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MCB CAMP LEJEUNE
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FINAL PHASE III VAPOR INTRUSION EVALUATION REPORT VOLUME 5 OF 5 MCB CAMP LEJEUNE NC

10/01/2011

CH2M HILL

Final

Phase III Vapor Intrusion Evaluation Report
Volume 5 of 5—Camp Geiger

Marine Corps Base Camp Lejeune
Jacksonville, North Carolina

Naval Facilities Engineering Command
NAVFAC MID-ATLANTIC

Prepared for

Department of the Navy

Naval Facilities Engineering Command
Mid-Atlantic

Contract No.
N62470-08-D-1000
CTO-0092

October 2011

Prepared by

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NAVFAC CLEAN 1000 Program
Contract N624670-08-D-1000

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Abbreviations and Acronyms

3-D	three-dimensional
AST	aboveground storage tank
COC	chain-of-custody record
COPC	constituent of potential concern
CSM	conceptual site model
DCA	dichloroethane
DCB	dichlorobenzene
DLA	Defense Logistics Agency
DoD	Department of Defense
DRMO	Defense Reutilization and Marketing Office
FSP	Field Sampling Plan
ft	feet/foot
GW	groundwater
GWSL	Groundwater Screening Level
IA	indoor air
IASL	Indoor Air Screening Level
IR	Installation Restoration
ITRC	Interstate Technology & Regulatory Council
LNAPL	light non–aqueous phase liquid
MCB	Marine Corps Base
MEK	methyl-ethyl-ketone
MLE	multiple lines of evidence
OA	outdoor air
PCA	tetrachloroethane
PCE	tetrachloroethene
ppbv	parts per billion by volume
QA/QC	quality assurance/quality control
RSL	Regional Screening Level
SG	soil gas
SGSL	Soil Gas Screening Level
SL	screening level
SV	soil vapor
SWMU	solid waste management unit
TCE	trichloroethene

USEPA	United States Environmental Protection Agency
UST	underground storage tank
VC	vinyl chloride
VI	vapor intrusion
VOC	volatile organic compound

SECTION 1

Introduction

Camp Geiger is part of the Marine Corps Base Camp Lejeune (MCB CamLej) complex and is home to the Marine Corps School of Infantry for all Marines recruited through the Eastern Recruiting Region. Camp Geiger is located in the northwest section of MCB CamLej. Approximately 20,000 Marines are trained at Camp Geiger every year.

Camp Geiger is one of the four investigation areas evaluated as part of Phase III of the base-wide vapor intrusion (VI) evaluation that took place from January to May 2010. Phase III of the base-wide VI evaluation was performed in accordance with the *Final Phase III Vapor Intrusion Evaluation Work Plan* (CH2M HILL, 2010). The purposes of the VI investigation to date are to (1) identify existing buildings where subsurface vapors, related to Navy releases, may be migrating to the indoor air, (2) assess the magnitude of indoor air concentrations potentially related to VI and compare these with risk-based screening levels, and (3) summarize these results and the associated uncertainties for Navy risk managers, regulators and other stakeholders involved in site-management decision making.

Buildings of interest at Camp Geiger were selected for Phase III sampling according to the process detailed in the Phase III Work Plan. Additional data were collected at six buildings within Camp Geiger during Phase III to assess temporal and spatial variability at buildings where subslab soil gas and/or indoor air sampling was conducted during Phase I or II.

The following sections provide information on the investigation methods, the data obtained, and the conclusions and recommendations of the overall VI evaluation at Camp Geiger.

SECTION 2

Phase III Investigation Methods

The rationale for developing the Phase III sampling plan is described in detail in the Phase III Work Plan (CH2M HILL, 2010). Six buildings were sampled at Camp Geiger during Phase I and/or II and were then recommended for additional sampling during Phase III.

The six Phase III Camp Geiger buildings of interest are located within two different environmental investigation sites: (1) Installation Restoration (IR) site (Site 35) and (2) Installation Restoration (IR) site (Site 89).

The following sampling activities were conducted at Camp Geiger during Phase III:

- A second round of subslab soil gas (Buildings G480, G531, G532, G533, TC860 and TC864) and indoor air (Buildings G480, TC860 and TC864) data was collected to assess temporal variability and to collect additional data for the calculation of empirical subslab soil gas-to-indoor air attenuation factors (AFs).
- Three outdoor air samples were collected during Phase III. The outdoor air sample data were used to determine if constituent concentrations detected in indoor air may be due to outdoor sources and therefore not related to VI.

The Phase III sample collection procedures are described in detail in the Phase III Work Plan (CH2M HILL, 2010) and are summarized in Volume 1.

2.1 Phase III Sample Locations

Sample locations from the Phase III sampling event are shown on **Figures V5-1 through V5-3.** The field data sheets associated with the samples collected are provided in **Appendix V5-A**. The chain-of-custody records (COCs) are provided in **Appendix V5-D**.

Twelve subslab soil gas (sample type-SG), six indoor air (sample type-IA), and two outdoor air (sample type-OA) samples were collected in the Camp Geiger area during Phase III. Quality control samples were also collected in accordance with Section 2.8 of the Field Sampling Plan (FSP), which is part of the Phase III Work Plan (CH2M HILL, 2010).

Table V5-1 lists the Phase III samples that were proposed in the Phase III Work Plan (CH2M HILL, 2010). As shown in Table V5-1, there were no Work Plan deviations during the Phase III field event.

TABLE V5-1
Phase III Sampling Summary
Camp Geiger, MCB CamLej, North Carolina

Site Name	Bldg	Sample Type	Sample ID	Sample Collected (Y/N)	Deviations
Site 35	G480	SG	IR35-SG05-10A	Y	—
		IA	IR35-IA05-10A	Y	—
		SG	IR35-SG06-10A	Y	—
		IA	IR35-IA06-10A	Y	—
	G531	SG	IR35-SG08-10A	Y	—
		SG	IR35-SG09-10A	Y	—
		OA	IR35-OA04-10A	Y	—
	G532	SG	IR35-SG10-10A	Y	—
		SG	IR35-SG11-10A	Y	—
	G533	SG	IR35-SG12-10A	Y	—
		SG	IR35-SG13-10A	Y	—
Site 89	TC860	SG	IR89-SG01-10A	Y	—
		IA	IR89-IA01-10A	Y	—
		SG	IR89-SG02-10A	Y	—
		IA	IR89-IA07-10A	Y	—
		OA	IR89-OA03-10A	Y	—
	TC864	SG	IR89-SG03-10A	Y	—
		IA	IR89-IA03-10A	Y	—
		SG	IR89-SG04-10A	Y	—
		IA	IR89-IA04-10A	Y	—

SECTION 3

Quality Assurance

The data quality evaluation assesses the effect of the overall analytical process on the "availability" of the analytical data. "Availability" in this context refers to whether results can be used by the project team based on the results' analytical soundness: if a result is analytically sound, it is available for use by the project team.

Evaluation of laboratory performance is a check for compliance with the method requirements. Additionally, an independent, third-party validator conducted a review of the laboratory data to assess whether the analytical methods were within required control limits at the time of analysis. Evaluation of potential matrix interferences involves the review of several areas of results, including surrogate spike recoveries, matrix spike recoveries, and duplicate sample results.

The data evaluation and validation is a multi-tiered process. The process begins with an internal laboratory review, continues with an independent review by a third-party validator, and ends with an overall review by the Navy contractor project chemistry team. While only the data validator is allowed to apply qualifiers to the data, the process provides a medium for essential communication among the laboratory, validator, and project team, and allows for data quality to be thoroughly evaluated. Details of the data quality evaluation are presented in **Appendix V5-B**.

The laboratory analytical data collected in support of the Phase III Camp Geiger sampling event are found to be of acceptable quality. No data were rejected due to quality assurance/ quality control (QA/QC) deficiencies, and the data are available for use by the project team.

SECTION 4

Vapor Intrusion Evaluation Results and Conclusions

4.1 Analytical Data

Tables V5-3 through V5-5 summarize the analytical results of the Phase III subslab soil gas, indoor air, and outdoor air samples. **Tables V5-3 through V5-5** include only constituents that were detected in at least one sample of each sample type in the investigation area during that phase of investigation. The validated laboratory data tables are provided in **Appendix V5-E**. Sample locations are provided on **Figures V5-1 through V5-3**. **Tables V5-6 through V5-11** present a summary of the constituents that exceeded the screening levels.

4.2 Outdoor Air

Outdoor air samples were collected during Phase III for comparison with indoor air concentrations in order to evaluate the potential influence of outside air on indoor air quality. **Table V5-5** presents the Phase III outdoor air results. The maximum concentrations for each constituent that was detected in at least one outdoor air sample are presented in **Table V5-2**.

The following outdoor air samples were collected during the Phase III investigation:

- IR89-OA03-10A collected near Building TC860
- IR35-OA04-10A collected near G531

TABLE V5-2
Maximum Concentrations Detected in Outdoor Air
Camp Geiger, MCB CamLej, North Carolina

Detected Constituents in Outdoor Air	Phase III Max Detect (ppbv)
1,1,2-Trichloro-1,2,2-trifluoroethane (Freon-13)	0.08
1,4-Dichlorobenzene (DCB)	0.02J
2-Butanone (methyl-ethyl-ketone [MEK])	0.37J
2-Hexanone	0.03J
Acetone	7.9
Benzene	0.19J
Carbon tetrachloride	0.08J
Chloromethane	0.2J
Dichlorodifluoromethane (Freon-12)	0.6
Ethylbenzene	0.02J
m-Xylene & p-Xylene	0.04J

TABLE V5-2
Maximum Concentrations Detected in Outdoor Air
Camp Geiger, MCB CamLej, North Carolina

Detected Constituents in Outdoor Air	Phase III Max Detect (ppbv)
Methylene Chloride	0.06J
o-Xylene	0.02J
Styrene	0.01J
Toluene	0.16J
Trichlorofluoromethane (Freon-11)	0.26

ppbv = parts per billion by volume
J = estimated value

4.3 Building-Specific Data Evaluations and Conceptual Site Model Discussions

A VI conceptual site model (CSM) addresses the following three components: (1) the volatile organic compound (VOC) source (soil or groundwater contamination), (2) migration from the subsurface and through the slab, and (3) building characteristics and potential receptors (building occupants). Consistent with the Department of Defense (DoD) Vapor Intrusion Handbook (2009), multiple lines of evidence (MLE) were incorporated into the VI CSM. The primary source in most cases is assumed to be related to a fuel or solvent spill or leak, with the secondary source being potentially impacted groundwater, soil, and/or soil gas.

Transport mechanisms for VOCs in the vadose zone and into buildings include primarily diffusion and advection. VOCs migrate following concentration gradients from source areas of high concentration to surrounding areas of lower concentration by diffusion. Soil gas can be pulled into the building through openings in the slab if the building is negatively pressurized in relation to the subsurface soil. Openings in the slab may include expansion joints, cracks, or utility conduits.

The building characteristics that affect vapor transport and VOC concentration include the pressurization of the building, indoor air volume, the rate of indoor-to-outdoor air exchange, and the integrity (thickness and presence of openings) of the slab. Pressurization of the building is dependent on factors such as the air handling system and the construction and use of the building. The indoor air volume and indoor-to-outdoor air exchange rate affect how quickly VOCs in the building dissipate or are diluted. The location of the slab (above, on, or below grade) determines how close the building is to the source area. The integrity of the slab determines how readily VOCs may enter the building.

Building surveys completed during Phase I and II were updated during Phase III at buildings where interior samples were collected to gather information on characteristics relevant to VI. The Phase III building survey forms are presented in **Appendix V5-C**.

Building information was also obtained from schematics provided by the Navy and/or photographs; however, these documents and photos are not included in the report due to their sensitive nature.

Building information that was added or revised from what was presented in the *Final Vapor Intrusion Evaluation Report* (CH2M HILL, 2009) is presented in this section; complete building descriptions are not provided.

4.3.1 Site 35

Site 35, formerly known as the Camp Geiger Area Fuel Farm, refers primarily to five 15,000-gallon aboveground storage tanks (ASTs), underground fuel transmission lines, a pump house, a fuel-unloading pad, an oil–water separator, and a distribution island. The Camp Geiger Area Fuel Farm was decommissioned in 1995 to make way for construction of the U.S. Highway 17 Bypass. The primary contaminants at Site 35 were identified to include fuel-related (primarily benzene) and solvent-related (primarily TCE and cis-1,2-DCE) groundwater contamination in the surficial aquifer. In general, this groundwater contamination occurs in the northeastern portion of Site 35 within 100 feet of the VI buildings of interest. More information about the status of this site and additional details from previous site reports are presented in Section 4.5.1 of the *Final Vapor Intrusion Evaluation Work Plan* (CH2M HILL, 2008) and Section 4.3.1 of the Final VI Evaluation Report (CH2M HILL, 2009).

Building G480

Building G480, which is located within Site 35, is used for equipment storage and contains classrooms. It is classified as a large industrial building for this evaluation. Building G480 is located within 100 feet (ft) of monitoring well IR35-MW67, which contained light non–aqueous phase liquid (LNAPL) during previous investigations. Shallow groundwater flows to the northeast. Based on the upgradient location of Building G480, it is not likely that impacted groundwater will flow toward the building.

Building G480 is a one-story concrete block building and is approximately 200 ft long by 70 ft wide (based on the figure scale). The ceiling is approximately 12 ft high. The eastern one-third of the building contains two classrooms and several offices and the remainder of the building is used as storage space.

Potential indoor sources of VOCs observed during the Phase III sampling event included two 10-gallon cans of gasoline, a gasoline-powered pressure washer, a gasoline-powered generator, a bottle of Clorox®, two bottles of Windex®, a can of WD-40®, a can of Triflow® lubricant, a container of Tilex®, a container of Febreze®, and a bottle of Brasso® metal polish.

The Phase III building survey did not identify any additional building characteristics that were not captured during the Phase II building survey. A more detailed description of building characteristics from previous investigation phases is presented in the Final VI Evaluation Report (CH2M HILL, 2009).

Analytical Results. Phase III sample locations and exceedances of risk-based screening levels are presented on **Figure V5-1**. **Figure V5-4** shows Phase I subslab soil gas and indoor

air sample locations and exceedances, as well as Phase III subslab soil gas sample and indoor air locations and exceedances. Data from samples collected during previous phases at Building G480 are presented in Volume 6 of the Final VI Evaluation Report (CH2M HILL, 2009). Phase I subslab soil gas and indoor air and Phase III sample results and screening level exceedances are provided in **Table V5-6.**

TABLE V5-6
Summary of Building G480 Investigation Results
Camp Geiger, MCB CamLej, North Carolina

Building G480 Phase I Subslab Soil Gas Screening Level Exceedances

Sample ID	Ethylbenzene (ppbv)
SGSL (based on industrial air RSL;AF=1E-01)	*11.3*
Base-Specific SGSLs (AF=1E-03)	*1,130*
IR35-SG05-08B	20
IR35-SG06-08B	27

Building G480 Phase I Indoor Air Screening Level Exceedances

Sample ID	Ethylbenzene (ppbv)	1,2-DCA (ppbv)	1,4-DCB (ppbv)	Benzene (ppbv)	Carbon Tetrachloride (ppbv)
Industrial Air RSL	*1.13*	*0.116*	*0.183*	*0.501*	*0.13*
IR35-IA05-08B	-	-	12	1.8	-
IR35-IA06-08B	2.4	0.13	11	2.7	0.13

Building G480 Phase III Subslab Soil Gas Screening Level Exceedances

Sample ID	Ethylbenzene (ppbv)	1,2-DCA (ppbv)	1,4-DCB (ppbv)	Benzene (ppbv)	Carbon Tetrachloride (ppbv)
SGSL (based on industrial air RSL;AF=1E-01)	*11.3*	*1.17*	*1.85*	*4.91*	*3.24*
Base-Specific SGSLs (AF=1E-03)	1,130	117	185	491	324
IR35-SG05-10A	-	-	-	-	-
IR35-SG06-10A	-	-	-	-	-

Building G480 Phase III Indoor Air Screening Level Exceedances

Sample ID	Ethylbenzene (ppbv)	1,2-DCA (ppbv)	1,4-DCB (ppbv)	Benzene (ppbv)	Carbon Tetrachloride (ppbv)
Industrial Air RSL	*1.13*	*0.117*	*0.185*	*0.491*	*0.324*
IR35-IA05-10A	-	-	9.5	1	-
IR35-IA06-10A	-	-	10	0.9	-

Notes: The VOCs shown are those that had one or more exceedances in previous phases or in the historical groundwater (GW) data. Phase I results were screened against screening levels (SLs) developed from the December 2009 RSLs; Phase III results were screened against SLs developed from May 2010 RSLs
- indicates the compound does not exceed the screening level; ppbv – parts per billion by volume; SGSL - Soil Gas Screening Level; RSL – Regional Screening Level; AF – attenuation factor; DCA = dichloroethane

Refined CSM. Two subslab soil gas probes were installed and sampled along with the collection of two co-located indoor air samples inside Building G480 during Phase I.

Ethylbenzene was detected at concentrations above the generic SGSL in both subslab soil gas samples. Ethylbenzene, 1,2-DCA, 1,4-DCB, benzene, and carbon tetrachloride were detected at concentrations similar to or slightly above the Indoor Air Screening Levels (IASLs) in one or both of the Phase I indoor air samples. However, it is not likely that their presence is related to VI, as these compounds (with the exception of ethylbenzene) were not detected in the co-located subslab soil gas samples at concentrations exceeding the generic SGSLs. The ethylbenzene concentration exceeded the generic SGSL by only approximately 2 times, and was well below the base-specific SGSL. Additionally, the indoor air concentration of carbon tetrachloride was similar to the maximum outdoor air detection (CH2M HILL, 2009). According to that report, significant VI impacts were not expected based on the Phase I data, but an additional of concurrent subslab soil gas and indoor air sampling was recommended at Building G480 during Phase III to address temporal variability and to assess the validity of the Phase I/II conclusions.

Two subslab soil gas samples were collected from the existing probes along with two indoor air samples during Phase III. Ethylbenzene, in exceedance of screening levels during previous phases, was not detected in subslab soil gas above the generic SGSL and was not detected in indoor air above the IASL during Phase III. No other constituents of potential concern (COPCs) were detected in exceedance of the generic SGSLs during Phase III. The lack of subslab SGSL exceedances during Phase III confirms the conclusion from Phase I that significant VI is not likely occurring.

Temporal variability between measured Phase I and Phase III subslab soil gas concentrations for ethylbenzene could not be quantitatively evaluated because ethylbenzene was not detected in Phase III subslab soil gas. However, the ethylbenzene concentrations did not exceed the base-specific SGSL. There were no other constituents detected above the generic SGSL during Phases I or III. Because concentrations of detected compounds did not exceed the base-specific SGLS, temporal variability is considered insignificant.

Similar to Phase I indoor air results, 1,4-DCB was detected in both indoor air samples approximately 35 times the subslab soil gas concentrations. 1,4-DCB was not detected above the generic SGSL in either of the subslab soil gas samples. Therefore, the Phase III indoor air concentrations of 1,4-DCB are not likely the result of VI. The outdoor air sample collected near Building G480 (IR35-OA04) of 0.02J ppbv 1,4-DCB was significantly lower than the measured indoor air concentrations; therefore, the measured indoor air levels were likely due to an indoor (not outdoor) air source. Indoor sources of 1,4-DCB can include urinal cakes, mothballs and air fresheners (.

Consistent with the sampling conducted during Phase I, benzene was detected in both Phase III indoor air samples at concentrations approximately 2 times the IASL. Benzene was not detected in the corresponding subslab soil gas samples above the SGSL. The outdoor air sample collected near Building G480 (IR35-OA04) contained 0.19J ppbv of benzene; therefore, the indoor air concentrations were likely due to an indoor source of benzene, such as the gasoline stored in 10-gallon containers and the gas-powered pressure washer and generator observed during the building survey.

There were no other COPCs detected in exceedance of IASLs during Phase III. Phase I and III results for ethylbenzene, 1,2-DCA, and carbon tetrachloride were similar based on the magnitude of their concentrations.

The overall range of observed temporal variability of VOC concentrations in subslab soil gas and indoor air was within the expected range of one to two orders of magnitude and considered minimal (Folkes et al., 2009; McHugh, 2007).

Conclusions. The following lines of evidence suggest that the VI pathway is not significant at Building G480:

- VOC concentrations in subslab soil gas did not exceed the base-specific SGSLs during two sampling events.
- Benzene and 1,4-DCB concentrations in indoor air was likely due to indoor air sources and not vapor intrusion.
- Ethylbenzene was the only COPC detected above the generic SGSL and was detected in only one subslab soil gas sample, at a concentration exceeding the screening level by approximately 2 times.
- Potential indoor sources of the compounds detected in indoor air above screening levels were documented during the building survey.
- The observed temporal variability is considered minimal and does not affect the conceptual site model or conclusions for Building G480.
- Building G480 is a warehouse building with a large indoor air volume that likely results in significant indoor-to-outdoor air exchange, mixing, and attenuation of indoor air concentrations.

Recommended Further Actions.

1. Further investigation of the VI pathway is not recommended for Building G480 because the MLE evaluation suggests that the VI pathway is not significant at the building.
2. The Base should consider the VI pathway during construction planning at Building G480 to ensure that the slab is not compromised, given the generic SGSL subslab exceedance. Air monitoring should be performed if construction activities that involve slab penetrations are necessary.

Building G531

Building G531, which is located within Site 35, is used as barracks. It is classified as a large residential building for this evaluation. Shallow groundwater near Building G531 flows to the northeast. Building G531 is located within 100 ft of two monitoring wells (IR35-IS218 and IR35-IS219) that had historical (2002-2007) detections of benzene and vinyl chloride (VC), respectively, that exceeded site-specific Groundwater Screening Levels (GWSLs). Based on the downgradient location of the building, shallow impacted groundwater may also migrate toward Building G531.

Building G531 is a three-story brick building that is approximately 100 ft long by 50 ft wide (based on figure scale). The building is approximately 35 ft high; the ceilings on each floor are approximately 10 ft high. One-third of each floor contains an office, restrooms, and laundry rooms. The remainder of each floor contains barracks: an open space with bunk beds and cubbies.

Floor drains are present in the laundry rooms and restrooms; vinyl tile covers the slab in the hallways, ceramic tile covers the slab in the restrooms, and the slab is bare in the laundry rooms and barracks. The bare concrete contains expansion joints that are sealed. The list of VOC-containing items observed during the Phase III building survey was updated and included general cleaning products (e.g. Windex®, Clorox®, Febreze®).

A more detailed description of building characteristics from previous investigation phases is presented in the Final VI Evaluation Report (CH2M HILL, 2009) and additional details are listed in the Phase III building survey sheets presented in **Appendix V5-C**.

Analytical Results. Phase III sample locations and exceedances of risk-based screening levels are presented on **Figure V5-2**. **Figure V5-4** shows historical (2002-2007) groundwater exceedances; Phase I groundwater and exterior soil vapor sample locations and exceedances; Phase II subslab soil gas sample locations and exceedances; and Phase III subslab soil gas sample locations and exceedances. Data from samples collected during previous phases at Building G531 are presented in Volume 6 of the Final VI Evaluation Report (CH2M HILL, 2009). Phase II subslab soil gas and Phase III sample results and screening level exceedances are provided in **Table V5-7**.

TABLE V5-7
Summary of Building G531 Investigation Results
Camp Geiger, MCB CamLej, North Carolina

Building G531 Phase II Subslab Soil Gas Screening Level Exceedances

Sample ID	Benzene (ppbv)	VC (ppbv)	Chloroform (ppbv)	Ethylbenzene (ppbv)	PCE (ppbv)
SGSL (based on residential air RSL;AF=1E-01))	*0.97*	*0.626*	*0.225*	*2.23*	*0.605*
Base-Specific SGSL (AF=1E-03)	*97*	*62.6*	*22.5*	*223*	*60.5*
IR35-SG08-08C	2U	2U	0.45J	-	2U
IR35-SG09-08C	2U	2U	1.2J	-	2U

Building G531 Phase III Subslab Soil Gas Screening Level Exceedances

Sample ID	Benzene (ppbv)	VC (ppbv)	Chloroform (ppbv)	Ethylbenzene (ppbv)	PCE (ppbv)
SGSL (based on residential air RSL;AF=1E-01)	*0.970*	*0.626*	*0.225*	*2.23*	*0.605*
Base-Specific SGSLs (AF=1E-03)	97.0	62.6	22.5	223	60.5
IR35-SG08-10A	-	0.95U	9.4	-	3.2J
IR35-SG09-10A	-	0.97U	1	2.3	3.4

Building G531 Phase III Subslab Soil Gas Screening Level Exceedances (continued)

Sample ID	1,4-Dichloro benzene (ppbv)
SGSL (based on residential air RSL;AF=1E-01))	*0.366*
IR35-SG08-10A	-
IR35-SG09-10A	0.4J

Notes: The VOCs shown are those that had one or more exceedances in previous phases or in the historical GW data. Phase II results were screened against SLs developed from December 2009 RSLs, Phase III results were screened against SLs developed from May 2010 RSLs

- indicates the compound does not exceed the screening level; J = estimated; U = undetected; ppbv – parts per billion by volume; SGSL - Soil Gas Screening Level; RSL – Regional Screening Level; AF – attenuation factor; PCE = tetrachloroethene; VC = vinyl chloride

Refined CSM. A three-dimensional (3-D) CSM is provided as **Figure V5-4**. The Phase I, II, and III sample locations and results for VOCs with previous or current screening level exceedances for Building G531 are shown in this figure. Due to the building's use as barracks, the results were compared to residential screening levels.

Four temporary groundwater wells and two shallow soil gas points were installed and sampled near Building G531 during Phase I. Chloroform was detected at a concentration above the generic GWSL in one of the four groundwater samples. Benzene, chloroform, ethylbenzene, and PCE were detected at concentrations above the generic SGSLs in one or both of the soil gas samples.

Two subslab soil gas probes were installed and sampled inside Building G531 during Phase II. Chloroform was the only VOC detected above the residential generic SGSL, but the detections were well below the base-specific SGSL. According to the Final VI Evaluation Report (CH2M HILL, 2009), significant VI impacts were not expected based on the Phase I and II data, but an additional round of subslab soil gas sampling was recommended at Building G531 during Phase III to address temporal variability and to assess the validity of the Phase I/II conclusions.

Two subslab soil gas samples were collected from the existing probes during Phase III. Chloroform was detected at concentrations above the generic SGSL in both subslab soil gas samples. IR35-SG08 contained chloroform at a concentration approximately 42 times the SGSL. IR35-SG09 contained chloroform at a concentration approximately 4 times the SGSL. Although both chloroform results exceeded the generic SGSL, neither exceeded the base-specific SGSL.

Ethylbenzene and 1,4-DCB were both detected at concentrations slightly above the generic SGSL in IR35-SG09 during Phase III, but concentrations did not exceed the base-specific SGSLs. Neither COPC was detected at a concentration in exceedance of the SGSL in either of the subslab soil gas samples collected during Phase II. However, ethylbenzene was detected above the SGSL in both shallow exterior soil gas samples collected near Building G531 during Phase II.

PCE was detected at concentrations above the generic SGSL in both subslab soil gas samples during Phase III. IR35-SG08 contained PCE at a concentration approximately 5 times the SGSL. IR35-SG09 contained PCE at a concentration approximately 9 times the SGSL.

Although both PCE results exceeded the generic SGSL, neither concentration exceeded the base-specific SGSL. PCE was not detected in either subslab soil gas samples collected during Phase II. However, PCE was detected above the SGSL in both shallow exterior soil gas samples collected near Building G531 during Phase II.

The overall range of observed temporal variability of VOC concentrations in subslab soil gas was within the expected range of one to two orders of magnitude and considered minimal (Folkes et al., 2009; McHugh, 2007).

Conclusions

The following lines of evidence suggest that the VI pathway is not significant at Building G531:

- VOC concentrations detected in subslab soil gas during two sampling events did not exceed base-specific SGSLs.
- Subslab concentrations from Buildings G532 (discussed in subsequent sections), which is located closer to the impacted groundwater plume at the former Camp Geiger Area Fuel Farm, did not exceed base-specific SGSLs.
- Expansion joints within the building are sealed, as observed in the Phase III building survey.
- The observed temporal variability is considered minimal and does not affect the conceptual site model or conclusions for Building G531.
- Building G531 is a multi-story building with a large indoor air volume that likely results in significant indoor-to-outdoor air exchange, mixing, and attenuation of indoor air concentrations.

Recommended Further Actions.

1. Further investigation of the VI pathway is not recommended for Building G531 because the MLE evaluation suggests that the VI pathway is not significant at the building.
2. The Base should consider the VI pathway during construction planning at Building G531 to ensure that the slab is not compromised given the generic SGSL subslab exceedances. Air monitoring should be performed if construction activities that involve slab penetrations are necessary.

Building G532

Building G532, which is located within Site 35, is used as barracks and has been classified as a large residential building for this evaluation. Shallow groundwater near Building G532 flows to the northeast. Building G532 is located within 100 ft of two monitoring wells (IR35-IS219 and IR35-MW29) that contained concentrations of VC and benzene, respectively, above their site-specific GWSLs. Based on the upgradient/cross-gradient location of the building, it is not likely that impacted groundwater will flow toward the building.

Building G532 is a three-story brick building that is approximately 100 ft long by 50 ft wide (based on the figure scale). The building is approximately 35 ft high; the ceilings on each floor are approximately10 ft high. One-third of each floor contains an office, restrooms, and

laundry rooms. The remainder of each floor contains barracks: an open space with bunk beds and cubbies.

Floor drains are present in the laundry rooms and restrooms, vinyl tile covers the slab in the hallways, ceramic tile covers the slab in the restrooms, and the slab is bare in the laundry rooms and barracks. The bare concrete contains expansion joints that are sealed. The list of VOC-containing items observed during the Phase III building survey was updated and includes general cleaning products (e.g. Windex®, Clorox®, Febreze®).

A more detailed description of building characteristics from previous investigation phases is presented in the Final VI Evaluation Report (CH2M HILL, 2009) and additional details are listed in the Phase III building survey sheets presented in **Appendix V5-C**.

Analytical Results. Phase III sample locations and exceedances of risk-based screening levels are presented on **Figure V5-2**. **Figure V5-4** presents historical (2002-2007) groundwater well locations and exceedances and Phase I groundwater and exterior soil vapor sample locations and exceedances; Phase II subslab soil gas sample locations and exceedances; and Phase III subslab soil gas sample locations and exceedances. Data from samples collected during previous phases at Building G532 are presented in Volume 6 of the Final VI Evaluation Report (CH2M HILL, 2009). Phase II subslab soil gas and Phase III sample results and screening level exceedances are provided in **Table V5-8**.

TABLE V5-8
Summary of Building G532 Investigation Results
Camp Geiger, MCB CamLej, North Carolina

Building G532 Phase II Subslab Soil Gas Screening Level Exceedances

Sample ID	Benzene (ppbv)	VC (ppbv)	Chloroform (ppbv)	Ethylbenzene (ppbv)	PCE (ppbv)
SGSL (based on residential air RSL; AF=1E-01)	*0.97*	*0.626*	*0.225*	*2.23*	*0.605*
Base-Specific SGSL (AF=1E-03)	*97*	*62.6*	*22.5*	*223*	*60.5*
IR35-SG10-08C	2U	2U	2U	-	2.2
IR35-SG11-08C	2U	2U	2U	-	2U

Building G532 Phase III Subslab Soil Gas Screening Level Exceedances

Sample ID	Benzene (ppbv)	VC (ppbv)	Chloroform (ppbv)	Ethylbenzene (ppbv)	PCE (ppbv)
SGSL (based on residential air RSL; AF=1E-01)	*0.970*	*0.626*	*0.225*	*2.23*	*0.605*
Base-Specific SGSL (AF=1E-03)	*97.0*	*62.6*	*22.5*	*223*	*60.5*
IR35-SG10-10A	-	0.94U	0.41J	-	2.7
IR35-SG11-10A	-	0.95U	1.9	-	3.1

Notes: The VOCs shown are those that had one or more exceedances in previous phases or in the historical GW data. Phase II results were screened against SLs developed from December 2009 RSLs, Phase III results were screened against SLs developed from May 2010 RSLs**.**
- indicates the compound does not exceed the screening level; U = undetected; ppbv – parts per billion by volume; SGSL - Soil Gas Screening Level; RSL – Regional Screening Level; AF – attenuation factor; PCE = tetrachloroethene; VC = vinyl chloride

Refined CSM. A 3-D CSM is provided as **Figure V5-4**. The Phase I, II, and III sample locations and results for VOCs with previous or current screening level exceedances for

Building G532 are shown in this figure. Due to the building's use as barracks, the results were compared to residential screening levels.

Three temporary groundwater wells and two shallow soil gas points were installed and sampled near Building G532 during Phase I. Benzene, chloroform, and ethylbenzene were detected at concentrations above the generic GWSLs in groundwater. Benzene, chloroform, ethylbenzene, and PCE were detected at concentrations above the SGSLs in exterior soil gas samples.

Two subslab soil gas probes were installed and sampled inside Building G532. PCE was the only VOC detected above the residential generic SGSL, but the detection was well below the base-specific SGSL. According to the Final VI Evaluation Report (CH2M HILL, 2009), significant VI impacts were not expected based on the Phase I and II data, but an additional round of subslab soil gas sampling was recommended at Building G532 during Phase III to address temporal variability and assess the validity of the Phase I/II conclusions.

Two subslab soil gas samples were collected from the existing probes during Phase III. Chloroform was detected in Phase III at concentrations above the generic residential SGSL in both subslab samples. Chloroform concentrations in the subslab soil gas samples exceeded the generic SGSL by 1.8 to 8 times (**Figure V5-4**). However, these concentrations did not exceed the base-specific SGSL.

PCE was detected above the generic residential SGSL in both subslab soil gas samples. PCE concentrations in the subslab soil gas samples exceeded the generic SGSL by 4.5 and 5 times (**Figure V5-4**). However, these concentrations did not exceed the base-specific SGSL. The Phase III PCE and chloroform concentrations in subslab soil gas correlate to Phase I shallow groundwater and exterior soil vapor results on the south side of the building. The overall range of observed temporal variability of VOC concentrations in subslab soil gas was within the expected range of one to two orders of magnitude and considered minimal (Folkes et al., 2009; McHugh, 2007).

Conclusions. The following lines of evidence suggest that the VI pathway is not significant at Building G532:

- VOC concentrations detected in subslab soil gas during two sampling events did not exceed the base-specific SGSLs.
- Expansion joints within the building are sealed, as observed during the Phase III building survey.
- The observed temporal variability is considered minimal and does not affect the conceptual site model or conclusions for Building G532.
- Building G532 is a multi-story building with a large indoor air volume that likely results in significant mixing and attenuation of indoor air concentrations.

Recommended Further Actions.

1. Further investigation of the VI pathway is not recommended for Building G532 because the MLE evaluation suggests that the VI pathway is not significant at the building.

2. The Base should consider the VI pathway during construction planning at Building G532 to ensure that the slab is not compromised, given the generic SGSL subslab exceedances. Air monitoring should be performed if construction activities that involve slab penetrations are necessary.

Building G533

Building G533 is located within Site 35 and is used as barracks. It is classified as a large residential building for this evaluation. Building G533 is located within 100 ft of monitoring well IR35-MW29, which had a historical (2002-2007) exceedance of the site-specific GWSL for benzene. The direction of shallow groundwater flow is to the northeast. Based on the upgradient location of Building G533, it is not likely that impacted groundwater will migrate toward the building.

Building G533 is a three-story brick building that is approximately 100 ft long by 50 ft wide (based on the figure scale). The building is approximately 35 ft high; the ceilings on each floor are approximately 10 ft high. One-third of each floor contains an office, restrooms, and laundry rooms. The remainder of each floor contains barracks: an open space with bunk beds and cubbies.

Floor drains are present in the laundry rooms and restrooms, vinyl tile covers the slab in the hallways, ceramic tile covers the slab in the restrooms, and the slab is bare in the laundry rooms and barracks. The bare concrete contains expansion joints that are sealed. The list of VOC-containing items observed during the Phase III building survey was updated and included general cleaning products (e.g. Windex®, Clorox®, Febreze®, GoJo®).

A more detailed description of building characteristics from previous investigation phases is presented in the Final VI Evaluation Report (CH2M HILL, 2009) and additional details are listed in the Phase III building survey sheets presented in **Appendix V5-C**.

Analytical Results. Phase III sample locations and exceedances of risk-based screening levels are presented on **Figure V5-2**. **Figure V5-4** shows historical (2002-2007) monitoring well locations and exceedances and Phase I groundwater and exterior soil vapor sample locations and exceedances; Phase II subslab soil gas sample locations and exceedances; and Phase III subslab soil gas sample locations and exceedances. Data from samples collected during previous phases at Building G533 are presented in Volume 6 of the Final VI Evaluation Report (CH2M HILL, 2009). Phase II subslab soil gas and Phase III sample results and screening level exceedances are provided in **Table V5-9**.

TABLE V5-9
Summary of Building G533 Investigation Results
Camp Geiger, MCB CamLej, North Carolina

Building G533 Phase II Subslab Soil Gas Screening Level Exceedances

Sample ID	Benzene (ppbv)	Chloroform (ppbv)	Ethylbenzene (ppbv)	PCE (ppbv)
SGSL (based on residential air RSL;AF=1E-01)	*0.97*	*0.225*	*2.23*	*0.605*
Base-Specific SGSL (AF=1E-03)	*97*	*22.5*	*223*	*60.5*
IR35-SG12-08C	2U	3.7	-	3.2
IR35-SG13-08C	2U	0.83	-	2U

Building G533 Phase III Subslab Soil Gas Screening Level Exceedances

Sample ID	Benzene (ppbv)	Chloroform (ppbv)	Ethylbenzene (ppbv)	PCE (ppbv)
SGSL (based on residential air RSL;AF=1E-01)	*0.970*	*0.225*	*2.23*	*0.605*
Base-Specific SGSL (AF=1E-03)	97.0	22.5	22.3	60.5
IR35-SG12-10A	-	2.2	-	1.3
IR35-SG13-10A	-	**23**	-	0.71

Building G533 Phase III Subslab Soil Gas Screening Level Exceedances (continued)

Sample ID	1,4-Dichloro-benzene (ppbv)	Bromo-dichloro methane (ppbv)	m- & p-Xylene (ppbv)
SGSL (based on residential air RSL;AF=1E-01)	*0.366*	*0.0985*	*23.0*
Base-Specific SGSL (AF=1E-03)	36.6	9.85	2,300
IR35-SG12-10A	0.48	-	28
IR35-SG13-10A	0.39	0.12J	-

Notes: The VOCs shown are those that had one or more exceedances in previous phases or in the historical GW data. Phase II results were screened against SLs developed from December 2009 RSLs, Phase III results were screened against SGSLs developed from May 2010 RSLs
BOLD indicates the compound exceeds the base-specific SGSL; - indicates the compound does not exceed the screening level; J = estimated; U = undetected; ppbv – parts per billion by volume; SGSL - Soil Gas Screening Level; RSL – Regional Screening Level; AF – attenuation factor; PCE = tetrachloroethene

Refined CSM. A 3-D CSM is provided as **Figure V5-4**, which shows Phase I, II, and III sample locations and results for VOCs with previous or current screening level exceedances for Building G533. Due to the building's use as barracks, the results were compared to residential screening levels.

Two temporary groundwater wells and two exterior shallow soil gas points were installed and sampled near Building G533 during Phase I. Benzene, chloroform, and ethylbenzene were detected at concentrations above the generic GWSLs in groundwater. Benzene, chloroform, ethylbenzene, and PCE were detected at concentrations above the generic SGSLs in both exterior soil gas samples.

Two subslab soil gas probes were installed and sampled inside Building G533 during Phase II. Chloroform and PCE were the only VOCs detected above the residential generic

SGSLs, but those detections were well below the base-specific SGSLs. According to the Final VI Evaluation Report (CH2M HILL, 2009) significant VI impacts were not expected based on the Phase I and II data, but an additional round of concurrent subslab soil gas and indoor air sampling was recommended at Building G533 during Phase III to address temporal variability and to assess the validity of the Phase I/II conclusions.

Two subslab soil gas samples were collected from the existing probes. Chloroform was detected at concentrations 10 to 100 times above the generic residential SGSL during Phase III and slightly above the base-specific SGSL in IR35-SG13-10A (**Table V5-9**).

PCE was detected at concentrations above the generic SGSL in both subslab samples. IR35-SG12 contained PCE at a concentration approximately 2 times the SGSL. IR35-SG13 contained PCE at a concentration approximately equal to the SGSL. However, these concentrations did not exceed the base-specific SGSL.

1,4-DCB was detected at or slightly above (1.3 times) the generic residential SGSL in both Phase III subslab soil gas samples, but was well below the base-specific SGSL. This COPC was not detected above screening levels in any previous phase of investigation.

Bromodichloromethane and m-&p-xylenes were detected slightly (1.2 times) above the generic residential SGSL, but were well below the base-specific SGSLs. The source of bromodichloromethane is not known; however, it is a by-product of municipally treated water.

The overall range of observed temporal variability of VOC concentrations in subslab soil gas was within the expected range of one to two orders of magnitude (Folkes et al., 2009; McHugh, 2007).

Conclusions. The following lines of evidence suggest that the VI pathway is not significant at Building G533:

- VOC concentrations in subslab soil gas did not exceed the base-specific SGSLs during Phase II.
- The observed temporal variability is considered minimal and does not affect the conceptual site model or conclusions for Building G533.
- Building G533 is a multi-story building with a large indoor air volume that likely results in significant indoor-to-outdoor air exchange, mixing, and attenuation of indoor air concentrations.
- However, there is some uncertainty as to whether the VI pathway could be significant in the future at Building G533 based on chloroform exceedance of the base-specific SGSL in subslab soil gas during Phase III. Although no indoor air samples have been collected to date, the magnitude of the exceedance of the base-specific SGSL (0.5 ppbv) suggests indoor air concentrations of chloroform are unlikely to result in estimated risks greater than the target risk range of 1E-06 to 1E-04.

Recommended Further Actions.

1. Due to the Phase III subslab concentration of chloroform at IR35-SG 13, co-located subslab soil gas and indoor air samples should be collected at Building G533 during the 5-year review to confirm that the VI pathway is minimal.
2. In addition, further consideration could be given to whether chloroform is present in the subsurface due to a regulated release or due widespread anthropogenic background conditions. Chloroform and other trihalomethanes are ubiquitous in the environment – commonly forming as disinfection byproducts in public water supplies and entering the environment though pipe leakage, septic systems and outside water use.
3. The Base should consider the VI pathway during construction planning at Building G533 to ensure that the slab is not compromised, given the generic and base-specific SGSL subslab exceedances. Air monitoring should be performed if construction activities that involve slab penetrations are necessary.

4.3.2 Site 89

Site 89, the former Defense Reutilization and Marketing Office (DRMO), is located within Camp Geiger. Historical records for Site 89 indicate that the Base Motor Pool operated onsite until approximately 1988. The Base Motor Pool, while located at Site 89, reportedly used solvents (acetone, TCE, and MEK) for parts cleaning. After 1988, the site was used as the DRMO by the Defense Logistics Agency (DLA) until 2000. The facility was used as a storage yard for items such as scrap and surplus metal, electronic equipment, vehicles, and rubber tires. The primary contaminants at Site 89 were identified to include solvent-related (primarily TCE and PCA) groundwater contamination in the surficial aquifer. In general, this groundwater contamination occurs in the southern portion of Site 89 within 100 feet of the VI buildings of interest. More information about the status of this site and additional details from previous site reports are presented in Section 4.5.1 of the Final VI Evaluation Work Plan (CH2M HILL, 2008) and Section 4.3.2 of the Final VI Evaluation Report (CH2M HILL, 2009).

Building TC860

Building TC860 is located within Site 89. It is used as a recruit processing building and is classified as a large industrial building for this evaluation. It is located within 100 ft of monitoring well IR89-MW43, which had historical exceedances of the site-specific GWSLs for PCE and TCE. Shallow groundwater flows southwest near Building TC860. Based on the cross-gradient location of Building TC860, it is not likely that impacted groundwater will migrate toward the building. Two permanent soil gas monitoring probes were installed on the east side of Building TC860 as part of an air sparging treatability study conducted in 2007. Data from the pilot study indicated elevated concentrations of several VOCs during the air sparge test.

The interior walls are constructed of sheet-rock panels with stucco on the exterior. The concrete slab is elevated 2 ft from the surrounding ground surface. The restroom floors are covered with ceramic tiles, while the office space contains a vinyl tile floor covering. Exposed concrete is present in part of the building, with expansion joints that need repair. Floor drains are present in the restrooms. The list of VOC-containing items observed during the Phase III building survey was updated and included general cleaning products (e.g.

ZEP® meter mist air freshener, Pledge®, Windex®, GoJo®, Purell®, Scott's Tuff™ Surface Disinfectant, Tough Guy™ Lemon Wax Furniture Polish).

A more detailed description of building characteristics from previous investigation phases is presented in the Final VI Evaluation Report (CH2M HILL, 2009) and additional details are listed in the Phase III building survey sheets presented in **Appendix V5-C**.

Analytical Results. Phase III sample locations and exceedances of risk-based screening levels are presented on **Figure V5-3**. Data from samples collected during previous phases at Building TC860 are presented in Volume 6 of the Final VI Evaluation Report (CH2M HILL, 2009). Phase I subslab soil gas and indoor air and Phase III sample results and screening level exceedances are provided in **Table V5-10**.

TABLE V5-10
Summary of Building TC860 Investigation Results
Camp Geiger, MCB CamLej, North Carolina

Building TC860 Phase I Subslab Soil Gas Screening Level Exceedances

Sample ID	PCE (ppbv)	TCE (ppbv)	1,1,2,2-PCA (ppbv)	VC (ppbv)	Ethyl-benzene (ppbv)	Chloroform (ppbv)
SGSL (based on industrial air RSL;AF=1E-01)	*3.1*	*11.4*	*0.306*	*11*	*11.3*	*1.09*
Base-Specific SGSL (AF=1E-03)	*310*	*1,140*	*30.6*	*1,100*	*1,130*	*109*
IR89-SG01-08B	23	230	1.6J	-	23	3.6U
IR89-SG02-08B	6	22	2U	-	33	2U

Building TC860 Phase I Indoor Air Screening Level Exceedances

Sample ID	PCE (ppbv)	TCE (ppbv)	1,1,2,2-PCA (ppbv)	VC (ppbv)	Ethyl-benzene (ppbv)	Chloroform (ppbv)
Industrial Air RSL	*0.31*	*1.14*	*0.0306*	*1.1*	*1.13*	*0.109*
IR89-IA01-08B	-	-	0.13J	-	-	-
IR89-IA02-08B	-	-	0.15J	-	-	-

Building TC860 Phase III Subslab Soil Gas Screening Level Exceedances

Sample ID	PCE (ppbv)	TCE (ppbv)	1,1,2,2-PCA (ppbv)	VC (ppbv)	Ethyl-benzene (ppbv)	Chloroform (ppbv)
SGSL (based on industrial air RSL;AF=1E-01)	*3.07*	*11.4*	*0.307*	*10.9*	*11.3*	*1.09*
Base-Specific SGSL (AF=1E-03)	*307*	*1,140*	*30.7*	*1,090*	*1,130*	*109*
IR89-SG01-10A	5.4	21	0.41	-	-	-
IR89-SG02-10A	5.8	-	0.34U	-	-	-

Building TC860 Phase III Subslab Soil Gas Screening Level Exceedances (continued)

Sample ID	1,4-DCB (ppbv)
SGSL (based on industrial air RSL;AF=1E-01)	*1.85*
Base-Specific SGSL (AF=1E-03)	185
IR89-SG01-10A	-
IR89-SG02-10A	-

Building TC860 Phase III Indoor Air Screening Level Exceedances

Sample ID	PCE (ppbv)	TCE (ppbv)	1,1,2,2-PCA (ppbv)	VC (ppbv)	Ethyl-benzene (ppbv)	Chloroform (ppbv)
Industrial Air RSL	*0.307*	*1.14*	*0.0307*	*1.09*	*1.13*	*0.109*
IR89-IA01-10A	-	-	0.12U	-	-	0.17U
IR89-IA07-10A	-	-	0.12U	-	-	0.16U

Building TC860 Phase III Indoor Air Screening Level Exceedances (continued)

Sample ID	1,4-DCB (ppbv)
Industrial Air RSL	*0.185*
IR89-IA01-10A	0.58
IR89-IA07-10A	0.89

Notes: The VOCs shown are those that had one or more exceedances in previous phases or in the historical GW data. Phase I results were screened against SLs developed from December 2009 RSLs, Phase III results were screened against SLs developed from May 2010 RSLs

- indicates the compound does not exceed the screening level; J = estimated; U = undetected; ppbv – parts per billion by volume; SGSL - Soil Gas Screening Level; RSL – Regional Screening Level; AF – attenuation factor; DCB = dichlorobenzene; TCE = trichloroethene; PCA = tetrachloroethane; PCE = tetrachloroethene; VC = vinyl chloride

Refined CSM. Two pre-existing exterior soil vapor probes were sampled near the building during Phase I. In addition, two subslab soil gas sample probes were installed and samples collected inside Building TC860 along with two co-located indoor air samples. TCE was detected above the base-specific SGSL in one of the exterior soil gas samples and PCE and chloroform were detected above the generic SGSL in the same sample. PCE, TCE, 1,1,2,2-PCA, and ethylbenzene were detected at concentrations above the generic SGSLs in one or both of the subslab soil gas samples. 1,1,2,2-PCA was detected above the IASL in both indoor air samples. Phase II sampling was not deemed a priority because significant indoor air impacts were not occurring at the time. According to the Final VI Evaluation Report (CH2M HILL, 2009) significant VI impacts were not expected based on the Phase I data, but an additional round of concurrent subslab soil gas and indoor air sampling was recommended at Building TC860 during Phase III to address temporal variability and to assess the validity of the Phase I conclusions.

Two subslab soil gas samples were collected from the existing probes during Phase III. In addition, two indoor air samples were collected: one (IR89-IA01) was collected in the classroom area and the other (IR89-IA07) was collected from the southern portion of the building in the office area. Indoor air sample location IR89-IA02 from Phase I was not re-sampled; IR89-IA07 was sampled instead because workers are present in the office area

more often and for longer periods of time than in the bathroom area where IR89-IA02 was located.

PCE was detected at concentrations above the generic SGSL at both subslab soil gas probe locations. IR89-SG01 contained PCE at a concentration approximately 1.7 times the SGSL. IR89-SG02 contained PCE at a concentration approximately 1.9 times the SGSL. Neither concentration exceeded the base-specific SGSL. PCE was not detected above the IASL in either sample collected during Phase III, suggesting that the PCE detected below the slab is not currently resulting in significant impacts to indoor air.

TCE was detected at a concentration above the generic SGSL in only one of the subslab soil gas samples. IR89-SG01 contained TCE at a concentration approximately 2 times the SGSL. TCE was detected in IR89-SG02 (10 ppbv) but did not exceed the generic SGSL. Neither result exceeded the base-specific SGSL. TCE was not detected above the IASL in samples collected during either Phase III or Phase I, indicating that TCE is not currently resulting in indoor air impacts.

1,1,2,2,-PCA was detected at a concentration above the generic SGSL in only one of the subslab soil gas samples. IR89-SG01 contained 1,1,2,2-PCA at a concentration approximately 1.3 times the SGSL. 1,1,2,2-PCA was not detected above the IASL in either indoor air sample collected during Phase III. Ethylbenzene was not detected above the generic SGSL in either subslab soil gas sample or above the IASL in either indoor air sample collected during Phase III.

1,4-DCB was detected at concentrations above the IASL in both indoor air samples collected during Phase III. IR89-IA01 contained 1,4-DCB at a concentration approximately 3 times the IASL and approximately 5 times the subslab soil gas concentration. IR89-IA07 contained 1,4-DCB at a concentration approximately 5 times the IASL and approximately 1.5 times the subslab soil gas concentration. 1,4-DCB was also detected in the outdoor air sample collected near Building TC860 (IR89-OA3) at 0.019J ppbv, which may contribute to the indoor air sample results. 1,4-DCB was not detected above the generic SGSL during either Phase I or Phase III and is likely attributable to an indoor air source, possibly the air fresheners observed during the building survey.

The overall range of observed temporal variability of VOC concentrations in subslab soil gas and indoor air was within the expected range of one to two orders of magnitude and considered minimal (Folkes et al., 2009; McHugh, 2007).

The maximum observed spatial variability in subslab soil gas was within one order of magnitude and in indoor air was approximately 2 times, which is below the range of up to one order of magnitude or 3 to 5 times that is generally typical in large industrial buildings. Therefore, spatial variability of VOC concentrations in subslab soil gas and indoor air at Building TC860 is considered minimal.

Conclusions

The following lines of evidence suggest that the VI pathway is not significant at Building TC860:

- VOC concentrations detected in subslab soil gas during two sampling events did not exceed base-specific screening levels.
- 1,4-DCB exceedances of IASLs are likely due to an indoor air source and not VI.
- The observed temporal and spatial variability are considered minimal and do not affect the conceptual site model or conclusions for Building TC860.

Recommended Further Actions.

1. Further investigation of the VI pathway is not recommended for Building TC860 because the MLE evaluation suggests that the VI pathway is not significant.
2. The Base should consider the VI pathway during construction planning at Building TC860 to ensure that the slab is not compromised based on the generic SGSL exceedances. Air monitoring should be performed if construction activities that involve slab penetrations are necessary.

Building TC864

Building TC864 is located within Site 89. It is used as a storage area and is classified as a large industrial building for this evaluation. Building TC864 is located within 100 ft of three monitoring wells that had exceedances of the site-specific GWSLs for PCE and TCE. Shallow groundwater flows to the west. Based on the down/cross gradient location of Building TC864, impacted groundwater could migrate toward the building.

A permanent soil gas monitoring probe was installed on the south side of Building TC864 as part of an air sparging treatability study conducted in 2007, and elevated concentrations of VOCs were detected during the study.

The Phase III building survey did not identify any additional building characteristics that were not captured during the Phase I building survey. A more detailed description of building characteristics from previous investigation phases is presented in the Final VI Evaluation Report (CH2M HILL, 2009).

Analytical Results. Phase III sample locations and exceedances of risk-based screening levels are presented on Figure V5-3. Data from samples collected during previous phases at Building TC864 are presented in Volume 6 of the Final VI Evaluation Report (CH2M HILL, 2009). Phase I subslab soil gas and indoor air and Phase III sample results and screening level exceedances are provided in Table V5-11.

TABLE V5-11
Summary of Building TC864 Investigation Results
Camp Geiger, MCB CamLej, North Carolina

Building TC864 Phase I Subslab Soil Gas Screening Level Exceedances

Sample ID	PCE (ppbv)	TCE (ppbv)	Benzene (ppbv)	1,1,2,2-PCA (ppbv)	VC (ppbv)	Chloroform (ppbv)	Ethyl benzene (ppbv)
Screening Criteria (Based on Industrial RSL;AF=1E-01)	*3.07*	*11.4*	*4.91*	*0.307*	*11*	*1.09*	*11.3*
Base-Specific SGSL (AF=1E-03)	*307*	*1,140*	*491*	*30.7*	*1,100*	*109*	*1,130*
IR89-SG03-08B	79	**2,000**	14U	14U	14U	14U	47
IR89-SG04-08B	110	**1,900**	13U	13U	13U	3.6	36

Building TC864 Phase I Indoor Air Screening Criteria Exceedances

Sample ID	PCE (ppbv)	TCE (ppbv)	Benzene (ppbv)	1,1,2,2-PCA (ppbv)	VC (ppbv)	Chloro form (ppbv)	Ethyl benzene (ppbv)
Industrial Air RSL	*0.31*	*1.14*	*0.501*	*0.0306*	*1.1*	*0.109*	*1.13*
IR89-IA03-08B	-	-	-	0.082	-	0.2U	-
IR89-IA04-08B	-	-	-	0.074	-	0.2U	-

Building TC864 Phase III Subslab Soil Gas Screening Level Exceedances

Sample ID	PCE (ppbv)	TCE (ppbv)	Benzene (ppbv)	1,1,2,2-PCA (ppbv)	VC (ppbv)	Chloro-form (ppbv)
Screening Criteria (Based on Industrial RSL;AF=1E-01)	*3.07*	*11.4*	*4.91*	*0.307*	*10.9*	*1.09*
Base-Specific SGSL (AF=1E-03)	*307*	*1,140*	*491*	*30.7*	*1,090*	*109*
IR89-SG03-10A	5	120	-	0.33U	-	-
IR89-SG04-10A	6.2	75	-	0.33U	-	-

Building TC864 Phase III Subslab Soil Gas Screening Level Exceedances (continued)

Sample ID	Ethyl benzene (ppbv)
Screening Criteria (Based on Industrial RSL;AF=1E-01)	*11.3*
Base-Specific SGSL (AF=1E-03)	*1,130*
IR89-SG03-10A	-
IR89-SG04-10A	-

Building TC864 Phase III Indoor Air Screening Criteria Exceedances

Sample ID	PCE (ppbv)	TCE (ppbv)	Benzene (ppbv)	1,1,2,2-PCA (ppbv)	VC (ppbv)	Chloro-form (ppbv)
Industrial Air RSL	*0.307*	*1.14*	*0.491*	*0.0307*	*1.09*	*0.109*
IR89-IA03-10A	4.7	-	-	0.03J	-	0.15U
IR89-IA04-10A	-	-	-	0.08U	-	0.12U

Building TC864 Phase III Indoor Air Screening Criteria Exceedances (continued)

Sample ID	Ethyl benzene (ppbv)
Industrial Air RSL	*1.13*
IR89-IA03-10A	-
IR89-IA04-10A	-

Notes: The VOCs shown are those that had one or more exceedances in previous phases or in the historical GW data. Phase I results were screened against SLs developed from December 2009 RSLs, Phase III results were screened against SLs developed from May 2010 RSLs
BOLD indicates exceeds Base-Specific SGSL; - indicates the compound does not exceed the screening level; J = estimated; U = undetected; ppbv – parts per billion by volume; SGSL - Soil Gas Screening Level; RSL – Regional Screening Level; AF – attenuation factor; PCE = tetrachloroethene; TCE = trichloroethene; VC = vinyl chloride

Refined CSM. Two permanent exterior soil vapor probes were installed and soil vapor samples collected near Building TC864 during Phase I. Two subslab soil gas probes were installed and soil gas samples collected inside Building TC864 along with the collection of two co-located indoor air samples. TCE was detected at a concentration slightly above the base-specific shallow SGSL in one sample collected from the two permanent soil vapor probes. PCE and chloroform were detected at concentrations above the generic shallow SGSLs in the same exterior sample. TCE was detected at concentrations above the base-specific SGSL in both of the subslab soil gas samples. PCE, chloroform, and ethylbenzene were detected at concentrations above the generic SGSLs in one or both of the subslab soil gas samples. 1,1,2,2-PCA was detected at concentrations slightly above the IASL in both samples.

Phase II sampling was not deemed a priority because significant indoor impacts were not occurring at the time. According to the Final VI Evaluation Report (CH2M HILL, 2009) significant VI impacts were not expected based on the Phase I data, but an additional round of concurrent subslab soil gas and indoor air sampling was recommended at Building TC864 during Phase III to address temporal variability and to assess the validity of the Phase I conclusions.

Two subslab soil gas samples were collected from the existing probes during Phase III. In addition, two co-located indoor air samples were collected. Although the collection of additional exterior soil vapor samples was recommended in the report, it was not proposed for this phase because subslab soil gas samples were collected instead.

PCE was detected at concentrations above the generic SGSL in both subslab soil gas samples. IR89-SG03 contained PCE at a concentration approximately 1.6 times the generic SGSL. IR89-SG04 contained PCE at a concentration approximately 2 times the generic SGSL. However, neither concentration exceeded the base-specific SGSL. PCE was detected at a concentration approximately 15 times the IASL in one of the indoor air samples and almost equal to the subslab soil gas concentration at the corresponding subslab soil gas location. PCE was not detected in the outdoor air sample collected near Building TC864 (IR89-OA03). The comparison of indoor and subslab PCE results suggests that the indoor PCE concentration may be attributable to an indoor source, such as dry-cleaned uniforms.

TCE was detected at concentrations above the generic SGSL in both subslab soil gas samples. IR89-SG03 contained TCE at a concentration approximately 11 times the generic SGSL. IR89-SG04 contained TCE at a concentration approximately 7 times the generic SGSL. TCE was not detected above the IASL in the samples collected during either Phase I or Phase III, indicating that VI impacts are not currently significant.

1,1,2,2-PCA was not detected at a concentration above the generic SGSL during Phase I and was not detected in the subslab in Phase III. Indoor air concentrations were slightly above IASLs in both samples collected during Phase I and the one indoor detection during Phase III was approximately equal to the generic IASL. The order of magnitude difference in

subslab and indoor air detection limits precludes meaningful comparisons of the indoor and subslab results. The following lines of evidence suggest vapor intrusion of 1,1,2,2-PCA at Building TC864 is not significant: (1) 1,1,2,2-PCA was non-detect in the Phase III subslab at a detection limit approximately equal to the generic SGSL and (2) the single Phase III indoor detection as approximately equal to the industrial IASL meaning that the corresponding cancer risk would not be greater than 1E-6 using one significant digit as recommended by RAGS Part A.

The overall range of observed temporal variability of VOC concentrations in subslab soil gas and indoor air was within the expected range of one to two orders of magnitude and considered minimal (Folkes et al., 2009; McHugh, 2007).

Conclusions. Groundwater data, subslab soil gas data, and the presence of an air sparge remediation system that has the potential to increase vapors in the subsurface suggest that VI could be significant at Building TC864 (CH2M HILL, 2009). However, indoor air is not currently being impacted by the VI pathway based on the following:

- VOC concentrations detected in subslab soil gas during two separate events did not exceed base-specific screening levels, with the exception of TCE.
- TCE concentrations in indoor air did not exceed the IASL during two sampling events.
- Other VOC concentrations detected in indoor air are likely due to indoor air sources and not related to vapor intrusion.
- The observed temporal variability in subslab soil gas and indoor air is considered minimal and does not affect the conceptual site model or conclusions for Building TC864.
- Building TC864 is a warehouse with a large indoor air volume that likely results in significant indoor-to-outdoor air exchange, mixing, and attenuation of indoor air concentrations.

However, there is uncertainty as to whether the VI pathway could be significant in the future at Building TC864 based on exceedances of the base-specific SGSL in subslab soil gas during Phase I and the down/cross-gradient location of Building TC864 where impacted groundwater could migrate toward the building.

Recommended Further Actions.

1. An additional round of subslab and indoor air samples should be collected at Building TC864 during the 5-year review to confirm whether the VOC concentrations in subslab soil gas remain below the base-specific SGSLs and indoor air VOC concentrations do not exceed the target cancer risk range (1E-06 to 1E-04).
2. The Base should consider the VI pathway during construction planning at Building TC864 to ensure that the slab is not compromised based on the generic SGSL exceedances. Air monitoring should be performed if construction activities that involve slab penetrations are necessary.

SECTION 5

Overall Conclusions and Recommendations

The purpose of this section is to summarize the overall conclusions of the VI evaluation for Camp Geiger that was performed as part of the base-wide Phase III VI evaluation of four investigation areas. Subslab soil gas and indoor air samples were collected within or near six buildings of interest to evaluate the potential for significant VI impacts. Consistent with the DoD Tri-Services (2009) and Interstate Technology & Regulatory Council (ITRC) VI Guidance documents (2007) and the USEPA draft Vapor Intrusion Guidance (2002), MLE were used in Section 4 to evaluate potential VI impacts at each of the six buildings. Conclusions and recommended further actions were based on the MLE evaluation and the refined CSMs. The recommendations from Phase III of the evaluation are summarized in **Table V5-12**.

TABLE V5-12
Summary of Phase III Recommendations
Camp Geiger, MCB CamLej, North Carolina

Bldg #	No Further Investigation	Monitor Subslab Soil Gas and/or Indoor Air During 5-year Review	Consider VI Pathway During Construction Planning
G480	X		X
G531	X		X
G532	X		X
G533		X	X
TC860	X		X
TC864		X	X

Overall, the subslab and/or indoor air data collected to date, along with the additional supporting lines of evidence, suggest that VI is not a current significant pathway of concern for any of the Camp Geiger buildings investigated during Phase III. Additionally, the data have suggested that temporal variability between the sampling events is minimal at the investigated Camp Geiger buildings.

Although current VI impacts are not suggested based on the data collected to date, site-related VOCs were detected in subslab samples from select buildings at concentrations above generic or at base-wide VI screening levels. Construction planning considerations or monitoring are recommended for select buildings to address the potential for future VI concerns.

5.1 Recommendation for Subslab Soil Gas and Indoor Air Monitoring

Although the data and lines of evidence evaluated to date suggest that current VI impacts are not occurring at the Camp Geiger buildings evaluated, subslab soil gas and concurrent indoor air monitoring is recommended at Buildings G533 and TC864 to address the potential for future VI concerns during the 5-year review. Another round of subslab sampling at G533 is recommended because site-related VOCs were detected in subslab samples at concentrations at the base-specific SGSLs during Phase III. Another round of subslab sampling at Building TC864 is recommended based on exceedances of the base-specific SGSLs during Phase I with temporal variability of greater than one order of magnitude and the potential for impacted groundwater to migrate toward the building.

5.2 Recommendations for Construction Planning

Although current risks have not been identified, the Base should consider the VI pathway during construction planning at buildings that had exceedances of the generic and/or base-wide SGSLs to ensure that the slab is not compromised since cracks, holes, or other penetrations of the slab have the potential to invalidate the use of the base-specific empirically derived AF. The Base should consider air monitoring for construction activities that involve slab penetrations, such as removing part of the slab or drilling holes through the slab. Additional data collection at the conclusion of construction may be warranted to ensure that the base-specific AF remains appropriate. In addition, buildings currently used for industrial purposes should remain industrial pending additional evaluation. Currently, the buildings that are recommended for additional VI pathway investigation in the event of construction activities include residential Buildings G480, G531, G532, G533, and industrial Buildings TC860, and TC864.

SECTION 6

References

CH2M HILL. 2008. *Final Vapor Intrusion Evaluation Work Plan.*

CH2M HILL. 2009. *Final Vapor Intrusion Evaluation Report*.

CH2M HILL. 2010. *Final Phase III Vapor Intrusion Evaluation Work Plan.*

DoD Tri-Services. 2009.

Folkes et al. 2009.

ITRC. 2007.

McHugh. 2007.

Tables

TABLE V5-3

Summary of Phase III Subslab Soil Gas Analytical Results

Phase III Vapor Intrusion Evaluation Report

Camp Geiger, MCB CamLej, North Carolina

Station ID	Generic Subslab Soil Gas Screening Level - Industrial[1] (AF=0.1) (ppbv)	Base-Specific Subslab Soil Gas Screening Level - Industrial[1] (AF=0.001) (ppbv)	Generic Subslab Soil Gas Screening Level - Residential[2] (AF=0.1) (ppbv)	Base-Specific Subslab Soil Gas Screening Level - Residential[2] (AF=0.001) (ppbv)	IR35-SG05	IR35-SG06	IR35-SG08		IR35-SG09	IR35-SG10	IR35-SG11	IR35-SG12	IR35-SG13	IR89-SG01	IR89-SG02	IR89-SG03	IR89-SG04
Sample ID					IR35-SG05-10A	IR35-SG06-10A	IR35-SG08-10A	IR35-SG08D-10A	IR35-SG09-10A	IR35-SG10-10A	IR35-SG11-10A	IR35-SG12-10A	IR35-SG13-10A	IR89-SG01-10A	IR89-SG02-10A	IR89-SG03-10A	IR89-SG04-10A
Sample Date					02/13/10	02/13/10	02/13/10	02/13/10	02/13/10	02/13/10	02/13/10	02/13/10	02/13/10	02/13/10	02/13/10	02/13/10	02/13/10
Chemical Name																	
Volatile Organic Compounds (ppbv)																	
1,1,1-Trichloroethane	4,010	401,000	953	95,300	0.42 U	0.42 U	0.44 U	0.44 U	0.46 U	0.44 U	0.44 U	0.42 U	0.42 U	0.44 U	0.43 U	0.3 J	0.42 U
1,1,2,2-Tetrachloroethane	0.307	31	0.0612	6.12	0.34 U	0.34 U	0.35 U	0.35 U	0.36 U	0.35 U	0.35 U	0.33 U	0.34 U	0.41	0.34 U	0.33 U	0.33 U
1,1,2-Trichloro-1,2,2-trifluoroethane(Freon-113)	17,100	1,710,000	4,040	404,000	0.07 J	0.07 J	0.09 J	0.08 J	0.07 J	0.06 J	0.06 J	0.09 J	0.08 J	0.06 J	0.06 J	0.08 J	0.3 U
1,4-Dichlorobenzene	1.85	185	0.366	36.6	0.44	0.28 J	0.13 J	0.15 J	0.4 J	0.4 U	0.4 U	0.48	0.39	0.11 J	0.6	0.09 J	0.38 U
2-Butanone	7,430	743,000	1,760	176,000	2.7	1.8	2	1.4 J	3.3	2.9	2.9	1.6	1.7	9.8	9.4	7.4	4
2-Hexanone	32.0	3,200	7.57	757	0.41 J	0.23 J	0.34 J	0.21 J	0.61 U	0.53 J	0.53 J	0.56 U	0.56 U	1.3	2.3	1.5	0.58
4-Methyl-2-pentanone	3,200	320,000	757	75,700	0.09 J	0.56 U	0.59 U	0.58 U	0.61 U	0.59 U	0.59 U	0.56 U	0.56 U	0.36 J	0.35 J	0.25 J	0.12 J
Acetone	56,800	5,680,000	13,500	1,350,000	10	7.8 J	13	11	30	16	13	7.1 J	14	29	30	25	14
Benzene	4.91	491	0.970	97	0.72 U	0.72 U	0.11 J	0.25 J	0.33 J	0.76 U	0.76 U	0.17 J	0.22 J	0.74 U	0.73 U	0.16 J	0.72 U
Bromodichloromethane	0.494	49	0.0985	9.85	0.34 U	0.35 U	0.36 U	0.35 U	0.37 U	0.36 U	0.36 U	0.34 U	0.12 J	0.35 U	0.35 U	0.33 U	0.34 U
Carbon disulfide	986	98,600	234	23,400	0.95 J	0.65 J	2 J	0.77 J	3.5	4.5	3.4	0.78 J	0.8 J	1.5 U	1.5 U	1.4 U	1.5 U
Carbon tetrachloride	3.24	324	0.652	65.2	0.1 J	0.06 J	0.07 J	0.15 J	0.4 U	0.1 J	0.06 J	0.07 J	0.08 J	0.06 J	0.37 U	0.36 U	0.36 U
Chloroethane	16,600	1,660,000	3790	379,000	0.59 J	0.37 J	0.24 J	0.56 J	0.57 J	0.85 J	0.93	0.39 J	0.21 J	0.9 U	0.88 U	0.85 U	0.87 U
Chloroform	1.09	109	0.225	22.5	0.18 J	0.08 J	9.4	9.4	1	0.41 J	1.9	2.2	**23**	0.1 J	0.11 J	0.08 J	0.27 J
Chloromethane	191	19,100	45.5	4,550	0.95 J	0.6 J	0.43 J	0.89 J	0.58 J	0.78 J	0.71 J	0.6 J	0.69 J	1.2 U	1.1 U	1.1 U	1.1 U
cis-1,2-Dichloroethene	--	--	--	--	0.58 U	0.58 U	0.61 U	0.6 U	0.63 U	0.61 U	0.61 U	0.58 U	0.58 U	0.6 U	0.59 U	0.47 J	0.07 J
Dichlorodifluoromethane (Freon-12)	177	17,700	42.5	4,250	0.48	0.49	0.55	0.55	0.89	0.59	0.57	0.55	0.5	0.5	0.48	0.51	0.5
Ethylbenzene	11.3	1,130	2.23	223	0.53 U	0.53 U	0.56 U	0.55 U	2.3	0.56 U	0.56 U	0.73	0.42 J	0.55 U	0.36 J	0.26 J	0.53 U
Isopropylbenzene	356	35,600	85.4	8,540	0.47 U	0.47 U	0.49 U	0.48 U	0.7	0.49 U	0.49 U	0.26 J	0.15 J	0.48 U	0.13 J	0.1 J	0.47 U
m- and p-Xylene	101	10,100	23.0	2,300	0.15 J	0.17 J	1.1 U	1.1 U	78	0.14 J	0.13 J	28	15	1.1 U	14	9.4	1.1 U
Methylene chloride	75.1	7,510	15.0	1,500	0.15 J	0.67 U	0.7 U	0.17 J	0.13 J	0.15 J	0.22 J	0.11 J	0.11 J	0.11 J	0.67 U	0.64 U	0.66 U
o-Xylene	707	70,700	168	16,800	0.53 U	0.53 U	0.56 U	0.55 U	29	0.56 U	0.56 U	10	5.5	0.55 U	5.1	3.3	0.53 U
Styrene	1,030	103,000	235	23,500	0.54 U	0.54 U	0.57 U	0.56 U	0.09 J	0.57 U	0.57 U	0.54 U	0.54 U	0.56 U	0.55 U	0.53 U	0.54 U
Tetrachloroethene	3.07	307	0.605	60.5	1.3	1.1	3.2 J	1.2 J	3.4	2.7	3.1	1.3	0.71	5.4	5.8	5	6.2
Toluene	5,810	581,000	1,380	138,000	0.16 J	0.13 J	0.12 J	0.12 J	2.7	0.17 J	0.14 J	0.78	0.62	0.63 U	0.36 J	0.35 J	0.61 U
trans-1,2-Dichloroethene	66.3	6,630	15.9	1,590	0.58 U	0.58 U	0.61 U	0.6 U	0.63 U	0.61 U	0.61 U	0.58 U	0.58 U	0.17 J	0.59 U	0.75	0.12 J
Trichloroethene	11.4	1,140	2.23	223	0.43 U	0.07 J	0.45 U	0.44 U	0.09 J	0.45 U	0.45 U	0.43 U	0.43 U	21	10	120	75
Trichlorofluoromethane(Freon-11)	546	54,600	130	13,000	0.22 J	0.23 J	0.26 J	0.25 J	0.33 J	0.35 J	0.29 J	0.25 J	0.22 J	0.21 J	0.21 J	0.19 J	0.16 J

Notes:

NA - Not analyzed

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

U - The material was analyzed for, but not detected

ppbv - Parts per billion volume

Green shading indicates samples collected in residential areas and thus screened against Residential criteria

Grey Shading indicates detected results that exceed the Industrial Shallow Soil Gas Screening Levels

Bold box indicates detected results that exceed the Residential Shallow Soil Gas Screening Levels

Blue shading indicates U-qualifed results that exceed the Residential Shallow Soil Gas Screening Levels

Pink shading indicates U-qualifed results that exceed both the Industrial Shallow Soil Gas Screening Levels

BOLD indicates Exceedance of the Base-specific Soil Gas Screening Levels

[1] U.S. EPA Regional Screening Levels (RSL) Table, May 17, 2010, Industrial Air RSLs (based on 10^{-6} for carcinogens and HQ of 0.1 for noncarcinogens) was used to compute the Industrial Subslab Soil Gas Screening levels. Values were rounded to 3 significant figures.

[2] U.S. EPA Regional Screening Levels (RSL) Table, May 17, 2010, Residential Air RSLs (based on 10^{-6} for carcinogens and HQ of 0.1 for noncarcinogens) was used to compute the Residential Subslab Soil Gas Screening levels. Values were rounded to 3 significant figures.

TABLE V5-4

Summary of Camp Geiger Phase III Indoor Air Analytical Results

Phase III Vapor Intrusion Evaluation Report

Camp Geiger, MCB CamLej, North Carolina

Station ID	**Adjusted Industrial Air RSLs (May 2010)[1] ppbv**	IR35-IA05	IR35-IA06	IR89-IA01	IR89-IA03	IR89-IA04	IR89-IA07	
Sample ID		IR35-IA05-10A	IR35-IA06-10A	IR89-IA01-10A	IR89-IA03-10A	IR89-IA04-10A	IR89-IA07-10A	IR89-IA07D-10A
Sample Date		02/13/10	02/14/10	02/14/10	02/14/10	02/14/10	02/14/10	02/14/10
Chemical Name								
Volatile Organic Compounds (ppbv)								
1,1,2,2-Tetrachloroethane	0.0307	0.12 U	0.11 U	0.12 U	0.03 J	0.08 U	0.12 U	0.02 J
1,1,2-Trichloro-1,2,2-trifluoroethane(Freon-113)	1,710	0.08 J	0.07 J	0.06 J	0.07 J	0.07	0.07 J	0.08
1,2-Dichloroethane	0.117	0.04 J	0.04 J	0.2 U	0.18 U	0.14 U	0.2 U	0.15 U
1,4-Dichlorobenzene	0.185	9.5	10	0.58	0.01 J	0.09 U	0.75	0.89
2-Butanone	743	0.53 J	0.97	0.61	0.91	0.21 J	0.4 J	0.51
2-Hexanone	3.20	0.2 U	0.16 J	0.09 J	0.17 J	0.02 J	0.04 J	0.09 J
4-Methyl-2-pentanone	320	0.2 U	0.06 J	0.2 U	0.07 J	0.14 U	0.19 U	0.03 J
Acetone	5,680	8.7	8.7	11	3.3	2.5	16	20
Benzene	0.491	1	0.9	0.15 J	0.15 J	0.14 J	0.15 J	0.18 J
Carbon tetrachloride	0.324	0.07 J	0.07 J	0.06 J	0.04 J	0.06 J	0.06 J	0.02 J
Chlorobenzene	4.76	0.17 U	0.01 J	0.18 U	0.16 U	0.12 U	0.17 U	0.13 U
Chloroform	0.109	0.02 J	0.02 J	0.17 U	0.15 U	0.12 U	0.16 U	0.02 J
Chloromethane	19.1	0.15 J	0.17 J	0.16 J	0.17 J	0.18 J	0.17 J	0.17 J
cis-1,2-Dichloroethene	--	0.2 U	0.18 U	0.21 U	0.02 J	0.14 U	0.2 U	0.02 J
Cyclohexane	764	0.31 J	0.28 J	0.48 U	0.43 U	0.33 U	0.46 U	0.36 U
Dichlorodifluoromethane (Freon-12)	17.7	0.52	0.42	0.5	0.51	0.51	0.51	0.62
Ethylbenzene	1.13	0.56	0.48	0.02 J	0.02 J	0.13 U	0.02 J	0.03 J
Isopropylbenzene	35.6	0.04 J	0.03 J	0.17 U	0.15 U	0.11 U	0.16 U	0.13 U
m- and p-Xylene	10.1	2.2	1.7	0.38 U	0.07 J	0.26 U	0.05 J	0.05 J
Methylene chloride	7.51	0.06 J	0.06 J	0.06 J	0.06 J	0.05 J	0.06 J	0.06 J
o-Xylene	70.7	0.83	0.6	0.19 U	0.03 J	0.13 U	0.02 J	0.02 J
Styrene	103	0.03 J	0.04 J	0.19 U	0.06 J	0.13 U	0.19 U	0.02 J
Tetrachloroethene	0.307	0.12 U	0.11 U	0.05 J	4.7	0.08 U	0.03 J	0.03 J
Toluene	581	3.6	3.4	0.14 J	0.13 J	0.09 J	0.14 J	0.14 J
Trichloroethene	1.14	0.15 U	0.14 U	0.09 J	0.14 U	0.11 U	0.08 J	0.09 J
Trichlorofluoromethane(Freon-11)	54.6	0.24	0.22	0.22	0.21	0.22	0.23	0.28

Notes:

NA - Not analyzed

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

U - The material was analyzed for, but not detected

ppbv - Parts per billion volume

Grey shading indicates exceedance of Adjusted Industrial Air RSLs

Pink shading indicates U-qualifed results that exceed the Industrial Air RSLs

[1] - RSLs were adjusted for noncarcinogens to account for exposure to multiple constituents. Values were rounded to 3 significant figures

TABLE V5-5

Summary of Phase III Outdoor Air Analytical Results

Phase III Vapor Intrusion Evaluation Report

Camp Geiger, MCB CamLej, North Carolina

Station ID	IR35-OA04	IR89-OA03
Sample ID	IR35-OA04-10A	IR89-OA03-10A
Sample Date	02/14/10	02/14/10
Chemical Name		
Volatile Organic Compounds (ppbv)		
1,1,2-Trichloro-1,2,2-trifluoroethane(Freon-113)	0.08	0.06 J
1,4-Dichlorobenzene	0.02 J	0.01 J
2-Butanone	0.37 J	0.29 J
2-Hexanone	0.03 J	0.03 J
Acetone	7.9	5.6
Benzene	0.19 J	0.14 J
Carbon tetrachloride	0.08 J	0.06 J
Chloromethane	0.2 J	0.17 J
Dichlorodifluoromethane (Freon-12)	0.6	0.51
Ethylbenzene	0.02 J	0.16 U
m- and p-Xylene	0.04 J	0.33 U
Methylene chloride	0.06 J	0.05 J
o-Xylene	0.02 J	0.16 U
Styrene	0.01 J	0.17 U
Toluene	0.16 J	0.08 J
Trichlorofluoromethane(Freon-11)	0.26	0.22

Notes:

Shading indicates detections

NA - Not analyzed

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

U - The material was analyzed for, but not detected

ppbv - Parts per billion volume

Figures

\\NORTHEND\PROJ\USNAVFACENGCOM\CAMPLEJEUNE\MAPFILES\VAPORINTRUSION\PHASE_III\VI_REPORT\FIGURE_V5_1_CAMP_GEIGER_SITE35_PHASE_III_B_VI_REPORT.MXD

Legend

- Indoor Air Sample Location
- Soil Gas Sample Location
- Monitoring Well with Exceedance(s)
- Shallow Groundwater Flow
- Buildings of Interest
- Installation Boundary
- Camp Geiger

Sample with one or more constituents exceeding generic screening levels

N

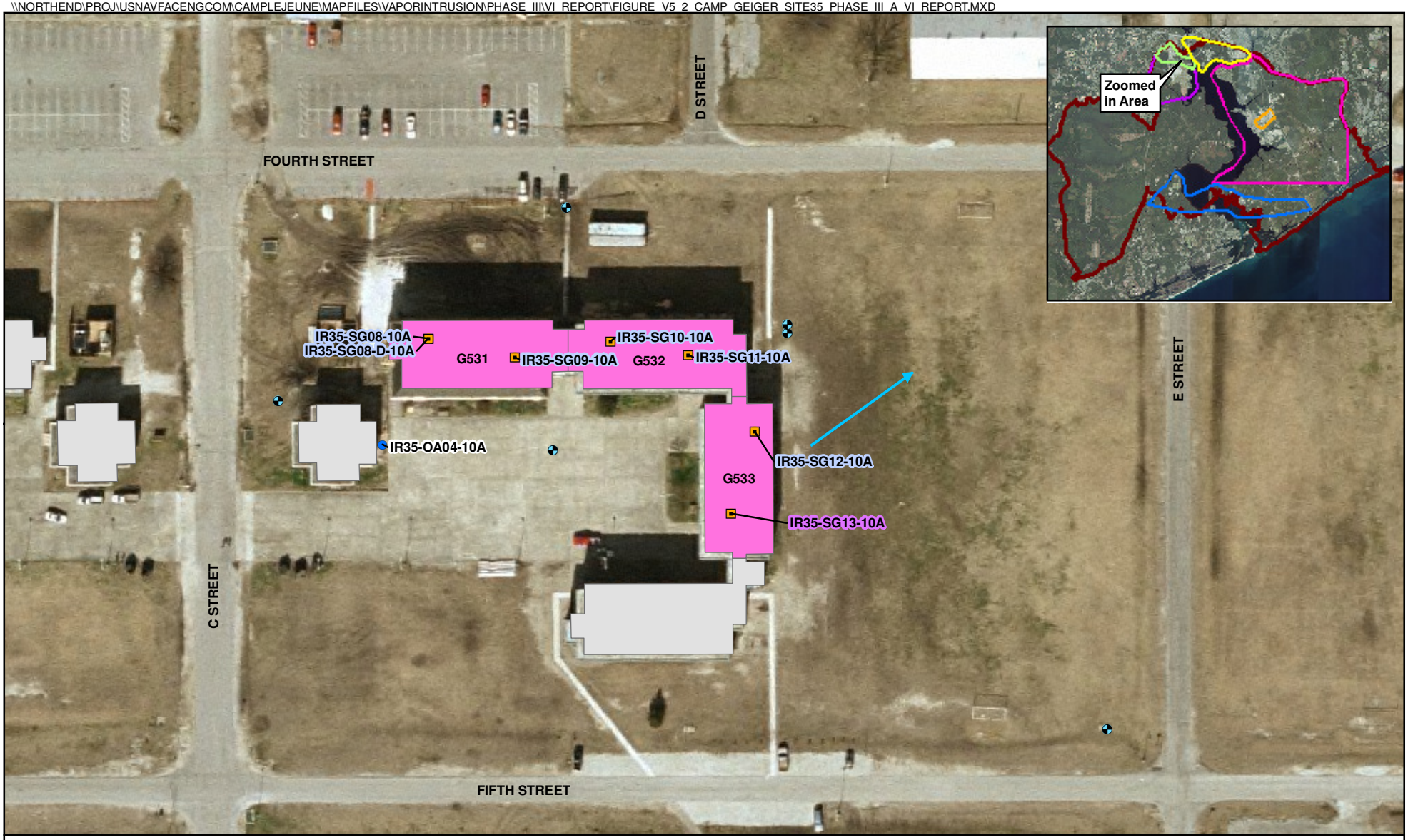
0 50 100 200 Feet

1 inch = 100 feet

Figure V5-1
Camp Geiger Site 35 - B Phase III Sample Locations and Exceedances of Risk-Based Screening Levels
Phase III Vapor Intrusion Report
MCB CamLej
North Carolina

CH2MHILL

\\NORTHEND\PROJ\USNAVFACENGCOM\CAMPLEJEUNE\MAPFILES\VAPORINTRUSION\PHASE_III\VI_REPORT\FIGURE_V5_2_CAMP_GEIGER_SITE35_PHASE_III_A_VI_REPORT.MXD



Legend

- Outdoor Air Sample Location
- Soil Gas Sample Location
- Monitoring Well with Exceedance(s)
- Shallow Groundwater Flow
- Buildings of Interest
- Installation Boundary
- Camp Geiger
- Sample with one or more exceeding constituents of generic unrestricted (residential) SGSLs
- Sample with one or more exceeding constituents of base specific unrestriced (residential) SGSLs

N

0 50 100 200 Feet

1 inch = 100 feet

Figure V5-2
Camp Geiger Site 35 - A Phase III Sample Locations and Exceedances of Risk-Based Screening Levels
Phase III Vapor Intrusion Report
MCB CamLej
North Carolina

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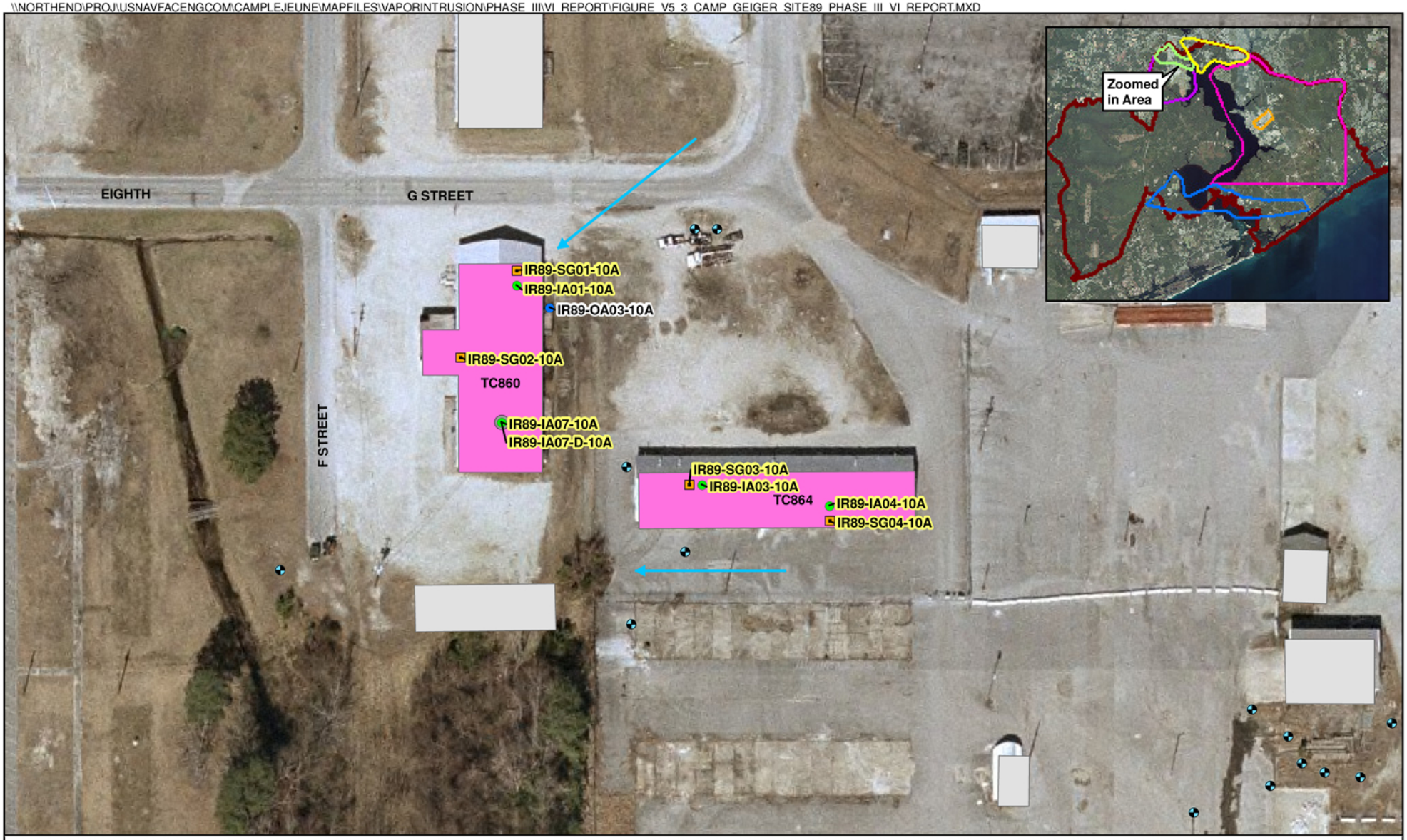
\\NORTHEND\PROJ\USNAVFACENGCOM\CAMPLEJEUNE\MAPFILES\VAPORINTRUSION\PHASE_III\VI_REPORT\FIGURE_V5_3_CAMP_GEIGER_SITE89_PHASE_III_VI_REPORT.MXD



Legend

- Indoor Air Sample Location
- Outdoor Air Sample Location
- Soil Gas Sample Location
- Monitoring Well with Exceedance(s)
- Proposed Sample Locations
- Shallow Groundwater Flow
- Camp Geiger
- Buildings of Interest
- Installation Boundary

Sample with one or more constituents exceeding generic screening levels

N

0 50 100 200 Feet

1 inch = 100 feet

Figure V5-3
Camp Geiger Site 89 Phase III Sample Locations
and Exceedances of Risk-Based Screening Levels
Phase III Vapor Intrusion Report
MCB CamLej
North Carolina

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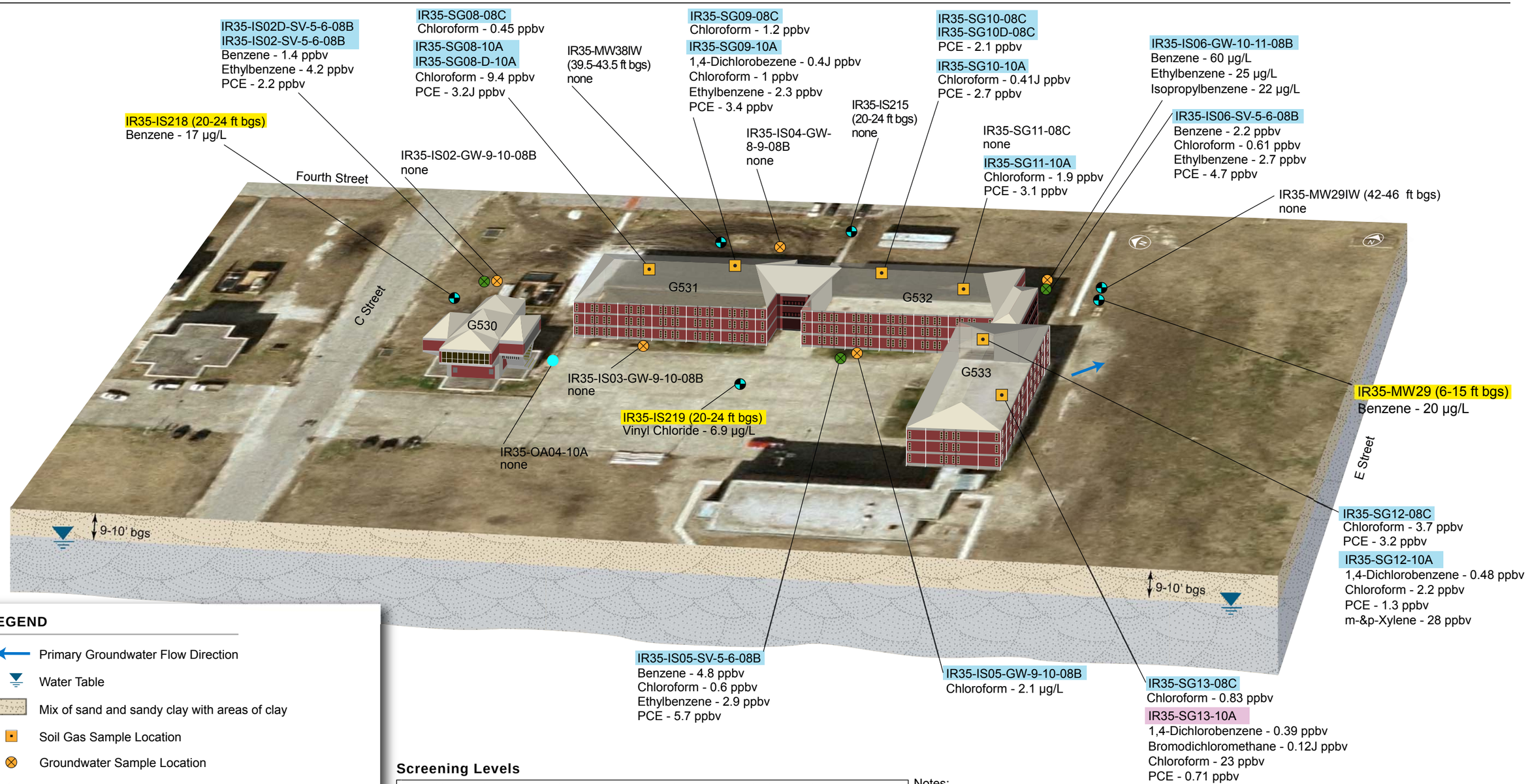

LEGEND

- Primary Groundwater Flow Direction
- Water Table
- Mix of sand and sandy clay with areas of clay
- Soil Gas Sample Location
- Groundwater Sample Location
- Soil Vapor Sample Location
- Shallow Monitoring Well (Sampled between 2002 and 2007)
- Outdoor Air Sample Location
- Sample with one or more constituents exceeding Site-Specific GWSLs
- Sample with one or more constituents exceeding Generic Unrestricted Screening Levels
- Sample with one or more constituents exceeding Base-Specific Unrestricted SGSLs

Screening Levels

Site-Specific GWSLs (µg/L)	Generic Unrestricted GWSLs (µg/L)
Benzene - 12.8	Chloroform - 0.73
Vinyl Chloride - 2.06	Benzene - 1.37
	Ethylbenzene - 3.01
	Isopropylbenzene - 8.85
Phase III Generic Unrestricted SGSLs (ppbv)	**Base-Specific Unrestricted SGSLs (ppbv)**
Chloroform - 0.225	Chloroform - 22.5
1,4-Dichlorobenzene - 0.366	Benzene - 97
Ethylbenzene - 2.23	Ethylbenzene - 223
PCE - 0.605	PCE - 60.5
Bromodichloromethane - 0.0985	1,4 Dichlorobenzene - 36.5
m-&p-Xylene - 23.0	Bromodichloromethane - 9.8
Benzene - 0.97	

Notes:
ppbv - Parts per billion volume
SL - screening level
µg/L - microgram/Liter
ft bgs - feet below ground surface

Figure V5-4
Site 35
Camp Geiger Buildings G530, G531, G532, and G533
Vapor Intrusion Conceptual Site Model
Phase III Vapor Intrusion Report
MCB CamLej
North Carolina

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ES040710032706KNV CampGeiger_BldgG530-G531-G532-G533_VaporIntrusionCSM_v13_10/8/10_lk

Appendix V5-A
Field Data Sheets

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Sheet 1 of __

Ambient Air, Outdoor Air & Crawl Space Air Sampling Log (Summa Canister)

Project Information

Project Name: MCB Camley CTO-092 Project #: 392664

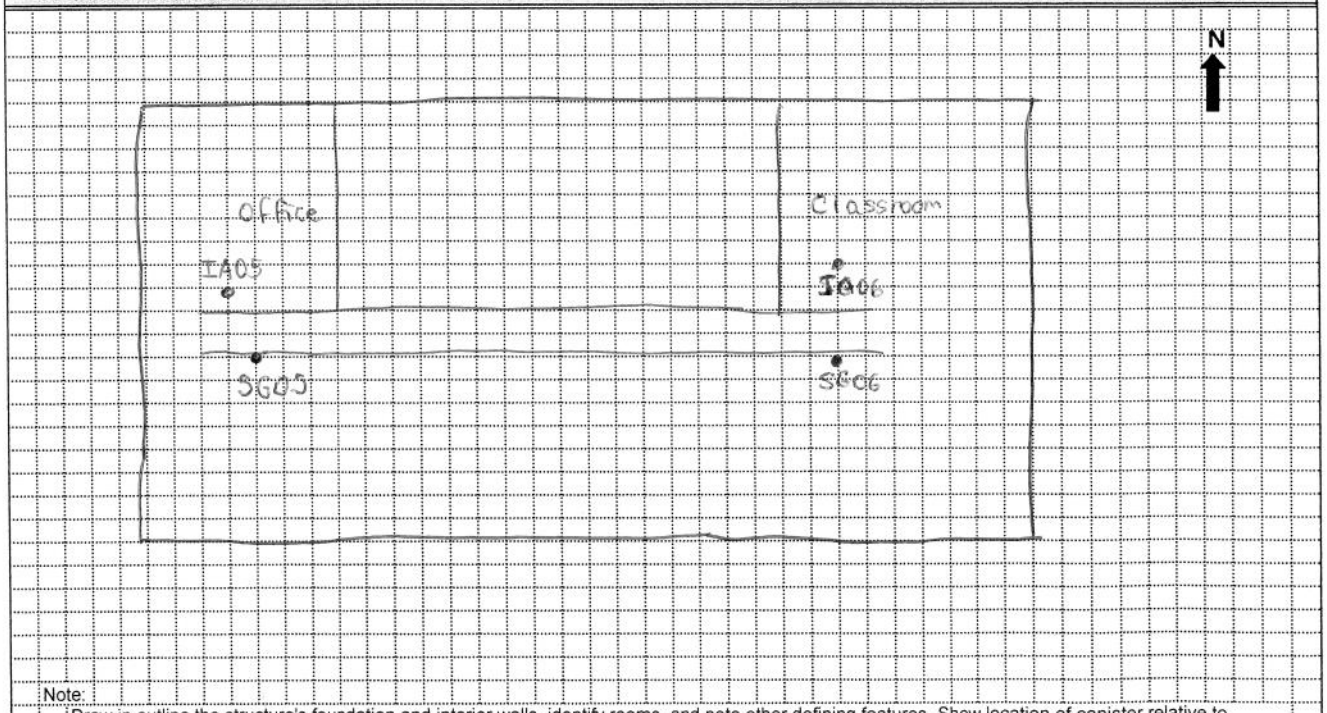
By: KS / MS Date: 2/13/10

G480

Sampling Data Log

	Sample Location	Field ID	Canister ID	Flow Controller ID	Initial Canister Pressure ("Hg)	Initial Flow Controller Rate (ml/min)	Start Date & Time	End Data & Time	Final Pressure ("Hg)	Final Flow Controller Rate (ml/min)
AVG00277	IR35-IA05	IR35-IA05-10A	AC00820	FC00298	-28.5	4.16	2/13/10 1505	2/14/10 1423	-9	
AVG00404	IR35-IA06	IR35-IA06-10A	AC00595	FC00446	-27	4.16	2/13/10 1503	2/14/10 1121	-6	
AVG00370	IR35-OA04	IR35-OA04-10A	AC00793	FC00816	-32	4.16	2/13/10 1520	2/14/10 1134	-3	

Sample Location Diagram



Note:
Draw in outline the structure's foundation and interior walls, identify rooms, and note other defining features. Show location of canister relative to physical objects, etc.

Other Observations and Comments (note any unique circumstances): BLDG #G480

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Sheet 1 of __

Ambient Air, Outdoor Air & Crawl Space Air Sampling Log (Summa Canister)

Project Information

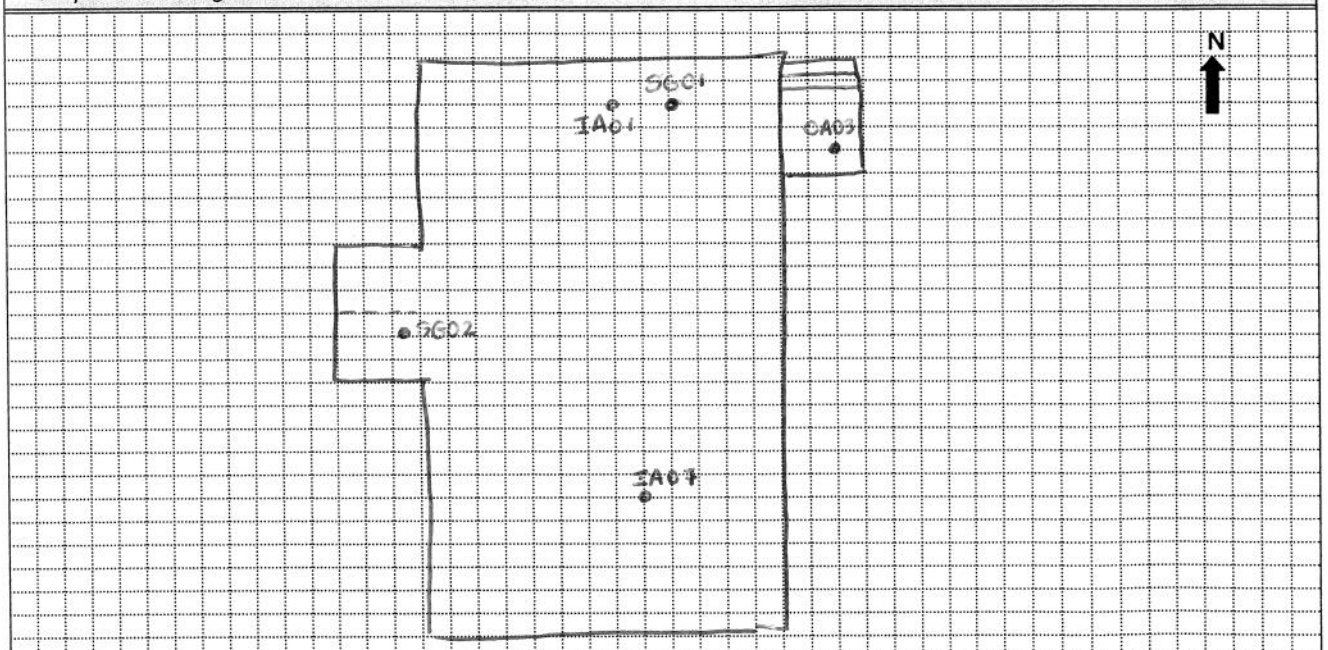
Project Name: MCB Camley CTO-092 Project #: 392664

By: KS/MS TC860 Date: 2/13/10

Sampling Data Log

	Sample Location	Field ID	Canister ID	Flow Controller ID	Initial Canister Pressure ("Hg)	Initial Flow Controller Rate (ml/min)	Start Date & Time	End Data & Time	Final Pressure ("Hg)	Final Flow Controller Rate (ml/min)
AVG00652	IR89-IA01	IR89-IA01-10A	AC01098	FC00625	-30.5	4.16	2/13/10 1436	2/14/10 1406	-8.5	
AVG00192	IR89-IA07	IR89-IA07D-10A	AC01488	FC00504	-30	4.16	2/13/10 1437	2/14/10 1405	-6	
AVG01017	IR89-IA07	IR89-IA07D-10A	AC01234	FC00644	-30.5	4.16	2/13/10 1438	2/14/10 1107	-3	
AVG00305	IR89-OA03	IR89-OA03-10A	AC00125	FC00608	-29.5	4.16	2/13/10 1452	2/14/10 1407	-7	

Sample Location Diagram



Note:
Draw in outline the structure's foundation and interior walls, identify rooms, and note other defining features. Show location of canister relative to physical objects, etc.

Other Observations and Comments (note any unique circumstances): Bldg TC860

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Sheet 1 of __

Ambient Air, Outdoor Air & Crawl Space Air Sampling Log (Summa Canister)

Project Information

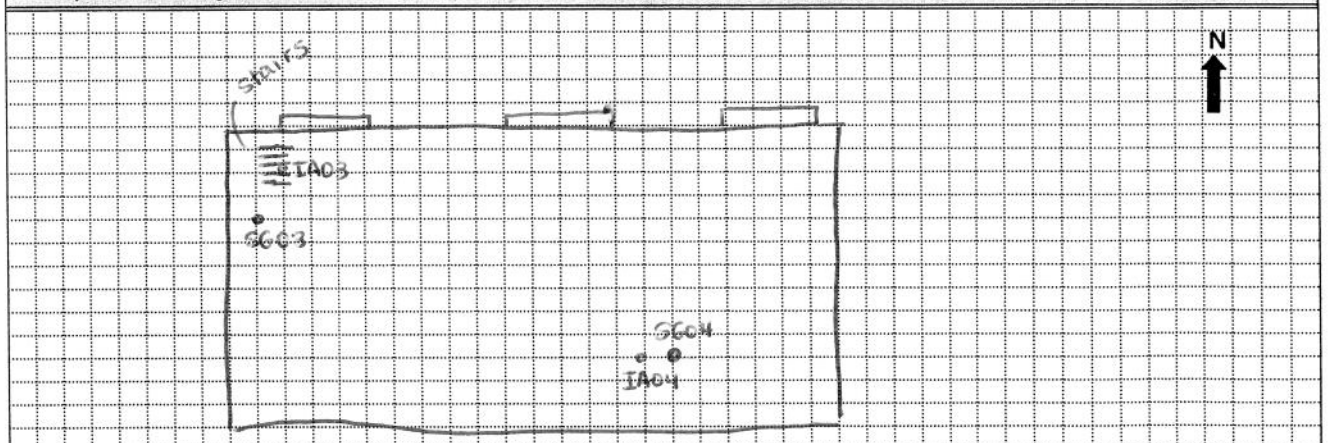
Project Name: MCB Camlej CTO-092 Project #: 392664

By: KS/MS TC864 Date: 2/13/10

Sampling Data Log

	Sample Location	Field ID	Canister ID	Flow Controller ID	Initial Canister Pressure ("Hg)	Initial Flow Controller Rate (ml/min)	Start Date & Time	End Data & Time	Final Pressure ("Hg)	Final Flow Controller Rate (ml/min)
AVG01120	IR89-IA03	IR89-IA03-10A	AC01225	FC00435	-35	4.16	2/13/10 1424	2/14/10 1411	-9	
AVG00574	IR89-IA04	IR89-IA04-10A	AC01005	FC00215	-29.5	4.16	2/13/10 1420	2/14/10 1111	-0.5	

Sample Location Diagram



Note:
Draw in outline the structure's foundation and interior walls, identify rooms, and note other defining features. Show location of canister relative to physical objects, etc.

Other Observations and Comments (note any unique circumstances): Broken windows - no HVAC
No updates to bldg survey - necessary.
PLOG TC864
Bldg TC864

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Indoor Vapor Intrusion Assessment
Sub-slab Vapor Field Sampling Log - Summa Canister Method

Project Info

Project Name: MCB Camley CTO-092 Project # : 392664

By: KS/MS Date: 2/13/10

Structure

Identification: Bldg G480

Address: Fourth St between E & F Streets

Slab Information:

- ☐ Concrete slab on grade (directly on top of soil)
- ☐ Other (describe)
- ☐ Concrete slab on gravel underlayment

Condition of slab

Type of Sub Slab Soil

Is water present in the soil

Sub-slab Probe Installation, Leak Checking, Probe Purging, & Sampling Log

	Sample location (show in diagram)	1	2	3	4
	Sample Identification (field ID)	IR35-SG05-10A	IR35-SG06-10A		
Probe Installation	Depth of slab (inches)	EXISTING	EXISTING		
	Depth of hole drilled (inches below slab surface)				
	Depth of installed probe (inches below slab surface)				
Manifold Leak check	Leak check (sampling manifold) - Pass/No Pass	PASS	PASS		
Probe Purge	Purge rate, cc/min.	200 mL/min	200 mL/min		
	Purge Start (time of day)	1103	1136		
	Purge vacuum, " Hg	-10 *	-10 *		
	Purge completed (time of day)	1108	1130		
Helium Leak Check (optional)	Leak check (Helium) - %	875 ppm	300 PPM		
Field Analysis (optional)	Gem 2000 (O2 / CO2 / CH4) - %	N/A	N/A		
	PID - ppmv	3.9 ppm	5.7 PPM		
Canister Sampling	Canister & flow controller ID (if used)	1SC00474/ 0A00739	1SC00260/ 0A00051		
	Initial Canister Pressure (" Hg)	-30.5	-28		
	Sampling rate, cc/min				
	Sampling period started (time of day)	1110	1132		
	Sampling vacuum, " Hg	-10 *	-10 *		
	Sampling period ended (time of day)	1115	1137		
	Final Canister Pressure (" Hg)	-4	-4		

Observations and Comments: Pressure Gauge: AVG00464 AVG01101

Background PID: 0.5 ppm 0.7 PPM

* Sample manifold read -10" Hg during ambient conditions and purge activities indicating sampling vacuum was truly 0" Hg.

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Indoor Vapor Intrusion Assessment
Sub-slab Vapor Sampling Field Log

Diagram - Outline of Structure Foundation & Location of Sub-slab Sampling Probes

N

Note:

Show the location of each soil probe and indicate distances from the foundation edge and other significant features.

Note location of sumps, drains, cleanouts, cracks, etc.

Other observations and comments:

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Indoor Vapor Intrusion Assessment
Sub-slab Vapor Field Sampling Log - Summa Canister Method

Project Info

Project Name: Phase III V.I. Project # : 392604

By: E. Barclay / R McCaul Date: 3/13/10

Structure

Identification: Bldg 6531

Address: McCAm LET

Slab Information:

☐ Concrete slab on grade (directly on top of soil) ☐ Other (describe)

☐ Concrete slab on gravel underlayment

Condition of slab

Type of Sub Slab Soil

Is water present in the soil

Sub-slab Probe Installation, Leak Checking, Probe Purging, & Sampling Log

	Sample location (show in diagram)	1	2	3	4
	Sample Identification (field ID)	IR35-SG09-10A			
Probe Installation	Depth of slab (inches)	EXISTING			
	Depth of hole drilled (inches below slab surface)				
	Depth of installed probe (inches below slab surface)				
Manifold Leak check	Leak check (sampling manifold) - Pass/No Pass	PASS			
Probe Purge	Purge rate, cc/min.	.2 LPM			
	Purge Start (time of day)	① 0934 ② ~~0957~~	③ 1010 ~~1008~~ 4th 1024		
	Purge vacuum, " Hg	Ø			
	Purge completed (time of day)	① ~~0945~~ ② ~~1003~~	③ 1026		
Helium Leak Check (optional)	Leak check (Helium) - %		1450 ppm		
Field Analysis (optional)	Gem 2000 (O2 / CO2 / CH4) - %	—	—		
	PID - ppmv	~~10~~ 2.1	18 ppm		
Canister Sampling	Canister & flow controller ID (if used)	1SC00706 0AC0744			
	Initial Canister Pressure (" Hg)	-27.5			
	Sampling rate, cc/min				
	Sampling period started (time of day)	1027			
	Sampling vacuum, " Hg				
	Sampling period ended (time of day)	1033			
	Final Canister Pressure (" Hg)	-3.5			

Observations and Comments: Gauge AVG00980 • failed 1st Helium test (4.3%), added additional cement. Retightened fittings.

- Second attempt = failure @ 3% Helium, applying modeling clay

- ~~pump rate se~~ fill rate seems slow, no sand in tubing observed (for helium test) tight subsurface?)

- Troubleshooting direction of flow, determined rate of bag was due to reverse air flow by disassembling flow pump, corrected air accumulation in of manifold, clog suspected.

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Indoor Vapor Intrusion Assessment
Sub-slab Vapor Sampling Field Log

Diagram - Outline of Structure Foundation & Location of Sub-slab Sampling Probes

N

Note:

Show the location of each soil probe and indicate distances from the foundation edge and other significant features.

Note location of sumps, drains, cleanouts, cracks, etc.

Other observations and comments:

CH2MHILL

Indoor Vapor Intrusion Assessment
Sub-slab Vapor Field Sampling Log - Summa Canister Method

2/13/10

Project Info

Project Name: MCB Camp Lejeune CTO-092 Project # : 392664

By: KS/MS Date: 392664

Structure

Identification: Bldg G531

Address: 5th St & C St.

Slab Information:

☐ Concrete slab on grade (directly on top of soil) ☐ Other (describe)

☐ Concrete slab on gravel underlayment

Condition of slab

Type of Sub Slab Soil

Is water present in the soil

Sub-slab Probe Installation, Leak Checking, Probe Purging, & Sampling Log

	Sample location (show in diagram)	1	2	3	4
	Sample Identification (field ID)	IR35-SG08-10A	IR35-SG08D-10A		
Probe Installation	Depth of slab (inches)	EXISTING	EXISTING		
	Depth of hole drilled (inches below slab surface)	|	|		
	Depth of installed probe (inches below slab surface)				
Manifold Leak check	Leak check (sampling manifold) - Pass/No Pass	PASS	PASS		
Probe Purge	Purge rate, cc/min.	200mL/min	200mL/min		
	Purge Start (time of day)	0918	|		
	Purge vacuum, " Hg	-10*	|		
	Purge completed (time of day)	0922	|		
Helium Leak Check (optional)	Leak check (Helium) - %	6,000 ppm	|		
Field Analysis (optional)	Gem 2000 (O2 / CO2 / CH4) - %	N/A	|		
	PID - ppmv	2.3 ppm	|		
Canister Sampling	Canister & flow controller ID (if used)	1SC00403-0A00134	1SC006021 0A01072		
	Initial Canister Pressure (" Hg)	-29.5	-30		
	Sampling rate, cc/min				
	Sampling period started (time of day)	924	930		
	Sampling vacuum, " Hg	-10*	-10*		
	Sampling period ended (time of day)	929	936		
	Final Canister Pressure (" Hg)	-4	-4		

Observations and Comments: Pressure gauge AVG01289 AVG01284

* Sample manifold read -10" Hg during ambient conditions and purge activities indicating sampling vacuum was truly 0" Hg

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Indoor Vapor Intrusion Assessment
Sub-slab Vapor Sampling Field Log

Diagram - Outline of Structure Foundation & Location of Sub-slab Sampling Probes

N

Note:

Show the location of each soil probe and indicate distances from the foundation edge and other significant features.

Note location of sumps, drains, cleanouts, cracks, etc.

Other observations and comments:

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Indoor Vapor Intrusion Assessment
Sub-slab Vapor Field Sampling Log - Summa Canister Method

Project Info

Project Name: MCB Camlej CTO-092 Project # : 392664

By: KS/MS Date: 2/13/10

Structure

Identification: Bldg G532

Address: C St & 5th St.

Slab Information:

- ☐ Concrete slab on grade (directly on top of soil)
- ☐ Other (describe)
- ☐ Concrete slab on gravel underlayment

Condition of slab

Type of Sub Slab Soil

Is water present in the soil

Sub-slab Probe Installation, Leak Checking, Probe Purging, & Sampling Log

	Sample location (show in diagram)	1	2	3	4
	Sample Identification (field ID)	IR35-SG10-10A	IR35-SG11-10A		
Probe Installation	Depth of slab (inches)	EXISTING	EXISTING		
	Depth of hole drilled (inches below slab surface)				
	Depth of installed probe (inches below slab surface)				
Manifold Leak check	Leak check (sampling manifold) - Pass/No Pass	PASS	PASS		
Probe Purge	Purge rate, cc/min.	~.2 L/min	200 mL/min		
	Purge Start (time of day)	1003	1031		
	Purge vacuum, " Hg	-10 *	-10 *		
	Purge completed (time of day)	1007	1036		
Helium Leak Check (optional)	Leak check (Helium) - %	1425 PPM	2025		
Field Analysis (optional)	Gem 2000 (O2 / CO2 / CH4) - %	N/A	N/A		
	PID - ppmv	5.5	5.6		
Canister Sampling	Canister & flow controller ID (if used)	1SC006991 0A00074	1SC007231 0A00731		
	Initial Canister Pressure (" Hg)	-29	-29		
	Sampling rate, cc/min				
	Sampling period started (time of day)	1009	1039		
	Sampling vacuum, " Hg	-10 *	-10 *		
	Sampling period ended (time of day)	1014	1045		
	Final Canister Pressure (" Hg)	-4	-4		

Observations and Comments: pressure gauge: AVG01283 AVG01300

PID BACKGROUNDS: 0.6 PPM 0.6 ppm

* Sample manifold read -10" Hg during ambient conditions and purge activities indicating sampling vacuum was truly 0" Hg.

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Indoor Vapor Intrusion Assessment
Sub-slab Vapor Sampling Field Log

Diagram - Outline of Structure Foundation & Location of Sub-slab Sampling Probes

N

Note:

Show the location of each soil probe and indicate distances from the foundation edge and other significant features.

Note location of sumps, drains, cleanouts, cracks, etc.

Other observations and comments:

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Indoor Vapor Intrusion Assessment
Sub-slab Vapor Field Sampling Log - Summa Canister Method

Project Info

Project Name: Phase III VI MOD2 Project # : 392664

By: E Barclay / R McCann Date: 2/13/10

Structure

Identification: Bld. G533

Address: MCB CAM LEJ, NC

Slab Information:

- ☐ Concrete slab on grade (directly on top of soil)
- ☐ Other (describe)
- ☐ Concrete slab on gravel underlayment

Condition of slab

Type of Sub Slab Soil

Is water present in the soil

Sub-slab Probe Installation, Leak Checking, Probe Purging, & Sampling Log

	Sample location (show in diagram)	1	2	3	4
	Sample Identification (field ID)	IR35-SG12-10A			
Probe Installation	Depth of slab (inches)	EXISTING			
	Depth of hole drilled (inches below slab surface)				
	Depth of installed probe (inches below slab surface)				
Manifold Leak check	Leak check (sampling manifold) - Pass/No Pass	PASS			
Probe Purge	Purge rate, cc/min.	.2LPM			
	Purge Start (time of day)	1105			
	Purge vacuum, " Hg	Ø			
	Purge completed (time of day)	1110			
Helium Leak Check (optional)	Leak check (Helium) - %	1350 ppm			
Field Analysis (optional)	Gem 2000 (O2 / CO2 / CH4) - %	—			
	PID - ppmv	15 ppm			
Canister Sampling	Canister & flow controller ID (if used)	1SCC0331 OAØ1159			
	Initial Canister Pressure (" Hg)	-27.0			
	Sampling rate, cc/min				
	Sampling period started (time of day)	1111			
	Sampling vacuum, " Hg				
	Sampling period ended (time of day)	1118			
	Final Canister Pressure (" Hg)	-3.0			

Observations and Comments: Gauge # AVG 00797

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Indoor Vapor Intrusion Assessment
Sub-slab Vapor Sampling Field Log

Diagram - Outline of Structure Foundation & Location of Sub-slab Sampling Probes

N

Note:

Show the location of each soil probe and indicate distances from the foundation edge and other significant features.

Note location of sumps, drains, cleanouts, cracks, etc.

Other observations and comments:

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Indoor Vapor Intrusion Assessment
Sub-slab Vapor Field Sampling Log - Summa Canister Method

Project Info

Project Name: Phase III VI MOB2 Project # : 392664

By: EBarclay / RMcLand Date: 8/13/10

Structure

Identification: Bldg 6533

Address: MCB CAMLEJ, NC

Slab Information:

- ☐ Concrete slab on grade (directly on top of soil)
- ☐ Other (describe)
- ☐ Concrete slab on gravel underlayment

Condition of slab

Type of Sub Slab Soil

Is water present in the soil

Sub-slab Probe Installation, Leak Checking, Probe Purging, & Sampling Log

	Sample location (show in diagram)	1	2	3	4
	Sample Identification (field ID)	IR35-SG137-01A			
Probe Installation	Depth of slab (inches)	EXISTING			
	Depth of hole drilled (inches below slab surface)	1			
	Depth of installed probe (inches below slab surface)				
Manifold Leak check	Leak check (sampling manifold) - Pass/No Pass	PASS			
Probe Purge	Purge rate, cc/min.	0.2LPM			
	Purge Start (time of day)	1134			
	Purge vacuum, " Hg	Ø			
	Purge completed (time of day)	1140			
Helium Leak Check (optional)	Leak check (Helium) - %	25ppm			
Field Analysis (optional)	Gem 2000 (O2 / CO2 / CH4) - %				
	PID - ppmv	13.2ppm			
Canister Sampling	Canister & flow controller ID (if used)	15C00439 OAØ1155			
	Initial Canister Pressure (" Hg)	-29.5			
	Sampling rate, cc/min	13.2			
	Sampling period started (time of day)	1141			
	Sampling vacuum, " Hg				
	Sampling period ended (time of day)	1146			
	Final Canister Pressure (" Hg)	-3.5			

Observations and Comments: Gauge # AVG00161

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Indoor Vapor Intrusion Assessment
Sub-slab Vapor Sampling Field Log

Diagram - Outline of Structure Foundation & Location of Sub-slab Sampling Probes

N

Note:

Show the location of each soil probe and indicate distances from the foundation edge and other significant features.

Note location of sumps, drains, cleanouts, cracks, etc.

Other observations and comments:

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Indoor Vapor Intrusion Assessment
Sub-slab Vapor Field Sampling Log - Summa Canister Method

Project Info

Project Name: Phase III V.I. MOB 2 Project #: 392664
By: E Barclay / R McCaul Date: 7/13/10

Structure

Identification: Bldg TC 860
Address: MCB Camp LEJ
Slab Information:
- ☐ Concrete slab on grade (directly on top of soil)
- ☐ Concrete slab on gravel underlayment
- ☐ Other (describe)

Condition of slab
Type of Sub Slab Soil
Is water present in the soil

Sub-slab Probe Installation, Leak Checking, Probe Purging, & Sampling Log

	Sample location (show in diagram)	1	2	3	4
	Sample Identification (field ID)	IR89-SG02-10A			
Probe Installation	Depth of slab (inches)	EXISTING			
	Depth of hole drilled (inches below slab surface)				
	Depth of installed probe (inches below slab surface)	1			
Manifold Leak check	Leak check (sampling manifold) - Pass/No Pass	PASS			
Probe Purge	Purge rate, cc/min.	0.2			
	Purge Start (time of day)	~~1327~~ 1327			
	Purge vacuum, " Hg	Ø			
	Purge completed (time of day)	1332			
Helium Leak Check (optional)	Leak check (Helium) - %	50 ppm			
Field Analysis (optional)	Gem 2000 (O2 / CO2 / CH4) - %	—			
	PID - ppmv	22.5 ppm			
Canister Sampling	Canister & flow controller ID (if used)	15C00778 0A01076			
	Initial Canister Pressure (" Hg)	-30.5			
	Sampling rate, cc/min				
	Sampling period started (time of day)	~~1331~~ 1333			
	Sampling vacuum, " Hg				
	Sampling period ended (time of day)	~~1~~ 1340			
	Final Canister Pressure (" Hg)	-4			

Observations and Comments: Gauge # AVE01304 ; had to apply cement to top of hole.

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Indoor Vapor Intrusion Assessment
Sub-slab Vapor Sampling Field Log

Diagram - Outline of Structure Foundation & Location of Sub-slab Sampling Probes

N

Note:

Show the location of each soil probe and indicate distances from the foundation edge and other significant features.

Note location of sumps, drains, cleanouts, cracks, etc.

Other observations and comments: .....

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Indoor Vapor Intrusion Assessment
Sub-slab Vapor Field Sampling Log - Summa Canister Method

Project Info

Project Name: MCB Camlej CTO-092 Project # : 392664

By: KS/MS Date: 2/13/10

Structure

Identification: Bldg TC860

Address: F & G Streets

Slab Information:

☐ Concrete slab on grade (directly on top of soil) ☐ Other (describe)

☐ Concrete slab on gravel underlayment

Condition of slab

Type of Sub Slab Soil

Is water present in the soil

Sub-slab Probe Installation, Leak Checking, Probe Purging, & Sampling Log

	Sample location (show in diagram)	1	2	3	4
	Sample Identification (field ID)	IR89-SG01-10A			
Probe Installation	Depth of slab (inches)	EXISTING			
	Depth of hole drilled (inches below slab surface)	1			
	Depth of installed probe (inches below slab surface)				
Manifold Leak check	Leak check (sampling manifold) - Pass/No Pass	PASS			
Probe Purge	Purge rate, cc/min.	200 mL/min			
	Purge Start (time of day)	1315			
	Purge vacuum, " Hg	-10 *			
	Purge completed (time of day)	1320			
Helium Leak Check (optional)	Leak check (Helium) - %	0 ppm			
Field Analysis (optional)	Gem 2000 (O2 / CO2 / CH4) - %	N/A			
	PID - ppmv	3.5 ppm			
Canister Sampling	Canister & flow controller ID (if used)	1SC007811 / 0A00728			
	Initial Canister Pressure (" Hg)	-29			
	Sampling rate, cc/min				
	Sampling period started (time of day)	1321			
	Sampling vacuum, " Hg	-10 *			
	Sampling period ended (time of day)	1326			
	Final Canister Pressure (" Hg)	-4			

Observations and Comments: Pressure Gauge: AVG00881
Background: 0.3 ppm

* Sample manifold read -10" Hg during ambient conditions and purge activities indicating sampling vacuum was truly 0" Hg.

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Indoor Vapor Intrusion Assessment
Sub-slab Vapor Sampling Field Log

Diagram - Outline of Structure Foundation & Location of Sub-slab Sampling Probes

N

Note:

Show the location of each soil probe and indicate distances from the foundation edge and other significant features.

Note location of sumps, drains, cleanouts, cracks, etc.

Other observations and comments:

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Indoor Vapor Intrusion Assessment
Sub-slab Vapor Field Sampling Log - Summa Canister Method

Project Info

Project Name: MCB Camley CTO-092 Project # : 392664

By: KS / MS Date: 2/13/10

Structure

Identification: Bldg TC864

Address: F & G Streets

Slab Information:

- ☐ Concrete slab on grade (directly on top of soil)
- ☐ Other (describe)
- ☐ Concrete slab on gravel underlayment

Condition of slab

Type of Sub Slab Soil

Is water present in the soil

Sub-slab Probe Installation, Leak Checking, Probe Purging, & Sampling Log

	Sample location (show in diagram)	1	2	3	4
	Sample Identification (field ID)	IR89-SG04-10A			
Probe Installation	Depth of slab (inches)	EXISTING			
	Depth of hole drilled (inches below slab surface)				
	Depth of installed probe (inches below slab surface)				
Manifold Leak check	Leak check (sampling manifold) - Pass/No Pass	PASS			
Probe Purge	Purge rate, cc/min.	200 mL/min			
	Purge Start (time of day)	1402			
	Purge vacuum, " Hg	-10 *			
	Purge completed (time of day)	1405			
Helium Leak Check (optional)	Leak check (Helium) - %	75 ppm			
Field Analysis (optional)	Gem 2000 (O2 / CO2 / CH4) - %	N/A			
	PID - ppmv	1.8 ppm			
Canister Sampling	Canister & flow controller ID (if used)	19C07731 0A01094			
	Initial Canister Pressure (" Hg)	-30 " Hg			
	Sampling rate, cc/min				
	Sampling period started (time of day)	1409			
	Sampling vacuum, " Hg	-10 *			
	Sampling period ended (time of day)	1415			
	Final Canister Pressure (" Hg)	-4			

Observations and Comments: Pressure Gauge AVG00535

PID Background: 0.4 ppm

* Sample manifold read -10" Hg during ambient conditions and purge activities indicating sampling vacuum was truly 0" Hg.

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Indoor Vapor Intrusion Assessment
Sub-slab Vapor Sampling Field Log

Diagram - Outline of Structure Foundation & Location of Sub-slab Sampling Probes

N

Note:

Show the location of each soil probe and indicate distances from the foundation edge and other significant features.

Note location of sumps, drains, cleanouts, cracks, etc.

Other observations and comments:

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Indoor Vapor Intrusion Assessment
Sub-slab Vapor Field Sampling Log - Summa Canister Method

Project Info

Project Name: Phase III V.I Mob 2 Project # : 362664

By: E Barclay / R McGuil Date: 8/13/10

Structure

Identification: Bldg TC864

Address: MCB-CAM LEJ, NC

Slab Information:

- ☐ Concrete slab on grade (directly on top of soil)
- ☐ Other (describe)
- ☐ Concrete slab on gravel underlayment

Condition of slab

Type of Sub Slab Soil

Is water present in the soil

Sub-slab Probe Installation, Leak Checking, Probe Purging, & Sampling Log

	Sample location (show in diagram)	1	2	3	4
	Sample Identification (field ID)	IRS9-SG03-10A			
Probe Installation	Depth of slab (inches)	EXISTING			
	Depth of hole drilled (inches below slab surface)				
	Depth of installed probe (inches below slab surface)				
Manifold Leak check	Leak check (sampling manifold) - Pass/No Pass	PASS			
Probe Purge	Purge rate, cc/min.	0.2 lpm			
	Purge Start (time of day)	1415			
	Purge vacuum, " Hg	Ø			
	Purge completed (time of day)	1420			
Helium Leak Check (optional)	Leak check (Helium) - %	1500 ppm			
Field Analysis (optional)	Gem 2000 (O2 / CO2 / CH4) - %	—			
	PID - ppmv	~~0.1~~ ppm 0.8 ppm			
Canister Sampling	Canister & flow controller ID (if used)	1SCØØ75 ØAØØ76			
	Initial Canister Pressure (" Hg)	-28.5			
	Sampling rate, cc/min				
	Sampling period started (time of day)	1420			
	Sampling vacuum, " Hg				
	Sampling period ended (time of day)	1428			
	Final Canister Pressure (" Hg)	-3.5			

Observations and Comments: Gauge # AVGØ1304

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Indoor Vapor Intrusion Assessment
Sub-slab Vapor Sampling Field Log

Diagram - Outline of Structure Foundation & Location of Sub-slab Sampling Probes

N

Note:

Show the location of each soil probe and indicate distances from the foundation edge and other significant features.

Note location of sumps, drains, cleanouts, cracks, etc.

Other observations and comments:

Appendix V5-B
Data Quality Evaluation

Data Quality Evaluation

1 Data Quality Assessment

This data quality evaluation assesses the effect of the overall analytical process on the "availability" of the analytical data. "Availability" in this context refers to whether results can be used by the project team based on their analytical soundness. If a result is analytically sound, it is available for use by the project team.

Evaluation of laboratory performance is a check for compliance with the method requirements; in other words, a check of whether the laboratory analyzed the samples within the limits of the analytical method. Additionally, an independent, third-party validator conducted a review of the laboratory data to assess whether the analytical methods were within required control limits at the time of analysis. Evaluation of potential matrix interferences involves the review of several areas of results, including surrogate spike recoveries, matrix spike recoveries, and duplicate sample results.

The data evaluation and validation is a multi-tiered approach. The process begins with an internal laboratory review, continues with an independent review by a third-party validator, and ends with an overall review by the Navy contractor project chemistry team. While only the data validator is allowed to apply qualifiers to the data, the process provides a medium for essential communication between the laboratory, validator, and project team, and allows for data quality to be thoroughly evaluated.

1.1 Laboratory Internal Quality Control Review

Prior to releasing the analytical data, the laboratory reviewed both the sample and QC data to verify sample identity, instrument calibration, quantitation limits, dilution factors, numerical computations, accuracy of transcriptions, and chemical interpretations. In addition, the QC data were tabulated and the results reviewed to ascertain whether they were within the contract-required or laboratory-defined limits for accuracy and precision. Any non-conforming data were discussed in the data package cover letter and case narrative. The case narrative was then reviewed by the data validator and incorporated into the data validation report. If necessary, qualifiers were applied based on this information.

1.2 Data Validation

An independent data validator reviewed all data packages using the validation criteria defined by USEPA National Functional Guidelines. These guidelines help the validator create a thorough and systematic approach to the validation process. As stated above, the data validation process was independent and separate from the laboratory's internal review. The process was specifically focused on the effects of the laboratory's performance and sample matrix on the analytical results. Areas of review consisted of holding time compliance, surrogate recovery accuracy, matrix spiked sample precision and accuracy, blank contamination, initial and continuing calibration accuracy and precision, laboratory control sample accuracy, internal standard response and retention time accuracy,

instrument tune criteria accuracy, and duplicate sample precision (laboratory and field duplicates). Additionally, the analytical spectrum and raw data output were reviewed and laboratory results selected by the validator were recalculated from the raw data to verify final laboratory quantitation.

When multiple analyses were performed, the analytical run with the lowest quantitation limits was selected by the validator if the QC criteria were met for that analysis. If a sample was analyzed more than once as a result of concentrations exceeding the calibration range, the data validator selected results from the appropriate dilution. When multiple analyses were performed and QC criteria were outside of control limits for all analyses, the data validator selected results from the analytical run with the least number of exceptions or best possible QC.

Qualification of data is not an unusual occurrence. To define a laboratory QC exceedance and when a laboratory QC exceedance occurs, the laboratory refers to its in-house SOPs. The SOPs are based on DOD requirements, the requested analytical method, and accumulated laboratory experience. When a laboratory QC exceedance occurs, the situation may be acceptable or it may require further action by the laboratory, such as application of a laboratory qualifier or reanalysis of the sample. The data validator uses a separate set of QC criteria, based on guidance from the EPA region that applies to the samples. Data validation criteria exceedances may result in the qualification of or rejection of data, as deemed appropriate by the third-party data validator.

The data validator examines each data point and determines any effects that QC exceedances have had. Most often, these effects dictate that the result or quantitation limit should be considered estimated, but is still available for use. The J qualification, UJ qualification, and U qualification of results are common occurrences and have no adverse effect on the availability of that result to the project team for making decisions. J qualified results are available, at the reported result, for use as detects as long as they are considered "estimated" by the project team. Human health risk assessment guidance suggests that these qualifiers "indicate uncertainty in the reported concentration of the chemical, but not in its assigned identity. Therefore, these data can be used just as positive data with no qualifiers or codes." In addition, one should use "J qualified concentrations the same way as positive data that do not have this qualifier" (Risk Assessment Guidance for Superfund: Volume I - Human Health Evaluation Manual. (Part A) EPA/540/1-89/002. Office of Emergency and Remedial Response, U.S. Environmental Protection Agency, Washington, D.C. 1989). U qualified and UJ qualified results are available, at the reported quantitation limit, for use as non-detects as long as they are considered "non-detect," "attributable to blank contamination," or "non-detect, estimated quantitation limit," as appropriate.

In extreme cases, a result is rejected and deemed to be unusable. "Unusable" in this instance is defined as a result that is not analytically sound and is not generally considered available for use by the project team. In some cases, the project team may still decide to use a rejected result. An example of this occurrence would be if a result is rejected because it is biased extremely high, yet it is still below the project action limits. A conservative decision may be made to consider this result a non-exceedance, even if its concentration was rejected. For that reason, it is important to examine why a result was rejected. For the most part, however, rejected results are not usable, and the R-qualifier is the only qualifier that has an adverse effect on the availability of data.

In large data sets, rejected results are often inconsequential because there is sufficient non-rejected data available to the project team. If there are enough non-rejected data or the project team is able to infer results from adjacent sampling locations or there is other site-specific information that can provide additional lines of evidence, it may not be necessary to know the concentrations of some rejected constituents. It may also not be necessary to prove a constituent's absence if there are sufficient additional lines of evidence.

1.2.1 Primary Data Validation Qualifiers

The following data validation qualifiers were applied to one or more analytical results:

- **U** - Not detected. Sample was analyzed for this parameter, but it was not detected at greater than reported quantitation limit. The data validator may also apply this qualifier to indicate that a concentration is attributed to blank contamination, but this qualifier does not necessarily indicate a quality control problem.
- **J** - Concentration estimated. The parameter was positively identified and the associated numerical value is the approximate concentration of the parameter in the sample.
- **[No qualifier present] -** Detected. Qualification was not warranted.

2 Impact of Data Quality on Project Data Quality Objectives and Data Usability

The laboratories analyzed the samples in accordance with EPA methods. The data packages were reviewed by an independent data validator using USEPA National Functional Guidelines. These guidelines are to be used for Region IV data.

The laboratory utilized various qualifiers to represent "below reporting limit," "non-detect," and "detected." The data validator utilized J qualifiers, and U qualifiers to represent "estimated,", "non-detect" or "attributable to blank contamination," respectively.

The J qualifier indicates that some results are estimated. This qualifier indicates that data are available for use as detects. This qualifier does not necessarily indicate a problem that adversely affects the availability of data. For example, J qualifiers are often applied simply because results are below the quantitation limit.

Region IV data validation guidance mandates the use of J qualifiers when QA/QC exceedances dictate their necessity. In general, J, and U qualified results are available for use as qualified.

3 Camp Geiger

The purpose of this data quality evaluation is to summarize the findings of the data validation and any effects on the availability of the data for the Camp Geiger sampling event as well as to provide an assessment of data usability.

3.1 Indoor Air Data

This evaluation assesses the analytical results of the indoor air samples collected on February 13 and 14 2010.

3.1.1 Volatile Organic Compounds

Volatiles were analyzed by EPA method TO-15. Excluding field quality control samples, 266 distinct data points were generated. There were no rejected results. The volatiles data set is 100% percent complete (all volatiles results are available for use). The validation process resulted in the following qualifiers for results in the volatiles fraction:

- 0.4 percent (1 of 266 results) were U qualified as "attributable to blank contamination" (see section 3.1.1.1, below)
- 31.2 percent (83 of 266 results) were J qualified as "estimated" because the results were below the quantitation limit (see section 3.1.1.2 below)

3.1.1.1 Blank Contamination

One result was U qualified as "attributable to blank contamination" because, tetrachloroethene was detected in associated blank samples. The U qualification of detects to indicate that they are "attributable to blank contamination" does not affect the availability of results because they are available for use as nondetects at the adjusted quantitation limit.

3.1.1.2 Quantitation Limits

A total of 83 results were J qualified as "estimated" simply because the results were lower than the quantitation limit. The J qualification of detects does not affect the availability of results because they are available for use as detects at the reported concentration.

3.2 Outdoor Air Data

This evaluation assesses the analytical results of the outdoor air samples collected on February 15, 2010.

3.2.1 Volatile Organic Compounds

Volatiles were analyzed by EPA method TO-15. Excluding field quality control samples, 76 distinct data points were generated. There were no rejected results. The volatiles data set is 100% percent complete (all volatiles results are available for use). The validation process resulted in the following qualifiers for results in the volatiles fraction:

- 27.6 percent (21 of 76 results) were J qualified as "estimated" because the results were below the quantitation limit (see section 3.2.1.1 below)

3.2.1.1 Quantitation Limits

A total of 21 results were J qualified as "estimated" simply because the results were lower than the quantitation limit. The J qualification of detects does not affect the availability of results because they are available for use as detects at the reported concentration.

3.3 Soil Gas Data

This evaluation assesses the analytical results of the soil gas samples collected on February 13, 2010.

3.3.1 Volatile Organic Compounds

Volatiles were analyzed by EPA method TO-15. Excluding field quality control samples, 494 distinct data points were generated. There were no rejected results. The volatiles data set

is 100% percent complete (all volatiles results are available for use). The validation process resulted in the following qualifiers for results in the volatiles fraction:

- 25.1 percent (124 of 494 results) were J qualified as "estimated" because the results were below the quantitation limit (see section 3.3.1.1 below)
- 0.8 percent (4 of 494 results) were J qualified as "estimated" due to lack of field duplicate reproducibility (see section 3.3.1.2 below).

3.3.1.1 Quantitation Limits

A total of 124 results were J qualified as "estimated" simply because the results were lower than the quantitation limit. The J qualification of detects does not affect the availability of results because they are available for use as detects at the reported concentration.

3.3.1.2 Field Duplicates

A total of 4 results were J qualified as "estimated" due to a lack of field duplicate reproducibility. Carbon disulfide and tetrachloroethene were both J qualified in samples IR35-SG08-10A and IR35-SG08D-10A. Carbon disulfide yielded a 88%RPD between the parent and duplicate sample, while tetrachloroethene yielded a 91%RPD between the parent and duplicate sample. In both cases the duplicate sample yielded the lower concentration. These results are available for use as detects however the data user should use caution due to the extreme %RPD between parent and duplicate sample results.

4 Overall Assessment

All data collected in support of the Camp Geiger sampling event are found to be of acceptable quality. No data was rejected due to QA/QC deficiencies and all data is available for use by the project team.

Appendix V5-C
Building Survey Forms

Preliminary Building Survey for Vapor Intrusion Investigation

CH2MHILL

Date: 2/13/10

Preparer: Kim Stokes

Facility: Bldg TC860

Address: F St & G St
Camp Geiger

Contact Person: Andy Unsworth

Phone Number: #910-449-0263

e-mail address: andrew.unsworth@usmc.mil

Building Description

Building or Room Identifier: Bldg TC860

Primary Activity within Building (select one):

- [ ] Manufacturing
- [ ] Storage
- [ ] Other
- [ ] Chemical processing
- [ ] Chemical Storage
- [X] Administrative
- [ ] Instrumentation/Control

Notes: Medical processing of new recruits
1/2 building - urine analysis 1/2 - office space

Approximate floor space 60 x 150 =

Number of floors 1

Multi-room building [X] or Single room [ ]

Ceiling height 10 ft.

Aboveground Construction
- [ ] Wood
- [ ] Concrete
- [ ] Brick
- [ ] Cinderblock
- [X] Other Stucco w/ drywall walls

Floor plan attached? [ ] Yes [X] No

Notes:

Evaluation of Potential Conduits from Soil

Floor/foundation description (check all that apply)

- [ ] Wood
- [x] Concrete
- [x] Elevated above grade? 2 ft.
- [ ] Below grade?
- [ ] Other Tile in restrooms

Expansion joints present (if concrete floor)?	[x] Yes	[ ] No	[ ] N/A	
Are expansion joints sealed?	[x] Yes	[ ] No	[ ] N/A	Need repair
Are sumps or floor drains present?	[x] Yes	[ ] No	[ ] N/A	Restrooms
Are basements or subsurface vaults present?	[ ] Yes	[x] No	[ ] N/A	
Are there subsurface drainage problems?	[ ] Yes	[ ] No	[x] N/A	

Notes:

Evaluation of Potential Pathways/Driving Forces

Are there locations with elevated positive or negative pressure (look for doors not opening/closing properly, perceptible airflow, audible fan noise)

Is there one air conditioning zone or multiple zones (if in a multi-room building)?

- [ ] Single zone
- [x] Multi-zone
- [ ] Other

Venting in walls

(building management may know; another tip-off is the presence of multiple thermostats = multiple zones)

Sources of outdoor air

- [x] Mechanical (air handling unit)
- [x] Doors
- [ ] Windows

Are windows/doors left open routinely? [X] Yes [ ] No

Notes: Doors propped open on warm days

Evaluation of Potential Existing Chemical Sources Indoors

List principal solvent or VOC-containing products used (obtain MSDSs if available)

(1) Air freshener - ZEP Meter mist
(2) pledge
(2) windex

GoJo
(1) pledge
(2) Scot's Tuff Surface Disinfectant

(14) 1L Pure II
(2) Windex
(4) Tough Guy Lemon Wax Furniture Polish

Are any of the target analytes used in this building/room? [ ] Yes [ ] No

Are pesticides used indoors for pest control? [ ] Yes [ ] No

Names of pesticide products used?

Has there been a pesticide application within the past 6 months? [ ] Yes [ ] No

Is smoking permitted in the building? [ ] Yes [X] No

Description of Vapor Mitigation Systems

Has a radon or vapor mitigation system been installed in this building/room? [ ] Yes [X] No

Date of installation?

Type of system?
[ ] Passive venting
[ ] Active subslab depressurization
[ ] Crack/crevice sealing
[ ] Dilution ventilation control
[ ] N/A

Notes:

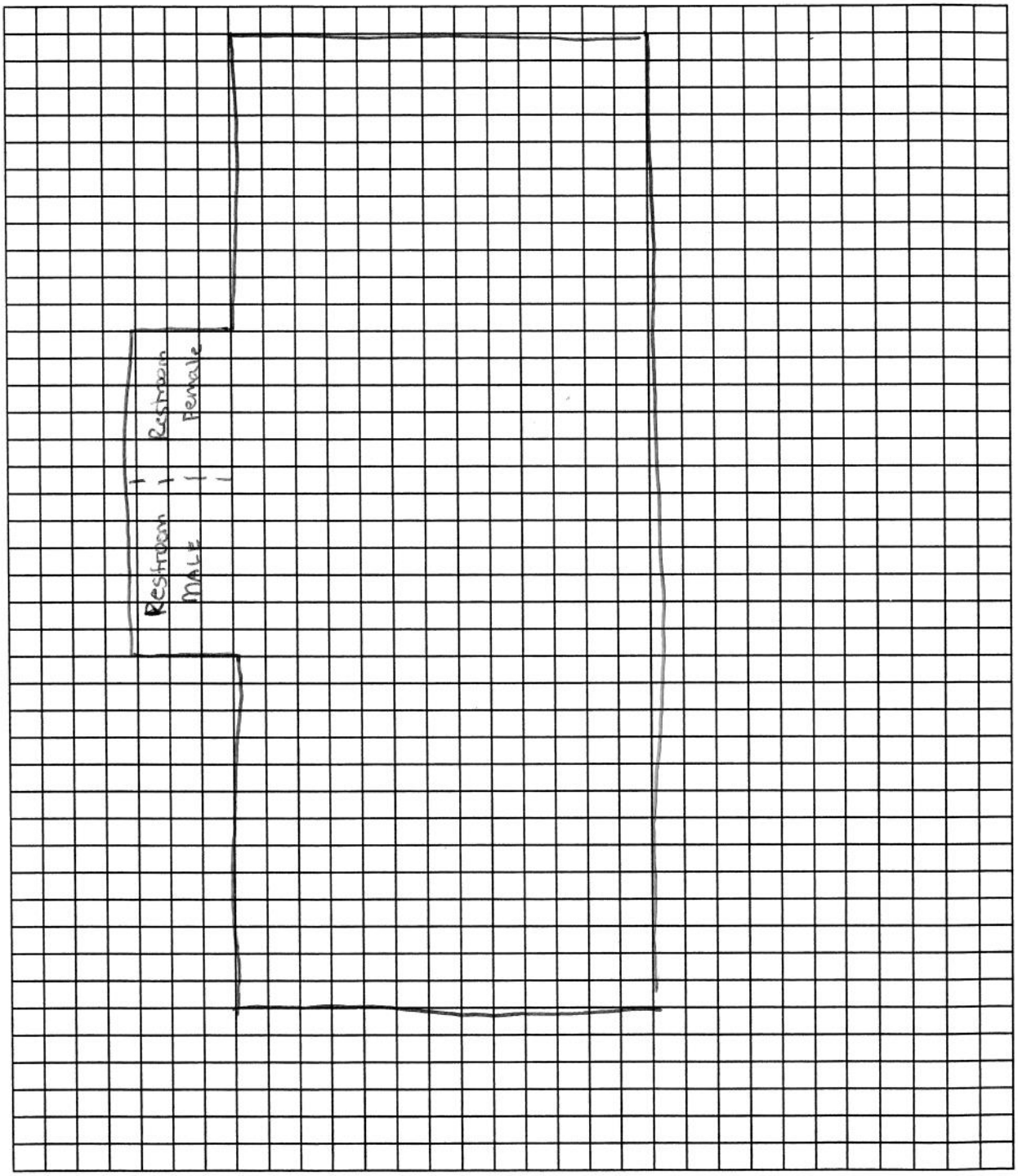
Additional Notes

Date: _____
Preparer: _____

Facility: _____
Description (floor): _____

CH2MHILL

Floor Plan Information



Preliminary Building Survey for Vapor Intrusion Investigation

CH2MHILL

Date: 2/13/10

Preparer: K. Stokes

Facility: MCB Camlej

Address:

Contact Person: Andy Unsworth

Phone Number:

e-mail address:

Building Description

Building or Room Identifier: G531-533

Primary Activity within Building (select one):

- [ ] Manufacturing
- [ ] Storage
- [x] Other
- [ ] Chemical processing
- [ ] Chemical Storage
- [ ] Administrative
- [ ] Instrumentation/Control

Notes: Barracks - for SCHOOL of INFANTRY

Approximate floor space 5,000 ft² / building

Number of floors 3

Multi-room building [x] or Single room [ ]

Ceiling height 10 ft.

Aboveground Construction [ ] Wood [ ] Concrete

(exterior) [x] Brick [x] Cinderblock (interior)

[ ] Other

Floor plan attached? [ ] Yes [ ] No

Notes:

Evaluation of Potential Conduits from Soil

Floor/foundation description (check all that apply)

- [ ] Wood
- [x] Concrete
- [ ] Elevated above grade?
- [ ] Below grade?
- [ ] Other: Concrete in barracks Vinyl tile down hallways; Ceramic tile in restrooms

Expansion joints present (if concrete floor)?	[x] Yes	[ ] No	[ ] N/A
Are expansion joints sealed?	[x] Yes	[ ] No	[ ] N/A
Are sumps or floor drains present?	[x] Yes	[ ] No	[ ] N/A Restrooms Laundry Rooms
Are basements or subsurface vaults present?	[ ] Yes	[x] No	[ ] N/A
Are there subsurface drainage problems?	[ ] Yes	[x] No	[ ] N/A

Notes:

Evaluation of Potential Pathways/Driving Forces

Are there locations with elevated positive or negative pressure (look for doors not opening/closing properly, perceptible airflow, audible fan noise)

None observed

Is there one air conditioning zone or multiple zones (if in a multi-room building)?

- [ ] Single zone
- [x] Multi-zone
- [ ] Other

(building management may know; another tip-off is the presence of multiple thermostats = multiple zones)

Sources of outdoor air

- [x] Mechanical (air handling unit)
- [x] Doors
- [x] Windows

Are windows/doors left open routinely? ☐ Yes ☒ No

Notes: Doors only

Evaluation of Potential Existing Chemical Sources Indoors

List principal solvent or VOC-containing products used (obtain MSDSs if available)

Windex
Febreze
Clorox
GoJo

Are any of the target analytes used in this building/room?

☒ Yes ☐ No

Are pesticides used indoors for pest control? ☐ Yes ☐ No Unknown

Names of pesticide products used? Unknown

Has there been a pesticide application within the past 6 months? ☐ Yes ☐ No Unknown

Is smoking permitted in the building? ☐ Yes ☒ No

Description of Vapor Mitigation Systems

Has a radon or vapor mitigation system been installed in this building/room? ☐ Yes ☒ No

Date of installation?

Type of system?

☐ Passive venting
☐ Active subslab depressurization
☐ Crack/crevice sealing
☐ Dilution ventilation control
☐ N/A

Notes:

Additional Notes

Additional Notes

Appendix V5-D
Chain-of-Custody Records

Air - Chain of Custody Record & Analytical Service Request

Columbia Analytical Services™
2655 Park Center Drive, Suite A
Simi Valley, California 93065
Phone (805) 526-7161
Fax (805) 526-7270

CTO-092

Requested Turnaround Time in Business Days (Surcharges) please circle
1 Day (100%) 2 Day (75%) 3 Day (50%) 4 Day (35%) 5 Day (25%) 10 Day - Standard

CAS Project No.

Company Name & Address (Reporting Information): CH2M Hill, 5700 Cleveland St, Suite 101, Virginia Beach, VA 23462

Project Name: MCB Camp Lejeune

Project Number: 392664

CAS Contact: Kate Aguilera

Project Manager: Keri Hallberg

P.O. # / Billing Information: As Per Contract

Phone: 757-671-6284

Fax:

Email Address for Result Reporting: genevieve.moore@ch2m.com

Sampler (Print & Sign): Kim Stokes / Kimberly Stokes

Analysis Method and/or Analytes

Client Sample ID	Laboratory ID Number	Date Collected	Time Collected	Sample Type (Air/Tube/Solid)	Canister ID (Bar Code # - AC, SC, etc.)	Flow Controller (Bar Code - FC #)	Sample Volume	TO-15 VOCs	Initial Pressure (" Hg)	Final Pressure (" Hg)		Comments e.g. Actual Preservative or specific instructions
												Pressure Gauge
IR86-SG05-10A		2/12/10	1305	AIR	1SC00674	OA01103	1 L	X	-28.5	-4		AVG00970
IR86-SG03-10A		2/12/10	1332		1SC00585	OA00055		X	-29	-4		AVG00981
IR86-SG02-10A		2/12/10	1400		1SC00603	OA01081		X	-27	-4		AVG01206
IR86-SG02D-10A		2/12/10	1407		1SC00746	OA01117		X	-31	-4		AVG01285
IR88-SG18-10A		2/12/10	1012		1SC00731	OA01102		X	-29	-3.5		AVG00472
HPFF-SG06-10A		2/12/10	0849		1SC00387	OA01654		X	-34	-4		AVG00505
IR35-SG05-10A		2/13/10	1115		1SC00474	OA00739		X	-30.5	-4		AVG00464
IR35-SG06-10A		2/13/10	1137		1SC00260	OA00051		X	-28	-4		AVG01101
IR89-SG01-10A		2/13/10	1326		1SC00782	OA00728		X	-29	-4		AVG00881
1SC00003 - bad canister												
AVG00238 - bad gauge												
OA01121 - bad critical orifice												

Report Tier Levels - please select
Tier I - (Results/Default if not specified) ____
Tier II - (Results + QC) ____
Tier III - (Data Validation Package) 10% Surcharge ____
Tier V - (client specified) ____

EDD required Yes / No
Type: _____
EDD Units: _____

Project Requirements (MRLs, QAPP): 8712-9642-7107

Relinquished by: (Signature)	Date:	Time:	Received by: (Signature)	Date:	Time:
Kimberly Stokes	2/16/10	1730			
Relinquished by: (Signature)	Date:	Time:	Received by: (Signature)	Date:	Time:
Relinquished by: (Signature)	Date:	Time:	Received by: (Signature)	Date:	Time:

Cooler / Blank
Temperature _____ °C

Air - Chain of Custody Record & Analytical Service Request

Columbia Analytical Services™
2655 Park Center Drive, Suite A
Simi Valley, California 93065
Phone (805) 526-7161
Fax (805) 526-7270

CTO-092

Requested Turnaround Time in Business Days (Surcharges) please circle
1 Day (100%) 2 Day (75%) 3 Day (50%) 4 Day (35%) 5 Day (25%) 10 Day - Standard

CAS Project No.

Company Name & Address (Reporting Information)
CH2M HILL
5700 Cleveland St.
Suite 101
Virginia Beach, VA 23462

Project Name: MCB Camp Lejeune

Project Number: 392664

Project Manager: Keri Hallberg

P.O. # / Billing Information: As per contract

Phone: 757-671-6284

Fax:

Email Address for Result Reporting: generieve.moore@ch2m.com

Sampler (Print & Sign): Kim Stokes [signature]

CAS Contact

Analysis Method and/or Analytes

Client Sample ID	Laboratory ID Number	Date Collected	Time Collected	Sample Type (Air/Tube/Solid)	Canister ID (Bar Code # - AC, SC, etc.)	Flow Controller (Bar Code - FC #)	Sample Volume	TO-15	Initial pressure (" Hg)	Final pressure (" Hg)		Comments e.g. Actual Preservative or specific instructions
IR89-IA04-10A		2/14/10	11 11	AIR	AC01005	FC00215	6L	x	-29.5	-0.5		AVG00574
IR89-IA03-10A		2/14/10	14"		AC01225	FC00435		x	-35	-9		AVG01120
IR89-OA03-10A		2/14/10	1407		AC001125	FC00608		x	-29.5	-7		AVG00305
IR89-IA01-10A		2/14/10	1406		AC01098	FC00625		x	-30.5	-8.5		AVG00652

Pressure gauge ID

Kim Stokes

Report Tier Levels - please select
Tier I - (Results/Default if not specified) ____
Tier II - (Results + QC) ____
Tier III - (Data Validation Package) 10% Surcharge ____
Tier V - (client specified) ____

EDD required Yes / No
Type: _____ EDD Units: _____

Project Requirements (MRLs, QAPP): 8712-9642-7130

Relinquished by: (Signature)	Date:	Time:	Received by: (Signature)	Date:	Time:
[signature]	2/16/10	1730			
Relinquished by: (Signature)	Date:	Time:	Received by: (Signature)	Date:	Time:
Relinquished by: (Signature)	Date:	Time:	Received by: (Signature)	Date:	Time:

Cooler / Blank
Temperature: °C

Air - Chain of Custody Record & Analytical Service Request

CTO-092

Columbia Analytical Services™
2655 Park Center Drive, Suite A
Simi Valley, California 93065
Phone (805) 526-7161
Fax (805) 526-7270

Requested Turnaround Time in Business Days (Surcharges) please circle
1 Day (100%) 2 Day (75%) 3 Day (50%) 4 Day (35%) 5 Day (25%) 10 Day - Standard

CAS Project No.

Company Name & Address (Reporting Information)
CH2M HILL
5700 Cleveland St.
Suite 101
Virginia Beach, VA 23462

Project Name: MCB Camp Lejeune

Project Number: 392664

Project Manager: Keri Hallberg

P.O. # / Billing Information: As per contract

Phone: 757-671-6284

Fax:

Email Address for Result Reporting: generieve.moore@ch2m.com

Sampler (Print & Sign): Kim Stokes [signature]

CAS Contact

Analysis Method and/or Analytes

Client Sample ID	Laboratory ID Number	Date Collected	Time Collected	Sample Type (Air/Tube/Solid)	Canister ID (Bar Code # - AC, SC, etc.)	Flow Controller (Bar Code - FC #)	Sample Volume	TO-15	Initial pressure (" Hg)	Final pressure (" Hg)		Comments e.g. Actual Preservative or specific instructions
IR89-IA07D-10A		2/14/10	1107	AIR	AC01234	FC00644	6 L	X	-30.5	-3		AVG01017
IR89-IA07-10A		2/14/10	1405		AC01488	FC00504		X	-30	-6		AVG00192
IR35-IA06-10A		2/14/10	1121		AC00595	FC00446		X	-27	-6		AVG00404
IR35-OA04-10A		2/14/10	1134		AC00793	FC00816		X	-32	-3		AVG00370

[signature]

Report Tier Levels - please select
Tier I - (Results/Default if not specified) ____
Tier II - (Results + QC) ____
Tier III - (Data Validation Package) 10% Surcharge ____
Tier V - (client specified) ____

EDD required Yes / No
Type: _____ EDD Units: _____

Project Requirements (MRLs, QAPP): 8712-9642-7060

Relinquished by: (Signature)	Date:	Time:	Received by: (Signature)	Date:	Time:
Kim Stokes [signature]	2/16/10	17 30			
Relinquished by: (Signature)	Date:	Time:	Received by: (Signature)	Date:	Time:
Relinquished by: (Signature)	Date:	Time:	Received by: (Signature)	Date:	Time:

Cooler / Blank
Temperature ____ °C

Air - Chain of Custody Record & Analytical Service Request

CTO-092

Columbia Analytical Services™
2655 Park Center Drive, Suite A
Simi Valley, California 93065
Phone (805) 526-7161
Fax (805) 526-7270

Requested Turnaround Time in Business Days (Surcharges) please circle
1 Day (100%) 2 Day (75%) 3 Day (50%) 4 Day (35%) 5 Day (25%) 10 Day - Standard

CAS Project No. 392664

CAS Contact

Company Name & Address (Reporting Information)
CH2M HILL
5700 Cleveland St.
Suite 101
Virginia Beach, VA 23462

Project Name: MCB Camp Lejeune

Project Number: 392664

Project Manager: Keri Hallberg

P.O. # / Billing Information: As per contract

Phone: 757-671-6284

Fax:

Email Address for Result Reporting: genevievemoore@ch2m.com

Sampler (Print & Sign): Kim Stokes [signature]

Analysis Method and/or Analytes

Client Sample ID	Laboratory ID Number	Date Collected	Time Collected	Sample Type (Air/Tube/Solid)	Canister ID (Bar Code # - AC, SC, etc.)	Flow Controller (Bar Code - FC #)	Sample Volume	TO-15	Initial pressure (" Hg)	Final pressure (" Hg)		Comments e.g. Actual Preservative or specific instructions
IR35-IA05-10A		2/13/10	1428	AIR	AC00820	FC00298	1 L	X	-28.5	-9		AV600277
IR88-IS15-10A		2/16/10	0920	AIR	IS600535	OA01150	1 L	X	-30	-4		AV601296

Report Tier Levels - please select
Tier I - (Results/Default if not specified) ____
Tier II - (Results + QC) ____
Tier III - (Data Validation Package) 10% Surcharge ____
Tier V - (client specified) ____

EDD required Yes / No
Type: _____ EDD Units: _____

Project Requirements (MRLs, QAPP)
AIRBILL = 8712 9642 0525

Relinquished by: (Signature)	Date:	Time:	Received by: (Signature)	Date:	Time:
[signature]	2/16/10	1100			
Relinquished by: (Signature)	Date:	Time:	Received by: (Signature)	Date:	Time:
Relinquished by: (Signature)	Date:	Time:	Received by: (Signature)	Date:	Time:

Cooler / Blank
Temperature: °C

Appendix V5-E
Laboratory Data

CTO-092
MCB CamLej - Camp Geiger
Phase III Indoor Air Raw Analytical Results
February 2010

Station ID	IR35-IA05	IR35-IA06	IR89-IA01	IR89-IA03	IR89-IA04	IR89-IA07	
Sample ID	IR35-IA05-10A	IR35-IA06-10A	IR89-IA01-10A	IR89-IA03-10A	IR89-IA04-10A	IR89-IA07-10A	IR89-IA07D-10A
Sample Date	02/13/10	02/14/10	02/14/10	02/14/10	02/14/10	02/14/10	02/14/10
Chemical Name							
Volatile Organic Compounds (ppbv)							
1,1,1-Trichloroethane	0.15 U	0.13 U	0.15 U	0.14 U	0.1 U	0.15 U	0.11 U
1,1,2,2-Tetrachloroethane	0.12 U	0.11 U	0.12 U	0.03 J	0.08 U	0.12 U	0.02 J
1,1,2-Trichloro-1,2,2-trifluoroethane(Freon-113)	0.08 J	0.07 J	0.06 J	0.07 J	0.07	0.07 J	0.08
1,1-Dichloroethane	0.2 U	0.18 U	0.2 U	0.18 U	0.14 U	0.2 U	0.15 U
1,1-Dichloroethene	0.2 U	0.18 U	0.21 U	0.19 U	0.14 U	0.2 U	0.16 U
1,2,4-Trichlorobenzene	0.11 U	0.09 U	0.11 U	0.1 U	0.07 U	0.11 U	0.08 U
1,2-Dichloroethane	0.04 J	0.04 J	0.2 U	0.18 U	0.14 U	0.2 U	0.15 U
1,2-Dichloropropane	0.17 U	0.16 U	0.18 U	0.16 U	0.12 U	0.17 U	0.13 U
1,4-Dichlorobenzene	9.5	10	0.58	0.01 J	0.09 U	0.75	0.89
2-Butanone	0.53 J	0.97	0.61	0.91	0.21 J	0.4 J	0.51
2-Hexanone	0.2 U	0.16 J	0.09 J	0.17 J	0.02 J	0.04 J	0.09 J
4-Methyl-2-pentanone	0.2 U	0.06 J	0.2 U	0.07 J	0.14 U	0.19 U	0.03 J
Acetone	8.7	8.7	11	3.3	2.5	16	20
Benzene	1	0.9	0.15 J	0.15 J	0.14 J	0.15 J	0.18 J
Bromodichloromethane	0.12 U	0.11 U	0.12 U	0.11 U	0.08 U	0.12 U	0.09 U
Bromomethane	0.21 U	0.19 U	0.21 U	0.19 U	0.15 U	0.2 U	0.16 U
Carbon disulfide	0.52 U	0.47 U	0.53 U	0.48 U	0.36 U	0.51 U	0.4 U
Carbon tetrachloride	0.07 J	0.07 J	0.06 J	0.04 J	0.06 J	0.06 J	0.02 J
Chlorobenzene	0.17 U	0.01 J	0.18 U	0.16 U	0.12 U	0.17 U	0.13 U
Chloroethane	0.31 U	0.28 U	0.31 U	0.28 U	0.21 U	0.3 U	0.24 U
Chloroform	0.02 J	0.02 J	0.17 U	0.15 U	0.12 U	0.16 U	0.02 J
Chloromethane	0.15 J	0.17 J	0.16 J	0.17 J	0.18 J	0.17 J	0.17 J
cis-1,2-Dichloroethene	0.2 U	0.18 U	0.21 U	0.02 J	0.14 U	0.2 U	0.02 J
Cyclohexane	0.31 J	0.28 J	0.48 U	0.43 U	0.33 U	0.46 U	0.36 U
Dichlorodifluoromethane (Freon-12)	0.52	0.42	0.5	0.51	0.51	0.51	0.62
Ethylbenzene	0.56	0.48	0.02 J	0.02 J	0.13 U	0.02 J	0.03 J
Isopropylbenzene	0.04 J	0.03 J	0.17 U	0.15 U	0.11 U	0.16 U	0.13 U
m- and p-Xylene	2.2	1.7	0.38 U	0.07 J	0.26 U	0.05 J	0.05 J
Methylene chloride	0.06 J	0.06 J	0.06 J	0.06 J	0.05 J	0.06 J	0.06 J
Methyl-tert-butyl ether (MTBE)	0.22 U	0.2 U	0.23 U	0.21 U	0.16 U	0.22 U	0.17 U
o-Xylene	0.83	0.6	0.19 U	0.03 J	0.13 U	0.02 J	0.02 J
Styrene	0.03 J	0.04 J	0.19 U	0.06 J	0.13 U	0.19 U	0.02 J
Tetrachloroethene	0.12 U	0.11 U	0.05 J	4.7	0.08 U	0.03 J	0.03 J
Toluene	3.6	3.4	0.14 J	0.13 J	0.09 J	0.14 J	0.14 J
trans-1,2-Dichloroethene	0.2 U	0.18 U	0.21 U	0.19 U	0.14 U	0.2 U	0.16 U
Trichloroethene	0.15 U	0.14 U	0.09 J	0.14 U	0.11 U	0.08 J	0.09 J
Trichlorofluoromethane(Freon-11)	0.24	0.22	0.22	0.21	0.22	0.23	0.28
Vinyl chloride	0.32 U	0.29 U	0.32 U	0.29 U	0.22 U	0.31 U	0.24 U

Notes:

NA - Not analyzed

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

U - The material was analyzed for, but not detected

ppbv - Parts per billion volume

CTO-092
MCB CamLej - Camp Geiger
Phase III Outdoor Air Raw Analytical Results
February 2010

Station ID	IR35-OA04	IR89-OA03
Sample ID	IR35-OA04-10A	IR89-OA03-10A
Sample Date	02/14/10	02/14/10
Chemical Name		
Volatile Organic Compounds (PPBV)		
1,1,1-Trichloroethane	0.12 U	0.13 U
1,1,2,2-Tetrachloroethane	0.09 U	0.1 U
1,1,2-Trichloro-1,2,2-trifluoroethane(Freon-113)	0.08	0.06 J
1,1-Dichloroethane	0.16 U	0.18 U
1,1-Dichloroethene	0.16 U	0.18 U
1,2,4-Trichlorobenzene	0.08 U	0.09 U
1,2-Dichloroethane	0.16 U	0.18 U
1,2-Dichloropropane	0.14 U	0.15 U
1,4-Dichlorobenzene	0.02 J	0.01 J
2-Butanone	0.37 J	0.29 J
2-Hexanone	0.03 J	0.03 J
4-Methyl-2-pentanone	0.15 U	0.17 U
Acetone	7.9	5.6
Benzene	0.19 J	0.14 J
Bromodichloromethane	0.09 U	0.11 U
Bromomethane	0.16 U	0.18 U
Carbon disulfide	0.4 U	0.46 U
Carbon tetrachloride	0.08 J	0.06 J
Chlorobenzene	0.14 U	0.16 U
Chloroethane	0.24 U	0.27 U
Chloroform	0.13 U	0.15 U
Chloromethane	0.2 J	0.17 J
cis-1,2-Dichloroethene	0.16 U	0.18 U
Cyclohexane	0.37 U	0.42 U
Dichlorodifluoromethane (Freon-12)	0.6	0.51
Ethylbenzene	0.02 J	0.16 U
Isopropylbenzene	0.13 U	0.15 U
m- and p-Xylene	0.04 J	0.33 U
Methylene chloride	0.06 J	0.05 J
Methyl-tert-butyl ether (MTBE)	0.17 U	0.2 U
o-Xylene	0.02 J	0.16 U
Styrene	0.01 J	0.17 U
Tetrachloroethene	0.09 U	0.11 U
Toluene	0.16 J	0.08 J
trans-1,2-Dichloroethene	0.16 U	0.18 U
Trichloroethene	0.12 U	0.13 U
Trichlorofluoromethane(Freon-11)	0.26	0.22
Vinyl chloride	0.25 U	0.28 U

Notes:

NA - Not analyzed
J - Analyte present, value may or may not be accurate or precise
U - The material was analyzed for, but not detected
PPBV - Parts per billion volume

CTO-092
MCB CamLej - Camp Geiger
Phase III Subslab Soil Gas Raw Analytical Results
February 2010

Station ID	IR35-SG05	IR35-SG06	IR35-SG08		IR35-SG09	IR35-SG10	IR35-SG11	IR35-SG12
Sample ID	IR35-SG05-10A	IR35-SG06-10A	IR35-SG08-10A	IR35-SG08D-10A	IR35-SG09-10A	IR35-SG10-10A	IR35-SG11-10A	IR35-SG12-10A
Sample Date	02/13/10	02/13/10	02/13/10	02/13/10	02/13/10	02/13/10	02/13/10	02/13/10
Chemical Name								
Volatile Organic Compounds (ppbv)								
1,1,1-Trichloroethane	0.42 U	0.42 U	0.44 U	0.44 U	0.46 U	0.44 U	0.44 U	0.42 U
1,1,2,2-Tetrachloroethane	0.34 U	0.34 U	0.35 U	0.35 U	0.36 U	0.35 U	0.35 U	0.33 U
1,1,2-Trichloro-1,2,2-trifluoroethane(Freon-113)	0.07 J	0.07 J	0.09 J	0.08 J	0.07 J	0.06 J	0.06 J	0.09 J
1,1-Dichloroethane	0.57 U	0.57 U	0.6 U	0.59 U	0.61 U	0.6 U	0.6 U	0.57 U
1,1-Dichloroethene	0.58 U	0.58 U	0.61 U	0.6 U	0.63 U	0.61 U	0.61 U	0.58 U
1,2,4-Trichlorobenzene	0.31 U	0.31 U	0.33 U	0.32 U	0.34 U	0.33 U	0.33 U	0.31 U
1,2-Dichloroethane	0.57 U	0.57 U	0.6 U	0.59 U	0.61 U	0.6 U	0.6 U	0.57 U
1,2-Dichloropropane	0.5 U	0.5 U	0.52 U	0.51 U	0.54 U	0.52 U	0.52 U	0.5 U
1,4-Dichlorobenzene	0.44	0.28 J	0.13 J	0.15 J	0.4 J	0.4 U	0.4 U	0.48
2-Butanone	2.7	1.8	2	1.4 J	3.3	2.9	2.9	1.6
2-Hexanone	0.41 J	0.23 J	0.34 J	0.21 J	0.61 U	0.53 J	0.53 J	0.56 U
4-Methyl-2-pentanone	0.09 J	0.56 U	0.59 U	0.58 U	0.61 U	0.59 U	0.59 U	0.56 U
Acetone	10	7.8 J	13	11	30	16	13	7.1 J
Benzene	0.72 U	0.72 U	0.11 J	0.25 J	0.33 J	0.76 U	0.76 U	0.17 J
Bromodichloromethane	0.34 U	0.35 U	0.36 U	0.35 U	0.37 U	0.36 U	0.36 U	0.34 U
Bromomethane	0.59 U	0.6 U	0.62 U	0.61 U	0.64 U	0.62 U	0.62 U	0.59 U
Carbon disulfide	0.95 J	0.65 J	2 J	0.77 J	3.5	4.5	3.4	0.78 J
Carbon tetrachloride	0.1 J	0.06 J	0.07 J	0.15 J	0.4 U	0.1 J	0.06 J	0.07 J
Chlorobenzene	0.5 U	0.5 U	0.53 U	0.52 U	0.54 U	0.52 U	0.53 U	0.5 U
Chloroethane	0.59 J	0.37 J	0.24 J	0.56 J	0.57 J	0.85 J	0.93	0.39 J
Chloroform	0.18 J	0.08 J	9.4	9.4	1	0.41 J	1.9	2.2
Chloromethane	0.95 J	0.6 J	0.43 J	0.89 J	0.58 J	0.78 J	0.71 J	0.6 J
cis-1,2-Dichloroethene	0.58 U	0.58 U	0.61 U	0.6 U	0.63 U	0.61 U	0.61 U	0.58 U
Cyclohexane	1.3 U	1.3 U	1.4 U	1.4 U	1.4 U	1.4 U	1.4 U	1.3 U
Dichlorodifluoromethane (Freon-12)	0.48	0.49	0.55	0.55	0.89	0.59	0.57	0.55
Ethylbenzene	0.53 U	0.53 U	0.56 U	0.55 U	2.3	0.56 U	0.56 U	0.73
Isopropylbenzene	0.47 U	0.47 U	0.49 U	0.48 U	0.7	0.49 U	0.49 U	0.26 J
m- and p-Xylene	0.15 J	0.17 J	1.1 U	1.1 U	78	0.14 J	0.13 J	28
Methylene chloride	0.15 J	0.67 U	0.7 U	0.17 J	0.13 J	0.15 J	0.22 J	0.11 J
Methyl-tert-butyl ether (MTBE)	0.64 U	0.64 U	0.67 U	0.66 U	0.69 U	0.67 U	0.67 U	0.63 U
o-Xylene	0.53 U	0.53 U	0.56 U	0.55 U	29	0.56 U	0.56 U	10
Styrene	0.54 U	0.54 U	0.57 U	0.56 U	0.09 J	0.57 U	0.57 U	0.54 U
Tetrachloroethene	1.3	1.1	3.2 J	1.2 J	3.4	2.7	3.1	1.3
Toluene	0.16 J	0.13 J	0.12 J	0.12 J	2.7	0.17 J	0.14 J	0.78
trans-1,2-Dichloroethene	0.58 U	0.58 U	0.61 U	0.6 U	0.63 U	0.61 U	0.61 U	0.58 U
Trichloroethene	0.43 U	0.07 J	0.45 U	0.44 U	0.09 J	0.45 U	0.45 U	0.43 U
Trichlorofluoromethane(Freon-11)	0.22 J	0.23 J	0.26 J	0.25 J	0.33 J	0.35 J	0.29 J	0.25 J
Vinyl chloride	0.9 U	0.91 U	0.95 U	0.93 U	0.97 U	0.94 U	0.95 U	0.9 U

Notes:

NA - Not analyzed

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

U - The material was analyzed for, but not detected

ppbv - Parts per billion volume

CTO-092
MCB CamLej - Camp Geiger
Phase III Subslab Soil Gas Raw Analytical Results
February 2010

Station ID	IR35-SG13	IR89-SG01	IR89-SG02	IR89-SG03	IR89-SG04
Sample ID	IR35-SG13-10A	IR89-SG01-10A	IR89-SG02-10A	IR89-SG03-10A	IR89-SG04-10A
Sample Date	02/13/10	02/13/10	02/13/10	02/13/10	02/13/10
Chemical Name					
Volatile Organic Compounds (ppbv)					
1,1,1-Trichloroethane	0.42 U	0.44 U	0.43 U	0.3 J	0.42 U
1,1,2,2-Tetrachloroethane	0.34 U	0.41	0.34 U	0.33 U	0.33 U
1,1,2-Trichloro-1,2,2-trifluoroethane(Freon-113)	0.08 J	0.06 J	0.06 J	0.08 J	0.3 U
1,1-Dichloroethane	0.57 U	0.59 U	0.57 U	0.55 U	0.57 U
1,1-Dichloroethene	0.58 U	0.6 U	0.59 U	0.56 U	0.58 U
1,2,4-Trichlorobenzene	0.31 U	0.32 U	0.31 U	0.3 U	0.31 U
1,2-Dichloroethane	0.57 U	0.59 U	0.57 U	0.55 U	0.57 U
1,2-Dichloropropane	0.5 U	0.51 U	0.5 U	0.48 U	0.5 U
1,4-Dichlorobenzene	0.39	0.11 J	0.6	0.09 J	0.38 U
2-Butanone	1.7	9.8	9.4	7.4	4
2-Hexanone	0.56 U	1.3	2.3	1.5	0.58
4-Methyl-2-pentanone	0.56 U	0.36 J	0.35 J	0.25 J	0.12 J
Acetone	14	29	30	25	14
Benzene	0.22 J	0.74 U	0.73 U	0.16 J	0.72 U
Bromodichloromethane	0.12 J	0.35 U	0.35 U	0.33 U	0.34 U
Bromomethane	0.6 U	0.61 U	0.6 U	0.58 U	0.59 U
Carbon disulfide	0.8 J	1.5 U	1.5 U	1.4 U	1.5 U
Carbon tetrachloride	0.08 J	0.06 J	0.37 U	0.36 U	0.36 U
Chlorobenzene	0.5 U	0.52 U	0.51 U	0.49 U	0.5 U
Chloroethane	0.21 J	0.9 U	0.88 U	0.85 U	0.87 U
Chloroform	23	0.1 J	0.11 J	0.08 J	0.27 J
Chloromethane	0.69 J	1.2 U	1.1 U	1.1 U	1.1 U
cis-1,2-Dichloroethene	0.58 U	0.6 U	0.59 U	0.47 J	0.07 J
Cyclohexane	1.3 U	1.4 U	1.4 U	1.3 U	1.3 U
Dichlorodifluoromethane (Freon-12)	0.5	0.5	0.48	0.51	0.5
Ethylbenzene	0.42 J	0.55 U	0.36 J	0.26 J	0.53 U
Isopropylbenzene	0.15 J	0.48 U	0.13 J	0.1 J	0.47 U
m- and p-Xylene	15	1.1 U	14	9.4	1.1 U
Methylene chloride	0.11 J	0.11 J	0.67 U	0.64 U	0.66 U
Methyl-tert-butyl ether (MTBE)	0.64 U	0.66 U	0.65 U	0.62 U	0.63 U
o-Xylene	5.5	0.55 U	5.1	3.3	0.53 U
Styrene	0.54 U	0.56 U	0.55 U	0.53 U	0.54 U
Tetrachloroethene	0.71	5.4	5.8	5	6.2
Toluene	0.62	0.63 U	0.36 J	0.35 J	0.61 U
trans-1,2-Dichloroethene	0.58 U	0.17 J	0.59 U	0.75	0.12 J
Trichloroethene	0.43 U	21	10	120	75
Trichlorofluoromethane(Freon-11)	0.22 J	0.21 J	0.21 J	0.19 J	0.16 J
Vinyl chloride	0.91 U	0.93 U	0.91 U	0.88 U	0.9 U

Notes:

NA - Not analyzed
J - Analyte present, value may or may not be accurate or precise
U - The material was analyzed for, but not detected
ppbv - Parts per billion volume