REVISED REMEDIAL INVESTIGATION REPORT

For

FORMER WILLOW SERVICE STATION (1810 LLC)
18-10 27th AVENUE
ASTORIA, NEW YORK

Prepared For

1810 LLC

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Prepared By

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Certification

I hereby certify that all activities described in this Remedial Investigation Report were performed in full accordance with the Department-approved Remedial Investigation Work Plan.

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Table of Contents

Page No.

Appendices

Appendix A: Maps and Figures

Appendix B: Data Usability Summary Reports (DUSR)

Appendix C: Tabulated Laboratory Results

Appendix D: Laboratory Analytical Data

1.0 INTRODUCTION

This report provides a description of previous site remediation and the results of the recent off-site and on-site investigations described in the Remedial Investigation (RI) work plan dated March 2006.

An addendum to the Remedial Investigation (RI) work plan was requested by James Quinn, P.E. of the New York State Department of Environmental Conservation (NYSDEC) Division of Environmental Remediation. The addendum was as a result of potential off-site contamination that may be present or have occurred with respect to the Former Willow Service Station located at 1810 27th Avenue, Astoria, New York (see Figure 1). The potential for off-site contamination and health and safety issues at adjacent and downgradient receptors arose. The following Site Investigation Results and Corrective Action Plan Report is based on the New York State Department of Environmental Conservation and New York State Department of Health investigation sampling protocols, procedures, and guidance.

In addition to the work called for in the RI work plan addendum, outdoor and indoor air quality testing was performed in December 2006. This testing was performed after review of the off-site and on-site soil vapor data, called for in the RI work plan addendum, which indicated the presence of soil vapor contamination.

Section 2 provides a site description and a description of previous remediation performed at the site. Section 3 describes the off-site field investigation procedures, results, and observations. Section 4 describes the on-site field investigation procedures, results, and observations. Section 5 presents observations based on the investigation results.

2.0 SITE DESCRIPTION AND PREVIOUS REMEDIATION

The subject site, 18-02 27th Avenue, is situated in a Commercial and Residential District C2-2/R6B of Astoria, Queens. The subject site is bound by 27th Avenue to the north, 21st Street to the east, 18th Street to the west, and Astoria Boulevard to the south. It is geographically located at latitude 40.772700 and longitude 73.927400. The subject site is listed in the tax map as follows:

Building Number	Zone	Blk.	Lot	Usage/Structure
18-02 27th Avenue	C2-1 / R-5	541	7	4 Stories 16 units residential 1 unit commercial - R&R General Supply Basement-R&R General Supply storage

The site was previously the Willow Service Station. Since 1948, the site was a retail fuel filling station and automotive repair garage. The present owner, 1810 LLC, acquired the site in 2002. Demolition of the existing structures began in early 2003. Construction of a four story commercial/residential building with a basement followed immediately. The basement and ground floor are devoted solely to hardware storage. There is an on-site outdoor parking lot in the north–northwest corner of the site.

A Tank Closure Report, prepared by Yellowstone Industries, Inc., indicated that a total of six (6) 550 gallon underground storage tanks (USTs) were located directly north of the original building; a second tank farm containing three (3) 550 gallon diesel USTs were buried south of the original building; and, a 2,000 gallon gasoline UST was located northeast of the building. See Figure 2 for the tank former locations, contents, and year of removal. In 1994, a leak was detected in one of the tanks located in the north tank farm and promptly reported to the

NYSDEC. Spill # 94-16654 was assigned to the site.

The tanks in the north tank farm were pressure tested and one of the tanks failed the tightness test. The failed tank was subsequently abandoned in place. Then the six (6) 550-gallon USTs in the north tank farm were excavated and removed from site in December 1999.

As a part of the site's extensive renovation/remodeling activities in 2004, a total of 298 tons of contaminated soil associated together with all the USTs and scrap metal were removed and disposed of at an approved and duly licensed disposal facility. See Figure 3 for the soil excavation area. During excavation, underground storage tanks 7 and 8 (see Figure 2) were discovered and removed. Since all USTs were removed, the sources of contamination no longer exist. Nevertheless, residual soil and groundwater sampling results confirmed BTEX/MTBE as the predominant contaminant remaining beneath the site.

Contaminated groundwater was detected in the shallow aquifer 13 to 19 feet below grade. The direction of site groundwater flow is generally northwesterly. A hydraulic gradient of 0.0056 ft/ft was determined from well monitoring data. This value is consistent with a predominantly silty lithology and yields a pore water velocity of 0.0012 ft/day.

The current site owner entered into a Voluntary Cleanup Agreement (VCA) with the New York State Department of Environmental Conservation (NYSDEC) in July of 2003, immediately upon site acquisition, and the site is duly listed on NYSDEC's Voluntary Cleanup database. The Contemplated Use of the site contained in the VCA is restricted commercial (excluding day care, child care, and medical care uses). However, construction of a 4-story commercial/residential building (hardware storage in the basement and first floor and 3 stories of apartments) began concurrently with soil remediation (excavation, screening, removal) in 2004. Pre-construction soil and groundwater

sampling indicated that volatile organic compounds (BTEX), MTBE, and semi-volatile organic compounds, or SVOCs (Acenaphthene, Naphthalene, Pyrene, Fluoranthene, Phenanthrene) were present in the soil and groundwater at levels exceeding the NYSDEC Cleanup (TAGM) Criteria in effect at the time.

Remediation of the site's soil, via excavation and removal to a permitted off-site recycling facility for proper disposal has been completed. A total of 6,027 tons of soil was removed. 84 tons of clean soil were disposed at Evergreen Recycling of Corona, 2,303 tons of contaminated soil were disposed at Clean Earth of Philadelphia and 3,640 tons of contaminated soil were disposed at Clean Earth of Carteret. Post-excavation confirmatory or end-point soil samples were collected. See Figure 4 for the sampling locations and Table 1 for the analytical results.

The excavation area was backfilled with clean fill. The backfill material consisted of recycled concrete and stone. The clean backfill was used as subsurface material (thickness of 7" – 8") in the excavated area and behind site shoring.

A passive bailing system was installed in four monitoring wells equipped with a time pump-off device to remove any free product that may enter the monitoring wells; all free product within the monitoring wells has been removed.

Piping for a sub-slab depressurization system was installed beneath the basement floor during the building's construction in the event it was deemed necessary to remove residual soil vapors that may exist beneath the basement floor.

To address the residual contamination after the previous remediation, an on-site and off-site remedial investigation work plan was submitted to and approved by NYSDEC. All remedial investigation work plan data have been collected and the findings are presented in the following sections.

3.0 RECENT OFF-SITE FIELD INVESTIGATION RESULTS

3.1 Soil

A total of ten (10) soil samples were collected on 18th Street, Astoria Blvd., and 27th Avenue on July 25 - 27, 2006 (see Figure 5 – OS-DP1 through OS-DP10). Prior to any intrusive work, utilities clearance was performed. Samples were obtained from soil borings using direct-push sampling equipment. Samples were collected at depth of 12 ft. to 20 ft. to identify the horizontal extent of contamination. Each soil sample was collected as a 5 ft. core retrieved in a 5 ft. long sampling tube with an acetate liner. The sampling equipment was decontaminated prior to the collection of each sample with Liquinox detergent and rinsed thoroughly with DI water. Decontamination of the sampling equipment prevented cross-contamination between sampling locations and ensured that representative soil samples were collected from each location.

The acetate liner was cut opened and the soil samples were screened in the field for the presence of volatile organic compounds with a photo-ionization detector (PID), a Mini Rae 2000. Prior to use, the PID instrument was calibrated and the screening procedure was as follows:

1. A sample of soil was carefully collected with minimal disturbance, which could cause the loss of volatile constituents. Sample collection was accomplished by half-filling a Ziploc® bag from the split spoon.

2. The Ziploc® bag was then zipped close.

3. The probe of the portable PID was inserted into the Ziploc® bag through an unzipped corner of about one inch. The maximum meter response was recorded (within the first 2-5 seconds).

All PID readings were logged (See Table 2). Based on field screening results the samples containing the highest PID readings were carefully transferred into laboratory provided containers. The samples collected in the containers were preserved with ice in a cooler to maintain a temperature of 4°C and submitted to Accredited Labs for STARS 8021 and 8270 analysis. Samples were labeled in the field with job name, number, sample identification number, sampling date and analysis required.

Chain of custody forms accompanied all samples in accordance with standard quality assurance and quality control measures.

A Data Usability Summary Report (DUSR), prepared in accordance with the NYSDEC "Draft DER-10 - Technical Guidance for Site Investigation and Remediation", dated December 2002, is provided in Appendix B.

All unsaturated zone soils were observed to be silt and clay.

Table 3 presents the analytical results for the soil samples (see Appendix D for the laboratory reports).

Table 3 also provides a comparison with 6 NYCRR Part 375 soil cleanup objectives and TAGM 4046 Recommended Soil Cleanup Objectives for substances not covered by Part 375. While this site is not in the Brownfields Program, but in the Voluntary Cleanup Program, the Part 375 soil cleanup objectives were utilized as they are a general requirement of all NYSDEC remediation programs. The residential soil cleanup objectives were utilized because residential apartments are at the site.

3.2 Groundwater

Groundwater samples were obtained at the same locations where the soil samples were obtained on July 25 – 27, 2006 (OSDP-1 through OSDP-10), using

direct-push technology and a two-foot mill slotted point. For each sample the slotted point was driven to 5 ft. below the water table. Polyethylene tubing was inserted down the rod to the depth of the slotted point. The samples were then extracted through the polyethylene tubing utilizing a check valve. Prior to sampling the rod was purged 3 to 5 times the approximate well volume as per EPA recommendations, and the sample was collected using a check valve and stored in 40 ml vials. All collected samples were placed in a cooler containing ice for preservation at 4° C and transported with a chain of custody documentation for laboratory analysis. All samples were submitted to Accredited Labs for EPA Method 8260 and EPA Method 8270 analysis.

Table 4 presents the analytical results for the groundwater samples (See Appendix D for the laboratory reports). No free phase product has been encountered within onsite monitoring wells since March 2007.

All saturated zone soils from which the groundwater samples were obtained were silt and clay.

3.3 Soil Vapor

Soil vapor samples were collected July 25 – 27, 2006 at the same 10 locations where soil and groundwater samples were obtained (OSDP-1 through OSDP-10).

Soil vapor samples were collected from the unsaturated zone, at all soil boring locations, using direct-push equipment. The samples were collected through a temporary slotted point installed into the soil boring and were removed via pre-evacuated summa canisters and screened utilizing a PID. Samples were submitted to Princeton Analytical for volatile organic compound analysis according to EPA method TO-15.

All borings were completed using direct-push equipment. to the target depth of 2 ft. below the 1810 building basement floor which is 12 ft. below street level.

Once the target depth was achieved, the rods were pulled up one foot, exposing the void space, and the sampling apparatus was set up in the borehole. Soil vapor sampling was then performed utilizing the following procedural steps:

a. New Teflon-lined tubing equipped with a threaded stainless steel fitting was attached to a disposable soil vapor drive point to prevent infiltration of the atmospheric air present at land surface directly above the soil boring (ambient air).

b. A clay seal was then placed at land surface in the annular space between the Geoprobe® rods and the concrete surface, as well as between the tip of the rods and the sample tubing.

c. The sampling tubing was connected to a 'T' connector three-way valve assembly, with one end of the 'T' connector leading to a vacuum pump and the other end leading to a pre-evacuated summa canister with a calibrated regulator.

d. The soil vapor sample tubing was then be purged of approximately two volumes of the sample tubing using a vacuum pump set at a rate of approximately 0.2 liters per minute.

e. A tracer gas (i.e. helium) was used to enrich the atmosphere in the immediate vicinity of the sampling location where the sample tubing intersected the ground surface in order to test the borehole seal and verify that ambient air was not inadvertently drawn into the sample. The tracer gas identified above was used to verify that the ambient air did not dilute the soil vapor samples collected. A plastic container (i.e. bucket) was placed over the boring with a soft seal and the helium was injected into the bucket to enrich the interior of the bucket with the tracer gas. A tedlar sampling bag was attached to the pump and filled with the purge vapor as

the tracer gas was added to the bucket. Both the purge volume from the sample tubing and the helium-enriched gas within the bucket were screened for the tracer gas. The tracer gas level was measured utilizing a gas check meter, which measures the rate of the helium leakage at the land surface. When the screening results showed that the rate of helium detected in the sampling tubing was greater than 20 percent of the helium detected in the enriched area (i.e., within the bucket), the seals around the sampling equipment were reset and the sample rods were purged again until the tracer gas no longer was detected at levels greater than 20 percent of the enriched area located directly above the borehole.

f. Following the purging and tracer gas verification steps, the valve leading to the pump was closed and the pump was turned off, and the soil vapor was directed to the summa canister for sample collection, using the calibrated summa canister regulator to restrict the sample collection rate to 0.2 liters per minute or less.

g. Once the samples were collected, the soil vapors were screened with a PID and gas meter for VOCs, oxygen and carbon dioxide to assist in determining soil vapor and natural attenuation conditions. VOC screening concentrations were measured using a PID, calibrated daily to a 100 parts per million (ppm) isobutylene standard. During completion of the fieldwork, the field screening data was evaluated by following a strict quality assurance and quality control protocol.

Upon completion of the sample collection and screening steps, the Geoprobe® rods and sampling apparatus were extracted from the borehole and decontaminated with Liquinox detergent.

The sampling team members avoided actions which would cause sample interference in the field (e.g., fueling vehicles, using permanent marking pens, and wearing freshly dry-cleaned clothing or personal fragrances).

Appropriate QA/QC protocols were followed for sample collection and laboratory analysis, such as use of certified clean sample devices, meeting sample holding times and temperatures, sample accession, chain of custody, etc.

Samples were delivered to Princeton Analytical as soon as possible after collection. In addition, laboratory accession procedures were followed including field documentation (sample collection information and locations), chain of custody, field blanks, field sample duplicates and laboratory duplicates, as appropriate.

Duplicate and/or split samples were collected in accordance with the requirements of the sampling and analytical methods being implemented.

Table 5 presents the soil vapor analytical results (see Appendix D for the laboratory reports).

3.4 Outdoor Air Quality

Outdoor air quality samples were obtained on December 14, 2006 after the results of the off-site sub-surface soil vapor data were reviewed and consultation with NYSDEC. 24-hour sampling and TO-15m analyses were performed. The analytical results are provided in Table 6. One sample was obtained on 18th Street, in the vicinity of OSDP-2, several feet above the sidewalk surface (sample AQ5). Another sample was obtained on the second floor balcony of Building B, to represent background outdoor air quality (sample AQ-BG). Figure 6 shows the air quality sampling locations.

4.0 RECENT ON-SITE FIELD INVESTIGATION RESULTS

4.1 Groundwater

Groundwater samples beneath the building slab were obtained from the 17 existing onsite monitoring wells on July 31, 2006 (see Figure 5 - MW-1 to MW-17).

Prior to sampling, the wells were purged 3 to 5 times the approximate well water volume per EPA recommendations, and the sample was collected using a pump and check valve and stored in 40 ml vials. All collected samples were placed in a cooler containing ice for preservation at 4° C and transported with a chain of custody documentation for laboratory analysis. All samples were submitted to Accredited Labs for EPA Method 8260 and EPA method 8270 analysis.

As part of data quality assurance program, trip and field blank samples were obtained.

Table 7 presents the groundwater analytical results (see Appendix D for the laboratory reports).

4.2 Soil Vapor

Sub-slab soil vapor samples were obtained on July 28, 2006 from existing locations SV1 through SV7 shown in Figure 5.

Soil vapor samples were collected from the unsaturated zone at sampling points SV! Through SV7 that had been installed in the floor slab. The samples were collected 2 ft. below the finished basement floor through direct-push temporary slotted points hand driven into the soil. Vapor samples were collected by the same basic procedure described in Section 2.3. Samples were submitted to Princeton Analytical for volatile organic compound analysis according to EPA method TO-15.

Table 8 presents the soil vapor results (see Appendix D for the laboratory reports).

4.3 Indoor Air Quality

Indoor air quality samples were obtained on December 15, 2006 after the results of the on-site sub-slab soil vapor data were reviewed and consultation with NYSDEC. 24-hour sampling and TO-15m analyses were performed. The analytical results are provided in Table 6. Two samples were obtained in the 1810 basement building (samples AQ1 and AQ2). Two samples were obtained in the first floor and basement of Building A (samples AQ3 and AQ4, respectively). Figure 6 shows the air quality sampling locations.

5.0 ANALYSIS OF RECENT INVESTIGATION RESULTS

5.1 Off-site Soils

Table 3 shows that there were no exceedances of the Part 375 residential soil cleanup objectives and TAGM 4046 Recommended Soil Cleanup Objectives for substances not covered by Part 375.

OSDP-2 and OSDP-4 are just west of on-site groundwater monitoring well locations W-15/W-16 and W-12, respectively. The soils around W-15/W-16 were very contaminated and were removed from that area approximately 10 years ago. Because no compounds exceeded the Part 375 soil cleanup objectives at OSDP-2, it probably indicates that contamination removal during excavation was complete. W-12 had contained 3 ft. to 4 ft. of free product but presently contains no free product after bailing of free product was performed over the last 1½ years. No soil contamination at OSDP-4 exceeding the Part 375 soil cleanup objectives indicates that migration of contamination from W-12 was limited.

These observations indicate that soil contamination near the known former sources was limited in extent due to the low permeability of subsurface soils.

5.2 Off-site Groundwater

Table 9 shows that exceedances of groundwater standards occurred at OSDP-2, 3, 4, 5, and 6. OSDP-2 was observed to have a sheen. OSDP-3, 4, 5, and 6 contained trace (low part-per-billion) levels of contamination. OSDP-1, 7, 8, 9, and 10 did not exhibit exceedances of groundwater standards. Since OS-DP9 is upgradient of the general direction of groundwater flow indicated in Figure 5, the one detected compound above the groundwater standards (12 ug/l MTBE) may be from another source which has not been identified...

The data indicate that the off-site groundwater contamination exists along 18th Street. The north-south extent of groundwater contamination has been defined and is limited to OS-DP2, 3, 4, 5, and 6. The east-west extent of groundwater contamination along 18th Street has not been defined; however, there are buildings west of the investigation locations.

5.3 Off-site Soil Vapor

To put some perspective on the soil vapor results, Table 10 shows a comparison of off-site soil vapor concentrations to the outdoor air background levels and Air Guideline Values contained in the New York State Department of Health (NYSDOH) "Guidance for Evaluating Soil Vapor Intrusion in New York", October 2006. As stated in the NYSDOH guidance, there are no standards or guidance values for volatile organic compounds (VOCs) in sub-surface vapors, and background air quality values are not standards. The comparison of soil vapor concentrations with air quality is intended to be a qualitative assessment of the potential for air quality impacts due to soil vapor intrusion.

The perspective gained from this comparison is that soil vapor VOC concentrations were greater than outdoor background air quality at all locations (OSDP-1 through 10), indicating potential air quality impacts due to soil vapor intrusion and potential need for remediation. The comparison also indicates that the horizontal extent of elevated soil vapor concentrations has not been defined.

Around Building A, a comparison of SV4 (Table 14) and OS-DP4 (Table 10) indicates similar soil vapor concentrations. A comparison of SV2 (Table 14) and OS-DP4 (Table 10) indicates soil vapor concentrations one to two orders of magnitude higher at SV2 on-site than OS-DP4 off-site. Based on this, it appears that the 1810 site is a source of off-site soil vapor contamination around Building A, with the exception discussed below.

There were exceedances of chlorinated VOCs (methylene chloride at OSDP-2, 3, and 4; tetrachloroethylene at OSDP-5, 6, 7, and 8; 1,1,1-trichloroethane at OSDP-2, 4, and 6; 1,2-dichloroethane at OSDP-8; and TCE at OSDP-6 and 7). However, while garage operations may have involved solvents for part and tool cleaning, none of these compounds were detected in the on-site groundwater (see Section 4.5). Only one of the chlorinated VOCs detected off-site (1,2-dichloroethane) was also detected on-site (See Section 4.6). Therefore, the chlorinated VOCs cannot be considered attributable to the 1810 site. Tetrachloroethylene ("perc") is typically used in dry cleaning operations.

5.4 Outdoor Air Quality

As stated above, NYSDOH recommends that soil vapor samples be compared to background outdoor air levels as a qualitative assessment of the potential for air quality impacts due to soil vapor intrusion. Based on the assessment cited above, air quality samples were obtained. An air quality sample was obtained on 18th Street, in the vicinity of OSDP-2 several feet above sidewalk level (see Figure 6). In addition, a background outdoor air quality sample was obtained on

the second floor balcony of Building B. Table 11 shows the substances detected in the 18th St. outdoor air quality sample that were at greater levels than those for the outdoor background air quality sample. Twelve substances were not at comparable levels with the outdoor background air quality data (i.e., they were at least an order of magnitude greater), indicating outdoor air quality impacts.

However, the presence of the dichlorobenzenes in outdoor air but not in the soil vapor, especially the elevated level of 1,4-dichlorobenzene, indicates the presence of a different source of gasoline-related substances in outdoor air, which has not been identified.

5.5 On-site Groundwater

The third round of sampling of the 17 wells in the basement of 1810 27th Avenue was performed. Table 12 shows that exceedances of groundwater standards occurred at W-2, 3, 5, 6, 7, 10, 11, 12, 13, 14, 15, and 17. W-1, 4, 8, 9, and 16 did not contain exceedances (the 10 ug/l m&p xylenes detected were also present in the field and trip blanks). W-5, 10, 15, and 17 contained trace (low part-per-billion) levels of contamination. W-7, 13, and 14 contain some free product which continues to be removed by bailing. W-12 originally contained some free product but no longer does.

Table 13 provides a comparison of the results from the previous two groundwater sampling events (3/16/05 and 11/1/05) and the latest (7/31/06) event described above and shown in Table 12. Where comparisons can be made, the data generally indicate that contaminant levels have decreased with time, usually dramatically. A reasonable explanation for this is that, because the saturated zone consists primarily of silt and clay, the samples represent contamination that diffused to the monitoring locations over time and, with little recharge at these monitoring points, purging and sampling of the wells has acted to decrease contaminant levels.

As referenced in Section 4.3, no chlorinated VOCs were present in on-site groundwater, indicating that on-site groundwater could not be the source of chlorinated VOCs detected in off-site soil vapor.

Figure 7 shows the on-site groundwater contours and indicates no real water table gradient, except to the northwest where native silt and clay soils were excavated and backfilled with clean sand approximately 10 years ago. This, and the fact that W-15 contains minor contamination and W-16 contains no contamination despite the high levels of contamination immediately upgradient in W-14, provides more evidence that groundwater and contaminant migration is insignificant beneath the slab.

5.6 On-site Soil Vapor

Soil vapor samples were obtained from 7 locations in the basement of 1810 27th Avenue. To puts some perspective on the sub-slab vapor results, Table 14 shows a comparison of the sub-slab soil vapor concentrations to indoor air background indoor contained in the New York State Department of Health (NYSDOH) "Guidance for Evaluating Soil Vapor Intrusion in New York", October 2006. As stated in Section 4.3, NYSDOH guidance indicates that there are no standards or guidance values for volatile organic compounds (VOCs) in sub-surface vapors, and background air quality values are not standards. The comparison of soil vapor concentrations with air quality is intended to be a qualitative assessment of the potential for air quality impacts due to soil vapor intrusion.

The perspective gained from this comparison is that sub-slab vapor concentrations are greater than indoor background air quality at all locations (SV1 through 7), indicating potential air quality impacts due to soil vapor intrusion and potential need for remediation.

A comparison of on-site soil vapor BTEX concentrations along 18th Street, at SV1, 2, 3 and 4 and off-site at OSPD-4, 5, 6, 7, and 8, indicates that on-site concentrations were higher than those off-site. Based on this, the 1810 site is the source of the off-site soil vapor contaminants along 18th Street. However, as referenced in Section 4.3, the only chlorinated VOC detected on-site was 1,2-dichloroethane at 2.9 ug/m^3 at SV2 on-site vs. 34 ug/m^3 at OSDP-8. The higher off-site concentration suggests that the source is off-site and migrating on-site. The elevated tetrachloroethylene off-site soil vapor concentrations, which are clearly not attributable to the 1810 site, are also at OSDP-8 (and in the vicinity in OSDP-5, 6, and 7 as well). In summary, based on soil vapor data it appears that the 1810 site is the source of off-site soil gas contaminants except for the off-site chlorinated VOCs. Apparently there is another source of soil and/or groundwater contamination off-site.

On the eastern portion of the 1810 building near Building B, a comparison of on-site soil vapor BTEX concentrations at SV6 and 7 and off-site at OSPD-9 and 10 indicates that on-site concentrations were lower than those off-site (specifically for benzene and toluene). This indicates that there is another source of soil and/or groundwater contamination off-site contributing soil vapor contamination that is migrating on-site, which has not been identified, and that 1810 may not be the source of soil vapor contamination in whole or in part.

5.7 Indoor Air Quality

NYSDOH guidance recommends that indoor air quality be compared to indoor background guidance levels as a qualitative assessment of potential air quality impacts due to soil vapor intrusion, with no further action required if indoor air quality is comparable to guidance values. Table 15 shows the substances detected in indoor air quality samples collected in the 1810 basement (two samples) and Building A (one sample in the basement and one on the first floor). Fifteen substances in the 1810 basement and two substances in Building A (both in the basement and in the first floor) were at greater levels than the background guidance levels (i.e., they were at least an order of magnitude higher).

However, a comparison of the 1810 basement levels (Table 15) and 18th St. outdoor air quality (Table 11) indicates, with very few exceptions, the same air quality (especially at 1810 location AQ2). This indicates that the 1810 basement air quality impacts are due to outdoor air quality and not sub-slab conditions.

5.8 Summary of Observations

Off-Site Soils

- No locations exceeded the Part 375 commercial soil cleanup objectives or TAGM 4046 Recommended Soil Cleanup Objectives for compounds not covered by Part 375.

Off-Site Groundwater

- Off-site groundwater exceeding the groundwater standards was located along 18th Street. The north-south extent of groundwater contamination along 18th Street has been defined and is limited to locations OSDP-2, 3, 4, 5, and 6. The east-west extent of groundwater contamination along 18th Street has not

been defined; however, buildings are located west of the locations investigated.

- MTBE exceeding the groundwater standard was detected in a well east of 1810 and upgradient of the general direction of groundwater flow. MTBE, which is significantly more soluble than other gasoline-derived substances and typically migrates further from its source, was the only substance detected at this location. These factors indicate another off-site source of groundwater contamination which has not been identified.

Off-Site Soil Vapor

- A comparison of off-site soil vapor concentrations with outdoor background air quality guidance values indicated potential air quality impacts due to soil vapor intrusion and potential need for remediation. Since all off-site soil vapor locations had concentrations higher than outdoor background air quality guidance values, the horizontal extent of potential air quality impacts was not defined.

    - Along 18th Street, lower off-site soil vapor concentrations than on-site concentrations indicate that the 18-10 site is a source of off-site soil vapor contamination; however, the off-site soil vapor chlorinated VOCs are not attributable to the 18-10 site and there is apparently another source of soil and/or groundwater contamination off-site which has not been identified.

    - On the eastern portion of the site, the off-site soil vapor concentrations were higher than the on-site concentrations (specifically for benzene and toluene), indicating that there is apparently another source of soil and/or groundwater contamination off-site which has not been identified.

Off-Site Air Quality

- In an outdoor air sample on 18th St., twelve substances were not at comparable levels with the background air quality sample (i.e., they were at least an order of magnitude greater), indicating outdoor air quality impacts.

- However, the major outdoor air contaminants detected, those two orders of magnitude above the background outdoor air quality guidance values (toluene, acetone, MEK, and 1,4-dichlorobenzene), were not present in the off-site soil or groundwater. This suggests that off-site groundwater and soil contamination is not the source of outdoor air quality impacts and there is another source(s) of outdoor air contamination that has not been identified. In addition, this indicates that remediation of off-site soil and groundwater would not improve outdoor air quality.

On-Site Groundwater

- The third round of sampling of the 17 on-site wells in the basement of 1810 27th Avenue indicated that groundwater standards were exceeded in 12 wells, 4 of which contained trace (low part-per-billion) levels and 3 of which contained some free product. One well that previously contained free product did not in this round of sampling.

- On-site groundwater contaminant migration is insignificant. Evidence of this includes:

  1) On-site groundwater contaminant concentrations have typically decreased over the three sampling events on 3/16/05, 11/1/05, and 7/31/06, usually dramatically. This is probably due to the fact that the saturated zone is silt and clay and the samples represent contamination that has diffused to these

locations over time. The purging and sampling is probably acting to remove contaminant levels at these locations.

2) The on-site groundwater table contours indicate no real gradient across the site, except on the northwest where native materials were replaced by clean sand when contamination was excavated from this area.

3) Well W16, located in the former excavation area and just west of highly contaminated W14 in native materials, is not contaminated. W15, also located just down gradient of W14, contains insignificant contaminant levels (Ethylbenzene 14 ppb, m,p-Xylene 6 ppb and Naphthalene 3 ppb).

On-Site Soil Vapor

- A comparison of on-site sub-slab soil vapor concentrations with indoor background air quality guidance values indicated potential indoor air quality impacts due to soil vapor intrusion and potential need for remediation at all 7 locations.

- However, as noted under Off-Site Soil Vapor: 1) along 18th Street the off-site soil vapor chlorinated VOCs are not attributable to the 18-10 site, indicating another source of soil and/or groundwater contamination off-site which has not been identified; 2) on the eastern portion of the site, the off-site soil vapor concentrations were higher than the on-site concentrations (specifically for benzene and toluene), indicating another source of soil and/or groundwater contamination off-site which has not been identified.

On-Site Air Quality

- Indoor air quality samples collected in the 1810 basement (two samples) and Building A (one sample in the basement and one on the first floor) indicated that 15 substances in the 1810 basement and two substances in Building A (both in the basement and in the first floor) were not comparable to the

background guidance levels (i.e., they were at least an order of magnitude higher).

- A comparison of the 1810 basement levels and sub-slab groundwater contaminants indicates that toluene, acetone, 1,4-dichlorobenzene, and MEK were present in indoor air at two orders of magnitude higher than background air quality guidance values; however, only toluene and acetone were present in sub-slab groundwater. This indicates that sub-slab contamination is not responsible for all the indoor air quality impacts.

- In addition, the 18th St. outdoor air quality is, with very few exceptions, the same as the 1810 basement air quality, indicating that at least some of the 1810 basement air quality impacts (1,4-dichlorobenzene and MEK) are due to outdoor air quality and not sub-slab contamination.

- As discussed under off-site air quality, outdoor air quality impacts are not due to off-site 1810 soil and groundwater contamination as these four contaminants are not present in off-site soil and groundwater. All of this evidence indicates that outside air quality impacts, not due to 1810 off-site soil or groundwater contamination but from another source(s) that has not been identified, are also responsible for indoor air quality impacts. The exceptions may be toluene and acetone, which were found in sub-slab groundwater. The sub-slab toluene may be the source of toluene in outdoor air.