C.	
Matrix: Water	

Client Sample ID	Lab Sample ID	Dilution Factor	RL	Result	Qual	Units	Date Analyzed
Iron: E200.7							
<i>Dissolved Metals</i>							
ContA_aug_t2	M167001F	1	100	17100		ug/L	04/18/13
Sulf_aug_t2	M167002F	1	100	5380		ug/L	04/18/13
ContB_bio_t2	M167003F	1	100	1490		ug/L	04/18/13
EHCL_bio_t2	M167004F	1	100	6710		ug/L	04/18/13
<i>Total Metals</i>							
WB1-0416	WB1-0416	1	100	100	U	ug/L	04/18/13

*=See case narrative

U=Not detected at specified reporting limit

E=Estimated value above calibration range

CH2M HILL Applied Sciences Laboratory (ASL)

<u>Client Information</u>	<u>Lab Information</u>
Project Name: Camp Lejeune	Lab Batch ID: M1670
Date Received: 04/17/13	Report Revision No.: 0
Type: See C.O.C.	
Matrix: Soil	
Basis: Dry Weight	

Client Sample ID	Lab Sample ID	Dilution Factor	RL	Result	Qual	Units	Date Analyzed
Iron: SW6010B							
<i>Total Metals</i>							
ContA_soil_t2	M167005	1	13.1	2060		mg/Kg	04/24/13
Sulf_soil_t2	M167006	1	11.1	737		mg/Kg	04/24/13
ContB_soil_t2	M167007	1	10.9	1610		mg/Kg	04/24/13
EHCL_soil_t2	M167008	1	11.1	2110		mg/Kg	04/24/13
SB1-0422	SB1-0422	1	10.0	10.0	U	mg/Kg	04/24/13

*=See case narrative

U=Not detected at specified reporting limit

E=Estimated value above calibration range

CH2M HILL Applied Sciences Laboratory (ASL)

<u>Client Information</u>	<u>Lab Information</u>
Project Name: Camp Lejeune Type: QC Matrix: Water	LCS ID: BS1W0416 Report Revision No.: 0 Dilution Factor: 1

Analyte	CAS#	Spike Amount	Sample Result	Units	%Recovery	Analysis Method	Date Analyzed
Metals							
Iron	7439-89-6	500	537	ug/L	107	E200.7	04/18/13

*=See case narrative
U=Not detected at specified reporting limit
E=Estimated value above calibration range

CH2M HILL Applied Sciences Laboratory (ASL)

<u>Client Information</u>	<u>Lab Information</u>
Project Name: Camp Lejeune Type: QC Matrix: Soil	LCS ID: BS1S0422 Report Revision No.: 0 Dilution Factor: 1

Analyte	CAS#	Spike Amount	Sample Result	Units	%Recovery	Analysis Method	Date Analyzed
Metals							
Iron	7439-89-6	50.0	56.2	mg/Kg	112	SW6010B	04/24/13

*=See case narrative

U=Not detected at specified reporting limit

E=Estimated value above calibration range

**CASE NARRATIVE
GENERAL CHEMISTRY ANALYSIS**

Lab Name: CH2M HILL/LAB/CVO

ASL SDG#: M1670

Project: Camp Lejeune

Project #: 387442.78.WP

I. Method(s):

Analysis: E300.0A

II. Receipt/Holding Times:

All acceptance criteria were met.

III. Analysis:

A. Initial Calibration(s):

All acceptance criteria were met.

B. Calibration Verification(s):

All acceptance criteria were met.

C. Blanks:

All acceptance criteria were met.

D. Laboratory Control Sample(s):

All acceptance criteria were met.

E. Matrix Spike/Matrix Spike Duplicate Sample(s):

Analyzed in accordance with standard operating procedure.

F. Analytical Exception(s):

None.

IV. Documentation Exception(s):

None.

V. I certify that this data package is in compliance with the terms and conditions agreed to by the client and CH2M HILL, both technically and for completeness, except for the conditions detailed above. Release of the data contained in this hardcopy data package has been authorized by the Laboratory Manager or designee, as verified by the following signatures.

Prepared by: 

Date: 4/19/2013

Reviewed by: Kathryn Mckenley

Date: 4/19/13

CH2M HILL Applied Sciences Laboratory (ASL)

<u>Client Information</u>	<u>Lab Information</u>
Project Name: Camp Lejeune	Lab Batch ID: M1670
Date Received: 04/17/13	Analysis Method: E300.0A
Type: See C.O.C.	Units: mg/L
Matrix: Water	Report Revision No.: 0

Client Sample ID	Lab Sample ID	Dilution Factor	RL	Nitrate-N Result	Qualifier	Date Analyzed
General Chemistry						
ContA_aug_t2	M167001	1	0.10	0.10	U	04/18/13 10:03
Sulf_aug_t2	M167002	1	0.10	0.10	U	04/18/13 10:26
ContB_bio_t2	M167003	1	0.10	0.10	U	04/18/13 10:48
EHCL_bio_t2	M167004	1	0.10	0.10	U	04/18/13 11:11
WB1-0418	WB1-0418	1	0.10	0.10	U	04/18/13 07:35

U=Not detected at specified reporting limit

E=Estimated value above calibration range

*=See case narrative

CH2M HILL Applied Sciences Laboratory (ASL)

<u>Client Information</u>	<u>Lab Information</u>
Project Name: Camp Lejeune	Lab Batch ID: M1670
Date Received: 04/17/13	Analysis Method: E300.0A
Type: See C.O.C.	Units: mg/L
Matrix: Water	Report Revision No.: 0

Client Sample ID	Lab Sample ID	Dilution Factor	RL	Sulfate Result	Qualifier	Date Analyzed
General Chemistry						
ContA_aug_t2	M167001	1	0.10	0.11		04/18/13
Sulf_aug_t2	M167002	5	0.50	38.1		04/18/13
ContB_bio_t2	M167003	1	0.10	0.10	U	04/18/13
EHCL_bio_t2	M167004	1	0.10	0.10	U	04/18/13
WB1-0418	WB1-0418	1	0.10	0.10	U	04/18/13

U=Not detected at specified reporting limit

E=Estimated value above calibration range

*=See case narrative

CH2M HILL Applied Sciences Laboratory (ASL)

<u>Client Information</u>	<u>Lab Information</u>
Project Name: Camp Lejeune Type: QC Matrix: Water	Lab Batch ID: M1670 Report Revision No.: 0

LCS ID	Analyte	Spike Amount	Sample Result	Units	% Recovery	Analysis Method	Date Analyzed
General Chemistry							
BS1W0418	Nitrate-N	3.00	2.75	mg/L	92	E300.0A	04/18/13
BS1W0418	Sulfate	15.0	14.8	mg/L	99	E300.0A	04/18/13

*=See case narrative
 U=Not detected at specified reporting limit
 E=Estimated value above calibration range

CASE NARRATIVE
GENERAL CHEMISTRY ANALYSIS

Lab Name: CH2M HILL/LAB/CVO

ASL SDG#: M1670

Project: Camp Lejeune

Project #: 387442.78.WP

I. Method(s):

Analysis: SM5310B

II. Receipt/Holding Times:

All acceptance criteria were met.

III. Analysis:

A. Initial Calibration(s):

All acceptance criteria were met.

B. Calibration Verification(s):

All acceptance criteria were met.

C. Blanks:

All acceptance criteria were met.

D. Laboratory Control Sample(s):

All acceptance criteria were met.

E. Matrix Spike/Matrix Spike Duplicate Sample(s):

Analyzed in accordance with standard operating procedure.

F. Analytical Exception(s):

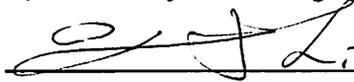
None.

IV. Documentation Exception(s):

None.

V. I certify that this data package is in compliance with the terms and conditions agreed to by the client and CH2M HILL, both technically and for completeness, except for the conditions detailed above. Release of the data contained in this hardcopy data package has been authorized by the Laboratory Manager or designee, as verified by the following signatures.

Prepared by:



Date:

4/24/2013

Reviewed by:

Kathy McKinley

Date:

4/25/13

CH2M HILL Applied Sciences Laboratory (ASL)

<u>Client Information</u>	<u>Lab Information</u>
Project Name: Camp Lejeune	Lab Batch ID: M1670
Date Received: 04/17/13	Analysis Method: SM5310B
Type: See C.O.C.	Units: mg/L
Matrix: Water	Report Revision No.: 0

Client Sample ID	Lab Sample ID	Dilution Factor	Total Organic Carbon		Qualifier	Date Analyzed
			RL	Result		
General Chemistry						
ContA_aug_t2	M167001	40	20.0	120		04/19/13
Sulf_aug_t2	M167002	39	19.5	120		04/19/13
ContB_bio_t2	M167003	7	3.50	17.0		04/19/13
EHCL_bio_t2	M167004	7	3.50	18.8		04/19/13
WB2-0418	WB2-0418	1	0.50	0.50	U	04/19/13

U=Not detected at specified reporting limit

E=Estimated value above calibration range

*=See case narrative

CH2M HILL Applied Sciences Laboratory (ASL)

<u>Client Information</u>	<u>Lab Information</u>
Project Name: Camp Lejeune Type: QC Matrix: Water	Lab Batch ID: M1670 Report Revision No.: 0

LCS ID	Analyte	Spike Amount	Sample Result	Units	% Recovery	Analysis Method	Date Analyzed
General Chemistry							
BS2W0418	Total Organic Carbon	5.00	4.70	mg/L	94	SM5310B	04/19/13

*=See case narrative
 U=Not detected at specified reporting limit
 E=Estimated value above calibration range

CASE NARRATIVE
GENERAL CHEMISTRY ANALYSIS

Lab Name: CH2M HILL/LAB/CVO

ASL SDG#: M1670

Project: Camp Lejeune

Project #: 387442.78.WP

I. Method(s):

Analysis: E376.2

II. Receipt/Holding Times:

All acceptance criteria were met.

III. Analysis:

A. Initial Calibration(s):

All acceptance criteria were met.

B. Calibration Verification(s):

All acceptance criteria were met.

C. Blanks:

All acceptance criteria were met.

D. Laboratory Control Sample(s):

All acceptance criteria were met.

E. Matrix Spike/Matrix Spike Duplicate Sample(s):

Analyzed in accordance with standard operating procedure.

F. Analytical Exception(s):

None.

IV. Documentation Exception(s):

None.

V. I certify that this data package is in compliance with the terms and conditions agreed to by the client and CH2M HILL, both technically and for completeness, except for the conditions detailed above. Release of the data contained in this hardcopy data package has been authorized by the Laboratory Manager or designee, as verified by the following signatures.

Prepared by: Janet McCreary

Date: 4/29/13

Reviewed by: Kathryn McKinley

Date: 4/29/13

CH2M HILL Applied Sciences Laboratory (ASL)

<u>Client Information</u>	<u>Lab Information</u>
Project Name: Camp Lejeune	Lab Batch ID: M1670
Date Received: 04/17/13	Analysis Method: E376.2
Type: See C.O.C.	Units: ug/L
Matrix: Water	Report Revision No.: 0

Client Sample ID	Lab Sample ID	Dilution Factor	RL	Sulfide Result	Qualifier	Date Analyzed
General Chemistry						
ContA_aug_t2	M167001	1	25.0	25.0	U	04/18/13
Sulf_aug_t2	M167002	1	25.0	47.7		04/18/13
ContB_bio_t2	M167003	1	25.0	25.0	U	04/18/13
EHCL_bio_t2	M167004	1	25.0	40.8		04/18/13
WB1-0418	WB1-0418	1	25.0	25.0	U	04/18/13

U=Not detected at specified reporting limit
 E=Estimated value above calibration range
 *=See case narrative

CH2M HILL Applied Sciences Laboratory (ASL)

<u>Client Information</u>	<u>Lab Information</u>
Project Name: Camp Lejeune Type: QC Matrix: Water	Lab Batch ID: M1670 Report Revision No.: 0

LCS ID	Analyte	Spike Amount	Sample Result	Units	% Recovery	Analysis Method	Date Analyzed
General Chemistry							
BS1W0418	Sulfide	320	279	ug/L	87	E376.2	04/18/13

*=See case narrative
 U=Not detected at specified reporting limit
 E=Estimated value above calibration range

CH2MHILL Applied Sciences Lab
CHAIN OF CUSTODY RECORD
AND AGREEMENT TO PERFORM SERVICES

1100 NE Circle Blvd., Suite 300
 Corvallis, OR 97330
 (541) 768-3120 FAX (541) 752-0276

COC #

Project # or Purchase Order # 387442.78.WP										T O T A L # O F C O N T A I N E R S	Requested Analytical Method #							THIS AREA FOR LAB USE ONLY		
Project Name Camp Lejeune Site 78											Sulfate & Nitrate (E300.0)	VOCs (SW8260B)*	Dissolved Iron (200.7) PRE-FILTERED	TOC	Sulfide	VOCs (SW8260B)*	Total Iron	Lab #	Page	of
Company Name or Home Address/Phone Number CH2M HILL																		M1670		
Email Address for Reporting Dusty Berggren/CVO					Report Copy to: Mike Nieme/CVO															
Turnaround Time <input type="checkbox"/> 24 hours <input type="checkbox"/> 48 hours <input type="checkbox"/> 72 hours <input checked="" type="checkbox"/> 7 days <input type="checkbox"/> 14 days <input type="checkbox"/> 21 d					Drinking Water? Yes <input type="checkbox"/> No <input checked="" type="checkbox"/>		Sample Disposal: Dispose <input checked="" type="checkbox"/> Return <input type="checkbox"/>													
Sampling		Type		Matrix			CLIENT SAMPLE ID							Preservative			EPA Tier QC Level			
Date	Time	COMP	GRAB	WATER	SOIL	AIR								UNPRES	HCl	HNO ₃	H ₂ SO ₄	ZnAc	UNPRES	UNPRES
4/17/13			x	x			ContA_aug_t2	5	1	1	1	1	1					Canister ID	Lab ID	
4/17/13			x	x			Sulf_aug_t2	5	1	1	1	1	1						1	
4/17/13			X	X			ContB_bio_t2	5	1	1	1	1	1						2	
4/17/13			X	X			EHCL_bio_t2	5	1	1	1	1	1						3	
4/17/13			x		x		ContA_soil_t2	2					1	1					4	
4/17/13			x		x		Sulf_soil_t2	2					1	1					5	
4/17/13			x		x		ContB_soil_t2	2					1	1					6	
4/17/13			x		x		EHCL_soil_t2	2					1	1					7	
Possible Hazard Identification: <input type="checkbox"/> Non-Hazard <input type="checkbox"/> Flammable <input type="checkbox"/> Skin Irritant <input type="checkbox"/> Poison B <input type="checkbox"/> Unknown <input checked="" type="checkbox"/> Volatile Contaminants/Odorous <input type="checkbox"/> Biohazard <input type="checkbox"/> Other _____																				
Relinquished By _____ Date/Time _____										Received By: _____ Date/Time _____										
Sampled By and Title (Please sign and print name) _____ Date/Time _____										Relinquished By (Please sign and print name) _____ Date/Time _____										
Received By (Please sign and print name) _____ Date/Time _____										Relinquished By (Please sign and print name) _____ Date/Time _____										
Received By (Please sign and print name) _____ Date/Time _____										Shipped Via _____ Tracking # _____										
Special Instructions Please provide preliminary VOC results when available. NOTE LIMITED VOLUME. See SDG M1488 for approximate analytical range. Only report the following VOCs: benzene, ethylbenzene, toluene, xylenes, tetrachloroethene (PCE), trichloroethene (TCE), 1,1-dichloroethene (DCE), cis-1,2-DCE, trans-1,2-DCE, vinyl chloride (VC), 1,1-dichloroethane (DCA), 1,2-DCA, 1,2-dibromo-3-chloropropane, isopropylbenzene, and methylene chloride.																				

Instructions and Agreement Provisions on Reverse Side

DISTRIBUTION: Original - LAB, Yellow - LAB, Pink - Client
 Rev 09/2010 LAB FORM 340

Appendix B
Notification of Intent to Construct or
Operate Injection Wells

NOTIFICATION OF INTENT TO CONSTRUCT OR OPERATE INJECTION WELLS

The following are "permitted by rule" and do not require an individual permit when constructed in accordance with the rules of 15A NCAC 02C .0200. This form shall be submitted at least 2 weeks prior to construction.

AQUIFER TEST WELLS (15A NCAC 02C .0227)

These wells are used to inject uncontaminated fluid into an aquifer to determine aquifer hydraulic characteristics.

IN SITU REMEDIATION (15A NCAC 02C .0225) or TRACER WELLS (15A NCAC 02C .0229):

- 1) Passive Injection Systems - In-well delivery systems to diffuse injectants into the subsurface. Examples include ORC socks, iSOC systems, and other gas infusion methods.
- 2) Small-Scale Injection Operations – Injection wells located within a land surface area not to exceed 10,000 square feet for the purpose of soil or groundwater remediation or tracer tests. **An individual permit shall be required for test or treatment areas exceeding 10,000 square feet.**
- 3) Pilot Tests - Preliminary studies conducted for the purpose of evaluating the technical feasibility of a remediation strategy in order to develop a full scale remediation plan for future implementation, and where the surface area of the injection zone wells are located within an area that does not exceed five percent of the land surface above the known extent of groundwater contamination. **An individual permit shall be required to conduct more than one pilot test on any separate groundwater contaminant plume.**
- 4) Air Injection Wells - Used to inject ambient air to enhance in-situ treatment of soil or groundwater.

Print Clearly or Type Information. Illegible Submittals Will Be Returned As Incomplete.

DATE: _____, **2013** _____ **PERMIT NO.** _____ (to be filled in by DWQ)

A. WELL TYPE TO BE CONSTRUCTED OR OPERATED

- (1) _____ Air Injection Well.....Complete sections B-F, K, N
- (2) _____ Aquifer Test Well.....Complete sections B-F, K, N
- (3) _____ Passive Injection System.....Complete sections B-F, H-N
- (4) _____ Small-Scale Injection Operation.....Complete sections B-N
- (5) X_____ Pilot Test.....Complete sections B-N
- (6) _____ Tracer Injection Well.....Complete sections B-N

B. STATUS OF WELL OWNER: Federal Government

C. WELL OWNER – State name of entity and name of person delegated authority to sign on behalf of the business or agency:

Name: Mr. John Townson – Director of Environmental Management Division

Mailing Address MCIEAST-MCB CAMLEJ; G-F/EMD/EQB; 12 Post Lane

City: Camp Lejeune State: NC Zip Code: 28547 County: Onslow

Day Tele No.: 910-451-7693 Cell No.: NA

EMAIL Address: NA Fax No.: 910-451-1143

D. PROPERTY OWNER (if different than well owner)

Name: _____

Mailing Address: _____

City: _____ State: _____ Zip Code: _____ County: _____

Day Tele No.: _____ Cell No.: _____

EMAIL Address: _____ Fax No.: _____

E. PROJECT CONTACT - Person who can answer technical questions about the proposed injection project.

Name: Monica Fulkerson, CH2M HILL

Mailing Address: 11301 Carmel Commons Boulevard Suite 304

City: Charlotte State: NC Zip Code: 28226 County: Mecklenburg

Day Tele No.: 704-544-5177 Cell No.: 919-624-3194

EMAIL Address: monica.fulkerson@ch2m.com Fax No.: 704-544-4041

F. PHYSICAL LOCATION OF WELL SITE

(1) Physical Address: 150 feet north of the intersection of Gum Street and Hammond Road

_____ County: Onslow

City: Camp Lejeune State: NC Zip Code: 28547

(2) Geographic Coordinates: **Please see Figure 2-2 of the Implementation Plan in lieu of geographic coordinate**

Latitude**: _____ ° _____ ' _____ " or _____ °

Longitude**: _____ ° _____ ' _____ " or _____ °

Reference Datum: _____ Accuracy: _____

Method of Collection: _____

****FOR AIR INJECTION AND AQUIFER TEST WELLS ONLY: A FACILITY SITE MAP WITH PROPERTY BOUNDARIES MAY BE SUBMITTED IN LIEU OF GEOGRAPHIC COORDINATES.**

G. TREATMENT AREA

Land surface area of contaminant plume: 73,500 square feet

Land surface area of inj. well network: 1,800 square feet ($\leq 10,000$ ft² for small-scale injections)

Percent of contaminant plume area to be treated: 2.5 (must be $\leq 5\%$ of plume for pilot test injections)

H. INJECTION ZONE MAPS – Attach the following to the notification.

(1) Contaminant plume map(s) with isoconcentration lines that show the horizontal extent of the contaminant plume in soil and groundwater, existing and proposed monitoring wells, and existing and proposed injection wells; and **(Please see Figure 2-2 of the Implementation Plan)**

(2) Cross-section(s) to the known or projected depth of contamination that show the horizontal and vertical extent of the contaminant plume in soil and groundwater, changes in lithology, existing and proposed monitoring wells, and existing and proposed injection wells. **(Please see Figure 2-3 of the Implementation Plan)**

I. DESCRIPTION OF PROPOSED INJECTION ACTIVITIES – Provide a brief narrative regarding the purpose, scope, and goals of the proposed injection activity.

Trichloroethene (TCE) has been detected at concentrations exceeding North Carolina Groundwater Quality Standards in groundwater samples collected from wells screened between 50 and 60 feet below ground surface (bgs) in the southern portion of Site 78. A bench-scale study conducted using soil and groundwater samples collected from this area indicated that in situ treatment with EHC-L and bioaugmentation may be effective for reducing contaminant concentrations in groundwater. The purpose of the treatability study is to evaluate the overall effectiveness of ERD (via EHC-L injections) with bioaugmentation in terms of reducing contaminant mass at Site 78 South and to obtain information on design parameters for site-wide implementation of ERD with bioaugmentation as an alternative to accelerate site closure. The reagents will be injected into two permanent injection wells, screened from 50 to 60 feet bgs. Groundwater and soil gas within the treatability study area will be monitored for six months following injections.

J. INJECTANTS – Provide a MSDS and the following for each injectant. Attach additional sheets if necessary.

NOTE: Approved injectants (tracers and remediation additives) can be found online at <http://portal.ncdenr.org/web/wq/aps/gwpro>. All other substances must be reviewed by the Division of Public Health, Department of Health and Human Services. Contact the UIC Program for more info (919-807-6496).

Injectant: EHC-L (FMC Corporation)

Volume of injectant: 8,000 gallons per well, 420 pounds EHC-L per well (16,000 gallons, 840 pounds total)

Concentration at point of injection: 6 g/L

Percent if in a mixture with other injectants: _____

Injectant: TSI-DC (Terra Systems)

Volume of injectant: 3 L per well (6 L total)

Concentration at point of injection: 5×10^{10} cells/L

Percent if in a mixture with other injectants: _____

Injectant: _____

Volume of injectant: _____

Concentration at point of injection: _____

Percent if in a mixture with other injectants: _____

K. WELL CONSTRUCTION DATA

(1) Number of injection wells: _____ Proposed 2 Existing

- (2) Provide well construction details for each injection well in a diagram or table format. A single diagram or line in a table can be used for multiple wells with the same construction details. Well construction details shall include the following:
- (a) well type as permanent, direct-push, or subsurface distribution system (infiltration gallery)
 - (b) depth below land surface of grout, screen, and casing intervals
 - (c) well contractor name and certification number

TABLE 1
Well Construction Details

Well ID	Well Type	Installation Date	Total Depth (ft bgs)	Well Diameter (in)	Screened Interval (ft bgs)	Grout (ft bgs)	Drilling Contractor
IR78-IW01	Permanent	4/12/12	60	4	50-60	1-43	Groundwater Protection
IR78-IW02	Permanent	4/13/12	60	4	50-60	1-43	Groundwater Protection

L. SCHEDULES – Briefly describe the schedule for well construction and injection activities.

Injection wells were constructed in April 2012. Injections will be conducted in November 2013, with post-injection monitoring events conducted at 1, 3, and 6 months.

M. MONITORING PLAN – Describe below or in separate attachment a monitoring plan to be used to determine if violations of groundwater quality standards specified in Subchapter 02L result from the injection activity.

Please see Section 4.4 of the Implementation Plan.

N. CERTIFICATION (to be signed as required below or by that person’s authorized agent)

15A NCAC 02C .0211(e) requires that all permit applications shall be signed as follows:

1. for a corporation: by a responsible corporate officer;
2. for a partnership or sole proprietorship: by a general partner or the proprietor, respectively;
3. for a municipality or a state, federal, or other public agency: by either a principal executive officer or ranking publicly elected official;
4. for all others: by the well owner;
5. for any other person authorized to act on behalf of the applicant: documentation shall be submitted with the notification that clearly identifies the person, grants them signature authority, and is signed and dated by the applicant.

“I hereby certify, under penalty of law, that I have personally examined and am familiar with the information submitted in this document and all attachments thereto and that, based on my inquiry of those individuals immediately responsible for obtaining said information, I believe that the information is true, accurate and complete. I am aware that there are significant penalties, including the possibility of fines and imprisonment,

for submitting false information. I agree to construct, operate, maintain, repair, and if applicable, abandon the injection well and all related appurtenances in accordance with the 15A NCAC 02C 0200 Rules.”

Signature of Applicant	Print or Type Full Name
Signature of Property Owner (if different from applicant)	Print or Type Full Name
Signature of Authorized Agent, if any	Print or Type Full Name

Submit one copy of the completed notification package to:

**DWQ - Aquifer Protection Section
1636 Mail Service Center
Raleigh, NC 27699-1636
Telephone: (919) 807-6464 | Fax: (919) 807-6496**

Material Safety Data Sheet

EHC® Liquid - liquid component

MSDS #: EHCL-C
Revision Date: 2013-04-11
Version 1.02



This MSDS has been prepared to meet U.S. OSHA Hazard Communication Standard 29 CFR 1910.1200 and Canada's Workplace Hazardous Materials Information System (WHMIS) requirements.

1. PRODUCT AND COMPANY IDENTIFICATION

Product name	EHC® Liquid - liquid component
Recommended use Uses advised against	Bioremediation product for the remediation of contaminated soil and groundwater Not for use in potable drinking water
Manufacturer	Emergency telephone number
FMC CORPORATION Environmental Solutions 1735 Market Street Philadelphia, PA 19103 Phone: +1 215/ 299-6000 (General Information) E-Mail: msdsinfo@fmc.com	For leak, fire, spill or accident emergencies, call: +1 703-527-3887 (CHEMTREC) 1 303 / 595 9048 (Medical - U.S. - Call Collect)

2. Hazards identification

Emergency Overview

CONTAINMENT HAZARD:

Any vessel that contains wet EHC-L must be vented due to potential pressure build up from fermentation gases

Potential health effects

Acute Toxicity

Eyes

Skin

Inhalation

Ingestion

No significant health effects anticipated

May cause slight irritation.

May cause irritation.

No information available.

No information available.

3. Composition/information on ingredients**Ingredients**

Chemical Name	CAS-No	Weight %
Water	7732-18-5	60-80
Lecithin	8002-43-5	20-30
Sorbitan monooleate, ethoxylated	9005-65-6	2-4
Sodium Benzoate	532-32-1	2-4

4. First aid measures

Eye contact	In case of contact, immediately flush eyes with plenty of water. Get medical attention if irritation develops and persists.
Skin contact	Wash skin with soap and water. Get medical attention if irritation develops and persists.
Inhalation	Move to fresh air in case of accidental inhalation of vapors. Consult a physician if necessary.
Ingestion	Drink 1 or 2 glasses of water. Get medical attention if symptoms occur.
Notes to physician	Treat symptomatically.

5. Fire-fighting measures

Flammable properties	Combustible material: may burn but does not ignite readily.
Flash Point	> 200 °F
Suitable extinguishing media	Carbon dioxide (CO ₂). Dry chemical. Dry powder.
Explosion Data	
Sensitivity to Mechanical Impact	Not sensitive.
Sensitivity to Static Discharge	Not sensitive.
Protective equipment and precautions for firefighters	As in any fire, wear self-contained breathing apparatus pressure-demand, MSHA/NIOSH (approved or equivalent) and full protective gear.

NFPA	Health Hazard 1	Flammability 1	Stability 0	Special Hazards -
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6. Accidental release measures

Personal precautions	For personal protection see section 8.
Methods for containment	Absorb with earth, sand or other non-combustible material and transfer to containers for later disposal.
Methods for cleaning up	After cleaning, flush away traces with water.

7. Handling and storage

Handling	Handle in accordance with good industrial hygiene and safety practice.
Storage	Any vessel that contains wet EHC-L must be vented due to potential pressure build up from fermentation gases. Keep away from open flames, hot surfaces and sources of ignition.

8. Exposure controls/personal protection

Exposure guidelines This product does not contain any hazardous materials with occupational exposure limits established by the region specific regulatory bodies.

Occupational exposure controls

Engineering measures	None under normal use conditions.
General Information	If the product is used in mixtures, it is recommended that you contact the appropriate protective equipment suppliers These recommendations apply to the product as supplied
Respiratory protection	Use only with adequate ventilation.
Eye/face protection	Safety glasses with side-shields
Skin and body protection	Wear suitable protective clothing.
Hand protection	Protective gloves

Hygiene measures Handle in accordance with good industrial hygiene and safety practice Wash hands before breaks and immediately after handling the product.

9. Physical and chemical properties**9.1 Information on basic physical and chemical properties**

Appearance	Light amber emulsion
Physical state	Liquid
Odor	odorless
pH	6.5 - 6.9
Melting Point/Range	No information available.
Freezing point	No information available.
Boiling Point/Range	No information available.
Flash Point	> 200 °F
Evaporation rate	not applicable
Flammable properties	Combustible material: may burn but does not ignite readily
Vapor pressure	No information available.
Vapor density	No information available.
Specific Gravity	1 - 1.1
Relative density	
Bulk density	not applicable
Water solubility	Dispersible in water
Percent volatile	No information available.
Partition coefficient:	not applicable
Viscosity	No information available.

9.2 Other information

Decomposition Temperature No information available.

10. Stability and reactivity

Stability	Stable.
Conditions to avoid	Temperatures above 71°C
Materials to avoid	Water, Alkalis
Hazardous decomposition products	None under normal use.
Hazardous polymerization	Hazardous polymerization does not occur.

11. Toxicological informationAcute effects

Remarks The product has not been tested. Ingredients in this product have been designated as GRAS (Generally Recognized as Safe) by government agencies.

Eye irritation No information available.
Skin irritation No information available.

LD50 Oral There are no data available for this product
LD50 Dermal There are no data available for this product
LC50 Inhalation: No information available.

Sensitization Not expected to be sensitizing based on the components.

Chronic Toxicity

Carcinogenicity Contains no ingredient listed as a carcinogen

12. Ecological informationEcotoxicity

Contains no substances known to be hazardous to the environment or that are not degradable in waste water treatment plants

Persistence and degradability Expected to biodegrade, based on component information

Bioaccumulation Bioaccumulation is unlikely.

Mobility No information available.

Chemical Name	log Pow
Sodium Benzoate	-2.13

Other adverse effects None known

13. Disposal considerations

Waste disposal methods	This material, as supplied, is not a hazardous waste according to Federal regulations (40 CFR 261). This material could become a hazardous waste if it is mixed with or otherwise comes in contact with a hazardous waste, if chemical additions are made to this material, or if the material is processed or otherwise altered. Consult 40 CFR 261 to determine whether the altered material is a hazardous waste. Consult the appropriate state, regional, or local regulations for additional requirements.
Contaminated packaging	Dispose of in accordance with local regulations.

14. Transport information

<u>DOT</u>	not regulated
<u>TDG</u>	not regulated
<u>ICAO/IATA</u>	not regulated
<u>IMDG/IMO</u>	not regulated

15. Regulatory information**International Inventories**

TSCA Inventory (United States of America)	Complies
DSL (Canada)	Complies
NDSL (Canada)	Complies
EINECS/ELINCS (Europe)	Complies
ENCS (Japan)	Complies
IECSC (China)	Complies
KECL (Korea)	Complies
PICCS (Philippines)	Complies
AICS (Australia)	Complies
NZIoC (New Zealand)	Complies

U.S. Federal Regulations**SARA 313**

Section 313 of Title III of the Superfund Amendments and Reauthorization Act of 1986 (SARA). This product does not contain any chemicals which are subject to the reporting requirements of the Act and Title 40 of the Code of Federal Regulations, Part 372.

SARA 311/312 Hazard Categories

Acute Health Hazard	no
Chronic Health Hazard	no
Fire Hazard	no
Sudden Release of Pressure Hazard	no
Reactive Hazard	no

CERCLA

This material, as supplied, does not contain any substances regulated as hazardous substances under the Comprehensive Environmental Response Compensation and Liability Act (CERCLA) (40 CFR 302) or the Superfund Amendments and Reauthorization Act (SARA) (40 CFR 355). There may be specific reporting requirements at the local, regional, or state level pertaining to releases of this material.

International Regulations

Mexico - Grade Minimum risk, Grade 0

Canada

This product has been classified in accordance with the hazard criteria of the Controlled Products Regulations (CPR) and the MSDS contains all the information required by the CPR.

WHMIS Hazard Class

Non-controlled

16. Other information

HMIS	Health Hazard 1	Flammability 1	Stability 0	Special precautions -
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NFPA/HMIS Ratings Legend

Severe = 4; Serious = 3; Moderate = 2; Slight = 1; Minimal = 0

Revision Date: 2013-04-11
Reason for revision: Qualify trade name.

Disclaimer

FMC Corporation believes that the information and recommendations contained herein (including data and statements) are accurate as of the date hereof. **NO WARRANTY OF FITNESS FOR ANY PARTICULAR PURPOSE, WARRANTY OF MERCHANTABILITY OR ANY OTHER WARRANTY, EXPRESSED OR IMPLIED, IS MADE CONCERNING THE INFORMATION PROVIDED HEREIN.** The information provided herein relates only to the specified product designated and may not be applicable where such product is used in combination with any other materials or in any process. Further, since the conditions and methods of use are beyond the control of FMC Corporation, FMC corporation expressly disclaims any and all liability as to any results obtained or arising from any use of the products or reliance on such information.

Prepared By

FMC Corporation
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End of Material Safety Data Sheet

Material Safety Data Sheet

EHC® Liquid - solid component

MSDS #: EHCLM-C
Revision Date: 2013-04-11
Version 1.02



ENVIRONMENTAL SOLUTIONS

This MSDS has been prepared to meet U.S. OSHA Hazard Communication Standard 29 CFR 1910.1200 and Canada's Workplace Hazardous Materials Information System (WHMIS) requirements.

1. PRODUCT AND COMPANY IDENTIFICATION

Product name	EHC® Liquid - solid component
Recommended use Uses advised against	Bioremediation product for the remediation of contaminated soil and groundwater Not for use in potable drinking water
Manufacturer	Emergency telephone number
FMC CORPORATION Environmental Solutions 1735 Market Street Philadelphia, PA 19103 Phone: +1 215/ 299-6000 (General Information) E-Mail: msdsinfo@fmc.com	For leak, fire, spill or accident emergencies, call: +1 703-527-3887 (CHEMTREC) 1 303 / 595 9048 (Medical - U.S. - Call Collect)

2. Hazards identification

Emergency Overview

The product contains no substances which at their given concentration, are considered to be hazardous to health

Potential health effects

Eyes	Product dust may cause mechanical eye irritation.
Skin	None known .
Inhalation	Inhalation of dust in high concentration may cause irritation of respiratory system.
Ingestion	Ingestion may cause gastrointestinal irritation, nausea, vomiting and diarrhea.

3. Composition/information on ingredients

Ingredients

Chemical Name	CAS-No	Weight %
Iron salt	Proprietary	92-97
Amino Acid	Proprietary	3-7

4. First aid measures

Eye contact	Rinse thoroughly with plenty of water for at least 15 minutes, lifting lower and upper eyelids intermittently. Consult a physician.
Skin contact	Wash off with warm water and soap.
Inhalation	Remove from exposure, lie down. If symptoms persist, call a physician.
Ingestion	If swallowed, do not induce vomiting - seek medical advice.

5. Fire-fighting measures

Flammable properties	Combustible material: may burn but does not ignite readily.
Flash Point	not determined
Suitable extinguishing media	Use extinguishing measures that are appropriate to local circumstances and the surrounding environment.
Hazardous combustion products	Carbon oxides.
Explosion Data	
Sensitivity to Mechanical Impact	Not sensitive.
Sensitivity to Static Discharge	Not sensitive.

NFPA	Health Hazard 1	Flammability 1	Stability 0	Special Hazards -
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6. Accidental release measures

Personal precautions	Avoid dust formation. For personal protection see section 8.
Methods for containment	Sweep or vacuum up spillage and return to container. Material may be recycled when contamination is not a problem.
Methods for cleaning up	Following product recovery, flush area with water.

7. Handling and storage

Handling	Avoid contact with skin, eyes and clothing. Do not ingest. Ensure adequate ventilation.
Storage	Keep tightly closed in a dry and cool place. Keep away from open flames, hot surfaces and sources of ignition.

8. Exposure controls/personal protectionExposure guidelines

Ingredients with workplace control parameters.

Chemical Name	ACGIH TLV	OSHA PEL	NIOSH	Mexico
Iron salt	TWA: 1 mg/m ³		TWA: 1 mg/m ³	
Chemical Name	British Columbia	Quebec	Ontario TWAEV	Alberta
Iron salt	TWA: 1 mg/m ³ STEL: 2 mg/m ³	TWA: 1.0 mg/m ³		TWA: 1 mg/m ³

Occupational exposure controls

Engineering measures	Ensure adequate ventilation, especially in confined areas.
General Information	If the product is used in mixtures, it is recommended that you contact the appropriate protective equipment suppliers. These recommendations apply to the product as supplied.
Respiratory protection	When workers are facing concentrations above the exposure limit they must use appropriate certified respirators.
Eye/face protection	Safety glasses with side-shields
Skin and body protection	Wear suitable protective clothing.
Hand protection	Protective gloves

Hygiene measures

Handle in accordance with good industrial hygiene and safety practice

9. Physical and chemical properties9.1 Information on basic physical and chemical properties

Appearance	dry powder
Color	light gray
Physical state	solid
Odor	slight
pH	4.5 (1% solution)
Melting Point/Range	Decomposes on heating. @ 100 °C
Freezing point	No information available.
Boiling Point/Range	not applicable
Flash Point	not determined
Evaporation rate	not applicable
Flammable properties	Combustible material: may burn but does not ignite readily
Vapor pressure	No information available.
Vapor density	No information available.
Water solubility	Fairly soluble
Percent volatile	No information available.
Partition coefficient:	not applicable
Viscosity	No information available.

9.2 Other information

10. Stability and reactivity

Stability	Stable under recommended storage conditions. Decomposes on heating.
Conditions to avoid	To avoid thermal decomposition, do not overheat
Materials to avoid	Strong oxidizing agents
Hazardous decomposition products	Carbon oxides.
Hazardous polymerization	Hazardous polymerization does not occur.

11. Toxicological information

Acute effects

Remarks There are no data available for this product.

Eye irritation Contact with eyes may cause irritation

Skin irritation No information available.

LD50 Oral Iron Salt: 2100 mg/kg (guinea pig)

Cysteine: 1890 mg/kg (rat)

LD50 Dermal No information available.

LC50 Inhalation: No information available.

Sensitization Not expected to be sensitizing based on the components.

Chronic Toxicity

Carcinogenicity Contains no ingredient listed as a carcinogen

12. Ecological information

Ecotoxicity

Not expected to have significant environmental effects

Persistence and degradability No information available.

Bioaccumulation No information available.

Mobility No information available.

Other adverse effects None known

13. Disposal considerations

Waste disposal methods	This material, as supplied, is not a hazardous waste according to Federal regulations (40 CFR 261). This material could become a hazardous waste if it is mixed with or otherwise comes in contact with a hazardous waste, if chemical additions are made to this material, or if the material is processed or otherwise altered. Consult 40 CFR 261 to determine whether the altered material is a hazardous waste. Consult the appropriate state, regional, or local regulations for additional requirements.
Contaminated packaging	Dispose of in accordance with local regulations.

14. Transport information

<u>DOT</u>	not regulated
<u>TDG</u>	not regulated
<u>ICAO/IATA</u>	not regulated
<u>IMDG/IMO</u>	not regulated

15. Regulatory information**International Inventories**

TSCA Inventory (United States of America)	Complies
DSL (Canada)	Complies
NDSL (Canada)	Complies
EINECS/ELINCS (Europe)	Complies
ENCS (Japan)	-
IECSC (China)	-
KECL (Korea)	Complies
PICCS (Philippines)	Complies
AICS (Australia)	Complies
NZIoC (New Zealand)	Complies

U.S. Federal Regulations**SARA 313**

Section 313 of Title III of the Superfund Amendments and Reauthorization Act of 1986 (SARA). This product does not contain any chemicals which are subject to the reporting requirements of the Act and Title 40 of the Code of Federal Regulations, Part 372.

SARA 311/312 Hazard Categories

Acute Health Hazard	no
Chronic Health Hazard	no
Fire Hazard	no
Sudden Release of Pressure Hazard	no
Reactive Hazard	no

CERCLA

This material, as supplied, does not contain any substances regulated as hazardous substances under the Comprehensive Environmental Response Compensation and Liability Act (CERCLA) (40 CFR 302) or the Superfund Amendments and Reauthorization Act (SARA) (40 CFR 355). There may be specific reporting requirements at the local, regional, or state level pertaining to releases of this material.

International Regulations

Mexico - Grade No information available.

Canada

This product has been classified in accordance with the hazard criteria of the Controlled Products Regulations (CPR) and the MSDS contains all the information required by the CPR.

WHMIS Hazard Class

Non-controlled

16. Other information

HMIS	Health Hazard 1	Flammability 1	Stability 0	Special precautions -
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Revision Date: 2013-04-11
 Reason for revision: Qualify trade name.

Disclaimer

FMC Corporation believes that the information and recommendations contained herein (including data and statements) are accurate as of the date hereof. NO WARRANTY OF FITNESS FOR ANY PARTICULAR PURPOSE, WARRANTY OF MERCHANTABILITY OR ANY OTHER WARRANTY, EXPRESSED OR IMPLIED, IS MADE CONCERNING THE INFORMATION PROVIDED HEREIN. The information provided herein relates only to the specified product designated and may not be applicable where such product is used in combination with any other materials or in any process. Further, since the conditions and methods of use are beyond the control of FMC Corporation, FMC corporation expressly disclaims any and all liability as to any results obtained or arising from any use of the products or reliance on such information.

Prepared By

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End of Material Safety Data Sheet



TSI-DC *Dehalococcoides ethenogenes* Bioaugmentation Culture[®] Material Safety Data Sheet

TSI-DC Bioaugmentation Culture[®] is an enriched natural bacterial culture that contains greater than 10^{11} *Dehalococcoides*/L for bioaugmentation. This culture completely dechlorinates tetrachloroethene (PCE) and trichloroethene (TCE) to the non-toxic endproduct ethene and 1,1,1-trichloroethane to 1,1-dichloroethene, 1,1-dichloroethane, and chloroethane. It also can biodegrade carbon tetrachloride and chloroform to methylene chloride and innocuous products. It can be used at sites where bacteria capable of complete dechlorination are not present in sufficient numbers or there is a need to decrease the remediation time frame.

SECTION 1 - MATERIAL IDENTIFICATION AND INFORMATION

Material Name: Microbial consortium TSI-DC

Date Revised: 1/1/2013

CAS #: N/A (Not Applicable)

Prepared By: Michael Lee, PhD

Formula #: N/A

Material Description: Non-hazardous, naturally occurring, non-altered anaerobic microbes and enzymes in a water-based medium.

SECTION 2 - INGREDIENTS

Components	%	OSHA PEL	ACGIH TLV	OTHER LIMITS
Non-Hazardous Ingredients	100	N/A	N/A	N/A

SECTION 3 - PHYSICAL/CHEMICAL CHARACTERISTICS

Boiling Point: 100°C (water)

Specific Gravity (H₂O = 1): 0.9 - 1.1

Vapor Pressure @ 25°C: 24 mm Hg (water)

Melting Point: 0°C (water)

Vapor Density: N/A

Evaporation Rate (H₂O = 1): 0.9 - 1.1

Solubility in Water: Soluble

Water Reactive: No

pH: 6.0 - 8.0



Appearance and Odor: Grey murky water. Musty odor.

SECTION 4 - FIRE AND EXPLOSION HAZARD DATA

Flash Point: N/A

Flammable Limits: N/A

Extinguishing Media: Foam, carbon dioxide, water

Special Fire Fighting Procedures: None

Unusual Fire and Explosion Hazards: None

SECTION 5 - REACTIVITY DATA

Stability: Stable

Conditions to Avoid: None

Incompatibility (Materials to Avoid): Water-reactive materials

Hazardous Decomposition Byproducts: None

SECTION 6 - HEALTH HAZARD DATA

HEALTH EFFECTS

The effects of exposure to this material have not been determined. Safe handling of this material on a long-term basis will avoid any possible effect from repetitive acute exposures. Below are possible health effects based on information from similar materials. Individuals hyper allergic to enzymes or other related proteins should not handle.

Ingestion: Ingestion of large quantities may result in abdominal discomfort including nausea, vomiting, cramps, diarrhea, and fever.

Inhalation: Hypersensitive individuals may experience breathing difficulties after inhalation of aerosols.

Skin Absorption: N/A

Skin Contact: May cause skin irritation. Hypersensitive individuals may experience allergic reactions to enzymes.



Eye Contact: May cause eye irritation.

FIRST AID

Ingestion: Get medical attention if allergic symptoms develop (observe for 48 hours). Never give anything by mouth to an unconscious or convulsing person.

Inhalation: Get medical attention if allergic symptoms develop.

Skin Absorption: N/A

Skin Contact: Wash affected area with soap and water. Get medical attention if allergic symptoms develop.

Eye Contact: Flush eyes with plenty of water for at least 15 minutes using an eyewash fountain, if available. Get medical attention if irritation occurs.

NOTE TO PHYSICIANS: All treatments should be based on observed signs and symptoms of distress in the patient. Consideration should be given to the possibility that overexposure to materials other than this material may have occurred.

SECTION 7 - SPILL AND LEAK PROCEDURES

Reportable quantities (in lbs of EPA Hazardous Substances): N/A

Steps to be taken in case of spill or release: No emergency results from spillage. However, spills should be cleaned up promptly. All personnel involved in the cleanup must wear protective clothing and avoid skin contact. Absorb spilled material or vacuum into a container. After clean-up, disinfect all cleaning materials and storage containers that come in contact with the spilled liquid.

Waste Disposal Method: No special disposal methods are required. The material may be sewerred, and is compatible with all known biological treatment methods. To reduce odors and permanently inactivate microorganisms, mix 100 parts (by volume) of TCA-DC and TSI-DC consortium with 1 part (by volume) of bleach. Dispose of in accordance with local, state and federal regulations.

SECTION 8 - HANDLING AND STORAGE

Hand Protection: Rubber gloves.

Eye Protection: Safety goggles with side splash shields.



Protective Clothing: Use adequate clothing to prevent skin contact.

Respiratory Protection: Surgical mask.

Ventilation: Provide adequate ventilation to remove odors.

Storage & Handling: Material may be stored for up to 3 weeks at 2-4°C without aeration.

Other Precautions: An eyewash station in the work area is recommended.

While the information and recommendations set forth herein are believed to be accurate as of the date hereof, Terra Systems, Inc. MAKES NO WARRANTY WITH RESPECT HERETO AND DISCLAIMS ALL LIABILITY FROM RELIANCE THEREON.