M67001.AR.002775
MCB CAMP LEJEUNE
5090.3a

Final

Vapor Intrusion Evaluation Report Volume 4 of 6—Marine Corps Air Station, New River

Marine Corps Base Camp Lejeune
Jacksonville, North Carolina

NAVFAC
Naval Facilities Engineering Command
NAVFAC MID-ATLANTIC

Prepared for
Department of the Navy
Naval Facilities Engineering Command
Mid-Atlantic

Contract No. N62470-03-D-0260
Task Order-0021

November 2009

Prepared by

AGVIQ
AGVIQ ENVIRONMENTAL SERVICES
CH2M HILL
JOINT VENTURE

Final

Vapor Intrusion Evaluation Report
Volume 4 of 6

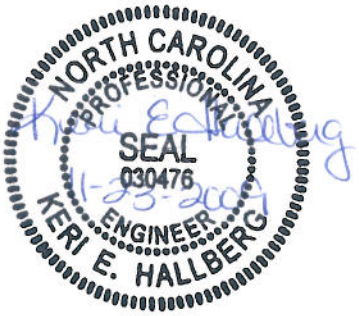
Marine Corps Base Camp Lejeune
Jacksonville, North Carolina

Task Order 21

November 2009

Prepared for

Department of the Navy
Naval Facilities Engineering Command
Mid-Atlantic



Keri E. Hallberg, P.E.
Project Manager
CH2M HILL
11301 Carmel Commons Blvd
Suite 304
Charlotte, North Carolina 28226
North Carolina Engineering License #F-0699

Final

Vapor Intrusion Evaluation Report
Volume 4 of 6—Marine Corps Air Station, New River

Marine Corps Base Lejeune
Jacksonville, North Carolina

Task Order 21

November 2009

Prepared for

Department of the Navy
Naval Facilities Engineering Command
Mid-Atlantic

Under the

AGVIQ–CH2M HILL JV 2 Program
Contract N62467-03-D-0260

Prepared by

Virginia Beach, Virginia

Contents

Acronyms and Abbreviations ..... **v**

1 Introduction **1-1**

2 Investigation Methods **2-1**
- 2.1 Phase I Sampling Event 2-1
  - 2.1.1 Phase I Sample Locations 2-1
- 2.2 Phase II Sampling Event 2-1
  - 2.2.1 Phase II Sample Locations 2-2

3 Quality Assurance **3-1**

4 Vapor Intrusion Evaluation Results and Conclusions **4-1**
- 4.1 Analytical Data 4-1
- 4.2 Building Specific Data Evaluations and Conceptual Site Model Discussions 4-2
  - 4.2.1 Site 86 4-3
  - 4.2.2 SWMU 336 4-12
  - 4.2.3 UST-CSFF 4-14

5 Overall Conclusions and Recommendations **5-1**

6 References **6-1**

Tables

V4-1 Phase I Sampling Summary
V4-2 Phase II Air Sampling Summary
V4-3 Summary of MCAS, New River Phase I Groundwater Analytical Results
V4-4 Summary of MCAS, New River Phase I Shallow Soil Gas Analytical Results
V4-5 Summary of MCAS, New River Phase I Deep Soil Gas Analytical Results
V4-6 Summary of MCAS, New River Phase II Subslab Soil Gas Analytical Results
V4-7 Phase I Oxygen Measurements
V4-8 Phase II Oxygen and Carbon Dioxide Measurements
V4-9 Summary of Building AS502 Investigation Results
V4-10 Summary of Building AS510 Investigation Results
V4-11 Summary of Building AS515 Investigation Results
V4-12 Summary of Building AS541 Investigation Results
V4-13 Summary of Building AS4106 Investigation Results
V4-14 Summary of Building AS143 Investigation Results
V4-15 Summary of Building AS4151 Investigation Results
V4-16 Summary of Recommendations

Figures

V4-1 Site 86/USTCSFF Phase I Sample Locations
V4-2 Site 86/SWMU336 Phase I Sample Locations
V4-3 Site 86/USTCSFF Phase II Sample Locations
V4-4 Site 86/Buildings AS502-AS541 Vapor Intrusion Conceptual Site Model
V4-5 Site 86/USTCSFF Historical Groundwater Exceedances
V4-6 Site 86/SWMU336 Historical Groundwater Exceedances

Appendices

V4-A Field Data Sheets
V4-B Data Validation/Quality Assurance Technical Memorandum
V4-C Building Survey Forms
V4-D Chain of Custody Records
V4-E Laboratory Data

Acronyms and Abbreviations

AST	aboveground storage tank
bgs	below ground surface
BTEX	benzene, toluene, ethylbenzene, and xylene
COC	chain of custody record
CSFF	Campbell Street Fuel Farm
CSM	conceptual site model
DOD	Department of Defense
ft	feet/foot
GW	groundwater
GWSL	Groundwater Screening Level
ITRC	Interstate Technology & Regulatory Council
IR	Installation Restoration
MCAS	Marine Corps Air Station
MCB	Marine Corps Base
ppbv	parts per billion by volume
QA/QC	quality assurance/quality control
RCRA	Resource Conservation and Recovery Act
RSL	Regional Screening Level
SG	soil gas
SGSL	Soil Gas Screening Level
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

Marine Corps Air Station, New River (MCAS, New River) is a major operational airfield on 2,600 acres northwest of Marine Corps Base (MCB) Camp Lejeune, across the New River. MCAS, New River is just south of Camp Geiger, with which it shares some of its facilities, and is a Marine Corps helicopter base that has been in service since 1943. Marine Aircraft Groups 26 and 29 are based at the Air Station.

MCAS, New River 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 MCAS, New River were selected for Phase I sampling according to the process detailed in the Work Plan.

One Installation Restoration (IR) site (Site 86), two Resource Conservation and Recovery Act (RCRA) sites (solid waste management unit [SWMU] 299 and SWMU 475), and five underground storage tank (UST) sites (USTAS4141, USTAS4158, USTAS843, USTASCSFF, and USTRR) were retained for further evaluation of vapor intrusion pathways in the MCAS, New River area. Constituents of concern in MCAS, New River 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 MCAS, Air Station.

SECTION 2

Investigation Methods

2.1 Phase I Sampling Event

Eight buildings of interest were identified in MCAS, New River for data collection during the Phase I sampling event. These eight buildings are located within 100 feet (ft) of a shallow groundwater well with exceedances of the site-specific groundwater-to-indoor-air screening levels. Samples collected in MCAS, New River were located near one IR site (Site 86), one RCRA site (SWMU 336), and one UST site (USTCSFF).

Sample collection procedures are provided in Volume 1, Section 2.

2.1.1 Phase I Sample Locations

Sample locations from the Phase I sampling event are shown on Figures V4-1 through V4-2. The field data sheets associated with the samples collected are provided in Appendix A. The chain of custody records (COCs), which log the samples collected, are provided in Appendix V4-D.

Fourteen groundwater grab (sample type—GW) and five soil vapor (sample type—SV) samples were collected in MCAS, New River during the Phase I field event. Quality control samples were collected in accordance with Section 2.7 of the Field Sampling Plan (CH2M HILL, 2008b). Additional information regarding the quality control samples is provided in Section 3.

Table V4-1 lists the samples that were proposed in the Work Plan and the deviations that occurred during the Phase I field event.

2.2 Phase II Sampling Event

Of the eight buildings sampled at MCAS, New River during Phase I, two 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 two buildings retained for Phase II sampling had exceedances in groundwater or soil gas. Samples collected in MCAS, New River were located near IR Site 86.

Sample collection procedures are provided in Volume 1.

TABLE V4-1
Phase I Sampling Summary
MCAS, New River, MCB Camp Lejeune, North Carolina

Site Name	Bldg	Sample Type	Sample ID	Sample Collected (Y/N)	Deviations
Site 86	AS502	GW	IR86-IS11-GW-10-12-08B	Y	—
		SV	IR86-IS11-SV-XX-XX-08B	N	Clay present from 0 ft- 6 ft bgs
	AS510	GW	IR86-IS12-GW-13-14-08B	Y	—
		GW	IR86-IS13-GW-08-09-08B	Y	—
		SV	IR86-IS12-SV-05-06-08B	Y	—
		SV	IR86-IS13-SV-05-06-08B	Y	—
	AS515	GW	IR86-IS05-GW-07-09-08B	Y	—
		GW	IR86-IS06-GW-09-11-08B	Y	—
		GW	IR86-IS07-GW-09-11-08B	Y	—
		SV	IR86-IS05-SV-XX-XX-08B	N	Moist soil at shallow depth (4 ft)
		SV	IR86-IS06-SV-XX-XX-08B	N	Moist soil at shallow depth (6.5 ft)
		SV	IR86-IS07-SV-XX-XX-08B	N	Moist soil at shallow depth (4 ft)
	AS541	GW	IR86-IS08-GW-11-13-08B	Y	—
		GW	IR86-IS09-GW-10-12-08B	Y	—
		GW	IR86-IS10-GW-10-12-08B	Y	—
		SV	IR86-IS08-SV-XX-XX-08B	N	Clay and moist soil at shallow depth (4 ft)
		SV	IR86-IS09-SV-XX-XX-08B	N	Moist soil at shallow depth (8 ft)
		SV	IR86-IS10-SV-XX-XX-08B	N	Moist soil at shallow depth (4 ft)
	AS510	GW	IR86-IS14-GW-14-15-08B	Y	—
		SV	IR86-IS14-SV-XX-XX-08B	N	Groundwater too shallow (4 ft-7 ft bgs)
SWMU 336	AS4106	GW	SWMU336-IS01-GW-14-16-08B	Y	—
		GW	SWMU336-IS02-GW-12-14-08B	Y	—
		SV	SWMU336-IS01-SV-08-09-08B	Y	Mislabeled: IR86-IS01-SV-08-09-08B
		SV	SWMU336-IS02-SV-06-07-08B	Y	Mislabeled: IR86-IS02-SV-06-07-08B
UST CSFF	AS143	GW	USTCSFF-IS03-GW-08-09-08B	Y	—
		SV	USTCSFF-IS03-SV-XX-XX-08B	N	Groundwater too shallow (4 ft bgs)
	AS4151	GW	USTCSFF-IS04-GW-12-13-08B	Y	Mislabeled: USTAS4151-IS04-GW-12-13-08B
		SV	USTCSFF-IS04-SV-05-06-08B	Y	Mislabeled: USTAS4151-IS04-SV-5-6-08B

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.
CSFF = Campbell Street Fuel Farm

2.2.1 Phase II Sample Locations

Sample locations from the Phase II sampling event are shown on Figure V4-3. The field data sheets associated with the samples collected are provided in Appendix A. The COCs, which log the samples collected, are provided in Appendix V4-D.

Three subslab soil gas (sample type—SG) were collected at MCAS, New River during the Phase 2 field event. Quality control samples were collected in accordance with Section 2.7 of

the Field Sampling Plan (CH2M HILL, 2008b). Additional information regarding the quality control samples is provided in Section 3.

Table V4-2 lists the air samples that were collected during the Phase 2 field event:

TABLE V4-2
Phase II Air Sampling Summary
MCAS, New River, MCB Camp Lejeune, North Carolina

Site Name	Building	Sample Type	Sample ID	Sample Collected (Y/N)	Deviations
Site 86	AS502	SG	IR86-SG01-08C	Y	—
	AS541	SG	IR86-SG02-08C	Y	—
		SG	IR86-SG03-08C	Y	—

There were no deviations from the Work Plan during the Phase II sampling event.

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 result's 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: 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 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. This process provides a medium for essential communication between the laboratory, validator, and project team, and allows for data quality to be thoroughly evaluated.

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

SECTION 4

Vapor Intrusion Evaluation Results and Conclusions

4.1 Analytical Data

Tables V4-3, V4-4, and V4-5 summarize the results from Phase I groundwater, shallow soil gas, and deep soil gas samples. Figures V4-1 and V4-2 present the Phase I sample locations at MCAS, New River.

Table V4-6 summarizes the results from the Phase II subslab soil gas samples. Figure V4-3 presents the Phase II sample locations at MCAS, New River.

The text tables (V4-9 through V4-15) present the constituents that exceeded the screening levels. The report tables (V4-3 through V4-6) included 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 V4-E.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 of each petroleum hydrocarbon in the vapor phase 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.

Table V4-7 lists the field measurements of oxygen 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 V4-7
Phase I Oxygen Measurements
MCAS, New River, MCB Camp Lejeune, North Carolina

Sample ID	O_2 (%)
IR86-IS12-SV-05-06-08B	20.1
IR86-IS13-SV-05-06-08B	20.8
SWMU336-IS01-SV-08-09-08B	15.1
USTAS4151-IS04-SV-05-06-08B	20.9

Table V4-8 lists the field measurements of oxygen that were collected during Phase II with a Gem2000 landfill gas meter to determine if sufficient oxygen is present in the subsurface to

allow for aerobic biodegradation. Table V4-8 also lists the field measurements of carbon dioxide collected with the Gem2000 meter to determine if aerobic biodegradation may have already occurred.

TABLE V4-8
Phase II Oxygen and Carbon Dioxide Measurements
MCAS, New River, MCB Camp Lejeune, North Carolina

Sample ID	O_2 (%)	CO_2 (%)
IR86-SG01-08C	21.2	0.0
IR86-SG02-08C	16.7	2.8
IR86-SG03-08C	21.9	0.0

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

4.2 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 (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 V4-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 are 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 V4-1. However, select groundwater and exterior soil gas samples were also considered in the evaluations at neighboring buildings.

4.2.1 Site 86

Site 86 is a heavily industrialized flight support area of MCB Camp Lejeune that has been in service since 1951. Site 86 is composed of buildings that support the operation of the air station, including aircraft storage and maintenance hangars, several former aboveground storage tanks (ASTs), former aircraft washing areas, and a rescue response center and fire station. All of the buildings investigated are located within or near the flight line. Major features within Site 86 include the Former Aircraft Wash Rack AS513; an aircraft-washing area (referred to as the "bird bath"); SWMUs 303 and 318 (former steel ASTs and an oil–water separator, respectively); aircraft hangars; and other MCAS, New River support buildings. Most of Site 86 is developed with buildings. More information about the status of this site and additional details from previous site reports can be found in Section 2.2.3 of the Work Plan (CH2M HILL, 2008a). Buildings AS502, AS510, AS515, and AS541 within Site 86 were retained for further evaluation (Figures V4-1 and V4-2).

Building AS502

Building AS502 is utilized as an emergency crash rescue response center and a fire station. It is classified as a large industrial building for this evaluation. Building AS502 was included in Phase I because it is located within 100 ft of two monitoring wells that have exceedances of the site-specific Groundwater Screening Levels (GWSLs) for large buildings, as shown in Table V4-9. The depth to groundwater in these wells ranges from approximately 6 to 11 ft below ground surface (bgs). Shallow groundwater flows to the northeast; one of the wells is upgradient of and the other is cross-gradient to Building AS502.

Building Characteristics. Building AS502 is a one-story concrete block building approximately 115 ft long by 100 ft wide. The east side of the building is utilized by the MCAS, New River as a crash rescue center for the aircraft and has a ceiling height of approximately 10 ft. The west side of the building is used as a fire house and has an approximate 30-ft-high ceiling for the fire truck storage.

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 slab is approximately 6 inches thick and contains wire mesh.

Building AS502 has a multi-zone heating/cooling system. The building has eight tall rollup doors, seven windows, and two doors that are routinely left open.

Potential indoor sources of VOCs observed during the Phase II building survey included spray paint and general cleaning products. These items are used inside the building on workbenches. Pesticide products are applied to the building once a year. Smoking is not permitted in the building but does occur directly outside of one of the main doorways.

There are approximately 15 workers occupying this building during normal work hours, which are 7am to 3pm on weekdays. There are also at least three workers on-call at the building at all times in case of emergencies.

Analytical Results. Historical (2002–2007) groundwater concentrations within 100 ft of Building AS502 which were above site-specific GWSLs are summarized in this section. The historical groundwater exceedances are shown in Figure V4-5. Phase I groundwater sample locations are shown in Figure V4-1, and the sample results are provided in Tables V4-3. The Phase II subslab soil gas sample locations are shown in Figure V4-3, and the results are provided in Table V4-6. Results for VOCs with GWSL exceedances are shown in Table V4-9.

TABLE V4-9
Summary of Building AS502 Investigation Results
MCAS, New River, MCB Camp Lejeune, North Carolina

Building AS502 Historical (2002–2007) Site-Specific Groundwater Screening Level Exceedances

Well ID	Screen Depth (ft bgs)	PCE (µg/L)	TCE (µg/L)	VC (µg/L)
GWSL		*7.69*	*38.5*	*2.86*
IR86-MW27IW	20–30	-	160	12
IR86-MW10IW	20–30	64	39	21
SWMU318-GW13	12–16	-	57	-

Building AS502 Phase I Generic Groundwater Screening Level Exceedances

Sample ID	PCE (µg/L)	TCE (µg/L)	VC (µg/L)
GWSL (based on Industrial Air RSL)	*2.79*	*14.5*	*2.54*
IR86-IS10-GW-10-12-08B	5U	300	-
IR86-IS11-GW-10-12-08B	5U	-	5U

Building AS502 Phase II Subslab Soil Gas Screening Level Exceedances

Sample ID	PCE (ppbv)	TCE (ppbv)	VC (ppbv)
SGSL (based on industrial air RSL;AF=1E-01)	*3.1*	*11.4*	*11.0*
Base-Specific SGSL (AF=1E-03)	310	1,140	1,100
IR86-SG01-08C	-	-	-

BOLD indicates exceeds the base-specific SGSL
- indicates the compound does not exceed the screening level
PCE = tetrachloroethene; VC = vinyl chloride; TCE = trichloroethene

Refined CSM. A three-dimensional CSM image is provided as Figure V4-4; the Phase I and II sample locations and results for VOCs with GWSL exceedances for Building AS502 are shown in this figure.

Historical (2002–2007) chlorinated solvent (PCE, TCE, and VC) concentrations in nearby monitoring wells (20 to 30 ft bgs screen depth) IR86-MW27IW and IR86-MW10IW exceeded the site-specific GWSLs by up to eight times. IR86-MW27IW is located southwest and upgradient of Building AS502 while IR86-MW10IW is northeast and downgradient of the building. The historical groundwater-monitoring well GWSL exceedances triggered the Phase I sampling.

Two near-water-table grab groundwater samples were collected near Building AS502 during Phase I. At IR86-IS10, located at the southwest corner of Building AS502, TCE was detected at 300 µg/L, approximately 20 times the generic GWSL. TCE was not detected above the GWSL in the other groundwater sample, IR86-IS11, on the south side of Building AS502. PCE and VC were not detected above the generic GWSLs in the two Phase I groundwater samples; however, the reporting limits were slightly above the GWSLs, resulting in limited uncertainty for these compounds.

The Phase I groundwater grab samples indicated that there were TCE impacts in near-water-table groundwater beneath the southwest corner of Building AS502, potentially extending beneath the building. The TCE detection of 300 µg/L at IR86-IS10 was greater than the nearby deeper historical monitoring well detections.

Soil gas sampling was attempted at the two Phase I grab groundwater-sampling locations, but was unsuccessful due to shallow groundwater. Saturated soils were encountered between 4 and 7.5 ft bgs at these locations. Subslab sampling was conducted during Phase II based on the GWSL exceedances and because exterior shallow (5 ft bgs) soil gas samples could not be collected.

One subslab soil gas sample was collected during Phase II near the center of Building AS502. The subslab soil gas sample did not contain any constituents at concentrations that exceeded generic Soil Gas Screening Levels (SGSLs), suggesting the observed groundwater concentrations near the southwest corner of Building AS502 are not currently a significant source of TCE in subslab soil gas.

Conclusions. Although the TCE groundwater concentration from the top of the water table near Building AS502 exceeded the generic GWSL, TCE was not detected in the Phase II subslab soil gas sample. The up-gradient concentrations of TCE in groundwater indicate a potential for future TCE impacts to subslab concentrations in the most southwestern corner of Building AS502.

However, it is unlikely the groundwater concentrations will result in significant future vapor intrusion impacts at the Building AS502 Fire Station given (1) that TCE was not detected in any of the subslab samples and (2) the characteristics of the building (e.g., significant outdoor air exchange through the large open bay doors).

Recommended Further Actions

1. An additional round of subslab sample data should be collected at Building AS502 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. An additional subslab soil gas sample should be collected at the southwest corner of Building AS502, where the highest TCE impacts are expected.

2. Groundwater concentrations at the top of the water table should be monitored for downgradient migration given the Phase I groundwater TCE concentration detected at IR86-IS10.

Building AS510

Building AS510 is located within Site 86. The building is utilized as a training and maintenance facility. It is classified as a large industrial building for this evaluation. Building AS510 was included in Phase I because it is located within 100 ft of one monitoring well that has an exceedance of the site-specific GWSLs for large buildings as shown in Table V4-10. The depth to groundwater in these wells ranges from approximately 6 to 11 ft bgs. Shallow groundwater flows northeast, away from the building.

Building Characteristics. Building AS510 is a one-story concrete block building that is approximately 150 ft long by 180 ft wide. The ceiling is approximately 8 ft high. The building is utilized as a training facility and contains classrooms.

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 slab depth is unknown because a subslab sample was not collected at Building AS510.

The building has five bays and eight double doors. Windows and doors typically remain closed. The building reportedly has a multi-zone heating and cooling system.

Potential indoor sources of VOCs observed during the Phase I sampling event included hydraulic fuel, which according to building personnel was stored inside the building. Access for a building survey was denied during Phase II field events.

There are approximately 100 potential receptors occupying this building during work hours, which are 7am to 3pm on weekdays.

Analytical Results. Historical (2002–2007) shallow groundwater VOC concentrations within 100 ft of Building AS510 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 V4-5. Phase I groundwater and soil gas sample locations are shown in Figure V4-1, the Phase I groundwater sample results are provided in Table V4-3, and the Phase I soil gas sample results are provided in Tables V4-4. Results for VOCs with GWSL and/or SGSL exceedances are provided in Table V4-10.

TABLE V4-10
Summary of Building AS510 Investigation Results
MCAS, New River, MCB Camp Lejeune, North Carolina

Building AS510 Historical (2002–2007) Site-Specific Groundwater Screening Level Exceedances

Well ID	Screen Depth (ft bgs)	PCE (µg/L)	TCE (µg/L)	VC (µg/L)
GWSL		*7.69*	*38.5*	*7.69*
IR86-MW10IW	20–30	-	39	64
IR86-IS62	22–27	-	-	-

Building AS510 Phase I Generic Groundwater Screening Level Exceedances

Sample ID	PCE (µg/L)	TCE (µg/L)	VC (µg/L)
GWSL (based on industrial air RSL)	*2.79*	*14.5*	*2.54*
IR86-IS12-GW-13-14-08B	-	-	-
IR86-IS13-GW-08-09-08B	-	-	-
IR86-IS14-GW-14-15-08B	-	-	-

Building AS510 Phase I Shallow Soil Gas Screening Level Exceedances

Sample ID	PCE (ppbv)	TCE (ppbv)	VC (ppbv)
SGSL (based on industrial air RSL;AF=1E-01)	*3.1*	*11.4*	*11.0*
Base-Specific SGSL (AF=1E-03)	*310*	*1,140*	*1,100*
IR86-IS12-SV-05-06-08B	-	-	-
IR86-IS13-SV-05-06-08B	-	-	-

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

Refined CSM. Historical (2002–2007) chlorinated solvent (TCE and VC) concentrations in one nearby monitoring well (20 to 30 ft bgs screen depth) exceeded the site-specific GWSLs by up to eight times. MW10IW is west and upgradient of Building AS510. There is one monitoring well south of Building AS502 that did not contain exceedances of the site-specific GWSLs (IR86-IS62). The historical groundwater-monitoring well GWSL exceedances triggered the Phase I sampling discussed in the following paragraph.

Groundwater samples were collected during Phase I from three locations near Building AS510. There were no constituents detected at concentrations that exceeded the generic GWSLs at any of the three sample locations. Co-located soil gas samples were collected at two of the three groundwater sample locations; soil gas could not be collected at IR86-IS14 due to shallow groundwater. No constituents were detected at concentrations that exceeded the generic SGSLs at either of the sample locations. Subslab sampling was not proposed for Phase II because there were no GWSL or SGSL exceedances in the Phase I samples.

Conclusions. There were no constituents detected in groundwater or shallow soil gas above the generic GWSLs or SGSLs. Therefore, it is highly unlikely that the vapor intrusion pathway would result in VOC concentrations above the IASLs in indoor air at Building AS510. No further actions are proposed at Building AS510.

Building AS515

Building AS515 is located within Site 86. The building is used mainly as an aircraft hangar and is classified as a large industrial building for this evaluation. Building AS515 was included in Phase I because it is located within 100 ft of two monitoring wells that have exceedances of the site-specific GWSLs for large buildings as shown Table V4-11. The depth to groundwater in these wells ranges from approximately 6 to 9 ft bgs. Shallow groundwater flows to the northeast; IR86-IS56 is upgradient of and IR86-IS57 is downgradient of Building AS515.

Building Characteristics. Building AS515 is a one-story concrete block building approximately 450 ft long by 100 ft wide. The ceiling is approximately 20 ft high. The main and central part of the building is utilized as an aircraft hangar and maintenance facility for ospreys. The eastern and western ends of the building are utilized for storage of unknown items. The northern portion of the building houses office spaces.

Building AS515 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 slab depth is unknown because a subslab sample was not collected at Building AS515. Expansion joints were present, sealed, and appeared to be in good condition. Sumps and drains were also observed within the building.

Building AS515 has a multi-zone heating/cooling system. The building has five bays and eight double doors. The south side of the building has a steel front with panels that slide open. Large metal hangar doors do not create a tight seal. Hangar doors and doors on the south side of the building are routinely left open.

Potential indoor sources of VOCs observed during the Phase I sampling event included oil, degreasers, and other aircraft maintenance products.

There are approximately 100 potential receptors occupying this building during work hours, which are 7am to 3pm on weekdays.

Analytical Results. Historical (2002–2007) shallow groundwater VOC concentrations within 100 ft of Building AS515 which were above the site-specific GWSLs are summarized in this section and were taken from the Work Plan (CH2M HILL, 2008a). Phase I groundwater sample locations are shown on Figure V4-1 and the analytical results are provided in Table V4-3. Results for VOCs with generic GWSLs exceedances are provided in Table V4-11.

TABLE V4-11
Summary of Building AS515 Investigation Results
MCAS, New River, MCB Camp Lejeune, North Carolina

Building AS515 Historical (2002–2007) Site-Specific Groundwater Screening Level Exceedances

Well ID	Screen Depth (ft bgs)	Benzene (µg/L)	VC (µg/L)
GWSL		*17.4*	*2.86*
IR86-IS56	22–27	140	5.2
IR86-IS57	22–27	--	5.3

Building AS515 Phase I Generic Groundwater Screening Level Exceedances

Sample ID	Benzene (µg/L)	VC (µg/L)
GWSL (based on industrial air RSL)	*7.05*	*2.54*
IR86-IS05-GW-07-09-08B	29	-
IR86-IS06-GW-09-11-08B	-	-
IR86-IS07-GW-09-11-08B	29	5U

- indicates the compound does not exceed the screening level

Refined CSM. Historical (2002–2007) benzene concentrations in nearby one monitoring well, IR86-IS56 (22 to 27 ft bgs screen depth) exceeded the site-specific GWSL by approximately eight times. IR86-IS56 is south of and downgradient of Building AS515. Historical VC concentrations in two nearby monitoring wells, IR86-IS56 and IR86-IS57 (22 to 27 ft bgs screen depths) exceeded the site-specific GWSL by 1.8 and 1.9 times. These historical groundwater-monitoring well GWSL exceedances triggered Phase I sampling.

During Phase I, groundwater samples were collected from three locations near Building AS515. Co-located soil gas samples could not be collected at any of the three Phase I locations due to shallow groundwater. Benzene was detected in two of the three Phase I groundwater samples, IR86-IS05 and IR86–IS07, at concentrations that exceeded the generic GWSL by approximately four times. Based on the Phase I groundwater results, benzene is present in shallow groundwater south and east of Building AS515 but does not appear to extend north of the building. VC did not exceed the GWSL in the samples collected from IR86-IS05 or IR86-IS06, and was not detected in the sample collected from IR86-IS07. However, there is some uncertainty regarding VC concentrations in IR86-IS07 due to the reporting limit being approximately two times the generic GWSL. Subslab sampling was not proposed for Phase II because the benzene detections in Phase I groundwater are unlikely to result in a cancer risk greater than 1E-06.

Additionally, the building is an aircraft hangar that has multiple large doors that remain open during business hours, resulting in significant outdoor air exchange.

Conclusions. Although benzene concentrations near Building AS515 exceeded the generic GWSL, the exceedances were within the target cancer risk range and therefore significant indoor air impacts resulting from vapor intrusion are not expected. Also, benzene readily aerobically biodegrades in the vadose zone in the presence of oxygen concentrations greater than four percent so benzene concentrations in soil gas are likely lower than would be predicted by the generic GWSLs, which do not account for degradation. In addition, significant vapor intrusion impacts within the hangar and maintenance areas of Building AS515 are not likely given the characteristics of the building (e.g., large air volume and significant outdoor air exchange through large open bay doors). There are no further actions proposed at Building AS515.

Building AS541

Building AS541 is located within Site 86. The building is utilized as a marine aviation logistic center and storage for materials/gear for flightline operations. It is classified as a large industrial building for this evaluation. Building AS541 was included in Phase I because it is located within 100 ft of four monitoring wells that have exceedances of the site-

specific GWSLs for large buildings as shown in Table V-4-12. The depth to groundwater in these wells is approximately 5 ft bgs. Shallow groundwater flows to the northeast; Building AS541 is downgradient of two of the wells and upgradient of the other two.

Building Characteristics. Building AS541 is a two-story concrete block building approximately 270 ft long by 50 ft wide. The ceiling is approximately 20 ft high. The first floor of this building is used mainly as a large warehouse. A small section of the building on the north side has a second level and is used for office space; the ceilings on both floors are approximately 8 ft high. There is also a small second level of office space in the southwest part of the building.

Building AS541 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 to 7 inches thick and contains wire mesh. Multiple expansion joints are present, mostly in good condition. The warehouse areas have exposed concrete floors.

Building AS541 has six doors around the building and seven steel bay doors on the west side of the building. Several of the large hangar doors are left open during work hours and do not seal tightly when closed. The building has a multi-zone heating and cooling system.

Some potential indoor sources of VOCs observed in the building during the Phase II building inspection included spray paint and pre-greased gears.

There are approximately 50 workers occupying this building during work 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 AS541 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 V4-5. Phase I groundwater sample locations are shown in Figure V4-1 and the analytical results are provided in Table V4-3. Phase II subslab soil gas sample locations are shown on Figure V4-3 and the analytical results are provided in Table V4-6. Results for VOCs with generic GWSLs and generic SGSLs exceedances are provided in Table V4-12.

TABLE V4-12
Summary of Building AS541 Investigation Results
MCAS, New River, MCB Camp Lejeune, North Carolina

Building AS541 Historical (2002–2007) Site-Specific Groundwater Screening Level Exceedances

Well ID	Screen Depth (ft bgs)	TCE (µg/L)	VC (µg/L)	Benzene (µg/L)
GWSL		*38.5*	*2.86*	*17.4*
IR86-MW27IW	20–30	160	12	-
SWMU318-MW02	20–30	79	14	29
SWMU318-TW01	5-15	-	-	-
SWMU318-GW10	12–16	1,200	140	-
SWMU318-GW13	12–16	57	-	-

Building AS541 Phase I Generic Groundwater Screening Level Exceedances

Sample ID	TCE (µg/L)	VC (µg/L)	Benzene (µg/L)
GWSL (based on industrial air RSL)	*14.5*	*2.54*	*7.05*
IR86-IS08-GW-11-13-08B	-	-	-
IR86-IS09-GW-10-12-08B	-	-	-
IR86-IS10-GW-10-12-08B	300	-	-

Building AS541 Phase II Subslab Soil Gas Screening Level Exceedances

Sample ID	TCE (ppbv)	VC (ppbv)	Benzene (ppbv)
SGSL (based on industrial air RSL;AF=1E-01)	*11.4*	*11.0*	*5.01*
Base-Specific SGSL (AF=1E-03)	1,140	1,100	501
IR86-SG02-08C	-	-	-
IR86-SG03-08C	-	-	-

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 V4-4. The Phase I and II sample locations and results for VOCs with GWSL and/or SGSL exceedances for Building AS541 are shown in this figure.

Historical (2002–2007) chlorinated solvent concentrations in four nearby monitoring wells (12 to 30 ft bgs screen depths) exceeded the site-specific GWSL by up to 49 times. Historical benzene concentrations in one upgradient monitoring well, SWMU318-MW02 (20 to 30 ft bgs screen depth) exceeded the site-specific GWSL by 1.7 times. The historical groundwater monitoring well GWSL exceedances triggered the Phase I sampling.

Three grab groundwater samples were collected adjacent to (IR86-IS08 and IR86-IS09) and downgradient (IR86-IS10) of Building AS541 during Phase I (Figure V4-4). Co-located soil gas samples could not be collected at the three Phase I locations due to shallow groundwater; saturated soils were encountered between 4 to 8 ft bgs at these locations. At the location east of and downgradient of Building AS541, IR86-IS10, TCE was detected at 300 µg/L, approximately 20 times the generic GWSL. The other two Phase I groundwater sample locations (up- and cross-gradient of Building AS541) did not contain any constitu-

ents in exceedance of the generic GWSLs. Subslab sampling was recommended for Phase II based on the GWSL exceedances and because exterior shallow (5 ft bgs) soil gas samples could not be collected.

Two subslab soil gas samples were collected during Phase II. There were no VOCs detected in either sample at concentrations above the generic SGSLs.

Conclusions. Although TCE groundwater concentrations from the top of the water table in one Phase I groundwater sample, collected downgradient of Building AS541, exceeded the generic GWSL, TCE was not detected above its generic GWSL in the Phase I samples collected adjacent to the building; nor was it detected above its generic SGSL in the subslab soil gas samples. The concentrations of TCE and VC in the groundwater west and upgradient of Building AS541 in monitoring well SWMU318-GW10 indicate a potential for future TCE impacts to subslab concentrations in the western portion of Building AS541. However, significant future vapor intrusion impacts within Building AS541 are not anticipated given (1) that TCE was not detected in the two subslab soil gas samples above the generic SGSL and (2) the characteristics of the building (e.g., large air volume and significant outdoor air exchange through the large open bay doors).

Recommended Further Actions

1. An additional round of subslab sample data should be collected at Building AS541 to confirm that subslab soil gas concentrations remain below the generic SGSLs. This is necessary due to the temporal variability associated with soil gas sampling.

2. Groundwater concentrations at the top of the water table should be monitored for downgradient migration given the historical chlorinated solvent concentrations at SWMU318-GW10.

3. If remedial actions are being performed to address groundwater or soil contamination, the vapor intrusion pathway should be evaluated during and after remedial actions.

4.2.2 SWMU 336

SWMU 336 is the site of a former paint-stripping vat within Building AS4106. This building is the only building within SWMU 336 for this evaluation.

Building AS4106

Building AS4106 is located within SWMU 336. One-half of the building is utilized as a helicopter maintenance facility while the other half is used as classrooms and offices. It is classified as a large industrial building for this evaluation. Building AS4106 was included in Phase I because it is within 100 ft of one monitoring well (SWMU336-TW01) that had an exceedance of the site-specific GWSL for large industrial buildings, as shown in Table V4-13. The depth to groundwater in SWMU336-TW01 is approximately 12 ft bgs. Shallow groundwater flows to the south. Building AS4106 is downgradient from SWMU336-TW01.

Building Characteristics. Building AS4106 is a one-story concrete block building with some walls constructed of metal sheeting. The building is approximately 290 ft long by 120 ft wide. The ceiling is approximately 20 ft high. The northwest portion of the building has classrooms and office space; this area of the building contains very few windows and doors,

and these typically remain closed. This portion of the building contains a multi-zone heating and cooling system. The southeast portion of the building is a helicopter maintenance facility. This area has 12 rollup doors to facilitate entrance and exit of the helicopters for maintenance. The rollup doors are left open during the day.

Building AS4106 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 depth of the slab is unknown because subslab samples were not collected. The majority of the building's floor consists of bare concrete.

Some potential indoor sources of VOCs observed during the Phase II building survey included degreasers, oils, and other mechanical products.

There are approximately 100 potential receptors or less occupying this building during work hours, which are 7am to 3pm on weekdays.

Analytical Results. Historical (2002–2007) shallow groundwater VOC concentrations within 100 ft of Building AS4106 which 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 V4-6. Phase I co-located groundwater and soil gas sample locations are shown in Figure V4-2 and the Phase I groundwater and soil gas sample results are provided in Tables V4-3, and V4-5. Results for VOCs with GWSL and/or SGSL exceedances are provided in Table V4-13.

TABLE V4-13
Summary of Building AS4106 Investigation Results
MCAS, New River, MCB Camp Lejeune, North Carolina

Building AS4106 Historical (2002–2007) Site-Specific Groundwater Screening Level Exceedances

Well ID	Screen Depth (ft bgs)	PCE (µg/L)
GWSL		*7.69*
SWMU336-TW01	11-16	27.0

Building AS4106 Phase I Generic Groundwater Screening Level Exceedances

Sample ID	PCE (µg/L)
GWSL (based on industrial air RSL)	*2.79*
SWMU336-IS01-GW-14-16-08B	3.4
SWMU336-IS02-GW-12-14-08B	-

Building AS4106 Phase I Deep Soil Gas Screening Level Exceedances

Sample ID	PCE (ppbv)
SGSL (based on industrial air RSL, AF=1E-02)	*31*
Base-specific SGSL (AF=0.001)	*310*
IR86-IS01-SV-08-09-08B	120
IR86-IS02-SV-08-09-08B	-

BOLD indicates exceedance of the base specific SGSL
- indicates the compound does not exceed the screening level

Refined CSM. The historical (2002–2007) PCE concentration in the nearby and upgradient monitoring well SWMU336-TW01 (11 to 16 ft bgs screen depth) was approximately 3.5 times the site-specific GWSL. This historical groundwater monitoring well GWSL exceedance triggered the Phase I sampling.

Two co-located grab groundwater and soil gas samples were collected near Building AS4106 during Phase I. PCE was detected (3.4 µg/L) in groundwater at 1.2 times the generic GWSL in the Phase I groundwater sample (SWMU336-IS01) northwest of Building AS4106 and near monitoring well SWMU336-TW01. The soil gas sample collected at this location had a PCE detection that was approximately four times its generic SGSL but less than the base-specific SGSL. PCE was not detected above the screening levels in either the Phase I groundwater or soil gas samples collected northeast of the building (SWMU336-IS02).

Subslab sampling was not proposed for Phase II because the one soil gas exceedance was only four times greater than the generic SGSL and less than the base-specific SGSL. Therefore, significant vapor intrusion impacts are not currently expected based on a review of the Phase I data.

Conclusions. PCE is present in deep soil gas northwest of Building AS4106 at a concentration above the generic deep SGSL but lower than the base-specific SGSL. Therefore, significant indoor air impacts resulting from vapor intrusion are not currently expected. There is a limited amount of uncertainty in this conclusion given the observed detections of PCE in deep soil gas northwest and northeast of Building AS4106 and the potential for PCE impacts in subslab soil gas beneath the northern portion of the building where the offices and classrooms are located (refer to the Recommended Further Actions section, below).

Recommended Further Actions

1. Consider collecting subslab soil gas samples in the northern portion of Building AS4106 to address the spatial and temporal limited uncertainties associated with the potential for PCE impacts in subslab soil gas beneath the northern portion of the building where the offices and classrooms are located.
2. If remedial actions are performed to address groundwater or soil contamination the vapor intrusion pathway should be reevaluated during and after remedial actions.

4.2.3 UST-CSFF

CSFF (Campbell Street Fuel Farm) is separated into two areas: one located at the fuel farm and Building AS143 and the other approximately 500 ft south near Building AS4151.

Building AS143

Building AS143 is located within UST-CSFF. The building is utilized as a gas station and base fuel office. It is classified as a small industrial building for this evaluation. Building AS143 was included in Phase I because it is located within 100 ft of two monitoring wells that have exceedances of the site-specific GWSLs for small industrial buildings as shown in Table V4-14. The depth to groundwater in these wells ranges from approximately 14 to 16 ft bgs. Shallow groundwater flows to the northeast; one of the wells is upgradient of and the other is downgradient of Building AS143.

Building Characteristics. Building AS143 is a one-story concrete masonry building that is approximately 35 ft long by 20 ft wide. The ceiling is approximately 10 ft high. The interior of the building is divided up into smaller spaces utilized as an office, break room, restroom, and storage.

Building AS143 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 concrete slab depth is unknown because subslab samples were not collected.

Building AS143 has a multi-zone heating/cooling system. The building has three doors and six windows that typically remain closed.

Some potential indoor sourced of VOCs observed during the Phase II building survey included aerosol furniture polish and all-purpose cleaner.

There are approximately five workers or less occupying this building during work hours, which are 7am to 3pm on weekdays.

Analytical Results. Historical (2002–2007) shallow groundwater VOC concentrations within 100 ft of Building AS143 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 V4-5. Phase I groundwater sample locations are shown in Figure V4-1, and the Phase I groundwater sample results are provided in Table V4-3. Results for VOCs with GWSL exceedances are provided in Table V4-14.

TABLE V4-14
Summary of Building AS143 Investigation Results
MCAS, New River, MCB Camp Lejeune, North Carolina

Building AS143 Historical (2002–2007) Site-Specific Groundwater Screening Level Exceedances

Well ID	Screen Depth (ft bgs)	Benzene (µg/L)
GWSL		*8.70*
USTCSFF-MW21	4–14	273
USTCSFF-MW24	3–11	248

Building AS143 Generic Groundwater Screening Level Exceedances

Sample ID	Benzene (µg/L)
GWSL	*7.05*
USTCSFF-IS03-GW-08-09-08B	-

- indicates the compound does not exceed the screening level

Refined CSM. Historical (2002–2007) benzene concentrations in nearby monitoring wells (3 to 14 ft bgs screen depths) were approximately 28 to 31 times the site-specific GWSL. These historical groundwater-monitoring well GWSLs exceedances triggered the Phase I sampling.

One grab groundwater sample was collected near Building AS143 during Phase I; however, a co-located soil gas sample could not be collected due to shallow groundwater (saturated

soils were encountered at 4 ft bgs). There were no detections of VOCs above the generic GWSLs in the Phase I groundwater sample. Subslab sampling was not proposed for Phase II because there were no Phase I GWSL exceedances.

Conclusions. There were no constituents detected above the generic GWSLs at Building AS143 in the Phase I groundwater sample. Therefore, significant vapor intrusion impacts are not currently expected. Additionally, benzene readily aerobically biodegrades in the vadose zone in the presence of oxygen concentrations greater than 4 percent so benzene concentrations in soil gas are likely lower than would be predicted by the generic GWSLs which do not account for this. There are no further actions proposed at Building AS143.

Building AS4151

Building AS4151 is a located within UST-CSFF. The building is utilized as a steam plant. It is classified as a small industrial building for this evaluation. Building AS4151 was included in Phase I because it is located within 100 ft of two monitoring wells that have exceedances of the site-specific GWSLs for small industrial buildings as shown in Table V4-15. The depth to groundwater in these wells ranges from approximately 14 to 16 ft bgs. Shallow groundwater flows to the east; Building AS4151 is up- and cross-gradient of these two wells.

Building Characteristics. Building AS4151 is a one-story concrete block building approximately 70 ft long by 70 ft wide. The ceiling is approximately 30 ft high.

Building AS4151 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. No expansion joints are present, but floor drains have been observed inside the building.

Building AS4151 has a single-zone heating and cooling system located in the office of the plant. The bathroom also has a window heating and cooling unit. The building has four single doors, four rollup doors, and two windows. The back door is routinely left open. Three exhaust fans are also present on the building. One of the doors does not close well and has to be slammed shut. One of the windows is also cracked.

Some of the potential indoor sources of VOCs observed during the Phase II building survey included natural gas, Citrasol, Simple Green, all-purpose cleaner, Windex, and sulfide.

There are typically less than five workers occupying this building during work 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 AS4151 which 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 V4-5. Phase I co-located groundwater and soil gas sample locations are shown in Figure V4-1, and the Phase I groundwater and soil gas sample results are provided in Tables V4-3, and V4-5. Results for VOCs with GWSL and/or SGSL exceedances are provided in Table V4-15.

TABLE V4-15
Summary of Building AS4151 Investigation Results
MCAS, New River, MCB Camp Lejeune, North Carolina

Building AS4151 Historical (2002–2007) Site-Specific Groundwater Screening Level Exceedances

Well ID	Screen Depth (ft bgs)	Benzene (µg/L)
GWSL		*8.7*
USTAS4151-MW07	3.8–13.8	29.8
USTAS4151-MW08	2–12	52.7

Building AS4151 Generic Groundwater Screening Level Exceedances

Sample ID	Benzene (µg/L)
GWSL (based on industrial air RSL)	*7.05*
USTAS4151-IS04-GW-12-13-08B	-

Building AS4151 Shallow Soil Gas Screening Level Exceedances

Sample ID	Benzene (ppbv)
GWSL (based on industrial air RSL;AF=1E-01)	*5.01*
Base-Specific SGSL (AF=1E-03)	*501*
USTAS4151-IS04-SV-05-06 -08B	-

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

Refined CSM. Historical (2002–2007) benzene concentrations in nearby monitoring wells (2 to 13.8 ft bgs screen depths) exceeded the site-specific GWSLs by approximately three to six times. The shallow historical monitoring wells near Building AS4151 are located at the northeast corner of the building so they are down- and cross-gradient of the building. These historical groundwater-monitoring well GWSLs exceedances triggered the Phase I sampling.

Co-located grab groundwater and soil gas samples were collected from one location on the northeast side of Building AS4151 during Phase I. There were no VOCs detected above the generic GWSLs or SGSLs in the groundwater or soil gas sample. Subslab sampling was not proposed for Phase II because there were no GWSL or SGSL exceedances in the Phase I samples.

Conclusions. There were no constituents detected in groundwater above the generic GWSLs at Building AS4151. Therefore, significant vapor intrusion impacts are not currently expected and no further actions are proposed at Building AS4151.

SECTION 5

Overall Conclusions and Recommendations

The purpose of this section is to summarize the overall conclusions of the vapor intrusion evaluation for MCAS, New River 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 seven buildings of interest in order to evaluate the potential for significant vapor intrusion impacts. Consistent with the Department of Defense (DOD) Tri-Services (2009) and Interstate Technology & Regulatory Council (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 seven 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 MCAS, New River during Phase I and II are summarized in Table V4-16.

TABLE V4-16
Summary of Recommendations
MCAS, New River, MCB Camp Lejeune, North Carolina

Bldg #	Additional Round of Subslab Sampling	Monitor VOCs in Groundwater	Install and Sample Subslab Probes
AS502	X	X	
AS510		No Further Action	
AS515		No Further Action	
AS541	X	X	
AS4106			X
AS143		No Further Action	
AS4151		No Further Action	

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 MCAS, New River buildings investigated during Phase I or II. However, 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 two of the buildings in MCAS, New River that were sampled once during Phase I or Phase II.

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 above generic vapor intrusion screening levels. However, soil gas concentrations (either exterior or subslab) were not detected above the base-specific SGSLs at any of the buildings investigated in MCAS, New River. Groundwater monitoring is recommended for two buildings (AS502 and AS541) in order to address the potential for future vapor intrusion concerns. In addition, a subslab sample is recommended in the office area of Building AS4106 to confirm subslab soil gas concentrations are below SGSLs.

In general it is considered to be more conservative to collect indoor air samples during the heating season because a building's windows and doors are more likely to be kept shut and the operation of the heating system may create a negative pressure differential between the indoor air and the subslab soil gas. The Phase I and II sampling events were performed in the summer and fall, respectively. If feasible, sampling during the winter should be considered for the Phase III sampling event.

If recommendations were not made for moving or adding sampling locations then it is assumed that the location and number of sampling locations from Phase I and II were sufficient for that building. However, the final decision on whether sufficient data have been collected for each building should be considered by the partnering team.

Underground utilities can serve as conduits for vapor migration in the subsurface. However, preferential vapor migration in utility corridors at MCAS, New River is not considered significant since there were no areas with significant (e.g., above base-specific SGSLs) exterior soil gas and/or subslab impacts. Therefore, there are no additional buildings recommended for further vapor intrusion evaluations based on the potential for preferential vapor migration in utility corridors.

SECTION 6

References

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

CH2M HILL. 2008b. Field Sampling Plan.

DOD. 2009. Tri-Services

ITRC. 2007.

DeVaull et al. 1997.

Tables

TABLE V4-3
Summary of MCAS, New River Phase I Groundwater Analytical Results
Vapor Intrusion Report
MCAS, New River, MCB Camp Lejeune, North Carolina

Station ID	**Industrial Generic GW SL (AF=0.1)**	**Unrestricted Generic GW SL (AF=0.1)**	IR86-IS05	IR86-IS06	IR86-IS07	IR86-IS08	IR86-IS09		IR86-IS10	IR86-IS11
Sample ID			IR86-IS05-GW-07-09-08B	IR86-IS06-GW-09-11-08B	IR86-IS07-GW-09-11-08B	IR86-IS08-GW-11-13-08B	IR86-IS09D-GW-10-12-08B	IR86-IS09-GW-10-12-08B	IR86-IS10-GW-10-12-08B	IR86-IS11-GW-10-12-08B
Sample Date			06/22/08	06/22/08	06/21/08	06/21/08	06/21/08	06/21/08	06/21/08	06/21/08
Chemical Name										
Volatile Organic Compounds (UG/L)										
1,1,2-Trichloro-1,2,2-trifluoroethane(Freon-113)	6,610	1,580	11	0.35 J	5 U	1 U	1 U	1 U	1.4 J	5 U
1,1-Dichloroethane	33.5	6.53	0.97 J	1 U	5 U	1 U	0.044 J	0.046 J	3.8 J	5 U
1,1-Dichloroethene	824	197	0.1 J	1 U	5 U	0.061 J	1 U	1 U	16	5 U
Acetone	88,200,000	20,200,000	10 U	10 U	50 U	10 U	10 U	10 U	50 U	50 U
Benzene	7.05	1.37	**29**	1 U	**29**	0.051 J	0.26 J	0.27 J	**1.7 J**	5 U
Carbon disulfide	5,300	1,200	2.5 J	1 UJ	5 U	55 J	2.6 J	0.37 J	1.1 J	5 UJ
Chloroethane	122,000	27,700	2 U	2 U	10 U	2 U	2 U	2 U	10 U	10 U
Cyclohexane	3,890	943	1 U	1 U	5 U	1 U	1 U	1 U	0.6 J	5 U
Ethylbenzene	15.2	3.01	**9.5**	1 U	**14**	1 U	1 U	1 U	5 U	5 U
Isopropylbenzene	37.9	8.85	1.2	1 U	1.3 J	1 U	0.23 J	0.24 J	5 U	5 U
Methyl acetate	--	--	1 U	1 U	4.5 J	1 U	1 U	1 U	5 U	5.1 U
Methyl-tert-butyl ether (MTBE)	1,840	368	1 U	1 U	5 U	0.4 J	1 U	1 U	5 U	5 U
Methylcyclohexane	3,084	735	0.14 J	1 U	5 U	1 U	0.18 J	0.23 J	0.72 J	5 U
Tetrachloroethene	2.79	0.545	1 U	0.11 J	5 U	1 U	1 U	1 U	5 U	5 U
Toluene	81,000	19,100	7.7	1 U	5 U	1 U	1 U	1 U	5 U	5 U
Trichloroethene	14.5	2.85	0.17 J	1 U	5 U	1.4	0.12 J	0.12 J	**300**	5 U
Vinyl chloride	2.54	0.145	1 U	1 U	5 U	1 U	1 U	1 U	**1.1 J**	5 U
cis-1,2-Dichloroethene	--	--	0.7 J	0.059 J	0.58 J	2.5	0.21 J	0.25 J	140	0.19 J
m- and p-Xylene	1,400	319	12	1 U	7.8 U	1 U	1 U	1 U	5 U	5 U
o-Xylene	14,600	3,440	8.3	1 U	3.1 J	1 U	1 U	1 U	5 U	5 U
trans-1,2-Dichloroethene	678	164	1 U	1 U	5 U	1 U	1 U	1 U	5.7	5 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
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 V4-3
Summary of MCAS, New River Phase I Groundwater Analytical Results
Vapor Intrusion Report
MCAS, New River, MCB Camp Lejeune, North Carolina

Station ID	**Industrial Generic GW SL (AF=0.1)**	**Unrestricted Generic GW SL (AF=0.1)**	IR86-IS12	IR86-IS13	IR86-IS14	SWMU336-IS01	SWMU336-IS02	USTAS4151-IS04	USTCSFF-IS03
Sample ID			IR86-IS12-GW-13-14-08B	IR86-IS13-GW-08-09-08B	IR86-IS14-GW-14-15-08B	SWMU336-IS01-GW-14-16-08B	SWMU336-IS02-GW-12-14-08B	USTAS4151-IS04-GW-12-13-08B	USTCSFF-IS03-GW-08-09-08B
Sample Date			06/23/08	06/23/08	06/23/08	06/22/08	06/21/08	06/22/08	06/22/08
Chemical Name									
Volatile Organic Compounds (UG/L)									
1,1,2-Trichloro-1,2,2-trifluoroethane(Freon-113)	6,610	1,580	1 U	1 U	1 U	0.098 J	1 U	5 U	1 U
1,1-Dichloroethane	33.5	6.53	1 U	1 U	1 U	0.12 J	1 U	5 U	1 U
1,1-Dichloroethene	824	197	1 U	1 U	1 U	0.04 J	1 U	5 U	1 U
Acetone	88,200,000	20,200,000	1.6 J	1.4 J	1.4 J	10 U	10 U	50 U	2.5 J
Benzene	7.05	1.37	1 U	1 U	1 U	1 U	1 U	5 U	0.03 J
Carbon disulfide	5,300	1,200	0.18 J	1 U	0.55 J	0.26 J	0.14 J	5 U	1.1
Chloroethane	122,000	27,700	2 U	2 U	2 U	2 U	0.57 J	10 U	2 U
Cyclohexane	3,890	943	1 U	1 U	1 U	1 U	1 U	5 U	1 U
Ethylbenzene	15.2	3.01	1 U	1 U	0.05 J	1 U	1 U	5 U	1 U
Isopropylbenzene	37.9	8.85	1 U	1 U	0.04 J	1 U	1 U	3.1 J	0.18 J
Methyl acetate	--	--	1 U	1 U	1 U	1 U	1 U	5 U	1 U
Methyl-tert-butyl ether (MTBE)	1,840	368	1 UJ	1 U	1 U	1 U	1 U	5 UJ	9.3 J
Methylcyclohexane	3,084	735	1 U	1 U	1 U	1 U	1 U	0.21 J	0.25 J
Tetrachloroethene	2.79	0.545	1 U	1 U	1 U	**3.4**	1 U	5 U	1 U
Toluene	81,000	19,100	0.091 J	0.057 J	0.1 J	0.054 J	1 U	0.32 J	1 U
Trichloroethene	14.5	2.85	1 U	1 U	0.21 J	0.079 J	0.11 J	5 U	1 U
Vinyl chloride	2.54	0.145	1 U	1 U	1 U	1 U	1 U	5 U	1 U
cis-1,2-Dichloroethene	--	--	1 U	1 U	0.068 J	1 U	0.11 J	5 U	1 U
m- and p-Xylene	1,400	319	1 U	1 U	0.059 J	1 U	1 U	5 U	0.12 J
o-Xylene	14,600	3,440	1 U	1 U	0.058 J	1 U	1 U	5 U	1 U
trans-1,2-Dichloroethene	678	164	1 U	1 U	1 U	1 U	1 U	5 U	1 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
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 V4-4
Summary of MCAS, New River Phase I Shallow Soil Vapor Analytical Results
Vapor Intrusion Report
MCAS, New River, MCB Camp Lejeune, North Carolina

Station ID	**Industrial Shallow**	**Unrestricted Shallow**	IR86-IS12	IR86-IS13	USTAS4151-IS04
Sample ID	**Generic SVSL**	**Generic SVSL**	IR86-IS12-SV-05-06-08B	IR86-IS13-SV-05-06-08B	USTAS4151-IS04-SV-5-6-08B
Sample Date	**(AF=0.1) (ppbv)**	**(AF=0.1) (ppbv)**	06/23/08	06/23/08	06/22/08
Chemical Name					
Volatile Organic Compounds (ppbv)					
1,1,1-Trichloroethane	40,300	9,530	2 U	2 U	2 U
1,1,2-Trichloro-1,2,2-trifluoroethane(Freon-113)	170,000	40,400	2 U	2 U	2 U
1,1-Dichloroethane	19	3.71	2 U	2 U	2 U
1,1-Dichloroethene	2,220	530	2 U	2 U	2 U
2-Butanone	74,600	17,600	10 U	14	5.5 J
2-Hexanone	31,700	7,570	5 U	0.95 J	5 U
4-Methyl-2-pentanone	31,700	7,560	5 U	3.1 J	5 U
Acetone	589,000	135,000	22 J	94	38 J
Benzene	5.01	0.97	2 U	**2.5**	2 U
Carbon disulfide	9,950	2,340	0.84 J	3.4 J	0.54 J
Chloromethane	32.9	6.78	1.7 J	2 J	5 U
Cyclohexane	75,500	18,300	5 U	3.7 J	5 U
Ethylbenzene	11.3	2.23	2 U	**2.4**	0.91 J
Isopropylbenzene	3,660	854	4 U	1.5 J	1.8 J
Methylene chloride	74.8	15	11	5 U	5 U
Tetrachloroethene	3.1	0.605	**1.4 J**	**2**	**1.7 J**
Toluene	58,400	13,800	0.85 J	2.2	0.59 J
Trichlorofluoromethane(Freon-11)	5,520	1,300	0.97 J	0.41 J	0.43 J
m- and p-Xylene	1,010	230	1.6 J	4.9	3.3

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
SVSL - Soil Vapor Screening Level
Shading indicates exceedance of Industrial Generic criteria
Bold text indicates exceedance of Unrestricted Generic criteria

TABLE V4-5
Summary of MCAS, New River Phase I Deep Soil Vapor Analytical Results
Vapor Intrusion Report
MCAS, New River, MCB Camp Lejeune, North Carolina

Station ID	**Industrial Deep Generic SVSL (AF=0.1) (ppbv)**	**Unrestricted Deep Generic SVSL (AF=0.1) (ppbv)**	IR86-IS01	IR86-IS02
Sample ID			IR86-IS01-SV-8-9-08B	IR86-IS02-SV-06-07-08B
Sample Date			06/22/08	06/22/08
Chemical Name				
Volatile Organic Compounds (ppbv)				
1,1,1-Trichloroethane	403,000	95,300	0.34 J	2 U
1,1,2-Trichloro-1,2,2-trifluoroethane(Freon-113)	1,700,000	404,000	0.84 J	0.65 J
1,1-Dichloroethane	190	37.1	0.55 J	2 U
1,1-Dichloroethene	22,200	5,300	0.88 J	2 U
2-Butanone	746,000	176,000	19	31
2-Hexanone	317,000	75,700	22	2.7 J
4-Methyl-2-pentanone	317,000	75,600	3.7 J	2.1 J
Acetone	5,890,000	1,350,000	130	160
Benzene	50.1	9.7	1.1 J	4.4
Carbon disulfide	99,500	23,400	12	2.1 J
Chloroform	10.9	2.25	2 U	0.88 J
Chloromethane	329	67.8	2.3 J	5 U
Cyclohexane	755,000	183,000	5 U	0.92 J
Ethylbenzene	113	22.3	9.8	2.4
Isopropylbenzene	36,600	8,540	3.1 J	4 U
Methylene chloride	748	150	6.2	9
Styrene	103,000	23,500	2 U	1.3 J
Tetrachloroethene	31	6.05	**120**	**23**
Toluene	584,000	138,000	30	9.8
Trichloroethene	114	22.3	22	0.45 J
Trichlorofluoromethane(Freon-11)	55,200	13,000	0.51 J	0.81 J
Vinyl chloride	110	6.26	1.1 J	2 U
cis-1,2-Dichloroethene	--	--	4.4	2 U
m- and p-Xylene	10,100	2,600	45	7
o-Xylene	71,400	16,800	16	2.3

Notes:

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

NA - Not analyzed

SVSL - Soil Vapor Screening Level

U - The material was analyzed for, but not detected

Shading indicates exceedance of Industrial Generic criteria

Bold text indicates exceedance of Unrestricted Generic criteria

TABLE V4-6
Summary of MCAS, New River Phase II Subslab Soil Gas Analytical Results
Vapor Intrusion Report
MCAS, New River, MCB Camp Lejeune, North Carolina

Station ID	**Industrial Shallow Generic SGSL (AF=0.1) (ppbv)**	**Industrial Shallow Base Specific SGSL (AF=0.001) (ppbv)**	**Residential Shallow Generic SGSL (AF=0.1) (ppbv)**	**Residential Shallow Base-Specific SGSL (AF=0.001) (ppbv)**	IR86-SG01		IR86-SG02	IR86-SG03
Sample ID					IR86-SG01-08C	IR86-SG01D-08C	IR86-SG02-08C	IR86-SG03-08C
Sample Date					10/04/08	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	3.1 J	10 U	10 U	3.2 J
Acetone	589,000	58,900,000	135,000	13,500,000	33 J	24 J	50 U	31 J
Dichlorodifluoromethane (Freon-12)	1,780	178,000	425	42,500	2 U	2 U	1 J	0.72 J
Methylene chloride	74.8	7480	15	1500	5 U	5 U	11	18 U
Tetrachloroethene	3.1	310	0.605	60.5	2 U	2 U	**3**	2 U
Toluene	58,400	5,840,000	13,800	1,380,000	2 U	2 U	0.84 J	0.68 J
Trichlorofluoromethane(Freon-11)	5,520	552,000	1,300	130,000	0.34 J	0.26 J	3.3	3

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

UJ - Analyte not detected, quantitation limit may be inaccurate

SGSL - Soil Gas Screening Level

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_V4_1_Rd2_AirStation_Site86_USTCSFF_Phase_1.mxd

Legend

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

IR86-IS10-GW-10-12-08B
- Sample with one or more exceeding constituents

N

0 250 500 1,000 Feet

Figure V4-1
Site 86/USTCSFF 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_V4_2_Rd2_AirStation_SWMU366_Phase_1.mxd

Legend

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

IR86-IS01-SV-8-9-08B
- Sample with one or more exceeding constituents

N

0 250 500 1,000 Feet

Figure V4-2
SWMU 336 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_V4_3_Rd2_AirStation_Site86_USTCSFF_Phase2.mxd

Legend

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

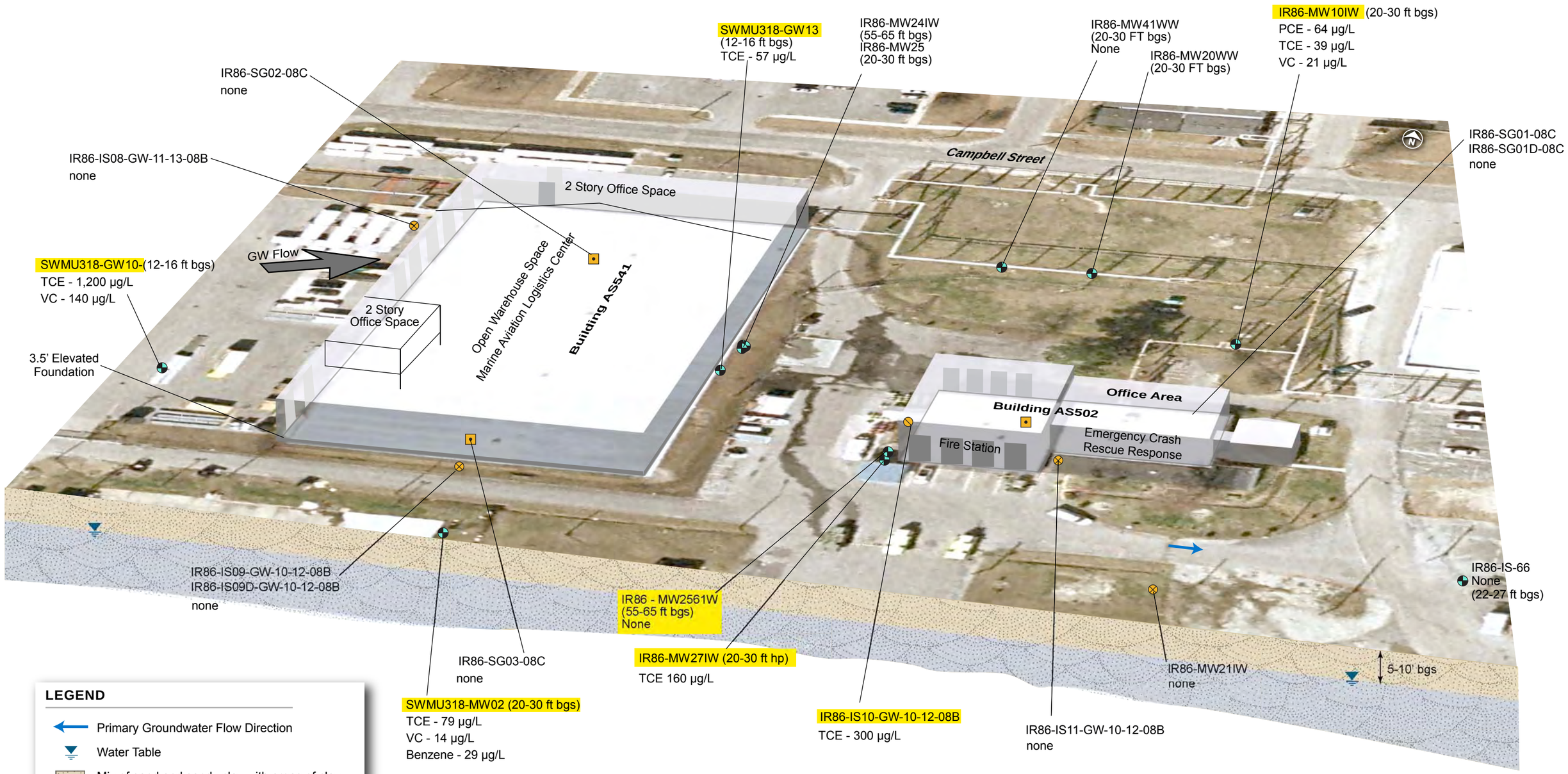
HPFF-IA21-08C - Sample with one or more exceeding constituents AF = 0.1

N

0 250 500 Feet

Figure V4-3
Site 86/USTCSFF 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
- Groundwater Sample Location
- Soil Gas Sample Location
- Shallow Monitoring Well (Sampled between 2002 and 2007)
- Sample with one or more exceeding constituents
- Sample with one or more exceeding constituents of Base-specific SGSLs

Screening Levels

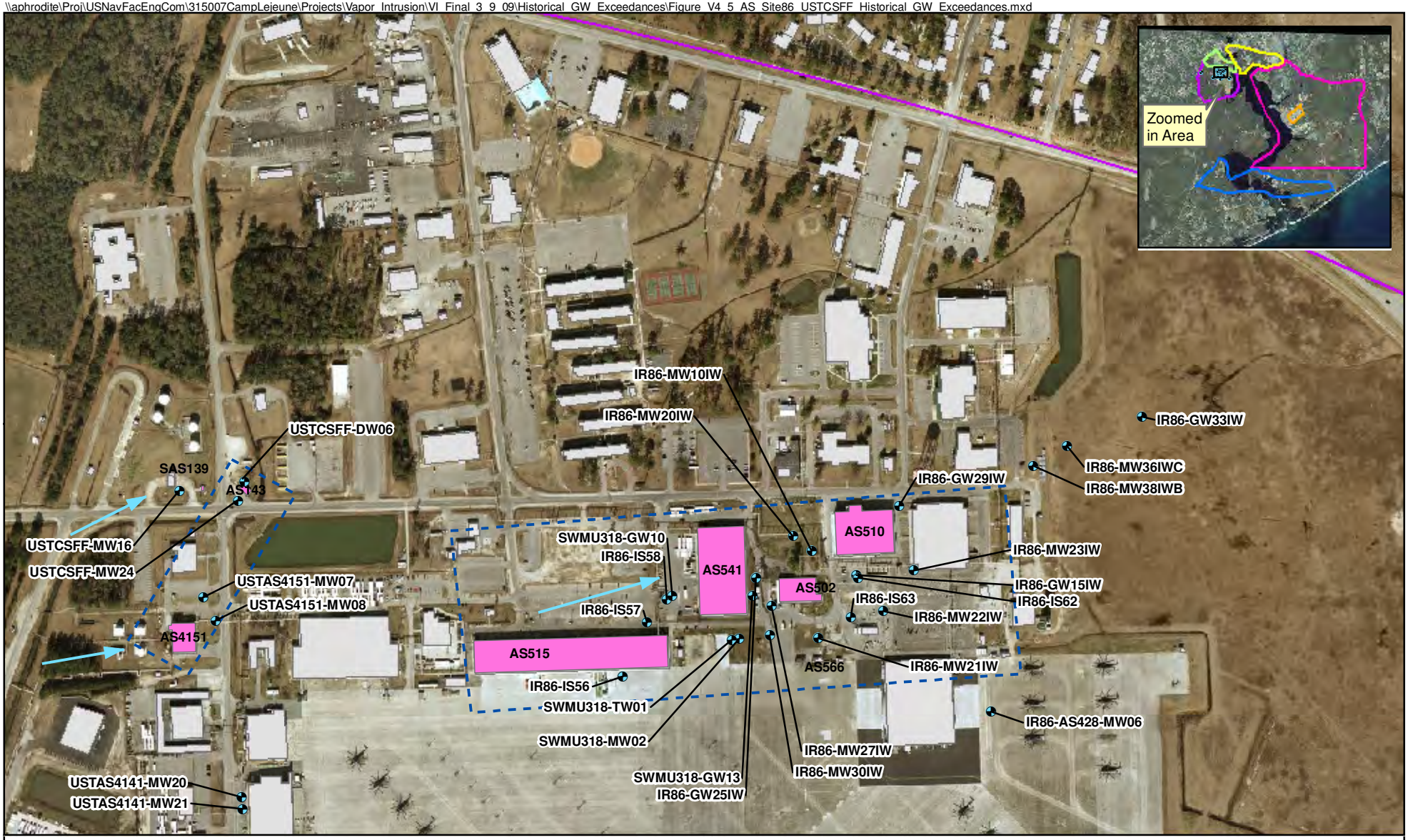
Site-Specific GWSLs (µg/L)	Generic GWSLs (µg/L)
VC - 2.53	VC - 2.54
TCE - 35.5	TCE - 14.5
PCE - 7.19	PCE - 2.79
Benzene - 9.96	Benzene - 7.05

FIGURE V4-4
MCAS, New River Buildings AS541 and AS502
Vapor Intrusion Conceptual Site Model
Camp Lejeune, North Carolina

AGVIO CH2M HILL

ES122008036MKE V4-4CL_AS_BldgAS541-AS502_VaporIntrusionCSM_v15.ai 5-5-09 jls/mjl

\\aphrodite\Proj\USNavFacEngCom\315007CampLejeune\Projects\Vapor_Intrusion\VI_Final_3_9_09\Historical_GW_Exceedances\Figure_V4_5_AS_Site86_USTCSFF_Historical_GW_Exceedances.mxd



Legend

- Monitoring Well with exceedances
- Shallow Groundwater Flow
- Buildings within100ft of Monitoring Wells
- Buildings Grouped for Sampling Analysis
- MCAS, New River
- Camp Geiger
- Courthouse Bay
- Hadnot Point
- Mainside
- Tarawa Terrace

N

0 250 500 1,000 Feet

Figure V4-5
Site 86/USTCSFF 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_V4_6_AS_SWMU336_Historical_GW_Exceedances.mxd

Legend

- Monitoring Well with exceedances
- Shallow Groundwater Flow
- Buildings within100ft of Monitoring Wells
- MCAS, New River
- Camp Geiger
- Courthouse Bay
- Hadnot Point
- Mainside
- Tarawa Terrace

N

0 250 500 1,000 Feet

Figure V4-6
SWMU 336 Historical Groundwater Exceedances
Vapor Intrusion Report
MCB Camp Lejeune
North Carolina

AGVIQ CH2M HILL

Appendix V4-A
Field Data Sheets

CH2MHILL

PROJECT NUMBER	BORING NUMBER	
TO 21	UST CSFF-IS03	SHEET 1 OF 1

SOIL BORING LOG

PROJECT: TO 21 LOCATION: UST CSFF, MCAS New River

ELEVATION: DRILLING CONTRACTOR: Zebra

DRILLING METHOD AND EQUIPMENT USED: Geoprobe

WATER LEVELS: START: 1345 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
					0-6" - organic material	
					6"-4' - medium to fine sand	
5					10YR 6/1 - gray	
					4'-5' - wet sandy clay odor	0.6 ppm
					5'-7' - same as above transition to sand	
10					7'-9' - saturated medium to course sand	1.7 ppm
15						
20						
25						

SBOR25FT.XLS

AGVIQ
CH2M HILL

GROUNDWATER SAMPLING DATA SHEET

Client: NAVFAC
Location: UST CSEF
Event: TO21
Date: 6/22/08
Weather: Overcast 80°

Project Number: TO21
Well ID: UST CSEF-TS03
Sample ID: UST CSEF-TS03-GW-8-9'-0808
Sampling Team: K. Riggs
J. Chalk

Total Depth: 9 FT.(BTOC)
Depth to water: (-) 8 FT.(BTOC)
Water Column: 1 FT.
(x) .163 GAL/FT.
Well Volume: .163 GAL.
Total Purge Vol.: GAL.

Purge Device: Peristaltic Pump

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

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 Time: 1929	Temp. °C	Cond. mS/cm	DO mg/L	pH SU	ORP mV	Turbidity NTU	Other: ____	Color / Odor / Comments
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
1909		23.00	.570	3.76	6.62	-92	999		
1914		22.33	.577	2.56	6.87	-118	999		
1929		22.59	.579	2.35	6.89	-125	990		

Sample Information: method, container number, size, and type, preservative used.

Analysis	Preservative	Container requirements	No. of containers
VOC	HCL	3 40ml VOA	5

Observations/Notes: cocy water

MS/MSD
Duplicate ID No.:
Signature(s):

CH2MHILL

PROJECT NUMBER	BORING NUMBER	
TO21	US7 4151 - IS04	SHEET 1 OF 1

SOIL BORING LOG

PROJECT : TO 21 LOCATION : Site US7 4151 - MCAS New River

ELEVATION : DRILLING CONTRACTOR : Zebra

DRILLING METHOD AND EQUIPMENT USED : Geoprobe

WATER LEVELS : START : 1430 END : LOGGER : K. Riggs

DEPTH BELOW SURFACE (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.	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION. OVM (ppm): Breathing Zone Above Hole
					0-6" - organic material	
					6"-3.5' - medium grained sand	
					2.5Y 7/4 pale yellow	
5					3.5'-5' - sandy clay very moist	
					2.5Y 4/1 dark grey	0.0 ppm
10					5'-9' - same as above	
					9'-13' - clay - sandy 15% - very saturated	
15						
20						
25						

SBOR25FT.XLS

AGVIQ
CH2M HILL

GROUNDWATER SAMPLING DATA SHEET

Client: NAVFAC
Location: MCAS New River
Event: TO 21
Date: 6/22/08
Weather: Cloudy ~ 80°

Project Number: TO 21
Well ID: UST AS4151-TS04
Sample ID: UST AS4151-TS04-GW-12-13-088
Sampling Team: K. Briggs
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.: 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 Time: 1510 Method: Low flow	Temp. °C	Cond. mS/cm	DO mg/L	pH SU	ORP mV	Turbidity NTU	Other: ____	Color / Odor / Comments

FIELD PARAMETERS

Time	Purge Vol. (gals)	Temp. °C	Cond. mS/cm	DO mg/L	pH SU	ORP mV	Turbidity NTU	Other: ____	Color / Odor / Comments
1500		24.89	.313	4.44	5.99	22	999		
1505		25.02	.346	4.09	5.95	21	999		
1510		24.76	.335	4.32	5.91	8	999		

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

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

Observations/Notes: Water is grey
no odor

MS/MSD | Duplicate ID No.:

Signature(s):

CH2MHILL

Figure 2-3

Soil Gas Sampling · Field Data Sheet

Soil Gas Point Installation

Time Installed	1527
Screen Depth	4'
Screen Volume	1 L
Helium Leak Check Result	75 ppm

Soil Gas Sample Point Purging

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

Multi Rae Readings

Total VOCs (ppm)	0.0
O2 (%)	20.9
H2S (ppm)	0
CO (ppm)	11
LEL (%)	0

Soil Gas Sample Collection

Sample ID	~~BR~~ UST A59151-I-504-SV-5-4-080
Sample Location	UST A59151, MCAS New River
Canister ID	L-5177
Critical Orifice or Flow Controller ID	08
Pressure Gauge ID	NA
Initital Pressure (in. Hg)	-30
Sample Date	4/22/08
Start Time	1548
End Time	1554
Final Pressure (in. Hg)	-2
Elapsed Time	4 min

Observations: _____

CH2MHILL

PROJECT NUMBER	BORING NUMBER	
364122	IR86-IS05	SHEET 1 OF 1

SOIL BORING LOG

PROJECT: Vapor Intrusion LOCATION: MCAS New River / IR 86
ELEVATION: DRILLING CONTRACTOR: EnviroTek
DRILLING METHOD AND EQUIPMENT USED: DPT / 7730 DT
WATER LEVELS: START: 6/22/08 ; 915 END: LOGGER: B. Sprouse

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
					Concrete (12")	0.0
					Brown sand	
					lt. gray clay	
					lt. gray sand, vfg, wet	
5						
	5-10	3.5/5			6.5-7.5 SM/SC ~~clay~~ sand w/ trace ~~clay~~ silt, lt. brown wet, vfg	0.0
10					7.5-10 SP sand, lt. gray fg, ws, saturated	
					Terminate at 10'	
15						
20						
25						

SBOR25FT.XLS

Attachment 4

PROJECT NUMBER	PROJECT NAME
364172	Vapor Intrusion

CH2MHILL

WELL PURGE AND SAMPLING FIELD SHEET

SITE: MCAS New River / IR86 — DATE: 6/22/08

FIELD CREW: BS / PB — WELL NUMBER: IR86-IS05

WEATHER: Sunny, low 80's

PURGE VOLUME CALCULATION:

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

METHOD OF PURGING (circle one)

PUMP: SUB., CENT., PERIST.

TIME ON: 938

FLOW RATE (gpm):

PUMP TIME (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	942		5.02	27.0	0.254	371	1.29 ; -25
2	945		4.89	26.8	0.260	103	0.50; -104
3	949		4.91	26.7	0.262	33.9	0.38 ; -133
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
IR86-IS05-GW-7-9-033	3 40mL VOAs	VOC	TA	

SIGNED/SAMPLER: _____

CH2MHILL

PROJECT NUMBER	BORING NUMBER	
364172	IR86-ISO6	SHEET 1 OF 1

SOIL BORING LOG

PROJECT: VI - JVII TO-21 LOCATION: MCAS New River / IR86

ELEVATION: DRILLING CONTRACTOR: EnviroTek

DRILLING METHOD AND EQUIPMENT USED: DPT / 7730 DT

WATER LEVELS: START: ~~6/21/08 1644~~ 6/22/08 END: LOGGER: B. Sprouse

DEPTH BELOW SURFACE (FT)	INTERVAL (FT)	RECOVERY (IN FT)	#/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
	HA				Asphalt Dk gray sandy clay Tan sand Lt gray sandy clay (2')	0.0
5	5 - 10	4/5			6-6.5 SC sandy clay, lt. gray dense, fg 6.5-9.5 SC clayey sand, y-o/lt. gray, wet, fg 9-10.5 SP sand, lt, gray, mg, ws, wet	
10					Terminate at 10	
15						
20						
25						

SBOR25FT.XLS

Attachment 4

	PROJECT NUMBER	PROJECT NAME
CH2MHILL	364172	VI (JVII 70-21)

WELL PURGE AND SAMPLING FIELD SHEET

SITE: MCAS New Riser / IR86 — DATE: 6/22/08

FIELD CREW: BS/PB — WELL NUMBER: IR86-IS06

WEATHER: Sunny, 70's

PURGE VOLUME CALCULATION:

			CASING DIAMETER	GAL/FT OF CASING
WELL DEPTH (FT):		11		
DEPTH TO WATER (FT):	-		2 IN.	0.1632
WATER COLUMN (FT):	=	0	4 IN.	0.6528
GAL/FT OF CASING (from table at right):	x	0.1632	6 IN.	1.4688
CASING VOLUME (GALs):	=	0	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: 802
FLOW RATE (gpm):
PUMP TIME (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	0810		5.09	25.5	0.343	95.4	0.70; 113
2	0812		5.87	25.4	0.341	38.1	0.31; 113
3	0814		5.86	25.3	0.343	49.0	0.25; 109
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
IR86-IS06-GW-9-11-08B	3, 40 mL VOA	VOC	Test America	

SIGNED/SAMPLER: P. Brown

CH2MHILL

PROJECT NUMBER	BORING NUMBER	
364122	IR86-IS07	SHEET 1 OF 1

SOIL BORING LOG

PROJECT: Vapor Intrusion LOCATION: MCAS New River IR86

ELEVATION: DRILLING CONTRACTOR: EnviroTek

DRILLING METHOD AND EQUIPMENT USED: DPT / 7730 DT

WATER LEVELS: START: 6/21/08; 1542 END: 1610 LOGGER: B. Sprouse

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
	HA				Asphalt Brown sand, fg, dry Lt. gray clay, moist	0.0
5					Lt. gray sandy clay, wet	
	5-10	3/5			7-8 same as above 8-9 SC clayey sand, tan fg wet	0.0
10					9-10 SP Sand, lt. gray, fg, wos, wet	
					Terminated at 10'	
15						
20						
25						

Attachment 4

PROJECT NUMBER	PROJECT NAME
364172	Vapor Intrusion

CH2MHILL

WELL PURGE AND SAMPLING FIELD SHEET

SITE: MCAS New River / IR84
DATE: 6/21/08
FIELD CREW: BS / PB
WELL NUMBER: IR86-IS07
WEATHER: cloudy, 20's

PURGE VOLUME CALCULATION:

		CASING DIAMETER	GAL/FT OF CASING
WELL DEPTH (FT):	11		
DEPTH TO WATER (FT):	-	2 IN.	0.1632
WATER COLUMN (FT):	= 0	4 IN.	0.6528
GAL/FT OF CASING (from table at right):	x 0.1632	6 IN.	1.4688
CASING VOLUME (GALs):	= 0	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: 1613
FLOW RATE (gpm):
PUMP TIME (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	1620		5.20	25.2	0.161	277.0	0.66 ; -11
2	1622		5.23	25.2	0.158	152.0	0.43 ; -58
3	1625		5.18	25.2	0.158	88.2	0.43 ; -79
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
IR86-IS06-GW-11-13-0813	3, 40mL VOA	VOC	Test America	

SIGNED/SAMPLER: _____

CH2MHILL

PROJECT NUMBER	BORING NUMBER	
364172	IR86-IS08	SHEET 1 OF 1

SOIL BORING LOG

PROJECT: VI - JVII 10-21 LOCATION: MCAS New River / IR 86
ELEVATION: DRILLING CONTRACTOR: EnviroTech
DRILLING METHOD AND EQUIPMENT USED: DPT / 7730
WATER LEVELS: START: 6/21/05 / 855 END: LOGGER: B. Sprouse

DEPTH BELOW SURFACE (FT)	INTERVAL (FT)	RECOVERY (%)	#/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
	HA				Asphalt Tan sand lt. gray sandy clay, wet	
5						
	5 - 10	5/5			CH (5-10) clay, lt. gray, soft, high plasticity, moist	
10						
	10 - 15	4.5/5			10.5-11 SC sandy clay, lt. gray, moist 11-15 SC sand, lt. gray fg, ws, wet/saturated	
15						
					Terminate at 15'	
20						
25						

SBOR25FT.XLS

Attachment 4

	PROJECT NUMBER	PROJECT NAME
CH2MHILL	364172	VI (OU II TO21)

WELL PURGE AND SAMPLING FIELD SHEET

SITE: IR 86 / MCAS New River
FIELD CREW: B. Sprouse / D. Brown
WEATHER: light rain
DATE: 6/21/08
WELL NUMBER: IR 86-IS08

PURGE VOLUME CALCULATION:

			CASING DIAMETER	GAL/FT OF CASING
WELL DEPTH (FT):		13		
DEPTH TO WATER (FT):	-		2 IN.	0.1632
WATER COLUMN (FT):	=	0	4 IN.	0.6528
GAL/FT OF CASING (from table at right):	x	0.1632	6 IN.	1.4688
CASING VOLUME (GALs):	=	0	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: 1135
FLOW RATE (gpm):
PUMP TIME (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	1139		5.29	24.6	0.429	502	0.29 / -181
2	1147		4.76	24.6	0.387	70.4	4.10 / -137
3	1150		4.71	24.5	0.379	18.7	0.35 / -172
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
IR86-IS08-GW-11-13-080	3 40mL VOAs	VOC	Test America	

SIGNED/SAMPLER: _____

CH2MHILL

PROJECT NUMBER	BORING NUMBER	
364172	IR86-IS09	SHEET 1 OF 1

SOIL BORING LOG

PROJECT: VI (OU II TO-21) LOCATION: MCAS New River IR86

ELEVATION: DRILLING CONTRACTOR: Enviro Tek

DRILLING METHOD AND EQUIPMENT USED:

WATER LEVELS: START: 6/21/08 1210 END: 1229/ 6/21 LOGGER: B. Sprouse

DEPTH BELOW SURFACE (FT)	INTERVAL (FT)	RECOVERY (IN)	#/TYPE	STANDARD PENETRATION TEST RESULTS 6"-6"-6"-8" (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
	HA				Grass	0.0
					Tan sand	(O2 20.9)
					Gray clay	
5	5-10	5/5			5-8 CH Clay, orange/gray soft, high plasticity	
					8-9.8 SC Sandy clay, lt. gray, moist, soft grading to clayey sand, lt. gray, moist, soft	
10					9.8-10 SP sand, lt. gray fg, wet/saturated	
					Terminate at 10'	
15						
20						
25						

SBOR25FT.XLS

Attachment 4

PROJECT NUMBER	PROJECT NAME
364170	VI - JVI - T021

CH2MHILL

WELL PURGE AND SAMPLING FIELD SHEET

SITE: MCAS New River IR 86
DATE: 6/21/08
FIELD CREW: RS / PB
WELL NUMBER: IR86-I509
WEATHER: cloudy ; 70's

PURGE VOLUME CALCULATION:

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

METHOD OF PURGING (circle one)
PUMP: SUB., CENT., PERIST.
TIME ON: 1235
FLOW RATE (gpm):
PUMP TIME (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	1239		4.63	24.0	0.267	771	2.59; 57
2	1242		4.51	23.9	0.263	408	1.23; 4
3	1246		4.49	23.9	0.263	381	1.07; -45
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
IR86-I509-GW-10-12-08B		VOC	TA	
IR86-I509D-GW-10-12-08B		VOC	TA	Y

SIGNED/SAMPLER: _____

CH2MHILL

PROJECT NUMBER	BORING NUMBER	
364172	IR86-IS10	SHEET 1 OF 1

SOIL BORING LOG

PROJECT: VI (JVI) IT021 LOCATION: MCAS New River / IR86
ELEVATION: DRILLING CONTRACTOR: EnviroTek
DRILLING METHOD AND EQUIPMENT USED: DPT / 4730 DT
WATER LEVELS: START: 6/21/08 ; 1320 END: 1345 LOGGER: B. Sprouse

DEPTH BELOW SURFACE (FT)	INTERVAL (FT)	RECOVERY (FT)	#/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
	HA				Grass gray sand lt. gray clay, water	
5						
	5-10	2.5/5			7.5-9.5 CH, lt. gray clay soft, high plasticity, moist	
					9.5-10 SP sand lt. gray fg, ws, saturated	
10						
15						
20						
25						

SBOR25FT.XLS

Attachment 4

CH2MHILL	PROJECT NUMBER 364172	PROJECT NAME VI (JVII TO21)

WELL PURGE AND SAMPLING FIELD SHEET

SITE: MCAS New River / IR 86 — DATE: 6/21/08

FIELD CREW: BS / PB — WELL NUMBER: IR86-IS10

WEATHER: cloudy, 70's

PURGE VOLUME CALCULATION:

			CASING DIAMETER	GAL/FT OF CASING
WELL DEPTH (FT):		12		
DEPTH TO WATER (FT):	-		2 IN.	0.1632
WATER COLUMN (FT):	=	0	4 IN.	0.6528
GAL/FT OF CASING (from table at right):	x	0.1632	6 IN.	1.4688
CASING VOLUME (GALs):	=	0	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: 1350

FLOW RATE (gpm): N/M

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	1353		4.58	25.3	0.222	331	2.62; 69
2	1359		4.54	24.6	0.217	175	1.18; -16
3			4.52	24.7	0.216	123	1.12; -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
IR86-IS10-GW-10-12-08B	3 40mL VOAs	VOCs	TA	N

SIGNED/SAMPLER: _____

CH2MHILL

PROJECT NUMBER	BORING NUMBER	
364172	IR86-IS11	SHEET 1 OF 1

SOIL BORING LOG

PROJECT: VI
LOCATION: MCAS New River HR 86
ELEVATION:
DRILLING CONTRACTOR: Enviro Tek
DRILLING METHOD AND EQUIPMENT USED: DPT / 7730 DT
WATER LEVELS:
START: 1423; 6/21 END: 1440
LOGGER: B. Sorouse

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
	HA				Asphalt Dk gray & organic sandy clay lt. gray clay	
5					5-7.5 CH clay, lt. gray soft, high plasticity	
	5-10				7.5-9.5 SC sandy clay, lt. gray, moist, soft	
10					9.5-10 SP sand, lt. gray, fg, ws saturated	
15						
20						
25						

SBOR25FT.XLS

Attachment 4

PROJECT NUMBER	PROJECT NAME
T.O 21	Soil Vapor Intrusion

CH2MHILL

WELL PURGE AND SAMPLING FIELD SHEET

SITE: 06 | DATE: 6-21-08

FIELD CREW: P. Brown, B. Sprouse | WELL NUMBER: IR86-IS11

WEATHER: mostly Cloudy, 78°F

PURGE VOLUME CALCULATION:

		CASING DIAMETER	GAL/FT OF CASING
WELL DEPTH (FT):	12		
DEPTH TO WATER (FT):	- 10	2 IN.	0.1632
WATER COLUMN (FT):	= 0	4 IN.	0.6528
GAL/FT OF CASING (from table at right):	x 0.1632	6 IN.	1.4688
CASING VOLUME (GALs):	= 0	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: 1445

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	1451		4.61	24.9	0.198	288.0	1.62; 24
2	1455		4.50	24.7	0.196	353.0	1.03; -20
3	1502		4.52	24.6	0.144	164.0	1.03; -82
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
IR86-IS11-GW-10-12-08	3, 40 mL VOA	VOC	Test America	

SIGNED/SAMPLER: _____

CH2MHILL

PROJECT NUMBER	BORING NUMBER	
TO 21	86-IS13	SHEET 1 OF 1

SOIL BORING LOG

PROJECT: TO 21 - Soil Vapor Intrusion LOCATION: MCAS New River
ELEVATION: DRILLING CONTRACTOR: Envirotech
DRILLING METHOD AND EQUIPMENT USED: Geoprobe
WATER LEVELS: START: 0855 END: 0909 LOGGER: R Ricos

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' - Asphalt	0.0ppm
					1'-5' - Fine grained sand	
					2.5Y 7/4 - yellow	
5					5'-6' - Same as above	
					6'-7.5' - sandy clay 30% sand - moist	
10					7.5'-10' - silty sand - saturated	
					2.5Y 8/2 - pale yellow	0.0ppm
15						
20						
25						

SBOR25FT.XLS

CH2MHILL

PROJECT NUMBER	BORING NUMBER	
TO 21	86-IS12	SHEET 1 OF 1

SOIL BORING LOG

PROJECT: TO 21 LOCATION: MCAS New River
ELEVATION: DRILLING CONTRACTOR: EnviroTech
DRILLING METHOD AND EQUIPMENT USED: Geoprobe
WATER LEVELS: START: 0725 END: LOGGER: R. 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' - Asphalt	
					1'-1.5' - medium-coarse sand	
					2.5Y 3/4 yellow	
5					1.5'-3' - silty sand very fine	
					2.5Y 4/1 - dark grey	
					3'-5' - sandy clay 25% sand	
10					medium plasticity	0.0ppm
					5'-6' - same as above	
					6'-7' - silty sand - fine grained	
15					2.5Y 7/3 - pale yellow	
					7'-10' - saturated clay high plasticity 10% sand	
20					2.5Y 6/1 - gray	
					10'-13' - same as above	
					13'-14' - saturated sand - fine to medium grained	
25					2.5Y 5/3 - light olive brown	0.0ppm
					no odor	

AGVIQ
CH2M HILL

GROUNDWATER SAMPLING DATA SHEET

Client: NAVFAC
Location: site 86
Event: TO 21
Date: 6/22/08
Weather: cloudy 1 70°

Project Number: TO21
Well ID: IR86-IS12
Sample ID: IR86-IS12-GW-13-14-0805
Sampling Team: K. Kiely
J. Chalk

Total Depth: 17.4 FT.(BTOC)
Depth to water: (-) 13 FT.(BTOC)
Water Column: 4.1 FT.
(x) .163 GAL/FT.
Well Volume: .163 GAL.
Total Purge Vol.: GAL.

Measuring Device: Horiba U22
Date and Time: 6/22/08

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 Time: 0805 Method: low flow	Temp. °C	Cond. mS/cm	DO mg/L	pH SU	ORP mV	Turbidity NTU	Other: ____	Color / Odor / Comments

FIELD PARAMETERS

Time	Purge Vol. (gals)	Temp. °C	Cond. mS/cm	DO mg/L	pH SU	ORP mV	Turbidity NTU	Other: ____	Color / Odor / Comments
0755		22.51	.312	3.67	5.23	186	990		
0800		22.05	.310	2.18	4.97	192	988		no odor
0805		22.64	.314	1.83	4.95	188	755		

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

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

Observations/Notes: water - is grey
low Turbidity

MS/MSD
Duplicate ID No.:
Signature(s):

CH2MHILL

Figure 2-3

Soil Gas Sampling Field Data Sheet

Soil Gas Point Installation

Time Installed	0810
Screen Depth	6'
Screen Volume	1 L
Helium Leak Check Result	0

Soil Gas Sample Point Purging

Purge Date	6-23-08
Purge Time	15 min
Purge Rate	200
Purged Volume	3 L

Multi Rae Readings

Total VOCs (ppm)	0.0
O2 (%)	20.1
H2S (ppm)	0
CO (ppm)	3
LEL (%)	0

Soil Gas Sample Collection

Sample ID	IR86-IS12-SV-5-6-08B
Sample Location	IR86-IS12, MCAS New River
Canister ID	5031 D
Critical Orifice or Flow Controller ID	98
Pressure Gauge ID	~~AF~~ NA
Initital Pressure (in. Hg)	-30
Sample Date	6/23/08
Start Time	0837
End Time	0842
Final Pressure (in. Hg)	-3
Elapsed Time	5 min

Observations:

AGVIQ
CH2M HILL

GROUNDWATER SAMPLING DATA SHEET

Client: NAVFAC
Location: TO 21 - MCAS New River
Event: TO 21
Date: 6/23/08
Weather: Sunny + 80°

Project Number: TO 21
Well ID: 86 - TS13
Sample ID: TR86-TS13-GW-8-9-080
Sampling Team: R Riggs
S. Brown

Total Depth: 9 FT.(BTOC)
Depth to water: (-) 8 FT.(BTOC)
Water Column: 1 FT.
(x) .163 GAL/FT.
Well Volume: .163 GAL.
Total Purge Vol.: GAL.

Purge Device: Peristaltic Pump

Measuring Device: Horiba U-22
Date and Time: 6/23/08

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: 6/23/08 Time: 0924 Method: Low flow	Temp. °C	Cond. mS/cm	DO mg/L	pH SU	ORP mV	Turbidity NTU	Other: ____	Color / Odor / Comments

FIELD PARAMETERS

Time	Purge Vol. (gals)	Temp. °C	Cond. mS/cm	DO mg/L	pH SU	ORP mV	Turbidity NTU	Other: ____	Color / Odor / Comments
0914		22.93	.234	2.76	4.87	248	999		
0919		22.47	.238	2.32	4.70	266	999		
0924		22.01	.229	1.80	4.69	261	999		

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

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

Observations/Notes: water is brown
High turbidity

MS/MSD
Duplicate ID No.:
Signature(s):

CH2MHILL

Figure 2-3
Soil Gas Sampling Field Data Sheet

Soil Gas Point Installation

Time Installed	0930
Screen Depth	6'
Screen Volume	1L
Helium Leak Check Result	12675

Soil Gas Sample Point Purging

Purge Date	6/23/08
Purge Time	15 min
Purge Rate	200
Purged Volume	3 L

Multi Rae Readings

Total VOCs (ppm)	0.0
O2 (%)	20.8
H2S (ppm)	0
CO (ppm)	186
LEL (%)	0

Soil Gas Sample Collection

Sample ID	IR46-IS13-SV-5-6-08B
Sample Location	Site 86, MCA 5 New River
Canister ID	L5108
Critical Orifice or Flow Controller ID	31
Pressure Gauge ID	NA
Initital Pressure (in. Hg)	-30
Sample Date	6/23/08
Start Time	0959
End Time	1006
Final Pressure (in. Hg)	-3
Elapsed Time	7 min

Observations: _____

CH2MHILL

PROJECT NUMBER	BORING NUMBER	
TO 21	TR86-IS14	SHEET 1 OF 1

SOIL BORING LOG

PROJECT: TO 21 Vapor Intrusion LOCATION: MCAS New River
ELEVATION: DRILLING CONTRACTOR: Enviro Tek
DRILLING METHOD AND EQUIPMENT USED: Geoprobe
WATER LEVELS: START: 1028 END: 1040 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'-Asphalt	
					1'-4'- fine to medium sand 2.5Y 6/1 - grey	
5					4'-7'- same as above - wet	
10					7'-10'- sandy clay 10% sand 2.5Y 5/1 gray moist	0.0ppm
15					10'-13'- same as above - very moist	
					13'-15'- sandy clay 50% sand - clay Very soft - high water content	
20						
25						

SBOR25FT.XLS

AGVIQ
CH2M HILL

GROUNDWATER SAMPLING DATA SHEET

Client: NAVFAC
Location: MCAS New River
Event: TO 21
Date: 6/23/08
Weather: cloudy 80°

Project Number: TO 21
Well ID: TR86-IS14
Sample ID: TR86-IS14-GW-14-15-08B
Sampling Team: K. Biggs, P. Brown

Measuring Device: Horiba U-22
Date and Time: 6/23/08

Total Depth: 15 FT.(BTOC)
Depth to water: (-) 14 FT.(BTOC)
Water Column: 1 FT.
(x) .163 GAL/FT.
Well Volume: .163 GAL.
Total Purge Vol.: _____ 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: 6/23/08	Temp. °C	Cond. mS/cm	DO mg/L	pH SU	ORP mV	Turbidity NTU	Other: ____	Color / Odor / Comments
1120 Time: ~~1105~~								
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
1110 1105		23.50	.306	4.88	5.21	13	999		
1115		23.60	.298	3.81	5.08	9	999		none
1120		23.95	.311	3.12	4.95	22	224		

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

Analysis	Preservative	Container requirements	No. of containers
VOC	HCL	40 ml VOA	5

Observations/Notes: grey water
High turbidity

MS/MSD
Duplicate ID No.:
Signature(s):

CH2MHILL

PROJECT NUMBER	BORING NUMBER SWMU336-ISO1 SHEET 1 OF 1

SOIL BORING LOG

PROJECT: VI (JVII TO-21) LOCATION: MCAS New River (SWMU 336
ELEVATION: DRILLING CONTRACTOR: EnviroTek
DRILLING METHOD AND EQUIPMENT USED: DPT / 7730 DT
WATER LEVELS: START: 6/22/05 1410 END: 1430, 6/22 LOGGER: B. Sprouse

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
					Grass	
					Tan sand	
					Lt. gray sandy clay	0.0
5						
		3/5			7-8 CL clay, lt. gray dense, high plasticity	
	5-10				8-9.5 SC sandy clay, lt. gray fg. soft	0.0
10					9.5-9.7 SP sand, white fg wg dry	
	10-15	4.5/5			9.7-10 SC sandy clay, lt. gray, moist, fg sand, soft	
					10.5-14.5 Same as above with increased moisture	0.0
15						
					14.5-15 SP sand, tan, saturated, mg, ps	
20					Terminate at 15'	
25						

SBOR25FT.XLS

Attachment 4

CH2MHILL

PROJECT NUMBER	PROJECT NAME
364172	Vapor Intrusion

WELL PURGE AND SAMPLING FIELD SHEET

SITE: MCAS New River
DATE: 6/22/09
FIELD CREW: BS / PB
WELL NUMBER: SWMU 336 - IS01
WEATHER: cloudy, 90's

PURGE VOLUME CALCULATION:

			CASING DIAMETER	GAL/FT OF CASING
WELL DEPTH (FT):		15		
DEPTH TO WATER (FT):	-		2 IN.	0.1632
WATER COLUMN (FT):	=	0	4 IN.	0.6528
GAL/FT OF CASING (from table at right):	x	0.1632	6 IN.	1.4688
CASING VOLUME (GALs):	=	0	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: 1435
FLOW RATE (gpm):
PUMP TIME (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	1455		4.69	26.4	0.143	max	1.74; 190
2	1458		4.50	26.[illegible]	0.143	999	0.51 160
3	1500		4.[illegible]	25.8	0.146	999	0.428 147
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
SWMU336-IS01-GW-14-16-08B	3 40mL VOAs	VOC	TA	

SIGNED/SAMPLER: [signature]

CH2MHILL

Figure 2-3

Soil Gas Sampling Field Data Sheet

Soil Gas Point Installation

Time Installed	1510
Screen Depth	8-9
Screen Volume	1L
Helium Leak Check Result	1568

Soil Gas Sample Point Purging

Purge Date	6/22/08
Purge Time	15 mins
Purge Rate	200mL/min
Purged Volume	~~3L~~ 3L

Multi Rae Readings

Total VOCs (ppm)	1.2
O2 (%)	15.1
H2S (ppm)	0
CO (ppm)	7
LEL (%)	0

Soil Gas Sample Collection

Sample ID	SWMU336-I501-SV-8-9-08B
Sample Location	SWMU336
Canister ID	L-5766
Critical Orifice or Flow Controller ID	123
Pressure Gauge ID	NA
Initital Pressure (in. Hg)	-30
Sample Date	6/22/08
Start Time	1545
End Time	1551
Final Pressure (in. Hg)	-1
Elapsed Time	6 mins

Observations: _____

CH2MHILL

PROJECT NUMBER	BORING NUMBER SWMU336-IS02 SHEET 1 OF 1

SOIL BORING LOG

PROJECT: VI - JVII 70-21 LOCATION: MCAS New River IR 86
ELEVATION: DRILLING CONTRACTOR: EnviroTek
DRILLING METHOD AND EQUIPMENT USED: DPT 17730 DT
WATER LEVELS: START: 6/22/05; 1100 END: LOGGER: B. Sprouse

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
					Asphalt	
					tan clay	
					lt. gray clayey sand	0.0
					Dk gray sandy clay	
5					7.5-8.5 SC sandy silty clay, lt. gray, soft, high plasticity	
	5-10	2.5/5			8.5-9 SM silty sand, dk gray vfg, soft	0.0
10					9-9.5 SM silty sand, brown fg, damp	
	10-15	4.5/5			9.5-10 SC sandy clay lt. gray, moist, soft	0.0
					10.5-12.5 same as above very moist to wet	
15					12.5-14 SC clayey sand lt. gray, mg, wet	
					14-15 SW sand, tan, mg PS, saturated	
20						
					Terminate at 15'	
25						

SBOR25FT.XLS

Attachment 4

CH2MHILL

PROJECT NUMBER	PROJECT NAME
TO 21	Soil Vapor Intrusion

WELL PURGE AND SAMPLING FIELD SHEET

SITE: SWMU 336-ISO2 | DATE: 6-22-08
FIELD CREW: Patrick Brown, Brook Spruce | WELL NUMBER: IW86-ISO2
WEATHER: Sunny, 87°F

PURGE VOLUME CALCULATION:

			CASING DIAMETER	GAL/FT OF CASING
WELL DEPTH (FT):		14		
DEPTH TO WATER (FT):	-	7	2 IN.	0.1632
WATER COLUMN (FT):	=	0	4 IN.	0.6528
GAL/FT OF CASING (from table at right):	x	0.1632	6 IN.	1.4688
CASING VOLUME (GALs):	=	0	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: 1127
FLOW RATE (gpm):
PUMP TIME (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	1133		4.48	25.9	0.235	999	0.92; 172
2	1136		4.24	25.4	0.234	944	0.53; 163
3	1138		4.02	25.3	0.237	308	0.37; 152
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
SWMU336-ISO2-GW-12-14-08B	3, 40 ml VOA	VOC	Test America	

SIGNED/SAMPLER: Patrick

CH2MHILL

Figure 2-3

Soil Gas Sampling Field Data Sheet

Soil Gas Point Installation

Time Installed	1210
Screen Depth	6-7
Screen Volume	1L
Helium Leak Check Result	125

Soil Gas Sample Point Purging

Purge Date	6/22/08
Purge Time	1215
Purge Rate	15mL/min
Purged Volume	3L

Multi Rae Readings N/M

battery died on Multi Rae

Total VOCs (ppm)	
O2 (%)	
H2S (ppm)	
CO (ppm)	
LEL (%)	

Soil Gas Sample Collection

Sample ID	SWMU 336-IS02-SV-6 -7 -08B
Sample Location	SWMU 336
Canister ID	L-3841
Critical Orifice or Flow Controller ID	19
Pressure Gauge ID	NA
Initital Pressure (in. Hg)	-30
Sample Date	6/22/08
Start Time	1233
End Time	1238
Final Pressure (in. Hg)	-3
Elapsed Time	5 mins

Observations:_____

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%

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: J. Simms Date: 09/27/08

Structure

Identification: Building AS541

Address:

Slab Information:

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

☐ Concrete slab on gravel underlayment

Condition of slab: Good - Some seals of expansion joints are bad

Type of Sub Slab Soil:

Is water present in the soil:

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

		1	2	3	4
	Sample location (show in diagram)				
	Sample Identification (field ID)	IR86-SG02	IR86-SG03		
Probe Installation	Depth of slab (inches)	6"	7"		
	Depth of hole drilled (inches below slab surface)	4"	4"		
	Depth of installed probe (inches below slab surface)	4"	5"		
Manifold Leak check	Leak check (sampling manifold) - Pass/No Pass	Pass	Pass		
Probe Purge	Purge rate, cc/min	200 mL/min	200 mL/min		
	Purge Start (time of day)	1710	1800		
	Purge vacuum, " Hg	0	0		
	Purge completed (time of day)	1719	1811		
Helium Leak Check (optional)	Leak check (Helium) - %	0 ppm	4675 ppm		
Canister Sampling	Canister & flow controller ID (if used)	L-5123/61			
	Initial Canister Pressure (" Hg)	-30			
	Sampling rate, ~~cc/min~~	200 mL/min			
	Sampling period started (time of day)	1724			
	Sampling vacuum, " Hg	0			
	Sampling period ended (time of day)	1730			
	Final Canister Pressure (" Hg)	-3			

Observations and Comments:

PID = 2.9 ppm
CO_2 = 2.8%
O_2 = 16.7%

Failed helium leak check
re-seal probe w/ cement

CH2MHILL

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:

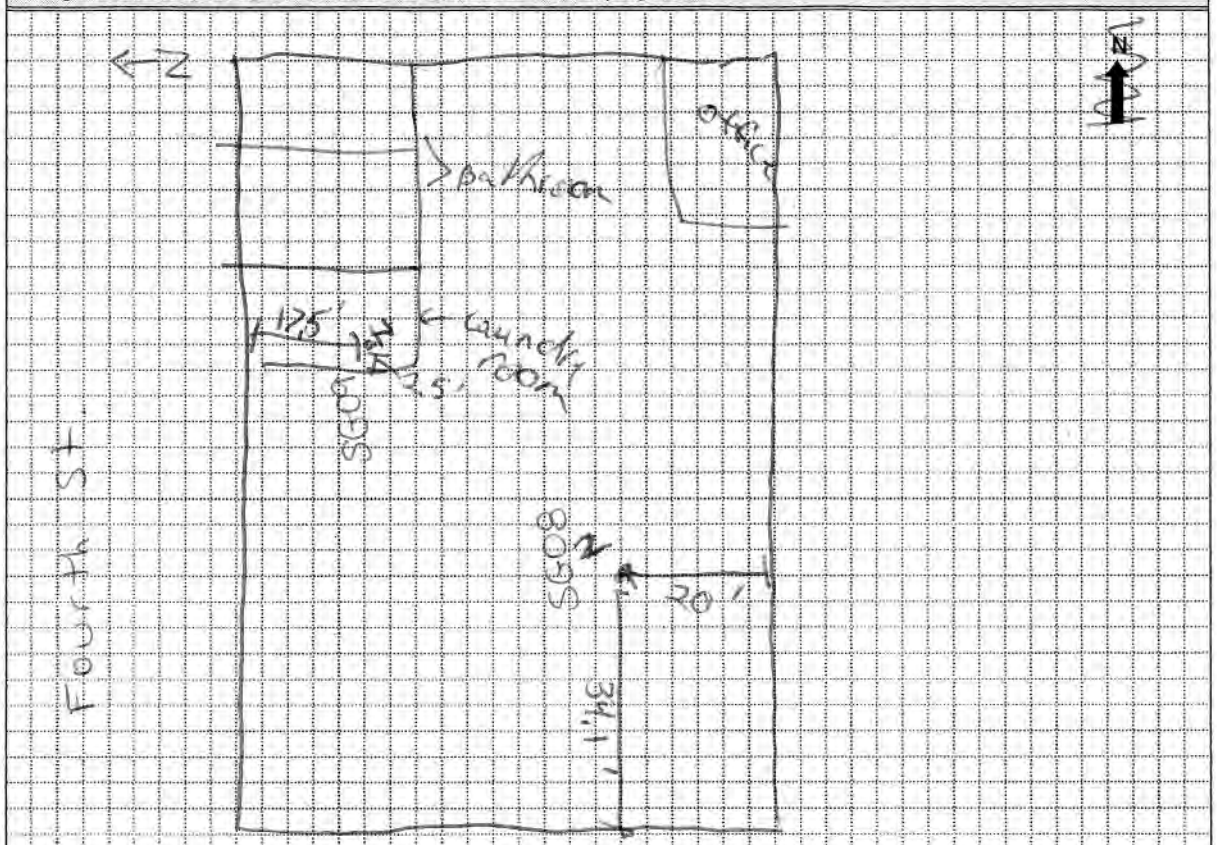
FID = 1.0 PID = 0.0
O_2 = 15% O_2 = 21.5
CO_2 = 0% CO_2 = 0.0

CH2MHILL *Applied Sciences Group*

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:

CH2MHILL

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			

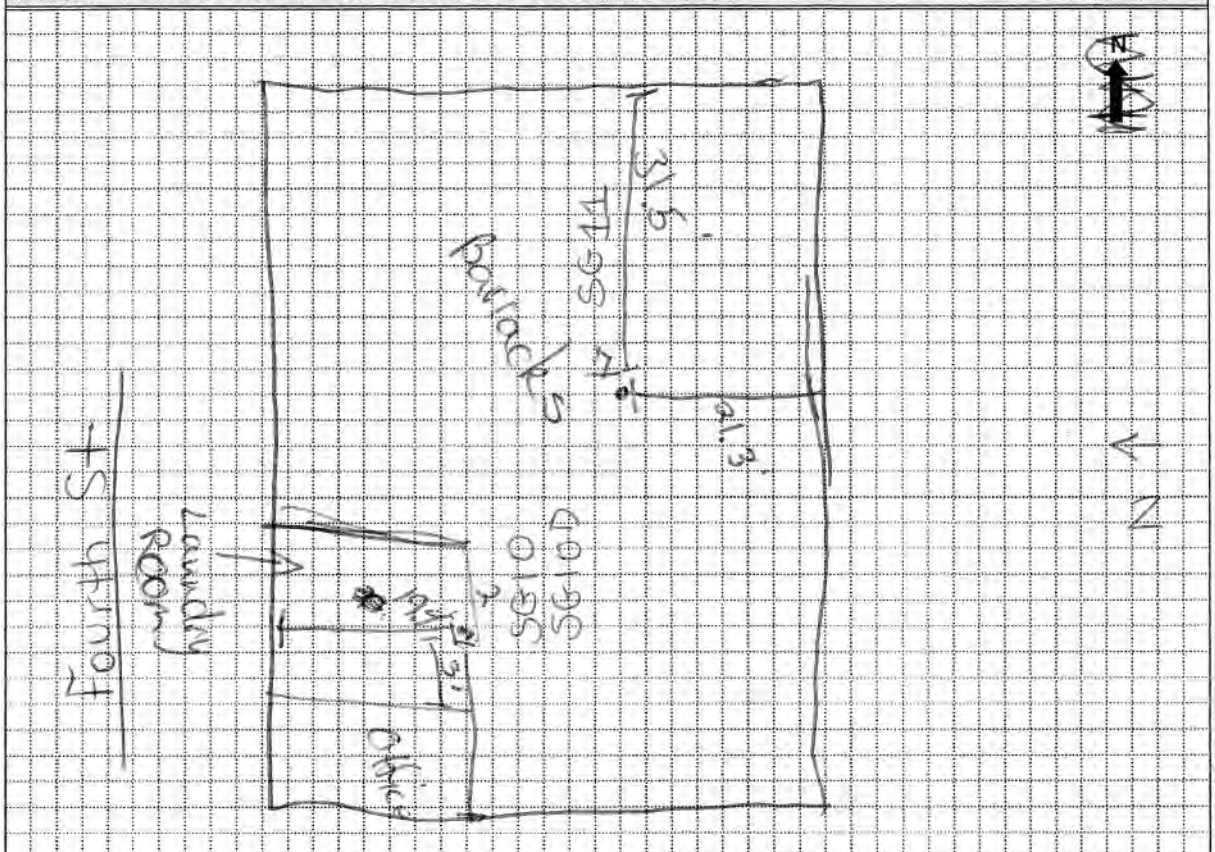
Observations and Comments: O_2 = 21.1
CO = 0.0
PID = 21.2

SG12 sampled previously (Bldg 533)

CH2MHILL *Applied Sciences Group*

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:

CH2MHILL

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			

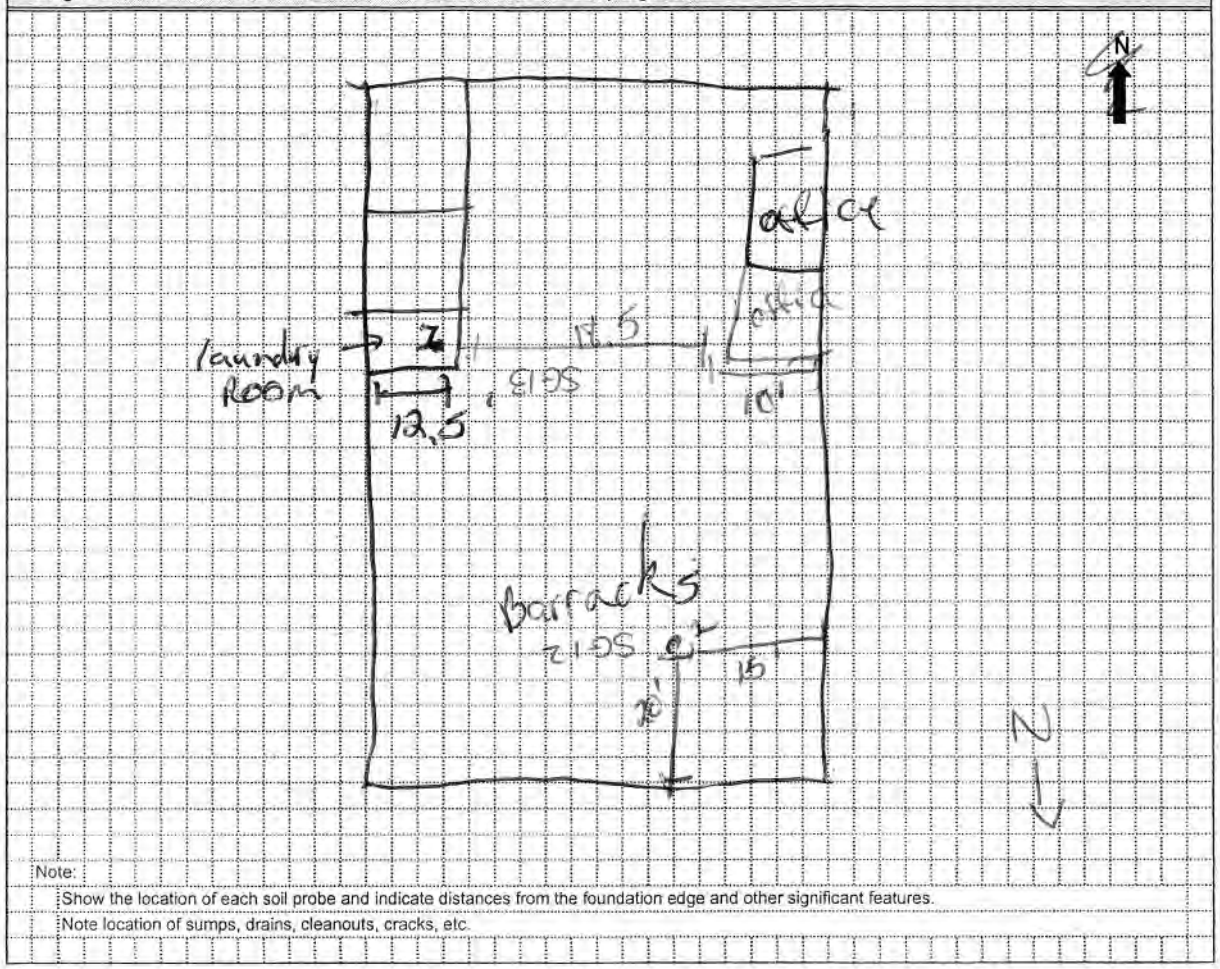
Observations and Comments: SG12 - sampled on seperate day
PID = 1.9 ppm
CO_2 = 0.0
O_2 = 20.8

CH2MHILL *Applied Sciences Group*

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:

CH2MHILL

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

Project Info

Project Name: CL VI
By: L. Riggs / E. Barclay
Project #: TO 21
Date: 10/19/02

Structure

Identification: 45502
Address: 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)				
	Sample Identification (field ID)	86-SG01	86-SG01D		
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)	~~0949~~ 1249	1249		
	Purge vacuum, " Hg	0	0		
	Purge completed (time of day)	~~1~~ 1304	1304		
Helium Leak Check (optional)	Leak check (Helium) - %	0.0ppm	0ppm		
Canister Sampling	Canister & flow controller ID (if used)	5172, 127	5159, 131		
	Initial Canister Pressure (" Hg)	-30	-30		
	Sampling rate, cc/min	.2	.2		
	Sampling period started (time of day)	~~1~~ 1310	1310		
	Sampling vacuum, " Hg	~~-8~~ -1	~~-4~~ -1		
	Sampling period ended (time of day)	1316	1316		
	Final Canister Pressure (" Hg)	-3	-4		

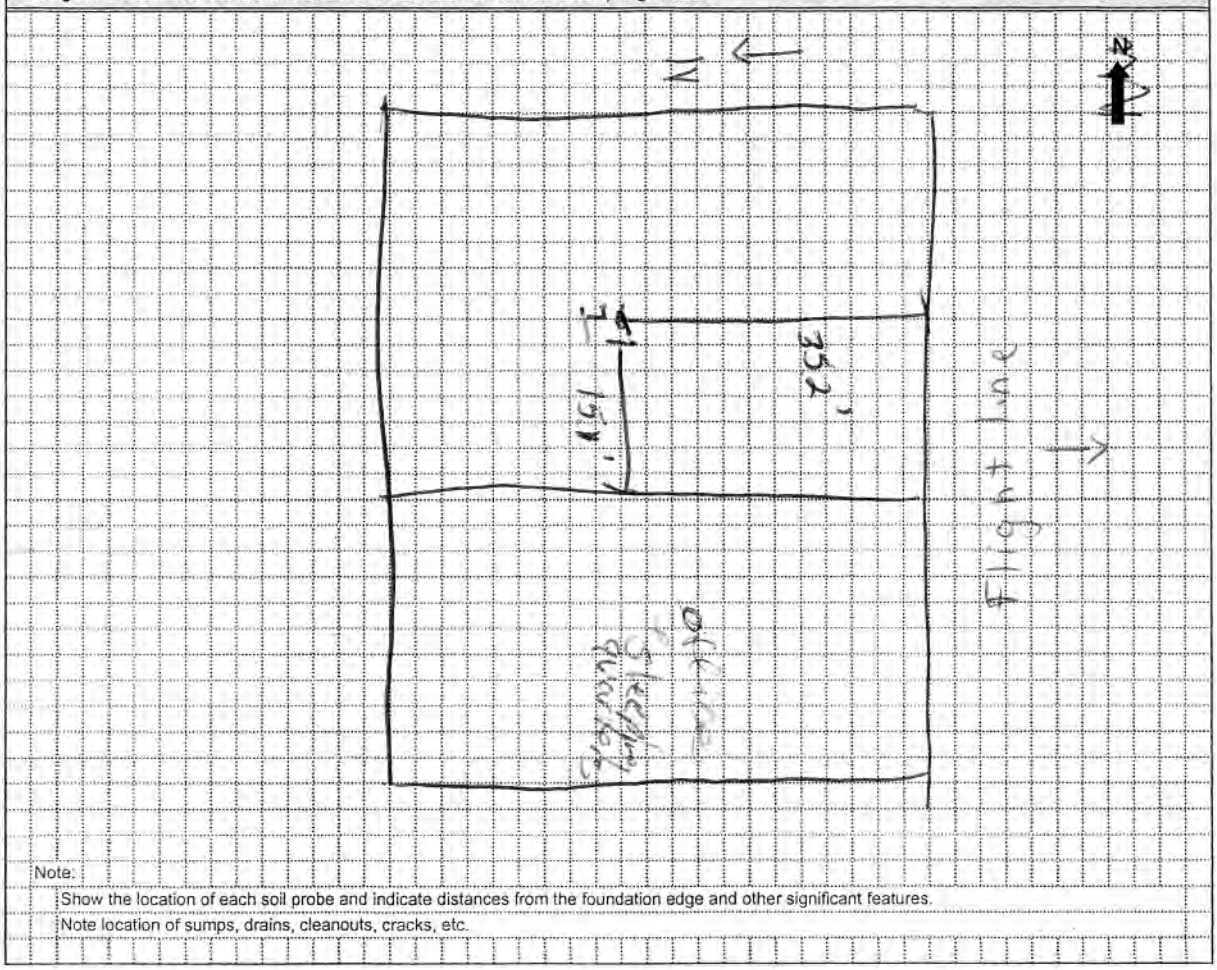
Observations and Comments: PID = 1.2
CO = 0.0
O_2 = 21.2

CH2MHILL *Applied Sciences Group*

Indoor Vapor Intrusion Assessment
Sub-slab Vapor Sampling Field Log

Bldg AS502

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:

CH2MHILL

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

Project Info

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

Structure

Identification: ~~A54151~~ A5541
Address: McAS New River

Slab Information:

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

Condition of slab: good - some cracks
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)	86-SG03	86-SG02		
Probe Installation	Depth of slab (inches)	7"			
	Depth of hole drilled (inches below slab surface)	9"			
	Depth of installed probe (inches below slab surface)	7"			
Manifold Leak check	Leak check (sampling manifold) - Pass/No Pass	Pass			
Probe Purge	Purge rate, cc/min.	2			
	Purge Start (time of day)	1349			
	Purge vacuum, " Hg	~~13~~ -2			
	Purge completed (time of day)	1354			
Helium Leak Check (optional)	Leak check (Helium) - %	0.0			
Canister Sampling	Canister & flow controller ID (if used)	L5178, 19			
	Initial Canister Pressure (" Hg)	-30			
	Sampling rate, cc/min	2			
	Sampling period started (time of day)	1402			
	Sampling vacuum, " Hg	-1			
	Sampling period ended (time of day)	1407			
	Final Canister Pressure (" Hg)	-4			

Observations and Comments: PID = 0.0 ppm
O_2 = 21.9
CO = 0.0

SG02 sampled on a previous day

Appendix V4-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 – Air Station

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 Air Station 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, 735 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:

- 4.4 percent (32 of 735 results) were U-qualified as "attributable to blank contamination" (see section 3.1.1.1, below)
- 0.7 percent (5 of 735 results) were UJ-qualified as "nondetect, estimated quantitation limit" because of high continuing calibration recovery (see section 3.1.1.2, below)
- 1.1 percent (8 of 735 results) were J-qualified as "estimated" due to high continuing calibration recovery (see section 3.1.1.2 below)
- 8.7 percent (64 of 735 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 32 results were U-qualified as "attributable to blank contamination" because acetone, chloromethane, methyl acetate, methylene chloride, m, p, and o-xylene, as well as toluene 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 five 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.

A total of eight results were J-qualified as "estimated" due to high continuing calibration recoveries. The J-qualification of detects does not affect the availability of results because they are available for use as detects at the reported concentration. The data user should

consider these results as possibly biased high. Carbon disulfide and methyl-tert-butyl-ether were the two compounds affected; however neither compound exceeded the screening criteria.

3.1.1.3 Quantitation Limits

A total of 64 results were J-qualified as "estimated" simply because the results were lower than the quantitation limit. The data user should consider the results estimated; however, 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 Shallow Soil Vapor Data

This evaluation assesses the analytical results of shallow soil vapor samples collected on June 22 and June 23, 2008.

3.2.1 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:

- 1.4 percent (2 of 138 results) were U-qualified as "attributable to blank contamination" (see section 3.2.1.1, below)
- 15.9 percent (22 of 138 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 two results were U-qualified as "attributable to blank contamination" because, methylene chloride was detected in associated blank samples. Methylene Chloride is a common lab 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 22 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 Deep Soil Vapor Data

This evaluation assesses the analytical results of deep soil vapor samples collected on June 20, 2008.

3.3.1 Volatile Organic Compounds

Volatiles were analyzed by EPA method TO-15. Excluding field quality control samples, 92 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:

- 20.7 percent (19 of 92 results) were J-qualified as "estimated" because the results were below the quantitation limit (see section 3.3.1.1 below)

3.3.1.1 Quantitation Limits

A total of 19 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 – Air Station

4.1 Soil Gas Data

This evaluation assesses the analytical results of soil gas samples collected on September 26 and October 4, and 6, 2008.

4.1.1 Volatile Organic Compounds

Volatiles were analyzed by EPA method TO-15. Excluding field quality control samples, 184 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:

- 3.3 percent (6 of 184 results) were U-qualified as "attributable to blank contamination" (see section 4.1.1.1, below)
- 1.1 percent (2 of 184 results) were UJ-qualified as "nondetect, estimated quantitation limit" because of high continuing calibration recovery (see section 4.1.1.2, below)
- 0.5 percent (1 of 184 results) were J-qualified as "estimated" due to high continuing calibration recovery (see section 4.1.1.2 below)
- 5.4 percent (10 of 184 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 six 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 two 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 J-qualification of detects does not affect the availability of results because they are available for use as detects at the reported concentration.

4.1.1.3 Quantitation Limits

A total of ten 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 at Air Station 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 V4-C
Building Survey Forms

Preliminary Building Survey for Vapor Intrusion Investigation

CH2MHILL

Date: 10-08-08

Preparer: Edward P. VanThiel / Kristi Riggs

Facility: AS-143

Address: MCAS New River

Contact Person: Mr. Shuler

Phone Number: 910-449-6739 X6462

e-mail address:

Building Description

Building or Room Identifier: AS-143

Primary Activity within Building (select one):

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

Notes: Operate Gov't Gas Pumps
operate fuel farm

Approximate floor space: 16'X33'

Number of floors: 1

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

Ceiling height: 10ft

Aboveground Construction
- [ ] Wood
- [ ] Concrete
- [ ] 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	[x] No	[ ] N/A
Are basements or subsurface vaults present?	[ ] Yes	[x] No	[ ] N/A
Are there subsurface drainage problems?	[ ] Yes	[ ] No	[x] N/A

Notes: _____

Evaluation of Potential Pathways/Driving Forces

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

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
- [x] 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)

Aerosol-furniture polish
Lemon Wood
Skill craft All-purpose cleaner

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

☑ Yes ☐ No

See above; used for occassional cleaning

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? N/A

Type of system?

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

Notes:

Additional Notes

AS-143 is on a list to be renovated because of Asbestos underneath the tile of the floor.

- AS-143 is next to gas pump.

- Smell of Jet fuel inside building
Smell is because gloves are left inside of building.

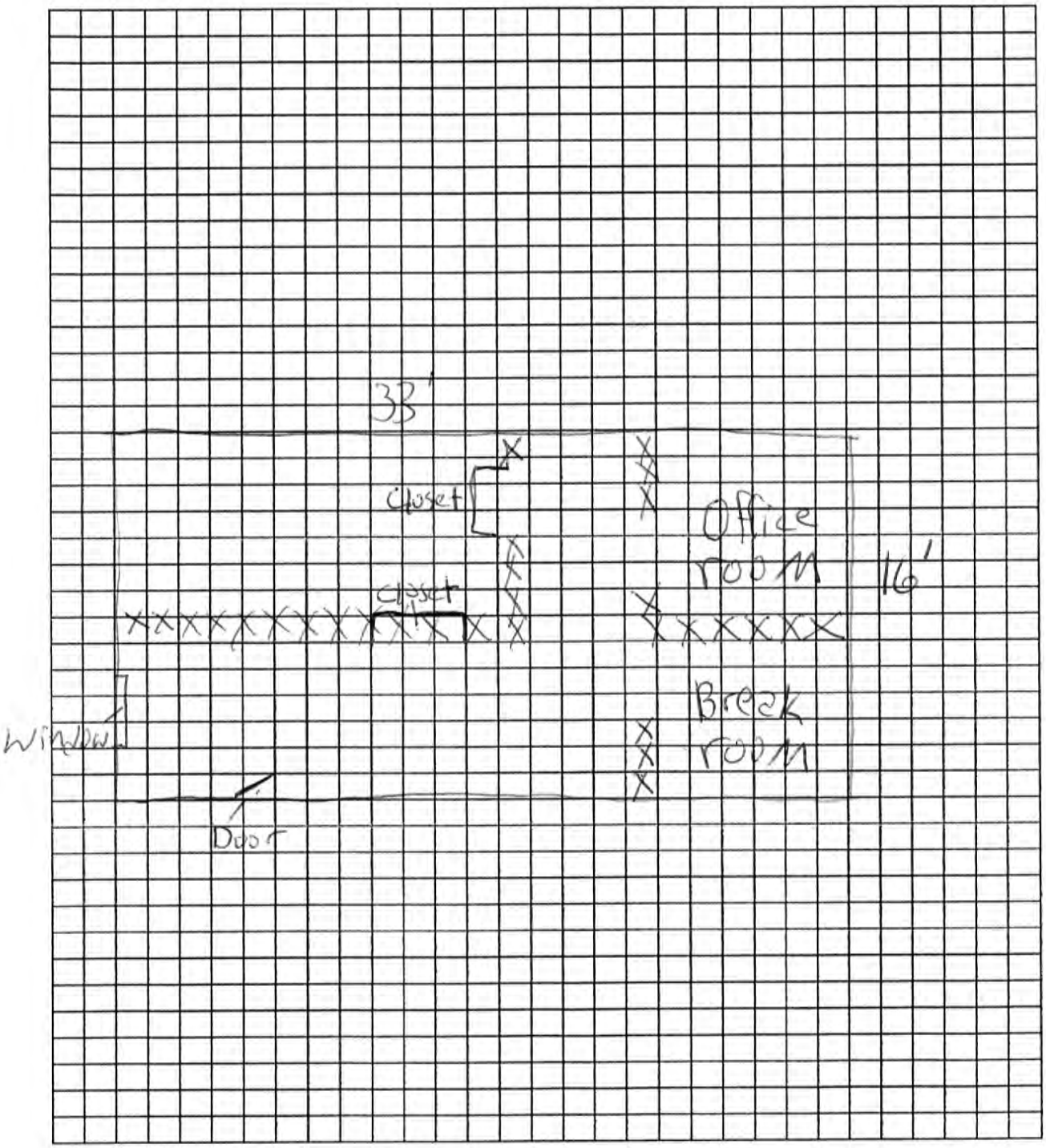
Additional Notes

Date: 10-8-08
Preparer: Edward Pivan Thick / Kristi Riggs

Facility: AS-143
Description (floor): Fire

CH2MHILL

Floor Plan Information



Preliminary Building Survey for Vapor Intrusion Investigation

Date: 10-8-08

Preparer: Edward P. VanThiel / Kristi Riggs

Facility: AS-424

Address:

CH2MHILL

Contact Person: CPR Dillard

Phone Number: 910-449-7616

e-mail address:

Building Description

Building or Room Identifier: AS-424

Primary Activity within Building (select one):

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

Notes:

Approximate floor space 100' X 100'

Number of floors 1

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

Ceiling height 40 feet

Aboveground Construction
- [ ] Wood
- [x] 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 _____

	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)?

- [ ] Single zone
- [ ] Multi-zone
- [x] Other No A/C

(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: leave Bay doors open during the day

Evaluation of Potential Existing Chemical Sources Indoors

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

Spray paint
Bulk paint
Paint thinner

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

☑ Yes ☐ No

Used occassionaly
used to mark crates

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

☐ N/A

Notes:

Additional Notes

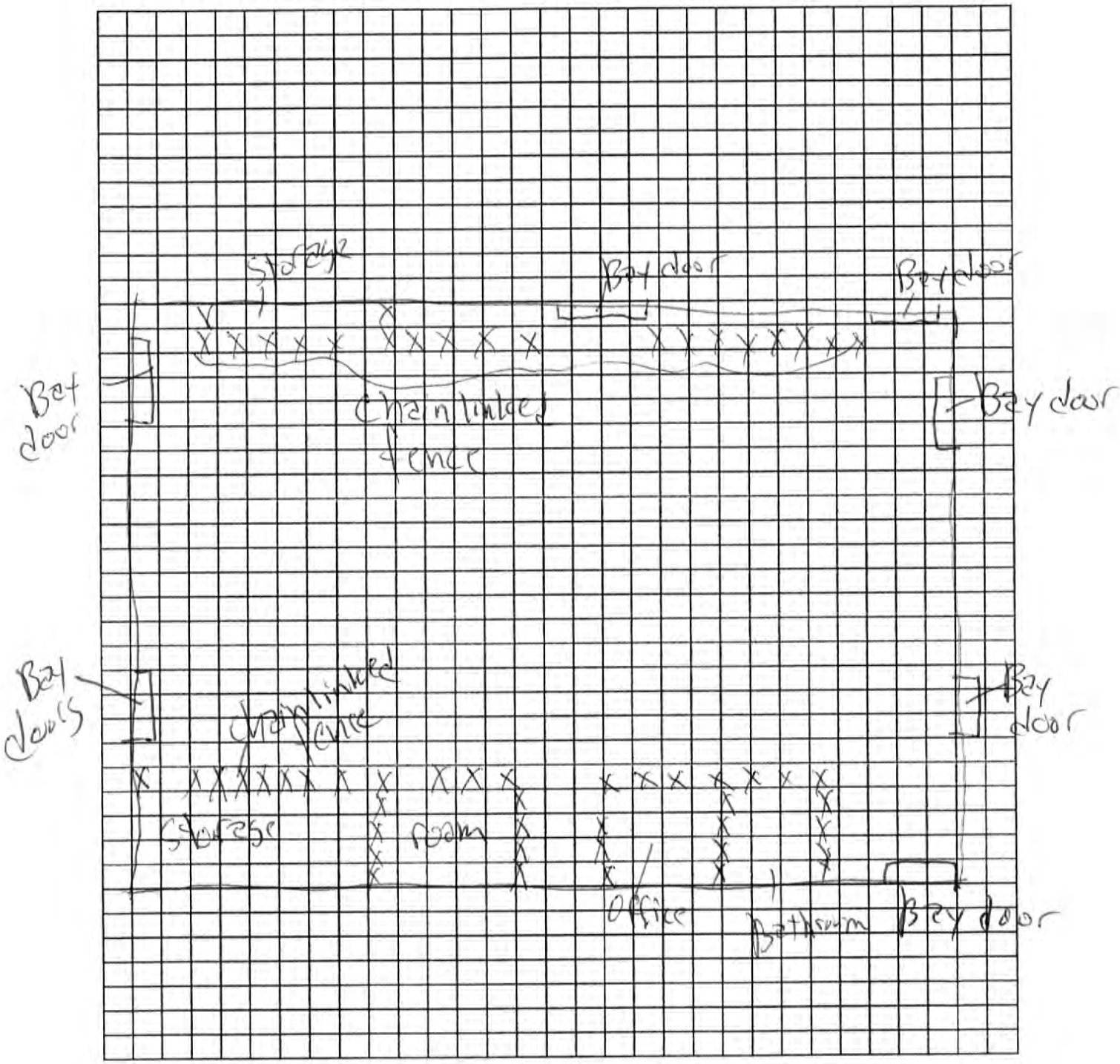
Additional Notes

Date: 10-8-08
Preparer: Edward P. van Thiel / Kristi Riggs

Facility: AS-~~510~~ 424
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: Crash crew Rescue

Address: MCAS ~~Air Sta~~ New River

Contact Person: Capt. Gallager

Phone Number: 910-449-6620

e-mail address:

Building Description

Building or Room Identifier: A5502

Primary Activity within Building (select one):

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

Notes: Crash crew & Rescue station

Approximate floor space 100 x 50'

Number of floors 1

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)?

- [ ] 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
- [x] Windows

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

Notes:

Evaluation of Potential Existing Chemical Sources Indoors

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

Spray paint
General cleaning products

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

[X] Yes [ ] No

used on work bench

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

Names of pesticide products used? Not sure - subcontractor comes in once a year

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

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

Description of Vapor Mitigation Systems

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

Date of installation? NA

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

Notes:

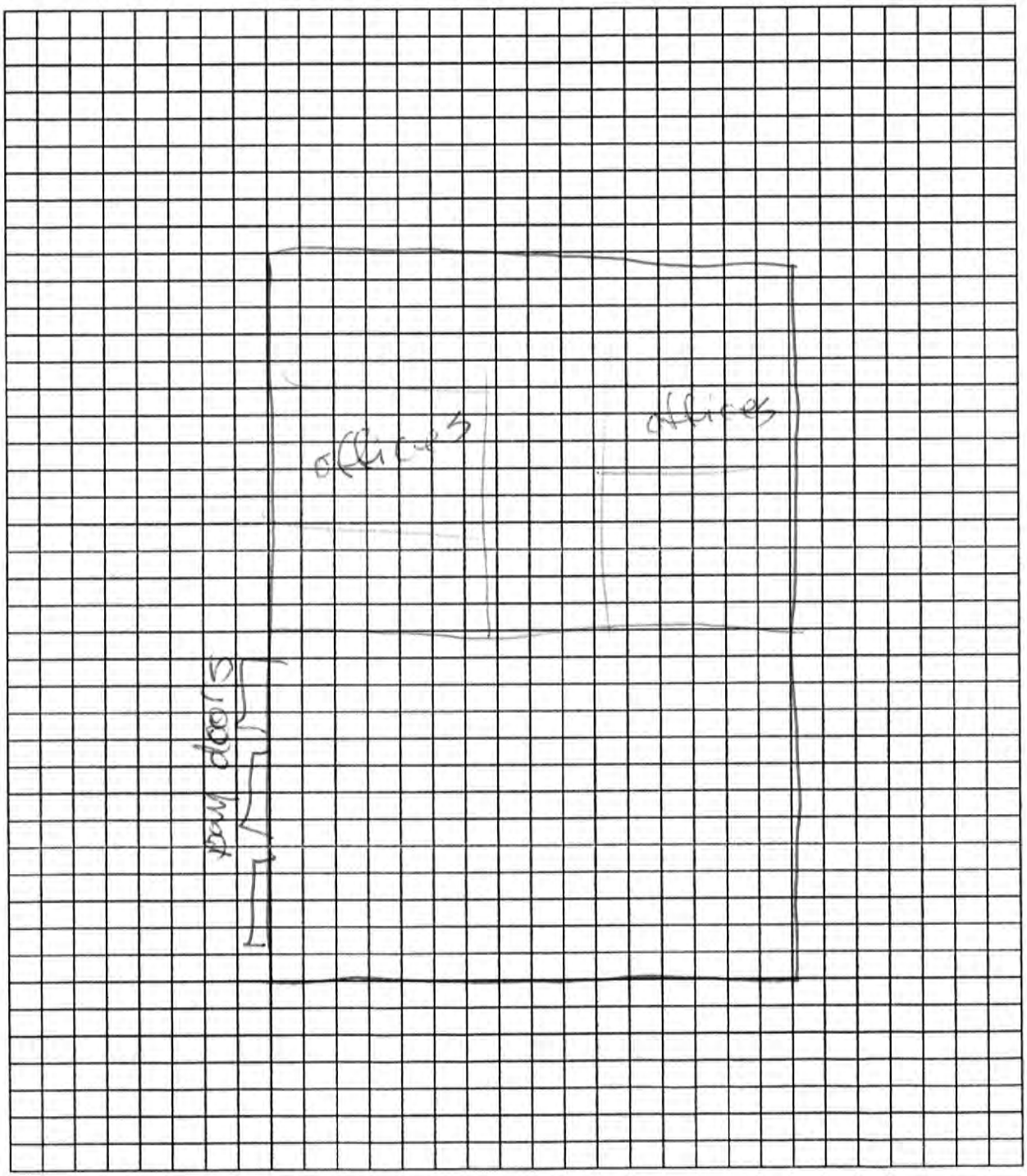
Additional Notes

Additional Notes

Date: 101410 5
Preparer: K Riggs
Facility: A5502
Description (floor): concrete

CH2MHILL

Floor Plan Information



Preliminary Building Survey for Vapor Intrusion Investigation

Date: 10-8-08

Preparer: Edward Pivan Thiel / Kristi Riggs

Facility: AS-510

Address:

CH2MHILL

Contact Person: MSGT Proctor

Phone Number: 449-5711

e-mail address:

Building Description

Building or Room Identifier:

Primary Activity within Building (select one):

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

Notes: Classroom, mainly a training facility;

Approximate floor space 150' X 100'

Number of floors 1

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

Ceiling height

Aboveground Construction
- [ ] Wood
- [ ] Concrete
- [ ] 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	[x] No	[ ] N/A
Are basements or subsurface vaults present?	[ ] Yes	[x] No	[ ] N/A
Are there subsurface drainage problems?	[ ] Yes	[ ] No	[x] N/A

Notes: _____

Evaluation of Potential Pathways/Driving Forces

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

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

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

(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
- [x] 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)

Hydraulic fluid - one day use.

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

☐ N/A

Notes: _____

Additional Notes

Didn't allow us to do a building tour. Next time we will need to contact personnel in building before arriving.

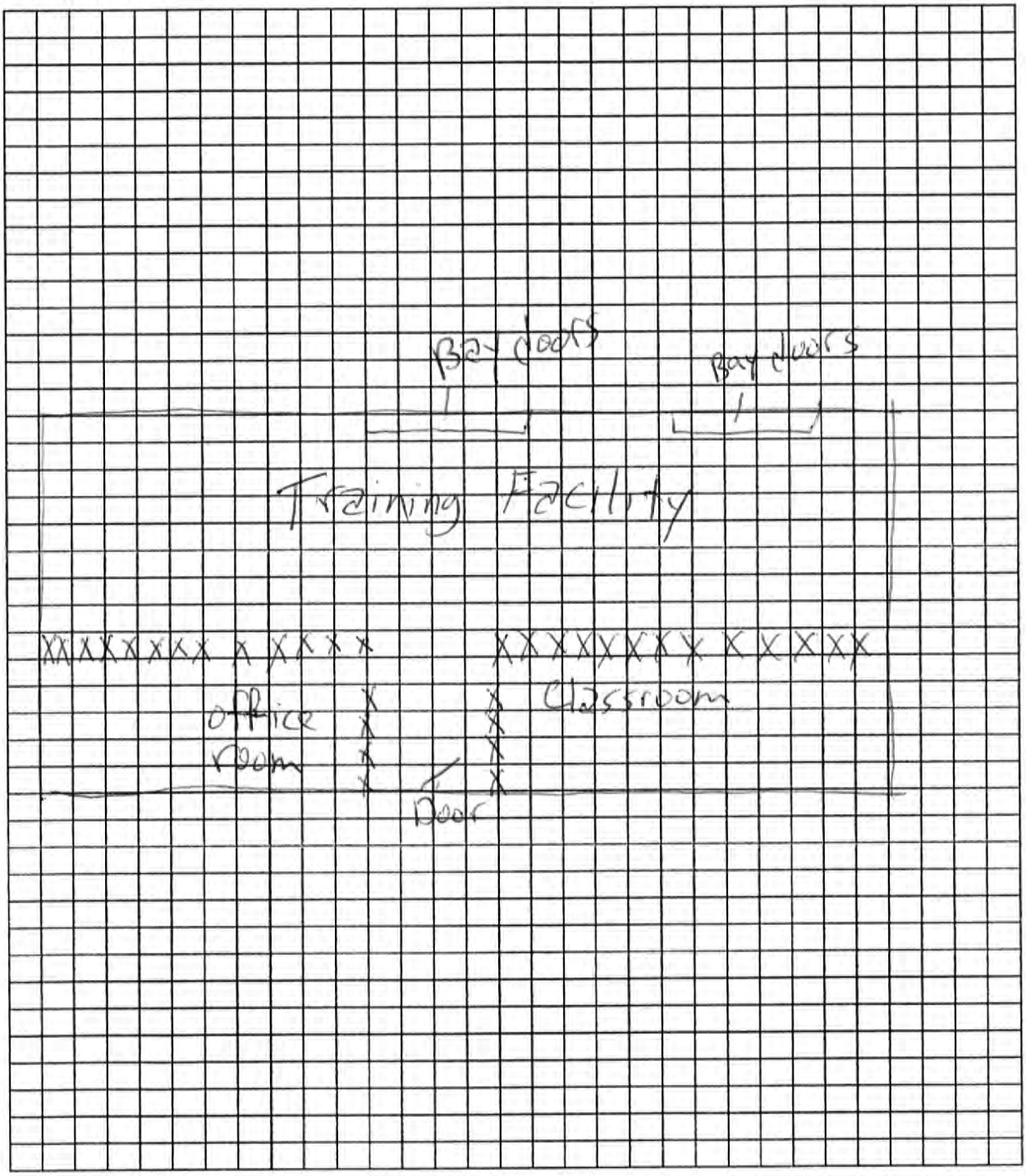
Additional Notes

Date: 10-8-08
Preparer: Gwen P. VanTiel / Kristi Riggs

Facility: AS-510
Description (floor): tile

CH2MHILL

Floor Plan Information



Preliminary Building Survey for Vapor Intrusion Investigation

CH2MHILL

Date: 9/24/08

Preparer: Kristi Riggs

Facility: A5515

Address: MCAS New River
Osprey hangar - Black Knights
Jacksonville, NC

Contact Person:

Phone Number:

e-mail address:

Building Description

Building or Room Identifier: A5515

Primary Activity within Building (select one):

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

Notes: Osprey hangar maintenance building

Approximate floor space 570 x 100

Number of floors 1

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

Ceiling height 20

Aboveground Construction
- [ ] Wood
- [x] Concrete
- [ ] Brick
- [x] Cinderblock
- [x] Other Metal hangar doors

Floor plan attached? [ ] Yes [x] No

Notes:

Evaluation of Potential Conduits from Soil

Floor/foundation description (check all that apply)

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

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	[ ] 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)

Large hangar doors do not create a tight seal

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
- [x] Windows

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

Notes: Hangars open - Back half of building has doors that are open

Evaluation of Potential Existing Chemical Sources Indoors

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

Oil, degreasers, standard plane maint. products

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

[X] Yes [ ] No

see above

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

Names of pesticide products used? NA

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? NA

Type of system?

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

Notes:

Additional Notes

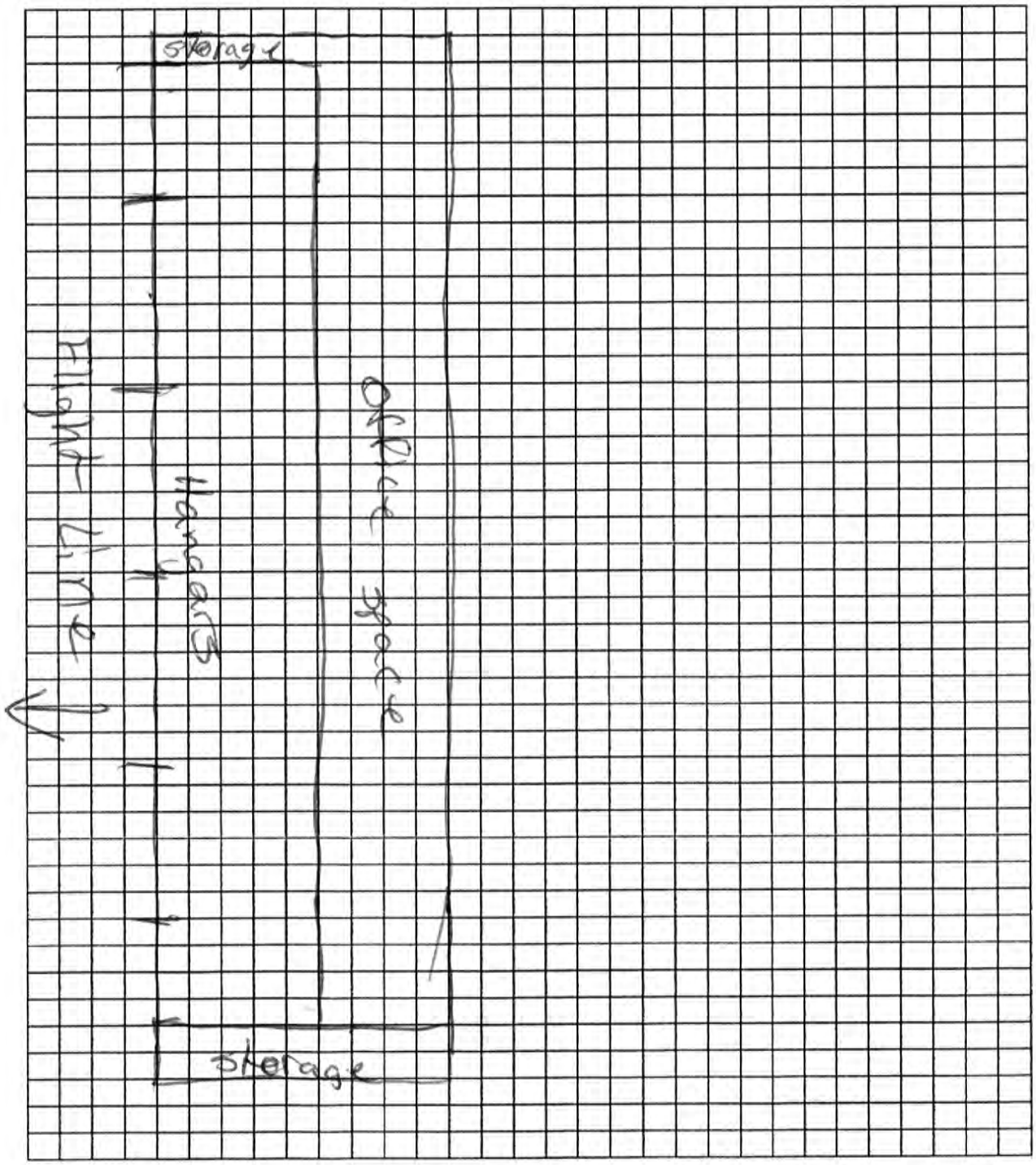
Additional Notes

Date: 9/26/08
Preparer: R. Riggs

Facility: A5515
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: ~~AS415~~ / AS541

Address: MCAS New River

Contact Person: duty person

Phone Number: Ring bell

e-mail address:

Building Description

Building or Room Identifier: ~~AS415~~ / AS541

Primary Activity within Building (select one):

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

Notes: stores materials/gear for flightline operations

Approximate floor space: 150 x 100

Number of floors: 1 1/2 - open warehouse - one small upstairs section - Front part of building has offices

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

Ceiling height: 20'

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)?	[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	[ ] 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)

Several bay doors - not sealed tightly.

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: large bay doors are open

Evaluation of Potential Existing Chemical Sources Indoors

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

spray paint, regular paint at southern end of building
Pre-greased gears

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

[X] Yes [ ] No

spray paint

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

Names of pesticide products used? NA

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? NA

Type of system?

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

Notes:

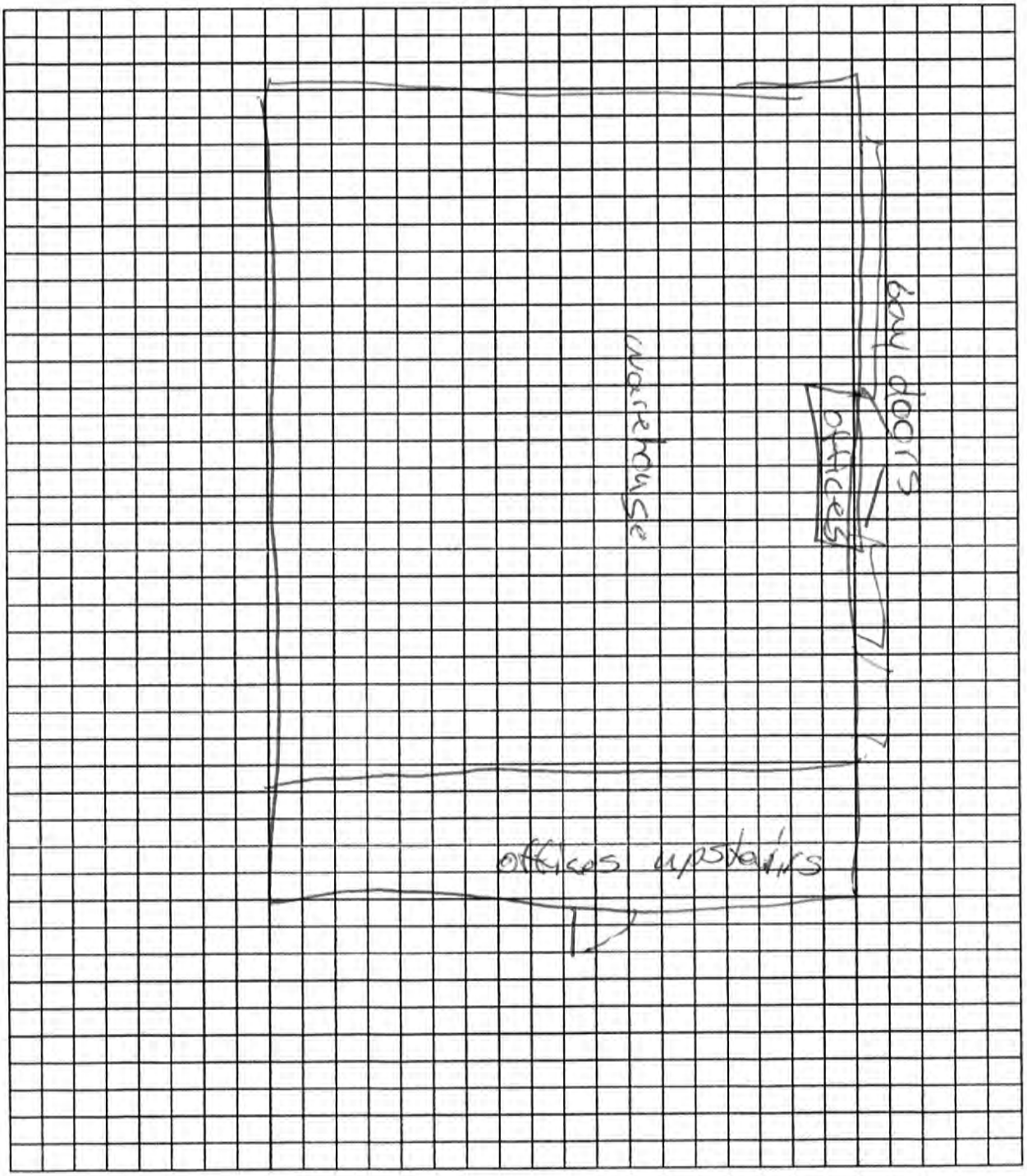
Additional Notes

Additional Notes

Date: 10/4/08
Preparer: R. Riggs + E. Barclay
Facility: ~~A5415~~ A5541
Description (floor): concrete

CH2MHILL

Floor Plan Information



Preliminary Building Survey for Vapor Intrusion Investigation

CH2MHILL

Date: 09/27/08

Preparer: Jen Simms

Facility:

Address: Building AS541

Contact Person:

Phone Number:

e-mail address:

Building Description

Building or Room Identifier: AS541

Primary Activity within Building (select one):

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

Notes: 1st floor is a large warehouse
it is a one storey bldg w/ a second floor within
office space on second floor. 2nd floor in 1/4 of bldg

Approximate floor space

Number of floors 2

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

Ceiling height

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

Corregated metal roof

Floor plan attached? [ ] Yes [ ] No

Notes:

Evaluation of Potential Conduits from Soil

Floor/foundation description (check all that apply)

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

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

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

Notes: very large hanger doors left open during work hours

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 [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

Preliminary Building Survey for Vapor Intrusion Investigation

CH2MHILL

Date: 9/24/08

Preparer: Kristi Riggs

Facility: AS4106 - Helicopter Hangar

Address: MCAS, New River Air Station, Site 86

Contact Person:

Phone Number:

e-mail address:

Building Description

Building or Room Identifier: Helicopter bay

Primary Activity within Building (select one):

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

Notes: Half building - Helicopter Maint
Other Half - Classrooms & offices

Approximate floor space Hanger 150 x 270 Classroom 150 x 270

Number of floors 1

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

Ceiling height 20

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

Floor plan attached? [ ] Yes [X] No

Notes:

Evaluation of Potential Conduits from Soil

Floor/foundation description (check all that apply)

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

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	[ ] 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)

NA

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
- [x] Windows

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

Notes: Hanger side - Hangers open
office side - very few windows + doors all closed

Evaluation of Potential Existing Chemical Sources Indoors

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

degreasers - oil, etc. - mechanical products

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

[X] Yes [ ] No

above products used

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

Names of pesticide products used? NA

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? NA

Type of system?

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

Notes:

Additional Notes

Floor in classroom areas are mostly concrete. Several small offices & classrooms / training rooms sectioned off by "hard" walls. Several people present in building.

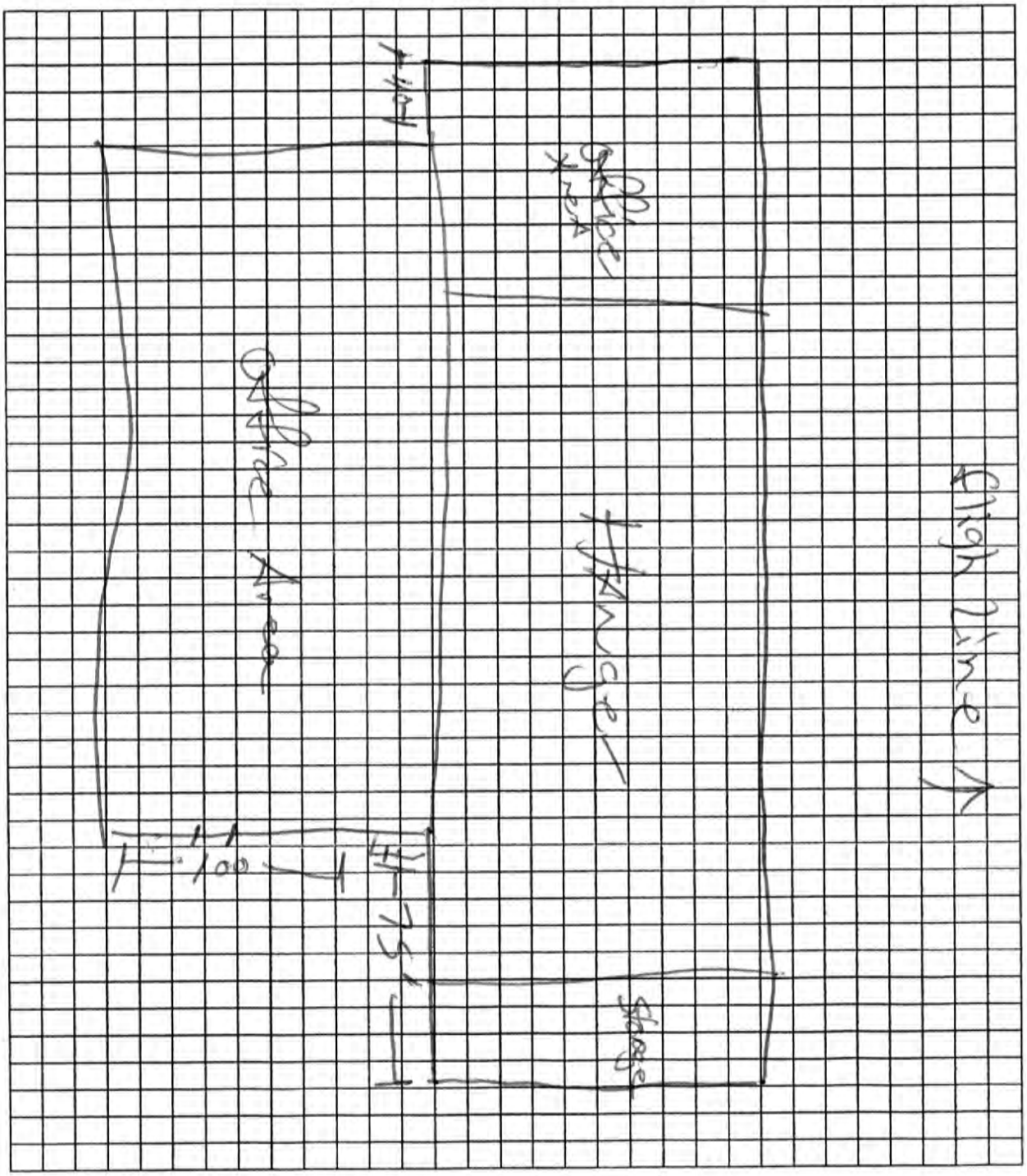
Additional Notes

Date: 9/26/07
Preparer: Kristi Riggs

Facility: AS4106
Description (floor):

CH2MHILL

Floor Plan Information



Preliminary Building Survey for Vapor Intrusion Investigation

CH2MHILL

Date: 014108

Preparer: K. Riggs + E. Barclay

Facility: AS4151

Address: MCAS New River

Contact Person:

Phone Number:

e-mail address:

Building Description

Building or Room Identifier: AS4151

Primary Activity within Building (select one):

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

Notes: steam plant

Approximate floor space 100 x 100

Number of floors 1 w/mezzanine

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

Ceiling height 30'

Aboveground Construction

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

Notes: _____

Evaluation of Potential Pathways/Driving Forces

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

One door needs to be slammed shut - window cracked

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

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

+ window unit in bathroom

(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: Back door open
3 exhaust fans

Evaluation of Potential Existing Chemical Sources Indoors

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

natural gas
citrasol
simple green
skilcraft - all purpose cleaner
windex
sulfide

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

[X] Yes [ ] No

burns natural gas to ~~steam~~ power w/ steam
sulfide - to process water

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

Names of pesticide products used? NA

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? NA

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

Notes:

Additional Notes

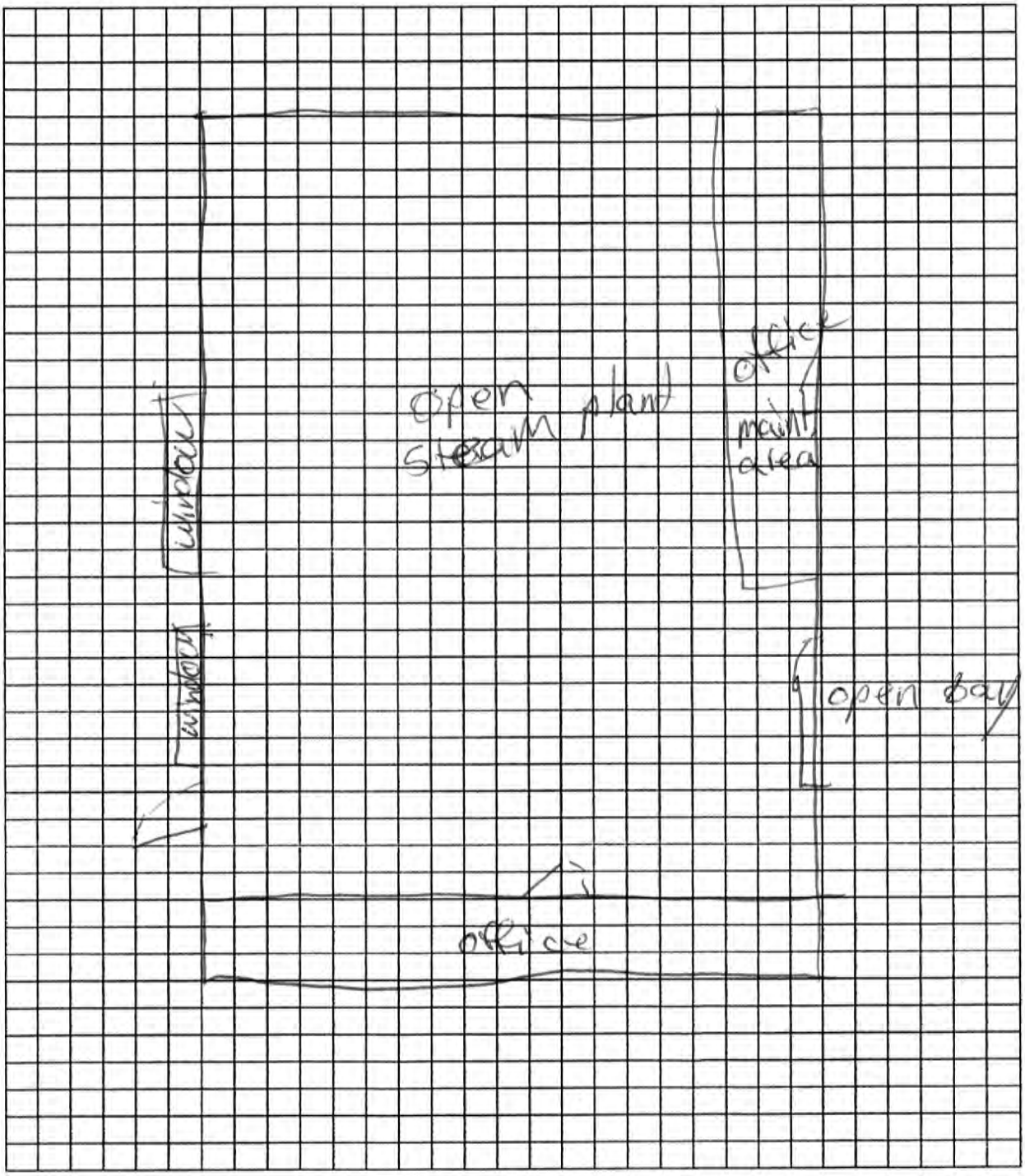
Additional Notes

Date: 10/4/08
Preparer: AS4151

Facility: steam plant
Description (floor): concrete

CH2MHILL

Floor Plan Information

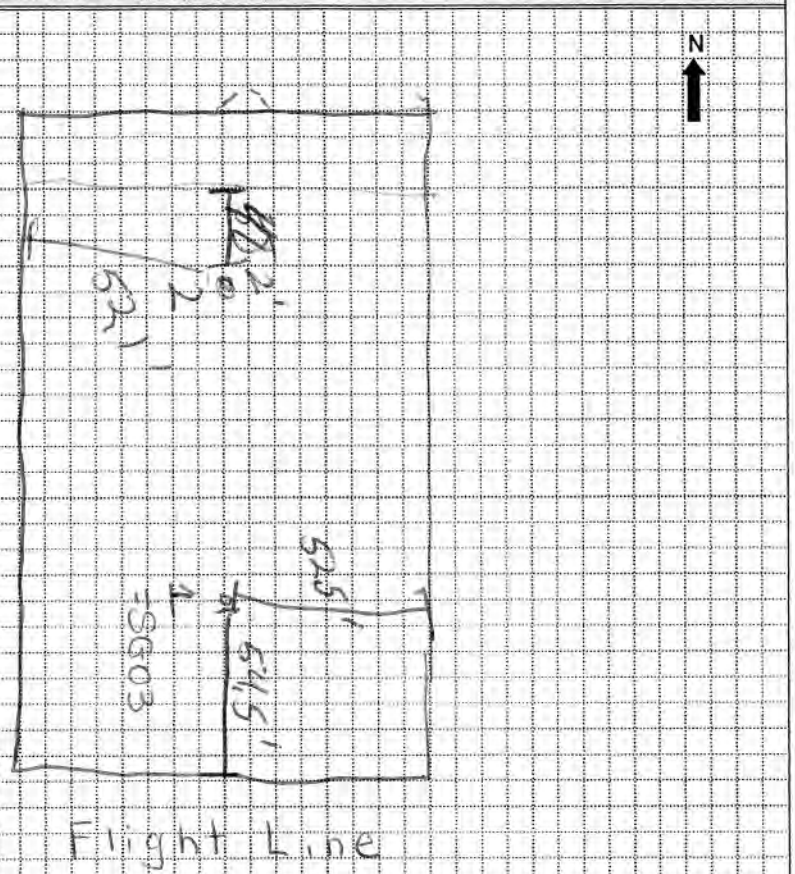


CH2MHILL *Applied Sciences Group*

Indoor Vapor Intrusion Assessment
Sub-slab Vapor Sampling Field Log

Bldg AS541

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 V4-D
Chain of Custody Data

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

JVII TO-21

Chain of Custody Record

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

Client Contact	Project Manager: Kerri Hallberg	Site Contact:	COC Record 1 of 6
Company Name: CH2M Hill	Tel/Mobile: 704-975-9381	Lab Contact: LINDA Carrier:	COC No: 00207
Address: 4824 Parkway Plaza	Analysis Turnaround Time	Analysis (Attach list if more space is needed)	Lab Use Only:
City/State/Zip: Charlotte, NC 28217	Calendar (C) or Work Days (W) _____		Custody Seals Intact? Y N NA
Phone: 704-329-0073	TAT if different from Below 28 days		Number of Packages: _____
Project Name/Number: JVII TO21 364167	☐ 2 weeks		Temperature: _____ deg C
Site: MCB Camp Lejeune	☐ 1 week		Shipper: __FedEx __UPS __Other:
PO #	☐ 2 days		Tracking Number:
Sampled by: BS/JS/PB	☐ 1 day		Recorded by: _____ Date: _____

Sample Identification	Sample Date	Sample Time	Sample Type	Matrix	# of Cont.	Field Filtered Sample	8260	Sample Specific Notes:
IR86-IS09D-GW-10-12-08B	6/21/08	1250	G	GW	3		X	
IR86-IS10-GW-10-12-08B		1405					X	
IR86-IS11-GW-10-12-08B		1510					X	
IR86-IS07-GW-9-11-08B		1630					X	
IR86 IS06-GW-9-11-08B	6/22/08	815					X	
IR86-IS05-GW-7-9-08B		955					X	
SWMU 336-IS02-GW-12-14-08B		1140					X	
SWMU 336-IS01-GW-14-16-08B		1500					X	

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:
Kimberly Stokes	CH2M HILL	6/23/08 1730		
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)

Chain of Custody Record

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

Client Contact	Project Manager: Keri Hallberg	Site Contact:	COC Record 2 of 6
Company Name: CH2M HILL	Tel/Mobile: 704-975-9381	Lab Contact: LINDA / Carrier:	COC No: 00210
Address: 4824 Parkway Plaza Blvd Ste 200	Analysis Turnaround Time		Lab Use Only:
City/State/Zip: Charlotte NC 28217	Calendar (C) or Work Days (W) _____		Custody Seals Intact? Y N NA
Phone: 704-329-0073	TAT if different from Below 28 days		Number of Packages: _____
Project Name/Number: VI (JVII TO21)	☐ 2 weeks		Temperature: _____ deg C
Site: MCB Camp Lejeune	☐ 1 week		Shipper: __FedEx __UPS __Other:
PO#	☐ 2 days		Tracking Number:
Sampled by: BS/JS	☐ 1 day		Recorded by: _____ Date: _____

Sample Identification	Sample Date	Sample Time	Sample Type	Matrix	# of Cont.	Field Filtered Sample	Analysis (Attach list if more space is needed): 8260	Sample Specific Notes:
IR78-IS09-GW-8-10-08B	6/19/08	1655	G	GW	3		X	
IR78-IS08-GW-6-8-08B	6/20/08	855					X	
IR78-IS05-GW-7-9-08B		1040					X	
IR78-IS04-GW-8-10-08B		1140					X	
IR78-IS06-GW-10-12-08B		1420					X	
IR78-IS07-GW-10-12-08B		1540					X	
IR86-IS08-GW-11-13-08B	6/21/08	1155					X	
IR86-IS09-GW-10-12-08B		1250					X	

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:
Kimberly Stokes	CH2M HILL	6/23/08 1730		
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: 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
KEEP YELLOW COPY FOR YOUR RECORDS

TAL-0046-140 (0208)

16894

CHAIN OF CUSTODY

CompuChem Test America
a division of Liberty Analytical Corp. TO 21
501 Madison Ave.
Cary, NC 27513
Phone: 919-379-4100 Fax 919-379-4040

Courier
Airbill No.
Sampling Complete? Y or N

Client/Reporting Information	Project Information
Company Name: AGVIQ	Project Name: TO 21, Soil Vapor Intrusion
Address: 4610 Westgrove Ct.	Sampling Location: MCB Lejeune
City: VA Beach State: VA Zip: 23455	Turnaround time: STD
Project Contact: R. Riggs	Batch QC or Project Specific? If Specific, which Sample ID?
Phone #: 757-319-9420	Are aqueous samples field filtered for metals? Y or N
Sampler's Name: KR PB	Are high concentrations expected? Y or N? If yes, which ID(s)?

Requested Analysis (include method and bottle type): VOC 8260

Matrices: GW - Ground water; WW - Waste water; SW - Surface water; SO - Soil/Sediment; TB - Trip Blank; RI - Rinsate; WP - Wipe; O - Other

CompuChem No (Lab Use)	Field ID	Collection Date	Collection Time	Matrix	# of bottles	HCl	NaOH	HNO3	H2SO4	MEOH	Other	pH / Sample Info (Lab Use)
	IRS16-IS14-GW-14-15-0608	6/23/08	1120	GW	3	3						
	MST1613-IS11-18-19-0608	6/23/08	1549	GW	3	3						
	IRS16-EB060730	6/23/08	1135	GW	3	3						

Lab Use Only	
Sample Unpacked By:	Cyanide samples checked for sulfide & chlorine? Y or NA
Sample Order Entry By:	625 & Phenol samples checked for chlorine? Y or NA
Samples Received in Good Condition? Y or N	608 samples checked for pH between 5.0-9.0? Y or NA
If no, explain:	

Comments

Sample Custody

Relinquished by:	Date/Time: 6/23/08	Received by:	Date/Time:
Relinquished by:	Date/Time:	Received by:	Date/Time:
Subcontact? Y or N If yes, where?	Custody Seal(s) intact? Y or N	On Ice? Y or N	Cooler Temp: °C

Samples stored 60 days after date report mailed at no extra charge.

White & Yellow copy to lab • Pink copy for customer

6/23/08

AGVIQ

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

Chain of Custody Record

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

Client Contact	Project Manager: Keri Hallberg	Site Contact: Kristi Riggs	COC Record 1 of 1
Company Name CH2m HILL	Tel/Mobile: 704-975-9381	Lab Contact: LINDA / Carrier:	COC No: 00192
Address 4824 Parkway Plaza	Analysis Turnaround Time	Analysis (Attach list if more space is needed)	Lab Use Only:
City/State/Zip Charlotte, NC 28217	Calendar (C) or Work Days (W) _____		Custody Seals Intact? Y N NA
Phone 704-329-0073	TAT if different from Below 28 days		Number of Packages: _____
Project Name/Number: JVII T021 364167	☐ 2 weeks		Temperature: _____ deg C
Site: MCB Camp Lejeune	☐ 1 week		Shipper: __FedEx __UPS __Other:
P O #	☐ 2 days		Tracking Number:
Sampled by: BS/KR	☐ 1 day		Recorded by: _____ Date: _____

Sample Identification	Sample Date	Sample Time	Sample Type	Matrix	# of Cont.	Field Filtered Sample	8260											Sample Specific Notes:
IR86-TB062008	06/22/08	1500	Grab	TB	2		X											

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:
Timothy Atom	CH2m HILL	6/23/08 7:50		
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)

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:

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

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)
IR86-SG03-08C	10/6/08	1402	1407	-30	-4	19	L-5178	X									X		
IR88-SG09-08C	10/6/08	0927	0932	-30	-3	22	L-5140	X									X		
IR88-SG08-08C	10/6/08	1051	1056	-29	-4	112	SL-1216	X									X		
IR88-SG07-08C	10/6/08	1132	1136	-30	-4	67	L-5146	X									X		
IR88-SG05-08C	10/6/08	945	949	-29.5	-4	114	L5189	X									X		
IR88-SG05D-08C	10/6/08	945	950	-30	-4	39	SL-1231	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:

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 V4-E
Laboratory Data

TO - 21
Camp Lejeune - Air Station
Phase II Soil Gas Raw Results
October 2008

Station ID	IR86-SG01		IR86-SG02	IR86-SG03
Sample ID	IR86-SG01-08C	IR86-SG01D-08C	IR86-SG02-08C	IR86-SG03-08C
Sample Date	10/04/08	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
1,1,2,2-Tetrachloroethane	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
1,1,2-Trichloroethane	2 U	2 U	2 U	2 U
1,1-Dichloroethane	2 U	2 U	2 U	2 U
1,1-Dichloroethene	2 U	2 U	2 U	2 U
1,2,4-Trichlorobenzene	10 U	10 UJ	10 U	10 U
1,2-Dibromoethane	2 U	2 U	2 U	2 U
1,2-Dichlorobenzene	2 U	2 U	2 U	2 U
1,2-Dichloroethane	2 U	2 U	2 U	2 U
1,2-Dichloropropane	2 U	2 U	2 U	2 U
1,3-Dichlorobenzene	2 U	2 U	2 U	2 U
1,4-Dichlorobenzene	2 U	2 U	2 U	2 U
2-Butanone	3.1 J	10 U	10 U	3.2 J
2-Hexanone	5 U	5 U	5 U	5 U
4-Methyl-2-pentanone	5 U	5 U	5 U	5 U
Acetone	33 J	24 J	50 U	31 J
Benzene	2 U	2 U	2 U	2 U
Bromodichloromethane	2 U	2 U	2 U	2 U
Bromoform	2 U	2 U	2 U	2 U
Bromomethane	2 U	2 U	2 UJ	2 U
Carbon disulfide	5 U	5 U	5 U	5 U
Carbon tetrachloride	2 U	2 U	2 U	2 U
Chlorobenzene	2 U	2 U	2 U	2 U
Chloroethane	2 U	2 U	2 U	2 U
Chloroform	2 U	2 U	2 U	2 U
Chloromethane	5 U	5 U	5 U	5 U
Cyclohexane	5 U	5 U	5 U	5 U
Dibromochloromethane	2 U	2 U	2 U	2 U
Dichlorodifluoromethane (Freon-12)	2 U	2 U	1 J	0.72 J
Ethylbenzene	2 U	2 U	2 U	2 U
Isopropylbenzene	4 U	4 U	4 U	4 U
Methyl-tert-butyl ether (MTBE)	10 U	10 U	10 U	10 U
Methylene chloride	5 U	5 U	11	18 U
Styrene	2 U	2 U	2 U	2 U
Tetrachloroethene	2 U	2 U	3	2 U
Toluene	2 U	2 U	0.84 J	0.68 J
Trichloroethene	2 U	2 U	2 U	2 U
Trichlorofluoromethane(Freon-11)	0.34 J	0.26 J	3.3	3
Vinyl chloride	2 U	2 U	2 U	2 U
cis-1,2-Dichloroethene	2 U	2 U	2 U	2 U
cis-1,3-Dichloropropene	2 U	2 U	2 U	2 U
m- and p-Xylene	2 U	2 U	2 U	2 U
o-Xylene	2 U	2 U	2 U	2 U
trans-1,2-Dichloroethene	2 U	2 U	2 U	2 U
trans-1,3-Dichloropropene	2 U	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

UJ - Analyte not detected, quantitation limit may be inaccurate

TO - 21
Camp Lejeune - Air Station
Shallow Soil Gas Raw Results
June 2008

Station ID	IR86-IS12	IR86-IS13	USTAS4151-IS04
Sample ID	IR86-IS12-SV-05-06-08B	IR86-IS13-SV-05-06-08B	USTAS4151-IS04-SV-5-6-08B
Sample Date	06/23/08	06/23/08	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	10 U	14	5.5 J
2-Hexanone	5 U	0.95 J	5 U
4-Methyl-2-pentanone	5 U	3.1 J	5 U
Acetone	22 J	94	38 J
Benzene	2 U	2.5	2 U
Bromodichloromethane	2 U	2 U	2 U
Bromoform	2 U	2 U	2 U
Bromomethane	2 U	2 U	2 U
Carbon disulfide	0.84 J	3.4 J	0.54 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	1.7 J	2 J	5 U
Cyclohexane	5 U	3.7 J	5 U
Dibromochloromethane	2 U	2 U	2 U
Dichlorodifluoromethane (Freon-12)	2 U	2 U	2 U
Ethylbenzene	2 U	2.4	0.91 J
Isopropylbenzene	4 U	1.5 J	1.8 J
Methyl-tert-butyl ether (MTBE)	10 U	10 U	10 U
Methylene chloride	11	5 U	5 U
Styrene	2 U	2 U	2 U
Tetrachloroethene	1.4 J	2	1.7 J
Toluene	0.85 J	2.2	0.59 J
Trichloroethene	2 U	2 U	2 U
Trichlorofluoromethane(Freon-11)	0.97 J	0.41 J	0.43 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	1.6 J	4.9	3.3
o-Xylene	2 U	2 U	2 U
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

TO - 21
Camp Lejeune - Air Station
Deep Soil Gas Raw Results
June 2008

Station ID	IR86-IS01	IR86-IS02
Sample ID	IR86-IS01-SV-8-9-08B	IR86-IS02-SV-06-07-08B
Sample Date	06/22/08	06/22/08
Chemical Name		
Volatile Organic Compounds (ppbv)		
1,1,1-Trichloroethane	0.34 J	2 U
1,1,2,2-Tetrachloroethane	2 U	2 U
1,1,2-Trichloro-1,2,2-trifluoroethane(Freon-113)	0.84 J	0.65 J
1,1,2-Trichloroethane	2 U	2 U
1,1-Dichloroethane	0.55 J	2 U
1,1-Dichloroethene	0.88 J	2 U
1,2,4-Trichlorobenzene	10 U	10 U
1,2-Dibromoethane	2 U	2 U
1,2-Dichlorobenzene	2 U	2 U
1,2-Dichloroethane	2 U	2 U
1,2-Dichloropropane	2 U	2 U
1,3-Dichlorobenzene	2 U	2 U
1,4-Dichlorobenzene	2 U	2 U
2-Butanone	19	31
2-Hexanone	22	2.7 J
4-Methyl-2-pentanone	3.7 J	2.1 J
Acetone	130	160
Benzene	1.1 J	4.4
Bromodichloromethane	2 U	2 U
Bromoform	2 U	2 U
Bromomethane	2 U	2 U
Carbon disulfide	12	2.1 J
Carbon tetrachloride	2 U	2 U
Chlorobenzene	2 U	2 U
Chloroethane	2 U	2 U
Chloroform	2 U	0.88 J
Chloromethane	2.3 J	5 U
Cyclohexane	5 U	0.92 J
Dibromochloromethane	2 U	2 U
Dichlorodifluoromethane (Freon-12)	2 U	2 U
Ethylbenzene	9.8	2.4
Isopropylbenzene	3.1 J	4 U
Methyl-tert-butyl ether (MTBE)	10 U	10 U
Methylene chloride	6.2	9
Styrene	2 U	1.3 J
Tetrachloroethene	120	23
Toluene	30	9.8
Trichloroethene	22	0.45 J
Trichlorofluoromethane(Freon-11)	0.51 J	0.81 J
Vinyl chloride	1.1 J	2 U
cis-1,2-Dichloroethene	4.4	2 U
cis-1,3-Dichloropropene	2 U	2 U
m- and p-Xylene	45	7
o-Xylene	16	2.3
trans-1,2-Dichloroethene	2 U	2 U
trans-1,3-Dichloropropene	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

TO - 21
Camp Lejeune - Air Station
Groundwater Raw Analytical Results
June 2008

Station ID	IR86-IS05	IR86-IS06	IR86-IS07	IR86-IS08	IR86-IS09		IR86-IS10	IR86-IS11	IR86-IS12	IR86-IS13	IR86-IS14
Sample ID	IR86-IS05-GW-07-09-08B	IR86-IS06-GW-09-11-08B	IR86-IS07-GW-09-11-08B	IR86-IS08-GW-11-13-08B	IR86-IS09D-GW-10-12-08B	IR86-IS09-GW-10-12-08B	IR86-IS10-GW-10-12-08B	IR86-IS11-GW-10-12-08B	IR86-IS12-GW-13-14-08B	IR86-IS13-GW-08-09-08B	IR86-IS14-GW-14-15-08B
Sample Date	06/22/08	06/22/08	06/21/08	06/21/08	06/21/08	06/21/08	06/21/08	06/21/08	06/23/08	06/23/08	06/23/08
Chemical Name											
Volatile Organic Compounds (UG/L)											
1,1,1-Trichloroethane	1 U	1 U	5 U	1 U	1 U	1 U	5 U	5 U	1 U	1 U	1 U
1,1,2,2-Tetrachloroethane	1 U	1 U	5 U	1 U	1 U	1 U	5 U	5 U	1 U	1 U	1 U
1,1,2-Trichloro-1,2,2-trifluoroethane(Freon-113)	11	0.35 J	5 U	1 U	1 U	1 U	1.4 J	5 U	1 U	1 U	1 U
1,1,2-Trichloroethane	1 U	1 U	5 U	1 U	1 U	1 U	5 U	5 U	1 U	1 U	1 U
1,1-Dichloroethane	0.97 J	1 U	5 U	1 U	0.044 J	0.046 J	3.8 J	5 U	1 U	1 U	1 U
1,1-Dichloroethene	0.1 J	1 U	5 U	0.061 J	1 U	1 U	16	5 U	1 U	1 U	1 U
1,2,4-Trichlorobenzene	1 U	1 U	5 U	1 U	1 U	1 U	5 U	5 U	1 U	1 U	1 U
1,2-Dibromo-3-chloropropane	2 U	2 U	10 U	2 U	2 U	2 U	10 U	10 U	2 U	2 U	2 U
1,2-Dibromoethane	1 U	1 U	5 U	1 U	1 U	1 U	5 U	5 U	1 U	1 U	1 U
1,2-Dichlorobenzene	1 U	1 U	5 U	1 U	1 U	1 U	5 U	5 U	1 U	1 U	1 U
1,2-Dichloroethane	1 U	1 U	5 U	1 U	1 U	1 U	5 U	5 U	1 U	1 U	1 U
1,2-Dichloropropane	1 U	1 U	5 U	1 U	1 U	1 U	5 U	5 U	1 U	1 U	1 U
1,3-Dichlorobenzene	1 U	1 U	5 U	1 U	1 U	1 U	5 U	5 U	1 U	1 U	1 U
1,4-Dichlorobenzene	1 U	1 U	5 U	1 U	1 U	1 U	5 U	5 U	1 U	1 U	1 U
2-Butanone	5 U	5 U	25 U	5 U	5 U	5 U	25 U	25 U	5 U	5 U	5 U
2-Hexanone	5 U	5 U	25 U	5 U	5 U	5 U	25 U	25 U	5 U	5 U	5 U
4-Methyl-2-pentanone	5 U	5 U	25 U	5 U	5 U	5 U	25 U	25 U	5 U	5 U	5 U
Acetone	10 U	10 U	50 U	10 U	10 U	10 U	50 U	50 U	1.6 J	1.4 J	1.4 J
Benzene	29	1 U	29	0.051 J	0.26 J	0.27 J	1.7 J	5 U	1 U	1 U	1 U
Bromodichloromethane	1 U	1 U	5 U	1 U	1 U	1 U	5 U	5 U	1 U	1 U	1 U
Bromoform	1 U	1 U	5 U	1 U	1 U	1 U	5 U	5 U	1 U	1 U	1 U
Bromomethane	2 U	2 U	10 UJ	2 U	2 U	2 U	10 U	10 U	2 U	2 U	2 U
Carbon disulfide	2.5 J	1 UJ	5 U	55 J	2.6 J	0.37 J	1.1 J	5 UJ	0.18 J	1 U	0.55 J
Carbon tetrachloride	1 U	1 U	5 U	1 U	1 U	1 U	5 U	5 U	1 U	1 U	1 U
Chlorobenzene	1 U	1 U	5 U	1 U	1 U	1 U	5 U	5 U	1 U	1 U	1 U
Chloroethane	2 U	2 U	10 U	2 U	2 U	2 U	10 U	10 U	2 U	2 U	2 U
Chloroform	1 U	1 U	5 U	1 U	1 U	1 U	5 U	5 U	1 U	1 U	1 U
Chloromethane	2 U	2 U	10 U	2 U	2 U	2 U	10 U	10 U	2 U	2 U	2 U
Cyclohexane	1 U	1 U	5 U	1 U	1 U	1 U	0.6 J	5 U	1 U	1 U	1 U
Dibromochloromethane	1 U	1 U	5 U	1 U	1 U	1 U	5 U	5 U	1 U	1 U	1 U
Dichlorodifluoromethane (Freon-12)	2 U	2 U	10 U	2 U	2 U	2 U	10 U	10 U	2 U	2 U	2 U
Ethylbenzene	9.5	1 U	14	1 U	1 U	1 U	5 U	5 U	1 U	1 U	0.05 J
Isopropylbenzene	1.2	1 U	1.3 J	1 U	0.23 J	0.24 J	5 U	5 U	1 U	1 U	0.04 J
Methyl acetate	1 U	1 U	4.5 J	1 U	1 U	1 U	5 U	5.1 U	1 U	1 U	1 U
Methyl-tert-butyl ether (MTBE)	1 U	1 U	5 U	0.4 J	1 U	1 U	5 U	5 U	1 UJ	1 U	1 U
Methylcyclohexane	0.14 J	1 U	5 U	1 U	0.18 J	0.23 J	0.72 J	5 U	1 U	1 U	1 U
Methylene chloride	2 U	2 U	10 U	2 U	2 U	2 U	10 U	10 U	2 U	2 U	2 U
Styrene	1 U	1 U	5 U	1 U	1 U	1 U	5 U	5 U	1 U	1 U	1 U
Tetrachloroethene	1 U	0.11 J	5 U	1 U	1 U	1 U	5 U	5 U	1 U	1 U	1 U
Toluene	7.7	1 U	5 U	1 U	1 U	1 U	5 U	5 U	0.091 J	0.057 J	0.1 J
Trichloroethene	0.17 J	1 U	5 U	1.4	0.12 J	0.12 J	300	5 U	1 U	1 U	0.21 J
Trichlorofluoromethane(Freon-11)	2 U	2 U	10 U	2 U	2 U	2 U	10 U	10 U	2 U	2 U	2 U
Vinyl chloride	1 U	1 U	5 U	1 U	1 U	1 U	1.1 J	5 U	1 U	1 U	1 U
cis-1,2-Dichloroethene	0.7 J	0.059 J	0.58 J	2.5	0.21 J	0.25 J	140	0.19 J	1 U	1 U	0.068 J
cis-1,3-Dichloropropene	1 U	1 U	5 U	1 U	1 U	1 U	5 U	5 U	1 U	1 U	1 U
m- and p-Xylene	12	1 U	7.8 U	1 U	1 U	1 U	5 U	5 U	1 U	1 U	0.059 J
o-Xylene	8.3	1 U	3.1 J	1 U	1 U	1 U	5 U	5 U	1 U	1 U	0.058 J
trans-1,2-Dichloroethene	1 U	1 U	5 U	1 U	1 U	1 U	5.7	5 U	1 U	1 U	1 U
trans-1,3-Dichloropropene	1 U	1 U	5 U	1 U	1 U	1 U	5 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 - Air Station
Groundwater Raw Analytical Results
June 2008

Station ID **Sample ID** **Sample Date**	SWMU336-IS01 SWMU336-IS01-GW-14-16-08B 06/22/08	SWMU336-IS02 SWMU336-IS02-GW-12-14-08B 06/21/08	USTAS4151-IS04 USTAS4151-IS04-GW-12-13-08B 06/22/08	USTCSFF-IS03 USTCSFF-IS03-GW-08-09-08B 06/22/08
Chemical Name				
Volatile Organic Compounds (UG/L)				
1,1,1-Trichloroethane	1 U	1 U	5 U	1 U
1,1,2,2-Tetrachloroethane	1 U	1 U	5 U	1 U
1,1,2-Trichloro-1,2,2-trifluoroethane(Freon-113)	0.098 J	1 U	5 U	1 U
1,1,2-Trichloroethane	1 U	1 U	5 U	1 U
1,1-Dichloroethane	0.12 J	1 U	5 U	1 U
1,1-Dichloroethene	0.04 J	1 U	5 U	1 U
1,2,4-Trichlorobenzene	1 U	1 U	5 U	1 U
1,2-Dibromo-3-chloropropane	2 U	2 U	10 U	2 U
1,2-Dibromoethane	1 U	1 U	5 U	1 U
1,2-Dichlorobenzene	1 U	1 U	5 U	1 U
1,2-Dichloroethane	1 U	1 U	5 U	1 U
1,2-Dichloropropane	1 U	1 U	5 U	1 U
1,3-Dichlorobenzene	1 U	1 U	5 U	1 U
1,4-Dichlorobenzene	1 U	1 U	5 U	1 U
2-Butanone	5 U	5 U	25 U	5 U
2-Hexanone	5 U	5 U	25 U	5 U
4-Methyl-2-pentanone	5 U	5 U	25 U	5 U
Acetone	10 U	10 U	50 U	2.5 J
Benzene	1 U	1 U	5 U	0.03 J
Bromodichloromethane	1 U	1 U	5 U	1 U
Bromoform	1 U	1 U	5 U	1 U
Bromomethane	2 U	2 U	10 U	2 U
Carbon disulfide	0.26 J	0.14 J	5 U	1.1
Carbon tetrachloride	1 U	1 U	5 U	1 U
Chlorobenzene	1 U	1 U	5 U	1 U
Chloroethane	2 U	0.57 J	10 U	2 U
Chloroform	1 U	1 U	5 U	1 U
Chloromethane	2 U	2 U	10 U	2 U
Cyclohexane	1 U	1 U	5 U	1 U
Dibromochloromethane	1 U	1 U	5 U	1 U
Dichlorodifluoromethane (Freon-12)	2 U	2 U	10 U	2 U
Ethylbenzene	1 U	1 U	5 U	1 U
Isopropylbenzene	1 U	1 U	3.1 J	0.18 J
Methyl acetate	1 U	1 U	5 U	1 U
Methyl-tert-butyl ether (MTBE)	1 U	1 U	5 UJ	9.3 J
Methylcyclohexane	1 U	1 U	0.21 J	0.25 J
Methylene chloride	2 U	2 U	10 U	2 U
Styrene	1 U	1 U	5 U	1 U
Tetrachloroethene	3.4	1 U	5 U	1 U
Toluene	0.054 J	1 U	0.32 J	1 U
Trichloroethene	0.079 J	0.11 J	5 U	1 U
Trichlorofluoromethane(Freon-11)	2 U	2 U	10 U	2 U
Vinyl chloride	1 U	1 U	5 U	1 U
cis-1,2-Dichloroethene	1 U	0.11 J	5 U	1 U
cis-1,3-Dichloropropene	1 U	1 U	5 U	1 U
m- and p-Xylene	1 U	1 U	5 U	0.12 J
o-Xylene	1 U	1 U	5 U	1 U
trans-1,2-Dichloroethene	1 U	1 U	5 U	1 U
trans-1,3-Dichloropropene	1 U	1 U	5 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