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FINAL PHASE III VAPOR INTRUSION EVALUATION REPORT VOLUME 4 OF 5 MCB CAMP LEJEUNE NC

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CH2M HILL

Final

Phase III Vapor Intrusion Evaluation Report Volume 4 of 5—Marine Corps Air Station, New River

Marine Corps Base Camp Lejeune
Jacksonville, North Carolina

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Naval Facilities Engineering Command
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Contents

1 Introduction 1-1

2 Phase III Investigation Methods 2-1
2.1 Phase III Sample Locations 2-1

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 4-1
4.2.1 Site 86 4-2
Building AS502 4-2
Building AS541 4-4
4.2.2 SWMU 336 4-7
Building AS4106 4-7

5 Overall Conclusions and Recommendations 5-1

6 References 6-1

Tables

V4-1 Phase III Sampling Summary
V4-2 Summary of MCAS, New River Phase I Groundwater Analytical Results
V4-3 Summary of MCAS, New River Phase II Subslab Soil Gas Analytical Results
V4-4 Summary of Building AS502 Investigation Results
V4-5 Summary of Building AS541 Investigation Results
V4-6 Summary of Building AS4106 Investigation Results
V4-7 Summary of Recommendations

Figures

V4-1 Site 86/USTCSFF Phase III Sample Locations
V4-2 Site 86/SWMU336 Phase III Sample Locations
V4-3 Site 86/Buildings AS502-AS541 Vapor Intrusion Conceptual Site Model

Appendixes

V4-A Field Data Sheets
V4-B Data Quality Evaluation
V4-C Building Survey Forms
V4-D Chain-of-Custody Records
V4-E Laboratory Data

Acronyms and Abbreviations

3-D	three-dimensional
AF	attenuation factor
bgs	below ground surface
CamLej	Camp Lejeune
COC	chain-of-custody
COPC	constituent of potential concern
CSM	conceptual site model
DoD	Department of Defense
ft	feet
GW	groundwater
GWSL	Groundwater Screening Level
HVAC	heating, ventilation, and air conditioning
IR	Installation Restoration
ITRC	Interstate Technology & Regulatory Council
MCAS	Marine Corps Air Station
MCB	Marine Corps Base
MLE	multiple lines of evidence
MW	monitoring well
µg/L	micrograms per liter
PCE	tetrachloroethene
ppbv	parts per billion by volume
QA/QC	quality assurance/quality control
QC	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
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 Camp Lejeune (MCB CamLej), across the New River. MCAS, New River is located 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 four investigation areas evaluated as part of Phase III of the base-wide vapor intrusion (VI) evaluation that took place from January to April 2010. Phase III of the base-wide VI evaluation at MCB CamLej was performed in accordance with the *Final Phase III Vapor Intrusion Evaluation Work Plan* (CH2M HILL, 2010). The purposes of the vapor intrusion investigation to date are to (1) identify existing buildings where subsurface vapors, related to Navy releases, may be migrating to the indoor air, (2) assess the magnitude of indoor air concentrations potentially related to vapor intrusion and compare these with risk-based screening levels, and (3) summarize these results and the associated uncertainties for Navy risk managers, regulators and other stakeholders involved in site-management decision making.

Buildings of interest at MCAS, New River were selected for Phase III sampling according to the process detailed in the Work Plan. Additional data were collected at MCAS, New River during Phase III to assess: (1) temporal and spatial variability at two buildings where subslab soil gas and/or indoor air sampling was conducted during Phase I or II; and (2) top-of-the-water-table groundwater concentrations adjacent to one building where volatile organic compound (VOC) migration from an upgradient source may be a concern.

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

SECTION 2

Phase III Investigation Methods

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

The three Phase III MCAS, New River buildings of interest are located within two different environmental investigation sites: (1) Installation Restoration (IR) site (Site 86); and (2) Resource Conservation and Recovery Act (RCRA) site (solid waste management unit [SWMU] 336).

The following sampling activities were conducted at MCAS, New River during Phase III:

- A second round of subslab soil gas (Buildings AS502 and AS541) data was collected to assess temporal variability of VOC concentrations.
- Additional subslab soil gas probes were installed and soil gas samples collected at Buildings AS502 and AS541 to further characterize potential impacts and assess spatial variability of VOC concentrations.
- Subslab soil gas probes were installed and soil gas samples collected at Building AS4106 to further characterize VOC concentrations and assess the spatial variability associated with exterior soil vapor samples.
- One groundwater grab sample was collected near Building AS541 to further characterize VOC concentrations in groundwater hydraulically upgradient from the building.

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

2.1 Phase III Sample Locations

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

One groundwater grab (sample type—GW) and seven subslab soil gas (sample type—SG) samples were collected within MCAS, New River during the Phase III field event. Quality control (QC) samples were collected in accordance with Section 2.8 of the Field Sampling Plan, which is part of the Phase III Work Plan (CH2M HILL, 2010).

Table V4-1 lists the samples that were proposed in the Phase III Work Plan (CH2M HILL, 2010). As shown in Table V4-1 there were no Work Plan deviations during the Phase III field event.

TABLE V4-1
Phase III Sampling Summary
MCAS, New River, MCB CamLej, North Carolina

Site Name	Bldg	Sample Type	Sample ID	Sample Collected (Y/N)	Deviations
Site 86	AS502	SG	IR86-SG01-10A	Y	—
		SG	IR86-SG04-10A	Y	—
	AS541	GW	IR86-IS15-GW-10-11-10A	Y	—
		SG	IR86-SG02-10A	Y	—
		SG	IR86-SG03-10A	Y	—
		SG	IR86-SG05-10A	Y	—
SWMU 336	AS4106	SG	SWMU336-SG06-10A	Y	—
		SG	SWMU336-SG07-10A	Y	—

The sample ID naming convention for GW samples indicates the sample depth interval; the two-digit number following GW is the sample depth interval in feet (ft) below ground surface (bgs).

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 analytical soundness of the results: 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. Details of the data quality evaluation are presented in **Appendix V4-B**.

Data collected in support of the Phase III MCAS, New River sampling events were found to be of acceptable quality. One result was rejected due to quality assurance/quality control (QA/QC) deficiencies, and 99 percent of the data are available for use by the project team.

SECTION 4

Vapor Intrusion Evaluation Results and Conclusions

4.1 Analytical Data

Tables V4-2 and **V4-3** summarize the analytical results of the Phase III groundwater and subslab soil gas samples. **Tables V4-2 and V4-3** include only constituents that were detected in at least one sample of each sample type in the investigation area during that phase of investigation. The validated laboratory data tables are provided in **Appendix V4-E**. Sample locations are provided on **Figures V4-1 and V4-2**. **Tables V4-4 through V4-6** present a summary of constituents that exceeded the screening levels.

4.2 Building-Specific Data Evaluations and Conceptual Site Model Discussions

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

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

The building characteristics that affect vapor transport and VOC concentration include the pressurization of the building, indoor air volume, the rate of indoor-to-outdoor air exchange, and the integrity of the slab. Pressurization of the building is dependent on factors such as the air handling system and the construction and use of the building. The indoor air volume and indoor-to-outdoor air exchange rate affect how quickly VOCs in the building dissipate or are diluted. The location (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 completed during Phases I and II were updated during Phase III at buildings where interior samples were collected to gather additional information on characteristics relevant to VI. The Phase III building survey forms are presented in **Appendix V4-C**.

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.

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

4.2.1 Site 86

Site 86 is a heavily industrialized flight support area of MCB CamLej that has been in service since 1951. More information about the status of this site and additional details from previous site reports is presented in Section 2.2.3 of the *Vapor Intrusion Evaluation Work Plan* (CH2M HILL, 2008) and Section 4.2.1 of the Final VI Evaluation Report (CH2M HILL, 2009).

Building AS502

Building AS502 is classified as a large industrial building for this evaluation. Building AS502 is located within 100 ft of two monitoring wells that have historical (2002-2007) exceedances of the site-specific Groundwater Screening Levels (GWSLs) for large buildings.

Building AS502 is a one-story concrete block building approximately 150 ft long by 75 ft wide with a second-story loft on the west side that is used for storage. Since Phase II, the crash rescue center has moved out of the building and the fire station now occupies the entire structure. Vinyl tile flooring covers the concrete slab in the east side offices and sleeping quarters. Floor drains are present in the garage and restrooms and portable air conditioning units and fans are present in the garage.

Potential indoor sources of VOCs observed during the Phase III building survey included gasoline, Clorox® Bleach, floor cleaner, wax stripper, Refresh® Air Freshener, detergent, and Pledge®. Over 100 gallons of Angus Foam Liquid Concentrate containing diethylene glycol monobutyl ether and surfactants is stored in a storage shed on the exterior west side of the building. One gallon of the foam concentrate is mixed with 100 gallons of water in the fire truck water tanks, which are stored in the fire station garage. Pesticides are applied inside the building once a year in October or November.

A more detailed description of building characteristics from previous investigation phases is presented in the Final VI Evaluation Report (CH2M HILL, 2009) and additional details are listed in the Phase III building survey sheets presented in **Appendix V4-C**.

Analytical Results. Phase III sample locations and exceedances of risk-based screening levels are presented on **Figure V4-1. Figure V4-3** shows historical (2002-2007) groundwater well locations and exceedances; Phase I groundwater sample locations and exceedances; Phase II subslab soil gas sample locations and exceedances; and Phase III subslab soil gas sample locations and exceedances. Data from samples collected during previous phases at Building AS502 are presented in Volume 4 of the Final VI Evaluation Report (CH2M HILL, 2009). Phase II subslab soil gas and Phase III sample results and screening level exceedances are shown in **Table V4-4**.

TABLE V4-4
Summary of Building AS502 Investigation Results
MCAS, New River, MCB CamLej, North Carolina

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	-	-	-

Building AS502 Phase III Subslab Soil Gas Screening Level Exceedances

Sample ID	PCE (ppbv)	TCE (ppbv)	VC (ppbv)
SGSL (based on industrial air RSL;AF=1E-01)	*3.07*	*11.4*	*10.9*
Base-Specific SGSL (AF=1E-03)	*307*	*1,140*	*1,090*
IR86-SG01-10A	-	-	-
IR86-SG04-10A	-	-	-

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

Refined CSM. A three-dimensional (3-D) CSM is provided as **Figure V4-3**. The Phase I, II, and III sample locations and results for VOCs with previous or current screening level exceedances for Building AS502 are shown in this figure.

Two temporary groundwater wells were installed and sampled during Phase I. TCE was detected at a concentration 20 times above the generic GWSL in one of the two samples.

One subslab soil gas probe was installed and sampled inside Building AS502 during Phase II. There were no constituents detected above the generic SGSLs. According to the Final VI Evaluation Report (CH2M HILL, 2009), significant VI impacts were not expected based on the Phase I and II data, but an additional round of subslab soil gas sampling was recommended during Phase III to address temporal variability and to assess the validity of the Phase I/II conclusions. Although top-of-the-water-table sampling was recommended in the report, it was not proposed for Phase III because the VOC concentrations did not exceed generic SGSLs during Phase II.

A probe was installed in the central portion of the building during Phase II to capture an overall representation of the subslab. Since VOCs detected in the central portion of the building did not exceed screening levels, a probe was installed during Phase III closer to the southwest corner of the building, where the greatest potential TCE impacts would likely be observed based on the groundwater results.

The newly installed probe in the southwest corner of the building (IR86-SG04) and the probe installed during Phase II (IR86-SG01) were sampled during Phase III. Neither Phase III subslab sample contained PCE, TCE, or VC above the generic SGSLs.

None of the subslab soil gas samples collected during Phases II and III contained VOC concentrations above the generic SGSLs. The overall range of observed temporal variability in VOC concentrations was within the expected range of one to two orders of magnitude (Folkes et al., 2009; McHugh, 2007). The Phase III VOC concentrations between IR86-SG01 and the newly installed point, IR86-SG04, varied by less than one order of magnitude, suggesting minimal spatial variability.

Conclusions. The following lines of evidence suggest that the VI pathway is not significant at Building AS502:

- Subslab soil gas concentrations from the probe installed in the western portion of the building were below generic SGSLs, providing relatively strong evidence that the observed groundwater concentrations near the southwest corner of Building AS502 are not a significant source of TCE in subslab soil gas.
- VOC concentrations were not detected in subslab soil gas above generic SGSLs during two sampling events.
- The observed temporal and spatial variability do not affect the conceptual site model or conclusions for Building AS502.
- The west side of Building AS502 houses the firefighting vehicles and contains large bay doors that enhance outdoor air exchange.

Recommended Further Actions.

1. Further investigation of the VI pathway is not recommended for Building AS502 because the MLE evaluation suggest that the VI pathway is not significant.

Building AS541

Building AS541 is used as office space and storage building for materials/gear and is classified as a large industrial building for this evaluation. Building AS541 is a two-story concrete block building approximately 320 ft long by 180 ft wide. 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 that is used for office space. There is also a small second level of office space in the southwest section of the building.

A building survey was not performed during the Phase III investigation as building use and characteristics have not changed since the Phase II investigation. A more detailed description of building characteristics from previous investigation phases is presented in the Final VI Evaluation Report (CH2M HILL, 2009).

Analytical Results. Phase III sample locations and exceedances of risk-based screening levels are presented on **Figure V4-1**. Historical (2002-2007) groundwater sampling locations and exceedances; Phase I groundwater sample locations and exceedances; Phase II subslab soil gas sample locations and exceedances; and Phase III subslab soil gas sample locations and exceedances are shown on **Figure V4-3**. Data from samples collected during previous phases at Building AS541 are presented in Volume 4 of the Final VI Evaluation Report (CH2M HILL, 2009). Phase II subslab soil gas and Phase III sample results and screening level exceedances are shown in **Table V4-5**.

TABLE V4-5
Summary of Building AS541 Investigation Results
MCAS, New River, MCB CamLej, North Carolina

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	-	-	-

Building AS541 Phase III Groundwater Screening Level Exceedances

Sample ID	TCE (µg/L)	VC (µg/L)	Benzene (µg/L)
GWSL (based on industrial air RSL)	*16.6*	*2.51*	*7.53*
IR86-IS15-GW-10-11-10A	-	-	-

Building AS541 Phase III Subslab Soil Gas Screening Level Exceedances

Sample ID	TCE (ppbv)	VC (ppbv)	Benzene (ppbv)	PCE (ppbv)
SGSL (based on industrial air RSL; AF=1E-01)	*11.4*	*10.9*	*4.91*	*3.07*
Base-Specific SGSL (AF=1E-03)	*1,140*	*1,090*	*491*	*307*
IR86-SG02-10A	-	-	-	3.5
IR86-SG03-10A	-	-	-	-
IR86-SG05-10A	-	-	-	-

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

Refined CSM. A 3-D CSM is provided as **Figure V4-3**. The Phase I, II, and III sample locations and results for VOCs with previous or current screening level exceedances for Building AS541 are shown in this figure.

Three temporary groundwater wells were installed and sampled during Phase I. TCE was detected at concentrations above the generic GWSL.

Two subslab soil gas probes were installed and sampled inside Building AS541 during Phase II. No constituents were detected at concentrations above the generic SGSLs. According to the Final VI Evaluation Report (CH2M HILL, 2009), significant VI impacts were not expected based on the Phase I and II data, but an additional round of subslab soil gas sampling was recommended during Phase III to address temporal variability and to assess the validity of Phase I/II conclusions. It was also recommended that top-of-the-water-table groundwater concentrations be monitored for downgradient migration given the TCE concentration detected at SWMU318-GW-10, which is located upgradient of Building AS541.

Two subslab soil gas samples were collected from the existing probes (IR86-SG02 and IR86-SG03) to assess temporal variability during Phase III. One new subslab soil gas probe (IR86-SG05) was installed and sampled in the southwest corner of the building to target the area of the building closest to SWMU318-GW10 where subslab concentrations could be higher and to further assess spatial variability beneath Building AS541. A top-of-the-water-table grab groundwater sample was also collected to further characterize groundwater concentrations on the western side of the building (IR86-IS15). This Phase III grab groundwater sample was located between SWMU318-GW10 and Building AS541 and did not contain VOCs at concentrations above their corresponding generic GWSLs.

None of the VOCs detected in historical or Phase I groundwater samples, including PCE, TCE, and benzene, were detected in the Phase II samples at concentrations above generic SGSLs. PCE was detected at IR86-SG02 during Phase II at a concentration of 3 ppbv, which is slightly below the SGSL. PCE was detected in IR86-SG02 during Phase III at a concentration (3.5 ppbv) slightly above the generic SGSL; however, the detection was well below the base-specific SGSL and PCE was not detected above the SGSL in the other two subslab soil gas samples. In addition, PCE was detected at 0.81 ppbv in the duplicate sample collected at that same location, indicating the actual PCE concentration is uncertain.

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

The Phase III VOC concentrations between the two existing subslab soil gas points and the newly installed point, IR86-SG05, varied by less than one order of magnitude, suggesting minimal spatial variability.

Conclusions. The following lines of evidence indicate that the VI pathway is not significant at Building AS541:

- Subslab soil gas concentrations were below their generic SGSLs from the probe installed in the western portion of the building, closest to the most elevated historical groundwater concentration, providing relatively strong evidence that the observed groundwater concentrations are not a significant source of VOCs in subslab soil gas.
- The groundwater grab sample results, collected from the top of the water table and adjacent to the building, did not exceed the generic GWSLs.
- VOC concentrations in subslab soil gas did not exceed the base-specific SGSL during two sampling events.
- PCE was the only COPC detected above the generic SGSL and was detected in only one subslab soil gas sample at a concentration barely exceeding the screening level, and the concentration detected in the duplicate sample at that location did not exceed the generic SGSL.
- The observed temporal and spatial variability do not affect the conceptual site model or conclusions for Building AS541.

- Building AS541 is a warehouse building with a large indoor air volume that likely results in significant indoor-to-outdoor air exchange, mixing, and attenuation of indoor air concentrations.

Recommended Further Actions.

1. Further investigation of the VI pathway is not recommended for Building AS541 because the MLE evaluation indicates that the VI pathway is not significant at the building.

4.2.2 SWMU 336

SWMU 336 is the site of a former paint-stripping vat within Building AS4106. SWMU 336 is a heavily industrialized flight support area of MCB CamLej that has been in service since 1951. More information about the status of this site and additional details from previous site reports are presented in Section 4.3.1 of the VI Evaluation Work Plan (CH2M HILL, 2008), Section 2.3.2 of the Phase III Work Plan (CH2M HILL, 2010), and Section 4.2.2 of the Final VI Evaluation Report (CH2M HILL, 2009).

Building AS4106

Building AS4106 is located within SWMU 336. One-half of the building is used as a maintenance facility, and the other half is used as classrooms and offices. It is classified as a large industrial building and is approximately 250 ft long by 420 ft wide. Building AS4106 is a concrete block building with some walls constructed of metal sheeting. One-half on the building is one story, the other half contains two stories with the upper level used as office space.

The ceiling height within the building is 30 ft and the slab is elevated 1 ft above grade. There is no heating/cooling system within the workshops and hangars, though a heating, ventilation, and air conditioning (HVAC) system will be included in the newly constructed office spaces on the second floor.

Potential indoor sources of VOCs observed during the Phase III building survey included paints and solvents used during helicopter parts cleaning and refurbishment.

A more detailed list of building characteristics from previous investigation phases is presented in the Final VI Evaluation Report (CH2M HILL, 2009) and additional details are listed in the Phase III building survey sheets presented in **Appendix V4-C**.

Analytical Results. Phase III sample locations are presented on **Figure V4-2**. Data from samples collected during previous phases at Building AS4106 are presented in Volume 4 of the Final VI Evaluation Report Evaluation Report (CH2M HILL, 2009). Phase III sample results and the screening level exceedances are provided in **Table V4-6**.

TABLE V4-6
Summary of Building AS4106 Investigation Results
MCAS, New River, MCB CamLej, North Carolina

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	-

Building AS4106 Phase III Subslab Soil Gas Screening Level Exceedances

Sample ID	PCE (ppbv)
SGSL (based on industrial air RSL; AF=1E-01)	*3.07*
Base-Specific SGSL (AF=1E-03)	*307*
SWMU336-SG06-10A	-
SWMU336-SG07-10A	6

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

Refined CSM. Two temporary groundwater wells and two exterior deep soil gas points were installed and sampled near Building AS4106 during Phase I. PCE was detected at a concentration 1.2 times above the generic GWSL in one of the two groundwater samples and 4 times above the generic deep SGSL in the corresponding soil gas sample. Additional subslab soil gas sampling was not deemed a priority for the Phase II sampling event because the generic SGSL exceedance was observed in deep soil vapor. According to the Final VI Evaluation Report (CH2M HILL, 2009), significant VI impacts were not expected based on the Phase I data, but subslab soil gas sampling was recommended during Phase III to further characterize potential impacts and address the spatial 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.

Two subslab soil gas samples were installed and soil gas samples collected in the northern portion of Building AS4106 during Phase III. PCE was detected at a concentration approximately 2 times the generic SGSL at SWMU336-SG07 but was not detected in exceedance of the generic SGSL at SWMU336-SG06.

Subslab soil gas PCE concentrations measured during Phase III at Building AS4106 varied spatially by less than 3 times, which is within the typical range expected at large industrial buildings. The spatial distribution of PCE in subslab soil gas correlates to the Phase I groundwater and exterior deep soil vapor results observed on the northwest side of the building.

Conclusions. The following lines of evidence indicate that the VI pathway is not significant at Building AS4106:

- PCE concentrations were not detected in subslab soil gas above the base-specific SGSL during Phase III.
- The PCE concentration in SWMU336-SG07-10A exceeded the generic SGSL by only a factor of 2.
- The observed spatial variability does not affect the conceptual site model or conclusions for Building AS4106.
- Building AS4106 is a large building, with high ceilings, containing several bay doors that remain open during working hours, likely resulting in significant indoor-to-outdoor air exchange, mixing, and attenuation of indoor air concentrations.

Recommended Further Actions.

1. Although the MLE evaluation suggests that the VI pathway at Building AS4106 is unlikely to be significant, the conclusions are based on only one round of subslab soil gas sampling. Therefore, an additional round of subslab soil gas sample data should be collected at Building AS4106 during the 5-year review to evaluate temporal variability within subslab soil gas.

SECTION 5

Overall Conclusions and Recommendations

The purpose of this section is to summarize the overall conclusions and recommendations from the VI evaluation for MCAS, New River that was performed as part of the Phase III base-wide VI evaluation of four investigation areas. Groundwater and subslab soil gas samples were collected within or near three buildings of interest to evaluate the potential for significant VI impacts. Consistent with the DoD Tri-Services (2009) and Interstate Technology & Regulatory Council (ITRC) Vapor Intrusion Guidance documents (2007), MLE were used in Section 4 to evaluate potential VI impacts at each of the three buildings. Conclusions and recommended further actions were based on the MLE evaluation and the refined CSMs. The recommended further actions for the buildings investigated at MCAS, New River during Phase III are summarized in Table V4-7.

TABLE V4-7
Summary of Phase III Recommendations
MCAS, New River, MCB CamLej, North Carolina

Bldg #	No Further Investigation	Additional Round of Subslab Sampling
AS502	X	
AS541	X	
AS4106		X

Overall, the subslab data collected to date, along with the additional supporting lines of evidence, indicate that VI is not likely to result in unacceptable indoor air risks for the MCAS, New River buildings investigated during Phase III. Additionally, the data collected to date indicate that temporal variability between the sampling events is small at the Air Station buildings investigated. However, as discussed in the DoD Tri-Services (2009) and ITRC VI guidance documents (2007) and at multiple Unites States Environmental Protection Agency (USEPA) and other VI conferences (e.g., http://iavi.rti.org/WorkshopsAndConferences.cfm), temporal and spatial variability are important factors to consider during VI investigations. Therefore, the CSM and conclusions should be confirmed during the 5-year review at Building AS4106, where only one round of subslab soil gas data has been collected.

No further action is recommended for Buildings AS502 and AS541 because two rounds of subslab soil gas data have been collected and neither building contained samples with concentrations exceeding the base-specific SGSLs.

SECTION 6

References

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

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

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

DoD Tri-Services. 2009.

Folkes et al., 2009.

McHugh. 2007.

ITRC. 2007.

Tables

TABLE V4-2

Summary of MCAS, New River Phase IIII Groundwater Analytical Results

Phase III Vapor Intrusion Evaluation Report

MCAS, New River, MCB CamLej, North Carolina

Station ID	**Industrial Generic Groundwater Screening Level (AF = 0.001)**	IR86-IS15
Sample ID		IR86-IS15-GW-10-11-10A
Sample Date		02/10/10
Chemical Name		
Volatile Organic Compounds (UG/L)		
1,1-Dichloroethane	34.6	0.14 J
1,1-Dichloroethene	84.6	0.58
Benzene	7.53	0.27 J
Carbon disulfide	538	0.11 J
cis-1,2-Dichloroethene	--	3
Cyclohexane	431	0.79 J
Methylcyclohexane	624	5.1
Tetrachloroethene	3.01	0.11 J
Trichloroethene	16.6	1.5
Xylene, total	231	0.36 J

Notes:

NA - Not analyzed

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

U - The material was analyzed for, but not detected

UG/L - Micrograms per liter

[1] - Generic Groundwater Screening Levels were generated from May 2010 Adjusted RSLs. RSLs were adjusted for noncarcinogens to account for exposure to multiple constituents. Values were rounded to 3 significant figures.

TABLE V4-3

Summary of MCAS, New River Phase III Subslab Soil Gas Analytical Results

Phase III Vapor Intrusion Evaluation Report

MCAS New River, MCB CamLej, North Carolina

Station ID	**Generic Subslab Soil Gas Screening Level - Industrial[1] (AF=0.1) (ppbv)**	**Base-Specific Subslab Soil Gas Screening Level - Industrial[1] (AF=0.001) (ppbv)**	IR86-SG01		IR86-SG02		IR86-SG03	IR86-SG04	IR86-SG05	SWMU336-SG06	SWMU336-SG07
Sample ID			IR86-SG01-10A	IR86-SG01D-10A	IR86-SG02-10A	IR86-SG02D-10A	IR86-SG03-10A	IR86-SG04-10A	IR86-SG05-10A	SWMU336-SG06-10A	SWMU336-SG07-10A
Sample Date			02/14/10	02/14/10	02/12/10	02/12/10	02/12/10	02/14/10	02/12/10	02/12/10	02/12/10
Chemical Name											
Volatile Organic Compounds (ppbv)											
1,1,1-Trichloroethane	4,010	401,000	0.44 U	0.43 U	0.42 U	0.41 U	0.41 U	0.45 U	0.17 J	0.47 U	0.2 J
1,1,2-Trichloro-1,2,2-trifluoroethane(Freon-113)	17,100	1,710,000	0.09 J	0.1 J	0.16 J	0.14 J	0.29 U	0.07 J	3.5	0.79	1.3
1,2,4-Trichlorobenzene	1.18	118	0.07 J	0.32 U	0.31 U	0.3 U	0.3 U	0.33 U	0.31 U	0.35 U	0.31 U
1,4-Dichlorobenzene	1.85	185	0.05 J	0.39 U	0.38 U	0.37 U	0.37 U	0.41 U	0.38 U	0.43 U	0.38 U
2-Butanone	7,430	743,000	1.4 J	1.6 J	0.99 J	2.6	0.59 J	2.3	2.6	7.3	3.1
2-Hexanone	32.0	3,200	0.25 J	0.2 J	0.14 J	0.4 J	0.12 J	0.35 J	0.41 J	0.32 J	0.36 J
4-Methyl-2-pentanone	3,200	320,000	0.59 U	0.58 U	0.56 U	0.55 U	0.55 U	0.11 J	0.13 J	0.1 J	0.12 J
Acetone	56,800	5,680,000	10 J	3.8 J	6.1 J	11	5.5 J	9.5 J	19	400	36
Benzene	4.91	491	0.24 J	0.14 J	0.71 U	0.7 U	0.29 J	0.77 U	0.21 J	0.29 J	0.71 U
Carbon disulfide	986	98,600	1.5 UJ	1.7 J	0.33 J	0.23 J	1.4 U	1.6 U	2.2	2.2	0.26 J
Carbon tetrachloride	3.24	324	0.09 J	0.09 J	0.05 J	0.36 U	0.36 U	0.06 J	0.37 U	0.12 J	0.06 J
Chloroethane	16,600	1,660,000	0.91 U	0.9 U	0.34 J	0.85 U	0.85 U	0.93 U	0.45 J	0.36 J	0.86 U
Chloroform	1.09	109	0.49 U	0.48 U	0.08 J	0.46 U	0.46 U	0.5 U	0.1 J	0.48 J	0.47 U
Chloromethane	191	19,100	1.2 U	1.1 U	0.59 J	1.1 U	1.1 U	1.2 U	1.1 U	0.94 J	1.1 U
Cyclohexane	7,640	764,000	1.4 U	1.4 U	1.3 U	1.3 U	1.3 U	1.4 U	1.3 U	0.76 J	0.27 J
Dichlorodifluoromethane (Freon-12)	177	17,700	0.7	0.66	0.64	0.63	0.77	0.52	6.7	0.51 J	0.51
Ethylbenzene	11.3	1,130	0.19 J	0.07 J	0.52 U	0.52 U	0.52 U	0.56 U	0.23 J	0.19 J	0.05 J
m- and p-Xylene	101	10,100	0.73 J	0.22 J	0.14 J	1 U	1 U	0.15 J	0.47 J	0.53 J	0.24 J
Methylene chloride	75.1	7,510	0.69 U	0.68 U	0.1 J	0.64 U	0.65 U	0.71 U	0.67 U	0.62 J	1.1
o-Xylene	707	70,700	0.33 J	0.07 J	0.52 U	0.52 U	0.52 U	0.56 U	0.16 J	0.18 J	0.14 J
Styrene	1,030	103,000	0.56 U	0.56 U	0.13 J	0.53 U	0.53 U	0.58 U	0.54 U	0.61 U	0.53 U
Tetrachloroethene	3.07	307	2.1 J	0.35 U	3.5	0.81	2.5	1.3	2.5	2.3	6
Toluene	5,810	581,000	0.64	0.35 J	0.21 J	0.17 J	0.16 J	0.18 J	2.6	2.6	0.21 J
Trichloroethene	11.4	1,140	0.45 U	0.44 U	0.42 U	0.42 U	0.42 U	0.46 U	1.6	0.48 U	0.42 U
Trichlorofluoromethane(Freon-11)	546	54,600	0.33 J	0.31 J	1.2	1.2	1.3	0.32 J	1.6	0.27 J	0.23 J

Notes:

NA - Not analyzed

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

U - The material was analyzed for, but not detected

UJ - Analyte not detected, quantitation limit may be inaccurate

ppbv - Parts per billion volume

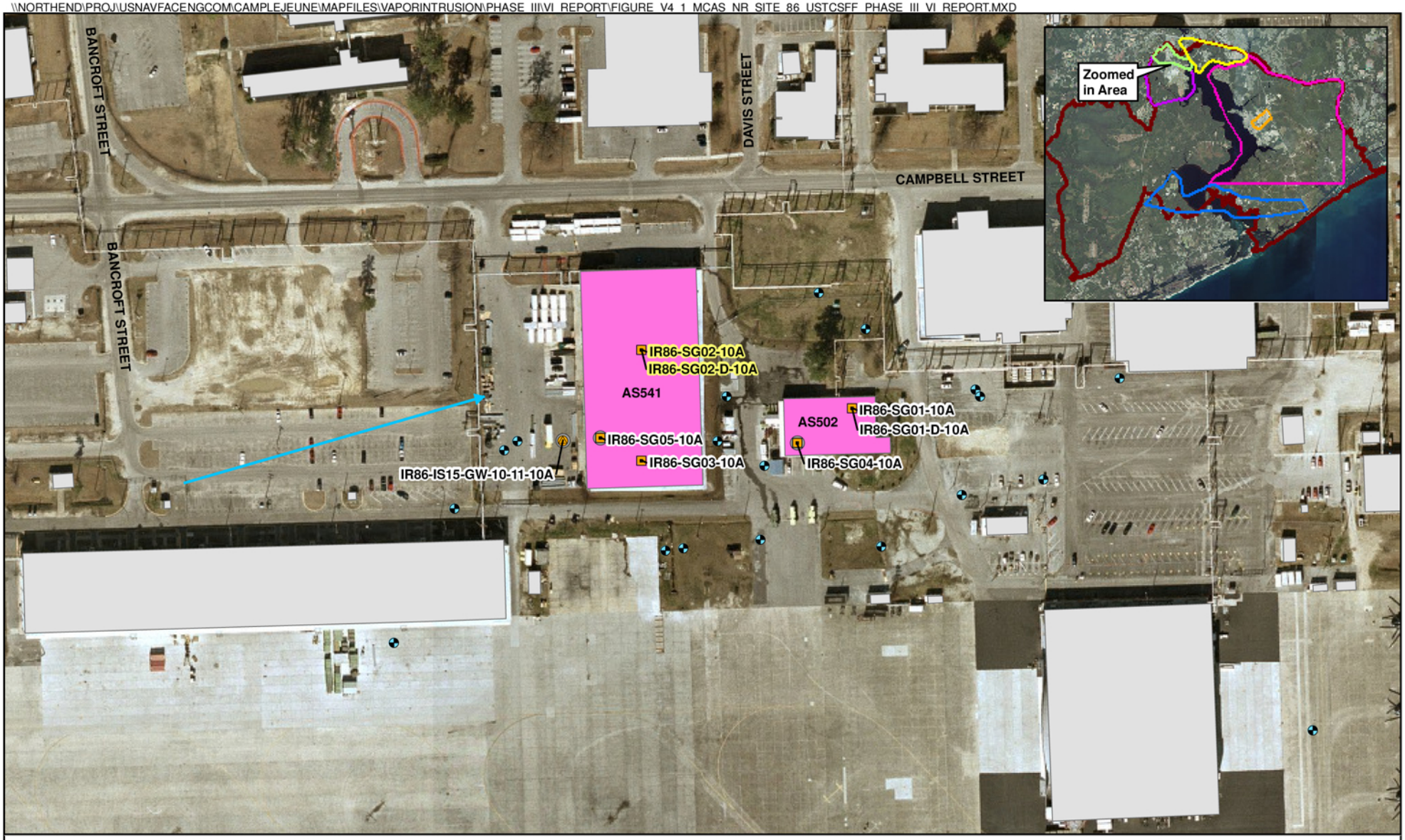
Grey Shading indicates detected results that exceed the Industrial Shallow Soil Gas Screening Levels

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

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

Figures

\\NORTHEND\PROJ\USNAVFACENGCOM\CAMPLEJEUNE\MAPFILES\VAPORINTRUSION\PHASE_III\VI_REPORT\FIGURE_V4_1_MCAS_NR_SITE_86_USTCSFF_PHASE_III_VI_REPORT.MXD



Legend

- Groundwater Grab Sample Location
- Soil Gas Sample Location
- Monitoring Well with Exceedance(s)
- Proposed Sample Locations
- Shallow Groundwater Flow
- Buildings of Interest
- MCAS, New River
- Installation Boundary

Sample with one or more constituents exceeding generic screening levels

N

0 100 200 400 Feet

1 inch = 200 feet

Figure V4-1
MCAS, New River Site 86/USTCSFF Phase III Sample Locations and Exceedances of Risk-Based Screening Levels
Phase III Vapor Intrusion Report
MCB CamLej
North Carolina

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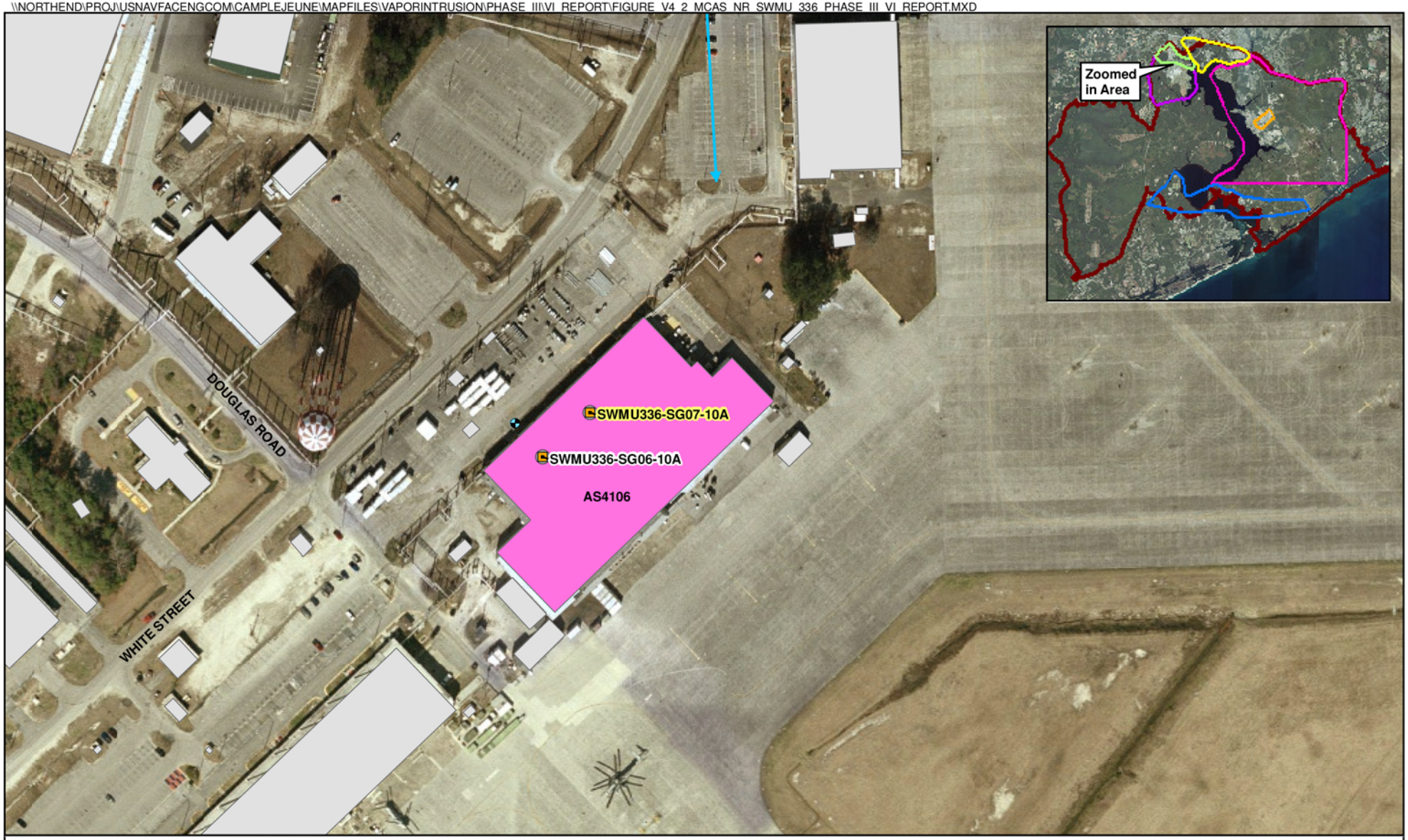
\\NORTHEND\PROJ\USNAVFACENGCOM\CAMPLEJEUNE\MAPFILES\VAPORINTRUSION\PHASE_III\VI_REPORT\FIGURE_V4_2_MCAS_NR_SWMU_336_PHASE_III_VI_REPORT.MXD



Legend

- Soil Gas Sample Location
- Monitoring Well with Exceedance(s)
- Proposed Sample Locations
- Shallow Groundwater Flow
- Buildings of Interest
- Installation Boundary
- MCAS, New River

Sample with one or more constituents exceeding generic screening levels

N

0 100 200 400 Feet

1 inch = 200 feet

Figure V4-2
MCAS, New River SWMU 336 Phase III Sample Locations and Exceedances of Risk-Based Screening Levels
Phase III Vapor Intrusion Report
MCB CamLej
North Carolina

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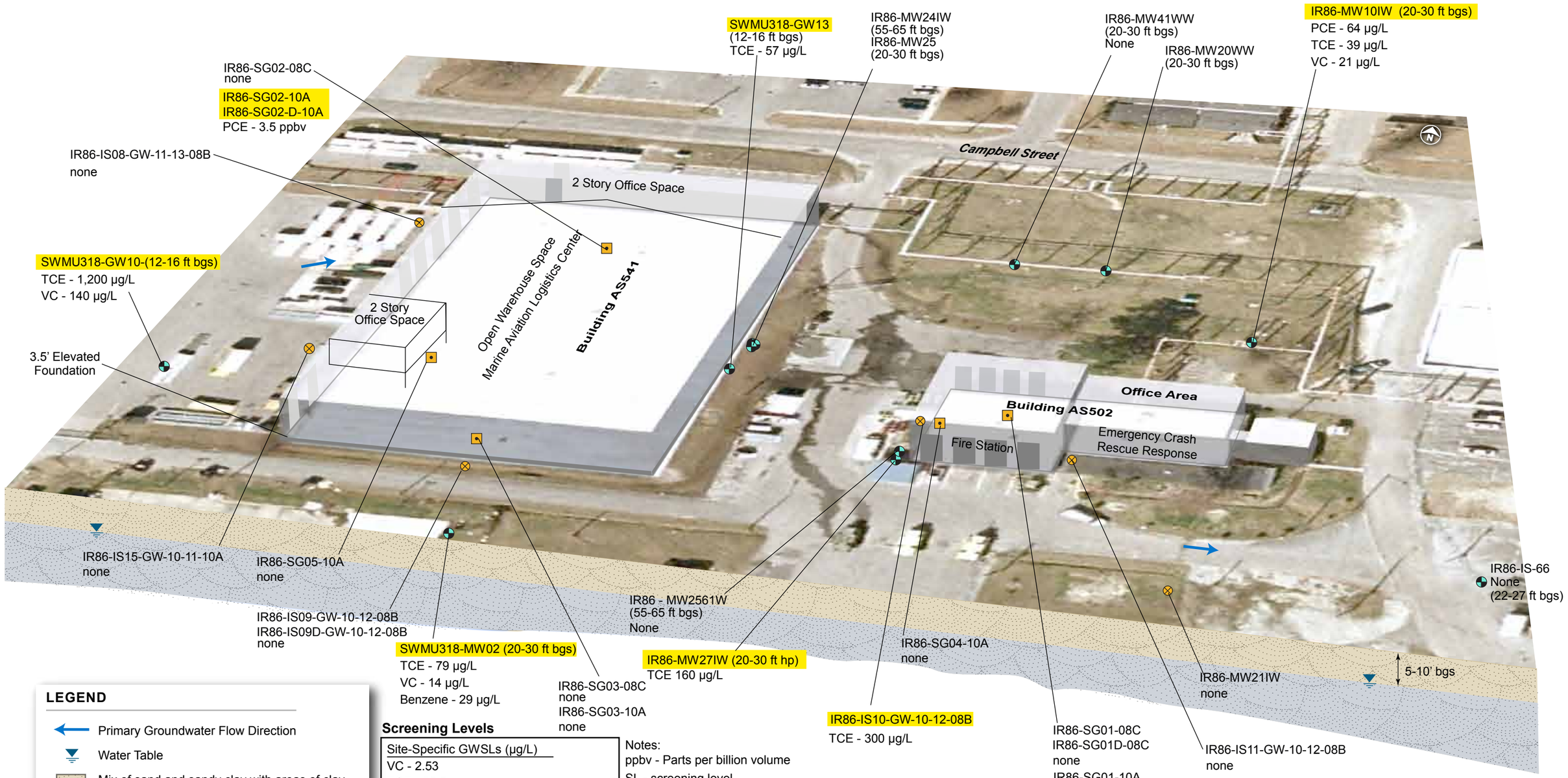

LEGEND

- Primary Groundwater Flow Direction
- Water Table
- Mix of sand and sandy clay with areas of clay
- Groundwater Sample Location
- Soil Gas Sample Location
- Shallow Monitoring Well (Sampled between 2002 and 2007)
- Sample with one or more constituents exceeding
- Sample with one or more constituents exceeding Base-specific SGSLs

Screening Levels

Site-Specific GWSLs (µg/L)
VC - 2.53
TCE - 35.5
PCE - 7.19
Benzene - 9.96

Generic GWSLs (µg/L)
VC - 2.52
TCE - 16.56
PCE - 3.04
Benzene - 7.67

Phase III Generic Shallow SGSLs (ppbv)
PCE - 3.07

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

Figure V4-3
Site 86
MCAS New River Buildings AS541 and AS502
Vapor Intrusion Conceptual Site Model
Phase III Vapor Intrusion Report
MCB CamLej
North Carolina

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ES040710032706KNV NewRiver_As_BldgAS541-As542_VaporIntrusionCSM_v8_8/2/10_lk

Appendix V4-A
Field Data Sheets

392664.F1.FS.01

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PROJECT NUMBER	BORING NUMBER
~~358454.AR.F1~~	FRS6-IS15-GW SHEET 1 OF 1

SOIL BORING LOG

PROJECT : ~~MCAS Cherry Point OU1 VI Evaluation~~ Phase III VI Map 2 LOCATION : AS 541

ELEVATION : DRILLING CONTRACTOR Probe Technology Inc.

DRILLING METHOD AND EQUIPMENT USE: Geoprobe Macro-Core® Sampler with polyvinyl chloride (PVC), or polyethylene terephalate glycol (PETG) line

WATER LEVELS : START : 7/10/10 END : LOGGER : Mecome

DEPTH BELOW SURFACE (FT)	SAMPLE INTERVAL	SAMPLE NUMBER AND TYPE	SAMPLE RECOVERY (FT)	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 Headspace
	0			N/A	0-1 silty sand (SM) with gravel (SM), light yellowish-brown (10YR 6/4) dry, soft. qtz, poorly sorted, any fossilony.	Øppm @ hole & breathing area
5	5				1-3 SAND (SP) V. dark grey (10YR 4/1) damp, soft, qtz, mod. sorted, fine to med grained, solony-solvent	MAX PID = Ø units (scan of soil)
		1 DPT	4'			
10	10				3-4' clayey SAND (SC) to sandy clay (CL) variegated yellowish-brown to v. dark greyish brown (10YR 5/4 to 10YR 3/2), damp, soft. some qtz w/ clay.	Øppm
					4-5 As Above.	MAX PID = Ø
					5-6' As Above sandy clay (CL)	Breathing zone = Ø ppm
					6-9.5' clayey SAND (SC) grey (10YR 6/1) moist, soft, qtz; v. poorly sorted.	
					9.5-10' SAND (SP) grey (10YR 5/1), wet, soft, qtz. well sorted, solony-solvent, med grained.	wet @ 9.5'
					10-11 same as 9.5-10	Sample interval 10-11'.
					TD = 11'	

CH2MHILL

PROJECT NUMBER	WELL NUMBER
392004.FI.FS.01 ~~358454.AR.FI~~	SHEET 1 OF 1

LOW FLOW SAMPLING LOG

Well Number: IR86-IS15-GW
Site: ~~MCAS Cherry Point OUT~~ AS 541
Field Crew: K. ~~Stokes/DFW~~: McCurt / Barclay
Date: 2/10/10

Well Depth (ft): 11
Purge Low Flow
Methodology: Peristaltic Pump
DTW (ft): ~9.5'
Water Column (ft):
Well Diameter (in):
Gal. Per ft:
Well volume (gal):
Depth of Screen (ft): 10-11'

Diameter	Gal. Per Foot	Diameter	Gal. Per Foot
1"	0.041	3"	0.367
2"	0.163	4"	0.653

Field Parameters

	Time	DTW (toc)	Flow Rate (ml/min)	Total Volume (gal)	pH (Std. Units)	Temp (C)	Cond. (mS/cm)	ORP (mV)	D.O. [Surface] (mg/L)	Turbidity (NTU)	Color/Odor
	Stabilization	<0.3'	300-500		0.2	1 C	3%	10 mV	10%	10%	
INT.	0930	10'	~300	initial	5.38	15.25	0.254	-23	0.96	off scale	brownish-gray
1 VOL.	0931	"	"	300	5.40	15.50	0.243	-23	0.58	"	"
2 VOL.	0932	"	"	600	5.41	15.66	0.241	-24	0.53	"	"
3 VOL.	0933			900	5.41	15.65	0.242	-25	0.56	970	"
4 VOL.	0934	"	"	1200	5.41	15.79	0.241	-26	0.65	830	"
5 VOL.	0935	"	"	1500	5.41	15.94	0.239	-27	0.80	730	"
6 VOL.					End Readings						
7 VOL.											
8 VOL.											
9 VOL.											
10 VOL.											
11 VOL.											
12 VOL.											
13 VOL.											
14 VOL.											
15 VOL.											
16 VOL.											
17 VOL.											
18 VOL.											
19 VOL.											
20 VOL.											

Remarks:
Collected sample in 3-40ml vials @ 0936 hrs; sample ID IR86-IS15-GW-10-11-10A,

Sampling

Depth to Water Before Sampling: ~10'
Depth sample was acquired: 10-11'
Sample Methodology: Low Flow
Sample Date/Time: 2/10/10
Signed Sampler: Ron McCurt
Filtered Metals Collected: Y / N
Filter Size:
Sample Observations: Turbid
Parameters: VOCs (8260B)

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

Project Info

Project Name: MCB Camp Lejeune Project # : 392664
By: KSlms Date: 2/14/10

Structure

Identification: Bldg AS502 (Fire House)
Address:
Slab Information:
☐ Concrete slab on grade (directly on top of soil) ☐ Other (describe)
☐ Concrete slab on gravel underlayment
Condition of slab
Type of Sub Slab Soil
Is water present in the soil

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

	Sample location (show in diagram)	1	2	3	4
	Sample Identification (field ID)	IR86-SG04-10A	IR86-SG01-10A	IR86-SG01D-10A	
Probe Installation	Depth of slab (inches)	8"	EXISTING		
	Depth of hole drilled (inches below slab surface)	10"			
	Depth of installed probe (inches below slab surface)	6"			
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)	1155	1223		
	Purge vacuum, " Hg	-10 *	-10 *		
	Purge completed (time of day)	1200	1227		
Helium Leak Check (optional)	Leak check (Helium) - %	0 ppm	125 ppm		
Field Analysis (optional)	Gem 2000 (O2 / CO2 / CH4) - %	N/A	N/A		
	PID - ppmv	11.0 ppm	10.9 ppm		
Canister Sampling	Canister & flow controller ID (if used)	1SC00643/ OA00712	1SC00008/ OA01119	1SC00586/ OA00049	
	Initial Canister Pressure (" Hg)	-28.5	-29.5	-29	
	Sampling rate, cc/min				
	Sampling period started (time of day)	1204	1228	1240	
	Sampling vacuum, " Hg	-10 *	-10 *	-10 *	
	Sampling period ended (time of day)	1209	1235	1245	
	Final Canister Pressure (" Hg)	-4	-4	-4	

Observations and Comments: AVG01288 AVG01294 AVG01286
Background PID = 0.5 ppm

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

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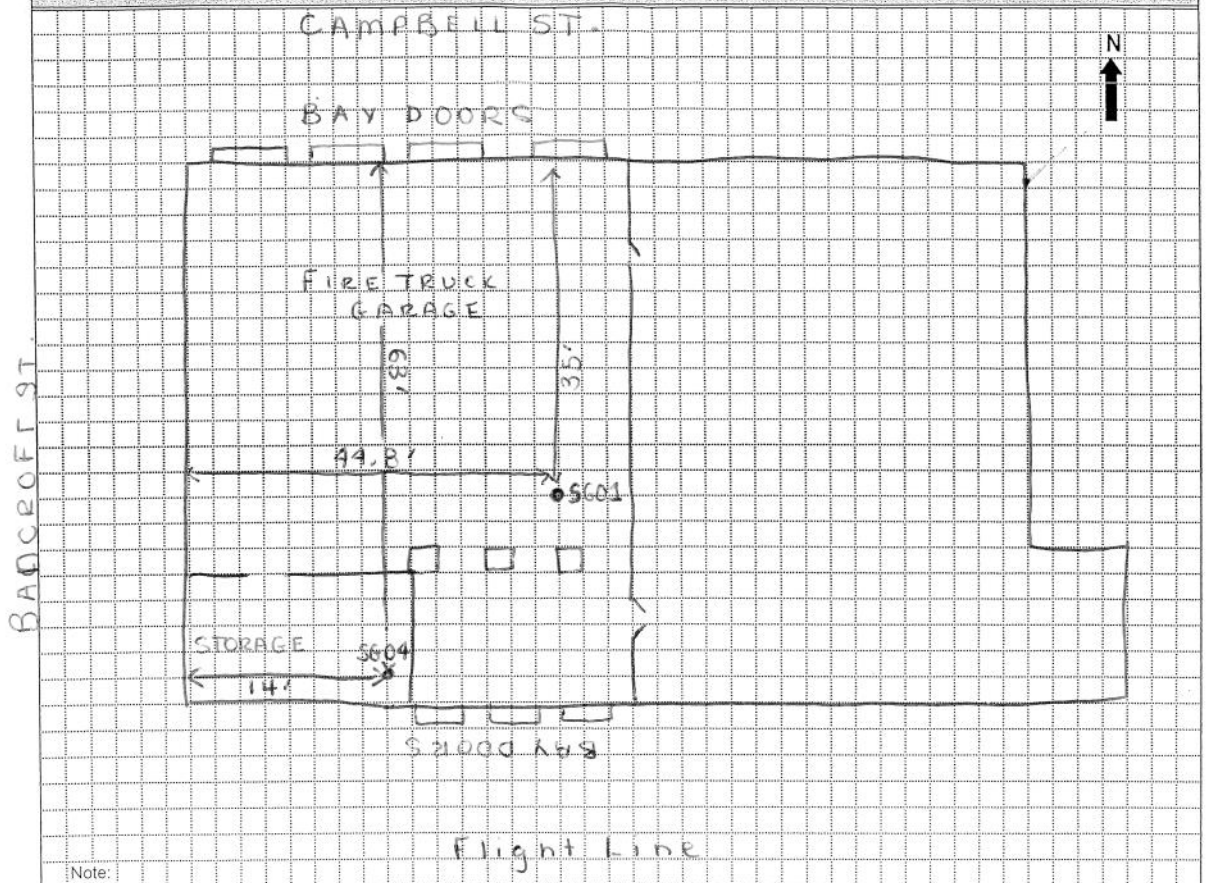
Indoor Vapor Intrusion Assessment
Sub-slab Vapor Sampling Field Log

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



Note:
Show the location of each soil probe and indicate distances from the foundation edge and other significant features.
Note location of sumps, drains, cleanouts, cracks, etc.

Other observations and comments:

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

Project Info

Project Name: MCB Cam Lej CTO-092 Project # : 392664

By: KS/MS Date: 2/12/10

Structure

Identification: Bldg AS541

Address:

Slab Information:

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

☐ Concrete slab on gravel underlayment

Condition of slab

Type of Sub Slab Soil

Is water present in the soil

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

	Sample location (show in diagram)	1	2	3	4
	Sample Identification (field ID)	IR86-SG05-10A	IR86-SG03 10A	IR86-SG02-10A	IR86-SG02D-10A
Probe Installation	Depth of slab (inches)	8"	EXISTING	EXISTING	EXISTING
	Depth of hole drilled (inches below slab surface)	10"	|	|	|
	Depth of installed probe (inches below slab surface)	6"			
Manifold Leak check	Leak check (sampling manifold) - Pass/No Pass	PASS	PASS	PASS	PASS
Probe Purge	Purge rate, cc/min.	200 mL/min	200 mL/min	200mL/min	|
	Purge Start (time of day)	1253	1320	1348	
	Purge vacuum, " Hg	-10 *	-10 *	-10 *	
	Purge completed (time of day)	1257	1326	1352	
Helium Leak Check (optional)	Leak check (Helium) - %	4575 ppm	9075 ppm	200 ppm	
Field Analysis (optional)	Gem 2000 (O2 / CO2 / CH4) - %	N/A	N/A	N/A	
	PID - ppmv	5.4 ppm	6.6 ppm	4.1 ppm	
Canister Sampling	Canister & flow controller ID (if used)	1SC00674/ 0A01103	1SC00585/ 0A00055	1SC00603/ 0A01081	1SC00746/ 0A01117
	Initial Canister Pressure (" Hg)	-28.5	-29	-27	-31
	Sampling rate, cc/min				
	Sampling period started (time of day)	1259	1327	1354	1401
	Sampling vacuum, " Hg	-10 *	-10 *	-10 *	-10 *
	Sampling period ended (time of day)	1305	1332	1400	1407
	Final Canister Pressure (" Hg)	-4	-4	-4	-4

Observations and Comments: Pressure gauge: AVG00970 AVG00981 AVG01206 AVG01285
Background 0.2 ppm 0.2 ppm 0.4 ppm

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

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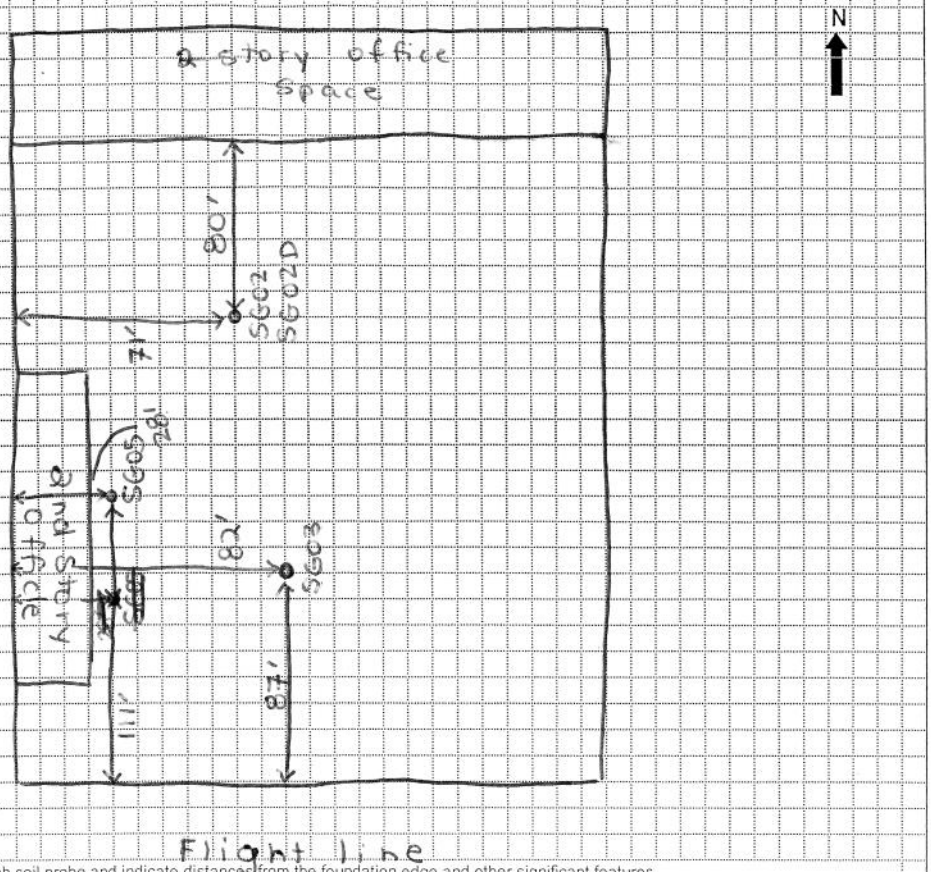
Indoor Vapor Intrusion Assessment
Sub-slab Vapor Sampling Field Log

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



Note:
Show the location of each soil probe and indicate distances from the foundation edge and other significant features.
Note location of sumps, drains, cleanouts, cracks, etc.

Other observations and comments:

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

Project Info

Project Name: MCB Camlej — Project #: 392664
By: JCS / MS — Date: 2/12/10

Structure

Identification: Bldg AS4106
Address: Douglas & White Sts
Slab Information:
- ☐ Concrete slab on grade (directly on top of soil)
- ☐ Concrete slab on gravel underlayment
- ☐ Other (describe)

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

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

	Sample location (show in diagram)	1	2	3	4
	Sample Identification (field ID)	SWMU336-SG07-10A	SWMU336-SG06-10A		
Probe Installation	Depth of slab (inches)	6"	6"		
	Depth of hole drilled (inches below slab surface)	8"	8"		
	Depth of installed probe (inches below slab surface)	5"	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)	1001	1027		
	Purge vacuum, " Hg	-10 *	-10 *		
	Purge completed (time of day)	1006	1032		
Helium Leak Check (optional)	Leak check (Helium) - %	0 ppm	0 ppm		
Field Analysis (optional)	Gem 2000 (O2 / CO2 / CH4) - %	N/A	N/A		
	PID - ppmv	4.4	5.6		
Canister Sampling	Canister & flow controller ID (if used)	1SC00691 / OA00711	1SC00282 / OA01112		
	Initial Canister Pressure (" Hg)	-29.5	-26		
	Sampling rate, cc/min	200 mL/min	200 mL/min		
	Sampling period started (time of day)	1007	1032		
	Sampling vacuum, " Hg	-10 *	-10 *		
	Sampling period ended (time of day)	1012	1038		
	Final Canister Pressure (" Hg)	-4	-4		

Observations and Comments: Pressure gauge: AVG01297 AVG00137
PID BACKGROUND: 1.5 PPM 3.3 PPM

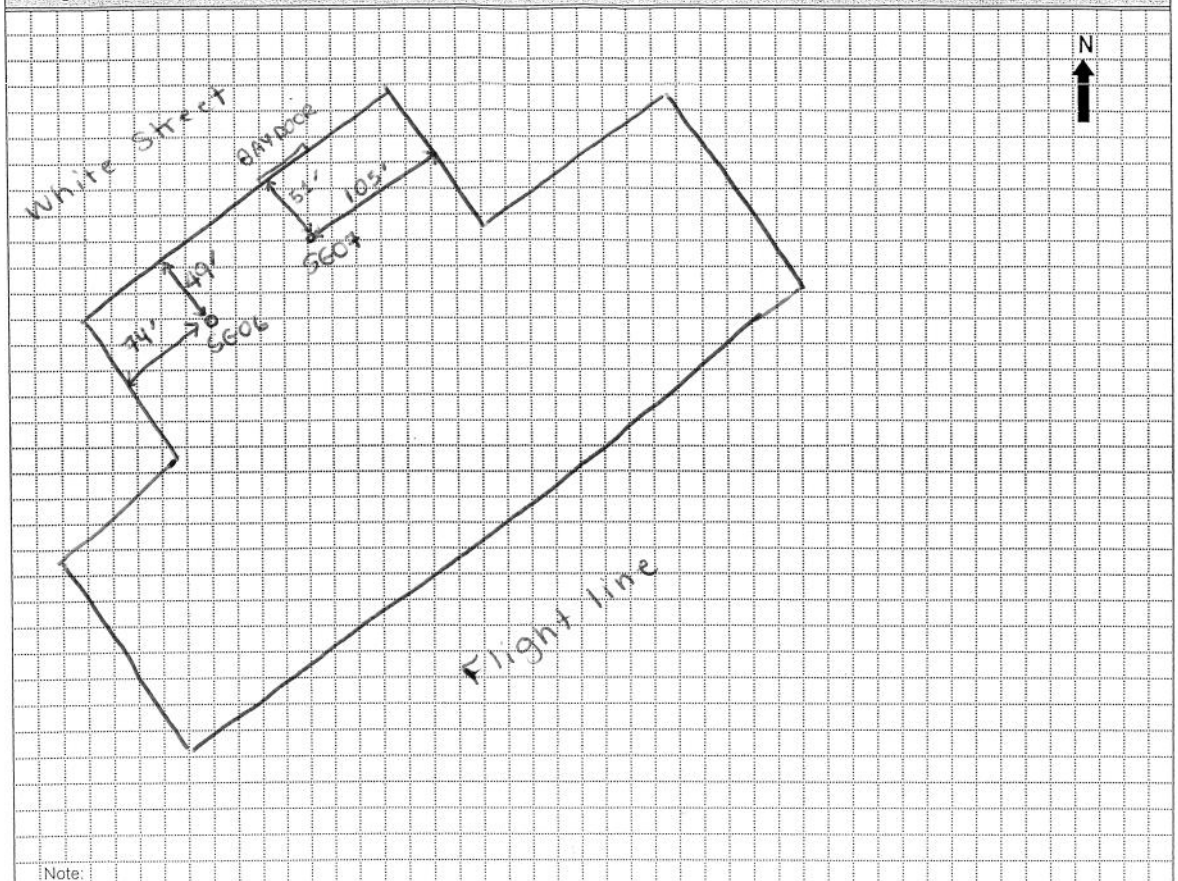
*Sample manifold read -10" Hg during ambient conditions and purge activities indicating sampling vacuum was truly 0" Hg

JCS/MS

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: SG07 placed by yellow pillar on corner of cleared walkways across from Bay Door. (Room T64)

SG06 placed by green eyewash on yellow pillar next to fridge in Rm – (AIRFRAMES plaque marks doorway)

Appendix V4-B
Data Quality Evaluation

Data Quality Evaluation

1 Data Quality Assessment

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

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

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

1.1 Laboratory Internal Quality Control Review

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

1.2 Data Validation

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

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

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

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

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

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

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

1.2.1 Primary Data Validation Qualifiers

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

- **U** - Not detected. Sample was analyzed for this parameter, but it was not detected at greater than reported quantitation limit. The data validator may also apply this qualifier to indicate that a concentration is attributed to blank contamination, but this qualifier does not necessarily indicate a quality control problem.
- **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. These guidelines are to be used for Region IV data.

The laboratory utilized various qualifiers to represent "below reporting limit," "non-detect," and "detected." The data validator utilized J qualifiers, UJ qualifiers, U qualifiers, and R qualifiers to represent "estimated," "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 MCAS New River

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 MCAS New River sampling event 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 February 10, 2010.

3.1.1 Volatile Organic Compounds

Volatiles were analyzed by SW-846 method 8260B. Excluding field quality control samples, 41 distinct data points were generated. One result was rejected. The volatiles data set is 97.6% percent complete (40 volatiles results are available for use). The validation process resulted in the following qualifiers for results in the volatiles fraction:

- 2.4 percent (1 of 41 results) were UJ -qualified as "nondetect, estimated quantitation limit" because of high continuing calibration recovery (see section 3.1.1.1 below)
- 12.2 percent (5 of 41 results) were UJ qualified as "nondetect, estimated quantitation limit" because of low continuing calibration recovery (see section 3.1.1.1 below)
- 2.4 percent (1 of 41 results) were J qualified as "estimated" due to low continuing calibration recovery (see section 3.1.1.1 below)
- 2.4 percent (1 of 41 results) were R qualified as "rejected" due to extremely low continuing calibration recovery (see section 3.1.1.2 below)
- 12.2 percent (5 of 41 results) were J qualified as "estimated" because the results were below the quantitation limit (see section 3.1.1.3 below)

Calibration

One result was 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 five results were UJ qualified as "nondetect, estimated quantitation limit" because of low continuing calibration recoveries. The UJ qualification of detects does not affect the availability of results because they are available for use as detects at the reported concentration.

One result was J qualified as "estimated" due to low continuing calibration recovery. The J qualification of detects does not affect the availability of results because they are available for use as detects at the reported concentration.

Rejected Results

One result was R qualified as "rejected" due to extremely low continuing calibration recovery. Sample R86-IS15-GW-10-11-10A received the R qualification for 2-butanone, this result is not available for use.

Quantitation Limits

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

3.2 Soil Gas Data

This evaluation assesses the analytical results of the groundwater samples collected on June 20 through June 24, 2008.

3.2.1 Volatile Organic Compounds

Volatiles were analyzed by EPA method TO-15. Excluding field quality control samples, 342 distinct data points were generated. There were no rejected results. The volatiles data set is 100% percent complete (all volatiles results are available for use). The validation process resulted in the following qualifiers for results in the volatiles fraction:

- 0.3 percent (1 of 342 results) were U qualified as "attributable to blank contamination" (see section 3.2.1.1 below)
- 0.3 percent (1 of 342 results) were UJ qualified as "nondetect" due to a lack of field duplicate reproducibility (see section 3.2.1.2 below)
- 1.2 percent (4 of 342 results) were J qualified as "estimated" due to a lack of field duplicate reproducibility (see section 3.2.1.2 below)
- 24.9 percent (85 of 342 results) were J qualified as "estimated" because the results were below the quantitation limit (see section 3.2.1.3 below)

Blank Contamination

One result was U qualified as "attributable to blank contamination" because tetrachloroethene was detected in the associated method blank sample. The affected sample is IR86-SG01D-10A. 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.

Field Duplicates

One result was UJ qualified as "nondetect, estimated quantitation limit" due to a lack of field duplicate reproducibility. The UJ qualification of detects does not affect the availability of results because they are available for use as nondetects at the reported concentration.

A total of four results were J qualified as "estimated" due to a lack of field duplicate reproducibility. Affected compounds and samples include acetone and carbon disulfide in samples IR86-SG01-10A and IR86-SG01D-10A. The J-qualification of detects does not affect the availability of results because they are available for use as detects at the reported concentration.

Quantitation Limits

A total of 85 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 Overall Assessment

Data collected in support of the MCAS New River sampling events are found to be of acceptable quality. One result was rejected due to QA/QC deficiencies and 99% of the data is available for use by the project team.

Appendix V4-C
Building Survey Forms

Preliminary Building Survey for Vapor Intrusion Investigation

CH2MHILL

Date: 2/14/10

Preparer: Kim Stokes

Facility: Bldg AS502

Address: Campbell St.
MCAS New River

Contact Person: Captain Vaughn (Fire Cheif)

Phone Number: (# 910-449-6620)

e-mail address:

Building Description

Building or Room Identifier: Bldg AS502

Primary Activity within Building (select one):

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

Notes: Fire Station

Approximate floor space 150 x 75 = 11,250 ft²

Number of floors 1 floor w/ storage loft

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

Ceiling height 30 ft.

Aboveground Construction
- [ ] Wood
- [x] 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?
- [x] Other Tile (vinyl) in east side (offices)

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

Notes:

Evaluation of Potential Pathways/Driving Forces

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

Portable AC & fans in garage.

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

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

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

Sources of outdoor air

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

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

Notes: Bay doors open during warmer months.

Evaluation of Potential Existing Chemical Sources Indoors

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

See notes section

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

[ ] Yes [ ] No

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

Names of pesticide products used? unknown

Has there been a pesticide application within the past 6 months? [X] Yes [ ] No Oct/Nov 2009

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?

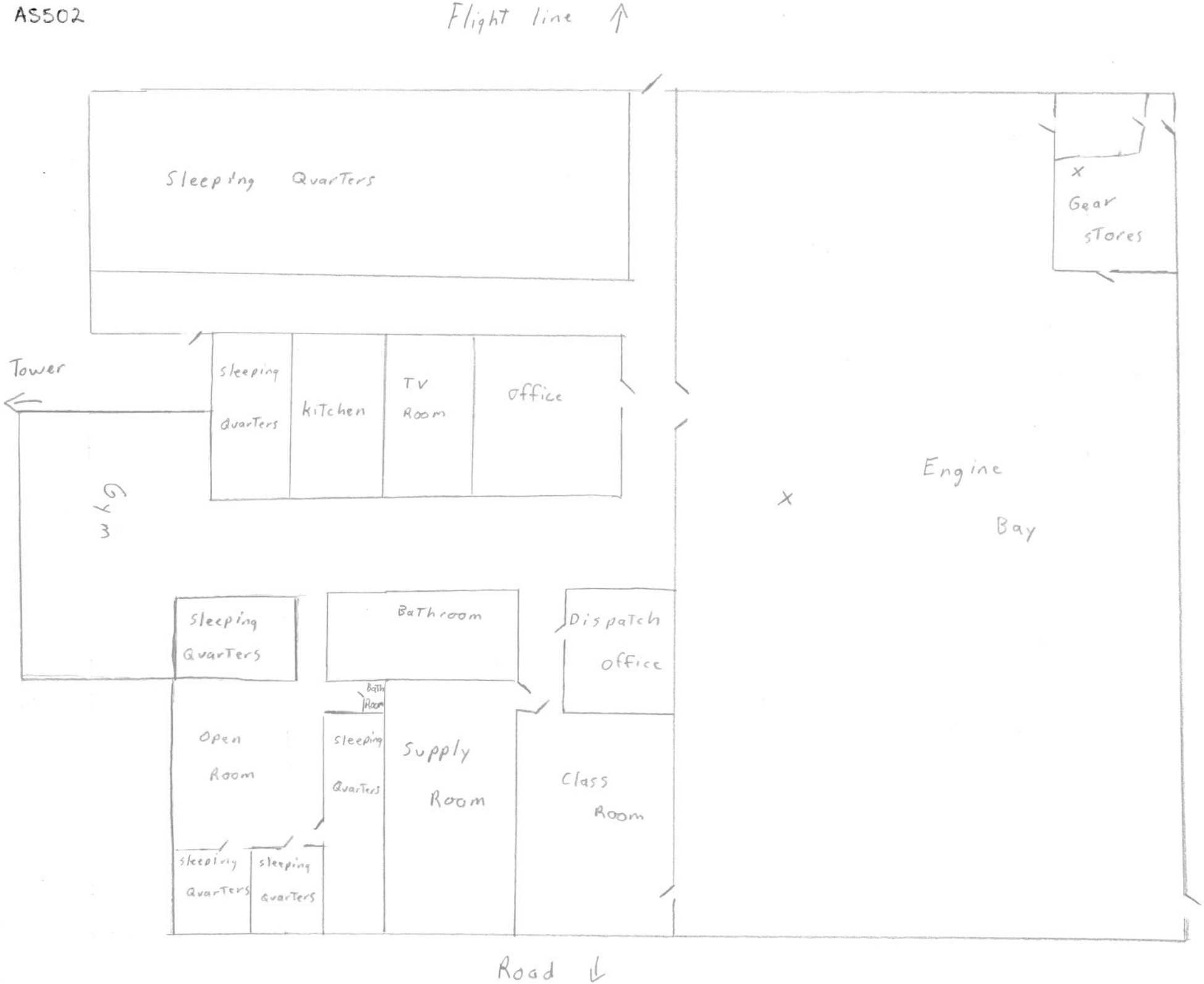
[ ] Passive venting
[ ] Active subslab depressurization
[ ] Crack/crevice sealing
[ ] Dilution ventilation control
[ ] N/A

Notes:

Additional Notes

(2) 1 gallon gasoline
(3) Clorox
(10) gallons floor cleaner
(5) cans Zep power house wax stripper
(10) cans Refresh Air Refresher
(5) detergent - 20 oz.
(5) Pledge
~100 gals* Angus Foam Liquid Concentrate
- diethylene glycol monobutyl ether
- surfactants.
* used in fire trucks to put out fires.
1 gal / 100 gal water

AS502


Flight line
Sleeping Quarters
Gear stores
Tower
Sleeping Quarters
Kitchen
TV Room
Office
Gym
Engine Bay
Sleeping Quarters
Bathroom
Dispatch office
Bath Room
Open Room
Sleeping Quarters
Supply Room
Class Room
Sleeping Quarters
Sleeping Quarters
Road

Preliminary Building Survey for Vapor Intrusion Investigation

*910-449-7057 Bldg AS4106 managers

Date: 2/12/10

Preparer: K Stokes

CH2MHILL

Facility: Bldg AS4106

Address: Douglas & White Street
MCAS New River

Contact Person: Randy Scott

Phone Number: 910-449-5403 or *

e-mail address:

Building Description

Building or Room Identifier: Bldg AS4106

Primary Activity within Building (select one):

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

Notes:

Approximate floor space ~83,750 ft² (footprint)

Number of floors 1/2 1 floor 1/2 2 floors - top floor office (under construction) S side of bldg - heli hangars.

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

Ceiling height 30'

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

Floor plan attached? [ ] Yes [X] No

Notes:

Evaluation of Potential Conduits from Soil

Floor/foundation description (check all that apply)

- [ ] Wood
- [x] Concrete
- [x] Elevated above grade? ~1 foot
- [ ] Below grade?
- [ ] Other _____

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

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 heating/cooling in workshops / hangars

Assume HVAC in new office space 2nd floor

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 Bay Door - heli hanger
- [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)

Paints solvents

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

[ ] Yes [ ] No

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

Names of pesticide products used? _____

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

Appendix V4-D
Chain-of-Custody Records

Air - Chain of Custody Record & Analytical Service Request

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

CTO-092

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

CAS Project No.

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

Project Name: MCB Camp Lejeune

Project Number: 392664

CAS Contact: Kate Aguilera

Project Manager: Keri Hallberg

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

Phone: 757-671-6284

Fax:

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

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

Analysis Method and/or Analytes

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

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

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

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

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

Cooler / Blank
Temperature _____ °C

Air - Chain of Custody Record & Analytical Service Request

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

CTO-092 AIRBILL 8712 9642 7059

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

CAS Project No.

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

Project Name: MCB Camp Lejeune

Project Number: 392664

Project Manager: Keri Hallberg

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

Phone: 757-671-6284

Fax:

Email Address for Result Reporting: genevievemoore@ch2m.com

Sampler (Print & Sign): Kim Stokes

CAS Contact

Analysis Method and/or Analytes

Client Sample ID	Laboratory ID Number	Date Collected	Time Collected	Sample Type (Air/Tube/Solid)	Canister ID (Bar Code # - AC, SC, etc.)	Flow Controller (Bar Code - FC #)	Sample Volume	TO-15	Initial pressure (" Hg)	Final pressure (" Hg)		Comments e.g. Actual Preservative or specific instructions: Pressure gauge ID
LCH4015-SG02-10A		2/14/10	1339	AIR	1SC 00066	OA 00732	1 L	X	-29.5	-4		AVG00858
HPFF-SG34-10A		2/14/10	1027		1SC 00046	OA00727		X	-26.5	-3		AVG00532
HPFF-SG35-10A		2/14/10	1102		1SC 00273	OA 00720		X	-29.5	-4		AVG01074
IR86-SG04-10A		2/14/10	1209		1SC 00643	OA 00712		X	-28.5	-4		AVG01288
IR86-SG01-10A		2/14/10	1235		1SC 00008	OA01119		X	-29.5	-4		AVG01294
IR86-SG01D-10A		2/14/10	1245		1SC 00586	OA00049		X	-29	-4		AVG01286
IR88-1520-SV-5-6-10A		2/15/10	1319		1SC00127	OA01096		X	-30.0	-4.0		AVG006006
IR88-1519-SV-5-6-10A		2/15/10	1409		1SC00690	OA00754		X	-34	-4.0		AVG00043
IR88-1519-SV-D-5-6-10A		2/15/10	1418		1SC00688	OA 01079		X	-26.5	-4.0		AVG00199
IR88-1517-SV5-6-10A		2/15/10	1610		1SC00366	OA01260		X	-29.5	-3.5		AVG00901

2/16/10

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

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

Project Requirements (MRLs, QAPP)

Relinquished by: (Signature)	Date:	Time:	Received by: (Signature)	Date:	Time:
	2/16/10	1700			
Relinquished by: (Signature)	Date:	Time:	Received by: (Signature)	Date:	Time:
Relinquished by: (Signature)	Date:	Time:	Received by: (Signature)	Date:	Time:

Cooler / Blank
Temperature _____ ºC

Air - Chain of Custody Record & Analytical Service Request

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

CTO-092 Airbill 8712-9642-7059

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

CAS Project No.

CAS Contact

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

Project Name: MCB Camp Lejeune

Project Number: 392664

Project Manager: Keri Hallberg

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

Phone: 757-671-6284

Fax:

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

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

Analysis Method and/or Analytes

Client Sample ID	Laboratory ID Number	Date Collected	Time Collected	Sample Type (Air/Tube/Solid)	Canister ID (Bar Code # - AC, SC, etc.)	Flow Controller (Bar Code - FC #)	Sample Volume	TO-15	Initial Pressure ("Hg)	Final Pressure ("Hg)		Comments e.g. Actual Preservative or specific instructions: Pressure gauge ID
IR89-SG02-10A		2/13/10	1340	AIR	1SC 00778	OA01076*	1L	X	-30.5	-4		AVG 01304*
IR89-SG03-10A		2/13/10	1428		1SC 00775	OA01076*		X	-28.5	-4		AVG 01304*
IR89-SG04-10A		2/13/10	1415		1SC 00773	OA01094		X	-30	-4		AVG 00535
IR35-SG09-10A		2/13/10	1033		1SC 00706	OA00744		X	-27.5	-4		AVG 00980
IR35-SG08-10A		2/13/10	929		1SC 00403	OA00134		X	-29.5	-4		AVG 01289
IR35-SG08D-10A		2/13/10	936		1SC 00602	OA01072		X	-30	-4		AVG 01284
IR35-SG10-10A		2/13/10	1014		1SC 00699	OA00074		X	-29	-4		AVG 01283
IR35-SG11-10A		2/13/10	1045		1SC 00723	OA00731		X	-29	-4		AVG 01300
IR35-SG12-10A		2/13/10	1118		1SC 00331	OA01159		X	-27	-3		AVG 00797
IR35-SG13-10A		2/13/10	1146		1SC 00439	OA01155		X	-29.5	-3.5		AVG 00161

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

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

Project Requirements (MRLs, QAPP)
* used on two canisters erroneously

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

Cooler / Blank
Temperature _____ °C

Air - Chain of Custody Record & Analytical Service Request

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

CTO - 092

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

CAS Project No.

Company Name & Address (Reporting Information): CH2m HILL, 5700 Cleveland St. Suite 101, Virginia Beach, VA 23462

Project Name: mcB Camp Lejeune

Project Number: 392664

Project Manager: Keri Hallberg

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

Phone: 757-671-6284

Fax:

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

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

CAS Contact

Analysis Method and/or Analytes

Client Sample ID	Laboratory ID Number	Date Collected	Time Collected	Sample Type (Air/Tube/Solid)	Canister ID (Bar Code # - AC, SC, etc.)	Flow Controller (Bar Code - FC #)	Sample Volume	TO-15	Initial Pressure (-Hg)	Final Pressure (-Hg)		Comments e.g. Actual Preservative or specific instructions: Pressure gauge
HPFF-SG52-10A		2/11/10	1056	AIR	1SC00774	OA01075	1L	X	-30	-4		AVG00482
HPFF-SG53-10A		2/11/10	1015		1SC00776	OA01115		X	-29	-4		AVG00813
HPFF-SG54-10A		2/11/10	1124		1SC00779	OA00753		X	-28	-4		AVG00753
HPFF-SG51-10A		2/11/10	1333		1SC00772	OA00750		X	-28.5	-4		AVG01239
IR88-SG07-10A		2/11/10	0930		1SC00780	OA00729		X	-30	-4		AVG01140
IR88-SG08-10A		2/11/10	0907		1SC00777	OA00719		X	-28.5	-4		AVG00985
HPFF-SG05-10A		2/11/10	1403		1SC00154	OA00072		X	-29.5	-4		AVG00462
SWMU336-SG06-10A		2/12/10	1038		1SC00282	OA01112		X	-26	-4		AVG00137
SWMU336-SG07-10A		2/12/10	1012		1SC00691	OA00711		X	-29.5	-4		AVG01297
1SC00211 - bad canister												
AVG00356 - bad gauge												
AVG00559 - bad gauge												

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

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

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

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

Cooler / Blank
Temperature _____ °C

Air - Chain of Custody Record & Analytical Service Request

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

CTO-092

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

CAS Project No.

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

Project Name: MCB Camp Lejeune

Project Number: 392664

CAS Contact: Kate Aguilera

Project Manager: Keri Hallberg

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

Phone: 757-671-6284

Fax:

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

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

Analysis Method and/or Analytes

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

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

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

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

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

Cooler / Blank
Temperature _____ °C

SHEALY *Chain of Custody Record*

SHEALY ENVIRONMENTAL SERVICES, INC.
106 Vantage Point Drive
West Columbia, South Carolina 29172
Telephone No. (803) 791-9700 Fax No. (803) 791-9111

Number 105976
CTO-092

Client: CH2M Hill	Report to Contact: PM: Keri Hallberg	Telephone No. / Fax No. / E-mail: 757-671-6284	Quote No.
Address: 5700 Cleveland St Suite 101	Sampler's Signature: X [signature]	Waybill No.: 8712-9642-7416 (Fed Ex)	Page 1 of 2
City: Virginia Beach; State: VA; Zip Code: 23462	Printed Name: Elizabeth J. Bailey	Analysis (Attach list if more space is needed.)	
Project Name: MCB Camp Lejeune			
Project No.: 392664	P.O. No.: As Per Contract		Lot No.

Sample ID / Description (Containers for each sample may be combined on one line.)	Date	Time	G=Grab C=Composite	Matrix: Aqueous	Solid	Non-Aqueous		No. of Containers by Preservative Type: Unpres.	H2SO4	HNO3	HCl	NaOH	5035 Kit		40 mL VOAs VOCs											Remarks / Cooler I.D.
ER-021210	2/12/10	1450	G	X							3				X											
FB-021210	2/12/10	1445	G	X							3				X											
TR78-TB021210	2/12/10	1440	G	X							3				X											
IR78-MWV101-10A	2/12/10	1406	G	X							9				X											MS/MSD
ER-021010	2/10/10	1500	G	X							3				X											
IR78-1525-GW-5-7-10A	2/10/10	1306	G	X							3				X											
IR78-1522-GW-5-7-10A	2/10/10	1226	G	X							3				X											
IR86-1515-GW-10-11-10A	2/10/10	0936	G	X							3				X											
ER-020910	2/09/10	1610	G	X							3				X											
IR78-1523-GW-5-7-10A	2/09/10	1520	G	X							3				X											

Possible Hazard Identification: ☐ Non-Hazard ☐ Flammable ☐ Skin Irritant ☐ Poison ☒ Unknown

Sample Disposal: ☐ Return to Client ☒ Disposal by Lab

Note: All samples are retained for six weeks from receipt unless other arrangements are made.

Turn Around Time Required (Prior lab approval required for expedited TAT.): ☒ Standard ☐ Rush (Specify) ~~[illegible]~~

QC Requirements (Specify):

	Date	Time		Date	Time
1. Relinquished by: [signature]	2/12/10	1700	1. Received by		
2. Relinquished by			2. Received by		
3. Relinquished by			3. Laboratory received by		

Comments:

LAB USE ONLY
Received on ice (Circle) Yes No Ice Pack

Receipt Temp. _____ °C

DISTRIBUTION: WHITE & YELLOW-Return to laboratory with Sample(s); PINK-Field/Client Copy

Document Number: F-AD-012 Effective Date: 08-04-02

SHEALY Chain of Custody Record

SHEALY ENVIRONMENTAL SERVICES, INC.
106 Vantage Point Drive
West Columbia, South Carolina 29172
Telephone No. (803) 791-9700 Fax No. (803) 791-9111

CTO-092

Number 105973

Client: CH2M HILL	Report to Contact: PM Keri Hallberg	Telephone No. / Fax No. / E-mail: 757-671-6284	Quote No.
Address: 5700 Cleveland St Suite 101	Sampler's Signature: X [signature]	Waybill No.: 8712-9642-7416 (FedEx)	Page 2 of 2
City: Virginia Beach; State: VA; Zip Code: 23462	Printed Name: ELIZABETH S. BARCLAY	Analysis (Attach list if more space is needed.)	
Project Name: MCB Camp Lejeune			
Project No.: 39216	P.O. No.		Lot No.

Sample ID / Description (Containers for each sample may be combined on one line.)	Date	Time	G=Grab C=Composite	Matrix: Aqueous	Solid	Non-Aqueous		No. of Containers by Preservative Type: Unpres.	H2SO4	HNO3	HCl	NaOH	5035 Kit		Homl VOCs										Remarks / Cooler I.D.
1R78-1523-GW-D-5-7-10A	2/9/10	1520	G	X							3				X										
1R78-1524-GW-6-8-10A	2/9/10	1402	G	X							3				X										

[signature] 2/12/10

Possible Hazard Identification: ☐ Non-Hazard ☐ Flammable ☐ Skin Irritant ☐ Poison ☒ Unknown	Sample Disposal: ☐ Return to Client ☒ Disposal by Lab	Note: All samples are retained for six weeks from receipt unless other arrangements are made.			
Turn Around Time Required (Prior lab approval required for expedited TAT.) ☒ Standard ☐ Rush (Specify)		QC Requirements (Specify)			
1. Relinquished by [signature]	Date 2/12/10	Time 1700	1. Received by	Date	Time
2. Relinquished by	Date	Time	2. Received by	Date	Time
3. Relinquished by	Date	Time	3. Laboratory received by	Date	Time
Comments			LAB USE ONLY Received on ice (Circle) Yes No Ice Pack	Receipt Temp. _____ °C	

DISTRIBUTION: WHITE & YELLOW-Return to laboratory with Sample(s); PINK-Field/Client Copy

SHEALY Chain of Custody Record

SHEALY ENVIRONMENTAL SERVICES, INC.
106 Vantage Point Drive
West Columbia, South Carolina 29172
Telephone No. (803) 791-9700 Fax No. (803) 791-9111

CTO-092 **Number** 105992

Client: CH2M Hill	Report to Contact: PM: Keri Hallberg	Telephone No. / Fax No. / E-mail: 757-671-6284	Quote No.
Address: 5700 Cleveland St Suite 101	Sampler's Signature: X [signature]	Waybill No.: 8712 9642 7390 (FedEx)	Page 1 of 1
City: Virginia Beach; State: VA; Zip Code: 23462	Printed Name: Elizabeth J. Barclay	Analysis (Attach list if more space is needed.)	
Project Name: MCB Camp Lejeune			
Project No.: 392664	P.O. No.: As Per Contract		Lot No.

Sample ID / Description (Containers for each sample may be combined on one line.)	Date	Time	G=Grab C=Composite	Matrix: Aqueous	Solid	Non-Aqueous		No. of Containers by Preservative Type: Unpres.	H2SO4	HNO3	HCl	NaOH	5035 Kit	NaOH/ZnAc/Ascorbic	1L amber TCLP RIC	TCLP, RIC Reactivity 500mL poly	Remarks / Cooler I.D.
1R78-1DW01 ~~-10A~~ -021210	2/12/10	1345	G		X			2							X	X	
1R78-1DW02 ~~-10A~~ 021210	2/12/10	1355	G	X				3						1	X	X	
1R86-1DW01-021210	2/12/10	1210	G		X			2							X	X	
1R86-1DW02-021210	2/12/10	1220	G	X				3						1	X	X	

[signature] 2/12/10

Possible Hazard Identification: ☐ Non-Hazard ☐ Flammable ☐ Skin Irritant ☐ Poison ☒ Unknown

Sample Disposal: ☐ Return to Client ☒ Disposal by Lab

Note: All samples are retained for six weeks from receipt unless other arrangements are made.

Turn Around Time Required (Prior lab approval required for expedited TAT.): ☐ Standard ☒ Rush (Specify) 14 Day TAT

QC Requirements (Specify):

	Date	Time		Date	Time
1. Relinquished by: [signature]	2/12/10	1700	1. Received by		
2. Relinquished by			2. Received by		
3. Relinquished by			3. Laboratory received by		

Comments:

LAB USE ONLY
Received on ice (Circle) Yes No Ice Pack

Receipt Temp. _____ °C

DISTRIBUTION: WHITE & YELLOW-Return to laboratory with Sample(s); PINK-Field/Client Copy

Appendix V4-E
Laboratory Data

CTO-092
MCB CamLej - MCAS New River
Groundwater Raw Analytical Results
February 2010

Station ID	IR86-IS15
Sample ID	IR86-IS15-GW-10-11-10A
Sample Date	02/10/10
Chemical Name	
Volatile Organic Compounds (UG/L)	
1,1,1-Trichloroethane	0.5 U
1,1,2,2-Tetrachloroethane	0.5 U
1,1,2-Trichloro-1,2,2-trifluoroethane(Freon-113)	0.5 U
1,1,2-Trichloroethane	0.5 U
1,1-Dichloroethane	0.14 J
1,1-Dichloroethene	0.58
1,2,4-Trichlorobenzene	0.5 U
1,2-Dichloroethane	0.5 U
1,2-Dichloropropane	0.5 U
1,4-Dichlorobenzene	0.5 U
2-Butanone	10 R
2-Hexanone	5 UJ
4-Methyl-2-pentanone	5 UJ
Acetone	10 UJ
Benzene	0.27 J
Bromodichloromethane	0.5 U
Bromoform	0.5 UJ
Bromomethane	0.5 U
Carbon disulfide	0.11 J
Carbon tetrachloride	0.5 U
Chlorobenzene	0.5 U
Chloroethane	0.5 U
Chloroform	0.5 U
Chloromethane	0.5 U
cis-1,2-Dichloroethene	3
Cyclohexane	0.79 J
Dichlorodifluoromethane (Freon-12)	0.5 UJ
Ethylbenzene	0.5 U
Isopropylbenzene	0.5 U
Methyl acetate	1 UJ
Methylcyclohexane	5.1
Methylene chloride	0.5 U
Methyl-tert-butyl ether (MTBE)	0.5 U
Styrene	0.5 U
Tetrachloroethene	0.11 J
Toluene	0.5 U
trans-1,2-Dichloroethene	0.5 U
Trichloroethene	1.5
Trichlorofluoromethane(Freon-11)	0.5 U
Vinyl chloride	0.5 U
Xylene, total	0.36 J

Notes:

NA - Not analyzed
J - Analyte present, value may or may not be accurate or precise
R - Unreliable Result
U - The material was analyzed for, but not detected
UJ - Analyte not detected, quantitation limit may be inaccurate
UG/L - Micrograms per liter

CTO-092
MCB CamLej - MCAS New River
Subslab Soil Gas Raw Analytical Results
February 2010

Station ID	IR86-SG01		IR86-SG02		IR86-SG03	IR86-SG04	IR86-SG05	SWMU336-SG06	SWMU336-SG07
Sample ID	IR86-SG01-10A	IR86-SG01D-10A	IR86-SG02-10A	IR86-SG02D-10A	IR86-SG03-10A	IR86-SG04-10A	IR86-SG05-10A	SWMU336-SG06-10A	SWMU336-SG07-10A
Sample Date	02/14/10	02/14/10	02/12/10	02/12/10	02/12/10	02/14/10	02/12/10	02/12/10	02/12/10
Chemical Name									
Volatile Organic Compounds (ppbv)									
1,1,1-Trichloroethane	0.44 U	0.43 U	0.42 U	0.41 U	0.41 U	0.45 U	0.17 J	0.47 U	0.2 J
1,1,2,2-Tetrachloroethane	0.35 U	0.34 U	0.33 U	0.33 U	0.33 U	0.36 U	0.34 U	0.38 U	0.33 U
1,1,2-Trichloro-1,2,2-trifluoroethane(Freon-113)	0.09 J	0.1 J	0.16 J	0.14 J	0.29 U	0.07 J	3.5	0.79	1.3
1,1-Dichloroethane	0.59 U	0.58 U	0.56 U	0.55 U	0.56 U	0.61 U	0.57 U	0.64 U	0.56 U
1,1-Dichloroethene	0.61 U	0.6 U	0.57 U	0.56 U	0.57 U	0.62 U	0.58 U	0.65 U	0.57 U
1,2,4-Trichlorobenzene	0.07 J	0.32 U	0.31 U	0.3 U	0.3 U	0.33 U	0.31 U	0.35 U	0.31 U
1,2-Dichloroethane	0.59 U	0.58 U	0.56 U	0.55 U	0.56 U	0.61 U	0.57 U	0.64 U	0.56 U
1,2-Dichloropropane	0.52 U	0.51 U	0.49 U	0.48 U	0.49 U	0.53 U	0.5 U	0.56 U	0.49 U
1,4-Dichlorobenzene	0.05 J	0.39 U	0.38 U	0.37 U	0.37 U	0.41 U	0.38 U	0.43 U	0.38 U
2-Butanone	1.4 J	1.6 J	0.99 J	2.6	0.59 J	2.3	2.6	7.3	3.1
2-Hexanone	0.25 J	0.2 J	0.14 J	0.4 J	0.12 J	0.35 J	0.41 J	0.32 J	0.36 J
4-Methyl-2-pentanone	0.59 U	0.58 U	0.56 U	0.55 U	0.55 U	0.11 J	0.13 J	0.1 J	0.12 J
Acetone	10 J	3.8 J	6.1 J	11	5.5 J	9.5 J	19	400	36
Benzene	0.24 J	0.14 J	0.71 U	0.7 U	0.29 J	0.77 U	0.21 J	0.29 J	0.71 U
Bromodichloromethane	0.36 U	0.35 U	0.34 U	0.33 U	0.34 U	0.37 U	0.35 U	0.38 U	0.34 U
Bromomethane	0.62 U	0.61 U	0.59 U	0.58 U	0.58 U	0.63 U	0.6 U	0.66 U	0.59 U
Carbon disulfide	1.5 UJ	1.7 J	0.33 J	0.23 J	1.4 U	1.6 U	2.2	2.2	0.26 J
Carbon tetrachloride	0.09 J	0.09 J	0.05 J	0.36 U	0.36 U	0.06 J	0.37 U	0.12 J	0.06 J
Chlorobenzene	0.52 U	0.51 U	0.49 U	0.49 U	0.49 U	0.53 U	0.5 U	0.56 U	0.49 U
Chloroethane	0.91 U	0.9 U	0.34 J	0.85 U	0.85 U	0.93 U	0.45 J	0.36 J	0.86 U
Chloroform	0.49 U	0.48 U	0.08 J	0.46 U	0.46 U	0.5 U	0.1 J	0.48 J	0.47 U
Chloromethane	1.2 U	1.1 U	0.59 J	1.1 U	1.1 U	1.2 U	1.1 U	0.94 J	1.1 U
cis-1,2-Dichloroethene	0.61 U	0.6 U	0.57 U	0.56 U	0.57 U	0.62 U	0.58 U	0.65 U	0.57 U
Cyclohexane	1.4 U	1.4 U	1.3 U	1.3 U	1.3 U	1.4 U	1.3 U	0.76 J	0.27 J
Dichlorodifluoromethane (Freon-12)	0.7	0.66	0.64	0.63	0.77	0.52	6.7	0.51 J	0.51
Ethylbenzene	0.19 J	0.07 J	0.52 U	0.52 U	0.52 U	0.56 U	0.23 J	0.19 J	0.05 J
Isopropylbenzene	0.49 U	0.48 U	0.46 U	0.46 U	0.46 U	0.5 U	0.47 U	0.52 U	0.46 U
m- and p-Xylene	0.73 J	0.22 J	0.14 J	1 U	1 U	0.15 J	0.47 J	0.53 J	0.24 J
Methylene chloride	0.69 U	0.68 U	0.1 J	0.64 U	0.65 U	0.71 U	0.67 U	0.62 J	1.1
Methyl-tert-butyl ether (MTBE)	0.67 U	0.66 U	0.63 U	0.62 U	0.62 U	0.68 U	0.64 U	0.71 U	0.63 U
o-Xylene	0.33 J	0.07 J	0.52 U	0.52 U	0.52 U	0.56 U	0.16 J	0.18 J	0.14 J
Styrene	0.56 U	0.56 U	0.13 J	0.53 U	0.53 U	0.58 U	0.54 U	0.61 U	0.53 U
Tetrachloroethene	2.1 J	0.35 U	3.5	0.81	2.5	1.3	2.5	2.3	6
Toluene	0.64	0.35 J	0.21 J	0.17 J	0.16 J	0.18 J	2.6	2.6	0.21 J
trans-1,2-Dichloroethene	0.61 U	0.6 U	0.57 U	0.56 U	0.57 U	0.62 U	0.58 U	0.65 U	0.57 U
Trichloroethene	0.45 U	0.44 U	0.42 U	0.42 U	0.42 U	0.46 U	1.6	0.48 U	0.42 U
Trichlorofluoromethane(Freon-11)	0.33 J	0.31 J	1.2	1.2	1.3	0.32 J	1.6	0.27 J	0.23 J
Vinyl chloride	0.94 U	0.92 U	0.89 U	0.88 U	0.88 U	0.96 U	0.91 U	1 U	0.89 U

Notes:

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