EXPANDED OUTREACH AREA
SOIL VAPOR INTRUSION INVESTIGATION
PHASE II

WORK ASSIGNMENT C007540-3.1

MEEKER AVENUE PLUME TRACKDOWN SITE
GREENPOINT/EAST WILLIAMSBURG INDUSTRIAL AREA

Prepared for:
NEW YORK STATE
DEPARTMENT OF ENVIRONMENTAL CONSERVATION
625 Broadway, Albany, New York

Joseph Martens, Commissioner

DIVISION OF ENVIRONMENTAL REMEDIATION
REMEDIAL BUREAU B

URS Corporation
77 Goodell Street
Buffalo, New York 14203

February 2013
# TABLE OF CONTENTS

LIST OF ACRONYMS AND ABBREVIATIONS ........................................................................ vi

1.0 INTRODUCTION ........................................................................................................... 1-1

  1.1 Site Background .................................................................................................. 1-2
    1.1.1 Site Location and Description .................................................................. 1-2

  1.2 Previous Investigations ................................................................................... 1-4

  1.3 Objectives and Scope ..................................................................................... 1-6

    1.3.1 EOA SVI Investigation Phase I .............................................................. 1-6
      1.3.1.1 Purpose of EOA SVI Investigation Phase I .................................. 1-6
      1.3.1.2 Scope of EOA SVI Investigation Phase I Fieldwork .................. 1-6

    1.3.2 EOA SVI Investigation Phase II ............................................................. 1-7
      1.3.2.1 Purpose of EOA SVI Investigation Phase II ............................... 1-7
      1.3.2.2 Scope of SVI Investigation Phase II Fieldwork .......................... 1-7

  1.4 Data Presentation ............................................................................................ 1-7

2.0 FIELD ACTIVITIES ...................................................................................................... 2-1

  2.1 Summary of Records Search .......................................................................... 2-1
  2.2 Utility Clearance ............................................................................................. 2-2
  2.3 Geophysical Survey for Utility Markouts ....................................................... 2-2
  2.4 Soil Vapor Implant Installation ..................................................................... 2-2
  2.5 Soil Vapor Sampling ....................................................................................... 2-4
  2.6 Investigation Derived Waste Disposal .......................................................... 2-5
  2.7 Site Survey ..................................................................................................... 2-5

3.0 SUBSURFACE CONDITIONS ...................................................................................... 3-1

  3.1 Regional Geology ........................................................................................... 3-1
  3.2 Site Geology .................................................................................................. 3-2
  3.3 Standards, Criteria and Guidance Values .................................................... 3-2

    3.3.1 Soil ........................................................................................................ 3-3
      3.3.1.1 Background Soil Analytical Results ......................................... 3-3
      3.3.1.2 Part 375 Criteria and CP-51 ...................................................... 3-4

    3.3.2 Soil Vapor ............................................................................................ 3-5

4.0 ANALYTICAL RESULTS ............................................................................................. 4-1

  4.1 Soil Analytical Results .................................................................................... 4-1

    4.1.1 Phase I Investigation ........................................................................... 4-1
    4.1.2 Phase II Investigation .......................................................................... 4-2

  4.2 Soil Vapor Analytical Results ....................................................................... 4-2
4.2.1 Phase I Investigation ................................................................. 4-2
4.2.2 Phase II Investigation ................................................................. 4-5

5.0 CONCLUSIONS AND RECOMMENDATIONS .............................................. 5-1
5.1 Conclusions ..................................................................................... 5-1
5.1.2 Soil ............................................................................................... 5-1
5.1.3 Soil Vapor .................................................................................... 5-1
5.2 Source Characterization .................................................................. 5-3
5.2.1 Sources ......................................................................................... 5-3
5.2.2 Potential Sources .......................................................................... 5-4
5.3 Recommendations for EOA SVI Investigation Phase III Fieldwork ........... 5-7

6.0 REFERENCES .......................................................................................... 6-1

TABLES
(Following Text)

Table 2-1 Potential Chlorinated VOC Sources
Table 2-2 Summary of Parameters Analyzed
Table 3-1 Summary of Detected Compounds in Site-Specific Soil Background Samples from McGolrick Park
Table 3-2 Statistical Summary of Compounds Detected in Site-Specific Soil Background Samples from McGolrick Park
Table 4-1 Summary of Detected VOCs in EOA SVI Phase I Investigation Soil Samples – Soil Background, Unrestricted Use and Protection of Groundwater Criteria
Table 4-2 Summary of Detected VOCs in EOA SVI Phase I Investigation Soil Samples – Residential and Restricted Residential Criteria
Table 4-3 Statistical Summary of Detected Compounds in EOA SVI Phase I Investigation Soil Samples
Table 4-4 Summary of Detected VOCs in EOA SVI Phase II Investigation Soil Samples – Soil Background, Unrestricted Use and Protection of Groundwater Criteria
Table 4-5 Summary of Detected VOCs in EOA SVI Phase II Investigation Soil Samples – Residential and Restricted Residential Criteria
Table 4-6 Summary of Detected VOCs in All EOA Soil Samples – Soil Background, Unrestricted Use and Protection of Groundwater Criteria
Table 4-7 Summary of Detected VOCs in All EOA Soil Samples – Residential and Restricted Residential Criteria
Table 4-8 Statistical Summary of Compounds Detected in All EOA Soil Samples
Table 4-9 Summary of Detected Compounds in EOA SVI Phase I Investigation Ambient Air and Soil Vapor Samples
Table 4-10 Statistical Summary of Detected Compounds in EOA SVI Phase I Investigation Soil Vapor Samples
Table 4-11 Summary of Detected Compounds in EOA SVI Phase II Investigation Ambient Air and Soil Vapor Samples
Table 4-12 Statistical Summary of Detected Compounds in EOA SVI Phase II Investigation Soil Vapor Samples
Table 4-13 Summary of Historically Detected Compounds in All EOA Soil Vapor Samples
Table 4-14 Statistical Summary of Compounds Detected in All EOA Soil Vapor Samples
Table 5-1 Summary of Select VOCs Detected and Potential Sources - EOA SIV Phase I
Table 5-2 Summary of Select VOCs Detected and Potential Sources - EOA SIV Phase II

FIGURES
(Following Tables)

Figure 1-1 Site Location
Figure 1-2 Site Plan
Figure 1-3 ExxonMobil OU-7 Area
Figure 1-4 Estimated Radius of Influence of ExxonMobil SVE System
Figure 2-1 Potential CVOC Sources
Figure 2-2 Soil Vapor Implant Locations
Figure 3-1 Regional Geologic Cross-Section
Figure 3-2 Subcrops Beneath The Upper Glacial Aquifer
Figure 3-3 Generalized Hydrogeologic Cross-Section B-B’
Figure 4-1 EOA SVI Phase I Investigation Soil Analytical Results Exceeding Background, Unrestricted Use and Protection of Groundwater Criteria
Figure 4-2 EOA SVI Phase I Investigation Soil Analytical Results Exceeding Residential Use and Restricted Residential Use Criteria
Figure 4-3 EOA SVI Phase II Investigation Soil Analytical Results Exceeding Background, Unrestricted Use and Protection of Groundwater Criteria
Figure 4-4 EOA SVI Phase II Investigation Soil Analytical Results Exceeding Residential Use and Restricted Residential Use Criteria
Figure 4-5 EOA SVI Phase I Investigation Select CVOC Soil Vapor Analytical Results (August 2012)
Figure 4-6 EOA SVI Phase I Investigation Tetrachloroethene Isoconcentration Contours In Soil Vapor (August 2012)
Figure 4-7  EOA SVI Phase I Investigation Trichloroethene Isoconcentration Contours In Soil Vapor (August 2012)

Figure 4-8  EOA SVI Phase I Investigation Cis-1,2-Dichloroethene Isoconcentration Contours In Soil Vapor (August 2012)

Figure 4-9  EOA SVI Phase I Investigation 1,1,1-Trichloroethane Isoconcentration Contours In Soil Vapor (August 2012)

Figure 4-10  EOA SVI Phase I Investigation 1,1-Dichloroethane Isoconcentration Contours In Soil Vapor (August 2012)

Figure 4-11  EOA SVI Phase I Investigation 1,1,2-Trichloroethane Isoconcentration Contours In Soil Vapor (August 2012)

Figure 4-12  EOA SVI Phase II Investigation Select CVOC Soil Vapor Analytical Results (January 2013)

Figure 4-13  EOA SVI Phase II Investigation Tetrachloroethene Isoconcentration Contours In Soil Vapor (January 2013)

Figure 4-14  EOA SVI Phase II Investigation Trichloroethene Isoconcentration Contours In Soil Vapor (January 2013)

Figure 4-15  EOA SVI Phase II Investigation Cis-1,2-Dichloroethene Isoconcentration Contours In Soil Vapor (January 2013)

Figure 4-16  EOA SVI Phase II Investigation 1,1,1-Trichloroethane Isoconcentration Contours In Soil Vapor (January 2013)

Figure 4-17  EOA SVI Phase II Investigation 1,1-Dichloroethane Isoconcentration Contours In Soil Vapor (January 2013)

Figure 4-18  EOA SVI Phase II Investigation 1,1,2-Trichloroethane Isoconcentration Contours In Soil Vapor (January 2013)

Figure 5-1  Select CVOC Soil Vapor Analytical Results (August 2012) With Potential Source Areas

Figure 5-2  Source and Potential Source Areas

Figure 5-3  Proposed Phase II Soil Vapor Implant Locations

PLATES

(Following Figures)

Plate 1  Select CVOC Detections in ExxonMobil OU-7 (August 2010 and May 2011)

Plate 2  Generalized Hydrogeologic Cross-Section Transects
APPENDICES
(Following Plate)

<table>
<thead>
<tr>
<th>Appendix</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Appendix A</td>
<td>EDR Reports (on compact disc)</td>
</tr>
<tr>
<td>Appendix B</td>
<td>OASIS Data</td>
</tr>
<tr>
<td>Appendix C</td>
<td>Photographic Log</td>
</tr>
<tr>
<td>Appendix D</td>
<td>Geophysical Survey Report</td>
</tr>
<tr>
<td>Appendix E</td>
<td>Field Notes</td>
</tr>
<tr>
<td>Appendix F</td>
<td>Soil Vapor Implant Construction Logs</td>
</tr>
<tr>
<td>Appendix G</td>
<td>Summa Canister Field Data Sheets</td>
</tr>
<tr>
<td>Appendix H</td>
<td>Investigation Derived Waste Disposal Documents</td>
</tr>
<tr>
<td>Appendix I</td>
<td>Survey Drawing</td>
</tr>
<tr>
<td>Appendix J</td>
<td>Data Usability Summary Report (on compact disc)</td>
</tr>
<tr>
<td>Acronym</td>
<td>Full Form</td>
</tr>
<tr>
<td>----------</td>
<td>---------------------------------------------------------------------------</td>
</tr>
<tr>
<td>1,1-DCA</td>
<td>1,1-dichloroethane</td>
</tr>
<tr>
<td>1,1,1-TCA</td>
<td>1,1,1-trichloroethane</td>
</tr>
<tr>
<td>1,1,2-TCA</td>
<td>1,1,2-trichloroethane</td>
</tr>
<tr>
<td>4,4-DDD</td>
<td>dichlorodiphenyl dichloroethane</td>
</tr>
<tr>
<td>4,4-DDE</td>
<td>dichlorodiphenyl dichloroethylene</td>
</tr>
<tr>
<td>4,4-DDT</td>
<td>dichlorodiphenyl trichloroethane</td>
</tr>
<tr>
<td>AARCO</td>
<td>AARCO Environmental Services Corporation</td>
</tr>
<tr>
<td>amsl</td>
<td>above mean sea level</td>
</tr>
<tr>
<td>Associated</td>
<td>Associated Environmental Services, Ltd.</td>
</tr>
<tr>
<td>AST</td>
<td>above ground storage tank</td>
</tr>
<tr>
<td>bgs</td>
<td>below ground surface</td>
</tr>
<tr>
<td>BP</td>
<td>British Petroleum</td>
</tr>
<tr>
<td>BQE</td>
<td>Brooklyn Queens Expressway</td>
</tr>
<tr>
<td>B. Thayer</td>
<td>B. Thayer Associates, Inc.</td>
</tr>
<tr>
<td>BTEX</td>
<td>benzene, toluene, ethylbenzene and xylene</td>
</tr>
<tr>
<td>CESQG</td>
<td>Conditionally Exempt Small Quantity Generator</td>
</tr>
<tr>
<td>cis-1,2-DCE</td>
<td>cis-1,2-dichloroethene</td>
</tr>
<tr>
<td>CD</td>
<td>compact disc</td>
</tr>
<tr>
<td>CO</td>
<td>certificate of occupancy</td>
</tr>
<tr>
<td>COC</td>
<td>chain-of-custody</td>
</tr>
<tr>
<td>Con Edison</td>
<td>Consolidated Edison Company of New York, Inc.</td>
</tr>
<tr>
<td>CP-51</td>
<td>NYSDEC, October 2010. CP-51 Soil Cleanup Guidance for Total PAHs</td>
</tr>
<tr>
<td>Con-Test</td>
<td>Con-Test Analytical Laboratory</td>
</tr>
<tr>
<td>CPT</td>
<td>cone penetrometer test</td>
</tr>
<tr>
<td>CVOCs</td>
<td>chlorinated volatile organic compounds</td>
</tr>
<tr>
<td>Department</td>
<td>New York State Department of Environmental Conservation</td>
</tr>
<tr>
<td>DOT</td>
<td>Department of Transportation</td>
</tr>
<tr>
<td>DUSR</td>
<td>Data Usability Summary Report</td>
</tr>
<tr>
<td>EDR</td>
<td>Environmental Data Resources, Inc.</td>
</tr>
<tr>
<td>ELAP</td>
<td>Environmental Laboratory Approval Program</td>
</tr>
<tr>
<td>EM</td>
<td>electromagnetic</td>
</tr>
<tr>
<td>EOA</td>
<td>expanded outreach area</td>
</tr>
<tr>
<td>ExxonMobil</td>
<td>ExxonMobil Environmental Services Company</td>
</tr>
<tr>
<td>FAP</td>
<td>Field Activities Plan</td>
</tr>
<tr>
<td>GKM</td>
<td>GKM Manufacturing Corporation</td>
</tr>
<tr>
<td>GPR</td>
<td>ground penetrating radar</td>
</tr>
<tr>
<td>H2M</td>
<td>H2M Labs, Inc.</td>
</tr>
<tr>
<td>IDW</td>
<td>investigation derived wastes</td>
</tr>
<tr>
<td>Inc.</td>
<td>Incorporated</td>
</tr>
<tr>
<td>LEL</td>
<td>lower explosive limit</td>
</tr>
<tr>
<td>LQG</td>
<td>Large Quantity Generator</td>
</tr>
<tr>
<td>MA</td>
<td>Massachusetts</td>
</tr>
<tr>
<td>NAD</td>
<td>North American Datum</td>
</tr>
</tbody>
</table>

vi
**LIST OF ACRONYMS AND ABBREVIATIONS**  
(Continued)

<table>
<thead>
<tr>
<th>Acronym</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>NAVD</td>
<td>North American Vertical Datum</td>
</tr>
<tr>
<td>NY</td>
<td>New York</td>
</tr>
<tr>
<td>NYC</td>
<td>New York City</td>
</tr>
<tr>
<td>NYCDep</td>
<td>New York City Department of Environmental Protection</td>
</tr>
<tr>
<td>NYCDOB</td>
<td>New York City Department of Buildings</td>
</tr>
<tr>
<td>NYCDOT</td>
<td>New York City Department of Transportation</td>
</tr>
<tr>
<td>NYSDEC</td>
<td>New York State Department of Environmental Conservation</td>
</tr>
<tr>
<td>NYCDOFAR</td>
<td>New York City Department of Finance Assessment Roll</td>
</tr>
<tr>
<td>NYSDOH</td>
<td>New York State Department of Health</td>
</tr>
<tr>
<td>NYSDOT</td>
<td>New York State Department of Transportation</td>
</tr>
<tr>
<td>OD</td>
<td>outside diameter</td>
</tr>
<tr>
<td>OASIS</td>
<td>Open Accessible Space Information System</td>
</tr>
<tr>
<td>Off-Site System</td>
<td>Off-Site Free Product Recovery System</td>
</tr>
<tr>
<td>OU-7</td>
<td>ExxonMobil Operable Unit 7</td>
</tr>
<tr>
<td>PAH</td>
<td>polycyclic aromatic hydrocarbons</td>
</tr>
<tr>
<td>Part 375</td>
<td>6 New York Codes, Rules and Regulations (NYCRR), Part 375</td>
</tr>
<tr>
<td>PCE</td>
<td>perchloroethene, aka tetrachloroethene or tetrachloroethylene or perchloroethylene</td>
</tr>
<tr>
<td>PID</td>
<td>photoionization detector</td>
</tr>
<tr>
<td>ppbv</td>
<td>parts per billion by volume</td>
</tr>
<tr>
<td>QA/QC</td>
<td>quality assurance/quality control</td>
</tr>
<tr>
<td>RCRA</td>
<td>Resource Conservation Recovery Act</td>
</tr>
<tr>
<td>Roux</td>
<td>Roux Associates, Inc.</td>
</tr>
<tr>
<td>RSI</td>
<td>Radar Solutions International</td>
</tr>
<tr>
<td>SC</td>
<td>Site Characterization</td>
</tr>
<tr>
<td>SCGs</td>
<td>standards, criteria and guidance values</td>
</tr>
<tr>
<td>SQG</td>
<td>Small Quantity Generator</td>
</tr>
<tr>
<td>SVE</td>
<td>soil vapor extraction</td>
</tr>
<tr>
<td>SVI</td>
<td>soil vapor intrusion</td>
</tr>
<tr>
<td>SVOC</td>
<td>semi volatile organic compound</td>
</tr>
<tr>
<td>TAGM</td>
<td>Technical and Administrative Guidance Memorandums</td>
</tr>
<tr>
<td>TAL</td>
<td>target analyte list</td>
</tr>
<tr>
<td>TCL</td>
<td>target compound list</td>
</tr>
<tr>
<td>TCE</td>
<td>trichloroethene, aka trichloroethylene</td>
</tr>
<tr>
<td>TCL</td>
<td>target compound list</td>
</tr>
<tr>
<td>TIC</td>
<td>tentatively identified compound</td>
</tr>
<tr>
<td>µg/m³</td>
<td>micrograms per cubic meter</td>
</tr>
<tr>
<td>USCG</td>
<td>United States Coast Guard</td>
</tr>
<tr>
<td>USGS</td>
<td>United States Geologic Survey</td>
</tr>
<tr>
<td>URS</td>
<td>URS Corporation - New York</td>
</tr>
<tr>
<td>USEPA</td>
<td>United States Environmental Protection Agency</td>
</tr>
<tr>
<td>VOC</td>
<td>volatile organic compound</td>
</tr>
<tr>
<td>WA</td>
<td>Work Assignment</td>
</tr>
</tbody>
</table>
1.0 INTRODUCTION

This Soil Vapor Intrusion Investigation Phase II Report has been prepared to summarize the field activities and analytical results associated with the Phase I and Phase II soil vapor intrusion (SVI) field activities performed in the expanded outreach area (EOA) at the Meeker Avenue Plume Trackdown Site (Site ID No. 224121) in the Greenpoint/East Williamsburg Industrial Area section of Brooklyn, New York. The work for the SVI investigation was issued to URS Corporation - New York (URS) as Work Assignment (WA) No. C007540-3 by the New York State Department of Environmental Conservation (NYSDEC) in January 2011, and amended in March 2012 to WA No. C007540-3.1 due to an increase in the scope of work, budget, and schedule which is discussed below. This report presents data and information gathered prior to and during the EOA SVI Phase I field investigation, which was conducted from July 19, 2012 through August 15, 2012 and data from the EOA SVI Phase II field investigation, which was conducted from December 11, 2012 through January 11, 2013.

The amendment to WA No. C007540-3.1 included the addition of Task 4, Task 5, and Task 6 to the original WA (No. C007540-3). A summary of the new tasks is as follows:

- **Task 4:** URS was directed to perform a records search for the EOA which is bound by Morgan Avenue to the west, Norman Avenue/ Bridgewater Street to the north, Stewart Avenue to the east, and Meeker Avenue/ Brooklyn Queens Expressway (BQE) to the south. The majority of this area is underlain by a petroleum free-product plume originating from the ExxonMobil Brooklyn Terminal. The records search was to focus on potential sources of chlorinated solvents that have been detected in existing ExxonMobil Environmental Services Company (ExxonMobil) soil vapor and groundwater monitoring/extraction wells in the EOA. The information would be used to determine the placement of soil vapor implants for soil vapor sampling. A summary of the records search is provided in this report.

- **Task 5:** URS was directed to install and sample approximately 50 soil vapor implants over two phases of fieldwork. The Phase I fieldwork was performed in July - August 2012. The Phase II fieldwork was performed in December 2012 - January 2013 and is summarized in this report.
Task 6: Draft and final reports would be compiled and submitted following each phase of fieldwork. The report summarizing the Phase I fieldwork and results was finalized in January 2013. This report incorporated both Phase I and Phase II field activities and results.

1.1 Site Background

The Meeker Avenue Plume Trackdown Site is located in the Greenpoint/East Williamsburg Industrial Area section of the Borough of Brooklyn, New York (Figure 1-1). Geographical, site use, and background information is provided in the following sections.

1.1.1 Site Location and Description

The Meeker Avenue Plume Trackdown Site investigation area (Figure 1-2) is located in a region of historic petroleum refining and storage operations that occupied a significant portion of the Greenpoint area. By 1870 over 50 refineries were located along the banks of Newtown Creek. Currently, bulk oil storage terminals exist north of the site, including the British Petroleum (BP) Terminal, and the ExxonMobil Brooklyn Terminal. The former Paragon Oil facility was located along the northeastern portion of the site along Newtown Creek, north of Bridgewater Street, between Meeker Avenue and Apollo Street. Peerless Importers, Incorporated (Inc.), is currently located on a portion of the former Paragon Oil facility along Newtown Creek.

In September 1978, the United States Coast Guard (USCG) noted the signs of an oil spill entering Newtown Creek from the northeastern end of Meeker Avenue. A subsequent investigation concluded that the area of the spill under the Greenpoint/East Williamsburg Industrial Area was in excess of 52 acres and the total spill volume, as estimated in 1979, was approximately 17 million gallons of petroleum products (Roux, October 14, 2005). The current BP property was determined to be the source of the petroleum free product plume. Investigation and remediation activities were conducted by Roux Associates, Inc. (Roux) on behalf of ExxonMobil from 1990 to the present and have further defined the extent of the Off-Site Plume. The Off-Site Plume area consists of the area underlain by the petroleum-free product plume that is not on the BP Terminal or the Peerless Importers, Inc. properties. Currently, the extent of the Off-Site Plume area is less than what it was in 1990 due to the operation of the Off-Site Free
Product Recovery System (Off-Site System). The Off-Site System has recovered over 6,000,000 gallons of free product since it became operational in 1995 (Roux, November 14, 2011).

The original Meeker Avenue Plume Trackdown site investigation area was bounded by the former ExxonMobil Brooklyn Refinery/current BP Terminal to the north (Norman Avenue/Bridgewater Street), Newtown Creek to the east, Lombardy Street to the south, and Kingsland Avenue to the west. During the first phase of Site Characterization (SC) fieldwork (May 7 through July 10, 2007), the southern boundary of the site investigation area along Lombardy Street between Porter and Morgan Avenues was extended three blocks south to Richardson Street. During the second phase of SC fieldwork (November 5 through December 27, 2007), the southern boundary of the site investigation area along Richardson Street between Vandervoort and Morgan Avenues was extended one block south to Frost Street. During the third phase of SC fieldwork (May 5 through July 24, 2008), the southern boundary was additionally extended one block south to Withers Street between Vandervoort and Morgan Avenues. In addition, the boundary in the northwestern corner of the site investigation area was extended west from Kingsland Avenue between Norman and Nassau Avenues to Monitor Street. A review of historical data during the fourth phase of SC fieldwork (November 3 through December 8, 2008) indicated that several additional potential sources of contamination may exist north of Norman Avenue, between Kingsland Avenue and Monitor Street. Therefore, the boundary in the northwestern corner of the site investigation area was extended approximately 1 block north of Norman Avenue, between Kingsland Avenue and Monitor Street.

The site boundary was once again expanded for the Phase VI SC field activities due to data obtained during the Groundwater Split Sampling Event which was performed in November 2009 (URS, February 2010). The data indicated the presence of a potential source of chlorinated solvents including tetrachloroethene (PCE) and trichloroethene (TCE) in groundwater originating to the west-southwest of the investigation area. The southwest corner of the site investigation area was extended west to Kingsland Avenue and south to Frost Street.

Land use within the Meeker Avenue Plume Trackdown site investigation area is a mixture of residential and manufacturing, including both commercial and industrial facilities. The areas located north of Nassau Avenue, east of Van Dam Street, and south of Meeker Avenue are primarily used for manufacturing purposes. Residential areas are located in both the
northwestern portion of the site (extending from Van Dam Street between Nassau and Meeker Avenues, to the western site boundary) and within the southern portion of the site (along Beadel Street from Morgan to Porter Avenues, along Vandervoort Avenue from Lombardy Street to Division Place, and along Kingsland Avenue from Meeker Avenue to Frost Street).

### 1.2 Previous Investigations

**Roux Associates – September 2005**

In September 2005, Roux Associates, on behalf of ExxonMobil, sampled soil vapor at 23 temporary locations in and around the perimeter of the Off-Site Plume area (Roux, October 14, 2005). The soil vapor samples collected in September 2005 indicated the presence of PCE at 10,200 micrograms per cubic meter (µg/m³) at the monitoring point located on the southwestern corner of the Vandervoort Avenue and Anthony Street intersection, and 7,050 µg/m³ at the monitoring point on the western side of Morgan Avenue between Nassau and Norman Avenues. Much lower concentrations of PCE were detected throughout the remainder of and around the perimeter of the Off-Site Plume area. In addition, TCE was detected at 4,500 µg/m³ at the monitoring point located on the western side of Apollo Street between Nassau Avenue and Meeker Avenue, and 151,000 µg/m³ at the monitoring point on the western side of Morgan Avenue between Nassau Avenue and Norman Avenue. Much lower concentrations of TCE were detected throughout the remainder of and around the perimeter of the Off-Site Plume area. It was determined that the chlorinated solvents detected (i.e., PCE and TCE) were from a different source than the petroleum-free product plume.

**Roux Associates – September 2006**

Between June and September 2006, Roux Associates performed an additional soil vapor investigation in and around the perimeter of the Off-Site Plume area (Roux, November 10, 2006). A total of 50 permanent soil vapor monitoring points were installed. This included 20 nested monitoring points (one shallow and one deep) in the commercial/industrial area and 10 deep monitoring points in the residential area. Elevated concentrations of PCE were detected at 1,300 µg/m³ at the monitoring point located at the northwestern corner of the intersection of Morgan and Nassau Avenues, and 930 µg/m³ at the monitoring point on the western side of Van Dam Street between Nassau and Meeker Avenues. Elevated concentrations of TCE were detected at
8,200 µg/m³ at the monitoring point on the eastern side of Apollo Street between Bridgewater Street and Nassau Avenue, and 700 µg/m³ at the monitoring point on the northwestern corner of the intersection of Morgan and Nassau Avenues.

**Roux Associates - Soil Vapor Monitoring/ Soil Vapor Extraction System, 2006 to Present**

Roux Associates has performed periodic soil vapor monitoring of over 50 permanent soil vapor monitoring points in ExxonMobil Operable Unit 7 (OU-7), which is outlined on Figure 1-3, from 2006 to the present. OU-7 roughly comprises the area south of Norman Avenue/ Bridgewater Street, west of Stewart Avenue, north of Lombardy Street and east of Sutton Street. The soil vapor monitoring was performed on a semi-annual basis from 2006 through August 2010 and subsequently on a 9 month basis which was proposed in November 2010 to the present. The contaminants of concern are primarily petroleum related compounds, specifically benzene and methane. However, chlorinated solvents such as PCE and TCE have also been detected. Plate 1 depicts results for select chlorinated volatile organic compounds (CVOCs) detected in the OU-7 area during the last several soil vapor monitoring events for which data is currently available, August 2010 through August 2012.

A soil vapor extraction (SVE) system is located in OU-7. The SVE system was constructed to mitigate methane and other volatile organic compounds (VOCs) in the shallow soil vapor in the vicinity of the Norman Avenue, Bridgewater Street, and Apollo Street intersection. The OU-7 SVE system consists of seven SVE wells (SVE-3, SVE-4 and SVE-6 through SVE-10) which are connected to a common header of 12-inch high-density polyethylene piping installed in the streets which leads to the SVE treatment facility located at 38 Varick Street (Roux, November 14, 2011). An interim SVE system was used from August 2009 until June 4, 2010, when the full-scale SVE system commenced operation. A Flame-Ox thermal treatment unit is present at the treatment facility. Figure 1-4 depicts the location of SVE wells, monitoring points, and the estimated radius of influence of the SVE system based on percent lower explosive limit (LEL) reduction and or vacuum response measured during the second quarter 2011 sampling activities (Roux, August 10, 2011).
1.3 **Objectives and Scope**

URS has been tasked by the Department to determine the potential sources of CVOCs that have historically been detected by Roux Associates in the EOA. The presence of the CVOCs may present a SVI issue to overlying residential/commercial/industrial buildings.

1.3.1 **EOA SVI Investigation Phase I**

1.3.1.1 **Purpose of EOA SVI Investigation Phase I**

The purpose of the EOA SVI Phase I Investigation fieldwork was to assist in determining:

- The location of potential sources of PCE, TCE, and other CVOCs impacting soil and soil vapor in the EOA;
- The horizontal extent of impacted soil and soil vapor in the EOA; and
- The potential for SVI of CVOCs into residential/commercial/industrial buildings located in the EOA.

1.3.1.2 **Scope of EOA SVI Investigation Phase I Fieldwork**

Tasks performed during the EOA SVI Phase I investigation field activities included:

- Geophysical utility clearance by Radar Solutions International of Waltham, Massachusetts (MA) (RSI) at all soil vapor and drilling locations;
- Sampling and installation of 35 soil vapor implants by Associated Environmental Services, Ltd. of Hauppauge, New York (NY) (Associated);
- Analysis of soil samples for VOCs by H2M Labs, Inc. of Melville, NY (H2M);
- Collection of 2 ambient air samples, and 38 soil vapor samples at 34 locations, including 4 field duplicates, for analysis by Con-Test Analytical Laboratory of Longmeadow, MA (Con-Test);
- Daily pick-up of investigation derived waste for disposal by AARCO Environmental Services Corporation of Lindenhurst, NY (AARCO); and
• Site survey by B. Thayer Associates, Inc. of Woodbury, NY (B. Thayer).

The results of the EOA SVI Phase I fieldwork and findings was documented in the Expanded Outreach Area Soil Vapor Intrusion Investigation Phase I Report (URS. January 2013).

1.3.2 **EOA SVI Investigation Phase II**

1.3.2.1 **Purpose of EOA SVI Investigation Phase II**

The purpose of the EOA SVI Phase II Investigation fieldwork was to assist in:

• Collecting additional information around 5 potential sources identified during the Phase I Investigation, to determine if any of these areas are responsible for, or are contributing to, the presence of CVOCs in the environment; and

• Collect a complete round of soil vapor samples from the EOA.

1.3.2.2 **Scope of SVI Investigation Phase II Fieldwork**

Tasks performed during the EOA SVI Phase II investigation field activities included:

• Geophysical utility clearance by RSI at all soil vapor and drilling locations;

• Sampling and installation of 15 soil vapor implants by Associated;

• Analysis of soil samples for VOCs by H2M;

• Collection of 5 ambient air samples, and 55 soil vapor samples at 47 locations, including 5 field duplicates, for analysis by Con-Test;

• Daily pick-up of investigation derived waste for disposal by AARCO; and

• Site survey by B. Thayer.

1.4 **Data Presentation**

This SVI Investigation Phase II Report has six sections. Section 1 includes background information and a synopsis of previous and current activities performed to date at this site. Section 2 includes a description of field activities that occurred during the EOA SVI Phase I and
Phase II fieldwork. Section 3 includes a description of the subsurface conditions that have been found within the project boundary. Section 4 includes a description and summary of the analytical results for the soil and soil vapor samples from locations sampled during the EOA SVI Phase I and Phase II fieldwork. Section 5 consists of the conclusions and recommendations derived from the EOA SVI Phase I and Phase II fieldwork. Section 6 contains a list of references cited. Tables, Figures, and Appendices immediately follow the text.
FIELD ACTIVITIES

Field activities were performed during EOA SVI Phase I investigation from July 19, 2012 through August 15, 2012 and during the EOA SVI Phase II field investigation, which was conducted from December 11, 2012 through January 11, 2013, and are discussed below.

2.1 Summary of Records Search

Historical records were obtained prior to the commencement of fieldwork through Environmental Data Resources, Inc. (EDR) for the EOA. The Sanborn maps and radius report submitted by EDR are provided on a compact disc (CD) in Appendix A. The Sanborn maps and radius report were reviewed for the presence of facilities that may have utilized CVOCs such as dry cleaners, metal working facilities, electronics, laboratories, and painting operations.

In addition, based upon the EDR data review, URS searched the Open Accessible Space Information System (OASIS) for each identified property of interest. OASIS provides access to data from such sources but not limited to the: New York City Department of Buildings (NYCDOB); New York City Department of Finance Assessment Roll (NYCDOFAR); New York City Digital Tax Map; New York City (NYC) zoning guide; and NYC Watershed Resources. The NYCDOB site in addition to containing information about the subject property also included Certificates of Occupancy (CO) where available. Data obtained from OASIS is provided in Appendix B and is organized by address.

Based upon a review of EDR data and information from OASIS, 19 potential sources of chlorinated solvents were identified in the vicinity of the EOA. A summary of each of the potential sources is provided on Table 2-1. The locations of the 19 potential chlorinated VOC sources are shown on Figure 2-1.

Based upon the historical review and after consultation with the NYSDEC Project Manager, 37 proposed soil vapor locations were identified. During a site visit on June 4 and 5, 2012, URS personnel and the NYSDEC Project Manager reviewed and marked out the 37 proposed soil vapor locations. During the installation of the soil vapor implants, 2 soil vapor locations on Apollo Street were canceled due to concerns of homeowners.
2.2 Utility Clearance

Prior to site work, the subcontractors arranged for all appropriate utility clearance mark-outs. This included (but was not limited to) contacting the NYC Department of Environmental Protection (NYCDEP) and NYC Department of Transportation (NYCDOT), the Transit Authority, Consolidated Edison Company of New York, Inc. (Con Edison), National Grid, and Verizon, in addition to using the Dig-Safely number for New York City – 811 or (800) 272-4480.

2.3 Geophysical Survey for Utility Markouts

On July 19, 20 and 23, 2012 for Phase I and again on December 11, 2012 for Phase II, RSI mobilized a two person crew with ground penetrating radar (GPR) and electromagnetic (EM) induction equipment to the site. The purpose of the geophysical survey was to screen for and identify the presence/location of underground utilities in areas where intrusive work for soil vapor implants was proposed.

An approximate 10-foot square reference grid was established around each soil vapor implant location prior to collecting the geophysical data. The size of the grid was adjusted to accommodate sidewalk width and avoid obstructions and utilities detected. A GSSI SIR-3000 digital radar system was used to perform the GPR survey. GPR data were acquired along lines spaced 1.0 to 2.5 feet apart. The EM induction equipment used to determine the location of buried utilities were a Ditch Witch 950 RT locating system and a McLoughlin’s Verifier G2 digital locator.

RSI marked utilities and anomalies by spray-painting the outline on the pavement as soon as they were located. A URS geologist supervised and assisted RSI. A photo log can be found in Appendix C and RSI’s report is provided are Appendix D.

2.4 Soil Vapor Implant Installation

Prior to any intrusive activities, the subcontractor obtained all necessary permits (i.e., NYCDOT sidewalk opening permits) for conducting intrusive activities. During Phase I, a total of 35 permanent soil vapor implants (SG-133 through SG-167) were installed between July 23 and 27, 2012 by Associated, under the direction of a URS geologist. During Phase II, a total of 15 permanent soil vapor implants (SG-168 through SG-182) were installed between December 12
and 14, 2012 by Associated, under the direction of a URS geologist. Locations of the soil vapor implants are shown on Figure 2-2.

All locations were installed through sidewalks. Rotary concrete drill bits were used to drill through the concrete sidewalk. A track-mounted Geoprobe® 6620 DT hydraulic direct-push unit was utilized to advance a 2-inch outside diameter (OD) by 5-foot long acetate-lined Macrocore sampler to a maximum depth of 8 feet below ground surface (bgs). All investigation derived waste (IDW) generated from the soil vapor implant installation was containerized in Department of Transportation (DOT) approved 55-gallon drums and picked up by AARCO on a daily basis for off-site disposal at a permitted facility.

Each sample core was screened with a photoionization detector (PID). One soil sample was collected from each boring from the interval exhibiting odors, staining, or the highest PID reading. If no odors, staining, or elevated PID readings were encountered, then a sample from the bottom of the boring was collected.

A 6-inch long double-woven stainless steel Geoprobe® vapor sampling implant was connected to an anchor and positioned above a less permeable or wet layer (if present) or at the bottom of the probe hole. Polyethylene tubing (3/8-inch OD) was connected to the implant and was cut above the ground surface. The annular space around the implant (screen) was backfilled with #1 silica sand to 6 inches above the implant. A bentonite slurry was placed immediately above the sand for the seal, and extended to the ground surface. The implants were completed with 5-inch diameter aluminum flush-mount protective casings, secured with approximately 1 foot of concrete. Each flush mount casing cover was secured with a 9/16-inch bolt.

All downhole equipment was decontaminated with a non-phosphate detergent and potable water between each soil vapor implant location. Site photographs are provided in Appendix C, copies of the daily field notes are provided in Appendix E, and soil vapor implant construction logs containing soil descriptions are provided in Appendix F.

A chain-of-custody (COC) form was maintained and accompanied the soil sample containers to H2M which is a New York State Department of Health (NYSDOH) Environmental Laboratory Approval Program (ELAP) certified laboratory. All soil samples were analyzed for target compound list (TCL) volatile organic compounds (VOCs) as listed in Table 2-2, following
United States Environmental Protection Agency (USEPA) SW 846 Method 8260B plus tentatively identified compounds (TICs).

2.5 **Soil Vapor Sampling**

During the RI Phase I field activities, between August 14 and 15, 2012, soil vapor samples were collected from 34 of 35 newly installed soil vapor implants, plus quality assurance/quality control (QA/QC) samples. A soil vapor sample could not be collected from location SG-158 due to failed helium tests. SG-158 would be assessed during Phase II fieldwork and replaced if necessary. Soil vapor sampling locations are shown on Figure 2-2.

During the RI Phase II field activities, between January 7 and 11, 2013, soil vapor samples were collected from 14 new and 34 existing soil vapor implants plus QA/QC samples. Soil vapor samples were not collected from 2 soil vapor locations. A soil vapor sample could not be collected from location SG-134 due to failed helium tests. A soil vapor sample could not be collected from location SG-157 due to a roll-off dumpster being staged on top of the location during the entire week of sampling. Soil vapor sampling locations are shown on Figure 2-2.

The soil vapor samples were collected in accordance with the procedures outlined in the Field Activities Plan (FAP) (URS, April 2010) using laboratory evacuated 6-liter Summa® canisters with 1-hour flow regulators provided by Con-Test. Per NYSDOH’s Guidance for Evaluating Soil Vapor Intrusion in the State of New York (NYSDOH, October 2006), a helium tracer gas was utilized during the sampling of each soil vapor implant. The tracer gas was used to verify that the infiltration of outdoor (ambient) air was not occurring during sample collection. A one-quart enclosure was placed over the well head. The well tubing was run through an outlet and plumber’s putty was used to seal the interface between the tubing and the enclosure. The enclosure was then sealed at the ground surface with a polyurethane foam gasket. A tank containing ultra-high purity helium (99.999%) was connected to the side port of the enclosure and enough helium was released to displace any ambient air and to maintain a positive pressure within the enclosure. Following the application of the tracer gas, one to three volumes were purged from the soil vapor implant using a Gilian GilAir-3 air sample pump.

A Dielectric MGD-2002 helium detector was used to check for the presence of the tracer gas in the purged soil vapor; if less than 10% of the tracer gas was detected, a sample was
collected. Following the collection of the soil vapor sample, the helium detector was re-connected to the tubing to check for the presence of the tracer gas in the soil vapor; if less than 10% of the tracer gas was detected, the sample was acceptable for analyses.

One outdoor (ambient) air sample was collected each day from a location upwind of the sample locations. The outdoor ambient air sample was collected by opening a summa canister fitted with a 1-hour flow controller drawing in the ambient air. Field duplicate samples were collected using stainless steel ‘T’ fittings. Copies of the daily field notes are provided in Appendix E and copies of the completed Summa Canister Field Data Sheets from the sampling event are provided in Appendix G.

A COC form was maintained and accompanied the air and soil gas samples, which were shipped, via Federal Express, to Con-Test, a NYSDOH ELAP accredited laboratory. The soil vapor and outdoor air samples were analyzed for the TCL VOCs listed in Table 2-2, following USEPA Method TO-15.

2.6 Investigation Derived Waste Disposal

AARCO was contracted for the daily pick-up and disposal of all drummed IDW at a permitted disposal facility. Copies of the non-hazardous bills of lading and hazardous waste manifests are provided in Appendix H.

2.7 Site Survey

B. Thayer surveyed the new soil vapor locations in September and October 2012 for Phase I and in January 2013 for Phase II. All surveying was performed under the supervision of a New York State licensed land surveyor. All vertical control points were referenced to the North American Vertical Datum 1988 (NAVD 1988). Horizontal datum was referenced to the North American Datum of 1983 (NAD 83), New York State Plane Coordinate System, Long Island Zone. The complete site survey drawing was prepared by URS and is provided in Appendix I.
3.0 SUBSURFACE CONDITIONS

3.1 Regional Geology

The site investigation area is located within the Atlantic Coastal Plain physiographic province of New York State (Broughton, et al. 1966). The Atlantic Coastal Plain is characterized by low relief with elevations ranging from sea level to almost 400 feet above mean sea level (amsl). The lithology of Brooklyn and Queens consists of Cretaceous and Pleistocene age unconsolidated deposits underlain by Precambrian crystalline bedrock. The unconsolidated deposits pinch out in northwestern Queens where bedrock outcrops, but reach a thickness of more than 1,000 feet in southeastern Queens. The unconsolidated deposits form six distinct hydrogeologic units consisting of four aquifers and two confining layers that generally dip to the south-southeast (Figure 3-1). The units in ascending order are the Lloyd aquifer (0-300 feet thick), the Raritan confining unit (0-200 feet thick), the Magothy aquifer (0-500 feet thick), the Jameco aquifer (0-200 feet thick), the Gardiners clay (0-150 feet thick), and the upper glacial aquifer (0-300 feet thick) [United States Geologic Survey (USGS), 1999 a and b]. The units pinch out to the north-northeast and may not all be found at any one location.

Based on borings performed near the site for unrelated work, the site is underlain from the surface down by upper glacial aquifer, the Raritan Formation, and crystalline bedrock (Figure 3-2). The upper glacial aquifer is of Wisconsin age and consists of a terminal moraine, a ground moraine, and glacial outwash deposits whose area is characterized as an unsorted and unstratified mixture of clay, sand, gravel and boulders. The Raritan Formation is recognized as a confining unit which has been described as light to dark gray, brown-red, pink, red and gray-white clay, silty clay and clayey to silty fine sand. Disseminated lignite and pyrite are common and calcareous concretions may be found. Prior to the Site Characterization (SC) Phase VI fieldwork, the Raritan Formation had previously been encountered in three borings performed near the site: one boring near Morgan Avenue and Meeker Avenue (-47 feet amsl); one boring under the BQE near the west bank of Newtown Creek (-48 feet amsl); and one boring near Meeker Avenue between Stewart Avenue and Gardner Avenue (-71 feet amsl). The boring near Morgan Avenue and Meeker Avenue penetrated the Raritan Formation into the underlying crystalline bedrock at an elevation of -163 feet amsl (USGS, 1999 a and b).
During the SC Phase VI fieldwork, the Raritan Formation was positively encountered in all eight of the top of clay well locations at depths between 108.5 and 138.0 feet bgs (elevations of -56.95 to -121.19 feet amsl) and has been described as gray with white banding, brown, brownish gray, greenish gray, dark gray to greenish brown, fine sand and silt, clays with carbonized plant fragments, clays with varying amounts of sand to silts with varying amounts of sand and clay (URS, April 2012).

3.2 Site Geology

The geology across the EOA has not yet been investigated by URS to depths greater than the depth of the soil vapor implants (approximately 8 feet bgs). However, Roux Associates has done extensive investigations in the EOA and has geologic data obtained from soil borings associated with monitoring wells, recovery wells, and cone penetrometer tests (CPTs). Plate 2 presents the locations of the monitoring wells, recovery wells, and CPT borings and cross-sections developed by Roux Associates through the EOA (Roux, May 27, 2011). Cross-section B-B’, shown on Figure 3-3, represents the only cross-section completed for the EOA.

Based upon Roux’s boring logs and cross-section, the upper glacial aquifer was penetrated and the top of the Gardiners Clay (possibly the Raritan Formation) has been encountered. The following textural units have been found in the upper glacial aquifer in most borings, from the surface downward: a fill unit; a sand unit; a discontinuous silt unit within the sand unit; a discontinuous clay, peat and silt unit with interbedded sand layers within the sand unit; a sand and gravel unit; the Gardiners Clay (possibly the Raritan Formation); a sand and gravel unit; and bedrock. Due to the heterogeneous nature of the geology, some but not all of the units may or may not be present at each boring. The thickness of the upper glacial aquifer in the EOA is approximately 60 to more than 115 feet.

3.3 Standards, Criteria and Guidance Values

For each medium, detected concentrations of individual contaminants were compared to applicable standards, criteria and guidance values (SCGs). The site-specific SCGs were determined for the individual media as follows:
3.3.1 Soil

Three sources of soil SCGs are considered appropriate for this site: site-specific background soil samples, 6 New York Codes, Rules and Regulations (NYCRR), Part 375 (Part 375), and NYSDEC CP-51 Soil Cleanup Guidance for Total PAHs (CP-51).

Background soil samples were collected from the zero to two-foot depth interval at eight locations in McGolrick Park on August 3, 2011 as part of the SC Phase VI fieldwork (URS, April 2011). These samples were analyzed for TCL and target analyte list (TAL) contaminants. Detected concentrations are considered to be representative of site-specific background soil for the Meeker Avenue Plume Trackdown site. These soil background concentrations are included as soil SCGs on the soil analytical tables presented in Section 4.

3.3.1.1 Background Soil Analytical Results

A summary of the detected analytical results in the background soil samples compared to unrestricted use SCGs is presented in Table 3-1. Results exceeding criteria are indicated with circles on the table. Table 3-2 provides a statistical summary of the detected compounds for background soil samples as follows: the number of detections; the minimum, maximum and average values; the location and depth of the maximum value, and the number of exceedances of unrestricted use criteria. One VOC, toluene, was detected below unrestricted use criteria at six of the eight sampling locations. As indicated on Table 3-1, semi-volatile organic compounds (SVOCs), including polycyclic aromatic hydrocarbons (PAHs), were detected in the majority of samples. One SVOC, di-n-butylphthalate, exceeded unrestricted use criteria at one location (SS-02). The pesticides dichlorodiphenyldichloroethane (4,4’-DDD), dichlorodiphenyl-dichloroethylene (4,4’-DDE), and dichlorodiphenyltrichloroethane (4,4’-DDT) were detected in all samples and exceeded unrestricted use criteria at all locations. Additionally, dieldrin exceeded unrestricted use criteria at two locations; gamma-chlordane was detected at three locations below unrestricted use criteria.

Metals which exceeded unrestricted use criteria in all samples include: copper, iron, lead, and mercury. Additionally, arsenic exceeded unrestricted use criteria at five locations, and zinc exceeded unrestricted use criteria at one location.
Since the detected concentrations of di-n-butylphthalate, 4,4’-DDD, 4,4’-DDE, 4,4’-DDT, dieldrin, arsenic, copper, iron, lead, mercury, and zinc exceeded unrestricted use criteria in the background soil samples, these contaminants are considered to be present as background conditions for the site. The maximum concentration of each contaminant detected at concentrations exceeding unrestricted use criteria is included as the soil background concentration and presented on the soil analytical results tables in Section 4.

3.3.1.2 Part 375 Criteria and CP-51

Part 375 criteria are considered as SCGs for soil samples in conjunction with CP-51 criteria. CP-51 supplements Part 375 by providing criteria for contaminants previously included under Technical and Administrative Guidance Memorandum (TAGM) 4046 where values were not included in Part 375. Hereafter, mention of Part 375 includes incorporation of CP-51 criteria values. Part 375 unrestricted use criteria are considered to assist in the development of a remedial alternative capable of achieving unrestricted future use, as required by DER-10 Section 4.4 (b) 3 ii. In addition, criteria for the Protection of Groundwater are considered as SCGs for contaminants which exceed groundwater SCGs. These are identified in Section 4.

Land use in New York City is regulated by the City’s Zoning Resolution, which has two parts: zoning text and zoning maps. The text establishes zoning districts and sets forth regulations governing their land use and development. The maps show the locations and boundaries of the zoning districts. The City is divided into three basic zoning districts: residential (R), commercial (C), and manufacturing (M). The three basic districts are further divided into a range of lower-, medium-, and higher-density residential, commercial, and manufacturing districts.

The project area falls within multiple zoning districts identified by the New York City Department of City Planning (http://www.nyc.gov/html/dcp/html/zone/zh_zmtable.shtml) including residential, manufacturing, and industrial. The current zoning and land use of individual properties may be determined through the NYCityMap (http://gis.nyc.gov/doitt/nycitymap).

Soil samples were obtained from soil borings on properties zoned residential and/or manufacturing by the NYC Department of City Planning. The zoning classification for the
location of the soil boring is a consideration in the determination of the appropriate soil SCGs. The majority of properties within the investigation area are zoned manufacturing. A few residential properties are present. Properties located in the manufacturing districts in NYC may be either industrial or commercial use. However, land uses allowed within manufacturing districts include residential use either within special mixed use districts or by special permit. Residences may be present on properties throughout the entire investigation area. Therefore, the soil SCGs considered appropriate for the site are residential criteria (as opposed to commercial or industrial criteria). Part 375 restricted residential and residential land use soil cleanup criteria for the soil samples are used on the soil analytical data tables in Section 4.

3.3.2 **Soil Vapor**

There are no SCGs for soil vapor analytical data.
4.0 **ANALYTICAL RESULTS**

The following section presents the results of the soil and soil vapor sample analyses for the EOA SVI Investigation Phase I and Phase II fieldwork.

4.1 **Soil Analytical Results**

4.1.1 **Phase I Investigation**

Soil sample results were compared to appropriate Part 375 criteria identified for the soil samples discussed in Section 3.3. (Soil analytical results for site-specific soil background samples collected as part of the determination of SCGs are presented and discussed in Section 3.3.) Thirty-eight soil samples, including QA/QC samples, were collected during the period July 23 through 27, 2012, from 35 soil vapor implant locations (Figure 4-1). A summary of the detected analytical results in all soil samples as compared to soil background concentrations, unrestricted use, and protection of groundwater SCGs is presented in Table 4-1. A summary of the detected analytical results in all soil samples as compared to residential and restricted residential SCGs are presented in Table 4-2. Results exceeding criteria are indicated with circles and/or squares on the tables. Table 4-3 provides a statistical summary of the detected compounds for all soil samples collected by URS during the EOA SVI Phase I Investigation as follows: the number of detections; the minimum, maximum and average values; the number of samples exceeding criteria; and the location and depth of the maximum value.

The complete validated analytical results from the EOA SVI Phase I Investigation soil samples are presented in the data usability summary report (DUSR) in Appendix J, on a CD. Data summary tables, Form I and Form Ie (TICs) are provided in the DUSR and include the reporting limit for each non-detected compound. Soil data exceeding criteria is presented on Figure 4-1 for soil background, unrestricted use and protection of groundwater, and Figure 4-2 for residential and restricted residential use.

No soil samples collected during the EOA SVI Phase I Investigation exceeded SCGs.
4.1.2 Phase II Investigation

Soil sample results were compared to appropriate background and Part 375 criteria identified for the soil samples discussed in Section 3.3. Fifteen soil samples, including QA/QC samples, were collected during the period December 12 through 14, 2012, from 15 soil vapor implant locations (Figure 4-3). A summary of the detected analytical results in all soil samples as compared to soil background concentrations, and unrestricted use and protection of groundwater SCGs is presented in Table 4-4. A summary of the detected analytical results in all soil samples as compared to residential and restricted residential SCGs are presented in Table 4-5. Results exceeding criteria are indicated with circles and/or squares on the tables. The complete validated analytical results from the EOA SVI Phase II Investigation soil samples are presented in the DUSR in Appendix J, on a CD. Data summary tables, Form I and Form Ie (TICs) are provided in the DUSR and include the reporting limit for each non-detected compound. Soil data exceeding criteria is presented on Figure 4-3 for soil background, unrestricted use and protection of groundwater, and Figure 4-4 for residential and restricted residential use. No soil samples collected during the EOA SVI Phase II Investigation exceeded SCGs.

A summary of the detected analytical results in all EOA soil samples were compared to soil background concentrations, unrestricted use, and protection of groundwater SCGs is presented in Table 4-6. Table 4-7 lists the detected analytical results for all EOA soil samples as compared to residential and restricted residential SCGs. Table 4-8 provides a statistical summary of the detected compounds for all EOA soil samples collected to date.

4.2 Soil Vapor Analytical Results

4.2.1 Phase I Investigation

The location of select CVOCs detected in soil vapor during the EOA SVI Phase I Investigation sampling effort, including PCE and its breakdown products, are shown on Figure 4-5. Isoconcentration contours of PCE, TCE, cis-1,2-dichloroethene (cis-1,2-DCE), 1,1,1-trichloroethane (1,1,1-TCA), 1,1-dichloroethane (1,1-DCA), and 1,1,2-trichloroethane (1,1,2-TCA) in the EOA SVI Phase I Investigation soil vapor samples are shown on Figures 4-6 through 4-11. A summary of detected VOCs in outdoor air and soil vapor collected during the EOA SVI
Phase I Investigation is presented in Table 4-9. Table 4-10 provides a statistical summary of the detected parameters for the EOA SVI Phase I Investigation soil vapor samples as follows: the number of detections; the minimum, maximum and average values; and the location of the maximum value. The complete validated analytical results from the EOA SVI Phase I Investigation soil vapor samples are presented in the DUSR in Appendix J. Data summary tables and Form I’s are provided in the DUSR and include the reporting limit for each non-detected compound. It should be noted that for locations where filed duplicate samples were collected, the higher of the two results are shown on the figures.

Two ambient air samples, presented in Table 4-4, were collected during the field investigations to represent background air conditions. Concentrations of VOCs ranged from 0.12 µg/m³ to 38 µg/m³. VOCs detected in both ambient air samples include 1,1,2-trichloro-1,2,2-trifluoroethane, 4-methyl-2-pentanone, acetone, benzene, carbon tetrachloride, chloromethane, cyclohexane, dichlorodifluoromethane, ethylbenzene, methylcyclohexane, styrene, PCE, toluene, TCE, trichlorofluoromethane, and xylene. 1,1,1-TCA, 2-hexanone, methyl ethyl ketone (2-Butanone), methylene chloride, and tetrahydrofuran, were detected in one of the two ambient air samples.

**PCE Results**

PCE was detected in 31 of the 38 samples collected, at concentrations ranging from 10 µg/m³ to a maximum of 5,400 µg/m³ at location SG-161 (Figure 4-6). This maximum PCE soil vapor concentration is adjacent to the Premier Dye Polish Corporation and former Empire State Varnish Company. Additional high concentrations of PCE detected within the EOA include:

- SG-140 south of the Adhesives Manufacturer on Apollo Street at 1,300 µg/m³;
- SG-138 adjacent to the former Seldner & Enequist Chemical Works and adhesive manufacturing facility on Apollo Street at 900 µg/m³;
- SG-139 adjacent to the former Seldner & Enequist Chemical Works and adhesive manufacturing facility on Apollo Street at 820 µg/m³;
- SG-149 near the intersection of Van Dam Street and Meeker Avenue at 540 µg/m³; and
- SG-160 near the intersection of Van Dam Street and Meeker Avenue at 510 µg/m³.

**TCE Results**

TCE was detected in 24 of the 38 samples collected, at concentrations ranging from 1.4 µg/m³ to a maximum of 12,000 µg/m³ at location SG-161 (Figure 4-7). The maximum TCE soil vapor concentration is adjacent to the Premier Dye Polish Corporation and former Empire State Varnish Company, where the PCE concentration was 5,400 µg/m³. Additional high concentrations of TCE were generally found at locations that did not correspond with high PCE concentrations and include:

- SG-150 adjacent to the former GKM Manufacturing Corporation (GKM) property on Bridgewater Street at 1,500 µg/m³;
- SG-152 adjacent to the former GKM facility on Varick Avenue at 680 µg/m³; and
- SG-141 north of the former fur dyeing facility on Van Dam Street at 410 µg/m³.

**Cis-1,2-DCE Results**

Cis-1,2-DCE, a daughter compound of PCE and TCE, was detected in 10 of the 38 samples collected, at concentrations ranging from 0.42 µg/m³ to a maximum of 3,500 µg/m³ at location SG-138 (Figure 4-8). This maximum cis-1,2-DCE soil vapor concentration is adjacent to the Seldner & Enequist Chemical Works and adhesive manufacturing facility on Apollo Street. An additional high concentration of cis-1,2-DCE was detected at SG-161 (320 µg/m³) which is located adjacent to the Premier Dye Polish Corporation and former Empire State Varnish Company on Bridgewater Street. This location also contained the highest concentration of PCE and TCE.

**1,1,1-TCA Results**

1,1,1-TCA was detected in 21 of the 38 samples collected, at concentrations ranging from 0.85 µg/m³ to a maximum of 11,000 µg/m³ at location SG-161 (Figure 4-9). The maximum 1,1,1-TCA soil vapor concentration is adjacent to the Premier Dye Polish Corporation and former Empire State Varnish Company.
1,1-DCA Results

1,1-DCA a daughter compound of 1,1,1-TCA and TCE, was detected in 13 of the 38 samples collected, at concentrations ranging from 0.53 µg/m³ to a maximum of 1,900 µg/m³ at location SG-161 (Figure 4-10). An additional high concentration of 1,1-DCA was detected at SG-154 (1,100 µg/m³) which is located adjacent to the former GKM facility on Varick Avenue.

1,1,2-TCA Results

1,1,2-TCA was detected in 10 of the 38 samples collected, at concentrations ranging from 1.90 µg/m³ to a maximum of 17,000 µg/m³ at location SG-134 (Figure 4-11). The maximum 1,1,2-TCA soil vapor concentration is adjacent to the former Taylor & Co. Foundry on Hausman Street. Additional high concentrations of 1,1,2-TCA detected within the EOA included:

- SG-159 adjacent to a former fur dyeing and former paint and lacquer manufacturer located on Meeker Avenue at 3,300 µg/m³;
- SG-138 adjacent to the former adhesive manufacturing facility on Apollo Street at 2,600 µg/m³; and
- SG-147 adjacent to a White Metal Smelting facility on Van Dam Street at 260 µg/m³.

Additional CVOCs Results

Additional CVOCs detected included: 1,1-dichloroethene in 2 of 38 samples (0.59 µg/m³ to 0.66 µg/m³); carbon tetrachloride in 8 of 38 samples (0.64 µg/m³ to 33.0 µg/m³); methylene chloride in 10 of 38 samples (19.0 µg/m³ to 5,000 µg/m³); and vinyl chloride in 4 of 38 samples (0.51 µg/m³ to 240 µg/m³). Additional VOCs detected included: benzene, toluene, ethylbenzene and xylenes (BTEX) and hexane-related compounds (e.g., cyclohexane, methylcyclohexane) were detected in more than 90% of the samples collected.

4.2.2 Phase II Investigation

The location of select CVOCs detected in soil vapor during the EOA SVI Phase II Investigation sampling effort, including PCE and its breakdown products, are shown on Figure 4-4-5.
12. Isoconcentration contours of PCE, TCE, cis-1,2-DCE, 1,1,1-TCA, 1,1-DCA, and 1,1,2-TCA in the EOA SVI Phase II Investigation soil vapor samples are shown on Figures 4-13 through 4-18. A summary of detected VOCs in outdoor air and soil vapor collected during the EOA SVI Phase II Investigation is presented in Table 4-11. Table 4-12 provides a statistical summary of the detected parameters for the EOA SVI Phase II Investigation soil vapor samples as follows: the number of detections; the minimum, maximum and average values; and the location of the maximum value. The complete validated analytical results from the EOA SVI Phase II Investigation soil vapor samples are presented in the DUSR in Appendix J. Data summary tables and Form I’s are provided in the DUSR and include the reporting limit for each non-detected compound.

Table 4-13 provides a historical summary of the detected parameters for all soil vapor samples collected in the EOA. Table 4-14 provides a statistical summary of the detected parameters for all soil vapor samples collected in the EOA as follows: the number of samples, the number of detections; the minimum, maximum and average values; and the location of the maximum value. It should be noted that for locations where filed duplicate samples were collected, the higher of the two results are shown on the figures.

Five ambient air samples, presented in Table 4-11, were collected during the field investigations to represent background air conditions. Concentrations of VOCs ranged from 0.16 µg/m³ to 47 µg/m³. VOCs detected in one or more of the ambient air samples include 1,1,2-trichloro-1,2,2-trifluoroethane, 1,4-dichlorobenzene, 2-hexanone, 4-methyl-2-pentanone, acetone, benzene, carbon tetrachloride, chloromethane, cyclohexane, dichlorodifluoromethane, ethylbenzene, methyl acetate, methyl tert-butyl ether, methylcyclohexane, methylene chloride, styrene, PCE, toluene, TCE, trichlorofluoromethane, and xylene.

**PCE Results**

PCE was detected in 43 of the 53 samples collected during Phase II, at concentrations ranging from 0.76 µg/m³ to a maximum of 660 µg/m³ at location SG-161 (Figure 4-13). This maximum PCE soil vapor concentration is adjacent to the Premier Dye Polish Corporation and former Empire State Varnish Company. Additional elevated concentrations of PCE detected within the EOA include:
• SG-140 south of the Adhesives Manufacturer on Apollo Street at 350 µg/m³;
• SG-144 near the intersection of Van Dam Street and Nassau Avenue at 150 µg/m³;
• SG-181 adjacent to the former paint and lacquer manufacture on Meeker Avenue at 140 µg/m³; and
• SG-139 adjacent to the former Seldner & Enequist Chemical Works and adhesive manufacturing facility on Apollo Street at 110 µg/m³.

During the Phase II sampling effort, concentrations of PCE were generally lower, up to one order of magnitude, in existing soil vapor implants when compared to the Phase I results. Based on the Phase II results, the overall area impacted by PCE exceeding 100 µg/m³ was dramatically reduced in size when compared to the Phase I results. Phase II data indicated that concentrations within the residential neighborhood located east of Van Dam Street and south of Nassau Avenue saw a marked drop in PCE contractions when compared to the Phase I results. Elevated concentrations of PCE continued to exist in the vicinities of SG-141 and SG-161 and was also found in the vicinity of the newly installed SG-181.

**TCE Results**

TCE was detected in 30 of the 53 Phase II samples collected, at concentrations ranging from 0.76 µg/m³ to a maximum of 2,200 µg/m³ at location SG-161 (Figure 4-14). The maximum TCE soil vapor concentration is adjacent to the Premier Dye Polish Corporation and former Empire State Varnish Company, where the PCE concentration was 660 µg/m³. Additional elevated concentrations of TCE were generally found at locations that did not correspond with elevated PCE concentrations and include:

• SG-150 adjacent to the former GKM Manufacturing Corporation (GKM) property on Bridgewater Street at 240 µg/m³;
• SG-152 adjacent to the former GKM facility on Varick Avenue at 130 µg/m³; and
• SG-142 adjacent to a former fur dyeing facility on Van Dam Street at 110 µg/m³.

During the Phase II sampling effort, concentrations of TCE were generally lower, up to one order of magnitude, in existing soil vapor implants when compared to the Phase I results. The overall area impacted by TCE exceeding 100 µg/m³ was comparable in size based on the
Phase II results when compared to the Phase I results. Elevated concentrations of TCE continued to exist in the vicinities of SG-150 and SG-161.

**Cis-1,2-DCE Results**

Cis-1,2-DCE, a daughter compound of PCE and TCE, was detected in 9 of the 53 Phase II samples collected, at concentrations ranging from 0.42 µg/m³ to a maximum of 84 µg/m³ at location SG-161 (Figure 4-15). This maximum cis-1,2-DCE soil vapor concentration is adjacent to the Premier Dye Polish Corporation and former Empire State Varnish Company on Bridgewater Street. This location also contained the highest concentration of PCE and TCE.

During the Phase II sampling effort, concentrations of Cis-1,2-DCE were generally lower, up to two orders of magnitude, in existing soil vapor implants when compared to the Phase I results.

**1,1,1-TCA Results**

1,1,1-TCA was detected in 24 of the 53 Phase II samples collected, at concentrations ranging from 0.59 µg/m³ to a maximum of 3,400 µg/m³ at location SG-161 (Figure 4-16). The maximum 1,1,1-TCA soil vapor concentration is adjacent to the Premier Dye Polish Corporation and former Empire State Varnish Company.

During the Phase II sampling effort, concentrations of 1,1,1-TCA were generally lower, up to one order of magnitude, in existing soil vapor implants when compared to the Phase I results.

**1,1-DCA Results**

1,1-DCA a daughter compound of 1,1,1-TCA and TCE, was detected in 8 of the 53 Phase II samples collected, at concentrations ranging from 0.52 µg/m³ to a maximum of 640 µg/m³ at location SG-161 (Figure 4-17). An additional elevated concentration of 1,1-DCA was detected at SG-154 (460 µg/m³) which is located adjacent to the former GKM Manufacturing facility on Varick Avenue.

During the Phase II sampling effort, concentrations of 1,1-DCA were generally lower, up to one order of magnitude, in existing soil vapor implants when compared to the Phase I results.
The overall area impacted by 1,1-DCA exceeding 100 µg/m³ was comparable in size based on the Phase II results when compared to the Phase I results

**1,1,2-TCA Results**

1,1,2-TCA was detected in 6 of the 53 Phase II samples collected, at concentrations ranging from 0.94 µg/m³ to a maximum of 5,200 µg/m³ at location SG-181 (Figure 4-18). The maximum 1,1,2-TCA soil vapor concentration is adjacent to a former paint and lacquer manufacturer located on Meeker Avenue. Additional elevated concentrations of 1,1,2-TCA detected within the EOA included:

- SG-142 adjacent to a former fur dyeing facility on Van Dam Street at 710 µg/m³;
- SG-178 east of the Premier Dye Polish Corporation near the intersection of Meeker Avenue and Bridgewater Street at 380 µg/m³;
- SG-152 adjacent to the former GKM facility on Varick Avenue at 310 µg/m³; and
- SG-159 adjacent to a former fur dyeing facility located on Meeker Avenue at 110 µg/m³.

During the Phase II sampling effort, concentrations of 1,1,2-TCA were generally lower, up to one order of magnitude, in existing soil vapor implants when compared to the Phase I results. However, SG-134 which had a concentration of 17,000 µg/m³ during the Phase I investigation was not sampled during Phase II due to a failed helium tests. Elevated concentrations of 1,1,2-TCA were detected in existing soil vapor implants SG-142 and SG-152 where Phase I results were non-detect at both locations. Elevated concentrations of 1,1,2-TCA were also detected in the vicinity of the newly installed soil vapor implants SG-178 and SG-181.

**Additional CVOCs Results**

Additional CVOCs detected during Phase II included: 1,1-dichloroethene in 1 of 53 samples (1.7 µg/m³); carbon tetrachloride in 4 of 53 samples (1.1 µg/m³ to 3.3 µg/m³); methylene chloride in 12 of 53 samples (3.6 µg/m³ to 820 µg/m³); and vinyl chloride in 2 of 53 samples (0.32 µg/m³ to 54 µg/m³). Other VOCs detected included the petroleum related hydrocarbons in a majority of the samples collected.
5.0 CONCLUSIONS AND RECOMMENDATIONS

5.1 Conclusions

Based upon the results of the EOA SVI Phase I and Phase II Investigations, the following conclusions are provided.

5.1.2 Soil

**Phase I**

No VOCs were detected in EOA SVI Phase I Investigation soil samples exceeding SCGs.

**Phase II**

No VOCs were detected in EOA SVI Phase II Investigation soil samples exceeding SCGs.

5.1.3 Soil Vapor

**Phase I**

A total of 34 soil vapor locations were sampled as part of the EOA SVI Phase I Investigation. Elevated concentrations of CVOCs were found in soil vapor samples in the EOA. A summary of soil vapor locations, potential sources and VOCs detected during the EOA SVI Phase I Investigation with their potential industrial uses may be found in Table 5-1. The locations of select CVOCs detected in soil vapor during the EOA SVI Phase I Investigation sampling effort, including potential sources are shown on Figure 5-1.

PCE was detected in 31 of the 38 samples collected, at concentrations ranging from 10 µg/m³ to a maximum of 5,400 µg/m³ at location SG-161. SG-161 is located adjacent to the Premier Dye Polish Corporation and former Empire State Varnish Company. The second highest concentration of PCE was detected at SG-140 (1,300 µg/m³) which is located south of the Adhesives Manufacturer on Apollo Street.

TCE was detected in 24 of the 38 samples collected, at concentrations ranging from 1.4 µg/m³ to a maximum of 12,000 µg/m³ at location SG-161. SG-161 is located adjacent to the Premier Dye Polish Corporation and former Empire State Varnish Company, where the PCE
concentration was 5,400 µg/m³. The second highest concentration of TCE was found at SG-150 (1,500 µg/m³) which is located adjacent to the former GKM property on Bridgewater Street.

Cis-1,2-DCE was detected in 10 of the 38 samples collected, at concentrations ranging from 0.42 µg/m³ to a maximum of 3,500 µg/m³ at location SG-138. SG-138 is located adjacent to the Seldner & Enequist Chemical Works and adhesive manufacturing facility on Apollo Street.

1,1,1-TCA was detected in 31 of the 38 samples collected, at concentrations ranging from 0.85 µg/m³ to a maximum of 11,000 µg/m³ at location SG-161. SG-161 is located adjacent to the Premier Dye Polish Corporation and former Empire State Varnish Company.

1,1-DCA was detected in 13 of the 38 samples collected, at concentrations ranging from 0.53 µg/m³ to a maximum of 1,900 µg/m³ at location SG-161. SG-161 is located adjacent to the Premier Dye Polish Corporation and former Empire State Varnish Company. An additional high concentrations of 1,1-DCA was detected at SG-154 (1,100 µg/m³) which is located adjacent to the former GKM Manufacturing facility on Varick Avenue.

1,1,2-TCA was detected in 10 of the 38 samples collected, at concentrations ranging from 1.90 µg/m³ to a maximum of 17,000 µg/m³ at location SG-134. SG-134 is located adjacent to the former Taylor & Co. Foundry on Hausman Street. Additional high concentrations of 1,1,2-TCA detected at SG-159 (3,300 µg/m³) which is located adjacent to a former fur dyeing facility located on Meeker Avenue and at SG-138 (2,600 µg/m³) which is located adjacent to the former Seldner & Enequist Chemical Works and adhesive manufacturing facility on Apollo Street.

**Phase II**

A total of 48 soil vapor locations were sampled as part of the EOA SVI Phase II Investigation. Elevated concentrations of CVOCs were found in soil vapor samples in the EOA. A summary of soil vapor locations, potential sources and VOCs detected during the EOA SVI Phase II Investigation with their potential industrial uses may be found in Table 5-2. The locations of select CVOCs detected in soil vapor during the EOA SVI Phase II Investigation sampling effort, including potential sources are shown on Figure 5-2.

PCE was detected in 43 of the 53 samples collected, at concentrations ranging from 0.76 µg/m³ to a maximum of 660 µg/m³ at location SG-161. SG-161 is located adjacent to the Premier Dye Polish Corporation and former Empire State Varnish Company.
TCE was detected in 30 of the 53 samples collected, at concentrations ranging from 0.76 µg/m³ to a maximum of 2,200 µg/m³ at location SG-161. Other notable locations are SG-150 (240 µg/m³), SG-152 (130 µg/m³), and SG-142 (110 µg/m³).

Cis-1,2-DCE, a daughter compound of PCE and TCE, was detected in 9 of the 53 samples collected, at concentrations ranging from 0.42 µg/m³ to a maximum of 84 µg/m³ at location SG-161.

1,1,1-TCA was detected in 24 of the 53 samples collected, at concentrations ranging from 0.59 µg/m³ to a maximum of 3,400 µg/m³ at location SG-161.

1,1-DCA a daughter compound of 1,1,1-TCA, was detected in 8 of the 53 samples collected, at concentrations ranging from 0.52 µg/m³ to a maximum of 640 µg/m³ at location SG-161.

1,1,2-TCA was detected in 6 of the 53 samples collected, at concentrations ranging from 9.4 µg/m³ to a maximum of 5,200 µg/m³ at location SG-181. SG-181 is located adjacent to a former paint and lacquer manufacturer located on Meeker Avenue.

In general, COVCs detected during the Phase II were generally lower, up to one order of magnitude, in existing soil vapor implants when compared to the Phase I results. The decrease in concentrations of detected CVOCs was seen over the entire EOA. During late October 2012, Hurricane Sandy impacted the New York Metropolitan area. The infiltration of large volumes of precipitation may have impacted concentrations of VOC detected in soil vapor. Similar changes in soil vapor results have been seen in other areas of the Meeker Plume Trackdown Site historically and during soil vapor sampling associated with the Remedial Investigations performed at the Former Spic and Span Site (NYSDEC Site ID # 224129) and the Former Klink Cosmo Cleaners Site (NYSDEC Site ID # 224129).

5.2 Source Characterization

5.2.1 Sources

Using data obtained during the EOA SVI Phase I and Phase II Investigations, one source of CVOC contamination has been identified and is shown on Figure 5-3. A description and location of the source is discussed below.
• Premier Dye Polish Corporation, located at 25 Bridgewater Street (Brooklyn Tax District, Block 02664, Lot 0127) is a likely source of soil vapor contamination. Based on an EDR radius search, as of November 11, 2011, 3 above ground storage tanks (ASTs) containing 1,1,1-TCA, ranging from a 550 to a 2,000 gallon capacity, were located at the site. During the EOA Phase I Investigation, soil vapor results from SG-161, which is located on Bridgewater Street in front of the Premier Dye Polish Corp., contained the following CVOC concentrations:
  o PCE at 5,400 µg/m³;
  o TCE at 12,000 µg/m³;
  o Cis-1,2-DCE at 320 µg/m³;
  o 1,1,1-TCA at 11,000 µg/m³; and
  o 1,1-DCA at 1,900 µg/m³.

5.2.2 Potential Sources

A total of 19 potential sources were identified within the vicinity of the EOA through historical research (Table 2-1). Of the 19 potential sources, 5 were identified during the EOA Phase I Investigation as areas where additional information needed to be gathered to determine if any of these areas are responsible for, or are contributing to, the presence of CVOCs in the environment. Descriptions and locations of the 5 potential sources in need of additional information are discussed below and shown on Figure 5-3.

• Taylor & Co. Foundry formerly located at: 314 Norman Avenue (Brooklyn Tax District, Block 02660, Lot 0001); 640 Morgan Avenue (Brooklyn Tax District, Block 02660, Lot 0020); 650 Morgan Avenue (Brooklyn Tax District, Block 02660, Lot 0030); and 634 Morgan Avenue (Brooklyn Tax District, Block 02660, Lot 0050) is a potential source of soil vapor contamination. Buildings on the lots were occupied by a foundry from at least 1905 to 1991, metal manufacturing in 1997 and an auto repair garage in 1997. Soil vapor results from SG-134, which is located on Hausman Street contained 1,1,2-TCA at 17,000 µg/m³ in the Phase I investigation.
Seldner & Enequist Chemical Works formerly located at: 86-88 Hausman Street (Brooklyn Tax District, Block 02661, Lot 0044); 90 Hausman Street (Brooklyn Tax District, Block 02661, Lot 0046); 92 Hausman Street (Brooklyn Tax District, Block 02661, Lot 0048); 94-104 Hausman Street (Brooklyn Tax District, Block 02661, Lot 0050); and 103 Apollo Street (Brooklyn Tax District, Block 02661, Lot 0015) was in operation from at least 1916 to 1951. In addition, a building located at 83 Apollo Street (Brooklyn Tax District, Block 02661, Lot 0016) was associated with the Seldner & Enequist Chemical Works from 1916 to 1951 and later became an adhesives manufacturer (1965-1996). During the EOA Phase I Investigation, soil vapor results associated with these properties contained the following CVOC concentrations:

- PCE at 900 µg/m³, 820 µg/m³, and 1,300 µg/m³ from SG-138, SG-139, and SG-140, respectively;
- TCE at 110 µg/m³ from SG-139;
- Cis-1,2-DCE at 3,500 µg/m³ from SG-138;
- 1,1,2-TCA at 2,600 µg/m³ from SG-138; and
- Chloromethane at 1,500 µg/m³ from SG-138.

The former GKM property located at 47 Bridgewater Street (Brooklyn Tax District, Block 02663, Lot 0028) is a potential source of soil vapor contamination. From EDR radius reports it has been determined that GKM disposed of F001 and F002 waste. F001 waste consists of spent halogenated solvents used in degreasing, including: PCE, TCE, 1,1,1-TCA, methylene chloride, carbon tetrachloride and chlorinated fluorocarbons. F002 waste consists of spent halogenated solvents including: PCE, TCE, 1,1,1-TCA, 1,1,2-TCA, and methylene chloride. GKM was also a Resource Conservation Recovery Act (RCRA) Large Quantity Generator (LQG) in 1981, a RCRA Small Quantity Generator (SQG) in 1999 and 2002, and a RCRA Conditionally Exempt Small Quantity Generator (CESQG) as of 2004. During the EOA Phase I Investigation, soil vapor results associated with GKM contained the following CVOC concentrations:

- PCE at 150 µg/m³ and 230 µg/m³ from SG-152 and SG-153, respectively;
TCE at 1,500 µg/m³ and 680 µg/m³ from SG-150 and SG-152, respectively;

1,1-DCA at 1,100 µg/m³ from SG-154;

Chloroethane at 230 µg/m³, 2,200 µg/m³, and 15,000 µg/m³ from SG-151, SG-153 and SG-154, respectively;

1,2-DCA at 1,100 µg/m³ from SG-154;

Methylene chloride at 5,000 µg/m³, 4,500 µg/m³, and 4,700 µg/m³ from SG-151, SG-153 and SG-154, respectively; and

Chloromethane at 1,200 µg/m³ from SG-154.

• Empire State Varnish Company formerly located at 38 Varick Avenue (Brooklyn Tax District, Block 02664, Lot 0009) is a potential source of soil vapor contamination. The Empire State Varnish Company is located adjacent to the Premier Dye Polish Corporation, which is located at 25 Bridgewater Street (see Section 5.2.1). The Empire State Varnish Company occupied the property from 1942 to 2007 and was a RCRA LQG for F003 and F005 waste. F003 waste consists of spent non-halogenated solvents including: xylene, acetone, ethyl acetate, ethyl benzene, methyl isobutyl ketone, n-butyl alcohol, cyclohexanone, and methanol. F005 waste consists of spent non-halogenated solvents including: toluene, methyl ethyl ketone, carbon disulfide, isobutanol, pyridine, benzene, 2-ethoxyethanol, and 2-nitropropane. The property is currently owned by ExxonMobil and is occupied by their treatment facility. During the EOA Phase I Investigation, soil vapor results associated with the Empire State Varnish Company property contained the following CVOC concentrations:

PCE at 5,400 µg/m³ from SG-161;

TCE at 12,000 µg/m³ from SG-161;

Cis-1,2-DCE at 320 µg/m³ from SG-161;

1,1,1-TCA at 11,000 µg/m³ from SG-161;

1,1-DCA at 1,900 µg/m³ from SG-161;

Chloroethane at 1,000 µg/m³ from SG-156; and
A paint and lacquer manufacturer formerly located at 855 Meeker Avenue (Brooklyn Tax District, Block 02694, Lot 0021) and 857-869 Meeker Avenue (Brooklyn Tax District, Block 02694, Lot 0015) is a potential source of soil vapor contamination. The paint and lacquer manufacturer was in operation from at least 1951 to 1988. In addition, fur dyeing was performed in an adjacent building located at 843-845 Meeker Avenue (Brooklyn Tax District, Block 02694, Lot 0022) from at least 1942 to 1951. During the EOA Phase I Investigation, soil vapor results associated with the former paint and lacquer manufacturer and fur dyeing facility contained the following CVOC concentrations:

- Methylene chloride at 4,700 µg/m³ from SG-156.
- 1,1,2-TCA at 3,300 µg/m³ from SG-159; and
- Chloromethane at 2,200 µg/m³ and 1,900 µg/m³ from SG-157 and SG-159, respectively.

### 5.3 Recommendations for EOA SVI Investigation Phase III Fieldwork

The following recommendations are offered for consideration by the NYSDEC.

- A complete round of soil vapor samples should be collected from all 50 soil vapor implants in the EOA. This additional round of soil vapor sampling should be conducted in late spring or early summer 2013 to determine if the infiltration of large volumes of precipitation following Hurricane Sandy decreased concentrations of VOCs detected in soil vapor within the EOA. The results of the additional sampling round will determine if additional investigations are required in the EOA. The soil vapor samples should be analyzed for VOCs by TO-15, as per the FAP.
6.0 REFERENCES


New York State Department of Environmental Conservation (NYSDEC). January 24, 1994. Technical and Administrative Guidance Memorandum (TAGM) #4046, Determination of Soil Cleanup Objectives and Cleanup Levels. (Revised), including the STARS Memo #1 compounds as per the NYSDEC Memorandum dated December 20, 2000

NYSDEC, December 14, 2006. 6 NYCRR PART 375 Environmental Remediation Programs Subparts 375-1 to 375-4 & 375-6

NYSDEC, May 2010. Department of Environmental Remediation, DER-10 Technical Guidance for Site Investigation and Remediation

NYSDEC, October 2010. CP-51 Soil Cleanup Guidance for Total PAHs


