



**U.S. ARMY CORPS OF ENGINEERS**

**FINAL**

**INDOOR AIR QUALITY  
REPORT #4**

**FORMER RARITAN ARSENAL  
EDISON, NEW JERSEY**

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## LIST OF ABBREVIATIONS

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|                  |   |                                                                                                                                         |
|------------------|---|-----------------------------------------------------------------------------------------------------------------------------------------|
| Amax             | - | Amax Engineering Corporation                                                                                                            |
| AOC              | - | area of concern                                                                                                                         |
| ATSDR            | - | Agency for Toxic Substances and Disease Registry                                                                                        |
| bgs              | - | below ground surface                                                                                                                    |
| Brooks           | - | Brooks Equipment Company                                                                                                                |
| Building 151     | - | 151 Fieldcrest Avenue                                                                                                                   |
| Building 160     | - | 160 Fieldcrest Avenue                                                                                                                   |
| Building 165     | - | 165 Fieldcrest Avenue                                                                                                                   |
| C                | - | cancer                                                                                                                                  |
| CD               |   | Compact Disc                                                                                                                            |
| Celsis           | - | Celsis Laboratory Group                                                                                                                 |
| cis-1,2-DCE      | - | cis-1,2-dichloroethene                                                                                                                  |
| Clayton          | - | Clayton Group Service                                                                                                                   |
| CLR              | - | Calcium Lime Rust                                                                                                                       |
| cm               | - | centimeter                                                                                                                              |
| COPC             | - | contaminant(s) of potential concern                                                                                                     |
| CSSC             | - | Coordinated Systems & Services Corporation                                                                                              |
| DERP-FUDS        | - | Defense Environmental Restoration Program – Formerly Used Defense Sites                                                                 |
| DOD              | - | Department of Defense                                                                                                                   |
| EPA              | - | United States Environmental Protection Agency                                                                                           |
| EPA Table 2C-GW  | - | EPA Generic Screening Benchmarks for Target Indoor Air Concentrations – Groundwater                                                     |
| EPA Table 2C-SSG | - | EPA Generic Screening Benchmarks for Target Indoor Air Concentrations – Shallow Soil Gas                                                |
| FBC              | - | Federal Business Centers                                                                                                                |
| former Arsenal   | - | Former Raritan Arsenal                                                                                                                  |
| ft               | - | feet                                                                                                                                    |
| GWQS             | - | Groundwater Quality Standard(s)                                                                                                         |
| i2t2             | - | International Information Technology Team                                                                                               |
| IAQ              | - | indoor air quality                                                                                                                      |
| IAQ Approach     | - | Approach for Evaluating Potential Indoor Air Quality Impacts (USACE, 2001)                                                              |
| Mackay           | - | Mackay Communications                                                                                                                   |
| Method TO-15     | - | Compendium of Methods for the Determination of Toxic Organic Compounds in Ambient Air: Method TO-15, Second Edition (EPA, January 1999) |
| mg/kg            | - | milligram per kilogram                                                                                                                  |
| mg/kg-d          | - | milligrams per kilogram per day                                                                                                         |
| mg/L             | - | milligrams per liter                                                                                                                    |
| MNA              | - | Monitored Natural Attenuation                                                                                                           |
| MOL              | - | MOL America, Inc.                                                                                                                       |

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## LIST OF ABBREVIATIONS (Continued)

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|                     |   |                                                         |
|---------------------|---|---------------------------------------------------------|
| MRL                 | - | Minimal Risk Levels                                     |
| MSDS                | - | Material Safety Data Sheet                              |
| MSSCC               | - | Most Stringent Soil Cleanup Criteria                    |
| MTBE                | - | methyl tertiary butyl ether                             |
| N                   | - | noncancer                                               |
| NIOSH               | - | National Institute for Occupational Safety and Health   |
| NJDEP               | - | New Jersey Department of Environmental Protection       |
| OSHA                | - | Occupational Safety and Health Administration           |
| PCE                 | - | tetrachloroethylene                                     |
| PEL                 | - | permissible exposure limits                             |
| PID                 | - | photoionization detector                                |
| QC                  | - | Quality Control                                         |
| RA                  | - | remedial action                                         |
| RAWP                | - | Remedial Action Work Plan                               |
| RBC                 | - | EPA Region III Risk Based Concentrations for Indoor Air |
| RD/RA               | - | remedial design/remedial action                         |
| RI/FS               | - | Remedial Investigation/Feasibility Study                |
| SOP                 |   | Standard Operating Procedure                            |
| Shaw                |   | Shaw Environmental, Inc.                                |
| TAGA                | - | trace atmospheric gas analyzer                          |
| TCE                 | - | trichloroethylene                                       |
| THQ                 | - | total hazard quotient                                   |
| TR                  | - | target risk                                             |
| ug/L                | - | micrograms per liter                                    |
| ug/m <sup>3</sup>   | - | micrograms per cubic meter                              |
| USACE               | - | United States Army Corps of Engineers                   |
| USI                 | - | US Infrastructure, Inc.                                 |
| VIG                 | - | Vapor Intrusion Guidance                                |
| VOC                 | - | volatile organic compound                               |
| Weston <sup>®</sup> | - | Weston Solutions, Inc.                                  |

## EXECUTIVE SUMMARY

The United States Army Corps of Engineers (USACE) is conducting an ongoing Remedial Investigation/Feasibility Study (RI/FS), and Remedial Design/Remedial Action (RD/RA) activities at the former Raritan Arsenal under the Defense Environmental Restoration Program/Formerly Used Defense Sites (DERP/FUDS). The New Jersey Department of Environmental Protection (NJDEP) provides regulatory oversight. The investigations have included ongoing sampling to evaluate potential vapor intrusion into buildings from volatile organic compounds (VOCs) in soil and groundwater. Beginning in 2003 the scope of the monitoring program to date has focused on Groundwater Areas of Concern (AOCs) 2, 4, 6, 8, and 10. Since that time, the USACE has been able to demonstrate that no further monitoring in AOCs 4 and 10 is required. In addition, the number of buildings that required monitoring in the remaining AOCs has also been reduced. USACE has evaluated all Groundwater AOCs with current/historical exceedances (attributable to historic Army contamination) of the New Jersey Department of Environmental Protection (NJDEP) Vapor Intrusion Guidance (VIG) groundwater screening levels. This report focuses on the results from indoor air and sub-slab soil gas sampling events completed during the period from August 2007 through October 2008, and summarizes results relative to prior sampling events. Future reports will summarize sampling results on an annual basis.

Buildings requiring investigation were sampled for VOCs in sub-slab soil gas and indoor air. Building walkthroughs were conducted and the *NJDEP Building Survey and Sampling Form* was completed prior to the sampling to identify non-vapor-migration-related potential sources of indoor air contaminants. Indoor air samples were collected with a SUMMA canister. Upon completion of indoor air sampling, sub-slab soil gas samples were collected using the previously installed sample ports through the building slab, and drawing the soil gas into a SUMMA canister. The results of all the data were evaluated collectively to determine whether the vapor intrusion pathway is complete for each building, to make recommendations for future action, and/or to determine if existing vapor mitigation systems are operating effectively. A summary of results and recommendations for each building sampled during this period is provided in Executive Summary Tables (ES) provided in this section.

### AOC 2

A total of seven buildings were sampled within AOC 2 (Table ES-1) during the current investigation. The following section provides a summary of analytical results and recommendations for subject buildings located within AOC-2.

The building located at 165 Fieldcrest Avenue (Building 165) had recent (August 2007-September 2008) sampling results showing a decreasing trend in volatile organic concentration in the sub-slab. However, volatile organic compounds continue to be detected above regulatory screening levels in both the indoor air samples and the vapor recovery system. After an evaluation of the data from the most recent sampling rounds (August 2007 – September 2008), continued semi-annual monitoring is proposed for Building 165. For Building 165, the adequacy of the monitoring program will continue to be reevaluated on an annual basis to determine whether to remain on the same or reduced monitoring frequency for the subsequent year. It is

also recommended that the vapor recovery system at Building 165 continue to be monitored on a semi-annual frequency to ensure that it is effectively removing contaminants present in the sub-slab soil gas.

Recent analytical data collected for the building located at 151 Fieldcrest Avenue (Building 151) continues to show volatile organic compounds in the sub-slab. However, indoor air analytical results for samples collected since January 2006 continue to show little or no volatile organic compounds above regulatory standards, indicating no volatile organic compound pathway between the sub-slab and indoor air. Because of the location of this building in relationship to the AOC-2 plume, the USACE and the NJDEP have agreed to continue annual sub-slab sampling for this building for the next 3 years.

Recent analytical data collected for the building located at 160 Fieldcrest Avenue (Building 160) continues to show sub-slab concentrations of tetrachloroethylene and trichloroethylene above regulatory standards. However, these compounds are not being detected in any indoor air samples collected during the same sampling periods, which indicates no current direct pathway between the sub-slab and indoor air. The USACE is currently operating a passive sub slab vapor mitigation system for this building. A final round of passive sampling will be completed in March 2009 followed by a summary report. This report will summarize the operation and monitoring of the system since it was installed and make recommendations for future monitoring of the building.

Campus Plaza I do not have exceedance for TCE in either soil gas or indoor air in all rounds collected to date. PCE has been detected periodically in soil gas and indoor air, however the most recent sampling event shows no exceedances in soil gas and two exceedances in indoor air (3.12 and 12.88 ug/m<sup>3</sup>) in indoor air. This would indicate that sources other than groundwater may be contributing to PCE in the indoor air. Furthermore, groundwater results in close proximity to Campus Plaza I do not show any exceedances of NJDEP VIG groundwater screening levels. USACE concludes that a complete vapor intrusion pathway is not present at this building and No Further Action is warranted.

Recent analytical data continues to show a decreasing trend in sub-slab volatile organic compounds in Campus Plaza 2. Since January 2006 (Sampling Event No. 2) volatile organic compounds, particularly trichloroethylene, has shown a steady decreasing trend in maximum sub-soil gas concentrations. Recent indoor air analytical results show trichloroethylene concentrations above regulatory screening levels. However, USACE recommends no further action at Campus Plaza 2 due to the presence of an interior source of TCE. In a May 7, 2008 letter to the USACE the NJDEP concurred with this recommendation with the condition that future sub-slab soil gas sampling may be required. Should the TCE source be eliminated, future sub-slab and indoor air sampling maybe needed to verify reduction of this contaminant to below levels of concern.

Recent sub-slab analytical results for Campus Plaza 4 continue to show elevated levels of tetrachloroethylene and trichloroethylene above regulatory screening levels. Though recent indoor air analytical results have levels for these compounds below regulatory screening levels, the USACE has agreed to continue both sub-slab and indoor air sampling for this building.

Campus Plaza V had a vapor mitigation system installed in 2004 following two indoor air rounds collected by EWMA in April 2004 and June 2004 and one sub slab soil gas round collected in June 2004. These rounds detected exceedances of both TCE and PCE in soil gas and indoor air. USACE collected one round of indoor air and subslab soil gas in October 2004 prior to start up of the vapor mitigation system and results indicated no exceedances of TCE or PCE in any of the samples. After system start up, USACE collected additional samples in January 2006, April 2007 and most recently in June 2008. All rounds indicate no exceedances of TCE or PCE with the exception of one anomaly in June 2008 which detected PCE at 579.1 ug/m3.

This result is not consistent with historic results from this sample point and does not suggest it is emanating from the subsurface. USACE's position for this building is No Further Action based on the fact that USACE would not have installed a system based on the preliminary data and USACE's one and only pre-mitigation system sampling round had no exceedances. USACE believes future monitoring of this system is the responsibility of the building owner.

## **AOC 6**

Only one building within AOC 6 (Table ES-2) requires semi-annual monitoring. The building located at 102-168 Fernwood Avenue within AOC 6 was evaluated during the current and past investigations. AOC 6 groundwater data collected in 2005 indicates a decrease of volatile organic contaminant levels to concentrations approaching and/or below the NJDEP GWQS. Recent indoor air and sub-slab analytical results continue to show volatile organic compounds exceeding regulatory screening levels. The data does not indicate a complete pathway for vapor intrusion, however sub slab soil gas at one location are ten times the screening number for TCE. Based on this information USACE is continuing to collect indoor air/soil gas data and also collecting data to measure flow and vacuum determine radius of influence, and analyzing real time sub surface soil gas concentrations utilizing a mobile laboratory. Based on these results a passive (wind driven) system may be installed to address TCE soil gas beneath the building.

## **AOC 8**

A total of five buildings were sampled within AOC 8 (Table ES-3) during the current investigation. All five buildings are owned and occupied by the United States Environmental Protection Agency (USEPA) located on Woodbridge Avenue. The following section provides a summary of analytical results and recommendations for subject buildings located within AOC-8.

Recent sub-slab analytical results for EPA Building 10 continue to show elevated concentrations of trichloroethylene in the soil gas above regulatory limits. Indoor air analytical results do not show trichloroethylene concentrations above regulatory limits for this building. However, indoor air concentrations of methylene chloride above regulatory screening levels were detected. Methylene chloride was not detected in groundwater analytical data or in any sub-slab soil gas concentration and was assumed to be related to non-DOD activities. EPA Building 10 currently has a sub-slab remediation system in place. Continued semi-annual sub-slab and indoor air sampling of this building is recommended with emphases on insuring that the sub-slab system is operating properly.

For EPA Building 18 the two most recent sampling events (June 2008 and September 2008) detected both tetrachloroethylene and/or trichloroethylene concentrations in sub-slab and indoor air samples exceeding current regulatory screening levels. Similar to EPA Building 10, indoor air concentrations of methylene chloride above regulatory screening levels were detected. Methylene chloride was not detected in groundwater analytical data or in any sub-slab soil gas concentration and was assumed to be related to non-DOD activities. EPA Building 18 also has a sub-slab remediation system. Continued semi-annual sub-slab and indoor air sampling of this building is recommended with emphases on insuring that the sub-slab system is operating properly.

Historical analytical data and analytical data from the most recent sampling events (August 2007 through October 2008) continues to show a decreasing trend in the concentration of trichloroethylene in sub-slab soil gas samples for EPA Building 200. Historical indoor air analytical data and indoor air analytical data from the most recent sampling events (August 2007 through October 2008) only show trichloroethylene concentrations in indoor air slightly above regulatory screening levels for this building (range of 3.1 to 3.8 micrograms per cubic meter). Similar to EPA Buildings 10 and 18, EPA Building 200 currently has an active sub-slab remediation system. The continued quarterly monitoring of Building 200 is recommended to monitor the proper operation of the remediation system.

For EPA Building 205, concentrations of trichloroethylene have been detected in the sub-slab exceeding current regulatory screening levels. However, the two most recent sampling events (September 2008 and June 2008) had sub-slab soil gas concentrations for trichloroethylene below regulatory screening levels. All 20 indoor air samples collected from August 2007 through September 2008 were below screening levels with the exception of one sample measured at 3.8 ug/m<sup>3</sup> in September 2008. Building 205 also has a sub-slab remediation system. Continued semi-annual sub-slab and indoor air sampling of this building is recommended with emphases on insuring that the sub-slab system is operating properly.

Continued monitoring is recommended for EPA Building 209. Tetrachloroethylene, trichloroethylene, chloroform and benzene were detected in sub-slab soil gas under Building 209 at concentrations exceeding their respective regulatory screening levels. These compounds were also detected in at least one indoor air sampling location point during the last three sampling events (September 2008, June 2008, and November 2007). Therefore, continued monitoring on a semi-annual basis is recommended for EPA Building 209.



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

| Area of Concern<br>AOC 2 | Results Summary                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | Proposed Action                                                                                                                                                                                                                                                                                                                                        |
|--------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Building 165             | This Report #4 includes data from the most recently sampled events that includes August 2007, May 2008 and September 2008. Tetrachloroethylene (PCE) was the only VOC detected in sub-soil gas at concentrations above its NJDEP VIG Generic Screening Levels. Benzene, chloroform and methylene/chloride, were detected in indoor air at concentrations above their NJDEP VIG Generic Screening Levels. These compounds are considered tenant-related, not being detected in soil gas. Therefore, the vapor recovery system for Building 165 is performing its intended function.                                                                                                                                                              | Continue monitoring the building on a semiannual basis to monitor the effectiveness of the vapor recovery system. The adequacy of the monitoring program will continue to be reevaluated on an annual basis to determine whether to maintain the same or reduced monitoring frequency for the subsequent year.                                         |
| Building 151             | This Report #4 includes analytical data from the most recent sampling events from November 2007 through June 2008. Report #4 only includes one round of indoor air sampling (November 2007) and two rounds of sub-slab sampling (November 2007 and June 2008). Both PCE and trichloroethylene (TCE) were analyzed above their respective NJDEP VIG Generic Screening Level only during the June 2008 sampling event. There were no sub-slab exceedances during the November 2007 sampling event. Except for benzene, no VOCs have been detected in indoor air above the NJDEP VIG screening levels during the November 2007 sampling event. Benzene is considered tenant-related as it was not detected in any recent sub-slab sampling events. | USACE has agreed to three consecutive annual sub-slab sampling rounds over the next three years to monitor this building. The first of these rounds was collected in June 2008, however another round will be collected in February 2009 in order to conduct the annual sampling in the winter.                                                        |
| Building 160             | Report #4 includes two sub-slab and indoor air sampling rounds (November 2007 and May 2008) for this building. TCE and PCE have continually been detected above VIG in sub-slab soil gas samples since September 2003 and again were detected above VIG in the two most recent sampling events. However, both TCE and PCE were not detected in indoor air above the VIG for both the November 2007 and May 2008 sampling rounds. MTBE were detected in indoor air but was unrelated to groundwater.                                                                                                                                                                                                                                             | Due to the continued presence of TCE and PCE in soil gas, USACE recommends passive indoor air monitoring of this building with operation of the passive mitigation system installed in June 2008. A separate draft report summarizing the installation of the passive mitigation system and post monitoring results was sent to NJDEP in January 2009. |

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

| Area of Concern<br>AOC 2 | Results Summary                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | Proposed Action                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
|--------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Campus Plaza 1           | Report #4 presents the sub-slab and indoor air analytical results for one sampling event (May 2008). PCE and TCE were not detected in soil gas above the current VIG. In indoor air one sample exceeded the VIG for benzene and another for PCE. PCE has not been detected in nearby groundwater wells above VIG screening levels suggesting that a complete pathway is not present.                                                                                                                                                                                                                                                                                                                                                                                                       | Based on the results to date, there does not appear to be a complete pathway for vapors at this building. There have been no exceedances for TCE in soil gas or indoor air in all sampling events to date. PCE has been detected periodically in both soil gas and indoor air, however it is often higher in indoor air than in soil gas indicating a source other than groundwater. Additionally groundwater results around Plaza I do not indicate any exceedances of NJDEP VIG groundwater screening levels. No Further Action is proposed for this building. |
| Campus Plaza 2           | Report #4 includes sub-slab and indoor air analytical results for only one sampling event (November 2007). TCE was detected in soil gas samples at a concentration exceeding the NJDEP VIG Generic Screening Level. However, it was not detected in concentrations above the NJDEP VIG Levels for indoor air.                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | USACE recommends no further action at Campus Plaza 2 due to the presence of an interior source of TCE. The NJDEP has concurred with this recommendation, but may require future indoor air monitoring if groundwater results demonstrate an increased trend for TCE and/or PCE. USACE will continue to monitor the AOC groundwater plume.                                                                                                                                                                                                                        |
| Campus Plaza 4           | Report #4 includes sub-slab and indoor air analytical for 4 individual sampling events that include August 2007, November 2007, May 2008 and September 2008. PCE and/or TCE were detected in sub-slab soil gas samples at concentrations greater than the NJDEP VIG Generic Screening Level for each of the 4 recent sampling events. However, both PCE and TCE were not detected at concentrations greater than the NJDEP VIG screening levels for all indoor air samples collected during all 4 sampling events. Only methylene chloride was detected in indoor air samples at levels exceeding NJDEP VIG screening levels for two sampling events (November 2007 and May 2008). Methylene chloride was not detected in the groundwater plume or sub-slab soil gas under Campus Plaza 4. | Continued quarterly monitoring as approved by NJDEP (letter, dated 7 Mar 2008) continues to support that a complete vapor intrusion pathway is not present at this building. USACE proposes to continue sampling indoor air and sub slab soil gas for this building on a semi-annual basis with the next round scheduled in February 2009.                                                                                                                                                                                                                       |

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

| Area of Concern<br>AOC 2 | Results Summary                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | Proposed Action                                                                                                                                                                              |
|--------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Campus Plaza 5           | All USACE sampling event prior to June 2008 indicated no VOCs were detected in sub-slab soil gas or indoor air at concentrations above their NJDEP VIG Generic Screening Levels. The first of these sampling events was completed in October 2004 prior to property owner activating the installed vapor mitigation system. This building was sampled most recently in June 2008 and results indicated PCE at a concentration of 579.11 micrograms per cubic meter of PCE in one indoor air sampling point. This anomaly is a significant spike when compared to 15 previous indoor air samples collected from October 2004 through April 2007 that did not detect any concentration of PCE. The exact source or cause for this unusual high concentration cannot be determined at this time. | USACE proposes no further monitoring at Campus Plaza 5 and recommends that the landowner be responsible for future operation and maintenance of the system as well as any future monitoring. |

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

| <b>Area of Concern<br/>AOC 6</b> | <b>Results Summary</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | <b>Proposed Action</b>                                                             |
|----------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------|
| 102-168 Fernwood Avenue          | Report #4 contains sub-slab and indoor air analytical results for 3 sampling events in November 2007, June 2008, and October 2008. PCE and TCE was detected in sub-slab soil gas samples at concentrations exceeding its NJDEP VIG screening level during the June 2008 and October 2008 sampling events with TCE results greater than 10 times the NJDEP VIG screening levels. TCE was never detected in indoor air above the NJDEP screening levels. USACE is currently collecting additional data to better delineate subsurface conditions at this building and for the possible installation of a passive mitigation system. | Continued monitoring of this building will be completed beginning in February 2009 |

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

| Area of Concern<br>AOC 8 | Results Summary                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | Proposed Action                                                                                                                                                                                   |
|--------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| EPA Building 10          | Report #4 contains sub-slab and indoor air analytical results for 3 sampling events for August 2007, June 2008, and September 2008. No VOC's were detected in indoor air samples above NJDEP VIG screening levels for the past seven sampling events (since the installation of the sub-slab remediation system) with the exception of methylene chloride which is not attributed to DOD. PCE and TCE were detected in sub-slab soil gas above NJDEP VIG screening levels, but are not posing a threat to indoor air.                                                                                                                                                                                                                                                                                                                                                                | Sub-slab and indoor air monitoring will continue on a semi-annual frequency.                                                                                                                      |
| EPA Building 18          | Report #4 contains sub-slab and indoor air analytical results for 3 sampling events for August 2007, June 2008, and September 2008. TCE was only detected once in both sub-slab and indoor air above NJDEP VIG screening levels. This occurred during the June 2008 sampling event. In the other two most recent sampling events (August 2007 and September 2008), VOC's (including TCE) was not detected above NJDEP VIG screening levels, with the exception of the June 2008 sampling event no VOC exceedances have been detected in indoor air for all eight sampling events (January 2006 through September 2008). PCE and TCE are periodically detected in soil gas, but are not posing a threat to indoor air.                                                                                                                                                                | Sub-slab and indoor air monitoring will continue on a semi-annual frequency.                                                                                                                      |
| EPA Building 200         | Report #4 contains sub-slab and indoor air analytical results for 4 sampling events for August 2007, November 2007, June 2008, and October 2008. TCE was detected in sub-slab soil gas at concentrations exceeding the NJDEP VIG screening levels in the first two recent sampling events (August – November 2007). However, it was not detected for both sub-slab and indoor air samples for the last two recent sampling events (June-October 2008).                                                                                                                                                                                                                                                                                                                                                                                                                               | Sub-slab and indoor air monitoring will continue on a quarterly frequency, however a reduced frequency of semi annual will be proposed if soil gas results continue to be below screening levels. |
| EPA Building 205         | Report #4 contains sub-slab and indoor air analytical results for 4 sampling events for August 2007, November 2007, June 2008, and September 2008. In September 2008 TCE was detected in indoor air samples at a concentration above NJDEP VIG screening levels. However, that concentration was only slightly above the VIG screening level (3.87 micrograms per cubic meter). Otherwise, it was not detected during the other 3 recent sampling events for indoor air. It was detected above NJDEP VIG sub-slab screening levels during the November 2007 sampling event, but was not detected in any indoor air samples during that same time period. Benzene was the only other VOC detected above NJDEP VIG screening levels for both sub-slab and indoor air during 3 of the 4 recent sampling events. However, it is attributed to tenant activities and was non-DOD related. | Sub-slab and indoor air monitoring will continue on a semi-annual frequency.                                                                                                                      |

| Area of Concern<br>AOC 8 | Results Summary                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | Proposed Action                                                              |
|--------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------|
| EPA Building 209         | Report #4 contains sub-slab and indoor air analytical results for 4 sampling events for August 2007, November 2007, June 2008, and September 2008. Both TCE and PCE were detected in sub-slab soil gas for the two most recent sampling events (June-September 2008) above NJDEP VIG screening levels. Indoor air analytical results for TCE and PCE were detected above NJDEP VIG screening levels in only one recent sampling event (June 2008). Recent sampling events indicate benzene and chloroform were detected in both indoor air and sub-slab soil gas samples at concentrations above their NJDEP VIG screening levels, but these compounds were attributed to non-DOD activities. | Sub-slab and indoor air monitoring will continue on a semi-annual frequency. |

## **SECTION 1.0 INTRODUCTION**

### **1.1 OBJECTIVE**

The U.S. Army Corps of Engineers (USACE) retained Weston Solutions, Inc. (Weston®) and Shaw Environmental, Inc. (Shaw) to evaluate the potential for vapor intrusion 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, sub-slab soil gas, and historical groundwater sampling results at each of the buildings recommended for continued evaluation per the Final Indoor Air Quality Semi-Annual Report #3 (Weston, July 2008), to assess whether a complete exposure pathway exists, and to provide recommendations on the need for further action.

This document reports the recent sampling results for buildings sampled within Groundwater Areas of Concern (AOCs) 2, 6, and 8 for the period of July 2007 through October 2008. As recommended in the *Indoor Air Quality Semi-Annual Reports #2* (Weston, September 2006) and #3 (Weston, July 2008), the buildings associated with Groundwater AOC 4 and 10 did not require any further investigation or action; therefore, Groundwater AOC 4 and AOC-10 are not included in this report.

As described in this report, USACE has evaluated all Groundwater AOCs with current/historical exceedances (attributable to historic Army contamination) of the New Jersey Department of Environmental Protection (NJDEP) Vapor Intrusion Guidance (VIG) groundwater screening levels.

### **1.2 BACKGROUND**

The 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 have identified seven Groundwater AOCs at the former Arsenal that required evaluation for indoor air quality (IAQ), as presented in the *Draft Final Groundwater Natural Attenuation Report* dated July 2002 (Weston 2002), and more recently in the *Indoor Air Quality Evaluation (Steps One through Four)* (Weston 2005), and the *Final Supplemental Groundwater Data Report* (Weston Sept 2006).

In a 12 March 2003 comment letter concerning the *Draft Final Groundwater Natural Attenuation Report* (Weston 2002), NJDEP approved natural attenuation as a means of addressing remaining groundwater contamination at the site, provided no vapor intrusion pathway existed in buildings located above the plumes. NJDEP requested the 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 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 (in December 2000).

In May 2003, prior to the initiation of the 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 sub-slab soil gas samples collected by USACE in June showed no PCE in indoor air, but did show PCE in the accompanying sub-slab soil gas samples. PCE was also found in one of four sub-slab soil samples collected from beneath Building 165. A sub-slab depressurization system was subsequently installed jointly by USACE and NJDEP; this system remains in operation.

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 the USACE evaluate the vapor intrusion 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 Indoor Air Quality Impacts*, (USACE 2004), referred to hereafter as "The IAQ Approach". In accordance with the IAQ Approach, the 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 *Vapor Intrusion Guidance* (NJDEP 2005), referred to hereafter as "VIG". The primary contaminants of concern in groundwater are VOCs, mainly trichloroethylene (TCE) and PCE. Groundwater AOC 2, Groundwater AOC 8, and Groundwater AOC 10 were evaluated first due to their higher historical concentrations of VOCs in the groundwater. In addition, Groundwater AOC 2 and Groundwater AOC 8 include buildings with sensitive receptors (e.g., daycare centers). Subsequent to evaluation of Groundwater AOCs 2, 8, and 10, Groundwater AOCs 4 and 6 were evaluated for the potential of vapor intrusion into indoor air in accordance with Work Plans developed in accordance with the NJDEP's VIG.

The first semi-annual report (Weston 2005) discussed the buildings being evaluated and monitored within Groundwater AOC 2, AOC 8, and AOC 10 from September 2004 through February 2005. The following is a list of those buildings and the proposed actions from that report.

In the first *Indoor Air Quality Semi-Annual Report*, (Weston 2005) USACE made the following recommendations by groundwater AOC:

- Groundwater AOC 2
  - 165 Fieldcrest Avenue – Continue monitoring semiannually;
  - 151 Fieldcrest Avenue – Continue monitoring semiannually;
  - 160 Fieldcrest Avenue – Continue monitoring semiannually;
  - Campus Plaza 1 – No Further Action;
  - Campus Plaza 2 – One confirmatory round of indoor air and sub-slab soil gas sampling;
  - Campus Plaza 3 – One confirmatory round of indoor air and sub-slab soil gas sampling;
  - Campus Plaza 4 – One confirmatory round of indoor air and sub-slab soil gas sampling;



- Campus Plaza 5 – One confirmatory round of indoor air and sub-slab soil gas sampling;
  - Campus Plaza 7 – One confirmatory round of indoor air and sub-slab soil gas sampling;
  - Campus Plaza 8 – One confirmatory round of indoor air and sub-slab soil gas sampling;
  - 25-27 Campus Drive – One confirmatory round of indoor air and sub-slab soil gas sampling; and
  - 20 Northfield Avenue – One confirmatory round of indoor air and sub-slab soil gas sampling.
- Groundwater AOC 8
    - 2815 Woodbridge Avenue (Grace Reformed Church and Small Blessings Day Nursery) – No Further Action;
    - 2825 Woodbridge Avenue (Apple Montessori School) – No Further Action; and
    - U.S. Environmental Protection Agency (EPA) property (Buildings 5, 10, 18, 200, 205, 238, and the Guard Shack) – one round of indoor air and sub-slab soil gas sampling was recommended.
  - Groundwater AOC 10
    - Middlesex County Training Facility – One confirmatory round of indoor air and sub-slab soil gas sampling.

The second semi-annual report (Weston 2006) discussed the buildings being evaluated and monitored within Groundwater AOC 2, AOC 4, AOC 6, AOC 8, and AOC 10 from April 2005 through April 2006. The following is a list of those buildings and the proposed actions from that report.

In the *Indoor Air Quality Semi-Annual Report #2*, (Weston September 2006) USACE made the following recommendations by groundwater AOC:

- Groundwater AOC 2
  - 165 Fieldcrest Avenue – Continue monitoring semiannually;
  - 151 Fieldcrest Avenue – No Further Action is recommended based on the weight of evidence.
  - 160 Fieldcrest Avenue – Continue monitoring semiannually; subsequently USACE agreed to quarterly monitoring.
  - Campus Plaza 1 – No Further Action; subsequently USACE agreed to one confirmatory round of indoor air and sub-slab soil gas sampling;
  - Campus Plaza 2 – Continue monitoring semiannually; subsequently USACE agreed to quarterly monitoring.
  - Campus Plaza 3 – No Further Action;
  - Campus Plaza 4 – Continue monitoring semiannually; subsequently USACE agreed to quarterly monitoring.
  - Campus Plaza 5 – No Further Action; subsequently USACE agreed to one confirmatory round of indoor air and sub-slab soil gas sampling;

- Campus Plaza 7 – No Further Action was recommended; subsequently USACE agreed to one confirmatory round of indoor air and sub-slab soil gas sampling;
  - Campus Plaza 8 – No Further Action;
  - 25-27 Campus Drive – No Further Action;
  - 20 Northfield Avenue – No Further Action; and
  - Building 150 – No additional investigation by USACE until the former tenant operations and their impact on the VOCs in the subsurface and indoor air are further evaluated by the tenant/landowner. Should the tenant/landowner investigation identify contamination that is related to the FUDS program, additional sampling by USACE may be recommended for this building.
- Groundwater AOC 4
    - 90/100-112 Northfield Avenue – one round of indoor air and sub-slab soil gas sampling was recommended; subsequently USACE agreed to semi-annual monitoring.
    - 95-97 Northfield Avenue – No Further Action;
    - 105-115 Northfield Avenue – No Further Action;
    - 114 Northfield Avenue – No Further Action;
    - 86/90-94/98-102 Mayfield Avenue and 5 Fernwood Avenue – No Further Action;
    - 75 Northfield Avenue – No Further Action;
    - 86 Northfield Avenue – No Further Action;
    - 125 Northfield Avenue – No Further Action;
    - 36/60 Mayfield Avenue – No Further Action;
    - 52/62-68/60-84 Mayfield Avenue – No Further Action;
    - 83-85 Mayfield Avenue – No Further Action;
    - 1-23 Mayfield Avenue – No Further Action;
    - 29-39 Mayfield Avenue – No Further Action; and
    - 70 Newfield Avenue – No Further Action;
  - Groundwater AOC 6
    - 102-168 Fernwood Avenue – one round of indoor air and sub-slab soil gas sampling was recommended; subsequently USACE agreed to semi-annual monitoring.
    - 110 Newfield Avenue – one round of indoor air and sub-slab soil gas sampling was recommended; subsequently USACE agreed to semi-annual monitoring.
    - 45 Fernwood Avenue – one round of indoor air and sub-slab soil gas sampling was recommended; subsequently USACE agreed to semi-annual monitoring.
    - Building 467 – one round of indoor air and sub-slab soil gas sampling was recommended; subsequently USACE agreed to semi-annual monitoring.
    - 104 Sunfield Avenue – No Further Action;
    - 107 Sunfield Avenue – No Further Action;
    - Raritan Expo Center (97 Sunfield Avenue) – No Further Action;
    - 125 Newfield Avenue – No Further Action; and
    - 105 Sunfield Avenue – No Further Action;

- Groundwater AOC 8
  - 2815 Woodbridge Avenue (Grace Reformed Church and Small Blessings Day Nursery) – No Further Action;
  - 2825 Woodbridge Avenue (Apple Montessori School) – No Further Action; and
  - U.S. Environmental Protection Agency (EPA) property
    - Building 5 – No Further Action;
    - Building 10 – Continue monitoring quarterly for the first year, with an evaluation of the proposed monitoring frequency thereafter;
    - Building 18 – Continue monitoring quarterly for the first year, with an evaluation of the proposed monitoring frequency thereafter;
    - Building 200 – Continue monitoring quarterly for the first year, with an evaluation of the proposed monitoring frequency thereafter;
    - Building 205 – Continue monitoring quarterly for the first year, with an evaluation of the proposed monitoring frequency thereafter;
    - Building 209 – No Further Action; subsequently USACE agreed to continue monitoring quarterly;
    - Building 238 – one round of sub-slab soil gas sampling after construction is completed and building is occupied;
    - New Guard Shack – one round of indoor air and sub-slab soil gas sampling is recommended after construction of newly built Guard Shack.
  
- Groundwater AOC 10
  - Middlesex County Training Facility – No further Action.

In a letter dated January 12, 2007, NJDEP concurred with USACE's findings and recommendations regarding no further action at several of these buildings (listed in tables ES-1 through ES-5) so they are not further discussed in this report.

The third report (Weston 2008) discussed the buildings being evaluated and monitored within Groundwater AOC 2, AOC 4, AOC 6, and AOC 8 from April 2006 through April 2007. The following is a list of those buildings and the proposed actions from that report.

In the Final *Indoor Air Quality Semi-Annual Report #3*, (Weston 2008) USACE made the following recommendations by groundwater AOC:

- Groundwater AOC 2
  - 165 Fieldcrest Avenue – Continue monitoring semiannually;
  - 151 Fieldcrest Avenue – USACE agrees to three consecutive sub-slab soil gas sampling rounds over the next three years to monitor this building. If the average of these three rounds of sub-slab sampling is below the NJDEP VIG screening guidelines, no further monitoring will be conducted for this building;
  - 160 Fieldcrest Avenue – Continued monitoring of soil gas and indoor air on a quarterly basis;
  - Campus Plaza 1 – The USACE agrees to one additional round of sub-slab soil gas testing at all six Campus Plaza 1 locations;
  - Campus Plaza 2 –No Further Action, due to the presence of an interior source of TCE. The NJDEP concurs subject to the condition that further sub-slab soil gas

sampling may be required. USACE will continue to monitor the AOC groundwater plume, but sees no further need for air or sub-slab soil gas monitoring;

- Campus Plaza 3 – No Further Action;
- Campus Plaza 4 – Continue semiannual monitoring while investigating potential tenant sources;
- Campus Plaza 5 - No further monitoring at Campus Plaza 5 since no COPCs were detected in sub-slab soil gas or indoor air, and the remediation system was installed by others prior to performing an evaluation of the risk level for this building. The landowner will continue to be responsible for future operation and maintenance of the system;
- Campus Plaza 7 – No Further Action;
- Campus Plaza 8 – No Further Action;
- 25-27 Campus Drive – No Further Action;
- 20 Northfield Avenue – No Further Action; and
- Building 150 – No additional investigation by USACE until the former tenant operations and their impact on the VOCs in the subsurface and indoor air are further evaluated by the tenant/landowner. Should the tenant/landowner investigation identify contamination that is related to the FUDS program, additional sampling by USACE may be recommended for this building.

- Groundwater AOC 4

- 90/100-112 Northfield Avenue – No further action is recommended, as neither TCE nor PCE were detected in sub-slab soil gas in exceedance of their respective NJDEP VIG Residential screening levels for two consecutive rounds. VOCs detected in indoor air are considered tenant-related;
- 95-97 Northfield Avenue – No Further Action;
- 105-115 Northfield Avenue – No Further Action;
- 114 Northfield Avenue – No Further Action;
- 86/90-94/98-102 Mayfield Avenue and 5 Fernwood Avenue – No Further Action;
- 75 Northfield Avenue – No Further Action;
- 86 Northfield Avenue – No Further Action;
- 125 Northfield Avenue – No Further Action;
- 36/60 Mayfield Avenue – No Further Action;
- 52/62-68/60-84 Mayfield Avenue – No Further Action;
- 83-85 Mayfield Avenue – No Further Action;
- 1-23 Mayfield Avenue – No Further Action;
- 29-39 Mayfield Avenue – No Further Action; and
- 70 Newfield Avenue – No Further Action.

- Groundwater AOC 6

- 102-168 Fernwood Avenue – One confirmatory round of sub-slab soil gas concurrent with indoor air sampling is recommended upon completion of construction in the building;
- 110 Newfield Avenue – No Further Action;
- 45 Fernwood Avenue – No Further Action;
- Building 467 – No Further Action;
- 104 Sunfield Avenue – No Further Action;

- 107 Sunfield Avenue – No Further Action;
  - Raritan Expo Center (97 Sunfield Avenue) – No Further Action;
  - 125 Newfield Avenue – No Further Action; and
  - 105 Sunfield Avenue – No Further Action.
- Groundwater AOC 8
    - 2815 Woodbridge Avenue (Grace Reformed Church and Small Blessings Day Nursery) – No Further Action;
    - 2825 Woodbridge Avenue (Apple Montessori School) – No Further Action; and
    - U.S. Environmental Protection Agency (EPA) property
      - Building 5 – No Further Action;
      - Building 10 – Reduce monitoring to a semi-annual frequency;
      - Building 18 – Reduce monitoring to a semi-annual frequency;
      - Building 200 – Continued monitoring of the remedial system on a quarterly basis, EPA already looked at adjusting the HVAC;
      - Building 205 – Continue monitoring on a quarterly basis;
      - Building 209 – Continue monitoring on a quarterly basis;
      - Building 238 – No Further Action;
      - New Guard Shack – No Further Action, the building is no longer occupied.
  - Groundwater AOC 10
    - Middlesex County Training Facility – No Further Action.

This report presents the findings of subsequent investigations conducted during the period of July 2007 through October 2008. 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 soil to indoor air. 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.

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 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 also 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 conceptual model for each Groundwater AOC plume.
- Step Three: Determine constituents of potential concern (COPCs) 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 vapor intrusion based on sensitive receptors and historical groundwater data. Expedite 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 vapor intrusion 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 will 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 vapor intrusion pathway from groundwater to indoor air and evaluate the potential IAQ impacts. If groundwater data indicate potential exceedence of residential indoor air screening benchmarks, then go to Step Six.
- Step Six: Conduct sub-slab soil gas sampling.
- Step Seven: Compare soil gas concentrations to the sub-slab soil gas screening benchmarks. Predict concentrations of VOCs in indoor air based on sub-slab soil gas data. If soil gas data indicate potential exceedence 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 Table 2C criteria, this approach was developed prior to publication of the NJDEP VIG. Moving forward, site-specific data have been and will 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 sub-slab 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 sub-slab soil gas samples to document system effectiveness.
- Step Twelve: Prepare report documenting process and results for the NJDEP.

## **1.5 REPORT ORGANIZATION**

This report presents the findings of the IAQ Investigation for Groundwater AOC 2, AOC 6, and AOC 8 at the former Arsenal, as well as supporting sub-slab soil gas data evaluations. Section 2.0, Methodology, describes the data collection methods employed, and defines the regulatory screening levels against which the analytical data are evaluated. Sections 3.0 through 5.0 present the analytical data for the various media sampled and provide discussion, conclusions, and recommendations based on the results for data collected by building. Data for each building is separated by color tabs specific to each building. Section 6.0 identifies references used in developing this report. Figures and tables for each section of the report are provided at the back of each building-specific color-coded tab. Building Survey Forms, meteorological data and Material Safety Data Sheets and the Appendices are provided electronically in Adobe format on the enclosed compact disk.

## **SECTION 2.0 METHODOLOGY**

### **2.1 SAMPLING DESIGN**

From July 2007 through October 2008, USACE collected samples of sub-slab soil gas, ambient air, 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).

Under the IAQ process for the former Arsenal, the decision to sample indoor air is based upon whether concentrations of VOCs in sub-slab soil gas exceed screening levels. The decision to sample sub-slab 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 groundwater screening levels identified in the NJDEP VIG). However, in several cases individual landowners have opted to sample indoor air directly, before sub-slab soil gas or groundwater was fully evaluated by USACE. In those cases, USACE proceeded to sample both sub-slab 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 vapor intrusion concern.

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

### **2.2 SAMPLING METHODS**

#### **2.2.1 Groundwater Evaluation**

The evaluation of groundwater has already been completed. The following section provides a summary of the methodology used to perform this past evaluation.

The process of identifying COPCs in groundwater has been described in the Draft Indoor Air Quality Investigation Report (Steps 1-4) (Weston 2004), 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. (Currently, groundwater data are evaluated against the groundwater screening criteria provided in the NJDEP VIG to determine which plumes/buildings require evaluation for potential vapor intrusion.) 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, concentrations have been attenuating over time, and so in many cases, the maximum concentrations do not reflect current conditions. Once it is determined that a groundwater plume contains VOCs at concentrations presenting a potential vapor intrusion pathway threat, sub-slab



soil gas is sampled from below buildings that are potentially affected by the contamination. The process of evaluating which specific buildings will require sub-slab soil gas sampling is determined on a building-by-building basis in accordance with the IAQ Approach (Weston 2004).

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

- *Final Site-wide Hydrogeology Report for the Former Raritan Arsenal* (Weston 1994);
- *Draft Monitored Natural Attenuation Report for the Former Raritan Arsenal* (Weston 2002); and
- *Final Supplemental Groundwater Data Report* (Weston 2006).

## 2.2.2 Sub-slab Soil Gas Sampling Method

Once it was determined that a given building required sub-slab 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 located away from sidewalls, and also are oriented toward the center of the plume.

The sub-slab soil gas sampling point installation procedure followed the *New Jersey Department of Environmental Protection Vapor Intrusion Guidance Document* (NJDEP 2005). 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, the brass vapor probe was inserted to a point flush with the top of the concrete slab (initial sub-slab 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 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. Once secured, the “T” setup made of Teflon tubing, a shut-off valve and three-way “T” was 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 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. Sub-slab soil gas samples were collected over a one-hour (approximate) period. Once the sample was collected, the SUMMA canister valve was closed and the sample port was capped.

During follow-up sampling events, the permanent port was sampled by removing the cap and securing the “T” setup to the vapor probe. A portable vacuum pump was used to purge the vapor probe through the purge line for two minutes. As soon as the vapor probe was purged, the line was closed, and the SUMMA canister valve was opened to collect the sample. Sub-slab soil gas samples were collected over a one-hour period. In cases where the vapor probe may have come

loose from the surrounding cement, Weston and Shaw repaired and resealed the port prior to sampling.

### **2.2.3 Building Survey Method**

In the event that sub-slab soil gas concentrations indicated a potential vapor intrusion pathway, indoor air sampling was performed consistent with the *Approach for Evaluating Potential Indoor Air Quality Impacts* (USACE 2004). However, 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 and Shaw conducted an inspection of each building being investigated for potential indoor air vapor intrusion to determine potential sampling locations, as well as chemical use within each building. Weston and Shaw 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 for each building. 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, 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 (MSDSs) were provided by some tenants for the chemicals observed. Weston and Shaw identified potential sample locations for indoor air and sub-slab 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 and Shaw reevaluated conditions for new products and chemicals being used or stored by building tenants that could potentially impact the indoor air quality 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 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 sub-slab soil gas and indoor air samples were collected concurrently, the indoor air samples were collected immediately prior to collection of the sub-slab soil gas samples. This was done to reduce the potential for contaminants that may be present in the sub-slab soil gas from impacting the indoor air samples, which have analytical detection limits an order of magnitude less than those obtainable for sub-slab soil gas samples.

### **2.2.5 Background Air Sampling Method**

Background ambient 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 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 from the breathing zone height (3 ft to 5 ft) and in a location away from pedestrian and vehicle traffic. The results of the background samples are compared to NJDEP Residential and Non-Residential Vapor Intrusion Guidelines so that results from indoor air sampling are viewed in an appropriate context reflective of the localized air quality.

### **2.2.6 Meteorological Data**

Meteorological data was provided by NOAA's National Climatic Data Center located in Ashville, North Carolina. Data was collected by the National Weather Service for the Newark Liberty International AP (KEWR) weather station. This location was considered to be a representative and reliable collection point for the entire Raritan Arsenal project area. The meteorological data were included in the indoor air survey forms, and in data tables included in the introductory sections for each AOC.

### **2.2.7 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 *Indoor Air VOC Sampling Analysis Requirements* (NJDEP, April 2003), and were not collected.

### **2.2.8 Sample Handling and Shipping**

Cleaned and certified 6-liter SUMMA canisters and regulators were obtained from a New Jersey certified laboratory as outlined in the *Indoor Air VOC Sampling Analysis Requirements* (NJDEP, April 2003) and the *NJDEP Vapor Intrusion Guidelines* (NJDEP 2006). After sampling, all SUMMA canisters were packaged in a box and transported to the selected New Jersey certified laboratory.

## **2.3 SCREENING BENCHMARKS**

Air sampling analytical data were compared to applicable regulatory screening levels to assess potential adverse impacts. These regulatory levels included:

1. NJDEP (March 2007) Residential and Non-Residential Vapor Intrusion Guidance Screening Levels for Sub-slab Soil Gas;
2. NJDEP (March 2007) Residential and Non-Residential Vapor Intrusion Guidance for Indoor Air; and

3. EPA Generic screening benchmarks for Target Indoor Air Concentrations and Shallow Soil Gas as provided in the *Draft Guidance for Evaluating the Vapor Intrusion to Indoor Air Pathway from Groundwater and Soils* (EPA, November 2002). (Indoor Air and Soil Gas, respectively, predominantly for evaluation of historic data.)

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 Sub-slab Soil Gas**

In October 2005, the NJDEP published the final *Vapor Intrusion Guidance* (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 Vapor Intrusion 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 2007.

In this report, the tables of results from the current sampling events and tables containing comparison of historical data from previous sampling rounds have highlighted exceedances of the 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 EPA Generic Screening Benchmarks for Target Indoor Air and Shallow Soil Gas Concentrations**

EPA published the *Draft Guidance for Evaluating the Vapor Intrusion to Indoor Air Pathway from Groundwater and Soils Vapor Intrusion* (EPA 2002). Target screening benchmark soil gas and indoor air concentrations are published in this guidance and are intended to provide a screening tool for determining whether direct indoor air sampling is appropriate. They are based on potential migration of VOCs from groundwater through soils and into the interior of a residence or office building. The screening numbers for each chemical equate to an indoor air concentration that is protective of a residential exposure (30 years, 350 days/year, 24 hours/day) based on defined target risk or hazard quotient levels. The target soil gas and indoor air levels were based on noncancer (N) or cancer (C) effects at a Target Risk (TR) of 1E-06 or a Target Hazard Quotient (THQ) of 1.

COPCs for each Groundwater AOC were evaluated by comparing their maximum detected concentrations to the screening benchmarks provided in Table 2C of EPA’s Subsurface Vapor Intrusion Guidance. The generic screening benchmark groundwater concentrations in EPA’s Table 2C reflect reasonable worst-case conditions. The USACE has identified the most recent groundwater concentrations at the same locations where maximum concentrations were detected.

Sub-slab soil gas sample results were compared to the EPA target shallow soil gas screening benchmarks, and indoor air sample results were compared directly with the target indoor air screening benchmarks. Remedial decisions are being made based on comparison of sample

concentrations to screening benchmarks presented in the NJDEP VIG. However, the EPA VI screening benchmarks continue to be presented for consistency sake, since the former Arsenal investigation began prior to publication of the VIG and the EPA Table 2c screening benchmarks were used at the onset of the sampling program.

On January 15, 2009 the USEPA signed a significant memorandum, “Interim Recommended Trichloroethylene (TCE) Toxicity Values to Assess Human Health Risk and Recommendations for the Vapor Intrusion (VI) Pathway Analysis.” The key element of the memorandum is the establishment of an interim action level of TCE in indoor residential air: 1.2 micrograms per cubic meter ( $\mu\text{g}/\text{m}^3$ ), based upon California EPA’s inhalation unit risk value. Currently NJDEP has not yet accepted this proposed interim action level.

### SECTION 3.0

#### SAMPLING RESULTS FOR GROUNDWATER AREA OF CONCERN 2

This section focuses on sampling results for indoor air and sub-slab soil gas collected between July 2007 and October 2008 from seven buildings evaluated within Groundwater AOC 2. Results are presented by building within the Groundwater AOC. Prior to the discussion of the sub-slab soil gas/indoor air results, a description of historic groundwater contaminant concentrations is presented. The plume boundaries, as revised per the *Supplemental Groundwater Data Report* (Weston, September 2006), defined the extent of the groundwater plume necessary to identify what buildings required evaluation for potential vapor intrusion.

Per the recommendations from the *Indoor Air Quality Semi-Annual Report #3* (Weston, 2008), seven buildings are still being evaluated and/or monitored for vapor intrusion issues in AOC 2. The buildings evaluated are:

- 165 Fieldcrest Avenue;
- 151 Fieldcrest Avenue;
- 160 Fieldcrest Avenue;
- Campus Plaza 1
- Campus Plaza 2;
- Campus Plaza 4; and
- Campus Plaza 5

The seven buildings evaluated within Groundwater AOC 2 consist of either warehouse or office space. The buildings are mostly surrounded by parking areas and roadways; few open/landscaped areas exist.

Buildings for which no further action was proposed in the vicinity of Groundwater AOC 2, and agreed to in NJDEP's 12 January 2007 and 7 May 2008 letters, include the following:

- Campus Plaza 3;
- Campus Plaza 7;
- Campus Plaza 8;
- 25-27 Campus Drive and
- 20 Northfield Avenue.

These buildings were not sampled during the current investigation, and are not discussed in this report. For information regarding the evaluation of the potential for vapor intrusion within these buildings, refer to the *Indoor Air Quality Semi-Annual Report #2* (Weston, ???September 2005) and *Indoor Air Quality Semi-Annual Report #3* (Weston, July 2008).

## 3.1 OVERVIEW OF GROUNDWATER AOC 2 RESULTS

### 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*, September 2006).

The historic constituents of concern in Groundwater AOC 2 are VOCs such as TCE, PCE, and cis-1,2-dichloroethene (cis-1,2-DCE), among others, as described in the *Final Site-Wide Hydrogeology Report* (Weston 1996) and the 2002 *Draft Final Groundwater Natural Attenuation Report* (NAR). Current constituents of concern for Groundwater AOC 2 are cis-1,2-DCE, PCE, TCE, vinyl chloride, and total-1,2-dichloroethene (total-1,2-DCE) as described in the 2005 *Draft Supplemental Groundwater Data Report*.

Groundwater analytical data for overburden monitoring wells and direct-push samples from 1994 to 2007 were reviewed and compared to screening levels presented in Table 1 of NJDEP's Vapor Intrusion Guidance (October 2005, updated March 2007) to characterize the COPCs in Groundwater AOC 2. Table 3-1 provides these data for all VOCs that have historically been detected in any of the groundwater samples collected from within the bounds of Groundwater AOC 2. Those VOCs that are considered COPCs for Groundwater AOC 2 are highlighted on Table 3-1 through the use of shading. Specifically, current constituents of concern for Groundwater AOC 2 are TCE, total-1,2-DCE, PCE, cis-1,2-DCE, and vinyl chloride. The current COPC list is based on the most recent concentrations detected in groundwater samples collected from the location with the historic highest concentration in Groundwater AOC 2. The historic constituents of concern in Groundwater AOC 2 are TCE, total-1,2-DCE, PCE, cis-1,2-DCE, vinyl chloride, 1,1,2-trichloroethane (1,1,2-TCA), benzene, and chloroform as shown in Table 3-1.

The COPC list for Groundwater AOC 2 includes one chemical that is considered to be unrelated to historic DOD activities. Benzene was detected during the second quarter (October 1998) sampling at MW-126; its historic highest concentration was detected in MW-13 during the remedial investigation activities performed in November 1994. The detection of benzene in MW-126 indicates an unknown non-DOD source of contamination in the southern portion of Groundwater AOC 2.

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 GWQS for TCE, PCE, and vinyl chloride. However, the main source of contamination (Building 256 UST system and leach field) was remediated in 1998 by removal of approximately 2,450 cubic yards of contaminated soils, as approved by the NJDEP. USACE conducted additional remedial activities from August to December 2002, when approximately an additional 3,500 cubic yards of contaminated soil were 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 downgradient of the former source area and upgradient 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.

In-situ treatment of groundwater (remedial action) associated with Groundwater AOC 2 is being proposed. Pre-pilot study field activities, bench scale treatability testing, and a pilot study associated with Groundwater AOC 2 have been undertaken, to evaluate the effectiveness of permanganate or a similar in-situ treatment for full-scale remediation.

Because of the concentrations of VOCs that have been detected in Groundwater AOC 2, IAQ sampling has been conducted below and at several buildings within 100 feet of the groundwater plume (further discussed below).

A groundwater treatability study was conducted by Shaw Environmental, Inc. for the source area of the groundwater AOC 2 plume during the reporting period. The findings of the study are presented in a letter report dated November 6, 2007; a copy of this letter report is provided on the CD attached to this report.

### 3.1.2 Sub-slab Soil Gas

Between July 2007 and October 2008, USACE collected up to three rounds of sub-slab soil gas samples at the buildings being evaluated for vapor intrusion. The table below summarizes the number of sub-slab soil gas samples collected during this period at each building.

| Building       | Number of Sub-slab Soil Gas Samples | Sampling Date          | Sampling Round                               |
|----------------|-------------------------------------|------------------------|----------------------------------------------|
| Building 165   | 4                                   | 14 August 2007         | Eleventh Round Post-Remediation (Round 12)   |
|                | 4                                   | 30 May 2008            | Twelfth Round Post-Remediation (Round 13)    |
|                | 4                                   | 24 September 2008      | Thirteenth Round Post-Remediation (Round 14) |
| Building 151   | 4                                   | 24 August 2007         | Twelfth Round                                |
|                | 3                                   | 6 November 2007        | Thirteenth Round                             |
|                | 5                                   | 30 May and 2 June 2008 | Fourteenth Round                             |
| Building 160   | 4                                   | 14 August 2007         | Tenth Round                                  |
|                | 3                                   | 6 November 2007        | Eleventh Round                               |
|                | 4                                   | 28 May 2008            | Twelfth Round                                |
| Campus Plaza 1 | 6                                   | 30 May 2008            | Third Round                                  |
| Campus Plaza 2 | 4                                   | 25 July 2007           | Sixth Round                                  |
|                | 4                                   | 8 November 2007        | Seventh Round                                |

|                |   |                   |               |
|----------------|---|-------------------|---------------|
| Campus Plaza 4 | 5 | 21 August 2007    | Sixth Round   |
|                | 5 | 8 November 2007   | Seventh Round |
|                | 5 | 28 May 2008       | Eighth Round  |
|                | 5 | 24 September 2008 | Ninth Round   |
| Campus Plaza 5 | 5 | 01 June 2008      | Fourth Round  |



Results of the sub-slab soil gas analyses for VOCs below buildings in Groundwater AOC 2 are discussed building by building in the following subsections of this report. Shaded values in the tables indicate exceedances of the NJDEP VIG residential screening levels, whereas bolded and shaded values indicate exceedances of the NJDEP VIG non-residential sub-slab soil gas screening levels. Compounds exceeding the VIG screening levels in sub-slab soil gas during the current sampling events included 1,3-butadiene, methylene chloride, chloroform, benzene, PCE, and TCE.

Per the IAQ approach, and consistent with the NJDEP VIG, indoor air samples were collected from all the buildings sampled in AOC 2 in conjunction with the sub-slab soil gas sampling. The only exception was Building 151, which was agreed upon with NJDEP to only collect sub-slab soil gas in three monitoring events over the next three years.

### **3.1.3 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 vapor intrusion. The buildings within Groundwater AOC 2 are primarily used as office space combined with attached warehouses. Common cleaning products were found in all of the buildings evaluated, but generally in small quantities and properly stored. As a result, in most cases, these cleaners may not necessarily constitute “significant” potential VOC sources. It should also be noted that Weston conducted file reviews, interviews or inspections only in tenant spaces where sub-slab soil gas and indoor air samples were collected. Additional VOC sources may be associated with those tenant spaces.

A review of publicly available NJDEP and local government files indicates that several industries are present (or have been present since 1963 when the Army sold the property) within Groundwater AOC 2. These include American Grocery Company, Compac Industries, Inc., Clayton Environmental/Bureau Veritas, General Cable Company, Salwen Paper Company, IT Corporation, and ML Systems. According to the public files reviewed, each of these facilities presently stores, or has stored in the past, compounds also present in the Groundwater AOC 2 plume. Furthermore, Inland Container Corporation (diesel), American Grocery Company (gasoline and diesel), and Compac Industries, Inc. (toluene) have all had confirmed releases of these compounds to the environment.

### **3.1.4 Indoor Air**

Between August 2007 and September 2008, USACE collected up to three rounds of indoor air samples at the buildings currently being evaluated for vapor intrusion. The table below summarizes the number of indoor air samples collected during this period at each building.

| Building       | Number of Indoor Air Samples | Ambient Air Samples              | Sampling Date        | Sampling Round                             |
|----------------|------------------------------|----------------------------------|----------------------|--------------------------------------------|
| Building 165   | 7                            | 1                                | 13-14 August 2007    | Tenth Round Post-Remediation (Round 11)    |
|                | 7                            | 1                                | 29-30 May 2008       | Eleventh Round Post-Remediation (Round 12) |
|                | 7                            | 1                                | 25 September 2008    | Round 12                                   |
| Building 151   | 5                            | 1                                | 23-24 August 2007    | Eleventh Round                             |
|                | 5                            | 1                                | 5-6 November 2007    | Twelfth Round                              |
|                | 0                            | 0                                | 30 May 2008          | Thirteenth Round                           |
| Building 160   | 5                            | 1                                | 13-14 August 2007    | Tenth Round                                |
|                | 5                            | 1                                | 5-6 November 2007    | Eleventh Round                             |
|                | 5                            | 1                                | 27-28 May 2008       | Twelfth Round                              |
| Campus Plaza 1 | 6                            | 1                                | 29-30 May 2008       | Third Round                                |
| Campus Plaza 2 | 6                            | 1                                | 18-19 July 2007      | Sixth Round                                |
|                | 6                            | Used ambient from Campus Plaza 4 | 7-8 November 2007    | Seventh Round                              |
| Campus Plaza 4 | 5                            | Used ambient from Campus Plaza 2 | 20-21 August 2007    | Third Round                                |
|                | 5                            | 1                                | 7-8 November 2007    | Fourth Round                               |
|                | 5                            | 1                                | 28-28 May 2008       | Fifth Round                                |
|                | 5                            | 1                                | 24-25 September 2008 | Sixth Round                                |
| Campus Plaza 5 | 5                            | 1                                | 31 May – 1 June 2008 | Third Round                                |

Results of the indoor air and background ambient air analyses for VOCs in the buildings within Groundwater AOC 2 are discussed building by building in the following subsections of this report. Shaded values in the tables indicate exceedances of the NJDEP VIG residential screening levels, whereas bolded and shaded values indicate exceedances of the NJDEP VIG non-residential indoor air screening levels. Some of the compounds exceeding the screening levels in indoor air and sub-slab soil gas samples collected during the current sampling events included benzene, chloroform, benzene, methylene chloride, methyl tertiary butyl ether (MTBE), PCE, and TCE. It should be noted that MTBE is not a DOD contaminant of concern since MTBE came into use after the Army ceased operations at the former Arsenal.

The following discussion focuses on soil gas and indoor air results on a building-by-building basis within Groundwater AOC 2.

### 3.1.5 Meteorological Data

Meteorological data for the July 2006 sampling event was 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 Newark Liberty International Airport.

Meteorological data were collected throughout each sampling event performed in 2007 and 2008. The data collected for the dates that AOC 2 buildings were sampled are summarized below. See Appendix A on the attached compact disk (CD) for the complete meteorological data.

| <b>Building</b> | <b>Dates Sampled</b>  | <b>Temperature Range (°F)</b> | <b>Barometric Pressure (Inches)</b> | <b>Precipitation (Inches)</b> | <b>Relative Humidity Range (%)</b> |
|-----------------|-----------------------|-------------------------------|-------------------------------------|-------------------------------|------------------------------------|
| Building 165    | August 13-14, 2007    | 62-88                         | 29.77-29.93                         | None                          | 30-69                              |
|                 | May 29-30, 2008       | 50-84                         | 29.98-30.20                         | None                          | 17-57                              |
|                 | September 23-24, 2008 | 53-72                         | 30.37-30.46                         | None                          | 36-80                              |
| Building 151    | August 23-24, 2007    | 63-85                         | 29.90-30.14                         | None                          | 61-93                              |
|                 | November 6-7, 2007    | 37-55                         | 29.70-30.05                         | 0.36                          | 33-70                              |
|                 | 30 May, 2 June 2008   | 54-85                         | 29.70-30.11                         | None                          | 20-84                              |
| Building 160    | August 13-14, 2007    | 62-88                         | 29.77-29.93                         | None                          | 30-69                              |
|                 | November 6-7, 2007    | 37-55                         | 29.70-30.05                         | 0.36                          | 33-70                              |
|                 | May 27-28 2008        | 54-87                         | 29.77-30.23                         | 0.13                          | 22-87                              |
| Campus Plaza 1  | May 29-30, 2008       | 50-84                         | 29.98-30.20                         | None                          | 17-57                              |
| Campus Plaza 2  | July 18-19, 2007      | 70-97                         | 29.62-29.96                         | 0.50                          | 51-93                              |
|                 | November 8-9, 2007    | 33-46                         | 30.03-30.21                         | 0.08                          | 39-83                              |
| Campus Plaza 4  | August 20-21, 2007    | 57-71                         | 30.07-30.18                         | 1.01                          | 51-90                              |
|                 | November 7-8, 2007    | 33-51                         | 29.87-30.21                         | None                          | 35-70                              |
|                 | May 27-28, 2008       | 54-87                         | 29.77-30.23                         | 0.13                          | 22-87                              |
|                 | September 23-24, 2008 | 53-72                         | 30.37-30.46                         | None                          | 36-80                              |
| Campus Plaza 5  | 31 May – 1 June 2008  | 64-85                         | 29.65-29.95                         | 0.68                          | 30-84                              |

## 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. The building consists of warehouse and office space and is currently occupied by six tenants. Building 165 is surrounded by a parking lot with a small landscaped lawn area.

Ten previous rounds of indoor air sampling were conducted at 165 Fieldcrest Avenue from June 2003 to January 2007. Six previous rounds of sub-slab soil gas sampling were conducted by USACE, from June 2003 to January 2007. Current investigation activities included sub-slab soil gas, vapor recovery system, and indoor air sample collection during August 2007, May 2008 and September 2008.

### 3.2.1 Prior Investigations

Building 165 is located in proximity to the 18C Ramp Area, a soil area of concern located on the eastern side of Building 256. Several phases of investigation and remediation have been completed within Area 18C, including a Supplemental Phase II Remedial Investigation (RI). This investigation led to the removal in 1998 of one 6,000-gallon steel underground storage tank (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).

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 12 March 2003 comment letter from the NJDEP concerning the USACE's *Draft Final Groundwater Natural Attenuation Report* (Weston, July 2002), for groundwater, 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.

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 Attachment A.

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 sub-slab 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 sub-slab soil gas samples or detected at concentrations below those detected in the indoor air samples (Tables 3-2 and 3-4).

In August 2003, a subsurface vapor remediation system was installed at Building 165 to mitigate potential migration of VOC vapors from the sub-slab soil gas into the building. The system consists of 20 sub-slab 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 vapor recovery 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 remediation 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, vapor recovery samples are also being taken during each monitoring event to monitor the vapor remediation system. As compared to current NJDEP VIG guidance, the vapor recovery system samples indicate exceedances of NJDEP VIG residential sub-slab soil gas screening levels for PCE during the January 2007 sampling event. A PCE exceedance was observed previously during the July 2005 sampling event. Chloroform and 1,4-dichlorobenzene have also been detected. A summary of historic vapor recovery sample analytical results is presented on Table 3-3.

During the January 2005 sampling event (the first semi-annual event following the quarterly post-remediation sampling program), four sub-slab soil gas points were installed in the same locations as were first sampled in June 2003. The sub-slab gas monitoring points were installed at Peppermint Tree Day Care Center, Amax Engineering, Celcis and the vacant location which was later occupied by GVT Skin Care and subsequently re-vacated. In addition, a total of seven indoor air quality 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 Laboratories Group (Celcis), Rockwell Automation, Amax Engineering Corp. (Amax), Mackay Communications (Mackay), and the vacant location (formerly GVT Skin Care) (Figure 3-2). The background air sample was collected from next to the playground at the Peppermint Tree Day Care Center. The two vapor recovery samples were collected from the shed behind the building, and the shed on the side of the building. These have been designated as the sampling locations for any samples that are or may be in Building 165 since the January 2005 sampling event.

One pre-remediation and nine post-remediation rounds of sampling have been performed by USACE at Building 165. The three most recent events are those discussed in detail under the Current Investigation subsection, below. A compendium of sub-slab soil gas, vapor recovery monitoring, and indoor air results for all samples collected from Building 165, in comparison to the NJDEP VIG residential and non-residential screening levels, are provided in Tables 3-2, 3-3, and 3-4, respectively. These tables summarize the number of detections and exceedances of NJDEP VIG screening levels, by sampling event, as well as the range of concentrations detected. The tables include only those VOCs that have been detected in any of the historic and current

samples (i.e., those compounds that have never been detected in sub-slab soil gas, or indoor air samples collected by USACE at Building 165 are not included on Tables 3-2, 3-3, and 3-4).

### 3.2.2 Current Investigation

The samples collected during the August 2007, May 2008 and September 2008 events were collected from the same locations and in a similar manner to the previous sampling events, as detailed in section 3.2.1. A pre-sampling walk-through was conducted to verify the locations of the sub-slab soil gas sampling points and to update the indoor air survey. One sample was collected from the each of the two vapor recovery sample ports during the August 2007, May 2008 and September 2008 sampling events, as in the previous rounds. The following table summarizes the samples collected during the current investigation at Building 165.

| Matrix            | Number of Samples | Parameters/Method | Dates Sampled      |
|-------------------|-------------------|-------------------|--------------------|
| Sub-slab Soil Gas | 4                 | VOCs/TO-15        | August 14, 2007    |
|                   | 4                 |                   | May 30, 2008       |
|                   | 4                 |                   | September 24, 2008 |
| Vapor Recovery    | 2                 | VOCs/TO-15        | August 14, 2007    |
|                   | 2                 |                   | May 30, 2008       |
|                   | 2                 |                   | September 25, 2008 |
| Indoor Air        | 7                 | VOCs/TO-15        | August 13, 2007    |
|                   | 7                 |                   | May 30, 2008       |
|                   | 7                 |                   | September 23, 2008 |
| Background        | 1                 | VOCs/TO-15        | August 13, 2007    |
|                   | 1                 |                   | May 30, 2008       |
|                   | 1                 |                   | September 23, 2008 |

### 3.2.3 Sub-slab Soil Gas and Vapor Recovery System Results

Building 165 had recent (August 2007- September 2008) sampling results showing a decreasing trend in volatile organic concentration in the sub-slab. Volatile organic compounds were detected above NJDEP VIG screening levels in the vapor recovery system. Tetrachloroethylene (PCE) was the only VOC detected in sub-soil gas at concentrations above its NJDEP VIG Generic Screening Levels. No other VOCs were detected in sub slab soil gas at concentrations greater than the NJDEP VIG residential and non-residential screening levels during these sampling events.

The following table summarizes the sub-slab soil gas exceedances in comparison with NJDEP VIG non-residential and residential sub-slab soil gas screening levels:

| Compound             | NJDEP VIG Table 1 Non-Residential<br>Sub-slab Soil Gas Screening Level |                                                                |                                   | NJDEP VIG Table 1 Residential<br>Sub-slab Soil Gas Screening Level |                                                                |                                   |
|----------------------|------------------------------------------------------------------------|----------------------------------------------------------------|-----------------------------------|--------------------------------------------------------------------|----------------------------------------------------------------|-----------------------------------|
|                      | No. of<br>Samples<br>Exceeding                                         | Range in<br>Concentration<br>Exceeding<br>(ug/m <sup>3</sup> ) | Criterion<br>(ug/m <sup>3</sup> ) | No. of<br>Samples<br>Exceeding                                     | Range in<br>Concentration<br>Exceeding<br>(ug/m <sup>3</sup> ) | Criterion<br>(ug/m <sup>3</sup> ) |
| PCE<br>(August 2007) | 1 of 4                                                                 | 68                                                             | 36                                | 1 of 4                                                             | 68                                                             | 34                                |

In the vapor recovery samples, methylene chloride (September 2008), and chloroform (August 2007) were detected at concentrations in exceedance of NJDEP VIG screening levels (Table 3-3).

The following table summarizes the vapor recovery exceedances in comparison with NJDEP VIG non-residential and residential sub-slab soil gas screening levels:

| Compound                                  | NJDEP VIG Table 1 Non-Residential<br>Sub-slab Soil Gas Screening Level |                                                                |                                   | NJDEP VIG Table 1 Residential<br>Sub-slab Soil Gas Screening Level |                                                                |                                   |
|-------------------------------------------|------------------------------------------------------------------------|----------------------------------------------------------------|-----------------------------------|--------------------------------------------------------------------|----------------------------------------------------------------|-----------------------------------|
|                                           | No. of<br>Samples<br>Exceeding                                         | Range in<br>Concentration<br>Exceeding<br>(ug/m <sup>3</sup> ) | Criterion<br>(ug/m <sup>3</sup> ) | No. of<br>Samples<br>Exceeding                                     | Range in<br>Concentration<br>Exceeding<br>(ug/m <sup>3</sup> ) | Criterion<br>(ug/m <sup>3</sup> ) |
| Chloroform<br>(August 2007)               | 1 of 2                                                                 | 100                                                            | 24                                | 1 of 2                                                             | 100                                                            | 24                                |
| Methylene<br>Chloride<br>(September 2008) | 1 of 2                                                                 | 277.23                                                         | 32                                | 1 of 2                                                             | 277.23                                                         | 30                                |

The PCE sub-slab soil gas and vapor recovery sampling results from August 2007 through September 2008 are shown on Figure 3-1.

### 3.2.4 Building Survey

Weston and Shaw conducted a building survey and completed the *Indoor Air Building Survey and Sampling Form* for each building tenant space 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 in the building. The survey and sampling form has been updated concurrent with each sampling event to include any changes observed. *The Indoor Air Building Survey and Sampling Forms* were updated on 13 August 2007 for the August 2007 sampling event, on 29 May 2008 for the May 2008 sampling event, and on 23 September 2008 for the September 2008 sampling event. The forms and lists of products used by building tenants are included in the attached CD. The following information was obtained during the survey.

1. Amax Engineering Corporation is now Cembre; they were in the process of moving into the tenant space during the May 2008 sampling event and were fully there in the September 2008 event.
2. Cleaning products, air fresheners, properly stored paints/thinners/strippers, anti tick insecticide were some of the chemicals found during the field survey at the tenant spaces.

- Celsis Laboratory is a quality control and testing laboratory for the pharmaceutical industry, and as a result uses many different types of chemicals.

### 3.2.5 Indoor Air Sampling Results

The indoor air and background sample results from the three most recent sampling events (August 2007, May 2008 and September 2008) are shown in Table 3-4. No DOD-related VOCs were detected at concentrations above VIG screening levels. VOCs detected at concentrations above their NJDEP VIG screening levels included benzene, chloroform, 1,4 dichlorobenzene and methylene chloride.

A summary table of indoor air exceedances from the past two rounds is included below:

| Compound                               | NJDEP VIG Table 1 Non-Residential<br>Indoor Air Screening Level |                                                                |                                   | NJDEP VIG Table 1 Residential<br>Indoor Air Screening Level |                                                                |                                   |
|----------------------------------------|-----------------------------------------------------------------|----------------------------------------------------------------|-----------------------------------|-------------------------------------------------------------|----------------------------------------------------------------|-----------------------------------|
|                                        | No. of<br>Samples<br>Exceeding                                  | Range in<br>Concentration<br>Exceeding<br>(ug/m <sup>3</sup> ) | Criterion<br>(ug/m <sup>3</sup> ) | No. of<br>Samples<br>Exceeding                              | Range in<br>Concentration<br>Exceeding<br>(ug/m <sup>3</sup> ) | Criterion<br>(ug/m <sup>3</sup> ) |
| Benzene<br>(May 2008)                  | 1 of 8                                                          | 2.46                                                           | 2                                 | 1 of 8                                                      | 2.46                                                           | 2                                 |
| Benzene<br>(September 2008)            | 2 of 8                                                          | 2.24-3                                                         | 2                                 | 2 of 8                                                      | 2.24-3                                                         | 2                                 |
| Chloroform<br>(August 2007)            | 1 of 8                                                          | 5.9                                                            | 2                                 | 1 of 8                                                      | 5.9                                                            | 2                                 |
| Chloroform<br>(May 2008)               | 3 of 8                                                          | 2.44 – 8.55                                                    | 2                                 | 3 of 8                                                      | 2.44 – 8.55                                                    | 2                                 |
| Chloroform<br>(September 2008)         | 1 of 8                                                          | 63                                                             | 2                                 | 1 of 8                                                      | 63                                                             | 2                                 |
| 1,4 Dichlorobenzene<br>(August 2007)   | 1 of 8                                                          | 43                                                             | 3                                 | 1 of 8                                                      | 43                                                             | 3                                 |
| 1,4 Dichlorobenzene<br>(May 2008)      | 1 of 8                                                          | 17.13                                                          | 3                                 | 1 of 8                                                      | 17.13                                                          | 3                                 |
| Methylene Chloride<br>(August 2007)    | 1 of 8                                                          | 180                                                            | 9                                 | 1 of 8                                                      | 180                                                            | 4                                 |
| Methylene Chloride<br>(May 2008)       | 1 of 8                                                          | 34.05                                                          | 9                                 | 1 of 8                                                      | 4.86                                                           | 4                                 |
| Methylene Chloride<br>(September 2008) | 2 of 8                                                          | 10.98-733.02                                                   | 9                                 | 5 of 8                                                      | 5.56-733.02                                                    | 4                                 |

### 3.2.6 Integrated Discussion of Results

The results from the current investigation indicate that, until January 2007, the sub-slab remediation system has been effective in reducing concentrations of PCE in sub-slab soil gas. PCE was detected in sub-slab soil gas samples greater than the NJDEP VIG screening levels during the August 2007 sampling event. However, the two sampling events after August 2007 (May 2008 and September 2008) did not detect PCE above NJDEP VIG screening levels and thus showing a decreasing trend. In addition PCE was not detected in the vapor recovery samples for all three sampling events (August 2007, May 2008 and September 2008).



TCE or PCE have not been detected in the last three sampling rounds in indoor air, or vapor recovery samples.

Other VOCs have been detected in indoor air (1,4-dichlorobenzene, chloroform, and methylene chloride) during the last several sampling events and periodically over the years. The VOCs have been suspected to be present due to building tenant-related activities, as 1,4-dichlorobenzene and methylene chloride were not detected in sub-slab soil gas/vapor recovery samples at concentrations above NJDEP VIG screening levels and historically have not been detected in groundwater at concentrations above the NJDEP VIG groundwater screening levels. While chloroform was detected in one vapor recovery sample at a concentration greater than the NJDEP VIG sub-slab soil gas screening level, chloroform is no longer considered a COPC in that it is no longer detected in groundwater at concentrations greater than the NJDEP VIG groundwater screening levels; and has not been detected in sub-slab soil gas samples at concentrations in excess of NJDEP VIG sub-slab soil gas screening levels.

### **3.2.7 Conclusions and Recommendations**

PCE and TCE levels in the soil gas samples, vapor recovery samples and indoor air samples are all trending lower when compared to past sampling events. The compounds were not detected in sub-slab soil gas, vapor recovery or indoor air samples greater than NJDEP VIG screening levels. This continues to indicate that the vapor recovery system is still functioning.

Based upon the vapor recovery results over the past year, the USACE recommends evaluating the operation of the system to determine the best flow rate of the vapor recovery system to maximize removal of the vapors from beneath the sub-slab and continued monitoring of the building.

### 3.3 151 FIELDCREST AVENUE

Building 151 is a two-story concrete and steel building built on a concrete slab on grade, located at 151 Fieldcrest Avenue within the Groundwater AOC 2 plume. The building consists of warehouse with little office space and the current tenant as of the May 2008 sampling event is Plastic Express. Building 151 is surrounded by a parking lot with a small landscaped lawn area.

Eleven previous rounds of indoor air sampling and six rounds of sub-slab soil gas sampling were conducted at 151 Fieldcrest Avenue from June 2003 to March 2007. Current investigation activities included sub-slab soil gas and indoor air sample collection during August 2007, November 2007 and May 2008.

#### 3.3.1 Prior Investigations

Building 151 is located in proximity to the 18C Ramp Area, which is a soil area of investigation located on the eastern side of Building 256 (described above under Sections 3.1.1 and 3.2.1). The results of analyses of the soil, soil gas and groundwater samples from the most recent investigation, including in the vicinity of Building 151, 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 12 March 2003 comment letter from the NJDEP concerning the USACE's *Draft Final Natural Attenuation Report* (Weston, July 2002), NJDEP requested that potential vapor risks at Building 151 be evaluated.

Eleven sampling events have been completed prior to the most recent three events detailed in this indoor air quality report. Indoor air sampling was conducted on a quarterly basis between June 2003 and November 2004, and was changed to semi-annually beginning with the July 2005 event. Historically, indoor air was sampled during each event, while sub-slab soil gas was sampled in June 2003 (Round 1), November 2004 (Round 6) and concurrently with indoor air since. Indoor air was not sampled during the May 2008 sampling event.

During prior investigations, PCE was detected in sub-slab soil gas in excess of its NJDEP VIG sub-slab soil gas screening level only during the June 2003 sampling event, while benzene was detected in sub-slab soil gas in excess of its NJDEP VIG sub-slab soil gas screening levels only during the July 2005 sampling event. In the air samples, several compounds in addition to PCE and TCE exhibited concentrations exceeding their NJDEP VIG screening levels. These compounds were: benzene, chloroform, methylene chloride, and MTBE. These compounds were attributed to building tenant-related activities and, in some cases, background (ambient) conditions, and do not provide evidence of a vapor intrusion pathway. Support for this theory includes the fact that VOCs have not been detected in indoor air at concentrations in excess of the NJDEP VIG screening levels during (and since) the January 2006 sampling event, which was the first event following the tenant's cessation of operations and departure from the building. However, the recommendation was made to continue monitoring on a semi-annual basis.

A compendium of sub-slab soil gas and indoor air sample results for the samples collected from Building 151 is provided in Tables 3-8 and 3-9, respectively. These tables summarize the number of detections and exceedances of NJDEP VIG screening levels by sampling event, as

well as the range of concentrations detected. The tables include only those VOCs that have been detected in any of the historic or current samples (i.e., those compounds that have never been detected in sub-slab soil gas or indoor air samples collected by USACE at Building 151 are not included on Tables 3-8 and 3-9).

### 3.3.2 Current Investigation

Three sampling events, which included indoor air and sub-slab soil gas, have taken place since the last indoor air quality report was issued. Round 12 took place on 23-24 August 2007, Round 13 on 6-7 November 2007 and round 14 on May 30-June 2 2008. The building has been occupied by Plastic Express since the August 2007 event.

With one exception, during each of the three events, four sub-slab soil gas samples (five sub-slab soil gas samples were taken during the May 2008 event), five indoor air samples, and one background (ambient) sample were collected at Building 151. No sub-slab soil gas samples were taken at 151-SG3 between March 21, 2007 and May 30, 2008. 151-SG3 was sampled on May 30, 2008. No indoor air was sampled during the May 2008 event. All samples were analyzed for VOCs. The locations of the sub-slab soil gas, indoor air, and background samples are shown on Figure 3-2. The locations of the samples were consistent between the three rounds, and corresponded to sample locations from earlier rounds.

The following table summarizes the samples collected under the current investigation at Building 151.

| Matrix            | Number of Samples | Parameters/Method | Dates Sampled        |
|-------------------|-------------------|-------------------|----------------------|
| Sub-slab Soil Gas | 4                 | VOCs/TO-15        | 24 August 2007       |
|                   | 4                 | VOCs/TO-15        | 6 November 2007      |
|                   | 5                 | VOCs/TO-15        | 30 May 2008          |
| Indoor Air        | 5                 | VOCs/TO-15        | 23-24 August 2007    |
|                   | 5                 | VOCs/TO-15        | 5-6 November 2007    |
|                   | 4                 | VOCs/TO-15        | 30 May – 2 June 2008 |
| Background        | 1                 | VOCs/TO-15        | 23-24 August 2007    |
|                   | 1                 | VOCs/TO-15        | 5-6 November 2007    |

### 3.3.3 Sub-slab Soil Gas Results

During the sampling events from August 2007 through June 2008 both PCE and TCE were the only VOCs detected above its VIG screening level. PCE was detected in five sub-slab soil gas samples at concentrations greater than its residential and non-residential NJDEP VIG screening levels in the August 2007 and June 2008 sampling events. Figure 3-2 shows the sampling locations and PCE and TCE results in sub-slab soil gas samples at Building 151. The complete sub-slab soil gas results for the three most recent rounds of samples are shown on Table 3-10.

The following table contains a summary of the sub-slab soil gas exceedances from the current three sampling rounds.

| Compound            | NJDEP VIG Table 1 Non-Residential Sub-slab Soil Gas Screening Level |                                                       |                                | NJDEP VIG Table 1 Residential Sub-slab Soil Gas Screening Level |                                                       |                                |
|---------------------|---------------------------------------------------------------------|-------------------------------------------------------|--------------------------------|-----------------------------------------------------------------|-------------------------------------------------------|--------------------------------|
|                     | No. of Samples Exceeding                                            | Range in Concentration Exceeding (ug/m <sup>3</sup> ) | Criterion (ug/m <sup>3</sup> ) | No. of Samples Exceeding                                        | Range in Concentration Exceeding (ug/m <sup>3</sup> ) | Criterion (ug/m <sup>3</sup> ) |
| PCE (August 2007)   | 4 of 4                                                              | 52 to 55                                              | 36                             | 4 of 4                                                          | 52 to 55                                              | 34                             |
| PCE (May/June 2008) | 2 of 5                                                              | 51.88-86.8                                            | 36                             | 2 of 5                                                          | 51.88-86.8                                            | 34                             |
| TCE (June 2008)     | 1 of 5                                                              | 36.06                                                 | 27                             | 1 of 5                                                          | 36.06                                                 | 27                             |

### 3.3.4 Building Survey

Prior to each subsequent indoor air sampling event, the *Indoor Air Building Survey and Sampling Form* was updated to reflect current conditions. The form was updated on 23 August 2007 for the August 2007 sampling event, on 6 November 2007 for the November 2007 sampling event and was updated again on 30 May 2008 for the May 2008 sampling event. These forms are included in the attached CD. The results of the site inspection have not revealed significant potential sources of VOCs in the building.

The former World Pac facility was utilized for the storage and distribution of automobile parts and accessories. The facility contained assorted cleaning products/latex paints in a cleaning closet and air fresheners in the bathroom. There were frequent painting touch-ups for the floors and columns. During collection of indoor air samples, World Pac would suspend the daily cleaning service for the night of the sampling. These conditions continued through the July 2005 sampling event. World Pac vacated the premises and removed all chemicals following the July 2005 sampling event and prior to the January 2006 sampling event. Prior to the August 2007 sampling event, the building was vacant, but Plastic Express has occupied the building since the August 2007 event. During the November 2007 sampling event, the following chemicals were observed onsite: Nylon, Polypropylene, Polyethylene, and Polystyrene.

### 3.3.5 Indoor Air Sampling Results

Benzene was the only compound detected in indoor air that exceeded NJDEP VIG screening levels during the recent sampling events. TCE and PCE were not detected in indoor air samples above NJDEP VIG screening levels. Benzene was not detected in groundwater samples in this area and is considered a non-DOD compound of concern. The complete indoor air analytical results for the three most recent sampling events are presented in Table 3-11.

Figure 3-2 shows the sampling locations and PCE and TCE results in indoor air and background collected at Building 151.

### **3.3.6 Integrated Discussion of Results**

PCE and TCE were detected in sub-slab soil samples during the recent two sampling rounds (August 2007 and June 2008). Prior to those two sampling events, a trend in decreasing concentrations of VOCs in the sub-slab was apparent. However, indoor air data collected to date continues to show that there is no vapor intrusion pathway in Building 151, corroborating the conclusion presented in the previous Indoor Air Quality Reports. In January 2006, the building was vacated by the previous tenants, who had stored numerous chemicals on site that may have been the sources of VOCs previously detected in indoor air. Since the tenant left the building, concentrations of VOCs reported in indoor air were either below NJDEP VIG screening levels or were detected at concentrations lower than their reporting limits.

During the most recent rounds of sampling, PCE and TCE were either not detected in indoor air or were detected at concentrations less than their respective residential and non-residential NJDEP VIG screening levels. Historically there have been exceedances in indoor air of NJDEP VIG screening levels of PCE in several prior sampling events and of TCE in one prior sampling event. During the sampling events when the tenant was occupying the building, various VOCs were detected in indoor air at concentrations greater than NJDEP VIG screening levels. However, during the last seven sampling events following the tenant's cessation of operations in Building 151 the analytical parameters detected, the frequency of detections, and the concentrations detected experienced a significant decrease from historic indoor air data. Benzene was the only VOC detected in indoor air above NJDEP VIG screening levels during the last two sampling events. However, this compound is not associated with any DOD activities.

It is significant that the previous tenant had vacated the premises prior to the January 2006 sampling event, after which time exceedances of NJDEP VIG screening levels in indoor air ceased. If the VOCs historically detected in Building 151 were a result of vapor intrusion rather than due to activities performed within the building, it would be expected that the concentrations would be highest in the winter months, when the stack effect is greatest, regardless of whether the building is occupied. However, as can be seen by the indoor air data trends presented on Table 3-9, since tenant activities ceased, indoor air concentrations have decreased to predominantly non-detectable levels.

### **3.3.7 Conclusions and Recommendations**

There does not appear to be a vapor intrusion pathway for Building 151 as supported by multiple lines of evidence. Based on the data trends in both indoor air and sub-slab soil gas sampling results over time the collection of additional indoor air samples is not recommended. The USACE has agreed to annual sub-slab soil gas monitoring for a total of three years. If the averages of these rounds of sub-slab samples are below the NJDEP screening criteria, no further monitoring will be recommended for this building.

### **3.4 160 FIELDCREST AVENUE**

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 and lawn area.

Nine previous rounds of indoor air sampling were conducted at 160 Fieldcrest Avenue from September 2003 through March 2007 and eight previous rounds of sub-slab soil gas sampling were conducted from September 2003 to March 2007. Current investigation activities included sub-slab soil gas and indoor air sample collection during August 2007, November 2007, and May 2008.

#### **3.4.1 Prior Investigations**

Nine sampling events were completed at Building 160 prior to the current investigation. All of the previous sampling events during which sub-slab soil gas samples were collected indicated the presence of TCE at concentrations greater than the NJDEP VIG residential and non-residential screening level in at least one sample per sampling event. Three of the five previous sub-slab soil gas sampling events (September 2003, June 2004 and July 2005) also had samples that exceeded the NJDEP VIG screening levels for PCE. During the July 2005 sampling event, benzene was detected in the sub-slab soil gas at concentrations greater than the residential, but less than the nonresidential, NJDEP VIG sub-slab soil gas screening level. No other VOCs have historically been detected in the sub-slab soil gas at concentrations greater than NJDEP VIG screening levels.

TCE and PCE were not detected in the indoor air samples collected during the prior six rounds of sampling, although MTBE (a non-DOD contaminant) was detected at concentrations above screening criteria during four of the prior investigation sampling events. Additionally, methylene chloride was detected at concentrations greater than the NJDEP VIG residential screening level but lower than the NJDEP VIG nonresidential screening level during two earlier sampling events (July 2005 and February 2006). Further, benzene was detected during one sampling event (February 2006) at concentrations greater than the NJDEP VIG residential/nonresidential screening level; however, the benzene detected during this sampling event was attributed to ambient conditions, since benzene was also detected in the ambient sample at a concentration similar to those detected in the indoor air samples collected within the building.

A compendium of sub-slab soil gas and indoor air sample results is provided in Tables 3-12 and 3-13, respectively. These tables summarize the number of detections and exceedances of NJDEP VIG screening levels, by sampling event, as well as the range of concentrations detected. The tables include only those VOCs that have been detected in any of the historic or current samples (i.e., those compounds that have never been detected in sub-slab soil gas, vapor recovery, or indoor air samples collected by USACE at Building 160 are not included on Tables 3-12 and 3-13).

### 3.4.2 Current Investigation

The permanent sub-slab soil gas points were sampled on 14 August 2007, 6 November 2007 and 28 May 2008. The sub-slab soil gas samples were collected over a 1-hour period upon completion of the air samples. Sub-slab soil gas samples were collected at the following locations: in the Miller's Rentals, (Miller's) warehouse, in the Clayton Group Services/Bureau Veritas (Clayton) warehouse, in the MOL warehouse, and in the electrical closet at MOL America, Inc (MOL).

Indoor air and background air quality samples were collected over a 24-hour period on 13-14 August 2007, 5-6 November 2007 and 27-28 May 2008. There were five indoor air samples collected during each sampling round. During each round, one indoor air sample was collected from Miller's, one indoor air sample was collected from Priority Express, one indoor air sample was collected from Clayton, and two indoor air samples were collected from MOL. The background sample was taken at ground level because there is no roof access at Building 160. The locations of the sub-slab soil gas, indoor air, and background samples are shown on Figure 3-3. The locations of the samples were consistent between the three sampling events, and corresponded to sample locations from earlier sampling events.

The following table summarizes the samples collected under the current investigation at Building 160.

| Matrix            | Number of Samples | Parameters/Method | Dates Sampled     |
|-------------------|-------------------|-------------------|-------------------|
| Sub-slab Soil Gas | 4                 | VOCs/TO-15        | 14 August 2007    |
|                   | 4                 | VOCs/TO-15        | 6 November 2007   |
|                   | 4                 | VOCs/TO-15        | 28 May 2008       |
| Indoor Air        | 5                 | VOCs/TO-15        | 13-14 August 2007 |
|                   | 5                 | VOCs/TO-15        | 5-6 November 2007 |
|                   | 5                 | VOCs/TO-15        | 27-28 May 2008    |
| Background        | 1                 | VOCs/TO-15        | 13-14 August 2007 |
|                   | 1                 | VOCs/TO-15        | 5-6 November 2007 |
|                   | 1                 | VOCs/TO-15        | 27-28 May 2008    |

### 3.4.3 Sub-slab Soil Gas Results

Two VOCs (PCE and TCE) were detected in soil gas at concentrations greater than the VIG screening levels. TCE concentrations exceeded the VIG screening level in two of the four samples collected in August 2007, 1 out of 3 samples collected in November 2007 and in 4 of 4 samples collected during May 2008 sampling event. PCE was detected at a concentration exceeding NJDEP VIG screening levels in two sub-slab soil gas sample collected during the August 2007 sampling event and in three samples collected during the May 2008 sampling event, but did not exceed its screening level in any samples collected during the November 2007 sampling event.

The PCE and TCE analytical results are shown on Figure 3-3. Full analytical results for the August 2007 through May 2008 sampling events are provided on Table 3-14. The following table summarizes the exceedances of the NJDEP VIG screening levels from the most recent three sampling rounds.

| Compound               | NJDEP VIG Table 1 Non-Residential<br>Sub-slab Soil Gas Screening Level |                                                                |                                   | NJDEP VIG Table 1 Residential<br>Sub-slab Soil Gas Screening Level |                                                                |                                   |
|------------------------|------------------------------------------------------------------------|----------------------------------------------------------------|-----------------------------------|--------------------------------------------------------------------|----------------------------------------------------------------|-----------------------------------|
|                        | No. of<br>Samples<br>Exceeding                                         | Range in<br>Concentration<br>Exceeding<br>(ug/m <sup>3</sup> ) | Criterion<br>(ug/m <sup>3</sup> ) | No. of<br>Samples<br>Exceeding                                     | Range in<br>Concentration<br>Exceeding<br>(ug/m <sup>3</sup> ) | Criterion<br>(ug/m <sup>3</sup> ) |
| PCE<br>(August 2007)   | 2 of 4                                                                 | 56 to 88                                                       | 36                                | 2 of 4                                                             | 56 to 88                                                       | 34                                |
| PCE<br>(May 2008)      | 3 of 4                                                                 | 86.97 to 895.12                                                | 36                                | 3 of 4                                                             | 86.97 to<br>895.12                                             | 34                                |
| TCE<br>(August 2007)   | 2 of 4                                                                 | 250-1600                                                       | 27                                | 2 of 4                                                             | 250-1600                                                       | 27                                |
| TCE<br>(November 2007) | 1 of 3                                                                 | 540                                                            | 27                                | 1 of 3                                                             | 540                                                            | 27                                |
| TCE<br>(May 2008)      | 4 of 4                                                                 | 38.05 to<br>3,804.96                                           | 27                                | 4 of 4                                                             | 38.05 to<br>3,804.96                                           | 27                                |

### 3.4.4 Building Survey

Weston and Shaw completed the *Indoor Air Building Survey and Sampling Form* for each building tenant space 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 in the building. These forms were updated on 13 August 2007 for the August 2007 sampling event, on 6 November 2007 for the November 2007 sampling event, and again on 27 May 2008 for the May 2008 sampling event. There were no chemicals observed that are considered significant potential VOC sources during the initial and subsequent sampling events. The Indoor Air Building Survey and Sampling Forms are included on the attached CD.

### 3.4.5 Indoor Air Sampling Results

Results from the three sampling events show that both TCE and PCE were not detected at concentrations above the NJDEP VIG screening levels for any indoor air samples. The only VOC's detected in indoor air samples above NJDEP VIG screening levels were 1,4-dichlorobenzene, methylene chloride, MTBE and benzene. None of these components are considered DOD-related. The PCE and TCE analytical results are presented on Figure 3-3.

Full analytical results for the recent sampling events of August 2007 through May 2008 are provided on Table 3-15. A summary table of indoor air sample result exceedances from the past three rounds is provided below:



| Compound                            | NJDEP VIG Table 1 Non-Residential Indoor Air Screening Level |                                                       |                                | NJDEP VIG Table 1 Residential Indoor Air Screening Level |                                                       |                                |
|-------------------------------------|--------------------------------------------------------------|-------------------------------------------------------|--------------------------------|----------------------------------------------------------|-------------------------------------------------------|--------------------------------|
|                                     | No. of Samples Exceeding                                     | Range in Concentration Exceeding (ug/m <sup>3</sup> ) | Criterion (ug/m <sup>3</sup> ) | No. of Samples Exceeding                                 | Range in Concentration Exceeding (ug/m <sup>3</sup> ) | Criterion (ug/m <sup>3</sup> ) |
| 1,4-Dichlorobenzene (November 2007) | 1 of 6                                                       | 3.8                                                   | 3                              | 1 of 6                                                   | 3.8                                                   | 3                              |
| 1,4-Dichlorobenzene (May 2008)      | 1 of 6                                                       | 7.88                                                  | 3                              | 1 of 6                                                   | 7.88                                                  | 3                              |
| Methylene Chloride (August 2007)    | 1 of 5                                                       | 18                                                    | 9                              | 1 of 5                                                   | 18                                                    | 4                              |
| MTBE (November 2007)                | 0 of 6                                                       | -                                                     | 4                              | 1 of 6                                                   | 3.3                                                   | 2                              |
| MTBE (May 2008)                     | 0 of 6                                                       | -                                                     | 4                              | 1 of 6                                                   | 2.9                                                   | 2                              |
| Benzene (May 2008)                  | 2 of 5                                                       | 3.19 to 4.41                                          | 2                              | 2 of 5                                                   | 3.19 to 4.41                                          | 2                              |

### 3.4.6 Integrated Discussion of Results

Two COPCs in AOC 2 groundwater, TCE and PCE, have consistently been detected in sub-slab soil gas at concentrations exceeding screening levels since the vapor intrusion investigation of Building 160 began. However, TCE and PCE were not detected in any indoor air samples during the last three sampling events that exceeded NJDEP VIG screening levels. Both TCE and PCE continue to be detected at elevated levels above NJDEP VIG screening levels, but there appears not be a pathway to indoor air. Both TCE and PCE continue to be detected in nearby groundwater monitoring wells at concentrations greater than the NJDEP VIG groundwater screening levels.

Additional compounds that were detected in indoor air at concentrations greater than NJDEP VIG screening levels included 1,4-dichlorobenzene, methylene chloride, MTBE, and benzene none of which are considered DOD-related. None of these compounds were detected in recent groundwater samples collected from wells in the vicinity of Building 160. Using the multiple line of evidence, it is concluded that their presence in the indoor air samples collected from Building 160 is indicative of tenant activities.

### 3.4.7 Conclusions and Recommendations

Both TCE and PCE were not detected in any of the indoor air samples collected during the recent three sampling events. However, since the September 2003 sampling event, TCE and PCE levels in soil gas, with occasional fluctuations, have been continually detected. There continues to be spike results of TCE in the sub-slab which is 2 to 3 orders of magnitude greater than the NJDEP screening levels. A Passive Sub-Slab Soil Gas Mitigation system was installed by USACE in June 2008. Passive indoor monitoring of the building is recommended to document no risk to the tenants and system effectiveness. The remaining compounds that have been detected in indoor air samples do not meet the criteria of COPCs, and are indicative of tenant operations within the building.

### 3.5 CAMPUS PLAZA 1

Campus Plaza 1 is a single-story concrete and steel building built on a concrete slab on grade, located within the Groundwater AOC 2 plume. The building consists of office space and/or warehouse and is occupied by 16 tenant locations. Campus Plaza 1 is comprised of: 35 Campus Drive; 37 Campus Drive; 45 Campus Drive; 65 Campus Drive; 67 Campus Drive; 75 Campus Drive; 85 Campus Drive; 95 Campus Drive; 115 Campus Drive; 125 Campus Drive; 145 Campus Drive; 155 Campus Drive; 175 Campus Drive; 185A Campus Drive; 195 Campus Drive; and 205 Campus Drive. Seven of the 15 tenant locations were chosen as sample sites. Campus Plaza 1 is surrounded by parking lot with small landscaped or lawn areas.

Two previous rounds of indoor air and sub-slab soil gas sampling were conducted at Campus Plaza 1 in October 2004 and April/May 2007. Current investigation activities included sub-slab soil gas and indoor air sample collection during May 2008.

#### 3.5.1 Prior Investigations

Based upon the vapor intrusion investigations being performed along Fieldcrest Avenue, the landowner of Campus Plaza 1 hired Environmental Waste Management Associates (EWMA) to perform an indoor air investigation. Two indoor air samples and one background sample were collected at 75 Campus Drive from 27 through 28 May 2004. This address was a vacant tenant location in the Campus Plaza 1 building at the time of the investigation. The PCE and TCE analytical results for all three samples were non-detect, although the detection limits for these parameters exceeded Region III Risk Based Concentrations (RBCs) and the EPA Table 2C generic screening benchmarks. Chloroform was detected in one indoor air sample (P1-2) at  $2.4 \mu\text{g}/\text{m}^3$  in exceedance of the EPA Region III RBC and the EPA Table 2C generic screening benchmark. Benzene was detected in both indoor air samples (P1-1 and P1-2 at  $5.4 \mu\text{g}/\text{m}^3$  and  $5.8 \mu\text{g}/\text{m}^3$ , respectively) in exceedance of the EPA Region III RBCs as well as the EPA generic screening benchmarks. (At the time of the EWMA sample collection and analysis, the NJDEP VIG had not been developed; therefore, the analytical results were compared to EPA Region III RBCs and EPA Table 2C screening benchmarks).

In October 2004, the USACE collected indoor air and sub-slab soil gas samples. The data suggested that there was no evidence of a complete vapor intrusion pathway at Campus Plaza 1. PCE was detected above the benchmark value in two of the six indoor air samples collected at Campus Plaza 1, but the sub-slab soil gas samples, while showing detectable results, did not exceed benchmark values. In addition, no detectable PCE concentrations were identified during EWMA's indoor air sampling in May 2004.

TCE was detected in sub-slab soil gas above the Table 2C-SSG benchmark, but was not detected in the indoor air samples during either Weston's November 2004 sampling event or EWMA's May 2004 sampling event.

Acetone was detected in the sub-slab soil gas and the indoor air, but was not detected in the groundwater. Benzene was detected in the sub-slab soil gas and the indoor air, but was not detected in the groundwater at the closest well, MW-127, in excess of the NJDEP GWQS or the EPA Table 2C-GW screening benchmark. Chloroform was detected in one of the sub-slab soil

gas samples and one of the indoor air samples, but was not detected in the groundwater at the closest well.

Based upon the IAQ Approach and analysis of the two rounds of sampling data, no further sampling had been proposed at this building because there was not a complete vapor intrusion pathway at Campus Plaza 1.

A compendium of sub-slab soil gas and indoor air sample results for the USACE-collected samples is provided in Tables 3-16 and 3-17, respectively. These tables summarize the number of detections and exceedances of NJDEP VIG screening levels, by sampling event, as well as the range of concentrations detected. The tables include only those VOCs that have been detected in any of the historic or current samples (i.e., those compounds that have never been detected in sub-slab soil gas, or indoor air samples collected by USACE at Campus Plaza 1 are not included on Tables 3-16 and 3-17).

### 3.5.2 Current Investigations

The permanent sub-slab soil gas points were sampled on 30 May 2008. The sub-slab soil gas samples were collected over a 1-hour period upon completion of the air samples. Sub-slab soil gas samples were collected at the following locations: in the Hill-Rom warehouse, in the Metagenics warehouse, in the Weston Solutions (Weston) warehouse, in the Barclay Water Management (Barclay) warehouse, in the ProSource warehouse and in the Pacific Channels Group (Pacific) storeroom.

Indoor air and background air quality samples were collected over a 24-hour period beginning on May 30, 2008. There were seven indoor air samples collected during the sampling event. One indoor air sample was collected from Weston, one indoor air sample was collected from Hill-Rom, one indoor air sample was collected from Metagenics, one indoor air sample was collected from Barclay, one indoor air sample was collected from Pacific and one indoor air sample was collected from USInfrastructure. The background sample was collected at ground level immediately adjacent to Campus Plaza 1. The locations of the sub-slab soil gas, indoor air, and background samples are shown on Figure 3-4.

The following table summarizes the samples collected under the current investigation at Campus Plaza 1.

| Matrix            | Number of Samples | Parameters/Method | Dates Sampled  |
|-------------------|-------------------|-------------------|----------------|
| Sub-slab Soil Gas | 6                 | VOCs/TO-15        | 30 May 2008    |
| Indoor Air        | 7                 | VOCs/TO-15        | 29-30 May 2008 |
| Background        | 1                 | VOCs/TO-15        | 29-30 May 2008 |

### 3.5.3 Sub-slab Soil Gas Results

Neither PCE nor TCE were in the most recent sub-slab soil gas at concentrations greater than the VIG screening levels. The recent May 2008 sampling event did not detect any VOCs in the sub-slab above NJDEP VIG screening levels. The PCE and TCE analytical results are shown on Figure 3-4. Full analytical results for the May 2008 sampling event are provided on Table 3-18.

### 3.5.4 Building Survey

Weston and Shaw completed the *Indoor Air Building Survey and Sampling Form* for each building tenant space 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 in the building. These forms were updated during the Shaw May 2008 sampling events. There were no chemicals observed that are considered significant potential VOC sources during the initial and subsequent sampling events. The Indoor Air Building Survey and Sampling Forms are included on the attached CD.

### 3.5.5 Indoor Air Sampling Results

Results from the May 2008 sampling events show that PCE was detected in one of the indoor air samples at a concentration greater than the VIG screening level. Benzene was detected in one sample at a concentration greater than the VIG screening level.

Full analytical results for the May 2008 sampling events are provided on Table 3-19. A summary table of indoor air sample result exceedances from the most recent round is provided below:

| Compound              | NJDEP VIG Table 1 Non-Residential<br>Indoor Air Screening Level |                                                                |                                   | NJDEP VIG Table 1 Residential<br>Indoor Air Screening Level |                                                                |                                   |
|-----------------------|-----------------------------------------------------------------|----------------------------------------------------------------|-----------------------------------|-------------------------------------------------------------|----------------------------------------------------------------|-----------------------------------|
|                       | No. of<br>Samples<br>Exceeding                                  | Range in<br>Concentration<br>Exceeding<br>(ug/m <sup>3</sup> ) | Criterion<br>(ug/m <sup>3</sup> ) | No. of<br>Samples<br>Exceeding                              | Range in<br>Concentration<br>Exceeding<br>(ug/m <sup>3</sup> ) | Criterion<br>(ug/m <sup>3</sup> ) |
| PCE<br>(May 2008)     | 1 of 7                                                          | 12.88                                                          | 3                                 | 1 of 7                                                      | 12.88                                                          | 3                                 |
| Benzene<br>(May 2008) | 1 of 7                                                          | 3.48                                                           | 2                                 | 1 of 7                                                      | 3.48                                                           | 2                                 |

### 3.5.6 Integrated Discussion of Results

PCE levels in the soil gas measured in May 2008 were not detected above the NJDEP VIG screening levels. However, PCE was detected above NJDEP VIG screening levels for indoor air. Recent groundwater shows that PCE is not present in groundwater at concentrations greater than the NJDEP VIG groundwater screening levels near Campus Plaza 1 (see Report #3). Taken collectively, the weight of evidence suggests that a complete vapor intrusion pathway is not present in Campus Plaza 1 and that tenant activities were likely contributing to indoor air quality.

### **3.5.7 Conclusions and Recommendations**

Based on the results to date, there does not appear to be a complete pathway for vapors at this building. There have been no exceedances for TCE in soil gas or indoor air in all sampling events to date. PCE has been detected periodically in both soil gas and indoor air, however it is often higher in the indoor air indicating a source other than groundwater. Additionally groundwater results in the vicinity of Plaza I do not indicate any exceedances of NJDEP VIG groundwater screening levels. No Further Action is recommended for this building.

### 3.6 CAMPUS PLAZA 2

Campus Plaza 2 is a single-story concrete and steel building built on a concrete slab on grade, located within the Groundwater AOC 2 plume. The building consists of office and warehouse space and is occupied by nine tenant locations. Four of the nine tenant locations were chosen as sample sites. Campus Plaza 2 is surrounded by a parking lot with small landscaped or lawn areas.

Five previous rounds of sub-slab soil gas sampling were conducted in October 2004 through March 2007. Indoor air sampling was conducted along with the historical sub-slab soil gas sampling events, except that the October 2004 indoor air sampling event was continued in December 2004, during which one indoor air sample was re-collected to confirm an analytical result. Current investigation activities included sub-slab soil gas and indoor air sample collection in July 2007 and November 2007.

#### 3.6.1 Prior Investigations

The initial sampling at Campus Plaza 2 was performed by EWMA in May 2004. One indoor air and one background sample were collected. Both PCE and TCE were reported to be below detection limits. However, benzene was detected in indoor air at a concentration exceeding its Table 2C benchmark at  $1.7 \mu\text{g}/\text{m}^3$ . It should be noted that the current NJDEP VIG residential/nonresidential indoor air screening level is  $2.0 \mu\text{g}/\text{m}^3$ ; the benzene detected in the EWMA indoor air sample would not be considered an exceedance using the current criterion.

Weston collected its first round of indoor air and sub-slab soil gas samples at Campus Plaza 2 in October 2004. Six indoor air and four sub-slab soil gas samples were collected. The results indicated the following: TCE was detected exceeding the EPA Table 2C benchmark in two of the four sub-slab soil gas samples, and also in two of the six indoor air samples. Benzene, bromomethane, ethylbenzene, methylene chloride, MTBE, 1,2,4-trimethylbenzene, and TCE were detected in between one and six indoor air samples at concentrations greater than EPA Table 2C benchmarks. Comparing the data to the current NJDEP VIG screening levels show that none of the sub-slab soil gas samples exceeded current screening levels. Comparison to the current NJDEP VIG screening levels also shows that benzene, methylene chloride, MTBE, and TCE exceeded the NJDEP VIG nonresidential screening values each in two indoor air samples or less.

No conclusion was reached as to the existence of a vapor intrusion pathway based on these data as the concentration of TCE in indoor air sample 1-CP2-1 was an order of magnitude higher than was detected in the sub-slab soil gas, and therefore more likely caused by tenant-related activities. Likewise, comparison of the concentrations of the other VOCs detected in indoor air to their concentrations detected in sub-slab soil gas suggests their presence in the indoor air is related to tenant-related activities.

During the second sampling event in January 2006, Weston collected four sub-slab soil gas samples and six indoor air samples. The results indicated the following: TCE was detected at concentrations greater than the NJDEP VIG screening levels in two of four sub-slab soil gas samples, and also in one of the indoor air samples. No other VOCs were detected in sub-slab

soil gas samples at concentrations greater than NJDEP VIG screening levels. Additional VOCs detected in indoor air samples at concentrations greater than NJDEP VIG screening levels included benzene in four samples, MTBE in three samples, 1,4-dichlorobenzene in two samples, and 3-chloropropene and methylene chloride in one sample each. The presence of benzene, MTBE, 1,4-dichlorobenzene, 3-chloropropene, and methylene chloride were attributed to non-DOD activities.

A compendium of sub-slab soil gas and indoor air sample results is provided in Tables 3-20 and 3-21, respectively. These tables summarize the number of detections and exceedances of NJDEP VIG screening levels, by sampling event. The tables include only those VOCs that have been detected in any of the current and historic samples (i.e., those compounds that have never been detected in sub-slab soil gas, vapor recovery, or indoor air samples collected by USACE at Campus Plaza 2 are not included on Tables 3-20 and 3-21).

### 3.6.2 Current Investigation

The current investigation includes both sub-slab and indoor air samples for two sampling events; July 2007 and November 2007. Both events were conducted by Weston Solutions. The sampling was performed in various tenant spaces that includes, Centurion, Blockbuster Video, CBM and CSSC.

The following table summarizes the samples collected under the current investigation at Campus Plaza 2.

| Matrix            | Number of Samples | Parameters/Method | Dates Sampled   |
|-------------------|-------------------|-------------------|-----------------|
| Sub-slab Soil Gas | 4                 | VOCs/TO-15        | 25 July 2007    |
|                   | 4                 | VOCs/TO-15        | 8 November 2007 |
| Indoor Air        | 6                 | VOCs/TO-15        | 18 July 2007    |
|                   | 6                 | VOCs/TO-15        | 8 November 2007 |

### 3.6.3 Sub-slab Soil Gas Results

During the November 2007 sampling event, TCE was detected in one of the sub-slab soil gas samples at concentrations that exceeded the NJDEP VIG residential/nonresidential screening level. No other VOCs were detected at concentrations greater than either residential or nonresidential NJDEP VIG screening levels. During the July 2007 sampling event, TCE was not detected in any samples. The full analytical results for the sub-slab soil gas samples are presented on Table 3-22. All PCE and TCE results are graphically depicted on Figure 3-5.

The exceedances of NJDEP VIG screening levels are summarized in the table below:

| Compound               | NJDEP VIG Table 1 Non-Residential<br>Sub-slab Soil Gas Screening Level |                                                                |                                   | NJDEP VIG Table 1 Residential<br>Sub-slab Soil Gas Screening Level |                                                                |                                   |
|------------------------|------------------------------------------------------------------------|----------------------------------------------------------------|-----------------------------------|--------------------------------------------------------------------|----------------------------------------------------------------|-----------------------------------|
|                        | No. of<br>Samples<br>Exceeding                                         | Range in<br>Concentration<br>Exceeding<br>(ug/m <sup>3</sup> ) | Criterion<br>(ug/m <sup>3</sup> ) | No. of<br>Samples<br>Exceeding                                     | Range in<br>Concentration<br>Exceeding<br>(ug/m <sup>3</sup> ) | Criterion<br>(ug/m <sup>3</sup> ) |
| TCE<br>(November 2007) | 1 of 4                                                                 | 28                                                             | 27                                | 1 of 4                                                             | 28                                                             | 27                                |

### 3.6.4 Building Survey

At Campus Plaza 2, there were four tenant locations surveyed: Blockbuster Video, formerly occupied by Dodge Newark, (80 Campus Drive), Centurion Systems, Inc. (105 Campus Drive), Innovative (formerly known as Coordinated Systems & Services Corporation, or CSSC) (130 Campus Drive), and CSM of America (180 Campus Drive); these tenants corresponded to the spaces where indoor air samples were collected as part of the current investigation. The *Indoor Air Building Survey and Sampling Form* for each tenant was updated during the November 2007 sampling event.

Blockbuster Video (80 Campus Drive) consists of a small office area and attached warehouse. The location acts as a distribution center for videotape and DVD orders. No chemicals were observed stored on site with the exception of ordinary cleaning products.

Centurion Systems, Inc. (105 Campus Drive) is a manufacturer and wholesale supplier of veterinary equipment and supplies. During the site inspection, potential VOC sources were found. The sources include PVC Cement, containing methyl ethyl ketone and cyclohexane; and Calcium Lime Rust (CLR) containing toluene and xylene.

Innovative is a worldwide distribution service located at 130 Campus Drive. No potential VOC sources were observed other than standard household cleaning products.

CSM of America is a provider of data network integrated products located at 180 Campus Drive. During the site inspection, several potential sources of VOCs were found, including Rust-Oleum brand flat protective enamel (containing acetone, ethylbenzene, 1,2,4-trimethylbenzene, toluene, and xylenes), SPECS brand paint thinner (containing benzene), Raid<sup>TM</sup> brand insecticide spray (containing 1,1,1-trichloroethane), and nail polish remover (containing acetone).

### 3.6.5 Indoor Air Sampling Results

Four VOCs (TCE, PCE, methylene chloride, and benzene) were each detected during both the July and November 2007 sampling events at concentrations that exceeded NJDEP VIG screening levels. No other VOCs were detected above their respective screening benchmarks. Other than TCE and PCE, none of the other VOCs were detected in groundwater during the 2005 or 2007 groundwater sampling event.

The compounds that exceeded the NJDEP VIG screening levels are shown in the table below.



| Compound                              | NJDEP VIG Table 1 Non-Residential<br>Indoor Air Screening Level |                                                                |                                   | NJDEP VIG Table 1 Residential<br>Indoor Air Screening Level |                                                                |                                   |
|---------------------------------------|-----------------------------------------------------------------|----------------------------------------------------------------|-----------------------------------|-------------------------------------------------------------|----------------------------------------------------------------|-----------------------------------|
|                                       | No. of<br>Samples<br>Exceeding                                  | Range in<br>Concentration<br>Exceeding<br>(ug/m <sup>3</sup> ) | Criterion<br>(ug/m <sup>3</sup> ) | No. of<br>Samples<br>Exceeding                              | Range in<br>Concentration<br>Exceeding<br>(ug/m <sup>3</sup> ) | Criterion<br>(ug/m <sup>3</sup> ) |
| Benzene<br>(July 2007)                | 1 of 6                                                          | 3.0                                                            | 2                                 | 1 of 6                                                      | 3.0                                                            | 2                                 |
| Methylene Chloride<br>(November 2007) | 6 of 6                                                          | 12 to 170                                                      | 9                                 | 6 of 6                                                      | 12 to 170                                                      | 4                                 |
| PCE<br>(November 2007)                | 1 of 6                                                          | 3.9                                                            | 3                                 | 1 of 6                                                      | 3.9                                                            | 3                                 |
| TCE<br>(July 2007)                    | 2 of 7                                                          | 3.2 to 6.4                                                     | 3                                 | 2 of 7                                                      | 3.2 to 6.4                                                     | 3                                 |
| TCE<br>(November 2007)                | 1 of 6                                                          | 86                                                             | 3                                 | 1 of 6                                                      | 86                                                             | 3                                 |

### 3.6.6 Integrated Discussion of Results

The only DOD-related COPCs detected in indoor air at concentrations above its VIG screening level were TCE and PCE. While TCE was detected during both sampling rounds in indoor air above NJDEP VIG screening levels in the northwestern portion of the building, PCE was only detected during the November 2007 sampling events. Of note, TCE was detected in the sub-slab soil gas under the northwestern portion of the building, at a location corresponding to the indoor air location. However, the TCE levels detected in sub-slab soil gas were less than the levels detected in indoor air not only during this sampling event but during past sampling event in September 2006 and March 2007. It has been determined that a TCE source does exist within this building.

Several other compounds, including gasoline-related constituents, were detected in indoor air samples at concentrations greater than NJDEP VIG screening levels. Since none of these compounds were present in sub-slab soil gas samples or recent groundwater samples from nearby wells at concentrations greater than NJDEP VIG screening levels, it would appear that the presence of these VOCs in indoor air is related to tenant-related activities.

### 3.6.7 Conclusions and Recommendations

USACE recommends No Further Action at Campus Plaza 2 due to the likely presence of an interior source for TCE. USACE will continue to monitor groundwater within the AOC-2 plume.

### **3.7 CAMPUS PLAZA 4**

Campus Plaza 4 is a single-story concrete and steel building built on a concrete slab on grade, located within footprint of the Groundwater AOC 2 plume. The building consists of office and warehouse space and is occupied by three tenants. All four tenant locations were chosen as sample sites. Campus Plaza 4 is surrounded by parking lot with small landscaped and lawn areas.

Five rounds of indoor air and sub-slab soil gas samples were collected at Campus Plaza 4 by Weston for USACE in October 2004 through March 2007. Current investigation activities included sub-slab soil gas and indoor air sample collection during August 2007, November 2007, May 2008, and September 2008.

#### **3.7.1 Prior Investigations**

The original indoor air sampling at Campus Plaza 4 was conducted in May 2004 by EWMA under contract to 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, sub-slab soil, and sub-slab soil gas samples in October and November 2004. The results of this investigation indicated the possibility of a vapor intrusion pathway based on the presence of TCE in both sub-slab soil gas and indoor air. However, the tenant at 284 Campus Drive (Englehard) utilizes a number of VOCs in their business, and may be contributing to the prior indoor air exceedances (of EPA Table 2C benchmarks) detected during that sampling event of benzene, ethylbenzene, methylene chloride, 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 sub-slab soil gas samples were collected in January 2006. Only one VOC, TCE, was detected in three of five sub-slab soil gas samples at concentrations above NJDEP VIG screening levels. 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 of 1,4-dichlorobenzene and benzene in four of five indoor air samples. USACE recommended continued semi-annual monitoring of sub-slab 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.

A compendium of sub-slab soil gas and indoor air sample results is provided in Tables 3-24 and 3-25, respectively. These tables summarize the number of detections and exceedances of the current NJDEP VIG screening levels, by sampling event. The tables include only those VOCs that have been detected in any of the current or prior USACE investigation samples (i.e., those compounds that have never been detected in sub-slab soil gas or indoor air samples collected by USACE at Campus Plaza 4 are not included on Tables 3-24 and 3-25).

### 3.7.2 Current Investigation

At Campus Plaza 4, sub-slab soil gas and indoor air samples were collected from 274 Raritan Center Parkway, 278 Raritan Center Parkway, 280 Raritan Center Parkway, and 300 Raritan Center Parkway. At 274 Raritan Center Parkway, one indoor air sample was taken in the office area and one sub-slab soil gas sample was taken in the southern corridor. At 278 Raritan Center Parkway, one indoor air sample was collected; the sub-slab soil gas sample was collected in the warehouse. At 280 Raritan Center Parkway, one indoor air sample was collected in the office area. The sub-slab soil gas sample was taken in the warehouse. At 300 Raritan Center Parkway, two indoor air samples were collected, one in the engineering office and one in the financial office area; two sub-slab soil gas samples were collected along the east and west wall of the warehouse. An ambient air sample was collected from outside 300 Raritan Center Parkway or from the roof of 180 Campus Drive (CP2-7) at Campus Plaza 2. The ambient sample was also used to evaluate the indoor air samples collected at Campus Plaza 2 that were also collected.

The following table summarizes the samples collected under the current investigation at Campus Plaza 4.

| Matrix            | Number of Samples | Parameters/Method | Dates Sampled        |
|-------------------|-------------------|-------------------|----------------------|
| Sub-slab Soil Gas | 5                 | VOCs/TO-15        | 21 August 2007       |
|                   | 5                 | VOCs/TO-15        | 8 November 2007      |
|                   | 5                 | VOCs/TO-15        | 28 May 2008          |
|                   | 5                 | VOCs/TO-15        | 24 September 2008    |
| Indoor Air        | 5                 | VOCs/TO-15        | 20-21 August 2007    |
|                   | 5                 | VOCs/TO-15        | 7-8 November 2007    |
|                   | 5                 | VOCs/TO-15        | 27-28 May 2008       |
|                   | 5                 | VOCs/TO-15        | 23-24 September 2008 |
| Background        | 1                 | VOCs/TO-15        | 20-21 August 2007    |
|                   | 1                 | VOCs/TO-15        | 7-8 November 2007    |
|                   | 1                 | VOCs/TO-15        | 27-28 May 2008       |

### 3.7.3 Sub-slab Soil Gas Results

During each of the four current sampling events, TCE was detected in soil gas samples at concentrations that exceeded its NJDEP VIG screening level. PCE was detected in sub-slab soil gas samples at concentrations that exceeded the NJDEP VIG screening levels during three of the four sampling events (August 2007, May 2008 and September 2008). PCE was not detected during the November 2007 sampling events. No other VOC was detected in sub-slab soil gas samples that exceeded its NJDEP residential screening level during all four sampling events. The sub-slab soil gas results are shown on Table 3-26. The PCE and TCE results are shown on Figure 3-6. The following table summarizes the NJDEP VIG exceedances in sub-slab soil gas samples during the current investigation:

| Compound                | NJDEP VIG Table 1 Non-Residential<br>Sub-slab Soil Gas Screening Level |                                                                |                                   | NJDEP VIG Table 1 Residential<br>Sub-slab Soil Gas Screening Level |                                                                |                                   |
|-------------------------|------------------------------------------------------------------------|----------------------------------------------------------------|-----------------------------------|--------------------------------------------------------------------|----------------------------------------------------------------|-----------------------------------|
|                         | No. of<br>Samples<br>Exceeding                                         | Range in<br>Concentration<br>Exceeding<br>(ug/m <sup>3</sup> ) | Criterion<br>(ug/m <sup>3</sup> ) | No. of<br>Samples<br>Exceeding                                     | Range in<br>Concentration<br>Exceeding<br>(ug/m <sup>3</sup> ) | Criterion<br>(ug/m <sup>3</sup> ) |
| TCE<br>(August 2007)    | 2 of 5                                                                 | 38 to 140                                                      | 27                                | 2 of 5                                                             | 38 to 140                                                      | 27                                |
| TCE<br>(November 2007)  | 2 of 5                                                                 | 36 to 450                                                      | 27                                | 2 of 5                                                             | 36 to 450                                                      | 27                                |
| TCE<br>(May 2008)       | 3 of 5                                                                 | 81.96 to 670.7                                                 | 27                                | 3 of 5                                                             | 81.96 to 670.7                                                 | 27                                |
| TCE<br>(September 2008) | 3 of 5                                                                 | 123.61 to<br>994.23                                            | 27                                | 3 of 5                                                             | 123.61 to<br>994.23                                            | 27                                |
| PCE<br>(August 2007)    | 5 of 5                                                                 | 37 to 58                                                       | 36                                | 5 of 5                                                             | 37 to 58                                                       | 34                                |
| PCE<br>(May 2008)       | 1 of 5                                                                 | 98.53                                                          | 36                                | 1 of 5                                                             | 98.53                                                          | 34                                |
| PCE<br>(September 2008) | 2 of 5                                                                 | 54.45 to 77.31                                                 | 36                                | 2 of 5                                                             | 54.45 to 77.31                                                 | 34                                |

### 3.7.4 Building Survey

At Campus Plaza 4, there were four tenant locations surveyed. These locations cumulatively encompass the entire building. The locations are American Income Life/Agilysys (274 Raritan Center Parkway), Fabrictex (278/284 Raritan Center Parkway) Bareweb (280 Raritan Center Parkway), and FBC (300 Raritan Center Parkway). The *Indoor Air Building Survey and Sampling Forms* were updated on 21 August 2007 for the August 2007 sampling event, on 8 November 2007 for the November 2007 sampling event, on 28 May 2008 for the May 2008 sampling event and on 23 September 2008 for the September 2008 sampling event. The updated forms include information on chemicals observed and building size and construction; the updated forms and MSDS forms can be found on the attached CD.

American Income Life is an insurance company was located at 274 Raritan Center Parkway. During the site inspection, no potential VOC sources were identified at this tenant location during the building surveys in August and November 2007. In May 2008, a new tenant, Agilysys occupied the tenant location. Agilysys is a company that provides computer server back-up assistance.

Fabrictex is a company that produces logos for clothing. They are currently located at 278 Raritan Center Parkway, but in the November 2007 building survey completed by Weston, their address was noted as 284 Raritan Center Parkway. The facility consists of a small office area with an attached warehouse. During the site inspection, only daily-use cleaning supplies, with minimal potential VOC sources, were found within the facility.

FBC plans, builds and manages office and distribution space. During the site inspection of this facility, many potential VOC sources were located and noted on the survey form. 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. Daily-use cleaning products were found throughout the location; however, these products did not present any significant potential VOC sources.

### 3.7.5 Indoor Air Sampling Results

Both PCE and TCE were not detected in indoor air at concentration greater than the NJDEP VIG screening levels. Methylene chloride, 1,4 dichlorobenzene and MTBE were detected periodically in indoor air above NJDEP VIG screening levels during all four sampling events (September 2008, May 2008 and November 2007). The analytical data is provided on Table 3-27, while the following table summarizes the exceedances of NJDEP VIG screening levels in indoor air samples:

| Compound                               | NJDEP VIG Table 1 Non-Residential<br>Indoor Air Screening Level |                                                                |                                   | NJDEP VIG Table 1 Residential<br>Indoor Air Screening Level |                                                                |                                   |
|----------------------------------------|-----------------------------------------------------------------|----------------------------------------------------------------|-----------------------------------|-------------------------------------------------------------|----------------------------------------------------------------|-----------------------------------|
|                                        | No. of<br>Samples<br>Exceeding                                  | Range in<br>Concentration<br>Exceeding<br>(ug/m <sup>3</sup> ) | Criterion<br>(ug/m <sup>3</sup> ) | No. of<br>Samples<br>Exceeding                              | Range in<br>Concentration<br>Exceeding<br>(ug/m <sup>3</sup> ) | Criterion<br>(ug/m <sup>3</sup> ) |
| 1,4-Dichlorobenzene<br>(August 2007)   | 4 of 6                                                          | 4.6 to 50                                                      | 3                                 | 4 of 6                                                      | 4.6 to 50                                                      | 3                                 |
| 1,4-Dichlorobenzene<br>(May 2008)      | 3 of 6                                                          | 13.95 to 138.16                                                | 3                                 | 3 of 6                                                      | 13.95 to 138.16                                                | 3                                 |
| Methylene Chloride<br>(November 2007)  | 0 of 6                                                          | -                                                              | 9                                 | 1 of 6                                                      | 7.3                                                            | 4                                 |
| Methylene Chloride<br>(May 2008)       | 0 of 6                                                          | -                                                              | 9                                 | 2 of 6                                                      | 4.52 to 6.22                                                   | 4                                 |
| Methylene Chloride<br>(September 2008) | 4 of 6                                                          | 10.11 to 28.45                                                 | 9                                 | 5 of 6                                                      | 7.33 to 38.45                                                  | 4                                 |
| MTBE<br>(November 2007)                | 0 of 5                                                          | -                                                              | 4                                 | 1 of 5                                                      | 2.1                                                            | 2                                 |

### 3.7.6 Integrated Discussion of Results

The last four sampling events continue to show exceedances of TCE and PCE in soil gas samples. Indoor air results for the current investigation, however, show no exceedances of TCE or PCE.

Other VOCS such as methylene chloride and 1,4-dichlorobenzene detected at concentration above NJDEP VIG screening levels for indoor air are present in the indoor air due to tenant-related activities.

### 3.7.7 Conclusions and Recommendations

Recent sub-slab analytical results for Campus Plaza 4 continue to show elevated levels of tetrachloroethylene and trichloroethylene above regulatory screening levels. Though recent indoor air analytical results have levels for these compounds below regulatory screening levels, the USACE has agreed to continue both sub-slab and indoor air sampling for this building.

### **3.8 CAMPUS PLAZA 5**

Campus Plaza 5 is a single-story concrete and steel building built on a concrete slab on grade, located within the Groundwater AOC 2 plume. The building consists of office and warehouse space and is made up of one tenant space, Wakefern Food Corporation (Wakefern). Campus Plaza 5 is surrounded by a parking lot with small landscaped and lawn areas. The tenant installed a sub-slab vapor recovery system prior to the initial sampling effort performed by Weston for USACE to assess the potential for vapor intrusion.

Three previous rounds of indoor and sub-slab soil gas sampling was conducted by Weston for USACE in October 2004 through April 2007. Current investigation activities included sub-slab soil gas and indoor air sample collection during May and June 2008 (over the weekend, Saturday to Sunday).

#### **3.8.1 Prior Investigations**

EWMA, contracted by FBC, conducted two indoor air sampling events in April and June of 2004, and one sub-slab soil gas sampling event in June 2004. The analytical results were compared to EPA Table 2c benchmarks since NJDEP had not yet published the VIG. TCE exceedances of EPA Table 2c benchmarks were detected in both rounds of indoor air sampling, and both TCE and PCE exceedances of EPA Table 2c benchmarks were detected in the sub-slab soil gas samples. In addition, carbon tetrachloride and chloroform were each detected in one sub-slab soil gas sample in exceedance of their respective EPA Table 2c screening benchmarks.

Weston's initial sampling occurred in October 2004. Six indoor air samples, including one ambient sample, and five sub-slab soil gas samples were collected. The three sub-slab soil gas sampling ports installed by EWMA were utilized. The other two sub-slab soil gas samples were collected from a sub-slab depressurization system installed by EWMA. The system had not been activated as of the October 2004 sampling event. Exceedances of EPA Table 2c benchmarks for TCE (four samples) and benzene (two samples) were detected in sub-slab soil gas. No indoor air exceedances were detected for these VOCs; however, one sample had an exceedance for 1,4-dichlorobenzene.

No vapor intrusion pathway was inferred from either EWMA's or Weston's data. Per the IAQ approach, a confirmatory round of indoor air and sub-slab soil gas sampling was recommended to confirm the lack of a vapor intrusion pathway.

A second round of sampling was conducted by Weston in January 2006. During that sampling event, VOCs were not detected in sub-slab soil gas at concentrations greater than the NJDEP VIG screening levels. While three VOCs (benzene, MTBE, and 1,4-dichlorobenzene) were detected in indoor air at concentrations greater than their NJDEP VIG screening levels, these compounds were not detected in the sub-slab soil gas samples. Further, benzene was detected in the ambient sample at a concentration similar than that detected in the indoor air, MTBE is a non-DOD related COPC since it came into use after the Army ceased operations at the former Arsenal, and 1,4-dichlorobenzene had not been detected in groundwater in Groundwater AOC 2. Therefore, for these various reasons, the exceedances of NJDEP VIG screening levels in the indoor air samples were attributed to reasons other than vapor intrusion.

A compendium of sub-slab soil gas and indoor air sample results is provided in Tables 3-28 and 3-29, respectively. These tables summarize the number of detections and exceedances of NJDEP VIG screening levels, by sampling event. The tables include only those VOCs that have been detected in any of the current and historic investigation samples (i.e., those compounds that have never been detected in sub-slab soil gas or indoor air samples collected by USACE at Campus Plaza 5 are not included on Tables 3-28 and 3-29, nor are data collected by EWMA).

### 3.8.2 Current Investigation

At Campus Plaza 5, the sub-slab soil gas and indoor air samples were collected from sample locations designed to provide full coverage of the building. The locations of the samples corresponded to sample locations from earlier sampling events. The sub-slab soil gas and indoor air sample locations are shown on Figure 3-7. The ambient air sample was collected from ground level because there was no access available to the roof during the time of sampling.

The following table summarizes the samples collected under the current investigation at Campus Plaza 5.

| Matrix            | Number of Samples | Parameters/Method | Dates Sampled        |
|-------------------|-------------------|-------------------|----------------------|
| Sub-slab Soil Gas | 5                 | VOCs/TO-15        | 1 June 2008          |
| Indoor Air        | 5                 | VOCs/TO-15        | 31 May – 1 June 2008 |
| Ambient Air       | 1                 | VOCs/TO-15        | 31 May – 1 June 2008 |

### 3.8.3 Sub-slab Soil Gas Results

Only 1,4 dichlorobenzene was detected at concentration above NJDEP VIG screening levels for sub-soil gas. All VOCs were either not detected or detected at concentrations lower than NJDEP VIG residential and nonresidential screening levels. The sub-slab soil gas results are shown on Table 3-30. PCE and TCE sample results are graphically depicted on Figure 3-7.

### 3.8.4 Building Survey

The Wakefern facility (244 Raritan Center Parkway) consists of an office area and an attached warehouse. The Indoor Air Building Survey and Sampling Form was updated on 31 May 2008. The updated form includes information on chemicals observed and building size and construction; it can be found on the CD attached to this report. Within the warehouse is a printing shop with numerous products used for printing of materials and cleaning of the printing equipment. A list of products used by Wakefern along with several MSDSs were provided. During the site inspection, potential VOC sources were found and noted on the survey forms. These included a deglazing solvent containing TCE, and solexolite deglazer solvent containing toluene, and acetone. Common cleaning products were found throughout the location; however, these products did not present any significant potential VOC sources.

### 3.8.5 Indoor Air Sampling Results

PCE was detected at one sampling point above NJDEP VIG screening levels during the May-June 2008 sampling event. Other VOCs detected in indoor air above NJDEP VIG screening levels include 1,4 dichlorobenzene and methylene chloride. No other VOCs were detected in indoor air at concentrations above the NJDEP VIG screening levels.

The indoor air results are presented on Table 3-31. PCE and TCE sample results are graphically depicted on Figure 3-7.

### **3.8.6 Integrated Discussion of Results**

Since October 2004 sub-slab analytical data for Campus Plaza 5 continues to show volatile organic compounds, particularly PCE and TCE below regulatory screening levels for sub soil gas. In June 2008 one indoor air sampling point detected a PCE concentration of 579.11 microgram per cubic meter. This anomaly is a significant spike when compared to 15 previous indoor air samples collected from October 2004 through April 2007 that did not detect any concentration of PCE. Based on recent and historical sub-slab analytical data for this building, the source of this spiked analytical result would not have occurred from the sub-slab. The exact source or cause for this unusual high concentration cannot be determined at this time. . The data from the most recent and past sampling event confirm that the sub-slab depressurization system is working effectively at Campus Plaza 5.

### **3.8.7 Conclusions and Recommendations**

As previously noted, the current building tenant elected to self-install a vapor extraction system for this building. Based on recent and historical data, the USACE would not have recommended the installation of this system. Therefore, the USACE recommends that any future operation/maintenance of this system and sampling is the responsibility of the building owner. The USACE is recommending “No Further Action” for Campus Plaza 5.



## SECTION 4.0 SAMPLING RESULTS FOR GROUNDWATER AREA OF CONCERN 6

### 4.1 OVERVIEW OF GROUNDWATER AOC 6 RESULTS

This section focuses on sampling results for sub-slab soil gas and indoor air collected during November 2007, June 2008, and October 2008 to evaluate the potential for vapor intrusion at one building in the vicinity of Groundwater AOC 6. Prior to the discussion of the sub-slab soil gas and indoor air results, a description of historic groundwater contaminant concentrations is presented. The plume boundaries, as revised per the *Draft Supplemental Groundwater Data Report* (Weston 2005) were those that defined the extent of the groundwater plume for identification of buildings requiring evaluation of the potential for vapor intrusion.

Per the recommendations from the *Indoor Air Quality Semi-Annual Report #3* (Weston, 2008), one building is still being evaluated and/or monitored for vapor intrusion issues in AOC 6. The only building located within Groundwater AOC 6 that was sampled during the current investigation was 102-168 Fernwood Avenue.

This building is commercial/industrial, and can be described as warehouse and/or office space. The building is, for the most part, surrounded by parking areas and roadways. Few open/landscaped areas exist. Sub-slab soil gas samples and indoor air samples were collected at this building within Groundwater AOC 6.

#### 4.1.1 Groundwater AOC 6

Groundwater AOC 6 is located in the central portion of the site. The plume has been subdivided into Groundwater AOC 6A, Groundwater AOC 6B and Groundwater AOC 6C. The northern extent of Groundwater AOC 6A lies north of the building located at 110 Fernwood Avenue and underlies a portion of Area 10, within Raritan Center, and a portion of 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 Groundwater AOC 6. Other potential sources may have included historic, or more recent, site activities not related to DOD activities (e.g., light manufacturing or industrial processes) as identified during a previously conducted file review.

Groundwater analytical data for overburden monitoring wells and direct-push samples from 1994 to 2005 were reviewed and compared to screening levels presented in Table 1 of NJDEP's Vapor Intrusion Guidance (October 2005, updated March 2007) to characterize the COPCs in Groundwater AOC 6. The location of the monitoring wells and shallow groundwater screening sample locations for AOC 6 are shown on Figures 7 and 13 of the 2005 *Draft Supplemental*

*Groundwater Data Report.* Table 5-1 provides these data for all VOCs that have historically been detected in any of the groundwater samples collected from within the bounds of Groundwater AOC 6. The historic contaminants of concern in Groundwater AOC 6 were TCE, PCE, total-1,2-dichloroethene (total-1,2-DCE), vinyl chloride, benzene, and cis-1,2-DCE as shown in Table 5-1. TCE concentration contours in groundwater for AOC 6 are shown on Figure 13 of the 2005 *Draft Supplemental Groundwater Data Report*.

The *Draft Supplemental Groundwater Data Report* (Weston, 2005) stated that USACE will prepare a Groundwater RAWP with MNA proposed as the remedial action for Groundwater AOC 6A and proposed no further action in association with Groundwater AOC 6B. Additionally, the report stated that USACE will prepare a RAWP for AOC 6C after further investigation is completed to evaluate the vapor intrusion pathway.

In the meantime buildings within a 100-foot radius of the groundwater plume boundaries for Groundwater AOCs 6A, 6B and 6C were evaluated to determine if a potential vapor intrusion pathway existed, and sub-slab soil gas sampling was warranted. Groundwater data from the *Draft Supplemental Groundwater Data Report* (Weston, October 2005) in conjunction with historic groundwater data were evaluated to determine which buildings would be considered for sub-slab soil gas sampling. If the groundwater data exceeded the NJDEP Table 1 Generic Vapor Intrusion Screening Levels for Groundwater (NJDEP Table 1-GW), it would indicate that groundwater could potentially be a source of vapors that could enter a building. If not, then a building was excluded from further vapor intrusion evaluation and sampling. In evaluating each building for vapor intrusion, recent groundwater data were given more importance than historic data, and the data from both monitoring wells and shallow groundwater screening (SGWS) points were included. Additionally, the position of the building in relation to the plume boundaries, the groundwater flow direction, and the most appropriate groundwater data points were used in determining whether a potential vapor intrusion pathway exists at each building.

A total of nine buildings within AOC 6 were previously evaluated to determine which specific buildings would require sub-slab soil gas sampling. Of the nine buildings evaluated, two were screened out of the sampling program based on groundwater data near the buildings, and seven buildings were sampled for sub-slab soil gas during the initial sampling effort conducted in March/April 2006. Since that time only 102-168 Fernwood Avenue remains and is included in this report (Report #4).

#### **4.1.2 Sub-slab Soil Gas**

From November 2007 until October 2008, USACE collected three rounds of sub-slab soil gas samples at 102-168 Fernwood, which is the only remaining building being sampled in the vicinity of Groundwater AOCs 6A, 6B and 6C. The table below summarizes the number of sub-slab soil gas samples collected during each sampling event at this building.

| <b>Building</b>         | <b>Number of Sub-slab Soil Gas Samples</b> | <b>Sampling Date</b> | <b>Sampling Round</b> |
|-------------------------|--------------------------------------------|----------------------|-----------------------|
| 102-168 Fernwood Avenue | 5                                          | 13 November 2007     | Fourth Round          |
|                         | 5                                          | 19 June 2008         | Fifth Round           |
|                         | 5                                          | 2 October 2008       | Sixth Round           |

Results of the sub-slab soil gas analyses for VOCs below the remaining building in the vicinity of Groundwater AOC 6 are discussed in the following subsections of this report, and are provided in Tables 4-2 through 4-5. Shaded values in the tables indicate exceedances of the NJDEP VIG residential screening levels whereas bolded and shaded values indicate exceedances of the NJDEP VIG non-residential sub-slab soil gas screening levels. Compounds exceeding the screening levels in indoor air during the current sampling events were limited to TCE and PCE.

Figure 4-1 shows the PCE and TCE concentrations for the remaining building investigated in the vicinity of Groundwater AOC 6. Exceedances of the NJDEP VIG screening levels are noted in red.

### 4.1.3 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 the building under evaluation for vapor intrusion. Building 102-168 Fernwood located within Groundwater AOC 6 is primarily used as office space combined with attached warehouses. Common cleaning products were found in the building evaluated, but generally in small quantities and properly stored. As a result, in most cases, these cleaners may not necessarily constitute “significant” potential VOC sources. Currently the only tenant is Computershare Inc. Painting occurred in October 2008 in a room adjacent to soil gas port 01 (102 FERN SG01).

### 4.1.4 Indoor Air

From November 2007 until October 2008, the USACE collected indoor air samples and sub-slab soil gas samples at one building in the vicinity of Groundwater AOCs 6A, 6B and 6C. The table below summarizes the number of indoor air samples collected during these sampling events.

| Building                | Number of Indoor Air Samples | Ambient Air Samples | Sampling Date       | Sampling Round |
|-------------------------|------------------------------|---------------------|---------------------|----------------|
| 102-168 Fernwood Avenue | 5                            | 1                   | 12-13 November 2007 | Fourth Round   |
|                         | 5                            | 1                   | 19-20 June 2008     | Fifth Round    |
|                         | 5                            | 1                   | 1-2 October 2008    | Sixth Round    |

Results of the indoor air and background ambient air analyses for VOCs in this remaining building within Groundwater AOC 6 are discussed in the following subsection of this report. Shaded values in the tables indicate exceedances of the NJDEP VIG residential screening levels, whereas bolded and shaded values indicate exceedances of the NJDEP VIG non-residential indoor air screening levels. Figure 4-1 shows the PCE and TCE concentrations for the building investigated in the vicinity of Groundwater AOC 6. Exceedances of the NJDEP VIG screening levels are noted in red.

### 4.1.5 Meteorological Data

Meteorological data for this sampling event was received from the National Climatic Data Center and utilized National Weather Service Data from Newark Liberty International Airport. 1.

The meteorological data collected during the sampling of the Groundwater AOC 6 buildings is summarized below. See the attached CD for the complete meteorological data.

| <b>Building</b>         | <b>Dates Sampled</b> | <b>Temperature Range (°F)</b> | <b>Barometric Pressure (Inches)</b> | <b>Precipitation (Inches)</b> | <b>Relative Humidity Range (%)</b> |
|-------------------------|----------------------|-------------------------------|-------------------------------------|-------------------------------|------------------------------------|
| 102-168 Fernwood Avenue | 12-13 November 2007  | 34-61                         | 29.89-30.26                         | 0.14                          | 46-90                              |
|                         | 19-20 June 2008      | 56-82                         | 29.86-30.01                         | None                          | 30-67                              |
|                         | 1-2 October 2008     | 51-73                         | 29.54-29.77                         | 0.30                          | 40-84                              |

## 4.2 102-168 Fernwood Avenue

102-168 Fernwood Avenue is a single-story concrete and steel building built on a concrete slab on grade, located within the Groundwater AOC 6 plume. The building consists of office space and/or warehouse and was occupied by two tenant locations. Currently (January 2009), it only has one tenant.

Three previous rounds of sub-slab soil gas sampling were conducted at 102-168 Fernwood Avenue during March 2006 through April 2007. Current investigation activities included sub-slab soil gas and indoor air sample collection during November 2007, June 2008, and October 2008.

### 4.2.1 Prior Investigations

The 102-168 Fernwood Avenue building is located to the north of AOC 6A, but within the 100-foot radius of the groundwater plume boundary. The closest sampling locations for which recent groundwater data (2004/2005) are available are SGWS219 (about 300 feet north of the building and upgradient of the plume), SGWS220 (about 270 feet northwest and upgradient), SGWS221 (about 60 feet to the west and sidegradient), SGWS223 (about 120 feet to the southwest), SGWS229 (within 60 feet to the southeast and downgradient of the plume), and MW-47A (about 100 feet south and downgradient). In addition, the closest historical sample (sampled in 1994) is about 50 feet from the northeast corner of the building at location SGWS113.

- Recent (October 2004) groundwater data from SGWS219, SGWS220, and SGWS221 located upgradient of this building did not show volatile organic compound (VOC) concentrations exceeding the NJDEP Table 1-GW screening levels.
- Historic (1994) groundwater data from sample location SGWS113 located upgradient of this building did not indicate detectable levels of VOCs.
- The most recent sampling data from the closest points downgradient of the building indicate slight exceedance of several VOCs above the NJDEP Table 1-GW. SGWS223 exhibited a vinyl chloride concentration at 13 micrograms per liter ( $\mu\text{g/l}$ ) compared with an NJDEP Table 1-GW screening level of 1  $\mu\text{g/l}$ . SGWS229 exhibited concentrations of vinyl chloride and TCE at 9.6  $\mu\text{g/l}$  and at 37  $\mu\text{g/l}$ , respectively, which exceed the NJDEP Table 1-GW screening level.
- Monitoring well MW-47A, also located downgradient and sampled in 2005, exhibited a TCE concentration of 13  $\mu\text{g/l}$ , which also exceeded the NJDEP screening level.
- The concentrations of VOCs detected in groundwater at the closest downgradient monitoring well MW-47A are demonstrating a consistently decreasing trend, as shown on Figure 7 of the *Draft Supplemental Groundwater Data Report* (Weston, October 2005).

- This building is primarily located outside of the groundwater plume in a hydraulically upgradient direction, as shown on Figures 7 and 13 of the *Draft Supplemental Groundwater Data Report* (Weston, October 2005).

Weston collected a round of sub-slab soil gas samples in March 2006. The results of this investigation indicated the possibility of a vapor intrusion pathway as TCE was detected in one of the five sub-slab soil gas samples in exceedance of the NJDEP VIG screening levels. Indoor air samples were not collected concurrent with the sub-slab soil gas samples during the initial sampling event.

#### 4.2.2 Current Investigation

Five sub-slab soil gas and indoor air samples were collected at 102-168 Fernwood Avenue on 12-13 November 2007, 19-20 June 2008 and on 1-2 October 2008. Four sub-slab soil gas points were sampled at 102 Fernwood Avenue (Computershare.) and one sub-slab soil gas point was sampled at 166 Fernwood Avenue (unoccupied). It should be noted that Shaw was required to re-drill permanent sub-slab sampling probes for SG-2 and SG-3 during the June 2008 sampling event. The previous ports were covered with a layer of concrete. Sub-slab soil gas sample locations for 102-168 Fernwood Avenue are shown on Figure 4-1.

The following table summarizes the samples collected under the current investigation.

| Matrix            | Number of Samples | Parameters/Method | Dates Sampled       |
|-------------------|-------------------|-------------------|---------------------|
| Sub-slab Soil Gas | 5                 | VOCs/TO-15        | 13 November 2007    |
|                   | 5                 | VOCs/TO-15        | 20 June 2008        |
|                   | 5                 | VOCs/TO-15        | 2 October 2008      |
| Indoor Air        | 5                 | VOCs/TO-15        | 12-13 November 2007 |
|                   | 5                 | VOCs/TO-15        | 19-20 June 2008     |
|                   | 5                 | VOCs/TO-15        | 1-2 October 2008    |
| Ambient           | 1                 | VOCs/TO-15        | 12-13 November 2007 |
|                   | 1                 | VOCs/TO-15        | 19-20 June 2008     |
|                   | 1                 | VOCs/TO-15        | 1-2 October 2008    |

#### 4.2.3 Sub-slab Soil Gas Results

Two VOCs (TCE and PCE) were detected in sub-slab soil gas at concentrations exceeding both the residential and non-residential NJDEP VIG screening levels during the June and September 2008 sampling event. TCE and PCE levels did not exceed NJDEP VIG screening levels during the November 2007 sampling event. . TCE exceeded the NJDEP VIG screening levels in five of the ten sub-slab soil gas samples collected during the June and October 2008 sampling events. PCE exceeded the NJDEP VIG screening levels in one of the five sub-slab soil gas samples collected during the June 2008 sampling event. PCE was not detected above the NJDEP VIG screening levels during the November 2007 or October 2008 sampling events. Chloroform was also detected above NJDEP VIG screening levels in one sample collected during the June 2008

sampling event. However, this VOC was not detected in groundwater samples and is not considered a DOD constituent of concern.

All other VOCs were either not detected or were detected at concentrations lower than their respective NJDEP VIG soil gas screening levels.

A summary of the detection frequency and concentration range of compounds detected in sub-slab soil gas is provided on Table 4-2. The complete sub-slab soil gas results for the current investigation are shown on Table 4-4. The following table contains a summary of the sub-slab soil gas exceedances.

| Compound                  | NJDEP VIG Table 1 Non-Residential<br>Sub-slab Soil Gas Screening Criteria and<br>Exceedances |                                                                |                                   | NJDEP VIG Table 1 Residential<br>Sub-slab Soil Gas Screening Criteria and<br>Exceedances |                                                                |                                   |
|---------------------------|----------------------------------------------------------------------------------------------|----------------------------------------------------------------|-----------------------------------|------------------------------------------------------------------------------------------|----------------------------------------------------------------|-----------------------------------|
|                           | No. of<br>Samples<br>Exceeding                                                               | Range in<br>Concentration<br>Exceeding<br>(ug/m <sup>3</sup> ) | Criterion<br>(ug/m <sup>3</sup> ) | No. of<br>Samples<br>Exceeding                                                           | Range in<br>Concentration<br>Exceeding<br>(ug/m <sup>3</sup> ) | Criterion<br>(ug/m <sup>3</sup> ) |
| TCE<br>(June 2008)        | 3 of 5                                                                                       | 44.66 to 851.28                                                | 27                                | 3 of 5                                                                                   | 44.66 to<br>851.28                                             | 27                                |
| TCE<br>(October 2008)     | 2 of 5                                                                                       | 24.46 to 355.77                                                | 27                                | 2 of 5                                                                                   | 24.46 to<br>355.77                                             | 27                                |
| Chloroform<br>(June 2008) | 1 of 5                                                                                       | 75.69                                                          | 24                                | 1 of 5                                                                                   | 75.69                                                          | 24                                |
| PCE<br>(June 2008)        | 1 of 5                                                                                       | 46.18                                                          | 36                                | 1 of 5                                                                                   | 46.18                                                          | 34                                |

The PCE and TCE sub-slab soil gas sampling results from November 2007 through September 2008 are shown on Figure 4-1.

#### 4.2.4 Building Survey

Weston and Shaw completed the *Indoor Air Building Survey and Sampling Form* for each building tenant space 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 in the building. There were no chemicals observed that are considered significant potential VOC sources during the initial and subsequent sampling events. The Indoor Air Building Survey and Sampling Form are included on the CD attached to this report.

#### 4.2.5 Indoor Air Sampling Results

During the June and October 2008 sampling events, PCE was detected in four of ten total indoor air samples that exceeded NJDEP VIG screening levels. Methylene chloride was detected at two sampling points that exceeded NJDEP VIG screening levels during the October 2008 sampling event. Trichlorofluoromethane was detected in one sample exceeding the NJDEP VIG screening levels during the June 2008 sampling event. However, this was a leak-detection gas used during this sampling event and it is assumed that the sampling “T” was not securely connected to the sub-slab sampling port. All other VOCs were either not detected or were detected at concentrations lower than their respective NJDEP VIG soil gas screening levels.

A summary of the detection frequency and concentration range of compounds detected in indoor air is provided on Table 4-3. The complete indoor air results for the current investigation are shown on Table 4-5. The following table contains a summary of the indoor air exceedances.

| Compound                           | NJDEP VIG Table 1 Non-Residential Indoor Air Screening Criteria and Exceedances |                                                       |                                | NJDEP VIG Table 1 Residential Indoor Air Screening Criteria and Exceedances |                                                       |                                |
|------------------------------------|---------------------------------------------------------------------------------|-------------------------------------------------------|--------------------------------|-----------------------------------------------------------------------------|-------------------------------------------------------|--------------------------------|
|                                    | No. of Samples Exceeding                                                        | Range in Concentration Exceeding (ug/m <sup>3</sup> ) | Criterion (ug/m <sup>3</sup> ) | No. of Samples Exceeding                                                    | Range in Concentration Exceeding (ug/m <sup>3</sup> ) | Criterion (ug/m <sup>3</sup> ) |
| Trichlorofluoromethane (June 2008) | 0 of 5                                                                          | -                                                     | 1,000                          | 1 of 5                                                                      | 877.79                                                | 730                            |
| Methylene Chloride (October 2008)  | 1 of 5                                                                          | 10.28                                                 | 9                              | 2 of 5                                                                      | 5.91 to 10.28                                         | 4                              |
| PCE (September 2006)               | 4 of 10                                                                         | 3.32 to 5.02                                          | 3                              | 4 of 10                                                                     | 3.32 to 5.02                                          | 3                              |

The PCE and TCE indoor air sampling results from November 2007 through October 2008 are shown on Figure 4-1.

#### 4.2.6 Integrated Discussion of Results

The results of this investigation suggest the possibility that TCE detected in soil gas below 102-168 Fernwood Avenue could be at least in part related to groundwater concentrations. TCE has historically been detected in several sub-slab soil gas samples at a concentration exceeding the NJDEP VIG soil gas screening levels for several consecutive sampling events. However, TCE was not detected in indoor air exceeding NJDEP VIG screening levels during the last three sampling rounds. Historically, TCE has been identified as a COPC in this plume, and was detected in groundwater at concentrations exceeding the NJDEP VIG screening level during recent sampling events at sampling locations MW-47A and SGWS229. These groundwater sampling locations are located within less than 60 feet downgradient from the building.

PCE was detected at concentrations greater than NJDEP VIG screening levels in one sub-slab soil gas sample during the June 2008 sampling event. It was detected above NJDEP VIG screening levels for indoor air for several sampling points during the June and October 2008 sampling event.

The other VOCs detected in indoor air at concentrations greater than their NJDEP VIG screening levels (methylene chloride in two samples during the October 2008 sampling event) appear to be related to tenant activities since these compounds were not recently detected above NJDEP VIG screening levels in the sub-slab soil gas.

#### 4.2.7 Conclusions and Recommendations

The presence of TCE in both the sub-slab soil gas and nearby groundwater sampling locations suggests the potential for a vapor intrusion pathway into the 102-168 Fernwood Avenue building. However, several recent rounds of data indicate no detections of TCE in indoor air.



Additional investigations are recommended to evaluate the elevated concentrations of TCE in the sub-slab soil gas. This information will be used for evaluating the installation of a passive mitigation system. Continued monitoring of the soil gas and indoor air is recommended..

## SECTION 5.0 SAMPLING RESULTS FOR GROUNDWATER AREA OF CONCERN 8

### 5.1 OVERVIEW OF GROUNDWATER AOC 8 RESULTS

This section focuses on sampling results for sub-slab soil gas and indoor air collected from August 2007 through October 2008 to evaluate the potential for vapor intrusion at five buildings in the vicinity of Groundwater AOC 8. Prior to the discussion of the sub-slab soil gas and indoor air results, a description of historic groundwater contaminant concentrations is presented. The plume boundaries, as revised per the *Supplemental Groundwater Data Report* (Weston 2006) were those that defined the extent of the groundwater plume for identification of buildings requiring evaluation of the potential for vapor intrusion.

Per the recommendations from the *Indoor Air Quality Semi-Annual Report #3* (Weston, 2008), five buildings are still being evaluated and/or monitored for vapor intrusion issues in AOC 8. The buildings evaluated within Groundwater AOC 8 are:

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

The buildings are mostly surrounded by parking lots, roads and few open/landscaped areas.

Buildings for which no further action was proposed in the vicinity of Groundwater AOC 8, and agreed to in NJDEP's 12 January 2007 and 7 May 2008 letters, include the following:

- 2815 Woodbridge Avenue);
- EPA Building 5; and
- the former EPA Guard Shack, which has been replaced by the New EPA Guard Shack, and is currently used for tool storage, is no longer occupied.

These buildings were not sampled during the current investigation, and are not discussed in this report. For information regarding the evaluation of the potential for vapor intrusion within these buildings, refer to the *Indoor Air Quality Semi-Annual Report # 2 & 3*

#### 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 Area 18E. On the basis of recent groundwater data (*Supplemental Groundwater Data Report*, Sept 2006), Groundwater AOC 8 has been subdivided into Groundwater plumes AOC 8A/B, AOC 8B, and, AOC 8D. AOC 8A/B footprint encompasses the former motor pool (Building 238) and the former GSA automotive shop (Building 241), AOC 8C encompasses the area along the southern investigation boundary of the

dump area in Area 18G, former dump area and Groundwater AOC 8D is located in the vicinity of Area 1. There are no buildings within 100 ft of AOC 8C and AOC 8D.

Current contaminants of concern in Groundwater AOC 8 are TCE, PCE, and vinyl chloride, as described in the 2006 *Supplemental Groundwater Data Report* (Table 5-1). 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*. The historic contaminants of concern in Groundwater AOC 8 are VOCs such as TCE, PCE, total 1,2-DCE, and chloroform, as described in the *Final Site-Wide Hydrogeology Report* (Weston, 1996) and the 2002 *Draft Final Groundwater Natural Attenuation Report* (NAR). TCE concentration contours in groundwater for AOC 8 are shown on Figure 11 of the 2006 *Supplemental Groundwater Data Report*.

Groundwater analytical data for overburden monitoring wells and direct-push samples from 1994 to 2005 were reviewed and compared to screening levels presented in Table 1 of NJDEP's Vapor Intrusion Guidance (October 2005, updated March 2007) to characterize the COPCs in Groundwater AOC 8. Table 5-1 provides these data for all VOCs that have historically been detected in any of the groundwater samples collected from within the bounds of Groundwater AOC 8. The historic contaminants of concern in Groundwater AOC 8 were TCE, PCE, benzene, and vinyl chloride as shown in Table 5-1.

The July 2008 Groundwater RAWP recommended proposed MNA as the remedial action for Groundwater AOCs 8C, and 8D. Preparation of a RAWP for Groundwater AOC 8A/B will be based on further investigation (associated with Area 18E) and additional IAQ results.

Because of the concentrations of VOCs that have been detected in Groundwater AOC 8A/B, IAQ sampling has been conducted at several buildings within 100 ft of the groundwater plume (further discussed below).

### **5.1.2 Sub-slab Soil Gas**

From August 2007 through October 2008, the USACE collected sub-slab 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. The table below summarizes the number of sub-slab soil gas samples collected during each sampling event at each building.

| Building     | Number of Sub-slab Soil Gas Samples | Sampling Date     | Sampling Round |
|--------------|-------------------------------------|-------------------|----------------|
| Building 10  | 2                                   | 21 August 2007    | Sixth Round    |
|              | 2                                   | 3 June 2008       | Seventh Round  |
|              | 2                                   | 26 September 2008 | Eighth Round   |
| Building 18  | 2                                   | 21 August 2007    | Sixth Round    |
|              | 2                                   | 3 June 2008       | Seventh Round  |
|              | 2                                   | 26 September 2008 | Eighth Round   |
| Building 200 | 1                                   | 24 August 2007    | Eighth Round   |
|              | 1                                   | 15 November 2007  | Ninth Round    |
|              | 1                                   | 11 June 2008      | Tenth Round    |
|              | 1                                   | 3 October 2008    | Eleventh Round |
| Building 205 | 5                                   | 29 August 2007    | Seventh Round  |
|              | 5                                   | 14 November 2007  | Eighth Round   |
|              | 5                                   | 3 June 2008       | Ninth Round    |
|              | 5                                   | 30 September 2008 | Tenth Round    |
| Building 209 | 3                                   | 29 August 2007    | Fourth Round   |
|              | 5                                   | 14 November 2007  | Fifth Round    |
|              | 5                                   | 11 June 2008      | Sixth Round    |
|              | 5                                   | 30 September 2008 | Seventh Round  |

Results of the sub-slab soil gas analyses for VOCs below buildings in the vicinity of Groundwater AOC 8 are discussed building by building in the following subsections of this report, and are provided in Tables 5-2 through 5-21. Shaded values in the tables indicate exceedances of the NJDEP VIG residential screening levels whereas bolded and shaded values indicate exceedances of the NJDEP VIG non-residential sub-slab soil gas screening levels. Some of the compounds exceeding VIG screening levels in sub-slab soil gas during the current sampling events included chloroform, carbon tetrachloride, PCE, and TCE.

### 5.1.3 Building Survey

Prior to collection of indoor air samples, a *NJDEP Building Survey and Sampling Form* was completed for each building from/under which samples were being collected. 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 on the CD attached to this report.

### 5.1.4 Indoor Air

From August 2007 to October 2008 the USACE collected indoor air samples and sub-slab soil gas samples at five buildings (Buildings 10, 18, 200, 205, and 209) located on EPA Property within 100 ft of Groundwater AOCs 8A/8B. The table below summarizes the number of indoor air samples collected during each sampling event at each building.

| Building     | Number of Indoor Air Samples | Ambient Air Samples | Sampling Date        | Sampling Round          |
|--------------|------------------------------|---------------------|----------------------|-------------------------|
| Building 10  | 2                            | 1                   | 20-21 August 2007    | Sixth Round             |
|              | 2                            | 0                   | 3-4 June 2008        | Seventh Round           |
|              | 2                            | 0                   | 25-26 September 2008 | Eighth Round            |
| Building 18  | 2                            | 1                   | 20-21 August 2007    | Sixth Round             |
|              | 0                            | 1                   | 14-15 November 2007  | Sixth Round (continued) |
|              | 2                            | 1                   | 2-3 June 2008        | Seventh Round           |
|              | 2                            | 1                   | 29-30 September 2008 | Eighth Round            |
| Building 200 | 2                            | 1                   | 23-24 August 2007    | Eighth Round            |
|              | 2                            | 1                   | 15-16 November 2007  | Ninth Round             |
|              | 2                            | 1                   | 10-11 June 2008      | Tenth Round             |
|              | 2                            | 1                   | 2-3 October 2008     | Eleventh Round          |
| Building 205 | 5                            | 1                   | 27-28 August 2007    | Sixth Round             |
|              | 5                            | 1                   | 14-15 November 2007  | Seventh Round           |
|              | 5                            | 1                   | 2-3 June 2008        | Eighth Round            |
|              | 5                            | 1                   | 29-30 September 2008 | Ninth Round             |
| Building 209 | 5                            | 1                   | 27-28 August 2007    | Fourth Round            |
|              | 5                            | 1                   | 13-14 November 2007  | Fifth Round             |
|              | 6                            | 1                   | 10-11 June 2008      | Sixth Round             |
|              | 6                            | 1                   | 25-26 September 2008 | Seventh Round           |

Results of the indoor air analyses for VOCs in buildings falling within Groundwater AOC 8 are discussed building by building in the following subsections of this report. Shaded compounds and values indicate exceedances of the NJDEP VIG screening levels. Some of the compounds exceeding VIG screening levels in indoor air during the current sampling events included benzene, chloroform, MTBE, PCE, and TCE.

### 5.1.5 Meteorological Data

Meteorological data utilized during 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 is summarized below. See the attached CD for the complete meteorological data.

| Building     | Dates Sampled        | Temperature Range (°F) | Barometric Pressure (Inches) | Precipitation (Inches) | Relative Humidity Range (%) |
|--------------|----------------------|------------------------|------------------------------|------------------------|-----------------------------|
| Building 10  | 20-21 August 2007    | 57-71                  | 30.07-30.18                  | 1.01                   | 51-90                       |
|              | 2-3 June 2008        | 60-84                  | 29.79-30.07                  | 0.08                   | 32-76                       |
|              | 25-26 September 2008 | 53-68                  | 30.08-30.40                  | 1.84                   | 51-90                       |
| Building 18  | 20-21 August 2007    | 57-71                  | 30.07-30.18                  | 1.01                   | 51-90                       |
|              | 14-15 November 2007  | 39-63                  | 29.45-29.94                  | 0.17                   | 41-57                       |
|              | 2-3 June 2008        | 60-84                  | 29.79-30.07                  | 0.08                   | 32-76                       |
|              | 29-30 September 2008 | 58-74                  | 29.79-29.91                  | 0.07                   | 57-81                       |
| Building 200 | 23-24 August 2007    | 63-85                  | 29.90-30.14                  | None                   | 61-93                       |
|              | 15-16 November 2007  | 36-63                  | 29.45-29.67                  | 0.17                   | 42-83                       |
|              | 10-11 June 2008      | 71-99                  | 29.79-30.07                  | 0.08                   | 32-76                       |
|              | 2-3 October 2008     | 47-66                  | 29.54-29.87                  | None                   | 40-71                       |
| Building 205 | 27-28 August 2007    | 67-94                  | 30.05-30.14                  | None                   | 47-76                       |
|              | 14-15 November 2007  | 39-63                  | 29.45-29.94                  | 0.17                   | 41-57                       |

| <b>Building</b> | <b>Dates Sampled</b> | <b>Temperature Range (°F)</b> | <b>Barometric Pressure (Inches)</b> | <b>Precipitation (Inches)</b> | <b>Relative Humidity Range (%)</b> |
|-----------------|----------------------|-------------------------------|-------------------------------------|-------------------------------|------------------------------------|
| Building 209    | 2-3 June 2008        | 60-84                         | 29.86-29.97                         | None                          | 25-65                              |
|                 | 29-30 September 2008 | 58-74                         | 29.79-29.91                         | 0.07                          | 57-81                              |
|                 | 27-28 August 2007    | 67-94                         | 30.05-30.14                         | None                          | 47-76                              |
|                 | 13-14 November 2007  | 39-61                         | 29.84-29.99                         | 0.14                          | 46-96                              |
|                 | 10-11 June 200       | 71-99                         | 29.79-30.07                         | 0.08                          | 32-76                              |
|                 | 25-26 September 2008 | 53-68                         | 30.08-30.40                         | 1.84                          | 51-90                              |

## 5.2 EPA BUILDING 10

EPA Building 10 is located within the western portion of Groundwater AOC 8 and upgradient 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 and lawn area. This building has never been identified as an area of investigation or a former DOD occupancy requiring investigation.

Six previous sampling events were conducted by USACE at EPA Building 10 in January 2005 through April 2007. Current investigation activities included sub-slab soil gas and indoor air sample collection during August 2007, June 2008, and September 2008.

### 5.2.1 Prior Investigations

Four sub-slab soil gas samples were collected at Building 10 by the EPA in December 2004. TCE was detected at concentrations ranging from 29 to 161  $\mu\text{g}/\text{m}^3$  in the sub-slab soil gas. In January 2005, the EPA took indoor air readings with the TAGA, and the TCE concentrations ranged from “not detected” to 1.07  $\mu\text{g}/\text{m}^3$  (EPA, January 2005). Based on EPA’s sub-slab soil gas and indoor air trace atmospheric gas analyzer (TAGA) results indicating the presence of TCE at concentrations exceeding its screening benchmark, USACE re-sampled the sub-slab soil gas point at which the highest TCE concentration was detected (1-010-SG-03). At location 1-010-SG-03, benzene, chloroform and TCE were detected in exceedance of the EPA Table 2C-SSG screening benchmarks. Of these, TCE exhibited the highest magnitude of the exceedances; the TCE concentration at location 1-010-SG-03 was 69 times the screening benchmark.

The soil and groundwater analytical results, collected as part of the Area 18E investigation, in close proximity (less than 100 ft) to Building 10, indicated the presence of TCE in both soil and groundwater. TCE was detected in soil within a localized area up to 3.5 ft below ground surface (bgs) at concentrations up to 17 mg/kg. TCE was detected in groundwater at concentrations to 5.9  $\mu\text{g}/\text{L}$ . The data suggest that soil may be a potential source of TCE concentrations in soil gas beneath and within Building 10.

Given that TCE was also detected in the indoor air within the building during the EPA investigation, there appeared to be a potential vapor intrusion pathway in this building. The USEPA installed a sub-slab depressurization system at Building 10.

Sub-slab soil gas and indoor air were subsequently sampled by Weston for USACE in January 2006. The results of that investigation indicated the possibility of a vapor intrusion pathway as PCE was detected in one of the two sub-slab soil gas samples and one of the two indoor air samples in exceedance of the NJDEP VIG screening levels. During that sampling event, benzene and MTBE were also detected in one of two indoor air samples at concentrations greater than NJDEP VIG screening levels; however, the presence of these compounds were attributed to non-DOD sources, likely related to use of gasoline in the vicinity of Building 10.

### 5.2.2 Current Investigation

Two sub-slab soil gas and two indoor air samples were collected from 19 through 20 August 2007, 2 through 3 June 2008, and 25 through 26 September 2008. Sub-slab soil gas and indoor air sample locations for EPA Building 10 are shown on Figure 5-1.

The following table summarizes the samples collected under the current investigation.

| Matrix            | Number of Samples | Parameters/Method | Dates Sampled        |
|-------------------|-------------------|-------------------|----------------------|
| Sub-slab Soil Gas | 2                 | VOCs/TO-15        | 21 August 2007       |
|                   | 2                 | VOCs/TO-15        | 3 June 2008          |
|                   | 2                 | VOCs/TO-15        | 26 September 2008    |
| Indoor Air        | 2                 | VOCs/TO-15        | 20-21 August 2007    |
|                   | 2                 | VOCs/TO-15        | 2-3 June 2008        |
|                   | 2                 | VOCs/TO-15        | 25-26 September 2008 |
| Background        | 1                 | VOCs/TO-15        | 26-27 August 2007    |
|                   | 1                 | VOCs/TO-15        | 13-14 November 2007  |

### 5.2.3 Sub-slab Soil Gas Results

TCE was detected in the sub-slab at concentration exceeding NJDEP VIG soil gas screening levels during the June 2008 and September 2008 sampling events. It was detected in only one sample during the August 2007 sampling event, but at levels below NJDEP VIG screening levels for soil gas. PCE was detected in only one sample during the August 2007 sample event above NJDEP VIG Screening Levels. All other samples collected during the previous three sampling events either did not detected PCE or detected PCE at levels below NJDEP VIG screening levels. All other VOCs were either not detected or were detected at concentrations lower than their respective NJDEP VIG soil gas screening levels.

A summary of the detection frequency and concentration range of compounds detected in sub-slab soil gas is provided on Table 5-2. The complete sub-slab soil gas results for the current investigation are shown on Table 5-4. The following table contains a summary of the sub-slab soil gas exceedances.



| NJDEP VIG Table 1 Non-Residential Sub-slab Soil Gas Screening Criteria and Exceedances |                          |                                                       |                                | NJDEP VIG Table 1 Residential Sub-slab Soil Gas Screening Criteria and Exceedances |                                                       |                                |
|----------------------------------------------------------------------------------------|--------------------------|-------------------------------------------------------|--------------------------------|------------------------------------------------------------------------------------|-------------------------------------------------------|--------------------------------|
| Compound                                                                               | No. of Samples Exceeding | Range in Concentration Exceeding (ug/m <sup>3</sup> ) | Criterion (ug/m <sup>3</sup> ) | No. of Samples Exceeding                                                           | Range in Concentration Exceeding (ug/m <sup>3</sup> ) | Criterion (ug/m <sup>3</sup> ) |
| PCE (August 2007)                                                                      | 1 of 2                   | 37                                                    | 36                             | 1 of 2                                                                             | 37                                                    | 34                             |
| TCE (June 2008)                                                                        | 1 of 2                   | 42.73                                                 | 27                             | 1 of 2                                                                             | 42.73                                                 | 27                             |
| TCE (September 2008)                                                                   | 1 of 2                   | 116.08                                                | 27                             | 1 of 2                                                                             | 116.08                                                | 27                             |

## 5.2.4 Building Survey

Weston and Shaw conducted initial inspections of Building 10 for each sampling event to confirm no significant changes in building activities between sampling events. For each inspection an *Indoor Air Building Survey and Sampling Form* was completed during each subsequent sampling event 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 in the building. There were no chemicals observed that are considered significant potential VOC sources during the initial and subsequent sampling events. The Indoor Air Building Survey and Sampling Form are included on the CD attached to this report.

## 5.2.5 Indoor Air Sampling Results

Both PCE and TCE were not detected at levels exceeding NJDEP VIG indoor air screening levels for all three recent sampling events. Methylene chloride was detected at levels exceeding NJDEP VIG screening levels for indoor air in both samples collected during the June 2008 and September 2008 sampling events. No other VOCs were detected in indoor air in exceedance of their respective VIG Generic screening guidelines.

A summary of the detection frequency and concentration range of compounds detected in indoor air is provided on Table 5-3. The complete indoor air sampling results for the current investigations are shown on Table 5-5. The following table contains a summary of the indoor air exceedances.

| NJDEP VIG Table 1 Non-Residential Indoor Air Screening Criteria and Exceedances |                          |                                                       |                                | NJDEP VIG Table 1 Residential Indoor Air Screening Criteria and Exceedances |                                                       |                                |
|---------------------------------------------------------------------------------|--------------------------|-------------------------------------------------------|--------------------------------|-----------------------------------------------------------------------------|-------------------------------------------------------|--------------------------------|
| Compound                                                                        | No. of Samples Exceeding | Range in Concentration Exceeding (ug/m <sup>3</sup> ) | Criterion (ug/m <sup>3</sup> ) | No. of Samples Exceeding                                                    | Range in Concentration Exceeding (ug/m <sup>3</sup> ) | Criterion (ug/m <sup>3</sup> ) |
| Methylene Chloride (June 2008)                                                  | 2 of 2                   | 14.83 to 22.23                                        | 9                              | 2 of 2                                                                      | 14.83 to 22.23                                        | 4                              |
| Methylene Chloride (September 2008)                                             | 0 of 2                   | -                                                     | 9                              | 2 of 2                                                                      | 5.52 to 6.95                                          | 4                              |

### **5.2.6 Integrated Discussion of Results**

Since the installation of the sub-slab remediation system, no VOC exceedances of PCE or TCE have been detected in indoor air for the past seven sampling events. PCE and TCE were detected in sub-slab soil gas, but are not posing a threat to indoor air. Methylene chloride was detected in indoor air at levels exceeding NJDEP VIG screening levels. However, this VOC was not detected in the groundwater plume associated with AOC 8 and is considered a non-DOD compound of concern. Continued semi-annual monitoring of the sub-slab remediation system will continue.

### **5.2.7 Conclusions and Recommendations**

Due to installation of a remedial system, VOCs have not been migrating into the indoor air at concentrations of concern. Semi-annual monitoring of the remedial system has proven that the system is operating properly. It is recommended that the monitoring at this frequency continue with an annual reevaluation.

### 5.3 EPA BUILDING 18

EPA Building 18 is located near the border of Area 18E. Building 18 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 and lawn area.

Five previous sampling events were conducted by USACE at EPA Building 18 in February 2006 through April 2007. Current investigation activities included sub-slab soil gas and indoor air sample collection during August 2007, June 2008, and September 2008.

#### 5.3.1 Prior Investigations

Five sub-slab soil gas samples were collected at Building 18 by the EPA in December 2004. TCE concentrations ranged from not detected to 1,021  $\mu\text{g}/\text{m}^3$ . In January 2005, the EPA took TAGA readings indicating that indoor air TCE concentrations ranged from 0.75 to 6.99  $\mu\text{g}/\text{m}^3$  (EPA, January 2005). As stated in the work plan submitted to the NJDEP by the USACE on 20 January 2005 (Weston, January 2005), location 018-05 (highest TCE concentration) was to be re-sampled, but could not be because the sampling point had been abandoned (filled in with clay) prior to the USACE's investigation.

During the 18E investigation, TCE was detected in both soil and groundwater exceeding its NJDEP criterion within 100 feet of the building. TCE was detected in soil north of Building 18 exceeding the NJDEP MSSCC in five samples collected at the sample interval of 1.5 to 2.0 ft bgs and in one sample collected at 3.5 to 4.0 ft bgs. It should be noted the soil samples collected from the two closest borings did not have any VOC exceedances. The samples collected from these borings were collected at depths ranging from 1.5 to 5.0 ft bgs. TCE was detected in the shallow groundwater sample, collected from a location completed immediately north of Building 18, at a concentration of 37  $\mu\text{g}/\text{L}$  (Weston, June 2005a).

The USEPA data suggested a complete vapor intrusion pathway existed at Building 18. USACE was unable to verify the USEPA's sub-slab soil gas results during this field program. However USACE re-sampled both sub-slab soil gas and indoor air to confirm prior USEPA results in January 2006.

Weston collected a round of sub-slab soil gas and indoor air samples in January 2006. The results of this investigation did not support the presence of a vapor intrusion pathway as no VOCs were detected in sub-slab soil gas or indoor air samples in exceedance of the NJDEP VIG screening levels.

#### 5.3.2 Current Investigation

Two sub-slab soil gas and two indoor air samples were collected from 20-21 August 2007, from 2-3 June 2008, and from 29-30 September 2007. Sub-slab soil gas and indoor air sample locations for EPA Building 18 are shown on Figure 5-2.

The following table summarizes the samples collected under the current investigation.

| Matrix            | Number of Samples | Parameters/Method | Dates Sampled        |
|-------------------|-------------------|-------------------|----------------------|
| Sub-slab Soil Gas | 2                 | VOCs/TO-15        | 21 August 2007       |
|                   | 2                 | VOCs/TO-15        | 3 June 2008          |
|                   | 2                 | VOCs/TO-15        | 30 September 2008    |
| Indoor Air        | 2                 | VOCs/TO-15        | 20-21 August 2007    |
|                   | 2                 | VOCs/TO-15        | 2-3 June 2008        |
|                   | 2                 | VOCs/TO-15        | 29-30 September 2008 |
| Background        | 1                 | VOCs/TO-15        | 20-21 August 2007    |
|                   | 1                 | VOCs/TO-15        | 13-14 November 2007  |
|                   | 1                 | VOCs/TO-15        | 2-3 June 2008        |
|                   | 1                 | VOCs/TO-15        | 29-30 September 2008 |

### 5.3.3 Sub-slab Soil Gas Results

Only one sampling point detected TCE above the NJDEP VIG screening levels for soil gas. PCE was not detected above its NJDEP VIG screening level during any of the three previous sampling events. No other VOCs were detected in exceedance of their respective NJDEP VIG screening levels.

A summary of the detection frequency and concentration range of compounds detected in sub-slab soil gas is provided on Table 5-6. The complete sub-slab soil gas results for the current investigation are shown on Table 5-8. The following table contains a summary of the sub-slab soil gas exceedances.

| NJDEP VIG Table 1 Non-Residential Sub-slab Soil Gas Screening Criteria and Exceedances |                          |                                                       |                                | NJDEP VIG Table 1 Residential Sub-slab Soil Gas Screening Criteria and Exceedances |                                                       |                                |
|----------------------------------------------------------------------------------------|--------------------------|-------------------------------------------------------|--------------------------------|------------------------------------------------------------------------------------|-------------------------------------------------------|--------------------------------|
| Compound                                                                               | No. of Samples Exceeding | Range in Concentration Exceeding (ug/m <sup>3</sup> ) | Criterion (ug/m <sup>3</sup> ) | No. of Samples Exceeding                                                           | Range in Concentration Exceeding (ug/m <sup>3</sup> ) | Criterion (ug/m <sup>3</sup> ) |
| TCE<br>(June 2008)                                                                     | 1 of 2                   | 87.06                                                 | 27                             | 1 of 2                                                                             | 87.06                                                 | 27                             |

### 5.3.4 Building Survey

Weston and Shaw completed the *Indoor Air Building Survey and Sampling Form* during each subsequent sampling event 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 in the building. There were no chemicals observed that are considered significant potential VOC sources during the initial and subsequent sampling events. The Indoor Air Building Survey and Sampling Forms are included on the CD attached to this report.

### **5.3.5 Indoor Air Sampling**

TCE was detected above NJDEP VIG screening levels in only one sampling point during the June 2008 sampling event. PCE was not detected in any sample above NJDEP VIG screening levels for all three sampling events. Methylene Chloride was detected in four samples above NJDEP VIG indoor air screening levels during the June 2008 and September 2008 sampling events. In addition, methylene chloride was detected above NJDEP VIG screening levels for indoor air in the ambient background sample collected during the June 2008 sampling event. Methylene chloride was not detected in groundwater above NJDEP Groundwater Screening Levels for the plume associated with AOC-8. It is considered to be associated with non-DOD activities. In addition, the other compounds detected in groundwater (acetone, benzene, chloromethane, ethylbenzene, and toluene), as well as all remaining VOC, were either not detected or were detected at concentrations less than the screening benchmarks.

The indoor air and background air results are shown on Table 5-9.

### **5.3.6 Integrated Discussion of Results**

Since the installation of the sub-slab remediation system, only one VOC exceedances have been detected in indoor air for the past seven sampling events. In addition, TCE was only detected in one sub-slab sample that exceeding NJDEP VIG screening levels during the last three sampling events (June 2008). Though PCE and TCE are periodically detected in sub-slab soil gas, they are not posing a threat to indoor air. Continued monitoring of the sub-slab remediation system will continue on a semi-annual basis.

### **5.3.7 Conclusions and Recommendations**

Due to installation of a remedial system, VOCs have not been migrating into the building at concentrations of concern. Previous monitoring of the remedial system has proven that the system is operating properly. It is recommended that the monitoring continue at the same semi-annual frequency. USACE will reevaluate the monitoring performed on an annual basis.

## 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 and lawn area.

Eight previous rounds of sub-slab soil gas sampling were conducted at EPA Building 200 in January 2005 through April 2007, and seven previous rounds of indoor air sampling were conducted in January 2006 through April 2007. Current investigation activities included sub-slab soil gas and indoor air sample collection during August 2007, November 2007, June 2008, and October 2008.

### 5.4.1 Prior Investigations

The EPA installed three sub-slab soil gas monitoring points in Building 200 during December 2004; the TCE concentrations ranged from 86 to 29,019  $\mu\text{g}/\text{m}^3$ . In January 2005, the EPA took TAGA indoor air readings; the TCE concentrations ranged from 20.42 to 59.11  $\mu\text{g}/\text{m}^3$  (EPA, January 2005). Based on EPA's December 2004 sub-slab soil gas and January 2005 indoor air TAGA results, USACE decided to re-sample the sub-slab soil gas monitoring point in Building 200 (200-02) where the highest TCE concentration was detected. Carbon tetrachloride, chloroform, and TCE were detected in exceedance of the EPA Table 2C-SSG screening benchmark in sample 1-200-SG-02. Of these, TCE exhibited the greatest magnitude of exceedance; the TCE concentration at location 1-200-SG-02 was 210  $\mu\text{g}/\text{m}^3$ .

TCE was also detected in groundwater exceeding the NJDEP Class IIA GWQS and EPA Table 2C-GW criteria at Building 200. The maximum TCE concentration in soil gas (210  $\mu\text{g}/\text{m}^3$ ) cannot be fully explained by the maximum groundwater TCE concentration of 120  $\mu\text{g}/\text{L}$  (location EPA200-02) detected at this building. TCE was detected in soil at concentrations as high as 9.5 mg/kg below the slab (location EPA200-06), indicating that subsurface soil contamination may be a source for a significant amount of the TCE detected in soil gas. EPA-installed monitoring point 200-02, where the highest TCE concentration was detected in the EPA-collected samples, is approximately 25 feet away from boring location EPA200-06 (Weston, June 2005a).

Results indicated that a complete vapor intrusion pathway from sub-slab soil gas to indoor air existed for Building 200. Based on the results, a sub-slab venting/depressurization system was installed by the EPA.

Weston collected a round of sub-slab soil gas samples in January 2005, and two subsequent rounds of sub-slab soil gas and indoor air samples in January and March 2006. The results of the earlier phases of investigation suggested the presence of a vapor intrusion pathway, since TCE was detected in sub-slab soil gas and indoor air samples in exceedance of the NJDEP VIG screening levels.

### 5.4.2 Current Investigation

One sub-slab soil gas and two indoor air samples were collected from each of the following periods: 23-24 August 2007, from 14-15 November 2007, from 10 through 11 June 2008, and from 2-3 October 2008. Sub-slab soil gas and indoor air sample locations for EPA Building 200 are shown on Figure 5-3. The sub-slab 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 patient's rooms. One background sample was collected during each sampling round in August and November 2007, but was not collection in June (because of weather) and October 2008.

The following table summarizes the samples collected under the current investigation:

| Matrix            | Number of Samples | Parameters/Method | Dates Sampled       |
|-------------------|-------------------|-------------------|---------------------|
| Sub-slab Soil Gas | 1                 | VOCs/TO-15        | 21 August 2007      |
|                   | 1                 | VOCs/TO-15        | 15 November 2007    |
|                   | 1                 | VOCs/TO-15        | 11 June 2008        |
|                   | 1                 | VOCs/TO-15        | 3 October 2008      |
| Indoor Air        | 2                 | VOCs/TO-15        | 20-21 August 2007   |
|                   | 2                 | VOCs/TO-15        | 14-15 November 2007 |
|                   | 2                 | VOCs/TO-15        | 10-11 June 2008     |
|                   | 2                 | VOCs/TO-15        | 2-3 October 2008    |
| Background        | 1                 | VOCs/TO-15        | 23-24 August 2007   |
|                   | 1                 | VOCs/TO-15        | 14-15 November 2007 |

### 5.4.3 Sub-slab Soil Gas Results

TCE has been detected consistently in sub-slab soil gas in exceedance of the NJDEP VIG Soil Gas Screening Level during previous and recent sampling events up to November 2007. However, TCE was not detected above the NJDEP VIG screening levels for soil gas during the last two sampling events (June and September 2008). No other VOCs were detected in exceedance of their NJDEP VIG screening guidelines during the sampling events.

A summary of the detection frequency and concentration range of compounds detected in sub-slab soil gas is provided on Table 5-10. The complete sub-slab soil gas results for the current investigation are shown on Table 5-12. The following table contains a summary of the sub-slab soil gas exceedances.

| Compound            | NJDEP VIG Table 1 Non-Residential Sub-slab Soil Gas Screening Criteria and Exceedances |                                                               |                                        | NJDEP VIG Table 1 Residential Sub-slab Soil Gas Screening Criteria and Exceedances |                                                               |                                        |
|---------------------|----------------------------------------------------------------------------------------|---------------------------------------------------------------|----------------------------------------|------------------------------------------------------------------------------------|---------------------------------------------------------------|----------------------------------------|
|                     | No. of Samples Exceeding                                                               | Range in Concentration Exceeding ( $\mu\text{g}/\text{m}^3$ ) | Criterion ( $\mu\text{g}/\text{m}^3$ ) | No. of Samples Exceeding                                                           | Range in Concentration Exceeding ( $\mu\text{g}/\text{m}^3$ ) | Criterion ( $\mu\text{g}/\text{m}^3$ ) |
| TCE (August 2007)   | 1 of 1                                                                                 | 810                                                           | 27                                     | 1 of 1                                                                             | 810                                                           | 27                                     |
| TCE (November 2007) | 1 of 1                                                                                 | 400                                                           | 27                                     | 1 of 1                                                                             | 400                                                           | 27                                     |

#### 5.4.4 Building Survey

Building 200 is currently used as the Health Center for the EPA facility. Weston and Shaw completed *Indoor Air Building Survey and Sampling Form* during each subsequent sampling event 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 in the building. There were no chemicals observed that are considered significant potential VOC sources during the initial and subsequent sampling events. The Indoor Air Building Survey and Sampling Forms are included on the CD attached to this report.

#### 5.4.5 Indoor Air Sampling Results

Only TCE was detected in one indoor air sample above NJDEP VIG indoor air screening levels (November 2007). However, that exceedance was only 1/10 above the screening level (result equaled  $3.1 \mu\text{g}/\text{m}^3$  versus the VIG screening level of  $3.0 \mu\text{g}/\text{m}^3$ ). No other VOCs were detected above their respective NJDEP VIG screening levels.

A summary of the detection frequency and concentration range of compounds detected in indoor air is provided on Table 5-11. The complete indoor air sampling results for the current investigation is shown on Table 5-13. The following table contains a summary of the indoor air exceedances.

| Compound               | NJDEP VIG Table 1 Non-Residential Indoor Air Screening Criteria and Exceedances |                                                               |                                        | NJDEP VIG Table 1 Residential Indoor Air Screening Criteria and Exceedances |                                                               |                                        |
|------------------------|---------------------------------------------------------------------------------|---------------------------------------------------------------|----------------------------------------|-----------------------------------------------------------------------------|---------------------------------------------------------------|----------------------------------------|
|                        | No. of Samples Exceeding                                                        | Range in Concentration Exceeding ( $\mu\text{g}/\text{m}^3$ ) | Criterion ( $\mu\text{g}/\text{m}^3$ ) | No. of Samples Exceeding                                                    | Range in Concentration Exceeding ( $\mu\text{g}/\text{m}^3$ ) | Criterion ( $\mu\text{g}/\text{m}^3$ ) |
| TCE<br>(November 2007) | 1 of 2                                                                          | 3.1                                                           | 3                                      | 1 of 2                                                                      | 3.1                                                           | 3                                      |

#### 5.4.6 Integrated Discussion of Results

Previous sub-slab and indoor air sampling results corroborated that a complete vapor intrusion pathway existed from groundwater to soil gas to indoor air at Building 200. However, data from the last five sampling events show a significant decreasing trend in indoor air concentration for TCE. Even more so for PCE, which has not been detected in either the indoor air or sub-slab soil gas in concentrations above NJDEP VIG screening levels since March 2006.

It appears that the sub-slab venting/depressurization system installed by the building owner is operating properly. The USACE has agreed to monitor Building 200 on a quarterly frequency to ensure the effectiveness of the system. It should be noted that there is no vent on this system that would allow vapor recovery samples to be collected.



#### **5.4.7 Conclusions and Recommendations**

Data from the last five sampling events show a significant decreasing trend in indoor air concentration for TCE. PCE that has not been detected in either the indoor air or sub-slab soil gas at concentrations above NJDEP VIG screening levels for the last eight sampling events dating back to March 2006. It appears that the sub-slab venting/depressurization system installed by the building owner is operating properly. The USACE recommends continue quarterly sampling with the option to reduce the frequency of sampling to semi-annual.

## **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 consists of office space and is surrounded by a parking lot with a small landscaped and lawn area.

Six previous rounds of sub-slab soil gas sampling events were conducted by USACE at EPA Building 205 in January 2005 through April 2007, and five previous rounds of indoor air sampling were conducted in January 2006 through April 2007. Current investigation activities included sub-slab soil gas and indoor air sample collection during August 2007, November 2007, June 2008, and September 2008.

### **5.5.1 Prior Investigations**

In December 2004, the EPA installed 19 sub-slab soil gas monitoring points; the TCE concentrations ranged from not detected to 27,407  $\mu\text{g}/\text{m}^3$ . In January 2005, the EPA decided to collect indoor air TAGA readings; the TCE concentrations ranged from not detected to 204  $\mu\text{g}/\text{m}^3$  (EPA, January 2005).

USACE collected two sub-slab soil gas samples in Building 205 in January 2005. Benzene, carbon tetrachloride, chloroform, and TCE were detected in sample 1-205-SG-11 on the west side of the building and carbon tetrachloride, chloroform, and TCE were detected in sample 1-205-SG-12 on the east side of the building in exceedance of their EPA Table 2C-SSG screening benchmarks.

The sub-slab soil gas results from January 2005 corroborated EPA's December 2004 sub-slab soil gas results including the concentrations of TCE detected in the sub-slab soil gas. In addition, TCE concentrations were detected in the indoor air during the EPA investigation. The TCE concentrations in sub-slab soil gas suggest soil gas is the source of the TCE concentrations detected by EPA in their indoor air investigation.

Weston collected a subsequent round of sub-slab soil gas coupled with indoor air samples in January 2006. The results of this investigation did not suggested the presence of a vapor intrusion pathway as TCE was detected in sub-slab soil gas in exceedance of the NJDEP VIG screening levels but not in indoor air.

The maximum TCE concentration detected in sub-slab soil gas (2,800  $\mu\text{g}/\text{m}^3$ , detected during the January 2005 sampling event) cannot be explained by the maximum groundwater TCE concentration of 7  $\mu\text{g}/\text{L}$  detected near this building. TCE was detected in soil beneath the building slab at a concentration as high as 14 mg/kg, indicating that contamination in subsurface soil may be a source for a significant amount of the TCE detected in sub-slab soil gas (Weston, June 2005a).

### **5.5.2 Current Investigation**

Five sub-slab soil gas and five indoor air samples were collected from 27-29 August 2007, from 13-14 November 2007, from 2-3 June 2008, and from 29-30 September 2008. Samples were

collected in Bay A, Bay B, Training Center, and Small Conference Room. Sub-slab soil gas and indoor air sample locations for EPA Building 205 are shown on Figure 5-4.

The following table summarizes the samples collected under the current investigation.

| Matrix            | Number of Samples | Parameters/Method | Dates Sampled        |
|-------------------|-------------------|-------------------|----------------------|
| Sub-slab Soil Gas | 5                 | VOCs/TO-15        | 29 August 2007       |
|                   | 5                 | VOCs/TO-15        | 15 November 2007     |
|                   | 5                 | VOCs/TO-15        | 3 June 2008          |
|                   | 5                 | VOCs/TO-15        | 30 September 2008    |
| Indoor Air        | 5                 | VOCs/TO-15        | 27-29 August 2007    |
|                   | 5                 | VOCs/TO-15        | 14-15 November 2007  |
|                   | 5                 | VOCs/TO-15        | 2-3 June 2008        |
|                   | 5                 | VOCs/TO-15        | 29-30 September 2008 |

### 5.5.3 Sub-slab Soil Gas Results

During the recent four sampling events (August 2007 through September 2008) only TCE was detected in sub-slab soil gas greater than NJDEP VIG Soil Gas Screening Levels. Elevated levels of TCE were detected from the same sampling point (Bay A, Cage 3, between 2<sup>nd</sup> and 3<sup>rd</sup> beams) in the August and November 2007 sampling events. It was not detected in soil gas above NJDEP VIG screening levels during the June and September 2008 sampling events. Except for vinyl chloride, no other VOC, including PCE, was detected above NJDEP VIG Soil Gas Screening Levels in sampling events from August 2007 through September 2008. Vinyl chloride was not a compound detected in previous groundwater samples.

A summary of the detection frequency and concentration range of compounds detected in sub-slab soil gas is provided on Table 5-14. The complete sub-slab soil gas results for the current investigation are shown on Table 5-16. The following table contains a summary of the sub-slab soil gas exceedances.

| Compound                        | NJDEP VIG Table 1 Non-Residential Sub-slab Soil Gas Screening Criteria and Exceedances |                                                       |                                | NJDEP VIG Table 1 Residential Sub-slab Soil Gas Screening Criteria and Exceedances |                                                       |                                |
|---------------------------------|----------------------------------------------------------------------------------------|-------------------------------------------------------|--------------------------------|------------------------------------------------------------------------------------|-------------------------------------------------------|--------------------------------|
|                                 | No. of Samples Exceeding                                                               | Range in Concentration Exceeding (ug/m <sup>3</sup> ) | Criterion (ug/m <sup>3</sup> ) | No. of Samples Exceeding                                                           | Range in Concentration Exceeding (ug/m <sup>3</sup> ) | Criterion (ug/m <sup>3</sup> ) |
| TCE (August 2007)               | 2 of 5                                                                                 | 33 to 160                                             | 27                             | 2 of 5                                                                             | 33 to 160                                             | 27                             |
| TCE (November 2007)             | 3 of 5                                                                                 | 28-31                                                 | 27                             | 3 of 5                                                                             | 28-31                                                 | 27                             |
| Vinyl Chloride (September 2008) | 1 of 5                                                                                 | 572.6                                                 | 48                             | 1 of 5                                                                             | 572.6                                                 | 13                             |

The sample locations are depicted and TCE exceedances are noted in red font on Figure 5-4.

### 5.5.4 Building Survey

This building is located within Groundwater AOC 8 and part of investigation Area 18F (former warehouses). Building 205 was constructed by the U.S. Army in 1918 and once included pits, degreaser tanks, stills, dip tanks, transformers, floor drain, and utility lines (Weston, 1997). Weston and Shaw completed the *Indoor Air Building Survey and Sampling Form* during each subsequent sampling event 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 in the building. There were no chemicals observed that are considered significant potential VOC sources during the initial and subsequent sampling events. The Indoor Air Building Survey and Sampling Forms are included on the CD attached to this report.

### 5.5.5 Indoor Air Sampling Results

Three VOCs (benzene, methylene chloride and TCE) were detected in indoor air samples in Building 205 at concentrations above the NJDEP VIG screening levels. The benzene exceedances were detected in three consecutive sampling events (August 2007, November 2007 and June 2008). It was not detected above NJDEP VIG screening levels in the most recent sampling event of September 2008. TCE was detected above NJDEP VIG screening levels in September 2008, but was not detected above screening levels in previous 9 sampling events prior to September 2008 dating back to January 2006. However, the exceedance was only  $0.87 \mu\text{g}/\text{m}^3$  above the NJDEP VIG screening level of  $3.0 \mu\text{g}/\text{m}^3$  for TCE. Methylene chloride was detected in seven samples in both the June and September 2008 sampling events.

A summary of the detection frequency and concentration range of compounds detected in indoor air is provided on Table 5-15. The complete indoor air sampling results for the current investigations are shown on Table 5-17. The following table contains a summary of the indoor air exceedances.

| Compound                            | NJDEP VIG Table 1 Non-Residential Indoor Air Screening Criteria and Exceedances |                                                               |                                        | NJDEP VIG Table 1 Residential Indoor Air Screening Criteria and Exceedances |                                                               |                                        |
|-------------------------------------|---------------------------------------------------------------------------------|---------------------------------------------------------------|----------------------------------------|-----------------------------------------------------------------------------|---------------------------------------------------------------|----------------------------------------|
|                                     | No. of Samples Exceeding                                                        | Range in Concentration Exceeding ( $\mu\text{g}/\text{m}^3$ ) | Criterion ( $\mu\text{g}/\text{m}^3$ ) | No. of Samples Exceeding                                                    | Range in Concentration Exceeding ( $\mu\text{g}/\text{m}^3$ ) | Criterion ( $\mu\text{g}/\text{m}^3$ ) |
| Benzene (August 2007)               | 1 of 5                                                                          | 2.2                                                           | 2                                      | 1 of 5                                                                      | 2.2                                                           | 2                                      |
| Benzene (November 2007)             | 3 of 5                                                                          | 2.2 to 2.8                                                    | 2                                      | 3 of 5                                                                      | 2.2 to 2.8                                                    | 2                                      |
| Benzene (June 2008)                 | 2 of 5                                                                          | 2.52 to 3.8                                                   | 2                                      | 2 of 5                                                                      | 2.52 to 3.8                                                   | 2                                      |
| TCE (September 2008)                | 1 of 5                                                                          | 3.87                                                          | 2                                      | 1 of 5                                                                      | 3.87                                                          | 2                                      |
| Methylene Chloride (June 2008)      | 2 of 5                                                                          | 19.28 to 20.77                                                | 9                                      | 4 of 5                                                                      | 5.11 to 20.77                                                 | 4                                      |
| Methylene Chloride (September 2008) | 2 of 5                                                                          | 12.51 to 13.24                                                | 9                                      | 3 of 5                                                                      | 4.59 to 13.24                                                 | 4                                      |

### **5.5.6 Integrated Discussion of Results**

TCE concentrations in sub-slab soil gas have been steadily decreasing since January 2006. The last two sampling rounds (June and September 2008) did not detect TCE in the soil gas above NJDEP VIG screening levels. In addition, only one sample (September 2008) of TCE has been detected in indoor air above NJDEP VIG screening levels in Building 205 since the USACE began their investigation, indicating that the remedial system is functioning effectively. Benzene and methylene chloride were detected in indoor air samples at a concentration exceeding their individual NJDEP VIG screening levels, but it is important to note that both compounds have not been detected in any of the sub-slab soil gas samples collected during current and previous sampling events.

These results confirm that the remedial system is operating effectively. As previously recommended, monitoring of sub-slab soil gas and indoor air should be continued on a semi-annual basis to ensure the effectiveness of the remedial system.

### **5.5.7 Conclusions and Recommendations**

The sub-slab soil gas results of this investigation were consistent with previous investigations indicating that TCE is present in the sub-slab soil gas at concentrations exceeding the NJDEP VIG screening levels, but continues to decrease in concentration. TCE was only detected in one indoor air samples during the current rounds of sampling, but at a very minimal level. This confirms that the sub-slab depressurization remediation system that was installed is functioning effectively in preventing/reducing migration of sub-slab soil gas contaminants into the air within the building. Continued monitoring on a semi-annual basis is recommended. USACE will reevaluate the monitoring frequency on an annual basis.

## 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 and lawn area.

Three previous sampling events were conducted by USACE at EPA Building 209 in January 2006, January 2007 and April 2007. Current investigation activities included sub-slab soil gas and indoor air sample collection during August 2007, November 2007, June 2008 and September 2008.

### 5.6.1 Prior Investigations

Weston collected a round of sub-slab soil gas and indoor air samples in January 2006 and April 2007. The results of previous investigations did not suggest the presence of a vapor intrusion pathway since, while TCE was detected in sub-slab soil gas in exceedance of the NJDEP VIG screening levels, it was not detected in indoor air.

### 5.6.2 Current Investigation

Six sub-slab soil gas points were sampled in the newly furnished cage areas (Randy Braun/MAB's cage and Lockheed Martin's cage), Griffen's service warehouse, the kitchen/office area, extraction lab and the microscopy lab on 29 August 2007, 14 November 2007, 11 June 2008 and 30 September 2008. In August and November 2007, 209-SG04 was not sampled. This port was located in the warehouse adjacent to the paint storage area, and could not be sampled by Weston during these two sampling events (no reason given by Weston).

| Matrix            | Number of Samples | Parameters/Method | Dates Sampled        |
|-------------------|-------------------|-------------------|----------------------|
| Sub-slab Soil Gas | 5                 | VOCs/TO-15        | 27 August 2007       |
|                   | 5                 | VOCs/TO-15        | 14 November 2008     |
|                   | 6                 | VOCs/TO-15        | 11 June 2008         |
|                   | 6                 | VOCs/TO-15        | 26 September 2008    |
| Indoor Air        | 5                 | VOCs/TO-15        | 27-29 August 2007    |
|                   | 5                 | VOCs/TO-15        | 13-14 November 2008  |
|                   | 6                 | VOCs/TO-15        | 10-11 June 2008      |
|                   | 6                 | VOCs/TO-15        | 25-26 September 2008 |

### 5.6.3 Sub-slab Soil Gas Results

During the sampling events from August 2007 through September 2008 five VOCs (benzene, methylene chloride, chloroform, PCE and TCE) were detected periodically in exceedance of their respective NJDEP VIG Soil Gas Screening Levels. PCE was detected in exceedance of the VIG screening levels during the last two sampling events (June and September 2008). Chloroform was detected above NJDEP VIG screening levels in all four previous sampling events (August 2007 through September 2008).

A summary of the detection frequency and concentration range of compounds detected in sub-slab soil gas is provided on Table 5-18. The complete sub-slab soil gas results for the current investigation are shown on Table 5-20. The following table contains a summary of the sub-slab soil gas exceedances.

| Compound                            | NJDEP VIG Table 1 Non-Residential Sub-slab Soil Gas Screening Criteria and Exceedances |                                                       |                                | NJDEP VIG Table 1 Residential Sub-slab Soil Gas Screening Criteria and Exceedances |                                                       |                                |
|-------------------------------------|----------------------------------------------------------------------------------------|-------------------------------------------------------|--------------------------------|------------------------------------------------------------------------------------|-------------------------------------------------------|--------------------------------|
|                                     | No. of Samples Exceeding                                                               | Range in Concentration Exceeding (ug/m <sup>3</sup> ) | Criterion (ug/m <sup>3</sup> ) | No. of Samples Exceeding                                                           | Range in Concentration Exceeding (ug/m <sup>3</sup> ) | Criterion (ug/m <sup>3</sup> ) |
| Benzene (September 2008)            | 0 of 6                                                                                 | -                                                     | 26                             | 1 of 6                                                                             | 19.68                                                 | 16                             |
| Chloroform (August 2007)            | 3 of 5                                                                                 | 26 to 210                                             | 24                             | 3 of 5                                                                             | 26 to 210                                             | 24                             |
| Chloroform (November 2007)          | 2 of 5                                                                                 | 30 to 210                                             | 24                             | 2 of 5                                                                             | 30 to 210                                             | 24                             |
| Chloroform (June 2008)              | 3 of 6                                                                                 | 31.74 to 85.44                                        | 24                             | 3 of 5                                                                             | 31.74 to 85.44                                        | 24                             |
| Chloroform (September 2008)         | 1 of 6                                                                                 | 31.25                                                 | 24                             | 1 of 5                                                                             | 31.25                                                 | 24                             |
| Methylene Chloride (September 2008) | 0 of 6                                                                                 | -                                                     | 430                            | 1 of 6                                                                             | 209.83                                                | 190                            |
| PCE (June 2008)                     | 1 of 6                                                                                 | 85.44                                                 | 36                             | 1 of 6                                                                             | 85.44                                                 | 34                             |
| PCE (September 2008)                | 2 of 6                                                                                 | 43.06 to 74.59                                        | 36                             | 2 of 6                                                                             | 43.06 to 74.59                                        | 34                             |
| TCE (September 2008)                | 1 of 6                                                                                 | 71.48                                                 | 27                             | 1 of 4                                                                             | 71.48                                                 | 27                             |

No other VOCs were detected at concentrations exceeding the NJDEP VIG screening levels. The sample locations are depicted and TCE and PCE exceedances are noted in red on Figure 5-5.

#### 5.6.4 Building Survey

Building 209 is currently used as office space and lab areas for the EPA facility. Weston and Shaw completed the *Indoor Air Building Survey and Sampling Form* during each subsequent sampling event 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 in the building. There were no chemicals observed that are considered significant potential VOC sources during the initial and subsequent sampling events. The Indoor Air Building Survey and Sampling Forms are included on the CD attached to this report, as are the MSDS forms obtained for chemicals present due to tenant activities in Building 209.

#### 5.6.5 Indoor Air Sampling Results

TCE and PCE were detected in ambient air samples collected during the June and September 2008 sampling events. However, it was not detected above NJDEP VIG screening levels for any indoor air samples collected during this period (August 2007 through September 2008). Benzene exceeded the VIG generic screening levels in three consecutive sampling events from November

2007 through September 2008. Methylene Chloride exceeds NJDEP VIG screening levels in various sampling points during all four current sampling events (August 2007 through September 2008). However, methylene chloride is not a COPC because it has not been detected in groundwater. Also, methylene chloride exceeding NJDEP VIG indoor air screening levels in one ambient air sample. Benzene may be related to gasoline use around the building. Similar to methylene chloride, benzene was detected at similar concentrations in previous ambient samples. The compounds that exceeded the NJDEP VIG screening levels are shown in the table below:

| Compound                               | NJDEP VIG Table 1 Non-Residential<br>Indoor Air Screening Criteria and<br>Exceedances |                                                                |                                   | NJDEP VIG Table 1 Residential<br>Indoor Air Screening Criteria and<br>Exceedances |                                                                |                                   |
|----------------------------------------|---------------------------------------------------------------------------------------|----------------------------------------------------------------|-----------------------------------|-----------------------------------------------------------------------------------|----------------------------------------------------------------|-----------------------------------|
|                                        | No. of<br>Samples<br>Exceeding                                                        | Range in<br>Concentration<br>Exceeding<br>(ug/m <sup>3</sup> ) | Criterion<br>(ug/m <sup>3</sup> ) | No. of<br>Samples<br>Exceeding                                                    | Range in<br>Concentration<br>Exceeding<br>(ug/m <sup>3</sup> ) | Criterion<br>(ug/m <sup>3</sup> ) |
| Benzene<br>(November 2007)             | 3 of 5                                                                                | 2.4 to 3                                                       | 2                                 | 3 of 5                                                                            | 2.4 to 3                                                       | 2                                 |
| Benzene<br>(June 2008)                 | 3 of 7                                                                                | 4.09 to 5.62                                                   | 2                                 | 3 of 7                                                                            | 4.09 to 5.62                                                   | 2                                 |
| Benzene<br>(September 2008)            | 1 of 6                                                                                | 2.59                                                           | 2                                 | 1 of 6                                                                            | 2.59                                                           | 2                                 |
| PCE<br>(June 2008)                     | 1 of 7<br>Ambient                                                                     | 4.68                                                           | 3                                 | 1 of 7                                                                            | 4.68<br>Ambient                                                | 3                                 |
| Methylene chloride<br>(August 2007)    | 2 of 5                                                                                | 32-34                                                          | 9                                 | 2 of 5                                                                            | 32-34                                                          | 4                                 |
| Methylene chloride<br>(November 2007)  | 2 of 5                                                                                | 16 to 33                                                       | 9                                 | 3 of 5                                                                            | 4.2 to 33                                                      | 4                                 |
| Methylene chloride<br>(June 2008)      | 5 of 7<br>Including<br>Ambient                                                        | 18 to 37.07                                                    | 9                                 | 7 of 7                                                                            | 6.25 to 37.07                                                  | 4                                 |
| Methylene chloride<br>(September 2008) | 3 of 6                                                                                | 21.23 to 37.17                                                 | 9                                 | 5 of 6                                                                            | 6.5 to 37.17                                                   | 4                                 |
| TCE<br>(June 2008)                     | 1 of 7<br>Ambient                                                                     | 79.91                                                          | 3                                 | 1 of 7                                                                            | 79.91<br>Ambient                                               | 3                                 |

A summary of the frequency of detections and ranges of detected concentrations are presented on Table 5-19. The complete indoor air and background air results for the current investigation are shown on Table 5-21. The PCE and TCE sample results for indoor air are shown on Figure 5-5.

### 5.6.6 Integrated Discussion of Results

The only VOCs detected in indoor air within Building 209 during this investigation were non-DOD related compounds (benzene and methylene chloride). While TCE, PCE, and chloroform were both detected in groundwater and sub-slab soil gas at concentrations greater than NJDEP VIG screening levels, neither compound was detected in indoor air at concentrations above its respective NJDEP VIG screening level.



### **5.6.7 Conclusions and Recommendations**

Although TCE and PCE were detected at concentrations exceeding their respective NJDEP VIG screening levels in sub-slab soil gas, they were not detected in the indoor air samples at concentrations exceeding the NJDEP VIG screening levels. Benzene and methylene chloride were detected in indoor air samples at concentrations above their NJDEP VIG screening levels, but these compounds are attributed to non-DOD activities. As TCE has been detected in groundwater and sub-slab soil gas, continued semi-annual monitoring is recommended for EPA Building 209 in accordance with the NJDEP VIG decision matrix. USACE will reevaluate the monitoring frequency on an annual basis.

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