U.S. ARMY CORPS OF ENGINEERS

FINAL

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LIST OF ABBREVIATIONS

1,2-DCA		1,2-dichloroethane
1,2-DCE		1,2-dichloroethene
1,4-DCB		1,4-dichlorobenzene
Amax	-	Amax Engineering Corporation
AOC	-	area of concern
Celsis	-	Celsis Laboratory Group
cis-1,2-DCE		cis-1,2-dichloroethene
COC	-	contaminant(s) of concern
COPC	-	contaminant(s) of potential concern
DERP-FUDS	-	Defense Environmental Restoration Program for Formerly Used Defense Sites
DOD	-	Department of Defense
EDD		Envirodata Database
EPA	-	U.S. Environmental Protection Agency
EPA Table 2C	-	EPA Generic Screening Benchmarks for Target Indoor Air Concentrations
EWMA	-	Environmental Waste Management Associates
FBC	-	Federal Business Center
former Arsenal	-	Former Raritan Arsenal
ft	-	feet
Geosyntec		Geosyntec Consultants Inc.
GW/VI FS	-	Groundwater and Vapor Intrusion Feasibility Study
GWRAWP	-	Groundwater Remedial Action Work Plan
GWQS	-	Groundwater Quality Standard(s)
IAQ	-	indoor air quality
The IAQ Approach	-	Approach for Evaluating Potential Indoor Air Quality Impacts (USACE, 2004)
LCD	-	Local Climatological Data
Mackay	-	Mackay Communications
mg/L	-	milligrams per liter
MNA	-	Monitored Natural Attenuation
MSDS	-	Material Safety Data Sheet
MTBE	-	methyl tertiary butyl ether

LIST OF ABBREVIATIONS (CONTINUED)

NAR	-	Natural Attenuation Report
NJDEP	-	New Jersey Department of Environmental Protection
NJDEP Table 1-GW		NJDEP Table 1 Generic Vapor Intrusion Screening Levels for Groundwater
NOAA	-	National Oceanic and Atmospheric Administration
PCE	-	tetrachloroethylene
QA		quality assurance
QAPP	-	Quality Assurance Project Plan
QC	-	quality control
RD/RA	-	remedial design/remedial action
RI/FS	-	Remedial Investigation/Feasibility Study
RPD	-	relative percent difference
SGSL		Site-Specific soil gas screening levels
Shaw	-	Shaw Environmental, Inc.
SOP		Standard Operating Procedure
TCE	-	trichloroethylene
the Form		Indoor Air Building Survey and Sampling Form
TO-15	-	Compendium of Methods for the Determination of Toxic Organic Compounds in Ambient Air: Method TO-15, Second Edition (EPA, January 1999)
$\mu g/m^3$	-	micrograms per cubic meter^3
USACE	-	U.S. Army Corps of Engineers
UST	-	underground storage tank
VI	-	vapor intrusion
VIG	-	Vapor Intrusion Guidance
VOC	-	volatile organic compound
VR		vapor recovery
Weston®	-	Weston Solutions, Inc.

EXECUTIVE SUMMARY

This *Indoor Air Quality (IAQ) Report #8* focuses on the results from indoor air and subslab soil gas sampling events completed at the Former Raritan Arsenal (former Arsenal) during September 2011 and January 2012 (Building 165 only), and February 2012 and April 2012 (Campus Plaza 4 only). The report also summarizes results relative to prior sampling events.

Buildings requiring investigation for vapor intrusion (VI), based on prior results from groundwater and VI sampling, were sampled for volatile organic compounds (VOC) in subslab soil gas and indoor air (Figure ES-1). The results were evaluated collectively to determine whether the VI pathway is complete for each building, to make recommendations for future action, and, where applicable, to determine if existing vapor mitigation systems are operating effectively.

Based on the analytical results of the most recent sampling events, the recommendations for each building are listed in Tables ES-1 through ES-3. It should be noted that the U.S. Army Corps of Engineers (USACE) is in the process of finalizing a site-wide *Draft Groundwater and Vapor Intrusion Feasibility Study* (GW/VI FS) Report. The recommendations in Tables ES-1 through ES-3 are consistent with the recommendations of the GW/VI FS (Weston, 2013).

AOC 2

USACE continues to track three buildings within Area of Concern (AOC) 2 for VI issues. Based on past analytical results from groundwater, subslab soil gas, and indoor air sampling two buildings (Building 165 and Campus Plaza 4) required sampling during this investigation within groundwater AOC 2 as part of an ongoing monitoring program. The third building (Building 160) is currently on a 5-year sampling frequency with annual inspections of the vapor mitigation system.

Building 160 (at 160 Fieldcrest Avenue) – Building 160 had a passive vapor mitigation system installed in June 2008 by Geosyntec Consultants Inc. (Geosyntec). Subsequent sampling has shown VOC concentrations in vapory recovery samples above the New Jersey Department of Environmental Protection (NJDEP) Vapor Intrusion Guidance (VIG) and Site-Specific soil gas screening levels (SGSL). All indoor air VOC results were non-detect. These analytical results illustrate that the vapor recovery (VR) system at Building 160 is operating as designed. It is recommended that system inspections continue on an annual basis to ensure the VR system continues to operate properly. The next analytical sampling round is scheduled for 2017.

Building 165 – Building 165 had a subslab mitigation system installed in August 2003 by the NJDEP because of historic exceedances of tetrachloroethylene (PCE) in subslab soil gas and indoor air that are potentially linked to groundwater. PCE and benzene concentrations exceeded residential and nonresidential NJDEP VIG screening levels in subslab soil gas and indoor air during the September 2011 sampling event. However, this was likely due to a malfunction of the subslab mitigation system during August 2011 which caused it to shut down for an unknown timeframe. During the January 2012 and February 2012 sampling events, the system was operating properly and there were no VOC concentrations in subslab soil gas exceeding the NJDEP VIG screening levels. Benzene, ethylbenzene, and chloroform concentrations in indoor air did exceed both the residential and nonresidential NJDEP VIG screening levels, suggesting a

tenant source. USACE recommends continued semi-annual monitoring to evaluate the operation of the system. This will assist in determining the optimal flow rate to maximize removal of the vapors from beneath the subslab.

Campus Plaza 4 – Campus Plaza 4 does not have a subslab vapor mitigation system installed since past results have not indicated evidence of indoor air impacts attributable to groundwater. Trichloroethylene (TCE) concentrations in soil gas samples, and occasionally in indoor air samples, continue to exceed both the residential and nonresidential standards for both NJDEP VIG screening levels and the Site-Specific screening levels. Other VOCs (1,2-dichloroethene [1,2-DCE] and ethylbenzene) were detected at concentrations above at least one of the NJDEP VIG screening levels for indoor air but were not detected in soil gas. Therefore, these latter concentrations can be attributed to potential tenant-related activities. The source of TCE and PCE in indoor air remains uncertain; however, USACE will continue to monitor both subslab and indoor air semi-annually over the next year (summer 2012 and winter 2013) and then re-evaluate.

AOC 6

One Building within AOC-6 (102-168 Fernwood) is being monitored. USACE installed a subslab venting mitigation system on October 2, 2009 to address VOCs in soil gas. No VOCs have ever been detected in indoor air at concentrations that would indicate a complete exposure pathway. The mitigation system was modified starting March 2011 from active (electric) to passive solar powered. Passive sampling of the mitigation system was performed, and results were submitted in March 2013 in a separate report entitled "Summary of Sub Slab Venting System Conversion to Solar Power". USACE recommends annual inspections of the passive treatment system to ensure the system is properly functioning with sampling every 5 years. The next sampling round is scheduled for 2017.

AOC 8

Five U.S. Environmental Protection Agency (EPA) buildings (Buildings 10, 18, 200, 205, and 209) were sampled within AOC 8 (Table ES-3) during September 2011 and February 2012, except for Building 18 which was vacated in the early winter of 2012. At all five buildings, there are no complete VI pathways to indoor air for any VOC. All buildings, except Building 209, have a subslab mitigation system in place.

EPA Building 10 – In September 2011 and February 2012, there were no VOC concentrations detected in the indoor air or subslab soil gas exceeding NJDEP VIG or Site-Specific screening levels. Since the installation of a subslab mitigation system, VOCs are not migrating into the indoor air. Semi-annual monitoring of the mitigation system has proven that the system is operating properly. This building will be monitored for another year (summer 2012 and winter 2013) and then re-evaluated.

EPA Building 18 – There were no VOC concentrations exceeding the NJDEP VIG or the Site-Specific screening levels during the September 2011 sampling event. The property owner, EPA, vacated the building in the early winter of 2012. The building's utilities have been terminated and the building is planned for demolition pending funding. The NJDEP and USACE agreed to discontinue monitoring as long as it remains unused and vacated.

EPA Building 200 – TCE concentrations were detected in subslab soil gas above both the residential and nonresidential NJDEP VIG and the Site-Specific screening levels. However, the indoor air samples from September 2011 and February 2012 did not indicate VOC concentrations exceeding any of the NJDEP VIG or the Site-Specific screening levels. The data illustrates that a complete VI pathway no longer exists at Building 200. It appears that the subslab mitigation system installed by the building owner is operating properly. USACE has agreed to monitor the system installed at Building 200 to ensure its effectiveness. It is recommended that the indoor air and subslab soil gas be monitored at the same semi-annual frequency. This building will be monitored for another year (summer 2012 and winter 2013) and then re-evaluated.

EPA Building 205 – TCE and chloroform were detected in the subslab soil gas during the September 2011 and February 2012 sampling events above the residential and nonresidential NJDEP VIG screening levels. TCE was detected in subslab soil gas above the residential and nonresidential Site-Specific screening levels. There were no VOC concentrations exceeding the NJDEP VIG or the Site-Specific screening levels for indoor air. It is recommended that the indoor air and subslab soil gas be monitored at the same semi-annual frequency. This building will be monitored for another year (summer 2012 and winter 2013) and then re-evaluated.

EPA Building 209 – EPA Building 209 does not have a subslab vapor mitigation system installed since past results have not indicated evidence of indoor air impacts attributable to groundwater. The analytical results indicated detections of chloroform concentrations in subslab soil gas above the residential and nonresidential NJDEP VIG screening levels during the September 2011 and February 2012 sampling event. There were no VOCs detected in indoor air above any of the NJDEP VIG screening levels. TCE was detected in indoor air samples above the residential Site-Specific criteria during the February 2012 sampling event, but results were below the strictest NJDEP VIG screening levels. As a result of TCE being above the Site-Specific criteria, the continuation of semi-annual monitoring of indoor air and subslab soil gas at Building 209 is recommended. This building will be monitored for another year (summer 2012 and winter 2013) and then re-evaluated.

TABLE ES-1
AOC 2 SAMPLING RESULTS AND PROPOSED ACTION SUMMARY

AOC 2	Results Summary	Proposed Action
Building 160	Data summarized in this report are from sampling events conducted by Geosyntec in November 2011 and show that the passive venting system is operating as designed. The vent pipe vapor concentrations have been decreasing over time (Geosyntec, 2012). See Appendix A. Subslab soil gas: • PCE was detected above both the residential NJDEP VIG and SGSL. • TCE was detected above the residential and nonresidential NJDEP VIG and SGSL. Indoor air: • No VOCs were detected during sampling events.	Continue annual inspections of the vapor mitigation system with 5-year sampling frequency. Last sampling event was conducted in November 2011 and next sampling event is scheduled for 2017.
Building 165	Data presented in this report are from the September 2011, January 2012, and February 2012 sampling events. The data show decreasing trends in VOC concentrations in the subslab soil gas and indoor air in comparison to previous sampling events. Subslab soil gas: • TCE in subslab soil gas did not exceed the strictest NJDEP VIG or Site-Specific screening levels. • Benzene in soil gas was detected above the residential NJDEP VIG screening levels during the September 2011 sampling event. • No other VOCs exceeded subslab soil gas screening levels. • Sample results from the two VR sampling ports did not have constituents exceeding the NJDEP VIG screening levels. Indoor air: • VOCs (benzene, ethylbenzene, and chloroform) were detected above the residential and nonresidential NJDEP VIG screening levels in indoor air. • PCE was detected above both the residential NJDEP VIG screening levels and the residential Site-Specific screening levels during the September 2011 sampling event. • TCE was detected above the Site-Specific screening levels during the January 2012 sampling event.	Continued monitoring for the next year (summer 2012 and winter 2013) is recommended to monitor the effectiveness of the subslab mitigation system. USACE takes ownership of the vapor mitigation system beginning in February 2013. Additionally, USACE will begin evaluations for potential modifications to the vapor mitigation system beginning in 2013.

TABLE ES-1 (CONTINUED)
AOC 2 SAMPLING RESULTS AND PROPOSED ACTION SUMMARY

AOC 2	Results Summary	Proposed Action
Campus Plaza 4	Data presented in the report are from September 2011, February 2012, and April 2012 and show a potential exposure pathway. Subslab soil gas: • TCE concentrations in soil gas were detected above both the residential and nonresidential NJDEP VIG and Site-Specific screening levels. • Chloroform concentrations in soil gas were detected above the residential and nonresidential NJDEP VIG screening levels. Indoor air: • Groundwater-related VOC TCE was detected in indoor air at concentrations above the residential and nonresidential for both the NJDEP VIG and Site-Specific screening levels. • Ethylbenzene was detected in indoor air at concentrations above the residential NJDEP VIG screening levels. • 1,2-Dichloroethane (1,2-DCA) was detected in indoor air at concentrations above both the residential and the non-residential NJDEP VIG screening levels.	Since there is a potential for a complete exposure pathway from groundwater to soil gas to indoor air, continued monitoring for this building is recommended. USACE will continue to monitor both subslab and indoor air semi-annually (summer 2012 and winter 2013) and then re-evaluate. Additionally, a separate study will be conducted in 2013 to investigate likely sources of indoor air contaminants using isotopes to distinguish between indoor air sources and subslab sources.

TABLE ES-2
AOC 6 SAMPLING RESULTS AND PROPOSED ACTION SUMMARY

AOC 6	Results Summary	Proposed Action
102-168 Fernwood Avenue	Data summarized in this report are from June 2011 thru June 2012 subsequent to a solar-powered subslab mitigation system that was installed in March 2011 by Geosyntec (Geosyntec, February 2013). See Appendix B for Geosyntec's report. Subslab soil gas: • TCE concentrations in soil gas were detected above both the residential and nonresidential NJDEP VIG and Site-Specific screening levels. • No other VOCs were detected in subslab soil gas above their respective screening levels. • Sample results from the four VR sampling ports did not have constituents exceeding the NJDEP VIG screening levels. Indoor air: • Neither TCE nor PCE concentrations were detected in indoor air exceeding the NJDEP VIG screening levels. • TCE was detected above the Site-Specific screening levels during the November 2011 indoor air sampling event. • No other VOCs were detected in indoor air samples above their respective screening levels.	Continue annual inspections of the vapor mitigation system with 5-year sampling frequency. Last sampling event was conducted in June 2012 and next sampling event is scheduled for 2017.

TABLE ES-3
AOC 8 SAMPLING RESULTS AND PROPOSED ACTION SUMMARY

AOC 8	Results Summary	Proposed Action
EPA Building 10	Subslab soil gas and indoor air analytical results are from September 2011 and February 2012 sampling events. Subslab soil gas: • No VOC concentrations exceeded either the residential or nonresidential for both the NJDEP VIG and the Site-Specific screening levels. Indoor air: • No VOC concentrations exceeded either the residential or nonresidential for both the NJDEP VIG and the Site-Specific screening levels.	Although there is not a complete exposure pathway, continued semi-annual monitoring is recommended (summer 2012 and winter 2013) to confirm proper operation of the mitigation system. After a year, the data will be evaluated to determine sampling needs, sampling frequency, and if continued operation of the system is necessary.
EPA Building 18	Subslab soil gas and indoor air analytical results are from September 2011. Subslab soil gas: • No VOC concentrations exceeded either the residential or nonresidential for both the NJDEP VIG and the Site-Specific screening levels. Indoor air: • No VOC concentrations exceeded either the residential or nonresidential for both the NJDEP VIG and the Site-Specific screening levels.	Sample results from this investigation do not indicate a complete VI pathway. Since the building is no longer in use and has been vacated, USACE and NJDEP agreed that monitoring will not continue.
EPA Building 200	Subslab soil gas and indoor air analytical results are from September 2011 and February 2012. Subslab soil gas: • TCE was detected above the residential and nonresidential screening levels for both NJDEP VIG and Site-Specific screening levels in both events. Indoor air: • No VOC concentrations in indoor air exceeded the NJDEP VIG screening levels in either sampling round indicating the subslab mitigation system is operating effectively.	USACE will continue to monitor both subslab and indoor air semi-annually over the next year (summer 2012 and winter 2013). After a year, the data will be evaluated to determine sampling needs, sampling frequency, and if continued operation of the system is necessary.

TABLE ES-3 (CONTINUED)
AOC 8 SAMPLING RESULTS AND PROPOSED ACTION SUMMARY

AOC 8	Results Summary	Proposed Action
EPA Building 205	Subslab soil gas and indoor air analytical results for September 2011 and February 2012. Subslab soil gas: • PCE concentrations were not detected in subslab soil gas exceeding either the residential or nonresidential for both the NJDEP VIG and the Site-Specific screening levels for both sampling events. • TCE concentrations were detected in subslab soil gas exceeding both the residential and nonresidential NJDEP VIG and the Site-Specific screening levels. • Chloroform concentrations were detected in subslab soil gas exceeding the residential and nonresidential NJDEP VIG screening levels. Indoor air: • There were no groundwater-related VOC concentrations exceeding NJDEP VIG screening levels.	Continued semi-annual subslab and indoor air sampling of this building is recommended for the next year (summer 2012 and winter 2013). After a year, the data will be evaluated to determine sampling needs, sampling frequency, and if continued operation of the system is necessary.
EPA Building 209	Subslab soil gas and indoor air analytical results for September 2011 and February 2012. Subslab soil gas: • Chloroform concentrations were detected above the residential and nonresidential NJDEP VIG screening levels in both sampling rounds. Indoor air: • TCE concentrations were detected above the residential Site-Specific screening levels, but below both of the NJDEP VIG screening levels and the nonresidential Site-Specific screening levels. • Benzene, ethylbenzene, and methylene chloride concentrations in indoor air exceeded the residential and nonresidential NJDEP VIG screening levels. These compounds were not detected in soil gas above screening levels and are not attributable to groundwater contamination or VI.	Although there is not a complete exposure pathway, continued semi-annual monitoring of this building is recommended for the next year (summer 2012 and winter 2013). After a year, the data will be evaluated to determine sampling needs, sampling frequency, and if continued operation of the system is necessary.

SECTION 1.0
INTRODUCTION

1.1 OBJECTIVE

U.S. Army Corps of Engineers (USACE) retained Weston Solutions, Inc. (Weston®) to evaluate the potential for vapor intrusion (VI) into buildings from contaminated groundwater at the Former Raritan Arsenal (former Arsenal) site in Edison, NJ. The objective of this report is:

- To summarize and evaluate indoor air, subslab soil gas, and historical groundwater sampling results at each of the buildings recommended in the *Final Indoor Air Quality (IAQ) Semi-Annual Report #7* (Weston, November 2012);
- To assess whether a complete exposure pathway exists; and
- To provide recommendations on the need for further action.

This report presents the analytical results for buildings sampled during September 2011 through April 2012 within Groundwater Areas of Concern (AOC) 2, 6, and 8. These Groundwater AOCs have exhibited current/historical exceedances of the New Jersey Department of Environmental Protection (NJDEP) Vapor Intrusion Guidance (VIG) Document groundwater screening levels (NJDEP, March 2007 and January 2012). As recommended in previous reports (Weston, September 2006; Weston, July 2008; Weston, November 2012), the buildings associated with Groundwater AOC 4 and 10 did not require any further investigation or action; therefore, they are not included in this report.

1.2 BACKGROUND

USACE is conducting Remedial Investigation/Feasibility Study (RI/FS) and Remedial Design/Remedial Action (RD/RA) activities at the former Arsenal under the Defense Environmental Restoration Program for Formerly Used Defense Sites (DERP-FUDS). NJDEP provides regulatory oversight for the project. Through these activities, USACE and NJDEP identified Groundwater AOCs for volatile organic compounds (VOC) at the former Arsenal that required evaluation for indoor air quality as presented in the *Final Groundwater Natural Attenuation Report (NAR)* dated May 2003 (Weston, 2003) and more recently in the *IAQ Evaluation (Steps One through Four)* (Weston, 2005) and the *Final Supplemental Groundwater Data Report* (Weston, September 2006).

In a March 2003 comment letter concerning the *Draft Final Groundwater NAR* (Weston 2002), NJDEP approved natural attenuation as a means of addressing remaining groundwater contamination at the former Arsenal, provided no VI pathway existed in buildings located above the plumes. NJDEP requested USACE to evaluate potential vapor risks at 151 Fieldcrest Avenue (Building 151), 165 Fieldcrest Avenue (Building 165), and other buildings near monitoring well MW-114. Well MW-114 is considered to be a "source well" of chlorinated solvents located within Groundwater AOC 2 and historically has exhibited the highest detected concentrations of VOCs in groundwater at the former Arsenal. Total VOCs in groundwater have been reported up to 13 milligrams per liter (mg/L) in this well (December 2000).

In May 2003, prior to the initiation of USACE's indoor air program, the property owner at Building 165 conducted indoor air sampling that indicated the presence of tetrachloroethylene

(PCE). Follow-up indoor air and subslab soil gas samples collected by USACE in June showed no PCE in indoor air, but did show PCE in the accompanying subslab soil gas samples. PCE was also found in one of four subslab soil samples collected from beneath Building 165. A subslab depressurization system was subsequently installed jointly by USACE and NJDEP; this system remains in operation at the present time (May 2013).

As a result of the findings at Building 165, awareness of the potential for intrusion of VOCs from soil and/or groundwater into indoor air at the former Arsenal was heightened. The NJDEP requested that USACE evaluate the VI pathway for all other Groundwater AOCs at the former Arsenal.

In October 2004, NJDEP agreed that assessment of the indoor air exposure pathway at the former Arsenal should be performed in accordance with the *Approach for Evaluating Potential IAQ Impacts* (USACE, 2004), referred to hereafter as "The IAQ Approach". In accordance with The IAQ Approach, USACE has been evaluating buildings located within 100 feet (ft) of groundwater AOCs, currently as defined by exceedances of the (current) groundwater screening levels identified in the NJDEP's *Draft VIG Document* (NJDEP, January 2012).

The Groundwater AOCs originally identified by USACE and NJDEP to be evaluated for IAQ were narrowed from seven to three since the primary contaminants of concern (COC) in groundwater are VOCs, mainly trichloroethylene (TCE) and PCE. Groundwater AOC 2, Groundwater AOC 8, and Groundwater AOC 10 became the focus and were evaluated due to their higher historical concentrations of VOCs in groundwater. In addition, Groundwater AOC 2 and Groundwater AOC 8 include buildings with sensitive receptors (e.g., daycare centers).

Subsequent to the evaluation of Groundwater AOCs 2, 8, and 10, Groundwater AOCs 4 and 6 were evaluated for the potential of VI into indoor air in accordance with work plans developed in accordance with the NJDEP's VIG.

Previous Reporting

Each semi-annual report discusses the buildings within the Groundwater AOCs which were evaluated and monitored along with the recommendations from USACE. The following is a list of the IAQ reports:

- *IAQ Semi-Annual Report* (Weston, November 2005);
- *IAQ Semi-Annual Report #2,* (Weston, September 2006);
- *IAQ Semi-Annual Report #3,* (Weston, July 2008);
- *IAQ Semi-Annual Report #4,* (Shaw [Shaw Environmental, Inc.], April 2009);
- *IAQ Semi-Annual Report #5,* (Shaw, July 2010);
- *IAQ Semi-Annual Report #6,* (Shaw, August 2010); and
- *IAQ Semi-Annual Report #7* (Weston, November 2012).

The recommendations from the prior reports have helped to focus the monitoring program. The following are the recommendations made for the specific Groundwater AOCs:

- Groundwater AOC 10 – Report #2 (Weston, September 2006) recommended no further action was necessary at buildings within Groundwater AOC 10, and NJDEP approved this recommendation.

- Groundwater AOC 4 – Report #3 (Weston, July 2008) recommended no further action at buildings within Groundwater AOC 4, and NJDEP approved this recommendation.

- Groundwater AOC 6 – Report #4 (Shaw, April 2009) recommended no further action for all buildings within Groundwater AOC6 except for 102-168 Fernwood. Installation of a vapor mitigation system was recommended.

The *IAQ Semi-Annual Report #7* (Weston, November 2012) discussed the buildings which are still being evaluated and monitored within Groundwater AOC 2, AOC 6, and AOC 8 from September 2010 through April 2011. The following are the recommendations of that report by Groundwater AOC:

- Groundwater AOC 2
  - 160 Fieldcrest Avenue – Continue annual inspection of the vapor mitigation system with a 5 year sampling frequency for indoor air and subslab soil gas. Next sampling round scheduled for 2017.
  - 165 Fieldcrest Avenue – Continue semi-annual sampling to monitor and confirm the vapor mitigation system is operating effectively.
  - Campus Plaza 4 – Continue semi-annual sampling to evaluate VI pathway.

- Groundwater AOC 6
  - 102-168 Fernwood Avenue – Perform passive sampling of the mitigation system only and submit results in a separate Interim Progress Report and Performance Monitoring Report for the subslab venting system.

- Groundwater AOC 8
  - Building 10 – Continue semi-annual sampling with an emphasis on ensuring the subslab system is operating properly.
  - Building 18 – Continue semi-annual sampling with an emphasis on ensuring the subslab system is operating properly.
  - Building 200 – Continue semi-annual sampling with an emphasis on ensuring the subslab system is operating properly.
  - Building 205 – Continue semi-annual sampling with an emphasis on ensuring the subslab system is operating properly.
  - Building 209 – Continue semi-annual sampling.

This report (IAQ Report #8) presents the findings of subsequent investigations conducted during the period of September 2011 through April 2012. Table 1-1 summarizes the buildings and tenants included in the investigation described in this report.

1.3 VAPOR MIGRATION PATHWAY

This report evaluates the potential migration pathway of VOCs from groundwater and soils to indoor air following the March 2013 NJDEP VI Technical Guidelines and the revised November 2010 U.S. Department of Defense (DOD) VI Handbook. Due to their high vapor pressures, VOCs dissolved in groundwater readily volatilize from the groundwater and move by diffusion and advection (which is actually the more dominant mechanism) through the capillary and unsaturated zones of the soil, eventually discharging to the atmosphere at the ground surface. Lateral and vertical migration of soil gas occurs in response to variations in pressure and can be quite complex. For example, high-pressure weather systems tend to keep soil gas in the subsurface, while low pressure weather systems allow the soil gas to move readily into the atmosphere. Variations in soil texture and permeability greatly affect the movement of soil gas, as do the presence of underground utilities and other structures that may act as conduits.

In areas where the ground surface is covered by a building or paved surface, VOCs in soil gas can become trapped beneath these structures resulting in a mounding effect. These vapors are capable of entering structures through minute cracks in foundations, pipe, or utility penetrations through the concrete floor slabs or walls, and through foundation drains.

Soil gas entry into structures is usually the result of pressure differentials which are mainly caused by indoor-outdoor thermal differences, wind loading on structures, and unbalanced ventilation systems that can result in the depressurization of a building (Hodgson, *et al.* 1992). Most buildings maintain an indoor air pressure that is often lower than outdoor air. Under this negative pressure, subsurface soil gas may be drawn to cracks in the basement or slab floor and into the building. A building in this situation has an "area of influence" which may draw subsurface soil gas toward the building slab from surrounding areas.

Many factors influence the rate of soil gas entry into a building at any given time. Increased soil moisture, which often occurs in the spring after the ground thaws and snow melts, can drive soil gas from surrounding areas into the relatively dry soils beneath structures, increasing the potential for vapor infiltration. Heavy rainfall can also result in a lens/layer of clean water at the water table reducing the source soil gas concentrations. Frozen ground can also limit the vertical migration of subsurface gases and increase mounding effects and lateral migration.

Under heating conditions, building basements or the first floor above the concrete slab can be under less pressure relative to the surrounding soil (Hodgson, *et al.* 1992). This is sometimes referred to as the "stack or chimney effect," and can greatly increase the rate of soil gas infiltration. For the above reasons, winter and spring conditions tend to promote the infiltration of soil gas into structures and generally represent "worst-case" conditions. As indicated in Section 6.1.3.3 of the NJDEP VIG, indoor air samples collected from November through March are required prior to making remedial decisions as this timeframe is considered as being most representative of the presumed "worst case" conditions.

1.4 USACE INDOOR AIR EVALUATION PROCESS

The IAQ Approach for the former Arsenal establishes the priorities for further investigation of potential IAQ impacts (Figure 1-1). The IAQ Approach, which has been approved by the NJDEP, is a step-wise approach to evaluate the potential for IAQ impacts from contaminated

groundwater and residual soil sources at the former Arsenal. Steps One through Four of the IAQ Approach are:

- Step One: Complete preliminary inventory of buildings potentially affected by Groundwater AOC plumes.
- Step Two: Develop a conceptual model for each Groundwater AOC plume.
- Step Three: Determine contaminants of potential concern (COPC) for further evaluation by comparing historical groundwater data to Table 2C-GW screening benchmarks.
- Step Four: Prioritize Groundwater AOC plumes to be evaluated for potential VI based on sensitive receptors and historical groundwater data. Expedite an evaluation process where groundwater concentrations are 50 times greater than Table 2C-GW screening benchmarks. It should be noted that going forward, the decision process set forth in the NJDEP VIG will be used to determine the need for expedited review of the potential for VI at the former Arsenal, if specific Groundwater AOCs and the buildings associated with those AOCs have not yet been evaluated.

The information gathered under Steps One through Four provide a basis for Steps Five through Twelve of the IAQ Approach.

- Step Five: Using existing groundwater quality data assess whether there is potential for a complete VI pathway from groundwater to indoor air and evaluate the potential IAQ impacts. If groundwater data indicate the potential for VI concerns (i.e., exceed screening criteria), then go to Step Six.
- Step Six: Conduct subslab soil gas sampling.
- Step Seven: Compare soil gas concentrations to the subslab soil gas screening benchmarks. Predict concentrations of VOCs in indoor air based on subslab soil gas data. If soil gas data indicate potential exceedance of residential indoor air screening benchmarks, then go to Step Eight. While The IAQ Approach originally required comparison of site-specific data to the EPA Generic Screening Benchmarks for Target Indoor Air Concentrations (EPA Table 2C) criteria, this approach was developed prior to publication of the NJDEP VIG. Moving forward, site-specific data have been, and will continue to be, compared to the most recent screening levels set forth in the NJDEP VIG.
- Step Eight: Evaluate indoor air impacts by conducting sampling to determine if indoor VOC concentrations exceed ambient air sample results and/or residential indoor air limits. Identify other buildings for soil gas sampling.
- Step Nine: Perform confirmatory sampling of subslab soil gas and indoor air at the building (to assess temporal variability and verify the initial findings).
- Step Ten: If the confirmatory sampling verifies the initial results, evaluate remedial alternatives for the building.
- Step Eleven: Implement remedy for the building and collect post-remedial indoor air and subslab soil gas samples to document system effectiveness.
- Step Twelve: Prepare report documenting process and results for the NJDEP.

SECTION 2.0
METHODOLOGY

2.1 SAMPLING DESIGN

From September 2011 through April 2012, USACE collected samples of subslab soil gas, ambient air, vapor recovery (VR), and indoor air at selected buildings within Groundwater AOCs 2, 6, and 8 for VOC analysis. Specific sample locations, parameters, methods, and dates sampled are presented in Tables 2-1 and 2-2 (Groundwater AOC 2), Tables 2-3 and 2-4 (Groundwater AOC 6), and Tables 2-5 and 2-6 (Groundwater AOC 8). This approach is based on the NJDEP-approved *Approach for Evaluating Potential IAQ Impacts* (Weston, September 2004).

Under The IAQ Approach for the former Arsenal, the decision to sample indoor air is based upon whether concentrations of VOCs in subslab soil gas exceed VIG screening levels. The decision to sample subslab soil gas is determined by the presence of VOCs in groundwater at concentrations exceeding groundwater screening levels (previously evaluated against EPA Table 2C values, but currently evaluated against the Table 1 groundwater screening levels identified in the NJDEP VIG).

However, in several cases individual landowners have opted to sample indoor air directly before subslab soil gas or groundwater was fully evaluated by USACE. In those cases, USACE proceeded to sample both subslab soil gas and indoor air for analysis of VOCs at those buildings. The objectives were to confirm the landowner's initial findings and to monitor the situation at each building where landowner testing indicated a potential VI concern.

USACE evaluated the remaining buildings by determining what buildings fall within 100 ft of each groundwater plume, comparing most recent groundwater concentrations in each plume to the NJDEP Table 1 Generic VI Screening Levels for Groundwater (NJDEP Table 1-GW), and analyzing subslab soil gas below each building potentially affected by DOD-related COPCs in groundwater and soil. Methods for each element of this IAQ approach are described in the following subsections.

2.2 SAMPLING METHODS

2.2.1 Groundwater Evaluation

The evaluation of groundwater for potential VI threat for any buildings within 100 ft of a VOC groundwater plume has already been completed in the Supplemental Groundwater Data Report (Weston, September 2006). The following section provides a summary of the methodology used.

The process of identifying COPCs in groundwater has been described in the IAQ Evaluation (Steps One through Four) (Weston 2005), and originally consisted of comparing the maximum concentration of VOCs in wells within a groundwater plume to the EPA Table 2C criteria for VOCs to determine if they are exceeded at any location. This approach is conservative from the perspective that in some cases the only groundwater data available may be from wells located several hundred feet away from a given building. Generally, VOC concentrations in

groundwater have been attenuating over time, and so in many cases, the maximum concentrations do not reflect current conditions.

Once it was determined that a groundwater plume contained VOCs at concentrations presenting a potential VI pathway threat, subslab soil gas was sampled from below buildings potentially affected by the contamination. The process of evaluating which specific buildings required subslab soil gas sampling was determined on a building-by-building basis in accordance with The IAQ Approach (USACE 2004).

Specific methods for groundwater sampling, upon which the groundwater data were based, have been described in prior reports such as the following:

- *Final Site-Wide Hydrogeology Report for the Former Raritan Arsenal Phase 2 Remedial Investigation* (Weston 1996);
- *Final Groundwater NAR for the Former Raritan Arsenal* (Weston 2002);
- *Final Supplemental Groundwater Data Report* (Weston 2006); and
- *Draft Groundwater Compliance Monitoring Progress Report for the Former Raritan Arsenal* (Weston 2013).

2.2.2 Subslab Soil Gas Sampling Method

If a given building required subslab soil gas sampling, a work plan was prepared with proposed sampling locations and was submitted to the NJDEP for approval. Locations were chosen in concurrence with the landowner to avoid interrupting their operations or biasing the sample. Where practical, sample locations were biased to anticipated conservative locations. Given that mounding effects would be more pronounced toward the center of a building, sample locations are generally oriented toward the center of the building and/or plume.

Permanent subslab sampling ports were installed by Weston several sampling events prior to the events presented in this report. The subslab soil gas sampling point installation procedure followed the *Vapor Intrusion Guidance Document* (NJDEP 2012). The first step was to drill a 3/8-inch hole approximately 1 to 2 inches below the concrete slab. Then, the top 1 inch of the hole was over-drilled to a 1-inch diameter. Next, a brass vapor probe was inserted to a point flush with the top of the concrete slab (initial subslab sample points were installed prior to the 2005 NJDEP VIG and brass ports were selected in accordance with the Draft NJDEP VIG). Subsequent sample ports were installed to be consistent with those installed during earlier phases of the investigation. Quick expansive Portland cement was used to seal the annular space between the probe and the slab and allowed to cure for 30 minutes to secure the vapor probe in place.

Sampling of secured ports involved a "T" setup made of Teflon tubing. A shut-off valve and three-way "T" were attached to the vacuum pump at one end and the SUMMA canister at the other. A middle line was connected to the sample port. While the valve allowing soil gas to flow from the sample port to the SUMMA canister remained closed, the portable vacuum pump purged the vapor probe. After two minutes, the pump was shut off, and the shut-off valve and the SUMMA canister valve were opened allowing the sample to be collected. Subslab soil gas samples were collected over a 1-hour (approximate) period. Once the sample was collected, the SUMMA canister valve was closed and the sample port was capped.

Prior to sampling at each subslab sampling port, a leak test was performed to determine the integrity of the seal of the subslab sampling port. A leak test setup included attaching Teflon tubing to the subslab sampling port and placing a 5-gallon bucket with two holes on the bottom over the subslab sampling port. The Teflon tube was pulled out of one of the holes in the bucket and helium was then pumped into the tubing for a period of 5-10 seconds. Helium pumping stopped and helium results were recorded using a helium detector from the tube and from the second hole in the 5-gallon bucket to determine if there was a leak in the subslab sampling port. Results of the subslab leak test results are presented in Appendix C.

AOC 2

A round of subslab soil gas samples were collected at the buildings (Building 160, Building 165, and Campus Plaza 4) being evaluated for VI in September 2011 and February 2012. Table 2-7 below summarizes the number of subslab soil gas samples collected during each sampling event at each building.

Table 2-7: AOC 2 Subslab Soil Gas Sample Summary

Building	Number of Subslab Soil Gas Samples*	Sampling Date	Sampling Round
Building 160	Not Sampled	-	-
Building 165	6	22 September 2011	Nineteenth Round
	6	24 February 2012	Twentieth Round
Campus Plaza 4	7	22 September 2011	Fifteenth Round
	6	24 February 2012	Sixteenth Round

*Including duplicate samples.

AOC 6

A round of subslab soil gas samples were collected at 102-168 Fernwood by Geosyntec in November 2011 and June 2012. Table 2-8 below summarizes the number of subslab soil gas samples collected during each sampling event at the building.

Table 2-8: AOC 6 Subslab Soil Gas Sample Summary

Building	Number of Subslab Soil Gas Samples	Sampling Date	Sampling Round
102-168 Fernwood	1	3 November 2011	NA*
	1	6 June 2012	NA*

*Geosyntec collected samples.

AOC 8

In September 2011, USACE collected subslab soil gas samples at five buildings (Buildings 10, 18, 200, 205, and 209) on EPA Property within 100 ft of Groundwater AOCs 8A and 8B. In the winter of 2012, Building 18 was permanently vacated and the utilities were shut down. The EPA has slated Building 18 for demolition pending appropriate funding. The NJDEP agreed to USACE's recommendation of not sampling Building 18 during the February 2012 sampling

event. Table 2-9 below summarizes the number of subslab soil gas samples collected during each sampling event at each building.

Table 2-9: AOC 8 Subslab Soil Gas Sample Summary

Building	Number of Subslab Soil Gas Samples*	Sampling Date	Sampling Round
Building 10	3	20 September 2011	Fifteenth
	3	22 February 2012	Sixteenth
Building 18	3	20 September 2011	Fourteenth
	Not sampled	-	-
Building 200	2	22 September 2011	Nineteenth
	2	22 February 2012	Twentieth
Building 205	7	20 September 2011	Sixteenth
	7	22 February 2012	Seventeenth
Building 209	8	20 September 2011	Thirteenth
	8	24 February 2012	Fourteenth

* Including duplicate samples.

2.2.3 Building Survey Method

Prior to indoor air sampling it was necessary to evaluate each building proposed for sampling to determine if there were facility conditions that could affect sampling results. Weston conducted an inspection of each building being investigated for potential indoor air VI to determine potential sampling locations, as well as chemical use within each building. Weston completed the *Indoor Air Building Survey and Sampling Form* (the Form) for each building tenant space with a tenant representative and/or the landlord during the site walkthrough. These building surveys are present in Appendix D. The Form was completed for each building space being evaluated in order to identify and evaluate site conditions that could impact the sample results, including any possible indoor air emission sources that could generate target VOCs. Possible emission sources include cleaning products, new carpet, recent painting, new furniture, indoor smoking areas, insecticides, and gasoline storage and/or gasoline-powered equipment.

The Form includes a list of the products identified during the inspection for indoor contaminants. If available, material safety data sheets (MSDS) were provided by some tenants for the chemicals observed. Weston identified potential sample locations for indoor air and subslab soil gas sampling during the site inspection. The sample locations and sample collection information are also identified on the Form. Prior to subsequent sampling events, Weston re-evaluated conditions for new products and chemicals being used or stored by building tenants that could potentially impact the IAQ results, and updated the Form with the date and observations.

2.2.4 Indoor Air Sampling Method

If appropriate, indoor air sampling was conducted with locations selected in advance and approved by NJDEP. Indoor air samples were collected over a 24-hour (approximate) period using evacuated stainless-steel SUMMA canisters equipped with appropriate pre-programmed flow-control valves (regulators). The indoor samples were collected from the breathing zone height (3 ft to 5 ft). All windows and overhead doors were closed to the extent possible.

Appliances that induce large pressure differences (e.g., exhaust fans) were not used 12 hours before measurements began and during sample collection. Ventilation systems were operated as normal. Vacuum readings on the SUMMA canisters were recorded before and after the start of each sample collection and after the completion of each sample collection to ensure that all regulators were working properly.

At buildings in which both subslab soil gas and indoor air samples were collected concurrently, the indoor air samples were collected immediately prior to collection of the subslab soil gas samples. This was done to reduce the potential for contaminants that may be present in the subslab soil gas, from impacting the indoor air samples which have analytical detection limits an order of magnitude less than those obtainable for subslab soil gas samples.

AOC 2

In September 2011, February 2012, and April 2012, USACE collected indoor air samples at Building 160, Buildings 165, and Campus Plaza 4. In November 2011 Geosyntec collected indoor air samples at Building 160 on behalf of the USACE. Table 2-10 below summarizes the number of indoor air samples collected during this period at each building.

Table 2-10: AOC 2 Indoor Air Sample Summary

Building	Number of Indoor Air Samples*	Sampling Date	Sampling Round
Building 160	9	2-22 November 2011	NA**
Building 165	8	21 - 22 September 2011	Nineteenth Round
	2	12 - 13 January 2012	Nineteenth Round
	9	23 - 24 February 2012	Twentieth Round
Campus Plaza 4	6	21 - 22 September 2011	Fifteenth Round
	6	23 – 24 February 2012	Sixteenth Round
	1	2 – 3 April 2012	Sixteenth Round

*Including duplicate samples.
** Geosyntec sampling event

AOC 6

In November 2011 and June 2012, Geosyntec collected indoor air samples at 102-168 Fernwood on behalf of the USACE for the purpose of checking the efficiency of the newly installed system. Table 2-11 below summarizes the number of indoor air samples collected during this period at each building.

Table 2-11: AOC 6 Indoor Air Sample Summary

Building	Number of Indoor Air Samples*	Sampling Date	Sampling Round
102-168 Fernwood	2	2-3 November 2011	NA**
	2	5-6 June 2012	NA**

*Including duplicate samples.
** Geosyntec sampling event

AOC 8

In September 2011 and February 2012, USACE collected indoor air samples at five EPA buildings (Buildings 10, 18, 200, 205, and 209) within 100 ft of Groundwater AOCs 8A/8B. Building 18 was not sampled during the February 2012 sampling event as explained in section 2.7. Table 2-12 below summarizes the number of indoor air samples collected during each sampling event at each building.

Table 2-12: AOC 8 Indoor Air Sample Summary

Building	Number of Indoor Air Samples*	Sampling Date	Sampling Round
Building 10	3	19-20 September 2011	Fifteenth Round
	3	21-22 February 2012	Sixteenth Round
Building 18	4	19-20 September 2011	Fourteenth Round
	Not Sampled	--	--
Building 200	3	19-20 September 2011	Eighteenth Round
	3	21-22 February 2012	Nineteenth Round
Building 205	7	19-20 September 2011	Fifteenth Round
	7	21-22 February 2012	Sixteenth Round
Building 209	8	19-20 September 2011	Thirteenth Round
	8	21-22 February 2012	Fourteenth Round

* Including duplicate samples.

2.2.5 Vapor Recovery Air Sampling Method

In order to ensure the system at Building 165 is working accordingly, two VR samples were collected during the September 2011 and February 2012 sampling events. The VR samples were collected over a 24-hour (approximate) period using evacuated stainless-steel, 6-liter SUMMA canisters equipped with appropriate pre-programmed flow-control valves (regulators). The SUMMA canister was connected to a port located on the out-going pipe of the system using polyethylene tubing and a brass connector. Once the tubing was secure, vacuum readings on the SUMMA canister were recorded at the start of each sample collection. After the 24-hour sample interval, the SUMMA canister was turned off and the completion time and vacuum reading were recorded to ensure that all regulators were working properly. The VR samples were collected simultaneously with the indoor air and ambient air samples.

Additionally Geosyntec collected VR samples at 4 locations within 102-168 Fernwood. These samples were collected in June 2011, November 2011, and June 2012 in order to monitor the performance of the mitigation system. A description of the sample methodology is located in the February 2013 Summary of Sub-Slab Venting System Conversion to Solar Power, 102-168 Fernwood Avenue report by Geosyntec (Appendix B)

2.2.6 Background Air Sampling Method

Background ambient (outdoor) air samples were collected for comparison with indoor air sampling results at each building in order to interpret whether the results from each building were potentially related to ambient sources outside of the building. Background air samples were collected over a 24-hour (approximate) period using evacuated stainless-steel SUMMA

canisters equipped with appropriate pre-programmed flow-control valves (regulators). One background sample was collected while indoor air samples were being collected at each building. The background air sample for each building was collected at ground level. The ground-level background air samples were collected in a location away from pedestrian and vehicle traffic. The results of the background samples were compared to NJDEP residential and nonresidential VIG so that results from indoor air sampling could be viewed in an appropriate context reflective of the localized air quality.

2.2.7 Variations from Previous Monitoring Investigations

During the September 2011 and the February 2012 sampling events, there were five variations from previous semi-annual monitoring events (Weston, November 2012). These are described below.

1. During the building surveys, prior to the September 2011 sampling event, it was noted that construction activities were occurring in 280 Campus Drive (Campus Plaza 4) in the vicinity of indoor air sample location CP4-4. Nonetheless, a sample was collected at CP4-4. The tables and figures have been noted as having a sample that was collected during construction activities.
2. After the September 2011 sampling event, it was determined that the ventilation system in Building 165 had not been operating properly prior to sampling. At the request of the NJDEP, samples within the daycare center (165-6 and 165-7) were recollected on January 13, 2012, along with a background sample.
3. Prior to the February 2012 sampling event and during the building surveys, EPA noted their intention of demolishing Building 18. At the time of the building survey, no employees were working in Building 18 and there was no electricity in the building. USACE notified the NJDEP of these findings and received the NJDEP's permission to not include Building 18 during the February 2012 sampling event.
4. During the February 2012 sampling event at Campus Plaza 4, construction activities were still ongoing while indoor air sampling was in progress. The only sample collected within the area affected by the construction was CP4-1. The CP4-1 sample was collected and run for analysis.
5. During the February 2012 sampling event at Campus Plaza 4, there was a malfunction of the SUMMA canister at location CP4-2. After 24 hours running, the regulator was still registering high amounts of pressure in the canister. Field teams thought that it could possibly be related to the regulator not working properly and sent the sample to the subcontracted laboratory for analysis. Upon inspection by the laboratory, the SUMMA canister had not collected enough volume to run the sample. As a result, on April 3, 2012, Weston recollected CP4-2 as well as collected an additional background sample.

2.2.8 Meteorological Data

Meteorological data were provided by National Oceanic and Atmospheric Administration's (NOAA) National Climatic Data Center located at Newark Liberty International Airport in Newark, New Jersey. Data were collected by the National Weather Service. This location was considered to be a representative and reliable collection point for the entire former Arsenal project area. The meteorological data were included in the indoor air survey forms, in data tables

included in the introductory sections for each AOC, and daily summaries for each sampling event area located in Appendix E.

2.2.9 Quality Assurance/Control

Field quality control (QC) samples consisting of field blanks and field duplicates are not required according to the guidelines outlined in the NJDEP VIG. During the September 2011 and February 2012 sampling events, duplicate samples were collected at the request of USACE for both subslab soil gas and IAQ samples. The purpose of the duplicate samples was to ensure accuracy in the sampling and analytical procedures. In the September 2011 sampling event, a total of nine duplicate indoor air and 10 duplicate subslab soil gas samples were collected. During the February and April 2012 sampling event, nine indoor air and nine subslab soil gas samples were collected. IAQ duplicate samples were collected by co-locating two SUMMA canisters side by side and turning them on and off at the same time. Subslab soil gas duplicate samples were collected by connecting a "T" valve to the subslab sampling set up allowing for two samples to be collected from one sample port at the same time.

2.2.10 Sample Handling and Shipping

Certified clean, 6-liter SUMMA canisters and regulators were obtained from a New Jersey-certified analytical laboratory as outlined in the *Indoor Air VOC Sampling Analysis Requirements* (NJDEP, April 2003) and the *NJDEP VIG* (NJDEP, 2005). After sampling, all SUMMA canisters were packaged in a box and transported by van to the selected New Jersey-certified laboratory. The certified laboratory used for samples presented in this report was Accutest Laboratories in Dayton, New Jersey.

2.2.11 Data Validation Procedures

Analytical data review included a review of the data package materials to check whether the data entry, transcription, and calculation/reduction were properly performed. The sample data were reviewed to verify that holding times were met and that the laboratory QC sample data were appropriate and met QC limits.

Data verification was performed by Weston for data package completeness, correctness, and compliance against the analytical method, procedural, and contractual requirements of the project. The field chain-of-custody and the internal chain-of-custody forms were reviewed to verify proper sample receipt, storage, sample preparation, and sample analysis. A review was completed of the instrument performance criteria, calibration results, detection limits, surrogate spike recovery and laboratory control recovery data, matrix spike results, internal standard responses, QC blank contamination results, as well as extraction and analytical run logs to verify proper sample preparation and analysis conditions.

Deviations from the Quality Assurance Project Plan (QAPP) and project laboratory quality assurance (QA) Plan and Standard Operating Procedures (SOP) were documented, often in the form of a case narrative included with the data package.

Field duplicate soil gas sample results were compared to assess field sampling precision. If the relative percent difference (RPD) of an analyte between the duplicate pair is greater than 50%,

the analyte results will be estimated (J) for both samples. If the analyte is detected in only one sample, it will also be estimated.

To assess field precision, co-located SUMMA canisters were placed side-by-side to simulate field duplicate samples collected for other sample matrices, as SUMMA canisters were not alternately filled by the same air "aliquot".

2.3 SCREENING BENCHMARKS

Analytical data were compared to applicable regulatory screening levels to assess potential adverse impacts. These regulatory levels included**:**

1. NJDEP (March 2013) Residential and Nonresidential Vapor Intrusion Guidance Screening Levels for Subslab Soil Gas;
2. NJDEP (March 2013) Residential and Nonresidential Vapor Intrusion Guidance Screening Levels for Indoor Air;
3. NJDEP Site-Specific Residential and Nonresidential Screening Levels for Subslab Soil Gas (March 2013); and
4. NJDEP Site-Specific Residential and Nonresidential Screening Levels for Indoor Air (March 2013).

The following is a brief discussion of each screening benchmark used, including assumptions and applicability. None of these benchmarks are promulgated regulatory criteria.

2.3.1 NJDEP Vapor Intrusion Guidelines for Indoor Air and Subslab Soil Gas

NJDEP has published VI Guidelines for residential and nonresidential scenarios for both indoor air and soil gas. Since these benchmarks have been used at the former Arsenal site throughout much of the VI sampling program, comparisons of sampling results with these values are included in this report as a means of comparison to prior investigation results.

In October 2005, the NJDEP published the final VIG. As the title implies, the VIG is intended as a guidance document and is not purely a regulatory requirement. However, while the NJDEP will consider alternative methods for VI investigations, they generally require that the analytical results of any VI investigation be compared to the (current) benchmarks included in Table 1 (NJDEP Master Table; Generic VI Screening Levels, originally issued October 2005) of the VIG. Table 1 consists of benchmark concentrations for a number of COPCs, as both residential and nonresidential concentrations. These concentrations will be revised periodically as the "state of the science" of VI changes over time, the most recent revision being in March 2013. For all of the compounds the residential criteria is either equal to the nonresidential standard or is more stringent than the nonresidential standards.

In this report, the tables of results from the current sampling events as well as and tables containing comparison of historical data from previous sampling rounds have highlighted any values where concentrations of VOCs exceed the current NJDEP VIG benchmarks. These tables are specific to individual buildings within each AOC, and specific table numbers are referenced within the text in association with each building.

2.3.2 Site-Specific Residential and Nonresidential Screening Levels for Indoor Air and Soil Gas

USACE previously developed Site-Specific indoor air and subslab soil gas screening numbers for Building 102-168 Fernwood Avenue and 160 Fieldcrest Avenue for TCE and PCE. These screening numbers were accepted by the NJDEP and documented in a letter dated March 8, 2010.

These Site-Specific numbers were as follows:

Table 2-13: Building 160 Specific Criteria

Compound	Site-Specific Residential Indoor Air Screening Level ($\mu g/m^3$)*	Site-Specific Nonresidential Indoor Air Screening Level ($\mu g/m^3$)	Site-Specific Residential Soil Gas Screening Level ($\mu g/m^3$)	Site-Specific Nonresidential Soil Gas Screening Level ($\mu g/m^3$)
TCE	1	6	61	310
PCE	0.4	2	34	100

**ug/m^3 = microgram per cubic meter^3*

Based on recent revisions to EPA toxicity values for PCE and TCE, USACE is updating these numbers for NJDEP review. Additionally, we have expanded the list to include all COCs for the VI pathway which include TCE, PCE, vinyl chloride, 1,2-dichloroethane (1,2-DCA), and cis-1,2-dichloroethene (cis-1,2-DCE).

All eight buildings that are currently monitored by USACE are of commercial use and are located in relative close proximity to one another at the former Arsenal. All are slab-on-grade construction with similar soil types and all are used as office space and/or light industrial. It should be noted that Building 165 has a daycare in use and both the children and the adult workers were evaluated in order to derive the appropriate protective criteria. The Site-Specific screening numbers are selected using the most restrictive nonresidential numbers and applied to all eight buildings.

Using the same methods that were employed previously and the same attenuation factor of 0.02 for converting indoor air to soil gas, USACE derived new Site-Specific indoor air and soil gas screening numbers. These values will be presented in the Draft Groundwater and Vapor Intrusion Feasibility Study (GW/VI FS) (Weston, 2013) currently being prepared for submission to NJDEP. An excerpt from the FS explaining the derivation of these numbers is provided as Appendix F.

Table 2-14: 2012 Site-Specific Criteria

Chemical	Site-Specific Residential Indoor Air Screening Level ($\mu g/m^3$)	Site-Specific Nonresidential Indoor Air Screening Level ($\mu g/m^3$)	Site-Specific Residential Soil Gas Screening Level ($\mu g/m^3$)	Site-Specific Nonresidential Soil Gas Screening Level ($\mu g/m^3$)
TCE	0.43	3	22	150
PCE	9.4	47	468	2358
Vinyl Chloride	0.16	0.22	8.1	11
1,2-DCA	0.094	0.47	4.7	24
cis-1,2-DCE	-	-	-	-

Values in ug/m^3

Value shown is the lower of the risk based concentration for non-cancer or cancer effects.

SECTION 3.0
SAMPLING RESULTS FOR GROUNDWATER AOC 2

Per the recommendations from the IAQ Semi-Annual Report #7 (Weston, November 2012), two buildings are still being monitored for VI issues in AOC 2. The buildings being evaluated are:

- 165 Fieldcrest Avenue; and
- Campus Plaza 4.

A third building, Building 160, is being sampled on a 5 year frequency with annual inspections of the vapor mitigation system to ensure it is operating effectively. This section focuses on sampling results from these buildings for indoor air and subslab soil gas collected in September 2011 and January, February, and April 2012. The two complete semi-annual sampling rounds occurred in September 2011 and February 2012. Resampling events occurred in January 2012 within Building 165 and in April 2012 within Campus Plaza 4 as mentioned in Subsection 2.2.7.

3.1 OVERVIEW OF GROUNDWATER AOC 2

3.1.1 Groundwater AOC 2

Groundwater AOC 2 is located within the north central portion of the former Arsenal beginning near Building 256 in Area 18C (previously identified and remediated source area). The 2004-2005 site-wide groundwater investigation redefined the plume boundary (*Supplemental Groundwater Data Report* [Weston, September 2006]).

The historic constituents of concern in Groundwater AOC 2 are VOCs such as TCE, PCE, and cis-1,2-DCE, among others, as described in the *Final Site-Wide Hydrogeology Report* (Weston, 1996) and the *Final Groundwater NAR* (Weston, 2003). Current constituents of concern in Groundwater AOC 2 are cis-1,2-DCE, PCE, TCE, vinyl chloride, and total 1,2-DCE as described in the 2006 Final *Supplemental Groundwater Data Report*. AOC 2 groundwater was most recently sampled in May 2012, September 2012, and July 2013.

Groundwater analytical data from 2005 to 2012 for monitoring wells within 100 feet of the established AOC 2 boundary from 2005 to present were reviewed to characterize the COPCs in Groundwater AOC 2. Any analytical result above either the Groundwater Screening Levels from the March 2013 NJDEP or the November 2002 EPA Table 2C Screening Level for Groundwater is considered a COPC. The list of groundwater COPCs are shown in Table 3-1.

The VOC concentrations in groundwater at and near the source area in Groundwater AOC 2 historically were the highest encountered in the former Arsenal, exceeding the NJDEP Groundwater Quality Standards (GWQS) for TCE, PCE, and vinyl chloride. However, the main source of contamination (Building 256 underground storage tank [UST] system and leach field) was remediated in 1998 by removal of approximately 2,450 cubic yards of contaminated soil, as approved by the NJDEP.

USACE conducted additional remedial activities from August to December 2002, when an additional 3,500 cubic yards (approximately) of contaminated soil was removed from the Area 18C-Building 265 Ramp Area, in the immediate vicinity of the earlier source removal, but from

deeper within the subsurface. Monitoring well MW-114 is located immediately down-gradient of the former source area and up-gradient of Buildings 151 and 165. Since the groundwater sampling event following the first removal action, the total VOC concentration in groundwater at this well has decreased by two orders of magnitude.

Two groundwater treatment pilot studies were executed in the Groundwater AOC 2 plume from 2008 to 2010. The first treatment was injection of an in-situ chemical oxidation compound, focused north of Building 165. The second pilot study consisted of biostimulation/ bioaugmentation at Building 256 (northern portion of AOC 2). This groundwater treatment has proven to be effective in decreasing groundwater contamination within AOC 2.

Due to the VOC concentrations detected in Groundwater AOC 2, IAQ sampling has been conducted at buildings within 100 ft of the groundwater plume (further discussed below).

3.1.2 Building Survey

Prior to collection of indoor air samples, a *NJDEP Building Survey and Sampling Form* was completed for each tenant space from/under which samples were being collected in each building under evaluation for VI. The building surveys for each building, conducted prior to each sampling event are located in Appendix D.

The results of the building surveys from within Groundwater AOC 2 illustrate the primary use for the tenants is office space combined with warehouse storage. Common cleaning products, paint, and paint thinners were found in all of the buildings evaluated, but generally in small quantities and properly stored. As a result, in most cases, these cleaners do not necessarily constitute "significant" potential VOC sources. The building surveys also concluded that there were no carpet cleanings or exterminators scheduled within two weeks prior to sampling or during the sampling event.

3.1.3 Subslab Soil Gas and Vapor Recovery System

VOC results of the subslab soil gas and VR system samples in the vicinity of Groundwater AOC 2 are discussed in the following building-specific subsections of this report and are provided in Tables 3-2, 3-4, and 3-5. Shaded values in the tables indicate concentrations exceeding the NJDEP VIG nonresidential subslab soil gas screening levels whereas bolded and shaded values indicate concentrations exceeding NJDEP VIG residential subslab soil gas screening levels.

3.1.4 Indoor Air

The indoor air analytical results for the buildings within Groundwater AOC 2 are discussed in the following subsections of this report and are provided in Tables 3-3 and 3-6. Shaded values in the tables indicate concentrations exceeding the NJDEP VIG nonresidential indoor air screening levels whereas bolded and shaded values indicate concentrations exceeding NJDEP VIG residential indoor air screening levels.

3.1.5 Meteorological Data

Meteorological data for the September 2011 and January, February, and April 2012 sampling events at AOC 2 buildings were downloaded from National Climatic Data Center consistent with

guidance provided in the NJDEP VIG. The data was taken from the Local Climatological Data (LCD) for the weather station located at Newark Liberty International Airport in Newark, Newark, NJ. The average meteorological parameters collected for the dates that the AOC 2 buildings were sampled are summarized below. See Appendix E for the complete meteorological data.

Table 3-7: Groundwater AOC 2 Meteorological Data Summary

Dates Sampled	Temperature Range Min-Max (degrees Fahrenheit)	Barometric Pressure Station Average (Inches)	Precipitation (Inches)
September 2011			
9/21/2011	62-75	30.16	0.05
9/22/2011	69-81	30.07	0.03
January 2012			
1/12/2012	42-49	29.54	1.35
1/13/2012	28-50	29.46	0.10
February 2012			
2/23/2012	45-60	29.49	0.00
2/24/2012	38-45	29.55	0.58
April 2012			
4/2/2012	41-59	29.69	0.05
4/3/2012	39-67	29.83	0.00

3.2 165 FIELDCREST AVENUE

Building 165 is a one-story concrete and steel building built on a concrete slab on grade located at 165 Fieldcrest Avenue along the western boundary of the Groundwater AOC 2 plume. Building 165 is surrounded by a parking lot with a small landscaped lawn area. The building consists of warehouse, laboratory, daycare, and office space. A VR system was installed in August 2003 by the NJDEP. There have been 18 rounds of sampling at this building since October 2003. The two recent sampling rounds occurred in September 2011 and February 2012. A resampling event occurred in January 2012 within one tenant area, Peppermint Tree Daycare. During these sampling events, the building was occupied by six building tenants.

The September 2011 and February 2012 investigation activities included subslab soil gas, VR system, and indoor air sample collection. Two indoor air samples from within the Peppermint Tree Daycare and a background sample were collected in January 2012.

3.2.1 Prior Investigations

Building 165 is located near soil Area 18C located on the eastern side of Building 256. Several phases of the investigation and remediation have been completed within Area 18C, including a Supplemental Phase II RI. In 1998, this investigation led to the removal of one 6,000-gallon steel UST, three smaller concrete USTs, former leach field piping, and associated contaminated soils. Additional oil-contaminated soil and buried construction debris were encountered beneath the asphalt pavement northeast of Building 256 and west of the UST excavation area during the 1998 remediation of the leach field system. USACE removed approximately 2,450 cubic yards of contaminated soil from this area in 1998, and during the summer of 2002 approximately 5,300 additional tons of TCE-contaminated soils were removed from this area (Weston, June 2005b). In addition, pilot studies using *in situ* chemical oxidation (165 Fieldcrest Avenue Area) have been performed to address vapor sources for AOC 2. Preliminary results indicate a substantial reduction in the concentrations of groundwater contaminants; however, continued groundwater and VI monitoring are being conducted to evaluate the full effectiveness of the treatments (Shaw, November 2010).

Additional investigations were completed in Area 18C and in the vicinity of Building 165. Those investigations included the collection of additional soil, soil gas, and groundwater samples for VOC analysis. The results of analyses of the soil, soil gas, and groundwater samples from the additional investigations were submitted to the NJDEP in the *Final Supplemental Remedial Investigation Report Areas 18C - Ramp Area and Buildings 151/165* (Weston, June 2005b).

In a March 12, 2003, comment letter from the NJDEP concerning USACE's *Draft Final Groundwater NAR* (Weston, July 2002), NJDEP requested that potential vapor risks at 165 Fieldcrest Avenue be evaluated.

Indoor air sampling conducted in May 2003 at Building 165 by the property owner's consultant, Environmental Waste Management Associates (EWMA), indicated that PCE was detected in the indoor air in building tenant spaces. Historic analytical results are provided in Appendix G.

Weston conducted an inspection of the building in June 2003 and completed the *Indoor Air Building Survey and Sampling Form* for each building tenant space. The most-recently updated

Indoor Air Building Survey and Sampling Forms and lists of products encountered are included in Appendix D.

Subsequent indoor air sampling conducted by USACE in June 2003 did not detect any PCE in the indoor air. However, PCE was detected in four subslab soil gas samples and in one soil sample collected from below the building, indicating a potential subsurface source of PCE below the building. Other VOCs that were detected in the indoor air samples collected during the June 2003 sampling event at concentrations above the indoor air guidance values were either not detected in the subslab soil gas samples or detected at concentrations below those detected in the indoor air samples.

In August 2003, a subsurface vapor mitigation system was installed at Building 165 to mitigate potential migration of VOC vapors from the subslab soil gas into the building. The system consists of 20 subslab vapor extraction points spaced throughout the building in order to obtain coverage of the entire floor space. The 20 extraction points are connected to two blowers that apply vacuum to the vapors beneath the building. Indoor air in Building 165 and the VR system sample ports were sampled for one year on a quarterly basis (October 2003 through July 2004) to evaluate the effectiveness of the subsurface vapor mitigation system in compliance with the work plan for the *Indoor Air Monitoring Work Plan for Building 165* (Weston, October 2003).

After four quarters of post-remediation sampling, the NJDEP and USACE agreed to semi-annual sampling at Building 165. At each blower, VR samples were also being taken during each monitoring event to monitor the vapor mitigation system.

During the January 2005 sampling event (the first semi-annual event following the quarterly post-remediation sampling program), four subslab soil gas points were installed in the same locations as were first sampled in June 2003. The subslab gas monitoring points were installed at Peppermint Tree Day Care Center, Amax Engineering Corporation (Amax), Celsis Laboratory Group (Celsis), and the vacant location which was later occupied and subsequently re-vacated by varying companies. In addition, a total of seven IAQ samples and one background air sample were collected at Building 165 for analysis of VOCs. The samples were collected from the same locations as each previous sampling event. The indoor air samples were collected at the following tenant locations: Peppermint Tree Day Care Center (one sample and duplicate), Celsis, Rockwell Automation, Amax, Mackay Communications (Mackay), and a vacant location at the time (Figure 3-1).

Historically, the background air sample was collected from next to the playground at the Peppermint Tree Day Care Center. During September 2010, the background location was moved to the roof above the Peppermint Tree Day Care Center and has continued to be sampled from this location. The two VR samples were collected from the shed behind the building (west side) and the shed on the side of the building (north side). These have been designated as the sampling locations for Building 165 since the January 2005 sampling event.

One pre-remediation and 17 post-remediation rounds of sampling have been performed by USACE at Building 165. Sampling events from August 2007 through September 2008 showed decreasing levels of PCE in subslab soil gas. Exceedance of PCE in subslab soil gas only occurred in August 2007. It was not detected above NJDEP VIG subslab screening levels in May and September 2008. From August 2007 through September 2008 PCE was not detected

above NJDEP VIG subslab screening levels from samples collected from the Vapor Extraction System. During sampling events in August 2007 and September 2008, chloroform and methylene chloride were detected in the vapor extraction system above NJDEP VIG subslab screening levels. From August 2007 through September 2008 the following compounds were detected in indoor air above NJDEP VIG screening levels; methylene chloride, benzene, chloroform and 1,4-dichlorobenzene (1,4 DCB).

The results from the March 2009 sampling event at Building 165 showed a decreasing trend in VOC concentrations in the subslab soil gas. PCE concentrations in soil gas exceeded NJDEP VIG screening levels at one sampling port (SG-04 Celsis). No other VOCs were detected at concentrations exceeding subslab screening levels. VOCs continue to be detected above NJDEP VIG screening levels within the VR system indicating that the system is functioning to remove them from the soil gas as intended. Although VOCs are detected in indoor air, they are likely due to a non-DOD source.

The September 2009 and February 2010 results indicated benzene was the only VOC detected in subslab soil gas at concentrations exceeding the VIG (SG-02 in February 2010 only). Benzene, 1,4-DCB, methylene chloride, chloroform and PCE were all detected in indoor air at a minimum of one sampling location at concentrations exceeding the VIG indicating that most of these were not groundwater related. During the September 2010 sampling event, only 1,4-DCB was detected in a duplicate soil gas sample above NJDEP VIG screening levels. No other VOCs were detected in subslab soil gas or VR samples at concentrations greater than the NJDEP VIG screening levels during the September 2010 and February 2011 sampling events. VOCs detected in indoor air at concentrations above the NJDEP VIG screening levels included 1,4-DCB and chloroform. The main groundwater COPCs for AOC 2 is PCE and TCE; however, both compounds were not detected in indoor air above the screening levels during September 2010 and February 2011.

3.2.2 Current Investigation

The indoor air and subslab soil gas samples collected during the September 2011 and February 2012 events were from the same locations as previous sampling events. The background ambient sample was collected from the roof of the Peppermint Tree Day Care Center (Figure 3-1). However, during the January 2012 resample event, a background ambient sample was collected from outside of the playground area fence. A pre-sampling walk-through was conducted the week prior to sampling to verify the locations of the subslab soil gas sampling points and to update the building survey. One sample was collected from each of the two VR sample ports during the September 2011 and February 2012 sampling events as in the previous rounds. The Hazsite Envirodata database (EDD) is provided in Appendix H and the laboratory analytical reports are provided in Appendix I. Table 3-8 below summarizes the samples collected during the current investigation at Building 165.

Table 3-8: 165 Fieldcrest Avenue Sample Summary

Matrix	Number of Samples*	Parameters/Method	Date Sampled
Subslab Soil Gas	7	VOCs/TO-15	22 September 2011
	8		24 February 2012
Vapor Recovery	2	VOCs/TO-15	21-22 September 2011
	2		23-24 February 2012
Indoor Air	9	VOCs/TO-15	21-22 September 2011
	2		12-13 January 2012
	10		23-24 February 2012
Background	1	VOCs/TO-15	21-22 September 2011
	1		12-13 January 2012
	1		23-24 February 2012

*Including duplicate samples.
TO-15 Compendium of Methods for the Determination of Toxic Organic Compounds in Ambient Air: Method TO-15, Second Edition (EPA, January 1999).

3.2.3 Subslab Soil Gas and Vapor Recovery System Results

A summary of subslab soil gas and VR monitoring samples collected from Building 165, in comparison to the NJDEP VIG residential and nonresidential screening levels, are provided in Tables 3-2 and 3-4, respectively.

Table 3-2 and Figure 3-1 present the analytical results of the subslab soil gas samples. Table 3-9 below summarizes the subslab soil gas exceedances in comparison with Site-Specific screening levels and NJDEP VIG screening levels:

Table 3-9: 165 Fieldcrest Avenue Subslab Soil Gas Sample Exceedance Summary

Compound	No. of Samples Exceeding*[1]	Maximum Concentration Exceeding[2] ($\mu g/m^3$)	NJDEP VIG Table 1 Nonresidential Subslab Soil Gas Screening Level ($\mu g/m^3$)	NJDEP VIG Table 1 Residential Subslab Soil Gas Screening Level ($\mu g/m^3$)	Site-Specific Nonresidential Subslab Soil Gas Screening Level ($\mu g/m^3$)	Site-Specific Residential Subslab Soil Gas Screening Level ($\mu g/m^3$)
Benzene (September 2011)	1 of 7	25-25	79	16	NLE	NLE

* Including duplicate samples.
NLE – No Level Established
[1]Exceedances are the most stringent of the four criteria compared in the table.
[2]Range of concentration exceeding the most stringent criterion listed.

During the September 2011 sampling event, benzene was detected in subslab soil gas at location Celsius 04 above the NJDEP VIG residential screening levels.

During the February 2012 sampling event, no other VOCs were detected in subslab soil gas at concentrations greater than the Site-Specific or the NJDEP VIG residential and nonresidential screening levels for subslab soil gas.

During September 2011 and February 2012, there were no VOC exceedances in the VR samples for either location. Table 3-4 and Figure 3-1 present the analytical results of the VR samples.

3.2.4 Building Survey

Weston conducted a walk-through of Building 165 and completed the *Indoor Air Building Survey and Sampling Form* for each tenant space. The survey did not identify any changes to operation activities within the tenant spaces. The survey and sampling form were updated concurrent with each sampling event to include any changes observed. The forms and lists of products used by building tenants are included in Appendix D. Celsius Laboratory provided the MSDS for all chemicals used in their facility (Appendix D).

3.2.5 Indoor Air Sampling Results

The indoor air and background sample results from September 2011 and January and February 2012 are shown in Table 3-3. VOCs detected in indoor air at concentrations above either the Site-Specific or the NJDEP VIG screening levels included benzene, chloroform, ethylbenzene, PCE, and TCE.

Table 3-9 is an indoor air summary of compounds exceeding NJDEP VIG screening levels from the September 2011 and January and February 2012 sampling events are included below:

Table 3-10: 165 Fieldcrest Avenue Indoor Air Sample Exceedance Summary

Compound	No. of Samples Exceeding*[1]	Range of Concentrations Exceeding[2] ($\mu g/m^3$)	NJDEP VIG Table 1 Non-residential Indoor Air Screening Level ($\mu g/m^3$)	NJDEP VIG Table 1 Residential Indoor Air Screening Level ($\mu g/m^3$)	Site-Specific Nonresidential Indoor Air Screening Level ($\mu g/m^3$)	Site-Specific Residential Indoor Air Screening Level ($\mu g/m^3$)
Benzene (January 2012)	1 of 2	4.3	2	2	NLE	NLE
Benzene (February 2012)	1 of 10	2.7	2	2	NLE	NLE
Chloroform (September 2011)	2 of 9	2.4-2.4	2	2	NLE	NLE
Chloroform (January 2012)	1 of 2	3.2	2	2	NLE	NLE
Ethylbenzene (September 2011)	3 of 9	2.1-3	5	2	NLE	NLE
Ethylbenzene (January 2012)	1 of 10	6.1	5	2	NLE	NLE
Ethylbenzene (February 2012)	5 of 10	2.4-10	5	2	NLE	NLE
PCE (September 2011)	2 of 9	11-16	47	9	47	9.4
TCE (January 2012)	1 of 2	0.51	3	3	0.43	3

* Including duplicate samples.
NLE – No Level Established
[1]Exceedances are the most stringent of the four criteria compared in the table.
[2]Range of concentration exceeding the most stringent criterion listed.

3.2.6 Integrated Discussion of Results

The data from September 2011 and January and February 2012 sampling events for Building 165 shows an incomplete exposure pathway for VOC concentrations in the subslab soil gas and indoor air. Although PCE and benzene were detected in soil gas and indoor air above NJDEP VIG screening levels, this occurred only when the VR system had malfunctioned and shut down

in August 2011 for an unknown amount of time. At that time, there were no alarms on the system to alert NJDEP or the system owner that the system was not functioning properly.

TCE concentrations did not exceed the NJDEP VIG screening levels in subslab soil gas nor indoor air as they have historically (Weston, 2008). There was one instance during January 2012 where TCE concentrations were slightly above the Site-Specific criteria level. Chloroform and ethylbenzene were also detected above NJDEP VIG screening levels at indoor air sample location points but were not detected in subslab soil gas above the NJDEP VIG screening levels. The analytical results from the two VR sampling ports did not have any constituents exceeding the NJDEP VIG subslab soil gas screening levels. This further confirms that these groundwater COPCs are not posing a VI threat and that exceedences are more likely from a tenant source.

3.2.7 Conclusions and Recommendations

Since chloroform and ethlylbenzene were detected only in the indoor air and not in soil gas or VR, there is not a complete exposure pathway. PCE and TCE concentrations in the soil gas samples, VR samples, and indoor air samples are all trending lower when compared to past sampling events as illustrated on Figure 3-1. TCE was not detected above NJDEP VIG screening levels in any indoor air, subslab soil gas, or VR samples from the three recent sampling events. PCE concentrations were detected in indoor air samples when the VR system was not functioning to its full potential prior to the September 2011 sampling event.

The results confirm that when the VR system is functioning correctly, it eliminates potential health risks at Building 165. Based on the VR results over the past year, USACE recommends continued semi-annual monitoring to evaluate the operation of the system. This will assist in determining the optimal flow rate to maximize removal of the vapors from beneath the subslab.

3.3 CAMPUS PLAZA 4

Campus Plaza 4 is a single-story concrete and steel building built on a concrete slab on grade located within the footprint of the Groundwater AOC 2 plume. The building consists of office and warehouse space and is occupied by three tenants and the property owner's firm. All four tenant locations were chosen as sample sites. Campus Plaza 4 is surrounded by a parking lot with a small landscaped lawn area. The building does not have a mitigation system installed.

Fourteen rounds of indoor air and subslab soil gas samples were collected at Campus Plaza 4 by Weston and Shaw for USACE from October 2004 through February 2011. Current investigation activities included subslab soil gas and indoor air sample collection during September 2011 and February 2012. During April 2012, an indoor air and a background ambient sample were also collected.

3.3.1 Prior Investigations

The original indoor air sampling at Campus Plaza 4 was conducted in May 2004 by EWMA under contract with Federal Business Center (FBC), the building owner. At the time, the levels of PCE and TCE were reported below detection limits. However, benchmark exceedances were reported for both benzene and methylene chloride.

Weston collected a round of indoor air, subslab soil, and subslab soil gas samples in October and November 2004. The results of this investigation indicated the possibility of a VI pathway based on the presence of TCE in both subslab soil gas and indoor air. However, the tenant at 284 Campus Drive (former tenant: Englehard) utilized a number of VOCs in their business which may have been contributing to the indoor air exceedances (EPA Table 2C benchmarks) detected during that sampling event. The VOCs with concentrations in soil gas that previously exceeded the EPA Table 2C guidelines were benzene, ethylbenzene, methylene chloride, methyl tertiary butyl ether (MTBE), and toluene, as well as PCE and TCE. A confirmatory round of indoor air sampling was recommended per The IAQ Approach.

A second round of indoor air and subslab soil gas samples were collected in January 2006. In subslab soil gas, TCE was the only VOC detected at concentrations above NJDEP VIG screening levels (in three of five samples). The indoor air sampling results showed exceedances of NJDEP VIG screening levels for TCE, PCE, and methylene chloride in one of five samples; of MTBE in two of five samples; and 1,4-DCB and benzene in four of five indoor air samples. USACE recommended continued semi-annual monitoring of subslab soil gas and indoor air monitoring along with an evaluation of remedial alternatives. Subsequently, USACE and NJDEP agreed to increase the monitoring frequency for Campus Plaza 4 to quarterly monitoring, beginning with the September 2006 sampling event. However, after the September 2008 summer sampling event, USACE and NJDEP agreed to continue sampling on a semi-annual basis.

March 2009 subslab analytical results for Campus Plaza 4 continued to show concentrations of PCE and TCE above VIG screening levels. However, the concentrations of these constituents in indoor air did not exceed the VIG screening levels. Because of the VOC concentrations in soil gas, USACE agreed to continue both subslab and indoor air sampling for this building. PCE and TCE concentrations in subslab soil gas have been detected above the NJDEP VIG screening levels between the September 2009 and February 2011 sampling events.

3.3.2 Current Investigation

At Campus Plaza 4, subslab soil gas and indoor air samples were collected in September 2011 and February and April 2012 from:

- FBC;
- GCI Technology Corp. (as of February 2012);
- Fabritex; and
- Agilysys.

For continuity, samples were collected from the same or similar locations as those during past sampling events. Due to the construction of an office in the FBC warehouse, CP4-SG-1 was abandoned and a new sampling port (CP4-SG-6) was installed in February 2012, two days prior to the sampling event. NJDEP agreed to the new location. A helium leak test was performed at CP4-SG-6, as is done on all sample ports, prior to sampling in order to ensure the port was sealed properly.

Due to a malfunction with a flow-controller, the indoor air sample CP4-2 was not analyzed in February 2012. The sample (CP4-2) along with an additional background ambient sample (CP4-BG-01) were collected in April 2012 and analyzed. The Hazsite EDD is provided in Appendix H and the laboratory analytical reports are provided in Appendix I. The following table summarizes the samples collected under the current investigation at Campus Plaza 4.

Table 3-11: Campus Plaza 4 Sample Summary

Matrix	Number of Samples*	Parameters/Method	Dates Sampled
Subslab Soil Gas	6	VOCs/TO-15	22 September 2011
	6		24 February 2012
Indoor Air	6	VOCs/TO-15	21-22 September 2010
	5		23-24 February 2012
	1		2-3 April 2012
Background Ambient Air	1	VOCs/TO-15	22 September 2011
	1		23-24 February 2012
	1		2-3 April 2012

* Including duplicate samples.
TO-15 Compendium of Methods for the Determination of Toxic Organic Compounds in Ambient Air: Method TO-15, Second Edition (EPA, January 1999).

3.3.3 Subslab Soil Gas Results

A summary of subslab soil gas analytical results from samples collected from Campus Plaza 4, in comparison to the residential and the nonresidential NJDEP VIG and Site-Specific screening levels, are provided in Table 3-5. Figure 3-2 presents the analytical results of the subslab soil gas samples. Table 3-12 below summarizes the subslab soil gas exceedances in comparison with NJDEP VIG and Site-Specific screening levels:

Table 3-12: Campus Plaza 4 Subslab Soil Gas Sample Exceedance Summary

Compound	No. of Samples Exceeding*[1]	Range In Concentration Exceeding[2] ($\mu g/m^3$)	NJDEP VIG Table 1 Nonresidential Subslab Soil Gas Screening Level ($\mu g/m^3$)	NJDEP VIG Table 1 Residential Subslab Soil Gas Screening Level ($\mu g/m^3$)	Site-Specific Nonresidential Subslab Soil Gas Screening Level ($\mu g/m^3$)	Site-Specific Residential Subslab Soil Gas Screening Level ($\mu g/m^3$)
Chloroform (September 2011)	1 of 6	25-25	27	24	NLE	NLE
TCE (September 2011)	5 of 6	26-2240	150	27	150	22
TCE (February 2012)	4 of 6	25-677	150	27	150	22

* Including duplicate samples.
NLE – No Level Established
[1]Exceedances are the most stringent of the four criteria compared in the table.
[2]Range of concentration exceeding the most stringent criterion listed.

During the recent sampling events at Campus Plaza 4, TCE and chloroform were detected in soil gas samples at concentrations that exceed the NJDEP VIG residential and nonresidential screening levels for subslab soil gas (Table 3-5). Additionally, TCE results were detected above both the residential and nonresidential Site-Specific screening levels for soil gas.

At Campus Plaza 4, four tenant locations were surveyed two weeks prior to each of the indoor air sampling events. The survey forms were updated to include information on chemicals observed, building size, and construction activities. The survey forms and MSDS forms can be found in Appendix D.

During the site survey, daily-use cleaning supplies were observed in each tenant space. These cleaning products would be expected to only produce a minimal potential source of VOCs. The only exception is the FBC warehouse space and the newly renovated 280 Raritan Center Parkway. Prior to the September 2011 sampling event, the former tenant of 280 Raritan Center Parkway (Bareweb) moved out of the space. The owner of the building (FBC) began renovations involving construction, painting, and carpet installation. USACE decided to sample in September 2011 regardless of the construction activities. Painting and carpet cleaning did not occur during the 2-day sampling event.

During the most recent site inspection and past site inspections of this facility, many potential VOC sources were located and noted on the survey form for the FBC warehouse space. These included several brands of paint thinner containing benzene, 1,2,4-trimethylbenzene, and 1,3,5-trimethylbenzene; multiple brands of paint primer containing ethylbenzene, acetone, and toluene; "Liquid Nail™" adhesive containing toluene; Siperstein™ brand acrylic urethane primer containing 1,3,5-trimethylbenzene, methyl isobutyl ketone, and 1,2,4-trimethylbenzene; Wasp and Hornet Killer containing 1,1,1-trichloroethane; and Imperial brand Rapid Brush Cleaner containing acetone, xylenes, and ethylbenzene. The storage and quantity of these products vary depending on current FBC needs. A variety of these products were used during the September 2011 renovations at 280 Raritan Center Parkway. However, the products were stored in FBC's

warehouse and proper ventilation was performed during the painting activities. Prior to the February 2012 sampling event, GCI Technology began leasing the space.

3.3.4 Indoor Air Sampling Results

During the September 2011 and February and April 2012 sampling events at Campus Plaza 4, TCE, ethylbenzene, and 1,2-DCA were detected in indoor air above NJDEP VIG screening levels. Additionally, TCE concentrations were detected above both residential and nonresidential Site-Specific screening levels for indoor air. The analytical data are provided on Table 3-6 and illustrated on Figure 3-2. The following table summarizes VOC concentrations exceeding NJDEP VIG screening levels in indoor air samples:

Table 3-13: Campus Plaza 4 Indoor Air Sample Exceedance Summary

Compound	No. of Samples Exceeding*[1]	Range of Concentrations Exceeding[2] ($\mu g/m^3$)	NJDEP VIG Table 1 Non-residential Indoor Air Screening Level ($\mu g/m^3$)	NJDEP VIG Table 1 Residential Indoor Air Screening Level ($\mu g/m^3$)	Site-Specific Nonresidential Indoor Air Screening Level ($\mu g/m^3$)	Site-Specific Residential Indoor Air Screening Level ($\mu g/m^3$)
Ethylbenzene (September 2011)	4 of 6	2.5-3.7	5	2	NLE	NLE
Ethylbenzene (February 2012)	1 of 5	2.4-2.4	5	2	NLE	NLE
1,2-DCA (February 2012)	1 of 5	2.7-2.7	2	2	NLE	NLE
TCE (January 2012)	3 of 5	0.46-7.5	3	3	0.43	3

* Including duplicate samples.
NLE – No Limit Established.
[1]Exceedances are the most stringent of the four criteria compared in the table.
[2]Range of concentration exceeding the most stringent criterion listed.

3.3.5 Integrated Discussion of Results

The data from September 2011 and February and April 2012 sampling events for Campus Plaza 4 show a potentially complete exposure pathway for TCE concentrations in the subslab soil gas and indoor air. TCE concentrations in subslab soil gas were detected above the NJDEP VIG and Site-Specific screening levels for subslab soil gas. Chloroform concentrations were above NJDEP VIG screening levels in subslab soil gas but not within indoor air. Ethylbenzene and 1,2-DCA were detected in indoor air at concentrations above NJDEP VIG screening levels, but they did not exceed in the subslab soil gas samples.

3.3.6 Conclusions and Recommendations

The subslab soil gas analytical results from September 2011 and February and April 2012 sampling events for Campus Plaza 4 continue to show concentrations of TCE above NJDEP VIG and Site-Specific screening levels for soil gas. The indoor air analytical results from the February 2012 sampling event had TCE concentrations above the regulatory limits. Since TCE was detected in both soil gas and indoor air during the February event, a complete exposure pathway still has the potential to exist in Campus Plaza 4. USACE plans to continue both subslab and indoor air sampling for Campus Plaza 4 over the next year at which time the data will be re-evaluated, as will the determination of additional sampling events.

3.4 BUILDING 160

Building 160 is a single-story concrete and steel building built on a concrete slab on grade located within the footprint of the Groundwater AOC 2 plume at 160 Fieldcrest Avenue. The building consists of office and warehouse space and is currently occupied by four tenants. Use of the building is primarily industrial. Building 160 is surrounded by a parking lot with a small landscaped lawn area.

3.4.1 Prior Investigations

Twelve previous rounds of indoor air sampling were conducted at 160 Fieldcrest Avenue from September 2003 through May 2008 and 11 previous rounds of subslab soil gas sampling were conducted from September 2003 to May 2008. Figure 3-3 shows PCE and TCE results from these sampling events. After the May 2008 sampling event, a VR system was installed in June 2008. The system was installed as a pre-emptive mitigation measure, despite the fact that indoor air concentrations did not exceed the NJDEP VIG indoor air screening levels for TCE, PCE, and cis-1,2-DCE which are present in soil gas and groundwater beneath the building.

Historic subslab vapor concentrations in some areas have been greater than 10 times the NJDEP soil gas screening levels, in which case the NJDEP VIG recommends either on-going monitoring or pre-emptive mitigation to provide protection against potential future exposures attributable to subsurface VI to indoor air. On behalf of USACE, Geosyntec Consultants Inc. (Geosyntec) installed a VR system consisting of six vent pipes with wind-driven turbines.

Performance monitoring reports for this mitigation system were submitted on March 17, 2009 (Geosyntec, 2009a), August 20, 2009 (Geosyntec, 2009b), December 15, 2009 (Geosyntec, 2009c), and May 12, 2010 (Geosyntec, 2010). The December 2009 report also requested permission to apply Site-Specific soil gas screening levels (SGSL). In a March 8, 2010 letter, NJDEP replied indicating acceptance of SGSLs of 310 $\mu g/m^3$ for TCE and 100 $\mu g/m^3$ for PCE.

3.4.2 Current Investigations

The most recent progress report by Geosyntec, titled "Remedial Progress Report, Passive Subslab Venting System, 160 Fieldcrest Avenue, former Arsenal, Edison, New Jersey" was submitted to the NJDEP on January 6, 2012. A copy of this report can be found attached in Appendix A.

The results from Geosyntec performance monitoring from November 2012 show the recovery system is operating as designed and the soil gas concentrations have been decreasing over time. The most recent round of sampling results by Geosyntec shows that VR results are above the nonresidential site specific criteria and the nonresidential NJDEP VIG screening levels for subslab soil gas. The indoor air results show that all of the parameters were not detected. Sample results and sample location figures are located in Appendix A.

3.4.3 Conclusions and Recommendations

It is expected that the VR system will continue to operate as designed and that the subslab soil gas concentrations will continue to decrease over time. In order to ensure continued effectiveness of the VR system, annual inspection of the VR system is recommended along with 5 year sampling frequency for indoor air and subslab soil gas. Next sampling round is scheduled in 2017.

SECTION 4.0
SAMPLING RESULTS FOR GROUNDWATER AOC 6

4.1 OVERVIEW OF GROUNDWATER AOC 6 RESULTS

This section focuses on the 102-168 Fernwood in April 2010. Based on past investigations of VI potential, this is the only building within Groundwater AOC 6 that requires monitoring under the VI monitoring program.

The building is currently occupied by Computershare and is being used for commercial/industrial use such as warehouse and office space. It is surrounded by parking areas and roadways with some landscaped areas. In March 2011, a solar powered passive vent system was installed by USACE. The prior round of subslab soil gas and indoor air samples was completed in April 2011 and presented in IAQ Report #7 (Weston, November 2012).

4.1.1 Groundwater AOC 6

Groundwater AOC 6 is located in the central portion of the site. The AOC consists of three smaller plumes, Groundwater AOC 6A, AOC 6B, and AOC 6C. The northern extent of Groundwater AOC 6A lies north of the building located at 110 Fernwood Avenue and underlies a portion of soil in Area 10 within Raritan Center and a portion of soil in Area 9. This plume extends into the wetland area south of the building located at 45 Fernwood Avenue. The northern extent of Groundwater AOC 6B lies north of the building located at 104 Sunfield Avenue and extends just south of the southern boundary of Area 19. The Groundwater AOC 6C boundary begins just south of the southeastern side of the Raritan Expo Center and encompasses a portion of a parking lot, a landscaped area, a portion of a wetland area, and an undeveloped area of Area 8.

With the exception of possible DOD-related storage activities associated with Building 520 (Groundwater AOC 6C), source area(s) have not been identified for the AOC as a whole. Other potential sources identified during a previously conducted file review may have included site activities not related to DOD activities (e.g., light manufacturing or industrial processes).

The 2006 Final *Supplemental Groundwater Data Report* summarized findings of the evaluation of groundwater for VI potential. A total of nine buildings within Groundwater AOC 6 were previously evaluated to determine which specific buildings would require subslab soil gas sampling. Of the nine buildings evaluated, two were not included in the sampling program based on groundwater data near the buildings. The remaining seven buildings were sampled for subslab soil gas during the initial sampling effort conducted in March/April 2006. Since that time, only 102-168 Fernwood Avenue remains which was sampled in April 2011 and included as part of IAQ Report #7 (Weston, November 2012). Figure 4-1 depicts PCE and TCE results that were reported in IAQ Report #7

Groundwater analytical data from 2005-present were reviewed and compared to screening levels presented in Table 1 of NJDEP's VIG (January 2012) and EPA Table 2C to characterize the COPCs in Groundwater AOC 6A. Table 4-1 provides data for all VOCs detected in groundwater samples within 100 the bounds of Groundwater AOC 6A since 2005. The COPCs in Groundwater AOC 6A are TCE and vinyl chloride.

4.2 102-168 FERNWOOD AVENUE

4.2.1 Prior Investigations

Since March 2006, there have been eight sampling events in the 102-168 Fernwood building with the most recent round of sampling in August 2011. Historic results showed elevated levels of TCE and PCE in subslab soil gas samples and intermittently in indoor air samples.

Between September 28, 2009 and October 2, 2009, Geosyntec on behalf of USACE installed an electrically-powered SSE system as a pre-emptive mitigation measure to protect again potential future exposures. In March 2011, Geosyntec converted the existing SSE system to a solar powered system and performed subsequent monitoring to assess performance.

The most recent samples collected in April 2011 and included as part of IAQ Report #7 showed TCE concentrations were detected in subslab soil gas samples above the residential and nonresidential NJDEP VIG screening levels. Indoor air samples were collected concurrent with the subslab soil gas samples and there were no TCE concentrations above the residential and nonresidential NJDEP VIG screening levels.

4.2.2 Current Investigation

Geosyntec submitted the Summary of Sub-Slab Venting System Conversion to Solar Power Report for 102-168 Fernwood Avenue in February 2013. This report provides a summary of the solar power conversion and performance monitoring of the subslab soil gas venting system at 102-168 Fernwood Ave. This report is included as Appendix B and includes sample results and sample location figures (including sample locations collected by Weston from IAQ Report #7).

Subslab soil gas samples were collected in November 2011 and June 2012 by Geosyntec. Both sampling rounds showed TCE results above both the residential and nonresidential NJDEP VIG and the Site Specific subslab soil gas criteria. No other compound was detected above the strictest NJDEP VIG and Site-Specific subslab soil gas criteria.

Indoor air samples were collected in November 2011 and June 2012 by Geosyntec. TCE samples were above the Site-Specific residential criteria and below the strictest NJDEP VIG criteria for indoor air and the Site-Specific nonresidential criteria for indoor air during the November 2011 sampling event. All other sample results were below the strictest NJDEP VIG and Site-Specific subslab soil gas criteria.

VR samples (called Vent Pipe samples in Geosytnec's report) were collected in March 2011, June 2011, November 2011, and June 2012 for TCE, PCE, and cis-1,2-DCE. All results were below the strictest NJDEP VIG and Site-Specific subslab soil gas criteria.

These sample results show the recovery system installed by Geosyntec, on behalf of USACE, is operating as designed and the soil gas concentrations have been decreasing over time. The results from Geosyntec performance monitoring from November 2011, the most recent round of sampling, shows that subslab soil gas results are above the residential and nonresidential criteria for both the NJDEP VIG and Site-Specific criteria for subslab soil gas. The indoor air and VR

results show that all of the parameters were either not detected or below residential and nonresidential NJDEP VIG standards. Therefore, there are no current health risks.

4.2.3 Conclusions and Recommendations

The historic presence of TCE in both the subslab soil gas and nearby down-gradient groundwater sampling location at MW-47, 100 ft away, suggested the possibility of a VI pathway into the 102-168 Fernwood Avenue building. However, based on the recent analytical results for subslab soil gas, indoor air and VR samples, the installation of the subslab venting mitigation system appears to have addressed this potential. Geosyntec is continuing with passive sample monitoring to ensure the system is operating properly. It is expected that the VR system will continue to operate as designed and that the subslab soil gas concentrations will continue to decrease overtime. In order to ensure continued effectiveness of the VR system, annual inspection of the VR system is recommended along with 5 year frequency sampling. T next round is scheduled for 2017.

SECTION 5.0
SAMPLING RESULTS FOR GROUNDWATER AOC 8

5.1 OVERVIEW OF GROUNDWATER AOC 8 RESULTS

Per the recommendations from the *IAQ Semi-Annual Reports #3, #4, #5, #6 and #7* (Weston, 2008; Shaw, 2009 and 2010; and Weston 2012), five buildings are being evaluated and/or monitored for VI issues in AOC 8. These buildings are:

- EPA Building 10;
- EPA Building 18;
- EPA Building 200;
- EPA Building 205; and
- EPA Building 209.

This section focuses on sampling results for subslab soil gas and indoor air collected from September 2011 and February 2012 to evaluate the potential for VI at the five buildings in the vicinity of Groundwater AOC 8. Prior to the discussion of the subslab soil gas and indoor air results, a description of historic groundwater contaminant concentrations are presented.

5.1.1 Groundwater AOC 8

Groundwater AOC 8 is located near the northern boundary of the former Arsenal in the central portion of the site, in the vicinity of soil Area 18E. On the basis of groundwater data from the *Supplemental Groundwater Data Report*, Groundwater AOC 8 has been further subdivided into three smaller plumes: AOC 8A/B, AOC 8C, and AOC 8D. The footprints of AOC 8A/B encompasses the former motor pool (Building 238) and the former GSA automotive shop (Building 241) which are known DOD-related sources of chlorinated solvents. Due to historic VOC concentrations detected in soil and groundwater within AOC 8A/B, IAQ sampling has been conducted at buildings within 100 ft of the groundwater plume. The historic analytical results are provided in Appendix J.

In contrast, there are no buildings within 100 ft of AOC 8C and AOC 8D. (AOC 8C encompasses the area along the southern investigation boundary of the dump area in Area 18G and the former dump area, while Groundwater AOC 8D is located in the vicinity of Area 1.)

Currently, the only COC in Groundwater AOC 8A/B is TCE as described in the 2013 *Draft GW/VI FS* (Table 1-4). TCE concentration contours in groundwater for AOC 8 are shown on Figure 11 of the 2006 *Supplemental Groundwater Data Report*. The location of the monitoring wells and shallow groundwater screening sample locations for AOC 8 are shown on Figures 5 and 11 of the 2006 *Supplemental Groundwater Data Report*.

Groundwater analytical data from 2005-present were reviewed and compared to screening levels presented in Table 1 of NJDEP's VIG (March 2013) and EPA Table 2C to characterize the COPCs in Groundwater AOC 8. Table 5-1 provides data for all VOCs detected in groundwater samples within 100 ft of Groundwater AOC 8 since 2005. The historic COCs in Groundwater AOC 8 were TCE, PCE, benzene, and vinyl chloride.

The July 2008 Groundwater Remedial Action Work Plan (GWRAWP) recommended monitored natural attenuation (MNA) as the remedial action for Groundwater AOCs 8C and 8D. The 2012 *Final GWRAWP Amendment* was submitted to the NJDEP and recommended including AOC 8A/B in the MNA program pending further groundwater analytical data proposed to be collected in 2012 and 2013.

5.1.2 Building Survey

Two weeks prior to collection of indoor air samples, a site walk-through was conducted and a *NJDEP Building Survey and Sampling Form* was completed for each building. No products or chemicals were observed during the building inspections that could be considered a potential VOC emissions source. The *Indoor Air Building Survey and Sampling Forms* are included as Appendix D.

5.1.3 Subslab Soil Gas

VOC results of the subslab soil gas in the vicinity of Groundwater AOC 8 are discussed in the following building-specific subsections of this report and are provided in Tables 5-2, 5-4, 5-6, 5-8 and 5-10. Shaded values in the tables indicate concentrations exceeding the NJDEP VIG nonresidential subslab soil gas screening levels whereas bolded and shaded values indicate concentrations exceeding NJDEP VIG residential sub-slab soil gas screening levels.

5.1.4 Indoor Air

The indoor air analytical results for the buildings within Groundwater AOC 8 are discussed in the following subsections of this report and are provided in Tables 5-3, 5-5, 5-7, 5-9, and 5-11. Shaded values in the tables indicate concentrations exceeding the NJDEP VIG nonresidential indoor air screening levels whereas, bolded and shaded values indicate concentrations exceeding NJDEP VIG residential indoor air screening levels.

5.1.5 Meteorological Data

Meteorological data corresponding to each sampling event was obtained from the National Climatic Data Center for Newark Liberty International Airport. The meteorological data collected during the sampling of the Groundwater AOC 8 buildings are summarized below in Table 5-12. See Appendix E for the complete meteorological data.

Table 5-12: Groundwater AOC 8 Meteorological Data Summary

Dates Sampled	Temperature Range Min-Max (degrees Fahrenheit)	Barometric Pressure Station Average (Inches)	Precipitation (Inches)
September 2011			
19 September 2011	53-69	30.23	0.00
20 September 2011	61-70	30.09	0.04
February 2012			
21 February 2011	27-47	30.18	0.00
22 February 2011	39-58	29.69	0.00

5.2 EPA BUILDING 10

EPA Building 10 is located within the western portion of Groundwater AOC 8A/B and up-gradient of Building 205. Building 10 is a two-story brick building built on a concrete slab on grade located within the Groundwater AOC 8A/B plume. The building consists of office space and is surrounded by a parking lot with a small landscaped lawn area. This building has never been identified as an area of investigation or a former DOD occupancy requiring investigation.

From January 2005 through February 2011, 14 previous sampling events were conducted by USACE. During the September 2011 and February 2012 sampling events, investigation activities included collecting subslab soil gas, indoor air, and background ambient air samples for analysis.

5.2.1 Prior Investigations

Subslab soil gas samples have been collected at Building 10 since December 2004 by the EPA and USACE. TCE, PCE, benzene, and chloroform concentrations have been detected in soil gas and indoor air exceeding the residential and nonresidential NJDEP VIG screening levels at the time at which they were sampled. Historic PCE and TCE are shown on Figure 5-1.

The Area 18E soil and groundwater historic analytical results, less than 100 ft away from Building 10, indicated the presence of TCE in both media. The data suggested that soil may be a potential source of TCE concentrations in subslab soil gas beneath and within Building 10. During EPA investigations, TCE was also detected in the indoor air within Building 10; therefore, the EPA installed a subslab mitigation system at Building 10 in 2005.

Since the installation of the subslab mitigation system, PCE concentrations have periodically been detected in indoor air exceeding residential and nonresidential NJDEP VIG screening levels. PCE and TCE have also been occasionally detected in subslab soil gas exceeding residential and nonresidential NJDEP VIG screening levels.

Methylene chloride concentrations in indoor air exceeded both residential and nonresidential NJDEP VIG screening levels. However, this VOC was not detected in the groundwater plume associated with AOC 8A/B and is considered a non-DOD compound of concern along with being a common laboratory contaminant. In addition, it was not detected in indoor air and is not considered a threat. Continued semi-annual monitoring of the subslab mitigation system was recommended by USACE.

5.2.2 Current Investigation

During September 2011 and February 2012, two subslab soil gas locations and two indoor air locations were sampled at Building 10. Subslab soil gas and indoor air sample locations for EPA Building 10 are shown on Figure 5-1. The Hazsite EDD is provided in Appendix H and the laboratory analytical reports are provided in Appendix I.

5.2.3 Subslab Soil Gas Results

During September 2011 and February 2012 sampling events at Building 10, there were no VOC concentrations detected above the residential and nonresidential Site-Specific or the NJDEP VIG screening levels at both subslab soil gas locations.

A summary of the analytical data is provided on Table 5-2. The TCE and PCE analytical subslab soil gas results are shown on Figure 5-1.

5.2.4 Indoor Air Sampling Results

During September 2011 and February 2012 sampling events at Building 10, there were no VOC concentrations detected above the residential and nonresidential Site-Specific or the NJDEP VIG screening levels at any of the indoor air locations.

The indoor air analytical results of all compounds are provided on Table 5-3. The TCE and PCE analytical results for indoor air are shown on Figure 5-1.

5.2.5 Integrated Discussion of Results

Subslab and indoor air analytical results from September 2011 and February 2012 sampling events indicate there is not a complete exposure pathway.

5.2.6 Conclusions and Recommendations

VOCs have not been migrating into the indoor air at concentrations of concern. This is likely due to the installation of the subslab mitigation system. Semi-annual monitoring of the remedial system has proven that the system is operating properly. USACE recommends continuing semi-annual monitoring for another year at which time the data will be evaluated to determine the need for further sampling, frequency of sampling, and operation of the mitigation system.

5.3 EPA BUILDING 18

EPA Building 18 is located near the border of soil Area 18E. Building 18 is a two-story brick building built on a concrete slab on grade and is located within the Groundwater AOC 8A/B plume. The building consists of office space and is surrounded by a parking lot with a small landscaped lawn area. The building is currently unoccupied and slated for demolition.

Thirteen sampling events were conducted by USACE at EPA Building 18 from February 2006 through February 2011. Current investigation activities included subslab soil gas and indoor air sampling collected during September 2011. The building was vacated and the utilities were turned off during the winter of 2012. The EPA plans to demolish the building, pending funding. After the September 2011 sampling event, USACE and NJDEP agreed to halt sampling at Building 18.

5.3.1 Prior Investigations

During Area 18E investigations, TCE concentrations were detected in both soil and groundwater exceeding their respective NJDEP criteria at locations within 100 ft of the building. Subslab soil gas samples have been collected at Building 18 since December 2004 by the EPA and USACE. TCE, PCE, and benzene concentrations have been detected in soil gas or indoor air exceeding the residential and nonresidential NJDEP VIG screening levels.

The EPA data suggested a complete VI pathway existed at Building 18. The EPA decided to install a subslab mitigation system in 2005. USACE re-sampled both subslab soil gas and indoor air to confirm prior EPA results in January 2006. The results of this investigation did not support the presence of a VI pathway as no VOCs were detected in either media in exceedance of the NJDEP VIG screening levels. However, sampling events continued with events from June 2006 to February 2011. PCE has only once been detected in indoor air samples greater than residential and nonresidential NJDEP VIG screening levels. However, TCE and PCE were detected in the subslab soil gas above the NJDEP VIG screening levels during varying sampling events. Because TCE and PCE continue to be detected in the subslab soil gas above the NJDEP VIG screening levels, semi-annual sampling continues for Building 18.

The March 2009 analytical results for Building 18 showed TCE and benzene concentrations detected in one subslab soil gas air sample exceeding the current regulatory screening levels. Benzene, PCE, and TCE concentrations in indoor air did not exceed regulatory screening levels for all samples; however, methylene chloride was detected at two location points (018-04 and 018-05) above regulatory screening levels. Since methylene chloride concentrations were not detected in groundwater or in any subslab soil gas samples, it was assumed to be related to non-DOD activities and is also a common laboratory contaminant. Continued semi-annual subslab and indoor air sampling of this building was recommended in the *Draft IAQ Report #6* (Shaw, August 2010) with emphasis on ensuring that the subslab system is operating properly.

During both September 2010 and February 2011 sampling events, TCE concentrations in subslab soil gas did exceed regulatory limits at sampling location 018-SG-05. However, indoor air and ambient sample results for Building 18 did not have any VOC concentrations above residential NJDEP VIG screening levels for both sampling events. Continued semi-annual monitoring of this building was recommended in the *Draft IAQ Report #7* (Weston, November 2012).

5.3.2 Current Investigation

Two subslab soil gas and two indoor air sample locations were collected during the September 2011 sampling event. They were not subsequently sampled since the building was vacated in the winter of 2012. Subslab soil gas and indoor air sample locations from EPA Building 18 are shown on Figure 5-2. The Hazsite EDD is provided in Appendix H and the laboratory analytical reports are provided in Appendix I.

5.3.3 Subslab Soil Gas Results

During the September 2011 sampling event, there were no VOC concentrations detected in the subslab soil gas exceeding the residential or nonresidential screening levels for either Site-Specific or the NJDEP VIG screening levels. The complete subslab soil gas results for the current investigation are shown on Table 5-4 and on Figure 5-2.

5.3.4 Indoor Air Sampling Results

During the September 2011 sampling event, there were no VOC concentrations exceeding the residential or nonresidential Site-Specific or the NJDEP VIG screening levels in the indoor air samples or the background ambient air samples. The indoor air and background ambient air results are shown on Table 5-5 and illustrated on Figure 5-2.

5.3.5 Integrated Discussion of Results

In previous investigations, TCE concentrations in subslab soil gas did exceed regulatory limits at sampling location 018-SG-05. However, there were no concentrations exceeding regulatory screening levels in subslab soil gas during the September 2011 sampling event. The indoor air and ambient sample results for Building 18 did not have any VOC concentrations above NJDEP VIG screening levels. This is likely due to the proper operation of the subslab mitigation system.

5.3.6 Conclusions and Recommendations

Based on the recent analytical results, VOCs have not been consistently migrating into the building at concentrations of concern likely due to the implementation of a subslab mitigation system. Monitoring of the system has proven that the system is operating properly. Since Building 18 is no longer in use and has been vacated with plans of demolition, monitoring was discontinued.

5.4 EPA BUILDING 200

EPA Building 200 is a single-story brick building built on a concrete slab on grade located within the Groundwater AOC 8A/B plume. The building consists of office space and is surrounded by a parking lot with a small landscaped lawn area. The building is currently used as a medical facility (nurse's station).

Eighteen previous rounds of subslab soil gas sampling were conducted at EPA Building 200 from January 2005 through February 2011, and 17 rounds of indoor air sampling were conducted from January 2006 through February 2011. Current investigation activities include subslab soil gas and indoor air sample collection during September 2011 and February 2012.

5.4.1 Prior Investigations

During Area 18E investigations, TCE concentrations were detected in both soil and groundwater exceeding the NJDEP criteria at locations within 100 ft of Building 200. Subslab soil gas samples have been collected at Building 200 since December 2004 by the EPA and by USACE. TCE, chloroform, and carbon tetrachloride concentrations have been detected in soil gas or indoor air exceeding the residential and nonresidential NJDEP VIG screening levels. Results indicated that a complete VI pathway from subslab soil gas to indoor air existed for Building 200. Based on the results, a subslab mitigation system was installed by the NJDEP in 2005.

Analytical data from sampling events through February 2011 continued to show sporadic concentrations of TCE detected above subslab soil gas screening levels (Weston, 2012).

5.4.2 Current Investigation

One subslab soil gas and two indoor air sample locations were collected during the September 2011 and February 2012 sampling events. Subslab soil gas and indoor air sample locations for EPA Building 200 are shown on Figure 5-3. The subslab soil gas point was sampled in the office area by the nurse's desk. The indoor air samples were collected at the nurse's desk and the bookcase by the patients' rooms. One background ambient air sample was collected during each sampling round. The Hazsite EDD is provided in Appendix H and the laboratory analytical reports are provided in Appendix I.

5.4.3 Subslab Soil Gas Results

During September 2011 and February 2012, TCE concentrations were detected in soil gas above the residential and nonresidential Site-Specific and the NJDEP VIG screening levels. No other VOCs were detected above their Site-Specific or NJDEP VIG screening levels for subslab soil gas. The complete subslab soil gas results for the current investigation (September 2011 and February 2012) are shown on Table 5-6 and on Figure 5-3. Table 5-13 contains a summary of the subslab soil gas exceeding the Site-Specific or the NJDEP VIG screening levels.

Table 5-13: Building 200 Subslab Soil Gas Sample Exceedance Summary

Compound	No. of Samples Exceeding*[1]	Range In Concentration Exceeding[2] ($\mu g/m^3$)	NJDEP VIG Table 1 Nonresidential Subslab Soil Gas Screening Level ($\mu g/m^3$)	NJDEP VIG Table 1 Residential Subslab Soil Gas Screening Level ($\mu g/m^3$)	Site-Specific Nonresidential Subslab Soil Gas Screening Level ($\mu g/m^3$)	Site-Specific Residential Subslab Soil Gas Screening Level ($\mu g/m^3$)
TCE (September 2011)	2 of 2	216 - 221	150	27	150	22
TCE (February 2012)	2 of 2	88.1 - 104	150	27	150	22

* Including duplicate samples.
[1]Exceedances are the most stringent of the four criteria compared in the table.
[2]Range of concentration exceeding the most stringent criterion listed.

5.4.4 Indoor Air Sampling Results

During September 2011 and February 2012, there were no VOC concentrations detected in indoor air samples above the Site-Specific or NJDEP VIG screening levels, nor did the background samples have concentrations exceeding the NJDEP VIG subslab soil gas screening levels. The complete indoor air sampling results for the current investigation are shown on Table 5-7 and on Figure 5-3.

5.4.5 Integrated Discussion of Results

During the September 2011 and February 2012 sampling events, TCE was detected above both the residential and nonresidential Site-Specific and NJDEP VIG screening levels for subslab soil gas. However, the indoor air samples in both rounds did not show VOC concentrations exceeding the screening levels, indicating there is not a complete exposure pathway - likely due to the proper operation of the subslab mitigation system. As a result, there are no health risks posed from vapors.

Historic subslab and indoor air sampling results corroborated that a complete exposure pathway existed from groundwater to soil gas to indoor air at Building 200. However, since the September 2010 sampling event, the data have shown a significant decrease in concentrations of PCE and TCE in subslab soil gas.

5.4.6 Conclusions and Recommendations

Based on the analytical data from September 2011 and February 2012, it appears that there is no longer a potential exposure pathway causing a human health risk likely due to the subslab mitigation system. It should be noted that there is no vent on this system that would allow VR samples to be collected. It is recommended that the monitoring continue at the same semi-annual frequency for the next year. USACE will evaluate the data to determine the proper flow-rate and operation of the mitigation system and need for future sampling.

5.5 EPA BUILDING 205

EPA Building 205 is a single-story brick building built on a concrete slab on grade, located within the Groundwater AOC 8A/B plume. The building is surrounded by a parking lot with a small landscaped area and contains EPA offices and warehouse space.

Fifteen previous rounds of subslab soil gas sampling events were conducted by USACE from January 2005 through February 2011, and 14 rounds of indoor air sampling were conducted in January 2006 through February 2011. Current investigation activities include subslab soil gas and indoor air sample collection during the September 2011 and February 2012 sampling events.

5.5.1 Prior Investigations

During Area 18E investigations, TCE concentrations were detected in both soil and groundwater exceeding the NJDEP criterion at locations within 100 ft of Building 205. Subslab soil gas samples have been collected at Building 205 since December 2004 by EPA and by USACE since January 2005. Benzene, carbon tetrachloride, chloroform, and TCE were detected in subslab soil gas exceeding the EPA Table 2C-SSG screening benchmarks. In addition, TCE concentrations were detected in the indoor air by EPA, suggesting soil gas as a source of the TCE concentrations detected during the EPA investigation. The EPA installed a subslab mitigation system in 2005.

USACE collected a subsequent round of subslab soil gas and indoor air samples in January 2006. The results of this investigation did not suggest the presence of a VI pathway as TCE was detected in subslab soil gas exceeding the residential and the nonresidential NJDEP VIG screening levels but not in indoor air.

In June 2008, September 2008, and March 2009, the analytical results did not have detections of PCE and TCE above the residential NJDEP VIG regulatory screening levels. However, the September 2010 and February 2011 results did show the presence of TCE and PCE in the subslab soil gas samples. Building 205 was undergoing renovations during these sampling events and sampling could have been affected by those activities. Methylene chloride was also detected in the subslab soil gas above NJDEP VIG screening levels during previous investigations and in indoor air at two locations (205-11 and 205-19). Since methylene chloride was not detected in groundwater analytical data, it is assumed to be related to non-DOD activities and is also a common laboratory contaminant. Continued semi-annual subslab and indoor air sampling of this building was recommended in the *Final IAQ Report #7.*

5.5.2 Current Investigation

Five subslab soil gas locations and five indoor air locations were each sampled during the September 2011 and February 2012 sampling events. Samples were collected in Bay A, Bay B, Training Center, and Small Conference Room. Subslab soil gas and indoor air sample locations for EPA Building 205 are shown on Figure 5-4. The Hazsite EDD is provided in Appendix H and the laboratory analytical reports are provided in Appendix I.

5.5.3 Subslab Soil Gas Results

The complete subslab soil gas results for the September 2011 and February 2012 sampling events at Building 205 are shown on Table 5-8. The sample locations along with the PCE and TCE results are depicted on Figure 5-4. The following Table 5-14 contains a summary of the subslab soil gas exceeding NJDEP VIG screening levels.

Table 5-14: Building 205 Subslab Soil Gas Sample Exceedance Summary

Compound	No. of Samples Exceeding*[1]	Range In Concentration Exceeding[2] ($\mu g/m^3$)	NJDEP VIG Table 1 Nonresidential Subslab Soil Gas Screening Level ($\mu g/m^3$)	NJDEP VIG Table 1 Residential Subslab Soil Gas Screening Level ($\mu g/m^3$)	Site-Specific Nonresidential Subslab Soil Gas Screening Level ($\mu g/m^3$)	Site-Specific Residential Subslab Soil Gas Screening Level ($\mu g/m^3$)
Chloroform (September 2011)	1 of 7	37-37	27	24	NLE	NLE
Chloroform (February 2012)	2 of 7	27-29	27	24	NLE	NLE
TCE (September 2011)	6 of 7	24-313	150	27	150	22
TCE (February 2012)	2 of 7	152-155	150	27	150	22

* Including duplicate samples.
NLE – No Level Established
[1]Exceedances are the most stringent of the four criteria compared in the table.
[2]Range of concentration exceeding the most stringent criterion listed.

During the September 2011 and February 2012 sampling events, the analytical results of subslab soil gas indicated TCE and chloroform concentrations above the residential and nonresidential NJDEP VIG screening levels. Additionally, TCE was detected at concentrations above both the residential and nonresidential Site-Specific screening levels as well. There were no other VOC concentrations detected above NJDEP VIG residential and nonresidential screening levels in the subslab soil gas samples.

5.5.4 Indoor Air Sampling Results

During September 2011 and February 2012, there were no VOC concentrations detected in indoor air samples above the Site-Specific or NJDEP VIG screening levels, nor did the background samples have concentrations exceeding the NJDEP VIG subslab soil gas screening levels. The complete indoor air sampling results for the current investigation are shown on Table 5-9 and on Figure 5-4.

5.5.5 Integrated Discussion of Results

While TCE and chloroform were detected in soil gas during both sampling events, it was not detected in the indoor air above NJDEP VIG screening levels. This is likely due to Building 205 having a subslab mitigation system. The methylene chloride concentrations in the indoor air analytical results are likely to be laboratory contaminants since there is not a complete exposure pathway.

5.5.6 Conclusions and Recommendations

Since TCE was not detected in indoor air, it is assumed that the exposure pathway is incomplete. It is concluded that the installation of a subslab mitigation system within the building has successfully addressed the potential for VI. Continued semi-annual subslab and indoor air sampling of this building is recommended for the next year. USACE will evaluate the data to determine future sampling needs.

5.6 EPA BUILDING 209

EPA Building 209 is a single-story brick building built on a concrete slab on grade, located to the west of the Groundwater AOC 8A/B plume. The building consists of office space and is surrounded by a parking lot with a small landscaped lawn area. Building 209 does not have a subslab mitigation system.

Twelve previous sampling events were conducted by USACE from January 2006 through February 2011. Current investigation activities include subslab soil gas and indoor air samples collected during the September 2011 and February 2012 sampling events.

5.6.1 Prior Investigations

USACE has collected 12 rounds of subslab soil gas and indoor air samples from January 2006 through March 2009. The results of previous investigations did not suggest the presence of a complete VI pathway. While TCE was detected in subslab soil gas exceeding NJDEP VIG screening levels, it was not detected consistently in indoor air. PCE and TCE were only detected in indoor air above the residential and nonresidential NJDEP VIG screening level during one of 12 sampling events (June 2008).

During the March 2009 sampling event, PCE, chloroform, and methylene chloride were detected in subslab soil gas under Building 209 at concentrations exceeding their residential NJDEP VIG screening levels. Methylene chloride was also detected in several indoor air sampling location points during the March 2009 event, as well as previous sampling events (September 2008, June 2008, and November 2007). However, methylene chloride is a common laboratory contaminant and the EPA operates a laboratory within Building 209.

During the September 2010 sampling event, chloroform, and PCE concentrations in subslab soil gas exceeded the residential NJDEP VIG screening levels. Although PCE was not detected in indoor air, concentrations were detected in the background ambient sample. Since the compounds vary by media, there does not appear to be a complete exposure pathway for VOC concentrations. However, USACE agreed to continue monitoring on a semi-annual basis for Building 209.

5.6.2 Current Investigation

A total of six subslab soil gas points and six indoor air points were sampled from the cage areas, service warehouse, the kitchen/office area, the extraction lab, and the microscopy lab during the September 2011 and February 2012 sampling event. Subslab soil gas and indoor air sample locations at EPA Building 209 are shown on Figure 5-5. The Hazsite EDD is provided in Appendix H and the laboratory analytical reports are provided in Appendix I.

5.6.3 Subslab Soil Gas Results

The complete subslab soil gas results for the current investigation are shown on Table 5-10. The sample locations with the TCE and PCE analytical results are depicted on Figure 5-5. Table 5-15 contains a summary of the subslab soil gas exceeding NJDEP VIG screening levels.

Table 5-15: Building 209 Subslab Soil Gas Sample Exceedance Summary

Compound	No. of Samples Exceeding*[1]	Range In Concentration Exceeding[2] ($\mu g/m^3$)	NJDEP VIG Table 1 Nonresidential Subslab Soil Gas Screening Level ($\mu g/m^3$)	NJDEP VIG Table 1 Residential Subslab Soil Gas Screening Level ($\mu g/m^3$)	Site-Specific Nonresidential Subslab Soil Gas Screening Level ($\mu g/m^3$)	Site-Specific Residential Subslab Soil Gas Screening Level ($\mu g/m^3$)
Chloroform (September 2011)	1 of 8	40-40	27	24	NLE	NLE
Chloroform (February 2012)	1 of 8	182-182	27	24	NLE	NLE

* Including duplicate samples.
NLE – No Level Established
[1]Exceedances are the most stringent of the four criteria compared in the table.
[2]Range of concentration exceeding the most stringent criterion listed.

During the September 2011 and February 2012 sampling events, chloroform concentrations in subslab soil gas exceeded the residential and nonresidential NJDEP VIG screening levels. No other VOCs were detected at concentrations exceeding the NJDEP VIG or the Site-Specific screening levels.

5.6.4 Indoor Air Sampling Results

The complete indoor air and background air results for the current investigation are shown on Table 5-10. The PCE and TCE sample results for indoor air are shown on Figure 5-5. Compounds that exceed any of the residential or nonresidential NJDEP VIG or Site-Specific screening levels are shown in Table 5-16 below:

Table 5-16: Building 209 Indoor Air Exceedance Sample Summary

Compound	No. of Samples Exceeding*[1]	Range of Concentrations Exceeding[2] ($\mu g/m^3$)	NJDEP VIG Table 1 Non-residential Indoor Air Screening Level ($\mu g/m^3$)	NJDEP VIG Table 1 Residential Indoor Air Screening Level ($\mu g/m^3$)	Site-Specific Nonresidential Indoor Air Screening Level ($\mu g/m^3$)	Site-Specific Residential Indoor Air Screening Level ($\mu g/m^3$)
Benzene (January 2012)	2 of 9	2.4-3.5	2	2	NLE	NLE
Benzene (February 2012)	4 of 9	3.5-6.1	2	2	NLE	NLE
Ethylbenzene (September 2011)	1 of 9	3.6-3.6	5	2	NLE	NLE
Ethylbenzene (February 2012)	4 of 9	4-6.1	5	2	NLE	NLE
Methylene chloride° (September 2011)	1 of 9	101-101	1200	96	NLE	NLE
Methylene chloride° (February 2012)	1 of 9	103-103	1200	96	NLE	NLE
TCE (February 2012)	3 of 9	0.7-2.5	3	3	3	0.43

*Including duplicate samples and ambient air samples.
°Common laboratory contaminant.
NLE – No Level Established
[1]Exceedances are the most stringent of the four criteria compared in the table.
[2]Range of concentration exceeding the most stringent criterion listed

During the February 2012 sampling event, TCE was detected above the residential Site-Specific screening levels, but below the NJDEP residential VIG screening levels. During the September 2011 and February 2012 sampling events, methylene chloride, ethylbenzene, and benzene were detected in indoor air above NJDEP VIG screening levels. Benzene and ethylbenzene may be related to gasoline used around the building and in the warehouse spaces, and methylene chloride is a common laboratory contaminant. None of these VOCs were detected above the NJDEP VIG and the Site-Specific screening levels in the background ambient sample.

5.6.5 Integrated Discussion of Results

Chloroform concentrations were detected in subslab soil gas above the NJDEP VIG screening levels in September 2011 and February 2012. However, chloroform was not detected in indoor air. Benzene, ethlybenzene, and methylene chloride concentrations were detected in indoor air exceeding NJDEP VIG screening levels. TCE was detected above the residential Site-Specific screening levels, but below the residential NJDEP VIG screening levels. Since the compounds vary by media, there does not appear to be a complete exposure pathway for VOC concentrations.

5.6.6 Conclusions and Recommendations

PCE and TCE concentrations in both soil gas and indoor air continue to remain below NJDEP VIG screening levels. Three indoor air TCE concentrations were above the Site-Specific residential screening levels, but below the NJDEP residential VIG screening levels. The continuation of semi-annual monitoring of Building 209 is recommended for the next year. USACE will evaluate the data to determine future sampling needs.

SECTION 6.0
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TABLES

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160 Fieldcrest - January 6, 2012 Progress Report

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