1675 APARTMENTS

1675-1679 WESTCHESTER AVENUE
BRONX, NEW YORK

Remedial Investigation Work Plan

NYSDEC BCP Site #: C203107
AKRF Project Number: 170250

Prepared For:

New York State Department of Environmental Conservation
Division of Environmental Remediation, Remedial Bureau B
625 Broadway, 12th Floor
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Prepared On Behalf Of:

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and

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1.0 INTRODUCTION

This Remedial Investigation Work Plan (RIWP) has been prepared by AKRF, Inc. (AKRF) on behalf of 1675 JV Associates LLC and 1675 Westchester Avenue Housing Development Fund Corporation (Applicants) for the property located at 1675-1679 Westchester Avenue in the Bronx, New York, hereafter referred to as the "Site". The Site is identified on the New York City Tax Map as Bronx Borough Tax Block 3780, Lot 1. The Site formerly comprised Bronx Borough Tax Block 3780, Lots 1 and 51; however, an application was filed with the New York City Department of Finance (NYCDOF) on March 1, 2018, which combined Lots 1 and 51 into Lot 1.

The Site is an approximately 36,865-square foot "L-shaped" lot developed with an approximately 15,800-square foot vacant commercial building with cellars fronting Westchester Avenue, with a north-adjacent asphalt-paved parking area and a small landscaped area on the southwestern portion. The western portion of the building was most recently occupied by a medical facility until it was vacated sometime in 2012. The eastern portion of the building was most recently occupied by a wine and liquor store and a dry cleaner until it was vacated in January 2018. The Site is bounded by: residential buildings to the north; Westchester Avenue and the elevated 6 Metropolitan Transit Authority (MTA) subway tracks to the south, followed by a commercial shopping center; Fteley Avenue, followed by commercial and residential buildings to the east; and Metcalf Avenue, followed by the Bronx River Parkway to the west. A Site Location map is provided as Figure 1.

This RIWP is being submitted concurrently with a New York State Department of Environmental Conservation (NYSDEC) Brownfield Cleanup Program (BCP) Application (BCP Site No. C203107). The Applicants plan to enter the New York State Department of Environmental Conservation (NYSDEC) Brownfield Cleanup Program (BCP) as a Volunteer. A November 2017 Subsurface (Phase II) Investigation Report prepared by AKRF for the Site concluded that there are elevated concentrations of metals and polycyclic aromatic hydrocarbons (PAHs) in soil, PAHs and arsenic in groundwater, and petroleum- and chlorinated solvent-related compounds in soil vapor at the Site.

This RIWP describes the procedures to be used to define the nature and extent of contamination at the Site. The data compiled from the Remedial Investigation (RI) described in this RIWP will be used to prepare an RI Report (RIR). All work will be completed in accordance with this RIWP, which includes a Quality Assurance Project Plan (QAPP) (Appendix A) and a Health and Safety Plan (HASP) (Appendix B). The Community Air Monitoring Plan (CAMP) detailed in the HASP will be implemented during all subsurface disturbance activities at the Site, including, but not limited to, soil boring advancement, soil sampling, and backfilling of boreholes.

Contact information for the parties responsible for the work described in this RIWP are included in In-Text Table 1:

In-Text Table 1
Remedial Investigation Personnel Contact Information

Company	Individual Name	Title	Contact Number
NYSDEC	Alicia Barraza	Project Manager	(518) 402-9690
AKRF	Michelle Lapin, P.E.	Quality Assurance/Quality Control Officer	(646) 388-9520
	Deborah Shapiro, QEP	Project Manager	(646) 388-9544
	Amy Jordan	Deputy Project	(646) 388-9864

In-Text Table 1
Remedial Investigation Personnel Contact Information

Company	Individual Name	Title	Contact Number
		Manager	
	Amy Jackson	Field Team Leader/Site Safety Officer	(970) 773-6829
1675 JV Associates LLC and 1675 Westchester Avenue Housing Development Fund Corporation (the Volunteers)	Michael Wadman	Client Representative	(646) 388-8216

2.0 SITE DESCRIPTION AND HISTORY

2.1 Site Description and Surrounding Land Use

The Site is an approximately 36,865-square foot "L-shaped" lot developed with a vacant commercial building with cellars fronting Westchester Avenue with a north-adjacent asphalt-paved parking area and a small landscaped area on the southwestern portion. The western portion of the building was most recently occupied by a medical facility until it was vacated sometime in 2012. The eastern portion of the building was most recently occupied by a wine and liquor store and a dry cleaner until it was vacated in January 2018. The Site is bounded by: residential buildings to the north; Westchester Avenue and the elevated 6 Metropolitan Transit Authority (MTA) subway tracks to the south, followed by a commercial shopping center; Fteley Avenue, followed by commercial and residential buildings to the east; and Metcalf Avenue, followed by the Bronx River Parkway to the west. The Site is located in a primarily residential and commercial area. Sensitive receptors located within a ½-mile radius of the Site include residences, daycares, parks and playgrounds, and K-12 schools. Daycares, parks and playgrounds, and K-12 schools within a ½-mile radius include the following:

Daycares

Five Star Day Care 1138 Manor Avenue Bronx, New York 10472 (347)297-6426 Distance: 1,120 feet west of the Site	Baby Blues Daycare and Preschool 1728 East 172nd Street Bronx, New York 10472 (718) 617-4883 Distance: 500 feet northeast of the Site
Tesoritos Learning Center 1234 Fteley Avenue Bronx, New York 10472 (718) 842-6674 Distance: 115 feet east of the Site	Xavier's Place Nursery & Learning Center 1303 Harrod Avenue, Bronx, New York 10472 (646) 510-0334 Distance: 650 feet northwest of the Site
Bright Star Stratford Inc. 1217 Stratford Avenue Bronx, New York 10472 (718) 842-9361 Distance: 845 feet west of the Site	Lisette's Family Daycare 1584 East 172nd Street Bronx, New York 10472 (646) 874-6754 Distance: 1,085 feet west-northwest of the Site
Bronxdale Tenants League Day Care Center/Sound Dale Day Care Center/Dale Sound DCC Family Day 1211 Croes Avenue Bronx, New York 10472 (718) 378-3533 Distance: 290 feet southeast of the Site	East Tremont Head Start 1244 Manor Avenue Bronx, New York 10472 (718) 328-8547 Distance: 970 feet west-northwest of the Site
Mama Miriam's Family Day Care 1047 Ward Avenue Bronx, New York (718) 991-4280 Distance: 2,060 feet southwest of the Site	Flo's Day Care 1330 Morrison Avenue Bronx, New York 10472 (718) 378-5866 Distance: 945 feet northeast of the Site

Jennifer's Daycare 1237 St. Lawrence Avenue Bronx, New York 10472 (347) 692-6394 Distance: 1,330 feet east of the Site	New Horizon Daycare 1262 White Plains Road Bronx, New York 10472 (347) 810-6233 Distance: 2,865 feet east of the Site
Precious Moments Daycare 1224 Thieriot Avenue Bronx, New York 10472 Distance: 2,260 feet east of the Site	Julia's Daycare 1410 Rosedale Avenue Bronx, New York 10472 Distance: 1,780 feet northeast of the Site
Paul T. Matson Headstart 1057 Boynton Avenue, # 1 Bronx, New York 10472 Distance: 2,075 feet southwest	Bronxdale Nursery 1065 Beach Avenue Bronx, New York 10472 Distance: 2,160 feet southeast of the Site

Schools

P.S. 196 (X196) 1250 Ward Avenue Bronx, New York 10472 Distance: 1,000 feet west-northwest of the Site	P.S. 195 (X195) 1250 Ward Avenue Bronx, New York 10472 Distance: 1,000 feet west-northwest of the Site
Mott Hall V (X242) 1551 East 172nd Street Bronx, New York 10472 Distance: 1,230 feet west-northwest of the Site	The Cinema School (X478) 1551 East 172nd Street Bronx, New York 10472 Distance: 1,230 feet west-northwest of the Site
The Metropolitan Soundview High School (X521) 1300 Boynton Avenue Bronx, New York 10472 Distance: 1,230 feet west-northwest of the Site	High School of World Cultures (X550) 1300 Boynton Avenue Bronx, New York 10472 Distance: 1,230 feet west-northwest of the Site
Pan American International High School at Monroe (X388) 1300 Boynton Avenue Bronx, New York 10472 Distance: 1,230 feet west-northwest of the Site	Bronx Little School (X691) 1827 Archer Street Bronx, New York 10460 Distance: 3,345 feet northeast of the Site
J.H.S 123 James M. Kieran 1025 Morrison Avenue Bronx, New York 10472 Distance: 1,923 feet south-southwest of the Site	P.S. 47 John Randolph (X047) 1794 East 172nd Street Bronx, New York 10472 Distance: 1,540 feet northeast of the Site
School of Urban and Global Mission 1260 Thieriot Avenue Bronx, New York 10472 Distance: 2,200 feet east of the Site	

Parks/Playgrounds

Metcalf Playground/Park 1409 Fteley Avenue Bronx, New York 10472 Distance: 1,330 feet north-northwest of the Site	Parque De Los Ninos Bound by Harrod Place to the north, Bronx River Parkway to the east, Watson Avenue to the south, and Morrison Avenue to the west (no street address) Bronx, New York 10472 Distance: 440 feet southwest of the Site
Watson Gleason Playground 1273 Noble Avenue Bronx, New York 10472 Distance: 770 feet southeast of the Site	St. Lawrence Triangle Cross Bronx Expressway Service Road (no street address) Bronx, New York 10465 Distance: 1,975 feet northeast of the Site
Noble Playground 1541 Bronx River Avenue Bronx, New York 10460 Distance: 2,260 feet north of the Site	Starlight Park 1490 Sheridan Expressway Bronx, New York 10459 Distance: 1,000 feet west-northwest of the Site

A map showing surrounding land usage and sensitive receptor populations is provided as Figure 3.

2.2 Site Geology, Hydrogeology, and Subsurface Characteristics

Surface topography at the Site and in the immediately surrounding area is generally level, except the Bronx River Parkway west of the Site, which slopes down towards the west. Based on the U.S. Geological Survey (USGS), New York 2011 Quadrangle Map, the Site is approximately 10 feet above the North American Datum of 1988 (an approximation of mean sea level).

Based on AKRF's November 2017 Subsurface (Phase II) Investigation Report conducted by AKRF, subsurface materials consisted of historic fill (sand with silt, gravel, concrete, brick, wood, and ceramics) from the surface to depths ranging between 10 and 20 feet below grade across the Site. The fill material was underlain by apparent native sand, silt, gravel, and peat in some boring locations.

Groundwater was measured between approximately 9 and 12 feet below grade during the Subsurface (Phase II) Investigation and likely flows in a southwesterly direction toward the Bronx River, approximately 0.6 mile southwest of the Site. However, actual groundwater flow direction in the Bronx is difficult to ascertain without measurements from on-site wells and can be affected by many factors, including subsurface openings or obstructions such as basements, utilities, bedrock geology, and various other factors. There are no surface water bodies or streams on or immediately adjacent to the Site. There are no public or private drinking water supply wells within a ½-mile radius of the Site.

2.3 Proposed Redevelopment Plan

The proposed project is named 1675 Apartments. The proposed redevelopment plan includes demolition of the existing building and construction of a new 10- to 12-story mixed-use building with 253 affordable apartment units and approximately 18,900 gross square feet of commercial and community facility space. Crawlspaces will comprise the lowest level in the eastern, southern, and northern portions of the building. A partial cellar on the western portion of the proposed new building will contain storage, a workshop, an office, a bike room, and mechanical spaces including: a compactor room, a mechanical closet, a water meter/pump room, a suction

tank room, an electrical room, a telecom room, and a detention tank room. The proposed courtyard on the northern portion of the Site will likely include landscaped and seating areas. Excavation for the new building foundation is expected to extend to: approximately 12 feet at the locations of the proposed cellar; approximately 5 feet at the location of the proposed crawl spaces; and approximately 2 feet below grade at the location of the proposed courtyard.

2.4 Site History

Historic records indicate that the western portion of the Site (former Lot 1) was undeveloped prior to 1964, when the current Site building was constructed. The western portion of the building was occupied formerly by several commercial and medical uses until approximately 2012; the building has been vacant since that time. The eastern portion of the Site (former Lot 51) was undeveloped prior to approximately 1969, when the current building was constructed. The eastern portion of the building was occupied formerly by several commercial uses, including a liquor store, and a dry cleaner since sometime between 1971 and 1975 until January 2018, when the building was vacated.

3.0 PREVIOUS INVESTIGATIONS

Phase I Environmental Site Assessment – 1675 Westchester Avenue, Bronx, New York, Environmental Investigations, LLC, July 2014

Environmental Investigations, LLC (EI) prepared a Phase I ESA report of former Lot 1 in July 2014. The Phase I ESA identified a fill line and a vent pipe north-adjacent to the Site building. EI recommended an investigation to determine whether an underground storage tank (UST) was present, its location, and whether or not it had leaked.

Phase II Environmental Site Assessment – 1675 Westchester Avenue, Bronx, New York, Cider Environmental, October 2014

Cider Environmental, Inc. (CE) prepared a Subsurface (Phase II) Environmental Site Assessment Report of former Lot 1 in October 2014. The investigation was conducted to investigate the potential presence of a UST, based on EI's July 2014 Phase I ESA. The investigation included a geophysical survey, the installation of three soil borings adjacent to the suspect UST, the collection and laboratory analysis of three soil samples, and the collection and laboratory analysis of one groundwater sample. Groundwater was reportedly encountered at approximately 12 feet below grade. Laboratory analytical results identified several fuel oil-related volatile organic compounds (VOCs) and semivolatile organic compounds (SVOCs) at levels above applicable standards.

Based on the findings, CE recommended that a spill be reported to NYSDEC and that the UST be closed and removed, along with any contaminated soil, in accordance with applicable local, state, and federal laws. CE also recommended installation of a groundwater monitoring well network at the Site to determine the extent of the groundwater contamination. NYSDEC Spill No. 1407300 was assigned to the Site.

Tank Closure Report – 1675 Westchester Avenue, Bronx, New York, Cider Environmental, December 2014

CE prepared a Tank Closure Report of former Lot 1 in December 2014. According to the report, 756 gallons of waste oil and 55.59 tons of petroleum-contaminated soil were disposed of off-site in October 2014. The tank was cut, cleaned, and removed from the Site. In addition, five endpoint soil samples were collected for laboratory analysis of Commissioner's Policy (CP)-51 VOCs and SVOCs. The results of the sampling indicated that benzo(a)pyrene was detected above 6 NYCRR Restricted Commercial Soil Cleanup Objectives (CSCOs). All other compounds analyzed were detected below CSCOs. The excavation area was backfilled with imported fill. Spill No. 1407300 was closed in October 2014.

Based on the proposed future use of the Site, AKRF compared the analytical results from CE's tank closure report to the 6 NYCRR Restricted Residential Use Soil Cleanup Objectives (RRSCOs). Benzo(a)anthracene, benzo(a)pyrene, and benzo(b)fluoranthene were detected in four soil samples at concentration ranging between 1,400 parts per billion (ppb) and 3,600 ppb, above their respective RRSCOs of 1,000 ppb. Indeno (1,2,3-cd)pyrene was detected in the same four soil samples at concentrations ranging between 780 ppb and 1,500 ppb, above its RRSCO of 500 ppb. These compounds are PAHs, a class of SVOCs most commonly associated with historic fill materials and degraded fuel oil.

Phase I Environmental Site Assessment – 1675 Westchester Avenue, Bronx, New York, Cider Environmental, February 2017

CE prepared a Phase I ESA Report of former Lot 1 in February 2017. The Phase I ESA identified no recognized environmental conditions (RECs). The report identified closed-status NYSDEC Spill No. 1407300 as a Historical Recognized Environmental Condition (HREC) and the active dry cleaner east-

adjacent to former Lot 1 (former Lot 51) as a vapor encroachment condition (VEC). The dry cleaner was also listed in the Resource Conservation and Recovery Act (RCRA) Conditionally Exempt Small Quantity Generator (CESQG) with no reported violations. CE did not provide any recommendations.

Phase I Environmental Site Assessment – 1679 Westchester Avenue, Bronx, New York, AKRF, Inc., October 2017

AKRF prepared a Phase I ESA Report for former Lot 51 in October 2017. The report identified the following RECs:

- At the time of inspection, the eastern portion of the former Lot 51 building was occupied by a dry cleaner. According to historic reverse telephone and database listings for 1681 Westchester Avenue, dry cleaners have operated on the eastern portion of the Site since sometime between 1971 and 1975. Additionally, the Site address appeared in the dry cleaner, historic dry cleaner, and RCRA CESQG databases. The eastern portion of the Site was also listed in the Manifest database for the disposal of several types of solvents, including tetrachloroethylene (PCE) and trichloroethylene (TCE), and in the US Airs database for compliance monitoring. During the inspection, several small labeled and unlabeled containers of various dry cleaning chemicals and 55-gallon drums that likely contain waste chemicals and staining on several walls was observed throughout the building. A storm drain with an unknown final discharge location was observed in the asphalt-paved yard north-adjacent to the dry cleaner. Although the Site was not listed with any violations related to dry cleaning operations and no evidence of an ongoing or past release was observed, the current and historical use of the Site as a dry cleaner constituted a REC.
- During the inspection, a fill port and a vent pipe were located on the eastern Site building façade along Fteley Avenue. Although a tank was not observed, several NYC Department of Buildings (DOB) documents dated between 2001 and 2007 related to a No. 2 fuel oil-powered boiler were reviewed, including two open violations. The eastern partial cellar was not able to be inspected due to water inundation. Based on the presence of tank piping and DOB documents related to a No. 2 fuel oil tank, it is likely that an oil tank currently exists or formerly existed at the Site. Current and/or historical on-site fuel oil storage and use was considered a REC.
- Databases identified nearby historical listings, including a closed-status fuel oil spill on the west-adjacent property (former Lot 1) that affected soil and groundwater, a former automotive repair shop east-adjacent to the Site across Fteley Avenue, and a former paint store approximately 30 feet north of former Lot 51.

The report identified the following environmental concerns:

- Historical filling of former Lot 51 with material of unknown origin likely occurred to support redevelopment of the Site and surrounding area.
- Based on the age of the Site building (constructed between 1950 and 1969), asbestos-containing material (ACM), lead-based paint (LBP), and/or polychlorinated biphenyls (PCBs) may be present in building components and/or in historic fill at the Site.
- At the time of reconnaissance, the eastern partial cellar (part of the former dry cleaner) was flooded and inaccessible for inspection. Water damage and mold were observed in the western partial cellar (part of the former wine and liquor store).

AKRF recommended: conducting a subsurface investigation, inclusive of soil, groundwater, and soil vapor sampling to investigate the RECs at the Site; the proper registration and/or closure and removal of any tank(s) and associated piping; and protocols for future disturbance of building materials and/or subsurface materials in accordance with applicable regulations, including building materials, soil, and groundwater dewatering.

In January 2018, the dry cleaner tenant vacated the Site. On April 18, 2018, AKRF walked through the former dry cleaner and exterior portions of former Lot 1 with a representative of the Requestor. The press stations, washing machine, dry cleaning machine, vapor barrier enclosure, stored chemicals and detergents, and 55-gallon drums were no longer present; however, the stains on the wall from the press machines were still present. The cellar, which was formerly inaccessible during the Phase I ESA inspection, was accessed. The cellar was vacant and two cut pipes were observed along the eastern wall. Based on their configuration, the pipes are suspected to be associated with the tank vent pipe and fill port observed along Fteley Avenue. No other evidence of an existing or former fuel oil tank was observed. The storm drain and electrical manholes on the eastern and western portions of the Site, respectively, were also inspected. The storm drain was not able to be fully inspected due to excessive debris and vegetation inside and around the drain. The electrical manholes were also unable to be inspected due to safety concerns.

Subsurface (Phase II) Investigation Report – 1675-1679 Westchester Avenue, Bronx, New York, AKRF, Inc., November 2017

AKRF prepared a Subsurface (Phase II) Investigation Report of the Site in November 2017. The investigation was conducted to determine whether current and/or former on-site or off-site activities had adversely affected the Site's subsurface. The investigation included: the advancement of 9 soil borings with the collection and laboratory analysis of 18 soil samples; the installation of 5 temporary groundwater monitoring wells with collection and laboratory analysis of 5 groundwater samples; and the installation of 5 temporary soil vapor points with the collection and laboratory analysis of 5 soil vapor samples and 1 ambient air sample. Groundwater was reportedly encountered between approximately 9 and 12 feet below grade. Laboratory analytical results identified: concentrations of select SVOCs, pesticides, and metals in soil; select metals in groundwater; and elevated concentrations of solvent and petroleum-related VOCs in soil vapor and ambient air above applicable standards.

Based on the findings, AKRF recommended preparing an RIWP and conducting an RI at the Site to further define the extent of contamination, inclusive of a geophysical survey, and soil, groundwater, and soil vapor sampling; and indicated that the Site was scheduled for redevelopment. The report indicated that remediation was slated to be completed in the BCP. AKRF also recommended the proper registration and/or closure and removal of any tank(s) and associated piping, and provided protocols for future disturbance of building materials and/or subsurface materials in accordance with applicable regulations.

Figures showing Subsurface (Phase II) Investigation soil sample concentrations detected above UUSCOs and/or RRSCOs, groundwater sample concentrations above Ambient Water Quality Standards (AWQSs), and soil vapor detections are provided as Figures 4, 5, and 6, respectively.

3.1 Areas of Concern (AOCs)

Based on the Site's history and previous reports prepared for the Site, the AOCs for the RI include:

1. The former dry cleaner that operated on the eastern portion of the Site since the 1970s until January 2018.
2. The former storage and use of fuel oil on the eastern portion of the Site.
3. The elevated concentrations of SVOCs and metals in soil/fill across the Site, elevated concentrations of SVOCs and arsenic in groundwater on the northeastern portion of the Site, and elevated concentrations of the chlorinated solvent PCE in soil vapor on the central and northeastern portions of the Site identified during AKRF's 2017 Subsurface (Phase II) Investigation.
4. The former UST north-adjacent to the Site building on the western portion of the Site and associated closed Spill No. 1407300.

4.0 FIELD PROGRAM

The RI field program will focus on collecting soil, groundwater, and soil vapor data to further define the nature and extent of Site contamination and to assist with determining the appropriate remedial action. The RI field program will be implemented in two phases. The first phase will be initiated immediately following NYSDEC approval of this RIWP and will include completion of the sample locations currently outside the footprint of the current Site building (RI-SB/MW/SV-1, RI-SB/MW/SV-2, RI-SB-6 through RI-SB-9, RI-SB-12 through RI-SB-21, and RI-SV-6 through RI-SV-11). After the Site building is demolished (estimated spring/summer 2018), the remaining sample locations will be completed (RI-SB/MW/SV-3 through RI-SB/MW/SV-5, RI-SB-10, and RI-SB-11). Proposed sample locations are shown on Figure 7.

4.1 Field Program Summary

A geophysical survey will be conducted across all accessible portions of the Site to investigate the presence of potential USTs and underground utilities, and to clear the proposed sampling locations. The geophysical survey will be conducted in two phases: outside the current Site building footprint during the initial phase of the RI; and within the current Site building footprint during the second phase of the RI. The field sampling scope of work consists of: the advancement of 21 soil borings with the collection and laboratory analysis of at least one soil sample from each boring; the installation of 5 permanent groundwater monitoring wells with the collection and laboratory analysis of 5 groundwater samples; and the installation of 11 temporary soil vapor points with the collection and laboratory analysis of 11 soil vapor samples. The proposed sample locations are shown on Figure 7.

The soil boring and temporary soil vapor point locations will be surveyed using a Global Positioning System (GPS) and will be measured off of fixed points in the field. The groundwater monitoring wells will be surveyed by a New York State-licensed surveyor. Any field evidence of contamination [visual, olfactory, or elevated photoionization detector (PID) readings] will be recorded. All sampling equipment (e.g., drilling rods and casing, macrocore samplers and probe rods) will be either dedicated or decontaminated between sampling locations.

The scope of work will be conducted by AKRF and its subcontractors. Qualifications for AKRF personnel are included in Section 2.0 of Appendix B. The following sections describe the methods that will be used to complete the aforementioned scope of work.

4.2 Geophysical Survey

A geophysical survey, including ground-penetrating radar (GPR) and magnetometry, will be performed across the Site to investigate the presence of potential USTs and underground utilities, and to clear the proposed sampling locations. GPR uses electromagnetic wave propagation and scattering to image and identify changes in electrical and magnetic properties in the ground. Magnetometers measure irregularities in the magnetic field in a given area. Any anomalies indicative of UST(s) will be marked in the field and surveyed using a GPS. The geophysical survey will be conducted in two phases: outside the current Site building footprint during the initial phase of the RI and within the current Site building footprint during the second phase of the RI.

4.3 Soil Boring Installation and Soil Sampling

A Rotosonic drill rig will be used to advance soil borings RI-SB-1 through RI-SB-4 and a Geoprobe™ direct-push drill rig will be used to advance soil borings RI-SB-5 through RI-SB-21 at the approximate locations shown on Figure 7. For soil borings drilled using a Geoprobe™, soil

cores will be collected in four-foot long, two-inch diameter, stainless steel macrocore piston rod samplers fitted with internal, dedicated acetate liners. For soil borings drilled using a Rotosonic drill rig, soil cores will be collected in four-foot long, four-inch diameter, dedicated plastic liners. Soil samples will be collected continuously from grade to the groundwater interface, expected to be encountered between 10 and 12 feet below grade. The soil samples will be inspected by AKRF field personnel for evidence of contamination (e.g., odors, staining, etc.), screened for the presence of VOCs with an 11.7 electron Volt (eV) lamp PID, and logged using the modified Burmister soil classification system. The PID will be calibrated at the beginning of each work shift and on an as-needed basis in accordance with manufacturer's specifications.

Soil samples will be submitted for laboratory analysis based on field observations and PID readings. It is anticipated that one to three soil samples will be submitted for laboratory analysis, depending upon the sample location. At a minimum, where possible, the soil samples from the two-foot interval immediately below the surface (asphalt, concrete, and/or vegetation) and the two-foot interval immediately above the groundwater interface will be submitted for laboratory analysis. A third soil sample will be submitted for laboratory analysis from the interval displaying the greatest evidence of contamination, if encountered. In the absence of contamination, the third soil sample submitted for laboratory analysis will be from the depth of the bottom of the proposed new building's foundation.

It is noted that soil borings RI-SB-3, RI-SB-4, RI-SB-5, RI-SB-10 and RI-SB-11 are located within the current Site building footprint, whose cellar slab is approximately eight feet below sidewalk grade. As such, it is anticipated that only one soil sample will be able to be submitted for laboratory analysis from beneath the cellar slab until the groundwater interface is encountered. In the event that the vadose zone is thicker than three feet, two soil samples will be submitted for laboratory analysis. In addition, soil boring RI-SB-12 will be advanced at the location of the former UST. According to CE's Tank Closure Report (see Section 3.0), the tank grave was excavated to approximately eight feet below grade and backfilled with clean soil meeting RRSCOs. Therefore, at soil boring RI-SB-12, no samples above eight feet below grade will be submitted for laboratory analysis. At each of the proposed soil boring locations, additional samples will be collected for laboratory analysis if soil exhibits evidence of contamination (elevated PID readings, odors, staining, etc.).

Soil samples slated for laboratory analysis will be labeled and placed in laboratory-supplied containers and shipped to the laboratory via a courier with a chain of custody (COC) in accordance with appropriate United States Environmental Protection Agency (EPA) protocols to a New York State Department of Health (NYSDOH) Environmental Laboratory Approval Program (ELAP)-certified laboratory.

Soil samples will be analyzed for VOCs by EPA Method 8260, SVOCs by EPA Method 8270, polychlorinated biphenyls (PCBs) by EPA Method 8082, pesticides by EPA Method 8081, Target Analyte List (TAL) metals by EPA Method 6000/7000 series, and hexavalent chromium by EPA Method 7196A. Category B deliverables will be requested from the laboratory.

After each boring is completed, the soil boring holes will be filled with on-site materials to 24 inches below the surface (if not noticeably contaminated) and patched with asphalt or concrete to match existing surface conditions in accordance with Section 3.3(e) of DER-10. Soil cuttings to be managed will be containerized in properly labeled Department of Transportation (DOT)-approved 55-gallon drums for future off-site disposal at a permitted facility. Boreholes that require drill cutting disposal would be filled with bentonite chips (hydrated). Disposable sampling

equipment that come in contact with environmental media will be double bagged and disposed of as municipal trash as non-hazardous refuse.

The rationale for the proposed soil sample locations is summarized in In-Text Table 2.

In-Text Table 2
Proposed Soil Sample Rationale

Soil Boring	On-Site Location	Soil Sample Analytical Parameters	Rationale
RI-SB-1	Northwestern	VOCs, SVOCs, PCBs, pesticides, TAL metals, and hexavalent chromium	To assess soil quality in the northwestern portion of the Site
RI-SB-2	West-central	VOCs, SVOCs, PCBs, pesticides, TAL metals, and hexavalent chromium	To assess soil quality in the west-central portion of the Site
RI-SB-3	South-central	VOCs, SVOCs, PCBs, pesticides, TAL metals, and hexavalent chromium	To assess soil quality in the south-central portion of the Site
RI-SB-4	East-central	VOCs, SVOCs, PCBs, pesticides, TAL metals, and hexavalent chromium	To assess soil quality in the east-central portion of the Site beneath the former dry cleaner
RI-SB-5	Southeastern	VOCs, SVOCs, PCBs, pesticides, TAL metals, and hexavalent chromium	To assess soil quality in the southeastern portion of the Site beneath the former dry cleaner
RI-SB-6	Southwestern	VOCs, SVOCs, PCBs, pesticides, TAL metals, and hexavalent chromium	To assess soil quality in the southwestern portion of the Site
RI-SB-7	Northwestern	VOCs, SVOCs, PCBs, pesticides, TAL metals, and hexavalent chromium	To assess soil quality in the northern portion of the Site
RI-SB-8	Northern	VOCs, SVOCs, PCBs, pesticides, TAL metals, and hexavalent chromium	To assess soil quality in the northern portion of the Site
RI-SB-9	North-central	VOCs, SVOCs, PCBs, pesticides, TAL metals, and hexavalent chromium	To assess soil quality in the north-central portion of the Site
RI-SB-10	Central	VOCs, SVOCs, PCBs, pesticides, TAL metals, and hexavalent chromium	To assess soil quality in the central portion of the Site
RI-SB-11	Central	VOCs, SVOCs, PCBs, pesticides, TAL metals, and hexavalent chromium	To assess soil quality in the central portion of the Site
RI-SB-12	Northeastern	VOCs, SVOCs, PCBs, pesticides, TAL metals, and hexavalent chromium	To assess soil quality underneath the former tank grave
RI-SB-13	Southwestern	VOCs, SVOCs, PCBs, pesticides, TAL metals, and hexavalent chromium	To assess soil quality in the southwestern portion of the Site
RI-SB-14 and RI-SB-15	Western	VOCs, SVOCs, PCBs, pesticides, TAL metals, and hexavalent chromium	To assess soil quality in the western portion of the Site

In-Text Table 2
Proposed Soil Sample Rationale

Soil Boring	On-Site Location	Soil Sample Analytical Parameters	Rationale
RI-SB-16 and RI-SB-17	Northern	VOCs, SVOCs, PCBs, pesticides, TAL metals, and hexavalent chromium	To assess soil quality in the northern portion of the Site
RI-SB-18 through RI-SB-21	North-central	VOCs, SVOCs, PCBs, pesticides, TAL metals, and hexavalent chromium	To assess soil quality in the north-central portion of the Site

Notes:
QA/QC sampling is discussed in Section 4.8.
VOCs – volatile organic compounds
SVOCs – semivolatile organic compounds
PCBs – polychlorinated biphenyls
TAL – target analyte list

4.4 Groundwater Monitoring Well Installation and Development

Five permanent monitoring wells (denoted as RI-MW-1 through RI-MW-5) will be installed using a Rotosonic drill rig at the proposed locations shown on Figure 7. Monitoring wells RI-MW-1 and RI-MW-2 will be installed during the initial phase of the RI and monitoring wells RI-MW-3 through RI-MW-5 will be installed during the second phase of the RI (once the building has been demolished).

The wells will be constructed with 10 feet of 2-inch diameter 0.002-inch slotted polyvinyl chloride (PVC) well screen straddling the water table, which is expected to be encountered between approximately 9 and 12 feet below grade. The wells will be constructed with 2-inch diameter solid PVC riser installed to the ground surface. A No. 2 morie sandpack will be installed to two feet above the well screen. The annular space around the solid well riser will be sealed with approximately two feet of bentonite and a non-shrinking grout/cement mixture to approximately one foot below grade. Each of the wells will be finished with a locking j-plug and flush-mounted protective locking well cover. Well construction logs will be prepared and included as an appendix to the RIR.

Following installation, each groundwater monitoring well will be developed via pumping and surging to remove any accumulated fines and establish a hydraulic connection with the surrounding aquifer. Development will continue until turbidity within the well is less than 50 nephelometric turbidity units (NTUs) for three successive readings and until water quality indicators have stabilized to within 10% for pH, temperature and specific conductivity for three successive readings, or until at least three well volumes have been purged from the well. Well development details will be noted on groundwater development logs, included as an appendix to the RIR.

The rationale for the proposed groundwater sample locations is summarized in In-Text Table 3.

In-Text Table 3
Proposed Groundwater Sample Rationale

Groundwater Monitoring Well ID	On-Site Location	Analytical Parameters	Rationale
RI-MW-1	Northwestern	VOCs, SVOCs, PCBs, pesticides, total and dissolved TAL metals, 1,4-Dioxane, and PFAS	To assess groundwater quality in the northwestern portion of the Site and determine Site-specific groundwater flow direction and elevation
RI-MW-2	West-central	VOCs, SVOCs, PCBs, pesticides, total and dissolved TAL metals, 1,4-Dioxane, and PFAS	To assess groundwater quality in the west-central portion of the Site and determine Site-specific groundwater flow direction and elevation
RI-MW-3	South-central	VOCs, SVOCs, PCBs, pesticides, total and dissolved TAL metals, 1,4-Dioxane, and PFAS	To assess groundwater quality at the southern Site boundary and determine Site-specific groundwater flow direction and elevation
RI-MW-4	East-central	VOCs, SVOCs, PCBs, pesticides, total and dissolved TAL metals, 1,4-Dioxane, and PFAS	To assess groundwater quality beneath the former dry cleaner and determine Site-specific groundwater flow direction and elevation
RI-MW-5	Central	VOCs, SVOCs, PCBs, pesticides, total and dissolved TAL metals, 1,4-Dioxane, and PFAS	To assess groundwater quality at the center of the Site and determine Site-specific groundwater flow direction and elevation

Notes:
QA/QC sampling is discussed in Section 4.8.
VOCs – volatile organic compounds
SVOCs – semivolatile organic compounds
PCBs – polychlorinated biphenyls
TAL – target analyte list
PFAS – per and polyfluoroakyl substances

4.5 Groundwater Elevation Survey

The monitoring wells will be surveyed by a New York State-licensed surveyor to determine their accurate location and elevation. Two elevation measurements will be taken at each well location: the at-grade elevation; and the elevation of the top of PVC casing (north side at marking), to facilitate preparation of a groundwater contour map and to determine the direction of groundwater flow. The elevation datum for the sampling points will be based on NVAD 88 Elevation Datum with the horizontal datum being based on NYS Plane Coordinates Long Island Zone. The groundwater elevation survey will be included as an appendix to the RIR.

4.6 Groundwater Sampling

In accordance with EPA low-flow sampling protocols, the wells will be sampled one to two weeks following their development. Prior to sampling, an electronic interface meter will be used to measure water levels and thickness of separate phase product, if any. To evaluate contaminant migration to soil vapor, groundwater samples will be collected from the top of the water table.

The purge water will be monitored for turbidity and water quality indicators (i.e., pH, dissolved oxygen, oxidation-reduction potential, temperature, and specific conductivity) with measurements collected approximately every five minutes. The criteria for stabilization will be three successive readings within ±10% for pH, temperature, and specific conductivity. Purge water needing to be managed on-site will be containerized in properly labeled, DOT-approved 55-gallon drums for off-site disposal at a permitted facility.

Groundwater samples slated for laboratory analysis will be placed in laboratory-supplied containers and shipped under COC in accordance with appropriate EPA protocols to a NYSDOH ELAP-certified laboratory. The samples will be analyzed for VOCs by EPA Method 8260, SVOCs by EPA Method 8270, PCBs by EPA Method 8082, pesticides by EPA Method 8081, total and dissolved TAL metals by EPA Method 6000/7000 series, 1,4-Dioxane by EPA Method 8270 SIM, and PFAS by Modified EPA Method 537 using Category B deliverables. Filtering will occur in the field.

4.7 Sub-Slab/Soil Vapor and Ambient Air Sampling

Eleven sub-slab/soil vapor samples (denoted as RI-SV-1 through RI-SV-11) will be collected from 11 temporary vapor monitoring points at the approximate locations shown on Figure 7. Sub-slab/soil vapor point installation and sampling will be performed in accordance with the guidelines provided in the NYSDOH document entitled, "Guidance for Evaluating Soil Vapor Intrusion in the State of New York, October 2006".

Soil vapor points RI-SV-1, RI-SV-2 and RI-SV-6 through RI-SV-11 will be installed during the initial phase of the RI and sub-slab soil vapor points RI-SV-3 through RI-SV-5 will be installed during the second phase of the RI. Although the building will be demolished during the second phase of the RI, it is anticipated that the concrete slab will remain and be competent so that soil vapor points RI-SV-3 through RI-SV-5 will be installed as sub-slab vapor points.

It is also noted that RI-SV-3, RI-SV-4, and RI-SV-5 are located within the current Site building footprint, whose cellar slab is approximately eight feet below sidewalk grade. It is assumed that a minimum one foot vadose zone is present beneath the current Site building slab. However, if there is no vadose zone or the zone is less than one foot below the slab, the points will not be able to be installed. The remaining soil vapor points RI-SV-1, RI-SV-2, and RI-SV-6 through RI-SV-11 will be installed approximately two feet above the observed groundwater table.

The temporary soil vapor points will be installed by advancing an expendable drive point using a Geoprobe™ direct-push drill rig to the target sampling depth. At each monitoring point, a six-inch stainless steel screen implant, connected to Teflon™ tubing will be installed through the drilling rods and threaded into the drive point. The sampling tubing will extend from the end of the screen to above grade. The push probe rods will then be removed and the boring will be backfilled with clean silica sand to approximately three to six inches above the screen. Hydrated bentonite will be used to fill the remaining void around the sampling tubing to the ground surface.

Prior to sample collection, the sampling points will be purged of three sample volumes using a peristaltic pump. During purging, a shroud will be placed over the sampling point and helium gas will be introduced through a small hole in the bucket to saturate the atmosphere around the sample port with helium gas. Purged vapors will be collected into a Tedlar™ bag and field-screened for organic vapors using a PID. The purged air will also be monitored using a portable helium detector to check for short-circuiting of ambient air into the vapor sampling point. If the purged soil vapor contains greater than 10% helium, additional bentonite will used to enhance the surface seal, and the point will be retested.

Following purging, the soil vapor samples will be collected over a 2-hour time period from each monitoring point using a 6-Liter, batch-certified SUMMA® canister equipped with a vacuum gauge and flow regulator set at a maximum rate of 0.2 liter per minute. Immediately after opening the flow control valve, the initial SUMMA® canister vacuum (inches of mercury) will be noted. After two hours, the flow controller valve will be closed, the final vacuum noted, and the canister placed in a shipping carton for delivery to the laboratory.

The soil vapor/sub-slab vapor and ambient air samples will be analyzed for VOCs by EPA Method TO-15 by a NYSDOH ELAP-certified laboratory with Category B deliverables. Samples will be shipped to the laboratory with a COC.

The rationale for the proposed sub-slab/soil vapor sample locations is summarized in In-Text Table 4.

In-Text Table 4
Proposed Sub-Slab/Soil Vapor Sample Rationale

Vapor Point ID	On-Site Location	Analytical Parameter	Rationale
RI-SV-1	Northwestern	VOCs	To evaluate the potential for off-site exposures to the west and complete the significant threat determination
RI-SV-2	West-central	VOCs	To evaluate extent of PCE detected in soil vapor during the Phase II from an upgradient location and to complete the significant threat determination
RI-SV-3	South-central	VOCs	To evaluate the potential for off-site exposures to the south and complete the significant threat determination
RI-SV-4	East-central	VOCs	To evaluate soil vapor beneath the former dry cleaner and complete the significant threat determination
RI-SV-5	Southeastern	VOCs	To evaluate soil vapor beneath the former dry cleaner, evaluate the potential for off-site exposures to the east and complete the significant threat determination
RI-SV-6	Northwestern boundary	VOCs	To evaluate the potential for off-site exposures to the north and complete the significant threat determination
RI-SV-7	Northern	VOCs	To evaluate the potential for future vapor intrusion into the proposed new building crawl space
RI-SV-8	Northeastern boundary	VOCs	To evaluate the potential for off-site exposures to the east and complete the significant threat determination
RI-SV-9	Northeast-central boundary	VOCs	To evaluate the potential for off-site exposures to the north and complete the significant threat determination
RI-SV-10	Northern boundary	VOCs	To evaluate the potential for off-site exposures to the north and complete the significant threat determination
RI-SV-11	Northern boundary	VOCs	To evaluate the potential for off-site exposures to the northeast and complete the significant threat determination

Note:
RI-SV-1 and RI-SV-2 and RI-SV-6 through RI-SV-11 will be installed and sampled during the first phase of the RI and RI-SV-3 through RI-MW-5 will be installed and sampled during the second phase of the RI.

4.8 Quality Assurance/Quality Control (QA/QC)

Additional analysis will be included for quality control measures, as required by the Category B sampling techniques. The QA/QC samples for soil and groundwater will include at least one field blank, one trip blank, one matrix spike/matrix spike duplicate (MS/MSD), and one blind duplicate sample at a frequency of at least one sample per 20 field samples per media. The field blank,

blind duplicate, and MS/MSD samples will be analyzed for VOCs by EPA Method 8260, SVOCs by EPA Method 8270, pesticides by EPA Method 8081, PCBs by EPA Method 8082, and TAL metals by EPA Method 6000/7000s series (plus hexavalent chromium by EPA Method 7196 for soil, and total and dissolved metals for groundwater) using Category B deliverables. The laboratory-prepared trip blanks will be submitted for analysis of VOCs only to determine the potential for cross-contamination. The QAPP describes the QA/QC protocols and procedures that will be followed during implementation of this RIWP. The QAPP is included as Appendix A.

4.9 Decontamination Procedures

All non-dedicated sampling equipment (e.g., submersible pumps and oil/water interface probe) will be decontaminated between sampling locations using the following procedure:

1. Scrub equipment with a bristle brush using a tap water/Alconox® solution.
2. Rinse with tap water.
3. Scrub again with a bristle brush using a tap water/Alconox® solution.
4. Rinse with tap water.
5. Rinse with distilled water.
6. Air-dry the equipment.

4.10 Management of Investigation-Derived Waste (IDW)

All IDW will be used to backfill the corresponding borehole that generated them to within 24 inches of the surface, or will be disposed of or treated according to applicable local, state, and federal regulations. Soil and groundwater IDW exhibiting evidence of gross contamination will be containerized in Department of Transportation (DOT)-approved 55-gallon drums. The drums will be sealed at the end of each work day and labeled with the date, the well or boring number(s), the type of waste (i.e., drill cuttings, decontamination fluids, development water, or purge water) and the name of an AKRF point-of-contact. All drums will be labeled "pending analysis" until laboratory data is available. All boreholes will be restored after backfill. Handling of IDW and backfilling of boreholes will be conducted in accordance with Section 3.3(e) of DER-10.

5.0 REPORTING REQUIREMENTS

5.1 Remedial Investigation Report (RIR)

Upon completion of all field work and receipt of laboratory analytical results, an RIR will be prepared in compliance with Section 3.14 of DER-10 that will: document field activities; present field and laboratory data; evaluate exposure pathways in an exposure assessment; identify and characterize the source(s) of contamination; a summary of the overall nature and extent of contamination using the applicable standards, criteria, and guidance; and discuss conclusions and recommendations drawn from the results of the RI.

5.1.1 Description of Field Activities

This section of the RIR will describe the field methods used to characterize the Site conditions, including: sampling techniques; field screening equipment; drilling and excavation equipment; monitoring well installation procedures; and management of IDW. This section will also include descriptions of hydrogeologic factors of the Site.

5.1.2 Soil Boring Assessment

The RIR will include a section that presents field and laboratory data for soil results. The section will include a description of soil characteristics and figures will be provided that illustrate soil boring locations. Field and laboratory analytical results will be presented in the body of the report, summarized in tables and figures, and the detected concentrations will be compared to regulatory standards and/or guidance values. Soil boring logs and laboratory analytical reports will be provided as attachments. Category B deliverables will be provided by the laboratory and a third-party Data Usability Summary Report (DUSR) will be prepared and discussed.

5.1.3 Groundwater Assessment

The RIR will include a section that presents field and laboratory data from the groundwater monitoring results. The section will include a description of groundwater characteristics and figures will be provided that illustrate monitoring well locations. Well survey data and water level measurements will be used to create a groundwater contour map and determine groundwater flow direction. Field and laboratory analytical results will be presented and compared with regulatory standards and/or guidance values. Well construction, well development, and low-flow groundwater sampling logs and laboratory analytical reports will be provided as attachments. Category B deliverables will be provided by the laboratory and a third-party DUSR will be prepared and discussed.

5.1.4 Sub-Slab/Soil Vapor and Ambient Air Assessment

The RIR will include a section that presents field and laboratory data from the soil vapor and ambient air results. The section will include a description of soil vapor characteristics and will provide a comparison of soil vapor and ambient air sample analytical data. Figures will be provided that illustrate the soil vapor point and ambient air locations. Field and laboratory analytical results will be presented and compared with regulatory standards and/or guidance values. Soil vapor and ambient air logs and laboratory analytical reports will be provided as attachments. Category B deliverables will be provided by the laboratory and a third-party DUSR will be prepared and discussed.

5.1.5 Qualitative Human Health Exposure Assessment (QHHEA)

A QHHEA will be performed in accordance with DER-10 Section 3.3(c)4 and Appendix 3B. The assessment will be included in the RIR.

6.0 PROPOSED PROJECT SCHEDULE

In-Text Table 4
Proposed Project Schedule

Activity	Time To Complete
End of BCP Application Public Comment Period and Draft RIWP Comments Received	March 2018
Execute Brownfield Cleanup Agreement and Final Submittal/Approval of RIWP	May 2018
Citizen Participation Plan (CPP)	May 2018
First Phase of Remedial Investigation (RI) is Initiated	May 2018
First Phase of RI is Completed	June 2018
Site Building Demolition	Spring/Summer 2018
Second Phase of Remedial Investigation (RI)	After Site Building Demolition (anticipated Summer 2018)
Draft RI Report (RIR) Submitted to NYSDEC	August/September 2018
Draft Remedial Action Work Plan (RAWP) and Fact Sheet Submitted to NYSDEC	August/September 2018
45-day Public Comment Period for RAWP is Initiated	September 2018
Public Comment Period for RAWP Ends	October 2018
Final RAWP Submitted/NYSDEC Approves and Issues Decision Document	November 2018
Issue Remedial/Construction Notice Fact Sheet	December 2018
Begin Redevelopment (Construction) with Implementation of RAWP	January 2019
Draft Site Management Plan (SMP) Submitted to NYSDEC	July 2020
Execution of Environmental Easement	Summer 2020
Draft Final Engineering Report and Fact Sheet	September 2020
Certificate of Completion and Fact Sheet	December 2020
Completion of Building	December 2022

7.0 CERTIFICATION

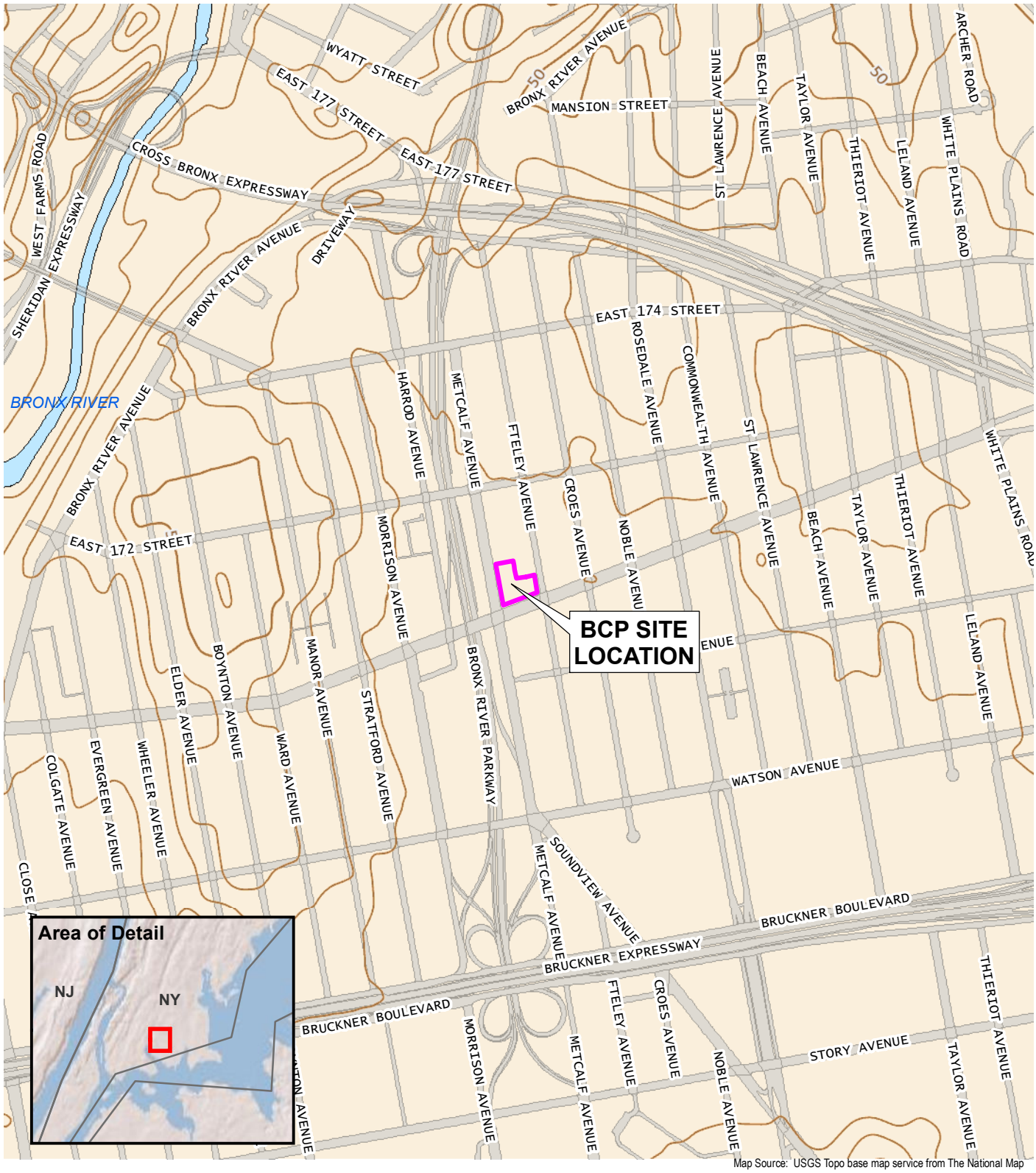
I, Deborah Shapiro, QEP, certify that I am currently a Qualified Environmental Professional as defined in 6 NYCRR Part 375 and that this Remedial Investigation Work Plan was prepared in accordance with all applicable statutes and regulations and in substantial conformance with the DER Technical Guidance for Site Investigation and Remediation (DER-10).

Deborah Shapiro, QEP		05/04/2018
Name	***Signature***	***Date***

8.0 REFERENCES

- Phase I Environmental Site Assessment – 1675 Westchester Avenue, Bronx, New York, Environmental Investigations, LLC, July 2014.
- Phase II Environmental Site Assessment – 1675 Westchester Avenue, Bronx, New York, Cider Environmental, October 2014.
- Tank Closure Report – 1675 Westchester Avenue, Bronx, New York, Cider Environmental, December 2014.
- Phase I Environmental Site Assessment – 1675 Westchester Avenue, Bronx, New York, Cider Environmental, February 2017.
- Phase I Environmental Site Assessment – 1679 Westchester Avenue, Bronx, New York, AKRF, Inc., October 2017.
- Subsurface (Phase II) Investigation Report – 1675-1679 Westchester Avenue, Bronx, New York, AKRF, November 2017.
- U.S. Geological Survey; Central Park Quadrangle – Central Park/New Jersey; 7.5 minute Series (Topographic), Scale 1:24,000, 1966, Photorevised 1979.
- U.S. Geological Survey; Central Park Quadrangle—Central Park/New Jersey; 7.5 Minute Series (Topographic); Scale 1:24,000; 1966; Photorevised 1979.
- 6 NYCRR Section 375-6: Remedial Program Soil Cleanup Objectives (SCOs), December 14, 2006.
- NYSDEC Division of Water Technical and Operational Guidance Series 1.1.1 Ambient Water Quality Standards and Guidance Values and Groundwater Effluent Limitations, March 1998.
- NYSDOH Final Guidance for Evaluating Soil Vapor Intrusion in the State of New York Air Guideline Values (AGVs) and Table 3.3 Matrix 1 and 2 Chemicals, October 2006; revised in fact sheets released in September 2013 for tetrachloroethene (PCE) and August 2015 for trichloroethene (TCE), and in the May 2017 Matrix Values updates.

FIGURES



Map Source: USGS Topo base map service from The National Map

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SCALE IN FEET

AKRF

440 Park Avenue South, New York, NY 10016

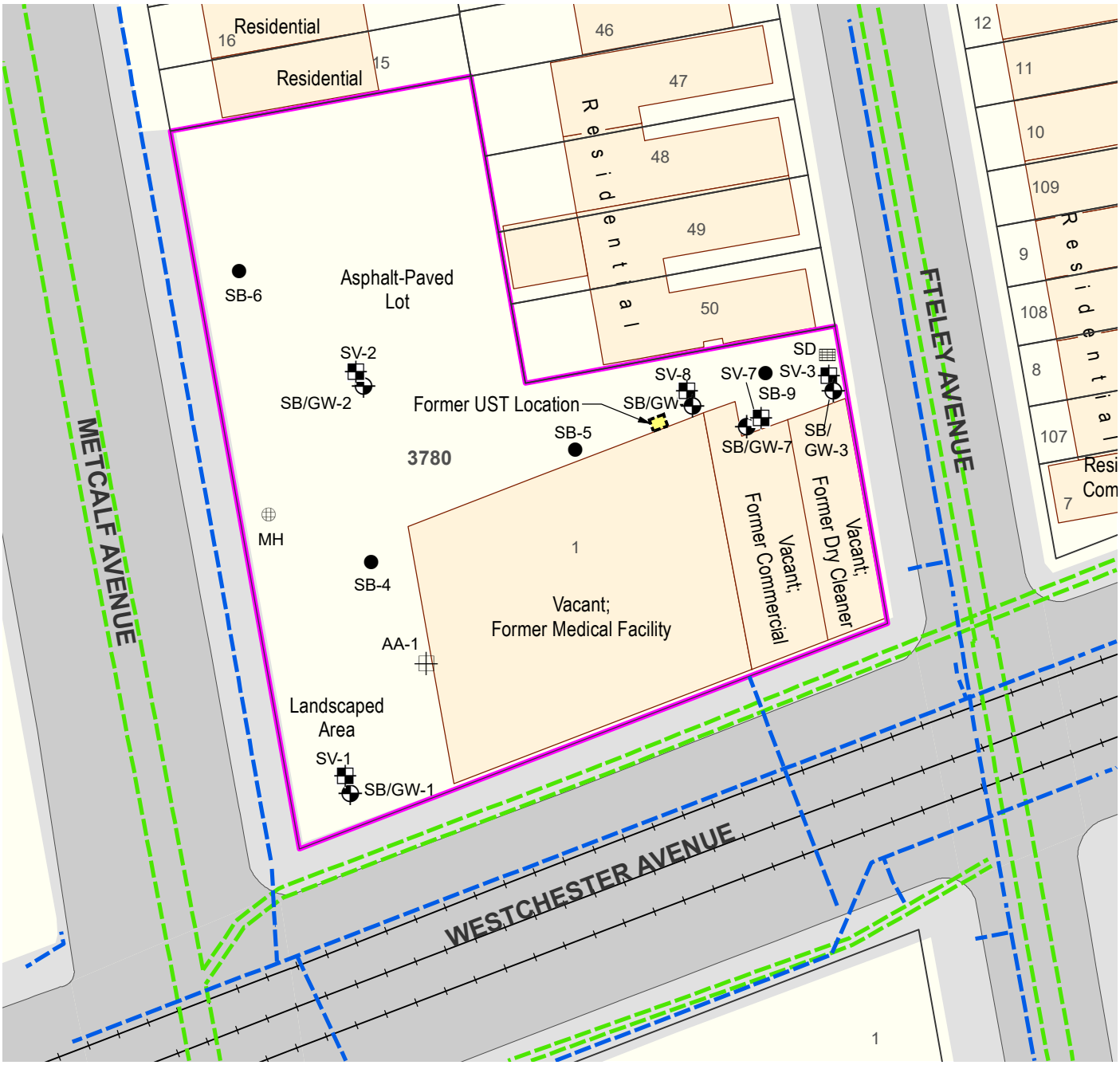
1675 Apartments
1675-1679 Westchester Avenue
Bronx, New York

BCP SITE LOCATION

DATE
5/4/2018

PROJECT NO.
170250

FIGURE
1



LEGEND

- BCP SITE BOUNDARY
- BUILDING
- 1 — LOT BOUNDARY AND TAX NUMBER
- 3780 — TAX BLOCK NUMBER
- NYCT ELEVATED SUBWAY
- WATER LINE FROM SURVEY
- COMBINED SEWER FROM SURVEY
- SUBSURFACE (PHASE II) INVESTIGATION AMBIENT AIR SAMPLE LOCATION (2017)
- SUBSURFACE (PHASE II) INVESTIGATION SOIL BORING/TEMPORARY GROUNDWATER MONITORING WELL LOCATION (2017)
- SUBSURFACE (PHASE II) INVESTIGATION SOIL BORING LOCATION (2017)
- SUBSURFACE (PHASE II) INVESTIGATION TEMPORARY SOIL VAPOR POINT LOCATION (2017)
- MH — APPROXIMATE ELECTRICAL MANHOLE LOCATION
- SD — APPROXIMATE STORM DRAIN LOCATION

Map Source:
NYCDCP (NYC Dept. of City Planning) GIS database

0 50 100
SCALE IN FEET

AKRF
440 Park Avenue South, New York, NY 10016

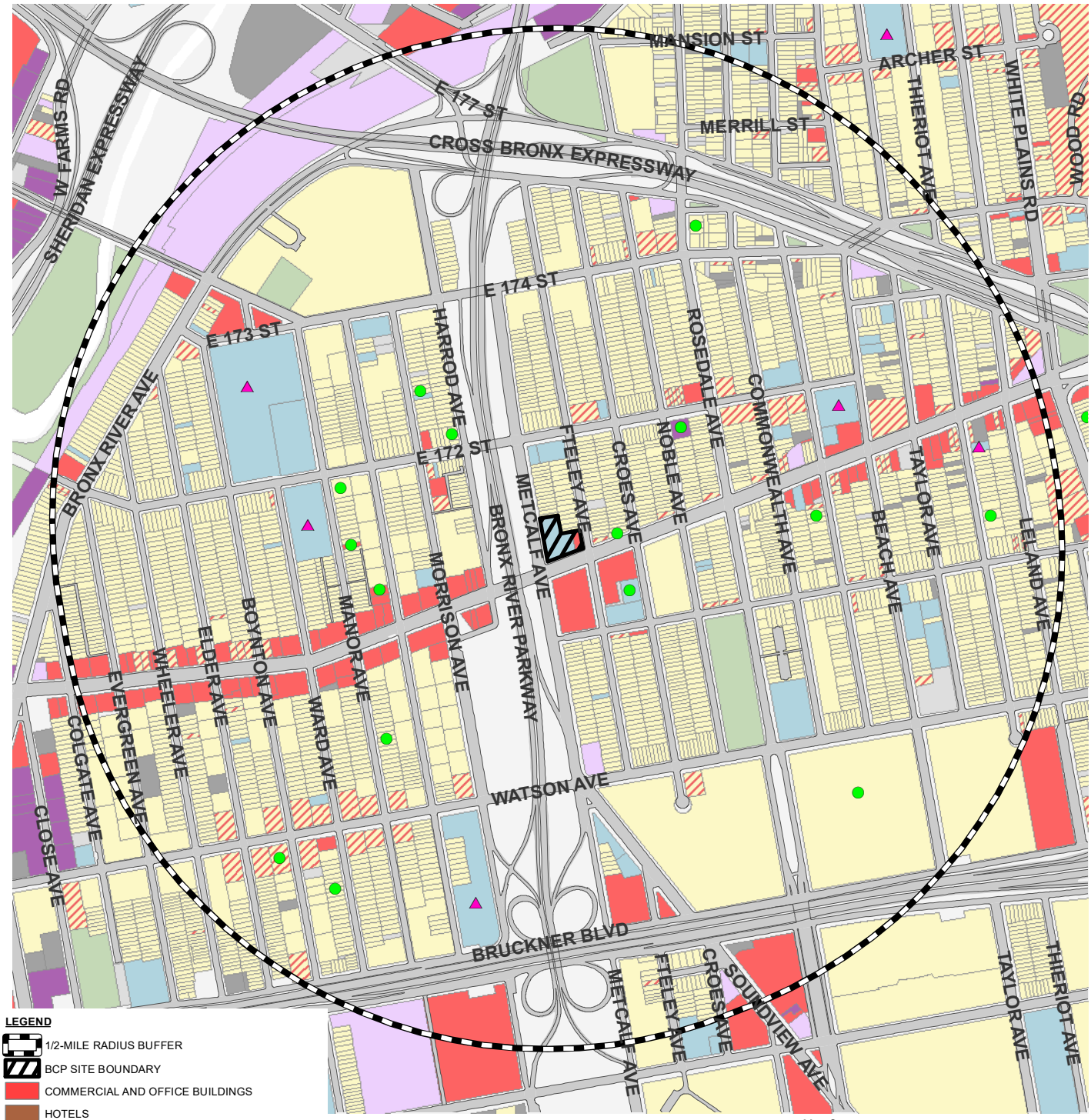
1675 Apartments
1675-1679 Westchester Avenue
Bronx, New York

SITE PLAN

DATE
5/4/2018

PROJECT NO.
170250

FIGURE
2



LEGEND

- 1/2-MILE RADIUS BUFFER
- BCP SITE BOUNDARY
- COMMERCIAL AND OFFICE BUILDINGS
- HOTELS
- INDUSTRIAL AND MANUFACTURING
- OPEN SPACE, PARKS AND OUTDOOR RECREATION
- PARKING FACILITIES
- PUBLIC FACILITIES AND INSTITUTIONS
- RESIDENTIAL
- RESIDENTIAL WITH COMMERCIAL BELOW
- TRANSPORTATION AND UTILITY
- VACANT LAND
- VACANT BUILDING
- UNDER CONSTRUCTION
- DAY CARE FACILITY
- SCHOOL

Map Source:
NYCDCP (NYC Dept. of City Planning) GIS database

0 800 1,600
SCALE IN FEET

AKRF
440 Park Avenue South, New York, NY 10016

1675 Apartments
1675-1679 Westchester Avenue
Bronx, New York

SURROUNDING LAND USE AND SENSITIVE RECEPTORS

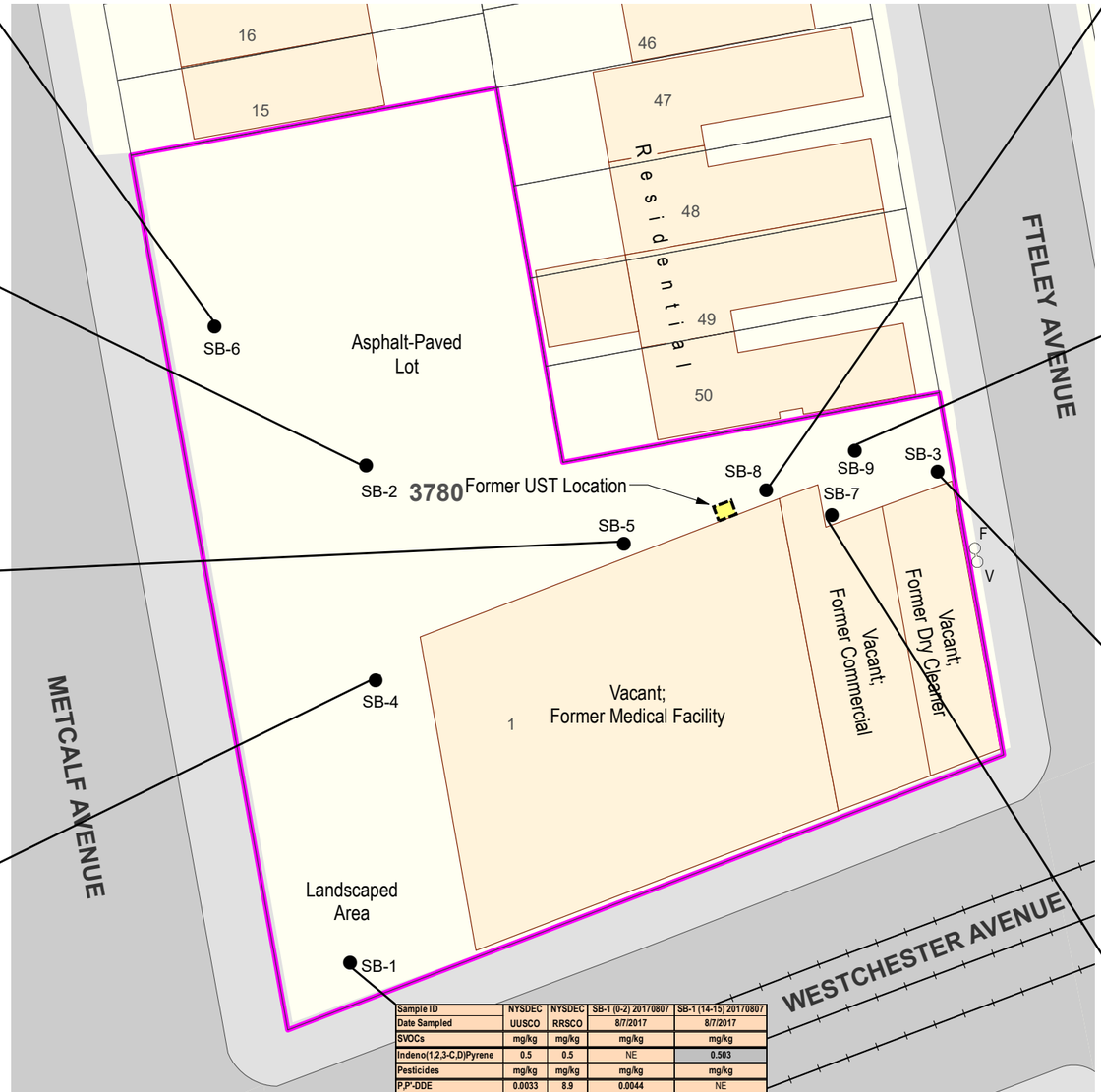
DATE
5/4/2018
PROJECT NO.
170250
FIGURE
3

Sample ID	NYSDEC	NYSDEC	SB-6 (0-2) 20170807	SB-6 (13-15) 20170807
Date Sampled	UUSCO	RRSCO	8/7/2017	8/7/2017
SVOCs	mg/kg	mg/kg	mg/kg	mg/kg
Benzo(A)Anthracene	1	1	1.42	1.12
Benzo(A)Pyrene	1	1	1.5	NE
Benzo(B)Fluoranthene	1	1	1.79	1.11
Chrysene	1	3.9	1.4	1.1
Indeno(1,2,3-C,D)Pyrene	0.5	0.5	1.05	0.627
Pesticides	mg/kg	mg/kg	mg/kg	mg/kg
Dieldrin	0.005	0.2	NE	0.0053
P,P'-DDE	0.0033	8.9	NE	0.0099
P,P'-DDT	0.0033	7.9	0.0074	0.0251
PCBs	mg/kg	mg/kg	mg/kg	mg/kg
Total PCBs	0.1	1	NE	0.472
Metals	mg/kg	mg/kg	mg/kg	mg/kg
Copper	50	270	61.6	NE
Lead	63	400	280	1,520 D
Mercury	0.18	0.81	0.62	1.2 D
Zinc	109	10,000	248	287

Sample ID	NYSDEC	NYSDEC	SB-2 (0-2) 20170807	SB-2 (3-5) 20170807
Date Sampled	UUSCO	RRSCO	8/7/2017	8/7/2017
VOCs	mg/kg	mg/kg	mg/kg	mg/kg
Acetone	0.05	100	NE	0.0681
SVOCs	mg/kg	mg/kg	mg/kg	mg/kg
Benzo(A)Anthracene	1	1	25.2 D	1.57
Benzo(A)Pyrene	1	1	21.5 D	1.85
Benzo(B)Fluoranthene	1	1	24.5 D	2.11
Benzo(K)Fluoranthene	0.8	3.9	9.63 D	NE
Chrysene	1	3.9	22.3 D	1.7
Dibenz(A,H)Anthracene	0.33	0.33	3.01 D	0.335
Indeno(1,2,3-C,D)Pyrene	0.5	0.5	13.1 D	1.32
Pesticides	mg/kg	mg/kg	mg/kg	mg/kg
P,P'-DDD	0.0033	13	NE	0.0067
P,P'-DDE	0.0033	8.9	0.0091	NE
Metals	mg/kg	mg/kg	mg/kg	mg/kg
Copper	50	270	56.3	NE
Lead	63	400	236	244
Mercury	0.18	0.81	0.27	0.52
Zinc	109	10,000	147	162

Sample ID	NYSDEC	NYSDEC	SB-5 (0-2) 20170807	SB-5 (11-12) 20170807
Date Sampled	UUSCO	RRSCO	8/7/2017	8/7/2017
SVOCs	mg/kg	mg/kg	mg/kg	mg/kg
Benzo(A)Anthracene	1	1	7.34 D	1.32
Benzo(A)Pyrene	1	1	6.51 D	1.27
Benzo(B)Fluoranthene	1	1	8.34 D	1.61
Benzo(K)Fluoranthene	0.8	3.9	2.74 D	NE
Chrysene	1	3.9	6.6 D	1.44
Dibenz(A,H)Anthracene	0.33	0.33	1.95	NE
Indeno(1,2,3-C,D)Pyrene	0.5	0.5	4.15 D	0.903
Pesticides	mg/kg	mg/kg	mg/kg	mg/kg
P,P'-DDD	0.0033	13	NE	0.0099
P,P'-DDE	0.0033	8.9	0.0066	NE
P,P'-DDT	0.0033	7.9	0.0105	0.0076
Metals	mg/kg	mg/kg	mg/kg	mg/kg
Chromium, Hexavalent	1	110	1.3	NE
Copper	50	270	91.9	115
Lead	63	400	254	381
Mercury	0.18	0.81	0.25	0.97
Zinc	109	10,000	224	395

Sample ID	NYSDEC	NYSDEC	SB-4 (0-2) 20170807	SB-4 (13-15) 20170807
Date Sampled	UUSCO	RRSCO	8/7/2017	8/7/2017
SVOCs	mg/kg	mg/kg	mg/kg	mg/kg
Benzo(A)Anthracene	1	1	3.3	NE
Benzo(A)Pyrene	1	1	3.12	NE
Benzo(B)Fluoranthene	1	1	3.25 D	NE
Benzo(K)Fluoranthene	0.8	3.9	1.07 D	NE
Chrysene	1	3.9	3.3	NE
Dibenz(A,H)Anthracene	0.33	0.33	0.57	NE
Indeno(1,2,3-C,D)Pyrene	0.5	0.5	2.21	NE
Pesticides	mg/kg	mg/kg	mg/kg	mg/kg
P,P'-DDD	0.0033	13	NE	0.0176
P,P'-DDE	0.0033	8.9	0.0037	0.0094
P,P'-DDT	0.0033	7.9	0.0071	0.0202
Metals	mg/kg	mg/kg	mg/kg	mg/kg
Barium	350	400	NE	899
Lead	63	400	283	2,130 D
Mercury	0.18	0.81	3.7 D	NE
Zinc	109	10,000	195	831



Map Source:
NYCDCP (NYC Dept. of City Planning) GIS database

Sample ID	NYSDEC	NYSDEC	SB-1 (0-2) 20170807	SB-1 (14-15) 20170807
Date Sampled	UUSCO	RRSCO	8/7/2017	8/7/2017
SVOCs	mg/kg	mg/kg	mg/kg	mg/kg
Indeno(1,2,3-C,D)Pyrene	0.5	0.5	NE	0.503
Pesticides	mg/kg	mg/kg	mg/kg	mg/kg
P,P'-DDE	0.0033	8.9	0.0044	NE
P,P'-DDT	0.0033	7.9	0.0212	NE
Metals	mg/kg	mg/kg	mg/kg	mg/kg
Cadmium	2.5	4.3	2.8	NE
Copper	50	270	60.5	106
Lead	63	400	637	278
Mercury	0.18	0.81	0.57	0.66
Nickel	30	310	30.2	NE
Zinc	109	10,000	193	202

Sample ID	NYSDEC	NYSDEC	SB-8 (0-2) 20170921	SB-8 (7-9) 20170921
Date Sampled	UUSCO	RRSCO	9/21/2017	9/21/2017
SVOCs	mg/kg	mg/kg	mg/kg	mg/kg
4-Methylphenol (P-Cresol)	0.33	NS	NE	0.42
Benzo(A)Anthracene	1	1	2.7	27.8 D
Benzo(A)Pyrene	1	1	2.84	23.7 D
Benzo(B)Fluoranthene	1	1	3.26	27.8 D
Benzo(K)Fluoranthene	0.8	3.9	1.3	9.97 D
Chrysene	1	3.9	2.78	26.5 D
Dibenz(A,H)Anthracene	0.33	0.33	0.557	4.25 D
Indeno(1,2,3-C,D)Pyrene	0.5	0.5	2.11	13 D
Pesticides	mg/kg	mg/kg	mg/kg	mg/kg
P,P'-DDD	0.0033	13	0.0267 D	NE
P,P'-DDE	0.0033	8.9	0.0538 D	0.0042
P,P'-DDT	0.0033	7.9	0.0111 D	NE
Metals	mg/kg	mg/kg	mg/kg	mg/kg
Barium	350	400	413	880
Chromium, Hexavalent	1	110	NE	1.3
Copper	50	270	NE	89.3
Lead	63	400	2,300 D	3,430 D
Mercury	0.18	0.81	0.26	1.2 D
Zinc	109	10,000	234	431

Sample ID	NYSDEC	NYSDEC	SB-9 (0-2) 20170921	SB-9 (7-9) 20170921
Date Sampled	UUSCO	RRSCO	9/21/2017	9/21/2017
SVOCs	mg/kg	mg/kg	mg/kg	mg/kg
Benzo(A)Anthracene	1	1	4.53 D	NE
Benzo(A)Pyrene	1	1	4.15 D	NE
Benzo(B)Fluoranthene	1	1	5.3 D	NE
Benzo(K)Fluoranthene	0.8	3.9	1.78	NE
Chrysene	1	3.9	4.2 D	NE
Dibenz(A,H)Anthracene	0.33	0.33	0.895	NE
Indeno(1,2,3-C,D)Pyrene	0.5	0.5	3	0.552
Metals	mg/kg	mg/kg	mg/kg	mg/kg
Arsenic	13	16	13.6	NE
Chromium, Hexavalent	1	110	31.6	NE
Chromium, Trivalent	30	180		
Copper	50	270	75.1	72.7
Lead	63	400	459	174
Mercury	0.18	0.81	0.55	0.34
Nickel	30	310	40.3	NE
Zinc	109	10,000	285	267
PCBs	mg/kg	mg/kg	mg/kg	mg/kg
Total PCBs	0.1	1	0.104	NE

Sample ID	NYSDEC	NYSDEC	SB-3 (0-2) 20170807	SB-3 (5-7) 20170807
Date Sampled	UUSCO	RRSCO	8/7/2017	8/7/2017
SVOCs	mg/kg	mg/kg	mg/kg	mg/kg
Benzo(A)Anthracene	1	1	NE	3.81 D
Benzo(A)Pyrene	1	1	1.02	3.78 D
Benzo(B)Fluoranthene	1	1	1.28	4.01 D
Benzo(K)Fluoranthene	0.8	3.9	NE	1.67 D
Chrysene	1	3.9	NE	3.58 D
Dibenz(A,H)Anthracene	0.33	0.33	NE	0.832
Indeno(1,2,3-C,D)Pyrene	0.5	0.5	0.754	2.64
Pesticides	mg/kg	mg/kg	mg/kg	mg/kg
P,P'-DDE	0.0033	8.9	NE	0.0095
Metals	mg/kg	mg/kg	mg/kg	mg/kg
Arsenic	13	16	NE	51.3
Chromium, Hexavalent	1	110	NE	1.1
Chromium, Trivalent	30	180	NE	36.2
Copper	50	270	62.5	245
Lead	63	400	310	498 D
Mercury	0.18	0.81	1.1 D	3.9 D
Nickel	30	310	NE	58.5
Zinc	109	10,000	188	576

Sample ID	NYSDEC	NYSDEC	SB-7 (0-2) 20170921	SB-7 (11-13) 20170921
Date Sampled	UUSCO	RRSCO	9/21/2017	9/21/2017
SVOCs	mg/kg	mg/kg	mg/kg	mg/kg
Benzo(A)Anthracene	1	1	5.38 D	4.88 D
Benzo(A)Pyrene	1	1	5.07 D	3.52
Benzo(B)Fluoranthene	1	1	5.8 D	4.84 D
Benzo(K)Fluoranthene	0.8	3.9	1.97 D	1.67
Chrysene	1	3.9	5.62 D	3.85
Dibenz(A,H)Anthracene	0.33	0.33	1.15 D	0.65
Indeno(1,2,3-C,D)Pyrene	0.5	0.5	3.09 D	2.27
Pesticides	mg/kg	mg/kg	mg/kg	mg/kg
P,P'-DDE	0.0033	8.9	NE	0.0057
PCBs	mg/kg	mg/kg	mg/kg	mg/kg
Total PCBs	0.1	1	NE	0.121
Metals	mg/kg	mg/kg	mg/kg	mg/kg
Arsenic	13	16	NE	17.1
Copper	50	270	65.1	57.2
Lead	63	400	719	544
Mercury	0.18	0.81	0.74	0.31
Zinc	109	10,000	265	222

LEGEND

- BCP SITE BOUNDARY
- BUILDING
- 1 — LOT BOUNDARY AND TAX LOT NUMBER
- 3780 — TAX BLOCK NUMBER
- NYCT ELEVATED SUBWAY
- F V — TANK FILL PORT AND VENT PIPE
- SUBSURFACE (PHASE II) INVESTIGATION SOIL BORING LOCATION (2017)

Sample Date
Sample ID

Sample ID	NYSDEC	NYSDEC	SB-1 (0-2) 20170807	SB-1 (14-15) 20170807
Date Sampled	UUSCO	RRSCO	8/7/2017	8/7/2017
SVOCs	mg/kg	mg/kg	mg/kg	mg/kg
Indeno(1,2,3-C,D)Pyrene	0.5	0.5	NE	0.503

Analyte/Compound
Concentration

D : The reported concentration is a result of a diluted sample analysis.

NE : The analyte was not detected at a concentration exceeding UUSCOs or RRSCOs.

Part 375 Soil Cleanup Objectives : Listed in New York State Department of Environmental Conservation (NYSDEC) Part 375 Regulations (6 NYCRR Part 375).

mg/kg : milligrams per kilogram = parts per million (ppm)

Exceedances of Part 375 Unrestricted Use Soil Cleanup Objectives (UUSCOs) are shown in bold font.
Exceedances of Part 375 Restricted Residential Soil Cleanup Objectives (RRSCOs) are highlighted in gray.

0 40 80
SCALE IN FEET

AKRF
440 Park Avenue South, New York, NY 10016

1675 Apartments
1675-1679 Westchester Avenue
Bronx, New York

SOIL SAMPLE CONCENTRATIONS ABOVE NYSDEC UUSCOs AND/OR RRSCOs

DATE
5/4/2018

PROJECT NO.
170250

FIGURE
4

Sample ID	NYSDEC	GW-2 20170808
Date Sampled	AWQS	8/8/2017
Total Metals	µg/L	µg/L
Manganese	300	344
Dissolved Metals	µg/L	µg/L
Manganese	300	330

Sample ID	NYSDEC	GW-8 20170921
Date Sampled	AWQS	9/21/2017
Total Metals	µg/L	µg/L
Manganese	300	392
Total Metals	µg/L	µg/L
Manganese	300	365

Sample ID	NYSDEC	GW-1 20170808
Date Sampled	AWQS	8/8/2017
Total Metals	µg/L	µg/L
Lead	25	27.5
Manganese	300	357
Dissolved Metals	µg/L	µg/L
Manganese	300	341

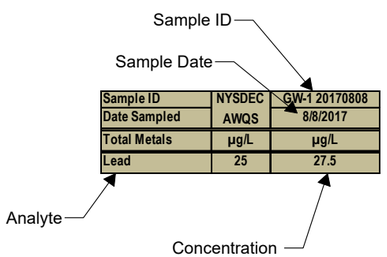
Sample ID	NYSDEC	GW-3 20170808
Date Sampled	AWQS	8/8/2017
SVOCs	µg/L	µg/L
Benzo(A)Anthracene	0.002	3.1
Benzo(A)Pyrene	ND	3.2
Benzo(B)Fluoranthene	0.002	3.6
Benzo(K)Fluoranthene	0.002	1.3
Chrysene	0.002	3.1
Indeno(1,2,3-C,D)Pyrene	0.002	2
Total Metals	µg/L	µg/L
Arsenic	25	598
Copper	200	321
Lead	25	504
Manganese	300	886
Mercury	0.7	1.9
Dissolved Metals	µg/L	µg/L
Arsenic	25	724
Manganese	300	808

Sample ID	NYSDEC	GW-7 20170921
Date Sampled	AWQS	9/21/2017
SVOCs	µg/L	µg/L
Benzo(A)Anthracene	0.002	5.6
Benzo(A)Pyrene	ND	5
Benzo(B)Fluoranthene	0.002	5.7
Benzo(K)Fluoranthene	0.002	2.5
Chrysene	0.002	4.9
Indeno(1,2,3-C,D)Pyrene	0.002	2.6
Total Metals	µg/L	µg/L
Lead	25	198
Manganese	300	420
Mercury	0.7	1.5
Dissolved Metals	µg/L	µg/L
Manganese	300	321

Map Source:
NYCDCP (NYC Dept. of City Planning) GIS database

LEGEND

- BCP SITE BOUNDARY
- BUILDING
- 1 — LOT BOUNDARY AND TAX LOT NUMBER
- 3780 — TAX BLOCK NUMBER
- NYCT ELEVATED SUBWAY
- F V — TANK FILL PORT AND VENT PIPE
- SUBSURFACE(PHASE II) INVESTIGATION SOIL BORING/TEMPORARY GROUNDWATER MONITORING WELL LOCATION (2017)



Sample ID	NYSDEC	GW-1 20170808
Date Sampled	AWQS	8/8/2017
Total Metals	µg/L	µg/L
Lead	25	27.5

ND : The standard is a non-detectable concentration by the approved analytical method.

NYSDEC Ambient Water Quality Standards : New York State Department of Environmental Conservation (NYSDEC) Technical and Operational Guidance Series (TOGS) (1.1.1): Class GA Ambient Waste Quality Standards (AWQS)

µg/L : micrograms per Liter = parts per billion (ppb)

Only exceedances of AWQS are shown.

0 40 80
SCALE IN FEET

AKRF
440 Park Avenue South, New York, NY 10016

1675 Apartments
1675-1679 Westchester Avenue
Bronx, New York

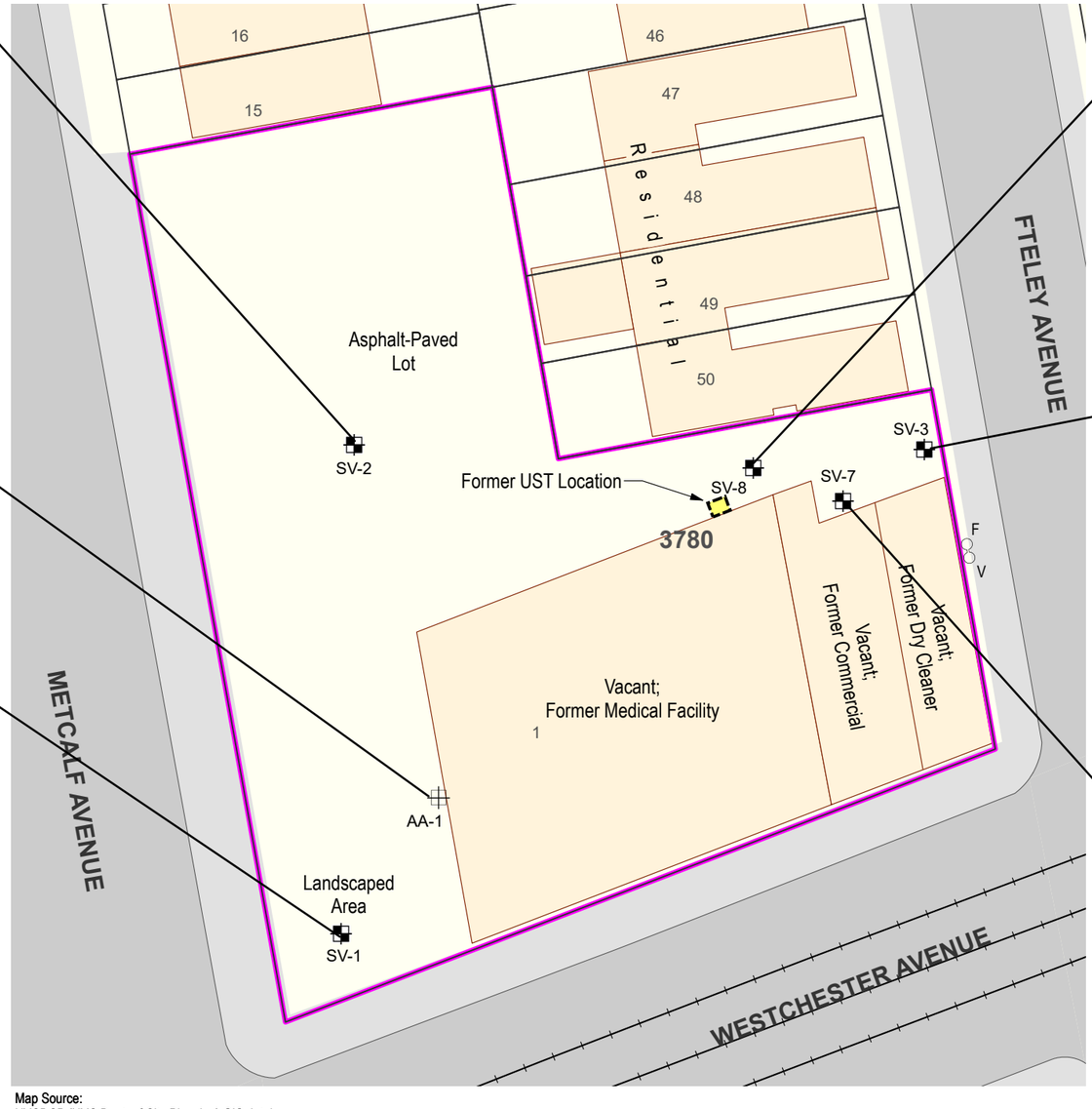
GROUNDWATER SAMPLE CONCENTRATIONS ABOVE NYSDEC AWQSs

DATE
5/4/2018
PROJECT NO.
170250
FIGURE
5

Sample ID	SV-2 20170808
Date Sampled	8/8/2017
VOCs	ug/m³
1,2,4-Trimethylbenzene	81.6
1,2-Dibromoethane (Ethylene Dibromide)	0.77
1,3,5-Trimethylbenzene (Mesitylene)	22
2,2,4-Trimethylpentane	13
2-Hexanone	98.6
4-Ethyltoluene	23
Acetone	1,290
Benzene	14
Carbon Disulfide	37.4
Chloroform	4.3
Cyclohexane	6.9
Dichlorodifluoromethane	2.4
Ethanol	20.9
Ethylbenzene	25
Isopropanol	2.7
Methyl Ethyl Ketone (2-Butanone)	263
Methyl Isobutyl Ketone (4-Methyl-2-Pentanone)	4.1
N-Heptane	26
N-Hexane	34
O-Xylene (1,2-Dimethylbenzene)	39
Styrene	23
Tert-Butyl Alcohol	10
Tetrachloroethylene (PCE)	80
Tetrahydrofuran	3.2
Toluene	60.7
Trans-1,2-Dichloroethene	1.3
Trichloroethylene (TCE)	1.5
Trichlorofluoromethane	1.7
Vinyl Chloride	0.28
Xylenes, Total	135

Sample ID	AA-1 20170808
Date Sampled	8/8/2017
VOCs	ug/m³
Acetone	19
Benzene	0.38 J
Chloromethane	1.2
Dichlorodifluoromethane	2.5
Ethanol	11
Isopropanol	2.9
Methyl Ethyl Ketone (2-Butanone)	1.7
Tert-Butyl Alcohol	0.58 J
Tetrachloroethylene (PCE)	0.88
Toluene	0.72 J
Trichloroethylene (TCE)	6.4
Trichlorofluoromethane	1.2

Sample ID	SV-1 20170808
Date Sampled	8/8/2017
VOCs	ug/m³
1,2,4-Trimethylbenzene	6.4
1,3,5-Trimethylbenzene (Mesitylene)	1.9
2,2,4-Trimethylpentane	10
2-Hexanone	22
4-Ethyltoluene	2.2
Acetone	295
Benzene	4.5
Carbon Disulfide	9.3
Chloroform	0.88 J
Chloromethane	0.81
Cyclohexane	0.96
Dichlorodifluoromethane	2.4
Ethanol	34.7
Ethylbenzene	7.4
Isopropanol	7.1
Methyl Ethyl Ketone (2-Butanone)	105
Methyl Isobutyl Ketone (4-Methyl-2-Pentanone)	0.94
N-Heptane	4.5
N-Hexane	5.6
O-Xylene (1,2-Dimethylbenzene)	9.6
Styrene	7.7
Tert-Butyl Alcohol	11
Tetrachloroethylene (PCE)	20
Tetrahydrofuran	6.2
Toluene	30
Trichloroethylene (TCE)	0.97
Trichlorofluoromethane	1.3
Xylenes, Total	38



Map Source:
NYCDCP (NYC Dept. of City Planning) GIS database

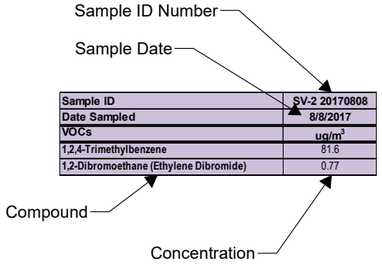
Sample ID	SV-8 20170921
Date Sampled	9/21/2017
VOCs	ug/m³
1,1,1-Trichloroethane	2.4
1,2,4-Trimethylbenzene	70.8
1,3,5-Trimethylbenzene (Mesitylene)	20
2,2,4-Trimethylpentane	22
2-Hexanone	77.7
4-Ethyltoluene	22
Acetone	967
Benzene	17
Carbon Disulfide	33
Chloroform	5.4
Cyclohexane	20
Ethanol	18
Ethyl Acetate	4
Ethylbenzene	38
Methyl Ethyl Ketone (2-Butanone)	158
Methyl Isobutyl Ketone (4-Methyl-2-Pentanone)	7
N-Heptane	35
N-Hexane	77.9
O-Xylene (1,2-Dimethylbenzene)	54.7
Styrene	27
Tert-Butyl Alcohol	10
Tetrachloroethylene (PCE)	220
Tetrahydrofuran	5.3
Toluene	99.1
Trichloroethylene (TCE)	0.81
Xylenes, Total	187

Sample ID	SV-3 20170808
Date Sampled	8/8/2017
VOCs	ug/m³
1,2,4-Trimethylbenzene	1.6
1,3,5-Trimethylbenzene (Mesitylene)	0.54 J
2,2,4-Trimethylpentane	6.1
2-Hexanone	10
4-Ethyltoluene	0.54 J
Acetone	182
Benzene	6.1
Carbon Disulfide	3
Chloromethane	0.66
Cyclohexane	1.4
Dichlorodifluoromethane	2.3
Ethanol	27.7
Ethylbenzene	3
Isopropanol	4.4
Methyl Ethyl Ketone (2-Butanone)	62.2
N-Heptane	3.6
N-Hexane	4.9
O-Xylene (1,2-Dimethylbenzene)	3.5
Styrene	2
Tert-Butyl Alcohol	5.5
Tetrachloroethylene (PCE)	14
Tetrahydrofuran	2.3
Toluene	20
Trichloroethylene (TCE)	0.39
Trichlorofluoromethane	1.3
Xylenes, Total	15

Sample ID	SV-7 20170921
Date Sampled	9/21/2017
VOCs	ug/m³
1,1,1-Trichloroethane	0.82
1,2,4-Trimethylbenzene	55.6
1,3,5-Trimethylbenzene (Mesitylene)	16
1,3-Butadiene	7.7
2,2,4-Trimethylpentane	21
2-Hexanone	126
4-Ethyltoluene	17
Acetone	964
Benzene	11
Carbon Disulfide	22
Chloroform	2.6
Chloromethane	0.56
Cyclohexane	12
Dichlorodifluoromethane	3
Ethanol	30.7
Ethyl Acetate	5.8
Ethylbenzene	33
Isopropanol	8.8
Methyl Ethyl Ketone (2-Butanone)	170
Methyl Isobutyl Ketone (4-Methyl-2-Pentanone)	3.8
N-Heptane	23
N-Hexane	31
O-Xylene (1,2-Dimethylbenzene)	47.3
Styrene	23
Tert-Butyl Alcohol	25
Tetrachloroethylene (PCE)	110
Tetrahydrofuran	4.4
Toluene	82.2
Trans-1,2-Dichloroethene	2.7
Trichloroethylene (TCE)	7.5
Trichlorofluoromethane	2
Xylenes, Total	162

LEGEND

- BCP SITE BOUNDARY
- BUILDING
- 1 — LOT BOUNDARY AND TAX NUMBER
- 3780 — TAX BLOCK NUMBER
- NYCT ELEVATED SUBWAY
- F V — TANK FILL PORT AND VENT PIPE
- SUBSURFACE (PHASE II) INVESTIGATION AMBIENT AIR SAMPLE LOCATION (2017)
- SUBSURFACE (PHASE II) INVESTIGATION TEMPORARY SOIL VAPOR POINT LOCATION (2017)



J : The analyte was detected above the laboratory reporting limit; the reported concentration is estimated.

D : The reported concentration is the result of a diluted sample analysis.

µg/m³ : micrograms per cubic meter

0 40 80
SCALE IN FEET

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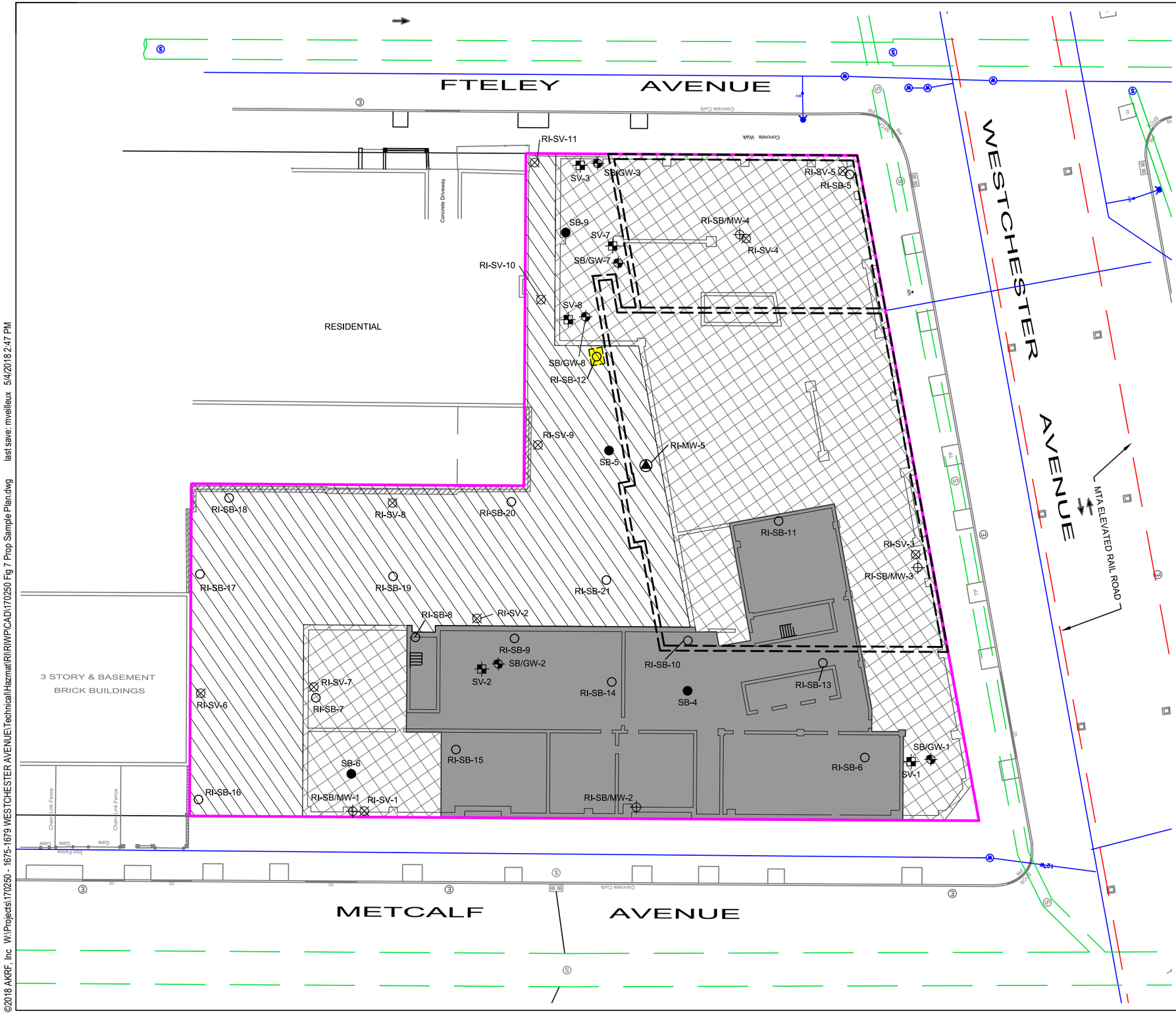
1675 Apartments
1675-1679 Westchester Avenue
Bronx, New York

SOIL VAPOR CONCENTRATIONS

DATE
5/4/2018

PROJECT NO.
170250

FIGURE
6



LEGEND

- BCP SITE BOUNDARY
- PROPOSED REMEDIAL INVESTIGATION SOIL BORING LOCATION
- PROPOSED REMEDIAL INVESTIGATION TEMPORARY SUB-SLAB/ SOIL VAPOR POINT LOCATION
- PROPOSED REMEDIAL INVESTIGATION SOIL BORING/GROUNDWATER MONITORING WELL LOCATION
- PROPOSED REMEDIAL INVESTIGATION MONITORING WELL LOCATION
- SUBSURFACE (PHASE II) INVESTIGATION SOIL BORING LOCATION (2017)
- SUBSURFACE (PHASE II) INVESTIGATION TEMPORARY SOIL VAPOR POINT LOCATION (2017)
- SUBSURFACE (PHASE II) INVESTIGATION SOIL BORING/TEMPORARY GROUNDWATER MONITORING WELL LOCATION (2017)
- EXISTING BUILDING FOOTPRINT
- PROPOSED NEW BUILDING CELLAR
- PROPOSED NEW BUILDING CRAWL SPACE
- PROPOSED COURTYARD
- FORMER UNDERGROUND STORAGE TANK (UST) LOCATION - REMOVED NOVEMBER 2014
- SEWER LINE
- WATER LINE

Map Sources:
1. Montrose Surveying Co., LLP. "City of New York, County The Bronx, Tax Block 3780, Tax Lots 1 & 51", Revised 8-25-17".

2. Dattner Architects D.P.C., "Foundation Plan", Dated November 14, 2017.

0 15 30 60
SCALE IN FEET

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440 Park Avenue South, New York, NY 10016

1675 Apartments
1675-1679 Westchester Avenue
Bronx, New York

PROPOSED SAMPLE LOCATION PLAN

DATE
5/4/2018

PROJECT NO.
170250

FIGURE
7

APPENDIX A

QUALITY ASSURANCE PROJECT PLAN

1675 APARTMENTS

1675-1679 WESTCHESTER AVENUE

BRONX, NEW YORK

Quality Assurance Project Plan

AKRF Project Number: 170250
NYSDEC BCP Site Number: C203107

Prepared For:

New York State Department of Environmental Conservation
Division of Environmental Remediation, Remedial Bureau B
625 Broadway, 12th Floor
Albany, New York 12233

Prepared On Behalf Of:

1675 JV Associates LLC
902 Broadway, 13th Floor
New York, New York 10010

and

1675 Westchester Avenue Housing Development Fund Corporation
902 Broadway, 13th Floor
New York, New York 10010

Prepared by:

AKRF, Inc.
440 Park Avenue South
New York, New York 10016
(212) 696-0670

MAY 2018

TABLE OF CONTENTS

TABLES

ATTACHMENTS

1.0 INTRODUCTION

This Quality Assurance Project Plan (QAPP) describes the protocols and procedures that will be followed during implementation of all environmental sampling, including under the Remedial Investigation Work Plan (RIWP) at the 1675 Apartments site, hereafter referred to as the Site. The Site is an approximately 36,865-square foot parcel located at 1675-1679 Westchester Avenue in the Soundview neighborhood of the Bronx, New York. The Site is identified on the New York City Tax Map as Bronx Borough Tax Block 3780, Lot 1. The Site formerly comprised Bronx Borough Tax Block 3780, Lots 1 and 51; however, an application was filed with the New York City Department of Finance (NYCDOF) on March 1, 2018, which combined Lots 1 and 51 into Lot 1.

The objective of this QAPP is to provide for Quality Assurance (QA) and maintain Quality Control (QC) of environmental investigative and sampling activities conducted under the New York State Department of Environmental Conservation (NYSDEC) oversight in the Brownfield Cleanup Program (BCP) (BCP Site No. C203107). Adherence to this QAPP will ensure that defensible data will be obtained during all environmental work at the Site.

2.0 PROJECT TEAM

The project team will be drawn from AKRF professional and technical personnel, and AKRF's subcontractors. All field personnel and subcontractors will have completed a 40-hour training course and updated 8-hour refresher course that meet the Occupational Safety and Health Administration (OSHA) requirements of 29 CFR Part 1910. The following sections describe the key project personnel and their responsibilities.

2.1 Quality Assurance/Quality Control (QA/QC) Officer

Ms. Lapin will serve as the QA/QC officer and will be responsible for adherence to the QAPP. The QA/QC officer will review the procedures with all personnel prior to commencing any fieldwork and will conduct periodic Site visits to assess implementation of the procedures. The QA/QC officer will also be responsible for reviewing the Data Usability Summary Reports (DUSRs) prepared by a third-party data validator for soil, groundwater, and soil vapor analytical results. Ms. Lapin's resume is included in Attachment A.

2.2 Project Manager

The project manager will be responsible for directing and coordinating all elements of the RIWP. The project manager will prepare reports and participate in meetings with the Site owner/Volunteer, and/or the NYSDEC. Deborah Shapiro, QEP will serve as the project manager for the RIWP. Ms. Shapiro's resume is included in Attachment A.

2.3 Deputy Project Manager

The deputy project manager will be responsible for assisting the project manager. The deputy project manager will help prepare reports and will participate in meetings with the Site owner/Volunteer, and/or the NYSDEC. Amy Jordan will serve as the deputy project manager for the RIWP. Ms. Jordan's resume is included in Attachment A.

2.4 Field Team Leader, Field Technician, Site Safety Officer (SSO), and Alternates

The field team leader will be responsible for supervising the daily sampling and health and safety activities in the field and will ensure adherence to the work plan and Health and Safety Plan (HASP), included as Appendix A of the RIWP. The field team leader will also act as the field

technician and Site Safety Officer (SSO), and will report to the project manager or project manager alternate on a regular basis regarding daily progress and any deviations from the work plan. The field team leader will be a qualified and responsible person able to act professionally and promptly during environmental work at the Site. Amy Jackson will be the field team leader. The field team leader alternate is Tara Simmons of AKRF. Ms. Jackson's and Ms. Simmons' resumes are included in Attachment A.

2.5 Laboratory Quality Assurance/Quality Control Officer

The laboratory QA/QC officer will be responsible for quality control procedures and checks in the laboratory and ensuring adherence to laboratory protocols. The QA/QC officer will track the movement of samples from the time they are checked in at the laboratory to the time that analytical results are issued, and will conduct a final check on the analytical calculations and sign off on the laboratory reports. The laboratory QA/QC officer will be Nick Straccione of SGS Accutest Inc. (Accutest), the New York State Department of Health (NYSDOH) Environmental Laboratory Approval Program (ELAP)-certified laboratory being employed for all environmental sampling at the Site.

2.6 Third-Party Data Validator

The third-party data validator will be responsible for reviewing the final data packages for soil, groundwater, and soil vapor and preparing a DUSR that will provide performance information with regard to accuracy, precision, sensitivity, representation, completeness, and comparability associated with the laboratory analyses for the investigation. The third-party data validator will be Lori Beyer of L.A.B. Validation Corporation of East Northrop, New York.

3.0 STANDARD OPERATING PROCEDURES (SOPS)

The following sections describe the SOPs for the remedial activities included in the RIWP. During these activities, safety monitoring will be performed as described in the HASP, included as Appendix A of the RIWP.

3.1 Decontamination of Sampling Equipment

All sampling equipment (augers, drilling rods, split spoon samplers, probe rods, pumps, etc.) will be either dedicated or decontaminated between sampling locations. Decontamination will be conducted on plastic sheeting (or equivalent) that is bermed to prevent discharge to the ground. The decontamination procedure will be as follows:

1. Scrub using tap water/Alconox® mixture and bristle brush.
2. Rinse with tap water.
3. Scrub again with tap water/Alconox® mixture and bristle brush.
4. Rinse with tap water.
5. Rinse with distilled water.
6. Air-dry the equipment, if possible.

3.2 Management of Investigation-Derived Waste (IDW)

IDW will be containerized in New York State Department of Transportation (NYSDOT)-approved 55-gallon drums. The drums will be sealed at the end of each work day and labeled with the date, the excavation grid(s), the type of waste (i.e., drill cuttings), and the name and

phone number of an AKRF point-of-contact. All IDW exhibiting field evidence of contamination will be disposed of or treated according to applicable local, state, and federal regulations.

4.0 SAMPLING AND LABORATORY PROCEDURES

4.1 Soil Sampling

Soil sampling will be conducted according to the following procedures:

- Characterize the sample according to the modified Burmister soil classification system.
- Field screen the sample for evidence of contamination (e.g., odors, staining, etc.) using visual and olfactory methods and screen for volatile organic compounds (VOCs) using a photoionization detector (PID) equipped with an 11.7 electron Volt (eV) lamp.
- Collect an aliquot of soil from each proposed sample location, place in laboratory-supplied glassware, label the sample in accordance with Section 4.4.1, and place in an ice-filled cooler for shipment to the laboratory.
- Complete the proper chain of custody paperwork and seal the cooler.
- Record sample location, sample depth, and sample observations (evidence of contamination, PID readings, soil classification, etc.) in field log book and boring log data sheet, if applicable.
- Decontaminate any soil sampling equipment between sample locations as described in Section 3.1 of this QAPP.

4.2 Laboratory Methods

Table 1 summarizes the laboratory methods that will be used to analyze field samples and the sample container type, preservation, and applicable holding times. Accutest of Dayton, New Jersey, a NYSDOH ELAP-certified laboratory subcontracted to AKRF, will be used for all chemical analyses in accordance with the Division of Environmental Remediation (DER)-10 2.1(b) and 2.1(f) with Category B Deliverables.

Table 1
Laboratory Analytical Methods for Analysis Groups

Matrix	Analysis	EPA Method	Bottle Type	Preservative	Hold Time
Soil and Soil QA/QC	Volatile Organic Compounds (VOCs)	8260C	EnCore samplers (3) and 2 oz. plastic jar	≤ 6 °C	48 hours to extract; 14 days to analyze
	Semivolatile Organic Compounds (SVOCs)	8270D	8 oz. Glass Jar	≤ 6 °C	14 days to extract; 40 days to analyze
	Total Analyte List (TAL) Metals, and Hexavalent Chromium	6000/7000 Series, 6010C, and 7196A	8 oz. Glass Jar	≤ 6 °C	6 months holding time; Mercury 28 days holding time; Hexavalent chromium 30 days to extract, 7 days to analyze
	Pesticides	8081B	8 oz. Glass Jar	≤ 6 °C	14 days to extract; 40 days to analyze
	Polychlorinated Biphenyls (PCBs)	8082A	8 oz. Glass Jar	≤ 6 °C	14 days to extract; 40 days to analyze
Groundwater and Groundwater QA/QC	VOCs	8260C	5 40 mL Glass Vials	HCl to pH < 2 and ≤ 6 °C	48 hours to extract; 14 days to analyze
	SVOCs	8270D plus Selective Ion Monitoring (SIM) for 1,4-Dioxane	2,000 mL Amber Jar	≤ 6 °C	7 days to extract; 40 days to analyze
	TAL Metals	6000/7000 Series	2,000 mL Amber Jar	HNO_3 to pH < 2	6 months for metals; 28 days for mercury; 24 hours for hexavalent chromium
	Pesticides	8081B	2,000 mL Amber Jar	≤ 6 °C	7 days to extract; 40 days to analyze
	PCBs	8082A	2,000 mL Amber Jar	≤ 6 °C	7 days to extract; 40 days to analyze
	Perfluorinated Compounds (PFCs)	Modified 537	3 x 250 mL Polypropylene Bottles	≤ 6 °C, Trizma	14 days to analyze
Soil Vapor	VOCs	TO-15	6L SUMMA® Canister	None	14 days

Notes:
QA/QC samples will be analyzed for the same parameters as the parent sample, with the exception of the trip blank(s), which will be analyzed for VOCs by EPA Method 8260C only.
EPA – Environmental Protection Agency
Hg – Mercury
RCRA – Resource Conservation and Recovery Act

4.3 Quality Control (QC) Sampling

In addition to the laboratory analysis of the soil samples, additional analysis will be included for QC measures, as required by the Category B sampling techniques. These samples will include field blank, trip blank, matrix spike/matrix spike duplicate (MS/MSD), and blind duplicate samples at a frequency of one sample per 20 field samples collected or per sample digestion

group (SDG). QC samples will be analyzed for the same parameters as the accompanying samples, with the exception of any trip blanks, which will be analyzed for the VOC list only.

4.4 Sample Handling

4.4.1 Sample Identification

All samples will be consistently identified in all field documentation, chain-of-custody (COC) documents, and laboratory reports. Soil, groundwater, soil vapor, and ambient air samples collected during the RI will be identified with "RI-" and "SB-" for soil borings "MW-" for groundwater monitoring wells, "SV-" for soil vapor points, and "AA-" for ambient air samples, and the soil boring, groundwater monitoring well number, soil vapor point, or ambient air sample number. All samples will be amended with the collection date at the end of the sample same in a year, month, day (YYYYMMDD) format. Blind duplicate sample nomenclature will consist of the sample type, followed by an "X"; MS/MSD samples nomenclature will consist of the parent sample name, followed by "MS/MSD"; and trip and field blanks will consist of "TB-" and "FB-", respectively, followed by a sequential number of the trip/field blanks collected within the sample digestion group (SDG). Special characters, including primes/apostrophes (’), will not be used for sample nomenclature. Table 2 provides examples of the sampling identification scheme for samples collected during the RI.

Table 2
RI Sample Nomenclature

Sample Description	Sample Designation
Groundwater sample collected from groundwater monitoring well RI-MW-1 on May 11, 2018	RI-MW-1 20180511
Matrix spike/matrix spike duplicate sample of groundwater sample collected from groundwater monitoring well RI-MW-1 on May 11, 2018	RI-MW-1 MS/MSD 20180511
Blind duplicate sample of groundwater sample collected from groundwater monitoring well RI-MW-1 on May 11, 2018	RI-MW-X 20180511
Second field blank collected during the RI on May 11, 2018	RI-FB-2 20180511
Soil sample collected from soil boring RI-SB-10 between 8 and 10 feet below grade on May 1, 2018	RI-SB-10 (8-10) 20180501
Second blind duplicate soil sample of SDG collected from soil boring RI-SB-10 between 8 and 10 feet below grade on May 1, 2018	RI-SB-X2 (8-10) 20180501

Sample Labeling and Shipping

All sample containers will be provided with labels containing the following information:

- Project identification, including Site name, BCP Site number, Site address
- Sample identification
- Date and time of collection
- Analysis(es) to be performed

- Sampler's initials

Once the samples are collected and labeled, they will be placed in chilled coolers and stored in a cool area away from direct sunlight to await shipment to the laboratory. All samples will be shipped to the laboratory at least twice per week. At the start and end of each workday, field personnel will add ice to the cooler(s) as needed.

The samples will be prepared for shipment by placing each sample in laboratory-supplied glassware, then wrapping each container in bubble wrap to prevent breakage, and adding freezer packs and/or fresh ice in sealable plastic bags. The COC form will be properly completed by the sampler in ink, and all sample shipment transactions will be documented with signatures, and the date and time of custody transfer. Samples will be shipped overnight (e.g., Federal Express) or transported by a laboratory courier. All coolers shipped to the laboratory will be sealed with mailing tape and a COC seal to ensure that the samples remain under strict COC protocol.

Sample Custody

Field personnel will be responsible for maintaining the sample coolers in a secured location until they are picked up and/or sent to the laboratory. The record of possession of samples from the time they are obtained in the field to the time they are delivered to the laboratory or shipped off-site will be documented on COC forms. The COC forms will contain the following information: project name; names of sampling personnel; sample number; date and time of collection and matrix; and signatures of individuals involved in sample transfer, and the dates and times of transfers. Laboratory personnel will note the condition of the custody seal and sample containers at sample check-in.

4.5 Field Instrumentation

Field personnel will be trained in the proper operation of all field instruments at the start of the field program. Instruction manuals for the equipment will be on file at the Site for referencing proper operation, maintenance, and calibration procedures. The equipment will be calibrated according to manufacturer specifications at the start of each day of fieldwork. If an instrument fails calibration, the project manager or QA/QC officer will be contacted immediately to obtain a replacement instrument. A calibration log will be maintained to record the date of each calibration, any failure to calibrate and corrective actions taken. The PID will be equipped with an 11.7 electron volt (eV) lamp and will be calibrated each day using 100 parts per million (ppm) isobutylene standard gas in accordance with the manufacturer's standards.

4.6 Quality Assurance (QA)

All soil, groundwater, and soil vapor laboratory analytical data will be reviewed by a third-party validator and a Data Usability Summary Report (DUSR) will be prepared to document the usability and validity of the data. The RIR will include a detailed description of endpoint sampling activities, data summary tables, concentration map showing sample locations and concentrations, DUSR, and laboratory reports.

ATTACHMENT A

RESUMES OF QA/QC OFFICER, PROJECT MANAGER, DEPUTY PROJECT MANAGER, AND FIELD TEAM LEADER/FIELD TECHNICIAN/SITE SAFETY OFFICER/ALTERNATE

MICHELLE LAPIN, P.E.

SENIOR VICE PRESIDENT

Michelle Lapin is a Senior Vice President with more than 25 years of experience in the assessment and remediation of hazardous waste issues. She leads the firm's Hazardous Materials group and offers extensive experience providing strategic planning and management for clients. Ms. Lapin has been responsible for the administration of technical solutions to contaminated soil, groundwater, air and geotechnical problems. Her other duties have included technical and report review, proposal writing, scheduling, budgeting, and acting as liaison between clients and regulatory agencies, and project coordination with federal, state, and local authorities.

Ms. Lapin's hydrogeologic experience includes groundwater investigations, formulation and administration of groundwater monitoring programs and remediation throughout the Northeast. Her experience with groundwater contamination includes Level B hazardous waste site investigations; leaking underground storage tank studies, including hazardous soil removal and disposal and associated soil and water issues; soil gas/vapor intrusion surveys; and wetlands issues. Ms. Lapin is experienced in coordinating and monitoring field programs concerning hazardous waste cell closures. She has directed hundreds of Phase I, Phase II, and Phase III investigations and remediations, many of them in conjunction with developers, law firms, lending institutions, and national retail chains. She is also experienced in the cleanup of contaminated properties under Brownfield Cleanup Program (BCP) regulations.

BACKGROUND

Education

M.S., Civil Engineering, Syracuse University, 1985
B.S., Civil Engineering, Clarkson University, 1983

Professional Licenses/Certifications

New York State P.E.
State of Connecticut P.E.

Professional Memberships

Member, National Society of Professional Engineers (NSPE), National and CT Chapters
Member, American Society of Civil Engineers (ASCE), National and CT Chapters
Member, Connecticut Business & Industry Association (CBIA), CBIA Environmental Policies Council (EPC)
Member, Environmental Professionals' Organization of Connecticut (EPOC)
Board Member, New York City Brownfield Partnership

Years of Experience

Year started in company: 1994
Year started in industry: 1986

RELEVANT EXPERIENCE

West 61st Street Rezoning/Residential Development, New York, NY

Ms. Lapin is directing the firm's hazardous materials work for this mixed-use development in Manhattan. The Algin Management Company hired AKRF to prepare an environmental impact statement (EIS) for the proposed rezoning of the western portion of the block between West 60th and 61st Streets, between Amsterdam and West

End Avenues. The purpose of the proposed action was to facilitate the development of two 30-story residential towers with accessory parking spaces, and landscaped open space. The EIS examined a "worst case" condition for rezoning the block, which allowed Algin to build a residential building of approximately 375,000 square feet at their site. The building now contains 475 apartments, 200 accessory parking spaces, a health club, and community facility space. This site, with the services of AKRF, entered into New York State's Brownfield Cleanup Program (BCP). On-site issues included underground storage tanks remaining from previous on-site buildings, petroleum contamination from these tanks and possibly from off-site sources, and other soil contaminants (metals, semi-volatile organic compounds, etc.) from fill materials and previous on-site buildings. AKRF oversaw the adherence to the Construction Health and Safety Plan (HASP), which was submitted to and approved by the New York State Department of Environmental Conservation (NYSDEC), and monitored the waste streams, to ensure that the different types of waste were disposed of at the correct receiving facilities. This oversight also included confirmation and characteristic soil sampling for the receiving facilities and NYSDEC. A "Track 1" Clean up of the majority of the property (the portion including the buildings) was completed and the final Engineering Report was approved by the NYSDEC. AKRF has also completed a smaller portion of the property as a "Track 4" cleanup, which includes a tennis court and landscaped areas.

Hudson River Park, New York, NY
Ms. Lapin is directing AKRF's hazardous materials work during construction of Hudson River Park, a five-mile linear park along Manhattan's West Side. As the Hudson River Park Trust's (HRPT's) environmental consultant, AKRF is overseeing preparation and implementation of additional soil and groundwater investigations (working with both NYSDEC and the New York City Department of Environmental Protection (NYCDEP)), all health and safety activities, and removal of both known underground storage tanks and those encountered during construction. Previously, the firm performed hazardous materials assessments as part of the environmental impact statement (EIS) process, including extensive database and historical research, and soil and groundwater investigations. Ms. Lapin has been the senior consultant for the soil and groundwater investigations and remediation, and the asbestos investigations and abatement oversight.

Roosevelt Union Free School District – District-wide Improvement Program, Roosevelt, NY
Ms. Lapin managed the hazardous materials investigation for the Draft and Final EISs for the improvement program, which included the demolition of three existing elementary schools and portions of the junior-senior high school, and the reconstruction of three replacement elementary schools, a separate replacement middle school, and renovations to the high school. Following the EIS, additional hazardous materials investigations were completed, including comprehensive asbestos and lead surveys; Phase I and Phase II Environmental Site Assessments; the preparation of asbestos, lead, hazardous materials and demolition specifications; and obtaining site-specific variances from the New York State Department of Labor (NYSDOL). The middle school remediation was conducted through coordination with the NYSDEC, New York State Department of Health (NYSDOH), the New York State Education Department (NYSED) and the local school district. After project approval and completion of construction/renovation of the new middle school, the school opened for the Fall 2008 semester as planned. AKRF continues to provide oversight for ongoing abatement at a number of the schools, and overall environmental consulting to the school district.

Fiterman Hall Deconstruction and Decontamination Project, New York, NY
The 15-story Fiterman Hall building, located at 30 West Broadway, originally constructed as an office building in the 1950s, had served as an extension of the City University of New York (CUNY) Borough of Manhattan Community College (BMCC) since 1993. The building was severely damaged during the September 11, 2001, World Trade Center (WTC) attack when 7 WTC collapsed and struck the south façade of the building, resulting in the partial collapse of the southwest corner of the structure. The building was subsequently stabilized, with breaches closed and major debris removed. Because extensive mold and WTC dust contaminants remain within the building, it must be taken down. The project required the preparation of two environmental assessment statements (EASs)—one for the deconstruction and decontamination of Fiterman Hall and one for the construction of a replacement building on the site. AKRF prepared the EAS for the Deconstruction and Decontamination project, which included the decontamination of the interior and exterior of the building, the

removal and disposal of all building contents, and the deconstruction of the existing, approximately 377,000-gross-square-foot partially collapsed structure. Ms. Lapin reviewed the EAS's deconstruction and decontamination plans. The cleanup plan was submitted to the United States Environmental Protection Agency (USEPA).

Columbia University Manhattanville Academic Mixed-Use Development, New York, NY
Ms. Lapin served as Hazardous Materials Task Leader on this EIS for approximately 4 million square feet of new academic, research and neighborhood uses to be constructed north of Columbia University's existing Morningside campus. The Hazardous Materials work included Phase I Environmental Site Assessments for the properties within the site boundaries, and estimates for a Subsurface (Phase II) Investigation of the entire development area. The firm's Hazardous Materials group has performed over 30 individual Phase I Environmental Site Assessments for properties within the development area. In addition, a Preliminary Environmental Site Assessment (PESA) was completed in conjunction with the EIS. Based on the Phase I studies, AKRF conducted a subsurface (Phase II) investigation in accordance with an NYCDEP-approved investigative work plan and health and safety plan. Subsurface activities included the advancement of soil borings, groundwater monitor wells, and the collection of soil and groundwater samples for laboratory analysis. This study estimated costs to remediate contaminated soil, groundwater and hazardous building materials, including lead-based paint and asbestos-containing materials.

Yonkers Waterfront Redevelopment Project, Yonkers, NY
For this redevelopment along Yonkers' Hudson River waterfront, Ms. Lapin headed the remedial investigation and remediation work that included Phase I assessments of 12 parcels, investigations of underground storage tank removals and associated soil remediation, remedial alternatives reports, and remedial work plans for multiple parcels. Several of the city-owned parcels were remediated under a Voluntary Cleanup Agreement; others were administered with state Brownfields grants. Hazardous waste remediation was completed on both brownfield and voluntary clean-up parcels, which enabled construction of mixed-use retail, residential development, and parking.

Davids Island Site Investigations, New Rochelle, NY
Ms. Lapin managed the hazardous materials investigation of Westchester County's Davids Island, The island, which features pre- and post-Civil War military buildings and parade grounds and is viewed as a major heritage, tourism, and recreational amenity, was planned for county park purposes. The investigation included a Phase I site assessment, with historical research dating to the 17th century, a Phase II (Subsurface) Investigation, underground storage tank investigations, asbestos surveys, and conditions surveys of all remaining structures. Cost estimates were submitted to Westchester County for soil remediation, asbestos abatement, and building demolition.

Site Selection and Installation of 11 Turbine Generators, New York and Long Island, NY
AKRF was retained by the New York Power Authority (NYPA) to assist in the State Environmental Quality Review Act (SEQRA) review of the proposed siting, construction, and operation of 11 single-cycle gas turbine generators in the New York metropolitan area. Ms. Lapin managed the hazardous materials investigation of the sites. The work included Phase I site assessments, subsurface investigations, and construction health and safety plans.

Cross Westchester (I-287) Expressway Phases V and VI, Westchester County, NY
Ms. Lapin served as Project Manager for the New York State Department of Transportation's (NYSDOT) reconstruction of Westchester County's major east-west artery and was responsible for directing the contaminated materials aspect of the final design effort. As part of her duties, she managed the asbestos investigations at eight bridges and wetland delineation along the entire corridor, wrote the scope of work and provided general project management.

Supermarket Redevelopment, New Fairfield, CT
AKRF provided consulting services to the developer and owner of a 9-acre site including conducting a remedial investigation and remediation of a site contaminated from former dry cleaning operations and off-site gasoline spills. The investigation included the installation of monitoring wells in three distinct aquifers, geophysical logging, pump tests, and associated data analysis. Ms. Lapin presented the environmental issues and planned remediation to local and state officials during the early stages of the planning process to incorporate their comments into the final remedial design. A remedial action work plan (RAWP) was completed and approved by the Connecticut

Department of Environmental Protection within a year to enable redevelopment work for a new supermarket and shopping center. The RAWP included the remediation of soil within the source area and a multi-well pump and treat system for the recovery of non-aqueous and dissolved phase contamination in groundwater. The design of the recovery well system included extensive groundwater modeling to ensure capture of the contaminant plume and the appropriate quantity and spacing of the wells. Ms. Lapin directed the soil removal remedial activities and monitoring for additional potential contamination during construction. In addition, AKRF performed comprehensive pre-demolition asbestos and lead-based paint surveys of the former site structures, conducted abatement, air monitoring and oversight, and provided environmental consulting support for the development of the site. The groundwater remediation system was installed during site development and began operation once development was complete.

East 75th/East 76th Street Site, New York, NY

Ms. Lapin served as Senior Manager for this project that encompassed coordination and direct remediation efforts of this former dry cleaning facility and parking garage prior to the sale of the property and its ultimate redevelopment for use as a private school. A preliminary site investigation identified 20 current and former petroleum and solvent tanks on the property. A soil and groundwater testing program was designed and implemented to identify the presence and extent of contamination resulting from potential tank spills. This investigation confirmed the presence of subsurface petroleum contamination in the soil and solvent contamination from former dry cleaning activities in the bedrock. AKRF completed oversight of the remediation under the State's Voluntary Cleanup Program. Remediation, consisting of tank removals and excavation of contaminated soil and the removal of solvent-contaminated bedrock down to 30 feet below grade, has been completed. AKRF completed oversight of the pre-treatment of groundwater prior to discharge to the municipal sewer system and an off-site study to determine impacts to groundwater in downgradient locations.

Home Depot, Various Locations, NY

Ms. Lapin, serving as either Project Manager or Senior Manager, has managed the investigations and remediation at multiple Home Depot sites in the five boroughs, Long Island, and Connecticut. The investigations have included Phase I and II site assessments, asbestos and lead paint surveys, abatement specifications and oversight, and soil and groundwater remediation.

Avalon on the Sound, New Rochelle, NY

For Avalon Bay Communities, Ms. Lapin managed the investigations and remediation of two luxury residential towers and an associated parking garage. Remediation of the first phase of development (the first residential tower and the parking garage) included gasoline contamination from a former taxi facility, fuel oil contamination from multiple residential underground storage tanks, and chemical contamination from former on-site manufacturing facilities. The remediation and closure of the tank spills was coordinated with the New York State Department of Environmental Conservation (NYSDEC). The initial investigation of the Phase II development—an additional high-rise luxury residential building—detected petroleum contamination. A second investigation was conducted to delineate the extent of the contamination and estimate the costs for remediation. AKRF oversaw the remediation and conducted the Health and Safety monitoring. The remediation was completed with closure and approvals of the NYSDEC.

East River Science Park, New York, NY

Originally, New York University School of Medicine (NYUSOM) retained the firm to prepare a full Environmental Impact Statement (EIS) for its proposed East River Science Park (ERSP). As originally contemplated, the proposed complex was to occupy a portion of the Bellevue Hospital campus between East 30th Street and approximately East 28th Street and would have included a clinical practice, research, and biotech facilities, housing units, a child care center, and a conference center and parking.

Ms. Lapin managed the Phase I Environmental Site Assessment and other hazardous materials-related issues. Events relating to September 11, 2001 delayed the project for several years. When it resurfaced with a new developer and a diminished scope, Ms. Lapin updated the hazardous materials issues and consulted with the new

developer regarding remediation strategies and involvement of regulatory agencies. For the actual remediation/development, the city requested oversight by AKRF to represent its interests (the city is retaining ownership of the land). Ms. Lapin completed directing the remediation oversight on behalf of the City of New York for the remediation of this former psychiatric hospital building, laundry building and parking areas. The new 550,000 square-foot development includes a biotechnology center, street level retail, and an elevated plaza.

DEBORAH SHAPIRO, QEP

VICE PRESIDENT

Deborah Shapiro is a Vice President with 17 years of experience in the assessment and remediation of hazardous waste issues. Ms. Shapiro supervises project teams and manages all aspects of assessment and remediation projects. Ms. Shapiro works with developers, non-profit organizations, architects, local community groups, local businesses, and government agencies. Her projects fall under the regulatory oversight of NYSDEC, NYCDEP, and NYCOER including the New York State Brownfield Cleanup Program (BCP), New York City Voluntary Cleanup Program (VCP), NYSDEC petroleum spills program, RCRA/UIC closures, and NYCOER's E-designation program. Ms. Shapiro has also assisted commercial and industrial property owners with maintaining the integrity of their portfolios by providing compliance related cleanup and chemical storage management services.

Ms. Shapiro manages all aspects of redevelopment projects from the initial Phase I ESA, Phase II, and remediation through post-remedial site management. In addition, her experience includes groundwater investigations, monitoring, and sampling programs; Brownfield and hazardous waste site investigations; In-Situ Chemical Oxidation; underground storage tank studies, including soil contamination delineation, classification, removal and disposal; waste characterization sampling; exposure assessments; on-going remedial action (especially AS/SVE), and permitting.

Prior to joining AKRF, Ms. Shapiro was a Senior Project Manager at CA RICH Consultants, Inc. in Plainview, New York. She was responsible for the design, implementation, and management of environmental assessment, investigation and remediation projects on Long Island and across the New York Metropolitan Area. Ms. Shapiro has also been a moderator and panelist at numerous conferences.

BACKGROUND

Education

M.S., Environmental Science, American University, 2001
B.A., Environmental Studies, American University, 1998

Professional Licenses/Certifications

Qualified Environmental Professional
Health and Safety Operations at Hazardous Materials Sites 29 CFR 1910.120
OSHA 10 Hour Occupational Construction Safety and Health

Professional Memberships

Past President, New York City Brownfield Partnership
Board Member, Residents for a More Beautiful Port Washington
Member, Institute of Professional Environmental Practitioners (IPEP)

Awards

Big Apple Brownfield Award recipient as part of the Courtlandt Crescent redevelopment team 2013
Big Apple Brownfield Award recipient as part of the Via Verde redevelopment team 2012
Big Apple Brownfield Award recipient as part of the Cornerstone B1 (LaTerraza) redevelopment team 2011

Years of Experience

Year started in company: 2013
Year started in industry: 1998

Relevant Experience

Elton Crossing, Bronx, NY

AKRF is currently providing environmental consulting services in connection with the Elton Crossing site in the Bronx, NY. The work initially involved the preparation of a Phase I Environmental Site Assessment and Phase II subsurface investigation including soil and soil vapor testing to determine if the site would be eligible for the New York State Brownfield Cleanup Program (NYSBCP) based on its historic usage. AKRF prepared a NYCBCP Application and the site was accepted in to the NYSBCP. AKRF managed all aspects of the brownfield cleanup including; development of Remedial Investigation (RI) and Supplemental Remedial Investigation (SRI) Work Plans, conducting the RI and SRI and preparing the associated reports, preparation of a Citizen Participation Plan, distribution of public notices, and preparation of a Remedial Action Work Plan (RAWP). AKRF managed all aspects of the remediation, including providing guidance for the closure of two petroleum spills; the registration, removal, and closure of six petroleum storage tanks encountered during excavation; and waste characterization and disposal of soil with contaminants including hazardous lead, petroleum, and pesticides, and design of a Sub-Slab Depressurization System (SSDS). AKRF prepared and submitted a Site Management Plan (SMP) and a Final Engineering Report (FER), which documented compliance with the RAWP. The SMP and FER were approved by NYS in 2016. AKRF is currently providing long-term site management in accordance with the NYSBCP.

On-Call Environmental Consulting Services (Various Locations), New York City Mayor's Office of Environmental Remediation (OER) (administered by NYCEDC)

Ms. Shapiro is managing an on-call contract with the OER for brownfields environmental assessment and remediation. The work has included conducting Phase I environmental site assessments (ESAs) and multi-media sampling of soil, groundwater, and soil vapor for various sites funded by EPA grants. The work plans and investigation reports were completed in accordance with OER and EPA requirements. AKRF also implemented a remedial plan for capping a park site in Staten Island. In addition, Ms. Shapiro is providing support to OER and an affordable housing developer to expedite an application for entry into the New York State Department of Environmental Conservation (NYSDEC) Brownfield Cleanup Program (BCP), as well as preparation and implementation of the remedial investigation and remedial plan.

Atlantic Chestnut, Brooklyn, NY

AKRF was retained by Phipps Houses to provide environmental consulting services in connection with the purchase and development of former burned manufacturing buildings encompassing an entire city block in Brooklyn, New York. As part of due diligence, AKRF prepared a Phase I Environmental Site Assessment (ESA) Report for the property. After acquisition, the property was divided into three separate sites (3264 Fulton Street, 235 Chestnut Street, and 3301 Atlantic Avenue). AKRF prepared a Subsurface (Phase II) Investigation Work Plans and conducted Phase IIs at each of the sites, which included the collection and analysis of soil, soil vapor, and groundwater samples. Based on the results of the Phase IIs, which were documented in Subsurface (Phase II) Reports, New York State Brownfield Cleanup Program (NYSBCP) applications were prepared for each of the sites. After acceptance into the NYSBCP, AKRF prepared Citizen Participation Plans (CPPs) and distributed public notices. AKRF prepared Remedial Investigation (RI) Work Plans (RIWPs) for each of the sites to further investigate contaminated media at the site prior to redevelopment, conducted the RIs, and is in the process of preparing the RI Reports (RIRs).

Second Farms, Bronx, NY

AKRF, Inc. was contracted by the New York City Office of Environmental Remediation (NYCOER) to conduct a subsurface investigation of a 1.12-acre parcel in the Bronx, New York under the United States Environmental Protection Agency (USEPA) Brownfield Assessment Grant program. The investigation included a geophysical survey and utility mark-outs, and the collection and analysis of soil, groundwater, soil vapor, indoor air and ambient air samples.

Brook 156, Bronx, NY

AKRF was retained by Phipps Houses to provide environmental consulting services in connection with the purchase and development of two lots located at 740 Brook Avenue in the Bronx, NY. AKRF prepared a Phase I Environmental Site Assessment (ESA) of the NYC-owned former gasoline service station and a former railroad. A Tier 1 Vapor Encroachment Screening was also conducted to satisfy HUD's vapor intrusion requirements. AKRF prepared a Remedial Investigation Work Plan (RIWP) and conducted a Remedial Investigation (RI) at the site, which included the collection and analysis of soil, soil vapor, and groundwater. The results of the RI, which were documented in a Remedial Investigation Report (RIR), were used to prepare a New York City Brownfield Cleanup Program (NYCBCP) application. The site was accepted into the New York State Brownfield Cleanup Program (NYSBCP). AKRF prepared a Citizen Participation Plan (CPP), distributed public notices, and is in the process of preparing a Supplemental Remedial Investigation Work Plan (SRIWP) to further investigate soil, soil vapor, and groundwater at the site prior to redevelopment.

Warbrook Portfolio, Manhattan, NY

AKRF provided environmental consulting services to Genesis Y15 Developer LLC and the Abyssinian Development Corporation (ADC) for the proposed rehabilitation of 30 parcels in Central Harlem for low- and moderate-income tenants. The parcels comprise two vacant lots and 28 residential buildings, including several buildings that are vacant or partially vacant. The client is seeking 4% Low-Income Housing Tax Credits issued by the New York City Housing Development Corporation (HDC) through the New York City Department of Housing Preservation & Development (HPD) to rehabilitate the 30 parcels. AKRF prepared a Phase I Environmental Site Assessment for all parcels. The Phase I summarized environmental issues based on a review of available environmental reports, a review of regulatory records, and on-site inspections. Limited Phase II Environmental Site Assessments were conducted at parcels where recognized environmental concerns were identified. Based on evidence of suspect mold associated with the Property parcels, AKRF also prepared a mold specification section for use during renovation of the Property.

Courtlandt Crescent, Bronx, NY

Ms. Shapiro directed all Phases of this NYS Brownfield Cleanup Program project in the Melrose Commons section of the Bronx from the initial Phase I and II through the Certificate of Completion and is currently managing the implementation of the Site Management Plan. A New York State Brownfield Cleanup Program (BCP) Application was submitted simultaneously with the Remedial Investigation Report (RIR) and Remedial Action Work Plan (RAWP), which sped up the timetable so that the remediation could be implemented concurrently with the planned site redevelopment activities. The site comprised an entire city block whose historic usage included a gasoline filling station, auto repair shop, machine shop, auto junkyard, iron works, boiler repair shop, brass fabricator shop, universal machinery manufacturing, waste paper company, cosmetic company, and a saw works. The investigation included soil and soil vapor testing as well as the installation and sampling of groundwater monitoring wells. The remedial activities included the removal of underground storage tanks and hydraulic lifts, soil waste classification testing, the excavation and removal of approximately 23,000 tons of non-hazardous petroleum and metals contaminated soil as well as hazardous soil containing lead, in-situ chemical oxidation, and installation of a composite cover system. In addition, site dewatering activities allowed the elevator pits to be advanced into the groundwater table. A vapor barrier (and water-proofing for the elevator pits) was installed beneath the two new buildings' foundations and a sub-slab depressurization system (SSDS) was incorporated into the buildings' foundations to eliminate the potential exposure pathway for soil vapor into the new affordable housing residential buildings. Ms. Shapiro directed the remedial activities and monitoring under a construction health and safety plan, which included a community air monitoring program. Site management activities include post-remedial groundwater monitoring and sampling, SSDS start-up testing and operations and maintenance, and annual institutional control/engineering control inspections. The project was the recipient of the 2013 Big Apple Brownfield Award.

ExxonMobil, Multiple Locations, NY

Ms. Shapiro has managed the investigation and remediation of numerous ExxonMobil retail service stations in the five boroughs and Long Island. The investigations have included Phase I, II, and III site assessments, regulatory compliance, emergency spill response, UST removals, and soil and groundwater remediation.

AMY T. JORDAN

GEOLOGIST

Amy Jordan is a Geologist with 6 years of environmental consulting experience related to site assessment and remediation. Ms. Jordan works with non-profit organizations, affordable housing developers, for-profit developers, and government agencies under the regulatory oversight of NYSDEC, NYCDEP, and NYCOER. She works with projects enrolled in the New York State Brownfield Cleanup Program (BCP), the New York City Voluntary Cleanup Program (VCP), NYSDEC petroleum spills program, and NYCOER's E-designation program. Ms. Jordan conducts and manages all aspects of redevelopment projects from the initial Phase I ESA, Phase II, and remediation through post-remedial site management.

BACKGROUND

Education

B.A. Geosciences, Franklin and Marshall College, Lancaster, PA, 2011

Licenses/Certifications

40 Hour OSHA HAZWOPER Certified

OSHA 10 Hour Occupational Construction Safety and Health

NYSDEC Erosion and Sediment Control Inspector

Amtrak Track Training

NYS Asbestos Inspector

Years of Experience

Year started in company: 2012
Year started in industry: 2011

RELEVANT EXPERIENCE

12 Eckford Street, Brooklyn, New York

AKRF is providing environmental consulting services in connection with the redevelopment of the New 470 Project into a mix of affordable and market-rate residences located at 12 Eckford Street in Brooklyn, New York. Ms. Jordan developed and conducted several investigations at the property under the oversight of NYCOER. Ms. Jordan is currently preparing a BCP Application and designing the remedial action for the site, which will include the design and installation of a sub-slab depressurization system (SSDS) and soil vapor extraction (SVE) system; hazardous waste delineation and disposal; construction oversight; and ongoing remedial monitoring under the oversight of the NYSDEC. The work will culminate with a Final Engineering Report to document the completion of remedial actions and to establish protocol for site monitoring.

Elton Crossing, Bronx, New York

AKRF provided environmental consulting services in connection with the purchase and redevelopment of the Elton Crossing site at 899 Elton Avenue in the Bronx, New York. The work initially involved the preparation of a Phase II subsurface investigation including soil and soil vapor testing to determine if the site would be eligible for the BCP under NYSDEC oversight. Upon completion of the investigation, Ms. Jordan prepared a NYCBCP Application and the site was accepted in to the NYSBCP. Ms. Jordan prepared an updated Phase I Environmental Site Assessment Report and managed all aspects of the brownfield cleanup including development of a Supplemental Investigation Work Plan, performing a Supplemental Remedial Investigation and preparing a Supplemental Investigation Report, preparation of a Citizen Participation Plan, distribution of public notices, and preparation of a Remedial Action Work Plan (RAWP). AKRF oversaw all remediation at the Site, which included the removal of numerous underground oil tanks, and waste characterization and disposal of soil with contaminants including hazardous lead, petroleum, and pesticides. The project will be completed in Fall 2016 with the preparation of a Final Engineering Report to document the remedial activities and installation of institutional controls including a vapor barrier and AKRF-designed sub-slab depressurization system.

3363 and 3365 Third Avenue, Bronx, New York

AKRF is providing environmental consulting services in connection with the purchase and redevelopment of this property into affordable housing units under NYCOER's VCP. Ms. Jordan prepared two Phase I ESAs in accordance with New York City Acquisition Fund (NYCAF) protocol; conducted several subsurface investigations and waste classification sampling; prepared a VCP Application; and manages all aspects of the construction phase of this project.

Atlantic Chestnut Lots 1, 2, and 3, Brooklyn, New York

AKRF is providing environmental consulting services in connection with the purchase and redevelopment of these three lots from a burned factory into affordable housing units. For this project, Ms. Jordan prepared a Phase I ESA, conducted three subsurface investigations, and prepared three BCP Applications. Ms. Jordan will oversee the redevelopment, remediation, and ongoing remedial monitoring for these three sites comprising an entire city block.

New York City School Construction Authority, Various Locations, New York City

Under an on-call contract, AKRF provides the New York City School Construction Authority (NYCSCA) with hazardous materials consulting services. Ms. Jordan is involved with various due diligence and environmental assessment projects including Phase I Environmental Site Assessments (ESAs); Phase II (Subsurface) Environmental Site Investigations (soil, groundwater and soil vapor intrusion investigations); Indoor Air Quality (IAQ) Assessments; Underground Storage Tank (UST) and Aboveground Storage Tank (AST) inspections relating to boiler conversions; and peer review of other consultant's due diligence reports.

AMY JACKSON

ENVIRONMENTAL ENGINEER

Ms. Jackson is an Environmental Engineer at AKRF. Her skills include technical writing and presenting; groundwater, soil, and soil vapor sampling; community air monitoring; electron microscopy, light microscopy, and general laboratory practices. She is proficient in AutoCAD, ArcGIS, gINT, HEC-HMS, HEC-RAS, EPANET, Visual MODFLOW, MS Office, Open Office, PDF Editing, Fortran and Matlab programming. She has Russian and German Language Certificates (Advanced Level) from the American Council for the Teaching of Foreign Languages.

BACKGROUND

Education

M.S., Environmental Engineering, New York University, 2017

B.S., Physics, German, Brigham Young University, 2012

Certifications

OSHA 40-hour Health & Safety Training for Hazardous Waste Operations, September 2017

OSHA 10-hour Health & Safety Training for Hazardous Waste Operations, September 2017

Years of Experience

Year started in company: 2017

Year started in industry: 2016

RELEVANT EXPERIENCE - AKRF

Larkin Plaza, Yonkers, NY – Remedial Investigation, Construction Oversight

AKRF was hired to perform a Remedial Investigation to support the Brownfield Cleanup Program application submitted for this property, and to prepare a Remedial Action Work Plan (RAWP). As part of the Remedial Investigation, Ms. Jackson collected soil and groundwater samples and assisted in the preparation of the Remedial Investigation Report. Ms. Jackson also served as an on-site environmental monitor to ensure the appropriate execution of the RAWP, to conduct community and work zone air monitoring, and to oversee excavation and export of soil.

Skyview Parc, Flushing, NY – Construction Oversight

Remediation of the former automotive repair shop is being conducted under the New York State Brownfield Cleanup Program (BCP). AKRF completed a Remedial Investigation, and prepared a Remedial Action Work Plan (RAWP) to address subsurface contamination during site redevelopment. For this project, Ms. Jackson conducted work zone air monitoring and oversaw excavation and export of soil.

3500 Park Avenue, Bronx, NY – Brownfield Cleanup Program Application

Ms. Jackson reviewed pertinent historical records and previous environmental investigations, and prepared the Brownfield Cleanup Program application for the property.

1888 Bathgate Avenue, Bronx, NY – Supplemental Remedial Investigation, Construction Oversight

AKRF was hired to perform a Supplemental Remedial Investigation to support the Brownfield Cleanup Program application submitted for this property, and to prepare a Remedial Action Work Plan (RAWP). As part of the Supplemental Remedial Investigation, Ms. Jackson collected groundwater samples. Ms. Jackson also served as an on-site environmental monitor to ensure the appropriate execution of the RAWP, to conduct community and work zone air monitoring, and to oversee excavation and export of soil.

2 North 6th Place, Brooklyn, NY – Construction Oversight

AKRF provided environmental services during the redevelopment of this residential property. Ms. Jackson served as an on-site environmental monitor who oversaw soil import and final installation of waterfront landscaping elements.

Grand Street Housing Development Guild, Manhattan, NY – Phase I Environmental Site Assessment

Ms. Jackson prepared a Phase I Environmental Site Assessment for this residential and commercial use property. As part of the assessment, Ms. Jackson performed site reconnaissance, reviewed federal and state regulatory databases, and evaluated historical and topographic maps and building records from the City of New York to identify recognized environmental conditions (RECs) and environmental concerns.

145 President Street, Brooklyn, NY – Construction Oversight

Redevelopment of former residential properties is being conducted. AKRF completed Phase I and Phase II Environmental Site Assessments, and prepared a Soil Management Plan (SMP) to address subsurface contamination during site redevelopment. For this project, Ms. Jackson oversaw excavation and export of soil.

Bronx Commons, Bronx, NY – Construction Oversight

AKRF provided environmental services during the redevelopment of this property. Ms. Jackson served as an on-site environmental monitor who oversaw the cutting, cleaning, and removal of several tanks uncovered in the course of site-wide excavation activities. Ms. Jackson also conducted waste classification sampling of stockpiles at the site.

Astoria Park, Queens, NY – Subsurface Investigation

Ms. Jackson collected soil samples in the course of a subsurface investigation which AKRF was hired to conduct to determine whether subsurface conditions had been affected by former on- or off-site activities.

Frick Collection, Manhattan, NY – Phase I Environmental Site Assessment

AKRF was hired to complete an Environmental Impact Statement (EIS) to support the re-zoning and expansion of the Frick Collection and Art Reference Library. As part of this effort, Ms. Jackson prepared a Phase I Environmental Site Assessment, including site reconnaissance, review of federal and state regulatory databases, and evaluation of historical and topographic maps and building records from the City of New York to identify recognized environmental conditions (RECs) and environmental concerns.

810 Fulton Street, Brooklyn, NY – Construction Oversight

Ms. Jackson served as an on-site environmental monitor who oversaw soil excavation and export, and conducted community and work zone air monitoring.

Caton Flats, Brooklyn, NY – Phase II Environmental Site Assessment

AKRF conducted a Phase II Environmental Site Assessment to determine whether subsurface conditions had been affected by former on-site or off-site activities. As part of the Phase II investigation Ms. Jackson collected groundwater samples from permanent geotechnical wells.

235-247 Cherry Street, Manhattan, NY – Phase II Environmental Site Assessment

AKRF conducted a Phase II Environmental Site Assessment to determine whether subsurface conditions had been affected by former on- or off-site activities. As part of the Phase II investigation Ms. Jackson collected soil,

groundwater, and soil vapor samples, and coordinated with the driller and the property owner for successful completion of the work. Ms. Jackson also prepared a report to summarize the findings of the investigation.

120 Glen Avenue, Mount Vernon, NY – Limited Subsurface Investigation

AKRF was hired to perform a Limited Subsurface Investigation following the discovery of a leaking underground storage tank (UST) and subsequent spill report at a private residence in Mount Vernon. Ms. Jackson collected soil and groundwater samples to delineate the extent of contamination, and coordinated with the driller and the property owner for successful completion of the work. Ms. Jackson also prepared a Limited Subsurface Investigation Report to summarize the findings of the investigation.

1675 Westchester Avenue, Bronx, NY – Phase II Environmental Site Assessment

AKRF conducted a Phase II Environmental Site Assessment to determine whether subsurface conditions had been affected by former on- or off-site activities. As part of the Phase II investigation Ms. Jackson collected soil, groundwater, and soil vapor samples, and coordinated with the driller and the property owner for successful completion of the work. Ms. Jackson also prepared a report to summarize the findings of the investigation.

144-74 Northern Boulevard, Flushing, NY – Phase II Environmental Site Assessment

AKRF conducted a Phase II Environmental Site Assessment to determine whether subsurface conditions had been affected by former on- or off-site activities. As part of the Phase II investigation Ms. Jackson collected soil samples and coordinated with the driller and the property owner for successful completion of the work.

2036 Webster Avenue, Bronx, NY – Phase II Environmental Site Assessment

AKRF conducted a Phase II Environmental Site Assessment to determine whether subsurface conditions had been affected by former on- or off-site activities. As part of the Phase II investigation Ms. Jackson collected soil, groundwater, and soil vapor samples, and coordinated with the driller and the property owner for successful completion of the work. Ms. Jackson also prepared a report to summarize the findings of the investigation.

East Fordham Road, Bronx, NY – Environmental Oversight

AKRF was hired to oversee site clean-up following a tank failure and subsequent oil spill. Ms. Jackson supervised dewatering activities and the removal of contaminated soil from the cellar of the property, and conducted community and work zone air monitoring.

211 East 70th Street, Manhattan, NY – Waste Classification

AKRF was hired to conduct waste classification sampling in connection with the renovation and landscaping of this residential property. Ms. Jackson coordinated with the property owner for successful completion of the work, collected soil samples, and prepared a waste classification report to summarize the findings of the sampling.

OTHER RELEVANT EXPERIENCE

FedEx Ground Sort Facility, Queens, NY – Construction Monitoring

While at another firm, Ms. Jackson served as an on-site environmental and geotechnical monitor who oversaw pile installation, inspecting piles for integrity, and periodically collected inclinometer measurements along a retaining wall on Newtown Creek to monitor the impact of construction activities on the wall's structural integrity.

420 Kent Avenue, Williamsburg, NY – Construction Monitoring

While at another firm, Ms. Jackson served as an on-site environmental monitor who ensured appropriate execution of the RAWP and oversaw soil excavation and export.

Brooklyn Navy Yard, Brooklyn, NY – Construction Monitoring

While at another firm, Ms. Jackson served as an on-site environmental monitor who ensured appropriate execution of the RAWP, oversaw soil excavation and export, and conducted community air monitoring.

481 Wortman Avenue, East New York, NY – SSDS Inspection and Groundwater Sampling

While at another firm, Ms. Jackson performed quarterly sub-surface depressurization system inspections and groundwater sampling at a site with a history of solvent contamination and industrial use.

1525 Bedford Avenue, Brookln, NY – Construction Monitoring

While at another firm, Ms. Jackson served as an on-site environmental monitor who ensured appropriate execution of the RAWP, oversaw soil excavation and export, and conducted community air monitoring.

ABC, 5-39 46th Avenue, Long Island, City, NY – Phase I and II Environmental Site Assessments

While at another firm, Ms. Jackson assisted in conducting a Phase I Site reconnaissance of the property, and subsequently collected soil and groundwater samples, performed field NAPL tests on sample media, and prepared a Subsurface Investigation Report to summarize the findings of the investigation.

TARA SIMMONS

ENVIRONMENTAL ENGINEER

Tara Simmons is an environmental engineer in AKRF's hazardous materials department with experience in soil, groundwater, and soil vapor sampling, and construction monitoring and oversight. Ms. Simmons' technical skills include Mathworks MATLAB, SolidWorks, R and C Programming, JMP Pro 12, and Microsoft Office.

BACKGROUND

Education

B.E., Thayer School of Engineering, Hanover, NH, 2017

B.A., Engineering Sciences modified with Environmental Sciences, Dartmouth College, Hanover, NH, 2017

Professional Memberships

Society of Women Engineers

Certifications

OSHA 40-hour Health & Safety Training for Hazardous Waste Operations, September 2017
OSHA 10-hour Health & Safety Training for Hazardous Waste Operations, October 2017
North Respirator Training, September 2017
Amtrak Contractor Orientation, October 2017

Years of Experience

Year started in company: 2017

Year started in industry: 2017

RELEVANT EXPERIENCE – AKRF

Larkin Plaza, Yonkers, NY – Remedial Investigation, Construction Oversight

AKRF was hired to perform a Remedial Investigation to support the Brownfield Cleanup Program application submitted for this property, and to prepare a Remedial Action Work Plan (RAWP). Ms. Simmons served as an on-site environmental monitor to ensure the appropriate execution of the RAWP, to conduct community and work zone air monitoring, to oversee excavation and export of soil, and to oversee the extraction and removal of an Underground Storage Tank (UST). Ms. Simmons collected endpoint soil samples as well as conducted monthly water samples from the dewatering system installed onsite during the duration of her work on the project.

HSS Esplanade, Manhattan, NY – Subsurface Investigation

Ms. Simmons collected soil samples in the course of a subsurface investigation in which AKRF was hired to determine whether subsurface conditions met required standards for the final installation of waterfront landscaping elements at this newly redeveloped hospital.

Home Depot Rego Park, Queens, NY – Environmental Monitoring

Environmental monitoring of contaminated groundwater and remedial wells is being quarterly conducted.. AKRF completed Phase 1 and Phase II Environmental Assessments, and installed remedial wells throughout the site. Ms. Simmons conducted groundwater sampling for quarterly reporting.

Lambert Houses Parcel 3A, Bronx, NY – Remedial Investigation, Construction Oversight

Redevelopment of former residential properties was being conducted. AKRF completed Phase I and Phase II Environmental Assessments and a Remedial Action Work Plan (RAWP) to address subsurface contamination during redevelopment. After conducting waste characterization, Ms. Simmons collected soil and non-aqueous liquid samples for fingerprint analysis, oversaw excavation and export of soil, oversaw vacuuming of contaminated non-aqueous liquid from installed piles, and conducted community and work zone air monitoring. During the remedial excavation process, Ms. Simmons delineated the extent of the spill onsite and collected endpoint samples for verification.

1043 Fulton Street, Brooklyn, NY – Construction Oversight

Redevelopment of former residential properties was being conducted. AKRF completed Phase 1 and Phase II Environmental Assessments. Ms. Simmons conducted community and work zone air monitoring, and oversaw excavation and export of soil.

11 Greene Street, Manhattan, NY – Construction Oversight

Redevelopment of former residential properties was being conducted. AKRF completed Phase 1 and Phase II Environmental Assessments. Ms. Simmons conducted community and work zone air monitoring, and oversaw excavation and export of soil.

St. John Villa, Staten Island, NY – Phase II Environmental Site Investigation

AKRF conducted a Phase II Environmental Site Investigation to determine whether subsurface conditions within a St John Villa campus required remediation before an acquisition by the NYC School Construction Authority. Ms. Simmons helped collect onsite sub-slab soil vapor samples at locations throughout the St John Villa campus.

NYU Kimmel, Manhattan, NY – Construction Oversight

Ms. Simmons served as an on-site environmental monitor who oversaw excavation and the installation of municipal separate stormwater system elements.

Manhattan West Southeast Tower, Manhattan, NY – Construction Oversight

Reconstruction of Amtrak and NJ Transit properties was being conducted. AKRF completed Phase 1 and Phase II Environmental Assessments. Ms. Simmons conducted work zone air monitoring, and oversaw excavation and export of bedrock.

PAST EXPERIENCE

The East Harlem School at Exodus House, Manhattan, NY

While at a previous employer, Ms. Simmons served as a Teaching Intern, where she:

- Developed a curriculum for and facilitated 7th grade Wildlife Habitat Evaluation Science class
- Taught a pre-algebra course and co-taught a film studies class that focused on demystifying social issues

FreePlay: Interactive Play Structures, Mendham, NJ

While at a previous employer, Ms. Simmons served as a Marketing Intern, where she:

- Created a database of playground equipment distributors throughout US
- Designed a Request for Information and Request for Proposal while initiating contact with 140 companies selected from the database

Informulary, Lebanon, NH

While at a previous employer, Ms. Simmons served as a Data Analyst Intern, where she:

- Researched FDA approved drugs, reviewing clinical trials and rewriting drug-specific information into a consumer friendly DRUG FACTS BOX ™

Dartmouth College Reunions, Hanover, NH

While at a previous employer, Ms. Simmons served as an Event Management Assistant, where she:

- Served as Toddler Program Assistant, Dorm Monitor, and Head Bartender
- Coordinated with Dartmouth Alumni in event planning, set-up and take-down

LEADERSHIP AND SERVICE

Alpha Phi (Iota Kappa Chapter), Hanover NH

Ms. Simmons served as Director of Chapter Events, where she:

- Collaborated with senior administrators of Greek houses on Dartmouth campus to plan and manage educational events
- Worked with the Executive Council and Greek Life Office to oversee ~20 events per term

The Memorial Challenge, Hanover NH

Ms. Simmons served as Team Leader, Social Media Coordinator, where she:

- Developed comprehensive social media strategy to market fundraising memorial event in honor of student athletes, resulting in >500 participants

North Carolina 4-H, Wayne County NC

Ms. Simmons served as Junior Leader, where she:

- Served in an advisory capacity to county 4-H'ers by teaching team-building exercises
- Coordinated County Council public relations and media

APPENDIX B

HEALTH AND SAFETY PLAN

1675 APARTMENTS

1675-1679 WESTCHESTER AVENUE

BRONX, NEW YORK

Health and Safety Plan and Community Air Monitoring Plan

NYSDEC BCP Site Number: C203107

AKRF Project Number: 170250

Prepared For:

New York State Department of Environmental Conservation
Division of Environmental Remediation, Remedial Bureau B
625 Broadway, 12th Floor
Albany, New York 12233

Prepared On Behalf Of:

1675 JV Associates LLC
902 Broadway, 13th Floor
New York, New York 10010

and

1675 Westchester Avenue Housing Development Fund Corporation
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Prepared by:

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440 Park Avenue South, 7th Floor
New York, NY 10016
212-696-0670

MAY 2018

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1.0 INTRODUCTION

This environmental Health and Safety Plan (HASP) and Community Air Monitoring Plan (CAMP) has been developed for the implementation of a Remedial Investigation (RI) conducted by all personnel on-site at 1675-1679 Westchester Avenue in the Soundview neighborhood of the Bronx, New York, hereafter referred to as "the Site". The Site is identified on the New York City Tax Map as Bronx Borough Tax Block 3780, Lot 1. The Site formerly comprised Bronx Borough Tax Block 3780, Lots 1 and 51; however, an application was filed with the New York City Department of Finance (NYCDOF) on March 1, 2018, which combined Lots 1 and 51 into Lot 1.

The Site is an approximately 36,865-square foot "L-shaped" lot developed with a vacant commercial building with cellars fronting Westchester Avenue with a north-adjacent asphalt-paved parking area and a small landscaped area on the southwestern portion. The portion of the building on former Lot 51 was most recently occupied by a wine and liquor store and a dry cleaner until it was vacated in January 2018. The portion of the building on former Lot 1 was most recently occupied by a medical facility until it was vacated sometime in 2012. The Site is bounded by: residential buildings to the north; Westchester Avenue and the elevated 6 Metropolitan Transit Authority (MTA) subway tracks to the south, followed by a commercial shopping center; Fteley Avenue, followed by commercial and residential buildings to the east; and Metcalf Avenue, followed by the Bronx River Parkway to the west. A Site Location map is provided as Figure 1.

A November 2017 Subsurface (Phase II) Investigation Report prepared by AKRF for the Site concluded that there are elevated concentrations of metals and polycyclic aromatic hydrocarbons (PAHs) in soil, metals in groundwater, and petroleum- and chlorinated solvent-related compounds in soil vapor at the Site. The Remedial Investigation (RI) will consist of the collection of soil, groundwater, and soil vapor samples to define the nature and extent of contamination in on-site soil, groundwater, and soil vapor.

This HASP and CAMP does not discuss routine health and safety issues common to general construction and excavation, including, but not, limited to slips, trips, falls, shoring, and other physical hazards. All AKRF employees are directed that all work must be performed in accordance with the AKRF's Generic HASP and all Occupation Safety and Health Administration (OSHA)-applicable regulations for the work activities required for the project. All project personnel are furthermore directed that they are not permitted to enter Permit Required Confined Spaces (as defined by OSHA). For issues unrelated to contaminated materials, all non-AKRF employees are to be bound by all applicable OSHA regulations as well as any more stringent requirements specified by their employer in their corporate HASP or otherwise. AKRF is not responsible for providing oversight for issues unrelated to contaminated materials for non-employees. This oversight shall be the responsibility of the employer of that worker or other official designated by that employer.

2.0 HEALTH AND SAFETY GUIDELINES AND PROCEDURES

2.1 Hazard Evaluation

2.1.1 Hazards of Concern

Check all that apply		
(**X**) Organic Chemicals	(**X**) Inorganic Chemicals	( ) Radiological
( ) Biological	( ) Explosive/Flammable	( ) Oxygen Deficient Atm.
(**X**) Heat Stress	(**X**) Cold Stress	( ) Carbon Monoxide
Comments: No personnel are permitted to enter permit confined spaces.		

2.1.2 Physical Characteristics

Check all that apply		
(**X**) Liquid	(**X**) Solid	( ) Sludge
(**X**) Vapors	( ) Unknown	( ) Other

2.1.3 Hazardous Materials

Check all that apply					
Chemicals	**Solids**	**Sludges**	**Solvents**	**Oils**	**Other**
( ) Acids	( ) Ash	( ) Paints	( ) Halogens	( ) Transformer	( ) Lab
( ) Caustics	( ) Asbestos	( ) Metals	(**X**) Petroleum	( ) Dielectric	( ) Pharmaceutical
(**X**) Pesticides	( ) Tailings		(**X**) Other: Chlorinated	(**X**) Motor or Hydraulic Oil	( ) Hospital
(**X**) Petroleum	(**X**) Other: Fill material			(**X**) Gasoline	( ) Radiological
( ) Inks				(**X**) Fuel Oil	( ) MGP
(**X**) PCBs					( ) Mold
(**X**) Metals					( ) Cyanide
(**X**)Other: VOCs & SVOCs					
Notes: VOCs – Volatile Organic Compounds SVOCs – Semivolatile Organic Compounds MGP – Manufactured Gas Plant					

2.1.4 Chemicals of Concern

Chemicals	REL/PEL/STEL	Health Hazards
Arsenic	REL = 0.002 mg/m^3 PEL = 0.010 mg/m^3	Ulceration of nasal septum, dermatitis, gastrointestinal disturbances, peripheral neuropathy, respiratory irritation, hyperpigmentation of skin, [potential occupational carcinogen]
Barium	REL = 0.5 mg/m^3 PEL = 0.5 mg/m^3	Irritation of eyes, skin, upper respiratory system; skin burns; gastroenteritis; muscle spasm; slow pulse, extrasystoles; hypokalemia.
Benzene	REL = 0.1 ppm PEL = 1 ppm STEL = 5 ppm	Irritation eyes, skin, nose, respiratory system; dizziness; headache, nausea, staggered gait; anorexia, lassitude, dermatitis; bone marrow depression, potential occupational carcinogen.
Cadmium	PEL = 0.005 mg/m^3	Pulmonary edema, dyspnea (breathing difficulty), cough, chest tightness, substernal (occurring beneath the sternum) pain; headache; chills, muscle aches; nausea, vomiting, diarrhea; anosmia (loss of the sense of smell), emphysema, proteinuria, mild anemia; [potential occupational carcinogen].
Copper	REL = 1 mg/m^3 PEL = 1 mg/m^3	Irritation eyes, nose, pharynx; nasal septum perforation; metallic taste; dermatitis.
Chromium	REL = 0.5 mg/m^3 PEL = 0.5 mg/m^3	Irritation eyes, skin; sensitization dermatitis; lung fibrosis (histologic)
Pesticides	REL = 0.5 mg/m^3 PEL = 1 mg/m^3 [skin]	Irritation eyes, skin; paresthesia tongue, lips, face; tremor; anxiety, dizziness, confusion, malaise (vague feeling of discomfort), headache, lassitude (weakness, exhaustion); convulsions; paresis hands; vomiting; potential carcinogen.
Dieldrin	REL = 0.25 mg/m^3 [skin] PEL = 0.25 mg/m^3 [skin]	Headache, dizziness; nausea, vomiting, malaise (vague feeling of discomfort), sweating; myoclonic limb jerks; clonic, tonic convulsions; coma; [potential occupational carcinogen].
Ethylbenzene	REL = 100 ppm PEL = 100 ppm	Irritation eyes, skin, mucous membrane; headache; dermatitis; narcosis, coma.
Fuel Oil	REL = 350 mg/m^3 PEL = 400 ppm	Nausea, irritation – eyes, hypertension, headache, light-headedness, loss of appetite, poor coordination; long-term exposure – kidney damage, blood clotting problems; potential carcinogen.
Lead	REL = 0.1 mg/m^3 PEL = 0.05 mg/m^3	Weakness, lassitude, insomnia; facial pallor, pale eye, anorexia, low-weight, malnutrition, constipation, abdominal pain, colic; anemia; gingival lead line; tremors, paralysis wrists and ankles; encephalopathy; kidney disease; irritation eyes; hypotension.

Chemicals	REL/PEL/STEL	Health Hazards
Manganese	REL = 1 mg/m^3 PEL = 5 mg/m^3 STEL = 3 mg/m^3	Manganism; asthenia, insomnia, mental confusion; metal fume fever: dry throat, cough, chest tightness, dyspnea (breathing difficulty), rales, flu-like fever; lower back pain; vomiting; malaise (vague feeling of discomfort); lassitude (weakness, exhaustion); kidney damage.
Mercury	REL = 0.1 mg/m^3 PEL = 0.05 mg/m^3	Irritation eyes, skin; cough, chest pain, dyspnea (breathing difficulty), bronchitis, pneumonitis; tremor, insomnia, irritability, indecision, headache, lassitude (weakness, exhaustion); stomatitis, salivation; gastrointestinal disturbance, anorexia, weight loss; proteinuria.
Naphthalene	REL = 15 ppm PEL = 10 ppm	Irritation eyes; headache, confusion, excitement, malaise (vague feeling of discomfort); nausea, vomiting, abdominal pain; irritation bladder; profuse sweating; jaundice; hematuria (blood in the urine), renal shutdown; dermatitis, optical neuritis, corneal damage.
Nickel	REL = 0.015 mg/m^3 PEL = 1 mg/m^3	Sensitization dermatitis, allergic asthma, pneumonitis; [potential occupational carcinogen].
PCBs	PCB-1242: REL = 1 mg/m^3 PEL = 0.001 mg/m^3 PCB-1254: REL = 0.5 mg/m^3 PEL = 0.001 mg/m^3	Rash; anemia, liver, stomach, thyroid damage; reduced ability to fight disease; impaired reproduction.
Polycyclic Aromatic Hydrocarbons (PAHs)	PEL = 5 mg/m^3	Harmful effects to skin, bodily fluids, and ability to fight disease, reproductive problems; [potential occupational carcinogen].
Tetrachloroethylene (PCE)	PEL = 100 ppm STEL = 200 ppm	Irritation eyes, skin, nose, throat, respiratory system; nausea; flush face, neck; dizziness, poor coordination; headache, drowsiness; skin erythema (skin redness); liver damage; potential occupational carcinogen.
Toluene	REL = 100 ppm PEL = 200 ppm STEL = 300 ppm	Irritation eyes, nose; lassitude, confusion, euphoria, dizziness, headache; dilated pupils, lacrimation (discharge of tears); anxiety, muscle fatigue, insomnia; paresthesia; dermatitis; liver, kidney damage.
Trichloroethylene (TCE)	PEL = 100 ppm	Lassitude (weakness, exhaustion), dizziness, tremor, drowsiness, nausea, vomiting; dermatitis; cardiac arrhythmias, paresthesia; liver injury; [potential occupational carcinogen].
Xylenes	REL = 100 ppm PEL = 100 ppm	Irritation eyes, skin, nose, throat; dizziness, excitement, drowsiness, poor coordination, staggering gait; corneal vacuolization; anorexia, nausea, vomiting, abdominal pain; dermatitis.
Zinc	REL = 5 mg/m^3 (dust and fume) PEL = 5 mg/m^3 (fume) 15 mg/m^3 (total dust) 5 mg/m^3 (respirable dust)	Metal fume fever: chills, muscle ache, nausea, fever, dry throat, cough; lassitude (weakness, exhaustion); metallic taste; headache; blurred vision; low back pain; vomiting; malaise (vague feeling of discomfort); chest tightness; dyspnea (breathing difficulty), rales, decreased pulmonary function.

Chemicals	REL/PEL/STEL	Health Hazards
Comments: REL = National Institute for Occupational Safety and Health (NIOSH) Recommended Exposure Limit PEL = OSHA Permissible Exposure Limit STEL = OSHA Short Term Exposure Limit		

2.2 Designated Personnel

AKRF will appoint one of its on-site personnel as the Site Safety Officer (SSO). This individual will be responsible for the implementation of the HASP. The SSO will have a 2-year or 4-year college degree in occupational safety or a related environmental science/engineering field, and experience in implementation of air monitoring and hazardous materials sampling programs. Health and safety training required for the SSO and all field personnel are outlined in Section 2.3 of this HASP.

2.3 Training

All personnel who enter the work area while intrusive activities are being performed will have completed a 40-hour training course that meets OSHA requirements of 29 CFR Part 1910, Occupational Safety and Health Standards. In addition, all personnel will have up-to-date 8-hour refresher training. The training will allow personnel to recognize and understand the potential hazards to health and safety. All field personnel must attend a training program, whose purpose is to:

- Make them aware of the potential hazards they may encounter;
- Provide the knowledge and skills necessary for them to perform the work with minimal risk to health and safety; Make them aware of the purpose and limitations of safety equipment; and
- Ensure that they can safely avoid or escape from emergencies.

Each member of the field crew will be instructed in these objectives before work begins. A Site safety meeting will be conducted at the start of the project. Additional meetings shall be conducted, as necessary, for new personnel working at the Site.

2.4 Medical Surveillance Program

All AKRF and subcontractor personnel performing field work involving subsurface disturbance at the site are required to have passed a complete medical surveillance examination in accordance with 29 CFR 1910.120 (f). A physician's medical release for work will be confirmed by the SSO before an employee can begin Site activities. The medical release shall consider the type of work to be performed and the required personal protective equipment (PPE). The medical examination will, at a minimum, be provided annually and upon termination of hazardous waste Site work.

2.5 Site Work Zones

During any activities involving subsurface disturbance, the work area must be divided into various zones to prevent the spread of contamination, ensure that proper protective equipment is donned, and provide an area for decontamination.

The Exclusion Zone is defined as the area where exposure to impacted media could be encountered. The Contamination Reduction Zone (CRZ) is the area where decontamination procedures take place and is located next to the Exclusion Zone. The Support is the zone area

where support facilities such as vehicles, fire extinguisher, and first aid supplies are located. The emergency staging area (part of the Support Zone) is the area where all workers on-site would assemble in the event of an emergency. A summary of these areas is provided below. These zones may be changed by the SSO, depending on that day's activities. All field personnel will be informed of the location of these zones before work begins.

Task	Exclusion Zone	CRZ	Support Zone
Remedial Investigation	10 feet from drill rig	25 feet from drill rig	As Needed
Comments: Control measures such as caution tape and/or traffic cones will be placed around the perimeter of the work area when work is being done in a public area.			

2.6 Community Air Monitoring Plan

The purpose of the air monitoring program is to identify any exposure of the field personnel and the community to potential environmental hazards in the soil and groundwater. Air Monitoring will be conducted in accordance with the New York State Department of Health (NYSDOH) and NYSDEC guidance. Results of the air monitoring will be used to determine the appropriate response action, if needed.

Demolition of the Site building is expected to occur prior to NYSDEC approval of the Remedial Action Work Plan (RAWP). As such, special requirements will be necessary for work within 20 feet of potentially exposed individuals or structures and for indoor work with co-located residences or facilities. NYSDEC will determine these requirements in consultation with NYSDOH.

2.6.1 VOC Monitoring

Continuous monitoring for VOCs will be conducted during all ground-intrusive activities, including soil boring advancement and groundwater monitoring well installation. Upwind concentrations will be measured at the start of each workday and periodically thereafter to establish background concentrations. VOCs will be monitored continuously at the downwind perimeter of the exclusion zone. Monitoring will be conducted with a PID equipped with an 11.7 eV lamp capable of calculating 15-minute running average concentrations.

More frequent intervals of monitoring will be conducted if required as determined by the SSO. All PID readings will be recorded and available for NYSDEC and NYSDOH personnel to review. Instantaneous readings, if any, will also be recorded.

2.6.2 Particulate Monitoring

Continuous monitoring for particulates will be conducted during all ground-intrusive activities, which will involve the measurement of respirable dust. Community air monitoring for dust particulates will be conducted using a MIE 1000 Personal DataRam or equivalent to measure the concentration of airborne respirable particulates less than 10 micrometers in size (PM_{10}). The dust monitor will be capable of calculating 15-minute running average concentrations and equipped with an audible alarm to indicate exceedance of action levels. Background readings and any readings that trigger response actions will be recorded in the project logbook, which will be available on site for NYSDOH and/or NYSDEC review.

2.6.3 Community Air Monitoring Action Levels

VOC Action Levels

The following actions will be taken based on organic vapor levels measured:

- If total organic vapor levels exceed 5 ppm above background for the 15-minute average at the exclusion zone perimeter, work activities will be temporarily halted and monitoring continued. If levels readily decrease (per instantaneous readings) below 5 ppm above background, work activities will resume with continued monitoring.
- If total organic vapor levels at the downwind perimeter of the exclusion zone persist at levels in excess of 5 ppm above background but less than 25 ppm, work activities will be halted, the source of vapors identified, corrective actions taken to abate emissions, and monitoring continued. After these steps, work activities will resume provided that the total organic vapor level 200 feet downwind of the hot zone or half the distance to the nearest potential receptor or residential/commercial structure, whichever is less – but in no case less than 20 feet – is below 5 ppm above background for the 15-minute average.
- If the total organic vapor level is above 25 ppm at the perimeter of the exclusion zone, activities will be shutdown.

Particulate Action Levels

The following actions will be taken based on particulate levels measured:

- If the downwind particulate concentrations are greater than 100 micrograms per cubic meter ($\mu g/m^3$) above background (upwind concentrations), and no other obvious source is apparent, then it will be assumed that the elevated particulate concentrations are a result of site activities. In such instances, dust suppression measures will be implemented and monitoring will be continued. Work will be allowed to continue with dust suppression if downwind particulate levels do not exceed 150 $\mu g/m^3$ above the background (upwind concentration) and provided that no visible dust is migrating from the work area.
- If particulate levels persist at 150 $\mu g/m^3$ above the background, work must be stopped until dust suppression measures bring particulate levels to below 150 $\mu g/m^3$ above background.

Major Vapor Emission Response Plan

If any organic levels greater than 5 ppm over background are identified 200 feet downwind from the work Site, or half the distance to the nearest residential or commercial property, whichever is less, all work activities must be halted or vapor controls must be implemented.

If, following the cessation of the work activities, or as the result of an emergency, organic levels persist above 5 ppm above background 200 feet downwind or half the distance to the nearest residential or commercial property from the exclusion zone, then the air quality must be monitored within 20 feet of the perimeter of the nearest residential or commercial structure (20 Foot Zone).

If either of the following criteria is exceeded in the 20 Foot Zone, then the Major Vapor Emission Response Plan shall automatically be implemented:

- Sustained organic vapor levels approaching 1 ppm above background for a period of more than 30 minutes; or
- Organic vapor levels greater than 5 ppm above background for any time period.

Upon activation, the following activities shall be undertaken as part of the Major Vapor Emission Response Plan:

- The NYSDEC, NYSDOH, and local police authorities will be immediately contacted by the SSO and advised of the situation;
- Frequent air monitoring will be conducted at 30-minute intervals within the 20 Foot Zone. If two successive readings below action levels are measured, air monitoring may be halted or modified by the Site Health and Safety Officer; and
- All Emergency contacts will go into effect as appropriate.

All readings will be recorded and be available for NYSDEC and NYSDOH personnel to review.

2.7 Personal Protection Equipment (PPE)

The PPE required for various kinds of site investigation tasks are based on 29 CFR 1910.120, Hazardous Waste Operations and Emergency Response, Appendix B, "General Description and Discussion of the Levels of Protection and Protective Gear."

AKRF field personnel and other site personnel shall wear, at a minimum, Level D personal protective equipment. The protection will be based on the air monitoring described in Section 2.6.

LEVEL OF PROTECTION & PPE		**Drilling/Sampling**
Level D (**X**) Steel Toe Shoes (**X**) Hard Hat (within 25 feet of drill rig) (**X**) Work Gloves	(**X**) Safety Glasses ( ) Face Shield (**X**) Ear Plugs (within 25 feet of drill rig) (**X**) Nitrile Gloves (**X**) Tyvek for drill rig operator if NAPL present	Yes
Level C ***(in addition to Level D)*** (**X**) Half-Face Respirator OR (**X**) Full Face Respirator ( ) Full-Face PAPR	( ) Particulate Cartridge ( ) Organic Cartridge (**X**) Dual Organic/ Particulate Cartridge	If PID > 10 ppm (breathing zone)
Comments: Cartridges to be changed out at least once per shift unless warranted beforehand (e.g., more difficult to breathe or any odors detected). NAPL – Non-aqueous Phase Liquid PAPR – Powdered Air Purifying Respirator		

2.8 General Work Practices

To protect the health and safety of the field personnel, field personnel will adhere to the guidelines listed below during activities involving subsurface disturbance:

- Eating, drinking, chewing gum or tobacco, and smoking are prohibited, except in designated areas on the Site. These areas will be designated by the SSO.
- Workers must wash their hands thoroughly on leaving the work area and before eating, drinking, or any other such activity.
- The workers should shower as soon as possible after leaving the Site. Contact with contaminated or suspected surfaces should be avoided.
- The buddy system should always be used; each buddy should watch for signs of fatigue, exposure, and heat/cold stress.

3.0 EMERGENCY PROCEDURES AND EMERGENCY RESPONSE PLAN

The field crew will be equipped with emergency equipment, such as a first aid kit and disposable eye washes. In the case of a medical emergency, the SSO will determine the nature of the emergency and he/she will have someone call for an ambulance, if needed. If the nature of the injury is not serious, i.e., the person can be moved without expert emergency medical personnel, he/she should be taken to a hospital by on-site personnel. Directions to the hospital are provided below, and a hospital route map is included as Figure 2.

3.1 HOSPITAL DIRECTIONS

Hospital Name:	New York City Health and Hospitals/Jacobi
Phone Number:	(718) 718-5000
Address:	1400 Pelham Parkway, Bronx, New York 10461
Directions:	1. Turn right out of the Site, heading west on Westchester Avenue. 2. Turn right onto Metcalf Avenue 3. Turn right onto East174th Street. 4. Turn left onto Fteley Avenue. 5. Turn right onto Cross Bronx Expressway. 6. Keep left to stay on Cross Bronx Expressway. 7. Use the right lane to take Bronx River Parkway North (towards White Plains). 8. Merge onto the Bronx River Parkway Northbound. 9. Take Exit 7E on the right for Pelham Parkway and Continue onto Pelham Parkway. 10. The emergency room entrance will be on the right.

3.2 EMERGENCY CONTACTS

Company	Individual Name	Title	Contact Number
AKRF	Michelle Lapin, P.E.	Quality Assurance/Quality Control Officer	646-388-9520 (office)
	Deborah Shapiro, QEP	Project Manager	646-388-9544 (office)
	Amy Jordan	Deputy Project Manager	646-388-9864 (office)
	Amy Jackson	Field Team Leader/Site Safety Officer (SSO)	970-773-6829 (cell)
	Tara Simmons	SSO (Alternate)	828-550-2612 (cell)
1675 JV Associates LLC and 1675 Westchester Avenue Housing Development Fund Corporation	Michael Wadman	Client Representative	646-388-8216 (office)
Ambulance, Fire Department & Police Department	-	-	911

Company	Individual Name	Title	Contact Number
NYSDEC Spill Hotline	-	-	800-457-7362

4.0 APPROVAL & ACKNOWLEDGMENTS OF HASP

APPROVAL

Signed: _____ Date: _____

AKRF Project Manager

Signed: _____ Date: _____

AKRF Health and Safety Officer

Below is an affidavit that must be signed by all workers who enter the site. A copy of the HASP must be on-site at all times and will be kept by the SSO.

AFFIDAVIT

I,_____(name), of_____(company name), have read the Health and Safety Plan (HASP) for the 1675 Apartments site located at 1675-1679 Westchester Avenue in the Bronx, New York. I agree to conduct all on-site work in accordance with the requirements set forth in this HASP and understand that failure to comply with this HASP could lead to my removal from the site.

Signed:	_____	Company:	_____	Date:	_____
Signed:	_____	Company:	_____	Date:	_____
Signed:	_____	Company:	_____	Date:	_____
Signed:	_____	Company:	_____	Date:	_____
Signed:	_____	Company:	_____	Date:	_____
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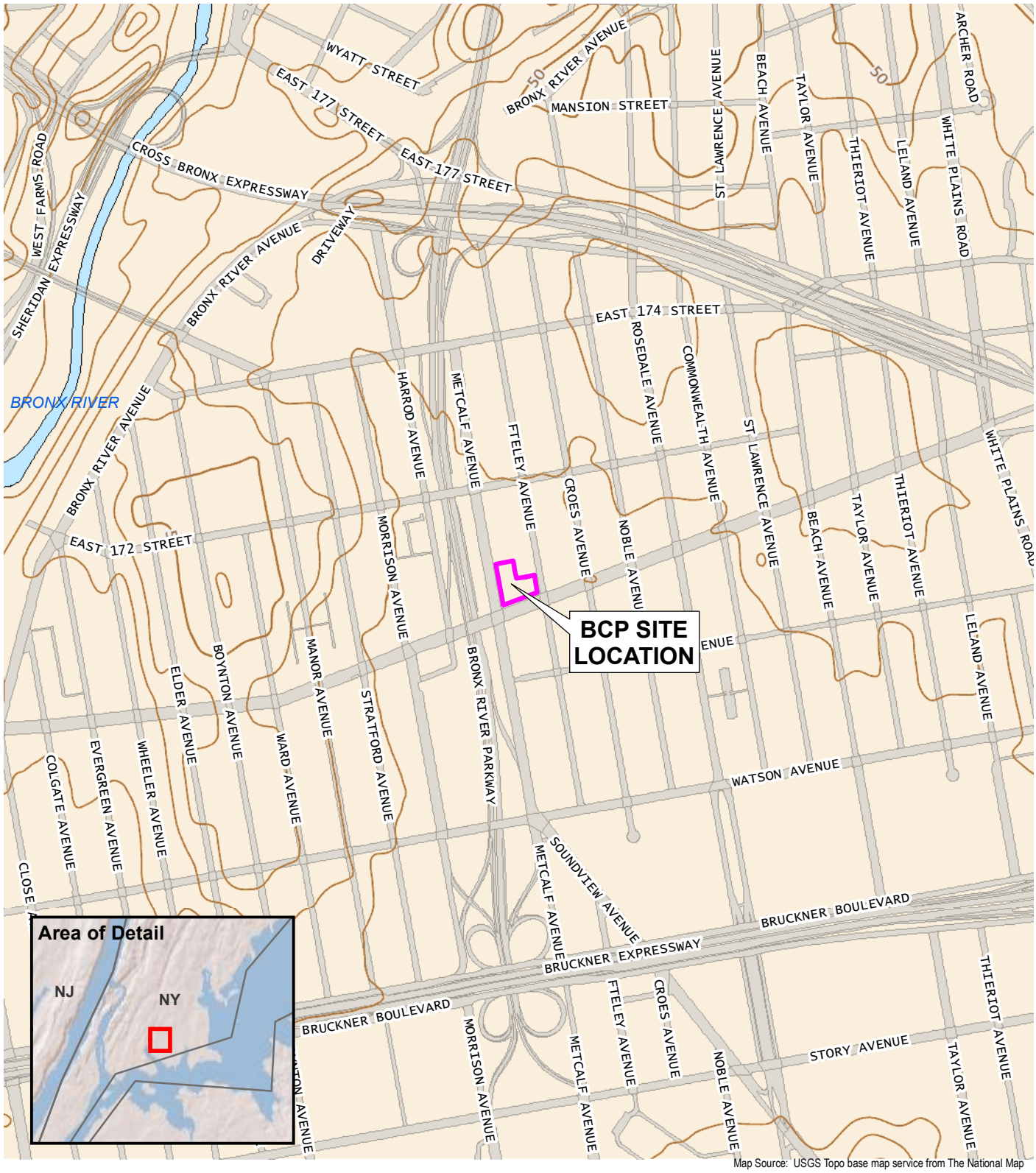
Signed:	_____	Company:	_____	Date:	_____
	_____		_____		_____

FIGURE 1

SITE LOCATION



Map Source: USGS Topo base map service from The National Map

0 800 1,600

SCALE IN FEET

AKRF

440 Park Avenue South, New York, NY 10016

1675 Apartments
1675-1679 Westchester Avenue
Bronx, New York

BCP SITE LOCATION

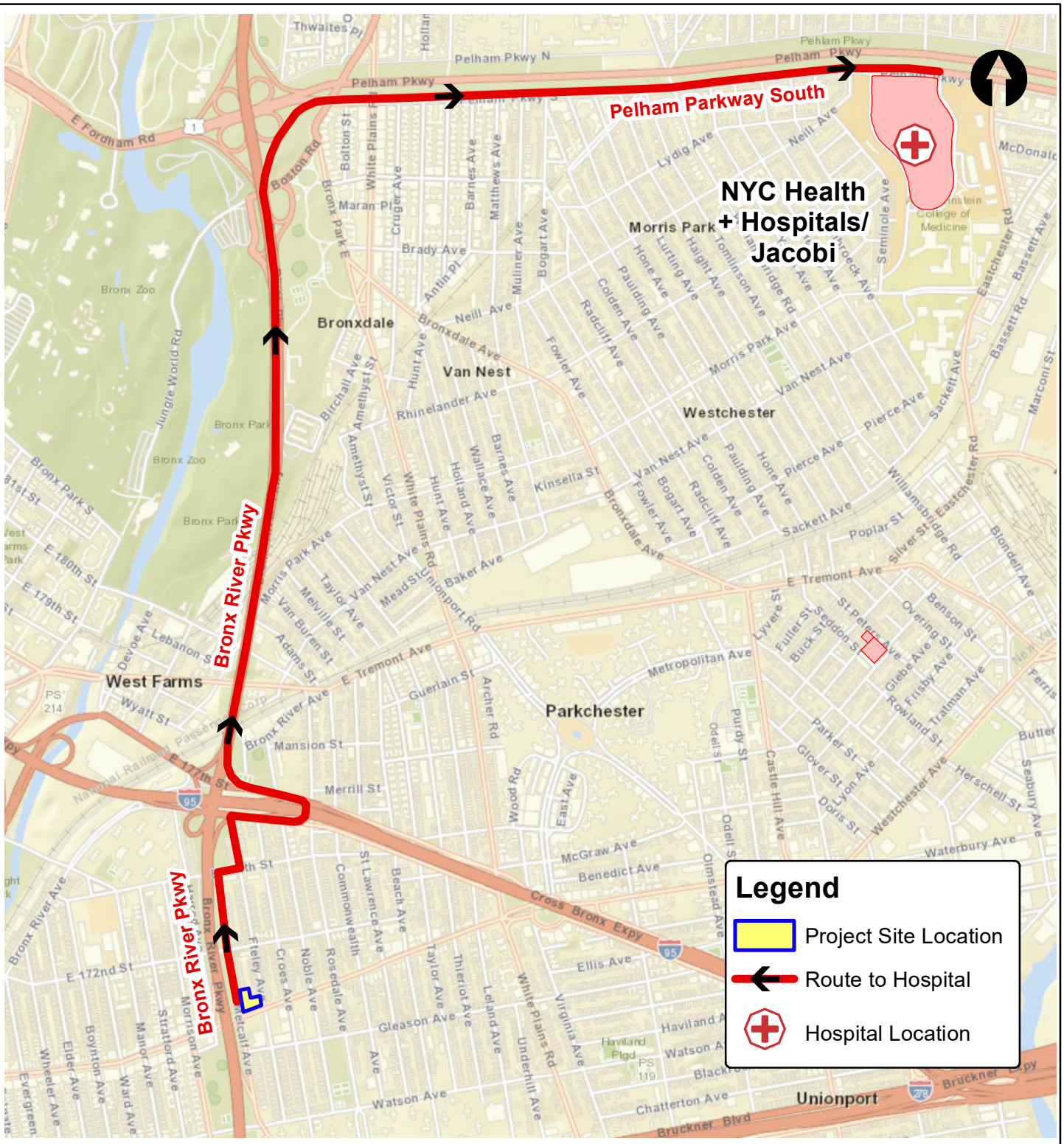
DATE
5/4/2018

PROJECT NO.
170250

FIGURE
1

FIGURE 2

HOSPITAL ROUTE MAP



Service Layer Credits: ESRC World Street Map 2016

1400 Pelham Parkway South
Bronx, New York 10461
(718) 918-5000

0 0.25 0.5 Miles

AKRF
440 Park Avenue South, New York, NY 10016

1675 Apartments
1675-1679 Westchester Avenue
Bronx, New York

HOSPITAL LOCATION MAP

DATE **5/4/2018**
PROJECT NO. **170250**
FIGURE **2**

APPENDIX A

POTENTIAL HEALTH EFFECTS FROM ON-SITE CONTAMINANTS

Arsenic - ToxFAQs™

CAS # 7440-38-2

This fact sheet answers the most frequently asked health questions (FAQs) about arsenic. For more information, call the CDC Information Center at 1-800-232-4636. This fact sheet is one in a series of summaries about hazardous substances and their health effects. It is important you understand this information because this substance may harm you. The effects of exposure to any hazardous substance depend on the dose, the duration, how you are exposed, personal traits and habits, and whether other chemicals are present.

HIGHLIGHTS: Exposure to higher than average levels of arsenic occur mostly in the workplace, near hazardous waste sites, or in areas with high natural levels. At high levels, inorganic arsenic can cause death. Exposure to lower levels for a long time can cause a discoloration of the skin and the appearance of small corns or warts. Arsenic has been found in at least 1,149 of the 1,684 National Priority List (NPL) sites identified by the Environmental Protection Agency (EPA).

What is arsenic?

Arsenic is a naturally occurring element widely distributed in the earth's crust. In the environment, arsenic is combined with oxygen, chlorine, and sulfur to form inorganic arsenic compounds. Arsenic in animals and plants combines with carbon and hydrogen to form organic arsenic compounds.

Inorganic arsenic compounds are mainly used to preserve wood. Copper chromated arsenate (CCA) is used to make "pressure-treated" lumber. CCA is no longer used in the U.S. for residential uses; it is still used in industrial applications. Organic arsenic compounds are used as pesticides, primarily on cotton fields and orchards.

What happens to arsenic when it enters the environment?

- Arsenic occurs naturally in soil and minerals and may enter the air, water, and land from wind-blown dust and may get into water from runoff and leaching.
- Arsenic cannot be destroyed in the environment. It can only change its form.
- Rain and snow remove arsenic dust particles from the air.
- Many common arsenic compounds can dissolve in water. Most of the arsenic in water will ultimately end up in soil or sediment.
- Fish and shellfish can accumulate arsenic; most of this arsenic is in an organic form called arsenobetaine that is much less harmful.

How might I be exposed to arsenic?

- Ingesting small amounts present in your food and water or breathing air containing arsenic.
- Breathing sawdust or burning smoke from wood treated with arsenic.
- Living in areas with unusually high natural levels of arsenic in rock.
- Working in a job that involves arsenic production or use, such as copper or lead smelting, wood treating, or pesticide application.

How can arsenic affect my health?

Breathing high levels of inorganic arsenic can give you a sore throat or irritated lungs.

Ingesting very high levels of arsenic can result in death. Exposure to lower levels can cause nausea and vomiting, decreased production of red and white blood cells, abnormal heart rhythm, damage to blood vessels, and a sensation of "pins and needles" in hands and feet.

Ingesting or breathing low levels of inorganic arsenic for a long time can cause a darkening of the skin and the appearance of small "corns" or "warts" on the palms, soles, and torso.

Skin contact with inorganic arsenic may cause redness and swelling.

Almost nothing is known regarding health effects of organic arsenic compounds in humans. Studies in animals show that some simple organic arsenic

compounds are less toxic than inorganic forms. Ingestion of methyl and dimethyl compounds can cause diarrhea and damage to the kidneys.

How likely is arsenic to cause cancer?

Several studies have shown that ingestion of inorganic arsenic can increase the risk of skin cancer and cancer in the liver, bladder, and lungs. Inhalation of inorganic arsenic can cause increased risk of lung cancer. The Department of Health and Human Services (DHHS) and the EPA have determined that inorganic arsenic is a known human carcinogen. The International Agency for Research on Cancer (IARC) has determined that inorganic arsenic is carcinogenic to humans.

How can arsenic affect children?

There is some evidence that long-term exposure to arsenic in children may result in lower IQ scores. There is also some evidence that exposure to arsenic in the womb and early childhood may increase mortality in young adults.

There is some evidence that inhaled or ingested arsenic can injure pregnant women or their unborn babies, although the studies are not definitive. Studies in animals show that large doses of arsenic that cause illness in pregnant females, can also cause low birth weight, fetal malformations, and even fetal death. Arsenic can cross the placenta and has been found in fetal tissues. Arsenic is found at low levels in breast milk.

How can families reduce the risks of exposure to arsenic?

- If you use arsenic-treated wood in home projects, you should wear dust masks, gloves, and protective clothing to decrease exposure to sawdust.
- If you live in an area with high levels of arsenic in water or soil, you should use cleaner sources of water and limit contact with soil.
- If you work in a job that may expose you to arsenic, be aware that you may carry arsenic home on your clothing, skin, hair, or tools. Be sure to shower and change clothes before going home.

Is there a medical test to determine whether I've been exposed to arsenic?

There are tests available to measure arsenic in your blood, urine, hair, and fingernails. The urine test is the most reliable test for arsenic exposure within the last few days. Tests on hair and fingernails can measure exposure to high levels of arsenic over the past 6-12 months. These tests can determine if you have been exposed to above-average levels of arsenic. They cannot predict whether the arsenic levels in your body will affect your health.

Has the federal government made recommendations to protect human health?

The EPA has set limits on the amount of arsenic that industrial sources can release to the environment and has restricted or cancelled many of the uses of arsenic in pesticides. EPA has set a limit of 0.01 parts per million (ppm) for arsenic in drinking water.

The Occupational Safety and Health Administration (OSHA) has set a permissible exposure limit (PEL) of 10 micrograms of arsenic per cubic meter of workplace air (10 $\mu g/m^3$) for 8 hour shifts and 40 hour work weeks.

References

Agency for Toxic Substances and Disease Registry (ATSDR). 2007. Toxicological Profile for Arsenic (Update). Atlanta, GA: U.S. Department of Health and Human Services. Public Health Service.

Where can I get more information?

For more information, contact the Agency for Toxic Substances and Disease Registry, Division of Toxicology and Human Health Sciences, 1600 Clifton Road NE, Mailstop F-57, Atlanta, GA 30329-4027.

Phone: 1-800-232-4636

ToxFAQs™ Internet address via WWW is http://www.atsdr.cdc.gov/toxfaqs/index.asp.

ATSDR can tell you where to find occupational and environmental health clinics. Their specialists can recognize, evaluate, and treat illnesses resulting from exposure to hazardous substances. You can also contact your community or state health or environmental quality department if you have any more questions or concerns.

ATSDR
AGENCY FOR TOXIC SUBSTANCES AND DISEASE REGISTRY

BARIUM

CAS # 7440-39-3

Division of Toxicology and Human Health Sciences ToxFAQs™ **June 2013**

This fact sheet answers the most frequently asked health questions (FAQs) about barium and barium compounds. For more information, call the ATSDR Information Center at 1-800-232-4636. This fact sheet is one in a series of summaries about hazardous substances and their health effects. It is important you understand this information because these substances may harm you. The effects of exposure to any hazardous substance depend on the dose, the duration, how you are exposed, personal traits and habits, and whether other chemicals are present.

HIGHLIGHTS: Exposure to barium occurs mostly in the workplace or from drinking contaminated water. Ingesting drinking water containing levels of barium above the EPA drinking water guidelines for relatively short periods of time can cause gastrointestinal disturbances and muscle weakness. Ingesting high levels for a long time can damage the kidneys. Barium and barium compounds have been found in at least 798 of the 1,684 National Priority List sites identified by the Environmental Protection Agency (EPA).

What is barium?

Barium is a silvery-white metal which exists in nature only in ores containing mixtures of elements. It combines with other chemicals such as sulfur or carbon and oxygen to form barium compounds.

Barium compounds are used by the oil and gas industries to make drilling muds. Drilling muds make it easier to drill through rock by keeping the drill bit lubricated. They are also used to make paint, bricks, ceramics, glass, and rubber.

Barium sulfate is sometimes used by doctors to perform medical tests and to take x-rays of the gastrointestinal tract.

What happens to barium when it enters the environment?

- Barium gets into the air during the mining, refining, and production of barium compounds, and from the burning of coal and oil.
- The length of time that barium will last in air, land, water, or sediments depends on the form of barium released.
- Barium compounds, such as barium sulfate and barium carbonate, which do not dissolve well in water, can last a long time in the environment.
- Barium compounds, such as barium chloride, barium nitrate, or barium hydroxide, that dissolve easily in water usually do not last in these forms for a long time in the environment. The barium in these compounds that is dissolved in water quickly combines with sulfate or carbonate that are naturally found in water and become the longer lasting forms (barium sulfate and barium carbonate).
- Fish and aquatic organisms can accumulate barium.

How might I be exposed to barium?

- Ingesting small amounts present in your food and water or breathing air containing very low levels of barium.
- Living in areas with unusually high natural levels of barium in the drinking water.
- Working in a job that involves barium production or use.
- Living or working near waste sites where barium has been disposed of.

How can barium affect my health?

The health effects of the different barium compounds depend on how well the compound dissolves in water or in the stomach contents. Barium compounds that do not dissolve well, such as barium sulfate, are not generally harmful.

Barium has been found to potentially cause gastrointestinal disturbances and muscular weakness when people are exposed to it at levels above the EPA drinking water standards for relatively short periods of time. Some people who eat or drink amounts of barium above background levels found in food and water for a short period may experience vomiting, abdominal cramps, diarrhea, difficulties in breathing, increased or decreased blood pressure, numbness around the face, and muscle weakness. Eating or drinking very large amounts of barium compounds that easily dissolve can cause changes in heart

rhythm or paralysis and possibly death. Animals that drank barium over long periods had damage to the kidneys, decreases in body weight, and some died.

How likely is barium to cause cancer?
The Department of Health and Human Services (DHHS) and the International Agency for Research on Cancer (IARC) have not classified barium as to its carcinogenicity. The EPA has determined that barium is not likely to be carcinogenic to humans following ingestion and that there is insufficient information to determine whether it will be carcinogenic to humans following inhalation exposure.

How can barium affect children?
We do not know whether children will be more or less sensitive than adults to barium toxicity. A study in rats that swallowed barium found a decrease in newborn body weight; we do not know if a similar effect would be seen in humans.

How can families reduce the risk of exposure to barium?
- The greatest potential source of barium exposure is through food and drinking water. However, the amount of barium in foods and drinking water are typically too low to be of concern.

Is there a medical test to determine whether I've been exposed to barium?
There is no routine medical test to determine whether you have been exposed to barium. Doctors can measure barium in body tissues and fluids, such as bones, blood, urine, and feces, using very complex instruments. These tests cannot be used to predict the extent of the exposure or potential health effects.

The geometric mean barium level measured in the U.S. general population aged 6 and older is reported by the Centers for Disease Control and Prevention (CDC) as 1.56 µg/g creatinine (measured in urine).

Has the federal government made recommendations to protect human health?
The EPA has set a limit of 2.0 milligrams of barium per liter of drinking water (2.0 mg/L), which is the same as 2 ppm.

The Occupational Safety and Health Administration (OSHA) has set Permissible Exposure Limits (PELs) of 0.5 milligrams of soluble barium compounds per cubic meter of workplace air (0.5 mg/m^3) for 8 hour shifts and 40 hour work weeks. The OSHA limits for barium sulfate dust are 15 mg/m^3 of total dust and 5 mg/m^3 for respirable fraction.

The National Institute for Occupational Safety and Health (NIOSH) has set Recommended Exposure Limits (RELs) of 0.5 mg/m^3 for soluble barium compounds. The NIOSH has set RELs of 10 mg/m^3 (total dust) for barium sulfate and 5 mg/m^3 (respirable fraction).

References
Agency for Toxic Substances and Disease Registry (ATSDR). 2007. Toxicological Profile for Barium and Compounds (*Update*). Atlanta, GA: U.S. Department of Public Health and Human Services, Public Health Service.

http://www.cdc.gov/exposurereport/pdf/FourthReport_UpdatedTables_Sep2012.pdf

Where can I get more information? For more information, contact the Agency for Toxic Substances and Disease Registry, Division of Toxicology and Human Health Sciences, 1600 Clifton Road NE, Mailstop F-57, Atlanta, GA 30333. Phone: 1-800-232-4636, FAX: 770-488-4178. ToxFAQs Internet address via WWW is http://www.atsdr.cdc.gov/toxfaqs/index.asp. ATSDR can tell you where to find occupational and environmental health clinics. Their specialists can recognize, evaluate, and treat illnesses resulting from exposure to hazardous substances. You can also contact your community or state health or environmental quality department if you have any more questions or concerns.

Cadmium- ToxFAQs™

CAS # 7440-43-9

This fact sheet answers the most frequently asked health questions (FAQs) about cadmium. For more information, call the CDC Information Center at 1-800-232-4636. This fact sheet is one in a series of summaries about hazardous substances and their health effects. It is important you understand this information because this substance may harm you. The effects of exposure to any hazardous substance depend on the dose, the duration, how you are exposed, personal traits and habits, and whether other chemicals are present.

HIGHLIGHTS: Exposure to cadmium happens mostly in the workplace where cadmium products are made. The general population is exposed from breathing cigarette smoke or eating cadmium contaminated foods. Cadmium damages the kidneys, lungs, and bones. Cadmium has been found in at least 1,014 of the 1,669 National Priorities List (NPL) sites identified by the Environmental Protection Agency (EPA).

What is cadmium?

Cadmium is a natural element in the earth's crust. It is usually found as a mineral combined with other elements such as oxygen (cadmium oxide), chlorine (cadmium chloride), or sulfur (cadmium sulfate, cadmium sulfide).

All soils and rocks, including coal and mineral fertilizers, contain some cadmium. Most cadmium used in the United States is extracted during the production of other metals like zinc, lead, and copper. Cadmium does not corrode easily and has many uses, including batteries, pigments, metal coatings, and plastics.

What happens to cadmium when it enters the environment?

- Cadmium enters soil, water, and air from mining, industry, and burning coal and household wastes.
- Cadmium does not break down in the environment, but can change forms.
- Cadmium particles in air can travel long distances before falling to the ground or water.
- Some forms of cadmium dissolve in water.
- Cadmium binds strongly to soil particles.
- Fish, plants, and animals take up cadmium from the environment.

How might I be exposed to cadmium?

- Eating foods containing cadmium; low levels are found in all foods (highest levels are found in leafy vegetables, grains, legumes, and kidney meat).
- Smoking cigarettes or breathing cigarette smoke.
- Breathing contaminated workplace air.
- Drinking contaminated water.
- Living near industrial facilities which release cadmium into the air.

How can cadmium affect my health?

Breathing high levels of cadmium can severely damage the lungs. Eating food or drinking water with very high levels severely irritates the stomach, leading to vomiting and diarrhea.

Long-term exposure to lower levels of cadmium in air, food, or water leads to a buildup of cadmium in the kidneys and possible kidney disease. Other long-term effects are lung damage and fragile bones.

How likely is cadmium to cause cancer?

The Department of Health and Human Services (DHHS) and the International Agency for Research on Cancer (IARC) have determined that cadmium and cadmium compounds are human carcinogens. The EPA determined that cadmium is a probable human carcinogen (group B1).

Cadmium

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How can cadmium affect children?

The health effects in children are expected to be similar to the effects seen in adults (kidney and lung damage depending on the route of exposure).

A few studies in animals indicate that younger animals absorb more cadmium than adults. Animal studies also indicate that the young are more susceptible than adults to a loss of bone and decreased bone strength from exposure to cadmium.

We don't know if cadmium causes birth defects in people. Studies in animals exposed to high levels of cadmium during pregnancy have resulted in harmful effects to the young. Young animals exposed to cadmium before birth have shown effects on behavior and learning. There is also some information from animal studies that high enough exposures to cadmium before birth can reduce body weights and affect the skeleton in the developing young.

How can families reduce the risk of exposure to cadmium?

- Do not allow children to play with batteries. Dispose of nickel-cadmium batteries properly.
- Cadmium is a component of tobacco smoke. Avoid smoking and smoking in enclosed spaces like inside the home or car in order to limit exposure to children and other family members.
- If you work with cadmium, use all safety precautions to avoid carrying cadmium-containing dust home from work on your clothing, skin, hair, or tools.
- A balanced diet can reduce the amount of cadmium taken into the body from food and drink.

Is there a medical test to determine whether I've been exposed to cadmium?

Cadmium can be measured in blood, urine, hair, or nails. Urinary cadmium has been shown to accurately reflect the amount of cadmium in the body.

The amount of cadmium in your blood shows your recent exposure to cadmium. The amount of cadmium in your urine shows both your recent and your past exposure.

Has the federal government made recommendations to protect human health?

The EPA has determined that exposure to cadmium in drinking water at concentrations of 0.04 milligrams per liter (0.04 mg/L) for up to 10 days is not expected to cause any adverse effects in a child.

The EPA has determined that lifetime exposure to 0.005 mg/L cadmium is not expected to cause any adverse effects.

The Food and Drug Administration (FDA) has determined that the cadmium concentration in bottled drinking water should not exceed 0.005 mg/L.

The Occupational Health and Safety Administration (OSHA) has limited workers' exposure to an average of 5 $\mu g/m^3$ for an 8-hour workday, 40-hour workweek.

References

Agency for Toxic Substances and Disease Registry (ATSDR). 2012. Toxicological Profile for Cadmium. Atlanta, GA: U.S. Department of Health and Human Services, Public Health Service.

Where can I get more information?

For more information, contact the Agency for Toxic Substances and Disease Registry, Division of Toxicology and Human Health Sciences, 1600 Clifton Road NE, Mailstop F-57, Atlanta, GA 30329-4027.

Phone: 1-800-232-4636

ToxFAQs™ Internet address via WWW is http://www.atsdr.cdc.gov/toxfaqs/index.asp.

ATSDR can tell you where to find occupational and environmental health clinics. Their specialists can recognize, evaluate, and treat illnesses resulting from exposure to hazardous substances. You can also contact your community or state health or environmental quality department if you have any more questions or concerns.

ATSDR
AGENCY FOR TOXIC SUBSTANCES AND DISEASE REGISTRY

COPPER
CAS # 7440-50-8

Division of Toxicology ToxFAQs™ **September 2004**

This fact sheet answers the most frequently asked health questions (FAQs) about copper. For more information, call the ATSDR Information Center at 1-888-422-8737. This fact sheet is one in a series of summaries about hazardous substances and their health effects. It is important you understand this information because this substance may harm you. The effects of exposure to any hazardous substance depend on the dose, the duration, how you are exposed, personal traits and habits, and whether other chemicals are present.

HIGHLIGHTS: Copper is a metal that occurs naturally in the environment, and also in plants and animals. Low levels of copper are essential for maintaining good health. High levels can cause harmful effects such as irritation of the nose, mouth and eyes, vomiting, diarrhea, stomach cramps, nausea, and even death. Copper has been found in at least 906 of the 1,647 National Priority Sites identified by the Environmental Protection Agency (EPA).

What is copper?

Copper is a metal that occurs naturally throughout the environment, in rocks, soil, water, and air. Copper is an essential element in plants and animals (including humans), which means it is necessary for us to live. Therefore, plants and animals must absorb some copper from eating, drinking, and breathing.

Copper is used to make many different kinds of products like wire, plumbing pipes, and sheet metal. U.S. pennies made before 1982 are made of copper, while those made after 1982 are only coated with copper. Copper is also combined with other metals to make brass and bronze pipes and faucets.

Copper compounds are commonly used in agriculture to treat plant diseases like mildew, for water treatment and, as preservatives for wood, leather, and fabrics.

What happens to copper when it enters the environment?

❏ Copper is released into the environment by mining, farming, and manufacturing operations and through waste water releases into rivers and lakes. Copper is also released from natural sources, like volcanoes, windblown dusts, decaying vegetation, and forest fires.

❏ Copper released into the environment usually attaches to particles made of organic matter, clay, soil, or sand.

❏ Copper does not break down in the environment. Copper compounds can break down and release free copper into the air, water, and foods.

How might I be exposed to copper?

❏ You may be exposed to copper from breathing air, drinking water, eating foods, or having skin contact with copper, particulates attached to copper, or copper-containing compounds.

❏ Drinking water may have high levels of copper if your house has copper pipes and acidic water.

❏ Lakes and rivers that have been treated with copper compounds to control algae, or that receive cooling water from power plants, can have high levels of copper. Soils can also contain high levels of copper, especially if they are near copper smelting plants.

❏ You may be exposed to copper by ingesting copper-containing fungicides, or if you live near a copper mine or where copper is processed into bronze or brass.

❏ You may be exposed to copper if you work in copper mines or if you grind metals containing copper.

How can copper affect my health?

Everyone must absorb small amounts of copper every day because copper is essential for good health. High levels of copper can be harmful. Breathing high levels of copper can cause irritation of your nose and throat. Ingesting high levels of copper can cause nausea, vomiting, and diarrhea. Very-high doses of copper can cause damage to your liver and kidneys, and can even cause death.

How likely is copper to cause cancer?

We do not know whether copper can cause cancer in humans. The EPA has determined that copper is not classifiable as to human carcinogenicity.

How can copper affect children?

Exposure to high levels of copper will result in the same type of effects in children and adults. We do not know if these effects would occur at the same dose level in children and adults. Studies in animals suggest that the young children may have more severe effects than adults, but we don't know if this would also be true in humans. There is a very small percentage of infants and children who are unusually sensitive to copper.

We do not know if copper can cause birth defects or other developmental effects in humans. Studies in animals suggest that high levels of copper may cause a decrease in fetal growth.

How can families reduce the risk of exposure to copper?

The most likely place to be exposed to copper is through drinking water, especially if your water is corrosive and you have copper pipes in your house. The best way to lower the level of copper in your drinking water is to let the water run for at least 15 seconds first thing in the morning before drinking or using it. This reduces the levels of copper in tap water dramatically.

If you work with copper, wear the necessary protective clothing and equipment, and always follow safety procedures. Shower and change your clothes before going home each day.

Is there a medical test to show whether I've been exposed to copper?

Copper is found throughout the body; in hair, nails, blood, urine, and other tissues. High levels of copper in these samples can show that you have been exposed to higher-than normal levels of copper. These tests cannot tell whether you will experience harmful effects. Tests to measure copper levels in the body are not usually available at a doctor's office because they require special equipment, but the doctor can send samples to a specialty laboratory.

Has the federal government made recommendations to protect human health?

The EPA requires that levels of copper in drinking water be less than 1.3 mg of copper per one liter of drinking water (1.3 mg/L).

The U.S. Department of Agriculture has set the recommended daily allowance for copper at 900 micrograms of copper per day (µg/day) for people older than eight years old.

The Occupational Safety and Health Administration (OSHA) requires that levels of copper in the air in workplaces not exceed 0.1 mg of copper fumes per cubic meter of air ($0.1\ mg/m^3$) and $1.0\ mg/m^3$ for copper dusts.

Reference

Agency for Toxic Substances and Disease Registry (ATSDR). 2004. Toxicological Profile for Copper. Atlanta, GA: U.S. Department of Health and Human Services, Public Health Service.

Where can I get more information? For more information, contact the Agency for Toxic Substances and Disease Registry, Division of Toxicology, 1600 Clifton Road NE, Mailstop F-32, Atlanta, GA 30333. Phone: 1-888-422-8737, FAX: 770-488-4178. ToxFAQs Internet address via WWW is http://www.atsdr.cdc.gov/toxfaq.html. ATSDR can tell you where to find occupational and environmental health clinics. Their specialists can recognize, evaluate, and treat illnesses resulting from exposure to hazardous substances. You can also contact your community or state health or environmental quality department if you have any more questions or concerns.

Chromium - ToxFAQs™

CAS # 7440-47-3

This fact sheet answers the most frequently asked health questions (FAQs) about chromium. For more information, call the CDC Information Center at 1-800-232-4636. This fact sheet is one in a series of summaries about hazardous substances and their health effects. It is important you understand this information because this substance may harm you. The effects of exposure to any hazardous substance depend on the dose, the duration, how you are exposed, personal traits and habits, and whether other chemicals are present.

HIGHLIGHTS: Exposure to chromium occurs from ingesting contaminated food or drinking water or breathing contaminated workplace air. Chromium(VI) at high levels can damage the nose and cause cancer. Ingesting high levels of chromium(VI) may result in anemia or damage to the stomach or intestines. Chromium(III) is an essential nutrient. Chromium has been found in at least 1,127 of the 1,669 National Priorities List (NPL) sites identified by the Environmental Protection Agency (EPA).

What is chromium?

Chromium is a naturally occurring element found in rocks, animals, plants, and soil. It can exist in several different forms. Depending on the form it takes, it can be a liquid, solid, or gas. The most common forms are chromium(0), chromium(III), and chromium(VI). No taste or odor is associated with chromium compounds.

The metal chromium, which is the chromium(0) form, is used for making steel. Chromium(VI) and chromium(III) are used for chrome plating, dyes and pigments, leather tanning, and wood preserving.

What happens to chromium when it enters the environment?

- Chromium can be found in air, soil, and water after release from the manufacture, use, and disposal of chromium-based products, and during the manufacturing process.
- Chromium does not usually remain in the atmosphere, but is deposited into the soil and water.
- Chromium can easily change from one form to another in water and soil, depending on the conditions present.
- Fish do not accumulate much chromium in their bodies from water.

How might I be exposed to chromium?

- Eating food containing chromium(III).
- Breathing contaminated workplace air or skin contact during use in the workplace.
- Drinking contaminated well water.
- Living near uncontrolled hazardous waste sites containing chromium or industries that use chromium.

How can chromium affect my health?

Chromium(III) is an essential nutrient that helps the body use sugar, protein, and fat.

Breathing high levels of chromium(VI) can cause irritation to the lining of the nose, nose ulcers, runny nose, and breathing problems, such as asthma, cough, shortness of breath, or wheezing. The concentrations of chromium in air that can cause these effects may be different for different types of chromium compounds, with effects occurring at much lower concentrations for chromium(VI) compared to chromium(III).

The main health problems seen in animals following ingestion of chromium(VI) compounds are irritation and ulcers in the stomach and small intestine and anemia. Chromium(III) compounds are much less toxic and do not appear to cause these problems.

Sperm damage and damage to the male reproductive system have also been seen in laboratory animals exposed to chromium(VI).

Skin contact with certain chromium(VI) compounds can cause skin ulcers. Some people are extremely sensitive tochromium(VI) or chromium(III). Allergic reactions consisting of severe redness and swelling of the skin have been noted.

Chromium

CAS # 7440-47-3

How likely is chromium to cause cancer?

The Department of Health and Human Services (DHHS), the International Agency for Research on Cancer (IARC), and the EPA have determined that chromium(VI) compounds are known human carcinogens.

In workers, inhalation of chromium(VI) has been shown to cause lung cancer. Chromium(VI) also causes lung cancer in animals. An increase in stomach tumors was observed in humans and animals exposed to chromium(VI) in drinking water.

How can chromium affect children?

It is likely that health effects seen in children exposed to high amounts of chromium will be similar to the effects seen in adults.

We do not know if exposure to chromium will result in birth defects or other developmental effects in people. Some developmental effects have been observed in animals exposed to chromium(VI).

How can families reduce the risk of exposure to chromium?

- Children should avoid playing in soils near uncontrolled hazardous waste sites where chromium may have been discarded.
- Chromium is a component of tobacco smoke. Avoid smoking in enclosed spaces like inside the home or car in order to limit exposure to children and other family members.
- Although chromium(III) is an essential nutrient, you should avoid excessive use of dietary supplements containing chromium.

Is there a medical test to determine whether I've been exposed to chromium?

Since chromium(III) is an essential element and naturally occurs in food, there will always be some level of chromium in your body. Chromium can be measured in hair, urine, and blood.

Higher than normal levels of chromium in blood or urine may indicate that a person has been exposed to chromium. However, increases in blood and urine chromium levels cannot be used to predict the kind of health effects that might develop from that exposure.

Has the federal government made recommendations to protect human health?

The EPA has established a maximum contaminant level of 0.1 mg/L for total chromium in drinking water.

The FDA has determined that the chromium concentration in bottled drinking water should not exceed 0.1 mg/L.

The Occupational Health and Safety Administration (OSHA) has limited workers' exposure to an average of 0.005 mg/m^3 chromium(VI), 0.5 mg/m^3 chromium(III), and 1.0 mg/m^3 chromium(0) for an 8-hour workday, 40-hour workweek.

References

Agency for Toxic Substances and Disease Registry (ATSDR). 2012. Toxicological Profile for Chromium. Atlanta, GA: U.S. Department of Health and Human Services, Public Health Service.

Where can I get more information?

For more information, contact the Agency for Toxic Substances and Disease Registry, Division of Toxicology and Human Health Sciences, 1600 Clifton Road NE, Mailstop F-57, Atlanta, GA 30329-4027.

Phone: 1-800-232-4636

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DDT, DDE, and DDD - ToxFAQs™

CAS # 50-29-3, 72-55-9, 72-54-8

This fact sheet answers the most frequently asked health questions (FAQs) about DDT, DDE, and DDD. For more information, call the CDC Information Center at 1-800-232-4636. This fact sheet is one in a series of summaries about hazardous substances and their health effects. It is important you understand this information because this substance may harm you. The effects of exposure to any hazardous substance depend on the dose, the duration, how you are exposed, personal traits and habits, and whether other chemicals are present.

HIGHLIGHTS: Exposure to DDT, DDE, and DDD occurs mostly from eating foods containing small amounts of these compounds, particularly meat, fish and poultry. High levels of DDT can affect the nervous system causing excitability, tremors and seizures. In women, DDE can cause a reduction in the duration of lactation and an increased chance of having a premature baby. DDT, DDE, and DDD have been found in at least 442 of the 1,613 National Priorities List (NPL) sites identified by the Environmental Protection Agency (EPA).

What are DDT, DDE, and DDD?

DDT (dichlorodiphenyltrichloroethane) is a pesticide once widely used to control insects in agriculture and insects that carry diseases such as malaria. DDT is a white, crystalline solid with no odor or taste. Its use in the U.S. was banned in 1972 because of damage to wildlife, but is still used in some countries.

DDE (dichlorodiphenyldichloroethylene) and DDD (dichlorodiphenyldichloroethane) are chemicals similar to DDT that contaminate commercial DDT preparations. DDE has no commercial use. DDD was also used to kill pests, but its use has also been banned. One form of DDD has been used medically to treat cancer of the adrenal gland.

What happens to DDT, DDE, and DDD when they enter the environment?

- DDT entered the environment when it was used as a pesticide; it still enters the environment due to current use in other countries.
- DDE enters the environment as contaminant or breakdown product of DDT; DDD also enters the environment as a breakdown product of DDT.
- DDT, DDE, and DDD in air are rapidly broken down by sunlight. Half of what's in air breaks down within 2 days.
- They stick strongly to soil; most DDT in soil is broken down slowly to DDE and DDD by microorganisms; half the DDT in soil will break down in 2–15 years, depending on the type of soil.
- Only a small amount will go through the soil into groundwater; they do not dissolve easily in water.
- DDT, and especially DDE, build up in plants and in fatty tissues of fish, birds, and other animals.

How might I be exposed to DDT, DDE, and DDD?

- Eating contaminated foods, such as root and leafy vegetables, fatty meat, fish, and poultry, but levels are very low.
- Eating contaminated imported foods from countries that still allow the use of DDT to control pests.
- Breathing contaminated air or drinking contaminated water near waste sites and landfills that may contain higher levels of these chemicals.
- Infants fed on breast milk from mothers who have been exposed.
- Breathing or swallowing soil particles near waste sites or landfills that contain these chemicals.

How can DDT, DDE, and DDD affect my health?

DDT affects the nervous system. People who accidentally swallowed large amounts of DDT became excitable and had tremors and seizures. These effects went away after the exposure stopped. No effects were seen in people who took small daily doses of DDT by capsule for 18 months. A study in humans showed that women who had high amounts of a form of DDE in their breast milk were unable to breast feed their babies for as long as women who had little DDE in the breast milk. Another study in humans showed that women who had high amounts of DDE in the blood had an increased chance of having premature babies. In animals, short-term exposure to large amounts of DDT in food affected the nervous system, while long-term exposure to smaller amounts affected the liver. Also in animals, short-term oral exposure to small amounts of DDT or its breakdown products may also have harmful effects on reproduction.

Agency for Toxic Substances and Disease Registry
Division of Toxicology and Human Health Sciences

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CS265956-A

DDT, DDE, and DDD - ToxFAQs™

CAS # 50-29-3, 72-55-9, 72-54-8

How likely are DDT, DDE, and DDD to cause cancer?

Studies in DDT-exposed workers did not show increases in cancer. Studies in animals given DDT with the food have shown that DDT can cause liver cancer.

The Department of Health and Human Services (DHHS) determined that DDT may reasonable be anticipated to be a human carcinogen.

The International Agency for Research on Cancer (IARC) determined that DDT may possibly cause cancer in humans. The EPA determined that DDT, DDE, and DDD are probable human carcinogens.

How can DDT, DDE, and DDD affect children?

There are no studies on the health effects of children exposed to DDT, DDE, or DDD. We can assume that children exposed to large amounts of DDT will have health effects similar to the effects seen in adults. However, we do not know whether children differ from adults in their susceptibility to these substances.

There is no evidence that DDT, DDE, or DDD cause birth defects in people. A study showed that teenage boys whose mothers had higher DDE amounts in the blood when they were pregnant were taller than those whose mothers had lower DDE levels. However, a different study found the opposite in preteen girls. The reason for the discrepancy between these studies is unknown.

Studies in rats have shown that DDT and DDE can mimic the action of natural hormones and in this way affect the development of the reproductive and nervous systems. Puberty was delayed in male rats given high amounts of DDE as juveniles. This could possibly happen in humans.

A study in mice showed that exposure to DDT during the first weeks of life may cause neurobehavioral problems later in life.

How can families reduce the risk of exposure to DDT,DDE, and DDE?

- Most families will be exposed to DDT by eating food or drinking liquids contaminated with small amounts of DDT.
- Cooking will reduce the amount of DDT in fish.
- Washing fruit and vegetables will remove most DDT from their surface.
- Follow health advisories that tell you about consumption of fish and wildlife caught in contaminated areas.

Is there a medical test to show whether I've been exposed to DDT, DDE, and DDD?

Laboratory tests can detect DDT, DDE, and DDD in fat, blood, urine, semen, and breast milk. These tests may show low, moderate, or excessive exposure to these compounds, but cannot tell the exact amount you were exposed to, or whether you will experience adverse effects. These tests are not routinely available at the doctor's office because they require special equipment.

Has the federal government made recommendations to protect human health?

The Occupational Safety and Health Administration (OSHA) sets a limit of 1 milligram of DDT per cubic meter of air (1 mg/m^3) in the workplace for an 8-hour shift, 40-hour workweek.

The Food and Drug Administration (FDA) has set limits for DDT, DDE, and DDD in foodstuff at or above which the agency will take legal action to remove the products from the market.

References

Agency for Toxic Substances and Disease Registry (ATSDR). 2002. Toxicological Profile for DDT/DDE/DDD (Update). Atlanta, GA: U.S. Department of Health and Human Services, Public Health Service.

Where can I get more information?

For more information, contact the Agency for Toxic Substances and Disease Registry, Division of Toxicology and Human Health Sciences, 1600 Clifton Road NE, Mailstop F-57, Atlanta, GA 30329-4027.

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Aldrin and Dieldrin- ToxFAQs™

CAS # 309-00-2 and 60-57-1

This fact sheet answers the most frequently asked health questions (FAQs) about aldrin and dieldrin. For more information, call the CDC Information Center at 1-800-232-4636. This fact sheet is one in a series of summaries about hazardous substances and their health effects. It is important you understand this information because this substance may harm you. The effects of exposure to any hazardous substance depend on the dose, the duration, how you are exposed, personal traits and habits, and whether other chemicals are present.

HIGHLIGHTS: Exposure to aldrin and dieldrin happens mostly from eating contaminated foods, such as root crops, fish, or seafood. Aldrin and dieldrin build up in the body after years of exposure and can affect the nervous system. Aldrin has been found in at least 207 of the 1,613 National Priorities List (NPL) sites identified by the Environmental Protection Agency (EPA). Dieldrin has been found in at least 287 of the 1,613 sites.

What are aldrin and dieldrin?

Aldrin and dieldrin are insecticides with similar chemical structures. They are discussed together in this fact sheet because aldrin quickly breaks down to dieldrin in the body and in the environment. Pure aldrin and dieldrin are white powders with a mild chemical odor. The less pure commercial powders have a tan color. Neither substance occurs naturally in the environment.

From the 1950s until 1970, aldrin and dieldrin were widely used pesticides for crops like corn and cotton. Because of concerns about damage to the environment and potentially to human health, EPA banned all uses of aldrin and dieldrin in 1974, except to control termites. In 1987, EPA banned all uses.

What happens to aldrin and dieldrin when they enter the environment?

- Sunlight and bacteria change aldrin to dieldrin so that we mostly find dieldrin in the environment.
- They bind tightly to soil and slowly evaporate to the air.
- Dieldrin in soil and water breaks down very slowly.
- Plants take in and store aldrin and dieldrin from the soil.
- Aldrin rapidly changes to dieldrin in plants and animals.
- Dieldrin is stored in the fat and leaves the body very slowly.

How might I be exposed to aldrin or dieldrin?

- Dieldrin is everywhere in the environment, but at very low levels.
- Eating food like fish or shellfish from lakes or streams contaminated with either chemical, or contaminated root crops, dairy products, or meats.
- Air, surface water, or soil near waste sites may contain higher levels.
- Living in homes that were once treated with aldrin or dieldrin to control termites.

How can aldrin and dieldrin affect my health?

People who have intentionally or accidentally ingested large amounts of aldrin or dieldrin have suffered convulsions and some died. Health effects may also occur after a longer period of exposure to smaller amounts because these chemicals build up in the body.

Some workers exposed to moderate levels in the air for a long time had headaches, dizziness, irritability, vomiting, and uncontrolled muscle movements. Workers removed from the source of exposure rapidly recovered from most of these effects.

Animals exposed to high amounts of aldrin or dieldrin also had nervous system effects. In animals, oral exposure to lower levels for a long period also affected the liver and decreased their ability to fight infections. We do not know whether aldrin or dieldrin affect the ability of people to fight disease.

Studies in animals have given conflicting results about whether aldrin and dieldrin affect reproduction in male animals and whether these chemicals may damage the sperm. We do not know whether aldrin or dieldrin affect reproduction in humans.

Agency for Toxic Substances and Disease Registry
Division of Toxicology and Human Health Sciences

ATSDR

CS265956-A

Aldrin and Dieldrin

CAS # 309-00-2 and 60-57-1

How likely are aldrin and dieldrin to cause cancer?

There is no conclusive evidence that aldrin or dieldrin cause cancer in humans. Aldrin and dieldrin have shown to cause liver cancer in mice. The International Agency for Research on Cancer (IARC) has determined that aldrin and dieldrin are not classifiable as to human carcinogenicity. The EPA has determined that aldrin and dieldrin are probable human carcinogens.

How can aldrin and dieldrin affect children?

Children can be exposed to aldrin and dieldrin in the same way as adults. There are no known unique exposure pathways for children. Children who swallowed amounts of aldrin or dieldrin much larger than those found in the environment suffered convulsions and some died, as occurred in adults. However, we do not know whether children are more susceptible than adults to the effects of aldrin or dieldrin.

We do not know whether aldrin or dieldrin cause birth defects in humans. Pregnant animals that ingested aldrin or dieldrin had some babies with low birth weight and some with alterations in the skeleton. Dieldrin has been found in human breast milk, therefore, it can be passed to suckling infants.

How can families reduce their risk for exposure to aldrin and dieldrin?

- Since aldrin and dieldrin are no longer produced or used, exposure to these compounds will occur only from past usage.
- Because aldrin and dieldrin were applied to the basement of some homes for termite protection, before buying a home families should investigate what, if any, pesticides have been used within the home.

Is there a medical test to show whether I've been exposed to aldrin and dieldrin?

There are laboratory tests that can measure aldrin and dieldrin in your blood, urine, and body tissues. Because aldrin changes to dieldrin fairly quickly in the body, the test has to be done shortly after you are exposed to aldrin. Since dieldrin can stay in the body for months, measurements of dieldrin can be made much longer after exposure to either aldrin or dieldrin. The tests cannot tell you whether harmful health effects will occur. These tests are not routinely available at the doctor's office because they require special equipment.

Has the federal government made recommendations to protect human health?

The EPA limits the amount of aldrin and dieldrin that may be present in drinking water to 0.001 and 0.002 milligrams per liter (mg/L) of water, respectively, for protection against health effects other than cancer. The EPA has determined that a concentration of aldrin and dieldrin of 0.0002 mg/L in drinking water limits the lifetime risk of developing cancer from exposure to each compound to 1 in 10,000.

The Occupational Safety and Health Administration (OSHA) sets a maximum average of 0.25 milligrams of aldrin and dieldrin per cubic meter of air (0.25 mg/m^3) in the workplace during an 8-hour shift, 40 hour week. The National Institute for Occupational Safety and Health (NIOSH) also recommends a limit of 0.25 mg/m^3 for both compounds for up to a 10-hour work day, 40-hour week.

The Food and Drug Administration (FDA) regulates the residues of aldrin and dieldrin in raw foods. The allowable range is from 0 to 0.1 ppm, depending on the type of food product.

References

Agency for Toxic Substances and Disease Registry (ATSDR). 2002. Toxicological Profile for Aldrin/Dieldrin. Atlanta, GA: U.S. Department of Health and Human Services, Public Health Service.

Where can I get more information?

For more information, contact the Agency for Toxic Substances and Disease Registry, Division of Toxicology and Human Health Sciences, 1600 Clifton Road NE, Mailstop F-57, Atlanta, GA 30329-4027.

Phone: 1-800-232-4636

ToxFAQs™ Internet address via WWW is http://www.atsdr.cdc.gov/toxfaqs/index.asp.

ATSDR can tell you where to find occupational and environmental health clinics. Their specialists can recognize, evaluate, and treat illnesses resulting from exposure to hazardous substances. You can also contact your community or state health or environmental quality department if you have any more questions or concerns.

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AGENCY FOR TOXIC SUBSTANCES AND DISEASE REGISTRY

FUEL OILS

CAS # 8008-20-6, 70892-10-3, 68476-30-2, 68476-34-6, 68476-31-3

This fact sheet answers the most frequently asked health questions (FAQs) about fuel oils. For more information, call the ATSDR Information Center at 1-888-422-8737. This fact sheet is one in a series of summaries about hazardous substances and their health effects. It's important you understand this information because this substance may harm you. The effects of exposure to any hazardous substance depend on the dose, the duration, how you are exposed, personal traits and habits, and whether other chemicals are present.

SUMMARY: Fuel oils are liquid mixtures produced from petroleum, and their use mostly involves burning them as fuels. Drinking or breathing fuel oils may cause nausea or nervous system effects. However, exposure under normal use conditions is not likely to be harmful. Fuel oils have been found in at least 26 of the 1,430 National Priorities List sites identified by the Environmental Protection Agency (EPA).

What are fuel oils?

(Pronounced fyo͞o′əl oilz)

Fuel oils are a variety of yellowish to light brown liquid mixtures that come from crude petroleum. Some chemicals found in fuel oils may evaporate easily, while others may more easily dissolve in water.

Fuel oils are produced by different petroleum refining processes, depending on their intended uses. Fuel oils may be used as fuel for engines, lamps, heaters, furnaces, and stoves, or as solvents.

Some commonly found fuel oils include kerosene, diesel fuel, jet fuel, range oil, and home heating oil. These fuel oils differ from one another by their hydrocarbon compositions, boiling point ranges, chemical additives, and uses.

What happens to fuel oils when they enter the environment?

- Some chemicals found in fuel oils may evaporate into the air from open containers or contaminated soil or water.
- Some chemicals found in fuel oils may dissolve in water after spills to surface waters or leaks from underground storage tanks.
- Some chemicals found in fuel oils may stick to particles in water, which will eventually cause them to settle to the bottom sediment.
- Some of the chemicals found in fuel oils may be broken down slowly in air, water, and soil by sunlight or small organisms.
- Some of the chemicals found in fuel oils may build up significantly in plants and animals.

How might I be exposed to fuel oils?

- Using a home kerosene heater or stove, or using fuel oils at work.
- Breathing air in home or building basements that has been contaminated with fuel oil vapors entering from the soil.
- Drinking or swimming in water that has been contaminated with fuel oils from a spill or a leaking underground storage tank.
- Touching soil contaminated with fuel oils.
- Using fuel oils to wash paint or grease from skin or equipment.

How can fuel oils affect my health?

Little information is available about the health effects that may be caused by fuel oils. People who use kerosene

stoves for cooking do not seem to have any health problems related to their exposure.

Breathing some fuel oils for short periods may cause nausea, eye irritation, increased blood pressure, headache, lightheadedness, loss of appetite, poor coordination, and difficulty concentrating. Breathing diesel fuel vapors for long periods may cause kidney damage and lower your blood's ability to clot.

Drinking small amounts of kerosene may cause vomiting, diarrhea, coughing, stomach swelling and cramps, drowsiness, restlessness, painful breathing, irritability, and unconsciousness. Drinking large amounts of kerosene may cause convulsions, coma, or death. Skin contact with kerosene for short periods may cause itchy, red, sore, or peeling skin.

How likely are fuel oils to cause cancer?

The International Agency for Research on Cancer (IARC) has determined that some fuel oils (heavy) may possibly cause cancer in humans, but for other fuel oils (light) there is not enough information to make a determination. IARC has also determined that occupational exposures to fuel oils during petroleum refining are probably carcinogenic in humans.

Some studies with mice have suggested that repeated contact with fuel oils may cause liver or skin cancer. However, other mouse studies have found this not to be the case. No studies are available in other animals or in people on the carcinogenic effects of fuel oils.

Is there a medical test to show whether I've been exposed to fuel oils?

There is no medical test that shows if you have been exposed to fuel oils. Tests are available to determine if some of the chemicals commonly found in fuel oils are in your blood. However, the presence of these chemicals in blood may not necessarily mean that you have been exposed to fuel oils.

Has the federal government made recommendations to protect human health?

The Occupational Safety and Health Administration (OSHA) and the Air Force Office of Safety and Health (AFOSH) have set a permissible exposure level (PEL) of 400 parts of petroleum distillates per million parts of air (400 ppm) for an 8-hour workday, 40-hour workweek.

The National Institute for Occupational Safety and Health (NIOSH) recommends that average workplace air levels not exceed 350 milligrams of petroleum distillates per cubic meter of air (350 mg/m^3) for a 40-hour workweek.

The Department of Transportation (DOT) lists fuel oils as hazardous materials and, therefore, regulates their transportation.

Glossary

Carcinogenic: Able to cause cancer.

CAS: Chemical Abstracts Service.

Evaporate: To change into a vapor or a gas.

Hydrocarbon: Any compound made up of hydrogen and carbon.

Milligram (mg): One thousandth of a gram.

ppm: Parts per million.

Sediment: Mud and debris that have settled to the bottom of a body of water.

References

Agency for Toxic Substances and Disease Registry (ATSDR). 1995. Toxicological profile for fuel oils. Atlanta, GA: U.S. Department of Health and Human Services, Public Health Service.

Where can I get more information? For more information, contact the Agency for Toxic Substances and Disease Registry, Division of Toxicology, 1600 Clifton Road NE, Mailstop F-32, Atlanta, GA 30333. Phone:1-888-422-8737, FAX: 770-488-4178. ToxFAQs Internet address via WWW is http://www.atsdr.cdc.gov/toxfaq.html ATSDR can tell you where to find occupational and environmental health clinics. Their specialists can recognize, evaluate, and treat illnesses resulting from exposure to hazardous substances. You can also contact your community or state health or environmental quality department if you have any more questions or concerns.

Lead – ToxFAQs™

CAS # 7439-92-1

This fact sheet answers the most frequently asked health questions (FAQs) about lead. For more information, call the CDC Information Center at 1-800-232-4636. This fact sheet is one in a series of summaries about hazardous substances and their health effects. It is important you understand this information because this substance may harm you. The effects of exposure to any hazardous substance depend on the dose, the duration, how you are exposed, personal traits and habits, and whether other chemicals are present.

HIGHLIGHTS: Exposure to lead can happen from breathing workplace air or dust, eating contaminated foods, or drinking contaminated water. Children can be exposed from eating lead-based paint chips or playing in contaminated soil. Lead can damage the nervous system, kidneys, and reproductive system. Lead has been found in at least 1,272 of the 1,684 National Priority List (NPL) sites identified by the Environmental Protection Agency (EPA).

What is lead?

Lead is a naturally occurring bluish-gray metal found in small amounts in the earth's crust. Lead can be found in all parts of our environment. Much of it comes from human activities including burning fossil fuels, mining, and manufacturing.

Lead has many different uses. It is used in the production of batteries, ammunition, metal products (solder and pipes), and devices to shield X-rays. Because of health concerns, lead from paints and ceramic products, caulking, and pipe solder has been dramatically reduced in recent years. The use of lead as an additive to gasoline was banned in 1996 in the United States.

What happens to lead when it enters the environment?

- Lead itself does not break down, but lead compounds are changed by sunlight, air, and water.
- When lead is released to the air, it may travel long distances before settling to the ground.
- Once lead falls onto soil, it usually sticks to soil particles.
- Movement of lead from soil into groundwater will depend on the type of lead compound and the characteristics of the soil.

How might I be exposed to lead?

- Eating food or drinking water that contains lead. Water pipes in some older homes may contain lead solder. Lead can leach out into the water.
- Spending time in areas where lead-based paints have been used and are deteriorating. Deteriorating lead paint can contribute to lead dust.
- Working in a job where lead is used or engaging in certain hobbies in which lead is used, such as making stained glass.
- Using health-care products or folk remedies that contain lead.

How can lead affect my health?

The effects of lead are the same whether it enters the body through breathing or swallowing. Lead can affect almost every organ and system in your body. The main target for lead toxicity is the nervous system, both in adults and children. Long-term exposure of adults can result in decreased performance in some tests that measure functions of the nervous system. It may also cause weakness in fingers, wrists, or ankles. Lead exposure also causes small increases in blood pressure, particularly in middle-aged and older people and can cause anemia. Exposure to high lead levels can severely damage the brain and kidneys in adults or children and ultimately cause death. In pregnant women, high-levels of exposure to lead may cause miscarriage. High-level exposure in men can damage the organs responsible for sperm production.

How likely is lead to cause cancer?

We have no conclusive proof that lead causes cancer in humans. Kidney tumors have developed in rats and mice that had been given large doses of some kind of lead compounds. The Department of Health and Human Services (DHHS) has determined that lead and lead compounds are reasonably anticipated to be human carcinogens and the EPA has determined that lead is a probable human carcinogen. The International Agency for Research on Cancer (IARC) has determined that inorganic lead is probably carcinogenic to humans and that there is insufficient information to determine whether organic lead compounds will cause cancer in humans.

Lead

CAS # 7439-92-1

How can lead affect children?

Small children can be exposed by eating lead-based paint chips, chewing on objects painted with lead-based paint, or swallowing house dust or soil that contains lead.

Children are more vulnerable to lead poisoning than adults. A child who swallows large amounts of lead may develop blood anemia, severe stomachache, muscle weakness, and brain damage. If a child swallows smaller amounts of lead, much less severe effects on blood and brain function may occur. Even at much lower levels of exposure, lead can affect a child's mental and physical growth.

Exposure to lead is more dangerous for young and unborn children. Unborn children can be exposed to lead through their mothers. Harmful effects include premature births, smaller babies, decreased mental ability in the infant, learning difficulties, and reduced growth in young children. These effects are more common if the mother or baby was exposed to high levels of lead. Some of these effects may persist beyond childhood.

How can families reduce the risks of exposure to lead?

- Avoid exposure to sources of lead.
- Do not allow children to chew or mouth surfaces that may have been painted with lead-based paint.
- If you have a water lead problem, run or flush water that has been standing overnight before drinking or cooking with it.
- Some types of paints and pigments that are used as make-up or hair coloring contain lead. Keep these kinds of products away from children.
- If your home contains lead-based paint or you live in an area contaminated with lead, wash children's hands and faces often to remove lead dusts and soil, and regularly clean the house of dust and tracked in soil.

Is there a medical test to determine whether I've been exposed to lead?

A blood test is available to measure the amount of lead in your blood and to estimate the amount of your recent exposure to lead. Blood tests are commonly used to screen children for lead poisoning. Lead in teeth or bones can be measured by X-ray techniques, but these methods are not widely available. Exposure to lead also can be evaluated by measuring erythrocyte protoporphyrin (EP) in blood samples. EP is a part of red blood cells known to increase when the amount of lead in the blood is high. However, the EP level is not sensitive enough to identify children with elevated blood lead levels below about 25 micrograms per deciliter (µg/dL). These tests usually require special analytical equipment that is not available in a doctor's office. However, your doctor can draw blood samples and send them to appropriate laboratories for analysis.

Has the federal government made recommendations to protect human health?

The Centers for Disease Control and Prevention (CDC) recommends that states test children at ages 1 and 2 years. Children should be tested at ages 3–6 years if they have never been tested for lead, if they receive services from public assistance programs for the poor such as Medicaid or the Supplemental Food Program for Women, Infants, and Children, if they live in a building or frequently visit a house built before 1950; if they visit a home (house or apartment) built before 1978 that has been recently remodeled; and/or if they have a brother, sister, or playmate who has had lead poisoning. CDC has updated its recommendations on children's blood lead levels. Experts now use an upper reference level value of 97.5% of the population distribution for children's blood lead. In 2012-2015, the value to identify children with blood lead levels that are much higher than most children have, is 5 micrograms per deciliter (µg/dL). EPA limits lead in drinking water to 15 µg per liter.

References

Agency for Toxic Substances and Disease Registry (ATSDR). 2007. Toxicological Profile for lead (Update). Atlanta, GA: U.S. Department of Public Health and Human Services, Public Health Service.

Where can I get more information?

For more information, contact the Agency for Toxic Substances and Disease Registry, Division of Toxicology and Human Health Sciences, 1600 Clifton Road NE, Mailstop F-57, Atlanta, GA 30329-4027.

Phone: 1-800-232-4636.

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Manganese - ToxFAQs™

CAS # 7439-96-5

This fact sheet answers the most frequently asked health questions (FAQs) about manganese. For more information, call the CDC Information Center at 1-800-232-4636. This fact sheet is one in a series of summaries about hazardous substances and their health effects. It is important you understand this information because this substance may harm you. The effects of exposure to any hazardous substance depend on the dose, the duration, how you are exposed, personal traits and habits, and whether other chemicals are present.

HIGHLIGHTS: Manganese is a trace element and eating a small amount from food or water is needed to stay healthy. Exposure to excess levels of manganese may occur from breathing air, particularly where manganese is used in manufacturing, and from drinking water and eating food. At high levels, it can cause damage to the brain. Manganese has been found in at least 869 of the 1,669 National Priorities List (NPL) sites identified by the Environmental Protection Agency (EPA).

What is manganese?

Manganese is a naturally occurring metal that is found in many types of rocks. Pure manganese is silver-colored, but does not occur naturally. It combines with other substances such as oxygen, sulfur, or chlorine. Manganese occurs naturally in most foods and may be added to some foods.

Manganese is used principally in steel production to improve hardness, stiffness, and strength. It may also be used as an additive in gasoline to improve the octane rating of the gas.

What happens to manganese when it enters the environment?

- Manganese can be released to the air, soil, and water from the manufacture, use, and disposal of manganese-based products.
- Manganese cannot break down in the environment. It can only change its form or become attached to or separated from particles.
- In water, manganese tends to attach to particles in the water or settle into the sediment.
- The chemical state of manganese and the type of soil determine how fast it moves through the soil and how much is retained in the soil.
- The manganese-containing gasoline additive may degrade in the environment quickly when exposed to sunlight, releasing manganese.

How might I be exposed to manganese?

- The primary way you can be exposed to manganese is by eating food or manganese-containing nutritional supplements. Vegetarians, who consume foods rich in manganese such as grains, beans and nuts, as well as heavy tea drinkers, may have a higher intake of manganese than the average person.
- Certain occupations like welding or working in a factory where steel is made may increase your chances of being exposed to high levels of manganese.
- Manganese is routinely contained in groundwater, drinking water, and soil at low levels. Drinking water containing manganese or swimming or bathing in water containing manganese may expose you to low levels of this chemical.

How can manganese affect my health?

Manganese is an essential nutrient, and eating a small amount of it each day is important to stay healthy.

The most common health problems in workers exposed to high levels of manganese involve the nervous system. These health effects include behavioral changes and other nervous system effects, which include movements that may become slow and clumsy. This combination of symptoms when sufficiently severe is referred to as "manganism". Other less severe nervous system effects such as slowed hand movements have been observed in some workers exposed to lower concentrations in the work place.

Manganese

CAS # 7439-96-5

Exposure to high levels of manganese in air can cause lung irritation and reproductive effects.

Nervous system and reproductive effects have been observed in animals after high oral doses of manganese.

How likely is manganese to cause cancer?

The EPA concluded that existing scientific information cannot determine whether or not excess manganese can cause cancer.

How can manganese affect children?

Studies in children have suggested that extremely high levels of manganese exposure may produce undesirable effects on brain development, including changes in behavior and decreases in the ability to learn and remember. We do not know for certain that these changes were caused by manganese alone. We do not know if these changes are temporary or permanent. We do not know whether children are more sensitive than adults to the effects of manganese, but there is some indication from experiments in laboratory animals that they may be.

Studies of manganese workers have not found increases in birth defects or low birth weight in their offspring. No birth defects were observed in animals exposed to manganese.

How can families reduce the risk of exposure to manganese?

- Children are not likely to be exposed to harmful amounts of manganese in the diet. However, higher-than-usual amounts of manganese may be absorbed if their diet is low in iron. It is important to provide your child with a well-balanced diet.
- Workers exposed to high levels of airborne manganese in certain occupational settings may accumulate manganese dust on their work clothes. Manganese-contaminated work clothing should be removed before getting into your car or entering your home to help reduce the exposure hazard for yourself and your family.

Is there a medical test to determine whether I've been exposed to manganese?

Several tests are available to measure manganese in blood, urine, hair, or feces. Because manganese is normally present in our body, some is always found in tissues or fluids.

Because excess manganese is usually removed from the body within a few days, past exposures are difficult to measure with common laboratory tests.

Has the federal government made recommendations to protect human health?

The EPA has determined that exposure to manganese in drinking water at concentrations of 1 mg/L for up to 10 days is not expected to cause any adverse effects in a child.

The EPA has established that lifetime exposure to 0.3 mg/L manganese is not expected to cause any adverse effects.

The Food and Drug Administration (FDA) has determined that the manganese concentration in bottled drinking water should not exceed 0.05 mg/L.

The Occupational Health and Safety Administration (OSHA) has established a ceiling limit (concentration that should not be exceeded at any time during exposure) of 5 mg/m^3 for manganese in workplace air.

References

Agency for Toxic Substances and Disease Registry (ATSDR). 2012. Toxicological Profile for Manganese. Atlanta, GA: U.S. Department of Public Health and Human Services, Public Health Service.

Where can I get more information?

For more information, contact the Agency for Toxic Substances and Disease Registry, Division of Toxicology and Human Health Sciences, 1600 Clifton Road NE, Mailstop F-57, Atlanta, GA 30329-4027.

Phone: 1-800-232-4636.

ToxFAQs™ Internet address via WWW is http://www.atsdr.cdc.gov/toxfaqs/index.asp.

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Mercury - ToxFAQs™

CAS # 7439-97-6

This fact sheet answers the most frequently asked health questions (FAQs) about mercury. For more information, call the CDC Information Center at 1-800-232-4636. This fact sheet is one in a series of summaries about hazardous substances and their health effects. It's important you understand this information because this substance may harm you. The effects of exposure to any hazardous substance depend on the dose, the duration, how you are exposed, personal traits and habits, and whether other chemicals are present.

HIGHLIGHTS: Exposure to mercury occurs from breathing contaminated air, ingesting contaminated water and food, and having dental and medical treatments. Mercury, at high levels, may damage the brain, kidneys, and developing fetus. This chemical has been found in at least 714 of 1,467 National Priorities List (NPL) sites identified by the Environmental Protection Agency (EPA).

What is mercury?

Mercury is a naturally occurring metal which has several forms. The metallic mercury is a shiny, silver-white, odorless liquid. If heated, it is a colorless, odorless gas.

Mercury combines with other elements, such as chlorine, sulfur, or oxygen, to form inorganic mercury compounds or "salts," which are usually white powders or crystals. Mercury also combines with carbon to make organic mercury compounds. The most common one, methylmercury, is produced mainly by microscopic organisms in the water and soil. More mercury in the environment can increase the amounts of methylmercury that these small organisms make.

Metallic mercury is used to produce chlorine gas and caustic soda, and is also used in thermometers, some dental fillings, and batteries. Mercury salts are sometimes used in skin lightening creams and as antiseptic creams and ointments.

What happens to mercury when it enters the environment?

- Inorganic mercury (metallic mercury and inorganic mercury compounds) enters the air from mining ore deposits, burning coal and waste, and from manufacturing plants.
- It enters the water or soil from natural deposits, disposal of wastes, and volcanic activity.
- Methylmercury may be formed in water and soil by small organisms called bacteria.
- Methylmercury builds up in the tissues of fish. Larger and older fish tend to have the highest levels of mercury.

How might I be exposed to mercury?

- Eating fish or shellfish contaminated with methylmercury.
- Breathing vapors in air from spills, incinerators, and industries that burn mercury-containing fossil fuels.
- Release of mercury from dental work and medical treatments.
- Breathing contaminated workplace air or skin contact during use in the workplace.
- Practicing rituals that include mercury.

How can mercury affect my health?

The nervous system is very sensitive to all forms of mercury. Methylmercury and metallic mercury vapors are more harmful than other forms, because more mercury in these forms reaches the brain. Exposure to high levels of metallic, inorganic, or organic mercury can permanently damage the brain, kidneys, and developing fetus. Effects on brain functioning may result in irritability, shyness, tremors, changes in vision or hearing, and memory problems.

Short-term exposure to high levels of metallic mercury vapors may cause effects including lung damage, nausea, vomiting, diarrhea, increases in blood pressure or heart rate, skin rashes, and eye irritation.

Mercury

CAS # 7439-97-6

How likely is mercury to cause cancer?

There are inadequate human cancer data available for all forms of mercury. Mercuric chloride has caused increases in several types of tumors in rats and mice, and methylmercury has caused kidney tumors in male mice. The EPA has determined that mercuric chloride and methylmercury are possible human carcinogens.

How can mercury affect children?

Very young children are more sensitive to mercury than adults. Mercury in the mother's body passes to the fetus and may accumulate there, possibly causing damage to the developing nervous system. It can also pass to a nursing infant through breast milk. However, the benefits of breast feeding may be greater than the possible adverse effects of mercury in breast milk.

Mercury's harmful effects that may affect the fetus include brain damage, mental retardation, incoordination, blindness, seizures, and inability to speak. Children poisoned by mercury may develop problems of their nervous and digestive systems, and kidney damage.

How can families reduce the risk of exposure to mercury?

Carefully handle and dispose of products that contain mercury, such as thermometers or fluorescent light bulbs. Do not vacuum up spilled mercury, because it will vaporize and increase exposure. If a large amount of mercury has been spilled, contact your health department. Teach children not to play with shiny, silver liquids.

Properly dispose of older medicines that contain mercury. Keep all mercury-containing medicines away from children.

Pregnant women and children should keep away from rooms where liquid mercury has been used.

Learn about wildlife and fish advisories in your area from your public health or natural resources department.

Is there a medical test to determine whether I've been exposed to mercury?

Tests are available to measure mercury levels in the body. Blood or urine samples are used to test for exposure to metallic mercury and to inorganic forms of mercury. Mercury in whole blood or in scalp hair is measured to determine exposure to methylmercury. Your doctor can take samples and send them to a testing laboratory.

Has the federal government made recommendations to protect human health?

The EPA has set a limit of 2 parts of mercury per billion parts of drinking water (2 ppb).

The Food and Drug Administration (FDA) has set a maximum permissible level of 1 part of methylmercury in a million parts of seafood (1 ppm).

The Occupational Safety and Health Administration (OSHA) has set limits of 0.1 milligram of organic mercury per cubic meter of workplace air (0.1 mg/m^3) and 0.05 mg/m^3 of metallic mercury vapor for 8-hour shifts and 40-hour work weeks.

References

Agency for Toxic Substances and Disease Registry (ATSDR). 1999. Toxicological profile for mercury. Atlanta, GA: U.S. Department of Health and Human Services, Public Health Service.

Where can I get more information?

For more information, contact the Agency for Toxic Substances and Disease Registry, Division of Toxicology and Human Health Sciences, 1600 Clifton Road NE, Mailstop F-57, Atlanta, GA 30329-4027.

Phone: 1-800-232-4636.

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ATSDR
AGENCY FOR TOXIC SUBSTANCES AND DISEASE REGISTRY

NICKEL

CAS # 7440-02-0

Division of Toxicology ToxFAQs™ **August 2005**

This fact sheet answers the most frequently asked health questions (FAQs) about nickel. For more information, call the ATSDR Information Center at 1-888-422-8737. This fact sheet is one in a series of summaries about hazardous substances and their health effects. It is important you understand this information because this substance may harm you. The effects of exposure to any hazardous substance depend on the dose, the duration, how you are exposed, personal traits and habits, and whether other chemicals are present.

HIGHLIGHTS: Nickel is a naturally occurring element. Pure nickel is a hard, silvery-white metal used to make stainless steel and other metal alloys. Skin effects are the most common effects in people who are sensitive to nickel. Workers who breathed very large amounts of nickel compounds developed chronic bronchitis and lung and nasal sinus cancers. Nickel has been found in at least 882 of the 1,662 National Priority List sites identified by the Environmental Protection Agency (EPA).

What is nickel?

Nickel is a very abundant natural element. Pure nickel is a hard, silvery-white metal. Nickel can be combined with other metals, such as iron, copper, chromium, and zinc, to form alloys. These alloys are used to make coins, jewelry, and items such as valves and heat exchangers. Most nickel is used to make stainless steel.

Nickel can combine with other elements such as chlorine, sulfur, and oxygen to form nickel compounds. Many nickel compounds dissolve fairly easy in water and have a green color. Nickel compounds are used for nickel plating, to color ceramics, to make some batteries, and as substances known as catalysts that increase the rate of chemical reactions. Nickel is found in all soil and is emitted from volcanoes. Nickel is also found in meteorites and on the ocean floor. Nickel and its compounds have no characteristic odor or taste.

What happens to nickel when it enters the environment?

❏ Nickel is released into the atmosphere by industries that make or use nickel, nickel alloys, or nickel compounds. It is also released into the atmosphere by oil-burning power plants, coal-burning power plants, and trash incinerators.

❏ In the air, it attaches to small particles of dust that settle to the ground or are taken out of the air in rain or snow; this usually takes many days.

❏ Nickel released in industrial waste water ends up in soil or sediment where it strongly attaches to particles containing iron or manganese.

❏ Nickel does not appear to accumulate in fish or in other animals used as food.

How might I be exposed to nickel?

❏ By eating food containing nickel, which is the major source of exposure for most people.

❏ By skin contact with soil, bath or shower water, or metals containing nickel, as well as by handling coins or touching jewelry containing nickel.

❏ By drinking water that contains small amounts of nickel.

❏ By breathing air or smoking tobacco containing nickel.

❏ Higher exposure may occur if you work in industries that process or use nickel.

How can nickel affect my health?

The most common harmful health effect of nickel in humans is an allergic reaction. Approximately 10-20% of the population is sensitive to nickel. People can become sensitive to nickel when jewelry or other things containing it are in direct contact with the skin for a long time. Once a person is sensitized to nickel, further contact with the metal may produce a reaction. The most common reaction is a skin rash at the site of contact. The skin rash may also

occur at a site away from the site of contact. Less frequently, some people who are sensitive to nickel have asthma attacks following exposure to nickel. Some sensitized people react when they consume food or water containing nickel or breathe dust containing it.

People working in nickel refineries or nickel-processing plants have experienced chronic bronchitis and reduced lung function. These persons breathed amounts of nickel much higher than levels found normally in the environment.

Workers who drank water containing high amounts of nickel had stomach ache and suffered adverse effects to their blood and kidneys.

Damage to the lung and nasal cavity has been observed in rats and mice breathing nickel compounds. Eating or drinking large amounts of nickel has caused lung disease in dogs and rats and has affected the stomach, blood, liver, kidneys, and immune system in rats and mice, as well as their reproduction and development.

How likely is nickel to cause cancer?

Cancers of the lung and nasal sinus have resulted when workers breathed dust containing high levels of nickel compounds while working in nickel refineries or nickel processing plants. The Department of Health and Human Services (DHHS) has determined that nickel metal may reasonably be anticipated to be a carcinogen and that nickel compounds are known human carcinogens. The International Agency for Research on Cancer (IARC) has determined that some nickel compounds are carcinogenic to humans and that metallic nickel may possibly be carcinogenic to humans. The EPA has determined that nickel refinery dust and nickel subsulfide are human carcinogens.

How can nickel affect children?

It is likely that the health effects seen in children exposed to nickel will be similar to those seen in adults. We do not know whether children differ from adults in their susceptibility to nickel. Human studies that examined whether nickel can harm the fetus are inconclusive. Animal studies have found increases in newborn deaths and decreased newborn weight after ingesting very high amounts of nickel. Nickel can be transferred from the mother to an infant in breast milk and can cross the placenta.

How can families reduce the risks of exposure to nickel?

❑ Avoiding jewelry containing nickel will eliminate risks of exposure to this source of the metal.

❑ Exposures of the general population from other sources, such as foods and drinking water, are almost always too low to be of concern.

Is there a medical test to determine whether I've been exposed to nickel?

There are tests available to measure nickel in your blood, feces, and urine. More nickel was measured in the urine of workers who were exposed to nickel compounds that dissolve easily in water than in the urine of workers exposed to nickel compounds that are hard to dissolve. This means that it is easier to tell if you have been exposed to soluble nickel compounds than less-soluble compounds. The nickel measurements do not accurately predict potential health effects from exposure to nickel.

Has the federal government made recommendations to protect human health?

The EPA recommends that drinking water should contain no more than 0.1 milligrams of nickel per liter of water (0.1 mg/L). To protect workers, the Occupational Safety and Health Administration (OSHA) has set a limit of 1 mg of nickel per cubic meter of air (1 mg/m^3) for metallic nickel and nickel compounds in workplace air during an 8-hour workday, 40-hour workweek.

References

Agency for Toxic Substances and Disease Registry (ATSDR). 2005. Toxicological Profile for Nickel (Update). Atlanta, GA: U.S. Department of Public Health and Human Services, Public Health Service.

Where can I get more information? For more information, contact the Agency for Toxic Substances and Disease Registry, Division of Toxicology, 1600 Clifton Road NE, Mailstop F-32, Atlanta, GA 30333. Phone: 1-888-422-8737, FAX: 770-488-4178. ToxFAQs Internet address via WWW is http://www.atsdr.cdc.gov/toxfaq.html. ATSDR can tell you where to find occupational and environmental health clinics. Their specialists can recognize, evaluate, and treat illnesses resulting from exposure to hazardous substances. You can also contact your community or state health or environmental quality department if you have any more questions or concerns.

Polychlorinated Biphenyls - ToxFAQs™

This fact sheet answers the most frequently asked health questions (FAQs) about polychlorinated biphenyls. For more information, call the CDC Information Center at 1-800-232-4636. This fact sheet is one in a series of summaries about hazardous substances and their health effects. It's important you understand this information because this substance may harm you. The effects of exposure to any hazardous substance depend on the dose, the duration, how you are exposed, personal traits and habits, and whether other chemicals are present.

HIGHLIGHTS: Polychlorinated biphenyls (PCBs) are a mixture of individual chemicals which are no longer produced in the United States, but are still found in the environment. Health effects that have been associated with exposure to PCBs include acne-like skin conditions in adults and neurobehavioral and immunological changes in children. PCBs are known to cause cancer in animals. PCBs have been found in at least 500 of the 1,598 National Priorities List (NPL) sites identified by the Environmental Protection Agency (EPA).

What are polychlorinated biphenyls?

Polychlorinated biphenyls are mixtures of up to 209 individual chlorinated compounds (known as congeners). There are no known natural sources of PCBs. PCBs are either oily liquids or solids that are colorless to light yellow. Some PCBs can exist as a vapor in air. PCBs have no known smell or taste. Many commercial PCB mixtures are known in the U.S. by the trade name Aroclor.

PCBs have been used as coolants and lubricants in transformers, capacitors, and other electrical equipment because they don't burn easily and are good insulators. The manufacture of PCBs was stopped in the U.S. in 1977 because of evidence they build up in the environment and can cause harmful health effects. Products made before 1977 that may contain PCBs include old fluorescent lighting fixtures and electrical devices containing PCB capacitors, and old microscope and hydraulic oils.

What happens to PCBs when they enter the environment?

- PCBs entered the air, water, and soil during their manufacture, use, and disposal; from accidental spills and leaks during their transport; and from leaks or fires in products containing PCBs.
- PCBs can still be released to the environment from hazardous waste sites; illegal or improper disposal of industrial wastes and consumer products; leaks from old electrical transformers containing PCBs; and burning of some wastes in incinerators.
- PCBs do not readily break down in the environment and thus may remain there for very long periods of time. PCBs can travel long distances in the air and be deposited in areas far away from where they were released. In water, a small amount of PCBs may remain dissolved, but most stick to organic particles and bottom sediments. PCBs also bind strongly to soil.
- PCBs are taken up by small organisms and fish in water. They are also taken up by other animals that eat these aquatic animals as food. PCBs accumulate in fish and marine mammals, reaching levels that may be many thousands of times higher than in water.

How might I be exposed to PCBs?

- Using old fluorescent lighting fixtures and electrical devices and appliances, such as television sets and refrigerators, that were made 30 or more years ago. These items may leak small amounts of PCBs into the air when they get hot during operation, and could be a source of skin exposure.
- Eating contaminated food. The main dietary sources of PCBs are fish (especially sportfish caught in contaminated lakes or rivers), meat, and dairy products.
- Breathing air near hazardous waste sites and drinking contaminated well water.
- In the workplace during repair and maintenance of PCB transformers; accidents, fires or spills involving transformers, fluorescent lights, and other old electrical devices; and disposal of PCB materials.

How can PCBs affect my health?

The most commonly observed health effects in people exposed to large amounts of PCBs are skin conditions such as acne and rashes. Studies in exposed workers have shown changes in blood and urine that may indicate liver damage. PCB exposures in the general population are not likely to result in skin and liver effects. Most of the studies of health effects of PCBs in the general population examined children of mothers who were exposed to PCBs.

Animals that ate food containing large amounts of PCBs for short periods of time had mild liver damage and some died. Animals that ate smaller amounts of PCBs in food over

several weeks or months developed various kinds of health effects, including anemia; acne-like skin conditions; and liver, stomach, and thyroid gland injuries. Other effects of PCBs in animals include changes in the immune system, behavioral alterations, and impaired reproduction. PCBs are not known to cause birth defects.

How likely are PCBs to cause cancer?

Few studies of workers indicate that PCBs were associated with certain kinds of cancer in humans, such as cancer of the liver and biliary tract. Rats that ate food containing high levels of PCBs for two years developed liver cancer. The Department of Health and Human Services (DHHS) has concluded that PCBs may reasonably be anticipated to be carcinogens. PCBs have been classified as probably carcinogenic, and carcinogenic to humans (group 1) by the Environmental Protection Agency (EPA) and International Agency for Research on Cancer (IARC), respectively.

How can PCBs affect children?

Women who were exposed to relatively high levels of PCBs in the workplace or ate large amounts of fish contaminated with PCBs had babies that weighed slightly less than babies from women who did not have these exposures. Babies born to women who ate PCB-contaminated fish also showed abnormal responses in tests of infant behavior. Some of these behaviors, such as problems with motor skills and a decrease in short-term memory, lasted for several years. Other studies suggest that the immune system was affected in children born to and nursed by mothers exposed to increased levels of PCBs. There are no reports of structural birth defects caused by exposure to PCBs or of health effects of PCBs in older children. The most likely way infants will be exposed to PCBs is from breast milk. Transplacental transfers of PCBs were also reported In most cases, the benefits of breast-feeding outweigh any risks from exposure to PCBs in mother's milk.

How can families reduce the risks of exposure to PCBs?

- You and your children may be exposed to PCBs by eating fish or wildlife caught from contaminated locations. Certain states, Native American tribes, and U.S. territories have issued advisories to warn people about PCB-contaminated fish and fish-eating wildlife. You can reduce your family's exposure to PCBs by obeying these advisories.
- Children should be told not play with old appliances, electrical equipment, or transformers, since they may contain PCBs.
- Children should be discouraged from playing in the dirt near hazardous waste sites and in areas where there was a transformer fire. Children should also be discouraged from eating dirt and putting dirty hands, toys or other objects in their mouths, and should wash hands frequently.
- If you are exposed to PCBs in the workplace it is possible to carry them home on your clothes, body, or tools. If this is the case, you should shower and change clothing before leaving work, and your work clothes should be kept separate from other clothes and laundered separately.

Is there a medical test to show whether I've been exposed to PCBs?

Tests exist to measure levels of PCBs in your blood, body fat, and breast milk, but these are not routinely conducted. Most people normally have low levels of PCBs in their body because nearly everyone has been environmentally exposed to PCBs. The tests can show if your PCB levels are elevated, which would indicate past exposure to above-normal levels of PCBs, but cannot determine when or how long you were exposed or whether you will develop health effects.

Has the federal government made recommendations to protect human health?

The EPA has set a limit of 0.0005 milligrams of PCBs per liter of drinking water (0.0005 mg/L). Discharges, spills or accidental releases of 1 pound or more of PCBs into the environment must be reported to the EPA. The Food and Drug Administration (FDA) requires that infant foods, eggs, milk and other dairy products, fish and shellfish, poultry and red meat contain no more than 0.2-3 parts of PCBs per million parts (0.2-3 ppm) of food. Many states have established fish and wildlife consumption advisories for PCBs.

References

Agency for Toxic Substances and Disease Registry (ATSDR). 2000. Toxicological profile for polychlorinated biphenyls (PCBs). Atlanta, GA: U.S. Department of Health and Human Services, Public Health Service.

Where can I get more information?

For more information, contact the Agency for Toxic Substances and Disease Registry, Division of Toxicology and Human Health Sciences, 1600 Clifton Road NE, Mailstop F-57, Atlanta, GA 30329-4027.

Phone: 1-800-232-4636.

ToxFAQs™ Internet address via WWW is http://www.atsdr.cdc.gov/toxfaqs/index.asp.

ATSDR can tell you where to find occupational and environmental health clinics. Their specialists can recognize, evaluate, and treat illnesses resulting from exposure to hazardous substances. You can also contact your community or state health or environmental quality department if you have any more questions or concerns.

Polycyclic Aromatic Hydrocarbons (PAHs) - ToxFAQs™

This fact sheet answers the most frequently asked health questions (FAQs) about polycyclic aromatic hydrocarbons (PAHs). For more information, call the CDC Information Center at 1-800-232-4636. This fact sheet is one in a series of summaries about hazardous substances and their health effects. This information is important because this substance may harm you. The effects of exposure to any hazardous substance depend on the dose, the duration, how you are exposed, personal traits and habits, and whether other chemicals are present.

HIGHLIGHTS: Exposure to polycyclic aromatic hydrocarbons usually occurs by breathing air contaminated by wild fires or coal tar, or by eating foods that have been grilled. PAHs have been found in at least 600 of the 1,430 National Priorities List (NPL) sites identified by the Environmental Protection Agency (EPA).

What are polycyclic aromatic hydrocarbons?

(Pronounced pŏl′ĭ-sī′klĭk ăr′ə-măt′ĭk hī′drə-kar′bənz)

Polycyclic aromatic hydrocarbons (PAHs) are a group of over 100 different chemicals that are formed during the incomplete burning of coal, oil and gas, garbage, or other organic substances like tobacco or charbroiled meat. PAHs are usually found as a mixture containing two or more of these compounds, such as soot.

Some PAHs are manufactured. These pure PAHs usually exist as colorless, white, or pale yellow-green solids. PAHs are found in coal tar, crude oil, creosote, and roofing tar, but a few are used in medicines or to make dyes, plastics, and pesticides.

What happens to PAHs when they enter the environment?

- PAHs enter the air mostly as releases from volcanoes, forest fires, burning coal, and automobile exhaust.
- PAHs can occur in air attached to dust particles.
- Some PAH particles can readily evaporate into the air from soil or surface waters.
- PAHs can break down by reacting with sunlight and other chemicals in the air, over a period of days to weeks.
- PAHs enter water through discharges from industrial and wastewater treatment plants.
- Most PAHs do not dissolve easily in water. They stick to solid particles and settle to the bottoms of lakes or rivers.
- Microorganisms can break down PAHs in soil or water after a period of weeks to months.
- In soils, PAHs are most likely to stick tightly to particles; certain PAHs move through soil to contaminate underground water.
- PAH contents of plants and animals may be much higher than PAH contents of soil or water in which they live.

How might I be exposed to PAHs?

- Breathing air containing PAHs in the workplace of coking, coal-tar, and asphalt production plants; smokehouses; and municipal trash incineration facilities.
- Breathing air containing PAHs from cigarette smoke, wood smoke, vehicle exhausts, asphalt roads, or agricultural burn smoke.
- Coming in contact with air, water, or soil near hazardous waste sites.
- Eating grilled or charred meats; contaminated cereals, flour, bread, vegetables, fruits, meats; and processed or pickled foods.
- Drinking contaminated water or cow's milk.
- Nursing infants of mothers living near hazardous waste sites may be exposed to PAHs through their mother's milk.

Polycyclic Aromatic Hydrocarbons

How can PAHs affect my health?

Mice that were fed high levels of one PAH during pregnancy had difficulty reproducing and so did their offspring. These offspring also had higher rates of birth defects and lower body weights. It is not known whether these effects occur in people.

Animal studies have also shown that PAHs can cause harmful effects on the skin, body fluids, and ability to fight disease after both short- and long-term exposure. But these effects have not been seen in people.

How likely are PAHs to cause cancer?

The Department of Health and Human Services (DHHS) has determined that some PAHs may reasonably be expected to be carcinogens.

Some people who have breathed or touched mixtures of PAHs and other chemicals for long periods of time have developed cancer. Some PAHs have caused cancer in laboratory animals when they breathed air containing them (lung cancer), ingested them in food (stomach cancer), or had them applied to their skin (skin cancer).

Is there a medical test to show whether I've been exposed to PAHs?

In the body, PAHs are changed into chemicals that can attach to substances within the body. There are special tests that can detect PAHs attached to these substances in body tissues or blood. However, these tests cannot tell whether any health effects will occur or find out the extent or source of your exposure to the PAHs. The tests aren't usually available in your doctor's office because special equipment is needed to conduct them.

Has the federal government made recommendations to protect human health?

The Occupational Safety and Health Administration (OSHA) has set a limit of 0.2 milligrams of PAHs per cubic meter of air (0.2 mg/m^3). The OSHA Permissible Exposure Limit (PEL) for mineral oil mist that contains PAHs is 5 mg/m^3 averaged over an 8-hour exposure period.

The National Institute for Occupational Safety and Health (NIOSH) recommends that the average workplace air levels for coal tar products not exceed 0.1 mg/m^3 for a 10-hour workday, within a 40-hour workweek. There are other limits for workplace exposure for things that contain PAHs, such as coal, coal tar, and mineral oil.

Glossary

Carcinogen: A substance that can cause cancer.

Ingest: Take food or drink into your body.

References

Agency for Toxic Substances and Disease Registry (ATSDR). 1995. Toxicological profile for polycyclic aromatic hydrocarbons. Atlanta, GA: U.S. Department of Health and Human Services, Public Health Service.

Where can I get more information?

For more information, contact the Agency for Toxic Substances and Disease Registry, Division of Toxicology and Human Health Sciences, 1600 Clifton Road NE, Mailstop F-57, Atlanta, GA 30329-4027.

Phone: 1-800-232-4636.

ToxFAQs™ Internet address via WWW is http://www.atsdr.cdc.gov/toxfaqs/index.asp.

ATSDR can tell you where to find occupational and environmental health clinics. Their specialists can recognize, evaluate, and treat illnesses resulting from exposure to hazardous substances. You can also contact your community or state health or environmental quality department if you have any more questions or concerns.

Tetrachloroethylene - ToxFAQs™

CAS # 127-18-4

This fact sheet answers the most frequently asked health questions (FAQs) about tetrachloroethylene. For more information, call the CDC Information Center at 1-800-232-4636. This fact sheet is one in a series of summaries about hazardous substances and their health effects. It's important you understand this information because this substance may harm you. The effects of exposure to any hazardous substance depend on the dose, the duration, how you are exposed, personal traits and habits, and whether other chemicals are present.

HIGHLIGHTS: Tetrachloroethylene is a manufactured chemical used for dry cleaning and metal degreasing. Exposure to very high concentrations of tetrachloroethylene can cause dizziness headaches, sleepiness, incoordination confusion, nausea, unconsciousness, and even death. Tetrachloroethylene has been found in at least 945 of the 1,699 National Priorities List sites identified by U.S. Environmental Protection Agency (EPA).

What is tetrachloroethylene?

Tetrachloroethylene is a nonflammable colorless liquid. Other names for tetrachloroethylene include perchloroethylene, PCE, perc, tetrachloroethene, and perchlor. Most people can smell tetrachloroethylene when it is present in the air at a level of 1 part in 1 million parts of air (1 ppm) or more.

Tetrachloroethylene is used as a dry cleaning agent and metal degreasing solvent. It is also used as a starting material (building block) for making other chemicals and is used in some consumer products.

What happens to tetrachloroethylene when it enters the environment?

- Tetrachloroethylene can be released into air, water, and soil at places where it is produced or used.
- Tetrachloroethylene breaks down very slowly in the air and so it can be transported long distances in the air. Half of the amount in the air will degrade in approximately 100 days.
- Tetrachloroethylene evaporates quickly from water into air. It is generally slow to break down in water.
- Tetrachloroethylene may evaporate quickly from shallow soils or may filter through the soil and into the groundwater below. It is generally slow to break down in soil.

How might I be exposed to tetrachloroethylene?

- When you bring clothes from the dry cleaners, they will release small amounts of tetrachloroethylene into the air.
- When you drink water containing tetrachloroethylene, you are exposed to it. You might also be exposed to tetrachloroethylene that is released into the air during showering and bathing.
- People residing near contaminated sites or dry cleaning locations may be exposed to higher levels than the general population.
- People working in the dry cleaning industries or using metal degreasing products may be exposed to elevated levels of tetrachloroethylene.

How can tetrachloroethylene affect my health?

Breathing high levels of tetrachloroethylene for a brief period may cause dizziness or drowsiness, headache, and incoordination; higher levels may cause unconsciousness and even death.

Exposure for longer periods to low levels of tetrachloroethylene may cause changes in mood, memory, attention, reaction time, and vision.

Studies in animals exposed to tetrachloroethylene have shown liver and kidney effects, and changes in brain chemistry, but we do not know what these findings mean for humans.

How likely is tetrachloroethylene to cause cancer?

Studies in humans suggest that exposure to tetrachloroethylene might lead to a higher risk of getting bladder cancer, multiple myeloma, or non-Hodgkin's lymphoma, but the evidence is not very strong.

Tetrachloroethylene

CAS # 127-18-4

In animals, tetrachloroethylene has been shown to cause cancers of the liver, kidney, and blood system.

EPA considers tetrachloroethylene likely to be carcinogenic to humans by all routes of exposure. The International Agency for Research on Cancer (IARC) considers tetrachloroethylene probably carcinogenic to humans. The Department of Health and Human Services (DHHS) considers tetrachloroethylene to be reasonable anticipated to be a human carcinogen.

How can tetrachloroethylene affect children?

It is not known whether children are more susceptible than adults to the effects of tetrachloroethylene.

A few studies in humans have suggested that exposure to tetrachloroethylene increased the numbers of babies with birth defects, but these studies were not large enough to clearly answer the question. Studies in animals exposed by inhalation or stomach tube have not shown clear evidence of specific birth defects.

How can families reduce the risks of exposure to tetrachloroethylene?

- Tetrachloroethylene has been found in low levels in some food. You can minimize the risk of your family's exposure by peeling and thoroughly washing fruits and vegetables before cooking.
- Use bottled water if you have concerns about the presence of tetrachloroethylene in your tap water. You may also contact local drinking water authorities and follow their advice.
- Prevent children from playing in dirt or eating dirt if you live near a waste site that has tetrachloroethylene.
- Tetrachloroethylene is widely used as a scouring solvent that removes oils from fabrics, as a carrier solvent, as a fabric finish or water repellant, and as a metal degreaser/cleaner. Follow instructions on product labels to minimize exposure to tetrachloroethylene.

Is there a medical test to show whether I've been exposed to tetrachloroethylene?

Tetrachloroethylene and its breakdown products (metabolites) can be measured in blood and urine. However, the detection of tetrachloroethylene or its metabolites cannot predict the kind of health effects that might develop from that exposure. Because tetrachloroethylene and its metabolites leave the body fairly rapidly, the tests need to be conducted within days after exposure.

Has the federal government made recommendations to protect human health?

The Occupational Safety and Health Administration (OSHA) has set an 8-hour time weighted average permissible exposure limit of 100 ppm, an acceptable ceiling exposure limit of 200 ppm, and a maximum peak of 300 ppm (not to be exceeded for more than 5 minutes of any 3-hour period).

The National Institute for Occupational Safety and Health (NIOSH) recommends that workplace exposure to tetrachloroethylene be minimized due to concerns about its carcinogenicity.

References

This ToxFAQs™ information is taken from the 2014 Toxicological Profile for Tetrachloroethylene (Draft for Public Comment) produced by the Agency for Toxic Substances and Disease Registry, Public Health Service, U.S. Department of Health and Human Services in Atlanta, GA

Where can I get more information?

For more information, contact the Agency for Toxic Substances and Disease Registry, Division of Toxicology and Human Health Sciences, 1600 Clifton Road NE, Mailstop F-57, Atlanta, GA 30329-4027.

Phone: 1-800-232-4636, FAX: 770-488-4178.

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Trichloroethylene - ToxFAQs™

CAS # 79-01-6

This fact sheet answers the most frequently asked health questions (FAQs) about trichloroethylene. For more information, call the CDC Information Center at 1-800-232-4636. This fact sheet is one in a series of summaries about hazardous substances and their health effects. It's important you understand this information because this substance may harm you. The effects of exposure to any hazardous substance depend on the dose, the duration, how you are exposed, personal traits and habits, and whether other chemicals are present.

HIGHLIGHTS: Trichloroethylene is used as a solvent for cleaning metal parts. Exposure to very high concentrations of trichloroethylene can cause dizziness, headaches, sleepiness, incoordination, confusion, nausea, unconsciousness, and even death. The Environmental Protection Agency (EPA) and the International Agency for Research on Cancer (IARC) classify trichloroethylene as a human carcinogen. Trichloroethylene has been found in at least 1,045 of the 1,699 National Priorities List sites identified by the EPA.

What is trichloroethylene?

Trichloroethylene is a colorless, volatile liquid. Liquid trichloroethylene evaporates quickly into the air. It is nonflammable and has a sweet odor.

The two major uses of trichloroethylene are as a solvent to remove grease from metal parts and as a chemical that is used to make other chemicals, especially the refrigerant, HFC-134a. Trichloroethylene was once used as an anesthetic for surgery.

What happens to trichloroethylene when it enters the environment?

- Trichloroethylene can be released to air, water, and soil at places where it is produced or used.
- Trichloroethylene is broken down quickly in air.
- Trichloroethylene breaks down very slowly in soil and water and is removed mostly through evaporation to air.
- It is expected to remain in groundwater for long time since it is not able to evaporate.
- Trichloroethylene does not build up significantly in plants or animals.

How might I be exposed to trichloroethylene?

- Breathing trichloroethylene in contaminated air.
- Drinking contaminated water.
- Workers at facilities using this substance for metal degreasing are exposed to higher levels of trichloroethylene.
- If you live near such a facility or near a hazardous waste site containing trichloroethylene, you may also have higher exposure to this substance.

How can trichloroethylene affect my health?

Exposure to moderate amounts of trichloroethylene may cause headaches, dizziness, and sleepiness; large amounts may cause coma and even death. Eating or breathing high levels of trichloroethylene may damage some of the nerves in the face. Exposure to high levels can also result in changes in the rhythm of the heartbeat, liver damage, and evidence of kidney damage. Skin contact with concentrated solutions of trichloroethylene can cause skin rashes.

There is some evidence exposure to trichloroethylene in the work place may cause scleroderma (a systemic autoimmune disease) in some people. Some men occupationally-exposed to trichloroethylene and other chemicals showed decreases in sex drive, sperm quality, and reproductive hormone levels.

How likely is trichloroethylene to cause cancer?

There is strong evidence that trichloroethylene can cause kidney cancer in people and some evidence for trichloroethylene-induced liver cancer and malignant lymphoma. Lifetime exposure to trichloroethylene resulted in increased liver cancer in mice and increased kidney cancer and testicular cancer in rats.

The National Toxicology Program (NTP) has determined that trichloroethylene is a "known human carcinogen". The EPA and the International Agency for Research on Cancer (IARC) have determined that trichloroethylene is "carcinogenic to humans."

Agency for Toxic Substances and Disease Registry
Division of Toxicology and Health Human Sciences

ATSDR

CS256651A

Trichloroethylene

CAS # 79-01-6

How can trichloroethylene affect children?

It is not known whether children are more susceptible than adults to the effects of trichloroethylene.

Some human studies indicate that trichloroethylene may cause developmental effects such as spontaneous abortion, congenital heart defects, central nervous system defects, and small birth weight. However, these people were exposed to other chemicals as well.

In some animal studies, exposure to trichloroethylene during development caused decreases in body weight, increases in heart defects, changes to the developing nervous system, and effects on the immune system.

How can families reduce the risk of exposure to trichloroethylene?

- Avoid drinking water from sources that are known to be contaminated with trichloroethylene. Use bottled water if you have concerns about the presence of chemicals in your tap water. You may also contact local drinking water authorities and follow their advice.
- Discourage your children from putting objects in their mouths. Make sure that they wash their hands frequently and before eating.
- Prevent children from playing in dirt or eating dirt if you live near a waste site that has trichloroethylene.
- Trichloroethylene is used in many industrial products. Follow instructions on product labels to minimize exposure to trichloroethylene.

Is there a medical test to show whether I've been exposed to trichloroethylene?

Trichloroethylene and its breakdown products (metabolites) can be measured in blood and urine. However, the detection of trichloroethylene or its metabolites cannot predict the kind of health effects that might develop from that exposure. Because trichloroethylene and its metabolites leave the body fairly rapidly, the tests need to be conducted within days after exposure.

Has the federal government made recommendations to protect human health?

The EPA set a maximum contaminant goal (MCL) of 0.005 milligrams per liter (mg/L; 5 ppb) as a national primary drinking standard for trichloroethylene.

The Occupational Safety and Health Administration (OSHA) set a permissible exposure limit (PEL) of 100 ppm for trichloroethylene in air averaged over an 8-hour work day, an acceptable ceiling concentration of 200 ppm provided the 8 hour PEL is not exceeded, and an acceptable maximum peak of 300 ppm for a maximum duration of 5 minutes in any 2 hours.

The National Institute for Occupational Safety and Health (NIOSH) considers trichloroethylene to be a potential occupational carcinogen and established a recommended exposure limit (REL) of 2 ppm (as a 60-minute ceiling) during its use as an anesthetic agent and 25 ppm (as a 10-hour TWA) during all other exposures.

References

This ToxFAQs™ information is taken from the 2014 Toxicological Profile for Trichloroethylene (Draft for Public Comment) produced by the Agency for Toxic Substances and Disease Registry, Public Health Service, U.S. Department of Health and Human Services.

Where can I get more information?

For more information, contact the Agency for Toxic Substances and Disease Registry, Division of Toxicology and human Health Sciences, 1600 Clifton Road NE, Mailstop F-57, Atlanta, GA 30329-4027.

Phone: 1-800-232-4636.

ToxFAQs™ Ion the web: www.atsdr.cdc.gov/toxFAQs.

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APPENDIX B

WEST NILE VIRUS/ST. LOUIS ENCEPHALITIS PREVENTION

WEST NILE VIRUS/ST. LOUIS ENCEPHALITIS PREVENTION

The following section is based upon information provided by the CDC Division of Vector-Borne Infectious Diseases. Symptoms of West Nile Virus include fever, headache, and body aches, occasionally with skin rash and swollen lymph glands, with most infections being mild. More severe infection may be marked by headache, high fever, neck stiffness, stupor, disorientation, coma, tremors, convulsions, muscle weakness, paralysis, and, rarely, death. Most infections of St. Louis encephalitis are mild without apparent symptoms other than fever with headache. More severe infection is marked by headache, high fever, neck stiffness, stupor, disorientation, coma, tremors, occasional convulsions (especially infants) and spastic (but rarely flaccid) paralysis. The only way to avoid infection of West Nile Virus and St. Louis encephalitis is to avoid mosquito bites. To reduce the chance of mosquito contact:

- Stay indoors at dawn, dusk, and in the early evening.
- Wear long-sleeved shirts and long pants whenever you are outdoors.
- Spray clothing with repellents containing permethrin or DEET (N, N-diethyl-meta-toluamide), since mosquitoes may bite through thin clothing.
- Apply insect repellent sparingly to exposed skin. An effective repellent will contain 35% DEET. DEET in high concentrations (greater than 35%) provides no additional protection.
- Repellents may irritate the eyes and mouth.
- Whenever you use an insecticide or insect repellent, be sure to read and follow the manufacturer's directions for use, as printed on the product.

APPENDIX C
REPORT FORMS

WEEKLY SAFETY REPORT FORM

Week Ending: _____ Project Name/Number: _____

Report Date: _____ Project Manager Name: _____

Summary of any violations of procedures occurring that week:

_____

_____

_____

Summary of any job related injuries, illnesses, or near misses that week:

_____

_____

_____

_____

Summary of air monitoring data that week (include and sample analyses, action levels exceeded, and actions taken):

_____

_____

_____

Comments:

_____

_____

_____

Name: _____ Company: _____

Signature: _____ Title: _____

INCIDENT REPORT FORM

Date of Report: _____

Injured: _____

Employer: _____

Site: _____ Site Location: _____

Report Prepared By: _____ _____
Signature Title

ACCIDENT/INCIDENT CATEGORY (check all that applies)

___Injury	___ Illness	___ Near Miss
__ Property Damage	___ Fire	___ Chemical Exposure
__ On-site Equipment	___ Motor Vehicle	___ Electrical
__ Mechanical	___ Spill	___ Other

DATE AND TIME OF ACCIDENT/INCIDENT: Narrative report of Accident/Incident: Identify: 1) actions leading to or contributing to the accident/incident; 2) the accident/incident occurrence; and 3) actions following the accident/incident.

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

WITNESS TO ACCIDENT/INCIDENT:

Name:	_____	Company:	_____
Address:	_____	Address:	_____
Phone No.:	_____	Phone No.:	_____
Name:	_____	Company:	_____
Address:	_____	Address:	_____
Phone No.:	_____	Phone No.:	_____

INJURED - ILL:

Name: _____ SSN: _____

Address: _____ Age: _____

Length of Service: _____ Time on Present Job: _____

Time/Classification: _____

SEVERITY OF INJURY OR ILLNESS:

____ Disabling ___ Non-disabling ___ Fatality

____ Medical Treatment ___ First Aid Only

ESTIMATED NUMBER OF DAYS AWAY FROM JOB: _____

NATURE OF INJURY OR ILLNESS: _____

_____

_____

_____

CLASSIFICATION OF INJURY:

__ Abrasions _____ Dislocations ____ Punctures

__ Bites _____ Faint/Dizziness ____ Radiation Burns

__ Blisters _____ Fractures ____ Respiratory Allergy

__ Bruises _____ Frostbite ____ Sprains

__ Chemical Burns _____ Heat Burns ____ Toxic Resp. Exposure

__ Cold Exposure _____ Heat Exhaustion ____ Toxic Ingestion

__ Concussion _____ Heat Stroke ____ Dermal Allergy

__ Lacerations

Part of Body Affected: _____

Degree of Disability: _____

Date Medical Care was Received: _____

Where Medical Care was Received: _____

Address (if off-site): _____

(If two or more injuries, record on separate sheets)

PROPERTY DAMAGE:

Description of Damage: _____

_____

Cost of Damage: $ _____

ACCIDENT/INCIDENT LOCATION: _____

ACCIDENT/INCIDENT ANALYSIS: Causative agent most directly related to accident/incident (Object, substance, material, machinery, equipment, conditions)

_____

_____

_____

_____

Was weather a factor?:_____

_____

Unsafe mechanical/physical/environmental condition at time of accident/incident (Be specific):

_____

_____

_____

Personal factors (Attitude, knowledge or skill, reaction time, fatigue):

_____

_____

ON-SITE ACCIDENTS/INCIDENTS:

Level of personal protection equipment required in Site Safety Plan:

_____

_____

Modifications:

_____

Was injured using required equipment?:

_____

_____

If not, how did actual equipment use differ from plan?:

_____

_____

ACTION TAKEN TO PREVENT RECURRENCE: (Be specific. What has or will be done? When will it be done? Who is the responsible party to insure that the correction is made?

ACCIDENT/INCIDENT REPORT REVIEWED BY:

SSO Name Printed SSO Signature

OTHERS PARTICIPATING IN INVESTIGATION:

Signature Title

Signature Title

Signature Title

ACCIDENT/INCIDENT FOLLOW-UP: Date: _____

Outcome of accident/incident: _____

Physician's recommendations: _____

Date injured returned to work: _____
Follow-up performed by:

Signature Title

ATTACH ANY ADDITIONAL INFORMATION TO THIS FORM

APPENDIX D
EMERGENCY HAND SIGNALS

EMERGENCY SIGNALS

In most cases, field personnel will carry portable radios for communication. If this is the case, a transmission that indicates an emergency will take priority over all other transmissions. All other site radios will yield the frequency to the emergency transmissions.

Where radio communications is not available, the following air-horn and/or hand signals will be used:

EMERGENCY HAND SIGNALS

OUT OF AIR, CAN'T BREATHE!

Hand gripping throat

LEAVE AREA IMMEDIATELY, NO DEBATE!

(No Picture) Grip partner's wrist or place both hands around waist

NEED ASSISTANCE!

Hands on top of head

OKAY! – I'M ALL RIGHT!

- I UNDERSTAND!

Thumbs up

NO! - NEGATIVE!

Thumbs down