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Vapor Intrusion Evaluation Report
Volume 6 of 6—Camp Geiger

Marine Corps Base Camp Lejeune
Jacksonville, North Carolina

NAVFAC
Naval Facilities Engineering Command
NAVFAC MID-ATLANTIC

Prepared for
Department of the Navy
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Prepared by

AGVIQ
AGVIQ ENVIRONMENTAL SERVICES
CH2M HILL
JOINT VENTURE

Final

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Task Order 21

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Abbreviations and Acronyms

AST	aboveground storage tank
bgs	below ground surface
BTEX	benzene, toluene, ethylbenzene, and xylene
COC	chain of custody record
CSM	conceptual site model
DCE	dichloroethane
DCE	dichloroethene
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
HVAC	heating, ventilation, and air conditioning
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
MIBK	methyl isobutyl ketone
NAPL	non–aqueous phase liquid
OA	outdoor air
PCE	tetrachloroethene
ppbv	parts per billion by volume
QA/QC	quality assurance/quality control

RSL	Regional Screening Level
SG	soil subslab
SGSL	Soil Gas 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
VOC	volatile organic compound

SECTION 1

Introduction

Camp Geiger is part of the Marine Corps Base (MCB), Camp Lejeune 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, Camp Lejeune. Approximately 20,000 Marines are trained at Camp Geiger every year.

Camp Geiger was one of the six investigation areas evaluated as part of the basewide vapor intrusion evaluation at MCB Camp Lejeune that took place from September 2007 to March 2009. The evaluation was performed in accordance with the Vapor Intrusion Evaluation Work Plan (CH2M HILL, 2008a). Buildings of interest at Camp Geiger were selected for Phase I sampling according to the process detailed in the Work Plan.

Three Installation Restoration (IR) sites (Site 35, Site 89, and Site 93) were retained for further evaluation of vapor intrusion pathways in the Camp Geiger area. Constituents of concern in Camp Geiger include chlorinated solvents and petroleum compounds.

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

SECTION 2

Investigation Methods

2.1 Phase I Sampling Event

As described in the *Vapor Intrusion Evaluation Work Plan* (CH2M HILL, 2008a), nine buildings of interest were identified in Camp Geiger for data collection during Phase I. Eight of these buildings are located within 100 feet (ft) of a shallow groundwater well with one or more exceedances of the site-specific groundwater-to-indoor-air screening levels. One building is located within 100 ft of a monitoring well with previously observed non–aqueous phase liquid (NAPL). Phase I samples collected in the Camp Geiger investigation area were located near IR Sites 35, 89 and 93.

Sample collection procedures have been provided in Volume 1.

2.1.1 Phase I Sample Locations

Sample locations from the Phase I sampling event are shown in Figures V6-1 through V6-3. The field data sheets associated with the samples collected are provided in Appendix V6-A. The chain of custody records (COCs), which log the samples collected, are provided in Appendix V6-D.

Nine groundwater grab (GW), nine soil gas (SV), six subslab (SG), six indoor air (IA) and two outdoor air (OA) samples were collected in the Camp Geiger area during Phase I. Quality control samples were also collected in accordance with Section 2.7 of the Field Sampling Plan (FSP) (CH2M HILL, 2008b).

Table V6-1 lists the Phase I samples that were proposed in the Work Plan and the deviations that occurred.

There were several minor deviations to the Work Plan during the Phase I sampling event. Three outdoor air samples were proposed for the Camp Geiger investigation area, but only two of the three were successfully collected. All three proposed outdoor air samples were only up to 2,400 ft apart; therefore, results from the two outdoor air samples successfully collected were assumed to be representative outdoor air samples for the Camp Geiger investigative area.

2.2 Phase II Sampling Event

Of the nine buildings sampled at Camp Geiger during Phase I, four were retained for Phase II sampling in accordance with the procedures described in Volume 1, Section 2, and the details provided in the refined conceptual site models for the buildings of interest provided in Section 4. The four buildings retained for Phase II sampling had exceedances in groundwater or soil gas. Samples collected in Camp Geiger were located near IR Site 35.

Sample collection procedures are provided in Volume 1.

TABLE V6-1
Phase I Sampling Summary
Camp Geiger, MCB Camp Lejeune, North Carolina

Site Name	Bldg	Sample Type	Sample ID	Sample Collected (Y/N)	Deviations
Site 35	G480	SG	IR35-SG05-08B	Y	—
		IA	IR35-IA05-08B	Y	—
		SG	IR35-SG06-08B	Y	—
		IA	IR35-IA06-08B	Y	—
		OA	IR35-OA03-08B	N	Not collected
	G521	GW	IR35-IS01-GW-08-09-08B	Y	—
		SV	IR35-IS01-SV-XX-XX-08B	N	Groundwater too shallow (6 ft below ground surface [bgs])
	G530	GW	IR35-IS02-GW-09-10-08B	Y	—
		SV	IR35-IS02-SV-05-06-08B	Y	—
	G531	GW	IR35-IS03-GW-09-10-08B	Y	—
		SV	IR35-IS03-SV-XX-XX-08B	N	Groundwater too shallow (5 ft bgs)
	G531/ G532	GW	IR35-IS04-GW-08-09-08B	Y	—
		SV	IR35-IS04-SV-XX-XX-08B	N	Groundwater too shallow (5 ft bgs)
	G532/ G533	GW	IR35-IS05-GW-09-10-08B	Y	—
		SV	IR35-IS05-SV-05-06-08B	Y	—
		GW	IR35-IS06-GW-10-11-08B	Y	—
		SV	IR35-IS06-SV-05-06-08B	Y	—
Site 89	TC860	SG	IR89-SG01-08B	Y	—
		IA	IR89-IA01-08B	Y	—
		OA	IR89-OA01-08B	Y	—
		SG	IR89-SG02-08B	Y	—
		IA	IR89-IA02-08B	Y	—
		SV	IR89-IS10-SV-04-05-08B	Y	—
		SV	IR89-IS11-SV-04-05-08B	Y	—
	TC864	SG	IR89-SG03-08B	Y	—
		IA	IR89-IA03-08B	Y	—
		OA	IR89-OA02-08B	Y	—
		SG	IR89-SG04-08B	Y	—
		IA	IR89-IA04-08B	Y	—
		SV	IR89-IS11-SV-04-05-08B	Y	—
		SV	IR89-IS12-SV-04-05-08B	Y	—
Site 93	G930	GW	IR93-IS07-GW-12-13-08B	Y	—
		SV	IR93-IS07-SV-07-08-08B	Y	—
		GW	IR93-IS08-GW-12-13-08B	Y	—
		SV	IR93-IS08-SV-07-08-08B	Y	—
		GW	IR93-IS09-GW-12-13-08B	Y	—
		SV	IR93-IS09-SV-06-07-08B	Y	—

The sample ID naming convention for SV samples indicates the sample depth interval; the two sets of two digit numbers following SV is the sample depth interval. Shallow samples are considered those between 0-6ft bgs; deep samples are considered those intervals that exceed 6 ft bgs. Example: SWMU360-IS10-SV-13-14-08B indicates this soil gas sample was collected between 13 and 14 ft bgs and is therefore a deep soil gas sample.

2.2.1 Phase II Sample Locations

Sample locations from the Phase II sampling event are shown in Figure V6-4. The field data sheets associated with the samples collected are provided in Appendix V6-A. The COCs, which log the samples collected, are provided in Appendix V6-D.

Six subslab soil gas (sample type—SG) were collected at Camp Geiger during the Phase II field event. Quality control samples were collected in accordance with Section 2.7 of the FSP (CH2M HILL, 2008b). Additional information regarding the quality control samples is provided in Section 3.

The air samples listed in Table V6-2 were collected during the Phase II field event.

TABLE V6-2
Phase II Air Sampling Summary
Camp Geiger, MCB Camp Lejeune, North Carolina

Site Name	Bldg	Sample Type	Sample ID	Sample Collected (Y/N)	Deviations
Site 35	G531	SG	IR35-SG08-08C	Y	—
		SG	IR35-SG09-08C	Y	—
	G532	SG	IR35-SG10-08C	Y	—
		SG	IR35-SG11-08C	Y	—
	G533	SG	IR35-SG12-08C	Y	—
		SG	IR35-SG13-08C	Y	—

One minor deviation to the Work Plan occurred during the Phase II sampling event; sample IR35-SG07-08C, which was proposed for Building G530, was not collected because the first floor of this building is a small utility closet that is kept locked and is unoccupied.

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 between 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 V6-B.

All data collected in support of Phase I and Phase II sampling events are found to be of exceptional quality. No data were rejected due to quality assurance/quality control (QA/QC) deficiencies, and all data are available for use by the project team.

SECTION 4

Vapor Intrusion Evaluation Results and Conclusions

The purpose of this section is to present the results and conclusions for the vapor investigation results collected during Phases I and II at Camp Geiger. Tables V6-3 through V6-8 present a summary of the results from Phase I groundwater, shallow soil gas, deep soil gas, subslab soil gas, and indoor air and outdoor air samples. Figures V6-1 through V6-3 present the Phase I sample locations.

Table V6-9 summarizes the results from the Phase II subslab soil gas samples. Figure V6-4 presents the Phase II sample locations.

The text tables (V6-13 through V6-21) present the constituents that exceeded the screening levels. The other tables (V6-3 through V6-9) 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 raw laboratory data tables are provided in Appendix V6-E.

4.1 Outdoor Air

Outdoor air samples were collected during Phase I for comparison with indoor air concentrations in order to evaluate the potential influence of outside air on the indoor air quality. Table V6-8 (Phase I) presents the outdoor air results. Outdoor air samples were not collected during Phase II because indoor air samples were not collected. The maximum concentrations for each constituent which was detected in at least one outdoor air sample are presented in Table V6-10.

The following outdoor air samples were collected during Phase I:

- IR89-OA01-08B was collected near Building TC860
- IR89-OA02-08B was collected near TC864

TABLE V6-10
Maximum Concentrations Detected in Outdoor Air
Camp Geiger, MCB Camp Lejeune, North Carolina

Detected Constituents in Outdoor Air	Phase I Max Detect (ppbv)
1,1,1-Trichloroethane	0.056J
1,1,2,2-Tetrachloroethane	0.17J
1,1,2-Trichloro-1,2,2-trifluoroethane (Freon-13)	0.086J
1,1-Dichloroethene	0.11J
cis-1,2-Dichloroethene	6.9
trans-1,2-Dichloroethene	1.9

TABLE V6-10
Maximum Concentrations Detected in Outdoor Air
Camp Geiger, MCB Camp Lejeune, North Carolina

Detected Constituents in Outdoor Air	Phase I Max Detect (ppbv)
1,4-Dichlorobenzene	0.12J
2-Butanone (methyl-ethyl-ketone [MEK])	2.4
2-Hexanone	0.15J
4-Methyl-2-pentanone (methyl isobutyl ketone [MIBK])	0.39J
Acetone	22
Benzene	0.33
Carbon disulfide	1.1
Carbon tetrachloride	0.12J
Chloroform	0.042J
Chloromethane	1.2
Cyclohexane	0.08J
Dichlorodifluoromethane (Freon-12)	0.68
Ethylbenzene	0.27
Isopropylbenzene	0.95
Methylene Chloride	2.1
Tetrachloroethene (PCE)	0.11J
Toluene	0.93
Trichloroethene	0.53
Trichlorofluoromethane (Freon-11)	0.6
Vinyl chloride (VC)	0.54
m-Xylene & p-Xylene	1.5
o-Xylene	0.36

ppbv = parts per billion by volume

4.2 Aerobic Biodegradation Parameters

Petroleum hydrocarbons biodegrade under aerobic conditions in soil gas and groundwater near the top of the water table. Vadose zone oxygen concentrations above 4 percent are adequate for substantial degradation of benzene, toluene, ethylbenzene, and xylene (BTEX) constituents (DeVaull et al., 1997). The rate of degradation in the vapor phase of each petroleum hydrocarbon is different and can vary based on site conditions and the presence of other constituents. The aerobic biodegradation of petroleum hydrocarbons consumes oxygen and generates carbon dioxide.

Field measurements of oxygen were collected during Phase I with a multiRae Five gas meter to determine if sufficient oxygen is present in the subsurface to allow for aerobic biodegradation.

TABLE V6-11
Phase I Oxygen Measurements
Camp Geiger, MCB Camp Lejeune, North Carolina

Sample ID	O_2 (%)
IR35-IS02-SV-5-6-08B	20.9
IR35-IS05-SV-5-6-08B	15.5
IR35-IS06-SV-5-6-08B	7.0
IR93-IS07-SV-6-7-08B	20.0
IR93-IS08-SV-7-8-08B	20.1
IR93-IS09-SV-6-7-08B	15.0
IR89-IS10-SV-4-5-08B	17.5
IR89-IS11-SV-4-5-08B	20.3
IR89-IS12-SV-4-5-08B	15.6
IR89-SG03-08B	14.8
IR89-SG04-08B	19.1
IR35-SG05-08B	20.6
IR35-SG06-08B	19.1

Field measurements of oxygen were collected during the Phase II with a Gem2000 landfill gas meter to determine if sufficient oxygen is present in the subsurface to allow for aerobic biodegradation. Field measurements of carbon dioxide were also collected with the Gem2000 meter to determine if aerobic biodegradation may have already occurred.

TABLE V6-12
Phase II Oxygen and Carbon Dioxide Measurements
Camp Geiger, MCB Camp Lejeune, North Carolina

Sample ID	O_2 (%)	CO_2 (%)
IR35-SG08-08C	21.5	0.0
IR35-SG09-08C	15.7	0.8
IR35-SG11-08C	21.2	0.0
IR35-SG12-08C	19.4	1.5
IR35-SG13-08C	20.8	0.0

At the least, 4 percent oxygen was detected at each of the sample locations from the Phase I and Phase II sampling events, which indicates that there is the potential for aerobic biodegradation of hydrocarbons in the soil gas near each of the buildings sampled. If petroleum hydrocarbons are determined to be constituents of interest at these buildings, the potential for aerobic biodegradation will be considered as an additional line of evidence for the vapor intrusion evaluation.

4.3 Building Specific Data Evaluations and Conceptual Site Model Discussions

A vapor intrusion 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 Department of Defense (DOD, 2009) vapor intrusion guidance, multiple lines of evidence were incorporated into the vapor intrusion CSM. The initial or 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, soil gas.

Transport mechanisms for VOCs in the vadose zone 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 will 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 of the slab. Pressurization of the building is dependent on things 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 affects how quickly VOCs in the building dissipate or are diluted. The location (above, on, or below grade) of the slab determines how close the building is to the source area. The integrity (thickness and presence of openings) of the slab determines how readily VOCs may enter the building.

Building surveys were completed during Phase I and II at buildings where interior samples were collected to gather information on building characteristics relevant to the vapor intrusion pathway. The building survey forms are presented in Appendix V6-C.

The information provided in the building survey forms was gathered during initial visits to the building and in some instances, obtained based only on rough estimates (e.g., dimensions were estimated, not measured). More complete and accurate information was gathered by the sampling team during other trips made to the buildings during the Phase II sampling event. Building information was also obtained from building schematics provided by the Navy and/or photographs; however, these documents and photos were not included in the report due to their sensitive nature.

Groundwater and exterior soil gas samples were associated primarily with individual buildings as indicated in Table V6-1. However, select groundwater and exterior soil gas samples were also considered in the evaluations at neighboring buildings.

4.3.1 Site 35

Site 35, formerly the Camp Geiger Area Fuel Farm, is located within Camp Geiger, in the northwest portion of the Base. Site 35 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 the construction of the U.S. Highway 17 Bypass. During the active life of the fuel farm, several releases of fuel occurred. Remedial investigations completed in 2007 identified fuel-related (primarily benzene) and solvent-related (primarily trichloroethene [TCE] and dichloroethene [cis-1,2-DCE]) groundwater contamination in the surficial aquifer.

Building G480

Building G480 is located within Site 35. It is utilized for equipment storage and contains teaching classrooms. It is classified as a large industrial building for this evaluation. Building G480 was included in Phase I based on the observance of light non–aqueous phase liquid (LNAPL) in monitoring well IR35-MW67 during previous investigations. Shallow groundwater flows to the northeast; Building G480 is upgradient of IR35-MW67.

Building Characteristics. Building G480 is a one-story concrete block building approximately 200 ft long by 75 ft wide. The ceiling is approximately 12 ft high. The east one third of the building contains two classrooms and several offices and the other two thirds of the building is used as storage space.

Building G480 has a stem wall foundation and there are likely additional footings underneath the pillars observed within the building. The concrete slab is elevated approximately 3 ft above the ground surface. The slab is approximately 8 inches thick and is in good condition.

Building G480 has a heating, ventilation, and air conditioning (HVAC) unit with one evaporator/condenser unit. The building has 13 windows and 11 doors that typically remain closed. However, the front doors are propped open during the day when the weather is nice.

Potential indoor sources of VOCs were observed during the Phase I sampling event and included unknown gas canisters and Pledge®.

There are approximately 10 workers occupying this building during working hours, which are 7:00 a.m. to 3:00 p.m. on weekdays and weekends.

Analytical Results. Phase I subslab and indoor air sample locations are shown in Figure V6-4. Analytical results are provided in Tables V6-6 and V6-7. Results for VOCs exceeding corresponding Soil Gas Screening Levels (SGSLs), or indoor air Regional Screening Levels (RSLs) are summarized in Table V6-13.

TABLE V6-13
Summary of Building G480 Investigation Results
Camp Geiger, MCB Camp Lejeune, 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	*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-Dichlorobenzene (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

BOLD indicates exceeds Base-Specific SGSL; IASL = Indoor Air Screening Level;
1,2-DCA = 1,2-dichloroethane;
- indicates the compound does not exceed the screening level

Refined CSM. Building G480 is located approximately 100 ft southwest and upgradient of IR35-MW67 (screened 5 to 15 ft bgs) where LNAPL has previously been observed.

Two subslab soil gas samples and two indoor air samples were collected during Phase I. Ethylbenzene was detected in subslab soil gas samples at concentrations 1.8 and 2.4 times the generic SGSL, but at least 42 times below the base-specific SGSL of 1,130 ppbv. Although ethylbenzene was detected in one of the two Phase I indoor air samples at two times its IASL and approximately 10 times the maximum outdoor air concentration (Table V6-13), it is likely due to an indoor source(s) since (1) subslab concentrations were significantly less than the base-specific SGSL, and (2) several other constituents were detected in indoor air that are unrelated to vapor intrusion. Regardless of the source (e.g., aboveground indoor source), the measured indoor air concentration of ethylbenzene at IR35-IA05 is assumed to be insignificant since it was only two times the IASL and therefore, would result in an estimated risk well below the upper end of the target cancer risk range (1E-06 to 1E-04). The absence of groundwater data does not create a significant data gap, since subslab soil vapor samples were collected and the measured concentrations would account for VOCs originating in groundwater, soil, and/or LNAPL (if actually present beneath the structure). The fact that these subslab soil gas samples had concentrations only about 2 times higher than the generic screening level and at least 42 times lower than a base-specific screening level provides a relatively good argument to support the conclusion. Although the conclusion is based on limited information, additional round of sampling aims to confirm the conclusion that the indoor air concentrations are not likely due to a subsurface source.

Four other constituents were detected in the two Phase I indoor air samples in exceedance of the IASLs: 1,2-DCA, 1,4-dichlorobenzene, benzene, and carbon tetrachloride. The presence of these constituents in indoor air is not likely related to vapor intrusion because they were

not detected in exceedance of the generic SGSLs in subslab soil gas. Additionally, the indoor air concentration of carbon tetrachloride was similar to the maximum outdoor air detection. Additional subslab and/or indoor air sampling was not proposed for the Phase II sampling event.

Conclusions. Significant subsurface-to-indoor impacts were not observed at Building G480A based on a review of the Phase I subslab and indoor air data, and the additional lines of evidence (e.g., outdoor air, potential indoor sources,) recommended by the DOD (2009) and Interstate Technology & Regulatory Council (ITRC, 2007). This multiple-lines-of-evidence review indicated that the measured indoor air concentrations above screening levels were likely due to indoor and/or outdoor sources.

Recommended Further Actions

1. An additional round of concurrent subslab and indoor air data should be collected at Building G480 to confirm the above conclusions and to address temporal variability associated with soil gas sampling.
2. The Base should consider the vapor intrusion pathway during construction planning at Building G480 to ensure 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.
3. If remedial actions are being performed to address groundwater or soil contamination the vapor intrusion pathway should be reevaluated during and after remedial actions.

Building G521

Building G521 is located within Site 35. It is utilized as barracks for the School of Infantry. It is classified as a large industrial building for this evaluation. Building G521 was included in Phase I and is located within 100 ft of one temporary monitoring well (IR35-IS213) which had an exceedance of the site-specific groundwater screening level (GWSL) for benzene. Shallow groundwater flows to the northeast; Building G521 is upgradient of IR35-IS213.

Building Characteristics. Building G521 is a three-story brick building that is approximately 150 ft long by 75 ft wide. The building is approximately 35 ft high; the ceilings on each floor are approximately 8 ft high. One third of each floor contains the bathrooms, laundry facilities, and an office. The other two thirds of each floor are sleeping quarters, which is an open space filled with bunk beds and cubbies.

Building G521 has a stem wall foundation, and there are likely additional footings underneath the pillars observed within the building. The concrete slab is elevated approximately 3 ft above the ground surface. The slab is approximately 6 inches thick and is in good condition.

Building G521 has a multi-zone heating/cooling system. The building has 66 windows, nine doors, and stairs on each side. Doors and windows are generally kept closed but doors may be propped open at times.

There are approximately 30 occupants on each floor of the building at any given time. A class of soldiers will live in the barracks for a few months before they graduate and are moved to housing that is more permanent.

Analytical Results. Historical (2002–2007) shallow VOC groundwater concentrations within 100 ft of Building G521 that were above the site-specific GWSLs are summarized in this section and were taken from the Work Plan (CH2M HILL, 2008a). The historical groundwater exceedances are shown in Figure V6-6. Phase I groundwater sample locations are shown in Figure V6-1, and the results are provided in Table V6-3. Results for VOCs with GWSL exceedances are shown in Table V6-14.

TABLE V6-14
Summary of Building G521 Investigation Results
Camp Geiger, MCB Camp Lejeune, North Carolina

Building G521 Historical (2002–2007) Site-Specific Groundwater Screening Level Exceedances

Well ID	Screen Depth (ft bgs)	Benzene (µg/L)
GWSL		*12.8*
IR35-IS213	20–24	21

Building G521 Phase I Generic Groundwater Screening Level Exceedances

Sample ID	Benzene (µg/L)
GWSL (based on residential air RSL)	*1.37*
IR35-IS01-GW-8-9-08B	-

- indicates the compound does not exceed the screening level

Refined CSM. Historical (from 2002 to 2007) benzene concentrations in a nearby monitoring well, IR35-IS213 (20 to 24 ft bgs screen depth), were 1.6 times the site-specific GWSL. This monitoring well is approximately 100 ft north and upgradient of Building G521. Based on the historical groundwater results, benzene impacts would be expected in shallow groundwater north of Building G521. However, as discussed below, benzene was not detected in the sample collected at the top of the water table during the Phase I sampling event.

One groundwater grab sample was collected during Phase I. One soil gas sample was proposed for this area however, groundwater was present at 6 ft bgs and was therefore too shallow to collect a soil gas sample. The groundwater sample collected at IR35-IS01 did not contain any constituents that exceeded the residential generic GWSLs. Additional subslab sampling was not proposed for the Phase II sampling event.

Conclusions. Groundwater does not appear to be a significant vapor intrusion source at Building G521 because there were no VOCs detected in exceedance of the generic GWSLs in the Phase I water table (8–9 ft bgs) groundwater grab sample. The historical benzene detection above the site-specific GWSL was from a deeper (20–24 ft bgs) well approximately 100 ft north and upgradient of the building.

An additional line of evidence that vapor intrusion is not likely significant at Building G521 is based on the observation that subslab concentrations from Buildings G532 and G533

(discussed in subsequent sections) that are located closer to the impacted groundwater plume at the former Camp Geiger Area Fuel Farm did not exceed residential base-specific SGSLs. It is unlikely that the vapor intrusion pathway could cause unacceptable concentrations of VOCs in indoor air at Building G521. If VOC concentrations significantly increase in subslab soil gas at Buildings G532 and G533, then subslab soil gas sampling at Building G521 may be recommended.

Building G530

Building G530 is located within Site 35. The building is utilized as an office. It is classified as a large industrial building for this evaluation. Building G530 was included in Phase I and is located within 100 ft of one temporary monitoring well (IR35-IS218) which has exceedance of the site-specific GWSLs for benzene. Shallow groundwater flows to the northeast; Building G530 is cross-gradient of IR35-IS218.

Building Characteristics. Building G530 is a two-story brick building approximately 50 ft long by 50 ft wide. The first floor of the building is only 25 ft long by 25 ft wide; portions of the second story on each side stick out from the first floor. The first floor is not occupied; it is a locked utility closet. The second floor is an office and lounge area for the soldiers in charge of the G531–534 barracks. The concrete slab is level with the ground surface; the slab thickness is unknown since no subslab samples were collected in this building. Building G530 has a single-zone heating/cooling system.

The building has 20 ft of continuous windows on three sides of the second floor and two doors on the other side. The windows do not open and the doors are generally kept closed but may be propped open at times.

There are approximately five workers occupying this building during business hours, which are 7:00 a.m. to 3:00 p.m. on weekdays.

Analytical Results. Historical (2002–2007) shallow groundwater VOC concentrations within 100 ft of Building G530 that were above the site-specific GWSLs were taken from the Work Plan (CH2M HILL, 2008a) and are summarized in this section. The historical groundwater exceedances are shown in Figure V6-6. Phase I groundwater sample locations are shown in Figure V6-1, and the Phase I groundwater sample results are provided in Table V6-3. Phase I soil gas sample locations are shown in Figure V6-1 and Phase I soil gas sample results are provided in Table V6-4. Results for VOCs with GWSL and/or SGSL exceedances are provided in Table V6-15.

TABLE V6-15
Summary of Building G530 Investigation Results
Camp Geiger, MCB Camp Lejeune, North Carolina

Building G530 Historical (2002–2007) Site-Specific Groundwater Screening Level Exceedances

Well ID	Screen Depth (ft bgs)	Benzene (µg/L)
GWSL		*12.8*
IR35-IS218	20 - 24	17

Building G530 Phase I Generic Groundwater Screening Level Exceedances

Sample ID	Benzene (µg/L)
GWSL (based on industrial air RSL)	*7.05*
IR35-IS02-GW-9-10-08B	-
IR35-IS03-GW-9-10-08B	-

Building G530 Phase I Shallow Soil Gas Screening Level Exceedances

Sample ID	Benzene (µg/L)	Ethylbenzene (ppbv)	PCE (ppbv)
SGSL (based on industrial air RSL; AF=1E-01)	*5.01*	*11.3*	*3.1*
Base-Specific SGSL (AF=1E-03)	501	1,130	310
IR35-IS02-SV-5-6-08B	-	-	-

BOLD indicates exceeds Base-Specific SGSL
- indicates the compound does not exceed the screening level

Refined CSM. A three dimensional CSM figure is provided as Figure V6-5. The Phase I sample locations and results for VOCs with GWSL and/or SGSL exceedances for Building G530 are shown in this figure. Historical (2002–2007) benzene concentrations in a nearby monitoring well, IR35-IS218 (20 to 24 ft bgs screen depth), were 1.3 times the site-specific GWSL. This monitoring well is located approximately 20 ft northwest and cross-gradient of Building G530. Based on the historical groundwater results, benzene impacts were potentially anticipated in shallow groundwater northwest of Building G530. This historical groundwater-monitoring well GWSL exceedance triggered the Phase I sampling.

Co-located Phase I groundwater grab and soil gas samples were collected from IR35-IS02, located due north of Building G530 (40 ft northeast of IR35-IS218). Although benzene exceeded its GWSL at IR35-IS218 (20 to 24 ft bgs), it was not detected in the IR35-IS02 water table sample during Phase I. Benzene was also not detected in the IR35-IS03 water table sample, which was collected south of Building G531 and 70 ft downgradient of Building G530 (Figure V6-5). The groundwater samples collected at IR35-IS02 and IR35-IS03 did not contain any constituents that exceeded the industrial generic GWSLs. The exterior soil gas sample collected at IR35-IS02 also did not contain any VOCs at concentrations above industrial generic SGSLs. Additional subslab and/or indoor air sampling was not proposed for the Phase II sampling event.

Conclusions. There were no VOCs exceedances of the generic GWSLs in the nearby and down-gradient Phase I water table groundwater grab samples. There were also no

exceedances of the industrial generic SGSL at exterior soil gas location IS02. Therefore, significant vapor intrusion impacts are not expected. Additionally, the first floor of Building G530 is not occupied and most of the second floor extends outward from the first floor so it is located above ambient air.

An additional line of evidence that vapor intrusion is not likely significant at Building G530 is based on the observation that subslab concentrations from Buildings G532 and G533 (discussed in subsequent sections) that are located closer to the impacted groundwater plume at the former Camp Geiger Area Fuel Farm did not exceed residential base-specific SGSLs. It is unlikely that the vapor intrusion pathway could cause unacceptable concentrations of VOCs in indoor air at Building G530. If VOC concentrations significantly increase in subslab soil gas at Buildings G532 and G533 then additional sampling at Building G530 may be recommended.

Building G531

Building G531 is located within Site 35. The building is utilized as barracks for the School of Infantry. It is classified as a large industrial building for this evaluation. Building G531 is located within 100 ft of two monitoring wells that had exceedances of the site-specific GWSLs. Shallow groundwater flows to the northeast; Building G531 is downgradient of IR35-IS218 and IR35-IS19.

Building Characteristics. Building G531 is a three-story brick building that is approximately 100 ft long by 50 ft wide. The building is approximately 35 ft high; the ceilings on each floor are approximately 8 ft high. One third of each floor contains the bathrooms, laundry facilities and an office. The other two thirds of each floor are sleeping quarters, an open space filled with bunk beds and cubbies.

Building G531 has a stem wall foundation and there are likely additional footings underneath the pillars observed within the building. The concrete slab is elevated approximately 3 ft above the ground surface. The slab is approximately 6 inches thick and is in good condition; the expansion joints are sealed.

Building G531 has a multi-zone heating/cooling system. The building has 66 windows, nine doors, and stairs on each side. Doors and windows are generally kept closed but doors may be propped open at times.

Some potential indoor sources of VOCs observed during the Phase II event include Simple Green®, bleach, Windex®, and 409® (all-purpose cleaner). These items are used regularly for cleaning.

There are approximately 30 occupants on each floor of the building at any given time. A class of soldiers will live in the barracks for a few months before they graduate and are moved to housing that is more permanent.

Analytical Results. Historical (2002–2007) shallow groundwater VOC concentrations within 100 ft of Building G531 that were above the site-specific GWSLs are summarized in this section and were taken from the Work Plan (CH2M HILL, 2008a). The historical groundwater exceedances are shown in Figure V6-6. Phase I groundwater sample locations are shown in Figure V6-1 and the Phase I groundwater sample results are provided in Table V6-3. Phase I soil gas sample locations are shown in Figure V6-1, and Phase I soil gas sample

results are provided in Table V6-4. Phase II subslab soil gas sample locations are shown in Figure V6-4, and the Phase II subslab soil gas sample results are provided in Table V6-9. Results for VOCs with GWSL and/or SGSL exceedances are provided in Table V6-16.

TABLE V6-16
Summary of Building G531 Investigation Results
Camp Geiger, MCB Camp Lejeune, North Carolina

Building G531 Historical (2002–2007) Site-Specific Groundwater Screening Level Exceedances

Well ID	Screen Depth (ft bgs)	Benzene (µg/L)	VC (µg/L)
GWSL		*12.8*	*2.06*
IR35-IS218	20–24	17	-
IR35-IS219	20–24	-	6.9
IR35-MW381W	39.5–43.5	-	-
IR35-IS215	20–24	-	-

Building G531 Phase I Generic Groundwater Screening Level Exceedances

Sample ID	Benzene (µg/L)	VC (µg/L)	Chloroform (µg/L)
GWSL (based on residential air RSL)	*1.37*	*0.145*	*0.733*
IR35-IS02-GW-9-10-08B	-	1U	1U
IR35-IS03-GW-9-10-08B	-	1U	1U
IR35-IS04-GW-8-9-08B	-	1U	1U
IR35-IS05-GW-9-10-08B	-	1U	2.1

Building G531 Phase I Shallow 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-IS02-SV-05-06-08B	1.4	2U	2U	4.4	3
IR35-IS05-SV-05-06-08B	4.8	2U	0.6	2.9	5.7

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

BOLD indicates exceeds the Base-Specific SGSL
- indicates the compound does not exceed the screening level

Refined CSM. A three-dimensional CSM image is provided as Figure V6-5. The Phase I and II sample locations and results for VOCs with GWSL and/or SGSL exceedances for Building G531 are shown in this figure. Historical VC concentrations in upgradient well IR35-IS219 were observed at concentrations 3.3 times the site-specific GWSL. The historical (2002–2007) benzene concentration from the ugradient temporary monitoring well, IR35-IS218 (20 to

24 ft bgs screen depth) north of Building G530 was 1.3 times the site-specific GWSL. The two monitoring wells located north and downgradient of Building G531 did not contain any VOC exceedances of the site-specific GWSLs. Based on the historical groundwater results, benzene and VC impacts were potentially anticipated in shallow groundwater south of Building G531. This historical groundwater-monitoring well GWSL exceedance triggered the Phase I sampling.

Four co-located groundwater grab and soil gas samples were targeted during Phase I and were within 100 ft of G531; IR35-IS02 is closer to G530, and IR35-IS05 is closer to G532 (Figure V6-5). Soil gas samples were not collected at IR35-IS03 and IR35-IS04 because groundwater was too shallow (5 ft bgs). VOCs were not detected above residential generic GWSLs at IR35-IS03 or IR35-IS04, which are located immediately up- and downgradient of Building G531 (Figure V6-5). However, there is some uncertainty about the concentrations of VC and chloroform in groundwater at these locations because the reporting limits were greater than the generic GWSLs. Benzene was detected at IR35-SG02 and IR35-SG05 between 1.4 and 4.9 times the residential SGSL based on an AF of 0.1. Ethylbenzene and PCE were also detected above the residential generic SGSLs in both soil gas samples. Chloroform was only detected in sample IR35-SG05 above the residential generic SGSL. There is some uncertainty about the concentrations of VC and chloroform in soil gas at these locations because the reporting limits were greater than the generic SGSLs. Subslab sampling was proposed for Phase II based on the Phase I groundwater and soil gas exceedances near adjacent Building G532 (Figure V6-5).

Two subslab soil gas samples (IR35-SG08 and IR35-SG09) were collected in Building G531 during Phase II. Chloroform was detected at between two and five times the residential generic SGSL in these two samples based on an AF of 0.1, but were well below (19 to 50 times) the base-specific residential SGSL based on an AF of 0.001. The results for chloroform were J-flagged to indicate the concentrations may be estimated. Benzene, VC, and PCE results at both subslab soil gas sample locations were non-detects above the respective reporting limits. There is some uncertainty about the concentrations of benzene, VC and PCE in the sub-slab soil gas at these locations because the reporting limits were greater than the generic SGSLs. Therefore, indoor air sampling was not warranted based on the Phase I and II results.

Conclusions. Groundwater does not appear to be a significant vapor intrusion source at Building G531 because there were no VOCs detected in exceedance of the generic GWSLs in the upgradient (IR35-IS03) or downgradient (IR35-IS04) Phase I water table groundwater grab samples. Chloroform was the only constituent that exceeded the residential generic SGSLs in the two Phase II subslab soil gas samples and those detections were well below the base-specific SGSLs; therefore, significant vapor intrusion impacts are not expected at Building G531.

An additional line of evidence that vapor intrusion is not likely significant at Building G531 is based on the observation that subslab concentrations from Buildings G532 and G533 (discussed in subsequent sections) that are located closer to the impacted groundwater plume at the former Camp Geiger Area Fuel Farm did not exceed residential base-specific SGSLs. It is unlikely that the vapor intrusion pathway could cause unacceptable concentrations of VOCs in indoor air at Building G531. If VOC concentrations significantly

increase in subslab soil gas at Buildings G532 and G533, then additional sampling at Building G531 may be recommended.

Recommended Further Actions

1. An additional round of subslab sample data should be collected at Building G531 to confirm that subslab soil gas concentrations are below the base-specific SGSLs. This is necessary due to the temporal variability associated with soil gas sampling.
2. The Base should consider the vapor intrusion pathway during construction planning at Building G531 to ensure 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 is a located within the Site 35 area. It is utilized as barracks for the School of Infantry. It is classified as a large industrial building for this evaluation. Building G532 was included in Phase I because it is located within 100 ft of two monitoring wells that have exceedances of the site-specific GWSLs. Shallow groundwater flows to the northeast; Building G532 is downgradient of IR35-IS219 and upgradient of IR35-MW29.

Building Characteristics. Building G532 is a three-story brick building that is approximately 100 ft long by 50 ft wide. The building is approximately 35 ft high; the ceilings on each floor are approximately 8 ft high. One third of each floor contains the bathrooms, laundry facilities, and an office. The other two thirds of each floor are sleeping quarters, which is an open space filled with bunk beds and cubbies.

Building G532 has a stem wall foundation and there are likely additional footings underneath the pillars observed within the building. The concrete slab is elevated approximately 3 ft above the ground surface. The slab is approximately 6 inches thick and is in good condition; the expansion joints are sealed.

Building G532 has a multi-zone heating/cooling system. The building has 66 windows, nine doors, and stairs on each side. Doors and windows are generally kept closed but doors may be propped open at times.

Some potential indoor sources of VOCs observed during the Phase II event include Simple Green®, bleach, Windex®, and 409® (all-purpose cleaner). These items are used regularly for cleaning.

There are approximately 30 occupants on each floor of the building at any given time. A class of soldiers will live in the barracks for a few months before they graduate and are moved to housing that is more permanent.

Analytical Results. Historical (2002–2007) shallow groundwater VOC concentrations within 100 ft of Building G532 that were above the site-specific GWSLs from the Work Plan (CH2M HILL, 2008a) are summarized in this section. The historical groundwater exceedances are shown in Figure V6-6. Phase I groundwater sample locations are shown in Figure V6-1, and the Phase I groundwater sample results are provided in Table V6-3. Phase I soil gas sample locations are shown in Figure V6-1, and Phase I soil gas sample results are

provided in Table V6-4. Phase II subslab soil gas sample locations are shown in Figure V6-4, and the Phase II subslab soil gas sample results are provided in Table V6-9. Results for VOCs with GWSL and/or SGSL exceedances are provided in Table V6-17.

TABLE V6-17
Summary of Building G532 Investigation Results
Camp Geiger, MCB Camp Lejeune, North Carolina

Building G532 Historical (2002–2007) Site-Specific Groundwater Screening Level Exceedances

Well ID	Screen Depth (ft bgs)	Benzene (µg/L)	VC (µg/L)
GWSL		*12.8*	*2.06*
IR35-IS219	20–24	-	6.9
IR35-MW381W	39.5–43.5	-	-
IR35-IS215	20–24	-	-
IR35-MW291W	42–46	-	-
IR35-MW29	6–15	20	-

Building G532 Phase I Generic Groundwater Screening Level Exceedances

Sample ID	Benzene (µg/L)	VC (µg/L)	Chloroform (µg/L)	Ethylbenzene (µg/L)
GWSL (based on residential air RSL)	*1.37*	*0.145*	*0.733*	*3.01*
IR35-IS04-GW-8-9-08B	-	1U	1U	-
IR35-IS05-GW-9-10-08B	-	1U	2.1	-
IR35-IS06-GW-10-11-08B	60	5U	5U	25

Building G532 Phase I Shallow 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-IS05-SV-05-06-08B	4.8	2U	0.6J	2.9	5.7
IR35-IS06-SV-05-06-08B	2.2	2U	0.61J	2.7	4.7

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)	*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

BOLD indicates exceeds Base-Specific SGSL
- indicates the compound does not exceed the screening level

Refined CSM. A three-dimensional CSM image is provided as Figure V6-5. The Phase I and II sample locations and results for VOCs with GWSL and/or SGSL exceedances for Building G532 are shown on this figure. The historical (2002–2007) VC concentration in nearby upgradient temporary monitoring well IR35-IS219 (20 to 24 ft bgs screen depth) was 3.3

times the site-specific GWSL. The historical benzene concentration in IR35-MW29 (6 to 15 ft bgs screen depth), downgradient of Building G532, was 1.6 times the site-specific GWSL. These historical groundwater-monitoring well GWSL exceedances triggered the Phase I sampling.

Choroform, benzene, and ethylbenzene were detected above generic residential-based GWSLs in up- and down-gradient Phase I water table samples adjacent to Building G532 (Figure V6-5). There is some uncertainty about the concentrations of chloroform in the groundwater at these locations because the reporting limits were greater than the generic GWSLs. Chloroform, benzene, ethylbenzene, isopropylbenzene, and PCE were detected above generic residential-based SGSLs at these same exterior up- and downgradient Phase I sampling locations. The results for chloroform were J-flagged to indicate the concentrations may be estimated. There is some uncertainty about the concentrations of VC in the soil gas at these locations because the reporting limits were greater than the generic SGSLs. Therefore, subslab sampling at Building G532 was proposed for Phase II.

Two subslab soil gas samples were collected in Building G532 during Phase II. PCE was the only VOC detected above (3.6 times IR35-SG10) its residential-based generic SGSL; however, this detection was well below (28 times) the base-specific residential SGSL. There is some uncertainty about the concentrations of benzene, VC, chloroform, and PCE in the sub-slab soil gas at these locations because the reporting limits were greater than the generic SGSLs. Therefore, indoor air sampling was not warranted based on the Phase I and II results.

Conclusions. Benzene, ethylbenzene, chloroform, and PCE were detected above generic residential-based GWSLs and/or SGSLs in the up- and downgradient Phase I exterior samples adjacent to Building G532. However, PCE was the only constituent that exceeded the residential generic SGSLs in the two Phase II subslab soil gas samples and that detection was well below the base-specific SGSLs. Therefore, significant vapor intrusion impacts are not expected at Building G532 based on the Phase I and II results.

Recommended Further Actions

1. An additional round of subslab sample data should be collected at Building G532 to confirm that subslab soil gas concentrations are below the base-specific SGSLs. This is necessary due to the temporal variability associated with soil gas sampling.
2. The Base should consider the vapor intrusion pathway during construction planning at Building G532 to ensure 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 within Site 35. It is utilized as barracks for the School of Infantry. It is classified as a large industrial building for this evaluation. Building G533 was included in Phase I because it is located within 100 ft of one monitoring well (IR35-MW29) that had exceedance of the site-specific GWSL for benzene. Shallow groundwater flows to the northeast; Building G53s is upgradient of IR35-MW29.

Building Characteristics. Building G533 is a three-story brick building that is approximately 100 ft long by 50 ft wide. The building is approximately 35 ft high; the ceilings on each floor are approximately 8 ft high. One third of each floor contains the bathrooms, laundry facilities and an office. The other two thirds of each floor are sleeping quarters which is an open space filled with bunk beds and cubbies.

Building G533 has a stem wall foundation and there are likely additional footings underneath the pillars observed within the building. The concrete slab is elevated approximately 3 ft above the ground surface. The slab is approximately 6 inches thick and is in good condition; the expansion joints are sealed.

Building G533 has a multi-zone heating/cooling system. The building has 66 windows, nine doors, and stairs on each side. Doors and windows are generally kept closed, but doors may be propped open at times.

Some potential indoor sources of VOCs observed during the Phase II event include Simple Green®, bleach, Windex®, and 409® (all-purpose cleaner). These items are used regularly for cleaning.

There are approximately 30 occupants on each floor of the building at any given time. A class of soldiers will live in the barracks for a few months before they graduate and are moved to housing that is more permanent.

Analytical Results. Historical (2002–2007) shallow groundwater VOC concentrations within 100 ft of Building G533 that were above the site-specific GWSLs are summarized in this section and were taken from the Work Plan (CH2M HILL, 2008a). The historical groundwater exceedances are shown in Figure V6-6. Phase I groundwater sample locations are shown in Figure V6-1 and the Phase I groundwater sample results are provided in Table V6-3. Phase I soil gas sample locations are shown in Figure V6-1, and Phase I soil gas sample results are provided in Table V6-4. Phase II subslab soil gas sample locations are shown in Figure V6-4, and the Phase II subslab soil gas sample results are provided in Table V6-9. Results for VOCs with GWSL and/or SGSL exceedances are provided in Table V6-18.

TABLE V6-18
Summary of Building G533 Investigation Results
Camp Geiger, MCB Camp Lejeune, North Carolina

Building G533 Historical (2002–2007) Site-Specific Groundwater Screening Level Exceedances

Well ID	Screen Depth (ft bgs)	Benzene (µg/L)
GWSL		*12.8*
IR35-MW291W	42–46	-
IR35-MW29	6–15	20

Building G533 Phase I Generic Groundwater Screening Level Exceedances

Sample ID	Benzene (µg/L)	Chloroform (µg/L)	Ethylbenzene (µg/L)
GWSL (based on residential air RSL)	*1.37*	*0.733*	*3.01*
IR35-IS05-GW-09-10-08B	-	2.1	-
IR35-IS06-GW-10-11-08B	60	5U	25

Building G533 Phase I Shallow 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-IS05-SV-05-06-08B	4.8	0.6J	2.9	5.7
IR35-IS06-SV-05-06-08B	2.2	0.61J	2.7	4.7

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	2U	3.2
IR35-SG13-08C	2U	0.83	2U	2U

BOLD indicates exceeds Base-Specific SGSL
- indicates the compound did not exceed the screening level

Refined CSM. A three-dimensional CSM image is provided as Figure V6-5, which shows the Phase I and II sample locations and results for VOCs with GWSL and/or SGSL exceedances for Building G533. The historical (2002–2007) benzene concentration in the nearby downgradient monitoring well IR35-MW29 (6–15 ft bgs screen depth) was 1.6 times the site-specific GWSL. The intermediate (42–46 ft bgs) well IR35-MW29IW did not have any VOC exceedances of the site-specific GWSLs. The historical VC concentration from the well (IR35-IS219) south of Buildings G531 and G532 exceeded its site-specific GWSL by 3.3 times. These historical groundwater-monitoring well GWSL exceedances triggered the Phase I sampling.

The Phase I water table and/or soil gas chloroform, benzene, ethylbenzene, and PCE exceedances of the generic residential-based GWSLs and/or SGSLs in the samples adjacent to Building G532 (Figure V6-5) resulted in subslab sampling at Building G533 during Phase II. There is some uncertainty about the concentrations of chloroform in the groundwater at these locations because the reporting limits were greater than the generic GWSLs. The results for chloroform in the soil gas samples were J-flagged to indicate the concentrations may be estimated.

Two subslab soil gas samples were collected in Building G533 during Phase II. Chloroform and PCE were the only VOCs detected above (four to 16 times) their generic residential-based SGSLs in one or both subslab soil gas samples (Figure V6-5); however, these

detections were well below (six to 27 times) their base-specific residential SGSLs. There is some uncertainty about the concentrations of benzene, ethylbenzene, and PCE in the sub-slab soil gas at these locations because the reporting limits were greater than the generic SGSLs. Therefore, indoor air sampling was not warranted based on the Phase I and II results.

Conclusions. Benzene, ethylbenzene, chloroform, and PCE were detected above generic residential-based GWSLs and/or SGSLs in the exterior samples adjacent to nearby Building G532. However, PCE and chloroform were the only constituent that exceeded the generic residential-based SGSLs in the Building G533 subslab soil gas samples and these detections were well below the base-specific SGSLs. Therefore, significant vapor intrusion impacts are not expected at Building G533 based on the Phase I and II results.

Recommended Further Actions

1. An additional round of subslab sample data should be collected at Building G533 to confirm that subslab soil gas concentrations are below the base-specific SGSLs. This is necessary due to the temporal variability associated with soil gas sampling.
2. The Base should consider the vapor intrusion pathway during construction planning at Building G533 to ensure 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.

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. Within Site 89, Buildings TC860 and TC864 were retained for further evaluation (Figure V6-2).

Building TC860

Building TC860 is located within Site 89. It is utilized as the initial recruit processing building. It is classified as a large industrial building for this evaluation. It is located within 100 ft of one monitoring well that had exceedances of the site-specific GWSLs for PCE and TCE. Shallow groundwater flows southwest; Building TC860 is cross-gradient of IR89-MW43. There are also two permanent soil gas–monitoring probes on the east side of Building TC860 that were installed and sampled as part of an air-sparging treatability study conducted in 2007 that had elevated concentrations of several VOCs while the air sparge test was occurring.

Building Characteristics. Building TC860 is a one-story wood building that is approximately 150 ft long by 75 ft wide. The ceiling is approximately 10 ft high. The northern half of the building contains a classroom and the southern half contains offices. There are also male and female restrooms on the west side of the building.

Building TC860 has a stem wall foundation; the concrete slab is elevated approximately 4 ft above the ground surface. The slab is approximately 6 inches thick and is in good condition; the expansion joints are sealed.

Building TC860 has a multi-zone heating/cooling system. The building has 66 windows, nine doors, and stairs on each side; eight doors and eight windows typically remain closed.

Some potential indoor sources of VOCs observed during the Phase I event include Pine Sol®, bleach, and other cleaning supplies that are used regularly for cleaning.

There are approximately 20 to 80 workers occupying this building during working hours, which are 7:00 a.m. to 3:00 p.m. weekdays.

Analytical Results. Historical (2002–2007) shallow groundwater VOC concentrations within 100 ft of Building TC860 which were above the site-specific GWSLs and the historical soil gas results, taken from the Work Plan (CH2M HILL, 2008a), are summarized in this section. The historical groundwater exceedances are shown in Figure V6-7. Phase I subslab and indoor air sample locations are shown in Figure V6-2. Analytical results are provided in Tables V6-6 and V6-7. Results for VOCs with SGSL, and/or IASL exceedances are provided in Table V6-19.

TABLE V6-19
Summary of Building TC860 Investigation Results
Camp Geiger, MCB Camp Lejeune, North Carolina

Building TC860 Historical (2002–2007) Site-Specific Groundwater Screening Level Exceedances

Well ID	Screen Depth (ft bgs)	PCE (µg/L)	TCE (µg/L)
GWSL		*5.82*	*28.7*
IR89-MW43	18-23	7.82	280

Building TC860 Historical (2002–2007) Soil Gas Concentrations

Sample ID	Screen Depth (ft bgs)	PCE (ppbv)	TCE (ppbv)	Cis-1,2-DCE (ppbv)	1,1,2,2-PCA (ppbv)	VC (ppbv)
SGSL (based on industrial air RSL;AF = 1E-01)		*3.1*	*11.4*	*NA*	*0.306*	*11*
Base-Specific SGSL (AF=1E-03)		*310*	*1,140*	*NA*	*30.6*	*1,100*
IR89-SV01	4–5	295	**8,370**	648	ND	2.09
IR89-SV02	4–5	**602**	**7,230**	244	**74**	3.46

Building TC860 Phase I Shallow Soil Gas Screening Level Exceedances

Sample ID	PCE (ppbv)	TCE (ppbv)	Cis-1,2-DCE (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*	*NA*	*0.306*	*11*	*11.3*	*1.09*
Base-Specific SGSL (AF=1E-03)	*310*	*1,140*	*NA*	*30.6*	*1,100*	*1,130*	*109*
IR89-IS10-SV-4-5-08B (IR89-SV01)	74	**1,200**	-	7.2U	-	-	2.9J
IR89-IS11-SV-5-5-08B (IR89-SV02)	-	-	-	2U	-	-	2U

Building TC860 Phase I Subslab Soil Gas Screening Level Exceedances

Sample ID	PCE (ppbv)	TCE (ppbv)	Cis-1,2-DCE (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*	*NA*	*0.306*	*11*	*11.3*	*1.09*
Base-Specific SGSL (AF=1E-03)	*310*	*1,140*	*NA*	*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)	Cis-1,2-DCE (ppbv)	1,1,2,2-PCA (ppbv)	VC (ppbv)	Ethyl benzene (ppbv)	Chloroform (ppbv)
Industrial Air RSL	*0.31*	*1.14*	*NA*	*0.0306*	*1.1*	*1.13*	*0.109*
IR89-IA01-08B	-	-	-	0.13J	-	-	-
IR89-IA02-08B	-	-	-	0.15J	-	-	-

BOLD indicates exceeds Base-Specific SGSL
- indicates the compound was not detected above the screening level

Refined CSM. Historical (2002–2007) PCE and TCE concentrations in a nearby cross-gradient monitoring well, IR89-MW43, were 1.3 and 9.8 times the site-specific GWSL. Concentrations of PCE and TCE in the two permanent soil gas probes on the east side of Building TC860 were elevated well above generic SGSLs while an air sparging treatability test was being performed in 2007. The historical groundwater and soil gas PCE and TCE concentrations triggered the Phase I sampling.

Two subslab soil gas samples and two indoor air samples were collected during Phase I at Building TC860. Soil gas samples were also collected from the two permanent soil gas probes, IR89-SV01 and -SV02. The concentrations of PCE and TCE in soil gas were significantly less than those measured in 2007 while the air sparging test was occurring. The concentrations of PCE and TCE at IR78-SV02 (IR89-IS11) were below the generic SGSLs. The concentration of PCE at IR78-SV01 (IR89-IS10) was 25 times the generic SGSL but well below the base-specific SGSL of 310 ppbv. The concentration of TCE at IR78-SV01 (IR89-IS10) was 105 times the generic SGSL and 1.1 times the base-specific SGSL of 1,140 ppbv. Chloroform at IR78-SV01 (IR89-IS10) was 2.7 times the generic SGSL but well below the base-specific SGSL of 109 ppbv. There is some uncertainty about 1,1,2,2-PCA and chloroform in exterior soil gas because the reporting limits were above the SGSLs.

Several VOCs had subslab soil gas concentrations above the generic SGLs. PCE exceeded the generic SGSL by 1.9 and 7.4 times. TCE exceeded the generic SGSL by 1.9 and 20 times. Ethylbenzene exceeded the generic SGSL by two and three times. 1,1,2,2-PCA exceeded the generic SGSL by 5.2 times in IR89-SG01. There were no exceedances of the base-specific SGSLs in subslab soil gas samples. The greater concentrations of PCE and TCE were detected in IR89-SG01, which is closer to IR89-SV01 where the highest PCE and TCE exterior soil gas concentrations were observed, at the north side of Building TC860.

PCE, TCE, and ethylbenzene were not detected in Phase I indoor air samples above the IASL. 1,1,2,2-PCA was detected in both indoor air samples at 4.2 and 4.9 times the IASL. These detections, however, were less than the maximum detected outdoor air concentration of 0.17J ppbv. Therefore, it is unlikely that concentrations of 1,1,2,2-PCA in indoor air are the due to vapor intrusion. Phase II sampling was not deemed a priority because indoor air impacts are not currently occurring.

Conclusions. Although PCE, TCE, ethylbenzene, and chloroform subslab soil gas concentrations from Building TC860 during Phase I exceeded the generic shallow SGSL, these constituents were not detected in the Phase I indoor air sample above the IASLs. 1,1,2,2-PCA was detected in Phase I indoor air samples above the IASL, but at a concentration comparable to outdoor air levels and therefore is likely unrelated to vapor intrusion. The 1,1,2,2-PCA concentrations in indoor air are less than five times the IASL and therefore well below the target non-cancer hazard quotient of 1. Additionally, none of the constituents detected in the subslab soil gas exceeded the base-specific shallow SGSLs. Therefore, significant vapor intrusion impacts are not expected. There are, however, concentrations of TCE in exterior soil gas (4–5 ft bgs) within 10 ft of Building TC860 that exceed the base-specific SGSLs.

Recommended Further Actions

1. An additional round of subslab and exterior soil gas sample data should be collected at Building TC860 to address temporal variability associated with soil gas sampling. This is necessary due to the temporal variability associated with soil gas sampling.
2. The Base should consider the vapor intrusion pathway during construction planning at Building TC860 to ensure 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.
3. Subslab soil gas and/or indoor air sampling should be performed every 5 years not to exceed three rounds of sampling in the event soil gas and/or indoor air concentrations do not or are not anticipated to result in vapor intrusion concerns.
4. If remedial actions are being performed to address groundwater or soil contamination, the vapor intrusion pathway should be evaluated during and after remedial actions.

Building TC864

Building TC864 is located within Site 89. It is utilized as a storage area for student gear. It is classified as a large industrial building for this evaluation. It 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; Building TC864 is down- and cross-gradient of the three monitoring wells. There is also one permanent soil gas–monitoring probe on the south side of Building TC864 that was installed and sampled as part of an air-sparging treatability study conducted in 2007 that had elevated concentrations of several VOCs while the air sparge test was occurring.

Building Characteristics. Building TC864 is a one-story steel building approximately 150 ft long by 50 ft wide. The ceiling is approximately 15 ft high. The interior space is one large room that is full of student equipment.

The building likely has perimeter wall footings with additional footings underneath the pillars observed within the building. The concrete slab is level with the exterior ground surface; it is approximately 6 inches thick. The entire floor is bare concrete. The overall condition of the concrete is good; there are sealed expansion joints present and there are no floor drains.

Building TC864 does not have a HVAC system. The building has 11 windows, three double doors, one single door, and four bay doors that typically remain closed.

The building is typically unoccupied but it is accessed frequently.

Analytical Results. Historical (2002–2007) shallow groundwater VOC concentrations within 100 ft of Building TC864 were above the site-specific GWSLs and the historical soil gas results, taken from the Work Plan (CH2M HILL, 2008a), are summarized in this section. The historical groundwater exceedances are shown in Figure V6-7. Phase I soil gas, subslab, and indoor air sample locations are shown in Figure V6-2. Analytical results are provided in Tables V6-4, V6-6, and V6-7. Results for VOCs with SGSL, and/or IASL exceedances are provided in Table V6-20.

TABLE V6-20
Summary of Building TC864 Investigation Results
Camp Geiger, MCB Camp Lejeune, North Carolina

Building TC864 Historical (2002–2007) Site-Specific Groundwater Screening Level Exceedances

Well ID	Screen Depth (ft bgs)	PCE (µg/L)	TCE (µg/L)
GWSL		*5.82*	*28.7*
IR89-MW43	18–23	7.82	280
IR89-MW32	4–14	-	74
IR89-MW48A	20–25	-	45

Building TC864 Historical (2002–2007) Soil Gas Concentrations

Sample ID	Screen Depth (ft bgs)	PCE (ppbv)	TCE (ppbv)	Benzene (ppbv)	Cis-1,2-DCE (ppbv)	1,1,2,2-PCA (ppbv)	VC (ppbv)
SGSL (based on industrial air RSL;AF=1E-01)		*3.1*	*11.4*	*5.01*	*NA*	*0.306*	*11*
Base-Specific SGSL (AF=1E-03)		*310*	*1,140*	*501*	*NA*	*30.6*	*1,100*
IR89-SV02	4–5	**602**	**7,230**	-	244	**74**	3.46
IR89-SV03	4–5	**406**	**13,800**	10.1	4,340	10.4	126

Building TC864 Phase I Shallow Soil Gas Screening Level Exceedances

Sample ID	PCE (ppbv)	TCE (ppbv)	Benzene (ppbv)	Cis-1,2-DCE (ppbv)	1,1,2,2-PCA (ppbv)	VC (ppbv)	Chloro form (ppbv)
SGSL (based on industrial air RSL;AF=1E-01)	*3.1*	*11.4*	*5.01*	*NA*	*0.306*	*11*	*1.09*
Base-Specific SGSL (AF=1E-03)	*310*	*1,140*	*501*	*NA*	*30.6*	*1,100*	*109*
IR89-IS11-SV-5-5-08B (IR89-SV02)	-	-	-	-	2U	-	2U
IR89-IS12-SV-04-05-08B (IR89-SV03)	64	**1,600**	-	-	7U	-	11

Building TC864 Phase I Subslab Soil Gas Screening Level Exceedances

Sample ID	PCE (ppbv)	TCE (ppbv)	Benzene (ppbv)	Cis-1,2-DCE (ppbv)	1,1,2,2-PCA (ppbv)	VC (ppbv)	Chloro form (ppbv)	Ethyl benzene (ppbv)
Screening Criteria (Based on Industrial RSL;AF=1E-01)	*3.1*	*11.4*	*5.01*	*NA*	*0.306*	*11*	*1.09*	*11.3*
Base-Specific SGSL (AF=1E-03)	*310*	*1,140*	*501*	*NA*	*30.6*	*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)	Cis-1,2-DCE (ppbv)	1,1,2,2-PCA (ppbv)	VC (ppbv)	Chloro form (ppbv)	Ethyl benzene (ppbv)
Industrial Air RSL	*0.31*	*1.14*	*0.501*	*NA*	*0.0306*	*1.1*	*0.109*	*1.13*
IR89-IA03-08B	-	-	-	-	0.082	-	0.2U	-
IR89-IA04-08B	-	-	-	-	0.074	-	0.2U	-

BOLD indicates exceeds base-specific SGSL
- indicates the compound was not detected above the screening level

Refined CSM. Historical (2002–2007) PCE concentrations in one nearby cross-gradient monitoring well, IR89-MW43, were 1.3 times the site-specific GWSL. Historical TCE concentrations at three nearby down- and cross-gradient monitoring wells were 1.6 to 9.8 times the site-specific GWSL. Concentrations of PCE and TCE in the two permanent soil gas probes within 100 ft of Building TC864 were elevated well above generic SGLs while an air sparging treatability test was being performed in 2007. The historical groundwater and soil gas PCE and TCE concentrations triggered the Phase I sampling.

Two subslab soil gas samples and two indoor air samples were collected during Phase I at Building TC864. Soil gas samples were also collected from the two permanent soil gas probes, IR89-SV02 and -SV03 that are within 100 ft of Building TC864. IR89-SV02 is located approximately 100 ft northwest of the building and IR89-SV03 is located within 10 ft of the south side of the building. The concentrations of PCE and TCE in soil gas were significantly less than those measured in 2007 while the air sparging test was occurring.

The concentrations of PCE and TCE at IR78-SV02 (IR89-IS11) were below the generic SGSLs. The concentration of PCE at IR78-SV03 (IR89-IS12) was 21 times the generic SGSL but well below the base-specific SGSL of 310 ppbv. The concentration of TCE at IR78-SV01 (IR89-IS10) was 105 times the generic SGSL and 1.4 times the base-specific SGSL of 1,140 ppbv. Chloroform at IR78-SV03 (IR89-IS12) was 10 times the generic SGSL but well below the base-specific SGSL of 109 ppbv. There is some uncertainty about 1,1,2,2-PCA and chloroform in exterior soil gas because the reporting limits were above the SGSLs.

Several VOCs had subslab soil gas concentrations above the SGLS; PCE, ethylbenzene and chloroform exceeded generic SGSLs and TCE exceeded the base-specific SGSL. PCE exceeded the generic SGSL by 25 and 35 times. Ethylbenzene exceeded the generic SGSL by three and four times. Chloroform exceeded the generic SGSL by 3.3 times in IR89-SG04. TCE exceeded the base-specific SGSL by 1.7 times in both subslab soil gas samples. Soil gas concentrations appear to be fairly uniform under the building slab. Concentrations of PCE and TCE in subslab soil gas are greater at Building TC864 compared to the neighboring Building TC860. This is likely because Building TC864 is closer to Site 89, and the air sparge test line from 2007 was directly under Building TC864.

PCE, TCE, and ethylbenzene were not detected in Phase I indoor air samples above the IASL. 1,1,2,2-PCA was detected in both indoor air samples at 2.4 and 2.7 times the IASL. These detections, however, were less than the maximum detected outdoor air concentration of 0.17J ppbv; therefore, it is unlikely that concentrations of 1,1,2,2-PCA in indoor air are due to vapor intrusion. Phase II sampling was not deemed a priority because indoor air impacts are not currently occurring.

Conclusions. Although TCE subslab soil gas concentrations exceeded the base-specific SGSL and PCE, ethylbenzene and chloroform subslab soil gas concentrations from Building TC864 during Phase I exceeded the generic shallow SGSL. These constituents were not detected in the Phase I indoor air samples above the IASLs. 1,1,2,2-PCA was detected in Phase I indoor air samples above the IASL, but at a concentration comparable to outdoor air levels and therefore is likely unrelated to vapor intrusion. The 1,1,2,2-PCA concentrations in indoor air were less than five times the IASL and therefore well below the non-cancer hazard quotient of 1. There are, however, concentrations of TCE in exterior soil gas (4–5 ft bgs) within 10 ft of Building TC864 that exceed the base-specific SGSLs.

Recommended Further Actions

1. An additional round of subslab and exterior soil gas sample data should be collected at Building TC864 to address temporal variability associated with soil gas sampling. This is necessary due to the temporal variability associated with soil gas sampling. Indoor air sampling was performed at Building TC864 during Phase I. The Phase I indoor air concentrations did not exceed the target cancer risk range (1E-06 to 1E-04) or the non-cancer hazard quotient of 1. Additional indoor air sampling is not proposed at Building TC864 because this building is not occupied.
2. The Base should consider the vapor intrusion pathway during construction planning at Building TC864 to ensure 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.
3. Subslab soil gas and/or indoor air sampling should be performed every 5 years not to exceed three rounds of sampling in the event soil gas and/or indoor air concentrations do not or are not anticipated to result in vapor intrusion concerns.
4. If remedial actions are being performed to address groundwater or soil contamination, the vapor intrusion pathway should be evaluated during and after remedial actions.

4.3.3 Site 93

Site 93 is located within Camp Geiger immediately west of Site 89. The buildings in this portion of Camp Geiger were constructed during the Korean War and currently function as classrooms, barracks, and supply rooms for the Marine Infantry School. Historical records indicate that a 550-gallon underground storage tank (UST) storing waste oil was previously located on Site 93. Building G930 is the only building retained for further evaluation within Site 93.

Building G930

Building G930 is located on Site 93. It is utilized as a gymnasium. It is classified as a large industrial building for this evaluation. It is located within 100 ft of one monitoring well (IR93-MW10) which had an exceedance of the site-specific GWSL for PCE. Shallow groundwater flows northeast; Building G930 is upgradient of IR93-MW10.

Building Characteristics. Building G930 is a two-story brick building approximately 200 ft long by 200 ft wide. The building likely has perimeter wall footings with additional footings underneath the pillars observed within the building. The concrete slab is level with the exterior ground surface. The building has 32 windows and 4 doors.

A building survey was not performed at Building G930 because there was no interior sampling performed during Phase I or Phase II, so specific structural characteristics are not known.

Analytical Results. Historical (2002–2007) shallow groundwater VOC concentrations within 100 ft of Building G930 that were above the site-specific GWSLs, taken from the Work Plan (CH2M HILL, 2008a), are summarized in this section. The historical groundwater exceedances are shown in Figure V6-8. Phase I groundwater sample locations are shown in

Figure V6-3, and the Phase I groundwater sample results are provided in Table V6-3. Phase I soil gas sample locations are shown in Figure V6-3 and Phase I soil gas sample results are provided in Table V6-4. Results for VOCs with GWSL and/or SGSL exceedances are provided in Table V6-21.

TABLE V6-21
Summary of Building G930 Investigation Results
Camp Geiger, MCB Camp Lejeune, North Carolina

Building G930 Historical (2002–2007) Site-Specific Groundwater Screening Level Exceedances

Well ID	Screen Depth (ft bgs)	PCE (µg/L)
GWSL		*5.82*
IR93-MW10	4.5 - 14.5	26

Building G930 Phase I Generic Groundwater Screening Level Exceedances

Sample ID	PCE (µg/L)
GWSL (based on industrial air RSL)	*2.79*
IR93-IS07-GW-12-13-08B	-
IR93-IS08-GW-12-13-08B	-
IR93-IS09-GW-12-13-08B	-

Building G930 Phase I Deep Soil Gas Screening Level Exceedances

Sample ID	PCE (ppbv)
SGSL (based on industrial air RSL;AF=1E-01))	*31.0*
Base-Specific SGSL (AF=1E-03)	*3,100*
IR93-IS07-SV-7-8-08B	-
IR93-IS08-SV-7-8-08B	-
IR93-IS09-SV-6-7-08B	-

BOLD indicates exceeds the Base-Specific SGSL
- indicates the compound was not detected above the screening level

Refined CSM. Historical (2002–2007) PCE concentrations in one nearby downgradient monitoring well, IR93-MW10 (screen depth of 4.5 to 14.5 ft bgs), was 4.5 times the site-specific GWSL. This historical groundwater PCE concentration triggered the Phase I sampling.

Three co-located groundwater and soil gas samples were collected during Phase I at Building G930. There were no exceedances of the generic GWSLs or SGSLs in the Phase I samples. It is highly unlikely that the vapor intrusion pathway could cause VOC concentrations above the IASLs in indoor air at Building G930. There are no further actions proposed for Building G930.

SECTION 5

Overall Conclusions and Recommendations

The purpose of this section is to summarize the overall conclusions of the vapor intrusion evaluation for Camp Geiger that were performed as part of a phased basewide vapor intrusion evaluation of six investigation areas. Groundwater, exterior soil gas, and subslab soil gas samples were collected within or near nine buildings of interest in order to evaluate the potential for significant vapor intrusion impacts. Consistent with the DOD Tri-Services (2009) and ITRC Vapor Intrusion Guidance documents (2007) and the recently released United States Environmental Protection Agency (USEPA) TCE Toxicity and Vapor Intrusion memorandum (2009), multiple lines of evidence were used in Section 4 to evaluate potential vapor intrusion impacts at each of the nine buildings. Conclusions and recommended further actions were based on the multiple-lines-of-evidence evaluation and the refined CSMs. The conclusions and recommended further actions for the buildings investigated at Mainside during Phase I and II are summarized in Table V6-22.

Overall, the subslab and/or indoor air data collected to-date, along with the additional supporting lines of evidence indicate that vapor intrusion is not a current significant pathway of concern for any of the Camp Geiger buildings investigated during Phase I or Phase II. However, due to the magnitude of temporal variability associated with vapor intrusion sampling, an additional round of subslab soil gas data should be collected to confirm the conclusions at all buildings with only one round of subslab soil gas data.

Although current vapor intrusion impacts are not indicated based on the data collected to-date, site-related VOCs were detected in subslab samples from select buildings at concentrations well above generic and/or basewide vapor intrusion screening levels. Construction planning considerations, and/or monitoring are recommended for select buildings in order to address the potential for future vapor intrusion concerns.

TABLE V6-22
Summary of Recommendations
Camp Geiger, MCB Camp Lejeune, North Carolina

Bldg #	Additional Round of Subslab Sampling	Consider Vapor Intrusion Pathway During Construction Planning	Monitor Subslab Soil Gas and/or Indoor Air Every 5 Years	Consider Subslab Sampling if VOC Concentrations at Bldgs G532 and G533 Increase Significantly
Buildings of Interest Sampled During Phase I and Phase II				
G480	X	X		
G521				X
G530				X
G531	X	X		
G532	X	X		
G533	X	X		
TC860	X	X	X	
TC864	X	X	X	
G930			No Further Action	

5.1 Recommendations for Additional Sampling

The conclusions discussed in Section 4 were based primarily on a single round of soil gas, subslab, indoor, and/or outdoor air data. As discussed in the DOD Tri-Services (2009) and ITRC vapor intrusion guidance documents (2007) and at multiple USEPA and other vapor intrusion conferences (e.g., http://iavi.rti.org/WorkshopsAndConferences.cfm), temporal and spatial variability are important factors to consider during vapor intrusion investigations. The current conditions and conclusions should be confirmed at all buildings with only one round of subslab and/or indoor data given the magnitude of temporal variability and uncertainty generally observed during vapor intrusion investigations. Therefore, an additional round of subslab, indoor, and/or outdoor air data should be collected in 2009 at six of the buildings in Camp Geiger that were sampled once during Phase I or Phase II.

Subslab sampling was not deemed necessary during Phase II at Buildings G521 and G530 based on the Phase I groundwater and soil gas sample results as discussed in Section 4. However, if subslab soil gas concentrations at Buildings G532 and G533, which are located closer to the VOC source area, increase significantly, then subslab sampling should be considered at Buildings G521 and G530.

5.2 Recommendations for Construction Planning

Although current risks have not been identified, the Base should consider the vapor intrusion pathway during construction planning at buildings that had exceedances of the generic and/or basewide SGSLs to ensure 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 attenuation factor. The Base should consider air monitoring for construction activities that involving slab penetrations, such as removal of part of the slab or drilling holes through the slab. Additional data collection at the conclusion of construction may be warranted to ensure the base-specific AF remains appropriate. In addition, buildings currently used as industrial should remain industrial pending additional evaluation. Currently, these buildings include Buildings G480, G531, G532, G533, TC860, and TC864.

5.3 Recommendations for Monitoring

Although the data and lines of evidence evaluated to date indicate current vapor intrusion impacts are not occurring at the Camp Geiger buildings evaluated, subslab soil gas and/or indoor air monitoring is recommended at Buildings TC860 and TC864 in order to address the potential for future vapor intrusion concerns. This recommendation is based on the observation that site-related VOCs were detected in subslab or near-slab soil gas samples at concentrations exceeding the base-specific SGSLs.

5.4 Preferential Pathways

A preferential pathway is defined by ITRC (2007) as a subsurface feature that would increase the likelihood that there would be significant flow of soil gas into a building. Per

ITRC (2007), "Most buildings have subsurface utility penetrations, so their presence alone is not considered 'preferential.' For this guidance, some increased component of soil gas flow into the building is usually required to consider the pathway to be preferential. Anthropogenic preferential pathways include building sumps or drainage pits (that can serve as conduits for soil gas to enter buildings) or subsurface utility conduits or drains (that intersect vapor sources or soil gas migration routes and a building foundation)."

Since underground utilities can serve as conduits for vapor migration in the subsurface, they were identified and mapped using GIS (Figure V6-8). The locations of utilities with the greatest potential for significant horizontal vapor transport in the backfill material (e.g., stormwater and wastewater lines) were reviewed relative to the areas with elevated shallow groundwater, exterior soil gas, and/or subslab soil gas concentrations were observed during Phase I or Phase II. A preliminary review of Phase I and II data from nearby buildings was conducted in order to determine if the utility lines were creating significant preferential pathways for horizontal transport. This preliminary evaluation did not identify any obvious cases where significant vapor transport was occurring via preferential transport in utility corridors.

The utilities near Buildings TC860 and TC864 are shown in Figure V6-9. There are no utilities connecting areas of observed soil gas exceedances above the base-specific screening levels to adjacent buildings; therefore, additional sampling is not necessary at other buildings near TC860 and TC864 due to preferential pathways.

SECTION 6

References

CH2M HILL. 2008a. Vapor Intrusion Evaluation Work Plan.

CH2M HILL. 2008b. Field Sampling Plan.

DOD. 2009. Tri-Services

DeVaull et al. 1997

ITRC. 2007.

Tables

TABLE V6-3
Summary of Camp Geiger Phase I Groundwater Anaytical Results
Vapor Intrusion Report
Camp Geiger, MCB Camp Lejeune, North Carolina

Station ID	**Industrial Generic GW SL**	**Unrestricted Generic GW SL**	IR35-IS01		IR35-IS02	IR35-IS03	IR35-IS04	IR35-IS05	IR35-IS06	IR93-IS07	IR93-IS08	IR93-IS09
Sample ID			IR35-IS01-GW-08-09-08B	IR35-IS01D-GW-08-09-08B	IR35-IS02-GW-09-10-08B	IR35-IS03-GW-09-10-08B	IR35-IS04-GW-08-09-08B	IR35-IS05-GW-09-10-08B	IR35-IS06-GW-10-11-08B	IR93-IS07-GW-12-13-08B	IR93-IS08-GW-12-13-08B	IR93-IS09-GW-12-13-08B
Sample Date			06/21/08	06/21/08	06/21/08	06/21/08	06/21/08	06/21/08	06/21/08	06/22/08	06/22/08	06/22/08
Chemical Name												
Volatile Organic Compounds (UG/L)												
Acetone	88,200,000	20,200,000	10 U	10 U	10 U	2.4 J	1.5 J	3.2 J	50 U	10 U	5.3 J	1.5 J
Benzene	7.05	1.37	1 U	1 U	1 U	1 U	0.033 J	1 U	**60**	1 U	1 U	0.035 J
Bromodichloromethane	--	--	1 U	1 U	1 U	1 U	1 U	0.081 J	5 U	1 U	1 U	1 U
Carbon disulfide	5,300	1,200	1 U	1 U	1 U	1 U	0.15 J	1 U	0.58 J	0.27 J	1 U	1 U
Chloroform	3.53	0.733	1 U	1 U	1 U	1 U	1 U	**2.1**	5 U	1 U	1 U	1 U
Chloromethane	18.9	3.88	0.087 J	0.088 J	0.16 J	0.14 J	2 U	0.098 J	10 U	2 U	2 U	2 U
Ethylbenzene	15.2	3.01	1 U	1 U	1 U	1 U	1 U	1 U	**25**	1 U	1 U	1 U
Isopropylbenzene	37.9	8.85	1 U	1 U	1 U	1 U	0.049 J	1 U	**22**	1 U	1 U	1 U
Methyl-tert-butyl ether (MTBE)	1,840	368	1 UJ	1 UJ	1 UJ	1 UJ	1 U	1 UJ	5 U	0.057 J	1 UJ	1 UJ
Styrene	39,100	8,890	1 U	1 U	1 U	1 U	1 U	1 U	1.1 J	1 U	1 U	1 U
Tetrachloroethene	2.79	0.545	1 U	1 U	1 U	1 U	1 U	1 U	5 U	0.37 J	1 U	0.055 J
Toluene	81,000	19,100	1 U	1 U	1 U	0.053 J	0.1 J	0.053 J	20	0.073 J	0.061 J	0.12 J
Trichloroethene	14.5	2.85	1 U	1 U	1 U	1 U	1 U	1 U	5 U	0.33 J	1 U	0.85 J
Trichlorofluoromethane(Freon-11)	781	184	2 U	2 U	2.7	2 U	2 U	2 U	10 U	2 U	2 U	2 U
cis-1,2-Dichloroethene	--	--	1 U	1 U	1 U	1 U	1 U	1 U	5 U	0.14 J	1 U	5
m- and p-Xylene	1,400	319	0.07 J	0.073 J	0.045 J	0.069 J	0.12 J	0.04 J	15	0.063 J	0.064 J	0.17 J
o-Xylene	14,600	3,440	1 U	1 U	1 U	1 U	0.049 J	1 U	9	1 U	1 U	0.054 J
trans-1,2-Dichloroethene	678	164	1 U	1 U	1 U	1 U	1 U	1 U	5 U	1 U	1 U	0.4 J

Notes:

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

NA - Not analyzed

U - The material was analyzed for, but not detected

UG/L - Micrograms per liter

UJ - Analyte not detected, quantitation limit may be inaccurate

SL - Screening Levels

Shading indicates exceedance of Industrial Generic criteria

Bold text indicates exceedance of Unrestricted Generic criteria

TABLE V6-4
Summary of Camp Geiger Phase I Shallow Soil Vapor Analytical Results
Vapor Intrusion Report
Camp Geiger, MCB Camp Lejeune, North Carolina

Station ID	**Industrial Shallow Generic SVSL (AF=0.1) (ppbv)**	**Unrestricted Shallow Generic SVSL (AF=0.1) (ppbv)**	IR35-IS02		IR35-IS05	IR35-IS06	IR89-IS10	IR89-IS11	IR89-IS12
Sample ID			IR35-IS02D-SV-05-06-08B	IR35-IS02-SV-05-06-08B	IR35-IS05-SV-05-06-08B	IR35-IS06-SV-05-06-08B	IR89-IS10-SV-04-05-08B	IR89-IS11-SV-04-05-08B	IR89-IS12-SV-04-05-08B
Sample Date			06/21/08	06/21/08	06/21/08	06/21/08	06/24/08	06/24/08	06/24/08
Chemical Name									
Volatile Organic Compounds (ppbv)									
2-Butanone	74,600	17,600	10	7.9 J	13	15	36 U	10 U	35 U
2-Hexanone	31,700	7,570	1.6 J	0.81 J	0.97 J	1.1 J	18 U	5 U	18 U
4-Methyl-2-pentanone	31,700	7,560	1.3 J	0.56 J	5 U	5 U	18 U	5 U	18 U
Acetone	589,000	135,000	70	56	110	120	66 J	36 J	180 U
Benzene	5.01	0.97	**1.3 J**	**1.4 J**	**4.8**	**2.2**	7.2 U	0.88 J	**3.1 J**
Bromomethane	56.7	13.4	2 U	2 U	2 U	0.37 J	7.2 U	2 U	7 U
Carbon disulfide	9,950	2,340	1.2 J	1.4 J	1.4 J	2.2 J	18 U	5 U	18 U
Chloroform	1.09	0.225	2 U	2 U	**0.6 J**	**0.61 J**	**2.9 J**	2 U	**11**
Chloromethane	32.9	6.78	5 U	5 U	5 U	4 J	18 U	5 U	18 U
Cyclohexane	75,500	18,300	1.3 J	1.5 J	5.3	2.6 J	18 U	5 U	2.1 J
Dichlorodifluoromethane (Freon-12)	1,780	425	0.74 J	2 U	0.81 J	2 U	7.2 U	2 U	7 U
Ethylbenzene	11.3	2.23	**4.4**	**4.2**	**2.9**	**2.7**	**2.6 J**	2 U	**6.9 J**
Isopropylbenzene	3,660	854	2.5 J	2.2 J	1.5 J	1.6 J	14 U	4 U	14 U
Tetrachloroethene	3.1	0.605	**3**	**2.2**	**5.7**	**4.7**	**74**	0.41 J	**64**
Toluene	58,400	13,800	1.8 J	1.2 J	4.2	3	2.1 J	1.6 J	6.8 J
Trichloroethene	11.4	2.23	2 U	2 U	2 U	2 U	**1,200**	**3.6**	**1,600**
Trichlorofluoromethane(Freon-11)	5,520	1,300	1.3 J	0.52 J	2	0.94 J	7.2 U	0.42 J	7 U
cis-1,2-Dichloroethene	--	--	2 U	2 U	2 U	2 U	16	2 U	84
m- and p-Xylene	1,010	230	11	8.5	5.8	6.1	5 J	2 U	21
o-Xylene	7,140	1,680	0.71 J	2 U	0.66 J	0.63 J	7.2 U	2 U	8.3
trans-1,2-Dichloroethene	656	159	2 U	2 U	2 U	2 U	12	2 U	50

Notes:

J - Analyte present, value may or may not be accurate or precise
NA - Not analyzed
U - The material was analyzed for, but not detected
ppbv - parts per billion volume
SVSL - Soil Vapor Screening Level
Shading indicates exceedance of Industrial Generic criteria
Bold text indicates exceedance of Unrestricted Generic criteria

TABLE V6-5

Summary of Camp Geiger Phase I Deep Soil Vapor Analytical Results

Vapor Intrusion Report

Camp Geiger, MCB Camp Lejeune, North Carolina

Station ID	**Industrial Deep Generic SVSL (AF=0.01) (ppbv)**	**Unrestricted Deep Generic SVSL (AF=0.01) (ppbv)**	IR93-IS07	IR93-IS08	IR93-IS09
Sample ID			IR93-IS07-SV-07-08-08B	IR93-IS08-SV-07-08-08B	IR93-IS09-SV-06-07-08B
Sample Date			06/22/08	06/22/08	06/22/08
Chemical Name					
Volatile Organic Compounds (ppbv)					
2-Butanone	746,000	176,000	5.2 J	15	33
2-Hexanone	317,000	75,700	0.65 J	0.67 J	3.1 J
4-Methyl-2-pentanone	317,000	75,600	5 U	5 U	2.2 J
Acetone	5,890,000	1,350,000	40 J	85	230
Benzene	50.1	9.7	1.2 J	1.1 J	2.8
Carbon disulfide	99,500	23,400	1.4 J	0.64 J	1 J
Chloromethane	329	67.8	5 U	2.3 J	5 U
Cyclohexane	755,000	183,000	1.1 J	21	3.5 J
Dichlorodifluoromethane (Freon-12)	17,800	4,250	0.69 J	0.76 J	0.78 J
Ethylbenzene	113	22.3	2.9	4.8	3.7
Isopropylbenzene	36,600	8,540	2 J	4.9	2.5 J
Tetrachloroethene	31	6.05	3.7	2.4	**29**
Toluene	584,000	138,000	1.3 J	1.9 J	3.5
Trichlorofluoromethane(Freon-11)	55,200	13,000	0.55 J	0.5 J	0.56 J
m- and p-Xylene	10,100	2,600	7.2	11	8.9
o-Xylene	71,400	16,800	2 U	1.2 J	1 J

Notes:

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

NA - Not analyzed

U - The material was analyzed for, but not detected

ppbv - parts per billion volume

SVSL - Soil Vapor Screening Level

Shading indicates exceedance of Industrial Generic criteria

Bold text indicates exceedance of Unrestricted Generic criteria

TABLE V6-6

Summary of Camp Geiger Phase I Subslab Soil Gas Analytical Results
Vapor Intrusion Report
Camp Geiger, MCB Camp Lejeune, North Carolina

Station ID	**Industrial Shallow Generic SGSL (AF=0.1) (ppbv)**	**Unrestricted Shallow Generic SGSL (AF=0.1) (ppbv)**	IR35-SG05	IR35-SG06	IR89-SG01	IR89-SG02	IR89-SG03	IR89-SG04
Sample ID			IR35-SG05-08B	IR35-SG06-08B	IR89-SG01-08B	IR89-SG02-08B	IR89-SG03-08B	IR89-SG04-08B
Sample Date			06/24/08	06/24/08	06/21/08	06/21/08	06/23/08	06/23/08
Chemical Name								
Volatile Organic Compounds (ppbv)								
1,1,1-Trichloroethane	40,300	9,530	2 U	2 U	3.6 U	2 U	3.4 J	13 U
1,1,2,2-Tetrachloroethane	0.306	0.0612	2 U	2 U	**1.6 J**	2 U	14 U	13 U
2-Butanone	74,600	17,600	5.2 J	6.9 J	18 U	4.1 J	72 U	65 U
2-Hexanone	31,700	7,570	0.58 J	5 U	9.1 U	5 U	36 U	32 U
4-Methyl-2-pentanone	31,700	7,560	5 U	2.5 J	9.1 U	5 U	36 U	32 U
Acetone	589,000	135,000	44 J	220	91 U	67	110 J	320 U
Benzene	5.01	0.97	2 U	0.67 J	3.6 U	0.9 J	14 U	13 U
Carbon disulfide	9,950	2,340	0.44 J	0.58 J	0.75 J	5 U	36 U	32 U
Chloroform	1.09	0.225	2 U	2 U	3.6 U	2 U	14 U	**3.6 J**
Cyclohexane	75,500	18,300	0.62 J	0.86 J	3.8 J	2.2 J	36 U	32 U
Dichlorodifluoromethane (Freon-12)	1,780	425	2 U	0.75 J	3.6 U	2 U	14 U	13 U
Ethylbenzene	11.3	2.23	**20**	**27**	**23**	**33**	**47**	**36**
Isopropylbenzene	3,660	854	1.4 J	2.2 J	1.8 J	2.4 J	29 U	4.1 J
Methylene chloride	74.8	15	5 U	5 U	19 U	4.8 J	36 U	32 U
Tetrachloroethene	3.1	0.605	2 U	2 U	**23**	**6**	**79**	**110**
Toluene	58,400	13,800	2.6	3.6	3 J	4.1	8.2 J	6.1 J
Trichloroethene	11.4	2.23	1.2 J	**3.8**	**230**	**22**	**2,000**	**1,900**
Trichlorofluoromethane(Freon-11)	5,520	1,300	0.35 J	0.87 J	3.6 U	0.59 J	14 U	13 U
cis-1,2-Dichloroethene	--	--	2 U	2 U	6.5	2 U	40	54
m- and p-Xylene	1,010	230	42	66	54	71	110	90
o-Xylene	7,140	1,680	15	24	21	25	41	34
trans-1,2-Dichloroethene	656	159	2 U	2 U	7.7	2 U	50	48

Notes:

J - Analyte present, value may or may not be accurate or precise
NA - Not analyzed
U - The material was analyzed for, but not detected
ppbv - parts per billion volume
SGSL - Soil Gas Screening Level
Shading indicates exceedance of Industrial Generic criteria
Bold text indicates exceedance of Unrestricted Generic criteria

TABLE V6-7
Summary of Camp Geiger Phase I Indoor Air Analytical Results
Vapor Intrusion Report
Camp Geiger, MCB Camp Lejeune, North Carolina

Station ID	**Industrial Generic Air SL (ppbv)**	**Unrestricted Generic Air SL (ppbv)**	IR35-IA05	IR35-IA06	IR89-IA01	IR89-IA02	IR89-IA03	IR89-IA04
Sample ID			IR35-IA05-08B	IR35-IA06-08B	IR89-IA01-08B	IR89-IA02-08B	IR89-IA03-08B	IR89-IA04-08B
Sample Date			06/24/08	06/24/08	06/21/08	06/21/08	06/24/08	06/24/08
Chemical Name								
Volatile Organic Compounds (ppbv)								
1,1,1-Trichloroethane	4,030	953	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
1,1,2,2-Tetrachloroethane	0.0306	0.00612	0.2 U	0.2 U	**0.13 J**	**0.15 J**	**0.082 J**	**0.074 J**
1,1,2-Trichloro-1,2,2-trifluoroethane(Freon-113)	17,000	4,040	0.11 J	0.11 J	0.074 J	0.081 J	0.074 J	0.073 J
1,1-Dichloroethene	222	53	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
1,2-Dichloroethane	0.116	0.0232	**0.053 J**	**0.13 J**	0.2 U	0.2 U	0.2 U	0.2 U
1,4-Dichlorobenzene	0.183	0.0366	**12**	**11**	0.2 U	0.2 U	0.2 U	0.2 U
2-Butanone	7,460	1,760	2.3	6.6	0.72 J	0.76 J	0.65 J	0.73 J
2-Hexanone	3,170	757	0.12 J	0.11 J	0.5 U	0.5 U	0.5 U	0.091 J
4-Methyl-2-pentanone	3,170	756	0.23 J	0.48 J	0.5 U	0.054 J	0.5 U	0.051 J
Acetone	58,900	13,500	39	30	9.7	10	5.1	5.3
Benzene	0.501	0.097	**1.8**	**2.7**	**0.28**	**0.28**	**0.11 J**	**0.11 J**
Carbon disulfide	995	234	0.039 J	0.5	0.5 U	0.038 J	0.21 J	0.1 J
Carbon tetrachloride	0.13	0.0254	**0.12 J**	**0.13 J**	**0.067 J**	**0.066 J**	**0.066 J**	**0.071 J**
Chlorobenzene	47.8	11.3	0.2 U	0.18 J	0.2 U	0.2 U	0.2 U	0.2 U
Chloroethane	16,700	3,790	0.2 U	0.2 U	0.2 U	0.2 U	0.04 J	0.2 U
Chloroform	0.109	0.0225	**0.1 J**	**0.096 J**	**0.062 J**	**0.066 J**	0.2 U	0.2 U
Chloromethane	3.29	0.678	**1.3**	**1.4**	0.65	**0.84**	**0.89**	0.57
Cyclohexane	7,550	1,830	0.72	3.8	0.071 J	0.088 J	0.5 U	0.5 U
Dichlorodifluoromethane (Freon-12)	178	42.5	0.68	0.7	0.49	0.48	0.41	0.42
Ethylbenzene	1.13	0.223	**0.95**	**2.4**	0.1 J	0.11 J	0.2 U	0.096 J
Isopropylbenzene	366	85.4	0.4 U	0.2 J	0.4 U	0.4 U	0.4 U	0.4 U
Methylene chloride	7.48	1.5	1.1	3.7	0.5 U	0.86	0.5 U	0.44 J
Styrene	1,030	235	0.13 J	0.92	0.2 U	0.2 U	0.2 U	0.2 U
Tetrachloroethene	0.31	0.0605	0.2 U	**0.18 J**	**0.1 J**	**0.12 J**	0.2 U	0.2 U
Toluene	5,840	1,380	5.8	17	0.65	0.71	0.14 J	0.17 J
Trichloroethene	1.14	0.223	0.2 U	0.15 J	**0.51**	**0.52**	0.12 J	0.11 J
Trichlorofluoromethane(Freon-11)	552	130	0.45	0.73	0.25	0.37	0.23	0.25
Vinyl chloride	1.1	0.0626	0.2 U	0.2 U	**0.41**	**0.44**	**0.2**	**0.17 J**
cis-1,2-Dichloroethene	--	--	0.13 J	0.066 J	7	6.5	2.3	2
m- and p-Xylene	101	23	3.5	7.7	0.28	0.29	0.2 U	0.26
o-Xylene	714	168	1.1	2.2	0.11 J	0.1 J	0.2 U	0.087 J
trans-1,2-Dichloroethene	65.6	15.9	0.2 U	0.2 U	2	1.9	0.44	0.41

Notes:
J - Analyte present, value may or may not be accurate or precise
NA - Not analyzed
U - The material was analyzed for, but not detected
ppbv - parts per billion volume
SL - Screening Levels
Shading indicates exceedance of Industrial Generic criteria
Bold text indicates exceedance of Unrestricted Generic criteria
* Outdoor air has not been compared to any criteria

TABLE V6-8

Summary of Camp Geiger Phase I Outdoor Air Analytical Results
Vapor Intrusion Report
Camp Geiger, MCB Camp Lejeune, North Carolina

Buildings

Station ID	**Industrial Generic Air SL (ppbv)**	**Unrestricted Generic Air SL (ppbv)**	IR89-OA01	IR89-OA02
Sample ID			IR89-OA01-08B	IR89-OA02-08B
Sample Date			06/21/08	06/24/08
Chemical Name				
Volatile Organic Compounds (ppbv)				
1,1,1-Trichloroethane	4,030	953	0.056 J	0.2 U
1,1,2,2-Tetrachloroethane	0.0306	0.00612	0.17 J	0.2 U
1,1,2-Trichloro-1,2,2-trifluoroethane(Freon-113)	17,000	4,040	0.071 J	0.086 J
1,1-Dichloroethene	222	53	0.11 J	0.2 U
1,2-Dichloroethane	0.116	0.0232	0.2 U	0.2 U
1,4-Dichlorobenzene	0.183	0.0366	0.2 U	0.12 J
2-Butanone	7,460	1,760	1.3	2.4
2-Hexanone	3,170	757	0.5 U	0.15 J
4-Methyl-2-pentanone	3,170	756	0.5 U	0.39 J
Acetone	58,900	13,500	15	22
Benzene	0.501	0.097	0.33	0.27
Carbon disulfide	995	234	0.3 J	1.1
Carbon tetrachloride	0.13	0.0254	0.069 J	0.12 J
Chlorobenzene	47.8	11.3	0.2 U	0.2 U
Chloroethane	16,700	3,790	0.2 U	0.2 U
Chloroform	0.109	0.0225	0.042 J	0.2 U
Chloromethane	3.29	0.678	0.95	1.2
Cyclohexane	7,550	1,830	0.08 J	0.5 U
Dichlorodifluoromethane (Freon-12)	178	42.5	0.48	0.68
Ethylbenzene	1.13	0.223	0.27	0.12 J
Isopropylbenzene	366	85.4	0.95	0.4 U
Methylene chloride	7.48	1.5	0.5 U	2.1
Styrene	1,030	235	0.2 U	0.2 U
Tetrachloroethene	0.31	0.0605	0.11 J	0.2 U
Toluene	5,840	1,380	0.93	0.61
Trichloroethene	1.14	0.223	0.53	0.53
Trichlorofluoromethane(Freon-11)	552	130	0.22	0.6
Vinyl chloride	1.1	0.0626	0.54	0.089 J
cis-1,2-Dichloroethene	--	--	6.9	0.79
m- and p-Xylene	101	23	1.5	0.26
o-Xylene	714	168	0.36	0.063 J
trans-1,2-Dichloroethene	65.6	15.9	1.9	0.12 J

Notes:

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

NA - Not analyzed

U - The material was analyzed for, but not detected

ppbv - parts per billion volume

SL - Screening Levels

Shading indicates exceedance of Industrial Generic criteria

Bold text indicates exceedance of Unrestricted Generic criteria

* Outdoor air has not been compared to any criteria

TABLE V6-9

Summary of Camp Geiger Phase II Subslab Soil Gas Analytical Results

Vapor Intrusion Report

Camp Geiger, MCB Camp Lejeune, North Carolina

Station ID	**Industrial Shallow Generic SGSL (AF=0.1) (ppbv)**	**Industrial Shallow Base-Specific SGSL (AF=0.001) (ppbv)**	**Unrestricted Shallow Generic SGSL (AF=0.1) (ppbv)**	**Unrestricted Shallow Base-Specific SGSL (AF=0.001) (ppbv)**	IR35-SG08	IR35-SG09	IR35-SG10		IR35-SG11	IR35-SG12	IR35-SG13
Sample ID					IR35-SG08-08C	IR35-SG09-08C	IR35-SG10-08C	IR35-SG10D-08C	IR35-SG11-08C	IR35-SG12-08C	IR35-SG13-08C
Sample Date					10/04/08	10/04/08	09/27/08	09/27/08	10/04/08	09/27/08	10/04/08
Chemical Name											
Volatile Organic Compounds (ppbv)											
2-Butanone	74,600	7,460,000	17,600	1,760,000	2.5 J	10 U	2.2 J	10 U	10 U	10 U	10 U
Acetone	589,000	58,900,000	135,000	13,500,000	34 J	50 UJ	26 J	17 J	50 UJ	50 U	50 UJ
Chloroform	1.09	109	0.225	22.5	**0.45 J**	**1.2 J**	2 U	2 U	2 U	**3.7**	**0.83 J**
Dichlorodifluoromethane (Freon-12)	1,780	178,000	425	42,500	2 U	2 U	0.75 J	0.81 J	2 U	2 U	2 U
Methylene chloride	74.8	7,480	15	1500	5 U	5 U	8.8	11	5 U	5.2 U	5 U
Tetrachloroethene	3.1	310	0.605	60.5	2 U	2 U	**2.1**	**2.2**	2 U	**3.2**	2 U
Toluene	58,400	5,840,000	13,800	1,380,000	2 U	2 U	0.78 J	0.96 J	2 U	0.54 J	2 U
Trichlorofluoromethane(Freon-11)	5,520	552,000	1,300	130,000	2 U	0.39 J	0.63 J	0.64 J	2 U	0.61 J	2 U

Notes:

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

NA - Not analyzed

U - The material was analyzed for, but not detected

SGSL - Soil Gas Screening Level

UJ - Analyte not detected, quantitation limit may be inaccurate

Shading indicates exceedance of Industrial Generic criteria

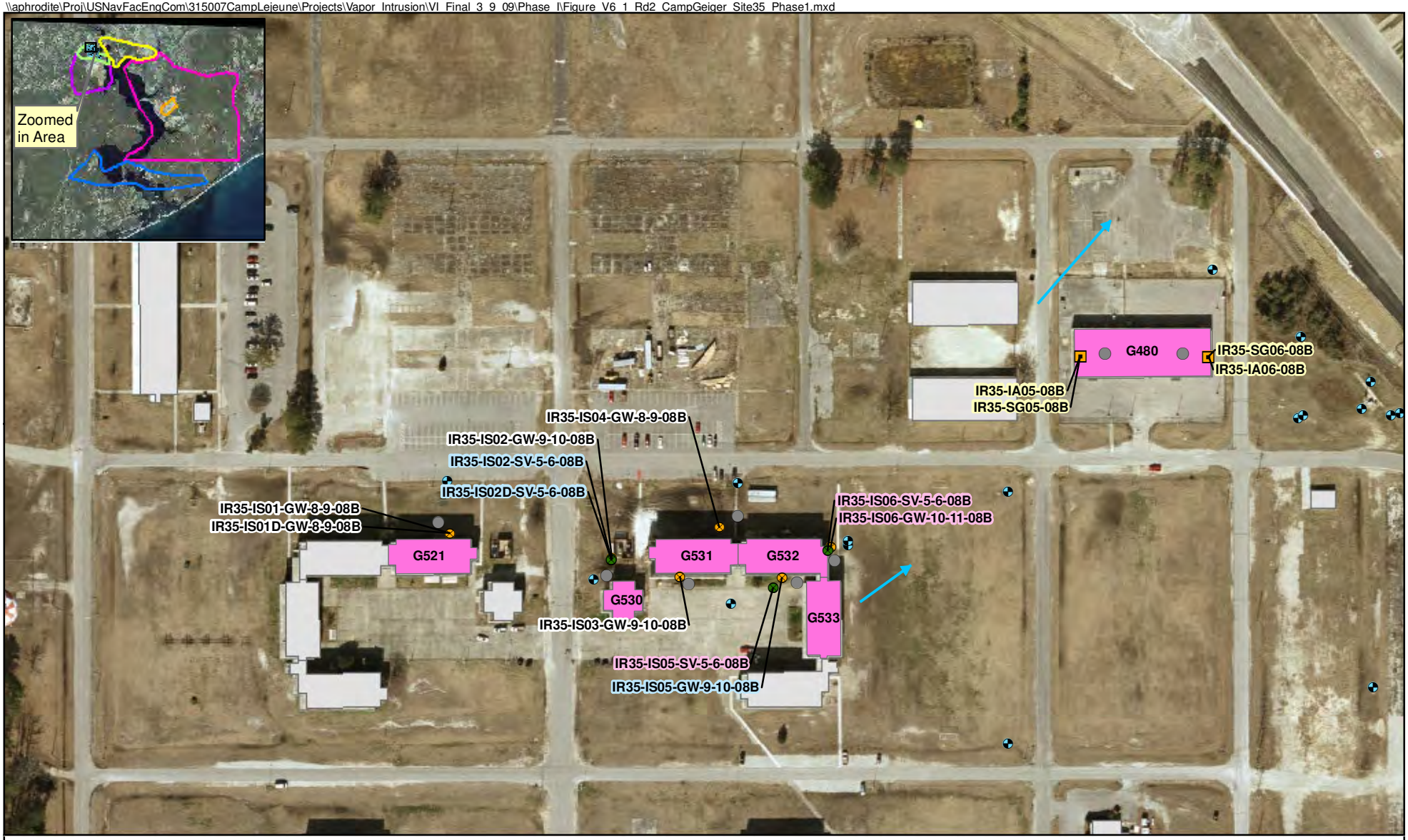
Bold text indicates exceedance of Unrestricted Generic criteria

Bold box indicates exceedance of Industrial Base-Specific criteria

Underline indicates exceedance of Unrestricted base Specific criteria

Figures

\\aphrodite\Proj\USNavFacEngCom\315007CampLejeune\Projects\Vapor_Intrusion\VI_Final_3_9_09\Phase_I\Figure_V6_1_Rd2_CampGeiger_Site35_Phase1.mxd



Legend

- Indoor Air Sample Location
- Soil Gas Sample Location
- Groundwater Sample Location
- Soil Vapor Sample Location
- Monitoring Well with exceedances
- Shallow Groundwater Flow
- Buildings Investigated
- MCAS, New River
- Camp Geiger
- Courthouse Bay
- Hadnot Point
- Mainside
- Tarawa Terrace
- Proposed Groundwater, Soil Gas, Subslab and Indoor Air Sample Locations

0 100 200 Feet

N

IR35-SG05-08B - Sample with one or more constituents exceeding industrial AF = 0.1

IR35-IS05-GW-9-10-08B - Sample with one or more constituents exceeding residential AF = 0.1

IR35-IS05-SV-5-6-08B - Sample with one or more constituents exceeding both AF = 0.1

Figure V6-1
Site 35 Phase I Sample Locations
Vapor Intrusion Report
MCB Camp Lejeune
North Carolina

AGVIQ CH2M HILL

\\aphrodite\Proj\USNavFacEngCom\315007CampLejeune\Projects\Vapor_Intrusion\VI_Final_3_9_09\Phase_I\Figure_V6_2_Rd2_CampGeiger_Site89_Phase1.mxd

Legend

- Indoor Air Sample Location
- Outdoor Air Sample Location
- Soil Gas Sample Location
- Soil Vapor Sample Location
- Monitoring Well with exceedances
- Shallow Groundwater Flow
- Buildings Investigated
- MCAS, New River
- Camp Geiger
- Courthouse Bay
- Hadnot Point
- Mainside
- Tarawa Terrace
- Proposed Subslab and Indoor Air Sample Locations

IR89-IA04-08B - Sample with one or more exceeding constituents AF = 0.1

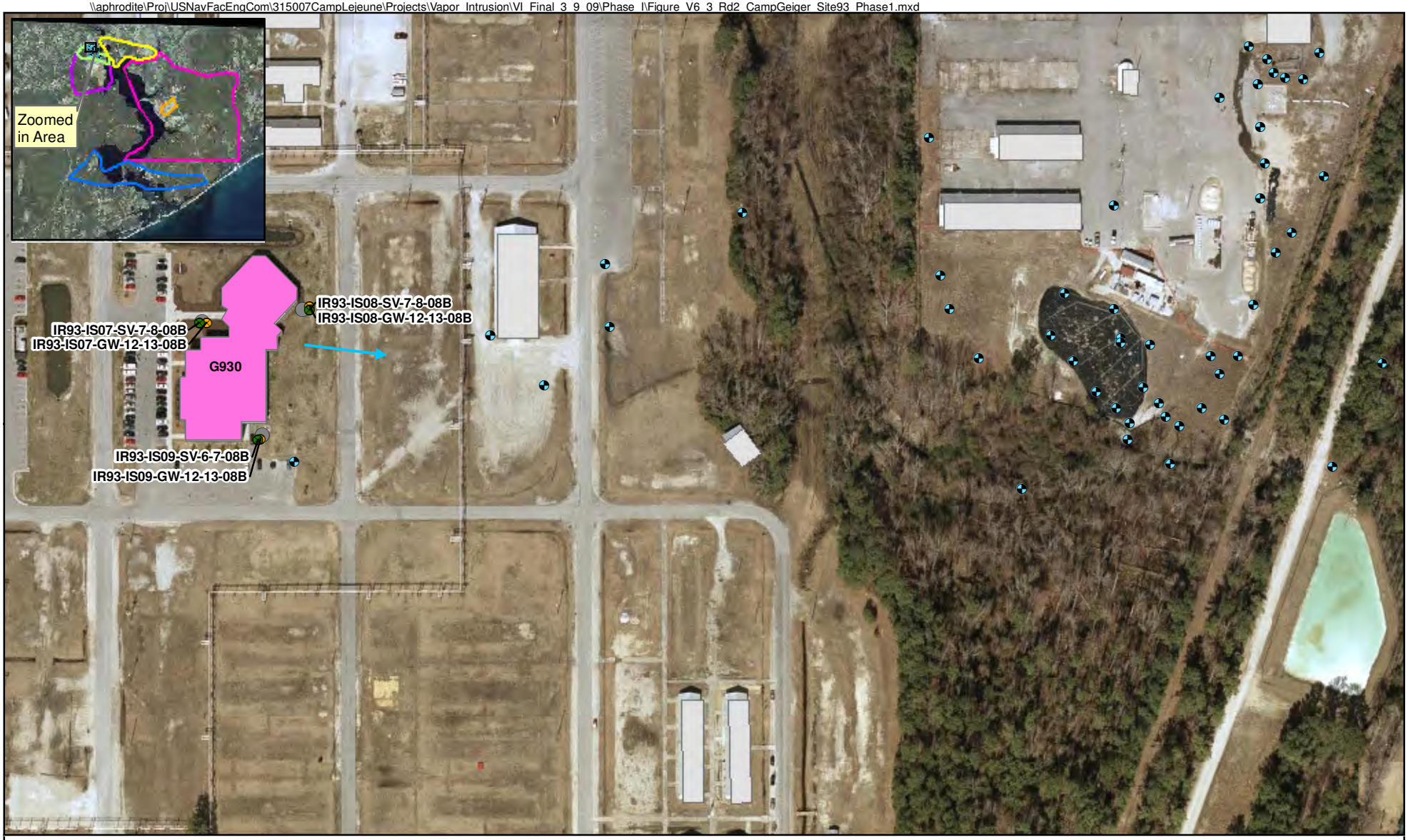
N

0 100 200 Feet

Figure V6-2
Site 89 Phase I Sample Locations
Vapor Intrusion Report
MCB Camp Lejeune
North Carolina

AGVIQ CH2M HILL

\\aphrodite\Proj\USNavFacEngCom\315007CampLejeune\Projects\Vapor_Intrusion\VI_Final_3_9_09\Phase_I\Figure_V6_3_Rd2_CampGeiger_Site93_Phase1.mxd



Legend

- Groundwater Sample Location
- Soil Vapor Sample Location
- Monitoring Well with exceedances
- Shallow Groundwater Flow
- Buildings Investigated
- MCAS, New River
- Camp Geiger
- Courthouse Bay
- Hadnot Point
- Mainside
- Tarawa Terrace
- Proposed Groundwater and Soil Gas Sample Locations

HPFF-IA21-08C - Sample with one or more exceeding constituents AF = 0.1

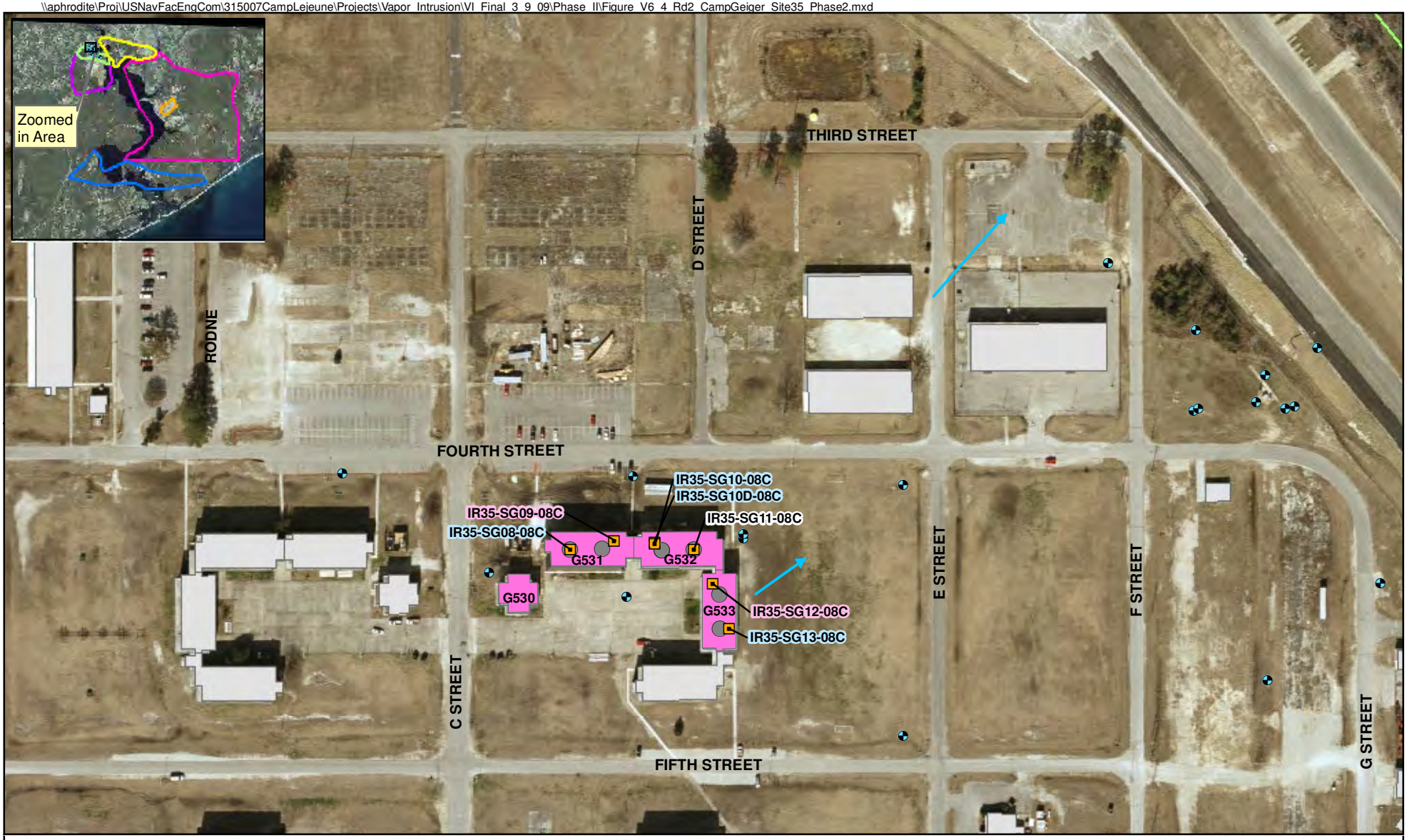
N

0 100 200 Feet

Figure V6-3
Site 93 Phase I Sample Locations
Vapor Intrusion Report
MCB Camp Lejeune
North Carolina

AGVIQ CH2M HILL

\\aphrodite\Proj\USNavFacEngCom\315007CampLejeune\Projects\Vapor_Intrusion\VI_Final_3_9_09\Phase_II\Figure_V6_4_Rd2_CampGeiger_Site35_Phase2.mxd



Legend

- Monitoring Well with exceedances
- Soil Gas Sample Location
- Proposed Soil Gas Sample Location
- Shallow Groundwater Flow
- Buildings Investigated - Phase II
- MCAS, New River
- Camp Geiger
- Courthouse Bay
- Hadnot Point
- Mainside
- Tarawa Terrace

HPFF-IA21-08C - Sample with one or more exceeding constituents AF = 0.1

IR35-SG13-08C - Sample with one or more exceeding residential AF = 0.1

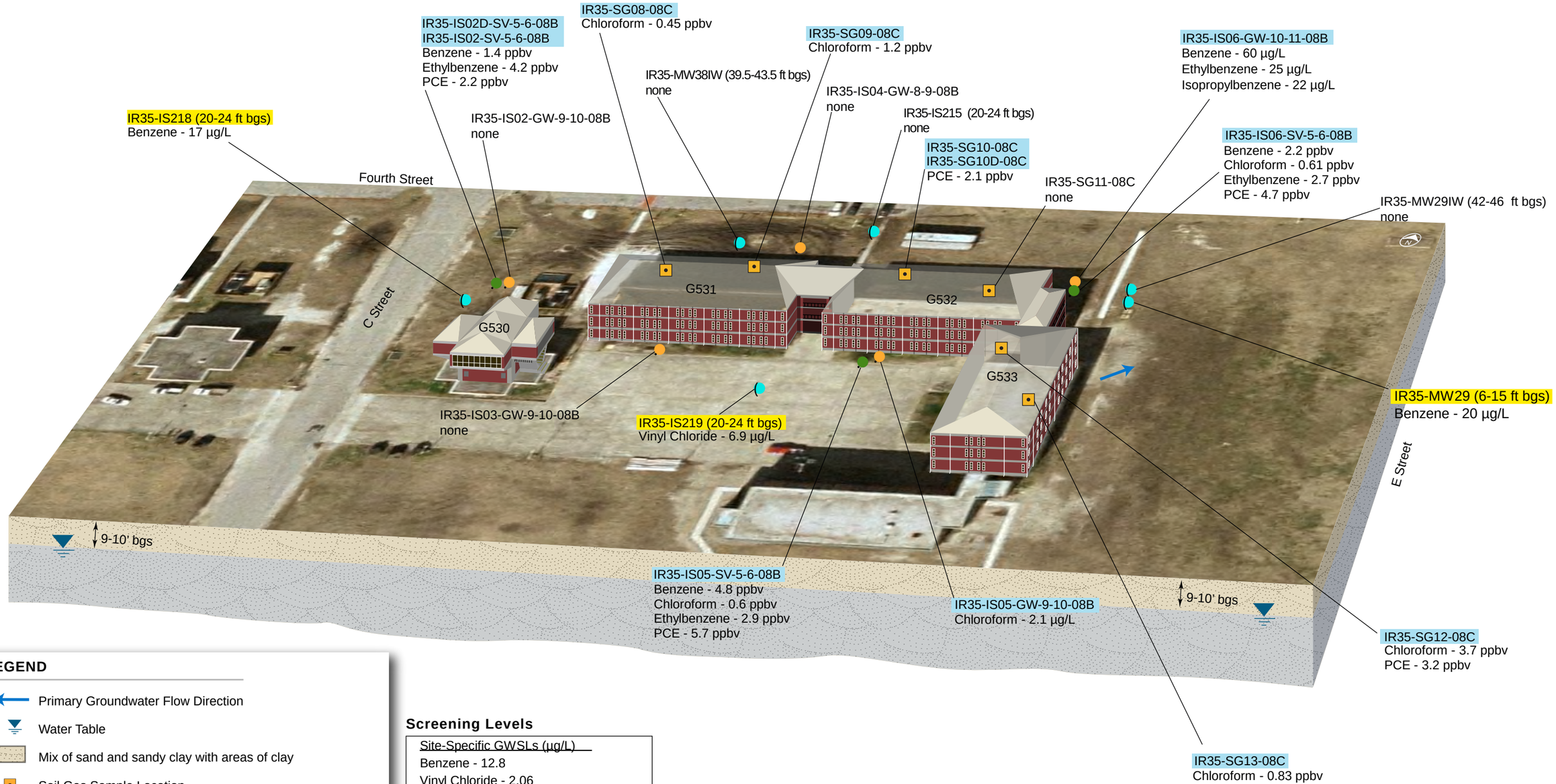
IR35-SG12-08C - Sample with one or more exceeding constituents and residential AF = 0.1

N

0 100 200 Feet

Figure V6-4
Site 35 Phase II Sample Locations
Vapor Intrusion Report
MCB Camp Lejeune
North Carolina

AGVIQ CH2M HILL



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)
- Sample with one or more constituent exceeding Site-Specific GWSLs
- Sample with one or more constituent exceeding Generic Unrestricted Screening Levels

Screening Levels

Site-Specific GWSLs (µg/L)
Benzene - 12.8
Vinyl Chloride - 2.06

Generic Unrestricted SGSLs (ppbv)
Benzene - 0.97
Ethylbenzene - 2.23
PCE - 0.605
Chloroform - 0.225

Generic Unrestricted GWSLs (µg/L)
Chloroform - 0.733
Benzene - 1.37
Ethylbenzene - 3.01
Isopropylbenzene - 8.85

FIGURE V6-5
Camp Geiger Buildings G530, G531, G532, and G533
Vapor Intrusion Conceptual Site Model
Camp Lejeune, North Carolina

ES122008037MKE CL_Camp_GeigerG530_G531_G532_G533_v12.ai 3-13-09 mlb/js

AGVIO CH2M HILL

\\aphrodite\Proj\USNavFacEngCom\315007CampLejeune\Projects\Vapor_Intrusion\VI_Final_3_9_09\Historical_GW_Exceedances\Figure_V6_6_CG_Site_35_Historical_GW_Exceedances.mxd

Legend

- Monitoring Well with exceedances
- Shallow Groundwater Flow
- Buildings Selected for Further Evaluation
- MCAS, New River
- Camp Geiger
- Courthouse Bay
- Hadnot Point
- Mainside
- Tarawa Terrace

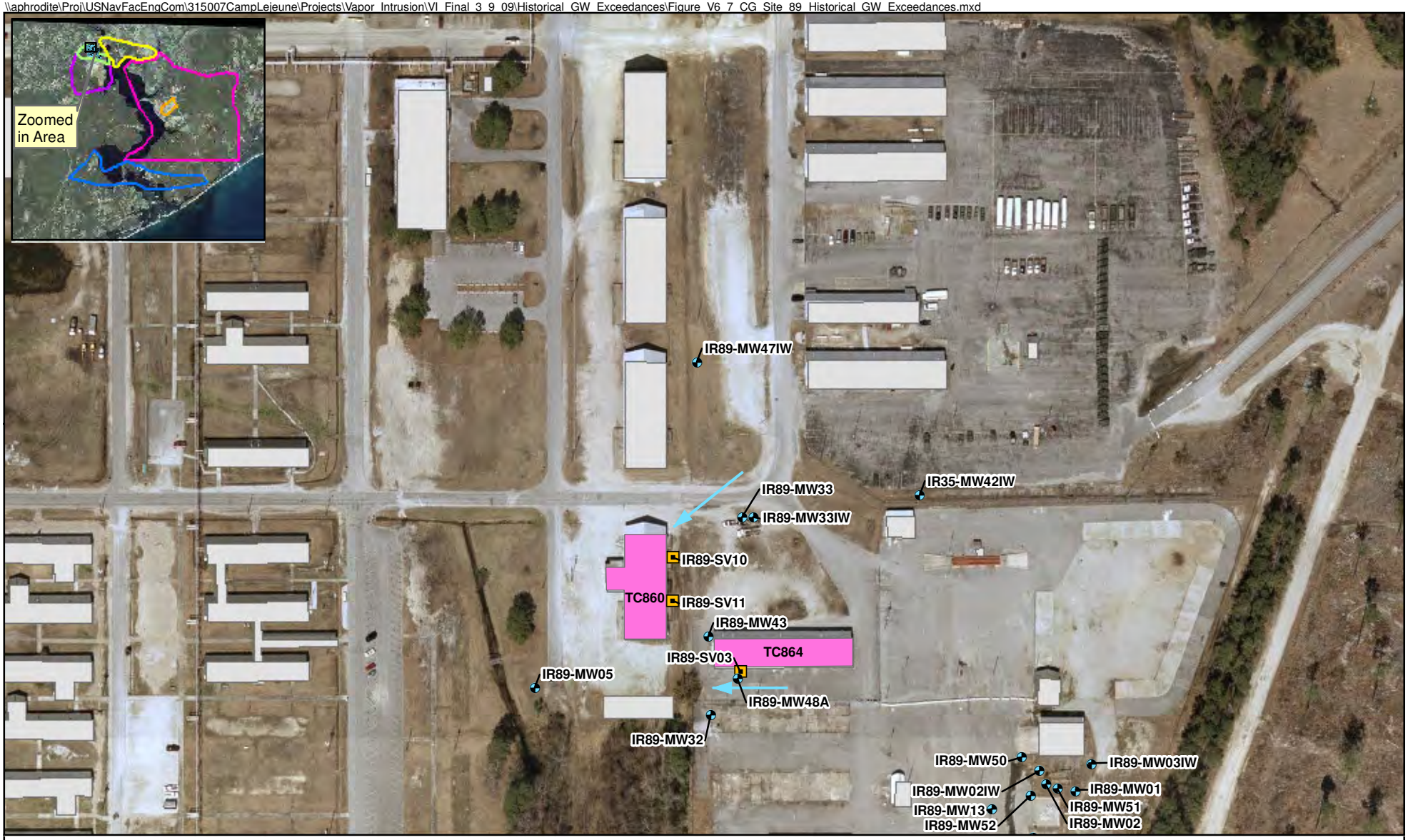
N

0 100 200 Feet

Figure V6-6
Site 35 Historical Groundwater Exceedances
Vapor Intrusion Report
MCB Camp Lejeune
North Carolina

AGVIQ CH2M HILL

\\aphrodite\Proj\USNavFacEngCom\315007CampLejeune\Projects\Vapor_Intrusion\VI_Final_3_9_09\Historical_GW_Exceedances\Figure_V6_7_CG_Site_89_Historical_GW_Exceedances.mxd



Legend

- Monitoring Well with exceedances
- Existing Soil Gas Sample Locations
- Shallow Groundwater Flow
- Buildings Selected for Further Evaluation
- MCAS, New River
- Camp Geiger
- Courthouse Bay
- Hadnot Point
- Mainside
- Tarawa Terrace

N

0 100 200 400 Feet

Figure V6-7
Site 89 Historical Groundwater Exceedances
Vapor Intrusion Report
MCB Camp Lejeune
North Carolina

AGVIQ CH2M HILL

\\aphrodite\Proj\USNavFacEngCom\315007CampLejeune\Projects\Vapor_Intrusion\VI_Final_3_9_09\Historical_GW_Exceedances\Figure_V6_8_CG_Site_93_Historical_GW_Exceedances.mxd

Legend

- Monitoring Well with exceedances
- Shallow Groundwater Flow
- MCAS, New River
- Camp Geiger
- Courthouse Bay
- Hadnot Point
- Mainside
- Tarawa Terrace

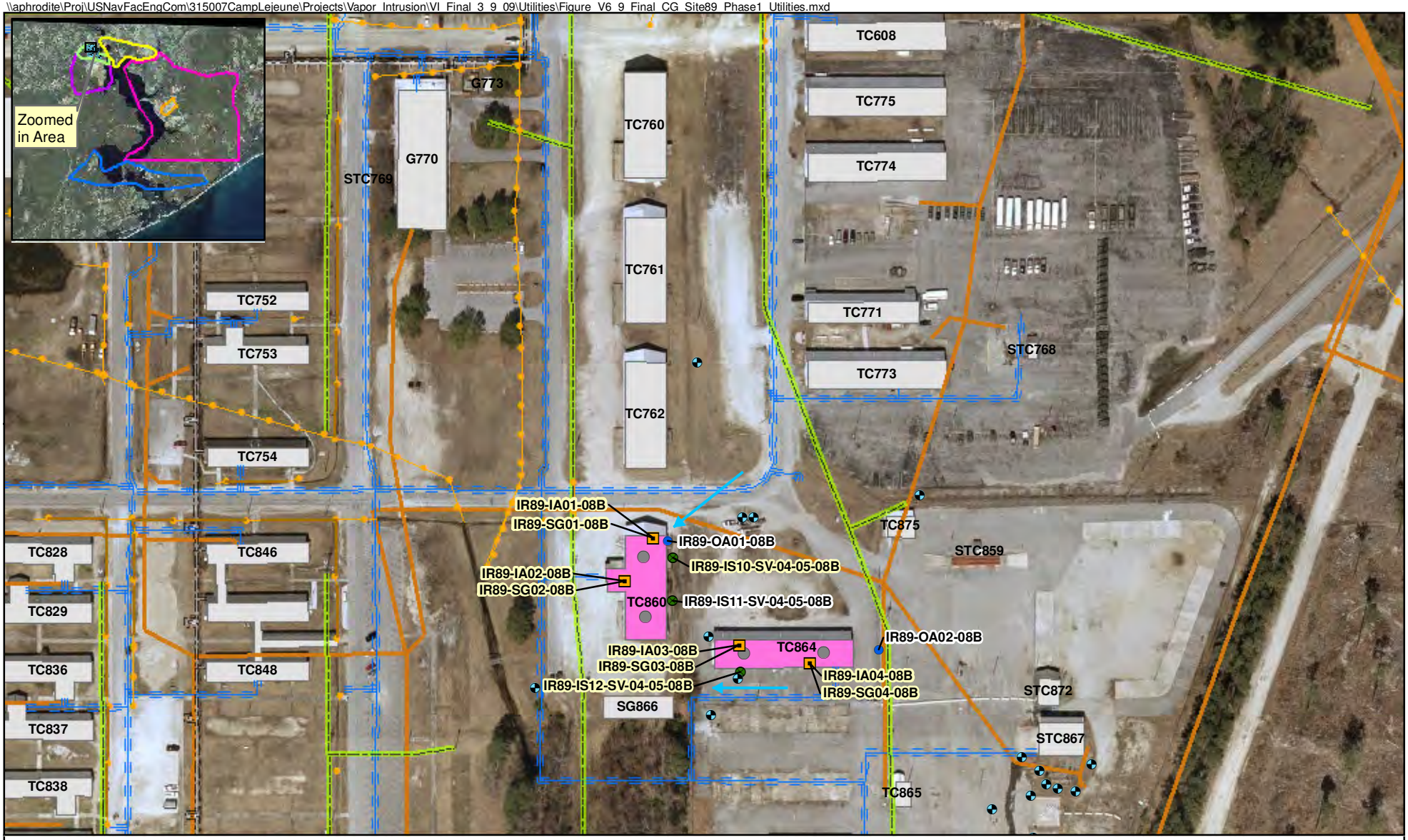
N

0 100 200 400 Feet

Figure V6-8
Site 93 Historical Groundwater Exceedances
Vapor Intrusion Report
MCB Camp Lejeune
North Carolina

AGVIQ CH2M HILL

\\aphrodite\Proj\USNavFacEngCom\315007CampLejeune\Projects\Vapor_Intrusion\VI_Final_3_9_09\Utilities\Figure_V6_9_Final_CG_Site89_Phase1_Utilities.mxd



Legend

- Indoor Air Sample Location
- Outdoor Air Sample Location
- Soil Gas Sample Location
- Monitoring Well with exceedances
- Soil Vapor Sample Location
- Proposed Subslab and Indoor Air Sample Locations
- Shallow Groundwater Flow
- Steam Line
- Storm Sewer Drainage Line
- Storm Sewer Utility Line
- Electrical Utility Line
- Water Utility Line
- Wastewater Utility Line
- Buildings Investigated
- MCAS, New River
- Camp Geiger
- Courthouse Bay
- Hadnot Point
- Mainside
- Tarawa Terrace

IR89-IA04-08B - Sample with one or more exceeding constituents AF = 0.1

N

0 100 200 Feet

Figure V6-9
Site 89 Utility Locations
Vapor Intrusion Report
MCB Camp Lejeune
North Carolina

AGVIQ CH2M HILL

Appendix V6-A
Field Data Sheets

CH2MHILL

PROJECT NUMBER	BORING NUMBER	
TO 21	35-ISO1	SHEET 1 OF 1

SOIL BORING LOG

PROJECT: TO 21 Soil Vapor Plume LOCATION: Camp Geiger MCAS New River
ELEVATION: DRILLING CONTRACTOR: Zebra
DRILLING METHOD AND EQUIPMENT USED: Geoprobe
WATER LEVELS: START: 0855 END: / LOGGER: K. Riggs

DEPTH BELOW SURFACE (FT)	INTERVAL (FT)	RECOVERY (IN)	#/TYPE	STANDARD PENETRATION TEST RESULTS 6"-6"-6"-6" (N)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY, OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY.	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION. OVM (ppm): Breathing Zone Above Hole
					0-6" - organic material	
					6"-4' - Dry - Medium to fine sand	
5					2.5Y 5/1 - gray	
					4'-5' - fine sand some clay lenses (5%) - moist	
					2.5Y 8/3 - Pale Yellow	
10					5'-7' - very moist medium - fine grain sand	
					2.5Y 7/4 - Pale Yellow	
15					7'-9' - saturated	
					2.5Y 8/2 - pale yellow	
20						
25						

SBOR25FT.XLS

Attachment 4

PROJECT NUMBER	PROJECT NAME
TO 21	Soil Vapor Plume

CH2MHILL

WELL PURGE AND SAMPLING FIELD SHEET

SITE: 33 | DATE: 6/21/07
FIELD CREW: [illegible] | WELL NUMBER: 33-IS01
WEATHER: Rainy & 80°

PURGE VOLUME CALCULATION:

			CASING DIAMETER	GAL/FT OF CASING
WELL DEPTH (FT):		9		
DEPTH TO WATER (FT):	-	7	2 IN.	0.1632
WATER COLUMN (FT):	=	0 2	4 IN.	0.6528
GAL/FT OF CASING (from table at right):	x	0.1632	6 IN.	1.4688
CASING VOLUME (GALs):	=	0 .326	8 IN.	2.611
NO. OF VOLUMES (min. 3):	x		10 IN.	4.0797
PURGE VOLUME (GAL):	=	0	12 IN.	5.8748

METHOD OF PURGING (circle one)

PUMP: SUB., CENT., PERIST.
TIME ON: 0918
FLOW RATE (gpm): 200
PUMP TIME (min): 10
VOL. PURGED (gals):

OTHER:

BAILER : TEFLON, SS ,OTHER:
BAILER VOL.. (gal) .25 / .33 / .75
REQUIRED PULLS:
VOL. PURGED (gals):
OTHER:

FIELD PARAMETER MEASUREMENTS Field Equipment Used: Horiba U-22

No.	Time	Volume	pH	Temperature	Conductivity	Turbidity	Other (DO; ORP)	
1	0919		5.32	21.64	.071	999	8.30	324
2	0924		4.50	21.29	.070	141	4.84	245
3	0929		4.49	21.18	.072	214	4.34	277
4								
5								
6								
7								
8								

OBSERVATIONS (circle as appropriate)

COLOR: CLEAR , AMBER , TAN , BROWN , GREY , MILKY WHITE , OTHER:
ODOR: NONE , LOW , MEDIUM , HIGH , VERY STRONG , H2S , FUEL LIKE , CHEMICAL ?, UNKNOWN
TURBIDITY: NONE , LOW , MEDIUM , HIGH , ~~VERY TURBID.~~ HEAVY SILTS

COMMENTS: —

Please use back of sheet for sketching maps, well location notes, etc. **See back of sheet? Y / N**

SAMPLE DATA:

Sample ID Number	No. and Types of Containers	Parameters Analyzed	Laboratory	QA/QC sample? Y /N
0929 ~~33~~35-IS01-GW-8-9-08	3 40ml VOA	VOC	TEST America	~~33~~35-IS01D-GW-8-9-08 0939 Dup

SIGNED/SAMPLER: [signature]

CH2MHILL

PROJECT NUMBER	BORING NUMBER	
TO 21	35-ISO2	SHEET 1 OF 1

SOIL BORING LOG

PROJECT: TO 21 Soil Vapor Plume LOCATION: EMCAS New River
ELEVATION: DRILLING CONTRACTOR: Zebra
DRILLING METHOD AND EQUIPMENT USED: Geoprobe
WATER LEVELS: START: END: LOGGER: K Riggs

DEPTH BELOW SURFACE (FT)	INTERVAL (FT)	RECOVERY (IN)	#/TYPE	STANDARD PENETRATION TEST RESULTS 6"-6"-6"-6" (N)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY, OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY.	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION. OVM (ppm): Breathing Zone Above Hole
					0-2' - organic material 2.5Y 3/1 - very dark gray	
5					2'-4' - medium to course grained sand 2.5Y 7/2 - light gray	
					4'-5' - sandy clay 2.5Y 7/4 - pale yellow - high plasticity	
10					5'-6.5' - same as above	
					6.5-8' - silty sand 2.5Y 8/1 - white moist	0.0ppm
15					~~8'~~ 8'-9' Saturated medium to course sand 2.5Y 8/2 pale yellow	
20						
25						

SBOR25FT.XLS

Attachment 4

PROJECT NUMBER	PROJECT NAME
T021	Vapor Intrusion

CH2MHILL

WELL PURGE AND SAMPLING FIELD SHEET

SITE: 35, MCAS New River
DATE: 6/2/09
FIELD CREW: KB JC
WELL NUMBER: 35-ISO2
WEATHER: Rainy 1 TP

PURGE VOLUME CALCULATION:

			CASING DIAMETER	GAL/FT OF CASING
WELL DEPTH (FT):		10		
DEPTH TO WATER (FT):	-	8	2 IN.	0.1632
WATER COLUMN (FT):	=	0 2	4 IN.	0.6528
GAL/FT OF CASING (from table at right):	x	0.1632	6 IN.	1.4688
CASING VOLUME (GALs):	=	0 .3262	8 IN.	2.611
NO. OF VOLUMES (min. 3):	x		10 IN.	4.0797
PURGE VOLUME (GAL):	=	0	12 IN.	5.8748

METHOD OF PURGING (circle one)

PUMP: SUB., CENT., PERIST.
TIME ON: 1058
FLOW RATE ~~(gpm)~~ mL/min: 300
PUMP TIME (min): 10
VOL. PURGED (gals): .50

OTHER:

BAILER : TEFLON, SS ,OTHER:
BAILER VOL.. (gal) .25 / .33 / .75
REQUIRED PULLS:
VOL. PURGED (gals):
OTHER:

FIELD PARAMETER MEASUREMENTS Field Equipment Used: Horiba U-22

No.	Time	Volume	pH	Temperature	Conductivity	Turbidity	Other (DO; ORP)
1	1059		4.70	22.28	.116	999	5.05 246
2	1104		4.48	22.24	.117	290	4.38 264
3	1109		4.38	22.22	.122	58.1	4.50 276
4							
5							
6							
7							
8							

OBSERVATIONS (circle as appropriate)

COLOR: CLEAR , AMBER , TAN , BROWN , GREY , MILKY WHITE , OTHER:

ODOR: NONE , LOW , MEDIUM , HIGH , VERY STRONG , H2S , FUEL LIKE , CHEMICAL ?, UNKNOWN

TURBIDITY: NONE , LOW , MEDIUM , HIGH , VERY TURBID. HEAVY SILTS

COMMENTS: —

Please use back of sheet for sketching maps, well location notes, etc. **See back of sheet? Y / N**

SAMPLE DATA:

Sample ID Number	No. and Types of Containers	Parameters Analyzed	Laboratory	QA/QC sample? Y /N
1109 IR35-ISO2-GW-9-10-09	40ml VOA	VOC	Test America	N

SIGNED/SAMPLER: [signature]

CH2MHILL

Figure 2-3

Soil Gas Sampling Field Data Sheet

Soil Gas Point Installation

Time Installed	1115
Screen Depth	10'
Screen Volume	1 L
Helium Leak Check Result	00000

Soil Gas Sample Point Purging

Purge Date	6/27/08
Purge Time	15 min
Purge Rate	200 ml/min
Purged Volume	3 L

Multi Rae Readings

Total VOCs (ppm)	5.6
O2 (%)	20.9
H2S (ppm)	0
CO (ppm)	480
LEL (%)	6

Soil Gas Sample Collection

Sample ID	~~TR35-SV~~ TR35-TS02-SV-5-6-08B	
Sample Location	S.K 35 camp Cutter	
Canister ID	L-5103	Dup: L-5183
Critical Orifice or Flow Controller ID	110	Dup: 120
Pressure Gauge ID	NA	
Initital Pressure (in. Hg)	-30	Dup: -31
Sample Date	6/27/08	
Start Time	1140	
End Time	1145	
Final Pressure (in. Hg)	-1	Dup: -2
Elapsed Time	5 min	

Observations: Collect Duplicate TR35-TS02D-SV5-6-08B

CH2MHILL

PROJECT NUMBER	BORING NUMBER	
TO 21	35-IS03	SHEET 1 OF 1

SOIL BORING LOG

PROJECT: TO 21 LOCATION: 5th 35 MCAS New River

ELEVATION: DRILLING CONTRACTOR: zebra

DRILLING METHOD AND EQUIPMENT USED: Geoprobe

WATER LEVELS: START: 1240 END: LOGGER: K Riggs

DEPTH BELOW SURFACE (FT)	INTERVAL (FT)	RECOVERY (IN)	#/TYPE	STANDARD PENETRATION TEST RESULTS 6"-6"-6"-6" (N)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY, OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY.	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION. OVM (ppm): Breathing Zone Above Hole
					0-5' organic material ~~mixed w/~~ - top soil seems to have been recently placed	
5					5'-7' same as above very moist	
					8' - saturated	
					8-9' fine grained sand	
10					2.5Y 6/2 - light brownish gray some medium grains	
15						
20						
25						

SBOR25FT.XLS

Attachment 4

CH2MHILL	PROJECT NUMBER: TO 21	PROJECT NAME: ~~35-ISO~~ Soil Vapor Intrusion

WELL PURGE AND SAMPLING FIELD SHEET

SITE: 35, Moss Glen River
DATE: 6/27/08
FIELD CREW: R. Riggs, J. Chalk
WELL NUMBER: 35-ISO3
WEATHER: Rainy 40

PURGE VOLUME CALCULATION:

			CASING DIAMETER	GAL/FT OF CASING
WELL DEPTH (FT):		10		
DEPTH TO WATER (FT):	-	8	2 IN.	0.1632
WATER COLUMN (FT):	=	0 2	4 IN.	0.6528
GAL/FT OF CASING (from table at right):	x	0.1632	6 IN.	1.4688
CASING VOLUME (GALs):	=	0 .3/.2	8 IN.	2.611
NO. OF VOLUMES (min. 3):	x		10 IN.	4.0797
PURGE VOLUME (GAL):	=	0	12 IN.	5.8748

METHOD OF PURGING (circle one)

PUMP: SUB., CENT., PERIST

		OTHER:
TIME ON:	1301	
FLOW RATE (gpm):	250	
PUMP TIME (min):	10	
VOL. PURGED (gals):	.50	

BAILER: TEFLON, SS, OTHER:
BAILER VOL.. (gal) .25 / .33 / .75
REQUIRED PULLS:
VOL. PURGED (gals):
OTHER:

FIELD PARAMETER MEASUREMENTS Field Equipment Used: Horiba U-22

No.	Time	Volume	pH	Temperature	Conductivity	Turbidity	Other (DO; ORP)
1	1301		5.10	23.06	.132	999	3.29 999
2	1306		4.63	22.74	.129	999	4.29 255
3	1311		4.57	22.73	.132	999	4.52 256
4							
5							
6							
7							
8							

OBSERVATIONS (circle as appropriate)

COLOR: CLEAR, AMBER, TAN, BROWN, GREY, MILKY WHITE, OTHER:

ODOR: NONE, LOW, MEDIUM, HIGH, VERY STRONG, H2S, FUEL LIKE, CHEMICAL ?, UNKNOWN

TURBIDITY: NONE, LOW, MEDIUM, HIGH, VERY TURBID. HEAVY SILTS

COMMENTS: —

Please use back of sheet for sketching maps, well location notes, etc. **See back of sheet? Y / N**

SAMPLE DATA:

	Sample ID Number	No. and Types of Containers	Parameters Analyzed	Laboratory	QA/QC sample? Y /N
1311	IR35-ISO3-GW-9-10-08	3 40ml VOA	VOC	Test America	N

SIGNED/SAMPLER: [signature]

CH2MHILL

PROJECT NUMBER	BORING NUMBER	
TO 24	35-IS04	SHEET 1 OF 1

SOIL BORING LOG

PROJECT: TO 4 LOCATION: Site 35, NCTS New River

ELEVATION: DRILLING CONTRACTOR: zebra

DRILLING METHOD AND EQUIPMENT USED: Geoprobe

WATER LEVELS: START: 1607 END: 1620 LOGGER: K Riggs

DEPTH BELOW SURFACE (FT)	INTERVAL (FT)	RECOVERY (IN)	#/TYPE	STANDARD PENETRATION TEST RESULTS 6"-6"-6"-6" (N)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY, OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY.	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION. OVM (ppm): Breathing Zone Above Hole
					0-5'-organic material 4'-5'-moist 5'-7'-moist sandy clay-high plasticity 2.5Y 4/3 olive brown 7'-saturated 7'-9'-fine sand 10% silt 2.5Y 4/3 olive brown	0.0 ppm
5						
10						
15						
20						
25						

SBOR25FT.XLS

Attachment 4

PROJECT NUMBER	PROJECT NAME
TO 21	Soil Vapor Intrusion

CH2MHILL

WELL PURGE AND SAMPLING FIELD SHEET

SITE: 35, MCAS New River
DATE: 6/24/07
FIELD CREW: K. Riggs, J Chalk
WELL NUMBER: 35-IS04
WEATHER: Overcast 81

PURGE VOLUME CALCULATION:

			CASING DIAMETER	GAL/FT OF CASING
WELL DEPTH (FT):		9		
DEPTH TO WATER (FT):	-	7	2 IN.	0.1632
WATER COLUMN (FT):	=	0 2	4 IN.	0.6528
GAL/FT OF CASING (from table at right):	x	0.1632	6 IN.	1.4688
CASING VOLUME (GALs):	=	0.362	8 IN.	2.611
NO. OF VOLUMES (min. 3):	x		10 IN.	4.0797
PURGE VOLUME (GAL):	=	0	12 IN.	5.8748

METHOD OF PURGING (circle one)

PUMP: SUB., CENT., ~~PERIST.~~ | OTHER:
TIME ON: 1624
FLOW RATE (gpm):
PUMP TIME (min):
VOL. PURGED (gals):

BAILER : TEFLON, SS ,OTHER:
BAILER VOL.. (gal) .25 / .33 / .75
REQUIRED PULLS:
VOL. PURGED (gals):
OTHER:

FIELD PARAMETER MEASUREMENTS Field Equipment Used: Horiba U-22

No.	Time	Volume	pH	Temperature	Conductivity	Turbidity	Other (DO; ORP)
1	1624		5.29	24.91	.179	900	7.99 42
2	1629		5.30	24.35	.184	900	7.41 29
3	1634		5.32	24.06	.187	900	7.25 24
4							
5							
6							
7							
8							

OBSERVATIONS (circle as appropriate)

COLOR: CLEAR , AMBER , TAN , BROWN , GREY , MILKY WHITE , OTHER:
ODOR: NONE , LOW , MEDIUM , HIGH , VERY STRONG , H2S , FUEL LIKE , CHEMICAL ?, UNKNOWN
TURBIDITY: NONE , LOW , MEDIUM , HIGH , VERY TURBID. HEAVY SILTS
COMMENTS:

Please use back of sheet for sketching maps, well location notes, etc. **See back of sheet? Y / N**

SAMPLE DATA:

Sample ID Number	No. and Types of Containers	Parameters Analyzed	Laboratory	QA/QC sample? Y /N
1634 IKSS-IS04-GW-8-9-08B	3 40ml VOA	VOC	Test Amer.	N

SIGNED/SAMPLER:

CH2MHILL

PROJECT NUMBER	BORING NUMBER	
TO 21	35-ISO5	SHEET 1 OF 1

SOIL BORING LOG

PROJECT: TO21 LOCATION: Site 35, Camp Geiger

ELEVATION: DRILLING CONTRACTOR: zebra

DRILLING METHOD AND EQUIPMENT USED: Geoprobe

WATER LEVELS: START: 1302 END: LOGGER: K Riggs

DEPTH BELOW SURFACE (FT)	INTERVAL (FT)	RECOVERY (IN)	#/TYPE	STANDARD PENETRATION TEST RESULTS 6"-6"-6"-6" (N)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY, OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY.	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION. OVM (ppm): Breathing Zone Above Hole
					0'-1'- Organic material	
					1'-5'- fine to medium sand	
5					2.5Y 7/6 - yellow	
					5'-8.5' medium to course sand - some moisture	
10					2.5Y 4/2 - pale yellow	0.0 ppm
					8.5-9'- Saturated medium to course sand	
15					2.5Y 8/2 - pale yellow	0.0 ppm
20						
25						

SBOR25FT.XLS

Attachment 4

	PROJECT NUMBER	PROJECT NAME
CH2MHILL	T021	35-IS05

WELL PURGE AND SAMPLING FIELD SHEET

SITE: 35, NCJS Mell River
DATE: 9/21/08
FIELD CREW: KR JC
WELL NUMBER: 35-IS05
WEATHER: Overcast ~ 8°

PURGE VOLUME CALCULATION:

			CASING DIAMETER	GAL/FT OF CASING
WELL DEPTH (FT):		10		
DEPTH TO WATER (FT):	-	8	2 IN.	0.1632
WATER COLUMN (FT):	=	0 2	4 IN.	0.6528
GAL/FT OF CASING (from table at right):	x	0.1632	6 IN.	1.4688
CASING VOLUME (GALs):	=	0.3262	8 IN.	2.611
NO. OF VOLUMES (min. 3):	x		10 IN.	4.0797
PURGE VOLUME (GAL):	=	0	12 IN.	5.8748

METHOD OF PURGING (circle one)

PUMP: SUB., CENT., PERIST.
TIME ON: 1345
FLOW RATE (gpm): 300
PUMP TIME (min): 10
VOL. PURGED (gals): 60

OTHER:

BAILER : TEFLON, SS ,OTHER:
BAILER VOL.. (gal) .25 / .33 / .75
REQUIRED PULLS:
VOL. PURGED (gals):
OTHER:

FIELD PARAMETER MEASUREMENTS Field Equipment Used: Horiba U-22

No.	Time	Volume	pH	Temperature	Conductivity	Turbidity	Other (DO; ORP)	
1	1345		6.04	24.30	.332	999	5.15	63
2	1350		6.22	24.25	.337	999	6.69	61
3	1355		6.24	24.22	.341	114	6.43	20
4								
5								
6								
7								
8								

OBSERVATIONS (circle as appropriate)

COLOR: CLEAR , AMBER , TAN , BROWN , GREY , MILKY WHITE , OTHER:

ODOR: NONE , LOW , MEDIUM , HIGH , VERY STRONG , H2S , FUEL LIKE , CHEMICAL ?, UNKNOWN

TURBIDITY: NONE , LOW , MEDIUM , HIGH , VERY TURBID. HEAVY SILTS

COMMENTS: —

Please use back of sheet for sketching maps, well location notes, etc. **See back of sheet? Y / N**

SAMPLE DATA:

Sample ID Number	No. and Types of Containers	Parameters Analyzed	Laboratory	QA/QC sample? Y /N
1355 IR35-IS05-GW-9-10-08 ~~ISO~~	3 40ml VOA	VOC	Test Amer.	MS/MSD

SIGNED/SAMPLER: [signature]

CH2MHILL

Figure 2-3

Soil Gas Sampling Field Data Sheet

Soil Gas Point Installation

Time Installed	1413
Screen Depth	10'
Screen Volume	1L
Helium Leak Check Result	250

Soil Gas Sample Point Purging

Purge Date	6/21/05
Purge Time	15 min
Purge Rate	200ml/min
Purged Volume	3L

Multi Rae Readings

Total VOCs (ppm)	0.7
O2 (%)	15.5
H2S (ppm)	0
CO (ppm)	68
LEL (%)	4

Soil Gas Sample Collection

Sample ID	FR35-IS05-SV-5-6-05B
Sample Location	Site 35, Camp Geiger
Canister ID	B47-47
Critical Orifice or Flow Controller ID	130
Pressure Gauge ID	NA
Initital Pressure (in. Hg)	-30
Sample Date	6/21/05
Start Time	1435
End Time	1440
Final Pressure (in. Hg)	-2
Elapsed Time	5 min

Observations:

CH2MHILL

PROJECT NUMBER	BORING NUMBER	
TO 21	35-I 504	SHEET 1 OF 1

SOIL BORING LOG

PROJECT: TO 21 LOCATION: Site 35, MCAS New River

ELEVATION: DRILLING CONTRACTOR: Zebra

DRILLING METHOD AND EQUIPMENT USED: Geoprobe

WATER LEVELS: START: 1450 END: 1505 LOGGER: K Riggs

DEPTH BELOW SURFACE (FT)	INTERVAL (FT)	RECOVERY (IN)	#/TYPE	STANDARD PENETRATION TEST RESULTS 6"-6"-6"-6" (N)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY, OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY.	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION. OVM (ppm): Breathing Zone Above Hole
					0-6"- organic material	
					6"-5'- fine to medium sand	
5					2.5Y 8/6 yellow	
					5'-7'- same as above	
					7'-9'- moist medium to couse sand	
10					2.5Y 7/1 - light gray	
					9'-13'- saturated medium to course sand	
					2.5Y 7/1 light gray	0.0 ppm
15					slight odor	
20						
25						

SBOR25FT.XLS

Attachment 4

PROJECT NUMBER	PROJECT NAME
7021	Soil Vapor Intrusion

CH2MHILL

WELL PURGE AND SAMPLING FIELD SHEET

SITE: 35, NCAS New River
FIELD CREW: R. Logs, J. Chalk
WEATHER: ~~Sunny~~ Overcast 1 81°
DATE: 10/21/08
WELL NUMBER: 35-IS06

PURGE VOLUME CALCULATION:

			CASING DIAMETER	GAL/FT OF CASING
WELL DEPTH (FT):		11		
DEPTH TO WATER (FT):	-	8	2 IN.	0.1632
WATER COLUMN (FT):	=	0 2	4 IN.	0.6528
GAL/FT OF CASING (from table at right):	x	0.1632	6 IN.	1.4688
CASING VOLUME (GALs):	=	0 .342	8 IN.	2.611
NO. OF VOLUMES (min. 3):	x		10 IN.	4.0797
PURGE VOLUME (GAL):	=	0	12 IN.	5.8748

METHOD OF PURGING (circle one)

PUMP: SUB., CENT., ~~PERIST.~~
TIME ON: 1512
FLOW RATE (gpm): 300
PUMP TIME (min): 5 min
VOL. PURGED (gals):

OTHER:

BAILER : TEFLON, SS ,OTHER:
BAILER VOL.. (gal) .25 / .33 / .75
REQUIRED PULLS:
VOL. PURGED (gals):
OTHER:

FIELD PARAMETER MEASUREMENTS Field Equipment Used: Horiba U-22

No.	Time	Volume	pH	Temperature	Conductivity	Turbidity	Other (DO; ORP)
1	1512		5.99	23.50	.220	999	5.31 -29
2	1517		5.66	22.13	.199	942	2.87 -81
3	1522		5.64	21.91	.199	551	2.73 -91
4							
5							
6							
7							
8							

OBSERVATIONS (circle as appropriate)

COLOR: CLEAR , AMBER , TAN , BROWN , GREY , MILKY WHITE , OTHER:
ODOR: NONE , LOW , MEDIUM , HIGH , VERY STRONG , H2S , FUEL LIKE , CHEMICAL ?, UNKNOWN
TURBIDITY: NONE , LOW , MEDIUM , HIGH , VERY TURBID. HEAVY SILTS
COMMENTS: —

Please use back of sheet for sketching maps, well location notes, etc. **See back of sheet? Y / N**

SAMPLE DATA:

Sample ID Number	No. and Types of Containers	Parameters Analyzed	Laboratory	QA/QC sample? Y /N
K22 IR35-IS06-GW-10-11-08B	3 40ml VOA	VOC	Test Amer.	N

SIGNED/SAMPLER: [signature]

CH2MHILL

Figure 2-3

Soil Gas Sampling Field Data Sheet

Soil Gas Point Installation

Time Installed	1525
Screen Depth	6'
Screen Volume	1 L
Helium Leak Check Result	>50

Soil Gas Sample Point Purging

Purge Date	6/21/07
Purge Time	15 min
Purge Rate	200 ml/min
Purged Volume	3 L

Multi Rae Readings

Total VOCs (ppm)	0.0
O2 (%)	20
H2S (ppm)	0
CO (ppm)	2.25
LEL (%)	6

Soil Gas Sample Collection

Sample ID	IR35-I5006-SV-5-6-08B
Sample Location	Site 35, MCAS Lejeune
Canister ID	1875D
Critical Orifice or Flow Controller ID	10
Pressure Gauge ID	NA
Initital Pressure (in. Hg)	-30
Sample Date	6/21/07
Start Time	1550
End Time	1557
Final Pressure (in. Hg)	-6
Elapsed Time	7 min

Observations:

CH2MHILL

PROJECT NUMBER	BORING NUMBER	
TO 21	IR93-IS07	SHEET 1 OF 1

SOIL BORING LOG

PROJECT: TO 21 Soil Vapor LOCATION: Site 93, MCAS New River
ELEVATION: DRILLING CONTRACTOR: zebra
DRILLING METHOD AND EQUIPMENT USED: Geoprobe
WATER LEVELS: START: 0740 END: LOGGER: K. Rigg

DEPTH BELOW SURFACE (FT)	INTERVAL (FT)	RECOVERY (IN)	#/TYPE	STANDARD PENETRATION TEST RESULTS 6"-6"-6"-6" (N)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY, OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY.	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION. OVM (ppm): Breathing Zone Above Hole
					0'-1'- mulch and organic material	
					1'-4'- medium grained sand	
5					2.5Y 7/4- pale yellow	
					4'-5'- sandy clay 20% sand	
					2.5Y 5/2- grayish brown- moist	
10					low plasticity	
					5'-9'- same as above	
15					9'-10.5'- same as above	
					10.5'-11'- Transition to clay silty sand	
					2.5Y 5/2- grayish brown moist	
20					11'-> very moist	
					12'-> saturated	
					11'-13'- medium to course sands	
25					2.5Y 6/1- gray	

SBOR25FT.XLS

Attachment 4

CH2MHILL

PROJECT NUMBER	PROJECT NAME
TO 21	Soil Vapor Intrusion

WELL PURGE AND SAMPLING FIELD SHEET

SITE: 93, MCAS New River
FIELD CREW: R Riggs, J Chalk
WEATHER: Sunny 4 80

DATE: 11/22/04
WELL NUMBER: 93-IS07

PURGE VOLUME CALCULATION:

			CASING DIAMETER	GAL/FT OF CASING
WELL DEPTH (FT):		13		
DEPTH TO WATER (FT):	-	12	2 IN.	0.1632
WATER COLUMN (FT):	=	0 1	4 IN.	0.6528
GAL/FT OF CASING (from table at right):	x	0.1632	6 IN.	1.4688
CASING VOLUME (GALs):	=	0 .163	8 IN.	2.611
NO. OF VOLUMES (min. 3):	x		10 IN.	4.0797
PURGE VOLUME (GAL):	=	0	12 IN.	5.8748

METHOD OF PURGING (circle one)

PUMP: SUB., CENT., PERIST.
TIME ON: 0813
FLOW RATE (gpm): 0.50
PUMP TIME (min): 10
VOL. PURGED (gals): .60

OTHER:

BAILER : TEFLON, SS ,OTHER:
BAILER VOL.. (gal) .25 / .33 / .75
REQUIRED PULLS:
VOL. PURGED (gals):
OTHER:

FIELD PARAMETER MEASUREMENTS Field Equipment Used: Horiba U-22

No.	Time	Volume	pH	Temperature	Conductivity	Turbidity	Other (DO; ORP)
1	0813	0	5.60	21.55	.178	999	4.33 80
2	0818	.25	5.23	20.55	.164	999	2.33 61
3	0823	.50	5.11	20.12	.172	999	1.99 57
4							
5							
6							
7							
8							

OBSERVATIONS (circle as appropriate)

COLOR: CLEAR , AMBER , TAN , BROWN , GREY , MILKY WHITE , OTHER:

ODOR: NONE , LOW , MEDIUM , HIGH , VERY STRONG , H2S , FUEL LIKE , CHEMICAL ?, UNKNOWN

TURBIDITY: NONE , LOW , MEDIUM , HIGH , VERY TURBID. HEAVY SILTS

COMMENTS: —

Please use back of sheet for sketching maps, well location notes, etc. **See back of sheet? Y / N**

SAMPLE DATA:

	Sample ID Number	No. and Types of Containers	Parameters Analyzed	Laboratory	QA/QC sample? Y /N
0823	IR93-IS07-GW-12-13-000	3 40ml VOA	VOC	Test Amer	N

SIGNED/SAMPLER: [signature]

CH2MHILL

Figure 2-3

Soil Gas Sampling Field Data Sheet

Soil Gas Point Installation

Time Installed	0830
Screen Depth	7'
Screen Volume	1L
Helium Leak Check Result	900

Soil Gas Sample Point Purging

Purge Date	6/22/08
Purge Time	15 min
Purge Rate	200 ml/min
Purged Volume	3L

Multi Rae Readings

Total VOCs (ppm)	0.0
O2 (%)	20.0
H2S (ppm)	0
CO (ppm)	117
LEL (%)	3

Soil Gas Sample Collection

Sample ID	IR93-I507-SV-6-7-08B
Sample Location	Site 93, MCAS New River
Canister ID	L-5142
Critical Orifice or Flow Controller ID	84
Pressure Gauge ID	NA
Initital Pressure (in. Hg)	-30
Sample Date	6/22/08
Start Time	0857
End Time	0902
Final Pressure (in. Hg)	-3
Elapsed Time	5 min

Observations: _____

CH2MHILL

PROJECT NUMBER:	BORING NUMBER:
TO 21	93-IS 08 SHEET OF

SOIL BORING LOG

PROJECT: TO 21 LOCATION: Site 93, MCAS New River

ELEVATION: DRILLING CONTRACTOR: Zebra

DRILLING METHOD AND EQUIPMENT: Geoprobe

WATER LEVELS: — START: 1140 END: 1205 LOGGER: K. Riggs

DEPTH BELOW EXISTING GRADE (ft)	INTERVAL (ft)	RECOVERY (in)	#TYPE	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	SYMBOLLIC LOG	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION
					0-6" - organic material 6"-3.5' - medium grained sand 2.5Y 4/1 - gray 3.5'-5' - sandy clay 25% sand - moist mottled color - 7.5YR 5/8 - strong brown 7.5YR 7/6 - reddish yellow 7.5YR 4/1 - gray 5'-9' - same as above 9'-11' - same as above 11'-12 - Transition to course sand - very moist 7.5YR 2.5/1 - black 12'-13' - saturated course sand 7.5YR 5/6 strong brown		
5							
10							
15							
20							

AGVIQ
CH2M HILL

GROUNDWATER SAMPLING DATA SHEET

Client: NAVFAC
Location: site 93, MCAS New River
Event: TO 21
Date: 6/22/08
Weather: partly cloudy + 80°

Project Number: TO 21
Well ID: 93-TS08
Sample ID: TR93-TS08-GW-12-13-0KA
Sampling Team: K Riggs, J. Chalk

Measuring Device: Horiba U-22
Date and Time: 6/22/08

Total Depth: 13 FT.(BTOC)
Depth to water: (-) 12 FT.(BTOC)
Water Column: 1 FT.
(x) .163 GAL/FT.
Well Volume: .163 GAL.
Total Purge Vol.: .40 GAL.

Purge Device: Peristaltic Pump

Well Dia. (inches)	Volume (gallons/foot)
1	0.041
1.25	0.064
2	0.163
4	0.653
6	1.469

SAMPLE DATA

Date: 6/22/08	Temp. °C	Cond. mS/cm	DO mg/L	pH SU	ORP mV	Turbidity NTU	Other: ____	Color / Odor / Comments
Time:								
Method: low flow								

FIELD PARAMETERS

Time	Purge Vol. (gals)	Temp. °C	Cond. mS/cm	DO mg/L	pH SU	ORP mV	Turbidity NTU	Other: ____	Color / Odor / Comments
1213	0	24.44	.135	4.10	5.18	176	999		
1218	—	24.65	.126	2.71	5.02	172	999		
1223	.40	24.35	.127	2.71	4.95	192	999		

Sample information: method, container number, size, and type, preservative used

Analysis	Preservative	Container requirements	No. of containers
VOC 8260	HCL	40 mL VOA	3

Observations/Notes: Reddish brown - high turbidity
slow recharge

MS/MSD | Duplicate ID No.:

Signature(s):

CH2MHILL

Figure 2-3

Soil Gas Sampling Field Data Sheet

Soil Gas Point Installation

Time Installed	1230
Screen Depth	8'
Screen Volume	1 L
Helium Leak Check Result	42 371

Soil Gas Sample Point Purging

Purge Date	4/22/08
Purge Time	15 min
Purge Rate	200 ml/min
Purged Volume	3 L

Multi Rae Readings

Total VOCs (ppm)	16.3
O2 (%)	20.1
H2S (ppm)	0
CO (ppm)	134
LEL (%)	0

Soil Gas Sample Collection

Sample ID	IR93-IS08-SV-7-8-08B
Sample Location	SWMU 93, MCAS New River
Canister ID	~~39~~ SL-1229
Critical Orifice or Flow Controller ID	39
Pressure Gauge ID	NA
Initital Pressure (in. Hg)	-30
Sample Date	4/22/08
Start Time	1256
End Time	1302
Final Pressure (in. Hg)	-2
Elapsed Time	6 min

Observations:

CH2MHILL

PROJECT NUMBER	BORING NUMBER	
TO 21	93-IS09	SHEET 1 OF 1

SOIL BORING LOG

PROJECT: TO21 Soil Vapor Intrusion LOCATION: Site 93 MCAS New River
ELEVATION: DRILLING CONTRACTOR: Zebra
DRILLING METHOD AND EQUIPMENT USED: Geoprobe
WATER LEVELS: START: 0919 END: LOGGER:

DEPTH BELOW SURFACE (FT)	INTERVAL (FT)	RECOVERY (IN)	#/TYPE	STANDARD PENETRATION TEST RESULTS 6"-6"-6"-6" (N)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY, OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY.	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION. OVM (ppm): Breathing Zone Above Hole
					0-2'- organic material	
					2'-4' - fine grained sand	
					2.5Y 6/4 - light yellowish brown	
5					4'-6' - medium to course grained sand moist	
10					5.-5.5' same as above	
					5.5'-9' - moist sandy clay - high plasticity 10% sand 2.5Y 4/2 dark grayish brown	0.0ppm
15					9'-9.5' - course grained sand - saturated perched aquafer	
20					9.5'-11' - sandy clay moist 20% sand 2.5Y 4/4 olive brown	
25					11'-13' - medium to course grained sand 2.5Y 4/1 gray	0.0ppm

SBOR25FT.XLS

Attachment 4

CH2MHILL	PROJECT NUMBER: TO 21	PROJECT NAME: 93-IS09

WELL PURGE AND SAMPLING FIELD SHEET

SITE: 93 - Soil Vapor Intrusion
DATE: 6/22/06
FIELD CREW: K. Riggs - S. Chalk
WELL NUMBER: 93 IS09
WEATHER: Sunny + 84°

PURGE VOLUME CALCULATION:

			CASING DIAMETER	GAL/FT OF CASING
WELL DEPTH (FT):		13		
DEPTH TO WATER (FT):	-	11	2 IN.	0.1632
WATER COLUMN (FT):	=	0 2	4 IN.	0.6528
GAL/FT OF CASING (from table at right):	x	0.1632	6 IN.	1.4688
CASING VOLUME (GALs):	=	0 .326	8 IN.	2.611
NO. OF VOLUMES (min. 3):	x		10 IN.	4.0797
PURGE VOLUME (GAL):	=	0	12 IN.	5.8748

METHOD OF PURGING (circle one)

PUMP: SUB., CENT., PERIST.
TIME ON: 0949
FLOW RATE (gpm): 2100
PUMP TIME (min): 10 min
VOL. PURGED (gals): .25

OTHER:

BAILER : TEFLON, SS ,OTHER:
BAILER VOL.. (gal) .25 / .33 / .75
REQUIRED PULLS:
VOL. PURGED (gals):
OTHER:

FIELD PARAMETER MEASUREMENTS Field Equipment Used: Horiba U-22

No.	Time	Volume	pH	Temperature	Conductivity	Turbidity	Other (DO; ORP)
1	0949	0	5.67	24.93	.333	999	3.10 66
2	0954	–	5.60	26.57	.353	999	5.14 57
3	0959	.25	5.54	26.95	.344	999	4.00 58
4							
5							
6							
7							
8							

OBSERVATIONS (circle as appropriate)

COLOR: CLEAR , AMBER , TAN , BROWN , GREY , MILKY WHITE , OTHER:

ODOR: NONE , LOW , MEDIUM , HIGH , VERY STRONG , H2S , FUEL LIKE , CHEMICAL ?, UNKNOWN

TURBIDITY: NONE , LOW , MEDIUM , HIGH , VERY TURBID. HEAVY SILTS

COMMENTS: —

Please use back of sheet for sketching maps, well location notes, etc. **See back of sheet? Y / N**

SAMPLE DATA:

Sample ID Number	No. and Types of Containers	Parameters Analyzed	Laboratory	QA/QC sample? Y /N
0959 IR93-IS07-GW-12-130806	3 40mL VOA	VOC	Test Amer.	N

SIGNED/SAMPLER:

CH2MHILL

Figure 2-3

Soil Gas Sampling Field Data Sheet

Soil Gas Point Installation

Time Installed	1085
Screen Depth	7'
Screen Volume	3L
Helium Leak Check Result	1475

Soil Gas Sample Point Purging

Purge Date	4/22/08
Purge Time	15 min
Purge Rate	200
Purged Volume	3L

Multi Rae Readings

Total VOCs (ppm)	2.9
O2 (%)	15.0
H2S (ppm)	0
CO (ppm)	182
LEL (%)	12

Soil Gas Sample Collection

Sample ID	IR93-IS09-SV-4-7-08B
Sample Location	Site 93, MCAS New River
Canister ID	L5143
Critical Orifice or Flow Controller ID	133
Pressure Gauge ID	NA
Initital Pressure (in. Hg)	-30
Sample Date	4/22/08
Start Time	1030
End Time	1035
Final Pressure (in. Hg)	-1
Elapsed Time	5 min

Observations:

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Figure 2-3

Soil Gas Sampling Field Data Sheet

Soil Gas Point Installation

Time Installed	11/2007
Screen Depth	5'
Screen Volume	1 L
Helium Leak Check Result	NA

Soil Gas Sample Point Purging

Purge Date	6/24/08
Purge Time	15 min
Purge Rate	200
Purged Volume	3 L

Multi Rae Readings

Total VOCs (ppm)	63
O2 (%)	17.5
H2S (ppm)	10
CO (ppm)	7
LEL (%)	0

Soil Gas Sample Collection

Sample ID	IR89-IS10-SV-4-5-0822
Sample Location	3.4 89 - MCAS Ucon River
Canister ID	B4672
Critical Orifice or Flow Controller ID	59
Pressure Gauge ID	NA
Initital Pressure (in. Hg)	-30
Sample Date	6/24/08
Start Time	1427
End Time	1432
Final Pressure (in. Hg)	-3
Elapsed Time	5 min

Observations:

CH2MHILL

Figure 2-3

Soil Gas Sampling Field Data Sheet

Soil Gas Point Installation

Time Installed	11/20/00
Screen Depth	5'
Screen Volume	1 L
Helium Leak Check Result	NA

Soil Gas Sample Point Purging

Purge Date	11/24/08
Purge Time	15 min
Purge Rate	200
Purged Volume	3 L

Multi Rae Readings

Total VOCs (ppm)	1.2
O2 (%)	20.3
H2S (ppm)	0
CO (ppm)	0
LEL (%)	0

Soil Gas Sample Collection

Sample ID	SR89-SS11-SV-4-5-08B
Sample Location	Site 89 MCAS New River
Canister ID	B4447
Critical Orifice or Flow Controller ID	89
Pressure Gauge ID	NA
Initital Pressure (in. Hg)	-30
Sample Date	11/24/08
Start Time	1400
End Time	1405
Final Pressure (in. Hg)	0
Elapsed Time	5 min

Observations: _____

CH2MHILL

Figure 2-3

Soil Gas Sampling Field Data Sheet

Soil Gas Point Installation

Time Installed	11/2006
Screen Depth	5'
Screen Volume	1L
Helium Leak Check Result	NA

Soil Gas Sample Point Purging

Purge Date	6/24/08
Purge Time	25 min
Purge Rate	100
Purged Volume	3L

Multi Rae Readings

Total VOCs (ppm)	Sec 9
O2 (%)	15.6
H2S (ppm)	0
CO (ppm)	0
LEL (%)	0

Soil Gas Sample Collection

Sample ID	IR89-ISD2-SV-4'-5'-0823
Sample Location	Site 89
Canister ID	B3845
Critical Orifice or Flow Controller ID	86
Pressure Gauge ID	NA
Initital Pressure (in. Hg)	-30
Sample Date	6/24/08
Start Time	1330
End Time	1335
Final Pressure (in. Hg)	-3
Elapsed Time	5 min

Observations:

Figure 2-5

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Sheet 1 of __

Indoor Air Sampling Log (Summa Canister)

Project Information

Project Name: MCB Camp Lejeune

Project #: 364167

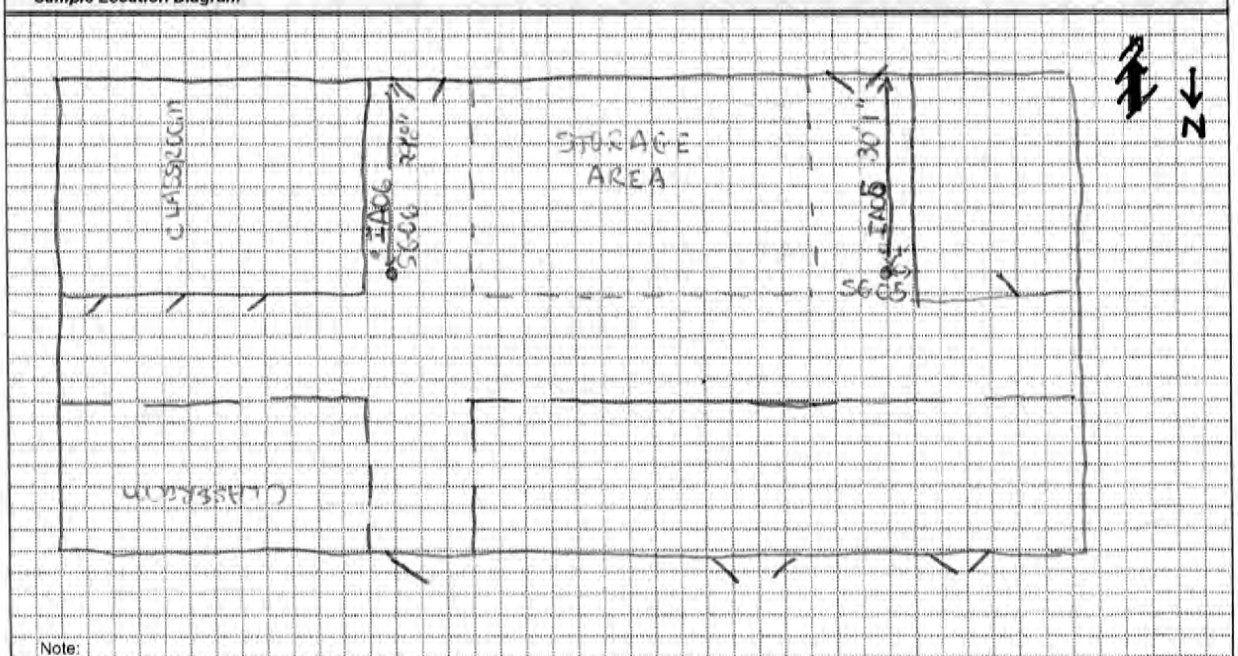
By: K Stokes

Date: 6/23/08

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)
IR35-IA06	IR35 IA06 -08B	2949	K437	-30	3.5	6/23/08 9 45	6/24/08 9 18	-6	3.5
IR35-IA05	IR35 IA05 -08B	6690	K265	-31	3.5	6/23/08 10 04	6/24/08 9 56	-7	3.5
~~IR35-OA03~~	~~IR35-OA03 -08B~~								

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): Did not collect an OA sample @ this location - oversight.

Bldg G480

Figure 2-4
CH2MHILL

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

Project Info

Project Name: MCB Camp Lejeune Project # : 364167
By: K Stokes Date: 6/23/08

Structure

Identification: G480 Site 35 Camp Geiger
Address:
Slab Information:
- [x] Concrete slab on grade (directly on top of soil)
- [ ] Concrete slab on gravel underlayment
- [ ] Other (describe)

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

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

	Sample location (show in diagram)	1	2	3	4
	Sample Identification (field ID)	IR35-SG06-088	IR35-SG05-088		
Probe Installation	Depth of slab (inches)	8"	8"		
	Depth of hole drilled (inches below slab surface)	10"	10"		
	Depth of installed probe (inches below slab surface)	8.5"	8.5"		
Manifold Leak check	Leak check (sampling manifold) - Pass/No Pass	pass (100 ppm)	Pass (275 ppm)		
Probe Purge	Purge rate, cc/min	200 mL/min	200 mL/min		
	Purge Start (time of day)	09 25	0953		
	Purge vacuum, " Hg	n/a	n/a		
	Purge completed (time of day)	0930	0958		
Helium Leak Check (optional)	Leak check (Helium) - %	0%	0%		
Canister Sampling	Canister & flow controller ID (if used)	L-5136/99	L-5190/70		
	Initial Canister Pressure (" Hg)	-30	-30		
	Sampling rate, cc/min	200 mL/min	200 mL/min		
	Sampling period started (time of day)	09 30	10 00		
	Sampling vacuum, " Hg	n/a	n/a		
	Sampling period ended (time of day)	09 35	10 06		
	Final Canister Pressure (" Hg)	-4	-3		

Observations and Comments:

SG-06: VOC 7
LEL 0
H_2S 0
O_2 19.1
CO 4

SG-05: VOC 2.4
LEL 0
H_2S 0
O_2 20.6
CO 0

Figure 2-5

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Sheet 1 of __

Indoor Air Sampling Log (Summa Canister)

Project Information

Project Name: NAVFAC MCB Camp Lejeune

Project #: 364167

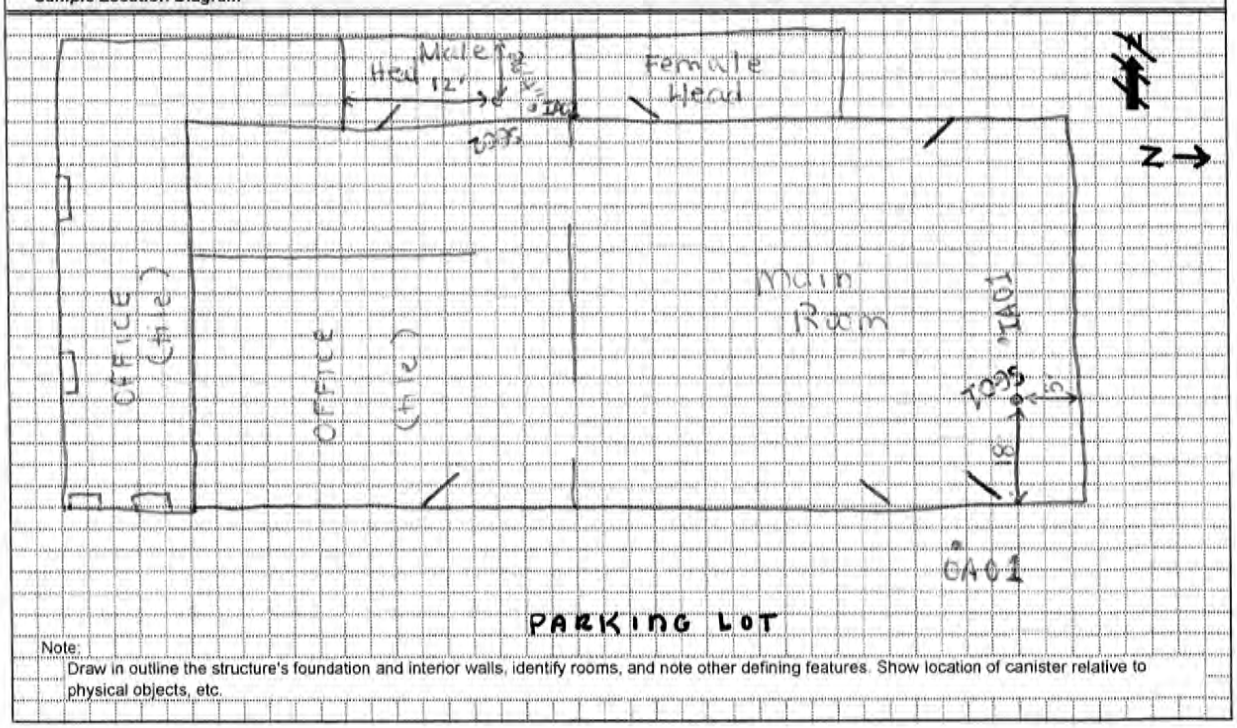
By: K Stokes / J Chalk

Date: 6/20/08

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)
IR89-IA01	IR89-IA01-08B	93186	K459	-29	3.5	6/20/08 17:07	6/21/08 16:13	-9	3.5
IR89-IA02	IR89-IA02-08B	92387	K113B	-30	3.5	6/20/08 17:08	6/21/08 15:25	-8	3.5
IR89-OA01	IR89-OA01-08B	6349	K118	-32	3.5	6/20/08 17:16	6/21/08 16:15	-8	3.5

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): TC 860

Both bathrooms and main room (concrete)

Figure 2-4
CH2MHILL

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

Project Info

Project Name: NAVFAC MCB Camp Lejeune **Project # :** 364167
By: K Stokes **Date:** 6/20/08

Structure

Identification: Bldg TC-860 Camp Geiger
Address: Unknown
Slab Information:
- [x] Concrete slab on grade (directly on top of soil)
- [ ] Other (describe)
- [ ] Concrete slab on gravel underlayment

Condition of slab: Several sections w/ expansion joints
Type of Sub Slab Soil: unknown
Is water present in the soil: unknown

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

	Sample location (show in diagram)	1	2	3	4
	Sample Identification (field ID)	IR89-SG01-08B	IR89-SG02-08B		
Probe Installation	Depth of slab (inches)	6"	6"		
	Depth of hole drilled (inches below slab surface)	8"	8"		
	Depth of installed probe (inches below slab surface)	6.5"	6.5"		
Manifold Leak check	Leak check (sampling manifold) - Pass/No Pass	Pass (0 ppm)	Pass (200 ppm)		
Probe Purge	Purge rate, cc/min.	200 mL/min	200 mL/min		
	Purge Start (time of day)	15 26	15 52		
	Purge vacuum, " Hg	n/a	n/a		
	Purge completed (time of day)	15 31	1556		
Helium Leak Check (optional)	Leak check (Helium) - %	0%	0%		
Canister Sampling	Canister & flow controller ID (if used)	L-5181/27	L-5116/06		
	Initial Canister Pressure (" Hg)	-30	-29		
	Sampling rate, cc/min	200 mL/min	200 mL/mn		
	Sampling period started (time of day)	1533	1556		
	Sampling vacuum, " Hg	n/a	n/a		
	Sampling period ended (time of day)	1539	1603		
	Final Canister Pressure (" Hg)	-3	-3		

Observations and Comments:

Figure 2-5

CH2M HILL

Sheet 1 of __

Indoor Air Sampling Log (Summa Canister)

Project Information

Project Name: MCB Camp Lejeune

Project #: 364167

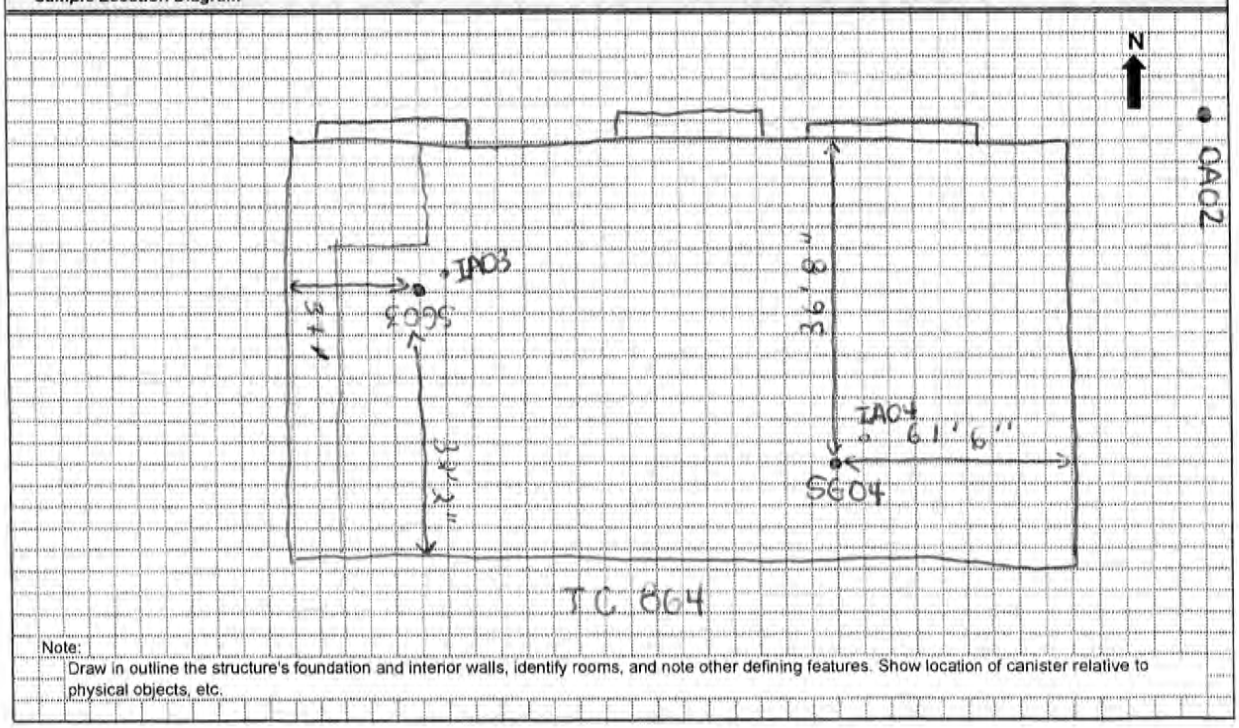
By: Kim Stokes

Date: 6/23/08

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)
1R89-IA03	1R89-IA03-08B	12521	K444	-31	3.5	6/23/08 08.53	6/24/08 09.06	-4	3.5
1R89-IA04	1R89-IA04-08B	12468	K157	-32	3.5	6/23/08 08.43	6/24/08 09.04	-7	3.5
1R89-OA02	1R89-OA02-08B	12460	K172	-32	3.5	6/23/08 09.02	6/24/08 09.07	-22	3.5

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): TC 864

OA canister regular was malfunctioning - did not go down to zero when shut off.

Figure 2-4
CH2MHILL

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

Project Info

Project Name: MCB Camp Lejeune Project #: 364167
By: Date: 6/23/08

Structure

Identification: IR89-SG04-08B
Address:
Slab Information:
☒ Concrete slab on grade (directly on top of soil) ☐ Other (describe)
☐ Concrete slab on gravel underlayment
Condition of slab: older - cracks
Type of Sub Slab Soil: unknown
Is water present in the soil: unknown

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

	Sample location (show in diagram)	1	2	3	4
	Sample Identification (field ID)	IR89-SG04-08B	IR89-SG03-08B		
Probe Installation	Depth of slab (inches)	6"	6"		
	Depth of hole drilled (inches below slab surface)	8"	8"		
	Depth of installed probe (inches below slab surface)	6.5"	6.5"		
Manifold Leak check	Leak check (sampling manifold) - Pass/No Pass	PASS (400ppm)	Pass (39%)		
Probe Purge	Purge rate, cc/min.	200mL/min	200mL/min		
	Purge Start (time of day)	08 05	08 35		
	Purge vacuum, " Hg	n/a	n/a		
	Purge completed (time of day)	08 10	08 40		
Helium Leak Check (optional)	Leak check (Helium) - %	0%	3.9%		
Canister Sampling	Canister & flow controller ID (if used)	1877D/44	5088D/42		
	Initial Canister Pressure (" Hg)	-30	-30		
	Sampling rate, cc/min	200mL/min	200mL/min		
	Sampling period started (time of day)	08 20	08 45		
	Sampling vacuum, " Hg	n/a	n/a		
	Sampling period ended (time of day)	08 26	08 51		
	Final Canister Pressure (" Hg)	-2	-3		

Observations and Comments:

VOC 12.6 LEL 0 | VOC 3.2 H_2S 0
O_2 19.1 H_2S 0 | CO 0 O_2 14.8
CO 0 | LEL 0

Figure 2-4
CH2MHILL

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

Project Info

Project Name: Camp Lejeune VI eval **Project #:**
By: Jen Simms **Date:** 09/27/08

Structure

Identification: Building G533
Address:
Slab Information:
☒ Concrete slab on grade (directly on top of soil) ☐ Other (describe)
☐ Concrete slab on gravel underlayment
Condition of slab: Good
Type of Sub Slab Soil: yellow sand then brown Clayey soil
Is water present in the soil: no

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

	Sample location (show in diagram)	1	2	3	4
	Sample Identification (field ID)	IR35-SG13	IR35-SG12		
Probe Installation	Depth of slab (inches)	6"	6"		
	Depth of hole drilled (inches below slab surface)	4"	4"		
	Depth of installed probe (inches below slab surface)	4"	4"		
Manifold Leak check	Leak check (sampling manifold) - Pass/No Pass	Pass	Pass		
Probe Purge	Purge rate, ~~cc/min~~	200 mL/min	200mL/m		
	Purge Start (time of day)				
	Purge vacuum, " Hg	0	0		
	Purge completed (time of day)		15:22		
Helium Leak Check (optional)	Leak check (Helium) - %	1825ppm	0 ppm		
Canister Sampling	Canister & flow controller ID (if used)		SL-1227/79		
	Initial Canister Pressure (" Hg)		-29		
	Sampling rate, cc/min		200mL/min		
	Sampling period started (time of day)		15:29		
	Sampling vacuum, " Hg		0		
	Sampling period ended (time of day)		15:35		
	Final Canister Pressure (" Hg)		-2		

Observations and Comments:

Fail leak check re-seal probe w/ cement

VOC > 3.6ppm
CO_2 1.5%
O_2 19.4%

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

Project Info

Project Name: CL VI
Project # : 70 21
By: K. Riggs
Date: 10/4/08

Structure

Identification: G-531
Address: MCAS New River

Slab Information:

- [x] Concrete slab on grade (directly on top of soil)
- [ ] Other (describe)
- [ ] Concrete slab on gravel underlayment

Condition of slab: good
Type of Sub Slab Soil: Sand
Is water present in the soil: no

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

		1	2	3	4
	Sample location (show in diagram)				
	Sample Identification (field ID)	IR35-SG09	IR35-SG08		
Probe Installation	Depth of slab (inches)	6"	6"		
	Depth of hole drilled (inches below slab surface)	9"	9"		
	Depth of installed probe (inches below slab surface)	6"	6"		
Manifold Leak check	Leak check (sampling manifold) - Pass/No Pass	Pass	Pass		
Probe Purge	Purge rate, cc/min.	.2	.2		
	Purge Start (time of day)	1030	1059		
	Purge vacuum, " Hg	-1	-1		
	Purge completed (time of day)	1040	1109		
Helium Leak Check (optional)	Leak check (Helium) - %	0.0	125		
Canister Sampling	Canister & flow controller ID (if used)	52-1215, 55	2-5152, 138		
	Initial Canister Pressure (" Hg)	-30	-30		
	Sampling rate, cc/min	.2	.2		
	Sampling period started (time of day)	1042	1112		
	Sampling vacuum, " Hg	-1	-1		
	Sampling period ended (time of day)	1047	1117		
	Final Canister Pressure (" Hg)	-4	-3		

Observations and Comments:

FID = 1.0 PID = 0.0
O_2 = 15% O_2 = 21.5
CO_2 = 0% CO_2 = 0.0

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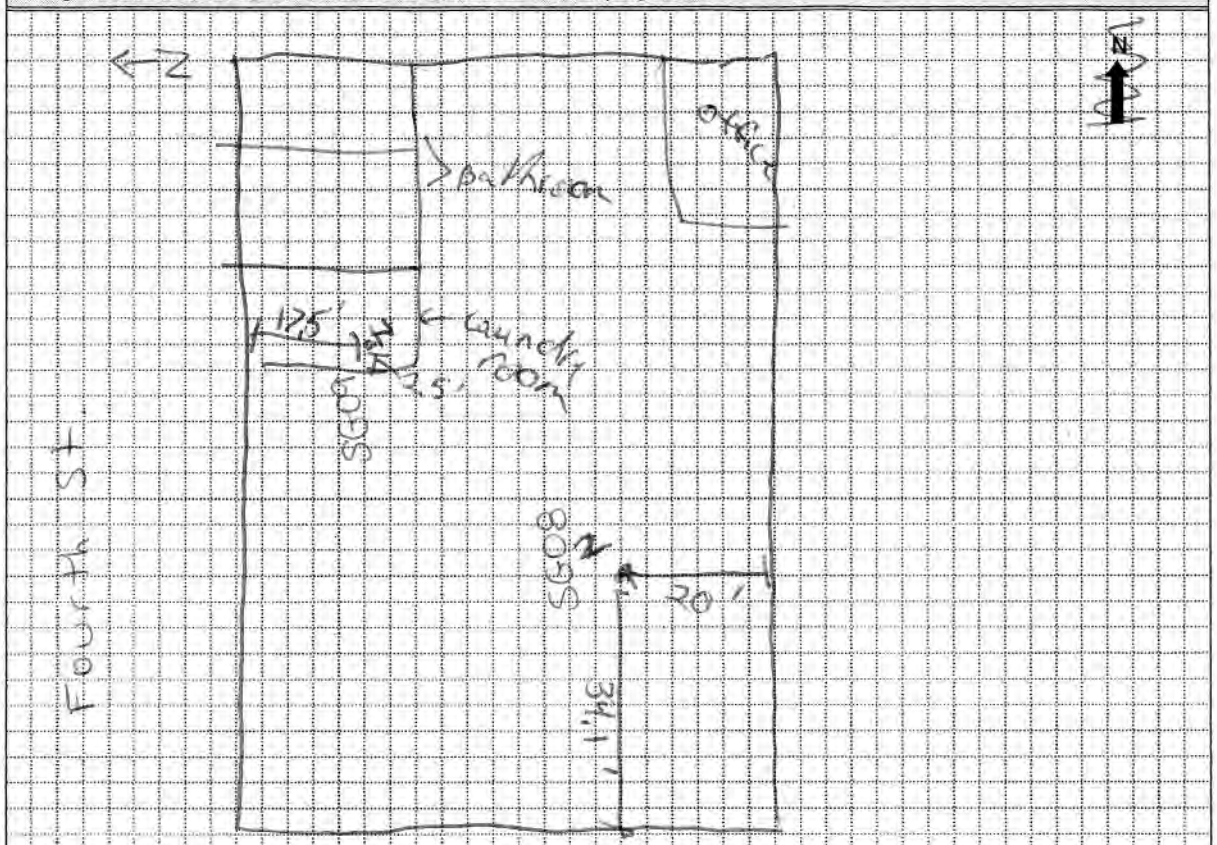
Indoor Vapor Intrusion Assessment
Sub-slab Vapor Sampling Field Log

Bldg G531
1R35SG08 & 1R35SG09

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



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: CL V.T
Project # : TO 21
By: L. Riggs & E. Barclay
Date: 10/4/10

Structure

Identification: G532
Address: MCAS New River, Camp Geiger

Slab Information:

- [x] Concrete slab on grade (directly on top of soil)
- [ ] Other (describe)
- [ ] Concrete slab on gravel underlayment

Condition of slab: good
Type of Sub Slab Soil: sand
Is water present in the soil: no

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

		1	2	3	4
	Sample location (show in diagram)	1	2	3	4
	Sample Identification (field ID)	35-SG11	35 SG12		
Probe Installation	Depth of slab (inches)	4"			
	Depth of hole drilled (inches below slab surface)	9"			
	Depth of installed probe (inches below slab surface)	4"			
Manifold Leak check	Leak check (sampling manifold) - Pass/No Pass	pass			
Probe Purge	Purge rate, cc/min.	.2			
	Purge Start (time of day)	0943			
	Purge vacuum, " Hg	-2			
	Purge completed (time of day)	0957			
Helium Leak Check (optional)	Leak check (Helium) - %	0.0			
Canister Sampling	Canister & flow controller ID (if used)	052-1229, 34			
	Initial Canister Pressure (" Hg)	-30			
	Sampling rate, cc/min	.2			
	Sampling period started (time of day)	1005	~~10~~		
	Sampling vacuum, " Hg	-1			
	Sampling period ended (time of day)	1010			
	Final Canister Pressure (" Hg)	-3			

Observations and Comments: O_2 = 21.1
CO = 0.0
PID = 21.2

SG12 sampled previously (Bldg 533)

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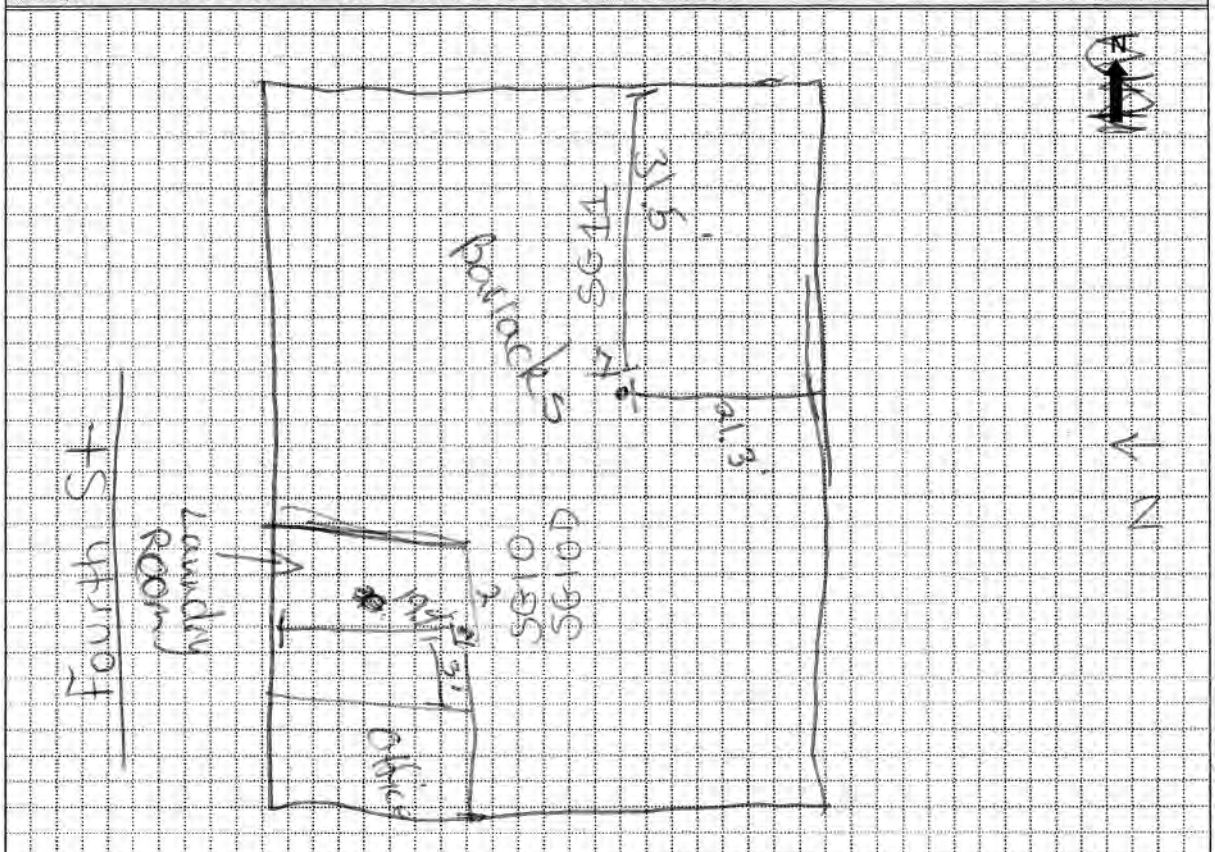
Indoor Vapor Intrusion Assessment
Sub-slab Vapor Sampling Field Log

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



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: CL VI
By: K.Riggs E.Barclay
Project #: TO 21
Date: 10/4/08

Structure

Identification: G-533
Address: MCAS New River
Slab Information:
- [x] Concrete slab on grade (directly on top of soil)
- [ ] Other (describe)
- [ ] Concrete slab on gravel underlayment

Condition of slab: Good
Type of Sub Slab Soil: Sand
Is water present in the soil: no

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

		1	2	3	4
	Sample location (show in diagram)				
	Sample Identification (field ID)	IR35-SG13	IR35-SG12		
Probe Installation	Depth of slab (inches)	6"			
	Depth of hole drilled (inches below slab surface)	9"			
	Depth of installed probe (inches below slab surface)	6"			
Manifold Leak check	Leak check (sampling manifold) - Pass/No Pass	Pass			
Probe Purge	Purge rate, cc/min.	.2			
	Purge Start (time of day)	0905			
	Purge vacuum, " Hg	-2			
	Purge completed (time of day)	0915			
Helium Leak Check (optional)	Leak check (Helium) - %	0.0			
Canister Sampling	Canister & flow controller ID (if used)	L-5115,108			
	Initial Canister Pressure (" Hg)	-31			
	Sampling rate, cc/min	.2			
	Sampling period started (time of day)	0919			
	Sampling vacuum, " Hg	-1			
	Sampling period ended (time of day)	0924			
	Final Canister Pressure (" Hg)	-4			

Observations and Comments: SG12 - sampled on seperate day
PID = 1.9 ppm
CO_2 = 0.0
O_2 = 20.8

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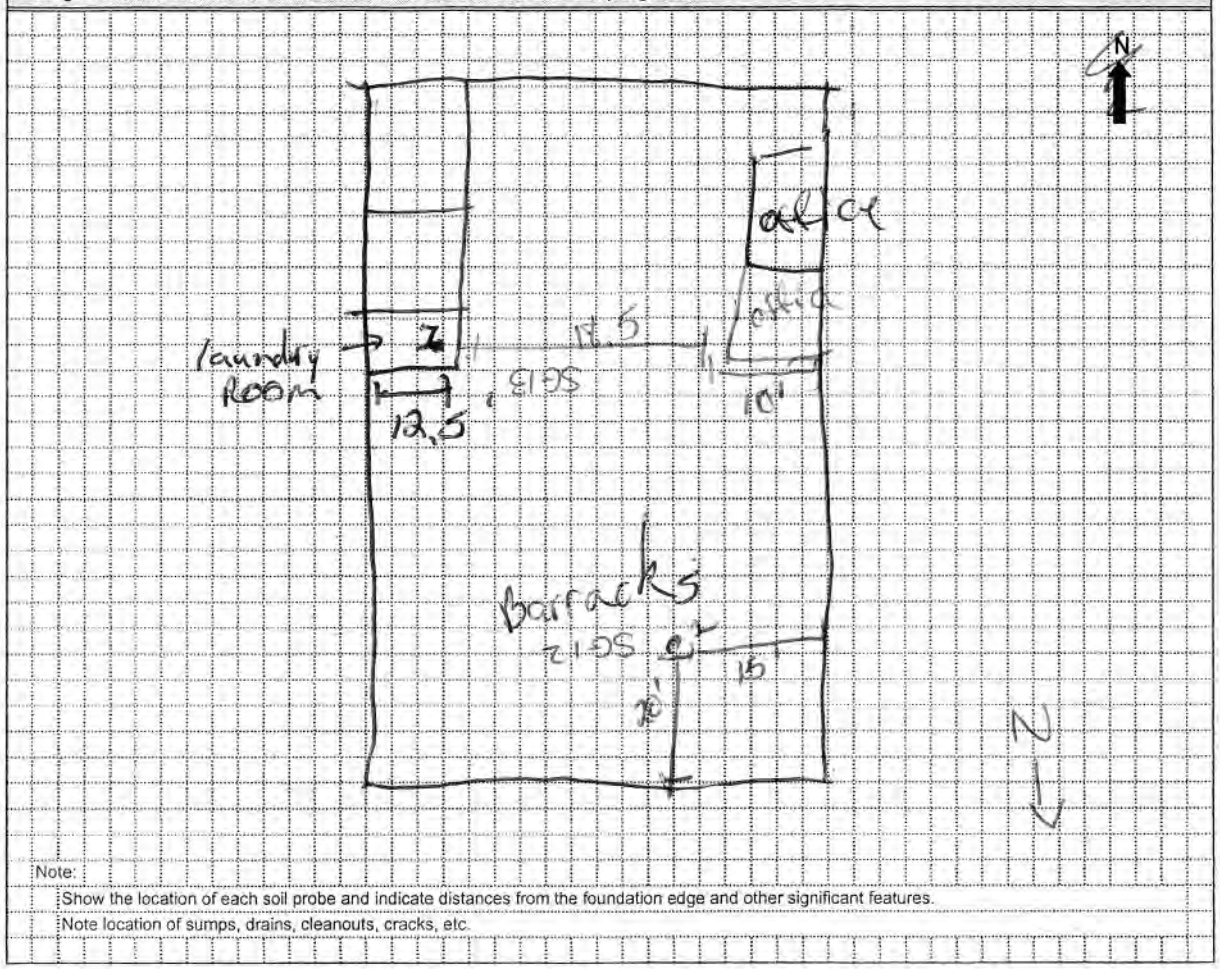
Indoor Vapor Intrusion Assessment
Sub-slab Vapor Sampling Field Log

Bldg - G533

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



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 V6-B
Data Validation/Quality Assurance
Technical Memorandum

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. This 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, analytical methods, and applicable laboratory SOPs. These criteria 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, NJ-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 and NJ-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.
- **UJ** – Not detected, quantitation limit is estimated. Sample was analyzed for this parameter, but it was not detected above the reported quantitation limit. The quantitation limit for this parameter is estimated due to a quality control issue.
- **J** - Concentration estimated. The parameter was positively identified and the associated numerical value is the approximate concentration of the parameter in the sample.
- **R** - Rejected. The result was rejected due to a quality control issue. The presence or absence of the parameter cannot be verified and the result generally is not usable as detected or not detected. R is also used to indicate an analytical result that is redundant because of reanalysis or dilution, in which case, there is no effect on the quality or usability of data.
- **[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, analytical methods, and applicable laboratory SOPs.

The laboratory utilized various qualifiers to represent "below reporting limit," "non-detect," and "detected." The data validator utilized J-qualifiers, NJ-qualifiers, UJ-qualifiers, U-qualifiers, and R-qualifiers to represent "estimated," "presumptively present at approximate quantity," "non-detect, estimated quantitation limit," "non-detect" or "attributable to blank contamination," and "rejected," respectively.

The J- and UJ-qualifiers indicate that some results are estimated. These qualifiers indicate that data are available for use as detects and non-detects, respectively. These qualifiers do 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- and UJ-qualifiers when QA/QC exceedances dictate their necessity. In general, J-, UJ-, and U-qualified results are available for use as qualified.

3 Phase I Sampling – 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 Phase I sampling at Camp Geiger as well as to provide an assessment of data usability.

3.1 Groundwater Data

This evaluation assesses the analytical results of the groundwater samples collected on June 21 through June 23, 2008.

3.1.1 Volatile Organic Compounds

Volatiles were analyzed by SW-846 method 8260B. Excluding field quality control samples, 490 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:

- 1.0 percent (5 of 490 results) were U-qualified as "attributable to blank contamination" (see section 3.1.1.1, below)
- 1.6 percent (8 of 490 results) were UJ-qualified as "nondetect, estimated quantitation limit" because of high continuing calibration recovery (see section 3.1.1.2, below)
- 0.2 percent (1 of 490 results) were J-qualified as "estimated" due to high continuing calibration recovery (see section 3.1.1.2 below)
- 8.4 percent (41 of 490 results) were J-qualified as "estimated" because the results were below the quantitation limit (see section 3.1.1.3 below)

3.1.1.1 Blank Contamination

A total of five results were U-qualified as "attributable to blank contamination" because acetone, methylene chloride, and chloromethane were detected in associated blank samples. Of these, acetone and methylene chloride are common laboratory contaminants. 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 Calibration

A total of eight results were UJ-qualified as "nondetect, estimated quantitation limit" because of high continuing calibration recoveries. The UJ-qualification of nondetects does not affect the availability of results because they are available for use as nondetects at the reported quantitation limit.

One result was J-qualified as "estimated" due to high continuing calibration recoveries. The affected compound, Methyl tert-butyl ether, did not exceed any screening criteria. The J-qualification of detects does not affect the availability of results because they are available

for use as detects at the reported concentration. However, the data user should consider the result as possibly biased high.

3.1.1.3 Quantitation Limits

A total of 41 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 Indoor Air and Outdoor Air Data

This evaluation assesses the analytical results of indoor air and outdoor air samples collected on June 21 and June 24, 2008.

3.2.1 Volatile Organic Compounds

Volatiles were analyzed by EPA method TO-15. Excluding field quality control samples, 392 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:

- 0.8 percent (3 of 392 results) were U-qualified as "attributable to blank contamination" (see section 3.2.1.1, below)
- 20.7 percent (81 of 392 results) were J-qualified as "estimated" because the results were below the quantitation limit (see section 3.2.1.2 below)

3.2.1.1 Blank Contamination

A total of three results were U-qualified as "attributable to blank contamination" because methylene chloride was detected in associated blank samples. Methylene chloride is a common laboratory contaminant. 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.

3.2.1.2 Quantitation Limits

A total of 81 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 soil gas samples collected on June 21, June 23, and June 24, 2008.

3.3.1 Volatile Organic Compounds

Volatiles were analyzed by EPA method TO-15. Excluding field quality control samples, 276 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:

- 1.8 percent (5 of 276 results) were U-qualified as "attributable to blank contamination" (see section 3.3.1.1, below)

- 12 percent (33 of 276 results) were J-qualified as "estimated" because the results were below the quantitation limit (see section 3.3.1.2 below)

3.3.1.1 Blank Contamination

A total of five results were U-qualified as "attributable to blank contamination" because methylene chloride was detected in associated blank samples. Methylene chloride is a common laboratory contaminant. 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.

3.3.1.2 Quantitation Limits

A total of 33 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.

3.4 Shallow Soil Vapor Data

This evaluation assesses the analytical results of shallow soil vapor samples collected on June 21 and June 24, 2008.

3.4.1 Volatile Organic Compounds

Volatiles were analyzed by EPA method TO-15. Excluding field quality control samples, 322 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:

- 2.2 percent (7 of 322 results) were U-qualified as "attributable to blank contamination" (see section 3.4.1.1, below)
- 14.9 percent (48 of 322 results) were J-qualified as "estimated" because the results were below the quantitation limit (see section 3.4.1.2 below)

3.4.1.1 Blank Contamination

A total of seven results were U-qualified as "attributable to blank contamination" because methylene chloride was detected in associated blank samples. Methylene chloride is a common laboratory contaminant. 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.

3.4.1.2 Quantitation Limits

A total of 48 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.

3.5 Deep Soil Vapor Data

This evaluation assesses the analytical results of deep soil vapor samples collected on June 22, 2008.

3.5.1 Volatile Organic Compounds

Volatiles were analyzed by EPA method TO-15. Excluding field quality control samples, 138 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:

- 2.2 percent (3 of 138 results) were U-qualified as "attributable to blank contamination" (see section 3.5.1.1, below)
- 18.8 percent (26 of 138 results) were J-qualified as "estimated" because the results were below the quantitation limit (see section 3.5.1.2 below)

3.5.1.1 Blank Contamination

A total of three results were U-qualified as "attributable to blank contamination" because methylene chloride was detected in associated blank samples. Methylene chloride is a common laboratory contaminant. 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.

3.5.1.2 Quantitation Limits

A total of 26 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.

4 Phase II Sampling – Camp Geiger

4.1 Soil Gas

This evaluation assesses the analytical results of soil gas samples collected on September 27 and October 4, 2008.

4.1.1 Volatile Organic Compounds

Volatiles were analyzed by EPA method TO-15. Excluding field quality control samples, 322 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:

- 2.8 percent (9 of 322 results) were U-qualified as "attributable to blank contamination" (see section 4.1.1.1, below)
- 1.9 percent (6 of 322 results) were UJ-qualified as "nondetect, estimated quantitation limit" because of high continuing calibration recovery (see section 4.1.1.2, below)
- 0.3 percent (1 of 322 results) were J-qualified as "estimated" due to high continuing calibration recovery (see section 4.1.1.2 below)
- 5 percent (16 of 322 results) were J-qualified as "estimated" because the results were below the quantitation limit (see section 4.1.1.3 below)

4.1.1.1 Blank Contamination

A total of nine results were U-qualified as "attributable to blank contamination" because carbon disulfide and methylene chloride were detected in associated blank samples. Methylene chloride is a common laboratory contaminant. 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.

4.1.1.2 Calibration

A total of six results were UJ-qualified as "nondetect, estimated quantitation limit" because of high continuing calibration recoveries. The UJ-qualification of nondetects does not affect the availability of results because they are available for use as nondetects at the reported quantitation limit.

One result was J-qualified as "estimated" due to high continuing calibration recoveries. The affected compound, Acetone, did not exceed any criteria. The J-qualification of detects does not affect the availability of results because they are available for use as detects at the reported concentration. However, the data user should consider this result as possibly biased high.

4.1.1.3 Quantitation Limits

A total of 16 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.

5 Overall Assessment

All data collected in support of Phase I and Phase II sampling events are found to be of exceptional quality. No data was rejected due to QA/QC deficiencies and all data is available for use by the project team.

Appendix V6-C
Building Survey Forms

Figure 2-1
Preliminary Building Survey for Vapor Intrusion Investigation

CH2MHILL

Date: 6/23/08
Preparer: K Stokes

Facility: Site 35 Camp Geiger G480
Address:

Contact Person: Andy Unsworth
Phone Number:
e-mail address:

Building Description

Building or Room Identifier: Bldg G480
Primary Activity within Building (select one):

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

Notes: Teaching classrooms, equipment storage

Approximate floor space
Number of floors 1
Multi-room building [x] or Single room [ ]
Ceiling height 12'
Aboveground Construction [ ] Wood [ ] Concrete [ ] Brick [x] Cinderblock [ ] Other

Floor plan attached? [x] Yes [ ] No
Notes:

Figure 2-1
Preliminary Building Survey for Vapor Intrusion Investigation

Evaluation of Potential Conduits from Soil

Floor/foundation description (check all that apply)

- [ ] Wood
- [x] Concrete
- [x] Elevated above grade?
- [ ] Below grade?
- [ ] Other

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?	[ ] Yes	[ ] No	[x] N/A
Are basements or subsurface vaults present?	[ ] Yes	[ ] No	[x] 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)

None

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)

Figure 2-1
Preliminary Building Survey for Vapor Intrusion Investigation

Sources of outdoor air

[X] Mechanical (air handling unit) [X] Doors
[X] Windows

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

Notes: Front doors propped open

Evaluation of Potential Existing Chemical Sources Indoors

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

PLEDGE
Gas canisters

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

[ ] Yes [X] No

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

Names of pesticide products used?

Has there been a pesticide application within the past 6 months? [ ] Yes [X] 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

_____

Figure 2-1
Preliminary Building Survey for Vapor Intrusion Investigation

Additional Notes

Figure 2-1
Preliminary Building Survey for Vapor Intrusion Investigation

Figure 2-1
Preliminary Building Survey for Vapor Intrusion Investigation

CH2MHILL

Date: 6/20/08
Preparer: Kim Stokes

Facility: TC-860 Camp Geiger
Address: Unknown

Contact Person: Andy Unsworth
Phone Number: #
e-mail address:

Building Description

Building or Room Identifier: Bldg TC-860
Primary Activity within Building (select one):

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

Notes: initial Recruit processing building

Approximate floor space 100 x 50 ft =
Number of floors 1
Multi-room building [X] or Single room [ ]
Ceiling height 10'
Aboveground Construction
- [x] Wood
- [ ] Concrete
- [ ] Brick
- [ ] Cinderblock
- [ ] Other

Floor plan attached? [X] 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 * partially covered w/ linoleum tile

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
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

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)

Figure 2-1
Preliminary Building Survey for Vapor Intrusion Investigation

Sources of outdoor air

[X] Mechanical (air handling unit) [X] Doors
[X] Windows

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

Notes: _____

Evaluation of Potential Existing Chemical Sources Indoors

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

Pine Sol _____
Clorox _____
Pine Oil Disinfectant Detergent _____

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

[ ] Yes [X] No

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

Names of pesticide products used? _____

Has there been a pesticide application within the past 6 months? [ ] Yes [X] 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

_____

Figure 2-1
Preliminary Building Survey for Vapor Intrusion Investigation

Additional Notes

Figure 2-1
Preliminary Building Survey for Vapor Intrusion Investigation

Figure 2-1
Preliminary Building Survey for Vapor Intrusion Investigation

Date: 6/23/08
Preparer: Kim Stokes

CH2MHILL

Facility: IR89 TC-864
Address:

Contact Person:
Phone Number:
e-mail address:

Building Description

Building or Room Identifier:
Primary Activity within Building (select one):

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

Notes:

Approximate floor space 100 x 50 = 5,000 ft²
Number of floors 1

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

Ceiling height 30

Aboveground Construction
- [ ] Wood
- [ ] Concrete
- [ ] Brick
- [ ] Cinderblock
- [x] Other corrugated metal

Floor plan attached? [x] 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

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?	[ ] Yes	[x] No	[ ] N/A
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)

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

- [ ] Single zone
- [ ] Multi-zone
- [x] Other None

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

Figure 2-1
Preliminary Building Survey for Vapor Intrusion Investigation

Sources of outdoor air

☐ Mechanical (air handling unit) ☒ Doors
☒ Windows

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

Notes: _____

Evaluation of Potential Existing Chemical Sources Indoors

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

_____ _____
_____ _____
_____ _____

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 ☒ 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

Figure 2-1
Preliminary Building Survey for Vapor Intrusion Investigation

☐ N/A

Notes: _____

Additional Notes

_____

Figure 2-1
Preliminary Building Survey for Vapor Intrusion Investigation

Additional Notes

Figure 2-1
Preliminary Building Survey for Vapor Intrusion Investigation

Preliminary Building Survey for Vapor Intrusion Investigation

CH2MHILL

Date: 10/4/08

Preparer: K. Riggs + E. Barclay

Facility: G-531 - Barracks

Address: Camp Lejeune, MCAS New River
Camp Geiger

Contact Person:

Phone Number: 910-449-0603

e-mail address:

Building Description

Building or Room Identifier: G-531

Primary Activity within Building (select one):

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

Notes: Marine Barracks

Approximate floor space 100 x 50'

Number of floors 2

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

Ceiling height 10'

Aboveground Construction
- [ ] Wood
- [x] Concrete
- [x] Brick
- [ ] Cinderblock
- [ ] Other

Floor plan attached? [x] Yes [ ] No

Notes: windows on sides but they do not open

Evaluation of Potential Conduits from Soil

Floor/foundation description (check all that apply)

- [ ] Wood
- [x] Concrete
- [ ] Elevated above grade?
- [ ] Below grade?
- [ ] Other _____

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?	[ ] Yes	[x] No	[ ] N/A
Are basements or subsurface vaults present?	[ ] Yes	[ ] No	[x] N/A
Are there subsurface drainage problems?	[ ] Yes	[x] 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)

No

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

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

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

Notes: Just doors.

Evaluation of Potential Existing Chemical Sources Indoors

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

Bleach
simple green
windex
409

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

[X] Yes [ ] No

cleaning

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

Names of pesticide products used? N/A

Has there been a pesticide application within the past 6 months? [ ] Yes [X] 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? N/A

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

Notes:

Additional Notes

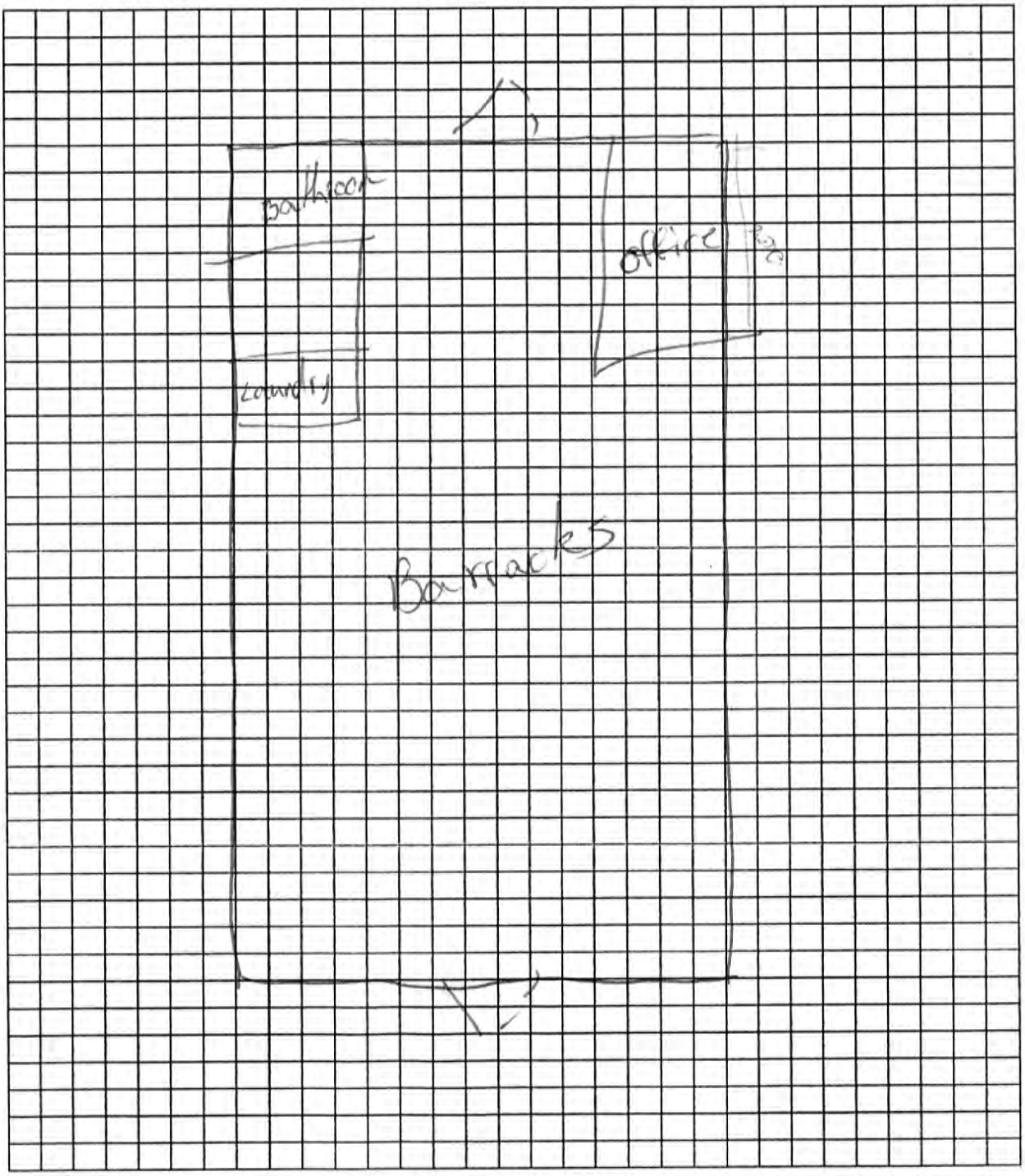
Additional Notes

Date: 10/4/08
Preparer: K. Riggs & E Barkley

Facility: Q531
Description (floor): concrete

CH2MHILL

Floor Plan Information



Preliminary Building Survey for Vapor Intrusion Investigation

CH2MHILL

Date: 10/4/08

Preparer: K. Riggs + E. Barclay

Facility: G532

Address: MCAS New River
Camp Geiger

Contact Person:

Phone Number:

e-mail address:

Building Description

Building or Room Identifier: G532

Primary Activity within Building (select one):

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

Notes: Marine Barracks

Approximate floor space 100' x 50'

Number of floors 2

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

Ceiling height 10'

Aboveground Construction
- [ ] Wood
- [x] Concrete
- [x] Brick
- [ ] Cinderblock
- [ ] Other

Floor plan attached? [x] 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 _____

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

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)

NO

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

- [x] 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

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

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

Notes: Just doors

Evaluation of Potential Existing Chemical Sources Indoors

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

Bleach
general cleaning products

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

[X] Yes [ ] No

cleaning products

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

Names of pesticide products used? N/A

Has there been a pesticide application within the past 6 months? [ ] Yes [X] 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? N/A

Type of system?

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

Notes:

Additional Notes

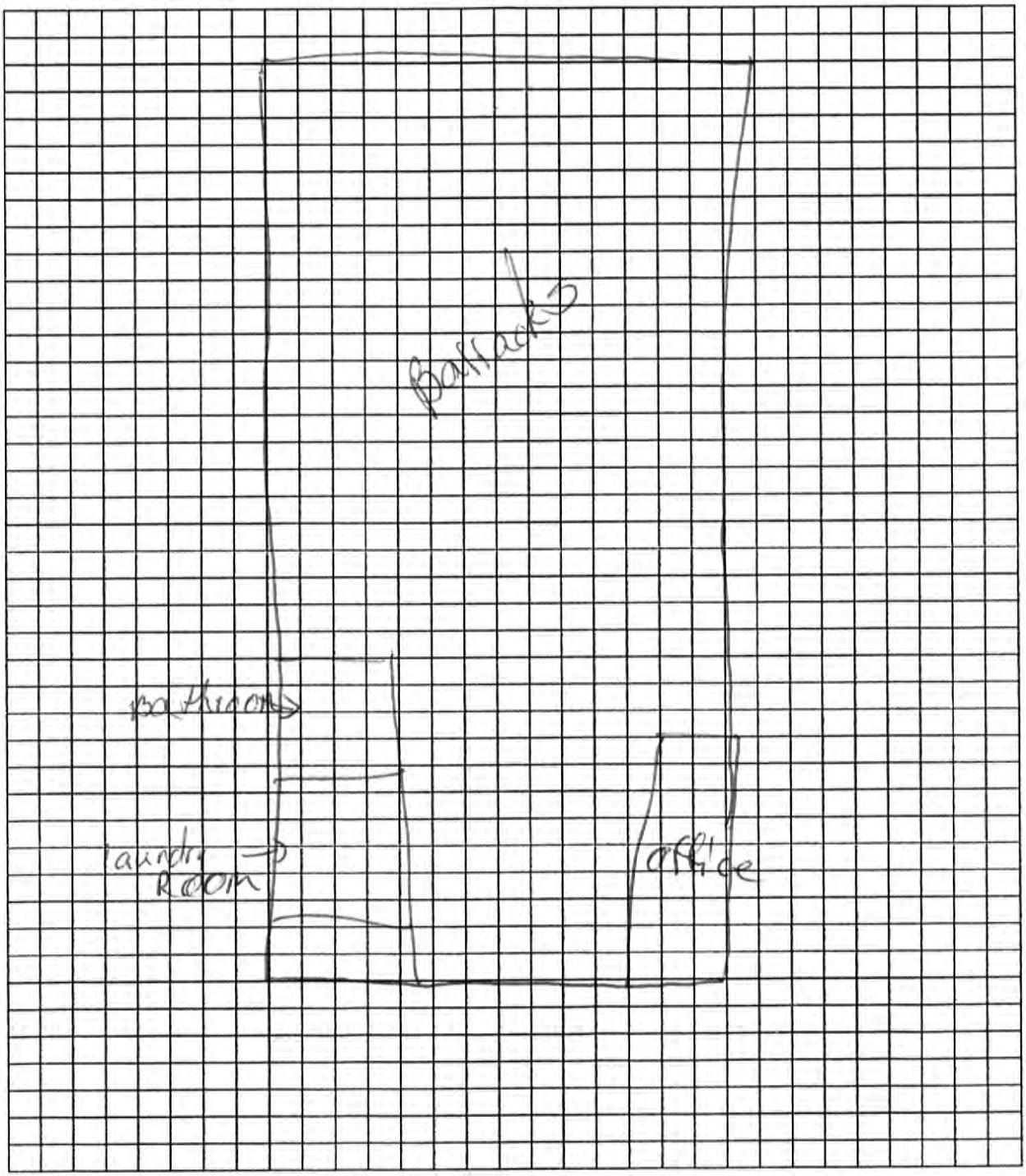
Additional Notes

Date: 10/4/08
Preparer: RR993

Facility: G532 - Barracks
Description (floor):

CH2MHILL

Floor Plan Information



Preliminary Building Survey for Vapor Intrusion Investigation

CH2MHILL

Date: 10/2/08

Preparer: K. Riggs & E. Barcla

Facility: G533

Address: Camp Geiger
MCAS New River

Contact Person:

Phone Number:

e-mail address:

Building Description

Building or Room Identifier: G533 - Barracks

Primary Activity within Building (select one):

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

Notes: Barracks

Approximate floor space 100' x 50'

Number of floors 2

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

Ceiling height 10'

Aboveground Construction
- [ ] Wood
- [ ] Concrete
- [x] Brick
- [x] Cinderblock
- [ ] Other

Floor plan attached? [x] 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 _____

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

no

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

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

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

Sources of outdoor air

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

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

Notes:

Evaluation of Potential Existing Chemical Sources Indoors

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

Bleach - cleaner

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? none

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

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? NA

Type of system?

☐ Passive venting ☐ Active subslab depressurization

☐ Crack/crevice sealing ☐ Dilution ventilation control

☐ N/A

Notes:

Additional Notes

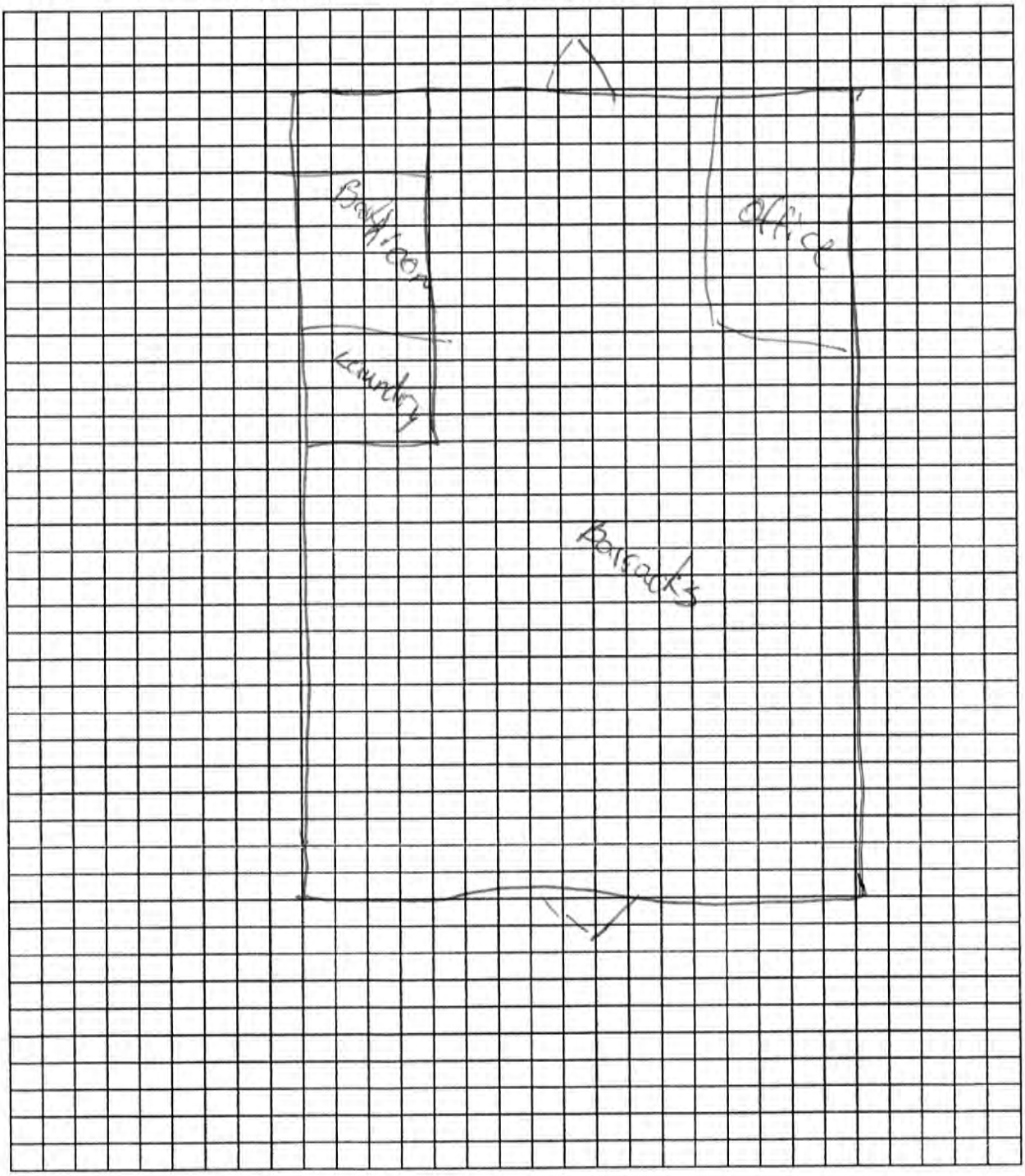
Additional Notes

Date: 10/4/08
Preparer: K. Riggs

Facility: 0-533
Description (floor): concrete

CH2MHILL

Floor Plan Information



Appendix V6-D
Chain of Custody Data

TestAmerica Knoxville
5815 Middlebrook Pike
Knoxville, TN 37921
Phone 865 291-3000 (Main)
Phone 865-291-3031 (Receiving)

TO 21

Chain of Custody Record

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

Client Contact	Project Manager: Bob Brown	Site Contact: Kristi Riggs	COC Record 3 of 6
Company Name AGVIQ	Tel/Mobile: 757-544-3006	Lab Contact: LINDA / Carrier:	COC No: 00204
Address 4610 Westgrove Ct.	Analysis Turnaround Time	Analysis (Attach list if more space is needed)	Lab Use Only:
City/State/Zip VA Beach VA 23455	Calendar (C) or Work Days (W) _____		Custody Seals Intact? Y N NA
Phone 757-318-9420	TAT if different from Below 28 days		Number of Packages: _____
Project Name/Number: TO 21 Soil Vapor	☐ 2 weeks		Temperature: _____ deg C
Site: Site 78	☐ 1 week		Shipper: __FedEx __UPS __Other:
PO #	☐ 2 days		Tracking Number:
Sampled by: KR PB	☐ 1 day		Recorded by: _____ Date: _____

Sample Identification	Sample Date	Sample Time	Sample Type	Matrix	# of Cont.	Field Filtered Sample	Analysis: VOC 8260	Sample Specific Notes:
IR78-IS14-GW-7-8-08B	6/20/08	0814	Grab	GW	3		3	
IR78-IS15-GW-19-20-08B	6/20/08	0955	Grab	GW	3		3	
IR78-IS17-GW-13-14-08B	6/20/08	1400	Grab	GW	3		3	
IR78-IS13-GW-13-14-08B	6/20/08	1515	Grab	GW	3		3	
UST1613-IS10-GW-16-17-08B	6/20/08	1700	Grab	GW	3		3	
IR78-TB062008	6/20/08	0820	Grab	TB	3		3	
UST1613-EB062008	6/20/08	1715	Grab	RB	3		3	
IR85-IS01-GW-8-9-08B	6/21/08	1909	Grab	GW	3		3	

Preservation Used: 1= Ice, 2= HCl; 3= H_2SO_4; 4=HNO_3; 5=NaOH; 6= $Na_2S_2O_3$ Other 1 & 2

Possible Hazard Identification
☐ *Non-Hazard* ☐ *Flammable* ☐ *Skin Irritant* ☐ *Poison B* ☐ *Unknown*

Sample Disposal (A fee may be assessed if samples are retained longer than 1 month)
☐ *Return To Client* ☑ *Disposal By Lab* ☐ *Archive For* _____ *Months*

Special Instructions/QC Requirements & Comments:

Relinquished by:	Company:	Date/Time:	Received by:	Date/Time:
[signature]	AGVIQ	6/23/08		
Relinquished by:	Company:	Date/Time:	Received by:	Date/Time:
Relinquished by:	Company:	Date/Time:	Received by:	Date/Time:

TAL-0046-140 (0208

RETURN WHITE COPY TO LAB WITH SAMPLES
KEEP YELLOW COPY FOR YOUR RECORDS

TestAmerica Knoxville
5815 Middlebrook Pike
Knoxville, TN 37921
Phone 865 291-3000 (Main)
Phone 865-291-3031 (Receiving)

TO 21

Chain of Custody Record

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

Client Contact	Project Manager: Bob Brown	Site Contact: Kristi Riggs	COC Record 4 of 6
Company Name AGVIQ	Tel/Mobile: 757-544-3006	Lab Contact: LINDA / Carrier:	COC No: 00211
Address 4610 Westgrove Ct.	Analysis Turnaround Time	Analysis (Attach list if more space is needed)	Lab Use Only:
City/State/Zip VA Beach VA 23455	Calendar (C) or Work Days (W) _____		Custody Seals Intact? Y N NA
Phone 757-318-9420	TAT if different from Below 28 days		Number of Packages: _____
Project Name/Number: TO21, Soil Vapor Plume	☐ 2 weeks		Temperature: _____ deg C
Site: Site 35	☐ 1 week		Shipper: __FedEx __UPS __Other:
P O #	☐ 2 days		Tracking Number:
Sampled by: K.R. JC.	☐ 1 day		Recorded by: _____ Date: _____

Sample Identification	Sample Date	Sample Time	Sample Type	Matrix	# of Cont.	Field Filtered Sample	VOC 8260	Sample Specific Notes:
IR35-IS010-GW-8-9-08B	6/21/08	0939	Grab	GW	3		3	
IR35-IS02-GW-9-10-08B	6/21/08	1109	Grab	GW	3		3	
IR35-IS03-GW-9-10-08B	6/21/08	1311	Grab	GW	3		3	
IR35-IS05-GW-9-10-08B	6/21/08	1355	Grab	GW	9		9	MS/MSD
IR35-IS06-GW-10-11-08B	6/21/08	1522	Grab	GW	3		3	
IR35-IS04-GW-8-9-08B	6/21/08	1634	Grab	GW	3		3	
IR35-EB062108	6/21/08	1745	Grab	RB	3		3	
IR93-IS07-GW-12-13-08B	6/22/08	0823	Grab	GW	3		3	

Preservation Used: 1= Ice, 2= HCl; 3= H_2SO_4; 4=HNO_3; 5=NaOH; 6= $Na_2S_2O_3$ Other 1 & 2

Possible Hazard Identification
☐ *Non-Hazard* ☐ *Flammable* ☐ *Skin Irritant* ☐ *Poison B* ☐ *Unknown*

Sample Disposal (A fee may be assessed if samples are retained longer than 1 month)
☐ *Return To Client* ☒ *Disposal By Lab* ☐ *Archive For* _____ *Months*

Special Instructions/QC Requirements & Comments:

Relinquished by:	Company:	Date/Time:	Received by:	Date/Time:
[signature]	AGVIQ	6/23/08		
Relinquished by:	Company:	Date/Time:	Received by:	Date/Time:
Relinquished by:	Company:	Date/Time:	Received by:	Date/Time:

RETURN WHITE COPY TO LAB WITH SAMPLES
KEEP YELLOW COPY FOR YOUR RECORDS

TAL-0046-140 (0208)

TestAmerica Knoxville
5815 Middlebrook Pike
Knoxville, TN 37921
Phone 865 291-3000 (Main)
Phone 865-291-3031 (Receiving)

TO 21

Chain of Custody Record

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

Client Contact	Project Manager: Bob Brown	Site Contact: Kisti Riggs	COC Record 5 of 6
Company Name AGVEQ	Tel/Mobile: 757-544-3006	Lab Contact: LINDA / Carrier:	COC No: 00205
Address 4610 Westgrove Ct.	Analysis Turnaround Time		Lab Use Only:
City/State/Zip VA Beach VA 23455	Calendar (C) or Work Days (W) _____		Custody Seals Intact? Y N NA
Phone 757-318-9420	TAT if different from Below 28 days		Number of Packages: _____
Project Name/Number: TO 21 / Soil Intrusion	☐ 2 weeks		Temperature: _____ deg C
Site: 93, MCAS New River	☐ 1 week		Shipper: __FedEx __UPS __Other:
PO #	☐ 2 days		Tracking Number:
Sampled by: KRJC	☐ 1 day		Recorded by: _____ Date: _____

Analysis (Attach list if more space is needed): VOC 8260B

Sample Identification	Sample Date	Sample Time	Sample Type	Matrix	# of Cont.	Field Filtered Sample	VOC 8260B	Sample Specific Notes:
IR93-IS09-GW-12-13-08B	6/22/08	0959	Grab	GW	3		3	
IR93-IS08-GW-12-13-08B	6/22/08	1223	Grab	GW	3		3	
USTCSFF-IS03-GW-8-9-08B	6/22/08	1429	Grab	GW	3		3	
USTA54151-IS09-GW-12-13-08B	6/22/08	1510	Grab	GW	3		3	
IR86-IS12-GW-13-14-08B	6/23/08	0805	Grab	GW	3		3	
IR93-EB062208	6/22/08	1705	Grab	RB	3		3	
IR86-IS13-GW-8-9-08B	6/23/08	0924	Grab	GW	3		3	
IR86-FB062308	6/23/08	1012	Grab	FB	3		3	

Preservation Used: 1= Ice, 2= HCl; 3= H_2SO_4; 4=HNO_3; 5=NaOH; 6= $Na_2S_2O_3$ Other 1 & 2

Possible Hazard Identification
☐ Non-Hazard ☐ Flammable ☐ Skin Irritant ☐ Poison B ☐ Unknown

Sample Disposal (A fee may be assessed if samples are retained longer than 1 month)
☐ Return To Client ☒ Disposal By Lab ☐ Archive For _____ Months

Special Instructions/QC Requirements & Comments:

Relinquished by:	Company:	Date/Time:	Received by:	Date/Time:
[signature]	AGVEQ	6/23/08		
Relinquished by:	Company:	Date/Time:	Received by:	Date/Time:
Relinquished by:	Company:	Date/Time:	Received by:	Date/Time:

RETURN WHITE COPY TO LAB WITH SAMPLES
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TAL Knoxville
5815 Middlebrook Pike
Knoxville, TN 37921
phone 865-291-3000 fax 865-584-4315

SVII TO21

Canister Samples Chain of Custody Record

TestAmerica assumes no liability with respect to the collection and shipment of these samples.

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

Client Contact Information
Company: AGVIQ
Address: 4610 Westgrove Ct
City/State/Zip: VA Beach VA 23455
Phone: 757-318-9420
FAX: 757-318-9421
Project Name: TO 21 - Vapor Intrusion
Site/location: Site 73, MCB Lejeune
PO #

Project Manager: Bob Brown
Phone: 757-544-3006
Site Contact: Kirsti Riggs
TAL Contact: 757-544-3392

Analysis Turnaround Time
Standard (Specify)
Rush (Specify)

Sampled By: K. Riggs, P. Brown

1 of 3 COCs

Sample Identification	Sample Date(s)	Time Start	Time Stop	Canister Vacuum in Field, "Hg (Start)	Canister Vacuum in Field, "Hg (Stop)	Flow Controller ID	Canister ID	TO-15	TO-14A	EPA 3C	EPA 25C	ASTM D-1946	Other (Please specify in notes section)	Sample Type	Indoor Air	Ambient Air	Soil Gas	Landfill Gas	Other (Please specify in notes section)
IR73-03-SG-08B	6/24/08	1038	1043	-30	-3	10	1869D	X									X		
IR73-02-SG-08B	6/24/08	1110	1115	-30	0	41	104743	X									X		
IR73-01-SG-08B	6/24/08	1139	1144	-27	-2	75	5033D	X									X		
IR89-IS12-SV-4-5-08B	6/24/08	1330	1335	-30	-3	86	B3845	X									X		
IR89-IS11-SV-4-5-08B	6/24/08	1400	1405	-30	0	89	B4667	X									X		
IR89-IS10-SV-4-5-08B	6/24/08	1427	1432	-30	-3	59	B4672	X									X		

Sampled by :
CHAMHILL / AGVIQ

Temperature (Fahrenheit)	Interior	Ambient	
Start			
Stop			

Pressure (inches of Hg)	Interior	Ambient	
Start			
Stop			

Special Instructions/QC Requirements & Comments:

Canisters Shipped by: Kim Stokes	Date/Time: 6/25/08 1200	Canisters Received by:
Samples Relinquished by: [signature]	Date/Time: 6/24/08 1700	Received by:
Relinquished by:	Date/Time:	Received by:

TAL Knoxville
5815 Middlebrook Pike
Knoxville, TN 37921
phone 865-291-3000 fax 865-584-4315

JVII T021

Canister Samples Chain of Custody Record

TestAmerica assumes no liability with respect to the collection and shipment of these samples.

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

Client Contact Information
Company: CH2MHILL/ADVIQ
Address: 1700 Arch St. Suite 4400
City/State/Zip: Phila., PA 19103
Phone: 215-640-9072
FAX: 215-640-9271
Project Name: MCB Camp Lejeune
Site/location: Camp Lejeune, NC
PO #

Project Manager: Keri Hallberg
Phone: 704-975-9381
Site Contact: Robert Lowder
TAL Contact: LINDA

Analysis Turnaround Time
Standard (Specify)
Rush (Specify)

Sampled By: KStokes/

3 of 3 COCs

Sample Identification	Sample Date(s)	Time Start	Time Stop	Canister Vacuum in Field, "Hg (Start)	Canister Vacuum in Field, "Hg (Stop)	Flow Controller ID	Canister ID	TO-15	TO-14A	EPA 3C	EPA 25C	ASTM D-1946	Other (Please specify in notes section)	Sample Type	Indoor Air	Ambient Air	Soil Gas	Landfill Gas	Other (Please specify in notes section)
UST1613-SG01-08B	6/24/08	1107	1112	-31	-3	63	L-5200	X									X		
IR35-SG05-08B	6/24/08	1000	1006	-30	-3	70	L-5190	X									X		
IR820-SG04-08B	6/24/08	1505	1510	-30	-3	15	B3838	X									X		
IR820-IA04-08B	6/23/08 6/24/08	1511	1509	-30	-6	K101	7481	X							X				

Sampled by :
CH2MHILL/AGVIQ

Temperature (Fahrenheit)	Interior	Ambient	
Start			
Stop			

Pressure (inches of Hg)	Interior	Ambient	
Start			
Stop			

Special Instructions/QC Requirements & Comments:

Canisters Shipped by: Kim Stokes	Date/Time: 6/25/08 1200	Canisters Received by:
Samples Relinquished by: Kimberly L Stokes	Date/Time: 6/24/08 1700	Received by:
Relinquished by:	Date/Time:	Received by:

TAL Knoxville
5815 Middlebrook Pike
Knoxville, TN 37921
phone 865-291-3000 fax 865-584-4315

JVII T021

Canister Samples Chain of Custody Record

TestAmerica assumes no liability with respect to the collection and shipment of these samples.

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

Client Contact Information	Project Manager: Keri Hallberg	Sampled By: KStokes/J Shim	1 of 1 COCs
Company: CH2MHILL/ADVIQ	Phone: 704-975-9381		
Address: 1700 Arch St. Suite 4400	Site Contact: Robert Lowder		
City/State/Zip Phila., PA 19103	TAL Contact: LINDA		
Phone: 215-640-9072			
FAX: 215-640-9271			
Project Name: MCB Camp Lejeune	Analysis Turnaround Time		
Site/location: Camp Lejeune, NC	Standard (Specify)		
PO #	Rush (Specify)		

Sample Identification	Sample Date(s)	Time Start	Time Stop	Canister Vacuum in Field, "Hg (Start)	Canister Vacuum in Field, "Hg (Stop)	Flow Controller ID	Canister ID	TO-15	TO-14A	EPA 3C	EPA 25C	ASTM D-1946	Other (Please specify in notes section)	Sample Type	Indoor Air	Ambient Air	Soil Gas	Landfill Gas	Other (Please specify in notes section)
1R89-IA04-08B	6/23-6/24/08	0843	0904	-32	-7	K157	12468	X							X				
1R89-IA03-08B	6/23-6/24/08	0853	0906	-31	-4	K444	12521	X							X				
LCH4015-OA01-08B	6/23-6/24/08	1326	1310	-35	-10	K384	1574	X								X			
1R35-IA05-08B	6/23/08-6/24/08	1004	0956	-31	-7	K265	6690	X							X				
1R89-OA02-08B	6/23-6/24/08	0902	0907	-32	-22	K172	12460	X								X			
1R820-IA03-08B	6/23-6/24/08	1458	1439	-30	-7	K460	6628	X							X				

Sampled by : CH2M HILL / AGVIQ

Temperature (Fahrenheit)	Interior	Ambient	
Start			
Stop			

Pressure (inches of Hg)	Interior	Ambient	
Start			
Stop			

Special Instructions/QC Requirements & Comments:
Sample 1R89-OA02-08B may have gotten water-logged w/ heavy rains - flow controller read -22 after 24 hour elapse time.

Canisters Shipped by: Kim Stokes	Date/Time: 6/25/08 12 00	Canisters Received by:
Samples Relinquished by: Kim Stokes	Date/Time: 6/24/08 17 00	Received by:
Relinquished by:	Date/Time:	Received by:

TAL Knoxville
5815 Middlebrook Pike
Knoxville, TN 37921
phone 865-291-3000 fax 865-584-4315

JVII TO21

Canister Samples Chain of Custody Record

TestAmerica assumes no liability with respect to the collection and shipment of these samples.

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

Client Contact Information	Project Manager: Bob Brown	Sampled By: KR PG	1 of ___ COCs
Company: ADVIQ	Phone: 757-544-3000 C		
Address: 4610 Westgrove Ct	Site Contact: Kristi Riggs		
City/State/Zip VA Beach VA 23455	TAL Contact: 757-544-3397		
Phone: 757-318-8420			
FAX: 757-318-8421			
Project Name: Soil Vapor - TO21	Analysis Turnaround Time		
Site/location: Site 78	Standard (Specify)		
PO #	Rush (Specify)		

Sample Identification	Sample Date(s)	Time Start	Time Stop	Canister Vacuum in Field, "Hg (Start)	Canister Vacuum in Field, 'Hg (Stop)	Flow Controller ID	Canister ID	TO-15	TO-14A	EPA 3C	EPA 25C	ASTM D-1946	Other (Please specify in notes section)	Sample Type	Indoor Air	Ambient Air	Soil Gas	Landfill Gas	Other (Please specify in notes section)
IR78-IS15-SV-~~07-08~~ ~~72-73~~-08B	6/20/08	1107	1112	-30	-3	66	L5157	X									X		
IR78-IS15D-SV-~~07-08~~ ~~72-73~~-08B	6/20/08	1107	1112	-30	-3	16	L5137	X									X		
IR78-IS17-SV-05-06-08B	6/20/08	1425	1430	-30	-3	23	L5188	X									X		
IR78-IS13-SV-05-06-08B	6/20/08	1539	1544	-30	-3	21	L5149	X									X		
UST1613-IS10-09-10-08B	6/20/08	1731	1736	-30	-3	125	25126	X									X		
IS35-IS02-SV-05-06-08B	6/21/08	1140	1145	-30	-1	110	L-5103	X									X		

Sampled by : CH2MHILL/ADVIQ

Temperature (Fahrenheit)	Interior	Ambient	
Start			
Stop			

Pressure (inches of Hg)	Interior	Ambient	
Start			
Stop			

Special Instructions/QC Requirements & Comments:

Canisters Shipped by: Kim Stokes	Date/Time: 06/23/08 1730	Canisters Received by:
Samples Relinquished by: K. Riggs / ADVIQ	Date/Time: 6/21/08 1500	Received by:
Relinquished by:	Date/Time:	Received by:

TAL Knoxville
5815 Middlebrook Pike
Knoxville, TN 37921
phone 865-291-3000 fax 865-584-4315

JVII T021

Canister Samples Chain of Custody Record

TestAmerica assumes no liability with respect to the collection and shipment of these samples

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

Client Contact Information
Company: CH2MHILL/ADVIQ
Address: 1700 Arch St. Suite 4400
City/State/Zip: Phila., PA 19103
Phone: 215-640-9072
FAX: 215-640-9271
Project Name: MCB Camp Lejeune
Site/location: Camp Lejeune, NC
PO #

Project Manager: Keri Hallberg
Phone: 704-975-9381
Site Contact: Robert Lowder
TAL Contact: LINDA

Analysis Turnaround Time
Standard (Specify)
Rush (Specify)

Sampled By: KStokes/J Shim

1 of 1 COCs

Sample Identification	Sample Date(s)	Time Start	Time Stop	Canister Vacuum in Field, "Hg (Start)	Canister Vacuum in Field, "Hg (Stop)	Flow Controller ID	Canister ID	TO-15	TO-14A	EPA 3C	EPA 25C	ASTM D-1946	Other (Please specify in notes section)	Sample Type	Indoor Air	Ambient Air	Soil Gas	Landfill Gas	Other (Please specify in notes section)
IR89-IA01-08B	6/20-6/21/08	17:07	1613	-29	-9	K459	93186	X							X				
IR89-IA02-08B	6/20/08 6/21/08	17:08	1525	-30	-8	K113B	92387	X							X				
HPFF-IA07D-08B	6/20-6/22/08	08 47	0830	-32	-8	K441	0163	X							X				
HPFF-IA07-08B	6/20-6/22/08	0847	0830	-28	-9	K298	93268	X							X				
SWMU118-CSA05-08B	6/20-6/22/08	1039	0957	-32	-6	K251	10267	X											X
SWMU118-CSA06-08B	6/21/08 6/22/08	1043	0954	-32	-8	K279	04174	X											X

Sampled by: CH2m HILL/ADVIQ

Temperature (Fahrenheit)

	Interior	Ambient	
Start			
Stop			

Pressure (inches of Hg)

	Interior	Ambient	
Start			
Stop			

Special Instructions/QC Requirements & Comments:
SWMU118-CSA05-08B and SWMU118-CSA06-08B were collected in the crawl space of an elevated building that was open to outdoor air; these samples were labelled CSA for CRAWL SPACE AIR.

Canisters Shipped by: Kim Stokes	Date/Time: 6/23/08 1800	Canisters Received by:
Samples Relinquished by: Kim Stokes	Date/Time: 6/22/08 1100	Received by:
Relinquished by:	Date/Time:	Received by:

TAL Knoxville
5815 Middlebrook Pike
Knoxville, TN 37921
phone 865-291-3000 fax 865-584-4315

Canister Samples Chain of Custody Record

TestAmerica assumes no liability with respect to the collection and shipment of these samples

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

Client Contact Information
Company: AGVIQ
Address: 4610 westgate Ct
City/State/Zip VA Beach VA 23455
Phone: 757-318-9420
FAX: 757-318-9421
Project Name: TO 21
Site/location: Site 35, MCAS New River
PO #

Project Manager: Bob Brown
Phone: 757-544-3006
Site Contact: Kristi Riggs
TAL Contact: 757-544-3392

Sampled By: K. Riggs

3 of 3 COCs

Analysis Turnaround Time
Standard (Specify)
Rush (Specify)

Sample Identification	Sample Date(s)	Time Start	Time Stop	Canister Vacuum in Field, "Hg (Start)	Canister Vacuum in Field, "Hg (Stop)	Flow Controller ID	Canister ID	TO-15	TO-14A	EPA 3C	EPA 25C	ASTM D-1946	Other (Please specify in notes section)	Sample Type	Indoor Air	Ambient Air	Soil Gas	Landfill Gas	Other (Please specify in notes section)
IR35-IS02D-SV-5-6-08B	6/21/08	1140	1145	-31	-2	120	L-5183	X									X		
IR35-IS05-SV-5-6-08B	6/21/08	1435	1440	-30	-2	130	B4847	X									X		
IR35-IS06-SV-5-6-08B	6/21/08	1550	1557	-30	-6	10	18750	X									X		
IR93-IS07-SV-7-8-08B	6/22/08	0857	0902	-30	-3	84	L5142	X									X		
IR93-IS09-SV-6-7-08B	6/22/08	1030	1035	-30	-1	133	L5143	X									X		
IR93-IS08-SV-7-8-08B	6/22/08	1256	1302	-30	-2	39	SL1229	X									X		

Sampled by : CH2MHILL / AGVIQ

Temperature (Fahrenheit)	Interior	Ambient	
Start			
Stop			

Pressure (inches of Hg)	Interior	Ambient	
Start			
Stop			

Special Instructions/QC Requirements & Comments:

Canisters Shipped by: Kim Stokes	Date/Time: 6/23/08 1750	Canisters Received by:
Samples Relinquished by: Kim Stokes	Date/Time: 6/22/08 1500	Received by:
Relinquished by:	Date/Time:	Received by:

TAL Knoxville
5815 Middlebrook Pike
Knoxville, TN 37921
phone 865-291-3000 fax 865-584-4315

JVII TO-21

Canister Samples Chain of Custody Record

TestAmerica assumes no liability with respect to the collection and shipment of these samples.

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

Client Contact Information
Company: CH2M Hill
Address: 4824 Parkway Plaza Blvd
City/State/Zip Charlotte NC 28217
Phone: 704-320-5712
FAX:
Project Name: JVII-TO21
Site/location: MCB Camp Lejeune
PO #

Project Manager: Keri Hallberg
Phone:
Site Contact:
TAL Contact:

Analysis Turnaround Time
Standard (Specify)
Rush (Specify)

Sampled By: Brooke Sprouse, Patrick Brown

___ of ___ COCs

Sample Identification	Sample Date(s)	Time Start	Time Stop	Canister Vacuum in Field, "Hg (Start)	Canister Vacuum in Field, "Hg (Stop)	Flow Controller ID	Canister ID	TO-15	TO-14A	EPA 3C	EPA 25C	ASTM D-1946	Other (Please specify in notes section)	Sample Type	Indoor Air	Ambient Air	Soil Gas	Landfill Gas	Other (Please specify in notes section)
IR86-IS01-SV-8-9-08B	6/22/08	~~1547~~ 1545	1551	-30	-1	123	L-5166	X									X		
IR86-IS02-SV-6-7-08B	1	1233	1238	-30	-3	19	L-3841	X									X		
IR89-SG03-08B	6/23/08	0845	0851	-30	-3	42	5088D	X									X		
LCH4015-IA02-08B	~~6/22/08~~ 6/23/08	1457	1341	-32	-7	K297	6384	X							X				
LCH4015-OA01-08B	~~6/22/08~~ 6/23/08	1506	1345	-30	-7	K270	12187	X								X			
IR89-SG04-08B	6/23/08	0830	0836	-30	-2	44	1877D	X									X		

Sampled by :
Brooke Sprouse
Patrick Brown

Temperature (Fahrenheit)	Interior	Ambient	
Start			
Stop			

Pressure (inches of Hg)	Interior	Ambient	
Start			
Stop			

Special Instructions/QC Requirements & Comments:

Canisters Shipped by: Kim Stokes	Date/Time: 6/24/08 1730	Canisters Received by:
Samples Relinquished by: Kimberly Stokes	Date/Time: 6/23/08 1700	Received by:
Relinquished by:	Date/Time:	Received by:

TAL Knoxville
5815 Middlebrook Pike
Knoxville, TN 37921
phone 865-291-3000 fax 865-584-4315

JVII T021

Canister Samples Chain of Custody Record

TestAmerica assumes no liability with respect to the collection and shipment of these samples.

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

Client Contact Information	Project Manager: Keri Hallberg	Sampled By: KStokes/JShim	2 of 2 COCs
Company: CH2MHILL/ADVIQ	Phone: 704-975-9381		
Address: 1700 Arch St. Suite 4400	Site Contact: Robert Lowder		
City/State/Zip Phila., PA 19103	TAL Contact: LINDA		
Phone: 215-640-9072			
FAX: 215-640-9271			
Project Name: MCB Camp Lejeune	Analysis Turnaround Time		
Site/location: Camp Lejeune, NC	Standard (Specify)		
PO #	Rush (Specify)		

Sample Identification	Sample Date(s)	Time Start	Time Stop	Canister Vacuum in Field, "Hg (Start)	Canister Vacuum in Field, "Hg (Stop)	Flow Controller ID	Canister ID	TO-15	TO-14A	EPA 3C	EPA 25C	ASTM D-1946	Other (Please specify in notes section)	Sample Type	Indoor Air	Ambient Air	Soil Gas	Landfill Gas	Other (Please specify in notes section)
LCH4015-SG02-08B	6/22/08	1455	1500	-30	-3	73	L-5119	X									X		
1R35-SG06-08B	6/24/08	0930	0935	-30	-4	99	L-5136	X									X		
1R35-1A06-08B	6/23/08 6/24/08	0945	0918	-30	-6	K437	2149	X							X				
LCH4015-IA02-08B	6/23-6/24/08	1457	1341	-32	-7	K297	63841	X							X				

Sampled by : CH2MHILL / ADVIQ

Temperature (Fahrenheit)	Interior	Ambient	
Start			
Stop			

Pressure (inches of Hg)	Interior	Ambient	
Start			
Stop			

Special Instructions/QC Requirements & Comments:

Canisters Shipped by: Kim Stokes	Date/Time: 6/24/08 1730	Canisters Received by:
Samples Relinquished by: [signature]	Date/Time: 6/24/08 1400	Received by:
Relinquished by:	Date/Time:	Received by:

JV II TO-21

TAL Knoxville
5815 Middlebrook Pike
Knoxville, TN 37921
phone 865-291-3000 fax 865-584-4315

Canister Samples Chain of Custody Record

TestAmerica assumes no liability with respect to the collection and shipment of these samples.

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

Client Contact Information
Company: CHam HILL
Address: 1700 Arch St Suite 4400
City/State/Zip Phila, PA 19090
Phone: 215-640-9071
FAX: 215-640-9271
Project Name: Camp Lejeune TO-21
Site/location: Camp Lejeune, NC
PO # 364167

Project Manager: Keri Hallberg
Phone: 704-975-9381
Site Contact: Bob Lowder
TAL Contact: Linda McWhirter

Analysis Turnaround Time
Standard (Specify)
Rush (Specify)

Sampled By: K Stokes/K Riggs

2 of 3 COCs

Sample Identification	Sample Date(s)	Time Start	Time Stop	Canister Vacuum in Field, "Hg (Start)	Canister Vacuum in Field, "Hg (Stop)	Flow Controller ID	Canister ID	TO-15	TO-14A	EPA 3C	EPA 25C	ASTM D-1946	Other (Please specify in notes section)	Sample Type	Indoor Air	Ambient Air	Soil Gas	Landfill Gas	Other (Please specify in notes section)
IR35-SG13-08C	10/4/08	0919	0924	-31	-4	108	L-5115	X									X		
IR35-SG11-08C	10-4-08	1005	1010	-30	-3	34	SL-1229	X									X		
IR35-SG09-08C	10-4-08	1042	1047	-30	-4	55	SL-1215	X									X		
IR35-SG08-08C	10-4-08	1312	1317	-30	-3	108	L-5152	X									X		
IR86-SG01-08C	10-4-08	1310	1316	-30	-3	127	L-5172	X									X		
IR86-SG01D-08C	10-4-08	1310	1316	-30	-4	131	L-5159	X									X		

Sampled by :
K Stokes/K Riggs

Temperature (Fahrenheit)	Interior	Ambient	
Start			
Stop			

Pressure (inches of Hg)	Interior	Ambient	
Start			
Stop			

Special Instructions/QC Requirements & Comments:

Canisters Shipped by:	Date/Time:	Canisters Received by:
Samples Relinquished by:	Date/Time:	Received by:
Relinquished by:	Date/Time:	Received by:

Appendix V6-E
Laboratory Data

TO - 21
Camp Lejeune - Camp Gieger
Soil Gas Raw Analytical Results
June 2008

Station ID	IR35-SG05	IR35-SG06	IR89-SG01	IR89-SG02	IR89-SG03	IR89-SG04
Sample ID	IR35-SG05-08B	IR35-SG06-08B	IR89-SG01-08B	IR89-SG02-08B	IR89-SG03-08B	IR89-SG04-08B
Sample Date	06/24/08	06/24/08	06/21/08	06/21/08	06/23/08	06/23/08
Chemical Name						
Volatile Organic Compounds (ppbv)						
1,1,1-Trichloroethane	2 U	2 U	3.6 U	2 U	3.4 J	13 U
1,1,2,2-Tetrachloroethane	2 U	2 U	1.6 J	2 U	14 U	13 U
1,1,2-Trichloro-1,2,2-trifluoroethane(Freon-113)	2 U	2 U	3.6 U	2 U	14 U	13 U
1,1,2-Trichloroethane	2 U	2 U	3.6 U	2 U	14 U	13 U
1,1-Dichloroethane	2 U	2 U	3.6 U	2 U	14 U	13 U
1,1-Dichloroethene	2 U	2 U	3.6 U	2 U	14 U	13 U
1,2,4-Trichlorobenzene	10 U	10 U	18 U	10 U	72 U	65 U
1,2-Dibromoethane	2 U	2 U	3.6 U	2 U	14 U	13 U
1,2-Dichlorobenzene	2 U	2 U	3.6 U	2 U	14 U	13 U
1,2-Dichloroethane	2 U	2 U	3.6 U	2 U	14 U	13 U
1,2-Dichloropropane	2 U	2 U	3.6 U	2 U	14 U	13 U
1,3-Dichlorobenzene	2 U	2 U	3.6 U	2 U	14 U	13 U
1,4-Dichlorobenzene	2 U	2 U	3.6 U	2 U	14 U	13 U
2-Butanone	5.2 J	6.9 J	18 U	4.1 J	72 U	65 U
2-Hexanone	0.58 J	5 U	9.1 U	5 U	36 U	32 U
4-Methyl-2-pentanone	5 U	2.5 J	9.1 U	5 U	36 U	32 U
Acetone	44 J	220	91 U	67	110 J	320 U
Benzene	2 U	0.67 J	3.6 U	0.9 J	14 U	13 U
Bromodichloromethane	2 U	2 U	3.6 U	2 U	14 U	13 U
Bromoform	2 U	2 U	3.6 U	2 U	14 U	13 U
Bromomethane	2 U	2 U	3.6 U	2 U	14 U	13 U
Carbon disulfide	0.44 J	0.58 J	0.75 J	5 U	36 U	32 U
Carbon tetrachloride	2 U	2 U	3.6 U	2 U	14 U	13 U
Chlorobenzene	2 U	2 U	3.6 U	2 U	14 U	13 U
Chloroethane	2 U	2 U	3.6 U	2 U	14 U	13 U
Chloroform	2 U	2 U	3.6 U	2 U	14 U	3.6 J
Chloromethane	5 U	5 U	9.1 U	5 U	36 U	32 U
Cyclohexane	0.62 J	0.86 J	3.8 J	2.2 J	36 U	32 U
Dibromochloromethane	2 U	2 U	3.6 U	2 U	14 U	13 U
Dichlorodifluoromethane (Freon-12)	2 U	0.75 J	3.6 U	2 U	14 U	13 U
Ethylbenzene	20	27	23	33	47	36
Isopropylbenzene	1.4 J	2.2 J	1.8 J	2.4 J	29 U	4.1 J
Methyl-tert-butyl ether (MTBE)	10 U	10 U	18 U	10 U	72 U	65 U
Methylene chloride	5 U	5 U	19 U	4.8 J	36 U	32 U
Styrene	2 U	2 U	3.6 U	2 U	14 U	13 U
Tetrachloroethene	2 U	2 U	23	6	79	110
Toluene	2.6	3.6	3 J	4.1	8.2 J	6.1 J
Trichloroethene	1.2 J	3.8	230	22	2,000	1,900
Trichlorofluoromethane(Freon-11)	0.35 J	0.87 J	3.6 U	0.59 J	14 U	13 U
Vinyl chloride	2 U	2 U	3.6 U	2 U	14 U	13 U
cis-1,2-Dichloroethene	2 U	2 U	6.5	2 U	40	54
cis-1,3-Dichloropropene	2 U	2 U	3.6 U	2 U	14 U	13 U
m- and p-Xylene	42	66	54	71	110	90
o-Xylene	15	24	21	25	41	34
trans-1,2-Dichloroethene	2 U	2 U	7.7	2 U	50	48
trans-1,3-Dichloropropene	2 U	2 U	3.6 U	2 U	14 U	13 U

Notes:

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

NA - Not analyzed

U - The material was analyed for, but not detected

ppbv - parts per billion volume

TO - 21
Camp Lejuene - Camp Geiger
Shallow Soil Vapor Raw Analytical Results
June 2008

Station ID	IR35-IS02		IR35-IS05	IR35-IS06	IR89-IS10	IR89-IS11	IR89-IS12
Sample ID	IR35-IS02D-SV-05-06-08B	IR35-IS02-SV-05-06-08B	IR35-IS05-SV-05-06-08B	IR35-IS06-SV-05-06-08B	IR89-IS10-SV-04-05-08B	IR89-IS11-SV-04-05-08B	IR89-IS12-SV-04-05-08B
Sample Date	06/21/08	06/21/08	06/21/08	06/21/08	06/24/08	06/24/08	06/24/08
Chemical Name							
Volatile Organic Compounds (ppbv)							
1,1,1-Trichloroethane	2 U	2 U	2 U	2 U	7.2 U	2 U	7 U
1,1,2,2-Tetrachloroethane	2 U	2 U	2 U	2 U	7.2 U	2 U	7 U
1,1,2-Trichloro-1,2,2-trifluoroethane(Freon-113)	2 U	2 U	2 U	2 U	7.2 U	2 U	7 U
1,1,2-Trichloroethane	2 U	2 U	2 U	2 U	7.2 U	2 U	7 U
1,1-Dichloroethane	2 U	2 U	2 U	2 U	7.2 U	2 U	7 U
1,1-Dichloroethene	2 U	2 U	2 U	2 U	7.2 U	2 U	7 U
1,2,4-Trichlorobenzene	10 U	10 U	10 U	10 U	36 U	10 U	35 U
1,2-Dibromoethane	2 U	2 U	2 U	2 U	7.2 U	2 U	7 U
1,2-Dichlorobenzene	2 U	2 U	2 U	2 U	7.2 U	2 U	7 U
1,2-Dichloroethane	2 U	2 U	2 U	2 U	7.2 U	2 U	7 U
1,2-Dichloropropane	2 U	2 U	2 U	2 U	7.2 U	2 U	7 U
1,3-Dichlorobenzene	2 U	2 U	2 U	2 U	7.2 U	2 U	7 U
1,4-Dichlorobenzene	2 U	2 U	2 U	2 U	7.2 U	2 U	7 U
2-Butanone	10	7.9 J	13	15	36 U	10 U	35 U
2-Hexanone	1.6 J	0.81 J	0.97 J	1.1 J	18 U	5 U	18 U
4-Methyl-2-pentanone	1.3 J	0.56 J	5 U	5 U	18 U	5 U	18 U
Acetone	70	56	110	120	66 J	36 J	180 U
Benzene	1.3 J	1.4 J	4.8	2.2	7.2 U	0.88 J	3.1 J
Bromodichloromethane	2 U	2 U	2 U	2 U	7.2 U	2 U	7 U
Bromoform	2 U	2 U	2 U	2 U	7.2 U	2 U	7 U
Bromomethane	2 U	2 U	2 U	0.37 J	7.2 U	2 U	7 U
Carbon disulfide	1.2 J	1.4 J	1.4 J	2.2 J	18 U	5 U	18 U
Carbon tetrachloride	2 U	2 U	2 U	2 U	7.2 U	2 U	7 U
Chlorobenzene	2 U	2 U	2 U	2 U	7.2 U	2 U	7 U
Chloroethane	2 U	2 U	2 U	2 U	7.2 U	2 U	7 U
Chloroform	2 U	2 U	0.6 J	0.61 J	2.9 J	2 U	11
Chloromethane	5 U	5 U	5 U	4 J	18 U	5 U	18 U
Cyclohexane	1.3 J	1.5 J	5.3	2.6 J	18 U	5 U	2.1 J
Dibromochloromethane	2 U	2 U	2 U	2 U	7.2 U	2 U	7 U
Dichlorodifluoromethane (Freon-12)	0.74 J	2 U	0.81 J	2 U	7.2 U	2 U	7 U
Ethylbenzene	4.4	4.2	2.9	2.7	2.6 J	2 U	6.9 J
Isopropylbenzene	2.5 J	2.2 J	1.5 J	1.6 J	14 U	4 U	14 U
Methyl-tert-butyl ether (MTBE)	10 U	10 U	10 U	10 U	36 U	10 U	35 U
Methylene chloride	5.7 U	5 U	5.2 U	8.6 U	18 U	5 U	18 U
Styrene	2 U	2 U	2 U	2 U	7.2 U	2 U	7 U
Tetrachloroethene	3	2.2	5.7	4.7	74	0.41 J	64
Toluene	1.8 J	1.2 J	4.2	3	2.1 J	1.6 J	6.8 J
Trichloroethene	2 U	2 U	2 U	2 U	1,200	3.6	1,600
Trichlorofluoromethane(Freon-11)	1.3 J	0.52 J	2	0.94 J	7.2 U	0.42 J	7 U
Vinyl chloride	2 U	2 U	2 U	2 U	7.2 U	2 U	7 U
cis-1,2-Dichloroethene	2 U	2 U	2 U	2 U	16	2 U	84
cis-1,3-Dichloropropene	2 U	2 U	2 U	2 U	7.2 U	2 U	7 U
m- and p-Xylene	11	8.5	5.8	6.1	5 J	2 U	21
o-Xylene	0.71 J	2 U	0.66 J	0.63 J	7.2 U	2 U	8.3
trans-1,2-Dichloroethene	2 U	2 U	2 U	2 U	12	2 U	50
trans-1,3-Dichloropropene	2 U	2 U	2 U	2 U	7.2 U	2 U	7 U

Notes:

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

NA - Not analyzed

U - The material was analyed for, but not detected

ppbv - parts per billion volume

Station ID **Sample ID** **Sample Date**	IR93-IS07 IR93-IS07-SV-07-08-08B 06/22/08	IR93-IS08 IR93-IS08-SV-07-08-08B 06/22/08	IR93-IS09 IR93-IS09-SV-06-07-08B 06/22/08
Chemical Name			
Volatile Organic Compounds (ppbv)			
1,1,1-Trichloroethane	2 U	2 U	2 U
1,1,2,2-Tetrachloroethane	2 U	2 U	2 U
1,1,2-Trichloro-1,2,2-trifluoroethane(Freon-113)	2 U	2 U	2 U
1,1,2-Trichloroethane	2 U	2 U	2 U
1,1-Dichloroethane	2 U	2 U	2 U
1,1-Dichloroethene	2 U	2 U	2 U
1,2,4-Trichlorobenzene	10 U	10 U	10 U
1,2-Dibromoethane	2 U	2 U	2 U
1,2-Dichlorobenzene	2 U	2 U	2 U
1,2-Dichloroethane	2 U	2 U	2 U
1,2-Dichloropropane	2 U	2 U	2 U
1,3-Dichlorobenzene	2 U	2 U	2 U
1,4-Dichlorobenzene	2 U	2 U	2 U
2-Butanone	5.2 J	15	33
2-Hexanone	0.65 J	0.67 J	3.1 J
4-Methyl-2-pentanone	5 U	5 U	2.2 J
Acetone	40 J	85	230
Benzene	1.2 J	1.1 J	2.8
Bromodichloromethane	2 U	2 U	2 U
Bromoform	2 U	2 U	2 U
Bromomethane	2 U	2 U	2 U
Carbon disulfide	1.4 J	0.64 J	1 J
Carbon tetrachloride	2 U	2 U	2 U
Chlorobenzene	2 U	2 U	2 U
Chloroethane	2 U	2 U	2 U
Chloroform	2 U	2 U	2 U
Chloromethane	5 U	2.3 J	5 U
Cyclohexane	1.1 J	21	3.5 J
Dibromochloromethane	2 U	2 U	2 U
Dichlorodifluoromethane (Freon-12)	0.69 J	0.76 J	0.78 J
Ethylbenzene	2.9	4.8	3.7
Isopropylbenzene	2 J	4.9	2.5 J
Methyl-tert-butyl ether (MTBE)	10 U	10 U	10 U
Methylene chloride	5 U	5 U	5 U
Styrene	2 U	2 U	2 U
Tetrachloroethene	3.7	2.4	29
Toluene	1.3 J	1.9 J	3.5
Trichloroethene	2 U	2 U	2 U
Trichlorofluoromethane(Freon-11)	0.55 J	0.5 J	0.56 J
Vinyl chloride	2 U	2 U	2 U
cis-1,2-Dichloroethene	2 U	2 U	2 U
cis-1,3-Dichloropropene	2 U	2 U	2 U
m- and p-Xylene	7.2	11	8.9
o-Xylene	2 U	1.2 J	1 J
trans-1,2-Dichloroethene	2 U	2 U	2 U
trans-1,3-Dichloropropene	2 U	2 U	2 U

Notes:

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

NA - Not analyzed

U - The material was analyed for, but not detected

ppbv - parts per billion volume

TO - 21
Camp Lejeune - Camp Geiger
Indoor and Outdoor Air Raw Analytical Results
June 2008

Station ID	IR35-IA05	IR35-IA06	IR89-IA01	IR89-IA02	IR89-IA03	IR89-IA04	IR89-OA01	IR89-OA02
Sample ID	IR35-IA05-08B	IR35-IA06-08B	IR89-IA01-08B	IR89-IA02-08B	IR89-IA03-08B	IR89-IA04-08B	IR89-OA01-08B	IR89-OA02-08B
Sample Date	06/24/08	06/24/08	06/21/08	06/21/08	06/24/08	06/24/08	06/21/08	06/24/08
Chemical Name								
Volatile Organic Compounds (ppbv)								
1,1,1-Trichloroethane	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.056 J	0.2 U
1,1,2,2-Tetrachloroethane	0.2 U	0.2 U	0.13 J	0.15 J	0.082 J	0.074 J	0.17 J	0.2 U
1,1,2-Trichloro-1,2,2-trifluoroethane(Freon-113)	0.11 J	0.11 J	0.074 J	0.081 J	0.074 J	0.073 J	0.071 J	0.086 J
1,1,2-Trichloroethane	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
1,1-Dichloroethane	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
1,1-Dichloroethene	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.11 J	0.2 U
1,2,4-Trichlorobenzene	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,2-Dibromoethane	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
1,2-Dichlorobenzene	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
1,2-Dichloroethane	0.053 J	0.13 J	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
1,2-Dichloropropane	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
1,3-Dichlorobenzene	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
1,4-Dichlorobenzene	12	11	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.12 J
2-Butanone	2.3	6.6	0.72 J	0.76 J	0.65 J	0.73 J	1.3	2.4
2-Hexanone	0.12 J	0.11 J	0.5 U	0.5 U	0.5 U	0.091 J	0.5 U	0.15 J
4-Methyl-2-pentanone	0.23 J	0.48 J	0.5 U	0.054 J	0.5 U	0.051 J	0.5 U	0.39 J
Acetone	39	30	9.7	10	5.1	5.3	15	22
Benzene	1.8	2.7	0.28	0.28	0.11 J	0.11 J	0.33	0.27
Bromodichloromethane	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
Bromoform	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
Bromomethane	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
Carbon disulfide	0.039 J	0.5	0.5 U	0.038 J	0.21 J	0.1 J	0.3 J	1.1
Carbon tetrachloride	0.12 J	0.13 J	0.067 J	0.066 J	0.066 J	0.071 J	0.069 J	0.12 J
Chlorobenzene	0.2 U	0.18 J	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
Chloroethane	0.2 U	0.2 U	0.2 U	0.2 U	0.04 J	0.2 U	0.2 U	0.2 U
Chloroform	0.1 J	0.096 J	0.062 J	0.066 J	0.2 U	0.2 U	0.042 J	0.2 U
Chloromethane	1.3	1.4	0.65	0.84	0.89	0.57	0.95	1.2
Cyclohexane	0.72	3.8	0.071 J	0.088 J	0.5 U	0.5 U	0.08 J	0.5 U
Dibromochloromethane	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
Dichlorodifluoromethane (Freon-12)	0.68	0.7	0.49	0.48	0.41	0.42	0.48	0.68
Ethylbenzene	0.95	2.4	0.1 J	0.11 J	0.2 U	0.096 J	0.27	0.12 J
Isopropylbenzene	0.4 U	0.2 J	0.4 U	0.4 U	0.4 U	0.4 U	0.95	0.4 U
Methyl-tert-butyl ether (MTBE)	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Methylene chloride	1.1	3.7	0.5 U	0.86	0.5 U	0.44 J	0.5 U	2.1
Styrene	0.13 J	0.92	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
Tetrachloroethene	0.2 U	0.18 J	0.1 J	0.12 J	0.2 U	0.2 U	0.11 J	0.2 U
Toluene	5.8	17	0.65	0.71	0.14 J	0.17 J	0.93	0.61
Trichloroethene	0.2 U	0.15 J	0.51	0.52	0.12 J	0.11 J	0.53	0.53
Trichlorofluoromethane(Freon-11)	0.45	0.73	0.25	0.37	0.23	0.25	0.22	0.6
Vinyl chloride	0.2 U	0.2 U	0.41	0.44	0.2	0.17 J	0.54	0.089 J
cis-1,2-Dichloroethene	0.13 J	0.066 J	7	6.5	2.3	2	6.9	0.79
cis-1,3-Dichloropropene	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
m- and p-Xylene	3.5	7.7	0.28	0.29	0.2 U	0.26	1.5	0.26
o-Xylene	1.1	2.2	0.11 J	0.1 J	0.2 U	0.087 J	0.36	0.063 J
trans-1,2-Dichloroethene	0.2 U	0.2 U	2	1.9	0.44	0.41	1.9	0.12 J
trans-1,3-Dichloropropene	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U

Notes:

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NA - Not analyzed

U - The material was analyed for, but not detected

ppbv - parts per billion volume

TO - 21
Camp Lejeune - Camp Geiger
Groundwater Raw Analytical Results
June 2008

Station ID	IR35-IS01		IR35-IS02	IR35-IS03	IR35-IS04	IR35-IS05	IR35-IS06	IR93-IS07	IR93-IS08	IR93-IS09
Sample ID	IR35-IS01-GW-08-09-08B	IR35-IS01D-GW-08-09-08B	IR35-IS02-GW-09-10-08B	IR35-IS03-GW-09-10-08B	IR35-IS04-GW-08-09-08B	IR35-IS05-GW-09-10-08B	IR35-IS06-GW-10-11-08B	IR93-IS07-GW-12-13-08B	IR93-IS08-GW-12-13-08B	IR93-IS09-GW-12-13-08B
Sample Date	06/21/08	06/21/08	06/21/08	06/21/08	06/21/08	06/21/08	06/21/08	06/22/08	06/22/08	06/22/08
Chemical Name										
Volatile Organic Compounds (UG/L)										
1,1,1-Trichloroethane	1 U	1 U	1 U	1 U	1 U	1 U	5 U	1 U	1 U	1 U
1,1,2,2-Tetrachloroethane	1 U	1 U	1 U	1 U	1 U	1 U	5 U	1 U	1 U	1 U
1,1,2-Trichloro-1,2,2-trifluoroethane(Freon-113)	1 U	1 U	1 U	1 U	1 U	1 U	5 U	1 U	1 U	1 U
1,1,2-Trichloroethane	1 U	1 U	1 U	1 U	1 U	1 U	5 U	1 U	1 U	1 U
1,1-Dichloroethane	1 U	1 U	1 U	1 U	1 U	1 U	5 U	1 U	1 U	1 U
1,1-Dichloroethene	1 U	1 U	1 U	1 U	1 U	1 U	5 U	1 U	1 U	1 U
1,2,4-Trichlorobenzene	1 U	1 U	1 U	1 U	1 U	1 U	5 U	1 U	1 U	1 U
1,2-Dibromo-3-chloropropane	2 U	2 U	2 U	2 U	2 U	2 U	10 U	2 U	2 U	2 U
1,2-Dibromoethane	1 U	1 U	1 U	1 U	1 U	1 U	5 U	1 U	1 U	1 U
1,2-Dichlorobenzene	1 U	1 U	1 U	1 U	1 U	1 U	5 U	1 U	1 U	1 U
1,2-Dichloroethane	1 U	1 U	1 U	1 U	1 U	1 U	5 U	1 U	1 U	1 U
1,2-Dichloropropane	1 U	1 U	1 U	1 U	1 U	1 U	5 U	1 U	1 U	1 U
1,3-Dichlorobenzene	1 U	1 U	1 U	1 U	1 U	1 U	5 U	1 U	1 U	1 U
1,4-Dichlorobenzene	1 U	1 U	1 U	1 U	1 U	1 U	5 U	1 U	1 U	1 U
2-Butanone	5 U	5 U	5 U	5 U	5 U	5 U	25 U	5 U	5 U	5 U
2-Hexanone	5 U	5 U	5 U	5 U	5 U	5 U	25 U	5 U	5 U	5 U
4-Methyl-2-pentanone	5 U	5 U	5 U	5 U	5 U	5 U	25 U	5 U	5 U	5 U
Acetone	10 U	10 U	10 U	2.4 J	1.5 J	3.2 J	50 U	10 U	5.3 J	1.5 J
Benzene	1 U	1 U	1 U	1 U	0.033 J	1 U	60	1 U	1 U	0.035 J
Bromodichloromethane	1 U	1 U	1 U	1 U	1 U	0.081 J	5 U	1 U	1 U	1 U
Bromoform	1 U	1 U	1 U	1 U	1 U	1 U	5 U	1 U	1 U	1 U
Bromomethane	2 U	2 U	2 U	2 U	2 U	2 U	10 UJ	2 U	2 U	2 U
Carbon disulfide	1 U	1 U	1 U	1 U	0.15 J	1 U	0.58 J	0.27 J	1 U	1 U
Carbon tetrachloride	1 U	1 U	1 U	1 U	1 U	1 U	5 U	1 U	1 U	1 U
Chlorobenzene	1 U	1 U	1 U	1 U	1 U	1 U	5 U	1 U	1 U	1 U
Chloroethane	2 U	2 U	2 U	2 U	2 U	2 U	10 U	2 U	2 U	2 U
Chloroform	1 U	1 U	1 U	1 U	1 U	2.1	5 U	1 U	1 U	1 U
Chloromethane	0.087 J	0.088 J	0.16 J	0.14 J	2 U	0.098 J	10 U	2 U	2 U	2 U
Cyclohexane	1 U	1 U	1 U	1 U	1 U	1 U	5 U	1 U	1 U	1 U
Dibromochloromethane	1 U	1 U	1 U	1 U	1 U	1 U	5 U	1 U	1 U	1 U
Dichlorodifluoromethane (Freon-12)	2 U	2 U	2 U	2 U	2 U	2 U	10 U	2 U	2 U	2 U
Ethylbenzene	1 U	1 U	1 U	1 U	1 U	1 U	25	1 U	1 U	1 U
Isopropylbenzene	1 U	1 U	1 U	1 U	0.049 J	1 U	22	1 U	1 U	1 U
Methyl acetate	1 U	1 U	1 U	1 U	1 U	1 U	5 U	1 U	1 U	1 U
Methyl-tert-butyl ether (MTBE)	1 UJ	1 UJ	1 UJ	1 UJ	1 U	1 UJ	5 U	0.057 J	1 UJ	1 UJ
Methylcyclohexane	1 U	1 U	1 U	1 U	1 U	1 U	5 U	1 U	1 U	1 U
Methylene chloride	2 U	2 U	2 U	2 U	2 U	2 U	10 U	2 U	2 U	2 U
Styrene	1 U	1 U	1 U	1 U	1 U	1 U	1.1 J	1 U	1 U	1 U
Tetrachloroethene	1 U	1 U	1 U	1 U	1 U	1 U	5 U	0.37 J	1 U	0.055 J
Toluene	1 U	1 U	1 U	0.053 J	0.1 J	0.053 J	20	0.073 J	0.061 J	0.12 J
Trichloroethene	1 U	1 U	1 U	1 U	1 U	1 U	5 U	0.33 J	1 U	0.85 J
Trichlorofluoromethane(Freon-11)	2 U	2 U	2.7	2 U	2 U	2 U	10 U	2 U	2 U	2 U
Vinyl chloride	1 U	1 U	1 U	1 U	1 U	1 U	5 U	1 U	1 U	1 U
cis-1,2-Dichloroethene	1 U	1 U	1 U	1 U	1 U	1 U	5 U	0.14 J	1 U	5
cis-1,3-Dichloropropene	1 U	1 U	1 U	1 U	1 U	1 U	5 U	1 U	1 U	1 U
m- and p-Xylene	0.07 J	0.073 J	0.045 J	0.069 J	0.12 J	0.04 J	15	0.063 J	0.064 J	0.17 J
o-Xylene	1 U	1 U	1 U	1 U	0.049 J	1 U	9	1 U	1 U	0.054 J
trans-1,2-Dichloroethene	1 U	1 U	1 U	1 U	1 U	1 U	5 U	1 U	1 U	0.4 J
trans-1,3-Dichloropropene	1 U	1 U	1 U	1 U	1 U	1 U	5 U	1 U	1 U	1 U

Notes:

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

NA - Not analyzed

U - The material was analyed for, but not detected

UG/L - Micrograms per liter

UJ - Analyte not detected, quantitation limit may be inaccurate

TO - 21
Camp Lejeune - Camp Geiger
Phase II Soil Gas Raw Analytical Results
September 2008

Station ID	IR35-SG08	IR35-SG09	IR35-SG10		IR35-SG11	IR35-SG12	IR35-SG13
Sample ID	IR35-SG08-08C	IR35-SG09-08C	IR35-SG10-08C	IR35-SG10D-08C	IR35-SG11-08C	IR35-SG12-08C	IR35-SG13-08C
Sample Date	10/04/08	10/04/08	09/27/08	09/27/08	10/04/08	09/27/08	10/04/08
Chemical Name							
Volatile Organic Compounds (ppbv)							
1,1,1-Trichloroethane	2 U	2 U	2 U	2 U	2 U	2 U	2 U
1,1,2,2-Tetrachloroethane	2 U	2 U	2 U	2 U	2 U	2 U	2 U
1,1,2-Trichloro-1,2,2-trifluoroethane(Freon-113)	2 U	2 U	2 U	2 U	2 U	2 U	2 U
1,1,2-Trichloroethane	2 U	2 U	2 U	2 U	2 U	2 U	2 U
1,1-Dichloroethane	2 U	2 U	2 U	2 U	2 U	2 U	2 U
1,1-Dichloroethene	2 U	2 U	2 U	2 U	2 U	2 U	2 U
1,2,4-Trichlorobenzene	10 U	10 U	10 U	10 U	10 U	10 U	10 U
1,2-Dibromoethane	2 U	2 U	2 U	2 U	2 U	2 U	2 U
1,2-Dichlorobenzene	2 U	2 U	2 U	2 U	2 U	2 U	2 U
1,2-Dichloroethane	2 U	2 U	2 U	2 U	2 U	2 U	2 U
1,2-Dichloropropane	2 U	2 U	2 U	2 U	2 U	2 U	2 U
1,3-Dichlorobenzene	2 U	2 U	2 U	2 U	2 U	2 U	2 U
1,4-Dichlorobenzene	2 U	2 U	2 U	2 U	2 U	2 U	2 U
2-Butanone	2.5 J	10 U	2.2 J	10 U	10 U	10 U	10 U
2-Hexanone	5 U	5 U	5 U	5 U	5 U	5 U	5 U
4-Methyl-2-pentanone	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Acetone	34 J	50 UJ	26 J	17 J	50 UJ	50 U	50 UJ
Benzene	2 U	2 U	2 U	2 U	2 U	2 U	2 U
Bromodichloromethane	2 U	2 U	2 U	2 U	2 U	2 U	2 U
Bromoform	2 U	2 U	2 U	2 U	2 U	2 U	2 U
Bromomethane	2 U	2 U	2 UJ	2 UJ	2 U	2 UJ	2 U
Carbon disulfide	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Carbon tetrachloride	2 U	2 U	2 U	2 U	2 U	2 U	2 U
Chlorobenzene	2 U	2 U	2 U	2 U	2 U	2 U	2 U
Chloroethane	2 U	2 U	2 U	2 U	2 U	2 U	2 U
Chloroform	0.45 J	1.2 J	2 U	2 U	2 U	3.7	0.83 J
Chloromethane	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Cyclohexane	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Dibromochloromethane	2 U	2 U	2 U	2 U	2 U	2 U	2 U
Dichlorodifluoromethane (Freon-12)	2 U	2 U	0.75 J	0.81 J	2 U	2 U	2 U
Ethylbenzene	2 U	2 U	2 U	2 U	2 U	2 U	2 U
Isopropylbenzene	4 U	4 U	4 U	4 U	4 U	4 U	4 U
Methyl-tert-butyl ether (MTBE)	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Methylene chloride	5 U	5 U	8.8	11	5 U	5.2 U	5 U
Styrene	2 U	2 U	2 U	2 U	2 U	2 U	2 U
Tetrachloroethene	2 U	2 U	2.1	2.2	2 U	3.2	2 U
Toluene	2 U	2 U	0.78 J	0.96 J	2 U	0.54 J	2 U
Trichloroethene	2 U	2 U	2 U	2 U	2 U	2 U	2 U
Trichlorofluoromethane(Freon-11)	2 U	0.39 J	0.63 J	0.64 J	2 U	0.61 J	2 U
Vinyl chloride	2 U	2 U	2 U	2 U	2 U	2 U	2 U
cis-1,2-Dichloroethene	2 U	2 U	2 U	2 U	2 U	2 U	2 U
cis-1,3-Dichloropropene	2 U	2 U	2 U	2 U	2 U	2 U	2 U
m- and p-Xylene	2 U	2 U	2 U	2 U	2 U	2 U	2 U
o-Xylene	2 U	2 U	2 U	2 U	2 U	2 U	2 U
trans-1,2-Dichloroethene	2 U	2 U	2 U	2 U	2 U	2 U	2 U
trans-1,3-Dichloropropene	2 U	2 U	2 U	2 U	2 U	2 U	2 U

Notes:

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NA - Not analyzed

U - The material was analyed for, but not detected

UJ - Analyte not detected, quantitation limit may be inaccurate