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FINAL PHASE III VAPOR INTRUSION EVALUATION REPORT VOLUME 1 OF 5 MCB CAMP LEJEUNE NC

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CH2M HILL

Final

Phase III Vapor Intrusion Evaluation Report
Volume 1 of 5

Marine Corps Base Camp Lejeune
Jacksonville, North Carolina

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Naval Facilities Engineering Command
NAVFAC MID-ATLANTIC

Prepared for

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Executive Summary

This Phase III Vapor Intrusion (VI) Evaluation Report summarizes activities and results, and presents conclusions, for the Phase III base-wide VI evaluation performed at the Marine Corps Base Camp Lejeune (MCB CamLej) in Jacksonville, North Carolina (**Figure V1-1**). The evaluation encompassed hundreds of buildings throughout the 236-square-mile Base, and approximately 150,000 potential receptors, including military personnel, dependents, retirees, and civilians. Four investigation areas were identified for the Phase III evaluation within MCB CamLej: Mainside; Hadnot Point; Marine Corps Air Station (MCAS), New River; and Camp Geiger (**Figure V1-2**).

This VI evaluation was conducted using a multiple–lines-of-evidence (MLE) approach consistent with the Department of Defense (DoD) Vapor Intrusion Handbook (2009), as well as Interstate Technology & Regulatory Council (ITRC) (2007) and U.S. Environmental Protection Agency (USEPA) (2002) VI guidance documents.

Objectives

The overall objective of the Phase III base-wide VI evaluation was to provide the Base with additional information on the potential for complete or significant exposure pathways within current buildings identified for further evaluation in the *Final Vapor Intrusion Evaluation Report* (CH2M HILL, 2009). Specific objectives for the Phase III evaluation were as follows:

1. Assess temporal variability of subslab soil gas concentrations at 40 buildings where samples were collected during either Phase I or II. (Temporal variability of indoor air was assessed at 15 of these buildings where samples were collected during either Phase I or II.)
2. Further characterize potential impacts and assess spatial variability of subslab soil gas at the 12 buildings where either significant (two orders of magnitude) variability was observed in subslab soil gas or only one subslab soil gas location was sampled in Phase I or II.
3. Assess the potential for underground utility conduits (i.e., potential preferential pathways) to transport soil gas by collecting subslab soil gas samples at four buildings that are connected by underground utilities passing through areas where soil gas concentrations exceeded base-specific soil gas screening levels during Phase I or Phase II.
4. Provide information that would be useful in evaluating the need for continued operation of existing active subslab depressurization systems at five Hadnot Point buildings.
5. Collect top of the water table groundwater data adjacent to two buildings where constituent migration from an upgradient source may be a concern.

6. Gather potential source area information (e.g., exterior soil vapor or exterior top of the water table data) at three buildings to refine the understanding of the source area potentially affecting the buildings. (These additional exterior data will be useful during remedy selection/design.)

Background

The *Final Vapor Intrusion Evaluation Work Plan* (CH2M HILL, 2008) presented the detailed screening steps of the phased evaluation and investigation process. The first step consisted of using the Base geographic information system (GIS) to identify buildings within 100 feet (ft) of monitoring wells containing volatile organic compound (VOC) concentrations (data collected between 2002 and 2007) that exceeded generic screening levels.

Screening levels are risk-based constituent concentrations below which no further action or study is warranted. Generic screening levels are based on conservative assumptions about site conditions and are used to identify areas that can be "screened out" of the evaluation process. The generic VI screening levels from the USEPA Vapor Intrusion Guidance (2002) were used to screen groundwater data; groundwater concentrations below these screening levels are unlikely to be a potential source for VI. The state regulatory standards, the North Carolina Groundwater Quality Standards (NC 2L Standards), were also used for screening when generic VI screening levels were not available or the NC 2L Standards were lower than the generic VI screening levels for a certain constituent. Through the initial screening step, 168 buildings were identified for further evaluation.

The next step consisted of generating site-specific VI screening levels using USEPA's (2004) version of the Johnson and Ettinger (J&E) (1991) model and comparing the existing groundwater data to the site-specific screening levels using GIS. Buildings located within 100 ft of shallow monitoring wells containing groundwater concentrations above the site-specific screening levels were retained for further evaluation. Buildings located within 100 ft of monitoring wells where non-aqueous phase liquids (NAPLs) have been previously identified were retained for further evaluation because the J&E model is limited where NAPLs are present. Buildings located within 100 ft of remediation systems such as air sparge (AS) or biosparge (BS) systems that can create pressure gradients which may promote VI were also retained for further evaluation. This refined screening resulted in the identification of 50 buildings for further evaluation. A phased field investigation was conducted to assess the potential for VI at these 50 buildings.

Phase I field activities were conducted in June 2008 and primarily included exterior sampling (i.e., groundwater grab sampling from the top of the water table and co-located soil vapor sampling) adjacent to the 50 buildings. However, interior sampling (i.e., indoor air and subslab soil gas sampling) was also conducted at buildings near AS or BS remediation systems and where NAPLs have been previously identified, due to the complexity of the subsurface environment and potential VI pathway in these areas.

Analytical data collected during Phase I were used to check the validity of the assumptions used to generate the site-specific J&E modeled screening levels developed during the work planning phase. This preliminary comparison highlighted some of the variability and uncertainties in modifying default input parameters when conducting site-specific

modeling. Additionally, between the completion of the work planning phase and the subsequent receipt of the Phase I sample data, the USEPA (2008) Regional Screening Levels (RSLs) were released. Because of the uncertainty regarding the site-specific screening levels and the availability of screening levels based on more recent toxicity values and inhalation risk calculation methods, the decision was made to use generic VI screening levels based on the USEPA (2008) RSLs to screen the Phase I data. USEPA's (2002) default shallow soil gas to indoor air attenuation factor (AF) (1E-01) and groundwater to indoor air AF (1E-03) were used to develop generic VI screening levels from the USEPA (2008) air RSLs. Based on the comparison of the Phase I sample data to the generic screening levels, additional data collection was proposed at 28 buildings, including 5 at Hadnot Point with existing active subslab depressurization (ASD) systems.

To further evaluate the 28 buildings, Phase II field activities were conducted in September and October 2008 and included indoor air, outdoor air, subslab sampling, and detailed building surveys. Pressure differential monitoring and groundwater sampling were also conducted at the five Hadnot Point ASD system buildings.

Empirical shallow soil gas to indoor air AFs were calculated using Phase I and II co-located subslab soil gas and indoor air data. Building-specific empirical AFs ranged from 1E-03 to 1E-05 based on the paired Phase I and Phase II subslab and indoor air data. A conservative base-wide AF of 1E-03 was selected and used to generate base-specific empirical shallow Soil Gas Screening Levels (SGSLs) from the USEPA (2008) RSLs.

The VI Evaluation Report (CH2M HILL, 2009) presented the results of the Phase I and II field activities. The Phase I and II sample data were compared to both generic and base-specific screening levels. Conceptual site models (CSMs) utilizing MLE collected during Phase I and II were developed for each building of interest. These CSMs indicated that, in general, VI is not currently a significant pathway of concern at the buildings investigated during Phase I and II. However, for the majority of the buildings, further sampling was recommended during Phase III, primarily to address temporal and spatial variability. In addition, the report identified select buildings where preferential transport for vapor migration in utility corridors should be investigated during Phase III. The VI Evaluation Report also identified several buildings where remediation or long-term monitoring was recommended.

Investigation Activities

A final work plan was submitted to the Navy in March 2010 (CH2M HILL, 2010). Phase III field activities were conducted in January 2010 and primarily included interior sampling (i.e., indoor air and subslab soil gas sampling) within 43 buildings. Sampling was conducted at 11 buildings in Mainside, 23 buildings in Hadnot Point, 3 buildings in MCAS, New River, and 6 buildings in Camp Geiger. Exterior sampling (i.e., groundwater grab sampling from the top of the water table and soil vapor sampling) was conducted adjacent to three buildings based on recommendations made in the VI Evaluation Report (CH2M HILL, 2009). Pressure differential monitoring was also conducted at the five Hadnot Point ASD system buildings (Buildings 1108,1200, 1201, 1202, and 1301) and one non-ASD system building (Building 1115).

Empirically based screening levels were again developed using the Phase III sample data. These screening levels were then compared with the site-specific modeled screening levels developed during the Phase III work planning phase using the J&E model (including temperature adjustments). This preliminary comparison highlighted some of the variability and uncertainties inherent in modifying default input parameters when conducting site-specific modeling. Because of these uncertainties and to prevent premature elimination of buildings of interest, the Phase III data were compared to screening levels based on the USEPA (2008) air RSLs adjusted using USEPA's (2002) default shallow soil gas to indoor air AF (1E-01) and groundwater to indoor air AF (1E-03).

In response to notification given to the Navy regarding preliminary data with base-specific SGSL exceedances, the Navy Directorate for Public Health, Industrial Hygiene Department, conducted area sampling to evaluate potential hazards according to Occupational Safety and Health Administration (OSHA) standards. Indoor air was collected at Buildings 3B, 43, and HP-57 on April 12 and 13, 2010.

To confirm outlier concentrations, Buildings HP-57, 1606, and 1828 were re-sampled during April/May 2010 and included indoor and outdoor air and subslab sampling.

Data Evaluation

Data collected during the Phase III investigation were evaluated as described below:

- Empirical shallow soil gas to indoor air AFs were calculated using co-located subslab soil gas and indoor air sample data. Building-specific empirical AFs ranged from 1E-02 to 1E-06 based on the paired Phase III subslab and indoor air data. Based on this evaluation, the base-wide AF of 1E-03 established using the Phase I and Phase II data was determined to remain applicable and was used to generate base-specific empirical shallow SGSLs.
- MLE were used to evaluate potential VI impacts. The MLE approach is consistent with DoD (2009), ITRC (2007), and USEPA (2002) VI guidance documents. Lines of evidence included, but were not limited to, the following:
  - a review of site history
  - historical groundwater data
  - building survey results
  - existing remediation and/or VI mitigation systems
  - the potential presence of NAPL
  - the magnitude, correlation, and spatial (horizontal and vertical) distribution of historical, Phase I and/or Phase II, and/or Phase III groundwater, exterior soil gas, interior subslab, indoor, and/or outdoor air data
  - chemical product and use inventory
  - pressure differential measurements
  - preferential pathways
  - modeling results

- CSMs were developed for each building using the MLE. Preliminary CSMs based on current land use were developed during the Phase I work planning phase (CH2M HILL, 2008), updated in the VI Evaluation Report (CH2M HILL, 2009), and refined in this report based on the Phase III evaluation. The CSMs generally describe potential contaminant sources, migration pathways, and human receptors. If the building to subslab pressure is negative during a portion or all of a day, soil gas migrates into the building through openings in the slab by diffusion, advection, and convection. The CSMs were refined based on the extent of depressurization, the size of the buildings, the type of construction material, the number and size of openings in the buildings and their usage patterns, subsurface lithology, groundwater depth and flow, and media-specific results.
- Horizontal transport via preferential pathways (e.g., underground utilities) at other buildings in the investigation areas was evaluated in the VI Evaluation Report (CH2M HILL, 2009). Four additional buildings were identified as buildings for Phase III data collection (Buildings 4, HP-57, 1827, and 1606) and are evaluated herein.

Results

The results of the Phase III field investigations along with the MLE suggest that VI is not currently a significant pathway of concern at MCB CamLej, with the exception of Building 3B. There is, however, a potential for the VI pathway to become significant at Buildings 3, 37, 43, HP-57, 1828, 902, and 1115 in the future. Conclusions of Phase III of the base-wide VI evaluation for each of the five areas are summarized in the following sections.

Mainside

Exterior soil gas and subslab soil gas samples were collected within or near 11 buildings (Buildings 3, 3B, 37, 43, 4, HP-57, 820, 1827, 1828, 1855, and LCH-4014) at Mainside to evaluate the potential for VI impacts. Indoor/outdoor air sampling was also conducted at eight buildings (Buildings 3, 3B, 37, 43, HP-57, 820, 1828, and LCH-4014).

The conclusions of the MLE evaluation are summarized below.

- VI is a significant pathway of concern at Building 3B. Indoor air PCE concentrations were detected at Building 3B at concentrations exceeding the IASL by more than 100 times, resulting in estimated risks exceeding the target cancer risk range (1E-06 to 1E-04).
- While VI is not currently a significant pathway of concern at Buildings 3, 37, 43, HP-57, and 1828, there is uncertainty regarding whether the pathway may become significant in the future due to elevated subslab soil gas concentrations.
- The VI pathway is not currently a significant pathway of concern at Buildings 4, 1855, 820, and LCH-4014.
- Additional data are necessary for Building 1827 because subslab soil gas conditions in the southern half of the building are unknown and, based on the results from neighboring Building 1828, there is likely an additional subsurface source of PCE near the south side of Buildings 1827 and 1828.

Hadnot Point

Twenty-four buildings of interest were retained within Hadnot Point for Phase III of the base-wide VI evaluation. Groundwater, exterior soil gas, subslab soil gas, and indoor/outdoor air samples were collected within or near 23 buildings (Buildings 901, 902, 903, 1502, 1601, 1603, 1606, 1707, 1817, 1819, 1611, 1613, 1005, 1068, 1114, 1220, 1100, 1115, 1108, 1200, 1201, 1202, and 1301) at Hadnot Point to evaluate the potential for VI impacts. Building 1111 was not sampled because shallow groundwater prevented the subslab soil gas probe from being sampled.

In addition, pressure differential monitoring was conducted at six buildings for additional lines of evidence in the VI evaluation. The building-specific differential pressure readings varied between positive, neutral, and negative and this information was used qualitatively to refine the CSMs.

The conclusions of the MLE evaluation are summarized below.

- The VI pathway could be significant at Building 902 due to high subslab PCE and TCE concentrations; however, the magnitude of VI impacts on indoor air is currently uncertain.
- While VI is not currently a significant pathway of concern at Buildings 1601, 1606, 1111, and 1115, there is uncertainty regarding whether the pathway may become significant in the future due to elevated subslab soil gas concentrations and/or lack or temporal variability information.
- VI is not currently a significant pathway of concern at the remaining 18 buildings located within Hadnot Point.

MCAS, New River

Groundwater and subslab soil gas samples were collected within or near three buildings (Buildings AS502, AS541, and AS4106) at the MCAS, New River to evaluate the potential for VI impacts.

The conclusions of the MLE evaluation are summarized below.

- VI is not currently a significant pathway of concern for buildings located aboard MCAS New River.
- An additional round of data is necessary at Building AS4106 to assess temporal variability and to confirm conclusions at this building because only one round of data has been collected.

Courthouse Bay

Subslab soil gas samples were proposed for collection within one building (Building A47) at Courthouse Bay during Phase III. However, upon surveying the building, it was discovered that all four existing subslab soil gas probes had been removed, damaged, or covered with flooring materials, making them inaccessible for sampling during Phase III. Significant VI impacts are not expected in A47 because VOCs were not detected at concentrations above the generic SGSLs and the building is a large maintenance building with multiple bay doors. However, only one round of subslab soil gas data has been collected. Therefore, re-

installation of the sampling probes and collection of an additional round of subslab soil gas data is recommended to assess temporal variability. The Phase III building survey is presented in **Appendix V1-A**.

Camp Geiger

Subslab soil gas and indoor/outdoor air samples were collected within or near six buildings (Building G480, G531, G532, G533, TC860, and TC864) at Camp Geiger to evaluate the potential for VI impacts. Indoor air sampling was also conducted at Buildings G480, TC860, and TC864.

The conclusions of the MLE evaluation are summarized below.

- VI is not currently a significant pathway of concern for the buildings investigated at Camp Geiger.
- While VI is not currently a significant pathway of concern at Buildings G533 and TC864, there is uncertainty regarding whether the pathway may become significant in the future due to elevated subslab soil gas concentrations and/or lack or temporal variability information.

Recommendations

The following additional actions are recommended at select buildings within Mainside; Hadnot Point; MCAS, New River; and/or Camp Geiger. **Table V1-1** summarizes the recommendations for each building by area.

- **Conduct Mitigation**
  - Identify the source, conduct mitigation, and/or conduct monitoring at four Mainside buildings (3, 3B, 37, and 43) and two Hadnot Point buildings (902 and 1115) where site-related VOCs were detected in subslab or exterior soil gas samples at concentrations exceeding: (1) the base-specific and generic carcinogenic-based SGSLs by more than 100 and 10,000 times, respectively, since these magnitudes of exceedance indicate a future VI risk that exceeds the 1E-04 upper end of the National Contingency Plan (NCP) target risk range; and (2) non-cancer base-specific SGSLs since this indicates a potential exceedance of a target non-cancer Hazard Quotient (HQ) of 1.0 (USEPA, 1991). In addition, the Base has elected to conduct mitigation at Building 1005 in Hadnot Point due to the building's proximity of the building to the bio-pulse system.
  - Seal expansion joints at Buildings 902 and 1115 where degradation was noted during the building surveys and in preparation for installation of the VIMS.
- **Conduct 5-Year Review Monitoring**
  - Collect an additional round of subslab soil gas data during the 5-year review at three Mainside buildings (HP-57, 1828 and 1827), three Hadnot Point buildings (1601, 1606, and 1111), 1 MCAS New River building (AS4106), one Courthouse Bay building (A47), and two Camp Geiger buildings (G533 and TC864) to assess temporal and spatial variability in the case of Building 1827, and spatial variability at

buildings where subslab soil gas sampling was conducted as recommended in documents from DoD (2009) and ITRC (2007).

  - Collect indoor air and/or outdoor air data concurrently with subslab soil gas sampling at select locations to confirm temporal and spatial variability. Concurrent subslab soil gas and indoor air sampling is recommended at two Mainside buildings (HP-57 and 1828), two Hadnot Point buildings (1601 and 1606), and two Camp Geiger buildings (G533 and TC864).
  - Install and sample a subslab probe at one Hadnot Point building (1111) where subslab soil gas has been sampled only once. The existing probe is too close to the top of the water table and it is recommended that a new probe be installed above the mechanics trench.
  - Confirm that the base-wide subslab to indoor air AF of 1E-03 remains appropriate as additional data (concurrent subslab soil gas and indoor air) are collected, and re-evaluate the AF during the 5-year review.
  - Consider the potential for future impacts resulting from migration of constituents in groundwater from upgradient areas to areas beneath two Mainside buildings (901 and 903) during future VI evaluations.
  - Monitor CVOC concentrations from the top of the water table in the newly installed shallow monitoring well near Building 901.
- **Consider the VI Pathway during Remedial Action Planning and Implementation**
  - Evaluate the potential for VI at sites where planned remedial action has the potential to cause a pathway or increase risk (e.g. air sparging, biosparging, electrical resistance heating, etc.).
- **Consider VI Pathway During Construction Planning**
  - Consider the VI pathway at buildings that have exceedances of the generic and/or base-wide SGSLs to prevent the slab from being compromised since cracks, holes, or other penetrations of the slab have the potential to invalidate the use of the base-specific AF. Consider air monitoring for construction activities that involve slab penetrations, such as removing part of the slab or drilling holes through the slab. Additional data collection at the conclusion of construction may be warranted to confirm that the base-specific AF remains appropriate.
  - Consider the VI pathway when new construction is planned over an existing VOC plume.

TABLE V1-1
Summary of Phase III Recommendations
MCB CamLej, North Carolina

Site Name	Bldg #	Conduct Mitigation	Seal Expansion Joints	Collect Additional Round of Subslab Soil Gas and/or Indoor Air Data during 5-Year Review	Monitor VI Pathway if CVOC Plume Migration is Identified	Monitor Top of Water Table	Consider VI Pathway During Remedial Action Planning and Implementation	Consider VI Pathway During Construction Planning	No Further Action
Mainside									
Buildings of Interest Sampled During Phase III									
IR Site 88	3	X							
	3B	X							
	37	X							
	43	X							
	4								X
	HP-57			X			X	X	
SWMU 360	1828			X			X	X	
	1855						X	X	X
	1827			X			X	X	
UST 820	820						X	X	X
UST LCH-4015	LCH-4014						X	X	X
Hadnot Point									
Buildings of Interest Sampled During Phase III									
IR Site 78	901				X	X	X	X	
	902	X	X						
	903				X		X	X	X
	1502						X	X	X
	1601			X	X		X	X	
	1603						X	X	X
	1606			X			X	X	
	1707						X	X	X
SWMU 360	1817						X	X	X
	1819						X	X	X
UST 1611	1611						X	X	X
	1613						X	X	X

TABLE V1-1
Summary of Phase III Recommendations
MCB CamLej, North Carolina

Site Name	Bldg #	Conduct Mitigation	Seal Expansion Joints	Collect Additional Round of Subslab Soil Gas and/or Indoor Air Data during 5-Year Review	Monitor VI Pathway if CVOC Plume Migration is Identified	Monitor Top of Water Table	Consider VI Pathway During Remedial Action Planning and Implementation	Consider VI Pathway During Construction Planning	No Further Action
Hadnot Point Fuel Farm	1005	X							
	1068								X
	1114						X	X	X
	1220						X	X	X
	1100						X	X	X
	1111			X			X	X	
	1115	X	X						
	1108						X	X	X
	1200						X	X	X
	1201						X	X	X
	1202						X	X	X
	1301						X	X	X
MCAS, New River									
Buildings of Interest Sampled During Phase III									
IR Site 86 / USTCSFF	AS502								X
	AS541								X
SWMU 336	AS4106			X					
Courthouse Bay									
IR Site 73	A47			X					
Camp Geiger									
Buildings of Interest Sampled During Phase III									
IR Site 35-B	G480						X	X	X
IR Site 35-A	G531						X	X	X
	G532						X	X	X
	G533			X			X	X	
IR Site 89	TC860						X	X	X
	TC864			X			X	X	

Notes:
IR - Installation Restoration
SWMU - Solid Waste Management Unit
UST - Underground Storage Tank

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Appendix

V1-A Building Survey - Courthouse Bay – Building A-47

Abbreviations and Acronyms

AF	attenuation factor
amsl	above mean sea level
AS	air sparge
ASD	active subslab depressurization
bgs	below ground surface
BS	biosparge
Cal/EPA	California Environmental Protection Agency
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
COC	chain-of-custody
COPC	constituent of potential concern
CSM	conceptual site model
°F	degree(s) Fahrenheit
DO	dissolved oxygen
DoN	Department of the Navy
DPT	direct push technology
FFA	Federal Facility Agreement
FSP	Field Sampling Plan
ft	feet/foot
ft^2	square feet/square foot
GC/MS	gas chromatograph/mass spectrometer
GIS	geographic information system
GWSL	groundwater screening level
HPFF	Hadnot Point Fuel Farm
HSWA	Hazardous and Solid Waste Amendments
HVAC	heating, ventilating, and air conditioning
IDW	investigation derived waste
IR	Installation Restoration
ITRC	Interstate Technology & Regulatory Council
J&E	Johnson and Ettinger
MCAS	Marine Corps Air Station
MCB	Marine Corps Base
MEC	Munitions and Explosives of Concern
mL/min	milliliter(s) per minute
MLE	multiple lines of evidence
MS/MSD	Matrix Spike/Matrix Spike Duplicate
NACIP	Navy Assessment and Control of Installation Pollutants
NAPL	nonaqueous phase liquid
NCDENR	North Carolina Department of Environment and Natural Resources

NC 2L Standards	North Carolina Groundwater Quality Standards
NCP	National Contingency Plan
NPL	National Priorities List
OSHA	Occupational Safety and Health Administration
PCE	tetrachloroethene
PETG	polyethylene terephalate glycol
PPE	personnel protective equipment
PRT	post-run tubing
QAPP	Quality Assurance Project Plan
RCRA	Resource Conservation and Recovery Act
RL	reporting limit
RSL	Regional Screening Level
SARA	Superfund Amendments and Reauthorization Act
SGSL	Soil Gas Screening Levels
SVE	soil vapor extraction
SWMU	Solid Waste Management Unit
2-D	two-dimensional
TCE	trichloroethene
TCL	Target Compound List
USEPA	United States Environmental Protection Agency
UST	underground storage tank
UXO	unexploded ordnance
VI	vapor intrusion
VOC	volatile organic compound

SECTION 1

Introduction

1.1 Site Background

The mission of Marine Corps Base Camp Lejeune (MCB CamLej) is to maintain combat-ready units for expeditionary deployment. MCB CamLej provides housing, training facilities, logistical support, and administrative supplies for Fleet Marine Force units and other assigned units. MCB CamLej is home to an active duty, dependent, retiree, and civilian population of approximately 150,000, of whom approximately 47,000 are military personnel.

Thousands of structures are located on MCB CamLej, which covers approximately 236 square miles in Onslow County, North Carolina. The Base is bisected by the New River, which flows in a southeasterly direction and forms a large estuary before entering the Atlantic Ocean (Figure V1-1). MCB CamLej lies within the outer part of the Atlantic Coastal Plain Physiographic Province in North Carolina. Low elevations and relatively low relief characterize the topography across MCB CamLej. The surface elevations range from sea level to approximately 70 feet (ft) above mean sea level (amsl), with most of MCB CamLej's elevation ranging from 20 to 40 ft amsl. The subsurface at MCB CamLej is generally sand and/or silt with sand/clay lenses. The depth to groundwater ranges from 0 (surface water) to 22 ft below ground surface (bgs).

Climatic conditions in southeastern North Carolina and at MCB CamLej are characterized by winters that are mild with occasional short, cold periods. Summers are long, hot, and humid. Average annual net precipitation is approximately 50 inches. Ambient air temperatures generally range from 33 to 53 degrees Fahrenheit (°F) in the winter months and 71°F to 88°F during the summer months. Winds are generally south-southwesterly in the summer, and north-northwesterly in the winter (CH2M HILL, 2008).

MCB CamLej has been actively engaged in environmental investigations and remediation programs since 1983, beginning with the Navy Assessment and Control of Installation Pollutants (NACIP) Program. The Installation Restoration (IR) program was initiated in 1986 following enactment of the Superfund Amendments and Reauthorization Act (SARA) legislation. The IR program, which was implemented to follow the requirements of SARA, replaced the NACIP. MCB CamLej was placed on the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) National Priorities List (NPL) on October 4, 1989 (54 *Federal Register* 41015, October 4, 1989). Following that listing, a Federal Facility Agreement (FFA) between United States Environmental Protection Agency (USEPA) Region 4, the North Carolina Department of Environment and Natural Resources (NCDENR), and the Department of the Navy (DoN) was signed in February 1991.

MCB CamLej was issued a Resource Conservation and Recovery Act (RCRA) Hazardous Waste Management Permit in September 1984. Subsequently, the permit was modified, and on January 10, 1997 the RCRA Part B Permit was approved to include corrective action at treatment, storage, and disposal facilities. MCB CamLej has a Hazardous and Solid Waste

Amendments (HSWA) Permit that took effect in 2008, replacing the Part B Permit, which expired in January 2007.

Leaking petroleum underground storage tank (UST) sites are also present at the Base. These USTs are regulated under the NCDENR Division of Waste Management UST Section.

Detailed background information about each of the investigation areas and the general activities that occur there is presented in the Phase I Work Plan (CH2M HILL, 2008) and the *Final Phase III Vapor Intrusion Evaluation Work Plan* (CH2M HILL, 2010).

1.2 Base-wide Vapor Intrusion Evaluation Objectives

The following sequence of primary objectives was identified for the base-wide vapor intrusion (VI) investigation during development of the original Work Plan (CH2M HILL, 2008):

1. Identify the buildings located within 100 ft vertically or horizontally of existing monitoring wells with groundwater volatile organic compound (VOC) concentrations exceeding generic VI screening values or North Carolina Groundwater Quality Standards (NC 2L Standards), and if present,
2. Determine whether a potentially complete and/or significant VI exposure pathway could exist based on a review of the preliminary Conceptual Site Model (CSM), and if so,
3. Assess whether significant VI impacts are occurring inside the buildings at levels that could adversely affect building occupants, and/or,
4. If necessary, provide recommendations to further investigate, remediate, or mitigate the potential VI pathway.

The specific objectives for Phase III of the VI evaluation, identified in the Phase III Work Plan (CH2M HILL, 2010), were as follows:

1. Assess temporal variability of subslab soil gas concentrations at 40 buildings where samples were collected during either Phase I or II.
2. Assess temporal variability of indoor air at 15 of the buildings where samples were collected during either Phase I or II.
3. Further characterize potential impacts and assess spatial variability of subslab soil gas at the 12 buildings where either significant (two orders of magnitude) variability was observed in subslab soil gas or only one subslab soil gas location was sampled in Phase I or II.
4. Assess the potential for underground utility conduits (i.e., potential preferential pathways) to transport soil gas by collecting subslab soil gas samples at four buildings that are connected by underground utilities passing through areas where soil gas concentrations exceeded base-specific soil gas screening levels during Phase I or Phase II.
5. Evaluate the need for continued operation of existing active subslab depressurization systems at five Hadnot Point buildings.

6. Collect top of the water table groundwater data adjacent to two buildings where constituent migration from an upgradient source may be a concern.
7. Gather potential source area information (e.g., exterior soil vapor or exterior top of the water table data) at three buildings to refine the understanding of the source area potentially affecting the buildings. (These additional exterior data will be useful during remedy selection/design.)

The scope of this investigation is limited to currently occupied buildings; should land use change, additional VI evaluations would be required. Several buildings were omitted from this investigation because they were not occupied at the time of the screening. A future VI evaluation may be required if these or other buildings (newly built) become occupied. Conversely, if buildings in this investigation become unoccupied, they may be omitted from a future phase of this VI evaluation.

For purposes of implementing this Phase III VI evaluation, MCB CamLej was divided into four investigation areas (**Figure V1-2**):

- Mainside
- Hadnot Point
- Marine Corps Air Station (MCAS), New River
- Camp Geiger

Data collection was also planned in one building located within a fifth investigation area, Courthouse Bay, during Phase III. However, upon surveying the building, it was discovered that all four existing subslab soil gas probes had been removed, damaged, or covered with flooring materials, making them inaccessible for sampling during Phase III.

Site background information, methodologies, and VI evaluation results common to all investigative areas are presented separately from the VI investigation results for each investigative area.

It should be noted that in the context of this report, the term "significant vapor intrusion impacts" indicates situations where the screening level assessment suggests there is potential for unacceptable risk. A full Human Health Risk Assessment was not conducted. Therefore, no risks have been quantified.

1.3 Report Organization

This base-wide VI report is divided into five volumes.

- **Volume 1 – Executive Summary, Introduction, Overall Investigation Methods, Screening Level Evaluations, and References.** The Executive Summary is contained in this volume and provides a brief overview of the objectives, investigative methods, results, conclusions, and recommendations for this Phase III base-wide VI investigation. Volume 1 also contains a discussion of the investigative methods common to all areas (Section 2); the development and evaluation of generic VI screening levels and empirical base-wide attenuation factors (AFs) (Section 3); and report references (Section 4).
- Volume 2 – Mainside

- Volume 3 – Hadnot Point
- Volume 4 – MCAS, New River
- Volume 5 – Camp Geiger
- Detailed information regarding the Phase III field investigation activities and results for each building are provided in Volumes 2 through 5. Results by building are compared with applicable screening levels and are discussed in relation to background sources, Phase I, II, and/or III results, spatial correlations, and building characteristics. Refined CSMs are provided for each building in Volumes 2 through 5, along with detailed conclusions and recommendations.

SECTION 2

Investigation Methods

The investigation methods used during the Phase III base-wide VI evaluation are consistent with U.S. Department of Defense (DoD) (2009), Interstate Technology & Regulatory Council (ITRC) (2007), and USEPA (2002) VI guidance documents. The phased approach taken during this VI evaluation is presented in the VI Evaluation Report (CH2M HILL, 2009) as **Figure V1-3**.

The Final Vapor Intrusion Evaluation Work Plan (CH2M HILL, 2008) presented the detailed screening steps of the phased evaluation and investigation process. The first step consisted of using the Base geographic information system (GIS) to identify buildings within 100 ft of monitoring wells containing volatile organic compound (VOC) concentrations (data collected between 2002 and 2007) which exceeded generic screening levels. Screening levels are risk-based constituent concentrations below which no further action or study is warranted. Generic screening levels are based on conservative assumptions about site conditions and are used to identify areas that can be "screened out" of the evaluation process. The generic VI screening levels from the USEPA Vapor Intrusion Guidance (2002) were used to screen groundwater data; groundwater concentrations below these screening levels are unlikely to be a potential source for VI. The state regulatory standards, the NC 2L Standards, were also used for screening when generic VI screening levels were not available or the NC 2L Standards were lower than the generic VI screening levels for a certain constituent. Through the initial screening step, 168 buildings were identified for further evaluation.

The next step consisted of generating site-specific VI screening levels using USEPA's (2004) version of the Johnson and Ettinger (J&E) (1991) model and comparing the existing groundwater data to the site-specific screening levels using GIS. Buildings located within 100 ft of shallow monitoring wells containing groundwater concentrations above the site-specific screening levels were retained for further evaluation. Buildings located within 100 ft of areas where non-aqueous phase liquids (NAPLs) have been previously identified were retained for further evaluation because the J&E model is limited where NAPLs are present. Buildings located within 100 ft of remediation systems such as air sparging (AS) or biosparge (BS) systems that can create pressure gradients which may promote VI were also retained for further evaluation. This refined screening resulted in the identification of 50 buildings for further evaluation. A phased field investigation was conducted to assess the potential for VI at these 50 buildings.

Phase I field activities were conducted in June 2008 and primarily included exterior sampling (i.e., groundwater grab sampling from the top of the water table and co-located soil vapor sampling) adjacent to the 50 buildings. However, interior sampling (i.e., indoor air and subslab soil gas sampling) was also conducted at buildings near AS or BS remediation systems and where NAPLs have been previously identified, due to the complexity of the subsurface environment and potential VI pathway in these areas.

Analytical data collected during Phase I were used to check the validity of the assumptions used to generate the site-specific J&E modeled screening levels developed during the work planning phase. This preliminary comparison highlighted some of the variability and uncertainties in modifying default input parameters when conducting site-specific modeling. Additionally, between the completion of the work planning phase and the subsequent receipt of the Phase I sample data, the USEPA (2008) Regional Screening Levels (RSLs) were released. Because of the uncertainty regarding the site-specific screening levels and the availability of screening levels based on more recent toxicity values and inhalation risk calculation methods, the decision was made to use generic VI screening levels based on the USEPA (2008) RSLs to screen the Phase I data. USEPA's (2002) default shallow soil gas to indoor air AF (1E-01) and groundwater to indoor air AF (1E-03) were used to develop generic VI screening levels from the USEPA (2008) air RSLs. Based on the comparison of the Phase I sample data to the generic screening levels, additional data collection was proposed at 28 buildings, including five at Hadnot Point with existing active subslab depressurization (ASD) systems.

To further evaluate the 28 buildings, Phase II field activities were conducted in September and October 2008 and included indoor air, outdoor air, subslab sampling, and detailed building surveys. Pressure differential monitoring and groundwater sampling were also conducted at the five Hadnot Point ASD system buildings.

Empirical shallow soil gas to indoor air AFs were calculated using Phase I and II co-located subslab soil gas and indoor air data. Building-specific empirical AFs ranged from 1E-02 to 1E-05 based on the paired Phase I and Phase II subslab and indoor air data. A conservative base-wide AF of 1E-03 was selected and used to generate base-specific empirical shallow Soil Gas Screening Levels (SGSLs) from the USEPA (2008) RSLs.

The VI Evaluation Report (CH2M HILL, 2009) presented the results of the Phase I and II field activities. The Phase I and II sample data were compared to both generic and base-specific screening levels. CSMs utilizing multiple lines of evidence (MLE) collected during Phase I and II were developed for each building of interest. These CSMs indicated that, in general, VI was not currently a significant pathway of concern at the buildings investigated during Phase I and II. However, for the majority of the buildings, further sampling was recommended during Phase III, primarily to address temporal and spatial variability. In addition, the report identified select buildings where preferential transport for vapor migration in utility corridors should be investigated during Phase III. The VI Evaluation Report also identified several buildings where remediation or long-term monitoring was recommended.

Phase III field activities were conducted in January 2010 and primarily included interior sampling (i.e. indoor air and subslab soil gas sampling) within 43 buildings. Sampling was conducted during Phase III at 11 buildings in Mainside, 23 buildings in Hadnot Point, 3 buildings in MCAS, New River, and 6 buildings in Camp Geiger. Exterior sampling (i.e., groundwater grab sampling from the top of the water table and soil vapor sampling) was conducted adjacent to three buildings based on recommendations made in the VI Evaluation Report (CH2M HILL, 2009). Pressure differential monitoring was also conducted at the five Hadnot Point ASD system buildings (Buildings 1108, 1200, 1201, 1202, and 1301) and one non-ASD system building (Building 1115).

Building-specific empirical AFs ranged from 1E-02 to 1E-06 based on the paired Phase III subslab and indoor air data. Based on the evaluation, the base-wide AF of 1E-03 established using the Phase I and Phase II data was determined to remain applicable and was used to generate base-specific empirical shallow SGSLs.

In response to notification given to the Navy regarding preliminary data with base-specific SGSL exceedances, the Navy Directorate for Public Health, Industrial Hygiene Department, conducted area sampling to evaluate potential hazards according to Occupational Safety and Health Administration (OSHA) standards. Indoor air was collected at Buildings 3B, 43, and HP-57 on April 12 and 13, 2010.

To confirm outlier concentrations, Buildings HP-57, 1606, and 1828 were re-sampled during April/May 2010 and included indoor and outdoor air and subslab soil gas sampling.

CSMs incorporating the MLE methods published by DoD (2009) and ITRC (2007) that were developed for each of the buildings of interest during the Phase I/II report (CH2M HILL, 2009) were refined to include data collected during Phase III. These CSMs and associated conclusions and recommendations are provided for each building of interest in each investigation area in Volumes 2 through 5.

2.1 Phase III Field Event – January/February 2010

Forty buildings were retained for Phase III sampling as recommended in the VI Evaluation Report (CH2M HILL, 2009). Detailed explanations for retaining certain buildings for Phase III sampling (and excluding others) are provided in the refined CSM section (Section 4) of Volumes 2 through 5. Phase III sampling decisions were made on a case-by-case basis considering the Phase I and/or II results, current building use, presence of preferential pathways, and other lines of evidence. Buildings that were only sampled once for subslab soil gas and/or indoor air were retained for Phase III sampling to assess temporal variability. Some buildings that had already been sampled more than once were retained and additional sample locations were proposed to assess spatial variability within the buildings. Four buildings (Building 4, HP-57, 1606, and 1827) were retained for Phase III sampling because they were connected by utilities that may be acting as preferential pathways to buildings with Phase I or II screening level exceedances.

A summary of the number of buildings retained for Phase III sampling is provided in **Table V1-2**:

Phase III sampling was proposed for 45 buildings (40 buildings plus 5 with ASD systems). However, Phase III sampling was performed at only 43 buildings in January/February 2010 and primarily included subslab and indoor/outdoor air sampling, with limited groundwater and exterior soil vapor sampling. Building 1111 could not be sampled due to a shallow water table and Building A47 was not sampled because the subslab soil gas probes could not be located. It was assumed, after a building survey was performed (**Appendix V1-A**), that the probes had been removed, damaged, or covered with floor coverings since the Phase I sampling event.

TABLE V1-2
Buildings of Interest Summary – Phase III
MCB CamLej, North Carolina

Investigation Area	Mainside	Hadnot Point	MCAS, New River	Courthouse Bay	Camp Geiger	Total
Buildings Retained due to Preferential Pathways	2	2				4
Buildings with active subslab depressurization systems		5				
Buildings Retained for Phase III Sampling	11	24	3	1	6	45

Additional investigation activities, including pressure differential monitoring, were performed at the five Hadnot Point ASD system buildings and one Hadnot Point non-ASD system building.

2.1.1 Phase III Sample Locations

Groundwater, exterior soil vapor, subslab soil gas, indoor air, and outdoor air samples were collected during Phase III sampling activities. Additional details regarding the number, location, and types of samples collected during the Phase III sampling are provided in Volumes 2 through 5.

Additional subslab soil gas and indoor and outdoor air samples were collected during April/May 2010 to confirm Phase III results at Buildings HP-57 and 1828 (Mainside) and 1606 (Hadnot Point). Additional details regarding the number, location, and types of samples collected during the confirmatory sampling event are provided in Volumes 2 and 3.

2.2 Sample Collection Procedures

The Phase III sampling events were performed in accordance with the procedures detailed in the Field Sampling Plan (FSP), included in the Phase III Work Plan (CH2M HILL, 2010).

The permanent groundwater well installation was performed with a hollow stem auger drill rig. The temporary groundwater well point and exterior soil vapor sampling was performed with direct push technology (DPT). The drilling work (auger and DPT) was subcontracted to a North Carolina licensed well driller, Probe Technology Inc.

During the Phase III field event in January/February 2010, subslab soil gas, indoor air, and outdoor air samples were collected at four investigation areas in MCB CamLej. Pressure differential monitoring was also performed at five ASD system buildings and one non-ASD system building. Additional information on the pressure differential monitoring is provided in Volume 3.

2.2.1 Site Preparation

Site preparation included utility clearance at each proposed exterior DPT sample location and Munitions and Explosives of Concern (MEC) avoidance at Building 1707 in Hadnot Point where potential MEC hazards exist.

Utility Clearance

For Phase III, five North Carolina One Call tickets were opened on February 3, 2010, to cover the proposed sample locations. The ticket numbers were C100340856, C100340862, C100340864, C100340867, and C100340871. These tickets were valid from February 3 through 22, 2010.

In addition, a utility clearance was performed by Accumark of Ashland, VA from January 25 to 27, 2010. The utility clearance activities were overseen by a member of the CH2M HILL field team. As an additional precaution, hand augering was performed at each exterior drilling location to prevent utilities from being encountered.

The following buildings were cleared on January 25: Buildings 3, 43, and HP-57 at Site 88, LCH-4014 at Site Underground Storage Tank (UST) LCH4015, 1827 and 1828 at Solid Waste Management Unit (SWMU) 360 on Mainside, and Buildings 902 at Site 78 North, 1819 at SWMU 360, and 1220 at Hadnot Point Fuel Farm (HPFF) on Hadnot Point. The following buildings were cleared on January 26: Buildings 902 at Site 78 North, 1601, 1603 1606, and 1707at Site 78 South on Hadnot Point and Buildings AS541, AS502, and AS4106 on MCAS, New River. The following were cleared on January 27: the exterior soil vapor locations near Building 3B at Site 88 on Mainside, temporary groundwater well points and permanent monitoring well near Buildings 901, 902, and 903 at Site 78 North on Hadnot Point, and the temporary groundwater well point near Building AS541 on MCAS, New River.

MEC Avoidance

MEC avoidance was conducted at Building 1707 at Site 78 in Hadnot Point where potential MEC hazards exist in the interest of the safety of onsite workers who could potentially be exposed to munitions hazards. Building 1707 is located close to unexploded ordnance (UXO) Site UXO-08.

Potential MEC hazards were cleared as necessary in accordance with the Health and Safety Plan (CH2M HILL, 2010, Appendix C). CH2M HILL supplied a trained and qualified UXO technician who provided MEC escort and avoidance services during the Phase III sampling activities at Building 1707. The UXO technician was informed of the shallow depth (< 12 inches below the top of the slab) to which the subslab soil gas probe was being drilled and remained onsite while drilling began. No MEC hazards were encountered.

2.2.2 Groundwater Monitoring Well Installation and Sampling

One permanent groundwater monitoring well, IR78-MWVI01, was installed at the northeast corner of Building 902 in Hadnot Point. VOCs at certain concentrations may be prone to volatilize and pass through the vadose zone; the monitoring well screen was installed at the top of the water table because the groundwater at the top of the aquifer is the most relevant portion of the aquifer for evaluating vapor intrusion. The monitoring well screen was placed such that it extends 2 ft above and 8 ft below the water table as determined in the field on the day of installation. The soil boring was logged to record lithology and to determine the depth of the water table. A copy of the soil boring log form, used to record the soil core information, is provided in Appendix V3-A of Volume 3.

The monitoring well was installed and developed in accordance with NC requirements and in accordance with the SOP #1 – Standard Operating Procedure for the Design and

Installation of Groundwater Monitoring Wells presented in the FSP (CH2M HILL, 2010). The well was developed approximately 48 hours after the well installation was completed. A copy of the development log for IR88-MWVI01 is presented in Appendix V3-A of Volume 3.

Groundwater sampling was performed in accordance with the SOP #3 – Standard Operating Procedure for Low-Flow Groundwater Sampling from Monitoring Wells presented in the FSP (CH2M HILL, 2010). The well was sampled approximately 4 days after installation. A centrifugal pump and disposable Teflon™ tubing were used for sampling. Field indicator parameters (turbidity, temperature, specific conductance, pH, Eh, and dissolved oxygen [DO]) were measured with a water quality meter (Horiba U-22 equipped with a flow through cell) and recorded. A groundwater sample was collected once the parameters stabilized. The groundwater samples were submitted to Shealy Environmental Services, Inc. in West Columbia, South Carolina following USEPA Method SW-8260 for Target Compound List (TCL) VOCs. Copies of the field data sheets, used to document the monitoring well installation and sampling activities, are presented in Appendix V3-A of Volume 3.

2.2.3 Groundwater Grab Sampling

Groundwater grab sampling was performed in the vicinity of Buildings 902 and 903 in Hadnot Point and Building AS541 in MCAS, New River. Groundwater grab sampling was performed in accordance with SOP #2 – Standard Operating Procedure for Direct Push Groundwater Sample Collection (CH2M HILL, 2010). Groundwater samples were collected using the Geoprobe® Screen Point Sampler (stainless-steel retractable screen attached to the DPT rods). To determine the sample depth, 5- to 10-ft soil cores were collected at each location using a Geoprobe Macro-Core® Sampler with polyethylene terephalate glycol (PETG) liners. The soil cores were logged to record lithology and to determine the depth of the water table. Copies of the soil boring log forms used to record the soil core information are presented in Appendixes V3-A (Hadnot Point) and V4-A (MCAS, New River).

At each selected groundwater grab sample location, the groundwater sampling device was pushed to the desired sample interval. Since the groundwater at the top of the aquifer is most representative of VOC concentrations at which the VOCs may volatilize and pass through the vadose zone, the sample interval was the top 1 ft of the water table. If there was not sufficient volume to collect a groundwater sample within the 1-ft interval, the exposed portion of the screen was increased at 1-ft intervals, thus drawing groundwater from a larger vertical interval.

The groundwater samples were collected directly through the screen following low-flow sampling protocol using a peristaltic pump and disposable Teflon™ tubing. Field indicator parameters (turbidity, temperature, specific conductance, pH, Eh, and DO) were measured with a water quality meter (Horiba U-22 or YSI 600 equipped with a flow through cell) and recorded. Collection of a groundwater sample was attempted within approximately 5 minutes of low-flow purging, regardless of the observed turbidity. Groundwater collected from the DPT is considered to be representative of groundwater in that sample interval, so significant purging was not required. The groundwater samples were submitted to Shealy Environmental Services, Inc. for analysis following USEPA Method SW-8260 for TCL VOCs (Table 2-1). Copies of the field data sheets used to document the groundwater grab

sampling activities are presented in Appendixes V3-A (Hadnot Point) and V4-A (MCAS New River).

2.2.4 Exterior Shallow Soil Vapor

In this document, the term soil vapor is used to describe soil gas samples collected outside of buildings. Temporary exterior shallow soil vapor samples were to be collected at six locations around Building 3B using a Geoprobe® post-run tubing (PRT) system. However, two of the six locations (IR88-IS16 and IR88-IS18) could not be sampled due to a shallow water table following recent rain events. Temporary exterior soil vapor sample probes were installed in accordance with SOP #4 - Standard Operating Procedure for the Installation of Shallow Soil Gas Sampling Probes in Conjunction with Indoor Vapor Intrusion Assessments (PRT Soil Gas Probes) (CH2M HILL, 2010) and were sampled in accordance with SOP #5 - Standard Operating Procedure for the Collection of Soil Gas Samples from Soil Gas Probes (GeoProbe System - PRT) using SUMMA Canisters and a Helium Leak Check (CH2M HILL, 2010). The soil vapor probe screen interval was 1 ft long and was located from 5 to 6 ft bgs. The screen interval was not extended above 5 ft bgs in accordance with USEPA's draft VI guidance (USEPA, 2002).

The basic PRT system consists of an expendable PRT drive point (tip), PRT point holder and assembly, hollow drive rod, drive point popper, PRT tubing adapter, Teflon™ tubing, and various O-rings used to create a gas-tight seal at connection points (at drive rods, PRT point holder, point, etc.).

A helium leak check was performed prior to sampling to confirm that the probe was installed correctly. The probe was purged with a sampling manifold (consisting of stainless steel Swagelok® gas tight valves and fittings and Teflon tubing) and an air pump. Three probe volumes of soil gas were purged at 200 milliliter(s) per minute (mL/min) into a Tedlar bag. A landfill gas meter was used to collect field measurements of oxygen, carbon dioxide, and methane. Soil vapor samples were collected in 1-L SUMMA canisters equipped with flow controllers. The flow controllers regulated the sample collection rate to 200 mL/min, which resulted in a sample collection period of 5 minutes. The soil gas samples were submitted to Columbia Analytical Services in Simi Valley, California for analysis following USEPA Method TO-15 for VOCs. Copies of the field data sheets used to document the soil vapor sampling activities are presented in Appendix V2-A.

A building survey was performed at each of the Phase III buildings of interest, except at buildings where the characteristics and usage have remained the same and matches information from previous phase building surveys. At buildings where building surveys where already performed in either Phase I or II, those building surveys were updated with current building conditions. The building surveys were performed in accordance with SOP #7 – Standard Operating Procedure for Conducting Building Surveys for Vapor Intrusion Evaluation (CH2M HILL, 2010). The CH2M HILL field team documented building conditions which are pertinent to VI. Such items include the location of underground utilities that may serve as preferential pathways, the type and typical operation of the heating, ventilating, and air conditioning (HVAC) system, and the condition of the slab. Chemical products stored and activities performed within the buildings surveyed which may be sources of VOCs in indoor air (dry cleaned clothing, solvents, cleaning products, etc.) were also be documented. This information was obtained by visual inspection and by holding

discussions with Base personnel. The gathered information was documented on building survey forms, copies of which are presented in Appendix C of Volumes 2 through 5.

At several buildings, constituents were detected above the IASLs in Phase I or II indoor air samples that were determined to be unrelated to VI. Attempts were made during the building surveys to identify and remove the indoor sources of these constituents.

- Building 820 – benzene, carbon tetrachloride, 1,4-dichlorobezene, and chloroform
- Building LCH4014 – chloroform
- Building 1005 – PCE, 1,1,2,2-tetrachloroethane, and 1,2-dichloroethane
- Building 1220 – 1,4-dichlorobenzene
- Building 1108 - 1,4-dichlorobenzene
- Building 1200 – 1,4-dichlorobenze (detected above the 10^{-4} target cancer risk level), benzene, ethylbenzene, and chloroform
- Building G480 – benzene, 1,2-dichloroethane and 1,4-dichlorobenzene

2.2.5 Subslab Soil Gas Sampling

Subslab soil gas samples were collected in accordance with SOP # 7- Standard Operating Procedure for Installing Subslab Probes and Collecting Subslab Soil Gas Samples Using SUMMA canisters (CH2M HILL, 2010). Copies of the field data sheets used to document the subslab soil gas probe installation and sampling activities are presented in Appendix A of Volumes 2 through 5.

Subslab Soil Gas Probe Installation

New subslab probes were installed in buildings for the following reasons:

- The building could not be sampled previously due to construction (Building 3).
- Spatial variability was to be assessed (Buildings 43, 1828, LCH4014, 902, 903, 1601, 1603, 1707, 1220, AS541 and AS502).
- Potential preferential pathways were to be assessed (Buildings 4, HP57, 1827 and 1606).
- Subslab sampling was not deemed a priority for Phase II but was required to draw conclusions about the potential VI pathway (Building AS4106).

The proposed locations of the new subslab soil gas probes are shown as grey dots on the two-dimensional (2-D) figures in Volumes 2 through 5. The subslab soil gas probes that were installed to assess preferential pathways were located near areas where the utilities enter the building and at least 5 ft from any exterior wall.

Subslab probes were installed by drilling through the building foundation with a rotary hammer drill and securing the probe in place with Portland cement placed into the hole so that it was flush with the foundation. The subslab probes consisted of stainless steel Swagelok® gas tight fittings (a length of one-quarter-inch stainless steel tubing [that did not extend below the slab], a probe union, a sampling union, and a probe cap). The cement was allowed to dry for 24 hours.

Subslab Soil Gas Probe Sampling

Subslab soil gas samples were collected in buildings for the following reasons:

- The building could not be sampled previously due to construction (Building 3).
- Temporal variability was to be assessed (Buildings 3B, 37, 43, 1828, 1855, 820, LCH4014, 901, 902, 903, 1611, 1613, 1502, 1601, 1603, 1707, 1817, 1819, 1068, 1114, 1005, 1100, 1115, 1220, 1108, 1200, 1201, 1202, 1301, AS541, AS502, G531, G532, G533, G480, TC860, and TC864).
- Additional data were to be collected for calculation of empirical subslab soil gas to indoor air AFs (Buildings 3, 3B, 37, 43, 820, LCH4014, 902, 1601, 1817, 1114, 1005, 1115, 1220, 1108, 1200, 1201, 1202, 1301, G480, TC860 and TC864).
- Spatial variability was to be assessed (Building 43, 1828, LCH4014, 902, 903, 1601, 1603, 1707, 1819, 1220, AS541 and AS502).
- Potential preferential pathways were to be assessed (Buildings 4, HP57, 1827, 1606).
- Subslab sampling was not deemed a priority for Phase II but was required to draw conclusions about the potential VI pathway (Building AS4106).
- The need for continued operation of ASD systems was to be assessed (1108, 1200, 1201, 1202 and 1301).

A helium leak check was performed prior to sampling all probes (new and existing) to confirm that the new probes were installed correctly and the existing probes had not been damaged since they were last sampled. The probes were purged with a sampling manifold (consisting of stainless steel Swagelok® gas tight valves and fittings and Teflon tubing) and an air pump. Two L of subslab soil gas were purged at 200 mL/min into a Tedlar bag. Subslab soil gas samples were collected in SUMMA canisters equipped with flow controllers. The flow controllers regulated the sample collection rate to 200 mL/min, resulting in a sample collection period of 5 minutes. The subslab soil gas samples were submitted to Columbia Analytical Services for analysis following USEPA Method TO-15 for VOCs.

2.2.6 Indoor Air Sampling

Indoor air sampling was performed for the following reasons:

- The building could not be sampled previously due to construction (Building 3).
- Temporal variability was to be assessed in indoor air and additional data were to be collected for calculation of empirical subslab soil gas to indoor air AFs (Buildings 3B, 37, 43, 820, LCH4014, 1817, 1114, 1005, 1100, 1115, 1220, G480, TC860 and TC864)
- Spatial variability in indoor air was to be assessed (Buildings 3B, LCH4014, 1005, 1220 and TC860).
- A determination was needed on whether indoor air concentrations exceed IASLs where base-specific subslab soil gas exceedances occurred and indoor air samples were not previously collected (Buildings 902 and 1601).
- The need for continued operation of ASD systems was to be assessed (Buildings 1108, 1200, 1201, 1202 and 1301).

Indoor air samples were collected in accordance with SOP #8 - Standard Operating Procedure for Integrated Ambient or Indoor Air for Trace VOCs by Method TO-14/15 (SUMMA canister) (CH2M HILL, 2010).

Indoor air samples were collected from the locations shown on the 2-D figures in Volumes 2, 3, and 5. New indoor air sample locations were on the first floor of the building away from exterior walls. Indoor air sample locations were slightly adjusted to target occupied areas and to keep the canisters out of the way of building occupants. The indoor air sample locations were also co-located with nearby subslab soil gas probes if appropriate. The SUMMA canisters were placed on tables or chairs to achieve a sample height approximately 3-5 ft above the ground (roughly breathing zone height).

Indoor air samples were collected over a 24-hour period in SUMMA canisters equipped with flow controllers. The SUMMA canisters were placed at the sampling location, turned on, and left undisturbed for 24 hours. The SUMMA canisters were checked after 20 hours to confirm that the canister pressure did not reach zero. The indoor air samples were submitted to Columbia Analytical Services for analysis following USEPA Method TO-15 for VOCs. Copies of the field data sheets used to document the indoor air sampling activities are presented in Appendix A of Volumes 2, 3, and 5.

2.2.7 Outdoor Air Sampling

Three outdoor air samples were collected from each of the investigation areas where indoor air sampling was being performed in Phase III; Mainside, Hadnot Point, and Camp Geiger. Outdoor air samples were collected in accordance with SOP #8 - Standard Operating Procedure for Integrated Ambient or Indoor Air for Trace VOCs by Method TO-14/15 (SUMMA canister) (CH2M HILL, 2010). The outdoor air sample canisters were placed in secure locations and were secured to a fence or other structure with a chain and padlock. Outdoor air samples were collected over a 24-hour period in SUMMA canisters equipped with flow controllers. The SUMMA canisters were placed at the sampling location, turned on and left undisturbed for 24 hours. The SUMMA canisters were checked after 20 hours to confirm that the canister pressure did not reach zero. The outdoor air samples were submitted to Columbia Analytical Services for analysis following USEPA Method TO-15 for VOCs. Copies of the field data sheets used to document the outdoor air sampling activities are presented in Appendix A of Volumes 2, 3, and 5.

2.2.8 Investigation-derived Waste Management

Investigation-derived waste (IDW) generated from the Phase III activities consisted of drill cuttings from the DPT soil borings, purge groundwater, decontamination fluids, disposable equipment, and personnel protective equipment (PPE). Water generated during the purging of the temporary groundwater well points at Site IR78 was disposed of at the Mainside Water Treatment Plant at Lot 203 Piney Green Road.

The remaining IDW water and soil generated during Phase III was identified as non-hazardous based on the results of waste characterization and properly disposed by Shamrock Environmental (**Table V1-4 and V1-5**). Disposable equipment, including PPE, Teflon tubing, poly sheeting, paper towels, and aluminum foil, was disposed of in garbage bags as solid waste.

2.2.9 Data Management and Usability

During the field activities, the following QA/QC samples were collected in accordance with the Quality Assurance Project Plan (QAPP), which is part of the Work Plan (CH2M HILL, 2010) and the FSP to ensure precision, accuracy, representativeness, completeness, and comparability:

- Equipment rinsate blanks (groundwater) - 1 per day for reusable equipment
- Trip blanks (groundwater) - 1 per cooler shipped to laboratory
- Field blanks (groundwater) – 1 per week of sampling
- Field duplicates (groundwater, soil vapor, indoor air, subslab soil gas, outdoor air) – 1 per 10 samples per sample type
- Matrix spike/matrix spike duplicates (MS/MSDs) (groundwater) – 1 per 20 samples

The duplicate samples were analyzed to verify the reproducibility of the laboratory results and the degree of variability of reported concentrations. The maximum concentrations from the parent and field duplicate sample results were utilized for purposes of this evaluation.

Equipment rinsate blanks were collected by running laboratory-supplied de-ionized water over/through the sampling equipment and placing it into the appropriate sample containers for laboratory analyses. Equipment rinsate blanks were collected from selected disposable sampling equipment (roll of tubing, stainless steel spoon, etc.); one equipment rinsate blank was collected each day for reusable sampling equipment. The results were used to verify that the sampling equipment had not contributed to contamination of the samples.

One field blank was collected from each source of water used in decontamination. The field blanks were collected by pouring the water from the original container or spigot directly into the sample bottle set. Field blanks were not collected in dusty environments. The results were used to verify that the water used in decontamination had not contributed to contamination of the samples.

Field duplicate samples consisted of one unique sample, split into two aliquots, which were analyzed independently. T-connectors were used to attach two SUMMA canisters together for simultaneous duplicate sample collection. Duplicate water samples were collected concurrently. The duplicate samples were analyzed to verify the reproducibility of the laboratory results and the degree of variability of reported concentrations. Duplicate samples were collected at a frequency of 10 percent; the samples were taken from locations anticipated to be contaminated.

MS/MSD samples were prepared in the field to address aliquoting reproducibility and to provide information on matrix reproducibility otherwise unobtainable from samples reported below analytically reproducible and statistically valid levels. MS/MSD samples were prepared at a frequency of 5 percent for each group of samples of a similar matrix; the samples were taken from locations anticipated to be contaminated.

2.2.10 Pressure Differential Monitoring

Subslab soil gas to indoor air pressure differential monitoring was performed at the 5 Hadnot Point ASD system buildings (Buildings 1108, 1200, 1201, 1202 and 1301) during Phase III in conjunction with subslab soil gas and indoor air sampling. Pressure differential monitoring was performed to evaluate the effect of the ASD system on the subslab soil gas pressure differential.

Pressure differential monitoring was performed in accordance with SOP #9 Standard Operating Procedure for Long-Term Measurement of Subslab/Indoor Air Differential Pressure for Vapor Intrusion Investigations (CH2M HILL, 2010). Pressure differential monitoring was performed with an Omniguard 4 and a Barrologger Gold. The Omniguard 4 was connected to a subslab soil gas probe and left for a period of time before and after subslab soil gas sample collection. The Omniguard 4 measured the maximum and minimum difference in pressure between the subslab soil gas and indoor air every 5 minutes. The Barrologger Gold recorded the barometric pressure in the indoor air every 5 minutes. These data were logged by the Omniguard 4 and Barrologger Gold and downloaded onto a computer once the monitoring period was complete. These instruments have a resolution of ±0.001 inch of water and are accurate to within ±1 percent.

Pressure differential monitoring was performed at the five ASD system buildings (1108, 1200, 1201, 1202, and 1301) during and after subslab soil gas sampling to evaluate the impact of the ASD system on the subslab soil gas to indoor air pressure differential. At Building 1115 the pressure data were collected to evaluate the subslab soil gas and indoor air samples that were collected concurrently in Phase III.

A digital micromanometer (Omniguard 4) was attached to a subslab soil gas probe in each of the six selected buildings: the five ASD system buildings (1108, 1200, 1201, 1202, and 1301) and Building 1115 (due to high subslab VOC concentrations). During collection of pressure differential data, the ASD systems, where present, were turned off to eliminate the pressure influence on the structure and allow for typical (non-mechanical) pressure differential conditions to be recorded.

SECTION 3

Screening Levels and Empirical Vapor Intrusion Attenuation Factors

The purpose of this section is to summarize the groundwater and soil gas screening levels used to evaluate the Phase III data. The screening levels that were used to evaluate the Phase III sampling data are similar to those used to evaluate the Phase I and II sampling data in the VI Evaluation Report (CH2M HILL, 2009). A detailed description of these screening levels and how they were generated is presented in Section 3 of the Final VI Evaluation Report (CH2M HILL, 2009, Volume 1). The screening levels were updated for this report with the most recent USEPA RSLs (May 2010). Additionally, the GWSLs were calculated with the Henry's Law coefficients used to calculate the May 2010 RSLs; the GWSLs in the VI Evaluation Report (CH2M HILL, 2009) were calculated with the Henry's Law coefficients from USEPA's 2004 version of the J&E model.

The majority of the buildings in the Phase III evaluation are industrial buildings, so the screening levels were based on the industrial air RSLs; however, there is one building in Mainside (Building HP-57) and three buildings in Camp Geiger (Buildings G531, G532 and G533) that are used as barracks; therefore, the screening levels for these buildings were based on the residential air RSLs with the understanding that this is a particularly conservative approach because the exposure duration for a barrack resident is much shorter that the 30-years assumed for calculating the residential air RSLs.

For both the carcinogenic and non-carcinogenic VOCs observed in subslab soil gas, the base-specific SGSLs were considered for this evaluation. Concentrations above these values generally require further action (remediation and/or mitigation of the VI pathway).

For the carcinogenic VOCs observed in indoor air, the USEPA (1991) risk management range of 1E-06 to 1E-04 was considered for this evaluation. Concentrations above this range (i.e., greater than 1E-04 cancer risk) generally require further action (remediation and/or mitigation of the VI pathway). Concentrations within the risk management range may require further action (further evaluation, additional sampling, etc.) based on site conditions. Concentrations above the USEPA (1991) noncancer target Hazard Quotient (HQ) of 1.0 may also require further action.

There are several constituents on the full TO-15 VOC list for which RSLs are not provided. The relative toxicities of these constituents were considered as part of the uncertainty evaluation.

Several constituents were reported with non-detect results and high reporting limits but were not listed in the text tables unless they exceeded screening levels during previous phases or in alternative media in the samples collected at or near the building evaluated. The details and conclusions from these evaluations are provided in this section.

3.1 Calculation of Generic Screening Levels

Generic GWSLs for industrial and residential scenarios are provided in **Tables V1-5** and **V1-6**, respectively. Generic SGSLs for industrial and residential scenarios are provided in **Tables V1-7** and **V1-8**, respectively. The GWSLs and SGSLs were calculated using the USEPA (2010) RSLs for air adjusted by USEPA (2002) default AFs of 1E-03 for groundwater, 1E-01 for shallow soil gas, and 1E-02 for deep soil gas. Based on a conversation with the USEPA representative, a target noncancer HQ of 0.1 was incorporated into the screening level calculations to account for cumulative risk from potential simultaneous exposure to multiple constituents of potential concern (COPCs). Indoor air screening levels (IASLs) for industrial and residential scenarios are provided in **Tables V1-9** and **V1-10**, respectively. The RSLs were finalized in May 2010, after the Phase III Work Plan (CH2M HILL, 2010) was published. Descriptions of the methodologies used to calculate generic GWSLs and SGSLs are provided in the following sections.

3.1.1 Generic Groundwater Screening Levels

The USEPA (2002) industrial and residential generic GWSLs have been updated for the VOCs detected in groundwater at MCB CamLej using USEPA (2010) RSLs for industrial and residential air and the USEPA (2002) default subsurface to indoor air AF of 1E-03 for groundwater (**Tables V1-5** and **V1-6**). USEPA (2008) confirmed that this is an upper percentile (conservative) value based on a national empirical database. A more detailed discussion of the methods used to calculate the generic GWSLs is provided in the following paragraphs.

Generic industrial GWSLs were calculated using the methodology described in Appendix D of the *OSWER Draft Guidance for Evaluating the Vapor Intrusion to Indoor Air Pathway from Groundwater and Soils (Subsurface Vapor Intrusion Guidance)* (USEPA, 2002). The target groundwater concentration (i.e., GWSL) corresponding to a chemical's target indoor air concentration was calculated by dividing the target indoor air concentration (i.e., the USEPA [2010] RSLs for industrial or residential air) by the default AF (1E-03) and then converting the vapor concentration to an equivalent groundwater concentration, assuming equilibrium between the aqueous and vapor phases. The equation is as follows (USEPA, 2002):

$$C_{gw}\ [\mu g/L] = [C_{target,ia}\ (\mu g/m^3) * 10^{-3}\ m^3/L * 1/H'_{TS} * 1/a$$

where,

Cgw	=	target groundwater concentration (i.e., GWSL),
$C_{target,ia}$	=	target indoor air concentration (i.e., RSLs for residential and industrial air),
α	=	AF (ratio of indoor air concentration to source vapor concentration; 1E-03), and
H'_{TS}	=	Henry's Law Constant at system (groundwater) temperature (dimensionless)

The dimensionless form of the Henry's Law Constant at the system temperature (i.e., at the average groundwater temperature) was estimated using the following equation (USEPA, 2004):

$$H'_{TS} = \frac{\exp\left[-\frac{\Delta H_{v,TS}}{RT_s}\left(\frac{1}{T_S} - \frac{1}{T_R}\right)\right] H_R}{RT_S}$$

where,

H'_{TS}	=	Henry's Law Constant at the system temperature (dimensionless)
ΔHv,TS	=	Enthalpy of vaporization at the system temperature (cal/mol)
T_S	=	System temperature (°K)
T_R	=	Henry's Law Constant reference temperature (°K)
H_R	=	Henry's Law Constant at the reference temperature (atm-m3/mol)
R_C	=	Gas constant (= 1.9872 cal/mol - °K)
R	=	Gas constant (= 8.205 E-05 atm-m3/mol-°K)

The enthalpy of vaporization at the system temperature is calculated using the following equation (USEPA, 2004):

$$\Delta H_{v,TS} = \Delta H_{v,b}\left[\frac{(1 - T_S/T_C)}{(1 - T_B/T_C)}\right]^n$$

where,

ΔHv,TS	=	Enthalpy of vaporization at the system temperature (cal/mol)
ΔHv,b	=	Enthalpy of vaporization at the normal boiling point (cal/mol)
TS	=	System temperature (□K)
TC	=	Critical temperature (□K)
TB	=	Normal boiling point (□K)
n	=	Constant (unitless) (The value of n is a function of the ratio of TB /TC.)

The site-specific average groundwater temperature (i.e., 23 □C or 296 □K) used in the calculation of the dimensionless Henry's Law Constant at the system temperature was based on data collected during the sampling events performed at each investigation area.

The generic GWSLs are based on a 1E-06 cancer risk and a non-cancer HQ of 1.0, which was divided by 10, resulting in a HQ of 0.1 to account for exposure to multiple constituents. The generic industrial GWSLs for VOCs detected in MCB CamLej groundwater are presented in **Table V1-5** and the generic residential GWSLs are presented in **Table V1-6**.

3.1.2 Soil Gas

Generic SGSLs were developed for chemicals detected in soil vapor and subslab samples using the methodology in Appendix D of the Draft VI Guidance (USEPA, 2002) for calculating target soil gas concentration corresponding to target indoor air concentration. SGSLs were calculated for both shallow soil gas (i.e., soil gas < 6 ft bgs) and deep soil gas (i.e., soil gas > 6 ft bgs). The target soil gas concentration (i.e., SGSL) corresponding to a chemical's target indoor air concentration (i.e. RSL for industrial and residential air) was calculated by dividing the indoor air concentration by the USEPA (2002) default AF for shallow or deep soil gas. The equation is presented below:

$$C_{soil\ gas}\ [\mu g/m^3] = C_{target,ia}\ [\mu g/m^3] / \alpha$$

where,

$C_{soil\ gas}$	=	target soil gas concentration (i.e., SGSL),
$C_{target,ia}$	=	target indoor air concentration (i.e., RSLs for residential and industrial air),and
α	=	AF [ratio of indoor air concentration to source vapor concentration; 1E-01 for shallow soil gas (i.e., soil gas <6 ft) and 1E-02 for deep soil gas (i.e., soil gas > 6 ft)]

The generic SGSLs are based on a 1E-06 cancer risk and a non-cancer HQ of 1.0, which was divided by 10, resulting in a HQ of 0.1 to account for exposure to multiple constituents. The generic industrial SGSLs for VOCs detected in MCB CamLej subsurface are presented in **Table V1-7** and the generic residential SGSLs are presented in **Table V1-8**.

3.2 Empirical Soil Gas to Indoor Air Attenuation Factors Derived Using Phase III Data

Concurrent subslab and indoor air data collected from 24 buildings sampled at multiple areas during Phase III were assessed when calculating empirical AFs and subsequent empirically based SGSLs. As discussed in USEPA (2008), AFs can be biased high (by up to orders of magnitude) if AFs are calculated without considering the subslab source strength. Consistent with the data evaluation and filtering approaches described in USEPA's (2008) Vapor Intrusion Database technical support document, empirical AFs were calculated only for constituents that had relatively high subslab soil gas concentrations (i.e., greater than 100 times the minimum subslab reporting limits). Also, in accordance with relevant guidance (USEPA, 2008), empirical AFs were not calculated for VOCs that were non-detect in the subslab samples since it is assumed that the chemical is either absent in the subsurface or present below levels of concern; however, that same chemical can be present in the indoor air due to background sources, which would result in AFs that are biased artificially high. The empirical AF calculations for all of the buildings with concurrent indoor and subslab results are provided in **Table V1-11**. Concurrent indoor air concentrations were paired with each subslab soil gas sample collected at a given building and the ratios (i.e., AFs) of indoor air concentrations to subslab soil gas concentrations were calculated for VOCs with subslab concentrations greater than 100 times the minimum Phase III reporting limits (RLs) (Table V1-12). Empirical AFs based on indoor air results that were 2 times greater than outdoor air concentrations were differentiated from AFs based on indoor air results that were similar to background outdoor levels (refer to the footnote in **Table V1-11**). USEPA (2008) states that:

> "*When background indoor air concentrations are equivalent to or greater than the concentration contributed by vapor intrusion, the empirical attenuation factor will be biased high relative to the true attenuation factor (i.e., towards higher, more conservative values) by the contribution of background sources to indoor air. The bias varies in proportion to the relative contribution of background sources to the total indoor air concentration. … The empirical attenuation factor is most likely to represent the attenuation due to vapor intrusion when the indoor air concentration*

> *from vapor intrusion is substantially greater than the background indoor air concentration, which is most likely to occur when subsurface vapor concentrations are high."*

As discussed by USEPA (2008), it is important to consider background indoor and/or outdoor air concentrations when calculating and interpreting empirical AFs. There is no hard-and-fast rule when attempting to determine if the indoor air concentrations are significantly greater than background levels. Some partnering team members (USEPA and state regulators) have suggested during other site evaluations for the Navy that indoor air concentrations may start to approach the point of being significantly different from outdoor air concentrations if they are more than two times the outdoor air concentrations. Therefore, two times the outdoor air concentrations was selected when highlighting the results in **Table V1-11**.

The empirical AFs were plotted against the subslab soil gas concentrations for chlorinated VOCs and petroleum hydrocarbons (**Figures V1-4** and **V1-5**). The AFs shown in Figure **V1-4** and **V1-5** were based on the AFs listed in Table V1-11 for those VOCs with subslab concentrations greater than 100 times the minimum reporting limits. There were 19 buildings with subslab concentrations greater than 100 times the minimum subslab RLs (**Table V1-11**). Additional information (e.g., building number, VOC, Phase, subslab and indoor air concentration, two times the outdoor air concentration) associated with each of the AFs presented on **Figures V1-4** and **V1-5** is provided in **Table V1-12**. The following building characteristics for all of the buildings examined in the empirical AF evaluation are summarized in **Table V1-13**: (1) size of the building (the cutoff for small and large buildings was selected at 5,000 square feet (ft^2), with the total square footage for all of these buildings ranging from <1,000 ft^2 to more than 50,000 ft^2); (2) the presence and operation of HVAC systems during sampling; (3) ceiling height; (4) whether the building consists primarily of offices, warehouse space, or both; and (5) if the windows and/or doors are typically closed or left open. There are no apparent correlations between the AFs and building characteristics listed in Tables **V1-11** and **V1-13**, respectively.

The empirical subslab to indoor air AFs ranged from 1E-02 to 1E-06 for those constituents with indoor air results two times greater than outdoor air (**Figures V1-4 and V1-5**). These results indicate that the shallow SGSLs based on USEPA's (2002) default AF of 1E-01 significantly (at least 100 times) over-predict indoor air concentrations when compared to the selected generic AF of 1E-03. The most conservative (rather than a statistical estimate given the limited data) AF calculated from buildings with indoor air concentrations greater than two times the outdoor air concentrations was 1E-02, as shown in Figures V1-4 and V1-5. However, this AF was not selected as a representative base-wide AF for the wide range of building types and sizes encountered at MCB CamLej for the following reasons.

<u>Chlorinated Solvents:</u>

- The calculated AF (1E-02) for freon, chloroform, and methylene chloride may be due to potential indoor air sources in the buildings where they were observed (Building 820, LCH-4014, and 1200, respectively). These constituents are not common site-related compounds and have markedly different AFs from the other compounds at these buildings.

- The one sample at Building 902 with a high subslab soil gas concentration (370,000 parts per billion by volume [ppbv] of TCE), when coupled with the co-located indoor air sample, yields an AF of 7E-06; the subslab soil gas concentration that yields a calculated AF of 1E-02 (170 ppbv) is more likely an artifact of the source strength and not representative of an AF at that location due to mixing within the building.
- For all remaining compounds with calculated AFs of 1E-02, the source concentration strengths are low and are likely biased by aboveground background sources.

Petroleum Hydrocarbons:

- The median AF of the calculated AFs from Phase I/II and Phase III at Building 1115 is 8E-04. Due to the high potential at this building for indoor air sources to bias the calculated AF high and the median AF of 1E-04, the AF was not changed during this evaluation. It is recommended that the AF be re-evaluated during the 5-year review.

It is also recommended that the HAPSITE® onsite gas chromatograph/mass spectrometer (GC/MS) be utilized during the 5-year review at the buildings where an AF equal to 1E-02 was calculated. This will allow for a more precise quantification of VOC concentrations and a more accurate calculation of empirical AFs for MCB CamLej buildings.

Shallow SGSLs were re-calculated based on an assumed base-wide empirical AF of 1E-03 and were used in the final evaluation of the soil gas and subslab results in subsequent volumes. Refer to **Tables V1-7** and **V1-8** for a list of the base-specific SGSLs that were calculated using the assumed shallow soil gas to indoor air empirical AF of 1E-03. Note that a shallow soil gas to indoor air AF of 1E-03 is similar to the default used by select states (e.g., California Environmental Protection Agency [Cal EPA], 2004) and the same as the sandy (most conservative) scenario-specific AF listed in USEPA's (2002) draft VI Guidance.

The base-specific SGSLs will be used for future VI evaluations at MCB CamLej. To confirm that these screening levels remain appropriate over time, a re-evaluation should be performed in 5 years. Concurrent subslab soil gas and indoor air sampling should be performed at buildings where exceedances of the base-specific SGSLs have occurred. These sample data will be used to re-calculate a base-specific empirical AF. Re-evaluation of the base-specific AF is necessary because AFs at buildings can change over time as the building ages because cracks may develop in the slab.

SECTION 4

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TABLE V1-3
Solid IDW Phase III Results
Phase III Vapor Intrusion Report
MCB CamLej, North Carolina

Sample ID	IR78-IDW02-021210	IR86-IDW02-021210
Sample Date	2/12/10	2/12/10
Chemical Name		
TCLP Volatile Organic Compounds (MG/L)		
Vinyl chloride	0.009 JH	0.01 UH
TCLP Semivolatile Organic Compounds (MG/L)		
No Detections		
TCLP Pesticides/Polychlorinated Biphenyls (MG/L)		
No Detections		
TCLP Herbicides (MG/L)		
No Detections		
TCLP Metals (MG/L)		
Barium	0.12 J	0.033 J
Mercury	4.20E-05 J	0.0002 U
Selenium	0.1 U	0.033 J
Silver	0.054	0.045 J
Wet Chemistry (SU)		
pH	5.78 H	4.41 H
Reactivity (MG/KG)		
No Detections		
Ignitability (DEG/F)		
No Detections		

Notes:

DEG/F - Degrees Fahrenheit
H - Out of hold time

J - Analyte present. Value may or may not be accurate or precise
MG/KG - Milligrams per kilogram
MG/L - Milligrams per liter
NS - Not sampled
SU - Standard units
U - The material was analyzed for, but not detected
Shading indicates detection

TABLE V1-4
Aqueous IDW Phase III Results
Phase III Vapor Intrusion Report
MCB CamLej, North Carolina

Sample ID	IR78-IDW01-021210	IR86-IDW01-021210
Sample Date	2/12/10	2/12/10
Chemical Name		
TCLP Volatile Organic Compounds (MG/L)		
No Detections		
TCLP Semivolatile Organic Compounds (MG/L)		
No Detections		
TCLP Pesticides/Polychlorinated Biphenyls (MG/L)		
No Detections		
TCLP Herbicides (MG/L)		
No Detections		
TCLP Metals (MG/L)		
Barium	0.51	0.094 J
Chromium	0.031 J	0.05 U
Lead	0.034 J	0.1 U
Selenium	0.1 U	0.032 J
Silver	0.047 BJ	0.069 B
Wet Chemistry (PCT)		
% Solids	76.7	84.5
pH	8.49 H	7.09 H
Reactivity (MG/KG)		
No Detections		
Ignitability (DEG/F)		
No Detections		

Notes:

B - Analyte not detected above the level reported in blanks
DEG/F - Degrees Fahrenheit
H - Out of hold time

J - Analyte present. Value may or may not be accurate or precise
MG/KG - Milligrams per kilogram
MG/L - Milligrams per liter
NS - Not sampled
PCT - Percent
SU - Standard units
U - The material was analyzed for, but not detected
Shading indicates detection

TABLE V1-5

Generic Vapor Intrusion Groundwater Screening Levels (Industrial Scenario)

Phase III Vapor Intrusion Report

MCB CamLej, North Carolina

CAS #	Constituent	Industrial Air RSL[1] Non-Cancer (Adjusted) µg/m^3	Industrial Air RSL[1] Cancer µg/m^3	Groundwater Attenuation Factor[2] (unitless)	System-Temp Henry's Law Constant (H'_{TS})[3] (unitless)	Non-Cancer (Adjusted) Generic GWSL[4] (ug/L)	Cancer Generic GWSL[4] (ug/L)	Final Generic GWSL[5] (ug/L)
630-20-6	1,1,1,2-Tetrachloroethane	NA	1.66E+00	1.00E-03	9.05E-02	NA	1.84E+01	1.84E+01 c
71-55-6	1,1,1-Trichloroethane	2.19E+03	NA	1.00E-03	6.77E-01	3.23E+03	NA	3.23E+03 n
79-34-5	1,1,2,2-Tetrachloroethane	NA	2.11E-01	1.00E-03	1.34E-02	NA	1.57E+01	1.57E+01 c
76-13-1	1,1,2-Trichloro-1,2,2-trifluoroethane	1.31E+04	NA	1.00E-03	2.00E+01	6.54E+02	NA	6.54E+02 n
79-00-5	1,1,2-Trichloroethane	NA	7.67E-01	1.00E-03	3.05E-02	NA	2.52E+01	2.52E+01 c
75-34-3	1,1-Dichloroethane	NA	7.67E+00	1.00E-03	2.22E-01	NA	3.46E+01	3.46E+01 c
75-35-4	1,1-Dichloroethene	8.76E+01	NA	1.00E-03	1.04E+00	8.46E+01	NA	8.46E+01 n
96-18-4	1,2,3-Trichloropropane	1.31E-01	NA	1.00E-03	1.25E-02	1.05E+01	NA	1.05E+01 n
120-82-1	1,2,4-Trichlorobenzene	8.76E-01	NA	1.00E-03	5.03E-02	1.74E+01	NA	1.74E+01 n
95-63-6	1,2,4-Trimethylbenzene	3.07E+00	NA	1.00E-03	2.22E-01	1.38E+01	NA	1.38E+01 n
106-93-4	1,2-Dibromoethane (ethylene dibromide)	3.94E+00	2.04E-02	1.00E-03	2.39E-02	1.65E+02	8.55E-01	8.55E-01 c
95-50-1	1,2-Dichlorobenzene	8.76E+01	NA	1.00E-03	6.93E-02	1.26E+03	NA	1.26E+03 n
107-06-2	1,2-Dichloroethane	1.06E+03	4.72E-01	1.00E-03	4.41E-02	2.40E+04	1.07E+01	1.07E+01 c
78-87-5	1,2-Dichloropropane	1.75E+00	1.23E+00	1.00E-03	1.05E-01	1.66E+01	1.17E+01	1.17E+01 c
108-67-8	1,3,5-Trimethylbenzene	NA	NA	1.00E-03	3.17E-01	NA	NA	NA
106-99-0	1,3-Butadiene	8.76E-01	4.09E-01	1.00E-03	2.86E+00	3.06E-01	1.43E-01	1.43E-01 c
542-75-6	1,3-Dichloropropene	8.76E+00	3.07E+00	1.00E-03	1.32E-01	6.64E+01	2.33E+01	2.33E+01 c
106-46-7	1,4-Dichlorobenzene	3.50E+02	1.11E+00	1.00E-03	8.74E-02	4.01E+03	1.27E+01	1.27E+01 c
109-69-3	1-Chlorobutane	NA	NA	1.00E-03	6.27E-01	NA	NA	NA
78-93-3	2-Butanone (MEK)	2.19E+03	NA	1.00E-03	2.13E-03	1.03E+06	NA	1.03E+06 n
126-99-8	2-Chloro-1,3-butadiene (chloroprene)	3.07E+00	NA	1.00E-03	2.09E+00	1.47E+00	NA	1.47E+00 n
95-57-8	2-Chlorophenol	NA	NA	1.00E-03	4.04E-04	NA	NA	NA
75-29-6	2-Chloropropane	NA	NA	1.00E-03	1.11E+00	NA	NA	NA
591-78-6	2-Hexanone	1.31E+01	NA	1.00E-03	3.80E-03	3.45E+03	NA	3.45E+03 n
91-57-6	2-Methylnaphthalene	NA	NA	1.00E-03	1.77E-02	NA	NA	NA
88-72-2	2-Nitrotoluene	NA	NA	1.00E-03	4.60E-04	NA	NA	NA
79-46-9	2-Nitropropane	8.76E+00	4.54E-03	1.00E-03	4.38E-03	2.00E+03	1.04E+00	1.04E+00 c
108-10-1	4-Methyl-2-pentanone (MIBK)	1.31E+03	NA	1.00E-03	5.08E-03	2.58E+05	NA	2.58E+05 n
83-32-9	Acenaphthene	NA	NA	1.00E-03	6.31E-03	NA	NA	NA
75-07-0	Acetaldehyde	3.94E+00	5.57E+00	1.00E-03	2.56E-03	1.54E+03	2.18E+03	1.54E+03 n
67-64-1	Acetone	1.35E+04	NA	1.00E-03	1.32E-03	1.02E+07	NA	1.02E+07 n
75-05-8	Acetonitrile	2.63E+01	NA	1.00E-03	1.30E-03	2.03E+04	NA	2.03E+04 n
98-86-2	Acetophenone	NA	NA	1.00E-03	3.63E-04	NA	NA	NA
107-02-8	Acrolein	8.76E-03	NA	1.00E-03	4.63E-03	1.89E+00	NA	1.89E+00 n
107-13-1	Acrylonitrile	8.76E-01	1.80E-01	1.00E-03	5.14E-03	1.70E+02	3.50E+01	3.50E+01 c
100-52-7	Benzaldehyde	NA	NA	1.00E-03	9.37E-04	NA	NA	NA
71-43-2	Benzene	1.31E+01	1.57E+00	1.00E-03	2.09E-01	6.28E+01	7.53E+00	7.53E+00 c
100-44-7	Benzylchloride	4.38E-01	2.50E-01	1.00E-03	1.50E-02	2.92E+01	1.66E+01	1.66E+01 c
92-52-4	Biphenyl	NA	NA	1.00E-03	1.08E-02	NA	NA	NA
111-44-4	Bis(2-chloroethyl)ether	NA	3.72E-02	1.00E-03	6.00E-04	NA	6.20E+01	6.20E+01 c
75-27-4	Bromodichloromethane	NA	3.31E-01	1.00E-03	7.91E-02	NA	4.18E+00	4.18E+00 c
75-25-2	Bromoform	NA	1.11E+01	1.00E-03	1.95E-02	NA	5.70E+02	5.70E+02 c
74-83-9	Bromomethane	2.19E+00	NA	1.00E-03	2.84E-01	7.72E+00	NA	7.72E+00 n
75-15-0	Carbon disulfide	3.07E+02	NA	1.00E-03	5.71E-01	5.38E+02	NA	5.38E+02 n
56-23-5	Carbon tetrachloride	4.38E+01	2.04E+00	1.00E-03	1.04E+00	4.21E+01	1.96E+00	1.96E+00 c
108-90-7	Chlorobenzene	2.19E+01	NA	1.00E-03	1.15E-01	1.91E+02	NA	1.91E+02 n
124-48-1	Chlorodibromomethane	NA	4.54E-01	1.00E-03	2.98E-02	NA	1.52E+01	1.52E+01 c
75-45-6	Chlorodifluoromethane	2.19E+04	NA	1.00E-03	1.60E+00	1.37E+04	NA	1.37E+04 n
75-00-3	Chloroethane	4.38E+03	NA	1.00E-03	4.42E-01	9.91E+03	NA	9.91E+03 n
67-66-3	Chloroform	4.28E+01	5.33E-01	1.00E-03	1.45E-01	2.96E+02	3.68E+00	3.68E+00 c
74-87-3	Chloromethane	3.94E+01	NA	1.00E-03	3.54E-01	1.11E+02	NA	1.11E+02 n
156-59-2	cis-1,2-Dichloroethene	NA	NA	1.00E-03	1.54E-01	NA	NA	NA

TABLE V1-5

Generic Vapor Intrusion Groundwater Screening Levels (Industrial Scenario)

Phase III Vapor Intrusion Report

MCB CamLej, North Carolina

CAS #	Constituent	Industrial Air RSL[1] Non-Cancer (Adjusted) µg/m^3	Industrial Air RSL[1] Cancer µg/m^3	Groundwater Attenuation Factor[2] (unitless)	System-Temp Henry's Law Constant (H'$_{TS}$)[3] (unitless)	Non-Cancer (Adjusted) Generic GWSL[4] (ug/L)	Cancer Generic GWSL[4] (ug/L)	Final Generic GWSL[5] (ug/L)
98-82-8	Cumene	1.75E+02	NA	1.00E-03	4.11E-01	4.26E+02	NA	4.26E+02 n
110-82-7	Cyclohexane	2.63E+03	NA	1.00E-03	6.10E+00	4.31E+02	NA	4.31E+02 n
75-71-8	Dichlorodifluoromethane	8.76E+01	NA	1.00E-03	1.29E+01	6.80E+00	NA	6.80E+00 n
60-29-7	Ethyl ether	NA	NA	1.00E-03	4.70E-02	NA	NA	NA
141-78-6	Ethylacetate	NA	NA	1.00E-03	5.01E-03	NA	NA	NA
100-41-4	Ethylbenzene	4.38E+02	4.91E+00	1.00E-03	2.89E-01	1.51E+03	1.70E+01	1.70E+01 c
75-21-8	Ethylene oxide	1.31E+01	1.39E-01	1.00E-03	5.69E-03	2.30E+03	2.44E+01	2.44E+01 c
97-63-2	Ethylmethacrylate	NA	NA	1.00E-03	2.04E-02	NA	NA	NA
110-54-3	Hexane	3.07E+02	NA	1.00E-03	6.80E+01	4.52E+00	NA	4.52E+00 n
1330-20-7	m,p-Xylenes	4.38E+01	NA	1.00E-03	1.90E-01	2.31E+02	NA	2.31E+02 n
126-98-7	Methacrylonitrile	3.07E-01	NA	1.00E-03	9.23E-03	3.33E+01	NA	3.33E+01 n
79-20-9	Methyl acetate	NA	NA	1.00E-03	4.33E-03	NA	NA	NA
96-33-3	Methyl acrylate	NA	NA	1.00E-03	7.43E-03	NA	NA	NA
74-83-9	Methyl bromide	2.19E+00	NA	1.00E-03	2.84E-01	7.72E+00	NA	7.72E+00 n
74-87-3	Methyl chloride (chloromethane)	3.94E+01	NA	1.00E-03	3.54E-01	1.11E+02	NA	1.11E+02 n
1634-04-4	Methyl tert-butyl ether	1.31E+03	4.72E+01	1.00E-03	2.23E-02	5.88E+04	2.12E+03	2.12E+03 c
108-87-2	Methylcyclohexane	2.63E+03	NA	1.00E-03	4.22E+00	6.24E+02	NA	6.24E+02 n
74-95-3	Methylene bromide	1.75E+00	NA	1.00E-03	3.06E-02	5.72E+01	NA	5.72E+01 n
75-09-2	Methylene chloride	4.56E+02	2.61E+01	1.00E-03	1.24E-01	3.69E+03	2.11E+02	2.11E+02 c
80-62-6	Methylmethacrylate	3.07E+02	NA	1.00E-03	1.17E-02	2.63E+04	NA	2.63E+04 n
91-20-3	Naphthalene	1.31E+00	3.61E-01	1.00E-03	1.57E-02	8.37E+01	2.31E+01	2.31E+01 c
98-95-3	Nitrobenzene	3.94E+00	3.07E-01	1.00E-03	8.49E-04	4.64E+03	3.61E+02	3.61E+02 c
95-47-6	o-Xylene	3.07E+02	NA	1.00E-03	1.90E-01	1.62E+03	NA	1.62E+03 n
100-42-5	Styrene	4.38E+02	NA	1.00E-03	1.01E-01	4.35E+03	NA	4.35E+03 n
127-18-4	Tetrachloroethylene	1.19E+02	2.08E+00	1.00E-03	6.90E-01	1.72E+02	3.01E+00	3.01E+00 c
108-88-3	Toluene	2.19E+03	NA	1.00E-03	2.47E-01	8.88E+03	NA	8.88E+03 n
156-60-5	trans-1,2-Dichloroethene	2.63E+01	NA	1.00E-03	1.61E-01	1.63E+02	NA	1.63E+02 n
79-01-6	Trichloroethylene	NA	6.13E+00	1.00E-03	3.68E-01	NA	1.66E+01	1.66E+01 c
75-69-4	Trichlorofluoromethane	3.07E+02	NA	1.00E-03	3.73E+00	8.24E+01	NA	8.24E+01 n
108-05-4	Vinyl acetate	8.76E+01	NA	1.00E-03	1.91E-02	4.59E+03	NA	4.59E+03 n
75-01-4	Vinyl chloride	4.38E+01	2.79E+00	1.00E-03	1.11E+00	3.94E+01	2.51E+00	2.51E+00 c
1330-20-7	Xylene, mixture	4.38E+01	NA	1.00E-03	1.90E-01	2.31E+02	NA	2.31E+02 n

Notes:

[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).
RSL value for cyclohexane used as surrogate for methylcyclohexane

[2] Attenuation factor for groundwater (0.001) recommended in Draft Vapor Intrusion Guidance (USEPA, 2002)

[3] H'TS = Henry's Law Constant (demensionless) at system (i.e., groundwater) temperature. Calculated using equation 3 from USEPA, 2004.
H'TS could not be calculated for the chemicals below. Therefore, the H' at reference temperature (i.e., 25 °C) was used.
2-Hexanone
Cyclohexane
Methylcyclohexane (value obtained from Texas Risk Reduction Chem/Phys Properties Table)
2-Chloropropane (value obtained from Texas Risk Reduction Chem/Phys Properties Table)

[4] The vapor intrusion screening levels [i.e., target groundwater concentration] were updated using the methodology presented in Section 7 of Appendix D of Subsurface Vapor Intrusion Guidance (EPA, 2002):

Generic GWSL [ug/L] = $RSL_{ind,air}$ [ug/m^3] x 10^{-3} m^3/L * 1/H'_{TS} [-] * 1/Attenuation Factor,α [-]

[5] The final vapor intrusion ground water screening level is the lower value of the non-cancer screening level and cancer screening level.

H' at reference temperature

Sources:

USEPA. 2004. User's Guide for Evaluating Subsurface Vapor Intrusion Into Buildings. Office of Emergency and Remedial Response. February.

USEPA. 2002. OSWER Guidance fir Evaluating the Vapor Intrusion to Indoor Air Pathway from Groundwater and Soils (Subsurface Vapor Intrusion Guidance). November.

TABLE V1-6

Generic Vapor Intrusion Groundwater Screening Levels (Residential Scenario)

Phase III Vapor Intrusion Report

MCB CamLej, North Carolina

CAS #	Volatile Organic Compounds	Residential Air RSL[1] Non-Cancer (Adjusted) µg/m^3	Residential Air RSL[1] Cancer µg/m^3	Groundwater Attenuation Factor[2] (unitless)	System-Temp Henry's Law Constant (H'_{TS})[3] (unitless)	Non-Cancer (Adjusted) Generic GWSL[4] (ug/L)	Cancer Generic GWSL[4] (ug/L)	Final Generic GWSL[5] (ug/L)
630-20-6	1,1,1,2-Tetrachloroethane	NA	3.30E-01	1.00E-03	9.05E-02	NA	3.65E+00	3.65E+00 c
71-55-6	1,1,1-Trichloroethane	5.20E+02	NA	1.00E-03	6.77E-01	7.68E+02	NA	7.68E+02 n
79-34-5	1,1,2,2-Tetrachloroethane	NA	4.20E-02	1.00E-03	1.34E-02	NA	3.13E+00	3.13E+00 c
76-13-1	1,1,2-Trichloro-1,2,2-trifluoroethane	3.10E+03	NA	1.00E-03	2.00E+01	1.55E+02	NA	1.55E+02 n
79-00-5	1,1,2-Trichloroethane	NA	1.50E-01	1.00E-03	3.05E-02	NA	4.93E+00	4.93E+00 c
75-34-3	1,1-Dichloroethane	NA	1.50E+00	1.00E-03	2.22E-01	NA	6.76E+00	6.76E+00 c
75-35-4	1,1-Dichloroethene	2.10E+01	NA	1.00E-03	1.04E+00	2.03E+01	NA	2.03E+01 n
96-18-4	1,2,3-Trichloropropane	3.10E-02	NA	1.00E-03	1.25E-02	2.49E+00	NA	2.49E+00 n
120-82-1	1,2,4-Trichlorobenzene	2.10E-01	NA	1.00E-03	5.03E-02	4.17E+00	NA	4.17E+00 n
95-63-6	1,2,4-Trimethylbenzene	7.30E-01	NA	1.00E-03	2.22E-01	3.28E+00	NA	3.28E+00 n
106-93-4	1,2-Dibromoethane (ethylene dibromide)	9.40E-01	4.10E-03	1.00E-03	2.39E-02	3.94E+01	1.72E-01	1.72E-01 c
95-50-1	1,2-Dichlorobenzene	2.10E+01	NA	1.00E-03	6.93E-02	3.03E+02	NA	3.03E+02 n
107-06-2	1,2-Dichloroethane	2.50E+02	9.40E-02	1.00E-03	4.41E-02	5.66E+03	2.13E+00	2.13E+00 c
78-87-5	1,2-Dichloropropane	4.20E-01	2.40E-01	1.00E-03	1.05E-01	3.99E+00	2.28E+00	2.28E+00 c
108-67-8	1,3,5-Trimethylbenzene	NA	NA	1.00E-03	3.17E-01	NA	NA	NA
106-99-0	1,3-Butadiene	2.10E-01	8.10E-02	1.00E-03	2.86E+00	7.34E-02	2.83E-02	2.83E-02 c
542-75-6	1,3-Dichloropropene	2.10E+00	6.10E-01	1.00E-03	1.32E-01	1.59E+01	4.62E+00	4.62E+00 c
106-46-7	1,4-Dichlorobenzene	8.30E+01	2.20E-01	1.00E-03	8.74E-02	9.50E+02	2.52E+00	2.52E+00 c
109-69-3	1-Chlorobutane	NA	NA	1.00E-03	6.27E-01	NA	NA	NA
78-93-3	2-Butanone (MEK)	5.20E+02	NA	1.00E-03	2.13E-03	2.44E+05	NA	2.44E+05 n
126-99-8	2-Chloro-1,3-butadiene (chloroprene)	7.30E-01	NA	1.00E-03	2.09E+00	3.49E-01	NA	3.49E-01 n
95-57-8	2-Chlorophenol	NA	NA	1.00E-03	4.04E-04	NA	NA	NA
75-29-6	2-Chloropropane	NA	NA	1.00E-03	1.11E+00	NA	NA	NA
591-78-6	2-Hexanone	3.10E+00	NA	1.00E-03	3.80E-03	8.16E+02	NA	8.16E+02 n
91-57-6	2-Methylnaphthalene	NA	NA	1.00E-03	1.77E-02	NA	NA	NA
88-72-2	2-Nitrotoluene	NA	NA	1.00E-03	4.30E-04	NA	NA	NA
79-46-9	2-Nitropropane	2.10E+00	9.00E-04	1.00E-03	4.38E-03	4.79E+02	2.05E-01	2.05E-01 c
108-10-1	4-Methyl-2-pentanone (MIBK)	3.10E+02	NA	1.00E-03	5.08E-03	6.10E+04	NA	6.10E+04 n
83-32-9	Acenaphthene	NA	NA	1.00E-03	6.31E-03	NA	NA	NA
75-07-0	Acetaldehyde	9.40E-01	1.10E+00	1.00E-03	2.56E-03	3.67E+02	4.30E+02	3.67E+02 n
67-64-1	Acetone	3.20E+03	NA	1.00E-03	1.32E-03	2.42E+06	NA	2.42E+06 n
75-05-8	Acetonitrile	6.30E+00	NA	1.00E-03	1.30E-03	4.85E+03	NA	4.85E+03 n
98-86-2	Acetophenone	NA	NA	1.00E-03	3.63E-04	NA	NA	NA
107-02-8	Acrolein	2.10E-03	NA	1.00E-03	4.63E-03	4.54E-01	NA	4.54E-01 n
107-13-1	Acrylonitrile	2.10E-01	3.60E-02	1.00E-03	5.14E-03	4.08E+01	7.00E+00	7.00E+00 c
100-52-7	Benzaldehyde	NA	NA	1.00E-03	9.37E-04	NA	NA	NA
71-43-2	Benzene	3.10E+00	3.10E-01	1.00E-03	2.09E-01	1.49E+01	1.49E+00	1.49E+00 c
100-44-7	Benzylchloride	1.00E-01	5.00E-02	1.00E-03	1.50E-02	6.66E+00	3.33E+00	3.33E+00 c
92-52-4	Biphenyl	NA	NA	1.00E-03	1.08E-02	NA	NA	NA
111-44-4	Bis(2-chloroethyl)ether	NA	7.40E-03	1.00E-03	6.00E-04	NA	1.23E+01	1.23E+01 c
75-27-4	Bromodichloromethane*	NA	6.60E-02	1.00E-03	7.91E-02	NA	8.34E-01	8.34E-01 c
75-25-2	Bromoform	NA	2.20E+00	1.00E-03	1.95E-02	NA	1.13E+02	1.13E+02 c
74-83-9	Bromomethane	5.20E-01	NA	1.00E-03	2.84E-01	1.83E+00	NA	1.83E+00 n
75-15-0	Carbon disulfide	7.30E+01	NA	1.00E-03	5.71E-01	1.28E+02	NA	1.28E+02 n
56-23-5	Carbon tetrachloride	1.00E+01	4.10E-01	1.00E-03	1.04E+00	9.62E+00	3.94E-01	3.94E-01 c
108-90-7	Chlorobenzene	5.20E+00	NA	1.00E-03	1.15E-01	4.54E+01	NA	4.54E+01 n
124-48-1	Chlorodibromomethane	NA	9.00E-02	1.00E-03	2.98E-02	NA	3.02E+00	3.02E+00 c
75-45-6	Chlorodifluoromethane	5.20E+03	NA	1.00E-03	1.60E+00	3.25E+03	NA	3.25E+03 n
75-00-3	Chloroethane	1.00E+03	NA	1.00E-03	4.42E-01	2.26E+03	NA	2.26E+03 n
67-66-3	Chloroform	1.00E+01	1.10E-01	1.00E-03	1.45E-01	6.91E+01	7.60E-01	7.60E-01 c
74-87-3	Chloromethane	9.40E+00	NA	1.00E-03	3.54E-01	2.66E+01	NA	2.66E+01 n
156-59-2	cis-1,2-Dichloroethene*	NA	NA	1.00E-03	1.61E-01	NA	NA	NA

TABLE V1-6

Generic Vapor Intrusion Groundwater Screening Levels (Residential Scenario)

Phase III Vapor Intrusion Report

MCB CamLej, North Carolina

CAS #	Volatile Organic Compounds	Residential Air RSL[1] Non-Cancer (Adjusted) µg/m^3	Residential Air RSL[1] Cancer µg/m^3	Groundwater Attenuation Factor[2] (unitless)	System-Temp Henry's Law Constant (H'$_{TS}$)[3] (unitless)	Non-Cancer (Adjusted) Generic GWSL[4] (ug/L)	Cancer Generic GWSL[4] (ug/L)	Final Generic GWSL[5] (ug/L)
98-82-8	Cumene	4.20E+01	NA	1.00E-03	4.11E-01	1.02E+02	NA	1.02E+02 n
110-82-7	Cyclohexane	6.30E+02	NA	1.00E-03	6.10E+00	1.03E+02	NA	1.03E+02 n
75-71-8	Dichlorodifluoromethane	2.10E+01	NA	1.00E-03	1.29E+01	1.63E+00	NA	1.63E+00 n
60-29-7	Ethyl ether	NA	NA	1.00E-03	4.70E-02	NA	NA	NA
141-78-6	Ethylacetate	NA	NA	1.00E-03	5.01E-03	NA	NA	NA
100-41-4	Ethylbenzene	1.00E+02	9.70E-01	1.00E-03	2.89E-01	3.46E+02	3.35E+00	3.35E+00 c
75-21-8	Ethylene oxide	3.10E+00	2.80E-02	1.00E-03	5.69E-03	5.45E+02	4.92E+00	4.92E+00 c
97-63-2	Ethylmethacrylate	NA	NA	1.00E-03	2.04E-02	NA	NA	NA
110-54-3	Hexane	7.30E+01	NA	1.00E-03	6.80E+01	1.07E+00	NA	1.07E+00 n
1330-20-7	m,p-Xylenes	1.00E+01	NA	1.00E-03	1.90E-01	5.26E+01	NA	5.26E+01 n
126-98-7	Methacrylonitrile	7.30E-02	NA	1.00E-03	9.23E-03	7.91E+00	NA	7.91E+00 n
79-20-9	Methyl acetate	NA	NA	1.00E-03	4.33E-03	NA	NA	NA
96-33-3	Methyl acrylate	NA	NA	1.00E-03	7.43E-03	NA	NA	NA
74-83-9	Methyl bromide	5.20E-01	NA	1.00E-03	2.84E-01	1.83E+00	NA	1.83E+00 n
74-87-3	Methyl chloride (chloromethane)	9.40E+00	NA	1.00E-03	3.54E-01	2.66E+01	NA	2.66E+01 n
1634-04-4	Methyl tert-butyl ether	3.10E+02	9.40E+00	1.00E-03	2.23E-02	1.39E+04	4.22E+02	4.22E+02 c
108-87-2	Methylcyclohexane	NA	NA	1.00E-03	4.22E+00	NA	NA	NA
74-95-3	Methylene bromide	4.20E-01	NA	1.00E-03	3.06E-02	1.37E+01	NA	1.37E+01 n
75-09-2	Methylene chloride	1.10E+02	5.20E+00	1.00E-03	1.24E-01	8.90E+02	4.21E+01	4.21E+01 c
80-62-6	Methylmethacrylate	7.30E+01	NA	1.00E-03	1.17E-02	6.24E+03	NA	6.24E+03 n
91-20-3	Naphthalene	3.10E-01	7.20E-02	1.00E-03	1.57E-02	1.98E+01	4.60E+00	4.60E+00 c
98-95-3	Nitrobenzene	9.40E-01	6.10E-02	1.00E-03	8.49E-04	1.11E+03	7.18E+01	7.18E+01 c
95-47-6	o-Xylene	7.30E+01	NA	1.00E-03	1.90E-01	3.85E+02	NA	3.85E+02 n
100-42-5	Styrene	1.00E+02	NA	1.00E-03	1.01E-01	9.94E+02	NA	9.94E+02 n
127-18-4	Tetrachloroethylene	2.80E+01	4.10E-01	1.00E-03	6.90E-01	4.06E+01	5.94E-01	5.94E-01 c
108-88-3	Toluene	5.20E+02	NA	1.00E-03	2.47E-01	2.11E+03	NA	2.11E+03 n
156-60-5	trans-1,2-Dichloroethene	6.30E+00	NA	1.00E-03	1.61E-01	3.91E+01	NA	3.91E+01 n
79-01-6	Trichloroethylene	NA	1.20E+00	1.00E-03	3.68E-01	NA	3.26E+00	3.26E+00 c
75-69-4	Trichlorofluoromethane	7.30E+01	NA	1.00E-03	3.73E+00	1.96E+01	NA	1.96E+01 n
108-05-4	Vinyl acetate	2.10E+01	NA	1.00E-03	1.91E-02	1.10E+03	NA	1.10E+03 n
75-01-4	Vinyl chloride	1.00E+01	1.60E-01	1.00E-03	1.11E+00	8.99E+00	1.44E-01	1.44E-01 c
1330-20-7	Xylene, mixture	1.00E+01	NA	1.00E-03	1.90E-01	5.26E+01	NA	5.26E+01 n

Notes:

[1] U.S. EPA Regional Screening Levels (RSL) Table, May 17, 2010, Residential Air RSLs (based on 10^{-6} for carcinogens and HQ of 0.1 for noncarcinogens).
RSL value for cyclohexane used as surrogate for methylcyclohexane

[2] Attenuation factor for groundwater (0.001) recommended in Draft Vapor Intrusion Guidance (USEPA, 2002)

[3] H'TS = Henry's Law Constant (demensionless) at system (i.e., groundwater) temperature. Calculated using equation 3 from USEPA, 2004.
H'TS could not be calculated for the chemicals below. Therefore, the H' at reference temperature (i.e., 25 °C) was used.
2-Hexanone
Cyclohexane
Methylcyclohexane (value obtained from Texas Risk Reduction Chem/Phys Properties Table)
2-Chloropropane (value obtained from Texas Risk Reduction Chem/Phys Properties Table)

[4] The vapor intrusion screening levels [i.e., target groundwater concentration] were updated using the methodology presented in Section 7 of Appendix D of Subsurface Vapor Intrusion Guidance (EPA, 2002):

Generic GWSL [ug/L] = $RSL_{res,air}$ [ug/m^3] x 10^{-3} m^3/L * 1/H'_{TS} [-] * 1/Attenuation Factor,α [-]

[5] The final vapor intrusion ground water screening level is the lower value of the non-cancer screening level and cancer screening level.

H' at reference temperature

USEPA. 2004. User's Guide for Evaluating Subsurface Vapor Intrusion Into Buildings. Office of Emergency and Remedial Response. February.

USEPA. 2002. OSWER Guidance fir Evaluating the Vapor Intrusion to Indoor Air Pathway from Groundwater and Soils (Subsurface Vapor Intrusion Guidance). November.

TABLE V1-7
Generic Vapor Intrusion Soil Gas Screening Levels (Industrial Scenario)
Phase III Vapor Intrusion Report
MCB CamLej, North Carolina

CAS #	Volatile Organic Compounds	Industrial Air RSL[1] Non-Cancer (Adjusted) µg/m^3	Industrial Air RSL[1] Cancer µg/m^3	Final Industrial Air RSL µg/m^3	Shallow Soil Gas Infinite Source Indoor Attenuation Coefficient[2] (unitless)	Shallow Samples ≤ 6 ft bgs Generic Soil Gas Screening Level[3] µg/m^3	Shallow Samples ≤ 6 ft bgs Generic Soil Gas Screening Level[3] ppbv	Deep Soil Gas Infinite Source Indoor Attenuation Coefficient[2] (unitless)	Deep Samples > 6 ft bgs Generic Soil Gas Screening Level[3] µg/m^3	Deep Samples > 6 ft bgs Generic Soil Gas Screening Level[3] ppbv
630-20-6	1,1,1,2-Tetrachloroethane	NA	1.66E+00	1.66E+00 c	0.1	1.66E+01	2.42E+00	0.01	1.66E+02	2.42E+01
71-55-6	1,1,1-Trichloroethane	2.19E+03	NA	2.19E+03 n	0.1	2.19E+04	4.01E+03	0.01	2.19E+05	4.01E+04
79-34-5	1,1,2,2-Tetrachloroethane	NA	2.11E-01	2.11E-01 c	0.1	2.11E+00	3.07E-01	0.01	2.11E+01	3.07E+00
76-13-1	1,1,2-Trichloro-1,2,2-trifluoroethane	1.31E+04	NA	1.31E+04 n	0.1	1.31E+05	1.71E+04	0.01	1.31E+06	1.71E+05
79-00-5	1,1,2-Trichloroethane	NA	7.67E-01	7.67E-01 c	0.1	7.67E+00	1.41E+00	0.01	7.67E+01	1.41E+01
75-34-3	1,1-Dichloroethane	NA	7.67E+00	7.67E+00 c	0.1	7.67E+01	1.90E+01	0.01	7.67E+02	1.90E+02
75-35-4	1,1-Dichloroethene	8.76E+01	NA	8.76E+01 n	0.1	8.76E+02	2.21E+02	0.01	8.76E+03	2.21E+03
96-18-4	1,2,3-Trichloropropane	1.31E-01	NA	1.31E-01 n	0.1	1.31E+00	2.17E-01	0.01	1.31E+01	2.17E+00
120-82-1	1,2,4-Trichlorobenzene	8.76E-01	NA	8.76E-01 n	0.1	8.76E+00	1.18E+00	0.01	8.76E+01	1.18E+01
95-63-6	1,2,4-Trimethylbenzene	3.07E+00	NA	3.07E+00 n	0.1	3.07E+01	6.24E+00	0.01	3.07E+02	6.24E+01
106-93-4	1,2-Dibromoethane (ethylene dibromide)	3.94E+00	2.04E-02	2.04E-02 c	0.1	2.04E-01	2.66E-02	0.01	2.04E+00	2.66E-01
95-50-1	1,2-Dichlorobenzene	8.76E+01	NA	8.76E+01 n	0.1	8.76E+02	1.46E+02	0.01	8.76E+03	1.46E+03
107-06-2	1,2-Dichloroethane	1.06E+03	4.72E-01	4.72E-01 c	0.1	4.72E+00	1.17E+00	0.01	4.72E+01	1.17E+01
78-87-5	1,2-Dichloropropane	1.75E+00	1.23E+00	1.23E+00 c	0.1	1.23E+01	2.66E+00	0.01	1.23E+02	2.66E+01
108-67-8	1,3,5-Trimethylbenzene	NA	NA	NA	0.1	NA	NA	0.01	NA	NA
106-99-0	1,3-Butadiene	8.76E-01	4.09E-01	4.09E-01 c	0.1	4.09E+00	1.85E+00	0.01	4.09E+01	1.85E+01
542-75-6	1,3-Dichloropropene	8.76E+00	3.07E+00	3.07E+00 c	0.1	3.07E+01	6.76E+00	0.01	3.07E+02	6.76E+01
106-46-7	1,4-Dichlorobenzene	3.50E+02	1.11E+00	1.11E+00 c	0.1	1.11E+01	1.85E+00	0.01	1.11E+02	1.85E+01
109-69-3	1-Chlorobutane	NA	NA	NA	0.1	NA	NA	0.01	NA	NA
78-93-3	2-Butanone (MEK)	2.19E+03	NA	2.19E+03 n	0.1	2.19E+04	7.43E+03	0.01	2.19E+05	7.43E+04
126-99-8	2-Chloro-1,3-butadiene (chloroprene)	3.07E+00	NA	3.07E+00 n	0.1	3.07E+01	8.48E+00	0.01	3.07E+02	8.48E+01
95-57-8	2-Chlorophenol	NA	NA	NA	0.1	NA	NA	0.01	NA	NA
75-29-6	2-Chloropropane	NA	NA	NA	0.1	NA	NA	0.01	NA	NA
591-78-6	2-Hexanone	1.31E+01	NA	1.31E+01 n	0.1	1.31E+02	3.20E+01	0.01	1.31E+03	3.20E+02
91-57-6	2-Methylnaphthalene	NA	NA	NA	0.1	NA	NA	0.01	NA	NA
79-46-9	2-Nitropropane	8.76E+00	4.54E-03	4.54E-03 c	0.1	4.54E-02	1.25E-02	0.01	4.54E-01	1.25E-01
108-10-1	4-Methyl-2-pentanone (MIBK)	1.31E+03	NA	1.31E+03 n	0.1	1.31E+04	3.20E+03	0.01	1.31E+05	3.20E+04
83-32-9	Acenaphthene	NA	NA	NA	0.1	NA	NA	0.01	NA	NA
75-07-0	Acetaldehyde	3.94E+00	5.57E+00	3.94E+00 n	0.1	3.94E+01	2.19E+01	0.01	3.94E+02	2.19E+02
67-64-1	Acetone	1.35E+04	NA	1.35E+04 n	0.1	1.35E+05	5.68E+04	0.01	1.35E+06	5.68E+05
75-05-8	Acetonitrile	2.63E+01	NA	2.63E+01 n	0.1	2.63E+02	1.57E+02	0.01	2.63E+03	1.57E+03
98-86-2	Acetophenone	NA	NA	NA	0.1	NA	NA	0.01	NA	NA
107-02-8	Acrolein	8.76E-03	NA	8.76E-03 n	0.1	8.76E-02	3.82E-02	0.01	8.76E-01	3.82E-01
107-13-1	Acrylonitrile	8.76E-01	1.80E-01	1.80E-01 c	0.1	1.80E+00	8.29E-01	0.01	1.80E+01	8.29E+00
100-52-7	Benzaldehyde	NA	NA	NA	0.1	NA	NA	0.01	NA	NA
71-43-2	Benzene	1.31E+01	1.57E+00	1.57E+00 c	0.1	1.57E+01	4.91E+00	0.01	1.57E+02	4.91E+01
100-44-7	Benzylchloride	4.38E-01	2.50E-01	2.50E-01 c	0.1	2.50E+00	4.83E-01	0.01	2.50E+01	4.83E+00
92-52-4	Biphenyl	NA	NA	NA	0.1	NA	NA	0.01	NA	NA
111-44-4	Bis(2-chloroethyl)ether	NA	3.72E-02	3.72E-02 c	0.1	3.72E-01	6.36E-02	0.01	3.72E+00	6.36E-01
75-27-4	Bromodichloromethane	NA	3.31E-01	3.31E-01 c	0.1	3.31E+00	4.94E-01	0.01	3.31E+01	4.94E+00
75-25-2	Bromoform	NA	1.11E+01	1.11E+01 c	0.1	1.11E+02	1.07E+01	0.01	1.11E+03	1.07E+02
74-83-9	Bromomethane	2.19E+00	NA	2.19E+00 n	0.1	2.19E+01	5.64E+00	0.01	2.19E+02	5.64E+01
75-15-0	Carbon disulfide	3.07E+02	NA	3.07E+02 n	0.1	3.07E+03	9.86E+02	0.01	3.07E+04	9.86E+03
56-23-5	Carbon tetrachloride	4.38E+01	2.04E+00	2.04E+00 c	0.1	2.04E+01	3.24E+00	0.01	2.04E+02	3.24E+01
108-90-7	Chlorobenzene	2.19E+01	NA	2.19E+01 n	0.1	2.19E+02	4.76E+01	0.01	2.19E+03	4.76E+02
124-48-1	Chlorodibromomethane	NA	4.54E-01	4.54E-01 c	0.1	4.54E+00	5.33E-01	0.01	4.54E+01	5.33E+00
75-45-6	Chlorodifluoromethane	2.19E+04	NA	2.19E+04 n	0.1	2.19E+05	6.19E+04	0.01	2.19E+06	6.19E+05
75-00-3	Chloroethane	4.38E+03	NA	4.38E+03 n	0.1	4.38E+04	1.66E+04	0.01	4.38E+05	1.66E+05
67-66-3	Chloroform	4.28E+01	5.33E-01	5.33E-01 c	0.1	5.33E+00	1.09E+00	0.01	5.33E+01	1.09E+01
74-87-3	Chloromethane	3.94E+01	NA	3.94E+01 n	0.1	3.94E+02	1.91E+02	0.01	3.94E+03	1.91E+03
156-59-2	cis-1,2-Dichloroethene	NA	NA	NA	0.1	NA	NA	0.01	NA	NA
98-82-8	Cumene	1.75E+02	NA	1.75E+02 n	0.1	1.75E+03	3.56E+02	0.01	1.75E+04	3.56E+03
110-82-7	Cyclohexane	2.63E+03	NA	2.63E+03 n	0.1	2.63E+04	7.64E+03	0.01	2.63E+05	7.64E+04
75-71-8	Dichlorodifluoromethane	8.76E+01	NA	8.76E+01 n	0.1	8.76E+02	1.77E+02	0.01	8.76E+03	1.77E+03
60-29-7	Ethyl ether	NA	NA	NA	0.1	NA	NA	0.01	NA	NA

TABLE V1-7
Generic Vapor Intrusion Soil Gas Screening Levels (Industrial Scenario)
Phase III Vapor Intrusion Report
MCB CamLej, North Carolina

CAS #	Volatile Organic Compounds	Industrial Air RSL[1] Non-Cancer (Adjusted) µg/m^3	Industrial Air RSL[1] Cancer µg/m^3	Final Industrial Air RSL µg/m^3	Shallow Soil Gas Infinite Source Indoor Attenuation Coefficient[2] (unitless)	Shallow Samples ≤ 6 ft bgs Generic Soil Gas Screening Level[3] µg/m^3	Shallow Samples ≤ 6 ft bgs Generic Soil Gas Screening Level[3] ppbv	Deep Soil Gas Infinite Source Indoor Attenuation Coefficient[2] (unitless)	Deep Samples > 6 ft bgs Generic Soil Gas Screening Level[3] µg/m^3	Deep Samples > 6 ft bgs Generic Soil Gas Screening Level[3] ppbv
141-78-6	Ethylacetate	NA	NA	NA	0.1	NA	NA	0.01	NA	NA
100-41-4	Ethylbenzene	4.38E+02	4.91E+00	4.91E+00 c	0.1	4.91E+01	1.13E+01	0.01	4.91E+02	1.13E+02
75-21-8	Ethylene oxide	1.31E+01	1.39E-01	1.39E-01 c	0.1	1.39E+00	7.72E-01	0.01	1.39E+01	7.72E+00
97-63-2	Ethylmethacrylate	NA	NA	NA	0.1	NA	NA	0.01	NA	NA
110-54-3	Hexane	3.07E+02	NA	3.07E+02 n	0.1	3.07E+03	8.71E+02	0.01	3.07E+04	8.71E+03
1330-20-7	m,p-Xylenes	4.38E+01	NA	4.38E+01 n	0.1	4.38E+02	1.01E+02	0.01	4.38E+03	1.01E+03
126-98-7	Methacrylonitrile	3.07E-01	NA	3.07E-01 n	0.1	3.07E+00	1.12E+00	0.01	3.07E+01	1.12E+01
79-20-9	Methyl acetate	NA	NA	NA	0.1	NA	NA	0.01	NA	NA
96-33-3	Methyl acrylate	NA	NA	NA	0.1	NA	NA	0.01	NA	NA
74-83-9	Methyl bromide	2.19E+00	NA	2.19E+00 n	0.1	2.19E+01	5.64E+00	0.01	2.19E+02	5.64E+01
74-87-3	Methyl chloride (chloromethane)	3.94E+01	NA	3.94E+01 n	0.1	3.94E+02	1.91E+02	0.01	3.94E+03	1.91E+03
1634-04-4	Methyl tert-butyl ether	1.31E+03	4.72E+01	4.72E+01 c	0.1	4.72E+02	1.31E+02	0.01	4.72E+03	1.31E+03
108-87-2	Methylcyclohexane	2.63E+03	NA	2.63E+03 n	0.1	2.63E+04	7.64E+03	0.01	2.63E+05	7.64E+04
74-95-3	Methylene bromide	1.75E+00	NA	1.75E+00 n	0.1	1.75E+01	2.46E+00	0.01	1.75E+02	2.46E+01
75-09-2	Methylene chloride	4.56E+02	2.61E+01	2.61E+01 c	0.1	2.61E+02	7.51E+01	0.01	2.61E+03	7.51E+02
80-62-6	Methylmethacrylate	3.07E+02	NA	3.07E+02 n	0.1	3.07E+03	7.50E+02	0.01	3.07E+04	7.50E+03
91-20-3	Naphthalene	1.31E+00	3.61E-01	3.61E-01 c	0.1	3.61E+00	6.89E-01	0.01	3.61E+01	6.89E+00
95-47-6	o-Xylene	3.07E+02	NA	3.07E+02 n	0.1	3.07E+03	7.07E+02	0.01	3.07E+04	7.07E+03
100-42-5	Styrene	4.38E+02	NA	4.38E+02 n	0.1	4.38E+03	1.03E+03	0.01	4.38E+04	1.03E+04
127-18-4	Tetrachloroethylene	1.19E+02	2.08E+00	2.08E+00 c	0.1	2.08E+01	3.07E+00	0.01	2.08E+02	3.07E+01
108-88-3	Toluene	2.19E+03	NA	2.19E+03 n	0.1	2.19E+04	5.81E+03	0.01	2.19E+05	5.81E+04
156-60-5	trans-1,2-Dichloroethene	2.63E+01	NA	2.63E+01 n	0.1	2.63E+02	6.63E+01	0.01	2.63E+03	6.63E+02
79-01-6	Trichloroethylene	NA	6.13E+00	6.13E+00 c	0.1	6.13E+01	1.14E+01	0.01	6.13E+02	1.14E+02
75-69-4	Trichlorofluoromethane	3.07E+02	NA	3.07E+02 n	0.1	3.07E+03	5.46E+02	0.01	3.07E+04	5.46E+03
108-05-4	Vinyl acetate	8.76E+01	NA	8.76E+01 n	0.1	8.76E+02	2.49E+02	0.01	8.76E+03	2.49E+03
75-01-4	Vinyl chloride	4.38E+01	2.79E+00	2.79E+00 c	0.1	2.79E+01	1.09E+01	0.01	2.79E+02	1.09E+02
1330-20-7	Xylene, mixture	4.38E+01	NA	4.38E+01 n	0.1	4.38E+02	1.01E+02	0.01	4.38E+03	1.01E+03

Notes:
[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).
RSL value for cyclohexane used as surrogate for methylcyclohexane
[2] Attenuation factor for soil gas (shallow - 0.1; deep - 0.01) recommended in Draft Vapor Intrusion Guidance (USEPA, 2002).
[3] The final vapor intrusion soil gas screening level is the lower value of the non-cancer screening level and cancer screening level.
ppbv = (ug/m^3 x 24.45)/molecular weight

Sources:
USEPA. 2002. OSWER Guidance fir Evaluating the Vapor Intrusion to Indoor Air Pathway from Groundwater and Soils (Subsurface Vapor Intrusion Guidance). November.

TABLE V1-8
Generic Vapor Intrusion Soil Gas Screening Levels (Residential Scenario)
Phase III Vapor Intrusion Report
MCB CamLej, North Carolina

CAS #	Volatile Organic Compounds	Residential Air RSL[1] Non-Cancer (Adjusted) µg/m³	Residential Air RSL[1] Cancer µg/m³	Final Residential Air RSL µg/m³	Shallow Soil Gas Infinite Source Indoor Attenuation Coefficient[2] (unitless)	Samples ≤ 6 ft bgs Generic Soil Gas Screening Level[3] µg/m³	Samples ≤ 6 ft bgs Generic Soil Gas Screening Level[3] ppbv	Deep Soil Gas Infinite Source Indoor Attenuation Coefficient[2] (unitless)	Samples > 6 ft bgs Generic Soil Gas Screening Level[3] µg/m³	Samples > 6 ft bgs Generic Soil Gas Screening Level[3] ppbv
630-20-6	1,1,1,2-Tetrachloroethane	NA	3.30E-01	3.30E-01 c	0.1	3.30E+00	4.81E-01	0.01	3.30E+01	4.81E+00
71-55-6	1,1,1-Trichloroethane	5.20E+02	NA	5.20E+02 n	0.1	5.20E+03	9.53E+02	0.01	5.20E+04	9.53E+03
79-34-5	1,1,2,2-Tetrachloroethane	NA	4.20E-02	4.20E-02 c	0.1	4.20E-01	6.12E-02	0.01	4.20E+00	6.12E-01
76-13-1	1,1,2-Trichloro-1,2,2-trifluoroethane	3.10E+03	NA	3.10E+03 n	0.1	3.10E+04	4.04E+03	0.01	3.10E+05	4.04E+04
79-00-5	1,1,2-Trichloroethane	NA	1.50E-01	1.50E-01 c	0.1	1.50E+00	2.75E-01	0.01	1.50E+01	2.75E+00
75-34-3	1,1-Dichloroethane	NA	1.50E+00	1.50E+00 c	0.1	1.50E+01	3.71E+00	0.01	1.50E+02	3.71E+01
75-35-4	1,1-Dichloroethene	2.10E+01	NA	2.10E+01 n	0.1	2.10E+02	5.30E+01	0.01	2.10E+03	5.30E+02
96-18-4	1,2,3-Trichloropropane	3.10E-02	NA	3.10E-02 n	0.1	3.10E-01	5.14E-02	0.01	3.10E+00	5.14E-01
120-82-1	1,2,4-Trichlorobenzene	2.10E-01	NA	2.10E-01 n	0.1	2.10E+00	2.83E-01	0.01	2.10E+01	2.83E+00
95-63-6	1,2,4-Trimethylbenzene	7.30E-01	NA	7.30E-01 n	0.1	7.30E+00	1.48E+00	0.01	7.30E+01	1.48E+01
106-93-4	1,2-Dibromoethane (ethylene dibromide)	9.40E-01	4.10E-03	4.10E-03 c	0.1	4.10E-02	5.34E-03	0.01	4.10E-01	5.34E-02
95-50-1	1,2-Dichlorobenzene	2.10E+01	NA	2.10E+01 n	0.1	2.10E+02	3.49E+01	0.01	2.10E+03	3.49E+02
107-06-2	1,2-Dichloroethane	2.50E+02	9.40E-02	9.40E-02 c	0.1	9.40E-01	2.32E-01	0.01	9.40E+00	2.32E+00
78-87-5	1,2-Dichloropropane	4.20E-01	2.40E-01	2.40E-01 c	0.1	2.40E+00	5.19E-01	0.01	2.40E+01	5.19E+00
108-67-8	1,3,5-Trimethylbenzene	NA	NA	NA	0.1	NA	NA	0.01	NA	NA
106-99-0	1,3-Butadiene	2.10E-01	8.10E-02	8.10E-02 c	0.1	8.10E-01	3.66E-01	0.01	8.10E+00	3.66E+00
542-75-6	1,3-Dichloropropene	2.10E+00	6.10E-01	6.10E-01 c	0.1	6.10E+00	1.34E+00	0.01	6.10E+01	1.34E+01
106-46-7	1,4-Dichlorobenzene	8.30E+01	2.20E-01	2.20E-01 c	0.1	2.20E+00	3.66E-01	0.01	2.20E+01	3.66E+00
109-69-3	1-Chlorobutane	NA	NA	NA	0.1	NA	NA	0.01	NA	NA
78-93-3	2-Butanone (MEK)	5.20E+02	NA	5.20E+02 n	0.1	5.20E+03	1.76E+03	0.01	5.20E+04	1.76E+04
126-99-8	2-Chloro-1,3-butadiene (chloroprene)	7.30E-01	NA	7.30E-01 n	0.1	7.30E+00	2.02E+00	0.01	7.30E+01	2.02E+01
95-57-8	2-Chlorophenol	NA	NA	NA	0.1	NA	NA	0.01	NA	NA
75-29-6	2-Chloropropane	NA	NA	NA	0.1	NA	NA	0.01	NA	NA
591-78-6	2-Hexanone	3.10E+00	NA	3.10E+00 n	0.1	3.10E+01	7.57E+00	0.01	3.10E+02	7.57E+01
91-57-6	2-Methylnaphthalene	NA	NA	NA	0.1	NA	NA	0.01	NA	NA
79-46-9	2-Nitropropane	2.10E+00	9.00E-04	9.00E-04 c	0.1	9.00E-03	2.47E-03	0.01	9.00E-02	2.47E-02
108-10-1	4-Methyl-2-pentanone (MIBK)	3.10E+02	NA	3.10E+02 n	0.1	3.10E+03	7.57E+02	0.01	3.10E+04	7.57E+03
83-32-9	Acenaphthene	NA	NA	NA	0.1	NA	NA	0.01	NA	NA
75-07-0	Acetaldehyde	9.40E-01	1.10E+00	9.40E-01 n	0.1	9.40E+00	5.22E+00	0.01	9.40E+01	5.22E+01
67-64-1	Acetone	3.20E+03	NA	3.20E+03 n	0.1	3.20E+04	1.35E+04	0.01	3.20E+05	1.35E+05
75-05-8	Acetonitrile	6.30E+00	NA	6.30E+00 n	0.1	6.30E+01	3.75E+01	0.01	6.30E+02	3.75E+02
98-86-2	Acetophenone	NA	NA	NA	0.1	NA	NA	0.01	NA	NA
107-02-8	Acrolein	2.10E-03	NA	2.10E-03 n	0.1	2.10E-02	9.16E-03	0.01	2.10E-01	9.16E-02
107-13-1	Acrylonitrile	2.10E-01	3.60E-02	3.60E-02 c	0.1	3.60E-01	1.66E-01	0.01	3.60E+00	1.66E+00
100-52-7	Benzaldehyde	NA	NA	NA	0.1	NA	NA	0.01	NA	NA
71-43-2	Benzene	3.10E+00	3.10E-01	3.10E-01 c	0.1	3.10E+00	9.70E-01	0.01	3.10E+01	9.70E+00
100-44-7	Benzylchloride	1.00E-01	5.00E-02	5.00E-02 c	0.1	5.00E-01	9.66E-02	0.01	5.00E+00	9.66E-01
92-52-4	Biphenyl	NA	NA	NA	0.1	NA	NA	0.01	NA	NA
111-44-4	Bis(2-chloroethyl)ether	NA	7.40E-03	7.40E-03 c	0.1	7.40E-02	1.27E-02	0.01	7.40E-01	1.27E-01
75-27-4	Bromodichloromethane*	NA	6.60E-02	6.60E-02 c	0.1	6.60E-01	9.85E-02	0.01	6.60E+00	9.85E-01
75-25-2	Bromoform	NA	2.20E+00	2.20E+00 c	0.1	2.20E+01	2.13E+00	0.01	2.20E+02	2.13E+01
74-83-9	Bromomethane	5.20E-01	NA	5.20E-01 n	0.1	5.20E+00	1.34E+00	0.01	5.20E+01	1.34E+01
75-15-0	Carbon disulfide	7.30E+01	NA	7.30E+01 n	0.1	7.30E+02	2.34E+02	0.01	7.30E+03	2.34E+03
56-23-5	Carbon tetrachloride	1.00E+01	4.10E-01	4.10E-01 c	0.1	4.10E+00	6.52E-01	0.01	4.10E+01	6.52E+00
108-90-7	Chlorobenzene	5.20E+00	NA	5.20E+00 n	0.1	5.20E+01	1.13E+01	0.01	5.20E+02	1.13E+02
124-48-1	Chlorodibromomethane	NA	9.00E-02	9.00E-02 c	0.1	9.00E-01	1.06E-01	0.01	9.00E+00	1.06E+00
75-45-6	Chlorodifluoromethane	5.20E+03	NA	5.20E+03 n	0.1	5.20E+04	1.47E+04	0.01	5.20E+05	1.47E+05
75-00-3	Chloroethane	1.00E+03	NA	1.00E+03 n	0.1	1.00E+04	3.79E+03	0.01	1.00E+05	3.79E+04
67-66-3	Chloroform	1.00E+01	1.10E-01	1.10E-01 c	0.1	1.10E+00	2.25E-01	0.01	1.10E+01	2.25E+00
74-87-3	Chloromethane	9.40E+00	NA	9.40E+00 n	0.1	9.40E+01	4.55E+01	0.01	9.40E+02	4.55E+02
156-59-2	cis-1,2-Dichloroethene*	NA	NA	NA	0.1	NA	NA	0.01	NA	NA
98-82-8	Cumene	4.20E+01	NA	4.20E+01 n	0.1	4.20E+02	8.54E+01	0.01	4.20E+03	8.54E+02
110-82-7	Cyclohexane	6.30E+02	NA	6.30E+02 n	0.1	6.30E+03	1.83E+03	0.01	6.30E+04	1.83E+04
75-71-8	Dichlorodifluoromethane	2.10E+01	NA	2.10E+01 n	0.1	2.10E+02	4.25E+01	0.01	2.10E+03	4.25E+02
60-29-7	Ethyl ether	NA	NA	NA	0.1	NA	NA	0.01	NA	NA

TABLE V1-8
Generic Vapor Intrusion Soil Gas Screening Levels (Residential Scenario)
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MCB CamLej, North Carolina

CAS #	Volatile Organic Compounds	Residential Air RSL[1] Non-Cancer (Adjusted) µg/m^3	Residential Air RSL[1] Cancer µg/m^3	Final Residential Air RSL µg/m^3	Shallow Soil Gas Infinite Source Indoor Attenuation Coefficient[2] (unitless)	Samples ≤ 6 ft bgs Generic Soil Gas Screening Level[3] µg/m^3	Samples ≤ 6 ft bgs Generic Soil Gas Screening Level[3] ppbv	Deep Soil Gas Infinite Source Indoor Attenuation Coefficient[2] (unitless)	Samples > 6 ft bgs Generic Soil Gas Screening Level[3] µg/m^3	Samples > 6 ft bgs Generic Soil Gas Screening Level[3] ppbv
141-78-6	Ethylacetate	NA	NA	NA	0.1	NA	NA	0.01	NA	NA
100-41-4	Ethylbenzene	1.00E+02	9.70E-01	9.70E-01 c	0.1	9.70E+00	2.23E+00	0.01	9.70E+01	2.23E+01
75-21-8	Ethylene oxide	3.10E+00	2.80E-02	2.80E-02 c	0.1	2.80E-01	1.55E-01	0.01	2.80E+00	1.55E+00
97-63-2	Ethylmethacrylate	NA	NA	NA	0.1	NA	NA	0.01	NA	NA
110-54-3	Hexane	7.30E+01	NA	7.30E+01 n	0.1	7.30E+02	2.07E+02	0.01	7.30E+03	2.07E+03
1330-20-7	m,p-Xylenes	1.00E+01	NA	1.00E+01 n	0.1	1.00E+02	2.30E+01	0.01	1.00E+03	2.30E+02
126-98-7	Methacrylonitrile	7.30E-02	NA	7.30E-02 n	0.1	7.30E-01	2.66E-01	0.01	7.30E+00	2.66E+00
79-20-9	Methyl acetate	NA	NA	NA	0.1	NA	NA	0.01	NA	NA
96-33-3	Methyl acrylate	NA	NA	NA	0.1	NA	NA	0.01	NA	NA
74-83-9	Methyl bromide	5.20E-01	NA	5.20E-01 n	0.1	5.20E+00	1.34E+00	0.01	5.20E+01	1.34E+01
74-87-3	Methyl chloride (chloromethane)	9.40E+00	NA	9.40E+00 n	0.1	9.40E+01	4.55E+01	0.01	9.40E+02	4.55E+02
1634-04-4	Methyl tert-butyl ether	3.10E+02	9.40E+00	9.40E+00 c	0.1	9.40E+01	2.61E+01	0.01	9.40E+02	2.61E+02
108-87-2	Methylcyclohexane	6.30E+02	NA	6.30E+02 n	0.1	6.30E+03	1.83E+03	0.01	6.30E+04	1.83E+04
74-95-3	Methylene bromide	4.20E-01	NA	4.20E-01 n	0.1	4.20E+00	5.91E-01	0.01	4.20E+01	5.91E+00
75-09-2	Methylene chloride	1.10E+02	5.20E+00	5.20E+00 c	0.1	5.20E+01	1.50E+01	0.01	5.20E+02	1.50E+02
80-62-6	Methylmethacrylate	7.30E+01	NA	7.30E+01 n	0.1	7.30E+02	1.78E+02	0.01	7.30E+03	1.78E+03
91-20-3	Naphthalene	3.10E-01	7.20E-02	7.20E-02 c	0.1	7.20E-01	1.37E-01	0.01	7.20E+00	1.37E+00
95-47-6	o-Xylene	7.30E+01	NA	7.30E+01 n	0.1	7.30E+02	1.68E+02	0.01	7.30E+03	1.68E+03
100-42-5	Styrene	1.00E+02	NA	1.00E+02 n	0.1	1.00E+03	2.35E+02	0.01	1.00E+04	2.35E+03
127-18-4	Tetrachloroethylene	2.80E+01	4.10E-01	4.10E-01 c	0.1	4.10E+00	6.05E-01	0.01	4.10E+01	6.05E+00
108-88-3	Toluene	5.20E+02	NA	5.20E+02 n	0.1	5.20E+03	1.38E+03	0.01	5.20E+04	1.38E+04
156-60-5	trans-1,2-Dichloroethene	6.30E+00	NA	6.30E+00 n	0.1	6.30E+01	1.59E+01	0.01	6.30E+02	1.59E+02
79-01-6	Trichloroethylene	NA	1.20E+00	1.20E+00 c	0.1	1.20E+01	2.23E+00	0.01	1.20E+02	2.23E+01
75-69-4	Trichlorofluoromethane	7.30E+01	NA	7.30E+01 n	0.1	7.30E+02	1.30E+02	0.01	7.30E+03	1.30E+03
108-05-4	Vinyl acetate	2.10E+01	NA	2.10E+01 n	0.1	2.10E+02	5.96E+01	0.01	2.10E+03	5.96E+02
75-01-4	Vinyl chloride	1.00E+01	1.60E-01	1.60E-01 c	0.1	1.60E+00	6.26E-01	0.01	1.60E+01	6.26E+00
1330-20-7	Xylene, mixture	1.00E+01	NA	1.00E+01 n	0.1	1.00E+02	2.30E+01	0.01	1.00E+03	2.30E+02

Notes:
[1] U.S. EPA Regional Screening Levels (RSL) Table, May 17, 2010, Residential Air RSLs (based on 10^{-6} for carcinogens and HQ of 0.1 for noncarcinogens).
RSL value for cyclohexane used as surrogate for methylcyclohexane
[2] Attenuation factor for soil gas (shallow - 0.1; deep - 0.01) recommended in Draft Vapor Intrusion Guidance (USEPA, 2002).
[3] The final vapor intrusion soil gas screening level is the lower value of the non-cancer screening level and cancer screening level.
ppbv = (ug/m^3 x 24.45)/molecular weight

Sources:
USEPA. 2002. OSWER Guidance fir Evaluating the Vapor Intrusion to Indoor Air Pathway from Groundwater and Soils (Subsurface Vapor Intrusion Guidance). November.

TABLE V1-9

Indoor Air Screening Levels (Industrial Scenario)

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CAS #	Volatile Organic Compounds	Industrial Air RSL[1] Non-Cancer (Adjusted) µg/m^3	Industrial Air RSL[1] Cancer µg/m^3	Final[2] Industrial Air RSL µg/m^3	Final[2] Industrial Air RSL ppbv
630-20-6	1,1,1,2-Tetrachloroethane	NA	1.66E+00	1.66E+00 c	2.42E-01 c
71-55-6	1,1,1-Trichloroethane	2.19E+03	NA	2.19E+03 n	4.01E+02 n
79-34-5	1,1,2,2-Tetrachloroethane	NA	2.11E-01	2.11E-01 c	3.07E-02 c
76-13-1	1,1,2-Trichloro-1,2,2-trifluoroethane	1.31E+04	NA	1.31E+04 n	1.71E+03 n
79-00-5	1,1,2-Trichloroethane	NA	7.67E-01	7.67E-01 c	1.41E-01 c
75-34-3	1,1-Dichloroethane	NA	7.67E+00	7.67E+00 c	1.90E+00 c
75-35-4	1,1-Dichloroethene	8.76E+01	NA	8.76E+01 n	2.21E+01 n
96-18-4	1,2,3-Trichloropropane	1.31E-01	NA	1.31E-01 n	2.17E-02 n
120-82-1	1,2,4-Trichlorobenzene	8.76E-01	NA	8.76E-01 n	1.18E-01 n
95-63-6	1,2,4-Trimethylbenzene	3.07E+00	NA	3.07E+00 n	6.24E-01 n
106-93-4	1,2-Dibromoethane (ethylene dibromide)	3.94E+00	2.04E-02	2.04E-02 c	2.66E-03 c
95-50-1	1,2-Dichlorobenzene	8.76E+01	NA	8.76E+01 n	1.46E+01 n
107-06-2	1,2-Dichloroethane	1.06E+03	4.72E-01	4.72E-01 c	1.17E-01 c
78-87-5	1,2-Dichloropropane	1.75E+00	1.23E+00	1.23E+00 c	2.66E-01 c
108-67-8	1,3,5-Trimethylbenzene	NA	NA	NA	NA
106-99-0	1,3-Butadiene	8.76E-01	4.09E-01	4.09E-01 c	1.85E-01 c
542-75-6	1,3-Dichloropropene	8.76E+00	3.07E+00	3.07E+00 c	6.76E-01 c
106-46-7	1,4-Dichlorobenzene	3.50E+02	1.11E+00	1.11E+00 c	1.85E-01 c
109-69-3	1-Chlorobutane	NA	NA	NA	NA
78-93-3	2-Butanone (MEK)	2.19E+03	NA	2.19E+03 n	7.43E+02 n
126-99-8	2-Chloro-1,3-butadiene (chloroprene)	3.07E+00	NA	3.07E+00 n	8.48E-01 n
95-57-8	2-Chlorophenol	NA	NA	NA	NA
75-29-6	2-Chloropropane	NA	NA	NA	NA
591-78-6	2-Hexanone	1.31E+01	NA	1.31E+01 n	3.20E+00 n
91-57-6	2-Methylnaphthalene	NA	NA	NA	NA
79-46-9	2-Nitropropane	8.76E+00	4.54E-03	4.54E-03 c	1.25E-03 c
108-10-1	4-Methyl-2-pentanone (MIBK)	1.31E+03	NA	1.31E+03 n	3.20E+02 n
83-32-9	Acenaphthene	NA	NA	NA	NA
75-07-0	Acetaldehyde	3.94E+00	5.57E+00	3.94E+00 n	2.19E+00 n
67-64-1	Acetone	1.35E+04	NA	1.35E+04 n	5.68E+03 n
75-05-8	Acetonitrile	2.63E+01	NA	2.63E+01 n	1.57E+01 n
98-86-2	Acetophenone	NA	NA	NA	NA
107-02-8	Acrolein	8.76E-03	NA	8.76E-03 n	3.82E-03 n
107-13-1	Acrylonitrile	8.76E-01	1.80E-01	1.80E-01 c	8.29E-02 c

TABLE V1-9

Indoor Air Screening Levels (Industrial Scenario)

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CAS #	Volatile Organic Compounds	Industrial Air RSL[1] Non-Cancer (Adjusted) µg/m^3	Industrial Air RSL[1] Cancer µg/m^3	Final[2] Industrial Air RSL µg/m^3	Final[2] Industrial Air RSL ppbv
100-52-7	Benzaldehyde	NA	NA	NA	NA
71-43-2	Benzene	1.31E+01	1.57E+00	1.57E+00 c	4.91E-01 c
100-44-7	Benzylchloride	4.38E-01	2.50E-01	2.50E-01 c	4.83E-02 c
92-52-4	Biphenyl	NA	NA	NA	NA
111-44-4	Bis(2-chloroethyl)ether	NA	3.72E-02	3.72E-02 c	6.36E-03 c
75-27-4	Bromodichloromethane	NA	3.31E-01	3.31E-01 c	4.94E-02 c
75-25-2	Bromoform	NA	1.11E+01	1.11E+01 c	1.07E+00 c
74-83-9	Bromomethane	2.19E+00	NA	2.19E+00 n	5.64E-01 n
75-15-0	Carbon disulfide	3.07E+02	NA	3.07E+02 n	9.86E+01 n
56-23-5	Carbon tetrachloride	4.38E+01	2.04E+00	2.04E+00 c	3.24E-01 c
108-90-7	Chlorobenzene	2.19E+01	NA	2.19E+01 n	4.76E+00 n
124-48-1	Chlorodibromomethane	NA	4.54E-01	4.54E-01 c	5.33E-02 c
75-45-6	Chlorodifluoromethane	2.19E+04	NA	2.19E+04 n	6.19E+03 n
75-00-3	Chloroethane	4.38E+03	NA	4.38E+03 n	1.66E+03 n
67-66-3	Chloroform	4.28E+01	5.33E-01	5.33E-01 c	1.09E-01 c
74-87-3	Chloromethane	3.94E+01	NA	3.94E+01 n	1.91E+01 n
156-59-2	cis-1,2-Dichloroethene	NA	NA	NA	NA
98-82-8	Cumene	1.75E+02	NA	1.75E+02 n	3.56E+01 n
110-82-7	Cyclohexane	2.63E+03	NA	2.63E+03 n	7.64E+02 n
75-71-8	Dichlorodifluoromethane	8.76E+01	NA	8.76E+01 n	1.77E+01 n
60-29-7	Ethyl ether	NA	NA	NA	NA
141-78-6	Ethylacetate	NA	NA	NA	NA
100-41-4	Ethylbenzene	4.38E+02	4.91E+00	4.91E+00 c	1.13E+00 c
75-21-8	Ethylene oxide	1.31E+01	1.39E-01	1.39E-01 c	7.72E-02 c
97-63-2	Ethylmethacrylate	NA	NA	NA	NA
110-54-3	Hexane	3.07E+02	NA	3.07E+02 n	8.71E+01 n
1330-20-7	m,p-Xylenes	4.38E+01	NA	4.38E+01 n	1.01E+01 n
126-98-7	Methacrylonitrile	3.07E-01	NA	3.07E-01 n	1.12E-01 n
79-20-9	Methyl acetate	NA	NA	NA	NA
96-33-3	Methyl acrylate	NA	NA	NA	NA
74-83-9	Methyl bromide	2.19E+00	NA	2.19E+00 n	5.64E-01 n
74-87-3	Methyl chloride (chloromethane)	3.94E+01	NA	3.94E+01 n	1.91E+01 n
1634-04-4	Methyl tert-butyl ether	1.31E+03	4.72E+01	4.72E+01 c	1.31E+01 c
108-87-2	Methylcyclohexane	2.63E+03	NA	2.63E+03 n	7.64E+02 n

TABLE V1-9

Indoor Air Screening Levels (Industrial Scenario)

Phase III Vapor Intrusion Report

MCB CamLej, North Carolina

CAS #	Volatile Organic Compounds	Industrial Air RSL[1] Non-Cancer (Adjusted) µg/m^3	Industrial Air RSL[1] Cancer µg/m^3	Final[2] Industrial Air RSL µg/m^3	Final[2] Industrial Air RSL ppbv
74-95-3	Methylene bromide	1.75E+00	NA	1.75E+00 n	2.46E-01 n
75-09-2	Methylene chloride	4.56E+02	2.61E+01	2.61E+01 c	7.51E+00 c
80-62-6	Methylmethacrylate	3.07E+02	NA	3.07E+02 n	7.50E+01 n
91-20-3	Naphthalene	1.31E+00	3.61E-01	3.61E-01 c	6.89E-02 c
95-47-6	o-Xylene	3.07E+02	NA	3.07E+02 n	7.07E+01 n
100-42-5	Styrene	4.38E+02	NA	4.38E+02 n	1.03E+02 n
127-18-4	Tetrachloroethylene	1.19E+02	2.08E+00	2.08E+00 c	3.07E-01 c
108-88-3	Toluene	2.19E+03	NA	2.19E+03 n	5.81E+02 n
156-60-5	trans-1,2-Dichloroethene	2.63E+01	NA	2.63E+01 n	6.63E+00 n
79-01-6	Trichloroethylene	NA	6.13E+00	6.13E+00 c	1.14E+00 c
75-69-4	Trichlorofluoromethane	3.07E+02	NA	3.07E+02 n	5.46E+01 n
108-05-4	Vinyl acetate	8.76E+01	NA	8.76E+01 n	2.49E+01 n
75-01-4	Vinyl chloride	4.38E+01	2.79E+00	2.79E+00 c	1.09E+00 c
1330-20-7	Xylene, mixture	4.38E+01	NA	4.38E+01 n	1.01E+01 n

Notes:

[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).
RSL value for cyclohexane used as surrogate for methylcyclohexane

[2] The final vapor intrusion indoor air screening level is the lower value of the non-cancer screening level and cancer screening level.

ppbv = (ug/m^3 x 24.45)/molecular weight

TABLE V1-10

Indoor Air Screening Levels (Residential Scenario)

Phase III Vapor Intrusion Report

MCB CamLej, North Carolina

CAS #	Volatile Organic Compounds	Residential Air RSL[1] Non-Cancer (Adjusted) µg/m^3	Residential Air RSL[1] Cancer µg/m^3	Final [2] Residential Air RSL µg/m^3	Final[2] Residential Air RSL ppbv
630-20-6	1,1,1,2-Tetrachloroethane	NA	3.30E-01	3.30E-01 c	4.81E-02 c
71-55-6	1,1,1-Trichloroethane	5.20E+02	NA	5.20E+02 n	9.53E+01 n
79-34-5	1,1,2,2-Tetrachloroethane	NA	4.20E-02	4.20E-02 c	6.12E-03 c
76-13-1	1,1,2-Trichloro-1,2,2-trifluoroethane	3.10E+03	NA	3.10E+03 n	4.04E+02 n
79-00-5	1,1,2-Trichloroethane	NA	1.50E-01	1.50E-01 c	2.75E-02 c
75-34-3	1,1-Dichloroethane	NA	1.50E+00	1.50E+00 c	3.71E-01 c
75-35-4	1,1-Dichloroethene	2.10E+01	NA	2.10E+01 n	5.30E+00 n
96-18-4	1,2,3-Trichloropropane	3.10E-02	NA	3.10E-02 n	5.14E-03 n
120-82-1	1,2,4-Trichlorobenzene	2.10E-01	NA	2.10E-01 n	2.83E-02 n
95-63-6	1,2,4-Trimethylbenzene	7.30E-01	NA	7.30E-01 n	1.48E-01 n
106-93-4	1,2-Dibromoethane (ethylene dibromide)	9.40E-01	4.10E-03	4.10E-03 c	5.34E-04 c
95-50-1	1,2-Dichlorobenzene	2.10E+01	NA	2.10E+01 n	3.49E+00 n
107-06-2	1,2-Dichloroethane	2.50E+02	9.40E-02	9.40E-02 c	2.32E-02 c
78-87-5	1,2-Dichloropropane	4.20E-01	2.40E-01	2.40E-01 c	5.19E-02 c
108-67-8	1,3,5-Trimethylbenzene	NA	NA	NA	NA
106-99-0	1,3-Butadiene	2.10E-01	8.10E-02	8.10E-02 c	3.66E-02 c
542-75-6	1,3-Dichloropropene	2.10E+00	6.10E-01	6.10E-01 c	1.34E-01 c
106-46-7	1,4-Dichlorobenzene	8.30E+01	2.20E-01	2.20E-01 c	3.66E-02 c
109-69-3	1-Chlorobutane	NA	NA	NA	NA
78-93-3	2-Butanone (MEK)	5.20E+02	NA	5.20E+02 n	1.76E+02 n
126-99-8	2-Chloro-1,3-butadiene (chloroprene)	7.30E-01	NA	7.30E-01 n	2.02E-01 n
95-57-8	2-Chlorophenol	NA	NA	NA	NA
75-29-6	2-Chloropropane	NA	NA	NA	NA
591-78-6	2-Hexanone	3.10E+00	NA	3.10E+00 n	7.57E-01 n
91-57-6	2-Methylnaphthalene	NA	NA	NA	NA
79-46-9	2-Nitropropane	2.10E+00	9.00E-04	9.00E-04 c	2.47E-04 c
108-10-1	4-Methyl-2-pentanone (MIBK)	3.10E+02	NA	3.10E+02 n	7.57E+01 n
83-32-9	Acenaphthene	NA	NA	NA	NA
75-07-0	Acetaldehyde	9.40E-01	1.10E+00	9.40E-01 n	5.22E-01 n
67-64-1	Acetone	3.20E+03	NA	3.20E+03 n	1.35E+03 n
75-05-8	Acetonitrile	6.30E+00	NA	6.30E+00 n	3.75E+00 n
98-86-2	Acetophenone	NA	NA	NA	NA
107-02-8	Acrolein	2.10E-03	NA	2.10E-03 n	9.16E-04 n
107-13-1	Acrylonitrile	2.10E-01	3.60E-02	3.60E-02 c	1.66E-02 c

TABLE V1-10

Indoor Air Screening Levels (Residential Scenario)

Phase III Vapor Intrusion Report

MCB CamLej, North Carolina

CAS #	Volatile Organic Compounds	Residential Air RSL[1] Non-Cancer (Adjusted) µg/m^3	Residential Air RSL[1] Cancer µg/m^3	Final [2] Residential Air RSL µg/m^3	Final[2] Residential Air RSL ppbv
100-52-7	Benzaldehyde	NA	NA	NA	NA
71-43-2	Benzene	3.10E+00	3.10E-01	3.10E-01 c	9.70E-02 c
100-44-7	Benzylchloride	1.00E-01	5.00E-02	5.00E-02 c	9.66E-03 c
92-52-4	Biphenyl	NA	NA	NA	NA
111-44-4	Bis(2-chloroethyl)ether	NA	7.40E-03	7.40E-03 c	1.27E-03 c
75-27-4	Bromodichloromethane	NA	6.60E-02	6.60E-02 c	9.85E-03 c
75-25-2	Bromoform	NA	2.20E+00	2.20E+00 c	2.13E-01 c
74-83-9	Bromomethane	5.20E-01	NA	5.20E-01 n	1.34E-01 n
75-15-0	Carbon disulfide	7.30E+01	NA	7.30E+01 n	2.34E+01 n
56-23-5	Carbon tetrachloride	1.00E+01	4.10E-01	4.10E-01 c	6.52E-02 c
108-90-7	Chlorobenzene	5.20E+00	NA	5.20E+00 n	1.13E+00 n
124-48-1	Chlorodibromomethane	NA	9.00E-02	9.00E-02 c	1.06E-02 c
75-45-6	Chlorodifluoromethane	5.20E+03	NA	5.20E+03 n	1.47E+03 n
75-00-3	Chloroethane	1.00E+03	NA	1.00E+03 n	3.79E+02 n
67-66-3	Chloroform	1.00E+01	1.10E-01	1.10E-01 c	2.25E-02 c
74-87-3	Chloromethane	9.40E+00	NA	9.40E+00 n	4.55E+00 n
156-59-2	cis-1,2-Dichloroethene	NA	NA	NA	NA
98-82-8	Cumene	4.20E+01	NA	4.20E+01 n	8.54E+00 n
110-82-7	Cyclohexane	6.30E+02	NA	6.30E+02 n	1.83E+02 n
75-71-8	Dichlorodifluoromethane	2.10E+01	NA	2.10E+01 n	4.25E+00 n
60-29-7	Ethyl ether	NA	NA	NA	NA
141-78-6	Ethylacetate	NA	NA	NA	NA
100-41-4	Ethylbenzene	1.00E+02	9.70E-01	9.70E-01 c	2.23E-01 c
75-21-8	Ethylene oxide	3.10E+00	2.80E-02	2.80E-02 c	1.55E-02 c
97-63-2	Ethylmethacrylate	NA	NA	NA	NA
110-54-3	Hexane	7.30E+01	NA	7.30E+01 n	2.07E+01 n
1330-20-7	m,p-Xylenes	1.00E+01	NA	1.00E+01 n	2.30E+00 n
126-98-7	Methacrylonitrile	7.30E-02	NA	7.30E-02 n	2.66E-02 n
79-20-9	Methyl acetate	NA	NA	NA	NA
96-33-3	Methyl acrylate	NA	NA	NA	NA
74-83-9	Methyl bromide	5.20E-01	NA	5.20E-01 n	1.34E-01 n
74-87-3	Methyl chloride (chloromethane)	9.40E+00	NA	9.40E+00 n	4.55E+00 n
1634-04-4	Methyl tert-butyl ether	3.10E+02	9.40E+00	9.40E+00 c	2.61E+00 c
108-87-2	Methylcyclohexane	6.30E+02	NA	6.30E+02 n	1.83E+02 n

TABLE V1-10

Indoor Air Screening Levels (Residential Scenario)

Phase III Vapor Intrusion Report

MCB CamLej, North Carolina

CAS #	Volatile Organic Compounds	Residential Air RSL[1] Non-Cancer (Adjusted) µg/m^3	Residential Air RSL[1] Cancer µg/m^3	Final [2] Residential Air RSL µg/m^3	Final[2] Residential Air RSL ppbv
74-95-3	Methylene bromide	4.20E-01	NA	4.20E-01 n	5.91E-02 n
75-09-2	Methylene chloride	1.10E+02	5.20E+00	5.20E+00 c	1.50E+00 c
80-62-6	Methylmethacrylate	7.30E+01	NA	7.30E+01 n	1.78E+01 n
91-20-3	Naphthalene	3.10E-01	7.20E-02	7.20E-02 c	1.37E-02 c
95-47-6	o-Xylene	7.30E+01	NA	7.30E+01 n	1.68E+01 n
100-42-5	Styrene	1.00E+02	NA	1.00E+02 n	2.35E+01 n
127-18-4	Tetrachloroethylene	2.80E+01	4.10E-01	4.10E-01 c	6.05E-02 c
108-88-3	Toluene	5.20E+02	NA	5.20E+02 n	1.38E+02 n
156-60-5	trans-1,2-Dichloroethene	6.30E+00	NA	6.30E+00 n	1.59E+00 n
79-01-6	Trichloroethylene	NA	1.20E+00	1.20E+00 c	2.23E-01 c
75-69-4	Trichlorofluoromethane	7.30E+01	NA	7.30E+01 n	1.30E+01 n
108-05-4	Vinyl acetate	2.10E+01	NA	2.10E+01 n	5.96E+00 n
75-01-4	Vinyl chloride	1.00E+01	1.60E-01	1.60E-01 c	6.26E-02 c
1330-20-7	Xylene, mixture	1.00E+01	NA	1.00E+01 n	2.30E+00 n

Notes:

[1] U.S. EPA Regional Screening Levels (RSL) Table, May 17, 2010, Residential Air RSLs (based on 10^{-6} for carcinogens and HQ of 0.1 for noncarcinogens).
RSL value for cyclohexane used as surrogate for methylcyclohexane

[2] The final vapor intrusion indoor air screening level is the lower value of the non-cancer screening level and cancer screening level.

ppbv = (ug/m^3 x 24.45)/molecular weight

TABLE V1-11
Calculation of Indoor air to Soil Gas Empirical Attenuation Factors
Vapor Intrusion Report
MCB Camp Lejeune, North Carolina

MAINSIDE - PHASE III																							
Building				**Building 3B**					**Buiding 3B**					**Building 3**					**Building 3**				
Indoor Air/Soil Gas Sample	**Min. Phase III**	**Outdoor**		**Indoor**		**Soil Gas**		**Indoor to**	**Indoor**		**Soil Gas**		**Indoor to**	**Indoor**		**Soil Gas**		**Indoor to**	**Indoor**		**Soil Gas**		**Indoor to**
Sample ID	**Subslab**	**2-Times Max**		IR88-IA04-10A		IR88-SG05-10A		**Subslab**	IR88-IA07-10A		IR88-SG13-10A		**Subslab**	IR88-IA11-10A		IR88-SG14-10A		**Subslab**	IR88-IA12-10A		IR88-SG15-10A		**Subslab**
Sample Date	**RL (ppbv)**	**Detected Value**		02/09/10		02/08/10		**Ratio**	02/09/10		02/08/10		**Ratio**	01/30/10		01/30/10		**Ratio**	01/30/10		01/30/10		**Ratio**
Chemical Name																							
Volatile Organic Compounds (ppbv)																							
1,1,1-Trichloroethane	0.39	#N/A	##	0.15 U		180 U		NC	0.13 U		4,300 U		NC	0.13 U		2.2 U		NC	0.11 U		0.44 U		NC
1,1,2,2-Tetrachloroethane	0.31	#N/A	##	0.12 U		140 U		NC	0.1 U		3,400 U		NC	0.1 U		1.7 U		NC	0.08 U		0.35 U		NC
1,1,2-Trichloro-1,2,2-trifluoroethane(Freon-113)	0.28	#N/A	##	0.07 J	#	130 U		NC	0.07 J	#	3,000 U		NC	0.07 J	#	1.5 U		NC	0.07 J	#	0.08 J	#	#N/A
1,1,2-Trichloroethane	1.2	#N/A	##	NA		NA		NC	NA		NA		NC	NA		NA		NC	NA		NA		NC
1,1-Dichloroethane	0.52	#N/A	##	0.2 U		240 U		NC	0.17 U		5,700 U		NC	0.17 U		2.9 U		NC	0.15 U		0.59 U		NC
1,1-Dichloroethene	0.53	#N/A	##	0.21 U		240 U		NC	0.18 U		5,900 U		NC	0.18 U		3 U		NC	0.15 U		0.61 U		NC
1,2,4-Trichlorobenzene	0.28	#N/A	##	0.11 U		130 U		NC	0.09 U		3,100 U		NC	0.09 U		1.6 U		NC	0.08 U		0.32 U		NC
1,2,4-Trimethylbenzene	1.2	#N/A	##	NA		NA		NC	NA		NA		NC	NA		NA		NC	NA		NA		NC
1,2-Dibromoethane	1.2	NA		NA		NA		NC	NA		NA		NC	NA		NA		NC	NA		NA		NC
1,2-Dichlorobenzene	1.2	#N/A	##	NA		NA		NC	NA		NA		NC	NA		NA		NC	NA		NA		NC
1,2-Dichloroethane	0.52	#N/A	##	0.2 U		240 U		NC	0.17 U		5,700 U		NC	0.17 U		2.9 U		NC	0.01 J	#	0.59 U		NC
1,2-Dichloropropane	0.46	#N/A	##	0.18 U		210 U		NC	0.15 U		5,000 U		NC	0.15 U		2.6 U		NC	0.13 U		0.52 U		NC
1,2-Dichlorotetrafluoroethane (Freon-114)	1.2	#N/A	##	NA		NA		NC	NA		NA		NC	NA		NA		NC	NA		NA		NC
1,3,5-Trimethylbenzene	1.2	#N/A	##	NA		NA		NC	NA		NA		NC	NA		NA		NC	NA		NA		NC
1,3-Dichlorobenzene	1.2	#N/A	##	NA		NA		NC	NA		NA		NC	NA		NA		NC	NA		NA		NC
1,4-Dichlorobenzene	0.35	#N/A	##	0.02 J	#	160 U		NC	0.02 J	#	3,900 U		NC	0.01 J	#	2 U		NC	0.02 J	#	0.4 U		NC
2-Butanone	1.4	#N/A		6.7	#	660 U		NC	1.1	#	16,000 U		NC	0.89	#	8 U		NC	0.55	#	1.7	#	#N/A
2-Hexanone	0.52	#N/A	##	0.06 J	#	240 U		NC	0.12 J	#	5,700 U		NC	0.05 J	#	2.9 U		NC	0.15 U		0.23 J	#	#N/A
4-Methyl-2-pentanone	0.52	#N/A	##	0.2 U		240 U		NC	0.04 J	#	5,700 U		NC	0.08 J	#	2.9 U		NC	0.13 J	#	0.59 U		NC
Acetone	8.9	#N/A		24	#	4,100 U		NC	10	#	98,000 U		NC	8.7	#	50 U		NC	12	#	23	#	#N/A
Benzene	0.66	#N/A	##	0.23 J	#	300 U		NC	0.21 J	#	7,300 U		NC	0.22 J	#	3.7 U		NC	0.24	#	0.75 U		NC
Benzyl chloride	1.2	#N/A	##	NA		NA		NC	NA		NA		NC	NA		NA		NC	NA		NA		NC
Bromodichloromethane	0.32	#N/A	##	0.12 U		140 U		NC	0.11 U		3,500 U		NC	0.11 U		1.8 U		NC	0.08 U		0.36 U		NC
Bromomethane	0.54	#N/A	##	0.21 U		250 U		NC	0.18 U		6,000 U		NC	0.18 U		3 U		NC	0.15 U		0.62 U		NC
Carbon disulfide	1.4	#N/A	##	0.53 U		620 U		NC	0.45 U		15,000 U		NC	0.45 U		1.7 J	#	#N/A	0.38 U		2.5	#	#N/A
Carbon tetrachloride	0.34	#N/A	##	0.05 J	#	150 U		NC	0.04 J	#	3,700 U		NC	0.07 J	#	1.9 U		NC	0.07 J	#	0.38 U		NC
Chlorobenzene	0.46	#N/A	##	0.18 U		210 U		NC	0.15 U		5,000 U		NC	0.15 U		2.6 U		NC	0.13 U		0.52 U		NC
Chloroethane	0.8	#N/A	##	0.31 U		370 U		NC	0.27 U		8,800 U		NC	0.27 U		4.5 U		NC	0.23 U		0.34 J	#	#N/A
Chloroform	0.43	#N/A	##	0.17 U		200 U		NC	0.14 U		4,800 U		NC	0.05 J	#	1.4 J	#	#N/A	0.07 J	#	0.24 J	#	#N/A
Chloromethane	1	#N/A		0.13 J	#	470 U		NC	0.18 J	#	11,000 U		NC	0.48	#	5.7 U		NC	0.47	#	0.57 J	#	#N/A
cis-1,2-Dichloroethene	0.53	#N/A	##	0.21 U		240 U		NC	0.18 U		5,900 U		NC	0.18 U		11	#	#N/A	0.15 U		13	#	#N/A
cis-1,3-Dichloropropene	1.2	#N/A	##	NA		NA		NC	NA		NA		NC	NA		NA		NC	NA		NA		NC
Cyclohexane	1.2	#N/A	##	0.48 U		560 U		NC	0.25 J	#	13,000 U		NC	0.41 U		6.9 U		NC	0.07 J	#	1.4 U		NC
Dichlorodifluoromethane (Freon-12)	0.43	#N/A		2	#	200 U		NC	0.64	#	4,700 U		NC	0.52	#	2.4 U		NC	0.53	#	0.49 U		NC
Ethylbenzene	0.49	#N/A	##	0.05 J	#	220 U		NC	0.14 J	#	5,300 U		NC	0.04 J	#	2.7 U		NC	0.04 J	#	0.55 U		NC
Hexachlorobutadiene	4.6	#N/A	##	NA		NA		NC	NA		NA		NC	NA		NA		NC	NA		NA		NC
Isopropylbenzene	0.43	#N/A	##	0.17 U		200 U		NC	0.14 U		4,700 U		NC	0.14 U		2.4 U		NC	0.12 U		0.49 U		NC
m- and p-Xylene	0.97	#N/A	##	0.19 J	#	450 U		NC	0.47	#	11,000 U		NC	0.12 J	#	5.4 U		NC	0.11 J	#	1.1 U		NC
Methylene chloride	0.61	#N/A	##	0.21 J	#	280 U		NC	0.08 J	#	6,700 U		NC	0.07 J	#	3.4 U		NC	0.08 J	#	0.69 U		NC
Methyl-tert-butyl ether (MTBE)	0.59	#N/A	##	0.23 U		270 U		NC	0.2 U		6,400 U		NC	0.2 U		3.3 U		NC	0.17 U		0.67 U		NC
o-Xylene	0.49	#N/A	##	0.07 J	#	220 U		NC	0.2	#	5,300 U		NC	0.04 J	#	2.7 U		NC	0.04 J	#	0.55 U		NC
Styrene	0.5	#N/A	##	0.04 J	#	230 U		NC	0.18	#	5,500 U		NC	0.06 J	#	2.8 U		NC	0.05 J	#	0.56 U		NC
Tetrachloroethene	0.31	#N/A	##	21	#	37,000	#	#N/A	46	#	580,000	#	#N/A	0.32	#	330	#	#N/A	0.29	#	73	#	#N/A
Toluene	0.56	#N/A	##	0.43	#	260 U		NC	1.2	#	6,200 U		NC	0.95	#	3.1 U		NC	0.96	#	0.29 J	#	#N/A
trans-1,2-Dichloroethene	0.53	#N/A	##	0.21 U		240 U		NC	0.18 U		5,900 U		NC	0.18 U		3 U		NC	0.15 U		0.61 U		NC
trans-1,3-Dichloropropene	1.2	#N/A	##	NA		NA		NC	NA		NA		NC	NA		NA		NC	NA		NA		NC

TABLE V1-11
Calculation of Indoor air to Soil Gas Empirical Attenuation Factors
Vapor Intrusion Report
MCB Camp Lejeune, North Carolina

MAINSIDE - PHASE III																							
Building				**Building 3B**					**Buiding 3B**					**Building 3**					**Building 3**				
Indoor Air/Soil Gas Sample	**Min. Phase III**	**Outdoor**		**Indoor**		**Soil Gas**		**Indoor to**	**Indoor**		**Soil Gas**		**Indoor to**	**Indoor**		**Soil Gas**		**Indoor to**	**Indoor**		**Soil Gas**		**Indoor to**
Sample ID	**Subslab**	**2-Times Max**		IR88-IA04-10A		IR88-SG05-10A		**Subslab**	IR88-IA07-10A		IR88-SG13-10A		**Subslab**	IR88-IA11-10A		IR88-SG14-10A		**Subslab**	IR88-IA12-10A		IR88-SG15-10A		**Subslab**
Sample Date	**RL (ppbv)**	**Detected Value**		02/09/10		02/08/10		**Ratio**	02/09/10		02/08/10		**Ratio**	01/30/10		01/30/10		**Ratio**	01/30/10		01/30/10		**Ratio**
Chemical Name																							
Trichloroethene	0.39	#N/A	##	0.15 U		180 U		NC	0.05 J	#	1,200 J	#	#N/A	0.13 U		91	#	#N/A	0.11 U		94	#	#N/A
Trichlorofluoromethane(Freon-11)	0.38	#N/A		0.27	#	170 U		NC	0.24	#	4,100 U		NC	0.26	#	2.1 U		NC	0.26	#	0.31 J	#	#N/A
Vinyl chloride	0.83	#N/A	##	0.32 U		380 U		NC	0.28 U		9,100 U		NC	0.28 U		4.6 U		NC	0.23 U		0.94 U		NC

Notes:

1 = Exceeds 2-times maximum background.

2 = Exeeds 100-times the minimum subslab soil gas reporting limit (RL).

3 = Exeeds both 2-times maximum background and 100-times the minimum subslab soil gas RL.

P = Parent sample

D = Duplicate sample

NC = Not Calculated

NA - Not analyzed

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

U - The material was analyzed for, but not detected

ppbv - Parts per billion volume

The AF values highlighted yellow may be higher than listed because they are based on indoor air non-detect concentrations

TABLE V1-11
Calculation of Indoor air to Soil Gas Empirical Attenua
Vapor Intrusion Report
MCB Camp Lejeune, North Carolina

MAINSIDE - PHASE III																								
Building	**Building 3**						**Building 37**						**Building 37**								**Building 43**			
Indoor Air/Soil Gas Sample	**Indoor**		**Soil Gas**		**Indoor to**		**Indoor**		**Soil Gas**		**Indoor to**		**Indoor**		**Soil Gas**		**Indoor (P) to**		**Indoor (D) to**		**Indoor**		**Soil Gas**		**Indoor to**
Sample ID	IR88-IA13-10A		IR88-SG16-10A		**Subslab**		IR88-IA09-10A		IR88-SG07-10A		**Subslab**		IR88-IA10-10A	IR88-IA10D-10A	IR88-SG08-10A		**Subslab**		**Subslab**		IR88-IA03-10A		IR88-SG17-10A		**Subslab**
Sample Date	01/30/10		01/30/10		**Ratio**		02/11/10		02/11/10		**Ratio**		02/11/10	02/11/10	02/11/10		**Ratio**		**Ratio**		02/04/10		02/03/10		**Ratio**
Chemical Name																								
Volatile Organic Compounds (ppbv)																								
1,1,1-Trichloroethane	0.13 U		1.6 U		NC		0.15 U		0.43 U		NC		0.11 U	0.14 U	0.44 U		NC		NC		0.16 U		230 U		NC
1,1,2,2-Tetrachloroethane	0.11 U		1.3 U		NC		0.12 U		0.34 U		NC		0.09 U	0.11 U	0.35 U		NC		NC		0.13 U		180 U		NC
1,1,2-Trichloro-1,2,2-trifluoroethane(Freon-113)	0.07 J	#	1.1 U		NC		0.06 J	#	0.07 J	#	#N/A		0.08	0.08 J #	0.07 J	#	#N/A		#N/A		0.09 J	#	160 U		NC
1,1,2-Trichloroethane	NA		NA		NC		NA		NA		NC		NA	NA	NA		NC		NC		NA		NA		NC
1,1-Dichloroethane	0.18 U		2.2 U		NC		0.2 U		0.58 U		NC		0.15 U	0.19 U	0.6 U		NC		NC		0.21 U		300 U		NC
1,1-Dichloroethene	0.19 U		2.2 U		NC		0.21 U		0.59 U		NC		0.16 U	0.19 U	0.61 U		NC		NC		0.22 U		310 U		NC
1,2,4-Trichlorobenzene	0.09 U		1.2 U		NC		0.11 U		0.32 U		NC		0.08 U	0.1 U	0.33 U		NC		NC		0.12 U		170 U		NC
1,2,4-Trimethylbenzene	NA		NA		NC		NA		NA		NC		NA	NA	NA		NC		NC		NA		NA		NC
1,2-Dibromoethane	NA		NA		NC		NA		NA		NC		NA	NA	NA		NC		NC		NA		NA		NC
1,2-Dichlorobenzene	NA		NA		NC		NA		NA		NC		NA	NA	NA		NC		NC		NA		NA		NC
1,2-Dichloroethane	0.18 U		2.2 U		NC		0.2 U		0.58 U		NC		0.15 U	0.19 U	0.6 U		NC		NC		0.21 U		300 U		NC
1,2-Dichloropropane	0.16 U		1.9 U		NC		0.18 U		0.51 U		NC		0.13 U	0.17 U	0.52 U		NC		NC		0.19 U		270 U		NC
1,2-Dichlorotetrafluoroethane (Freon-114)	NA		NA		NC		NA		NA		NC		NA	NA	NA		NC		NC		NA		NA		NC
1,3,5-Trimethylbenzene	NA		NA		NC		NA		NA		NC		NA	NA	NA		NC		NC		NA		NA		NC
1,3-Dichlorobenzene	NA		NA		NC		NA		NA		NC		NA	NA	NA		NC		NC		NA		NA		NC
1,4-Dichlorobenzene	0.03 J	#	1.5 U		NC		0.14 U		0.39 U		NC		0.1 U	0.13 U	0.4 U		NC		NC		33	#	200 U		NC
2-Butanone	0.56	#	6 U		NC		0.42 J	#	3.9	#	#N/A		0.75	# 1.2	# 9	#	#N/A		#N/A		1.3	#	830 U		NC
2-Hexanone	0.04 J	#	2.1 U		NC		0.05 J	#	0.43 J	#	#N/A		0.11 J	# 0.26	# 1.4	#	#N/A		#N/A		0.14 J	#	300 U		NC
4-Methyl-2-pentanone	0.12 J	#	2.1 U		NC		1.1	#	0.15 J	#	#N/A		0.7	# 0.43	# 0.38 J	#	#N/A		#N/A		22	#	300 U		NC
Acetone	14	#	8 J	#	#N/A		5	#	15	#	#N/A		9.8	# 13	# 28	#	#N/A		#N/A		22	#	5,200 U		NC
Benzene	0.21 J	#	2.8 U		NC		0.15 J	#	0.73 U		NC		0.18 J	# 0.19 J	# 0.76 U		NC		NC		0.29	#	390 U		NC
Benzyl chloride	NA		NA		NC		NA		NA		NC		NA	NA	NA		NC		NC		NA		NA		NC
Bromodichloromethane	0.11 U		1.3 U		NC		0.12 U		0.35 U		NC		0.09 U	0.11 U	0.36 U		NC		NC		0.13 U		180 U		NC
Bromomethane	0.19 U		2.3 U		NC		0.21 U		0.6 U		NC		0.16 U	0.2 U	0.62 U		NC		NC		0.22 U		320 U		NC
Carbon disulfide	0.47 U		5.7 U		NC		0.52 U		1.5 U		NC		0.4 U	0.49 U	1.6 U		NC		NC		0.55 U		790 U		NC
Carbon tetrachloride	0.07 J	#	1.4 U		NC		0.06 J	#	0.05 J	#	#N/A		0.07 J	# 0.07 J	# 0.06 J	#	#N/A		#N/A		0.08 J	#	200 U		NC
Chlorobenzene	0.16 U		1.9 U		NC		0.18 U		0.51 U		NC		0.13 U	0.17 U	0.52 U		NC		NC		0.19 U		270 U		NC
Chloroethane	0.28 U		3.3 U		NC		0.31 U		0.89 U		NC		0.24 U	0.29 U	0.91 U		NC		NC		0.33 U		470 U		NC
Chloroform	0.03 J	#	1.8 U		NC		0.17 U		0.48 U		NC		0.02 J	# 0.02 J	# 0.18 J	#	#N/A		#N/A		0.36	#	250 U		NC
Chloromethane	0.36	#	4.3 U		NC		0.18 J	#	1.1 U		NC		0.21 J	# 0.22 J	# 1.2 U		NC		NC		0.22 J	#	600 U		NC
cis-1,2-Dichloroethene	0.19 U		32	#	#N/A		0.21 U		0.59 U		NC		0.16 U	0.19 U	0.61 U		NC		NC		0.22 U		310 U		NC
cis-1,3-Dichloropropene	NA		NA		NC		NA		NA		NC		NA	NA	NA		NC		NC		NA		NA		NC
Cyclohexane	0.43 U		5.1 U		NC		0.47 U		1.4 U		NC		0.36 U	0.45 U	1.4 U		NC		NC		0.5 U		710 U		NC
Dichlorodifluoromethane (Freon-12)	0.54	#	0.56 J	#	#N/A		0.52	#	0.52	#	#N/A		0.59	# 0.54	# 0.49	#	#N/A		#N/A		3	#	250 U		NC
Ethylbenzene	0.05 J	#	2 U		NC		0.02 J	#	0.54 U		NC		0.04 J	# 0.03 J	# 0.56 U		NC		NC		0.11 J	#	280 U		NC
Hexachlorobutadiene	NA		NA		NC		NA		NA		NC		NA	NA	NA		NC		NC		NA		NA		NC
Isopropylbenzene	0.15 U		1.8 U		NC		0.17 U		0.48 U		NC		0.13 U	0.16 U	0.49 U		NC		NC		0.18 U		250 U		NC
m- and p-Xylene	0.14 J	#	4.1 U		NC		0.07 J	#	0.19 J	#	#N/A		0.12 J	# 0.09 J	# 1.1 U		NC		NC		0.31 J	#	570 U		NC
Methylene chloride	0.07 J	#	2.5 U		NC		0.83	#	0.21 J	#	#N/A		0.33	# 0.38	# 0.69 U		NC		NC		0.08 J	#	350 U		NC
Methyl-tert-butyl ether (MTBE)	0.2 U		2.4 U		NC		0.23 U		0.65 U		NC		0.17 U	0.21 U	0.67 U		NC		NC		0.24 U		340 U		NC
o-Xylene	0.05 J	#	2 U		NC		0.02 J	#	0.08 J	#	#N/A		0.04 J	# 0.03 J	# 0.56 U		NC		NC		0.11 J	#	280 U		NC
Styrene	0.06 J	#	2.1 U		NC		0.02 J	#	0.55 U		NC		0.02 J	# 0.04 J	# 0.57 U		NC		NC		0.03 J	#	290 U		NC
Tetrachloroethene	0.07 J	#	5	#	#N/A		0.1 J	#	62	#	#N/A		0.67 J	# 0.03 J	# 11	#	#N/A		#N/A		7.6	#	32,000	#	#N/A
Toluene	0.42	#	0.55 J	#	#N/A		0.49	#	0.15 J	#	#N/A		0.36	# 0.58	# 0.11 J	#	#N/A		#N/A		1.9	#	330 U		NC
trans-1,2-Dichloroethene	0.19 U		2.2 U		NC		0.21 U		0.59 U		NC		0.16 U	0.19 U	0.61 U		NC		NC		0.22 U		310 U		NC
trans-1,3-Dichloropropene	NA		NA		NC		NA		NA		NC		NA	NA	NA		NC		NC		NA		NA		NC

TABLE V1-11
Calculation of Indoor air to Soil Gas Empirical Attenua
Vapor Intrusion Report
MCB Camp Lejeune, North Carolina

MAINSIDE - PHASE III																							
Building	**Building 3**					**Building 37**					**Building 37**							**Building 43**					
Indoor Air/Soil Gas Sample	**Indoor**		**Soil Gas**		**Indoor to**	**Indoor**		**Soil Gas**		**Indoor to**	**Indoor**				**Soil Gas**		**Indoor (P) to**	**Indoor (D) to**	**Indoor**		**Soil Gas**		**Indoor to**
Sample ID	IR88-IA13-10A		IR88-SG16-10A		**Subslab**	IR88-IA09-10A		IR88-SG07-10A		**Subslab**	IR88-IA10-10A		IR88-IA10D-10A		IR88-SG08-10A		**Subslab**	**Subslab**	IR88-IA03-10A		IR88-SG17-10A		**Subslab**
Sample Date	01/30/10		01/30/10		**Ratio**	02/11/10		02/11/10		**Ratio**	02/11/10		02/11/10		02/11/10		**Ratio**	**Ratio**	02/04/10		02/03/10		**Ratio**
Chemical Name																							
Trichloroethene	0.14 U		240	#	#N/A	0.04 J	#	0.44 U		NC	0.12 U		0.14 U		0.45 U		NC	NC	0.04 J	#	230 U		NC
Trichlorofluoromethane(Freon-11)	0.25	#	1.6 U		NC	0.21	#	0.23 J	#	#N/A	0.27	#	0.26	#	0.23 J	#	#N/A	#N/A	0.28	#	220 U		NC
Vinyl chloride	0.29 U		3.4 U		NC	0.32 U		0.91 U		NC	0.24 U		0.3 U		0.94 U		NC	NC	0.34 U		480 U		NC

Notes:

1 = Exceeds 2-times maximum background.

2 = Exeeds 100-times the minimum subslab soil gas reporting

3 = Exeeds both 2-times maximum background and 100-times

P = Parent sample

D = Duplicate sample

NC = Not Calculated

NA - Not analyzed

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

U - The material was analyzed for, but not detected

ppbv - Parts per billion volume

The AF values highlighted yellow may be higher than listed because they are based on indoor air non-detect concentrations

TABLE V1-11
Calculation of Indoor air to Soil Gas Empirical Attenua
Vapor Intrusion Report
MCB Camp Lejeune, North Carolina

MAINSIDE - PHASE III																				
Building	**Building 43**								**Building HP-57**					**Building HP-57**						
Indoor Air/Soil Gas Sample	**Indoor**		**Soil Gas**				**Indoor to**	**Indoor to**	**Indoor**		**Soil Gas**		**Indoor to**	**Indoor**				**Soil Gas**		**Indoor (P) to**	**Indoor (D) to**
Sample ID	IR88-IA08-10A		IR88-SG06-10A		IR88-SG06D-10A		**Subslab (P)**	**Subslab (D)**	IR88-IA15-10B		IR88-SG19-10A		**Subslab**	IR88-IA16-10B		IR88-IA16D-10B		IR88-SG20-10A		**Subslab**	**Subslab**
Sample Date	01/30/10		01/31/10		01/31/10		**Ratio**	**Ratio**	4/21/10		01/30/10		**Ratio**	4/21/10		4/21/10		01/30/10		**Ratio**	**Ratio**
Chemical Name																					
Volatile Organic Compounds (ppbv)																					
1,1,1-Trichloroethane	0.12 U		210 U		200 U		NC	NC	0.08 U		5.1 U		NC	0.08 U		0.08 U		1.5 U		NC	NC
1,1,2,2-Tetrachloroethane	0.09 U		170 U		160 U		NC	NC	0.08 U		4.1 U		NC	0.08 U		0.08 U		1.2 U		NC	NC
1,1,2-Trichloro-1,2,2-trifluoroethane(Freon-113)	0.07 J	#	150 U		140 U		NC	NC	0.071 J	#	3.7 U		NC	0.075 J	#	0.068 J	#	1 U		NC	NC
1,1,2-Trichloroethane	NA		NA		NA		NC	NC	0.08 U		NA		NC	0.08 U		0.08 U		NA		NC	NC
1,1-Dichloroethane	0.17 U		280 U		270 U		NC	NC	0.08 U		6.9 U		NC	0.08 U		0.08 U		2 U		NC	NC
1,1-Dichloroethene	0.17 U		290 U		270 U		NC	NC	0.08 U		7.1 U		NC	0.08 U		0.08 U		2 U		NC	NC
1,2,4-Trichlorobenzene	0.09 U		150 U		150 U		NC	NC	0.4 U		3.8 U		NC	0.4 U		0.4 U		1.1 U		NC	NC
1,2,4-Trimethylbenzene	NA		NA		NA		NC	NC	0.066 J	#	NA		NC	0.027 J	#	0.059 J	#	NA		NC	NC
1,2-Dibromoethane	NA		NA		NA		NC	NC	0.08 U		NA		NC	0.08 U		0.08 U		NA		NC	NC
1,2-Dichlorobenzene	NA		NA		NA		NC	NC	0.08 U		NA		NC	0.08 U		0.08 U		NA		NC	NC
1,2-Dichloroethane	0.17 U		280 U		270 U		NC	NC	0.08 U		6.9 U		NC	0.023 J	#	0.021 J	#	2 U		NC	NC
1,2-Dichloropropane	0.15 U		250 U		230 U		NC	NC	0.08 U		6.1 U		NC	0.08 U		0.08 U		1.7 U		NC	NC
1,2-Dichlorotetrafluoroethane (Freon-114)	NA		NA		NA		NC	NC	0.021 J	#	NA		NC	0.022 J	#	0.021 J	#	NA		NC	NC
1,3,5-Trimethylbenzene	NA		NA		NA		NC	NC	0.08 U		NA		NC	0.08 U		0.08 U		NA		NC	NC
1,3-Dichlorobenzene	NA		NA		NA		NC	NC	0.08 U		NA		NC	0.089	#	0.08 U		NA		NC	NC
1,4-Dichlorobenzene	120	#	190 U		180 U		NC	NC	0.23	#	4.7 U		NC	0.085	#	0.38	#	1.3 U		NC	NC
2-Butanone	0.72	#	770 U		730 U		NC	NC	NA		19 U		NC	NA		NA		5.4 U		NC	NC
2-Hexanone	0.08 J	#	280 U		260 U		NC	NC	NA		6.8 U		NC	NA		NA		1.9 U		NC	NC
4-Methyl-2-pentanone	0.39	#	280 U		260 U		NC	NC	NA		6.8 U		NC	NA		NA		1.9 U		NC	NC
Acetone	8.3	#	4,800 U		4,500 U		NC	NC	NA		120 U		NC	NA		NA		6.8 J	#	#N/A	#N/A
Benzene	0.18 J	#	120 J	#	340 U		#N/A	NC	0.16	#	8.8 U		NC	0.15	#	0.13	#	2.5 U		NC	NC
Benzyl chloride	NA		NA		NA		NC	NC	0.16 U		NA		NC	0.16 U		0.16 U		NA		NC	NC
Bromodichloromethane	0.1 U		170 U		160 U		NC	NC	NA		4.2 U		NC	NA		NA		1.2 U		NC	NC
Bromomethane	0.17 U		290 U		280 U		NC	NC	0.08 U		7.2 U		NC	0.08 U		0.08 U		2 U		NC	NC
Carbon disulfide	0.43 U		730 U		690 U		NC	NC	NA		18 U		NC	NA		NA		5.1 U		NC	NC
Carbon tetrachloride	0.05 J	#	180 U		170 U		NC	NC	0.083	#	4.5 U		NC	0.088	#	0.082	#	1.3 U		NC	NC
Chlorobenzene	0.15 U		250 U		230 U		NC	NC	0.08 U		6.1 U		NC	0.08 U		0.08 U		1.7 U		NC	NC
Chloroethane	0.26 U		430 U		410 U		NC	NC	0.08 U		11 U		NC	0.08 U		0.08 U		3 U		NC	NC
Chloroform	0.02 J	#	230 U		220 U		NC	NC	0.42	#	5.7 U		NC	0.78	#	0.73	#	1.6 U		NC	NC
Chloromethane	0.18 J	#	550 U		520 U		NC	NC	0.68	#	14 U		NC	0.84	#	0.78	#	3.8 U		NC	NC
cis-1,2-Dichloroethene	0.05 J	#	290 U		270 U		NC	NC	0.08 U		110	#	#N/A	0.08 U		0.08 U		37	#	#N/A	#N/A
cis-1,3-Dichloropropene	NA		NA		NA		NC	NC	0.08 U		NA		NC	0.08 U		0.08 U		NA		NC	NC
Cyclohexane	0.39 U		150 J	#	630 U		#N/A	NC	NA		16 U		NC	NA		NA		4.6 U		NC	NC
Dichlorodifluoromethane (Freon-12)	1.2	#	230 U		220 U		NC	NC	0.52	#	5.7 U		NC	0.53	#	0.5	#	0.43 J	#	#N/A	#N/A
Ethylbenzene	0.04 J	#	260 U		250 U		NC	NC	0.054 J	#	6.4 U		NC	0.072 J	#	0.072 J	#	1.8 U		NC	NC
Hexachlorobutadiene	NA		NA		NA		NC	NC	0.4 U		NA		NC	0.4 U		0.4 U		NA		NC	NC
Isopropylbenzene	0.14 U		230 U		220 U		NC	NC	NA		5.7 U		NC	NA		NA		1.6 U		NC	NC
m- and p-Xylene	0.1 J	#	530 U		500 U		NC	NC	0.14	#	13 U		NC	0.16	#	0.17	#	3.7 U		NC	NC
Methylene chloride	0.06 J	#	330 U		310 U		NC	NC	0.26 B	#	8.1 U		NC	0.59 B	#	0.17 J B	#	2.3 U		NC	NC
Methyl-tert-butyl ether (MTBE)	0.19 U		320 U		300 U		NC	NC	NA		7.8 U		NC	NA		NA		2.2 U		NC	NC
o-Xylene	0.03 J	#	260 U		250 U		NC	NC	0.05 J	#	6.4 U		NC	0.056 J	#	0.068 J	#	1.8 U		NC	NC
Styrene	0.03 J	#	270 U		250 U		NC	NC	0.08 U		6.6 U		NC	0.08 U		0.039 J	#	1.9 U		NC	NC
Tetrachloroethene	5.9	#	32,000	#	30,000	#	#N/A	#N/A	0.15	#	1.5 J	#	#N/A	0.47	#	0.4	#	0.76 J	#	#N/A	#N/A
Toluene	1.3	#	480	#	290 U		#N/A	NC	0.33	#	7.4 U		NC	0.44	#	0.38	#	2.1 U		NC	NC
trans-1,2-Dichloroethene	0.17 U		290 U		270 U		NC	NC	NA		7.1 U		NC	NA		NA		2 U		NC	NC
trans-1,3-Dichloropropene	NA		NA		NA		NC	NC	0.08 U		NA		NC	0.08 U		0.08 U		NA		NC	NC

TABLE V1-11
Calculation of Indoor air to Soil Gas Empirical Attenua
Vapor Intrusion Report
MCB Camp Lejeune, North Carolina

MAINSIDE - PHASE III																					
Building	**Building 43**									**Building HP-57**					**Building HP-57**						
Indoor Air/Soil Gas Sample	**Indoor**		**Soil Gas**				**Indoor to**	**Indoor to**		**Indoor**		**Soil Gas**		**Indoor to**	**Indoor**				**Soil Gas**		**Indoor (P) to**	**Indoor (D) to**
Sample ID	IR88-IA08-10A		IR88-SG06-10A		IR88-SG06D-10A		**Subslab (P)**	**Subslab (D)**		IR88-IA15-10B		IR88-SG19-10A		**Subslab**	IR88-IA16-10B		IR88-IA16D-10B		IR88-SG20-10A		**Subslab**	**Subslab**
Sample Date	01/30/10		01/31/10		01/31/10		**Ratio**	**Ratio**		4/21/10		01/30/10		**Ratio**	4/21/10		4/21/10		01/30/10		**Ratio**	**Ratio**
Chemical Name																						
Trichloroethene	0.03 J	#	210 U		200 U		NC	NC		0.04 U		1,000	#	#N/A	0.022 J	#	0.04 U		280	#	#N/A	#N/A
Trichlorofluoromethane(Freon-11)	0.21	#	200 U		190 U		NC	NC		0.28	#	5 U		NC	0.36	#	0.24	#	1.4 U		NC	NC
Vinyl chloride	0.26 U		450 U		420 U		NC	NC		0.08 U		11 U		NC	0.08 U		0.08 U		3.1 U		NC	NC

Notes:

1 = Exceeds 2-times maximum background.

2 = Exeeds 100-times the minimum subslab soil gas reporting

3 = Exeeds both 2-times maximum background and 100-times

P = Parent sample

D = Duplicate sample

NC = Not Calculated

NA - Not analyzed

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

U - The material was analyzed for, but not detected

ppbv - Parts per billion volume

The AF values highlighted yellow may be higher than listed because they are based on indoor air non-detect concentrations

TABLE V1-11
Calculation of Indoor air to Soil Gas Empirical Attenua
Vapor Intrusion Report
MCB Camp Lejeune, North Carolina

MAINSIDE - PHASE III															
Building	**Building 820**					**Building 820**					**Building LCH4014**				
Indoor Air/Soil Gas Sample	**Indoor**		**Soil Gas**		**Indoor to**	**Indoor**		**Soil Gas**		**Indoor to**	**Indoor**		**Soil Gas**		**Indoor to**
Sample ID	UST820-IA03-10A		UST820-SG03-10A		**Subslab**	UST820-IA04-10A		UST820-SG04-10A		**Subslab**	LCH4015-IA15-10A		LCH4015-SG23-10A		**Subslab**
Sample Date	02/01/10		02/08/10		**Ratio**	02/01/10		02/08/10		**Ratio**	01/29/10		01/29/10		**Ratio**
Chemical Name															
Volatile Organic Compounds (ppbv)															
1,1,1-Trichloroethane	0.11 U		1.1 U		NC	0.47 U		1.7 U		NC	0.15 U		0.42 U		NC
1,1,2,2-Tetrachloroethane	0.08 U		0.84 U		NC	0.37 U		1.3 U		NC	0.12 U		0.33 U		NC
1,1,2-Trichloro-1,2,2-trifluoroethane(Freon-113)	0.08	#	0.75 U		NC	0.08 J	#	1.2 U		NC	0.07 J	#	0.07 J	#	#N/A
1,1,2-Trichloroethane	NA		NA		NC	NA		NA		NC	NA		NA		NC
1,1-Dichloroethane	0.15 U		1.4 U		NC	0.63 U		2.3 U		NC	0.2 U		0.57 U		NC
1,1-Dichloroethene	0.15 U		1.4 U		NC	0.64 U		2.3 U		NC	0.21 U		0.58 U		NC
1,2,4-Trichlorobenzene	0.08 U		0.77 U		NC	0.34 U		1.2 U		NC	0.11 U		0.31 U		NC
1,2,4-Trimethylbenzene	NA		NA		NC	NA		NA		NC	NA		NA		NC
1,2-Dibromoethane	NA		NA		NC	NA		NA		NC	NA		NA		NC
1,2-Dichlorobenzene	NA		NA		NC	NA		NA		NC	NA		NA		NC
1,2-Dichloroethane	0.06 J	#	1.4 U		NC	0.63 U		2.3 U		NC	0.09 J	#	0.57 U		NC
1,2-Dichloropropane	0.13 U		1.2 U		NC	0.55 U		2 U		NC	0.18 U		0.5 U		NC
1,2-Dichlorotetrafluoroethane (Freon-114)	NA		NA		NC	NA		NA		NC	NA		NA		NC
1,3,5-Trimethylbenzene	NA		NA		NC	NA		NA		NC	NA		NA		NC
1,3-Dichlorobenzene	NA		NA		NC	NA		NA		NC	NA		NA		NC
1,4-Dichlorobenzene	0.04 J	#	0.95 U		NC	0.42 U		1.5 U		NC	0.02 J	#	0.08 J	#	#N/A
2-Butanone	1.4	#	3.2 J	#	#N/A	2.3	#	1.6 J	#	#N/A	1	#	10	#	#N/A
2-Hexanone	0.27	#	0.35 J	#	#N/A	0.62 U		2.2 U		NC	0.2 U		0.41 J	#	#N/A
4-Methyl-2-pentanone	0.06 J	#	1.4 U		NC	0.08 J	#	2.2 U		NC	0.35	#	0.27 J	#	#N/A
Acetone	22	#	36	#	#N/A	24	#	9.1 J	#	#N/A	26	#	100	#	#N/A
Benzene	0.98	#	0.36 J	#	#N/A	1.4	#	0.44 J	#	#N/A	0.26	#	0.14 J	#	#N/A
Benzyl chloride	NA		NA		NC	NA		NA		NC	NA		NA		NC
Bromodichloromethane	0.08 U		0.86 U		NC	0.38 U		1.4 U		NC	0.03 J	#	0.08 J	#	#N/A
Bromomethane	0.15 U		1.5 U		NC	0.66 U		2.4 U		NC	0.21 U		0.59 U		NC
Carbon disulfide	0.14 J	#	3.7 U		NC	0.34 J	#	1 J	#	#N/A	0.13 J	#	1 J	#	#N/A
Carbon tetrachloride	0.11	#	0.91 U		NC	0.14 J	#	1.5 U		NC	0.07 J	#	0.36 U		NC
Chlorobenzene	0.13 U		1.2 U		NC	0.55 U		2 U		NC	0.18 U		0.5 U		NC
Chloroethane	0.23 U		2.2 U		NC	0.97 U		3.5 U		NC	0.31 U		0.27 J	#	#N/A
Chloroform	0.29	#	0.18 J	#	#N/A	0.31 J	#	1.9 U		NC	0.71	#	50	#	#N/A
Chloromethane	0.22 J	#	0.64 J	#	#N/A	0.81 J	#	1.3 J	#	#N/A	0.27 J	#	0.3 J	#	#N/A
cis-1,2-Dichloroethene	0.15 U		1.4 U		NC	0.64 U		2.3 U		NC	0.21 U		0.58 U		NC
cis-1,3-Dichloropropene	NA		NA		NC	NA		NA		NC	NA		NA		NC
Cyclohexane	0.83	#	1.5 J	#	#N/A	1.6	#	5.3 U		NC	0.47 U		1.3 U		NC
Dichlorodifluoromethane (Freon-12)	9.1	#	500	#	#N/A	10	#	760	#	#N/A	0.52	#	0.54	#	#N/A
Ethylbenzene	0.15	#	0.22 J	#	#N/A	0.21 J	#	2.1 U		NC	0.12 J	#	0.15 J	#	#N/A
Hexachlorobutadiene	NA		NA		NC	NA		NA		NC	NA		NA		NC
Isopropylbenzene	0.02 J	#	1.2 U		NC	0.52 U		1.9 U		NC	0.17 U		0.12 J	#	#N/A
m- and p-Xylene	0.38	#	0.56 J	#	#N/A	0.57 J	#	4.2 U		NC	1.2	#	0.79 J	#	#N/A
Methylene chloride	0.14 J	#	0.26 J	#	#N/A	0.19 J	#	2.6 U		NC	0.2 J	#	0.11 J	#	#N/A
Methyl-tert-butyl ether (MTBE)	0.17 U		1.6 U		NC	0.71 U		2.5 U		NC	0.23 U		0.63 U		NC
o-Xylene	0.14	#	0.24 J	#	#N/A	0.21 J	#	2.1 U		NC	0.1 J	#	0.53	#	#N/A
Styrene	0.29	#	0.39 J	#	#N/A	0.29 J	#	2.1 U		NC	0.11 J	#	0.06 J	#	#N/A
Tetrachloroethene	0.02 J	#	63	#	#N/A	0.38 U		180	#	#N/A	0.03 J	#	0.16 J	#	#N/A
Toluene	3.7	#	7.4	#	#N/A	3.7	#	0.44 J	#	#N/A	0.69	#	0.37 J	#	#N/A
trans-1,2-Dichloroethene	0.15 U		1.4 U		NC	0.64 U		2.3 U		NC	0.21 U		0.58 U		NC
trans-1,3-Dichloropropene	NA		NA		NC	NA		NA		NC	NA		NA		NC

TABLE V1-11
Calculation of Indoor air to Soil Gas Empirical Attenua
Vapor Intrusion Report
MCB Camp Lejeune, North Carolina

MAINSIDE - PHASE III															
Building	**Building 820**					**Building 820**					**Building LCH4014**				
Indoor Air/Soil Gas Sample	**Indoor**		**Soil Gas**		**Indoor to**	**Indoor**		**Soil Gas**		**Indoor to**	**Indoor**		**Soil Gas**		**Indoor to**
Sample ID	UST820-IA03-10A		UST820-SG03-10A		**Subslab**	UST820-IA04-10A		UST820-SG04-10A		**Subslab**	LCH4015-IA15-10A		LCH4015-SG23-10A		**Subslab**
Sample Date	02/01/10		02/08/10		**Ratio**	02/01/10		02/08/10		**Ratio**	01/29/10		01/29/10		**Ratio**
Chemical Name															
Trichloroethene	0.11 U		1.1 U		NC	0.13 J	#	0.25 J	#	#N/A	0.04 J	#	0.69	#	#N/A
Trichlorofluoromethane(Freon-11)	5	#	2.5	#	#N/A	4.4	#	1.8	#	#N/A	0.29	#	0.32 J	#	#N/A
Vinyl chloride	0.03 J	#	2.2 U		NC	1 U		3.6 U		NC	0.32 U		0.9 U		NC

Notes:

1 = Exceeds 2-times maximum background.

2 = Exeeds 100-times the minimum subslab soil gas reporting

3 = Exeeds both 2-times maximum background and 100-times

P = Parent sample

D = Duplicate sample

NC = Not Calculated

NA - Not analyzed

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

U - The material was analyzed for, but not detected

ppbv - Parts per billion volume

The AF values highlighted yellow may be higher than listed because they are based on indoor air non-detect concentrations

TABLE V1-12

Paired Subslab and Indoor Air Samples

Phase III Vapor Intrusion Report

MCB CamLej, North Carolina

Bldg	VOC	Phase	Subslab (ppb)	Indoor Air (ppbv)	2X Outdoor Air (ppbv)	Attenuation Factor (unitless)
Chlorinated Solvents						
3B	Tetrachloroethene	PIII	580,000 (PCE)	46	<0.83	8E-05
1200	Trichlorofluoromethane(Freon-11)	PIII	85 (Freon-11)	2.2	0.62	3E-02
902	Trichloroethene	PIII	370,000 (TCE)	2.5	1.2	7E-06
902	Trichloroethene	PIII	170 (TCE)	11	1.2	6E-02
1601	Trichloroethene	PIII	3,600 (TCE)	0.13	1.2	4E-05
1601	Trichloroethene	PIII	3,500 (TCE)	0.15	1.2	4E-05
3B	Trichloroethene	PIII	1,200 (TCE)	0.05	<0.83	4E-05
HP-37	Trichloroethene	PIII	1,000 (TCE)	<0.04	<0.83	4E-05
1601	Trichloroethene	PIII	580 (TCE)	0.14	1.2	2E-04
HP-37	Trichloroethene	PIII	280 (TCE)	0.022	<0.83	8E-05
3	Trichloroethene	PIII	240 (TCE)	<0.14	<0.83	6E-04
TC864	Trichloroethene	PIII	120 (TCE)	<0.14	<0.13	1E-03
1202	Trichloroethene	PIII	110 (TCE)	<0.52	1.2	5E-03
3	Trichloroethene	PIII	94 (TCE)	<0.11	<0.83	1E-03
3	Trichloroethene	PIII	91 (TCE)	<0.13	<0.83	1E-03
TC864	Trichloroethene	PIII	75 (TCE)	<0.11	<0.13	1E-03
902	trans-1,2-Dichloroethene	PIII	480 (trans12DCE)	<0.19	<0.28	4E-04
3B	Tetrachloroethene	PIII	37,000 (PCE)	21	<0.83	6E-04
43	Tetrachloroethene	PIII	32,000 (PCE)	7.6	<0.83	2E-04
43	Tetrachloroethene	PIII	32,000 (PCE)	5.9	<0.83	2E-04
902	Tetrachloroethene	PIII	92 (PCE)	7.3	12.2	8E-02
1606	Tetrachloroethene	PIII	3,000 (PCE)	<0.88	12.2	3E-04
3	Tetrachloroethene	PIII	330 (PCE)	0.32	<0.83	1E-03
1606	Tetrachloroethene	PIII	310 (PCE)	0.16	12.2	5E-04
820	Tetrachloroethene	PIII	180 (PCE)	<0.38	<0.83	2E-03
1115	Tetrachloroethene	PIII	110 (PCE)	0.03	12.2	3E-04
3	Tetrachloroethene	PIII	73 (PCE)	0.29	<0.83	4E-03
1100	Tetrachloroethene	PIII	65 (PCE)	0.06	12.2	9E-04
820	Tetrachloroethene	PIII	63 (PCE)	0.02	<0.83	3E-04
37	Tetrachloroethene	PIII	62 (PCE)	0.1	<0.83	2E-03
1601	Tetrachloroethene	PIII	48 (PCE)	0.04	12.2	8E-04
1202	Tetrachloroethene	PIII	40 (PCE)	0.36	12.2	9E-03
1601	Tetrachloroethene	PIII	38 (PCE)	0.03	12.2	8E-04
1200	Methylene Chloride	PIII	120 (MeCl)	3.1	0.78	3E-02
820	Dichlorodifluoromethane (Freon-12)	PIII	760 (Freon-12)	10	1.06	1E-02
820	Dichlorodifluoromethane (Freon-12)	PIII	500 (Freon-12)	9.1	1.06	2E-02
1005	Dichlorodifluoromethane (Freon-12)	PIII	320 (Freon-12)	1.2	1.14	4E-03
1220	Dichlorodifluoromethane (Freon-12)	PIII	230 (Freon-12)	0.58	1.14	3E-03
902	cis-1,2-Dichloroethene	PIII	120,000 (cis12DCE)	0.84	0.06	7E-06
HP-57	cis-1,2-Dichloroethene	PIII	110 (cis12DCE)	<0.08	<0.83	7E-04
LCH4014	Chloroform	PIII	50 (Chloroform)	0.71	0.042	1E-02
1817	Chloroform	PIII	88 (Chloroform)	<0.16	0.158	2E-03
1601	Chloroform	PIII	47 (Chloroform)	0.05	0.158	1E-03
1115	Carbon Disulfide	PIII	260 (CD)	<0.56	<0.72	2E-03
1115	1,2-Dichloropropane	PIII	120 (12DCP)	<0.19	<0.88	2E-03
902	1,2,4-Trimethlybenzene	PIII	250 (124TMB)	<0.09	<0.88	4E-04
1601	1,1,1-Trichloroethane	PIII	470 (111TCA)	0.04	0.88	9E-05
1601	1,1,1-Trichloroethane	PIII	270 (111TCA)	0.08	0.88	3E-04
1601	1,1,1-Trichloroethane	PIII	62 (111TCA)	0.04	0.88	6E-04

TABLE V1-12

Paired Subslab and Indoor Air Samples

Phase III Vapor Intrusion Report

MCB CamLej, North Carolina

Bldg	VOC	Phase	Subslab (ppb)	Indoor Air (ppbv)	2X Outdoor Air (ppbv)	Attenuation Factor (unitless)
Petroleum Hydrocarbons						
1115	m-&p-Xylene	PIII	40,000 (m-&p-Xyl)	22	0.78	6E-04
1115	o-Xylene	PIII	21,000 (o-Xyl)	7.5	0.3	4E-04
1100	m-&p-Xylene	PIII	7,100 (m-&p-Xyl)	1.5	0.78	2E-04
1100	o-Xylene	PIII	6,500 (o-Xyl)	1	0.3	2E-04
1100	Toluene	PIII	3,000 (Toluene)	1	0.56	3E-04
1115	Ethylbenzene	PIII	1800 (EtB)	5.6	1.14	3E-03
1115	Toluene	PIII	1,800 (Toluene)	28	0.56	2E-02
1115	Benzene	PIII	840 (Benzene)	7.6	0.76	9E-03
1115	Cyclohexane	PIII	320 (Cyclohexane)	2	0.52	6E-03
902	m-&p-Xylene	PIII	300 (m-&p-Xyl)	4.7	0.78	2E-02
1200	m-&p-Xylene	PIII	150 (m-&p-Xyl)	8.6	0.78	6E-02
1108	m-&p-Xylene	PIII	130 (m-&p-Xyl)	2.3	0.78	2E-02
902	o-Xylene	PIII	100 (o-Xyl)	1.7	0.3	2E-02
1200	o-Xylene	PIII	59 (o-Xyl)	3.2	0.3	5E-02
1141	Cyclohexane	PIII	2,000 (Cyclohexane)	0.07	0.52	4E-05
1100	Ethylbenzene	PIII	1800 (EtB)	0.29	0.24	2E-04
1100	Benzene	PIII	470 (Benzene)	0.26	0.76	6E-04
1100	Cyclohexane	PIII	250 (Cyclohexane)	<0.50	0.52	2E-03
43	Cyclohexane	PIII	150 (Cyclohexane)	<0.39	<0.51	3E-03
1100	Isopropylbenzene	PIII	120 (IPB)	0.02	<0.23	2E-04
1115	Isopropylbenzene	PIII	60 (IPB)	0.4	<0.23	7E-03

= Significantly greater than 2-times the outdoor air concentration.

TABLE V1-13
Building Characteristics Considered During Empirical Attenuation Factor (AF) Calculations
Phase III Vapor Intrusion Report
MCB CamLej, North Carolina

Building	Size [a/]	HVAC Running?	Ceiling Height (ft)	Offices or Warehouse	Windows or Doors Typically Open or Closed?
3B	Small	Yes	8	Offices	Closed
3	Small	Yes	8	Offices	Closed
37	Small	Yes	8	Offices	Closed
43	Small	Yes	8	Offices	Closed
HP-57	Large	Yes	8	Offices	Closed
820	Large	Yes	12	Offices	Closed
LCH-41014	Large	Yes	10 -50	Offices	Closed
902	Large	Yes	15-20	Both	Open
1601	Large	Yes (office space)	30	Both	Open
1606	Large	Yes (Window AC)	30	Both	Open
1817	Large	No HVAC	30	Both	Closed
1005	Large	Yes	8	Offices	Closed
1114	Large	No HVAC	25	Warehouse	Open
1220	Large	Yes	8-15	Both	Closed
1100	Small	Yes (Window AC)	8	Offices	Closed
1115	Small	Yes (Window AC)	12	Warehouse	Open
1108	Large	Yes (offices)	8-30	Both	Open
1200	Large	Yes (offices)	8-30	Both	Open
1201	Large	Yes (offices)	10-35	Both	Open
1202	Large	Yes	10	Both	Closed
1301	Large	No HVAC	25-30	Warehouse	Open
G480	Large	Yes	12	Both	Closed
TC860	Large	Yes	10	Offices	Closed
TC864	Large	No HVAC	15	Warehouse	Closed

[a/] Cutoff between small and large buildings is approximately 5,000 ft^2.

\\NORTHEND\PROJ\USNAVFACENGCOM\CAMPLEJEUNE\MAPFILES\VAPORINTRUSION\PHASE_III\VI_REPORT\FIGURE_V1_1_BASE_LOCATION_MAP.MXD MARTESE 7/27/2010 13:06:12

Legend
- Installation Area
- Limited Access Highway
- Highway
- Local Roads
- Cities

N

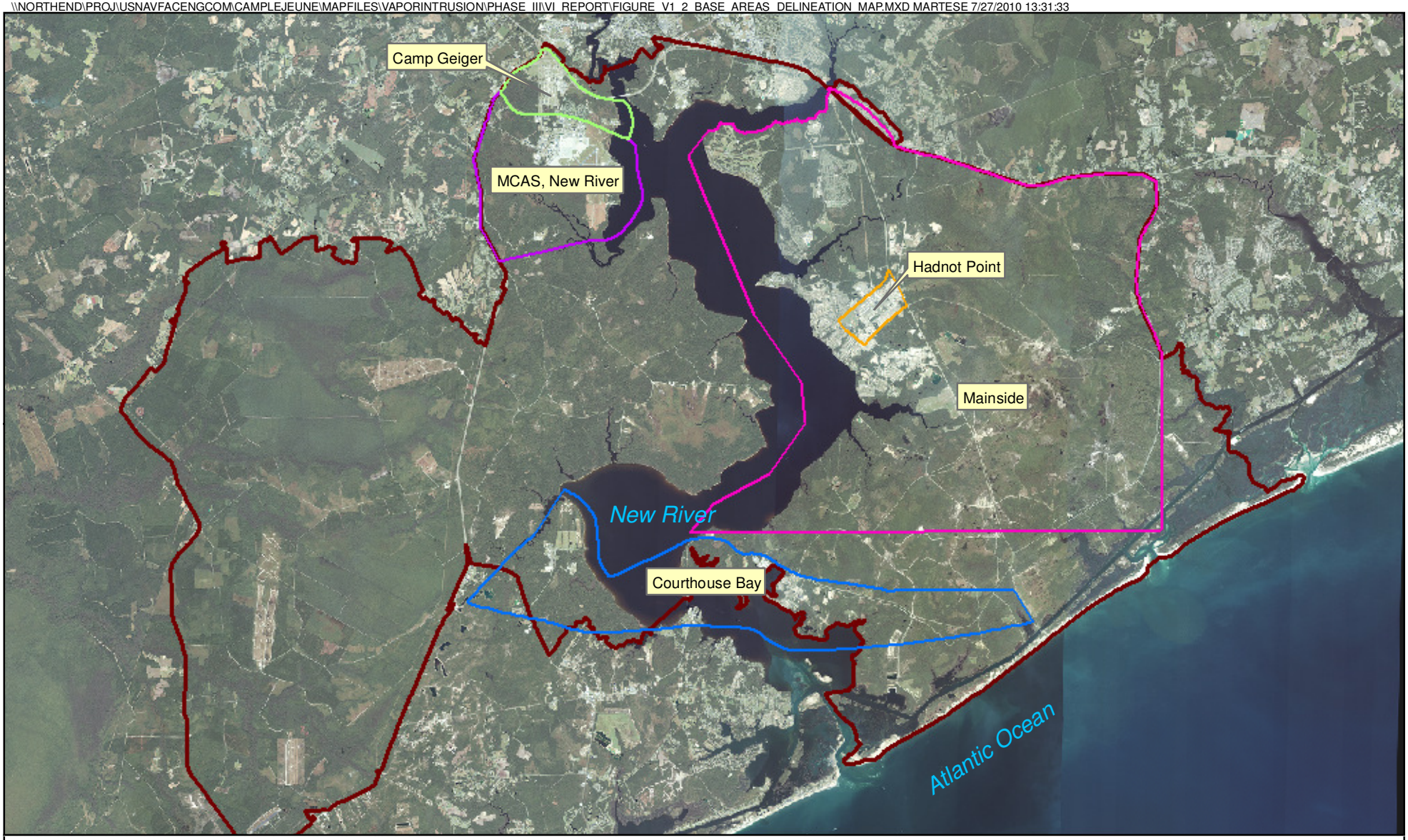
0 10,000 20,000 40,000 Feet

1 inch = 20,000 feet

Figure V1-1
Base Location Map
Phase III Vapor Intrusion Evaluation Report
MCB CamLej
North Carolina

CH2MHILL

\\NORTHEND\PROJ\USNAVFACENGCOM\CAMPLEJEUNE\MAPFILES\VAPORINTRUSION\PHASE_III\VI_REPORT\FIGURE_V1_2_BASE_AREAS_DELINEATION_MAP.MXD MARTESE 7/27/2010 13:31:33



Legend

- MCAS, New River
- Camp Geiger
- Courthouse Bay
- Hadnot Point
- Mainside
- Installation Boundary

N

0 7,500 15,000 30,000 Feet

1 inch = 15,000 feet

Figure V1-2
Delineation of Base Areas
Phase III Vapor Intrusion Evaluation Report
MCB CamLej
North Carolina

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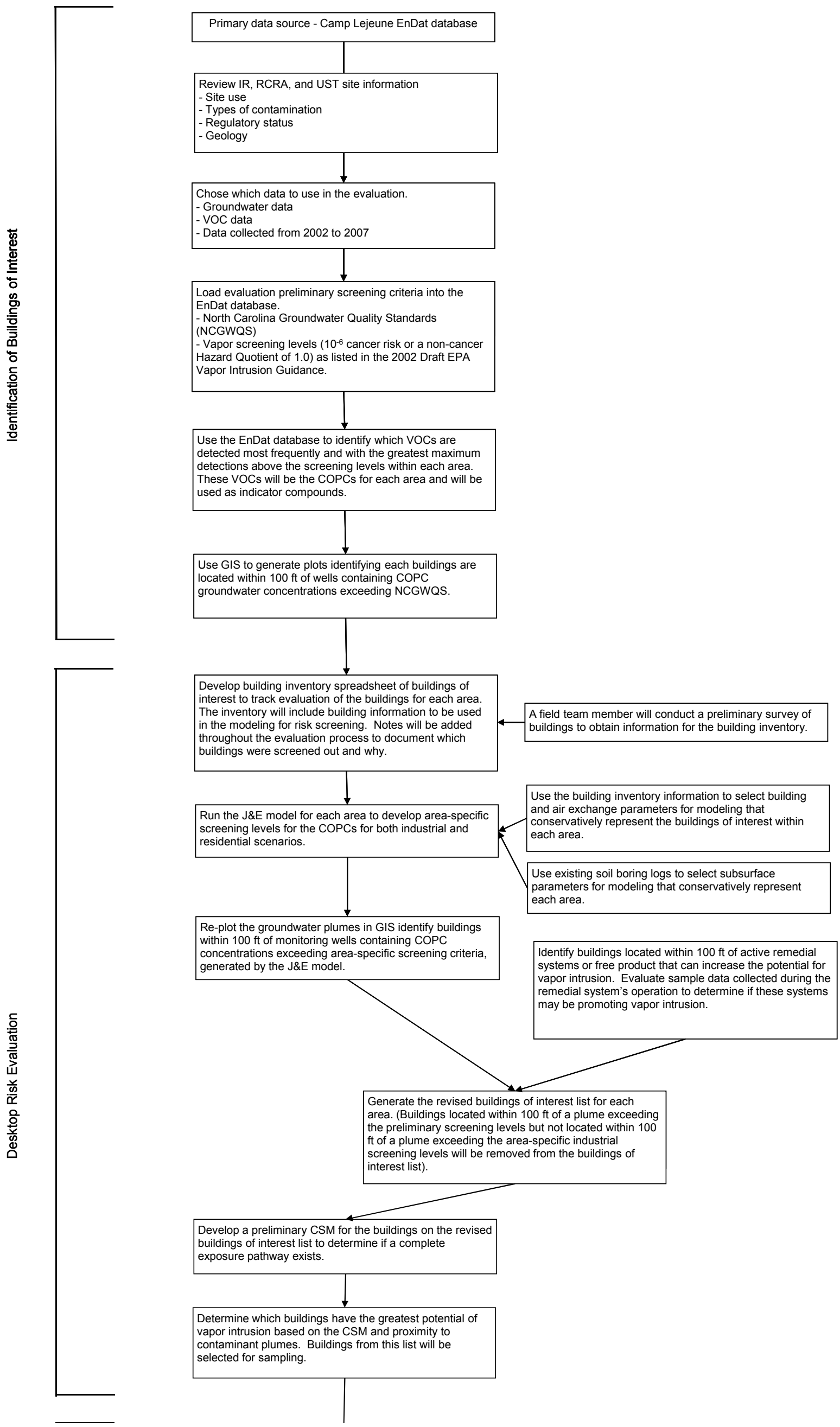
Figure V1-3
Vapor Intrusion Evaluation Approach



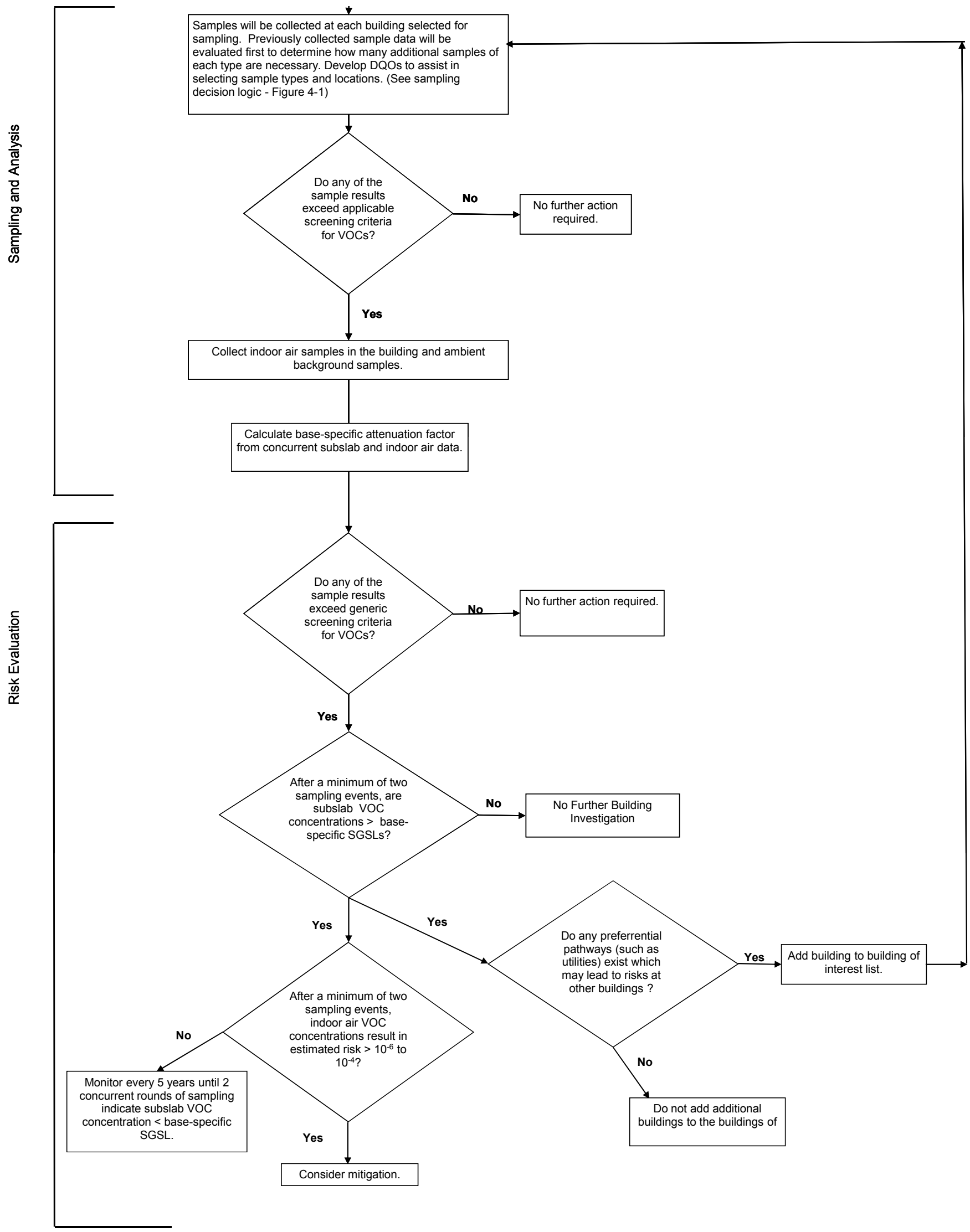
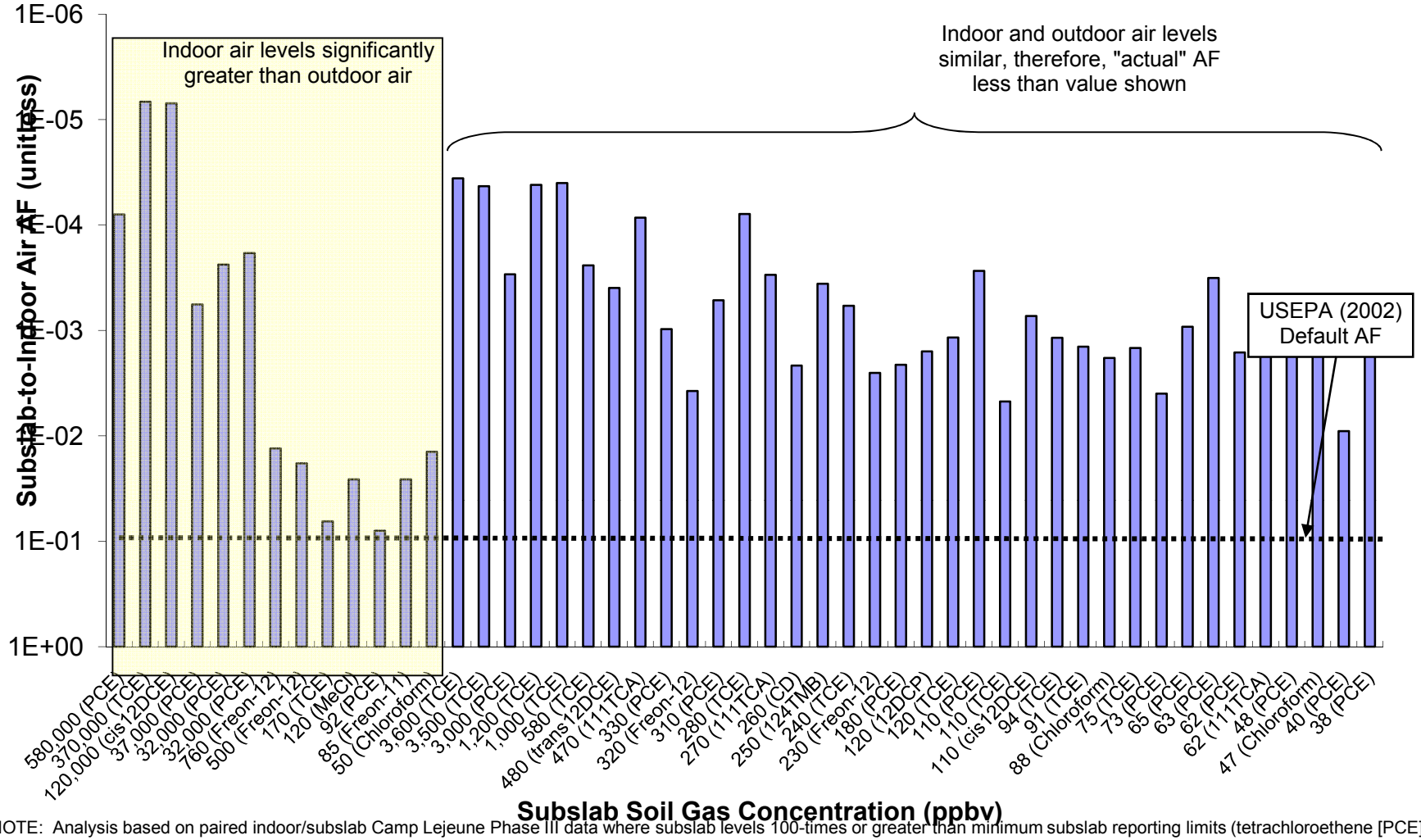
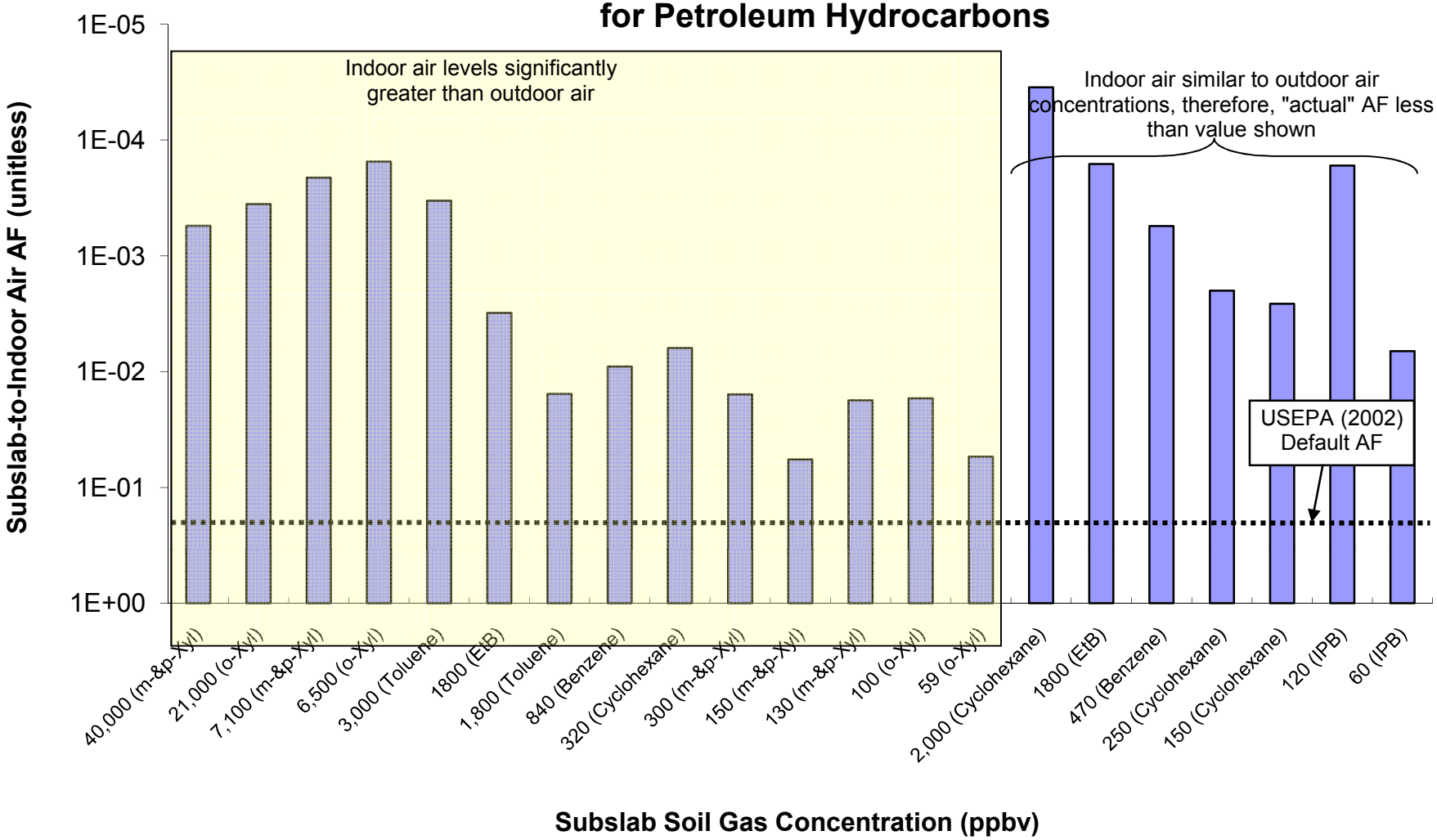

Sampling and Analysis
Risk Evaluation
Samples will be collected at each building selected for sampling. Previously collected sample data will be evaluated first to determine how many additional samples of each type are necessary. Develop DQOs to assist in selecting sample types and locations. (See sampling decision logic - Figure 4-1)
Do any of the sample results exceed applicable screening criteria for VOCs?
No
No further action required.
Yes
Collect indoor air samples in the building and ambient background samples.
Calculate base-specific attenuation factor from concurrent subslab and indoor air data.
Do any of the sample results exceed generic screening criteria for VOCs?
No
No further action required.
Yes
After a minimum of two sampling events, are subslab VOC concentrations > base-specific SGSLs?
No
No Further Building Investigation
Yes
Yes
Do any preferrential pathways (such as utilities) exist which may lead to risks at other buildings ?
Yes
Add building to building of interest list.
No
Do not add additional buildings to the buildings of
After a minimum of two sampling events, indoor air VOC concentrations result in estimated risk > 10^{-6} to 10^{-4}?
No
Monitor every 5 years until 2 concurrent rounds of sampling indicate subslab VOC concentration < base-specific SGSL.
Yes
Consider mitigation.

Figure V1-4: Empirical Subslab-to-Indoor Attenuation Factors (AFs) for Chlorinated Solvents



NOTE: Analysis based on paired indoor/subslab Camp Lejeune Phase III data where subslab levels 100-times or greater than minimum subslab reporting limits (tetrachloroethene [PCE], trichloroethene [TCE], methylene chloride [MeCl], chloroform, cis-1,2-dichloroethene [cis12DCE], trans-1,2-dichloroethene [trans12DCE], and 1,1,1-trichloroethane [111TCA]).

Figure V1-5: Empirical Subslab-to-Indoor Attenuation Factors (AFs) for Petroleum Hydrocarbons



NOTE: Analysis based on paired indoor and subslab Camp Lejeune Phase III data for VOCs where subslab concentrations 100-times or greater than minimum subslab reporting limits (benzene, ethylbenzene [EtB], toluene, m-&p- and o- Xylenes [Xyl], cyclohexane, and isopropylbenzene)

Appendix V1-A
Building Survey
Courthouse Bay – Building A-47

HMIL LOCKER CONTENTS #1		11-Jan
PRODUCT# OR NSN	**PRODUCT**	**MANUFACTURE/ DISTRIBUTOR**
06MT55	Dem-Kote Enamel Finish Flat White	Dayton Electric MFG. Co./ Seymour of Sycamore
FMSCT11S	Zero-Rust Camouflage TopCoat Cammy Brown	Amteco, INC.
FMSCT10S	Zero-Rust Camouflage TopCoat Cammy Top Green	Amteco, INC.
FMSCT15S	Zero-Rust Camouflage Cammy TopCoat SeaFoam Green	Amteco, INC.
FMSCT12S	Zero-Rust Camouflage Cammy TopCoat Black	Amteco, INC.
V2176838	High Heat Coating High Temp Black	Rust-Oleum Corporation
FMSCT13S	Zero-Rust Camouflage Cammy TopCoat Tan	Amteco, INC.
V2137838	Dark Green	Rust-Oleum Corporation
2867SP	Zero-Rust White	Amteco, INC.
V2413830	Overall Machine Gray	Rust-Oleum Corporation
1VKA9	Safety Red	Industrial Choice
1VKB2	Safety Yellow	Industrial Choice
944402	Rust-Oleum Safety Yellow	Rust-Oleum Corporation
220145	Porch and Floor Battleship Grey	Bennette Paint MFG. Co.
290151	Quick Drying Enamel American [illegible]	Bennette Paint MFG. Co.
290134	Quick Drying Enamel Palace Red	Bennette Paint MFG. Co.
[illegible]	[illegible] Gloss Coral Sand	[illegible]

HMIL LOCKER CONTENTS #2		11-Jan
PRODUCT# OR NSN	**PRODUCT**	**MANUFACTURE/ DISTRIBUTOR**
DA6310	Take Charge Battery Cleaner and Protector	Drummond American Corporation
03017	Gasket Remover	CRC Industries INC
8030009381947	Corrosion Preventative Compound	LHB Industries
10016	Tap Magic Cutting Fluid	The Steco Corporation
A-202	Noco NCP-2 Battery Corrosion Preventative Spray	The NOCO Company
3575402	Special Use Industrial Rust Reformer	Rust-Oleum Corporation
20880LQ	Sprayon General Purpose Cleaner	Krylon Products Co.
8030008387789	WD40	WD-40 Company
6850009739091	So Sure Penetrating Fluid	Lighthouse For The Blind, INC
03155	XT-2000 Precision Cleaner	CRC Industries INC
8030000625666	Corrosion Preventative Compound	Daubert Chemical Inc.

HMIL LOCKER CONTENTS #3		11-Jan
PRODUCT# OR NSN	**PRODUCT**	**MANUFACTURE/ DISTRIBUTOR**
NA55	Brush-On Liquid Electrical Tape	Blue Magic Inc.
27005	Permatex High Strength Threadlocker Red	Permatex Inc. (Loctite)
IS800.09	Silicone Rubber Adhesive Sealant	GE Silicones
3439002559935	Coppermate Soldering Flux	Bow Electronic Solders
59675	Superflex Red High Temp RTV	Loctite Corporation (Div. of Henkel Corporation)
9150010536688	CLP	Anderol INC
76732	Silver Grade Anti-Seize	Loctite Corporation (Div. of Henkel Corporation)
3439000098808	Flux, Soldering 1135	Gardiner Metal Company
80008 (1B)	Gasket Sealant	Permatex Inc. (Loctite)

HMIL LOCKER CONTENTS #4		11-Jan
PRODUCT# OR NSN	**PRODUCT**	**MANUFACTURE/ DISTRIBUTOR**
FMSCT13S	Zero Rust Cammy Top Tan	FSC Coatings INC
FMSCT12S	Zero Rust Cammy Top Black	FSC Coatings INC
FMSCT15S	Zero Rust Cammy Top Seafoam Green	FSC Coatings INC
FMSCT11S	Zero Rust Cammy Top Brown	FSC Coatings INC
FMSCT10S	Zero Rust Cammy Top Green	FSC Coatings INC
2867SP	Zero Rust Flat White	FSC Coatings INC
V2176	High Heat Coating High Heat Black	Rust-Oleum Corporation
1VKB2	Demkote Enamel Finish Safety Yellow	Dayton Electric MFG. Co. / Seymour of Sycamore
8030014189008	WD-40	WD-40 Company
6850009739091	So Sure Penetrating Fluid	Lighthouse for the Blind, INC
V2413	Machine Gray	Rust-Oleum Corporation
[illegible]	So Sure Corrosion Preventative Compound	Lighthouse for the Blind, INC

HMIL LOCKER CONTENTS #5		11-Jan
PRODUCT# OR NSN	**PRODUCT**	**MANUFACTURE/ DISTRIBUTOR**
137010092593	Flare	Orion Marine Signal Products
FMSCT12S	Zero Rust Cammy Top Black	Amteco INC
FMSCT10S	Zero Rust Cammy Top Green	Amteco INC
FMSCT13S	Zero Rust Cammy Top Tan	Amteco INC

HMIL LOCKER CONTENTS #6		11-Jan
PRODUCT# OR NSN	**PRODUCT**	**MANUFACTURE/ DISTRIBUTOR**
FMSCT11S	Zero-Rust Camouflage TopCoat Cammy Brown	Amteco, INC.
FMSCT10S	Zero-Rust Camouflage TopCoat Cammy Top Green	Amteco, INC.
FMSCT15S	Zero-Rust Camouflage Cammy TopCoat SeaFoam Green	Amteco, INC.
FMSCT12S	Zero-Rust Camouflage Cammy TopCoat Black	Amteco, INC.
FMSCT13S	Zero-Rust Camouflage Cammy TopCoat Tan	Amteco, INC.

HMIL LOCKER CONTENTS #7		11-Jan
PRODUCT# OR NSN	**PRODUCT**	**MANUFACTURE/ DISTRIBUTOR**
7930007218592	Scouring Powder	Capital Soap Products LLC
485788	Windex	SC Johnson
1MN66	Ramsey Break Away Heavy Duty Not Rinse Stripper	The Ramsey Company
7930011838585	Finish, Floor, Nonbuffing	Hillyard Industries INC
7930014692433	Starpower Super Cleaner/ Degreaser	Paradigm International INC
7930007218592	Ajax Oxygen Bleach Cleanser	Colgate-Palmore Co/ Institutional Products Division
6840005843129	Disinfectant Detergent	Pine Oil
6840007210055	Refresh Air Freshner	LHB Industries
141	Strip-All	Hillyard Industries INC
62632	Hand Cleaner	GoJo Industries INC
7930016048600	Powder, Cleaning	[illegible]
94430	Pledge Furniture Polish	SC Johnson & Son INC

HMIL LOCKER CONTENTS #8		11-Jan
PRODUCT# OR NSN	**PRODUCT**	**MANUFACTURE/ DISTRIBUTOR**
FMSCT10S	Zero Rust Cammy Top Green	FSC Coatings INC
FMSCT12S	Zero Rust Cammy Top Black	FSC Coatings INC
1VKB5	Dem-Kote White	Dayton Electric MFG Co
2867SP	Zero-Rust White	Amteco INC
8030014189008	WD-40	WD-40 Company

HMIL LOCKER COMM		14-Jan-10
PRODUCT NUM OR NSN	**PRODUCT**	**MANUFACTURE/DISTRIBUTOR**
3439-CL-000-1716	Solder Flux Paste	LA-CO Industries INC.
8030-00-734-1546	Copper Grade Anti-sezie	Loctite Corps Division of Henkel Corp.
8030-01-311-6473	Silver Grade Anti-sezie	Loctite Corps Division of Henkel Corp.
8010-01-A15-6305	Zero-rust Cammy Green	Amteco Inc.
8010-01-A15-6307	Zero-rust Cammy Black	Amteco Inc.
8030-00-838-7789	WD-40	WD-40 Company
8030-00-753-5005	Sealing Compound	Desoto International
3439-01-381-1128	Nickel Chronium Wire Solder	J. W. Harris Co. INC.
RIV-VIC-414-5	Cleaner/Degreaser	Cortec Corps.

Preliminary Building Survey for Vapor Intrusion Investigation

CH2MHILL

Date: 2/11/10

Preparer: E. Barclay + R. McCombs

Facility: A-47

Address: Courthouse Bay
MCB Camp Lejeune, NC

Contact Person: MSgt Gerald M. Thomas / Rick Wallace

Phone Number: 910-440-7616 / 440-7586

e-mail address: gerald.m.thomas@usmc.mil

Building Description

Building or Room Identifier: A-47

Primary Activity within Building (select one):

- [ ] Manufacturing
- [ ] Storage
- [X] Other — Maintenance, Amphibious Vehicle Repair + Communication Repair, Hazmat Storage
- [ ] Chemical processing
- [ ] Chemical Storage
- [ ] Administrative
- [ ] Instrumentation/Control

Notes: 2nd Floor – Classrooms, locker rooms, offices.

Approximate floor space: 100 x 400 = 40,000 ft² (footprint)

Number of floors: 1 – 2nd floor on East end

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

Ceiling height: 15' in Communication up to 35'-40' in Battalion Maint.

Aboveground Construction:

- [ ] Wood
- [ ] Concrete
- [ ] Brick
- [X] Cinderblock
- [ ] Other _____

Floor plan attached? [X] Yes [ ] No

Notes:

Evaluation of Potential Conduits from Soil

Floor/foundation description (check all that apply)

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

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

Notes: Sump is for water drainage (from exhaust)
4 - 6' (square grates are vents) - sump not working ∴ Subsurface drainage problems
Some cracks in floor, around supports

Evaluation of Potential Pathways/Driving Forces

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

NO

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

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

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

Sources of outdoor air

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

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

Notes: Large Bay doors

Evaluation of Potential Existing Chemical Sources Indoors

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

See attached Lists

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

[ ] Yes [ ] No

see lists

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

Names of pesticide products used?

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

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

Description of Vapor Mitigation Systems

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

Date of installation?

Type of system?

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

Notes:

Additional Notes

2 oil water separaters out by ramp; grate by bay door go to oil-water separator

Date: 2/11/10
Preparer: Ken McCurdy

Facility: A47
Description (floor): Concrete block & Metal

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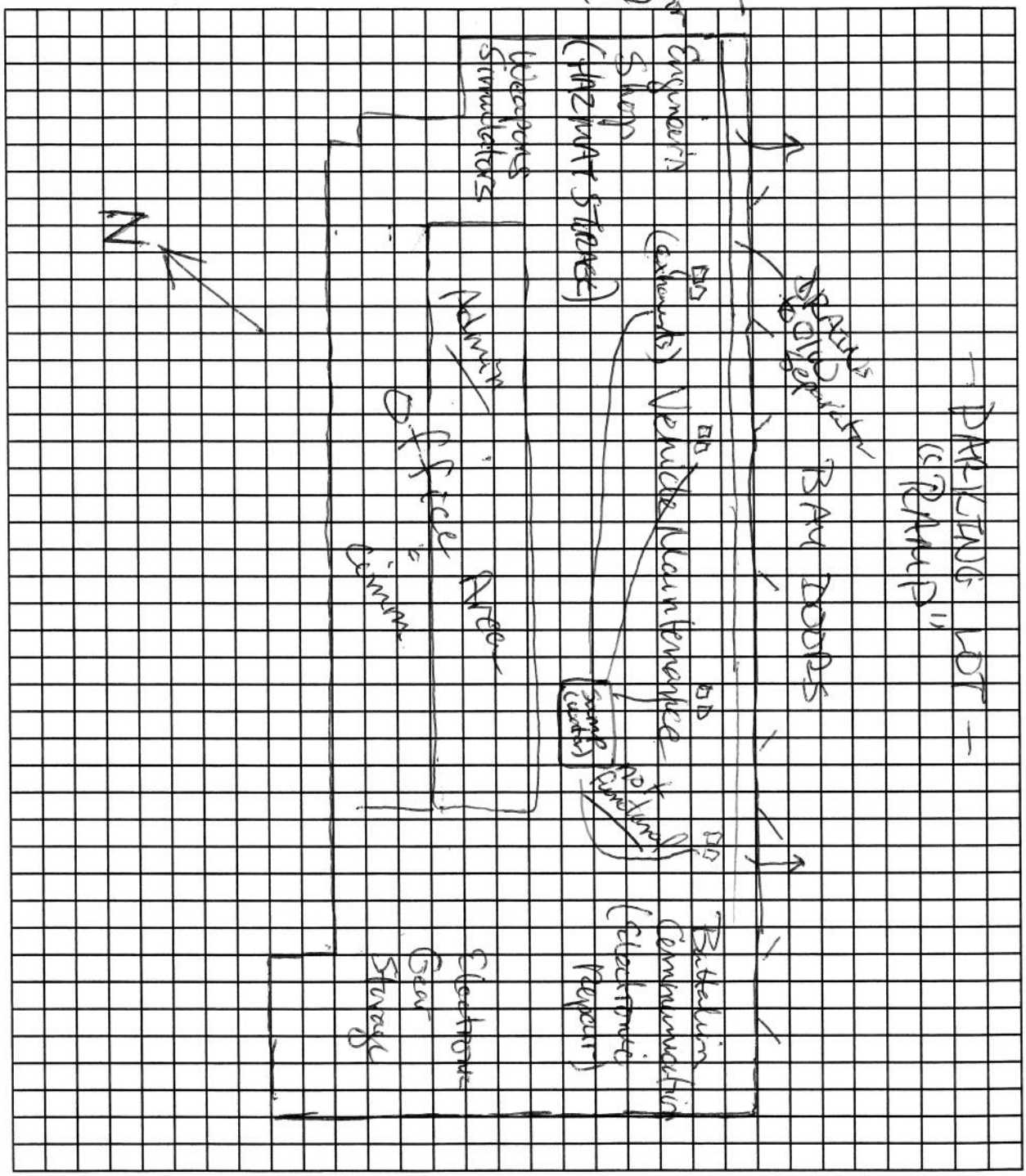
Floor Plan Information