



REMEDIAL INVESTIGATION REPORT & CLEANUP PLAN

FORMER LEHIGH STRUCTURAL STEEL

CITY OF ALLENTOWN, LEHIGH COUNTY, PENNSYLVANIA

MARCH 9, 2015

Prepared by:

A handwritten signature in blue ink that reads 'Elizabeth K.T. Schamberger, P.G.'.

Elizabeth K.T. Schamberger, P.G.
Moonstone Environmental, LLC
1150 Glenlivet Drive, Suite C-31
Allentown, PA 18106

CERTIFICATION BY PROFESSIONAL GEOLOGIST

for

REMEDIAL INVESTIGATION REPORT & CLEANUP PLAN
FORMER LEHIGH STRUCTURAL STEEL
CITY OF ALLENTOWN, LEHIGH COUNTY, PENNSYLVANIA

MARCH 9, 2015

By affixing my seal to this document, I am certifying that the information is true and correct. I further certify I am licensed to practice in the Commonwealth of Pennsylvania and that it is within my professional expertise to verify the correctness of the information.

Elizabeth K.T. Schamberger, P.G.

Elizabeth K.T. Schamberger (PG- 003970)
Signed and sealed this day, March 9, 2015.



EXECUTIVE SUMMARY

The Site consists of seven parcels located in the City of Allentown, Lehigh County, Pennsylvania. The Site is located north and south of the Tilghman Street Bridge on the west bank of the Lehigh River, between the river and North Brick Street. The overall acreage of the Site is approximately 26 acres. The Site itself is level, but topography rises steeply up a hillside to the west, and drops steeply down a river bank to the Lehigh River to the east.

The Site and surrounding properties are, and historically have been, used primarily for industrial activities. By 1885, the Site was developed as a steel fabrication facility. It operated as such under various names until 1989, when Lehigh Structural Steel ceased production there. The Site has since been occupied by a variety of commercial and industrial tenants, including several who handle or handled hazardous materials. The future use of the Site includes residential and recreational components (apartments and a public walkway) in addition to commercial use (offices, retail, restaurants, etc.).

Based on the current and past use of the Site, soil and groundwater were investigated via GeoProbe™ soil borings, monitoring wells, and temporary well points. The investigation identified detectable volatile organic compounds (VOCs), semivolatile organic compounds (SVOCs), pesticides, and heavy metals in soil and groundwater. Because the Site's anticipated end use includes a residential component, concentrations of the detected analytes were compared to the Pennsylvania Department of Environmental Protection's (PADEP's) Residential Statewide Health Standard.

Several VOCs, SVOCs, and metals were present in soil and groundwater at concentrations exceeding the Residential Statewide Health Standard. Since the Residential Statewide Health Standard could not be attained, engineering and institutional controls will be used to demonstrate attainment of the Site-Specific Standard using a combination of active remediation (targeted excavation and disposal of petroleum-impacted soil) and pathway elimination. Engineering controls will consist of capping the entire Site, and institutional controls will include a deed notice/environmental covenant to maintain the engineering controls and prohibit use of on-site groundwater.

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1. PUBLIC NOTIFICATIONS

Copies of the public and municipal notifications are included in Appendix A, along with proof of delivery and/or publication.

1.1. Notice of Intent to Remediate

Public notification for the Notice of Intent to Remediate (NIR) was published in The Morning Call, a local newspaper, on February 11, 2013. Publication initiated the 30-day public comment period. A municipal notice of NIR submission was sent to the City of Allentown via certified mail, return receipt requested. The City received the notice on February 7, 2013.

There was no request for public involvement during the 30-day public comment period.

1.2. Report Submission

Public notice for submission of this *Remedial Investigation Report & Cleanup Plan* was scheduled for publication in the March 12, 2015 edition of The Morning Call. A municipal notice of report submission was sent to the City of Allentown via certified mail, return receipt requested. The City received the notice on March 12, 2015.

2. SITE DESCRIPTION

2.1. Physical Description

The Site consists of seven parcels located in the City of Allentown, Lehigh County, Pennsylvania (Figure 1). The Site is located north and south of the Tilghman Street Bridge on the west bank of the Lehigh River, east of North Brick Street. The parcels included in the Site are listed below, and are indicated on Figure 2. The overall acreage of the Site is approximately 26 acres.

Tax Assessment Records for Properties Included in the Site Former Lehigh Structural Steel City of Allentown, Lehigh County, Pennsylvania				
Parcel ID on Figures	Assessment Parcel ID No. (PIN)	Size	Property Address	Map Tile
A	<i>Parcel A is not part of the Act 2 Site. Its Parcel ID was reserved so that subsequent Parcel ID references (Parcels B-H) would be consistent with previous reporting.</i>			
B	640747522290-1	3.45 Ac.	N Brick St. Rear	G09NE3B-003-037
C	640746662165-1	4.13 Ac.	1 Furnace St.	G09NE3B-003-036
D	640746713805-1	4.5 Ac.	N Brick St. or 2 Furnace St.	G10NW4D-007-001
E	640745795680-1	1.26 Ac.	Furnace St. or 4 Furnace St.	G10NW4D-007-002
F	640745957064-1	9.83 Ac. (deed) 10.376 Ac. (tax)	W Sycamore St. or 4 Furnace St. Rear	G10NW4D-001-001
G	640745538601-1	164' x 216' irreg	3 W Sycamore St.	G09NE3C-020-001
H	640745552838-1	96' x 220'	6 W Tilghman St.	G09NE3C-016-003

The Site itself is level due to historical fill placement along the west bank of the Lehigh River. West of the Site, topography rises steeply up a hillside. To the east, topography drops steeply down the riverbank to the Lehigh River. Topography is indicated on Figure 3.

2.2. Historical Site Use

The Site has historically been used for industrial activities. By 1885, the Site was developed as a steel fabrication facility. It operated as such under various names until 1989, when Lehigh Structural Steel ceased production there. The Site has since been occupied by a variety of

commercial and industrial tenants, including several who handle or handled hazardous materials. The areas surrounding the site are and historically have been a mix of industrial, commercial, and residential use.

2.3. Current Site Use

The Site is densely developed with large steel frame and/or concrete block buildings, many of which are in poor condition. Photographs from the site characterization are provided in Appendix B. During the site characterization process (2007-2012), the Site had multiple commercial and industrial occupants, including two cryogenic tank manufacturing/refurbishing companies, a tire warehouse, a heavy metal burning and scrap facility, a fencing warehouse, two storage warehouses, and two heavy vehicle maintenance shops. Rail lines access the Site from the west side, with numerous spurs entering the property. Due to the presence of a cryogenic tank manufacturing/refurbishing companies, there are large tank farms located on the north and south ends of the site. The tanks located in these staging and storage areas are empty.

Two Site buildings were demolished in February 2013, and additional buildings south of the Tilghman Street bridge were demolished in 2014 (Figure 4) to make way for the first phase of redevelopment.

2.4. Redevelopment Plans

The Waterfront, consisting of 1,000,000 square feet of space, is projected to be built-out over a ten-year period beginning in 1Q 2015.

Phase I of the project has already begun. Phase I primarily encompasses the area south of the Tilghman Street bridge and includes some site infrastructure through Phase II, the initial phase of the public walkway along the river, a community plaza, three commercial office buildings, a residential apartment complex, and a parking garage.

Phase II will include all buildings and land north of the Tilghman Street bridge, which includes three commercial office buildings, two residential apartment complexes and one parking garage.

3. PREVIOUS ENVIRONMENTAL REPORTS

3.1. 2007 Phase I ESA

Moonstone completed a Phase I Environmental Site Assessment (ESA) for the subject property in 2007 to determine which parcels (if any) would require additional environmental investigation. The work was performed by Moonstone under a contract with the Lehigh Valley Economic Development Corporation (LVEDC), using a United States Environmental Protection Agency (USEPA) Brownfields Assessment Grant that was awarded to LVEDC. Appendix C contains the executive summary and figures from the 2007 Phase I ESA.

Based on the findings of the 2007 Phase I ESA, Moonstone performed a limited Phase II ESA in 2007 to investigate potential areas of concern.

3.2. 2007 Limited Phase II ESA

Moonstone’s Limited Phase II ESA consisted of 22 soil samples from 15 soil boring locations at four areas of potential environmental concern (APECs). Figure 5 presents the boring locations on a historical site plan to show the areas of concern (frequently historical sources) being investigated.

Moonstone Soil Boring Summary			
APEC # : Name	# Soil Borings	# Soil Samples	Description of APEC
01 : Former USTs	6	6	Six former underground storage tank (UST) locations.
02 : ASTs in Bldg. #2	2	2	Two existing aboveground storage tanks (ASTs) that were not stored in secondary containment.
03 : RediStrip Facility	2	4	Floor and ground surface around the open dip tanks at the RediStrip (a.k.a. Kwik Strip) facility.
04 : Site-Wide Soil	5	10	Potential site-wide impacts from historical use.

Moonstone collected five grab samples of groundwater from temporary well points at existing soil boring locations (UST-G, SS-2, SS-3, SS-4, SS-5), but did not install any permanent groundwater monitoring wells. The locations of the temporary well points are indicated on a historical site map on Figure 5. The well points were installed to evaluate a) impacts from former USTs where soil borings indicated a release, and b) downgradient (point of compliance) groundwater quality.

The detailed findings of Moonstone's limited Phase II ESA are presented in Section 4: Site Characterization, and a copy of the report is located in Appendix D. The findings indicated that additional investigation of the site was warranted, and that the scope of work would exceed the grant funding available under Moonstone's contract with LVEDC. LVEDC assisted the prospective purchaser of the Site with obtaining a Targeted Brownfields Assessment Grant from the USEPA to further characterize the Site. The Targeted Brownfields Assessment was completed by USEPA's contractor, Tetra Tech Inc. in 2009.

3.3. 2009 Phase II ESA

Tetra Tech Inc. (Tetra Tech) performed additional investigation of the Site in 2009 under a USEPA Targeted Brownfields Assessment Grant. Tetra Tech's Phase II ESA consisted of 103 soil samples from 51 soil boring locations. Boring locations are indicated on Figure 6.

Tetra Tech also installed eight permanent monitoring wells at the Site and performed two rounds of groundwater sampling. Tetra Tech's monitoring well locations are indicated on Figure 7. Tetra Tech reported their findings in a report entitled "Final Trip Report for the Former Lehigh Structural Steel Site Groundwater and Soil Investigation, Allentown, PA," dated May 29, 2009. The details of Tetra Tech's Phase II ESA are presented in Section 4: Site Characterization. A copy of their report is included in Appendix E.

Tetra Tech Soil Boring Summary			
APEC # : Name	# Soil Borings	# Soil Samples	Description of APEC
01 : Two former 3,000-gallon gasoline USTs	8	16	Former underground storage tank (UST) locations.
02 : Sussman Bros. UST Removals	2	3	Former USTs at adjacent parcel.
03 : Existing AST outside Acme Cryogenics	2	4	Aboveground storage tanks (ASTs) that were not stored in secondary containment.
04 : Historical acid/chloride use	10	20	Building #2, south of Tilghman Street bridge; cryogenics facility.
05 : RediStrip Facility	4	8	RediStrip (a.k.a. Kwik Strip) facility.
06 : Storm Drains	5	11	Exterior storm drains.
07 : Site-Wide Soil	20	41	Potential site-wide impacts from historical use.

3.4. 2012 Phase I ESA

Moonstone completed a new Phase I ESA for the subject property in 2012. The Phase I ESA was again completed under contract with LVEDC using USEPA Brownfields Assessment Grant funds. Appendix E contains the executive summary and figures from the 2012 Phase I ESA. The following Recognized Environmental Conditions (RECs) were identified:

- **Off-Site Sources of Contamination**

The PADEP conducted an inspection in April 2009 based on a complaint, reference Parcel ID 640747079685, which is west of and adjacent to Site parcel A. During the inspection, composite samples from the adjacent parcel were taken and analyzed for Polychlorinated Biphenyl (PCB), Semi-Volatile Organic Compounds (SVOC), Volatile Organic Compounds (VOC), and metals. Analysis of the samples showed concentrations of lead, arsenic, iron, and benzo(a)pyrene in amounts greater than the PADEP direct contact limits. Cadmium and PCB Aroclor-1016 were also detected at levels of concern. A resolution to these issues was not reached until June 2010. There is no evidence that the property owner instituted any of the recommendations discussed

during resolution. Therefore, it is possible that the conditions on the adjacent property have an impact on the Site property.

- **Releases from Former On-Site Underground Storage Tanks (USTs)**

Although the PADEP files indicate that all USTs were removed from the site in 1989, subsequent environmental assessments performed by Moonstone and Tetra Tech indicate that two 3,000-gallon gasoline USTs had leaked prior to their removal. Petroleum-related compounds were detected in soil and groundwater in this area at concentrations exceeding the PADEP Residential MSCs.

- **Releases from On-Site Aboveground Storage Tanks (ASTs)**

A 275-gallon diesel AST, a 100-gallon diesel AST, and a 275-gallon waste oil AST all located in Building #2 are not in secondary containment. In addition, the waste oil container in the Replacement Parts building was cited for not meeting design standards. All the ASTs showed staining and signs of minor spills. Based on general maintenance and housekeeping in these areas, these ASTs are considered a material threat of a release from spills.

- **Impacts to Groundwater**

Groundwater collected by Moonstone (2007) and Tetra Tech (2009) near two former 3,000-gallon USTs contained petroleum-related compounds at concentrations exceeding the PADEP Residential MSCs. Moonstone also found several SVOCs exceeding the PADEP Residential MSCs for groundwater at a separate location (MW-2), and Tetra Tech found manganese and iron at concentrations exceeding the EPA Screening Level (SL) for tap water and/or groundwater.

- **Impacts from Historical Sludge Lagoon**

Drawings for the Acid Waste Treatment Plant for the Lehigh Structural Steel Company, dated December 4, 1947, indicate (in the notes section) that a sludge lagoon was located on the northwest section of the plant property. The exact location is not identified on the drawing, and it is unclear whether the lagoon was within the current Site boundaries. If the former lagoon is on-Site, it represents a potential pathway for regulated substances to enter the ground.

NOTE: This lagoon was later determined to be off-site, to the north.

- **Impacts from Historical Use of Acids and Chlorides**

Historical galvanizing operations at the Site, which ceased in 1978, reportedly used sulfuric acid, hydrofluoric acid, zinc ammonium chloride, and potassium chloride. Tetra Tech collected a total of twenty (20) soil samples from the galvanizing operations area. The samples were analyzed for Priority Pollutant List (PPL) metals, sulfide, sulfate, chloride, and corrosivity (pH). Tetra Tech reported that two shallow zone soil samples contained cadmium and lead at concentrations exceeding PADEP MSCs, which may be associated with fill material.

- **Heavy Metals in Soil**

Moonstone collected 10 soil samples from across the Site to characterize general soil conditions. Heavy metals antimony, arsenic, copper, and lead were found at concentrations exceeding the Residential and Non-Residential Statewide Health Standard (NR-SHS). In addition, Tetra Tech collected a total of 41 soil samples across the Site in November 2008. Tetra Tech reported that five of the 41 soil samples contained lead, cadmium, and/or zinc at concentrations exceeding the PADEP MSCs.

- **Releases to the Storm Water Drainage System**

Intake grates for the storm water system are located throughout the Site, indoors and outdoors, frequently in the middle of active areas (e.g., scrap yard, maintenance areas). In November 2008, Tetra Tech selected five storm drains for sampling based on their current accessibility and proximity to current and/or historical industrial activities. According to Tetra Tech, two of the 11 soil samples contained VOCs at concentrations exceeding the PADEP MSC. The VOCs detected were 1,2,4-trimethylbenzene and 1,3,5-trimethylbenzene.

3.5. 2012 Remedial Options Report

In December 2012, Moonstone prepared a Remedial Options Report for the Site (Appendix G). For soil, the site was conceptually divided into two separate areas: a public walkway, which was evaluated using risk assessment, and the remainder of the site, where pathway elimination (engineering and institutional controls) was evaluated. For groundwater, remediation was evaluated using pathway elimination.

For the public walkway, risk assessment successfully addressed all contaminants except lead, but it required that PADEP agree with the underlying exposure assumptions, some of which were debatable. For lead, development of a site-specific MSC was not considered feasible due to the constraints of the model used to develop the standard. Some degree of pathway

elimination was considered likely to remediate lead along the public walkway to PADEP's satisfaction.

For areas of the Site not associated with the public walkway, impermeable surfaces will act as a cap that both eliminates direct contact routes of exposure (i.e., inhalation, ingestion) and mitigates the soil-to-groundwater pathway by reducing infiltration of storm water. A Cleanup Plan for the Site will outline the types of capping that will be used at the Site and the types of institutional controls that will be used to maintain the pathway elimination.

Specifically, the risk assessment involved development of site-specific MSCs based on anticipated site-specific exposure scenarios. While risk assessment successfully addresses all contaminants except lead, it requires that PADEP agree with the underlying assumptions about exposure, some of which may be open to debate. For lead, development of a site-specific MSC is not considered a feasible option. Some degree of pathway elimination will likely be required to remediate the public walkway to PADEP's satisfaction.

3.6. 2013 Groundwater Sampling

On June 21, 2013, Moonstone conducted groundwater sampling at seven of the eight monitoring wells Tetra Tech installed on Site in 2008. Well MW-4, which was centrally located on the Site, could not be found due to significant piles of metal-bearing debris and soil associated with and on-site scrap metal facility. The 2013 groundwater sampling was performed to verify that groundwater quality had not changed significantly since the 2008 sampling performed by Tetra Tech. In addition, Moonstone had the wells professionally surveyed so a groundwater equipotential map could be developed for the 2013 sampling event. The results of the 2013 sampling event are presented in Section 4.4.4.

4. SITE CHARACTERIZATION

For the purpose of the Act 2 demonstration of attainment and the request for a Release of Liability, the “Site” consists of all seven (7) parcels listed in Section 2 and indicated on Figure 2 (parcels B-H).

Site characterization included sampling and analysis of soil and groundwater. Site characterization was completed in iterative steps from 2007 through 2013 by Moonstone and Tetra Tech, as summarized in the previous sections.

Moonstone issued a “Report of Findings, Former Lehigh Structural Steel Site,” dated July 5, 2007 (2007 Phase II) and Tetra Tech issued a “Final Trip Report for the Former Lehigh Structural Steel Site Groundwater and Soil Investigation,” dated May 29, 2009 (2009 Phase II). These reports summarized the findings of the Phase II investigations. Copies of these reports are included in Appendices D and E. Laboratory data reports received by Moonstone are presented in Appendix I.

4.1. Sampling Design and Methods

Based on the information obtained during previous environmental investigations of the site, and on intended use of the site for mixed residential and commercial purposes, areas of potential environmental concern were identified and investigated by Moonstone and Tetra Tech.

The methods Moonstone used to perform Phase II investigation were defined in Site-specific Sampling and Analysis Plans (SAPs) and in a Generic Quality Assurance Project Plan (QAPP) dated October 2006. The SAPs and the QAPP were approved by the United States Environmental Protection Agency (USEPA) prior to implementation and are included in Appendix H.¹ Monitoring well logs were not provided in Tetra Tech’s 2009 Phase II report, but a summary of the well construction is provided in Section 4.4.2. Soil boring logs from Moonstone and Tetra Tech are located in Appendix J.

¹ This project was completed using funds from a United State Environmental Protection Agency (USEPA) Brownfields Assessment Grant, granted to the Lehigh Valley Land Recycling Initiative (LVLRI, a division of the Lehigh Valley Economic Development Corporation), in Bethlehem, Pennsylvania..

The methods used by Tetra Tech were dictated by their contract with the EPA are described in their 2009 Phase II report, located in Appendix E.

4.2. Quality Assurance and Quality Control Samples

Moonstone collected quality assurance and quality control (QA/QC) samples to document the accuracy and reproducibility of the laboratory and field sampling techniques and protocols. The QA/QC results for blind duplicates are included in the data tables for comparison. Tetra Tech also collected QA/QC samples, as presented in their full report (Appendix E).

4.3. Soil

4.3.1. Moonstone 2007 Phase II Field and Laboratory Methods

During the 2007 Phase II, Moonstone collected a total of 22 soil samples from 15 soil boring locations. Soil borings were advanced with a four-foot long, two-inch diameter acetate-lined MacroCore™ to the desired depth interval using a truck-mounted GeoProbe™. The contents of each soil boring were screened with a photoionization detector (PID) at six-inch intervals, and inspected for soil attributes such as texture, odors, color, and staining, all of which were recorded in a field notebook. Soil samples collected for analysis from the MacroCore™ were transferred to laboratory-provided containers using a decontaminated stainless steel spoon. Filled sample containers were transferred to an ice-filled cooler and maintained at or below 4°C until remanded to the laboratory. Sample information was recorded on the sample container, in a field logbook, and on the laboratory's chain of custody form.

From each boring, at least one discrete soil sample was collected from the depth that appeared to contain the highest concentration of contaminants based on field screening observations such as odors, staining, and PID readings. If no evidence of a release was observed in the field, samples were collected at the sampler's discretion. A summary of the soil boring data is provided below. Moonstone's soil boring locations are indicated on Figure 5, and soil boring logs are located in Appendix J.

Samples were sent to TestAmerica Laboratories in King of Prussia, Pennsylvania, for analysis.

Moonstone Soil Sampling Summary			
APEC # : Name	# Soil Borings	Sampling	Analysis
01 : Former USTs	6	6 samples collected @ highest field indication of a release	5 for PADEP “short list” petroleum-related compounds; 1 for PADEP full list petroleum compounds
02 : ASTs in Bldg. #2	2	2 samples collected 0-2 ft bgs	1 for PADEP “short list” diesel compounds; 1 for PADEP “short list” used motor oil compounds
03 : RediStrip Facility	2	4 samples: collected one 0-2 ft bgs and one 2-15 ft bgs per soil boring	4 for pH; 2 (0-2 ft bgs) for PPL metals
04 : Site-Wide Soil	5	10 samples: collected one 0-2 ft bgs and one 2-15 ft bgs per soil boring	10 for VOCs, SVOCs, and PPL metals

PADEP = Pennsylvania Department of Environmental Protection
 VOC = Volatile Organic Compounds
 SVOC = Semi-Volatile Organic Compounds
 PPL = Priority Pollutant List

4.3.2. Tetra Tech 2009 Phase II Field and Laboratory Methods

A complete copy of Tetra Tech’s Phase II report is included in Appendix E. Tetra Tech’s 2009 Phase II consisted of 103 soil samples from 51 soil boring locations. Soil samples were collected in accordance with Tetra Tech SOP No. 005 “Soil Sampling” and Tetra Tech SOP No. 054 “Using the Geoprobe System”. Boring samples were taken from the shallow zone (0-8 bgs) or the deep zone (8-16 bgs). A summary of the soil boring data is provided below. Tetra Tech’s soil boring locations are shown on Figure 6 and soil boring logs are located in Appendix J.

Tetra Tech Soil Sampling Summary			
APEC # : Name	# Soil Borings	Sampling	Analysis
01 : Two former 3,000-gallon gasoline USTs	8	16 samples: collected one from the “shallow zone” and one from the “deep zone” per soil boring	16 for VOCs and total lead
02 : Sussman Bros. UST Removals	2	3 samples collected: 2 from “deep zones” plus one duplicate at a field-observed contaminant	3 for VOCs, SVOCs, and metals
03 : Existing AST outside Acme Cryogenics	2	4 samples: collected one from the “shallow zone” and one from the “deep zone” per soil boring	4 for VOCs
04 : Historical acid/chloride use	10	20 samples: collected one from the “shallow zone” and one from the “deep zone” per soil boring	20 for PPL metals, sulfides, sulfates, chloride, pH
05 : RediStrip Facility	4	8 samples: collected one from the “shallow zone” and one from the “deep zone” per soil boring	4 (shallow zones) for pH; 4 (deep zones) for pH, VOCs, and SVOCs, PCBs
06 : Storm Drains	5	11 samples: collected one from the “shallow zone” and one from the “deep zone” per soil boring, plus one blind duplicate	11 for VOCs, SVOCs, and PPL metals
07 : Site-Wide Soil	20	41 samples: collected one from the “shallow zone” and one from the “deep zone” per soil boring, plus one blind duplicate	41 for VOCs, SVOCs, and PPL metals

VOC = Volatile Organic Compounds
 SVOC = Semi-Volatile Organic Compounds
 PPL = Priority Pollutant List
 PCB = Polychlorinated Biphenyls

Soil samples were sent to KAP Technologies in The Woodlands, Texas, for organic analysis; Liberty Analytical Corporation in Cary, North Carolina, for inorganic analysis; EPA Region 3’s Office of Analytical Services and Quality Assurance (OASQA) in Fort Meade, Maryland for pH, chloride, and sulfate analysis; and TestAmerica in Pittsburgh, Pennsylvania, for total sulfide analysis. Analytical data generated by the laboratories was validated by the EPA OASQA.

4.3.3. Findings for Soil

Analytical results for soil were tabulated in each Phase II report, but the Medium Specific Concentrations (MSCs) to which they were compared are no longer current. Moonstone re-tabulated the analytical results and compared them to the current MSCs, as presented in Tables 1 through 5.

Table 1 shows the results for VOCs in soil, and Table 4 shows results for petroleum analysis, which includes several VOCs. Exceedances of the Residential MSCs for VOCs were observed in samples from two areas:

- 1) The former gasoline UST location (samples SB-01-B, SB-05-B, SB-27-B (from Table 1) and sample UST-G (from Table 4)); and
- 2) The northwest corner of Building 3, at the location of an ASTs without secondary containment (sample SB-11-A (Table 1)).

Exceedances at the former gasoline UST location were produced by samples collected from 8-15 feet below ground surface, as expected for a release from a buried tank. Here, the VOCs exceeding the Residential MSC also exceeded the Non-Residential MSC: benzene, 1,3,4-trimethylbenzene, and 1,3,5-trimethylbenzene. The samples collected by Tetra Tech (Table 1) were collected from 14-15 feet below ground surface and may have been saturated with groundwater. The only other VOC exceedance of a Residential MSC was for soil sample SB-11-A, collected from 1-2 feet below ground surface in the vicinity of an AST at the northwest corner of Building 3. The exceedance was for 1,3,4-trimethylbenzene only, and exceeded only the Residential MSC (it was below the Non-Residential MSC).

Table 2 shows the results for SVOCs in soil, and Table 4 shows results for petroleum analysis, which includes several SVOCs. Exceedances of the Residential MSC for SVOCs were observed at several locations across the Site and appear to be associated with fill material and/or historical site use. The following SVOCs exceeded the Residential MSC for soil: benzo(a)anthracene, benzo(a)pyrene; benzo(b)fluoranthene; dibenzo(a,h)anthracene; 2,4-dinitrotoluene; and indeno(1,2,3-cd)pyrene. The most prevalent of these were benzo(a)pyrene and dibenzo(a,h)anthracene, which were the

only SVOC exceedances identified by Tetra Tech's extensive sampling. The other SVOCs exceeded the Residential MSC in only one sample: for 2-4-dinitrotoluene in sample SS-2(2'); and for the other SVOCs in sample SS-4(2'). None of the SVOC results exceeded the Non-Residential MSC.

Table 3 shows the results for inorganic analysis of soil, and Table 4 (for petroleum analysis) includes lead. The following metals exceeded the Residential MSC for soil: antimony, arsenic, cadmium, iron, lead, manganese, and zinc. With the exception of iron, all metals exceeding the Residential MSC also exceeded the Non-Residential MSC in at least one sample. Iron exceeded only the Residential MSC. Metals exceedances were distributed widely across the Site.

Table 5 shows the results for pesticide analysis of soil. No pesticides were identified at concentrations exceeding the Residential MSC, although many were detected.

There is no table for PCBs in soil. Only one soil sample contained a detectable PCB: Aroclor 1268 in Tetra Tech's sample FLSS-SB25-B, as documented in Appendix M of their report. The result did not exceed the Residential MSC.

Based on the comparison of data to the current standards, Moonstone identified the following compounds and/or metals at concentrations exceeding the PADEP's Residential MSCs for soil:

EXCEEDANCES OF THE RESIDENTIAL MSC for SOIL:

- Benzene;
- 1,3,4-Trimethylbenzene (a.k.a. 1,2,4-Trimethylbenzene);
- 1,3,5-Trimethylbenzene;
- Benzo(a)anthracene
- Benzo(a)pyrene;
- Benzo(b)fluoranthene;
- Dibenzo(a,h)anthracene;
- 2,4-Dinitrotoluene;
- Indeno(1,2,3-cd)pyrene;
- Antimony;
- Arsenic;
- Cadmium;
- Iron;
- Lead;
- Manganese;
- Zinc.

4.4. Groundwater

4.4.1. *Moonstone 2007 Phase II Field and Laboratory Methods*

Moonstone's 2007 Phase II included a preliminary screening of groundwater to determine the presence/absence of site-wide groundwater issues. Groundwater grab samples were collected from five locations by installing temporary PVC well points in existing soil boreholes. The temporary monitoring well (MW) data are summarized below. Figure 5 shows the locations of the temporary well points.

Moonstone Groundwater Sampling	
Temporary Well Point ID	Location
MW-1	in soil boring UST-G (APEC 01:Former USTs)
MW-2	in soil boring SS-2 (APEC 04:Site-Wide Soil)
MW-3	in soil boring SS-3 (APEC 04:Site-Wide Soil)
MW-4	in soil boring SS-4 (APEC 04:Site-Wide Soil)
MW-5	in soil boring SS-5 (APEC 04:Site-Wide Soil)

Three to five borehole volumes were purged from the borehole with a disposable polyethylene bailer. After purging was complete, the bailer was lowered into the borehole for sample retrieval. Groundwater samples were poured directly from the bailer into laboratory provided sampling bottles with the appropriate preservatives. Filled sample containers were transferred to an ice-filled cooler, maintained at or below 4°C until remanded to the laboratory. Sample information was recorded on the sample container, in a field logbook, and on the laboratory's chain of custody.

Groundwater grab samples were analyzed for VOCs, SVOCs, PPL Metals (dissolved). Samples were sent to Test America Laboratories in King of Prussia, Pennsylvania for analysis. Samples submitted for laboratory analysis of PPL Metals were submitted without preservation and were filtered at the laboratory prior to analysis.

4.4.2. Tetra Tech 2009 Phase II Field and Laboratory Methods

Tetra Tech supervised the installation of eight permanent, single-screened, monitoring wells between June 16 and 19, 2008. Wells MW-1 and MW-2 were drilled with an air rotary drill rig and wells MW-3 through MW-8 were drilled with a hollow-stem auger rig. All monitoring well drilling, installation, completion, and development activities were conducted in accordance with PADEP's *Groundwater Monitoring Manual* and Tetra Tech SOP No. 020, "Monitoring Well Installation" (see Appendix E). Well development activities were initiated no sooner than 24 hours after well completion by pumping until a minimum of three (3) borehole volumes had been purged and groundwater parameters had stabilized to within 10 percent. Monitoring well locations are presented on Figure 7. The well construction specifications are summarized below; detailed well logs were not included in Tetra Tech's 2009 Phase II report.

Tetra Tech Groundwater Sampling			
Well ID*	Location	Well Depth (ft)	Screen Length (ft)
MW-1	West side of Site	20.5	15
MW-2	Near former 3,000-gal gasoline USTs (APEC 01)	19.5	15
MW-3	West side of Site	Not reported	15
MW-4	North end of Building #2	19	15
MW-5	South end of RediStrip building (APEC 05)	19	15.2
MW-6	Along Lehigh River	18	15
MW-7	Along Lehigh River	18	15
MW-8	Along Lehigh River	18	15

* These well IDs do not correlate to the temporary well points installed by Moonstone.

Tetra Tech performed two rounds of groundwater sampling. The first round was conducted on July 7 and 8, 2008, the second round was conducted on July 21, 2008. Groundwater grab samples were analyzed for VOCs, SVOCs, and PPL metals (dissolved) for the first round; for the second round, pesticide analysis was added.

Although the text of their report indicates that PCBs were also analyzed for the second round, the data tables do not include any PCB results or any indication that they were submitted. A total of 12 samples were analyzed during each round, including one sample per monitoring well, a blind duplicate, field blank, trip blank, and rinsate blank.

The first round of groundwater samples were sent to KAP Technologies in The Woodlands, Texas, for organic analysis and Liberty Analytical Corporation in Cary, North Carolina, for inorganic analysis. Second round groundwater samples were sent to Datachem Laboratories, Inc. in Salt Lake City, Utah, for organic analysis and Liberty Analytical Corporation in Cary, North Carolina, for inorganic analysis.

4.4.3. Moonstone 2013 Field and Laboratory Methods

On June 21, 2013, Moonstone conducted groundwater sampling at seven of the eight monitoring wells Tetra Tech installed on Site in 2009. Well MW-4, which was centrally located on the Site, could not be found due to significant piles of metal-bearing debris and soil associated with an on-site scrap metal facility.

Groundwater was purged from each well using a low-flow peristaltic pump. Field measurements of depth to water, temperature, pH, conductivity, dissolved oxygen, turbidity, and general description of water were recorded in a field notebook. Samples were taken after purge measurements became stable ($\pm 10\%$) and were pumped directly from the peristaltic tubing into laboratory-provided sampling bottles with the appropriate preservatives. Samples submitted for laboratory analysis of PPL Metals were field-filtered prior to sample collection. Filled sample containers were transferred to an ice-filled cooler, maintained at or below 4°C until remanded to the laboratory. Sample information was recorded on the sample container, in a field logbook, and on the laboratory's chain of custody. All field equipment was decontaminated with non-phosphate detergent and distilled water between each well and after the final well.

Seven groundwater grab samples and one blind duplicate were analyzed for VOCs, SVOCs, and PPL Metals (dissolved). Samples were sent to Test America Laboratories in King of Prussia, Pennsylvania for analysis.

4.4.4. Findings for Groundwater

The seven monitoring wells sampled in 2013 were surveyed for location and elevation so that groundwater elevation data could be contoured. The resulting groundwater equipotential map is included in Appendix K and is shown on Figure 8. The map indicates that groundwater flows from the Site towards the Lehigh River, sometimes in a straight line, and sometimes in a circuitous route. There is an anomalously high area in the middle of the Site, around MW-5. This localized high point in the water table appears to make water to flow radially away from MW-5 for a short distance before returning to an easterly flow direction. Based on the groundwater equipotential map and the general topography of the area around the Site, groundwater from the Site is expected to flow into the Lehigh River.

Analytical results were tabulated in both the Moonstone 2007 and the Tetra Tech 2009 Phase II reports, but the MSCs to which results were compared are no longer current. Moonstone re-tabulated the groundwater analytical results and compared them to the current MSCs, as presented in Tables 6 through 8. The 2013 groundwater analytical data are included in the tables.

Table 6 shows the results for VOCs in groundwater. Moonstone's temporary well points produced exceedances of the Residential MSC for benzene and ethylbenzene at the former gasoline UST location. Tetra Tech's permanent well at this location (MW-2) confirmed the presence of benzene at concentrations exceeding the Residential MSC, but did not reproduce the ethylbenzene exceedance. No other VOC exceedances were documented in other wells at the Site.

Table 7 shows the results for SVOCs in groundwater. Moonstone's temporary well points produced exceedances of the Residential MSC at two areas:

- 1) The former gasoline UST location (point "MW-1" had exceedances for benzo(a)anthracene, benzo(g,h,i)perylene, dibenzo(a,h)anthracene, indeno(1,2,3-cd)pyrene, 2-methylnaphthalene, and naphthalene); and
- 2) The north end of Building 1 (point "MW-2" had exceedances for benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(g,h,i)perylene, benzo(k)fluoranthene, and chrysene.

With the exception on benzo(a)pyrene and indeno(1,2,3-cd)pyrene, SVOCs exceeding the Residential MSC also exceeded the Non-Residential MSC. None of the SVOC exceedances were reproduced in the permanent monitoring wells -- no SVOCs exceedances were reported from any of the permanent wells and very few SVOCS were even detected.

Tetra Tech's analysis also detected 0.16 µg/L of alpha-chlordane (a pesticide) in the second round of sampling for MW-5 (sample FLSS-GW-05B). At the time of analysis, alpha-chlordane had an MSC of 2 µg/L, but the 2011 updated MSC list does not include this pesticide.

Table 8 shows the results for inorganic analysis of groundwater. The temporary well point installed by Moonstone at the former gasoline UST location ("MW-1") had arsenic and lead results that exceeded the Residential MSC, and the temporary well point at the base of the Tilghman Street bridge at the top of the river bank ("MW-4") had a lead exceedance. These exceedances were not reproduced in the permanent monitoring wells. The permanent wells identified the following metals exceedances:

- Aluminum, iron, manganese, and zinc at MW-7 (along the river, south end of Site);
- Aluminum, iron, and manganese at MW-2 (former gasoline UST location)
- Iron and manganese at MW-5 (west of MW-7, south end of the Site) and MW-8 (along the river, north of Tilghman Street);
- Manganese at MW-3 (western (e.g., upgradient) property boundary) near Tilghman Street) and MW-4 (south central part of the Site); and
- Iron at MW-6 (along the river, southern tip of Site).

Based on the comparison of data to the current standards, Moonstone identified the following compounds and/or metals at concentrations exceeding the PADEP's Residential MSCs for groundwater:

EXCEEDANCES OF THE RESIDENTIAL MSC for GROUNDWATER:

From permanent wells:

- Benzene;
- Aluminum;
- Iron;
- Manganese;
- Zinc.

From temporary well points:

- Benzene;
- Ethylbenzene;
- Benzo(a)anthracene;
- Benzo(a)pyrene;
- Benzo(b)fluoranthene;
- Benzo(g,h,i)perylene;
- Benzo(k)fluoranthene;
- Chrysene;
- Dibenzo(a,h)anthracene;
- Indeno(1,2,3-cd)pyrene;
- 2-methylnaphthalene;
- Naphthalene;
- Arsenic;
- Lead.

4.5. Conceptual Site Model

Environmental sampling indicates that the Site's soil and groundwater have been impacted by historical commercial/industrial use at the Site and surrounding properties. The future use of the Site includes residential and recreational components (apartments and a public walkway) in addition to commercial use. Based on the planned residential and recreational uses for portions of the Site, the Site must be evaluated using the default residential exposure assumptions unless other site-specific exposure scenarios are justified.

The following compounds and/or metals exceed the Residential Statewide Health Standard for soil and/or groundwater.

SUMMARY OF EXCEEDANCES OF THE RESIDENTIAL MSC		
Soil	Groundwater: Permanent Wells	Groundwater: Temporary Well Points
Benzene 1,3,4-Trimethylbenzene (a.k.a. 1,2,4-Trimethylbenzene) 1,3,5-Trimethylbenzene Benzo(a)anthracene Benzo(a)pyrene Benzo(b)fluoranthene Dibenzo(a,h)anthracene 2,4-Dinitrotoluene Indeno(1,2,3-cd)pyrene Antimony Arsenic Cadmium Iron Lead Manganese Zinc	Benzene Aluminum Iron Manganese Zinc	Benzene Ethylbenzene Benzo(a)anthracene Benzo(a)pyrene Benzo(b)fluoranthene Benzo(g,h,i)perylene Benzo(k)fluoranthene Chrysene Dibenzo(a,h)anthracene Indeno(1,2,3-cd)pyrene 2-Methylnaphthalene Naphthalene Arsenic Lead

4.5.1. Potential Routes of Exposure

The potentially complete routes of exposure for humans and ecologic receptors at the site are discussed below.

Direct Contact with Soil

Direct contact with contaminants in surface soil by ingestion and/or inhalation is a potential route of exposure. This route of exposure will be addressed via pathway elimination, as described in Section 6: Fate and Transport Analysis.

Soil to Groundwater Migration

Soil-to-groundwater migration is not considered a major risk at the site due to the concentrations and nature of the contaminants identified. Contaminants appear to be metals associated with fill material and/or volatile and semi-volatile organic compounds associated with historical releases. Soil at the site has been exposed to the elements for several decades. The remaining compounds and metals in soil are therefore expected to be relatively immobile in soil, and unlikely to migrate to groundwater. In addition,

groundwater samples from point-of-compliance wells (at the downgradient property boundary) meet the Residential Statewide Health Standard, indicating that soil-to-groundwater migration is not occurring at a sufficient rate to significantly affect groundwater conditions at the Site.

Direct Contact with Groundwater

The City of Allentown has an ordinance requiring all improved properties within the City limits to connect to the municipal water supply. In addition, a deed restriction will be placed on the property deed to prevent installation of wells for any use other than groundwater monitoring and/or treatment.

Vapor Intrusion

The following volatile and semi-volatile organic compounds exceeded the Residential Statewide Health Standard at the Site and are listed as compounds of potential concern for vapor intrusion:

- **Soil:** *benzene, 1,3,5-trimethylbenzene, and 1,3,4-trimethylbenzene;*
- **Groundwater:** *benzene, ethylbenzene, 2-methylnaphthalene, naphthalene.*

These compounds were identified at two locations: 1) the former 3,000-gallon gasoline USTs located in the west-central portion of the Site, and 2) a single soil boring located near an AST at the northwest corner of Building 3.

Conceptually, the vapor intrusion exposure pathway will be eliminated by removing VOCs that are present at concentrations that exceed vapor intrusion screening values – namely, at the former UST location. The specifics of the vapor intrusion analysis are discussed in Section 6: Fate and Transport Analysis.

4.5.2. Pathway Elimination

Engineering and institutional controls will be used to eliminate exposure pathways. In the area of former petroleum USTs (APEC 01) a small amount of removal and disposal will be performed to mitigate nuisance petroleum odors and potential vapor intrusion. The use of engineering and institutional controls to eliminate routes of exposure is described in Section 6: Fate and Transport Analysis.

5. RISK ASSESSMENT

Data generated by previous soil and groundwater investigations at the site was used to perform a risk assessment along the eastern side of the site, where a public walkway is planned. The risk assessment used the highest concentrations of regulated materials detected at the site, and the exposure scenarios anticipated for a public walkway, as input for the site-specific MSC formulas in 25 PA Code §250.306-307. Attainable site-specific MSCs were established for every regulated substance except lead. Lead's site-specific exposure scenario could not be modified sufficiently to establish an attainable MSC for lead. Pathway elimination was selected as a more feasible remedy than performing an in-depth, site-specific uptake study for lead in soil.

6. FATE AND TRANSPORT ANALYSIS

This section describes how pathway elimination will be used to mitigate routes of exposure at the Site. A combination of engineering and institutional controls is proposed to mitigate direct contact with SVOCs and metals in Site soil and groundwater. Targeted excavation and disposal are proposed to mitigate VOCs associated with petroleum-impacted soil at the Site. Groundwater modeling indicates that the metals detected in groundwater at the downgradient property boundary at concentrations exceeding the Residential MSC for groundwater (aluminum, iron, manganese, and zinc) are not producing exceedances of the surface water standards in the Lehigh River.

PROPOSED PATHWAY ELIMINATION METHODS			
Media	Engineering Controls	Institutional Controls	Remediation/Modeling
Soil	Capping	Deed notice/environmental covenant indicating that cap must be maintained, with biennial inspections.	Excavation of petroleum-impacted soil at former gasoline USTs.
Groundwater	N/A	Deed notice/environmental covenant indicating that no groundwater production wells (potable or otherwise) may be installed.	Groundwater modeling for metals to surface water.
Vapor	N/A	N/A	Excavation of petroleum-impacted soil at former gasoline USTs.

6.1. Groundwater Modeling – Metals to Surface Water

As described in Section 4.4.4, groundwater flows from the Site towards the Lehigh River, sometimes in a straight line, and sometimes in a circuitous route. There is an anomalously high area in the middle of the Site, around MW-5. This localized high point in the water table appears to make water to flow radially away from MW-5 for a short distance before returning to an easterly flow direction. Based on the groundwater equipotential map and the general

topography of the area around the Site, groundwater from the Site is expected to flow into the Lehigh River (see Appendix K and Figure 8).

Results for groundwater analysis indicate that aluminum, iron, manganese, and zinc exceeded the Residential MSC at the downgradient property boundary. (Note: Benzene was detected in groundwater at the former UST area (temporary well point “MW-1” and permanent well MW-2) but did not extend to the point of compliance at downgradient property boundary.) Moonstone performed a fate and transport analysis for metals using PADEP’s SWLOAD groundwater model to determine whether their concentrations in groundwater would result in degradation of surface water quality in the Lehigh River. Preliminary results from SWLOAD indicated that further analysis was required using the PENTOX groundwater model. The input assumptions, data, and model results for both SWLOAD and PENTOX are presented in Appendix K.

The Lehigh River is part of the Delaware River Basin, in the Lehigh River watershed. Moonstone used the USGS StreamStats online program to determine the area of the drainage basin above the Site, and used online USGS topographic maps to estimate elevations along the stream. Moonstone estimated the value of discharge flow (Q) for the PENTOX calculations by making assumptions about aquifer thickness and recharge zone width, and by using site-specific data to estimate hydraulic gradient (from groundwater contour maps) and hydraulic conductivity (from soil type). The value for pH was estimated to be 8.5 based on the underlying limestone. The maximum detected concentration of each metal was used, regardless of where on-site it was detected.

The PENTOX output for aluminum, manganese and zinc indicated that they do not cause degradation of stream quality in the Lehigh River (result is a “pass” in the PENTOX model; see Appendix K). To test the limits of the results and the validity of the assumptions, Moonstone performed a sensitivity analysis on the model. Values for discharge flow were increased and decreased by an order of magnitude, and pH was adjusted to 6 and 11. These changes did not change the outcome of the model. The PENTOX output again indicated that for all scenarios, the aluminum, manganese, and zinc in groundwater do not cause degradation of stream quality in the Lehigh River (result is a “pass”).

The Residential MSC for iron is a secondary maximum contaminant level (SMCL), identified as such because it is a “nuisance” concentration based on discoloration, taste, etc. The MSC was established based on aesthetics, not health effects. Iron is not listed as a contaminant in PENTOX nor is it included in Chapter 93 regulations for surface water quality (§ 93.8c: *Human health and aquatic life criteria for toxic substances*, Table 5). Iron was therefore not modeled for impacts to surface water.

6.2. Engineering and Institutional Controls

Capping at the Site will consist of buildings, asphalt, concrete, and/or one foot of clean topsoil. The entire Site will be capped by these materials. Appendix L contains details about the proposed cap materials, including the extent of each capping material and cross sections.

Deed notices/environmental covenants will be developed and recorded in accordance with the Uniform Environmental Covenants Act (UECA). A draft environmental covenant will be submitted to PADEP for review at the same time as the Final Report is submitted for approval. The environmental covenant will specify that periodic inspections of the cap must be reported to PADEP and that corrective actions must be taken to repair any damage to the cap. The covenant will also indicate that groundwater wells will not be installed at the Site for any purposes other than monitoring and/or treatment of groundwater.

The environmental covenant will be recorded at the Lehigh County Recorder of Deeds office and proof of recordation will be provided to PADEP within 60 days of submitting the Final Report.

6.3. Vapor Intrusion

Vapor Intrusion was evaluated for the Site using the PADEP vapor intrusion guidance². Although the guidance is designed for sites that meet the Statewide Health Standard, it may be used for sites being remediated under the Site-Specific Standard as long as cumulative risks are considered.

² *Land Recycling Program Technical Guidance Manual-Section IV.A.4: Vapor Intrusion into Buildings from Groundwater and Soil under the Act 2 Statewide Health Standard.*

The pre-screen decision matrices in the guidance may not be used for this Site because future buildings will not be in the same location as the existing buildings. Therefore, no conclusions may be drawn with respect to distance between contaminants and a building, or whether any preferential pathways exist. Moonstone skipped the pre-screen decision matrices and performed a site-specific analysis by comparing analytical results from the Site to the PA Default Nonresidential Volatilization to Indoor Air Screen values³.

For groundwater, none of the analytical results from the Site exceeds the indoor air screening values, and no further analysis is required to address indoor air quality (see below).

Indoor Air Quality Screening			
Medium	Compound Exceeding the Residential MSCs	Max. Concentration Detected	PA Defaults Residential Volatilization to Indoor Air Screen
Soil	benzene	2.8 mg/kg	0.37 mg/kg
	1,3,4-trimethylbenzene	180 mg/kg	20 mg/kg
	1,3,5-trimethylbenzene	55 mg/kg	4.6 mg/kg
Groundwater	benzene	6.9 ug/L	3,500 ug/L
	ethylbenzene*	1,300 ug/L	27,000 ug/L
	2-methylnaphthalene	480 ug/L	NOC**
	naphthalene*	950 ug/L	25,000 ug/L
<i>Note: all groundwater exceedances were from the former gasoline UST location.</i>			

* Compound is a COPIAC (Contaminant of Potential Indoor Air Concern)

** NOC = Compound “Not of Concern” because the Indoor Air Screening value is higher than the water solubility for the compound.

For soil, all three compounds that exceed the Residential Statewide Health Standard (benzene, 1,3,4-trimethylbenzene, and 1,3,5-trimethylbenzene, highlighted above) also exceed the screening values for indoor air volatilization. A review of the sampling locations for these exceedances indicates that all but one were located near the former USTs (APEC-01):

³ Table 5, *Land Recycling Program Technical Guidance Manual-Section IV.A.4: Vapor Intrusion into Buildings from Groundwater and Soil under the Act 2 Statewide Health Standard.*

Volatile Compounds Exceeding the Residential Statewide Health Standard for Soil			
Sample ID	Location	Compound Exceeding RSHS	Concentration (mg/kg)
UST-G	Former USTs	benzene	1.1
SB01-B	Former USTs	benzene	2.8
		1,3,4-trimethylbenzene	170
		1,3,5-trimethylbenzene	48
SB05-B	Former USTs	benzene	1.9
		1,3,4-trimethylbenzene	150
SB27-B	Former USTs	1,3,4-trimethylbenzene	180
		1,3,5-trimethylbenzene	55
SB11-A	NW Corner of Acme Cryogenics (Building 3)	1,3,4-trimethylbenzene	11

Removal of contaminated soils from the former UST location would leave only one volatile compound exceeding the Residential Statewide Health Standard for soil: 1,3,4-trimethylbenzene at 11 mg/kg near Building 3. This concentration is below the screening value of 20 mg/kg (see previous table). Physical remediation (removal) of contaminated soil around the former USTs would therefore eliminate the need for any further vapor intrusion analysis at the Site.

7. OTHER INFORMATION REQUIRED UNDER THE SITE SPECIFIC STANDARD

7.1. Public Benefits of Reuse

The public will benefit greatly from the redevelopment of the former Lehigh Structural Steel into The Waterfront, a mixed-use development of multistory buildings containing residential, retail, and office uses taking advantage of the scenic waterfront location. Attractive and inviting public spaces will accentuate the views and proximity to the Lehigh River.

The full scope of the project entails rezoning the site, obtaining land development approvals, installing infrastructure, and building over 1,000,000 square feet of buildings. Development of the Waterfront will provide public access to the Lehigh River, including a public walkway that will be built along the river and connect The Waterfront to downtown Allentown.

The Waterfront is a critical piece of the larger riverfront redevelopment effort by the City of Allentown. Other properties that the City is actively targeting for redevelopment along the riverfront include the Lehigh Landing (near Hamilton Street, including the new America on Wheels museum) and the former Neuweiler Brewery on Front Street.

7.2. Ecological Risk Assessment

Moonstone performed a search for potential impacts to “special concern species or resources” in the project area via the Pennsylvania Natural Diversity Inventory (PNDI) website. The PNDI consults the PA Game Commission, the PA Department of Conservation and Natural Resources (DCNR), the PA Fish and Boat Commission, and the U.S. Fish and Wildlife Service (FWS). The PNDI receipt indicated that no known impacts existed at the Site and no further review of the Site is required. A copy of the PNDI Project Environmental Review Receipt is provided in Appendix M.

7.3. Completed Exposure Pathways

Potential exposure pathways are discussed in the preceding section on Fate and Transport. After implementation of the proposed remedies, there will be no completed exposure pathways at the Site.

8. CONCLUSIONS & RECOMMENDATIONS

A Release of Liability is requested for soil and groundwater at the Site, pursuant to the Site Specific Standard. The potential routes of exposure for regulated substances at the Site will be eliminated using targeted excavation/disposal and site-wide pathway elimination. Pathway elimination will be maintained by engineering and institutional controls in the form of capping and deed notices/environmental covenants.

The compounds and metals detected above the laboratory reporting limit at the Site, as indicated on Tables 1-8, should be included in the Site-Specific Release of Liability.

9. CLEANUP PLAN

This Cleanup Plan details the engineering and institutional controls that will be employed in order to reduce risk for the existing exposure pathways and to demonstrate compliance with Subchapter D (Site Specific Standard) Section 250.401, of the Act 2 regulations.

9.1. Pathway Elimination and Controls

The protection of future Site occupants will be accomplished through the use of targeted excavation/disposal of petroleum-impacted soil, and site-wide engineering and institutional controls, which will eliminate current and future exposure pathways. Redevelopment activities will be performed using normal construction procedures and following OSHA regulations for the protection of construction workers. A Soil Management Plan will define the steps to be followed should unexpected environmental conditions be encountered that require the use of procedures other than those of normal construction at the Site (see Appendix N).

The controls that will be used on Site to eliminate current and future pathways include the following:

- 1) Soils containing volatile organic compounds (VOCs) from the former UST location will excavated and transported off-site for disposal. Once this area has been remediated to remove VOCs, only one sample exceeding the Residential Statewide Health Standard for soil would remain: 1,3,4-trimethylbenzene at 11 mg/kg near Building 3. This concentration is below the screening value of 20 mg/kg. Physical remediation (removal) of contaminated soil around the former USTs will therefore eliminate the need for any further vapor intrusion analysis at the Site. Post-excavation soil sampling will be used to document that the removal of VOCs has been successfully accomplished prior to capping.
- 2) The property will be improved with asphalt-paved roads and parking areas, sidewalks, and landscaped areas. These site features will act as engineering controls and provide pathway elimination for contact with any impacted residual materials (soil and/or fill material) located at or below grade.

- 3) Landscaped areas will be capped with one (1) foot of clean fill prior to the installation of landscaping components. Several discrete surface elevations will be collected by a Pennsylvania Licensed Surveyor prior to and after fill placement has occurred. These elevations will be included in the Final Report to document that the thickness of the clean fill.
- 4) The Soil Management Plan will specify that engineering controls shall be properly inspected and maintained, and that the appropriate actions will be taken during future earth disturbance activities (e.g. utility maintenance, erosion, construction or site maintenance activities) that might compromise the cap. The Soil Management Plan is presented in Appendix N.
- 5) Any digging, excavating, grading, or other earth moving activities conducted on the property and the excavation or removal of asphalt, concrete, soil, or other groundcover and foundations and the digging of foundations for buildings and utility trenches shall be stored, managed, transported, and disposed of in compliance with all federal, state, local rules, regulations and ordinances and in compliance with the Soil Management Plan as part of the Cleanup Plan.
- 6) Groundwater use restrictions will be documented in an environmental covenant in accordance with Uniform Environmental Covenants Act (UECA). Groundwater underlying the property shall not be used for any purpose, and no wells for the extraction of groundwater shall be installed, permitted, or utilized on the property. Groundwater monitoring wells may be installed and operated on the property for the purpose of monitoring, treating, and remediating groundwater.

9.2. Engineering Control Design

Pathway elimination for contact with soil will be accomplished through the use of the engineering controls described in this section in addition to the site use restrictions discussed above. The entire Site will be capped with buildings, paving, and/or top soil, as described below. A site plan showing the extent of each type of cap is included in Appendix L.

Existing Buildings

None of the existing buildings at the site will be present after redevelopment. All existing buildings are slated for demolition.

Proposed Buildings

New buildings at the Site will be built as concrete slab on grade, built over micropiles. The concrete floor of each building will act as a cap that prevents direct contact with soil

Proposed Asphalt/Concrete Pavement Areas

The cross-sectional design for proposed asphalt and concrete pavement is included in Appendix L.

Landscaped Areas

A cross-section for the proposed landscaping areas is described in Appendix L. Landscaped areas will be capped with at least one foot of clean topsoil. Several discrete surface elevations will be collected by a Pennsylvania Licensed Surveyor prior to and after clean fill placement has occurred, and the elevations will be documented in the Final Report.

10. POST-REMEDATION CARE PLAN

The Post-Remediation Care Plan is intended to ensure that the conditions set forth in the Cleanup Plan, Final Report, and environmental covenant remain in effect both during and after construction.

10.1. Construction Phase

During construction, the Soil Management Plan (Appendix N) will be used to communicate environmental issues to site contractors. The Soil Management Plan specifies how materials with potential environmental impact are to be handled during construction.

10.2. Post-Construction Phase

In order to ensure compliance with the Act 2 Site Specific Standard, post-remediation procedures will be implemented to ensure the ongoing integrity of areas where engineering and institutional controls are utilized to eliminate potential exposure pathways. Details of these procedures are described below:

1) Periodic Inspections

To ensure the integrity of engineering controls, the capped areas will be periodically inspected by the Site Owner for damage to the cap. Inspections will document any significant damage to the cap and identify corrective actions taken to restore or maintain the integrity of the cap. Corrective actions involving the repair/replacement of the engineering controls shall be performed in accordance with the Soil Management Plan, which details procedures for material management and cap replacement. The frequency of the inspections will be specified in the environmental covenant for the Site. Inspection reports will be kept on file by the Site Owner.

2) Planned Cap Disturbance

Future development and/or maintenance activities performed on the property may require existing engineering controls to be temporarily disturbed or removed. As such, any engineering control that is disturbed or removed must be replaced with the same engineering control or another approved engineering control as described in the Cleanup

Plan. If replacing the engineering control is not desired, the Site Owner may characterize regulated substances in the soils/materials beneath the removed engineering control and manage or remediate those soils/materials in accordance with Act 2 and all applicable laws and regulations. The material management procedures cited in the Soil Management Plan will be required at all times when conducting any intrusive activities that breach the cap.

3) Institutional Controls

In order to ensure ongoing compliance with the Act 2 Site Specific Standard, an environmental covenant will be applied to the Site specifying that the engineering controls must be properly maintained and that no production wells (potable or otherwise) may be installed. A draft environmental covenant will be submitted to PADEP for review and approval when the Act 2 Final Report is submitted. The approved environmental covenant will be recorded in accordance with UECA regulations.

4) Reporting

The proposed compliance reporting schedule will be specified in the environmental covenant. The compliance reports will document that the activity use limitations of the environmental covenant are being abided by. The reports shall be submitted to:

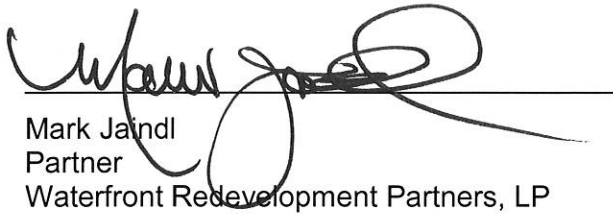
Program Manager, Environmental Cleanup Program
Northeast Regional Office
Pennsylvania Department of Environmental Protection
2 Public Square
Wilkes-Barre, PA 18701-1915
Phone: 570-826-2511
Fax: 570-826-4907

11. PUBLIC COMMENTS

The Notice of Intent to Remediate was publicized in the February 11, 2013, edition of The Morning Call newspaper. The publication initiated a 30-day public comment period ending on March 12, 2013. No public comments were received by the City of Allentown during the public comment period.

12. SIGNATURES

The Waterfront Redevelopment Partners, LP are seeking an eventual Release of Liability for the Site-Specific Standard for soil and groundwater in a manner that is consistent with the Site's intended future commercial and residential mixed use. This *Remedial Investigation Report & Cleanup Plan* indicates that the remediation of the Site will attain compliance with the Site Specific Standard.



Mark Jaendl
Partner
Waterfront Redevelopment Partners, LP