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MCB CAMP LEJEUNE
5090.3a

FINAL TECHNICAL MEMORANDUM FOR ADDITIONAL GROUNDWATER SAMPLING
RESULTS SITE 49 OPERABLE UNIT 23 (OU23) MCB CAMP LEJEUNE NC
2/12/2013
CH2M HILL

Additional Groundwater Sampling Results, Site 49, Operable Unit No. 23, Marine Corps Installations East-Marine Corps Base Camp Lejeune

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PREPARED BY: CH2M HILL

DATE: February 12, 2013

Purpose

The purpose of this technical memorandum is to provide a brief site background and a summary of additional groundwater analytical data, subsequent trend analysis, and updated costs for the monitored natural attenuation (MNA) component of the remedial alternatives at Operable Unit (OU) No. 23, Site 49 located on Marine Corps Air Station (MCAS) New River aboard Marine Corps Installations East - Marine Corps Base Camp Lejeune (MCIEAST-MCB CAMLEJ) in Jacksonville, North Carolina (Figure 1).

Background

Site 49 was initially identified as the MCAS Suspected Minor Dump, where possible disposal of potentially hazardous substances may have occurred. The site covers 0.95 acres and is located on the south bank of the New River. Building AS810, primarily used for storage, is located immediately northwest of the site. The previous reports and investigations conducted at Site 49 are listed below:

- Initial Assessment Study (IAS) (Water and Air Research, Inc. [WAR], 1983)
- Preliminary Assessment (PA)/Site Inspection (SI) (CH2M HILL, 2011a)
- Remedial Investigation (RI)/Feasibility Study (FS) (CH2M HILL, 2012)

The results of previous investigations indicated that the presence of volatile organic compounds (VOCs) in groundwater is limited in extent, isolated in one shallow monitoring well (IR49-MW01), and could result in potential human health risks based on potable use. No constituents in site media are expected to cause a significant risk to populations of ecological receptors. The following remedial alternatives were evaluated in the FS to address the VOC-contaminated groundwater:

- No action
- Monitored natural attenuation (MNA) and land use controls (LUCs)
- Air sparging (AS) with MNA and LUCs
- Enhanced in situ bioremediation (EISB) with MNA and LUCs

Monitored natural attenuation (MNA) was evaluated as a component of each remedial alternative in the RI/FS (CH2M HILL, 2012), and assumed that natural processes other than biodegradation (adsorption, dispersion, dilution) would be the primary mechanisms to degrade the VOCs in groundwater. After a review of the draft Preliminary Remedial Action Plan (PRAP), the MCIEAST-MCB CAMLEJ Partnering Team concurred that an

additional round of groundwater analytical data from monitoring well IR49-MW01 would be needed to assess groundwater data over time in support of MNA as a remedial alternative.

Additional Groundwater Sampling

On October 24, 2012, a groundwater sample was collected from monitoring well IR49-MW01. The groundwater sample was collected via low-flow sampling techniques in accordance with the sampling protocol identified in the Site 49 Uniform Federal Policy Sample Analysis Plan (UFP-SAP) (CH2M HILL, 2011b). The groundwater sample was placed in laboratory-provided bottleware and shipped to Trimatrix Laboratories under chain-of-custody protocol for select VOCs analysis by United States Environmental Protection Agency (USEPA) Method 8260B. Analytical data sheets and chain-of-custody documentation is provided as Attachment A, and the analytical results for the chemicals of concern are summarized with previous groundwater data collected from IR49-MW01 in Table 1.

TABLE 1
Groundwater Analytical Results

Sample Identification	IR49-MW01				
	VOCs	NCGWQS/MCL*	04/01/2011	08/04/2011	10/24/2012
1,1,2,2-PCA	0.2	1	0.46J	0.33J	67%
1,1,2-TCA	5	0.81J	<0.5	<0.5	69%
1,2-DCA	0.4	<0.5	<0.5	<0.5	NA
Benzene	1	1	0.61J	0.42J	58%
cis-1,2-DCE	70	70	42	29	59%
trans-1,2-DCE	100	19	9.9	7.1	63%
PCE	0.7	<0.5	<0.5	<0.5	NA
TCE	3	100	58	41	59%
VC	0.03	2	1.4	0.84J	58%

All concentration shown in µg/L

1,2-DCA – 1,2 Dichloroethane

PCE - Tetrachloroethene

NCGWQS – North Carolina Groundwater Quality Standards

MCL – Maximum Contaminant Level

*NCGWQS or MCL, whichever is more conservative

Bold - exceedance of NCGWQS/MCL

J - estimated value

Trend Analysis

Figure 2, Figure 3, and Figure 4 depict concentration trends for TCE, PCA, and VC respectively. An exponential trend line was fitted to each curve and carried forward in time. The trend lines represent possible degradation scenarios for each constituent to achieve their respective NCGWQS based on the historical data. Assuming that the degradation trends interpolated from groundwater data collected over the 17-month period continue, it is likely that the remedial goals will be achieved in a relatively shorter time frame compared to the information provided in the RI/FS. Specifically, the time to achieve the NCGWQS is projected to be approximately 5 years compared to 30 years predicted in the RI/FS.

FIGURE 2
TCE Trend Plot

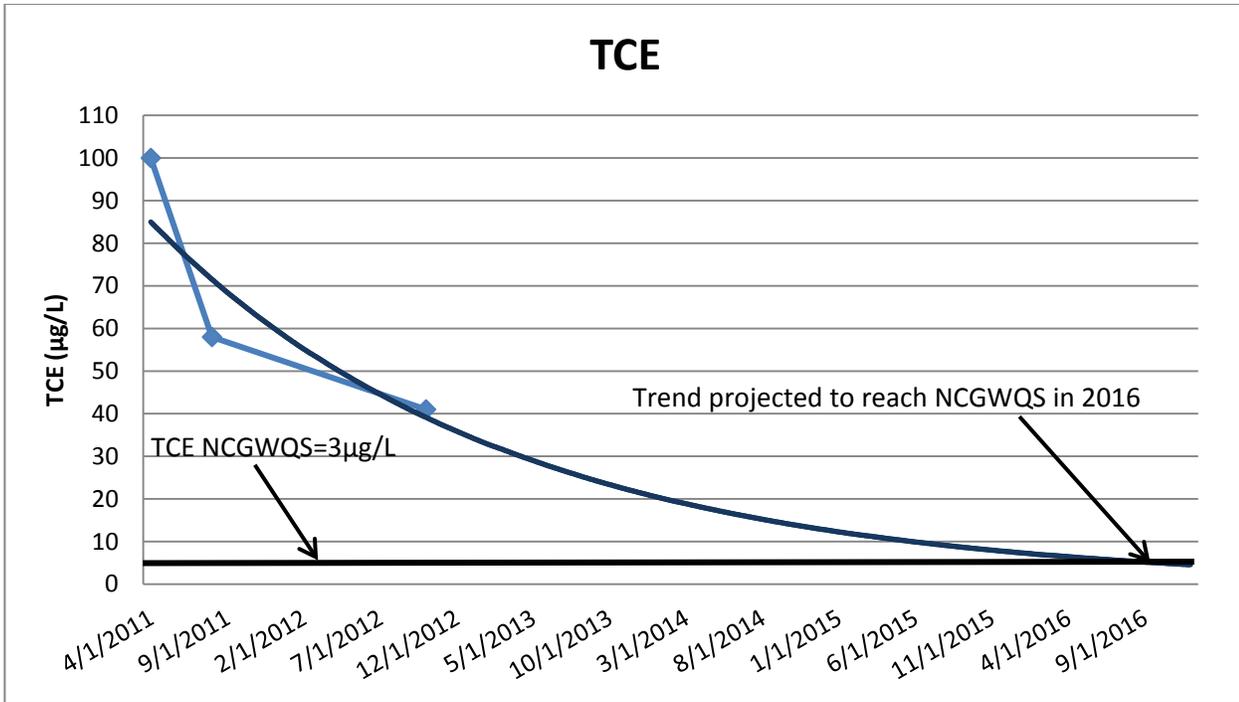


FIGURE 3
1,1,2,2-PCA Trend Plot

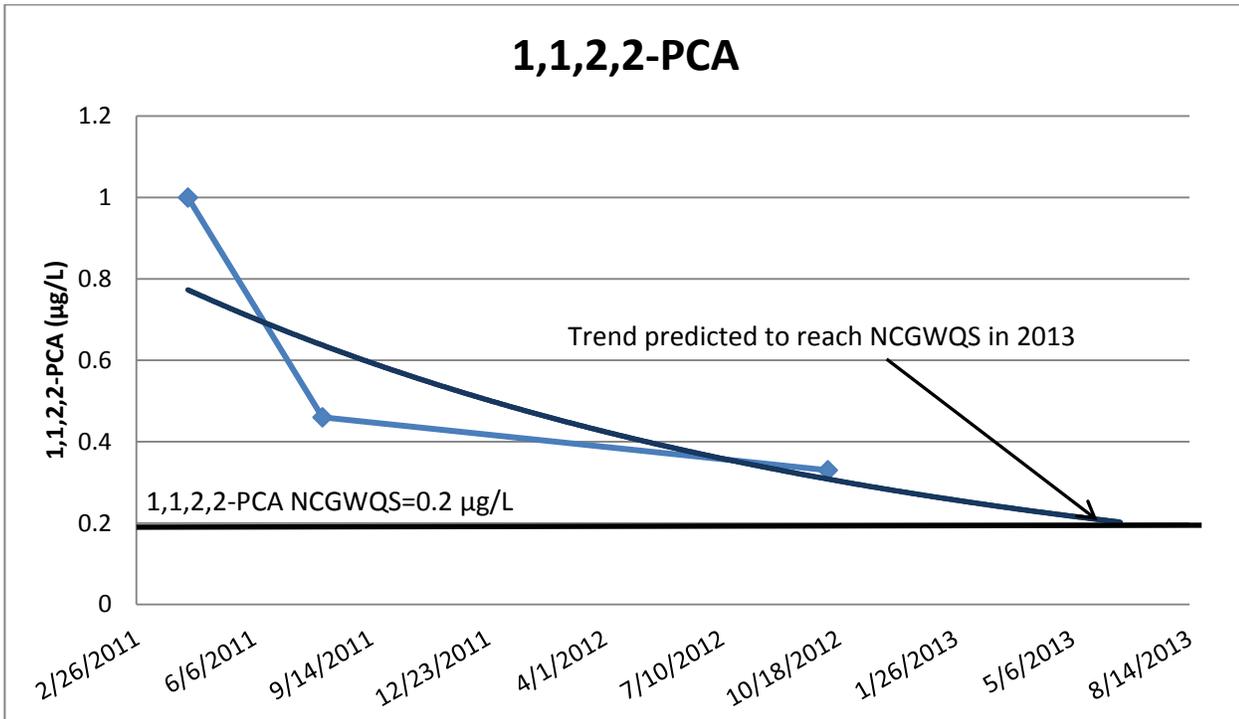
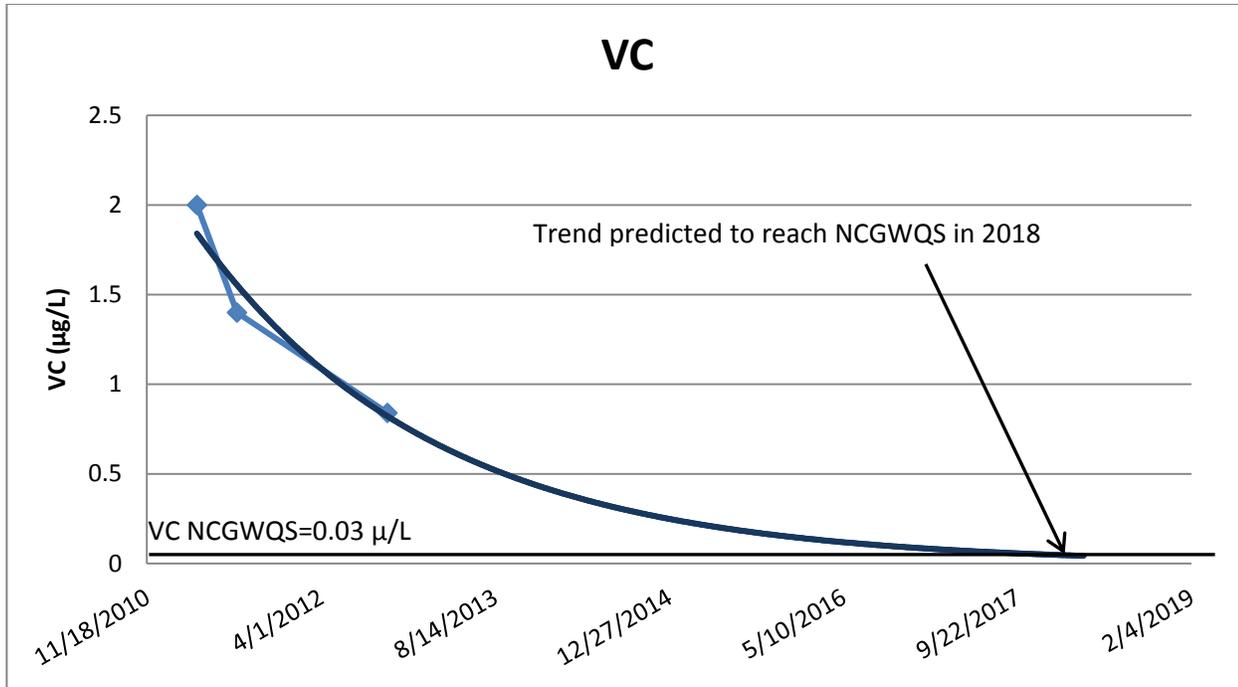


FIGURE 4
VC Trend Plot



Updated Cost Information

If the remedial time frame for MNA is reduced from 30 years to approximately 5 years, the costs associated with the MNA component of each remedial alternative will also be reduced. Alternative 4 had the largest reduction in cost (approximately \$157,000 in monitoring and O&M costs) based on the reduction of the MNA remedial time frame from 10 years to 2 years. However, Alternative 4 is still the most expensive alternative with an estimated total present value of \$306,000. With a 25-year reduction in the MNA remedial time frame, Alternative 2 would save approximately \$88,000 in monitoring costs and is the least expensive option with a total present value of \$79,000. Alternative 3 would save approximately \$53,000 in monitoring costs with a 3-year reduction of the MNA remedial time frame and is the second most expensive alternative with an estimated total present value of \$302,000. Alternative 2 has the lowest total capital cost, estimated at \$13,000. Alternatives 3 and 4 have estimated capital costs of \$120,000 and \$138,000, respectively. The updated cost estimates from the RI/FS are included as Attachment B and a summary of the cost differences for the action alternatives are presented in Table 2.

TABLE 2
Updated Cost Summary

Action Alternatives	Timeframe for MNA		Total Present Value Cost	
	RI/FS (2012)	Current (2013)	RI/FS (2012)	Current (2013)
Alternative 2 (MNA and LUCs)	30	5	\$167,000	\$79,000
Alternative 3 (EISB, MNA, and LUCs)	5	2	\$355,000	\$302,000
Alternative 4 (AS, MNA, and LUCs)	10	2	\$463,000	\$306,000

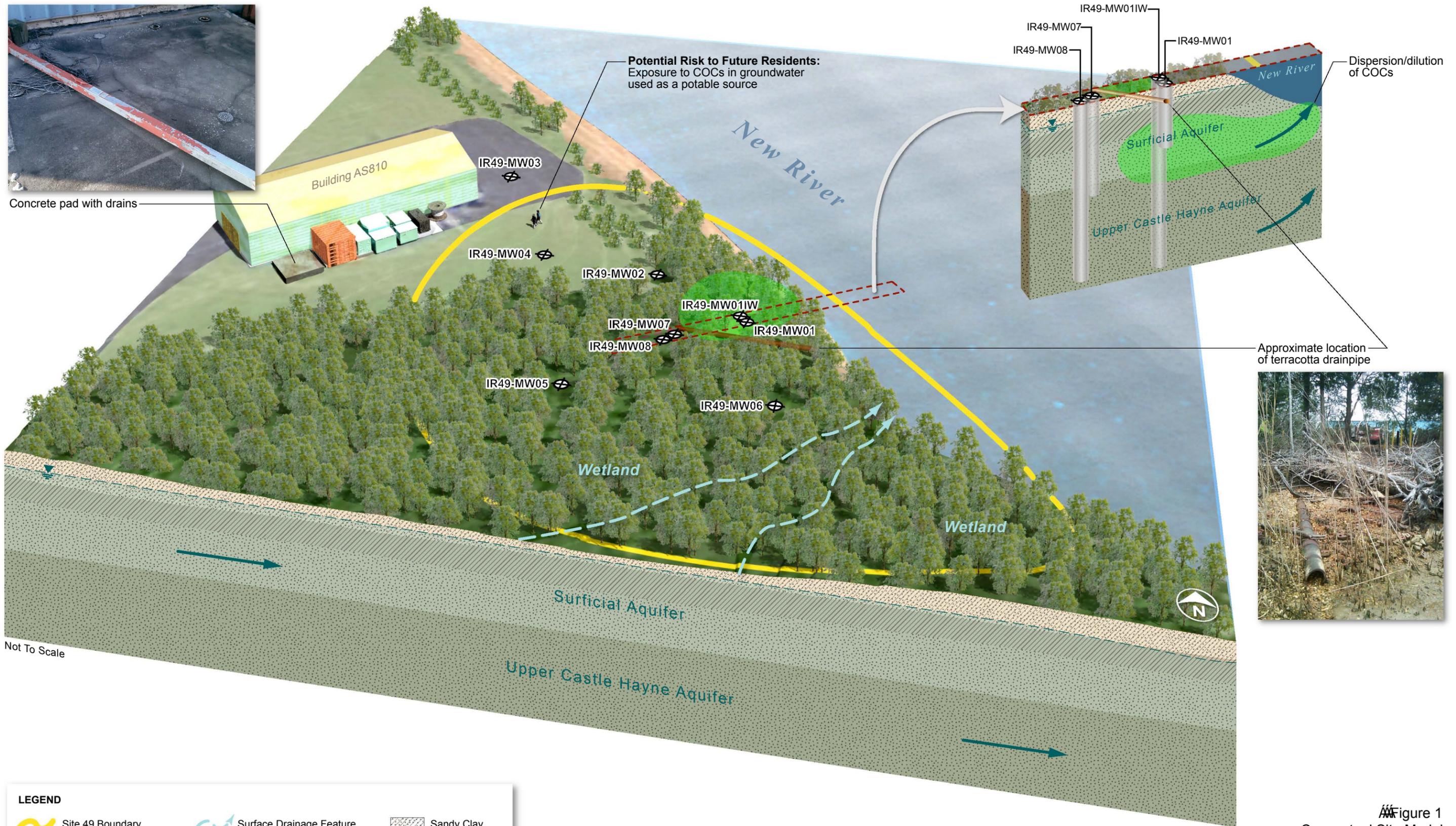
References

CH2M HILL. 2011a. *Final Preliminary Assessment/Site Inspection Report, Site 49, Marine Corps Air Station, Suspected Minor Dump. Marine Corps Base Camp Lejeune, Jacksonville, North Carolina.* March.

CH2M HILL. 2011b. *Final Uniform Federal Policy Sample Analysis Plan, Site 49, Marine Corps Air Station New River, Suspected Minor Dump. Marine Corps Base Camp Lejeune, North Carolina.* August.

CH2M HILL. 2012. *Final Remedial Investigation/Feasibility Study, Site 49, Marine Corps Air Station New River, Suspected Minor Dump. Marine Corps Base Camp Lejeune, North Carolina.* August.

Water and Air Research, Inc. (WAR). 1983. Initial Assessment Study.



LEGEND

Site 49 Boundary	Surface Drainage Feature	Sandy Clay
Monitoring Well Location	Water Table	Clay
VOC Extents	Groundwater Flow Direction	Sand with Fines

Figure 1
 Conceptual Site Model
 Site 49 Remedial Investigation/Feasibility Study
 MCIEAST MCB CAMLEJ
 North Carolina

Attachment A

ORGANIC ANALYSIS DATA SHEET
USEPA-8260B

IR49-GW01-12D

Laboratory: TriMatrix Laboratories, Inc.

SDG: 50069-23

Client: CH2M HILL - VA

Project: 1000-CTO-WE36 Site 49 Oct 2012

Matrix: Ground Water

Laboratory ID: 1210293-01

File ID: 1210293-01.D

Sampled: 10/09/12 17:30

Prepared: 10/15/12 07:00

Analyzed: 10/15/12 13:30

Solids:

Preparation: 5030B Aqueous Purge &

Initial/Final: 5 mL / 5 mL

QC Batch: 1212414

Sequence: 2J15048

Calibration: 2J12001

Instrument: 224

CAS No.	Analyte	Dilution	CONC. (ug/L)	DL	LOD	LOQ	Q
67-64-1	Acetone	1	2.9	1.1	2.0	5.0	J
71-43-2	Benzene	1	0.42	0.11	0.20	1.0	J
75-27-4	Bromodichloromethane	1	0.50	0.13	0.50	1.0	U
75-25-2	Bromoform	1	1.0	0.26	1.0	1.0	U
74-83-9	Bromomethane	1	0.50	0.21	0.50	1.0	U
75-15-0	Carbon Disulfide	1	1.0	0.23	1.0	5.0	U
56-23-5	Carbon Tetrachloride	1	0.50	0.26	0.50	1.0	U
108-90-7	Chlorobenzene	1	0.50	0.17	0.50	1.0	U
75-00-3	Chloroethane	1	0.50	0.14	0.50	1.0	U
67-66-3	Chloroform	1	0.20	0.098	0.20	1.0	U
74-87-3	Chloromethane	1	0.50	0.29	0.50	1.0	U
110-82-7	Cyclohexane	1	0.50	0.18	0.50	5.0	U
96-12-8	1,2-Dibromo-3-chloropropane	1	0.50	0.13	0.50	2.0	U
124-48-1	Dibromochloromethane	1	0.50	0.15	0.50	1.0	U
106-93-4	1,2-Dibromoethane	1	0.50	0.15	0.50	1.0	U
95-50-1	1,2-Dichlorobenzene	1	0.50	0.24	0.50	1.0	U
541-73-1	1,3-Dichlorobenzene	1	0.50	0.24	0.50	1.0	U
106-46-7	1,4-Dichlorobenzene	1	0.50	0.25	0.50	1.0	U
75-71-8	Dichlorodifluoromethane (Freon-12)	1	0.50	0.21	0.50	1.0	U
75-34-3	1,1-Dichloroethane	1	0.50	0.18	0.50	1.0	U
107-06-2	1,2-Dichloroethane	1	0.50	0.21	0.50	1.0	U
75-35-4	1,1-Dichloroethene	1	0.50	0.21	0.50	1.0	U
156-59-2	cis-1,2-Dichloroethene	1	29	0.12	0.50	1.0	
156-60-5	trans-1,2-Dichloroethene	1	7.1	0.20	0.50	1.0	
78-87-5	1,2-Dichloropropane	1	0.50	0.28	0.50	1.0	U
10061-01-5	cis-1,3-Dichloropropene	1	0.50	0.19	0.50	1.0	U
10061-02-6	trans-1,3-Dichloropropene	1	0.50	0.19	0.50	1.0	U
100-41-4	Ethylbenzene	1	0.50	0.21	0.50	1.0	U
591-78-6	2-Hexanone	1	1.0	0.49	1.0	5.0	U
98-82-8	Isopropylbenzene	1	0.50	0.22	0.50	1.0	U
79-20-9	Methyl Acetate	1	0.71	0.42	1.0	5.0	J
1634-04-4	Methyl-tert-butyl ether (MTBE)	1	0.50	0.19	0.50	1.0	U
108-87-2	Methylcyclohexane	1	1.0	0.37	1.0	5.0	U
75-09-2	Methylene Chloride	1	1.0	0.24	1.0	1.0	U
78-93-3	2-Butanone	1	1.0	0.63	1.0	5.0	U
108-10-1	4-Methyl-2-pentanone	1	1.0	0.40	1.0	5.0	U

ORGANIC ANALYSIS DATA SHEET
USEPA-8260B

IR49-GW01-12D

Laboratory: TriMatrix Laboratories, Inc.

SDG: 50069-23

Client: CH2M HILL - VA

Project: 1000-CTO-WE36 Site 49 Oct 2012

Matrix: Ground Water

Laboratory ID: 1210293-01

File ID: 1210293-01.D

Sampled: 10/09/12 17:30

Prepared: 10/15/12 07:00

Analyzed: 10/15/12 13:30

Solids:

Preparation: 5030B Aqueous Purge &

Initial/Final: 5 mL / 5 mL

QC Batch: 1212414

Sequence: 2J15048

Calibration: 2J12001

Instrument: 224

CAS No.	Analyte	Dilution	CONC. (ug/L)	DL	LOD	LOQ	Q
100-42-5	Styrene	1	0.50	0.20	0.50	1.0	U
79-34-5	1,1,2,2-Tetrachloroethane	1	0.33	0.26	0.50	1.0	J
127-18-4	Tetrachloroethene	1	0.50	0.23	0.50	1.0	U
108-88-3	Toluene	1	0.50	0.18	0.50	1.0	U
120-82-1	1,2,4-Trichlorobenzene	1	0.50	0.13	0.50	2.0	U
71-55-6	1,1,1-Trichloroethane	1	0.50	0.14	0.50	1.0	U
79-00-5	1,1,2-Trichloroethane	1	0.50	0.20	0.50	1.0	U
79-01-6	Trichloroethene	1	41	0.21	0.50	1.0	
75-69-4	Trichlorofluoromethane (Freon-11)	1	0.50	0.27	0.50	1.0	U
76-13-1	1,1,2-Trichloro-1,2,2-trifluoroethane (Freon-113)	1	0.50	0.24	0.50	1.0	U
75-01-4	Vinyl Chloride	1	0.84	0.21	0.50	1.0	J
1330-20-7	Xylene, total	1	1.2	0.39	1.2	3.0	U

System Monitoring Compound	ADDED (ug/L)	CONC (ug/L)	% REC.	QC Limits	Q
Dibromofluoromethane	40.0	42.0	105	85 - 115	
1,2-Dichloroethane-d4	40.0	42.1	105	70 - 120	
Toluene-d8	40.0	40.0	100	85 - 120	
4-Bromofluorobenzene	40.0	38.6	96	75 - 120	

Internal Standard	Area	RT	Ref. Area	Ref. RT	Q
Fluorobenzene	709461	6.6	940512	6.6	
Chlorobenzene-d5	586115	10.8	768387	10.8	
1,4-Dichlorobenzene-d4	333328	13.74	445335	13.74	

* Values outside of QC limits

ORGANIC ANALYSIS DATA SHEET
USEPA-8260B

IR49-EB100912

Laboratory: TriMatrix Laboratories, Inc.

SDG: 50069-23

Client: CH2M HILL - VA

Project: 1000-CTO-WE36 Site 49 Oct 2012

Matrix: Water

Laboratory ID: 1210293-02

File ID: 1210293-02.D

Sampled: 10/09/12 18:30

Prepared: 10/15/12 07:00

Analyzed: 10/15/12 12:35

Solids:

Preparation: 5030B Aqueous Purge &

Initial/Final: 5 mL / 5 mL

QC Batch: 1212414

Sequence: 2J15048

Calibration: 2J12001

Instrument: 224

CAS No.	Analyte	Dilution	CONC. (ug/L)	DL	LOD	LOQ	Q
67-64-1	Acetone	1	1.9	1.1	2.0	5.0	J
71-43-2	Benzene	1	0.20	0.11	0.20	1.0	U
75-27-4	Bromodichloromethane	1	0.50	0.13	0.50	1.0	U
75-25-2	Bromoform	1	1.0	0.26	1.0	1.0	U
74-83-9	Bromomethane	1	0.50	0.21	0.50	1.0	U
75-15-0	Carbon Disulfide	1	1.0	0.23	1.0	5.0	U
56-23-5	Carbon Tetrachloride	1	0.50	0.26	0.50	1.0	U
108-90-7	Chlorobenzene	1	0.50	0.17	0.50	1.0	U
75-00-3	Chloroethane	1	0.50	0.14	0.50	1.0	U
67-66-3	Chloroform	1	0.20	0.098	0.20	1.0	U
74-87-3	Chloromethane	1	0.50	0.29	0.50	1.0	U
110-82-7	Cyclohexane	1	0.50	0.18	0.50	5.0	U
96-12-8	1,2-Dibromo-3-chloropropane	1	0.50	0.13	0.50	2.0	U
124-48-1	Dibromochloromethane	1	0.50	0.15	0.50	1.0	U
106-93-4	1,2-Dibromoethane	1	0.50	0.15	0.50	1.0	U
95-50-1	1,2-Dichlorobenzene	1	0.50	0.24	0.50	1.0	U
541-73-1	1,3-Dichlorobenzene	1	0.50	0.24	0.50	1.0	U
106-46-7	1,4-Dichlorobenzene	1	0.50	0.25	0.50	1.0	U
75-71-8	Dichlorodifluoromethane (Freon-12)	1	0.50	0.21	0.50	1.0	U
75-34-3	1,1-Dichloroethane	1	0.50	0.18	0.50	1.0	U
107-06-2	1,2-Dichloroethane	1	0.50	0.21	0.50	1.0	U
75-35-4	1,1-Dichloroethene	1	0.50	0.21	0.50	1.0	U
156-59-2	cis-1,2-Dichloroethene	1	0.50	0.12	0.50	1.0	U
156-60-5	trans-1,2-Dichloroethene	1	0.50	0.20	0.50	1.0	U
78-87-5	1,2-Dichloropropane	1	0.50	0.28	0.50	1.0	U
10061-01-5	cis-1,3-Dichloropropene	1	0.50	0.19	0.50	1.0	U
10061-02-6	trans-1,3-Dichloropropene	1	0.50	0.19	0.50	1.0	U
100-41-4	Ethylbenzene	1	0.50	0.21	0.50	1.0	U
591-78-6	2-Hexanone	1	1.0	0.49	1.0	5.0	U
98-82-8	Isopropylbenzene	1	0.50	0.22	0.50	1.0	U
79-20-9	Methyl Acetate	1	0.72	0.42	1.0	5.0	J
1634-04-4	Methyl-tert-butyl ether (MTBE)	1	0.50	0.19	0.50	1.0	U
108-87-2	Methylcyclohexane	1	1.0	0.37	1.0	5.0	U
75-09-2	Methylene Chloride	1	1.8	0.24	1.0	1.0	
78-93-3	2-Butanone	1	1.0	0.63	1.0	5.0	U
108-10-1	4-Methyl-2-pentanone	1	1.0	0.40	1.0	5.0	U

ORGANIC ANALYSIS DATA SHEET
USEPA-8260B

IR49-EB100912

Laboratory: TriMatrix Laboratories, Inc.

SDG: 50069-23

Client: CH2M HILL - VA

Project: 1000-CTO-WE36 Site 49 Oct 2012

Matrix: Water

Laboratory ID: 1210293-02

File ID: 1210293-02.D

Sampled: 10/09/12 18:30

Prepared: 10/15/12 07:00

Analyzed: 10/15/12 12:35

Solids:

Preparation: 5030B Aqueous Purge &

Initial/Final: 5 mL / 5 mL

QC Batch: 1212414

Sequence: 2J15048

Calibration: 2J12001

Instrument: 224

CAS No.	Analyte	Dilution	CONC. (ug/L)	DL	LOD	LOQ	Q
100-42-5	Styrene	1	0.50	0.20	0.50	1.0	U
79-34-5	1,1,2,2-Tetrachloroethane	1	0.50	0.26	0.50	1.0	U
127-18-4	Tetrachloroethene	1	0.50	0.23	0.50	1.0	U
108-88-3	Toluene	1	0.50	0.18	0.50	1.0	U
120-82-1	1,2,4-Trichlorobenzene	1	0.50	0.13	0.50	2.0	U
71-55-6	1,1,1-Trichloroethane	1	0.50	0.14	0.50	1.0	U
79-00-5	1,1,2-Trichloroethane	1	0.50	0.20	0.50	1.0	U
79-01-6	Trichloroethene	1	0.50	0.21	0.50	1.0	U
75-69-4	Trichlorofluoromethane (Freon-11)	1	0.50	0.27	0.50	1.0	U
76-13-1	1,1,2-Trichloro-1,2,2-trifluoroethane (Freon-113)	1	0.50	0.24	0.50	1.0	U
75-01-4	Vinyl Chloride	1	0.50	0.21	0.50	1.0	U
1330-20-7	Xylene, total	1	1.2	0.39	1.2	3.0	U

System Monitoring Compound	ADDED (ug/L)	CONC (ug/L)	% REC.	QC Limits	Q
Dibromofluoromethane	40.0	41.7	104	85 - 115	
1,2-Dichloroethane-d4	40.0	42.0	105	70 - 120	
Toluene-d8	40.0	39.3	98	85 - 120	
4-Bromofluorobenzene	40.0	38.2	95	75 - 120	

Internal Standard	Area	RT	Ref. Area	Ref. RT	Q
Fluorobenzene	731089	6.61	940512	6.6	
Chlorobenzene-d5	599036	10.8	768387	10.8	
1,4-Dichlorobenzene-d4	336944	13.75	445335	13.74	

* Values outside of QC limits

ORGANIC ANALYSIS DATA SHEET
USEPA-8260B

IR49-TB100912

Laboratory: TriMatrix Laboratories, Inc.

SDG: 50069-23

Client: CH2M HILL - VA

Project: 1000-CTO-WE36 Site 49 Oct 2012

Matrix: Water

Laboratory ID: 1210293-03

File ID: 1210293-03.D

Sampled: 10/09/12 18:40

Prepared: 10/15/12 07:00

Analyzed: 10/15/12 13:03

Solids:

Preparation: 5030B Aqueous Purge &

Initial/Final: 5 mL / 5 mL

QC Batch: 1212414

Sequence: 2J15048

Calibration: 2J12001

Instrument: 224

CAS No.	Analyte	Dilution	CONC. (ug/L)	DL	LOD	LOQ	Q
67-64-1	Acetone	1	8.1	1.1	2.0	5.0	
71-43-2	Benzene	1	0.20	0.11	0.20	1.0	U
75-27-4	Bromodichloromethane	1	0.50	0.13	0.50	1.0	U
75-25-2	Bromoform	1	1.0	0.26	1.0	1.0	U
74-83-9	Bromomethane	1	0.50	0.21	0.50	1.0	U
75-15-0	Carbon Disulfide	1	1.0	0.23	1.0	5.0	U
56-23-5	Carbon Tetrachloride	1	0.50	0.26	0.50	1.0	U
108-90-7	Chlorobenzene	1	0.50	0.17	0.50	1.0	U
75-00-3	Chloroethane	1	0.50	0.14	0.50	1.0	U
67-66-3	Chloroform	1	0.84	0.098	0.20	1.0	J
74-87-3	Chloromethane	1	0.50	0.29	0.50	1.0	U
110-82-7	Cyclohexane	1	0.50	0.18	0.50	5.0	U
96-12-8	1,2-Dibromo-3-chloropropane	1	0.50	0.13	0.50	2.0	U
124-48-1	Dibromochloromethane	1	0.50	0.15	0.50	1.0	U
106-93-4	1,2-Dibromoethane	1	0.50	0.15	0.50	1.0	U
95-50-1	1,2-Dichlorobenzene	1	0.50	0.24	0.50	1.0	U
541-73-1	1,3-Dichlorobenzene	1	0.50	0.24	0.50	1.0	U
106-46-7	1,4-Dichlorobenzene	1	0.50	0.25	0.50	1.0	U
75-71-8	Dichlorodifluoromethane (Freon-12)	1	0.50	0.21	0.50	1.0	U
75-34-3	1,1-Dichloroethane	1	0.50	0.18	0.50	1.0	U
107-06-2	1,2-Dichloroethane	1	0.50	0.21	0.50	1.0	U
75-35-4	1,1-Dichloroethene	1	0.50	0.21	0.50	1.0	U
156-59-2	cis-1,2-Dichloroethene	1	0.50	0.12	0.50	1.0	U
156-60-5	trans-1,2-Dichloroethene	1	0.50	0.20	0.50	1.0	U
78-87-5	1,2-Dichloropropane	1	0.50	0.28	0.50	1.0	U
10061-01-5	cis-1,3-Dichloropropene	1	0.50	0.19	0.50	1.0	U
10061-02-6	trans-1,3-Dichloropropene	1	0.50	0.19	0.50	1.0	U
100-41-4	Ethylbenzene	1	0.50	0.21	0.50	1.0	U
591-78-6	2-Hexanone	1	1.0	0.49	1.0	5.0	U
98-82-8	Isopropylbenzene	1	0.50	0.22	0.50	1.0	U
79-20-9	Methyl Acetate	1	0.64	0.42	1.0	5.0	J
1634-04-4	Methyl-tert-butyl ether (MTBE)	1	0.50	0.19	0.50	1.0	U
108-87-2	Methylcyclohexane	1	1.0	0.37	1.0	5.0	U
75-09-2	Methylene Chloride	1	7.0	0.24	1.0	1.0	
78-93-3	2-Butanone	1	1.0	0.63	1.0	5.0	U
108-10-1	4-Methyl-2-pentanone	1	1.0	0.40	1.0	5.0	U

ORGANIC ANALYSIS DATA SHEET
USEPA-8260B

IR49-TB100912

Laboratory: TriMatrix Laboratories, Inc.

SDG: 50069-23

Client: CH2M HILL - VA

Project: 1000-CTO-WE36 Site 49 Oct 2012

Matrix: Water

Laboratory ID: 1210293-03

File ID: 1210293-03.D

Sampled: 10/09/12 18:40

Prepared: 10/15/12 07:00

Analyzed: 10/15/12 13:03

Solids:

Preparation: 5030B Aqueous Purge &

Initial/Final: 5 mL / 5 mL

QC Batch: 1212414

Sequence: 2J15048

Calibration: 2J12001

Instrument: 224

CAS No.	Analyte	Dilution	CONC. (ug/L)	DL	LOD	LOQ	Q
100-42-5	Styrene	1	0.50	0.20	0.50	1.0	U
79-34-5	1,1,2,2-Tetrachloroethane	1	0.50	0.26	0.50	1.0	U
127-18-4	Tetrachloroethene	1	0.50	0.23	0.50	1.0	U
108-88-3	Toluene	1	0.50	0.18	0.50	1.0	U
120-82-1	1,2,4-Trichlorobenzene	1	0.50	0.13	0.50	2.0	U
71-55-6	1,1,1-Trichloroethane	1	0.50	0.14	0.50	1.0	U
79-00-5	1,1,2-Trichloroethane	1	0.50	0.20	0.50	1.0	U
79-01-6	Trichloroethene	1	0.50	0.21	0.50	1.0	U
75-69-4	Trichlorofluoromethane (Freon-11)	1	0.50	0.27	0.50	1.0	U
76-13-1	1,1,2-Trichloro-1,2,2-trifluoroethane (Freon-113)	1	0.50	0.24	0.50	1.0	U
75-01-4	Vinyl Chloride	1	0.50	0.21	0.50	1.0	U
1330-20-7	Xylene, total	1	1.2	0.39	1.2	3.0	U

System Monitoring Compound	ADDED (ug/L)	CONC (ug/L)	% REC.	QC Limits	Q
Dibromofluoromethane	40.0	41.2	103	85 - 115	
1,2-Dichloroethane-d4	40.0	41.6	104	70 - 120	
Toluene-d8	40.0	39.4	98	85 - 120	
4-Bromofluorobenzene	40.0	38.6	96	75 - 120	

Internal Standard	Area	RT	Ref. Area	Ref. RT	Q
Fluorobenzene	719535	6.6	940512	6.6	
Chlorobenzene-d5	591357	10.8	768387	10.8	
1,4-Dichlorobenzene-d4	335534	13.74	445335	13.74	

* Values outside of QC limits

Attachment B

Alternative 2: MNA and LUCs

Site: Site 49
 Location: Site 49 - Camp Lejeune, NC
 Phase: PRAP
 Base Year: 2012

KEY ASSUMPTIONS

1. Surveyor will take 1 (10-hr) day.
2. Four existing groundwater monitoring wells within the site boundary will be monitored during all sampling events.
3. Each sampling event will take 2 Geologists - one (10-hr) day.
4. Monitoring will be conducted every 2 years until RAOs are achieved (estimated to be 30 years).
5. Groundwater analysis: Site-related COCs and their degradation products (1,1,2,2-PCA, 1,1,2-TCA, PCE, TCE, *cis*-DCE, *trans*-DCE, VC, Benzene; 1,2-DCA, chloroethane, 1,1-DCE, ethene, and ethane) and field water quality parameters (dissolved oxygen, oxidation-reduction potential, pH, salinity, specific conductivity, temperature and turbidity).
6. The total number of samples for VOCs is 9 (4 normal GW, 1 trip blank, 1 field duplicate, 1 MS, 1 MSD, 1 equipment blank).
7. Design details are conceptual in nature and presented in this FS to develop costs for alternative comparison.

Alternative 2: MNA and LUCs

DESCRIPTION	QTY	UNIT	UNIT COST	TOTAL	NOTES
CAPITAL COSTS					
<u>Land Use Controls</u>					
Signs	4	EACH	\$294	\$1,176	R.S. Means #10-14-19.10 (2100)
Deed Notifications	1	LS	\$5,000	\$5,000	Engineer's Estimate
SUBTOTAL				\$6,176	
<u>Surveying LUCs</u>					
Surveyor	1	LS	\$1,500	\$1,500	Engineer's Estimate
Geologist	10	HR	\$80	\$800	Navy CLEAN Rate
Geologist (Per Diem)	1	DY	\$142	\$142	DOD Per Diem
SUBTOTAL				\$2,442	
COMBINED SUBTOTAL				\$8,618	
Contingency	15%	of	\$8,618	\$1,293	
Project Management	8%	of	\$8,618	\$689	
Remedial Design	15%	of	\$8,618	\$1,293	
Construction Management	10%	of	\$8,618	\$862	
TOTAL CAPITAL COSTS				\$12,755	

OPERATION AND MAINTENANCE COSTS					
<u>Cost per Land Use Controls Inspection (Years 1-5)</u>					
Annual Inspection (Engineer)	1	LS	\$1,000	\$1,000	Navy CLEAN Rate
SUBTOTAL				\$1,000	
<u>Cost per Long-Term Monitoring (Years 1-5)</u>					
Field Work (1 day - 2 Geologists)	20	HR	\$80	\$1,600	Navy CLEAN Rate
Field Equipment	1	LS	\$1,500	\$1,500	Engineer's Estimate
Geologists (per diem, 2-person crew)	1	DY	\$284	\$284	Engineer's Estimate
Analytical (VOCs)	1	LS	\$990	\$990	2009 Navy CLEAN BOA Rates
Data Validation (VOCs)	1	LS	\$189	\$189	2010 Navy CLEAN BOA Rates
Data Analysis/Interpretation	15	HR	\$120	\$1,800	Engineer's Estimate
Report	1	LS	\$10,000	\$10,000	Engineer's Estimate
SUBTOTAL				\$16,363	
SUBTOTAL					
Contingency	15%		\$16,363	\$2,454	
Project Management	8%	of	\$16,363	\$1,309	
LTM Costs				\$20,126	

PRESENT VALUE ANALYSIS Discount Rate : 7.0% USEPA. 2000. A Guide to Developing and Documenting Cost Estimates during the Feasibility Study. EPA/540/R-00/002. July.

END YEAR	DESCRIPTION	TOTAL COST	TOTAL COST PER YEAR	DISCOUNT FACTOR	PRESENT VALUE
0	Total Capital Costs	\$12,755	\$12,755	1	\$12,755
1	Total Annual O&M Costs	\$33,881	\$21,126	0.935	\$31,665
2	Total Annual O&M Costs	\$34,881	\$1,000	0.873	\$873
3	Total Annual O&M Costs	\$56,008	\$21,126	0.816	\$17,246
4	Total Annual O&M Costs	\$57,008	\$1,000	0.763	\$763
5	Total Annual O&M Costs	\$78,134	\$21,126	0.713	\$15,063
6	Total Annual O&M Costs	\$78,134	\$0	0.666	\$0
7	Total Annual O&M Costs	\$78,134	\$0	0.623	\$0
8	Total Annual O&M Costs	\$78,134	\$0	0.582	\$0
9	Total Annual O&M Costs	\$78,134	\$0	0.544	\$0
10	Total Annual O&M Costs	\$78,134	\$0	0.508	\$0
11	Total Annual O&M Costs	\$78,134	\$0	0.475	\$0
12	Total Annual O&M Costs	\$78,134	\$0	0.444	\$0
13	Total Annual O&M Costs	\$78,134	\$0	0.415	\$0
14	Total Annual O&M Costs	\$78,134	\$0	0.388	\$0
15	Total Annual O&M Costs	\$78,134	\$0	0.362	\$0
16	Total Annual O&M Costs	\$78,134	\$0	0.339	\$0
17	Total Annual O&M Costs	\$78,134	\$0	0.317	\$0
18	Total Annual O&M Costs	\$78,134	\$0	0.296	\$0
19	Total Annual O&M Costs	\$78,134	\$0	0.277	\$0
20	Total Annual O&M Costs	\$78,134	\$0	0.258	\$0
21	Total Annual O&M Costs	\$78,134	\$0	0.242	\$0
22	Total Annual O&M Costs	\$78,134	\$0	0.226	\$0
23	Total Annual O&M Costs	\$78,134	\$0	0.211	\$0
24	Total Annual O&M Costs	\$78,134	\$0	0.197	\$0
25	Total Annual O&M Costs	\$78,134	\$0	0.184	\$0
26	Total Annual O&M Costs	\$78,134	\$0	0.172	\$0
27	Total Annual O&M Costs	\$78,134	\$0	0.161	\$0
28	Total Annual O&M Costs	\$78,134	\$0	0.150	\$0
29	Total Annual O&M Costs	\$78,134	\$0	0.141	\$0
30	Total Annual O&M Costs	\$78,134	\$0	0.131	\$0
TOTAL SUBSEQUENT YEARS					\$65,609
SUBTOTAL					\$78,364
TOTAL PRESENT VALUE OF ALTERNATIVE 2				\$79,000	
TOTAL PRESENT VALUE OF ALTERNATIVE 2 (+50%)				\$119,000	
TOTAL PRESENT VALUE OF ALTERNATIVE 2 (-30%)				\$56,000	

This cost estimate has been prepared in accordance with EPA 540-R-00-002 and represents a (-30 to +50 percent) range of accuracy. This estimate is limited to the conditions existing at its issuance and is not a guaranty of actual price or cost. Uncertain market conditions such as, but not limited to: local labor or contractor availability, wages, other work, material market fluctuations, price escalations, force majeure events, and developing bidding conditions, may affect the accuracy of this estimate. CH2M HILL is not responsible for any variance from this estimate or actual prices and conditions obtained.

Alternative 3: EISB, LUCs, and LTM

Site: Site 49
 Location: Site 49 - Camp Lejeune, NC
 Phase: PRAP
 Base Year: 2012

KEY ASSUMPTIONS

1. Six injection wells will be installed and screened from 8 to 23 feet bgs and 40 DPT injections to 10 feet bgs.
2. Injection well installation will take 7 days (10 hrs/day), DPT injections will take 4 days (10hrs/day).
3. Utility clearance and surveyor will take one (1) (10-hr) day total.
4. Four existing groundwater monitoring wells will be monitored during all sampling events.
5. Each sampling event will take 2 Geologists one (1) (10-hr) day.
6. Monitoring will be conducted quarterly in year 1 and annually in years 2 through 5 until RAOs are achieved (estimated to be 5 years or less).
7. Groundwater analysis: Site-related COCs and their degradation products (1,1,2,2-PCA, 1,1,2-TCA, PCE, TCE, *cis*-DCE, *trans*-DCE, VC, Benzene; 1,2-DCA, chloroethane, 1,1-DCE, ethene, and ethane) as well as geochemical parameters (alkalinity, TOC, nitrate, nitrite, sulfate, sulfide, methane, Fe²⁺), and field water quality parameters (dissolved oxygen, oxidation-reduction potential, pH, salinity, specific conductivity, temperature and turbidity). Semi-annual monitoring of volatile fatty acids (VFAs) and microbial test (CENSUS) from 2 selected wells during performance monitoring.
8. The total number of samples for VOCs is 9 (4 normal GW, 1 trip blank, 1 field duplicate, 1 MS, 1 MSD, 1 equipment blank). Samples for geochemical parameters, VFAs, and CENSUS don't need any QA/QC samples.
9. The estimated dosage of lactate 60% solution is 370 lbs. A mobile porosity of 0.20 is assumed.
10. Injection can be completed in a 8-day period in each injection event (7-day injection plus 1 day for mobilization/demobilization), assuming average injection rate of 2 gpm, 10 hours of injection per day, simultaneous injection into 3 locations.
11. Re-injection is scheduled at 6 months after the initial injection.
12. 11 Liters of KB-1 Plus would be injected with each injection event.
13. Design details are conceptual in nature and presented in this FS to develop costs for alternative comparison.

Alternative 3: EISB, LUCs, and LTM

DESCRIPTION	QTY	UNIT	UNIT COST	TOTAL	NOTES
CAPITAL COSTS					
Land Use Controls					
Signs	4	EACH	\$294	\$1,176	R.S. Means #10-14-19.10 (2100)
Deed Notifications	1	LS	\$5,000	\$5,000	Engineer's Estimate
SUBTOTAL				\$6,176	
Utility Locator and Surveyor (Well Installation)					
Private Utility Locator	1	LS	\$1,500	\$1,500	Engineer's Estimate
Surveyor	1	LS	\$1,500	\$1,500	2-surveyors 1 day on site (Oct. 2009 BOA Rates)
Geologist	10	HR	\$80	\$800	Navy CLEAN Rate
Geologist (Per Diem)	1	DY	\$142	\$142	DOD Per Diem
SUBTOTAL				\$3,942	
Injection Well Installation (6 wells to 23 feet) and DPT Injections (40 points to 10 feet)					
Drilling costs 25 ft wells, includes well installation and completion	1	LS	\$15,000	\$15,000	Engineer's estimate based on drilling BOA rates
DPT costs for 40 injection points	1	LS	\$12,000	\$12,000	Estimate based on subcontractor quote 2010 Navy CLEAN BOA Rates, assuming 2
Disposal of Generated Wastes	12	EA	\$94	\$1,128	drums per well (1 water 1 soil)
Geologist	110	HR	\$80	\$8,800	Engineer's estimate
Geologist (per diem)	11	DY	\$142	\$1,562	DOD Travel Per Diem Allowance, FY2011
Field Monitoring Equipment	11	DY	\$100	\$1,100	
SUBTOTAL				\$39,590	
Baseline Monitoring Event					
Field Work (1 day - 2 Geologists)	20	HR	\$80	\$1,600	Navy CLEAN Rate
Field Equipment	1	LS	\$1,500	\$1,500	Engineer's Estimate
Geologists (per diem, 2-person crew)	1	DY	\$284	\$284	DOD Travel Per Diem Allowance, FY2009
Analytical (VOCs and Geochem)	1	LS	\$2,074	\$2,074	2009 Navy CLEAN BOA Rates
Data Validation (VOCs)	1	LS	\$189	\$189	2010 Navy CLEAN BOA Rates
Data Analysis/Interpretation	15	HR	\$120	\$1,800	Engineer's Estimate
SUBTOTAL				\$7,447	
EISB Injections					
Lactate (Including Delivery)	2	Drum	\$1,090	\$2,180	JRW Bioremediation LLC (Nov. 2011)
Culture (KB-1 Plus)	11	Liter	\$360	\$3,960	SIREM (Nov. 2011)
Shipping of Culture	1	LS	\$550	\$550	SIREM (Nov. 2011)
Sodium Bicarbonate	276	LB	\$0.65	\$179	Engineer's Estimate
Injection Equipment and Material	1	LS	\$20,000	\$20,000	Engineer's Estimate
Equipment Setup	10	HR	\$100	\$1,000	Navy CLEAN Rate
Engineer/Hydrogeologist	160	HR	\$100	\$16,000	2 people, eight 10-hr days
Engineer/Hydrogeologist (per diem, 2-person crew)	8	DY	\$284	\$2,272	DOD Travel Per Diem Allowance, FY2009
SUBTOTAL				\$46,141	
Reporting					
Construction Completion Report	1	LS	\$20,000	\$20,000	Engineer's Estimate
SUBTOTAL				\$20,000	
COMBINED SUBTOTAL				\$123,296	
Contingency	15%	of	\$123,296	\$18,494	
Project Management	8%	of	\$123,296	\$9,864	
Remedial Design	15%	of	\$123,296	\$18,494	
Construction Management	10%	of	\$123,296	\$12,330	
TOTAL CAPITAL COSTS				\$182,479	

Alternative 3: EISB, LUCs, and LTM

DESCRIPTION	QTY	UNIT	UNIT COST	TOTAL	NOTES
OPERATION AND MAINTENANCE COSTS					
Cost per Land Use Controls Inspection (Years 1-5)					
Annual Inspection (Engineer)	1	LS	\$1,000	\$1,000	Navy CLEAN Rate
SUBTOTAL				\$1,000	
Cost for EISB Performance Monitoring (Year 1)					
Quarterly groundwater monitoring					4 Events
Field Work (1 day - 2 Geologists)	80	HR	\$80	\$6,400	Navy CLEAN Rate
Field Equipment	4	LS	\$1,500	\$6,000	Engineer's Estimate
Geologists (per diem, 2-person crew)	4	DY	\$284	\$1,136	DOD Travel Per Diem Allowance, FY2009
Analytical (VOCs and Geochem)	4	LS	\$2,074	\$8,296	2009 Navy CLEAN BOA Rates
Data Validation (VOCs)	4	LS	\$189	\$756	2010 Navy CLEAN BOA Rates
Data Analysis/Interpretation	40	HR	\$120	\$4,800	Engineer's Estimate
Semiannual groundwater monitoring (VFAs and CENSUS)	2	LS	\$1,000	\$2,000	Microbial Insights Price; 2 wells only
Annual Report	1	LS	\$10,000	\$10,000	Engineer's Estimate
SUBTOTAL				\$39,388	
Cost Per EISB Re-injection (During Year 1)					
ERD EVO Injection - Field Work	1	LS	\$46,141	\$46,141	1 event
SUBTOTAL				\$46,141	
Subtotal for Year 1				\$86,529	
Contingency	15%	of	\$86,529	\$12,979	
Project Management	8%	of	\$86,529	\$6,922	
Total Year 1				\$106,431	
Cost per Performance Monitoring (Years 1 and 2)					
Annual groundwater monitoring					
Field Work (1 day - 2 Geologists)	20	HR	\$80	\$1,600	Navy CLEAN Rate
Field Equipment	1	LS	\$1,500	\$1,500	Engineer's Estimate
Geologists (per diem, 2-person crew)	1	DY	\$284	\$284	DOD Travel Per Diem Allowance, FY2009
Analytical (VOCs, Geochem)	1	LS	\$2,074	\$2,074	2009 Navy CLEAN BOA Rates
Data Validation (VOCs)	1	LS	\$189	\$189	2010 Navy CLEAN BOA Rates
Data Analysis/Interpretation	15	HR	\$120	\$1,800	Engineer's Estimate
Annual Report	1	LS	\$10,000	\$10,000	Engineer's Estimate
SUBTOTAL (includes \$1,000 LUC inspection)				\$18,447	
Contingency	15%	of	\$18,447	\$2,767	
Project Management	8%	of	\$18,447	\$1,476	
Total Years 2-5				\$22,690	

PRESENT VALUE ANALYSIS

Discount Rate : 7.0%

USEPA. 2000. *A Guide to Developing and Documenting Cost Estimates during the Feasibility Study*. EPA/540/R-00/002. July.

END YEAR	DESCRIPTION	TOTAL COST	TOTAL COST PER YEAR	DISCOUNT FACTOR	PRESENT VALUE	
0	Total Capital Costs	\$182,479	\$182,479	1	\$182,479	
1	Re-injection and Total Annual O&M Costs	\$106,431	\$106,431	0.935	\$99,468	Reinjection at Year 1
2	Total Annual O&M Costs	\$22,690	\$22,690	0.873	\$19,818	
3	Total Annual O&M Costs	\$0	\$0	0.816	\$0	
4	Total Annual O&M Costs	\$0	\$0	0.763	\$0	
5	Total Annual O&M Costs	\$0	\$0	0.713	\$0	
TOTAL SUBSEQUENT YEARS					\$119,287	
Total Present Value					\$301,765	
TOTAL PRESENT VALUE OF ALTERNATIVE 3				\$302,000		
TOTAL PRESENT VALUE OF ALTERNATIVE 3 (+50%)				\$453,000		
TOTAL PRESENT VALUE OF ALTERNATIVE 3 (-30%)				\$211,000		

This cost estimate has been prepared in accordance with EPA 540-R-00-002 and represents a (-30 to +50 percent) range of accuracy. This estimate is limited to the conditions existing at its issuance and is not a guaranty of actual price or cost. Uncertain market conditions such as, but not limited to: local labor or contractor availability, wages, other work, material market fluctuations, price escalations, force majeure events, and developing bidding conditions, may affect the accuracy of this estimate. CH2M HILL is not responsible for any variance from this estimate or actual prices and conditions obtained.

Alternative 4: AS, LUCs, and MNA

Site: Site 49
 Location: Site 49 - Camp Lejeune, NC
 Phase: PRAP
 Base Year: 2012

KEY ASSUMPTIONS

1. Nine injection well will be installed to 28 ft bgs, and equipped with a 2.5-ft-long stainless steel Microbubble™ sparger and 40 DPT injections to 10 feet bgs..
2. Two vapor monitoring points will be installed to 5 ft bgs, and screened between 3-5 ft bgs.
3. Well and system installation will take 9 (10-hr) days, DPT injections will take 4 days (10hrs/day)..
4. Utility clearance and surveyor will take 1 (10-hr) day total.
5. Four existing groundwater monitoring wells within the site boundary will be monitored during all sampling events.
6. Each sampling event will take 2 Geologists one (1) (10-hr) day.
7. Monitoring will be conducted semi-annually in years 1 through 3 and annually in years 4 through 10. Assuming AS operation lasts 3 years, RAOs met in 10 years.
8. Groundwater analysis: Site-related COCs (1,1,2,2-PCA, 1,1,2-TCA, PCE, TCE, cis-DCE, trans-DCE, VC, Benzene) and DO measurement on field.
9. The total number of samples for VOCs is 9 (4 normal GW, 1 trip blank, 1 field duplicate, 1 MS, 1 MSD, 1 equipment blank).
10. Design details are conceptual in nature and presented in this FS to develop costs for alternative comparison.

Alternative 4: AS, LUCs, and MNA

DESCRIPTION	QTY	UNIT	UNIT COST	TOTAL	NOTES
CAPITAL COSTS					
<u>Land Use Controls</u>					
Signs	4	EACH	\$294	\$1,176	R.S. Means #10-14-19.10 (2100)
Deed Notifications	1	LS	\$5,000	\$5,000	Engineer's Estimate
SUBTOTAL				\$6,176	
<u>Utility Locator and Surveyor (Well Installation)</u>					
Private Utility Locator	1	LS	\$1,500	\$1,500	Engineer's estimate
Surveyor	1	LS	\$1,500	\$1,500	2-surveyors 1 day on site (Oct. 2009 BOA Rates)
Geologist	10	HR	\$80	\$800	Navy CLEAN Rate
Geologist (Per Diem)	1	DY	\$142	\$142	DOD Per Diem
SUBTOTAL				\$3,942	
<u>AS Well Installation, DPT Injections, and VMPs Construction</u>					
AS wells (9 wells 28 feet deep)					
	1	LS	\$21,000	\$21,000	Engineer's Estimate
Drilling costs 28 ft wells, includes well installation and completion Spargers (Model #2240-A32-30-A00-2-aa)	9	EA	\$405	\$3,645	Vendor quote (5/20/2011)
Vapor monitoring ports (2 VMP @ 5 feet depth)					
Drilling (4.25-in HSA)	10	LF	\$16.73	\$167	Option Yr 4 Navy CLEAN BOA Rates
Well Materials	2	EA	\$36	\$72	Riser/2-ft Screen, 2-inch sched 40 PVC (Option Yr 4 Navy CLEAN BOA Rates)
Annular Materials	10	LF	\$12.56	\$126	sand/bentonite/concrete (4.25"auger) (Option Yr 4 Navy CLEAN BOA Rates)
Well Completion	2	EA	\$281	\$562	Installation of flush-mounted covers (Option 2010 Navy CLEAN BOA Rates, assuming 2 drums per well (1 water 1 soil) and one drum for the VMPs)
Disposal of Generated Wastes	19	EA	\$100	\$1,900	for the VMPs
Geologist	90	HR	\$80	\$7,200	Engineer's estimate
Geologist (per diem)	9	DY	\$142	\$1,278	DOD Travel Per Diem Allowance, FY2011
Field Monitoring Equipment	9	DY	\$100	\$900	
SUBTOTAL				\$36,850	
<u>Baseline Monitoring Event</u>					
Field Work (1 day - 2 Geologists)	20	HR	\$80	\$1,600	Navy CLEAN Rate
Field Equipment	1	LS	\$1,500	\$1,500	Engineer's Estimate
Geologists (per diem, 2-person crew)	1	DY	\$284	\$284	DOD Travel Per Diem Allowance, FY2009
Analytical (VOCs)	1	LS	\$990	\$990	2009 Navy CLEAN BOA Rates
Data Validation (VOCs)	1	LS	\$189	\$189	2010 Navy CLEAN BOA Rates
Data Analysis/Interpretation	15	HR	\$120	\$1,800	Engineer's Estimate
SUBTOTAL				\$6,363	
<u>AS Equipment</u>					
AS system including 10 to 12 HP blower, manifold panel, control system, skid, trailer/shed	1	LS	\$35,000	\$35,000	Vendor quote (Dec. 2011)
Electrical Connections	1	LS	\$2,025	\$2,025	R.S. Means #26-05-33.13 (1800)
Furnish and install 0.5-inch diameter HDPE piping materials (AS)	200	LF	\$0.80	\$160	For AS conveyance (R.S.Means #33-41-13.50)
Vendor start-up assistance and expenses	1	LS	\$3,000	\$3,000	Engineer's Estimate
SUBTOTAL				\$40,185	
<u>Reporting</u>					
Construction Completion Report	1	LS	\$20,000	\$20,000	Engineer's Estimate
SUBTOTAL				\$20,000	
COMBINED SUBTOTAL				\$113,516	
Contingency	15%	of	\$113,516	\$17,027	
Project Management	8%	of	\$113,516	\$9,081	
Remedial Design	15%	of	\$113,516	\$17,027	
Construction Management	10%	of	\$113,516	\$11,352	
TOTAL CAPITAL COSTS				\$168,004	

Alternative 4: AS, LUCs, and MNA

DESCRIPTION	QTY	UNIT	UNIT COST	TOTAL	NOTES
OPERATION AND MAINTENANCE COSTS					
Cost per Land Use Controls Inspection (Years 1-2)					
Annual Inspection (Engineer)	10	HR	\$100	\$1,000	Navy CLEAN Rate
SUBTOTAL				\$1,000	
<i>Undefined Scope and Market Allowance</i>	20%	of	\$1,000	\$200	
SUBTOTAL				\$1,200	
<i>Project Management</i>	8%	of	\$1,200	\$96	
Operation and Maintenance Cost				\$1,296	
Cost per AS Operation and Performance Monitoring (Year 1-2)					
Semi-annual groundwater monitoring					2 events
Field Work (2 days - 2 Geologists)	40	HR	\$80	\$3,200	Navy CLEAN Rate
Field Equipment	2	LS	\$1,500	\$3,000	Engineer's Estimate
Geologists (per diem, 2-person crew)	2	DY	\$284	\$568	DOD Travel Per Diem Allowance, FY2009
Analytical (VOCs)	2	LS	\$990	\$1,980	2009 Navy CLEAN BOA Rates
Data Validation (VOCs)	2	LS	\$189	\$378	2010 Navy CLEAN BOA Rates
Data Analysis/Interpretation	20	HR	\$120	\$2,400	Engineer's Estimate
O&M Trips					
Monthly O&M Labor and Travel	12	LS	\$1,250	\$15,000	Engineer's Estimate
Quarterly Heavy Maintenance	4	LS	\$2,300	\$9,200	Engineer's Estimate
O&M Supplies	1	LS	\$2,000	\$2,000	Engineer's Estimate
Annual Report	1	LS	\$20,000	\$20,000	Engineer's Estimate
Consumables					
Compressor electrical usage (\$0.075/kw-hr)	39,201	kWh	\$0.075	\$2,940	12-hp air compressor - 8.95 KW operate 12 hr/day
SUBTOTAL				\$60,666	
<i>Contingency</i>	15%	of	\$60,666	\$9,100	
<i>Project Management</i>	8%	of	\$60,666	\$4,853	
Operation and Maintenance Cost				\$74,619	

PRESENT VALUE ANALYSIS Discount Rate : 7.0% USEPA. 2000. *A Guide to Developing and Documenting Cost Estimates during the Feasibility Study.* EPA/540/R-00/002. July.

END YEAR	DESCRIPTION	TOTAL COST	TOTAL COST PER YEAR	DISCOUNT FACTOR	PRESENT VALUE
0	Total Capital Costs	\$168,004	\$168,004	1	\$168,004
1	Total Annual O&M Costs	\$75,915	\$75,915	0.935	\$70,949
2	Total Annual O&M Costs	\$75,915	\$75,915	0.873	\$66,307
3	Total Annual O&M Costs	\$0	\$0	0.816	\$0
4	Total Annual O&M Costs	\$0	\$0	0.763	\$0
5	Total Annual O&M Costs	\$0	\$0	0.713	\$0
6	Total Annual O&M Costs	\$0	\$0	0.666	\$0
7	Total Annual O&M Costs	\$0	\$0	0.623	\$0
8	Total Annual O&M Costs	\$0	\$0	0.582	\$0
9	Total Annual O&M Costs	\$0	\$0	0.544	\$0
10	Total Annual O&M Costs	\$0	\$0	0.508	\$0
TOTAL SUBSEQUENT YEARS					\$137,256
TOTAL					\$305,260
TOTAL PRESENT VALUE OF ALTERNATIVE 4				\$306,000	
TOTAL PRESENT VALUE OF ALTERNATIVE 4 (+50%)				\$459,000	
TOTAL PRESENT VALUE OF ALTERNATIVE 4 (-30%)				\$215,000	

This cost estimate has been prepared in accordance with EPA 540-R-00-002 and represents a (-30 to +50 percent) range of accuracy. This estimate is limited to the conditions existing at its issuance and is not a guaranty of actual price or cost. Uncertain market conditions such as, but not limited to: local labor or contractor availability, wages, other work, material market fluctuations, price escalations, force majeure events, and developing bidding conditions, may affect the accuracy of this estimate. CH2M HILL is not responsible for any variance from this estimate or actual prices and conditions obtained.