LETTER REPORT

OFF-SITE PHASE III REMEDIAL INVESTIGATION
WORK ASSIGNMENT C007540-2.1

FORMER SPIC AND SPAN CLEANERS AND DYERS 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

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Final
September 2014
LETTER REPORT
OFF-SITE PHASE III REMEDIAL INVESTIGATION
FOR THE
FORMER SPIC AND SPAN CLEANERS & DYERS, INC. SITE
SITE ID NO. 224129
BROOKLYN, KINGS COUNTY, NEW YORK

PREPARED FOR:
NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION
DIVISION OF ENVIRONMENTAL REMEDIATION
REMEDIAL BUREAU B
WORK ASSIGNMENT NUMBER C007540-2.1

PREPARED BY:
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257 WEST GENESEE STREET, SUITE 400
BUFFALO, NEW YORK 14202

SEPTEMBER 2014
September 4, 2014

Mr. David K. Harrington, P.E.
Senior Environmental Engineer
Remedial Bureau B
Division of Environmental Remediation
NYS Department of Environmental Conservation
625 Broadway, 12th Floor
Albany, New York 12233-7016

Re: NYSDEC Standby Contract, Work Assignment No. C007540-2.1
Former Spic and Span Cleaners & Dyers, Inc., Site ID No. 224129
Letter Report – Off-Site Phase III Remedial Investigation

Dear Mr. Harrington:

URS Corporation - New York (URS) has prepared this Letter Report to summarize the field investigation and analytical results associated with the Remedial Investigation (RI) Off-Site Phase III field investigation at the Former Spic and Span Cleaners & Dyers, Inc. (Spic and Span) Site [New York State Department of Environmental Conservation (NYSDEC) Site Number 224129] in the Greenpoint/East Williamsburg Industrial Area section of Brooklyn, New York (Figure 1). A portion of the field activities were performed on the Crown Enterprises Inc. (Crown) property which is located northeast (i.e., downgradient) of the Spic and Span Site. The location of the Crown property in relation to the Spic and Span Site is shown on Figure 1. The work associated with the RI Off-Site Phase III field investigation was completed under the Work Assignment No. C007540-2.1.

1.0 INTRODUCTION

The RI Off-Site Phase III field investigation was completed to fill data gaps concerning the downgradient extent of the dissolved-phase chlorinated volatile organic compound (CVOC) groundwater plume in the shallow and deep overburden groundwater zones. In addition, deep monitoring wells were installed to assist in determining if CVOC-impacted groundwater is migrating into the deeper groundwater zone and migrating beneath the Crown property towards ExxonMobil recovery well RW-17. The following soil vapor, soil boring, and monitoring wells were installed during the field investigation:

**Monitoring Wells**

<table>
<thead>
<tr>
<th>DEC-001R</th>
<th>DEC-001D</th>
<th>MW-42D*</th>
<th>MW-43D*</th>
</tr>
</thead>
<tbody>
<tr>
<td>DEC-083</td>
<td></td>
<td>MW-44D*</td>
<td>MW-85D*</td>
</tr>
<tr>
<td>DEC-107</td>
<td>DEC-107D</td>
<td></td>
<td></td>
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<tr>
<td>DEC-108</td>
<td>DEC-108D</td>
<td></td>
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<tr>
<td>DEC-109</td>
<td>DEC-109D</td>
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<tr>
<td>DEC-110</td>
<td>DEC-110D</td>
<td></td>
<td></td>
</tr>
<tr>
<td>DEC-112*</td>
<td>DEC-112D*</td>
<td><strong>installed on Crown Property</strong></td>
<td><strong>installation not completed</strong></td>
</tr>
</tbody>
</table>

**Soil Vapor Implants**

<table>
<thead>
<tr>
<th>SG-183</th>
<th>SG-184</th>
<th>SG-185</th>
<th>SG-186</th>
<th>SG-187</th>
<th>SG-188</th>
</tr>
</thead>
</table>
Activities associated with the RI Off-Site Phase III field investigation consisted of:

- Utility clearance by a geophysical contractor at all soil vapor, soil boring, and monitoring well locations;
- Collection of soil samples from 12 proposed soil vapor implants locations and the installation of 11 of 12 proposed soil vapor implants;
- Collection of soil vapor samples plus ambient air and Quality Assurance/Quality Control (QA/QC) samples from 11 new soil vapor implants;
- Advancement of 18 soil borings using sonic drilling methods down to approximately 90 feet below ground surface (bgs). All boring locations were cleared to 5 feet bgs by Vac-Tron© prior to drilling;
- Installation of 18 monitoring wells in the 18 soil borings using sonic drilling methods.
  - 3 wells were installed on Kingsland Avenue between Greenpoint and Norman Avenues (1 well pair; a shallow well at DEC-083)
  - 2 wells were installed on Kingsland Avenue between Norman and Nassau Avenues (1 well pair)
  - 2 wells were installed on Sutton Street between Norman and Nassau Avenues (1 well pair)
  - 4 wells were installed on Morgan Avenue between Norman and Nassau Avenues (2 well pairs)
  - 7 wells were installed on the Crown Property (1 well pair; 5 deep wells);
- Development of 18 new monitoring wells;
- Collection of a complete round of water levels in the Spic and Span area. In addition, gauging for product thickness was performed in the new and existing monitoring wells;
- Collection of a petroleum product sample for laboratory analyses from DEC-112;
- Collection of groundwater plus QA/QC samples from the 18 new monitoring wells;
- Removal of all investigation derived waste (IDW) from (e.g., soil cuttings, development, purge and decontamination water) the Site on a daily basis;
- Survey of all new soil vapor implant and monitoring well locations. The survey was tied into the existing site survey; and
- Restoration of 24 sidewalk flags in kind.
2.0 PREVIOUS INVESTIGATIONS

2.1 URS Investigations

Spic and Span RI

URS has previously conducted two phases of RI/FS investigation field work at the Spic and Span Site. The results for the previous phases of investigations at the Spic and Span Site have been reported in the Phase II Remedial Investigation Report (URS, April 2012).

Groundwater sampling results obtained by URS as part of the Spic and Span RI have shown that a shallow dissolved-phase CVOC groundwater plume is originating from the Spic and Span Site and is migrating towards the Crown property. Wells located near the southwest corner of the Crown property (i.e., DEC-058) reported concentrations of CVOCs up to 4 orders of magnitude greater than groundwater standards.

Crown Property

URS performed a groundwater sampling event at the Crown Property in January 2013. The results of this groundwater sampling event were reported in the Letter Report – Crown Property Groundwater Sampling Event (URS, April 2013).

Results of the January 2013 groundwater sampling event indicated that:

- The operation of ExxonMobil groundwater recovery well RW-17 on the property to the east of the Crown property may have increased the downward vertical gradients in the vicinity of DEC-058. The increase in the downward vertical gradients may be causing the dissolved phase CVOCs to migrate beneath the shallow groundwater zone on the Crown property.
- Tetrachloroethene (PCE) and its degradation products were not detected in shallow groundwater beneath the Crown property. However, the potential exists for the presence of CVOCs in the deeper groundwater beneath the Crown property. This conclusion is based upon the November 2012 groundwater analytical data from RW-17. CVOCs from the Spic and Span Site appear to be migrating toward RW-17 (Roux, March 2013) beneath the Crown property in the deep groundwater.

2.2 Investigations by Others

Historic groundwater sampling data collected from monitoring wells situated on the Crown property by Roux Associates, Inc. (Roux) has shown that little to no CVOCs were detected in groundwater samples collected from the shallow groundwater zone. Several of the wells on the Crown property are located only a short distance from CVOC-impacted wells situated around the perimeter of the Crown property. The nearby off-property perimeter wells contained elevated concentrations of CVOCs (i.e., DEC-058 vs. MW-85).

ExxonMobil groundwater recovery well RW-17 is located on the property to the east of the Crown property. November 2012 groundwater data from RW-17 indicated the presence of PCE at 250 micrograms per liter (µg/L), trichloroethene (TCE) at 50 µg/L, cis-1,2-dichloroethene (cis-1,2-DCE)
at 120 µg/L, and vinyl chloride at 12 µg/L (Roux, March 2013), indicating that CVOCs are impacting RW-17.

3.0 FIELD ACTIVITIES

RI Off-Site Phase III field activities were performed between January 20 and May 7, 2014. Site photographs are provided in Attachment 1 and copies of the daily field notes are provided in Attachment 2.

3.1 Utility Clearance

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

3.2 Geophysical Survey

On January 20, 2014 and again on February 11, 2014, Radar Solutions International of Waltham, MA (RSI) mobilized a one 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 monitoring wells, soil borings, and soil vapor implant installations were proposed.

A 10-foot square reference grid was established around each soil vapor implant, soil boring, and monitoring well location prior to collecting the geophysical data. A GSSI SIR-2000 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 was a Ditch Witch 950 RT locating system and a McLaughlin’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. RSI’s reports are provided in Attachment 3.

3.3 Soil Vapor Implant Installation

Prior to any intrusive activities, the subcontractor obtained all necessary permits (i.e., NYC DOT street opening permits) for conducting intrusive activities. Eleven of the twelve proposed permanent soil vapor implants (SG-183 through SG-193) were installed between February 4 and 7, 2014 by Zebra Environmental Corp. of Lynbrook, NY (Zebra) under the direction of a URS geologist. SG-194 installation was not completed due to water entering the borehole from the sidewalk sub-base. Locations of the soil vapor implants are shown on Figure 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 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 bgs.

At each location, sampling was performed to a maximum depth of 8 feet bgs using a Macrocore sampler. 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 the silty clay layer (if present) or at the bottom of the probe hole. The implants were constructed to a minimum depth of 2 feet Polyethylene tubing (3/8-inch OD) was connected to the implant and cut above the ground surface. The annular space around the implant (screen) was backfilled with #1 silica sand to a minimum of 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, set in approximately 1 foot of concrete. All downhole equipment was decontaminated between each soil vapor implant location with a non-phosphate detergent and potable water. Soil vapor implant construction details are provided in Attachment 4.

For the soil samples collected during installation of the soil vapor implants, a chain-of-custody (COC) form was maintained and accompanied the soil sample containers to Pace Analytical Service of Melville, NY (Pace), a New York State Department of Health (NYSDOH) Environmental Laboratory Approval Program (ELAP) accredited laboratory. The soil samples were analyzed for target compound list (TCL) volatile organic compounds (VOCs) plus tentatively identified compounds (TICs), following United States Environmental Protection Agency (USEPA) SW846 Method 8260B.

All IDW generated from the soil vapor implant installation was containerized in Department of Transportation (DOT) approved 55-gallon drums and picked up by AARCO Environmental Services Corporation of Lindenhurst, NY (AARCO), on a daily basis for off-site disposal at a permitted facility.

### 3.4 Soil Vapor Sampling

Twelve soil vapor samples (including one field duplicate) and 2 outdoor air samples were collected on February 11 and 12, 2014 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 Eurofins/Air Toxics of Folsom, CA (Eurofins/Air Toxics ). Per the New York State Department of Health’s (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 or 5-gallon bucket lid was placed over the well head. The well tubing was run through an outlet and a silicone gasket was used to seal the interface between the tubing and the enclosure or lid. The enclosure or lid 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 or lid and enough helium was released to displace any ambient air and to maintain a positive pressure within the enclosure or lid. 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. Not all soil vapor implants were sampled on the first attempt. 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 and drawing in the ambient air. Field duplicate samples were collected using stainless steel ‘T’ fittings. The Summa Canister Sampling Field Data Sheets documenting the sampling event are presented in Attachment 5.

All samples were transported under COC via FedEx to Eurofins/Air Toxics. The samples were analyzed for VOCs following USEPA Compendium Method TO-15.

3.5 Monitoring Well Installation

3.5.1 Pre-Boring Clearing

Prior to any intrusive activities, the subcontractor obtained all necessary permits (i.e., NYC DOT street opening permits) for conducting intrusive activities. On January 20, 2014 Glacier Drilling LLC of Durham, CT (Glacier) mobilized one Vac-Tron® unit to perform location specific utility clearance at each of the proposed monitoring well locations. A total of 18 monitoring well locations were cleared between January 20, 2014 and February 12, 2014. At each location, an approximately two-foot by two-foot square area of the sidewalk was cut. An approximately one-foot diameter by five-foot deep hole was excavated using post-hole diggers, pry bars, and an air knife along with the Vac-Tron® unit. After the location was cleared for drilling, the hole was backfilled flush with the sidewalk using the excavated spoils (rocks and debris were removed and not re-used as backfill) and if necessary, temporarily patched with blacktop patch or concrete.

3.5.2 Soil Borings

Between January 20, 2014 and February 20, 2014, Glacier utilized a track-mounted Geoprobe® 8140LS Roto Sonic drill rig for the installation of the 18 monitoring wells located on Figure 3. Of the 18 monitoring wells installed, 7 were shallow overburden (water table) wells, and 11 were deep overburden wells.

The soil borings at the shallow and deep well locations were advanced using a 4-inch outside diameter (OD) inner sampler and a 6-inch OD outer casing with sonic drilling methods. Soil samples were collected continuously from the ground surface to the terminus of each boring. The procedure for the advancement of the borehole was to advance the inner sampler the appropriate interval (5 or 10 feet) and then advance the outer casing over the inner sampler to the desired depth. After the outer casing was advanced, the inner sampler was retrieved and the sample core collected was placed in a polyethylene sample tube. The process was repeated until the desired depth was reached. At locations where a monitoring well pair was installed, only the deep monitoring well locations was sampled and logged. Following the installation of the deep monitoring well, the corresponding shallow monitoring well was advanced to a pre-determined depth and installed without the collection of any soil samples.

Each sample core was screened with a PID. Up to three soil samples were collected from each boring; one soil sample was collected from the interval just above the water table, the second and/or additional samples were collected from the intervals exhibiting odors, staining, or elevated PID reading(s). If no odors, staining, or elevated PID readings were encountered, then only one sample from the interval just above the water table was collected. Soil boring logs are provided in Attachment 6.
A COC form was maintained and accompanied the soil sample containers to Pace. The soil samples were analyzed for TCL VOCs plus TICs following USEPA SW846 Method 8260B. All IDW generated from monitoring well installation was containerized in DOT approved 55-gallon drums and picked up by AARCO on a daily basis for off-site disposal at a permitted facility.

3.5.3 **Shallow and Deep Monitoring Well Construction**

A total of 7 shallow monitoring wells were installed during the RI Off-Site Phase III field investigation. Four shallow monitoring wells (DEC-001R, DEC-108, DEC-109, and DEC-110) were constructed with 15 feet of 2-inch ID, Schedule 40 polyvinyl chloride (PVC) 0.010-inch slot screen and riser. The screen was nominally set between 5 feet above and 10 feet below the water table at most locations. At the three shallow monitoring wells (DEC-083, DEC-107, and DEC-112) which are located on and around the immediate vicinity of the Crown property, the screen was nominally set between 5 feet above and 15 feet below the water table. The 20 foot screen length was installed due to the anticipated drawn down associated with the future operation of the ExxonMobil recovery well RW-28. A #1 size sand pack was installed from the bottom of the well up to 2 feet above the top of the well screen at all locations. A bentonite slurry was then installed around the riser to an elevation of 2 feet below grade via tremie pipe.

A total of 11 deep monitoring wells were installed during the RI Off-Site Phase III field investigation. Eight deep monitoring wells (DEC-107D, DEC-109D, DEC-112D, MW-042D, MW-043D, MW-044D, MW-085D, and MW-087D) were constructed with 10 feet of 2-inch ID, Type 304 stainless steel 0.010-inch continuous wire-wrapped screen with a 2-foot long sump and Schedule 40 PVC riser. Stainless steel screen and sumps were used at these well locations due to the potential presence of DNAPL due to their location immediately downgradient of the Spic and Span Site. The three deep monitoring wells located on Sutton Street and Morgan Avenue (DEC-001D, DEC-108D and DEC-110D) were constructed with 10 feet of 2-inch ID, Schedule 40 PVC 0.010-inch slot screen and Schedule 40 PVC riser. A #1 size sand pack was installed from the bottom of the well up to 2 feet above the top of the well screen at all well locations. A bentonite slurry was then installed around the riser to an elevation of 2-feet below grade via tremie pipe.

Each monitoring well was finished with a locking well cap, a 2-foot square concrete apron, and a flush-mounted curb box. All wells on the Crown Property were finished with flush-mounted curb boxes with one-piece cast collars. The one-piece cast collars were installed on the Crown property due to the heavy truck traffic. Security bolts were installed in the well covers to minimize the potential for unauthorized well access. The concrete apron for each well pad was approximately 6 inches thick. Monitoring well construction logs are included in Attachment 7.

3.5.4 **Monitoring Well Development**

At least 24 hours after the monitoring wells were installed the wells were developed by URS personnel with the pump and surge development method using a Waterra Inertial Hydrolift pump equipped with dedicated/disposable high density polyethylene (HDPE) tubing and dedicated/disposable HDPE check valves. Prior to well development, a 200-foot long Solinst oil/water interface probe was used to check for the presence/thickness of any free product. During well development, water quality parameters (pH, specific conductivity, temperature, turbidity) were measured using a Hanna 991301 Multiparameter Meter and a LaMotte 2020 turbidimeter and recorded. A monitoring well was considered developed when a minimum of 100 gallons was removed and the water quality parameters had stabilized.
Well development water was collected in DOT approved 55-gallon drums and picked up daily by AARCO for off-site disposal at a permitted facility. Well development forms are included in Attachment 8.

3.6 Monitoring Well and Soil Vapor Implant Inspections and Maintenance

Monitoring well and soil vapor implant inspections and maintenance was performed on all DEC soil vapor points and monitoring wells that were entered during the RI Off-Site Phase III field investigation. If maintenance was necessary and performed, it is noted on the form. Maintenance includes: tapping out bolt holes, replacement of security bolts, addition of an anti-seize paste to security bolts, and location ID stenciling adjacent to the locations. Completed inspection forms are provided in Attachment 9.

3.7 Groundwater Level Measurements

Between March 3 and 6, 2014, a round of water levels was collected from the 61 existing and 18 new monitoring wells (Figure 4). Monitoring wells were checked for depth to groundwater and thickness of accumulated light non-aqueous phase liquid (LNAPL), if any. Water levels were measured using a 200-foot long Solinst oil/water interface probe. Table 1 presents groundwater level measurements and the presence/absence of LNAPL in monitoring wells. Groundwater elevations were adjusted if LNAPL was present, based upon the (laboratory) measured specific gravity of the product present in monitoring wells at the Site either during this sampling phase or a previous sampling phase.

3.8 Non-Aqueous Phase Liquid Gauging

During the RI Off-Site Phase III field investigation, LNAPL was detected in: DEC-034 (at a thickness of 2.99 feet); DEC-053 (1.05 feet); DEC-058 (1.49 feet); DEC-083 (0.02 feet); DEC-112 (1.83 feet); MW-042 (0.98 feet); MW-043 (0.35 feet); MW-045 (0.35 feet); and MW-082 (2.0 feet).

3.9 Light Non-Aqueous Phase Liquid Sampling

On March 7, 2014, URS personnel collected one LNAPL sample from DEC-112 using a dedicated/disposable HDPE bailer. The LNAPL sample was included on the COC with the groundwater sample containers and sent via lab courier to Pace. The LNAPL sample was analyzed for TCL VOCs plus TICs following USEPA SW846 Method 8260B; semi-volatile organic compounds (SVOCs) following USEPA Method 8270C; petroleum hydrocarbon identification by NYSDOH Method 310-13, specific gravity by American Society of Testing and Materials (ASTM) Method D-1298, viscosity by ASTM Method D-445, and interfacial tension by ASTM Method D-971. The specific gravity, viscosity, and interfacial tension analysis were subcontracted by Pace to Harris Testing Laboratories of Houston, TX (Harris).

3.10 Groundwater Sampling

URS personnel collected 20 groundwater samples (including 2 field duplicates) between March 4 and March 7, 2014 from the 18 monitoring wells shown on Figure 3. Prior to sample collection, standing water was purged from each well using a Geopump 2 peristaltic pump, QED SamplePro Micropurge bladder pump, or a Grundfos Redi-Flo2 submersible pump equipped with dedicated/disposable bladders and HDPE tubing. At well locations where LNAPL was encountered, a groundwater sample was collected from the well by lowering a capped tremie pipe into the well to a depth at least 5 feet below the LNAPL layer. The tremie pipe was secured with a clamp to limit movement and the cap was pushed out from the bottom end of the tremie pipe to allow the sample tubing to be lowered to the desired sampling depth without coming into contact with the LNAPL. The cap was attached to the tremie pipe for retrieval.
Wells were purged at a rate of 1-liter per minute or less and the purge rate was adjusted to minimize draw down. During the purging of the well, water quality parameters (pH, specific conductivity, temperature, dissolved oxygen, turbidity) were measured using a Horiba U-52 Multi-parameter Instrument with a flow-through cell and documented on a purge log. Samples were collected after the water quality parameters stabilized and a minimum of one well volume had been removed. All IDW including purge water, bailers, and HDPE tubing, was collected and placed into DOT approved 55-gallon drums and removed by AARCO on a daily basis for off-site disposal at a permitted facility. Purge logs are provided in Attachment 10.

All samples were transported under COC via laboratory courier to Pace. The samples were analyzed for TCL VOCs, plus TICs following USEPA SW846 Method 8260B.

3.11 Concrete Flag Replacement

AARCO was contracted for the replacement of sidewalk flags where soil vapor implants and monitoring wells were installed during previous and current site activities. AARCO replaced a total of 24 sidewalk flags between April 8 and 11, 2014 and May 5 and 7, 2014. The sidewalk flags ranged in size from 5-foot by 5-foot square to 5-foot by 12-foot square. Prior to removal of the damaged flags, AARCO saw cut the perimeter of each flag to be replaced using a water-cooled pavement saw to reduce fugitive dust. The flags were demolished, removed and disposed of by AARCO. New flags were replaced in kind to the surrounding flags. The daily construction reports detailing the flag replacement activities are provided in Attachment 11.

3.12 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 for IDW are provided in Attachment 12.

3.13 Site Survey

B. Thayer Associates of Woodbury, NY, was contracted to survey additional monitoring well, soil vapor, and soil boring locations in May 2014. The survey provides 100-scale mapping and does not include elevated roadways and expressways (i.e., BQE). The survey was tied into the existing site survey. 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.
4.0 STUDY AREA GEOLOGY

This section discusses the physical characteristics of the study area including: geology, hydrogeology, and SCGs.

4.1 Regional Geology

The Spic and Span Site 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. 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) (USGS, 1999a 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 the upper glacial aquifer, the Raritan Formation, and crystalline bedrock. 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 by the USGS: 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 a depth of -163 feet amsl.

As of December 2013, the Raritan Formation was positively encountered in 10 top of clay well locations on-site at depths between 108.5 and 138.0 feet bgs (elevations of -56.95 to -121.19 feet amsl) and was 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.

4.2 Site Geology

Figure 4 presents the locations of the monitoring wells and cross sections developed during the Remedial Investigation (URS, September 2012) which have been updated to include RI Off-Site Phase III information. Cross sections A-A’, B-B’ and C-C’ are shown on Figures 5, 6, and 7, respectively and represent the cross-sections that may be found in the Spic and Span area. Based upon subsurface data obtained during this and previous investigations, both the upper glacial aquifer was penetrated and the top of the Raritan Formation was encountered at the top of clay monitoring well locations (i.e., DEC-035TC, DEC-058TC, DEC-062TC, and DEC-063TC). The following textural units have been found in the upper glacial aquifer in most borings, from the surface downward: a fill unit; a glacial till unit; an inclusive sand unit within the glacial till unit; a sand unit;
a lacustrine clayey silt unit; a fine sand and silt unit; a sand/ sand and gravel unit; and the Raritan Formation. Due to the heterogeneous nature of the geology, some but not all of the units were identified at each boring. The thickness of the upper glacial aquifer in the Spic and Span Area is approximately 125.0 to more than 138.0 feet thick.

A fill unit is present, varying in thickness from approximately 0 to 9 feet, and consists of a heterogeneous mixture of sand, silt, clay and varying amounts of construction and demolition debris (i.e., bricks, concrete, coal, slag, etc.).

A glacial till unit was noted at the surface in some borings and consists of a heterogeneous mixture of sand, silt, and clay and varying amounts of gravel, cobbles and boulders. The glacial till unit found at the surface pinches out to the north and northeast between DEC-057 and DEC-054 to the north and DEC-058 to the northeast. At these locations and the wells located to the north of these locations, the sand unit may be found at the surface.

An inclusive sand layer was identified within the glacial till unit in between SSB-26 and SSB-32 (Figure 6). The inclusive sand layer in this area contained elevated concentrations of PCE and dense non-aqueous phase liquid (DNAPL). The inclusive sand unit is present along Kingsland Avenue, adjacent to the Former Spic and Span building and is found laterally north and south between SSB-025 and DEC-024. The east/west extent of the inclusive sand unit is unknown and is assumed to be present to the east beneath Kingsland Avenue. The inclusive sand has been found between approximately 12.0 and 24.0 feet bgs. The bottom of the northern edge of the inclusive sand layer has vertical sand stringers present with DNAPL in them and represents a vertical migration pathway for DNAPL from the shallow zone through the glacial till unit to the lower units. The northern edge of the inclusive sand layer is approximately 35 feet from DEC-024D and DEC-024DR, where DNAPL has also been identified at the top of the clayey silt unit.

A deeper sand unit is present at the majority of boring locations and is represented by stratified sands of varying textures containing some to no fines.

A lacustrine clayey silt unit has been observed as an inclusive unit within the sand unit, and was observed in most of the borings at the site. The thickness of the clayey silt unit, where present, varies from 0.5 to over 20 feet thick. The presence of the clayey silt unit (i.e., a low permeability unit) at well location DEC-024D and DEC-024DR has resulted in the accumulation of DNAPL at the interface between the sand unit and the inclusive clayey silt unit at approximately 50 feet bgs (-29.78 feet amsl). This clayey silt unit was also identified in nearby wells at depths ranging from 50 feet bgs (-29.84 feet amsl) at DEC-024DR to 65 feet bgs (-48.80 feet amsl) at DEC-023D. The clayey silt unit’s thickness is greatest at DEC-063D (approximately 28 feet thick) and thins to the north (approximately 1-foot thick at DEC-034D and DEC-058D) and east (approximately 2.5 feet thick at DEC-062D). The lacustrine clayey silt has a lower permeability which has impeded further downward migration of DNAPL and dissolved phase contaminants.

The fine sand and silt unit beneath the sand unit consists of inter-bedded very fine to fine sands, silt and fine sands and silt mixtures with inter-bedded, discontinuous beds of sands, silts and clays. This unit is laterally discontinuous and texturally variable in nature and was typically found north of Norman Avenue and east of Kingsland Avenue, including beneath the Crown property.

A sand/ sand and gravel unit was identified overlying the Raritan Formation at the four top of clay locations (DEC-035TC, DEC-058TC, DEC-062TC and DEC-063TC) in the Spic and Span area.

The Raritan Formation consisted of green gray, green brown, brown, or white with brown banding, silt with some sand; clay with some sand; clay and silt; or fine sand and silt and was encountered
between 125 and 138.5 feet bgs ( -103.89 and -121.19 feet amsl). The top of the Raritan Formation
dips to the west/northwest.

4.3 Groundwater Levels

Between March 3 and March 6, 2014, a round of groundwater level measurements was obtained
from 61 existing and 18 new monitoring wells. Groundwater elevation measurements are provided
in Table 1.

A potentiometric surface map based on the water level measurements from the shallow overburden
wells, using a 1-foot contour interval, is provided in Figure 8. The groundwater flow direction in
March 2014 was to the east and northeast from the Spic and Span Site which is consistent with
historic groundwater flow direction, but with a more easterly component than previously observed.

A potentiometric surface map based on the water level measurements from the deep overburden
wells, using a 1-foot contour interval, is provided in Figure 9. The groundwater flow direction in
March 2014 was generally to the east and east-northeast from the Spic and Span Site.

A potentiometric surface map based on the water level measurements from the Top of Raritan wells,
using a 0.5-foot contour interval, is provided in Figure 10. The groundwater flow direction in March
2014 was generally to the northeast from the Spic and Span Site.

ExxonMobil monitoring well MW-44, along with several other monitoring wells as indicated by a
“P” on Table 1 (i.e., DEC-001, DEC-002, and DEC-003), appears to represent perched groundwater.
MW-44 appears to be screened through interbedded silt, clay, and sandy silt. As a result the
groundwater level at this location is approximately 10 to 13 feet higher than the nearest shallow
monitoring wells.

Vertical hydraulic gradients between the shallow and deep overburden and between the shallow
overburden and Top of Raritan are downwards.

4.3.1 Influence of ExxonMobil Recovery Wells

The operation of ExxonMobil recovery wells RW-17 and RW-22 appear to have influenced the
shallow and deep groundwater flow direction. Well construction logs for RW-17 and RW-22 may be
found in Attachment 7.

RW-17 is located in the northeast corner of the property located on the 297 Norman Avenue property
(MV Transportation) which is immediately east of the Crown property. RW-17 consists of a 12-inch
diameter well with a 55-foot long stainless steel screen (10-65 feet bgs) equipped with a 5-foot long
stainless steel sump (65-70 feet bgs) and stainless steel riser. During 2012, the average pumping rate
for RW-17 was 26 gallons per minute (gpm). The operation of RW-17 appears to have locally
impacted the groundwater flow and has potentially drawn groundwater northeast from the Spic and
Span site, beneath the Crown property. The most recent groundwater data collected in March 2014
from RW-17 (e-mail from Roux, July 3, 2014) reported concentrations of PCE at 260 µg/L, TCE at
29 µg/L, cis-1,2-DCE at 58 µg/L, and vinyl chloride at 8 µg/L.

RW-22 is located southeast of the Spic and Span Site at 90-92 Hausman Street. RW-22 consists of a
12-inch diameter well with a 50-foot long stainless steel screen (28-78 feet bgs) equipped with a 5-
foot long stainless steel sump (78-83 feet bgs) and stainless steel riser. During 2012, the average
pumping rate for RW-22 was 36 gpm. The operation of RW-22 appears to have locally impacted the
groundwater flow and has potentially drawn groundwater southeast from the Spic and Span Site.
The most recent groundwater data collected in March 2014 from RW-22 (e-mail from Roux, July 3,
2014) reported concentrations of PCE at 97 µg/L, TCE at 280 µg/L, cis-1,2-DCE at 80 µg/L, and vinyl chloride at 9 µg/L in RW-22.

ExxonMobil has installed new recovery wells (RW-27P and RW-27W at location RW-27 and RW-28) in the vicinity of the Spic and Span Site. RW-27P and RW-27W are located at 369 Kingsland Avenue, which is northwest of the Crown property. RW-27P consists of a 6-inch diameter well with a 20-foot long stainless steel screen (3-23 feet bgs) equipped with a 5-foot long stainless steel sump (23-28 feet bgs) and stainless steel riser. RW-27W consists of a 6-inch diameter well with a 20-foot long stainless steel screen (38-58 feet bgs) equipped with a 5-foot long stainless steel sump (58-63 feet bgs) and stainless steel riser. RW-28 is located on the southwest corner of the Crown property. RW-28 consists of a 12-inch diameter well with a 30-foot long stainless steel screen (10-40 feet bgs) equipped with a 5-foot long stainless steel sump (40-45 feet bgs) and stainless steel riser. At this time it is unknown when RW-27 and RW-28 will go on-line, however their operation will most likely influence the groundwater flow direction in the vicinity of the Spic and Span Site. Well construction logs for RW-27P, RW-27W, and RW-28 may be found in Attachment 7.

4.4 Standards, Guidance, and Criteria

Soil

Three sources of soil SCGs are considered appropriate for this site: site-specific background soil samples, NYSDEC Part 375, and NYSDEC CP-51. Site-specific background soil sample results are detailed in the Spic and Span RI (URS, September 2012). Soil samples during this Off-Site Phase III RI were only analyzed for VOCs, and since no VOCs were detected in soil background samples, soil background is not included on the analytical tables and figures presented in Section 5.

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 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. Soil SCGs also considered appropriate for the site are Residential criteria. Part 375 Residential and Restricted Residential Use soil cleanup criteria for the soil samples are used on the soil analytical data tables in Section 5.

Groundwater

The SCGs for groundwater are the Class GA standards and guidance values presented in NYSDEC Technical and Operational Guidance Series (TOGS) 1.1.1 Ambient Water Quality Standards and Guidance Values and Groundwater Effluent Limitations, June 1998 (including subsequent revisions). These groundwater SCGs are included on the groundwater analytical tables presented in Section 5.

Soil Vapor

There are no criteria for soil vapor analytical data.
5.0 ANALYTICAL RESULTS

Full deliverable data packages [i.e., NYSDEC Analytical Service Protocol (ASP) Category B] were provided by the laboratory and included all reporting forms and raw data necessary to fully evaluate and verify the reported analytical results.

A Data Usability Summary Report (DUSR) was prepared following the guidelines provided NYSDEC Division of Environmental Remediation DER-10 Technical Guidance for Site Investigation and Remediation, Appendix 2B - Guidance for Data Deliverables and the Development of Data Usability Summary Reports, May 2010. The data packages were reviewed for compliance with analytical method requirements and the following USEPA Region II guidelines: Validating Volatile Organic Compounds by Gas Chromatography/Mass Spectrometry SW-846 Method 8260B, HW-24, Revision 2, August 2008; Validating Semi-volatile Organic Compounds by SW-846 Method 8270D, HW-22 Revision 4, August 2008; and Volatile Organic Analysis of Ambient Air in Canister By Method TO-15, SOP HW-31, Revision 4, October 2006. The type and quality of analytical results that are needed to answer specific environmental questions and support proper environmental decisions met the project quality objectives (PQOs) for this sampling event.

The complete validated analytical results from the soil, groundwater, and soil vapor samples are presented in the DUSR in Attachment 13, on a compact disk (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.

5.1 Soil Analytical Results

A summary of detected TCL VOCs in the soil samples collected from monitoring wells and soil vapor implants is presented in Table 2A for those detected compounds exceeding Unrestricted Use and Protection of Groundwater criteria. Table 2B lists the detected analytical results exceeding Residential and Restricted Residential Use Criteria. Soil data exceeding criteria is presented on Figure 11A for Unrestricted Use and Protection of Groundwater and Figure 11B for Restricted Residential and Residential Use. Table 3 provides a statistical summary of the detected parameters for the soil samples as follows: the number of detections; the minimum, maximum and average values; and the location and depth of the maximum value.

VOCs, including PCE and its degradation products, were detected above Unrestricted Use and Protection of Groundwater criteria in DEC-107D (5.7 mg/kg 38-39 feet bgs and 1.7 mg/kg 63-64 feet bgs). TCE was not detected above Unrestricted Use or Protection of Groundwater criteria. However, cis-1, 2-dichloroethene was detected above Unrestricted Use and Protection of Groundwater criteria in DEC-107D (0.26 mg/kg 38-39 feet bgs).

Additionally, isopropylbenzene was detected above Unrestricted Use and Protection of Groundwater criteria in MW-42D (2.5 mg/kg 12-13 feet bgs), and acetone was detected above Unrestricted Use and Protection of Groundwater criteria in: DEC-107D (0.055 mg/kg 13-14 feet bgs); DEC-112D (0.14 mg/kg 13-14 feet bgs); MW-043D (0.069 mg/kg 16-17 feet bgs); MW-085D (0.07 mg/kg 14-15 feet bgs); MW-87D (0.059 mg/kg 7-8 feet bgs); SG-183 (0.14 mg/kg 0.8-1.2 feet bgs); and SG-185 (0.11 mg/kg 4.5-5 feet bgs).

PCE exceeded Residential Use criteria in DEC-107D (5.7 mg/kg 38-39 feet bgs). No other VOCs exceeded either Residential or Restricted Residential Use criteria.
5.2 **Groundwater Analytical Results**

A summary of the detected VOCs in the groundwater samples collected from monitoring wells is presented in Table 4. Results exceeding Technical Guidance Series Memorandum (TOGS) No. 1.1.1 Class GA groundwater criteria are indicated with a circle. The locations of detected VOCs that have exceeded their respective criteria are shown on Figure 12. PCE concentrations in the shallow and deep overburden groundwater samples are shown on Figures 13 and 14, respectively. TCE concentrations for shallow and deep overburden groundwater are shown on Figures 15 and 16, respectively. Table 5 provides a statistical summary of the detected parameters for the groundwater samples as follows: the number of detections; the minimum, maximum and average values; and the location of the maximum value.

**Groundwater PCE Detections**

PCE was detected in 16 of the 18 monitoring wells sampled, with 14 locations at concentrations exceeding groundwater criteria. Concentrations exceeding groundwater criteria ranged from 15 µg/L to 90,000 µg/L (Figure 12). The highest concentration of PCE was detected at MW-085D (90,000 µg/L), followed by DEC-107D (65,000 µg/L), MW-087D (8,400 µg/L), DEC-112D (7,100 µg/L), DEC-001D (5,500 µg/L), and DEC-110D (4,300 µg/L).

**Groundwater TCE Detections**

TCE was detected in 15 of the 18 monitoring wells sampled with 12 locations at concentrations exceeding groundwater criteria. Concentrations exceeding groundwater criteria ranged from 6 µg/L to 7,800 µg/L (Figure 12). The highest concentration found at MW-085D (7,800 µg/L), followed by DEC-112D (2,100 µg/L), and DEC-107D (2,000 µg/L).

**Groundwater PCE and TCE Degradation Product Detections**

The presence of PCE and TCE degradation products have also been detected during this groundwater sampling event at concentrations exceeding groundwater criteria both on and off the Crown property (Figure 12). The concentrations of PCE and TCE degradation products are similar to the concentrations found during the previous rounds of groundwater sampling in this area.

Cis-1, 2-dichloroethene (cis-1,2-DCE) was detected in 17 of the 18 monitoring wells sampled, with 13 locations at concentrations exceeding groundwater criteria, as listed in Table 4. The range of cis-1,2-DCE exceeding groundwater criteria varied from 9 µg/L to 9,400 µg/L, with the highest concentration detected at MW-085D.

Trans-1,2-dichloroethene (trans-1,2-DCE) was detected in 8 of the 18 monitoring wells sampled, with 4 locations at concentrations exceeding groundwater criteria, as listed in Table 4. The range of trans-1,2-DCE exceeding groundwater criteria varied from 7 µg/L to 46 µg/L, with the highest concentration detected at MW-085D.

Vinyl chloride was detected in 11 of the 18 monitoring wells sampled, with 10 locations at concentrations exceeding groundwater criteria, as listed in Table 4. The range of vinyl chloride exceeding groundwater criteria varied from 3 µg/L to 670 µg/L, with the highest concentration detected at MW-085D.

**Groundwater BTEX Results**

Additional VOCs detected in groundwater samples include benzene, toluene, ethylbenzene, and xylenes. High concentrations (> 100 µg/L) were detected in DEC-108 (on Morgan Avenue near Norman Avenue) and DEC-112 (on Norman Avenue near Kingsland Avenue). Concentrations
which exceeded SCGs but were lower than 100 µg/L include monitoring wells within or near the Crown property: DEC-083, DEC-107, DEC-107D, DEC-112, DEC-112D, MW-42D, MW-85D; and along Kingsland Avenue and south of Norman Avenue: DEC-108, DEC-108D, and DEC-110D.

5.3 Light Non-Aqueous Phase Liquid Analytical Results

One LNAPL sample was collected from monitoring well DEC-112 on March 7, 2014. Results are presented on Table 6 and include detections of high concentrations of: benzene 1,700 mg/kg; cyclohexane 9,600 mg/kg; chrysene 120 mg/kg; isopropylbenzene 970 mg/kg; methylcyclohexane 22,000 mg/kg; toluene 120 mg/kg; xylenes 230 mg/kg; 2-methylnaphthalene 4,800 mg/kg; fluorene 170 m/kg; naphthalene 390 mg/kg; and phenanthrene 230 mg/kg. The petroleum hydrocarbon identification indicated kerosene at 390,000 mg/kg. Laboratory measured parameters include: viscosity of 1.919 centipoise, surface tension of 26 dynes/cm, and specific gravity of 0.8136.

5.4 Soil Vapor Analytical Results

Outdoor air and soil vapor implant results are presented on Table 7 and are shown on Figure 17. A statistical summary is presented on Table 8. Two outdoor air samples were collected on February 11 and 12, 2014. Results indicated detections of low levels (< 10 µg/m³) ranging from 0.82 to 9.8 µg/m³ of the following VOCs: 1,4-dichlorobenzene, acetone, benzene, carbon disulfide, cyclohexane, dichlorodifluoromethane, ethanol, ethylbenzene, methylene chloride, n-hexane, toluene, trichlorofluoromethane, and xylenes.

PCE was detected at two locations with a concentration of 8.5 µg/m³ at SG-192 on Sutton Street, and 1,800 µg/m³ at SG-188 on the southeast corner of the intersection of Kingsland and Norman Avenues as shown on Figure 18.

TCE was detected at one location with a concentration of 2,800 µg/m³ at SG-188 on the corner of Kingsland and Norman Avenues as shown on Figure 19.

Additional VOCs detected in soil vapor samples include: 1,1-dichloroethene, 1,2,4-trimethylbenzene, cis-1,2-dichloroethene, trans-1,2-dichloroethene, 1,3-butadiene, 1,3-dichlorobenzene, 1,4-dichlorobenzene, 1,4-dioxane, 2,2,4-trimethylpentane, acetone, benzene, carbon disulfide, chloroform, cyclohexane, dichlorodifluoromethane, ethanol, ethylbenzene, isopropyl alcohol, methylene chloride, n-heptane, n-hexane, toluene, trichlorofluoromethane, vinyl chloride, and xylenes.
6.0 CONCLUSIONS AND RECOMMENDATIONS

6.1 Conclusions

Based upon the results of the previous site investigations, the following conclusions are provided.

6.1.1 Geology

- The potentiometric surface may be found between 11.44 and 29.91 feet bgs in the wells sampled. Perched groundwater was encountered at four locations (DEC-001, DEC-002, DEC-003, and MW-44).
- Shallow overburden groundwater flow in the vicinity of the Spic and Span Site is to the east and northeast.
- Deep overburden groundwater flow in the vicinity of the Spic and Span Site is to the east and east-northeast.
- The operation of ExxonMobil recovery wells RW-17 and RW-22 appear to have influenced the shallow and deep groundwater flow direction resulting in the horizontal and vertical migration of dissolved phase CVOCs from the Spic and Span Site.

6.1.2 Soil

- PCE was detected above Unrestricted Use or Protection of Groundwater criteria in DEC-107D (5.7 mg/kg 38-39 feet bgs and 1.7 mg/kg 63-64 feet bgs). PCE exceeded Residential Use criteria in DEC-107D (5.7 mg/kg 38-39 feet bgs).
- TCE was not detected above Unrestricted Use or Protection of Groundwater criteria.
- Cis-1,2-dichloroethene was detected above Unrestricted Use and Protection of Groundwater criteria in DEC-107D (0.26 mg/kg 38-39 feet bgs).

6.1.3 Groundwater Analytical Results

- PCE and its degradation products were detected in shallow groundwater monitoring wells located downgradient of the Spic and Span Site to the east and at the perimeter of the Crown property to the northeast.
- PCE and its degradation products were detected in deep groundwater monitoring wells located downgradient of the Spic and Span Site to the east and beneath the Crown property to the northeast. The highest concentration of PCE was detected at MW-085D (90,000 µg/L), followed by DEC-107D (65,000 µg/L), MW-087D (8,400 µg/L), DEC-112D (7,100 µg/L), DEC-001D (5,500 µg/L), and DEC-110D (4,300 µg/L).
- The operation of ExxonMobil recovery wells RW-17 and RW-22 appears to have affected migration of dissolved phase of the CVOC plume originating from the Spic and Span Site. There is a northeast and east–southeast component of the plume. One component of the dissolved CVOC plume is migrating northeast from the Spic and Span Site towards RW-17, beneath the Crown property. A second component of the dissolved CVOC plume is moving east-southeast from the Spic and Span Site towards RW-22 which is located on Hausman Street between Norman and Nassau Avenues.
- In addition, the operation of ExxonMobil recovery wells RW-17 and RW-22 appears to have affected vertical migration of PCE and its degradation products from the shallow to the deep groundwater regimes. Concentrations of CVOCs in paired monitoring wells were up to an order of magnitude higher in the deep groundwater when compared to the shallow groundwater.
6.1.4 **Light Non-Aqueous Phase Liquid**

- During the RI Off-Site Phase III field investigation, LNAPL was detected in 9 monitoring wells (DEC-034, DEC-053, DEC-058, DEC-083, DEC-112, MW-042, MW-043, MW-045, and MW-082) with thicknesses ranging between 0.02 feet and 2.99 feet.
- Analytical results from a LNAPL sample collected from DEC-112 indicated kerosene at 390,000 mg/kg, a viscosity of 1.919 centipoise, surface tension of 26 dynes/cm, and specific gravity of 0.8136.

6.1.5 **Soil Vapor**

- PCE and TCE were detected in soil vapor immediately downgradient of the Spic and Span Site in SG-188 at 1,800 µg/m³ and 2,800 µg/m³, respectively. PCE was also detected at a concentration of 8.5 µg/m³ at SG-192 on Sutton Street. TCE was not detected in any other soil vapor samples.
- Additional VOCs detected in the 11 soil vapor samples were: 1,1-dichloroethene, 1,2,4-trimethylbenzene, cis-1,2-dichloroethene, trans-1,2-dichloroethene, 1,3-butadiene, 1,3-dichlorobenzene, 1,4-dichlorobenzene, 1,4-dioxane, 2,2,4-trimethylpentane, acetone, benzene, carbon disulfide, chloroform, cyclohexane, dichlorodifluoromethane, ethanol, ethylbenzene, isopropyl alcohol, methylene chloride, n-heptane, n-hexane, toluene, trichlorofluoromethane, vinyl chloride, and xylenes.
- Based upon the soil vapor sampling results, the CVOC soil vapor plume originating from the Spic and Span Site has nearly been fully delineated.

6.2 **Recommendations**

The following recommendations are offered for consideration by the Department.

- Additional shallow and deep groundwater monitoring well pairs should be installed on the west side of Hausman Street between Norman and Nassau Avenues to determine the horizontal and vertical extent of CVOC-impacted groundwater migrating to the ExxonMobil recovery well RW-22. The rationale for the monitoring well locations can be found in Table 9 and the proposed locations are shown on Figure 20.
- Additional deep monitoring wells should be installed on the 297 Norman Avenue property (MV Transportation) to determine the horizontal extent of CVOC impacted deep groundwater migrating to the ExxonMobil recovery well RW-17. The rationale for the monitoring well locations can be found in Table 9 and the proposed locations are shown on Figure 20.
- An additional deep monitoring well should be installed on the west side of the Crown property (i.e., MW-46D). The deep well will assist in assessing deep groundwater flow dynamics and the movement of CVOCs in deep groundwater after ExxonMobil recovery wells RW-27 and RW-28 are operational. The rationale for the monitoring well location can be found on Table 9 and the proposed location is shown on Figure 20.
- An additional deep monitoring well should be installed on the southeast corner of the Crown property (i.e., MW-083D) to determine the horizontal extent of CVOC impacted deep groundwater migrating to the ExxonMobil RW-17. The rationale for the monitoring well location can be found on Table 9 and the proposed location is shown on Figure 20.
- The shallow monitoring wells should be constructed with a 15-foot long 2- inch ID PVC screen and PVC riser. The deep monitoring wells should be constructed with 10 feet of
2-inch ID, PVC 0.010-inch slot screen and PVC riser. A #0 or #1 size sand pack should be installed from the bottom of the well up to 2 feet above the top of the well screen. A bentonite slurry should then be installed around the riser to an elevation of 2-foot below grade via tremie pipe. An 8-inch diameter, flush-mount protective casing should complete each well. All wells on the Crown property should be finished with a flush-mounted curb box equipped with a heavy duty one-piece cast collar due to the heavy truck traffic.

- Up to two soil samples should be collected from each boring location: one soil sample from the interval just above water table; and the second sample from the interval exhibiting odors, staining, or the highest PID reading. If no odors, staining, or elevated PID reading are encountered, then only one sample from the interval just above the water table should be collected, as per the FAP (URS, April 2010). All soil samples should be analyzed for TCL VOCs plus TICs by USEPA SW846 Method 8260B.

- Groundwater samples should be collected from the 10 newly installed monitoring wells. All groundwater samples should be analyzed for TCL VOCs plus TICs. Prior to the start of groundwater sampling, a synoptic round of water levels/ LNAPL gauging should be collected from all monitoring wells in the Spic and Span area. At well locations where LNAPL is encountered, a groundwater sample should be collected from the well by lowering a capped tremie pipe into the well to a depth at least 5 feet below the LNAPL layer. The tremie pipe should be secured to limit movement and the cap should be pushed out from the bottom end of the tremie pipe to allow the sample tubing to be lowered to the desired sampling depth without coming into contact with the LNAPL. The cap should be attached to the tremie pipe for retrieval. A peristaltic pump should be used to purge the wells containing LNAPL.
7.0 REFERENCES


URS Corporation – New York, April 2012. Final – Site Characterization, Phase VI Data Summary Report

URS Corporation – New York, September 2012. Final – Remedial Investigation, Former Spic and Span Cleaners and Dyers, Inc. Site


8.0 TABLES, FIGURES, AND ATTACHMENTS

The following tables, figures, and attachments are included as part of this letter report:

Tables (following text)

Table 1 Groundwater Elevation Measurements
Table 2A Summary of Detected Compounds in Phase III Soil Samples – Soil Background, Unrestricted Use and Protection of Groundwater Criteria
Table 2B Summary of Detected Compounds in Phase III Soil Samples – Residential and Restricted Residential Criteria
Table 3 Statistical Summary of Detected Compounds in Phase III Soil Samples
Table 4 Summary of Detected Compounds in Phase III Groundwater Samples
Table 5 Statistical Summary of Detected Compounds in Phase III Groundwater Samples
Table 6 Summary of Detected Compounds in Phase III NAPL
Table 7 Summary of Detected Compounds in Phase III Soil Vapor Samples
Table 8 Statistical Summary of Detected Compounds in Phase III Soil Vapor Samples
Table 9 Proposed Monitoring Well Location Rationale

Figures (following Tables)

Figure 1 Site Location
Figure 2 Soil Vapor Implant Locations
Figure 3 Groundwater Monitoring Well Sampling Locations
Figure 4 Monitoring Well and Cross Section Locations
Figure 5 Cross Section A-A’
Figure 6 Cross Section B-B’
Figure 7 Cross Section C-C’
Figure 8 Shallow Overburden Groundwater Potentiometric Surface (March 2014)
Figure 9 Deep Overburden Groundwater Potentiometric Surface (March 2014)
Figure 10 Top of Raritan Groundwater Potentiometric Surface (March 2014)
Figure 11A Soil Analytical Results Exceeding Unrestricted Use and Protection of Groundwater Criteria
Figure 11B Soil Analytical Results Exceeding Residential Use and Restricted Residential Use Criteria
Figure 12 Groundwater Analytical Results
Figure 13 Tetrachloroethene in Shallow Overburden Groundwater
Figure 14 Tetrachloroethene in Deep Overburden Groundwater
Figure 15 Trichloroethene in Shallow Overburden Groundwater
Figure 16 Trichloroethene in Deep Overburden Groundwater
Figure 17 Soil Vapor Analytical Results
Figure 18 Tetrachloroethene in Soil Vapor
Figure 19 Trichloroethene in Soil Vapor
Figure 20 Proposed Monitoring Well Locations
Attachments (following Figures)

Attachment 1 Photographic Log
Attachment 2 Field Notes
Attachment 3 Geophysical Survey Reports
Attachment 4 Soil Vapor Implant Construction Details
Attachment 5 Summa Canister Sampling Field Data Sheets
Attachment 6 Soil Boring Logs
Attachment 7 Monitoring Well Construction Logs
Attachment 8 Well Development Logs
Attachment 9 Monitoring Well and Soil Vapor Inspection Forms
Attachment 10 Purge Logs
Attachment 11 Daily Construction Reports for Flag Replacement
Attachment 12 Investigation Derived Waste Disposal Documents
Attachment 13 Data Usability Summary Report (on CD)

Please contact me at 716-856-5636 if you have any questions or comments.

Sincerely,

URS Corporation

[Signature]

Michael Gutmann
Project Manager

cc: File: 11176359 (R-1)
    George Kisluk URS
    Scott McCabe URS