ATLANTIC CHESTNUT – LOT 2

235 CHESTNUT STREET
BROOKLYN, NEW YORK

Remedial Investigation Work Plan

BCP Site #: C224235
AKRF Project Number: 12493

Prepared for:

Atlantic Chestnut Affordable Housing LLC
902 Broadway, 13th Floor
New York, New York 10010

Prepared by:

AKRF, Inc.
440 Park Avenue South, 7th Floor
New York, New York 10016
212-696-0670

NOVEMBER 2016

TABLE OF CONTENTS

FIGURES

APPENDICES

1.0 INTRODUCTION

This Draft Remedial Investigation Work Plan (RIWP) has been prepared by AKRF, Inc. (AKRF) on behalf of Atlantic Chestnut Affordable Housing LLC (the Volunteer) for the Atlantic Chestnut – Lot 2, New York State Department of Environmental Conservation (NYSDEC) Brownfield Cleanup Program (BCP) Site #C224235, located at 235 Chestnut Street in Brooklyn, New York (Site). The legal definition of the Site is Brooklyn Borough Tax Block 4143, Lot 2. Historically, Lot 1 encompassed the entirety of Block 4143, but was apportioned into three lots (Lots 1, 2, and 3) in 2016. The approximately 81,783-square foot Site is bound by vacant manufacturing buildings to the north and south, Euclid Avenue to the east, and Chestnut Street to the west. The Site consists of a series of vacant, interconnected, fire-damaged factory buildings. Demolition of the buildings began in July 2016 and is expected to be completed in December 2016. A Site Location Plan is provided as Figure 1.

Atlantic Chestnut Affordable Housing LLC entered into a Brownfield Cleanup Agreement (BCA) (BCA #C224235-05-16) with the NYSDEC on May 26, 2016. A Subsurface (Phase II) Investigation Report was submitted to the NYSDEC as part of the Brownfield Cleanup Program (BCP) application. The Phase II Report concluded that there is solvent-related contamination in soil, groundwater, and soil vapor and petroleum-related contamination in soil vapor present at the Site, which appears to be related to historic industrial operations. This RIWP describes the procedures to be used to define the nature and extent of the solvent contamination in on-site soil, groundwater, and soil vapor. The data compiled from the Remedial Investigation (RI) will be used to complete a Remedial Action Work Plan (RAWP). 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.

2.0 SITE DESCRIPTION AND HISTORY

2.1 Site Description and Surrounding Land Use

The Site consists of an approximately 81,783-square foot tax lot consisting of a series of vacant, interconnected, fire-damaged factory buildings. The buildings extend to the north and south across two adjoining properties, 3301 Atlantic Avenue and 3264 Fulton Street. The elevated J and Z Metropolitan Transit Authority (MTA) subway tracks are located above Fulton Avenue to the north and the Long Island Railroad (LIRR) tracks are located beneath Atlantic Avenue to the south. The surrounding area is developed with residential, commercial, manufacturing, transportation, and industrial uses. A Site Plan that shows the surrounding land usage is provided as Figure 2.

2.2 Site Geology, Hydrogeology, and Subsurface Characteristics

Surface topography at the Site is generally level. According to the April 2015 ALTA/ACSM Land Title Survey prepared by Roguski Land Surveying, P.C., the Site lies at an elevation of approximately 39 feet above mean sea level. The surrounding area slopes down to the south.

Site lithology, based on soil borings, consists of historic fill materials (including sand, gravel, silt, ash, slag, concrete, and asphalt) from just below the surface to depths up to approximately 7 feet below grade. Based on information from an investigation at 3319-3325 Atlantic Avenue, located east of the Site across Euclid Avenue, groundwater is expected to flow southerly in the Site vicinity; however, the presence of subsurface utilities in the vicinity of the Site may influence groundwater flow direction.

Groundwater in Brooklyn is not used as a potable source. There are no surface water bodies or streams on or immediately adjacent to the Site.

2.3 Nearby Areas of Public Concern

A Citizen Participation Plan (CPP) for the Site, dated September 2016, identified major issues of public concern related to the Site and surrounding area. Current issues including poverty, unemployment, and underutilization of land; potential remediation and construction-related issues including handling of contaminated soil and generation of vapors and/or dust during excavation activities, truck traffic, and noise; and environmental justice and language-barrier issues were evaluated and addressed in the CPP. The CPP provides this information to the public and allows for involvement regarding the environmental investigation and cleanup of the Site. The CPP was approved in a NYSDEC-issued letter dated September 13, 2016.

2.4 Site History

Historic records indicated that the Site was developed historically with industrial and manufacturing uses, including the Columbia Machine Works and Malleable Iron Company, the Columbia Cable and Electric Corporation, Blue Ridge Farms, Inc. and Chloe Foods Corp. between 1908 and 2012. The Site has remained vacant since a July 2012 fire caused severe structural damage to the eastern portion of the Site. Since that time, these vacant industrial buildings have blighted the neighborhood.

2.5 State and Federal Database Listings

2.5.1 Comprehensive Environmental Response, Compensation, and Liability Information System (CERCLIS)

3301 Atlantic Avenue, the address historically associated with the entirety of Block 4143 (former Lot 1), was listed in the CERCLIS database for the removal of a potential tank of anhydrous ammonia after a fire engulfed the eastern portion of the Site in July 2012. According to a July 2012 United States Environmental Protection Agency (EPA) Pollution Situation Report, approximately 18,800 pounds of anhydrous ammonia previously used for refrigeration at the Site, had been removed prior to the fire in 2012. An inspection by the EPA in association with the NYC Office of Emergency Management (OEM), NYC Housing Preservation and Development (HPD), NYSDEC concluded that little damage occurred in the portion of the building that potentially housed the ammonia refrigeration system. Additionally, perimeter air monitoring conducted during the July 2012 inspection reportedly did not indicate evidence of an ammonia release.

2.5.2 Petroleum Bulk Storage (PBS)

The Site, through its historic address 3301 Atlantic Avenue, is listed as (PBS Facility 2-095923) on the NYSDEC PBS database. Details of the facility data is summarized in the following table.

Petroleum Bulk Storage Facility Data

Facility	Capacity (gallons)	Product Stored	Status
Blue Ridge Farms, Inc. 3301 Atlantic Avenue Brooklyn, New York	10,000 UST	No. 2 Fuel Oil	Closed - Removed
	6 x 4,000 UST	Gasoline	Closed - Removed
	10,000 AST	No. 2 Fuel Oil	Temporarily Out of Service
	300 AST	Lubrication Oil	In Service
	4,000 UST	Diesel	Closed - Removed

Notes:
UST = underground storage tank
AST = aboveground storage tank

2.5.3 Chemical Bulk Storage (CBS)

The Site, through its historic address 3301 Atlantic Avenue, is listed as CBS Facility ID 2-000338 on the NYSDEC CBS database. Details of the facility data are illustrated on the following table.

Chemical Bulk Storage Facility Data

Facility	Capacity (gallons)	Product Stored	Status
Blue Ridge Farms 3301 Atlantic Avenue Brooklyn, New York	1,500 AST	Sodium Hypochlorite	In Service
	1,000 AST	Sodium Hydroxide	In Service
	1,000 AST	Potassium Hydroxide	In Service
	2 x 3,664 AST	Ammonia	Converted/ Non-Regulated
Notes: AST = aboveground storage tank			

2.5.4 Historic Petroleum Spills

Four closed-status NYSDEC Petroleum Spill Numbers are associated with the Site. The following is a summary of the spills as listed in the NYSDEC Spills database:

- Spill No. 8805745 was assigned to the historic address 3301 Atlantic Avenue when two 4,000-gallon tanks failed tank tightness tests. Spill No. 8805745 was combined with Spill No. 0101620 when field evidence of petroleum contamination and volatile organic compounds (VOCs) above applicable standards were identified in soil and groundwater samples collected adjacent to a closed-in-place tank system on the southern portion of Block 4143. According to Conestoga-Rovers & Associates February 2007 Status Report, approximately 600 pounds of permanganate mixed with approximately 3,300 gallons of water was injected into 19 chemical oxidation injection points located on the south-central portion of the Site. Post-treatment groundwater laboratory results indicated that detections of petroleum-related VOCs and semivolatile organic compounds (SVOCs) were below applicable standards and/or laboratory detection limits and the spill was closed in March 2003. Details of the listing and available environmental reports indicate that the spill occurred south of the Site on the southern portion of Block 4143.
- Spill No. 9412423 was reported when a tank gauge failed and approximately three gallons of No. 2 fuel oil were released onto the concrete at an exterior portion of the Site. According to the listing, the product was cleaned up and the spill closed the same day.
- Spill No. 205903 was reported when a traffic accident caused approximately 100 gallons of diesel fuel to be released into the subsurface, affecting soil. No further details were listed. The spill was closed on September 9, 2002. Based on details in the database, the spill most likely occurred on the street adjacent to the Site.

Based on listing details, the majority of these spill listings most likely occurred off-site. Spill No. 941243 potentially occurred on-site, but appears not to be related to contamination identified during AKRF's January 2016 Subsurface (Phase II) Investigation.

2.5.4 Toxics Release Inventory System (TRIS)

USEPA Facility ID 11208BLRDG3301A was issued for Blue Ridge Foods, Inc.; Fugitive or non-point air emissions of 6,000 pounds per year of ammonia in 1990.

2.5.5 Air Discharge Facilities Index (ADF)

USEPA Facility ID 36047N1202 was issued for Blue Ridge Farms, Inc.; Operational State Implementation Plan (SIP) source and Title V Permits for nitrogen dioxide. According to the listing, the Site was in compliance with procedural requirements and in violation with regard to procedural compliance.

3.0 PREVIOUS INVESTIGATIONS

3.1 Phase I Environmental Site Assessment (ESA) – June 2010

Property Solutions, Inc. (PSI) conducted a Phase I ESA of a larger area including the Site in June 2010. The Phase I ESA identified historical uses at the Site including a machine and iron works facility, an electrical cable manufacturer, and a food processing plant. PSI recommended conducting a subsurface investigation, including a geophysical survey, to investigate the potential impacts associated with historic operations and fuel oil storage at the Site. The Phase I ESA report also recommended addressing the EPA air permit violation and updating the PBS and chemical bulk storage (CBS) databases.

3.2 Asbestos Investigation and Bulk Sample/Laboratory Analysis – July 2013

Safety Environmental Co. of NY, Inc. (Safety) conducted an asbestos survey of the buildings located on the Site in July 2013. A total of 131 samples were collected for laboratory analysis from on-site and off-site portions of the building. Asbestos was identified within the building at the following locations: boiler No. 4 door insulation, boiler No. 3 caulking, first floor pipe insulation, roof transite shingles, roof membranes, roof flashing, and roof vent membranes. Safety recommended removal of all asbestos-containing material (ACM) prior to demolition of the Site building.

3.3 Phase I ESA – March 2014

Legette, Brashears, & Graham, Inc. (LBG) conducted a Phase I ESA of the Site and the immediately north- and south-adjacent areas in March 2014. The Phase I ESA identified RECs associated with former uses at the Site, including: blacksmithing and stamping, a machine and iron works shop, and an electric cable manufacturer. The report also noted the following de Minimis conditions: nearby hazardous materials/waste storage, use, or releases; and the potential presence of ACM, lead based paint (LBP), and fluorescent lighting at the Site. LBG recommended handling potential contaminated soil discovered during redevelopment of the Site according to applicable federal, state, and local regulations.

3.4 Chain of Title Summary Report – June 2015

A Chain of Title Summary Report was compiled by Phipps Houses, which outlined ownership of the Site, north- and south-adjacent properties, and nearby properties between 2004 and 2015. The report showed: the transfer of ownership from Blue Ridge Farms, Inc. to 3301 Atlantic Avenue, LLC in May 2004; from 3301 Atlantic Avenue, LLC to Sapphire Luxury Estates, LLC in July 2013; a foreclosure and sale judgement for the Site and north- and south-adjacent properties to be sold at public auction in September 2013; and an agreement for assignment of rights and claims from Blue Ridge Farms, Inc. to 3301 Atlantic Partners, LLC in March 2014.

3.5 Phase I ESA – September 2015

AKRF conducted a Phase I ESA of a larger area including the Site in September 2015. The Phase I ESA identified the following related to the Site:

- Historic on-site industrial operations, including the Columbia Machine Works and Malleable Iron Company and the Columbia Cable and Electric Corporation. Documented and undocumented releases from historic industrial uses may have affected subsurface conditions at the Site.
- The address 3301 Atlantic Avenue was formerly associated with the entirety of Block 4143. At the time of the Phase I ESA, 3301 Atlantic Avenue was listed in the following databases: PBS database for the storage of several underground storage tanks (USTs) and aboveground storage tanks (ASTs),

some of which may still be present; the CERCLIS; CBS; Spills database; TRIS; and Air Discharge databases. These listings may be related to the Site and/or the north-adjacent property.

- The eastern portions of the interconnected factory buildings were damaged by a fire in 2012. Abundant debris, including metal, wood, and ash were observed throughout the buildings during the Site inspection. Based on the documented storage of petroleum and chemicals, undocumented discharges due to the fire may have affected subsurface conditions at the Site, including high concentrations of metals and SVOCs in the ash, LBP, and/or ACM.
- Two July 2013 Asbestos Reports identified ACM throughout the buildings' interiors and on exterior built-up roofing materials. Interior and exterior building materials were observed to be in fair to poor condition, with the majority of the eastern portion of the Site buildings damaged by fire. Observed painted surfaces were generally in fair to poor condition. Based on the age of the Site buildings, LBP may have been present and the fluorescent lighting fixtures and remaining electrical equipment may have contained mercury and/or polychlorinated biphenyls (PCBs). No evidence of leaks or stains from these fixtures and equipment was observed; however, releases may have occurred during the fire that was not able to be investigated due to inaccessibility and/or debris throughout the Site buildings.

AKRF recommended a Subsurface (Phase II) Investigation to characterize subsurface conditions of soil, groundwater, and soil vapor throughout the Site prior to redevelopment.

3.6 Phase II Investigation- January 2016

AKRF conducted a Subsurface (Phase II) Investigation at the Site in January 2016. The Subsurface (Phase II) Investigation included the advancement of three soil borings with the collection and laboratory analysis of six soil samples; the installation of one temporary groundwater monitoring well with the collection and laboratory analysis of one groundwater sample; and the advancement of one soil vapor point with the collection and analysis of one soil vapor sample and one off-site ambient air sample. The scope of the investigation was based on the September 2015 Phase I ESA by AKRF.

Soil beneath the Site consisted of fill material (sand, gravel, silt, ash, slag, concrete, brick, and asphalt) to between approximately 3 and 7 feet below grade, underlain by apparent native soil (sand and gravel) to 40 feet below grade. Groundwater was encountered at approximately 30 feet below grade.

The Subsurface (Phase II) Investigation Report concluded that contaminated soil, groundwater, and soil vapor are present at the Site. Tetrachloroethylene (PCE) was detected in soil samples L2-SI-SB-2 (0-2) and L2-SI-SB-6 (0-2) advanced on the western portion of the Site at concentrations of 9.6 milligrams per kilogram (mg/kg) and 2.4 mg/kg, respectively, above its Unrestricted Use Soil Cleanup Objective (UUSCO) of 1.3 mg/kg, but below its Restricted Residential Soil Cleanup Objective (RRSCO) of 19 mg/kg. Trichloroethylene (TCE) was detected in soil samples L2-SI-SB-2 (0-2) and L2-SI-SB-6 (14-15) at concentrations of 14 mg/kg and 2.1 mg/kg, respectively, above its UUSCO of 0.47 mg/kg, but below its RRSCO of 21 mg/kg. TCE was also detected in soil sample L2-SI-SB-6 (0-2) at a concentration of 22 mg/kg, above its UUSCO and RRSCO. Polyaromatic hydrocarbons (PAHs) and heavy metals were detected in several soil samples on the western portion of the Site at concentrations above UUSCOs and RRSCOs.

PCE was detected at a concentration of 10 micrograms per liter (µg/L) and TCE was detected at a concentration of 17 µg/L, above their respective Ambient Water Quality Standards (AWQSs) of 5 µg/L in groundwater sample L2-SI-GW-2 collected from the western portion of the Site.

Petroleum-related compounds were detected in the soil vapor sample collected from the western portion of the Site at individual concentrations up to 358 micrograms per cubic meter (µg/m^3). Solvent-related compounds were detected at individual concentrations up to 7,090 µg/m^3. PCE was detected in the soil vapor sample at concentration of 483 µg/m^3, above its Air Guideline Value (AGV) of 30 µg/m^3. According to NYSDOH Soil Vapor/Indoor Air Matrix 2, the applicable matrix for PCE, sub-slab soil vapor concentrations between 100 µg/m^3 and 1,000 µg/m^3 result in a “mitigate/monitor action”, depending on indoor air concentrations. TCE was detected in the soil vapor sample at a concentration of 7,090 µg/m^3, above the AGV of 2 µg/m^3. According to the NYSDOH Soil Vapor/Indoor Air Matrix 1, the applicable matrix for TCE, sub-slab soil vapor concentrations of 250 µg/m^3 and above result in a “mitigate action”, even if the indoor air concentration is less than 0.25 µg/m^3.

AKRF concluded that these soil, groundwater, and soil vapor contaminants appear to be associated with former industrial operations at the Site. The concentrations of solvents, PAHs, and metals appear to be distributed across the western portion of Site; the eastern portion of the Site was inaccessible at the time of the investigation.

4.0 FIELD PROGRAM

The RI field program will focus on collecting soil, groundwater, and soil vapor data to determine the nature and extent of Site contamination and to assist with determining the appropriate remedial action.

4.1 Field Program Summary

The field sampling scope of work consists of: the advancement of ten soil borings with the collection and analysis of two to three soil samples per boring, the installation of seven groundwater monitoring wells with the collection and analysis of seven groundwater samples, and the installation of five soil vapor points with the collection and analysis of five soil vapor samples and one ambient air sample. The proposed sample locations are shown on Figure 6. The following sections describe the methods that will be used to complete the scope of work.

The rationale for the proposed sample locations is as follows:

Sampling Locations	Location	Rationale
L2-RI-SB/MW-1	Northwestern portion of Site	To assess soil and groundwater quality in the upgradient/northern portion of the Site
L2-RI-SB/MW-2	Northeastern portion of Site	To assess soil and groundwater quality beneath the former manufacturing areas
L2-RI-SB/MW-3	Southeastern portion of Site	To assess soil and groundwater quality beneath the former manufacturing areas/downgradient portion of the Site
L2-RI-SB/MW-4	Southwestern portion of Site	To assess soil and groundwater quality beneath the former manufacturing areas
L2-RI-SB/MW-5	Western portion of Site	To assess soil and groundwater quality beneath the former manufacturing areas
L2-RI-SB/MW-6	Central portion of Site	To assess soil and groundwater quality beneath the former manufacturing areas
L2-RI-SB/MW-7	West-central portion of the Site	To assess/confirm soil and groundwater quality near Phase II soil boring/temporary well L1-SI-SB/GW-2
L2-RI-SB-8	Northern portion of Site	To assess soil quality beneath the former manufacturing areas
L2-RI-SB-9	Eastern portion of Site	To assess soil quality beneath the former manufacturing areas
L2-RI-SB-10	South-central portion of Site	To assess soil quality beneath the former manufacturing areas
L2-RI-SV-1	Northwestern portion of Site	To assess soil vapor quality beneath the former manufacturing areas, evaluate the potential for off-site exposures, and complete the significant threat determination
L2-RI-SV-2	Northeastern portion of Site	To assess soil vapor quality beneath the former manufacturing areas, evaluate the potential for off-site exposures, and complete the significant threat determination
L2-RI-SV-3	Southeastern portion of the Site	To assess soil vapor quality beneath the former manufacturing areas, evaluate the potential for

		off-site exposures, and complete the significant threat determination
L2-RI-SV-4	Southwestern portion of Site	To assess soil vapor quality beneath the former manufacturing areas, evaluate the potential for off-site exposures, and complete the significant threat determination
L2-RI-SV-5	Western portion of Site	To assess soil vapor quality beneath the former manufacturing areas, evaluate the potential for off-site exposures, and complete the significant threat determination
L2-RI-AA-1	Central portion of Site	To provide comparative data for soil vapor samples

4.2 Soil Sampling

A Geoprobe™ direct-push drill rig will be used to advance soil borings L2-RI-SB-7 through L2-RI-SB-10 and a Rotosonic drill rig will be used to advance soil borings L2-RI-SB/MW-1 through L2-RI-SB/MW-7 at the approximate locations shown on Figure 6 to assess soil quality throughout the Site. Soil samples will be collected continuously at each boring to 30 feet below grade and to 40 feet below grade at the locations of the groundwater monitoring wells. For soil borings drilled using the Geoprobe™, soil cores will be collected in five-foot long, two-inch diameter, stainless steel macrocore piston rod samplers fitted with an internal acetate liner. For soil borings drilled using a Rotosonic drill rig, soil cores will be collected in five-foot long, four-inch diameter dedicated plastic bags. Soil samples will be inspected by AKRF field personnel for evidence of contamination (e.g., odors, staining), screened for the presence of volatile organics with a PID equipped with a 11.7 electron volt (eV) lamp, and logged using the modified Burmister soil classification system. The PID will be calibrated in accordance with manufacturer's recommendations prior to sampling.

Two to three soil samples will be collected from each soil boring. One soil sample will be collected from approximately 12-13 feet below grade, and a second soil sample will be collected from the one-foot interval directly above the groundwater interface, expected to be encountered approximately 30 feet below grade. If field evidence of contamination (visual, olfactory, or elevated PID reading) is observed, an additional soil sample per soil boring will be collected from the interval exhibiting the highest contamination. All sampling equipment (e.g., drilling rods and casing, macro core samplers and probe rods) will be either dedicated or decontaminated between sampling locations.

Soil samples slated for laboratory analysis will be labeled and placed in laboratory-supplied containers and shipped to the laboratory via courier with appropriate chain of custody documentation in accordance with appropriate USEPA 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, and the total analyte list (TAL) of metals by EPA Method 6000/7000 series plus hexavalent chromium by EPA Method 7196A using Category B deliverables. A standard turnaround time will be requested from the laboratory.

One blind duplicate, field blank, trip blank and MS/MSD will be collected for QA/QC purposes for every 20 field samples collected. It is anticipated that two field blanks, two blind duplicates, two MS/MSDs and two trip blanks will be required during the soil portion of the field investigation. The QA/QC samples, besides trip blanks, will be analyzed for all of the testing parameters previously noted. Trip blanks will be analyzed for VOCs only. The 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 soil boring locations will be surveyed using the Global Positioning System (GPS).

After each boring is completed, the soil boring holes will be filled with on-site materials (if not noticeably contaminated) and patched with asphalt or concrete to match existing surface conditions. 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. All boreholes that require drill cutting disposal would be filled with bentonite chips (hydrated) and concrete capping. Disposable sampling equipment, including spoons, gloves, bags, paper towels, etc. that come in contact with environmental media will be double bagged and disposed of as municipal trash in a facility trash dumpster as non-hazardous refuse.

4.3 Monitoring Well Installation and Development

Seven two-inch diameter permanent monitoring wells (L2-RI-SB/MW-1 through L2-RI-SB/MW-7) will be installed in the locations of the soil borings using a Rotosonic drill rig. The monitoring wells will be installed 5 feet into the shallow groundwater table, expected to be encountered approximately 30 feet below grade. Procedures for field screening and soil sample collection will be consistent with those described in Section 4.2 and the QAPP included as Appendix A. Well construction will consist of 10 feet of 0.020-inch slotted polyvinyl chloride (PVC) monitoring well screen installed 5 feet into the water table; solid PVC riser will be placed to 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 bentonite and the well will be completed with a non-shrinking cement mixture to approximately one foot below grade. The wells will be finished with a locking j-plug and flush-mounted protective locking well cover. The proposed monitoring well locations are shown on Figure 6.

Immediately following installation, each 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 logs. Purge water needing to be managed will be containerized in properly labeled DOT approved 55-gallon drums for future off-site disposal at a permitted facility.

4.4 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 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.

4.5 Groundwater Sampling

In accordance with USEPA 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. 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 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, and total and dissolved TAL metals by EPA Method 6000/7000 series using Category B deliverables. Filtering will occur in the field. A standard turnaround time will be requested from the laboratory.

One blind duplicate, field blank, trip blank and MS/MSD sample will be collected for QA/QC purposes. The QA/QC samples, besides trip blanks, will be analyzed for all of the testing parameters previously noted. Trip blanks will be analyzed for VOCs only. The data will be reviewed by a third-party validator, and a DUSR will be prepared to document the usability and validity of the data.

4.6 Soil Vapor and Ambient Air Sampling

Soil vapor 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”. Five soil vapor samples will be collected from five temporary monitoring points. If a competent, minimum 6-inch thick concrete slab is identified at the sampling locations, the soil vapor points will be installed immediately below the slab. If a competent concrete slab does not exist at the proposed soil vapor sample locations, the soil vapor points will be installed at a depth of 8 feet below grade. The soil vapor sampling locations are shown on Figure 6. Each soil vapor probe location will be surveyed using GPS to determine their accurate location.

Soil vapor monitoring points installed to 8 feet below grade will be installed by advancing an expendable drive point using a direct-push drilling rig to the specified depth below grade. The sub-slab soil vapor monitoring points will be installed using a slide hammer or hammer drill. At each monitoring point, a six-inch stainless steel screen implant, connected to Teflon tubing will be installed by hand or 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 3 to 6 inches above the screen. Hydrated bentonite will be used to fill the remaining void around the sampling tubing to the ground surface.

The soil vapor samples will be collected over a 2-hour time period from each monitoring point using a 6-liter (6L), batch-certified SUMMA canister equipped with a vacuum gauge and flow regulator set at a maximum rate of 0.2 liters per minute. Prior to sample collection, the sampling points will be purged of three sample volumes using a peristaltic pump. During purging, an inverted 5-gallon bucket 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 and for methane using a landfill gas meter or similar instrument. 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, a soil vapor sample will be collected using the vacuum from the SUMMA canister. Immediately after opening the flow control valve equipped with a 2-hour regulator, 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.

One ambient air sample will be collected for QA/QC purposes and to provide a general assessment of ambient air quality in the site vicinity. The ambient sample will be collected over a two-hour period using 6L batch-certified SUMMA canisters.

All samples will be analyzed for VOCs according to USEPA Method TO-15 by a NYSDOH-certified laboratory with Category B deliverables. Samples will be shipped to the laboratory with appropriate chain of custody documentation. No sample preservation is required for soil vapor or ambient air samples. The data will be reviewed by a third-party validator, and a DUSR will be prepared to document the suitability of using the data.

4.7 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 one field blank, one trip blank, one MS/MSD, and one blind duplicate sample at a frequency of one sample per 20 field samples per media. The field blank, blind duplicate, and MS/MSD samples will be analyzed for VOCs using EPA Method 8260, SVOCs using EPA Method 8270, pesticides using EPA Method 8081, PCBs using EPA Method 8082, and TAL metals using EPA Method 6000/7000s series (plus hexavalent chromium for soil by EPA Method 7196A) using Category B deliverables. One laboratory-prepared trip blank will be submitted for analysis of VOCs to determine the potential for cross-contamination. The QA/QC sample for soil vapor will include the collection of one ambient air sample analyzed for VOCs by EPA Method TO-15. The QAPP describes the QA/QC protocols and procedures that will be followed during implementation of the RIWP. The QAPP is included as Appendix A.

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

4.9 Management of Investigation-Derived Waste (IDW)

IDW that does not exhibit of evidence of contamination (e.g., staining, presence of ash, oily sheens, odors, etc.) will be used to fill in the corresponding soil boring hole. Soil and groundwater IDW exhibiting evidence of contamination will be containerized in 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 IDW will be disposed of or treated according to applicable local, state, and federal regulations.

5.0 REPORTING REQUIREMENTS

5.1 Remedial Investigation Report (RIR)

Upon completion of all field work and receipt of laboratory analytical results, a RIR will be prepared that will: document field activities; present field and laboratory data; evaluate exposure pathways in an exposure assessment; and discuss conclusions and recommendations drawn from the results of the investigation.

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.

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 DUSR will be prepared.

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.

5.1.4 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.

5.1.5 Qualitative Human Health Exposure Assessment

A Qualitative Human Health Exposure Assessment will be performed in accordance with DER-10 Section 3.3. The assessment will be included in the RIR.

6.0 SCHEDULE OF WORK

The following tentative schedule has been developed for the project. This schedule is subject to change.

Activity	**Time To Complete**
Building Demolition and Asbestos Abatement	September to December 2016
Submittal of Draft Remedial Investigation Work Plan (RIWP) and Fact Sheet	September 2016
Public Comment Period is Initiated	September 19, 2016
Public Comment Period Ends	October 19, 2016
Final RIWP Submitted/DEC Approves Work Plan	November 8, 2016
Remedial Investigation is Initiated	November 28, 2016
Remedial Investigation is Completed	December 2016
Draft Remedial Investigation Report (RIR) Submitted to NYSDEC	January 2017
Submittal of Draft Remedial Action Work Plan (RAWP) and Fact Sheet	February/March 2017
45-day Public Comment Period for RIR and RAWP is Initiated	March 2017
Public Comment Period for RIR and RAWP Ends	April/May 2017
Final RAWP Submitted/DEC Approves and Issues Decision Document	May 2017
Construction Closing	June 2017
Issue Remedial/Construction Notice Fact Sheet	June 2017
Begin Redevelopment (Construction) with Implementation of RAWP	June 2017
Draft Site Management Plan (SMP) Submitted to NYSDEC	January 2019
Execution of Environmental Easement	30 days after SMP approval
Draft Final Engineering Report and Fact Sheet	March 2019
Certificate of Completion and Fact Sheet	December 2019
Completion of Building	December 2020

7.0 CERTIFICATION

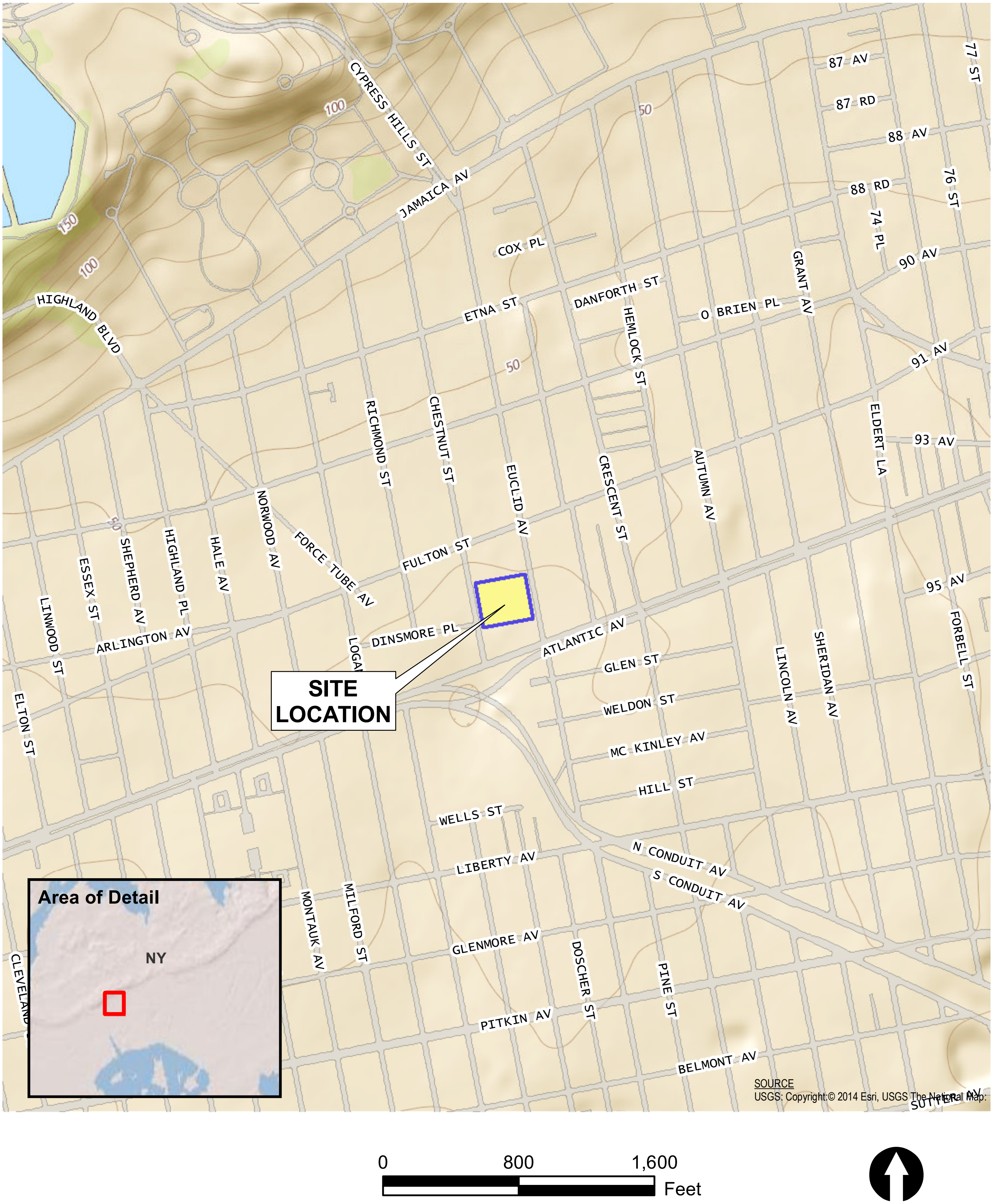
I, Deborah Shapiro, QEP, certify that I am currently a Qualified Environmental Professional as defined in 6 NYCRR Part 375 and that this Remedial Investigation Work Plan was prepared in accordance with all applicable statutes and regulations and in substantial conformance with the DER Technical Guidance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

Deborah Shapiro, QEP	D. Shapiro	11/30/16
Name	***Signature***	***Date***

8.0 REFERENCES

- Subsurface (Phase II) Investigation – 3301 Atlantic Avenue, Brooklyn, New York, AKRF, January 2016.
- Subsurface (Phase II) Investigation – 2364 Fulton Street, Brooklyn, New York, AKRF, January 2016.
- U.S. Geological Survey, Brooklyn, N.Y. – Brooklyn Quadrangle, 7.5 minute Series (Topographic), Scale 1:24,000, 1966, Photorevised 2011.
- 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.
- U.S. Geological Survey, Open Files Report 89-462, Bedrock and Engineering Geologic Maps of New York County and Parts of Kings and Queens Counties, New York, and Parts of Bergen and Hudson Counties, New Jersey, Sheet 3 - Bedrock Contours and Outcrops, 1990.
- Subsurface (Phase II) Investigation – Blue Ridge Farms, 3301 Atlantic Avenue, 84 Dinsmore Place, and 111 Dinsmore Place, Brooklyn, New York, AKRF, Inc., May 2001.
- Phase I Environmental Site Assessment (ESA) – 3301 Atlantic Avenue, 3428 Fulton Street, 226-296 (even) Euclid Avenue, and 215-279 (odd) Chestnut Street, Brooklyn, New York, Property Solutions, Inc., June 2010.
- Remedial Investigation Report – 3319-3325 Atlantic Avenue, Brooklyn, New York, CNS Management Corp., June 2013.
- Asbestos Investigation and Bulk Sample/Laboratory Analysis – 3301 Atlantic Avenue, Brooklyn, New York, Safety Environmental Co. of NY, Inc., July 2013.
- Phase I Environmental Site Assessment (ESA) – 3301 Atlantic Avenue (Block 4143, Lot 1), Brooklyn, New York, Legette, Brashears, & Graham, Inc., April 2014.
- Test Pit Report – 3301 Atlantic Avenue, Brooklyn, New York, Galli Engineering, P.C., October 2014.
- Chain of Title Summary Report – 3301 Atlantic Avenue and 242 Chestnut Street, Brooklyn, New York, Phipps Houses, March 2015.
- Phase I Environmental Site Assessment (ESA) –3301 Atlantic Avenue and 242 Chestnut Street, Brooklyn, New York, AKRF, September 2015.
- Citizen Participation Plan (CPP) – Atlantic Chestnut – Lot 2, AKRF, September 2016.

FIGURES



SOURCE
USGS: Copyright:© 2014 Esri, USGS The National Map:

235 Chestnut Street
Brooklyn, New York

SITE LOCATION

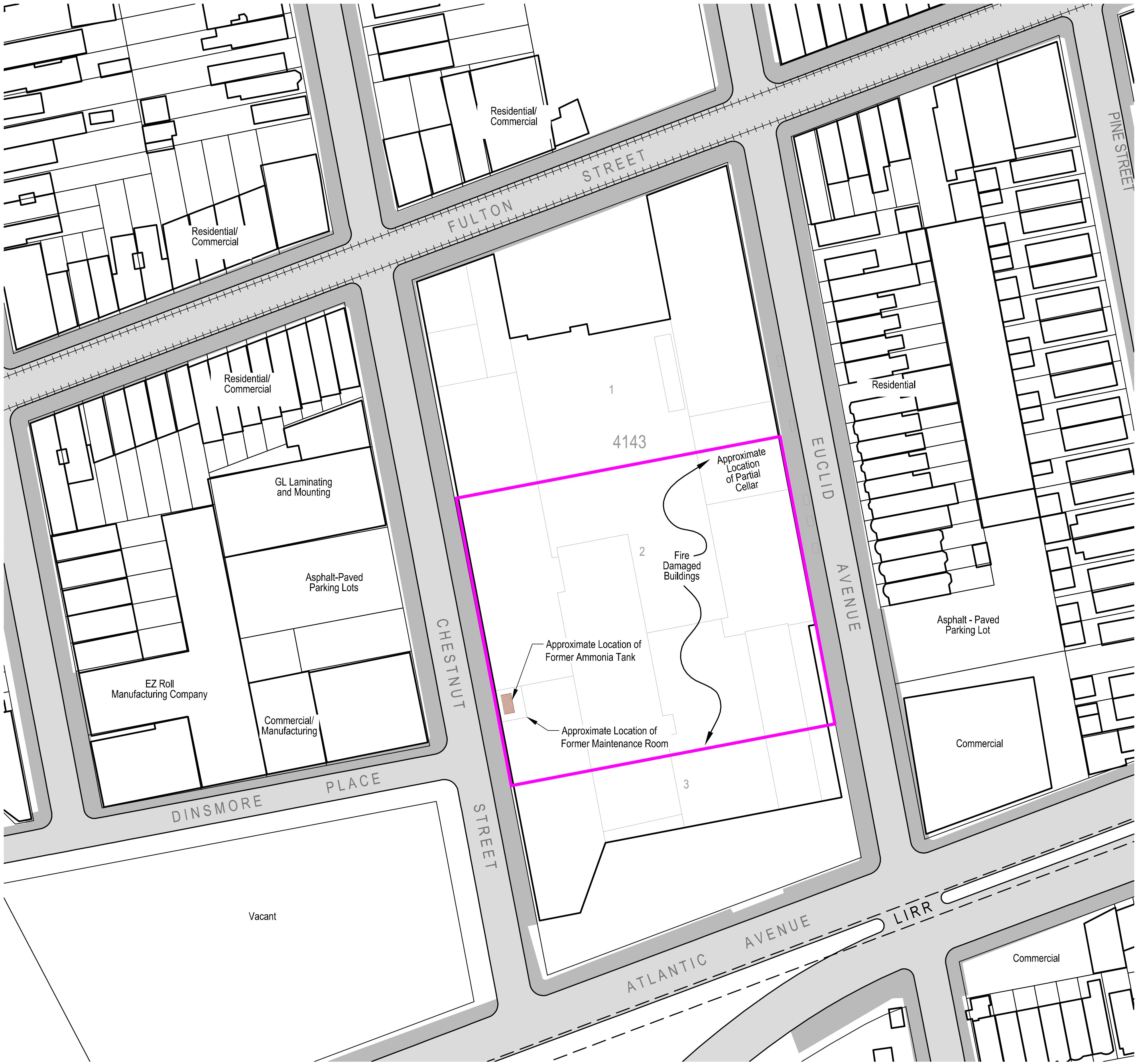
AKRF
Environmental Consultants
440 Park Avenue South, New York, NY 10016

DATE
2/4/2016

PROJECT No.
12184

FIGURE
1

W:\Projects\12184 - PHIPPS 3301 ATLANTIC\Technical\Hazmat\Phase II\235 Chestnut Street (Middle Lot)\GIS\12184 Fig 1 site loc map.mxd



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

LEGEND:

🟪	PROJECT SITE BOUNDARY
▭ 2	LOT BOUNDARY
4143	BLOCK NUMBER
──	BUILDING LINE
┼┼┼┼┼┼┼	MTA RAILROAD ELEVATED TRACKS
— — — —	LIRR SUBTERRANEAN TRACKS

0' 50' 100' 200'
SCALE IN FEET

AKRF
Environmental Consultants
440 Park Avenue South, New York, NY 10016

235 Chestnut Street
Brooklyn, New York

SITE PLAN

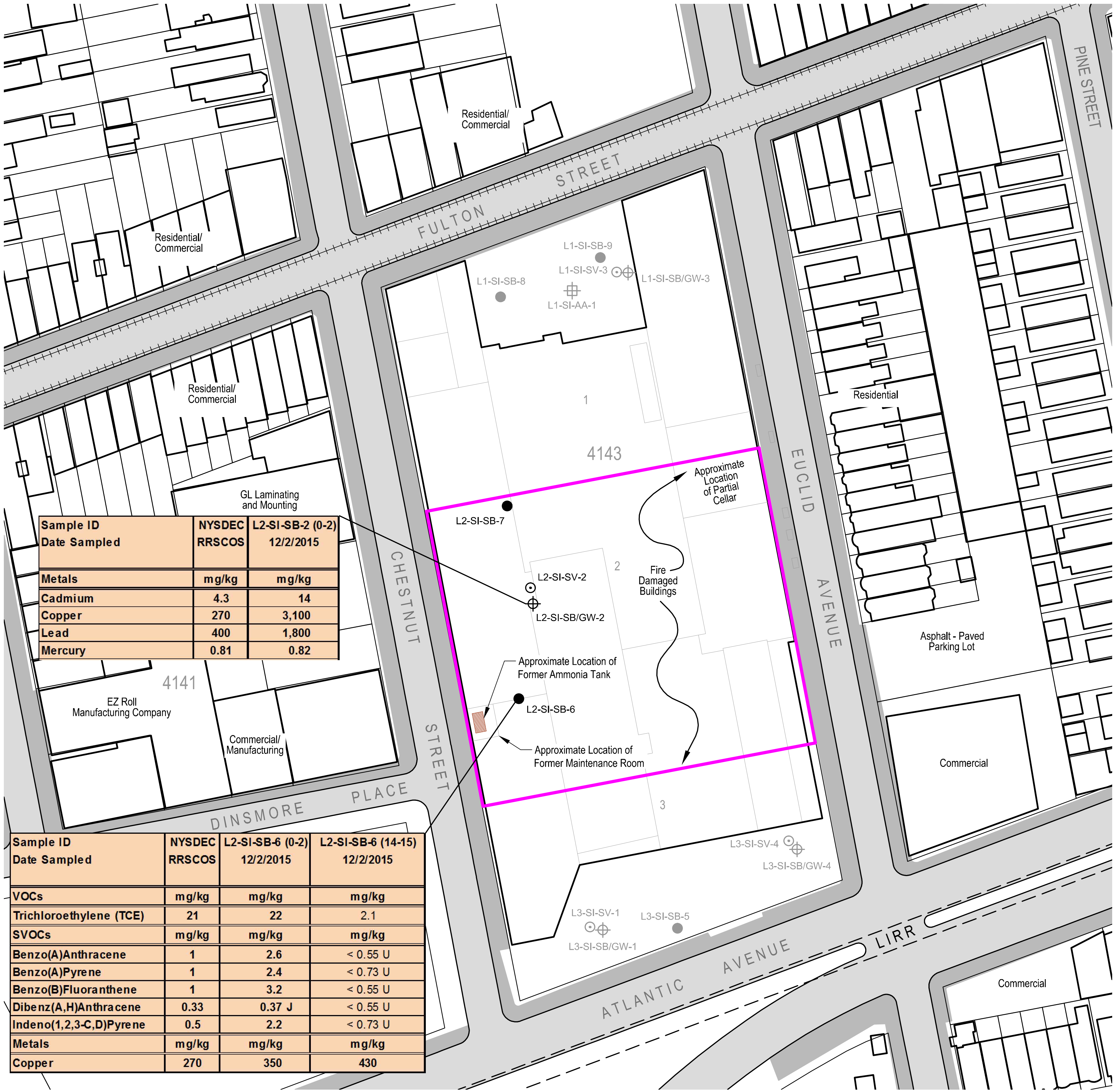
DATE
2/4/2016

PROJECT NO.
12184

SCALE
as shown

FIGURE
2

w:\projects\12184 - phipps 3301 atlantic\technical\hazmat\bcp\235 chestnut street (middle lot)\cad\12184 fig 2 site plan.dwg



Sample ID Date Sampled	NYSDEC RRSCOS	L2-SI-SB-2 (0-2) 12/2/2015
Metals	mg/kg	mg/kg
Cadmium	4.3	14
Copper	270	3,100
Lead	400	1,800
Mercury	0.81	0.82

Sample ID Date Sampled	NYSDEC RRSCOS	L2-SI-SB-6 (0-2) 12/2/2015	L2-SI-SB-6 (14-15) 12/2/2015
VOCs	mg/kg	mg/kg	mg/kg
Trichloroethylene (TCE)	21	22	2.1
SVOCs	mg/kg	mg/kg	mg/kg
Benzo(A)Anthracene	1	2.6	< 0.55 U
Benzo(A)Pyrene	1	2.4	< 0.73 U
Benzo(B)Fluoranthene	1	3.2	< 0.55 U
Dibenz(A,H)Anthracene	0.33	0.37 J	< 0.55 U
Indeno(1,2,3-C,D)Pyrene	0.5	2.2	< 0.73 U
Metals	mg/kg	mg/kg	mg/kg
Copper	270	350	430

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

LEGEND:

▬	PROJECT SITE BOUNDARY
☐ 2	LOT BOUNDARY
4143	BLOCK NUMBER
—	BUILDING LINE
┼┼┼┼┼┼┼┼	MTA RAILROAD ELEVATED TRACKS
— — — —	LIRR SUBTERRANEAN TRACKS
● L2-SI-SB-7	SOIL BORING LOCATION
⊕ L2-SI-SB/GW-2	SOIL BORING/GROUNDWATER SAMPLE LOCATION
⊙ L2-SI-SV-2	SOIL VAPOR SAMPLE LOCATION
⊕ L1-SI-AA-1	OFF-SITE AMBIENT AIR SAMPLE LOCATION
● ⊕ ⊙	OFF-SITE SAMPLE LOCATIONS (IDENTIFIED IN GRAY)

SOIL

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

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

Exceedances of Part 375 Restricted Residential Soil Cleanup Objectives (RRSCOs) are highlighted in gray.

U : The analyte was not detected at the indicated concentration.
J : The concentration given is an estimated value.

Sample ID Date Sampled	NYSDEC RRSCOS	L2-SI-SB-2 (0-2) 12/2/2015
Metals	mg/kg	mg/kg
Cadmium	4.3	14
Copper	270	3,100
Lead	400	1,800
Mercury	0.81	0.82

Sample ID
Sample Date
Concentration in Soil
Analyte/Compound in Soil

0' 50' 100' 200'
SCALE IN FEET

AKRF
Environmental Consultants
440 Park Avenue South, New York, NY 10016

235 Chestnut Street
Brooklyn, New York

SOIL SAMPLE CONCENTRATIONS ABOVE NYSDEC RRSCOs

DATE
1/25/2016

PROJECT NO.
12184

SCALE
as shown

FIGURE
3

w:\projects\12184 - phipps 3301 atlantic\technical\hazmat\phase ii\235 chestnut street (middle lot)\cad\12184 figs 3,4 and 5 spider maps lot 2.dwg

Sample ID **Date Sampled**	**NYSDEC** **Class GA**	**L2-SI-GW-2** **12/3/2015**
VOCs	**µg/L**	**µg/L**
Tetrachloroethylene (PCE)	**5**	**10**
Trichloroethylene (TCE)	**5**	**17**
Metals	**µg/L**	**µg/L**
Sodium, Total	**20,000**	**73,800**
Sodium, Dissolved	**20,000**	**73,300**

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

© 2016 AKRF, Inc. Environmental Consultants w:\projects\12184 - phipps 3301 atlantic\technical\hazmat\phase ii\235 chestnut street (middle lot)\cad\12184 figs 3,4 and 5 spider maps lot 2.dwg

LEGEND:

▬	PROJECT SITE BOUNDARY
2	LOT BOUNDARY
4143	BLOCK NUMBER
—	BUILDING LINE
++++++++	MTA RAILROAD ELEVATED TRACKS
— — — —	LIRR SUBTERRANEAN TRACKS
● L2-SI-SB-7	SOIL BORING LOCATION
⌖ L2-SI-SB/GW-2	SOIL BORING/GROUNDWATER SAMPLE LOCATION
⊙ L2-SI-SV-2	SOIL VAPOR SAMPLE LOCATION
⌖ L1-SI-AA-1	OFF-SITE AMBIENT AIR SAMPLE LOCATION
● ⌖ ⊙	OFF-SITE SAMPLE LOCATIONS (IDENTIFIED IN GRAY)

GROUNDWATER

Class GA Ambient Water Quality Standards : New York State Department of Environmental Conservation Technical and Operational Guidance Series (1.1.1): Class GA Ambient Water Quality Standards and Guidance Values.

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

Exceedances of NYSDEC Class GA Ambient Water Quality Standards (AWQSs) are highlighted in bold font.

Sample ID **Date Sampled**	**NYSDEC** **Class GA**	**L2-SI-GW-2** **12/3/2015**
VOCs	**µg/L**	**µg/L**
Tetrachloroethylene (PCE)	**5**	**10**
Trichloroethylene (TCE)	**5**	**17**
Metals	**µg/L**	**µg/L**
Sodium, Total	**20,000**	**73,800**
Sodium, Dissolved	**20,000**	**73,300**

Sample ID
Sample Date
Concentration in Groundwater
Analyte/Compound in Groundwater

0' 50' 100' 200'
SCALE IN FEET

AKRF
Environmental Consultants
440 Park Avenue South, New York, NY 10016

235 Chestnut Street
Brooklyn, New York

GROUNDWATER SAMPLE CONCENTRATIONS ABOVE NYSDEC AWQSs

DATE
1/25/2016

PROJECT NO.
12184

SCALE
as shown

FIGURE
4

Sample ID Date Sampled	NYSDOH 2006 AGV or MATRIX VALUE	L2-SI-SV-2 12/3/2015
VOCs	µg/m3	µg/m3
Carbon Tetrachloride	60	98.8
Tetrachloroethylene (PCE)	30	483
Trichloroethylene (TCE)	2	7,090

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

LEGEND:

	PROJECT SITE BOUNDARY
2	LOT BOUNDARY
4143	BLOCK NUMBER
	BUILDING LINE
	MTA RAILROAD ELEVATED TRACKS
	LIRR SUBTERRANEAN TRACKS
● L2-SI-SB-7	SOIL BORING LOCATION
⊕ L2-SI-SB/GW-2	SOIL BORING/GROUNDWATER SAMPLE LOCATION
⊙ L2-SI-SV-2	SOIL VAPOR SAMPLE LOCATION
⊕ L1-SI-AA-1	OFF-SITE AMBIENT AIR SAMPLE LOCATION
● ⊕ ⊙	OFF-SITE SAMPLE LOCATIONS (IDENTIFIED IN GREY)

SOIL VAPOR NYSDOH Soil Vapor Intrusion Air Guidance Value : NYSDOH Air Guideline Values (AGVs) and Table 3.3 Matrix 1 and 2 Chemicals presented in the Final Guidance for Evaluating Soil Vapor Intrusion in the State of New York, dated October 2006 ("NYSDOH Vapor Intrusion Guidance Document"), updated September 2013 for change of AGV for PCE, updated August 2015 for change of AGV for TCE.

µg/m^3 : micrograms per cubic meter of air

Exceedances of NYSDOH Soil Vapor Intrusion Air Guidance Values are highlighted in bold font.

Sample ID Date Sampled	NYSDOH 2006 AGV or MATRIX VALUE	L2-SI-SV-2 12/3/2015
VOCs	µg/m3	µg/m3
Carbon Tetrachloride	60	98.8
Tetrachloroethylene (PCE)	30	483
Trichloroethylene (TCE)	2	7,090

Sample ID
Sample Date
Concentration in Soil Vapor
Compound in Soil Vapor

0' 50' 100' 200'
SCALE IN FEET

AKRF
Environmental Consultants
440 Park Avenue South, New York, NY 10016

235 Chestnut Street
Brooklyn, New York

SOIL VAPOR SAMPLE CONCENTRATIONS ABOVE NYSDOH AGVs or MATRIX VALUES

DATE
1/25/2016

PROJECT NO.
12184

SCALE
as shown

FIGURE
5

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

©2016 AKRF, Inc   W:\Projects\12493 - PHIPPS 235 CHESTNUT LOT 2\Technical\Hazmat\CAD\12493 Fig 6 Prop Sample Plan.dwg   last save: mveilleux   11/2/2016 1:55 PM

AKRF
Environmental Consultants
440 Park Avenue South, New York, N.Y. 10016

Atlantic Chestnut - Lot 2
235 Chestnut Street
Brooklyn, New York

PROPOSED SAMPLE LOCATION PLAN

DATE
11/2/2016

PROJECT NO.
12492

FIGURE
6

APPENDIX A

QUALITY ASSURANCE PROJECT PLAN

ATLANTIC CHESTNUT – LOT 2

325 CHESTNUT STREET
BROOKLYN, NEW YORK

Site-Specific Quality Assurance Project Plan

BCP Site #: C224235
AKRF Project Number: 12493

Prepared for:

Atlantic Chestnut Affordable Housing LLC
902 Broadway, 13th Floor
New York, New York 10010

Prepared by:

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

NOVEMBER 2016

TABLE OF CONTENTS

FIGURES

APPENDIX

TITLE AND APPROVAL PAGE

Title: Remedial Investigation – Atlantic Chestnut – Lot 2 Quality Assurance Project Plan (QAPP)
Project Name/Property Name: Remedial Investigation/ Atlantic Chestnut – Lot 2
Property/Site Location: 235 Chestnut Street, Brooklyn, NY 11208

Date: November 8, 2016
Agreement Number: C224235-05-16

Atlantic Chestnut Affordable Housing LLC
Brownfield Cleanup Program Volunteer

Michelle Lapin, P.E.
AKRF, Inc.
440 Park Avenue South, 7th Floor, New York, NY 10016
646-388-9520, mlapin@akrf.com
Preparer's Name and Organizational Affiliation
Preparer's Address, Telephone Number, and E-mail Address

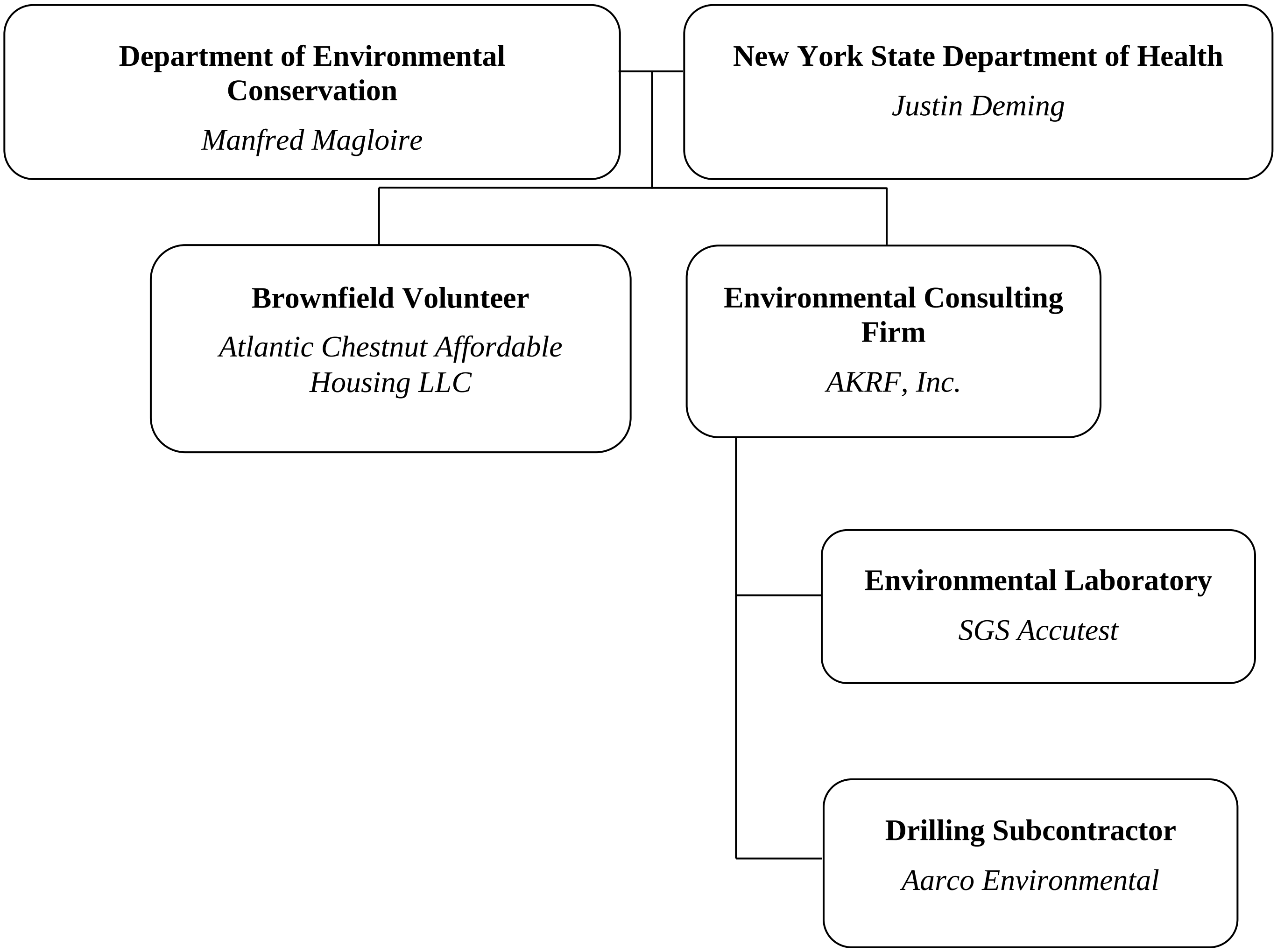
November 8, 2016
Preparation Date (Day/Month/Year)

Environmental Consultant Quality Assurance Officer (QAO)

D. Shapiro

Deborah Shapiro, QEP/AKRF, Inc./ November 8, 2016
Printed Name/Organization/Date

1.0 PROJECT ORGANIZATION CHART



2.0 PERSONNEL RESPONSIBILITIES

Name	**Title**	**Organization**	**Telephone Number**	**Responsibilities**
Manfred Magloire	BCP Manager	NYSDEC	718-482-4078	Review all technical and schedule aspects of the project. Communicate regularly with AKRF and NYSDOH to ensure project in compliance with project work plans.
Michelle Lapin, P.E.	Project Director	AKRF, Inc.	646-388-9520	General oversight of all aspects of the project. Communicate regularly with all members of the AKRF project team to ensure a smooth flow of information between involved parties.
Deborah Shapiro, QEP	Project Manager and Quality Assurance Officer	AKRF, Inc.	646-388-9544	Coordinate the implementation of all aspects of the technical scope, and communicate with NYSDEC. Interpretation of laboratory results and preparation of report.
Amy Jordan	Alternate Project Manager and QA/QC Officer	AKRF, Inc.	646-388-9864	Coordinate the implementation of all aspects of the technical scope, and communicate with NYSDEC. Interpretation of laboratory results and preparation of report.
Nick Straccione	Laboratory QA/QC Officer	SGS Accutest	732-329-0200 ext. 1202	Responsible for quality control procedures and checks in the laboratory and ensuring adherence to laboratory protocols. Conduct a final check on the analytical calculations and sign off on the laboratory reports.
Lori Beyer	DUSR Preparer	Lab Validation Corp.	631-454-6100	Responsible for third-party data validation and DUSR preparation.
Jennifer Pensky	Field Team Leader	AKRF, Inc.	646-388-9782	Oversee installation of soil borings, monitoring wells, and soil vapor probes; Collect soil samples, groundwater samples, and sub-slab vapor samples.
Adrianna Bosco	Field Team Leader Alternate	AKRF, Inc.	646-388-9567	Oversee installation of soil borings, monitoring wells, and soil vapor probes; Collect soil samples, groundwater samples, and sub-slab vapor samples.

Resumes of key personnel are provided as Appendix A.

3.0 PROBLEM DEFINITION/PROJECT DESCRIPTION

3.1 Problem Definition

Historic records indicated that the Site was historically developed with industrial and manufacturing uses, including the Columbia Machine Works and Malleable Iron Company, the Columbia Cable and Electric Corporation, Blue Ridge Farms, Inc. and Chloe Foods Corp. between 1908 and 2012. Blue Ridge Farms, Inc. and Chloe Foods Corp. are listed on multiple federal and state databases. Prior uses that appear to have led to Site contamination include blacksmithing and stamping, a brass foundry, wood working, a blacksmith, a machine shop, tank and engine rooms, an iron works, wire braiding, and cable manufacturing. The Site has remained vacant since a July 2012 fire caused severe structural damage to the eastern portion of the Site.

Based on an evaluation of the available data and information from AKRF's January 2016 Phase II (Subsurface) Investigation, on-site soil has been contaminated with the chlorinated solvents trichloroethylene (TCE) and tetrachloroethylene (PCE), semivolatile organic compounds (SVOCs), and heavy metals. Petroleum-related volatile organic compounds (VOCs) and SVOCs, pesticides, and metals were also detected in the soil. Chlorinated solvent PCE was detected in the groundwater samples above Ambient Water Quality Standards (AWQS). Petroleum-related and solvent-related compounds were also detected in the soil vapor samples. TCE and PCE were also detected in the soil vapor samples at concentrations above their respective Air Guideline Values (AGVs). The presence of soil, groundwater, and soil vapor contaminants appear to be associated with former industrial operations at the Site. The concentrations of solvents, polycyclic aromatic hydrocarbons (PAHs), and metals appear to be distributed across the western portion of Site; the eastern portion of the Site was inaccessible at the time of the investigation.

The environmental questions being asked are:

(1) Are there contaminants in the soil and/or groundwater that exceed New York State Department of Environmental Conservation (NYSDEC) criteria and may impact human health and the environment?

(2) Are there VOCs in the soil vapor at the Site and/or ambient air that may impact indoor air quality during future use of the Site?

3.2 Project Description

3.2.1 Site Location and Description

The approximately 81,783-square foot Site is located at 235 Chestnut Street in Brooklyn, New York. The Site consists of a series of vacant, interconnected, fire-damaged factory buildings. The buildings extend to the north and south across two adjoining properties, 3301 Atlantic Avenue (BCP Site No. C224236) and 3264 Fulton Street (BCP Site No. C224234). The elevated J and Z Metropolitan Transit Authority (MTA) subway tracks are located above Fulton Avenue to the north and the Long Island Railroad (LIRR) tracks are located beneath Atlantic Avenue to the south. The surrounding area is developed with residential, commercial, manufacturing, transportation, and industrial uses. The Site location is provided as Figure 1 and a Site Plan that shows the surrounding land usage is provided as Figure 2.

Surface topography at the Site is generally level. According to the April 2015 ALTA/ACSM Land Title Survey prepared by Roguski Land Surveying, P.C., the Site lies at an elevation of approximately 39 feet above mean sea level. The surrounding area slopes down to the south. Site lithology, based on soil borings, consists of historic fill materials (including sand, gravel, silt, ash, slag, concrete, and asphalt) from just below the surface to depths up to approximately 7 feet below grade. Based on information from an investigation at 3319-3325 Atlantic Avenue, located east of the Site across Euclid Avenue, groundwater is expected to flow southerly in the Site vicinity; however, the presence of subsurface utilities in the vicinity of the Site may influence groundwater flow direction.

Proposed soil, groundwater, soil vapor, and ambient air sample locations are shown on Figure 3. AKRF and their subcontractors will be responsible for installing the soil borings, groundwater monitoring wells, and soil vapor sampling points. AKRF will collect soil, groundwater, and soil vapor, and ambient air samples and submit them for laboratory analysis for the contaminants of concern. The field sampling scope of work consists of: the advancement of 10 soil borings with the collection and analysis of two to three soil samples per boring, the installation of seven groundwater monitoring wells with the collection and analysis of seven groundwater samples, and the installation of six soil vapor points with the collection and analysis of six soil vapor samples and one ambient air sample.

3.2.2 Site History

Historic records indicated that the Site was historically developed with industrial and manufacturing uses, including the Columbia Machine Works and Malleable Iron Company, the Columbia Cable and Electric Corporation, Blue Ridge Farms, Inc. and Chloe Foods Corp. between 1908 and 2012. The Site has remained vacant since a July 2012 fire caused severe structural damage to the eastern portion of the Site. Blue Ridge Farms, Inc. and Chloe Foods Corp. are listed on multiple federal and state databases. 3301 Atlantic Avenue, the address historically associated with the entirety of Block 4143 (former Lot 1), which included the Site was listed in the CERCLIS database for the removal of a potential tank of anhydrous ammonia in the buildings after a fire engulfed the eastern portion of the Site in July 2012. According to a July 2012 United States Environmental Protection Agency (EPA) Pollution Situation Report, approximately 18,800 pounds of anhydrous ammonia previously used for refrigeration at the Site had been removed prior to the fire in 2012. An inspection by the USEPA in association with the NYC Office of Emergency Management (OEM), NYC Housing Preservation and Development (HPD), NYSDEC concluded that little damage occurred in the portion of the building that potentially housed the ammonia refrigeration system.

The Site, through its historic address 3301 Atlantic Avenue, was also listed on the Petroleum Bulk Storage (PBS) and Chemical Bulk Storage (CBS) database with four closed-status NYDEC Petroleum Spill Numbers associated with the Site. Based on listing details, the majority of these spill listings most likely occurred off-site. Spill No.

941243 potentially occurred on-site, but appears not to be related to contamination identified during AKRF's January 2016 Subsurface (Phase II) Investigation. The Site was listed in the TRIS database for fugitive or non-point air emissions of 6,000 pounds per year of ammonia in 1990. The Site was listed in the Air Discharge Facility database as an operational State Implementation Plan (SIP) source and Title V Permits for nitrogen dioxide. According to the listing, the Site was in compliance with regard to procedural requirements and in violation with regard to procedural compliance.

3.3 Project Decision Statements

To assess the contaminant pathway for potential contaminants of concern, it is necessary to acquire soil and groundwater samples for analysis of VOCs, SVOCs, pesticides, polychlorinated biphenyls (PCBs) and metals (including hexavalent chromium for soil), and soil vapor and ambient air samples for analysis of VOCs. The primary concern is to identify potential impacts to the environment that may affect human health. Soil and groundwater analytical results will be evaluated against NYSDEC criteria listed in Part 375: "Restricted Residential and for Protection of Groundwater" and Part 703.5: "Water Quality Standards Surface Water and Groundwater". If an analyte(s) in the collected groundwater exceeds criteria listed in Part 703.5, then the exceedance will be evaluated against potential human health and safety protection as well as discharge requirements for the collected groundwater. Based on these assessments, it may be necessary to develop a construction health and safety plan (CHASP) for mitigating potential exposure for any activities that may encounter contaminated media.

Due to the presence of potential sources of petroleum hydrocarbons or solvents at or near the Site, there is the possibility that VOCs may exist in the soil vapor that may impact future indoor air quality. These VOCs may also be present in groundwater at the Site. An evaluation of potential vapor intrusion impacts need to be performed using soil vapor and ambient air samples. For this evaluation, the assessment will be made using screening criteria developed by the New York State Department of Health (NYSDOH) Guidance for Evaluating Soil Vapor Intrusion in the State of New York (October 2006). The type and magnitude of any elevated soil vapor concentrations will be evaluated as to potential impacts to indoor air quality of future Site structures.

4.0 PROJECT QUALITY OBJECTIVES

The overall project objectives for the RI include:

- Determine whether soil, groundwater, and/or soil vapor at the Site poses a risk to human health and safety by exposure to hazardous substances;
- Determine whether collected groundwater from any Site activities (if any) will require treatment prior to disposal;
- Investigate the potential for off-site impacts; and
- Determine the potential for vapor intrusion into future structures from soil vapors.

To meet these objectives, soil and groundwater samples will be analyzed for regulated hazardous substances including VOCs by EPA Method 8260C, SVOCs by EPA Method 8270D, pesticides by EPA Method 8081B, PCBs by EPA Method 8082A, Target Analyte List (TAL) metals by EPA Method 6000/7000 series, and hexavalent chromium by EPA Method 7196A using Category B deliverables. Soil vapor and ambient air samples will be analyzed for VOCs by EPA Method TO-15.

Who will use the data?

The collected data will be used by NYSDEC, NYSDOH, Atlantic Chestnut Affordable Housing LLC, and AKRF to be implemented to determine what remedial location will be necessary to redevelop the Site.

What types of data are needed?

- Soil samples will be collected from soil borings and analyzed at an off-site laboratory for VOCs by EPA Method 8260C, SVOCs by EPA Method 8270D, pesticides by EPA Method 8081B, PCBs by EPA Method 8082A, TAL metals by EPA Method 6000/7000 series, and hexavalent chromium by EPA Method 7196A using Category B deliverables.
- Groundwater samples will be collected from monitoring wells using low-flow groundwater sampling techniques and analyzed at an off-site laboratory for VOCs using EPA Method 8260C, SVOCs by EPA Method 8270D, pesticides by EPA Method 8081B, PCBs by EPA Method 8082A, and total and dissolved TAL metals by EPA Method 6000/7000 series using Category B deliverables.
- Soil vapor samples and the ambient air sample will be collected in Summa canisters and analyzed for VOCs by Method TO-15 using Category B deliverables.
- Groundwater elevation measurements will be taken from the newly installed monitoring wells to confirm groundwater flow direction.

How much data are needed?

- Two to three soil samples from 10 soil borings will be collected and analyzed.
- Seven groundwater samples will be collected and analyzed.
- Five soil vapor samples and one ambient air sample will be collected.
- For soil and groundwater samples - one field blank, one blind duplicate, one matrix spike/matrix spike duplicate, and one trip blank at a sample frequency of one sample per 20 field samples per media.

Figure 3 shows the proposed soil, groundwater, soil vapor, and ambient air sampling locations.

Where, when, and how should the data be collected/generated?

- Soil samples will be recovered from the soil borings, which will be advanced to refusal or the soil/groundwater interface, whichever is shallower. Two to three soil samples will be collected from each soil boring. One soil sample will be collected from approximately 12-13 feet below grade, and a second soil sample will be collected from the one-foot interval directly above the groundwater interface, expected to be encountered approximately 30 feet below grade. If field evidence of contamination [visual, olfactory, or elevated photoionization detector (PID) reading[is observed, an additional soil sample per soil boring will be collected from the interval exhibiting the highest contamination.
- Groundwater samples will be collected from six monitoring wells to be installed as part of this investigation. Groundwater sampling will occur one to two weeks after well installation and development.
- Soil vapor and ambient air samples will be collected in Summa canisters over a 2-hour sampling period.

Who will collect and generate the data?

AKRF will be responsible for: advancing the soil borings and sampling the soil; installing, developing, and sampling the monitoring wells; and installing soil vapor points and sampling the soil vapor and ambient air. All samples will be analyzed by SGS Accutest (subcontracted to AKRF), a NYSDOH-certified laboratory. AKRF will be responsible for collecting, reviewing, assessing, and disseminating validated data. Third-party data validation and the preparation of a Data Summary Usability Report (DUSR) will be prepared by Ms. Lori Beyer of Lab Validation Corp. Ms. Beyer’s professional certification and resume are attached in Appendix A.

How will the data be reported?

The data will be reported in a Remedial Investigation Report (RIR) and as EQuIS™-compatible electronic data deliverables (EDDs).

How will the data be archived?

All hard-copy data will be maintained at AKRF offices for a minimum of one year. Field logbooks and forms will be scanned and all electronic data will be archived on the AKRF corporate server.

5.0 PROJECT SCHEDULE/TIMELINE

Activities	Organization	Dates (MM/DD/YY) Anticipated Date(s) of Initiation	Dates (MM/DD/YY) Anticipated Date of Completion	Deliverable	Deliverable Due Date
Preparation of Work Plan and QAPP	AKRF, Inc.	7/1/16	11/08/16	Work Plan	11/08/16
Preparation of Health and Safety Plan	AKRF, Inc.	7/1/16	11/08/16	HASP	11/08/16
Procurement of Equipment	AKRF, Inc.	10/3/16	11/23/16	N/A	NA
Laboratory Request	AKRF, Inc.	10/4/16	11/23/16	N/A	NA
Field Reconnaissance/ Access	AKRF, Inc.	11/28/16	11/28/16	N/A	N/A
Collection of Field Samples	AKRF, Inc.	11/29/16	12/15/16	N/A	N/A
Laboratory Package Received	AKRF, Inc.	12/30/16	12/30/16	Unvalidated data package	12/30/16
Validation of Laboratory Results	L.A.B Validation Corp.	1/15/17	1/20/17	Validated data Package	1/20/17
Data Evaluation/ Preparation of Final Report	AKRF, Inc.	1/20/16	1/30/17	Final Report	1/30/17

6.0 SAMPLING METHODS AND LOCATIONS

Samples will be collected from soil borings, monitoring wells, and soil vapor points and the outdoor (ambient) air at the Site to provide information on general conditions at the Site. AKRF will use a Geoprobe™ direct-push probe (DPP) drill rig to advance soil borings L2-RI-SB-7 through L2-RI-SB-10 and a Rotosonic drill rig will be used to advance soil borings L2-RI-SB/MW-1 through L2-RI-SB/MW-7 at the approximate locations shown on Figure 3. For soil borings drilled using the Geoprobe™, soil cores will be collected in five-foot long, two-inch diameter, stainless steel macrocore piston rod samplers fitted with an internal acetate liner. For soil borings drilled using a Rotosonic drill rig, soil cores will be collected in five-foot long, four-inch diameter dedicated plastic bags.

Soil samples will be inspected by AKRF field personnel for evidence of contamination (e.g., odors, staining) and field-screened for presence of volatile organics using a PID. Soil samples being collected for analysis of VOCs will be taken consistent with Method 5035A. Seven borings will be converted into two-inch diameter groundwater monitoring wells. The wells will be finished with a flush-mount locking well cover. The wells will be developed and sampled one to two weeks after installation utilizing the low flow sampling methodology. In addition, one trip blank, one field blank, one blind duplicate, and one matrix spike/matrix spike duplicate will be collected at a frequency of one sample per 20 samples. The Geoprobe™ DPP unit will be used to collect soil vapor samples from four proposed locations to adequately evaluate soil vapor. Samples will be collected using six-liter stainless steel Summa canisters.

Samples slated for laboratory analysis will be placed in laboratory-supplied containers and shipped in accordance with appropriate EPA protocols to a NYSDOH-certified laboratory certified in the appropriate fields of accreditation. All non-dedicated drilling and sampling equipment will be decontaminated between sampling locations. Soil and groundwater samples will be placed on ice and stored in a cooler at temperatures below 4 ºC. Soil vapor samples will be placed in the laboratory-supplied containers immediately after sample collection.

The following table summarizes the sampling locations, analytical groups, number of samples, section reference for sampling SOP and rationale for sampling locations.

Matrix	Sampling Location	Depth (feet below grade)	Analytical Group	Rationale for Sampling Location
Soil/Ground water	L2-RI-SB/MW-1	All borings have 2 to 3 samples; (12-13') and directly above the groundwater interface, third sample to be determined based on field observation. Groundwater sample from interface (~30')	VOCs, SVOCs, Pesticides, PCBs, and Metals (including hexavalent chromium for soil)	To assess soil and groundwater quality in the upgradient/northern portion of the Site
Soil/Ground water	L2-RI-SB/MW-2	All borings have 2 to 3 samples; (12-13') and directly above the groundwater interface, third sample to be determined based on field observation. Groundwater sample from interface (~30')	VOCs, SVOCs, Pesticides, PCBs, and Metals (including hexavalent chromium for soil)	To assess soil and groundwater quality beneath the former manufacturing areas
Soil/Ground water	L2-RI-SB/MW-3	All borings have 2 to 3 samples; (12-13') and directly above the groundwater interface, third sample to be determined based on field observation. Groundwater sample from interface (~30')	VOCs, SVOCs, Pesticides, PCBs, and Metals (including hexavalent chromium for soil)	To assess soil and groundwater quality beneath the former manufacturing areas/downgradient portion of the Site
Soil/Ground water	L2-RI-SB/MW-4	All borings have 2 to 3 samples; (12-13') and directly above the groundwater interface, third sample to be determined based on field observation. Groundwater sample from interface (~30')	VOCs, SVOCs, Pesticides, PCBs, and Metals (including hexavalent chromium for soil)	To assess soil and groundwater quality beneath the former manufacturing areas

Matrix	Sampling Location	Depth (feet below grade)	Analytical Group	Rationale for Sampling Location
Soil/Ground water	L2-RI-SB/MW-5	All borings have 2 to 3 samples; (12-13') and directly above the groundwater interface, third sample to be determined based on field observation. Groundwater sample from interface (~30')	VOCs, SVOCs, Pesticides, PCBs, and Metals (including hexavalent chromium for soil)	To assess soil and groundwater quality beneath the former manufacturing areas
Soil/Ground water	L2-RI-SB/MW-6	All borings have 2 to 3 samples; (12-13') and directly above the groundwater interface, third sample to be determined based on field observation. Groundwater sample from interface (~30')	VOCs, SVOCs, Pesticides, PCBs, and Metals (including hexavalent chromium for soil)	To assess soil and groundwater quality beneath the former manufacturing areas/downgradient portion of the Site
Soil/Ground water	L2-RI-SB/MW-7	All borings have 2 to 3 samples; (12-13') and directly above the groundwater interface, third sample to be determined based on field observation. Groundwater sample from interface (~30')	VOCs, SVOCs, Pesticides, PCBs, and Metals (including hexavalent chromium)	To assess/confirm soil and groundwater quality near Phase II soil boring/temporary well L1-SI-SB/GW-2
Soil	L2-RI-SB-8	All borings have 2 to 3 samples; (12-13') and directly above the groundwater interface, third sample to be determined based on field observation.	VOCs, SVOCs, Pesticides, PCBs and Metals (including hexavalent chromium)	To assess soil quality beneath the former manufacturing areas
Soil	L2-RI-SB-9	All borings have 2 to 3 samples; (12-13') and directly above the groundwater interface, third sample to be determined based on field observation.	VOCs, SVOCs, Pesticides, PCBs, and Metals (including hexavalent chromium)	To assess soil quality beneath the former manufacturing areas
Soil	L2-RI-SB-10	All borings have 2 to 3 samples; (12-13') and directly above the groundwater interface, third sample to be determined based on field observation.	VOCs, SVOCs, Pesticides, PCBs, and Metals (including hexavalent chromium)	To assess soil quality beneath the former manufacturing areas
Soil Vapor	L2-RI-SV-1	Sub-Slab or 8'	VOCs (TO-15)	To assess soil vapor quality beneath the former manufacturing areas, evaluate the potential for off-site exposures, and complete the significant threat determination

Matrix	Sampling Location	Depth (feet below grade)	Analytical Group	Rationale for Sampling Location
Soil Vapor	L2-RI-SV-2	Sub-Slab or 8’	VOCs (TO-15)	To assess soil vapor quality beneath the former manufacturing areas, evaluate the potential for off-site exposures, and complete the significant threat determination
Soil Vapor	L2-RI-SV-3	Sub-Slab or 8’	VOCs (TO-15)	To assess soil vapor quality beneath the former manufacturing areas, evaluate the potential for off-site exposures, and complete the significant threat determination
Soil Vapor	L2-RI-SV-4	Sub-Slab or 8’	VOCs (TO-15)	To assess soil vapor quality beneath the former manufacturing areas, evaluate the potential for off-site exposures, and complete the significant threat determination
Soil Vapor	L2-RI-SV-5	Sub-Slab or 8’	VOCs (TO-15)	To assess soil vapor quality beneath the former manufacturing areas, evaluate the potential for off-site exposures, and complete the significant threat determination
Soil Vapor	L2-RI-AA-1	Sub-Slab or 8’	VOCs (TO-15)	To provide comparative data for soil vapor samples

6.1 Soil Boring Installation

The 10 proposed soil boring locations are depicted on Figure 3. Utility mark-outs are required by law and the drilling contractor is required to call Dig Safely New York at least two days prior to intrusive work. If there are any questions regarding locations of utilities in the sidewalk, the respective utility(s) will be contacted to clarify any concerns and/or the sampling location would be adjusted following consultation with NYSDEC.

Borings L2-RI-SB-8 to L2-RI-SB-10 will be advanced using a Geoprobe™ direct-push and borings L2-RI-SB/MW-1 to L2-RI-SB/MW-7 will be advanced using a Rotosonic drill rig to the groundwater interface at the approximate locations shown on Figure 3. Soil will be inspected for evidence of contamination (e.g., odors, staining), screened for the presence of volatile organics with a photoionization detector (PID) equipped with a

11.7 electron volt (eV) lamp, and logged using the modified Burmister soil classification system. The PID will be calibrated prior to sampling in accordance with the manufacturer's recommendations. NYSDEC will be contacted immediately if evidence of contamination is identified during the sampling activities. Each soil boring location will be surveyed using a Global Positioning System (GPS) handheld device to determine their accurate location. At each boring location, AKRF field personnel will record and document subsurface conditions.

6.2 Soil Sampling

Soil is being sampled as part of this RI to: (1) determine the nature and extent of potentially impacted media; (2) determine whether potentially contaminated soil may require special handling requirements relating to construction worker health and safety; and (3) determine the potential for a soil to soil vapor to indoor air pathway. Two to three soil samples from each boring will be submitted for laboratory analysis. Samples from soil borings will be analyzed for the following:

- VOCs by EPA Method 8260C;
- SVOCs by EPA Method 8270D;
- Pesticides by EPA Method 8081B;
- PCBs by EPA Method 8082A;
- TAL Metals by EPA Method 6000/7000 series; and
- Hexavalent Chromium by EPA Method 7196A.

The proposed locations of the soil borings are shown on Figure 3. At each boring location, one soil sample will be collected from immediately below the surface to two feet below grade and a second soil sample will be collected from the anticipated depth of the proposed foundation excavation, approximately 10 feet below grade. If field evidence of contamination (visual, olfactory, or elevated PID reading) is observed, an additional soil sample per soil boring will be collected from the interval exhibiting the highest contamination. All sampling equipment (e.g., drilling rods and casing, macro core samplers and probe rods) will be either dedicated or decontaminated between sampling locations.

One field blank, one blind duplicate, and one MS/MSD will be collected for quality control/quality assurance (QA/QC) purposes for analysis of all of the above parameters and one laboratory-prepared trip blank will be submitted for analysis of VOCs to determine the potential for cross-contamination at a frequency of one sample per 20 samples. All samples will be analyzed by a NYSDOH certified laboratory with Category B deliverables.

6.3 Monitoring Well Installation

A Rotosonic drill rig will be used to advance a steel core barrel from grade to approximately 5 feet into the groundwater table, expected to be encountered approximately 30 feet below grade. Well construction will consist of 10 feet of 0.020-inch slotted polyvinyl chloride (PVC) monitoring well screen installed 5 feet into the water table; solid PVC riser will be placed to ground surface. At each well, a No. 2 morie sandpack will be installed around the well screen to a depth of one to two feet above the top of the screen and a bentonite seal will be installed to a depth of one to two feet above the sand pack. The remainder of the annular space will be filled with a bentonite cement grout. The monitoring wells will be completed with a flush-to-grade manholes. A concrete apron will be set around the manhole to prevent drainage of surface runoff toward the well. The wells will be capped with a locking cap. The proposed well locations are provided on Figure 3. Following well installation, the wells will be developed according to the following procedure:

- Measure the depth to water using an oil/water interface probe and the total depth of the well using a weighted tape. Use these measurements to calculate the length of the water column. Calculate the volume of water in the well using 0.163 gallons per foot of water column as the conversion factors for a 2-inch diameter well.
- For the first 5-minutes of well development, develop the well using a check valve pump and re-circulate the water back into the well to create maximum agitation. This method is intended to remove fines from the sand pack, the adjacent formation and from the well.
- After the first 5-minutes of well development, develop the well using a check valve pump and discharge the water to five-gallon buckets. Transfer water from the buckets to 55-gallon drums designated for well development water.
- During development, collect periodic samples and analyze for turbidity and water quality indicators (pH, temperature, dissolved oxygen, reduction-oxidation potential, and specific conductivity) with measurements collected approximately every five minutes.
- Continue developing the well until turbidity 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 if not possible, until at least three well volumes have been purged from the well.
- Document the volume of water removed and any other observations made during well development in the field book or on field data sheets.
- Decontaminate the equipment prior to and following development at each well location as described in Section 6.6 of this QAPP.

Additionally, each well will be surveyed by a New York State licensed surveyor to determine their accurate location and elevation. A permanent marker (e.g., a sharpie) will be used to draw a thick line on the northern lip of the PVC casing – this will be the marker of what would be considered “Top of Casing” for surveying and measuring the depth to water/product and the total depth. Depth to groundwater will be measured to the nearest 0.01 of a foot.

6.4 Groundwater Sampling

One to two weeks after well installation and development, one groundwater sample will be collected from each of the wells in accordance with United States Environmental Proection Agency (USEPA) low flow sampling techniques. The expected targeted purge rate will be around 500 mililiters per minute (ml/min) and water quality parameters will be monitored during purging. Prior to collecting any samples, each well will be screened for the presence of VOCs using a PID after removing the well cap. The depth to groundwater will then be measured in the wells using an electronic oil/water interface probe attached to a measuring tape accurate to 0.01 feet.

The groundwater samples monitoring wells will be analyzed for the following:

- VOCs by EPA Method 8260C;
- SVOCs by EPA Method 8270D;
- Pesticides by EPA Method 8081B;
- PCBs by EPA Method 8082A; and
- TAL Metals by EPA Method 6000/7000 series.

One field blank, one blind duplicate, and one MS/MSD will be collected for QA/QC purposes for analysis of all of the above parameters and one laboratory-prepared trip blank will be submitted for analysis of VOCs to determine the potential for cross-contamination at a frequency of one sample per 20 samples. All samples will be analyzed by a NYSDOH certified laboratory with Category B deliverables.

6.5 Soil Vapor and Ambient Air Sampling

One soil vapor sample will be collected from each of the six temporary vapor monitoring points. If a competent, minimum 6-inch thick concrete slab is identified at the sampling locations, the soil vapor points will be installed immediately below the slab. If a competent concrete slab does not exist at the proposed soil vapor sample locations, the soil vapor points will be installed at a depth of 8 feet below grade. Each soil vapor probe location will be surveyed using a GPS handheld device to determine their accurate location. The proposed soil vapor and ambient air sampling locations are shown on Figure 3.

Soil vapor monitoring points will be installed by advancing an expendable drive point using a direct-push drilling rig to the specified depth below grade. A 6-inch stainless steel screen implant, connected to Teflon tubing will be installed through the drilling rods and threaded into the drive points. The sampling tubing will extend from the end of the screen to above grade. The push probe rods will then be removed and the borings will be backfilled with clean silica sand to 3 to 6 inches above the screen. Hydrated bentonite will be used to fill the remaining void around the sampling tubing to the ground surface.

The soil vapor samples will be collected over an approximately 2-hour time period using a 6-liter (6L), batch-certified SUMMA canister equipped with a vacuum gauge and flow regulator set at a maximum of 0.2 liters per minute. Prior to sample collection, the sampling point will be purged of three sample volumes using a peristaltic pump. During purging, an inverted five-gallon bucket 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 and for helium 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, a soil vapor sample will be collected using the vacuum from the SUMMA canister. Immediately after opening the flow control valve equipped with a two-hour regulator, the initial SUMMA canister vacuum (inches of mercury) will be noted. After approximately 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.

One ambient air sample will be collected concurrently with the soil vapor samples for QA/QC purposes and to provide a general assessment of ambient air quality in the Site vicinity. The ambient air sample will be collected over a two-hour period using six-liter (6L) batch-certified SUMMA canister.

The soil vapor and ambient air samples will be analyzed for VOCs according to EPA Method TO-15 by a NYSDOH-certified laboratory with Category B deliverables.

6.6 Decontamination of Sampling Equipment

All sampling equipment (augers, drilling rods, split spoon samplers, probe rods and pumps, etc.) will be either dedicated or decontaminated between sampling locations. The decontamination procedure will be as follows:

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

6.7 Management of Investigation-Derived Waste (IDW)

IDW that does not exhibit of evidence of contamination (e.g., staining, presence of ash, oily sheens, odors, etc.) will be used to fill in the corresponding soil boring hole. Soil and groundwater IDW exhibiting evidence of contamination will be containerized in 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 IDW will be disposed of or treated according to applicable local, state, and federal regulations.

7.0 ANALYTICAL METHODS AND REQUIREMENTS

SGS Accutest of Dayton, New Jersey will perform analyses on soil, groundwater, and soil vapor.

Matrix	Analytical Group	Conc. Level	Analytical and Preparation Method	Sample Volume *	Containers	Preservation Requirement	Max. Hold Time
Soil	VOCs	Low	SW5035A 8260C	17 oz.	3 encores and % Solid	4 °C	2 days
Soil	SVOCs	Low	SW846 8270D	8 oz.	1, 8-oz Clear Glass	4 °C	14 days
Soil	PCBs	Low	SW846 8082A	8 oz.	1, 8-oz Clear Glass	4 °C	14 days
Soil	Pesticides	Low	SW846 8081B	8 oz.	1, 8-oz Clear Glass	4 °C	14 days
Soil	Metals	Low	SW846 6010C	8 oz.	1, 8-oz Clear Glass	4°C	6 months
Soil	Hexavalent Chromium	Low	SW7196A 7196A	4 oz.	1, 4-oz Amber Glass	4°C	30 days
Groundwater	VOCs	Low	SW846 8260C	120 mL	3, 40-ml VOAs	HCl, 4 °C	14 days
Groundwater	SVOCs	Low	SW846 8270D	2 L	2, 1L Amber Glass	4°C	7 days
Groundwater	PCBs	Low	SW846 8082A	1L	1L Amber Glass	4°C	7 days
Groundwater	Pesticides	Low	SW846 8081B	1L	1L Amber Glass	4°C	7 days
Groundwater	Metals	Low	SW846 6000/7000 series	250 mL	250 mL, Plastic	4°C	6 months
Air	VOCs	Low	TO-15	6 L	6-L Summa Canister	None	30 days
Soil Vapor	VOCs	Low	TO-15	6 L	6-L Summa Canister	None	30 days

* Sample volumes recommended by the laboratory per sample. Additional volume may be requested as a contingency for dilutions, breakage, etc.

8.0 ANALYTICAL LABORATORY SENSITIVITY AND PROJECT CRITERIA

Laboratory performance criteria are provided in this Section.

Matrix: Aqueous and Soil
Analytical Group: VOC
Concentration Level Low

Analytical Method/SOP	Data Quality Indicators (DQIs)	Measurement Performance Criteria	QC Sample and/or Activity Used to Assess Measurement Performance	QC Sample Assesses Error for Sampling (S), Analytical (A) or Both (S&A)
8260C	Precision – Lab	RPD < 30%	MS/MSD	A
	Precision – Overall Representativeness	RPD < 40% for compounds w/ concentrations > QL	Field Duplicates	S&A
	Accuracy	Recovery within lab statistical QC limits provided in Table 1	LCS	A
	Accuracy	Recovery within lab statistical QC limits provided in Table 1	MS/MSD	A
	Accuracy	Per lab limits provided in Table 1	Surrogate spike	A
	Sensitivity	< QL	Low point calibration standard	A

Matrix Aqueous and Soil
Analytical Group SVOC
Concentration Level Low

Analytical Method/SOP	Data Quality Indicators (DQIs)	Measurement Performance Criteria	QC Sample and/or Activity Used to Assess Measurement Performance	QC Sample Assesses Error for Sampling (S), Analytical (A) or Both (S&A)
8270D	Precision – Lab	RPD < 40%	MS/MSD	A
	Precision – Overall Representativeness	RPD < 40% for compounds w/ concentrations > QL	Field Duplicates	S&A
	Accuracy	Recovery within lab statistical QC limits provided in Table 1	LCS	A
	Accuracy	Recovery within lab statistical QC limits provided in Table 1; 40% RPD	MS/MSD	A
	Accuracy	Per lab limits provided in Table 1; one AE and one BN can be out if >10%	Surrogate spike	A
	Sensitivity	< QL	Low point calibration standard	A

Matrix Aqueous and Soil
Analytical Group Metals
Concentration Level Low

Analytical Method/SOP	Data Quality Indicators (DQIs)	Measurement Performance Criteria	QC Sample and/or Activity Used to Assess Measurement Performance	QC Sample Assesses Error for Sampling (S), Analytical (A) or Both (S&A)
6000/7000 series	Precision – Lab	RPD < 20% if conc > 5*QL	Laboratory Duplicates	A
	Precision – Overall Representativeness	RPD < 30% for compounds w/ concentrations >5*QL	Field Duplicates	S&A
	Accuracy	% Recovery 80-120%	LCS	A
	Accuracy	80-120% or as per lab limits provided in Table 1	MS/MSD	A
	Accuracy	80-120% or as per lab limits provided in Table 1	PDS	A
	Sensitivity	< QL	Low point calibration standard	A

Matrix Aqueous and Soil
Analytical Group Pesticides
Concentration Level Low

Analytical Method/SOP	Data Quality Indicators (DQIs)	Measurement Performance Criteria	QC Sample and/or Activity Used to Assess Measurement Performance	QC Sample Assesses Error for Sampling (S), Analytical (A) or Both (S&A)
8081B	Precision – Lab	RPD < 40%	MS/MSD	A
	Precision – Overall Representativeness	RPD < 40% for compounds w/ concentrations > OL	Field Duplicates	S&A
	Accuracy	Recovery within lab statistical QC limits provided in Table 1	LCS	A
	Accuracy	Recovery within lab statistical QC limits provided in Table 1; 40 % RPD	MS/MSD	A
	Accuracy	Per lab limits provided in Table 1	Surrogate spike	A
	Sensitivity	< QL	Low point calibration standard	A

Matrix Aqueous and Soil
Analytical Group PCBs
Concentration Level Low

Analytical Method/SOP	Data Quality Indicators (DQIs)	Measurement Performance Criteria	QC Sample and/or Activity Used to Assess Measurement Performance	QC Sample Assesses Error for Sampling (S), Analytical (A) or Both (S&A)
8082A	Precision – Lab	RPD < 40%	MS/MSD	A
	Precision – Overall Representativeness	RPD < 40% for compounds w/ concentrations > OL	Field Duplicates	S&A
	Accuracy	Recovery within lab statistical QC limits provided in Table 1	LCS	A
	Accuracy	Recovery within lab statistical QC limits provided in Table 1; 40 % RPD	MS/MSD	A
	Accuracy	Per lab limits provided in Table 1	Surrogate spike	A
	Sensitivity	< QL	Low point calibration standard	A

Matrix Aqueous and Soil
Analytical Group Hexavalent Chromium
Concentration Level Low

Analytical Method/SOP	Data Quality Indicators (DQIs)	Measurement Performance Criteria	QC Sample and/or Activity Used to Assess Measurement Performance	QC Sample Assesses Error for Sampling (S), Analytical (A) or Both (S&A)
7196A	Precision – Lab	RPD < 40%	MS/MSD	A
	Precision – Overall Representativeness	RPD < 40% for compounds w/ concentrations > OL	Field Duplicates	S&A
	Accuracy	Recovery within lab statistical QC limits provided in Table 1	LCS	A
	Accuracy	Recovery within lab statistical QC limits provided in Table 1; 40 % RPD	MS/MSD	A
	Accuracy	Per lab limits provided in Table 1	Surrogate spike	A
	Sensitivity	< QL	Low point calibration standard	A

Matrix Air
Analytical Group VOC
Concentration Level Low

Analytical Method/SOP	Data Quality Indicators (DQIs)	Measurement Performance Criteria	QC Sample and/or Activity Used to Assess Measurement Performance	QC Sample Assesses Error for Sampling (S), Analytical (A) or Both (S&A)
TO-15	Precision – Lab	RPD < 25%	LCS	A
	Precision – Overall Representativeness	RPD < 40%	Field duplicate	A & S
	Accuracy	% Recovery = 60-140%	LCS	A
	Accuracy	% Recovery 70-130% or as per lab limits provided in Table 1	Surrogate spike	A
	Sensitivity	<QL	Low point calibration standard	A

9.0 SECONDARY DATA CRITERIA AND LIMITATIONS

Table 1

Secondary Data	Data Source (Originating Organization, Report Title, and Date)	Data Generator(s) (Originating Org., Data Types, Data Generation/ Collection Dates)	How Data Will Be Used	Limitations on Data Use
Phase I Environmental Site Assessment	Phase I Environmental Site Assessment of the Site, prepared by Property Solutions Inc. (PSI) in June 2010, by Legette, Brashears & Graham in March 2014, and by AKRF in September 2015	General information on Recognized Environmental Conditions	Indicated possible locations of contaminant sources; may be used to position sampling locations	Qualitative data
Subsurface Investigation	Subsurface Investigations of the Site, conducted by AKRF, Inc., in May 2001 and December 2015, and by Galli Engineering in October 2014	Soil, groundwater, and soil vapor data	Preliminary delineation of contaminants	Quantitative data

10.0 FIELD EQUIPMENT CALIBRATION, MAINTENANCE, TESTING, AND INSPECTION

Field Equipment (Parameter)	Calibration Activity	Maintenance Activity	Testing/ Inspection Activity	Frequency	Acceptance Criteria	Corrective Action	SOP
Mini Rae 2000 or 3000 PID (Organic vapor)	Instrument calibration with isobutylene	Charge battery Replace or clean sensor	Clean air reading Inspect for visual damage	Calibration – daily Maintenance as needed	As per operator’s manual	Recalibrate Perform maintenance	Operation manual
Oil/water interface probe (Depth to GW and LNAPL or DNAPL)	Calibrated by Manufacturer	Check battery and decontaminate between wells	Lower into well water to check alarm Inspect for visual damage	Between wells	Proper tone produced	Replace battery and/or decontaminate	Operation manual
Horiba U-52 water quality meter (conductivity, turbidity, pH, ORP, DO, temperature)	Verify calibration with auto-calibration solution for pH, DO, conductivity, turbidity, ORP	Charge battery	NA Inspect for visual damage	Calibrate at beginning of day After maintenance as required	Calibration does not drift	Recalibrate or replace	Operation model
MGD 2002 helium leak detector (helium)	Instrument calibration with helium span gas	Charge or replace battery	Clean air reading Inspect for visual damage	Calibration daily	As per operator’s manual	Recalibrate, replace battery, replace instrument	Operation manual

Note: Equivalent equipment may also be used as available.

11.0 ANALYTICAL LABORATORY INSTRUMENTS AND EQUIPMENT

11.1 Analytical Laboratory Instruments and Equipment Maintenance, Testing and Inspection

Instrument/ Method/ SOP	Maintenance Activity	Testing Activity	Inspection Activity	Frequency	Acceptance Criteria	Corrective Action	Responsible Person
GC/MS 8260C 8270D TO-15 1A 2A 16A	Check for leaks, replace gas line filters, recondition or replace trap, replace column, clean injection port/liner, replace Electron Multiplier	Tune (BFB or DFTPP), Calibration	Monitor instrument performance via tuning mass criteria, and Calibration criteria	See following table	See following table	Replace connections, replace gas line filters, replace trap, replace GC column, clip column, replace injection port liner, clean injection port, replace Electron Multiplier; repeat calibration or CCV	Lab chemist
GC/ECD 8081B 8082A 10A 11A	Check for leaks, replace gas line filters, recondition or replace column, clean injection port/liner	Calibration	Monitor instrument performance via Calibration criteria	See following table	See following table	Replace connections, replace gas line filters, replace GC column, clip column, replace injection port liner, clean injection port; repeat calibration or CCV	Lab chemist
ICP –MS 6000/7000 series 5A	Perform leak test, change pump tubing, change torch and window, clean filters	Initial Calibration Verification and IC Blank	Monitor instrument performance via Initial Calibration Verification and IC Blank	See following table	See following table	Replace pump tubing, replace torch and window, clean all filters; repeat calibration or CCV	Lab chemist
CVAA 7470 6A	Perform leak test, change tubing, clean window, clean filters	Initial Calibration Verification and IC Blank	Monitor instrument performance via Initial Calibration Verification and IC Blank	See following table	See following table	Replace connections, replace pump tubing, clean all filters; repeat calibration or CCV	Lab chemist

11.2 Analytical Laboratory Instrument Calibration

Instrument/ Method/SOP	**Calibration Procedure**	**Frequency of Calibration**	**Acceptance Criteria**	**Corrective Action (CA)**	**Person Responsible for CA**
GC/MS 8260C 8270D 1A, 2A	Initial 5-point Calibration	Prior to sample analysis	Response Factor (RF)>0.05 and %RSD<15%	Service instrument	Lab chemist
	Continuing calibration – mid-level standard	Once every 12 hours prior to sample analysis	RF%D<30% from initial calibration	Reanalyze continuing calibration standard. If still outside limits, recalibrate and reanalyze all samples since last complaint calibration standard.	Lab chemist
GC/MS TO-15 16A	Initial 5-point Calibration 0.05/0.10 to 20 ppbv	As needed	RSD ≤ 30% Allow 2 excursions	If the daily calibration technical acceptance criteria are not met, inspect the system for problems. It will be necessary to rerun daily calibration sample.	Lab chemist
	Continuing calibration – mid-level standard, LCS mid-level WC	Every 24 hours Duplicate	70-130% D for compounds on compendium list; 50-150% for others	Recalibrate and report non-conforming compounds in case narrative.	Lab chemist
GC/ECD 8081B 8082A 10A, 11A	Initial calibration – 5 levels-one <= quantitation limit	Prior to sample analysis	80-20% of true value or r>0.99	Reanalyze continuing calibration standard. If still outside limits, recalibrate and reanalyze all samples since last complaint calibration standard.	Lab chemist
	Continuing calibration – mid-level standard	1 standard per 20 samples or every 12 hours, whichever is more frequent	%Difference < 15% from initial calibration	If the daily calibration technical acceptance criteria are not met, inspect the system for problems. It will be necessary to rerun daily calibration sample.	Lab chemist
ICP-MS 6000/7000 series 5A	Initial calibration	Daily	r>0.995	Recalibrate and reanalyze.	Lab chemist
	Continuing calibration – mid level standard	Every 10 samples and at end of run	Results 90-110% true value	Reanalyze continuing calibration standard. If still outside limits, recalibrate and reanalyze all samples since last complaint calibration standard.	Lab chemist
CVAA 7470 6A	Initial Calibration – 5 levels and a blank (one level must be a quantitation level)	Prior to sample analysis	r>0.995	Reanalyze continuing calibration standard. If still outside limits, recalibrate and reanalyze all samples since last complaint calibration standard.	Lab chemist
	Continuing Calibration – mid level standards	Every 10 samples and at end of run	80-120 % recovery	Reanalyze continuing calibration standard. If still outside limits, recalibrate and reanalyze all samples since last complaint calibration standard.	Lab chemist

12.0 SAMPLE HANDLING SYSTEM

SAMPLE COLLECTION, PACKAGING, AND SHIPMENT
Sample Collection (Personnel/Organization): Jennifer Pensky or Adrianna Bosco, AKRF
Sample Packaging (Personnel/Organization): Jennifer Pensky or Adrianna Bosco, AKRF
Coordination of Shipment (Personnel/Organization): Jennifer Pensky or Adrianna Bosco, AKRF
Type of Shipment/Carrier: Courier or overnight delivery services
SAMPLE RECEIPT AND ANALYSIS
Sample Receipt (Personnel/Organization): SGS Accutest Personnel
Sample Custody and Storage (Personnel/Organization): SGS Accutest Personnel
Sample Preparation (Personnel/Organization): SGS Accutest Personnel
Sample Determinative Analysis (Personnel/Organization): SGS Accutest Personnel
SAMPLE ARCHIVING
Field Sample Storage (No. of days from sample collection): Samples to be sent to SGS Accutest Laboratories either by an SGS Accutest Personnel courier the same day as the sampling or by overnight delivery services to laboratory for delivery the following morning. 1 day
Sample Extract/Digestate Storage (No. of days from extraction/digestion): As per analytical methodology; 30 days
SAMPLE DISPOSAL
Personnel/Organization: SGS Accutest Personnel
Number of Days from Analysis: Until analysis and QA/QC checks are completed; as per analytical methodology; 30 days

13.0 SAMPLE CUSTODY REQUIREMENTS

13.1 Sample Identification

All samples will be consistently identified in all field documentation, chain-of-custody documents and laboratory reports using an alpha-numeric code. The samples will be identified by a prefix of “L2-RI” to designate the Site Lot, the type of investigation (RI), followed by the soil boring or monitoring well number with sample depth interval in parenthesis (for soil samples only), and the sampling date.

The blind duplicate samples will be labeled with a dummy sample location to ensure that they are submitted as blind samples to the laboratory. The dummy identification will consist of the sample type followed by a letter. Trip blanks and field blanks will be identified with “TB” and “FB”, respectively, and the sampling date.

The following table presents the sampling identification scheme.

Sample Description	Sample Designation
Soil sample collected from 0 to 2 feet at boring L2-RI-SB-7 on November 1, 2016	L2-RI-SB-7 (0-2’) 20161101
Groundwater sample collected from monitoring well L2-RI-MW-3 on November 1, 2016	L2-RI-MW-3 20161101
MS/MSD duplicate groundwater sample from L2-RI-MW-1 on November 1, 2016	L2-RI-MW-1-MS/MSD 20161101
Duplicate soil sample from 0 to 2 feet at L2-RI-SB-8 on November 1, 2016	L2-RI-SB-X (0-2’) 20161101
Soil vapor sample collected L2-RI-SV-1 on November 1, 2016	L2-RI-SV-1 20161101
Ambient air sample on November 1, 2016	L2-RI-AA-1 20161101
Trip Blank submitted with samples collected on November 1, 2016	TB 20161101
Field Blank submitted with samples collected on November 1, 2016	FB 20161101

Following the labeling of each sample, the appropriate laboratory Chain-of-Custody (COC) form will be completed and will accompany the samples. Each person having custody of the samples will document receipt and relinquishment of such samples.

13.2 Sample Labeling and Shipping

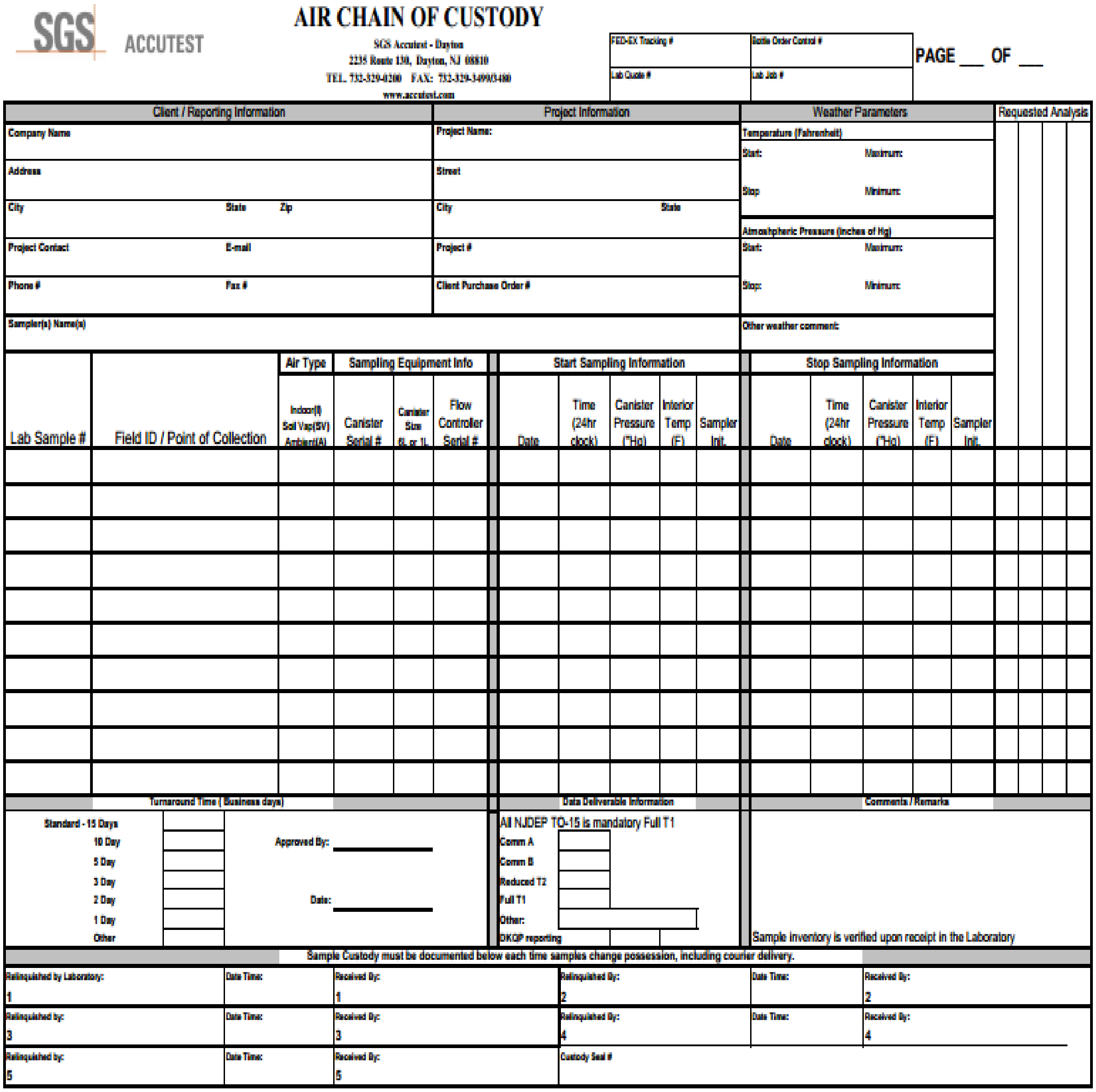
All sample containers will be provided with labels containing the following information:

- Project identification
- 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 a container and maintained in a secure environment until transported to the laboratory. The soil and groundwater samples will be prepared for shipment by placing each sample in a sealable plastic bag, then wrapping each container in bubble wrap to prevent breakage, adding freezer packs and/or fresh ice in sealable plastic bags and the COC form. Samples will be transported by a laboratory courier or, if necessary, shipped via FedEx.

13.3 Sample Custody

Field personnel will be responsible for maintaining the sample containers 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; signatures of individuals involved in sample transfer; and the dates and times of transfers. Blanks and example COCs for soil and groundwater and air are provided on the following pages.



SGS ACCUTEST

AIR CHAIN OF CUSTODY

SGS Accutest - Dayton
2235 Route 130, Dayton, NJ 08810
TEL. 732-329-0200 FAX: 732-329-3499/3480
www.accutest.com

FED-EX Tracking #	Bottle Order Control #
Lab Quote #	Lab Job #

PAGE __ OF __

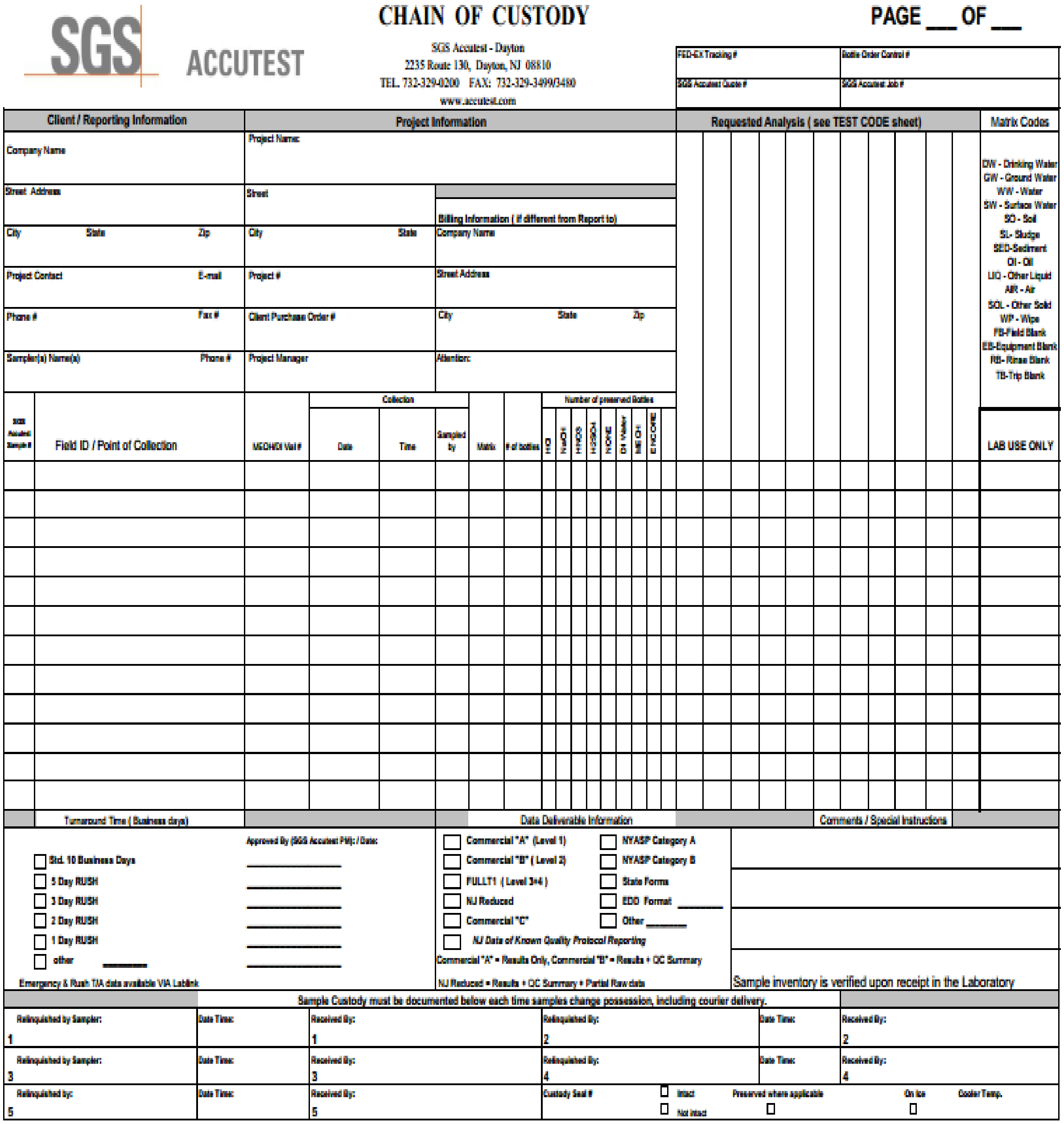
Client / Reporting Information		Project Information		Weather Parameters		Requested Analysis
Company Name		Project Name:		Temperature (Fahrenheit)		
				Start:	Maximum:	
Address		Street		Stop:	Minimum:	
City	State Zip	City	State			
				Atmoshpheric Pressure (inches of Hg)		
Project Contact	E-mail	Project #		Start:	Maximum:	
Phone #	Fax #	Client Purchase Order #		Stop:	Minimum:	
Sampler(s) Name(s)				Other weather comment:		

		Air Type	Sampling Equipment Info			Start Sampling Information					Stop Sampling Information					Requested Analysis			
Lab Sample #	Field ID / Point of Collection	Indoor(I) Soil Vap(SV) Ambient(A)	Canister Serial #	Canister Size 6L or 1L	Flow Controller Serial #	Date	Time (24hr clock)	Canister Pressure ("Hg)	Interior Temp (F)	Sampler Init.	Date	Time (24hr clock)	Canister Pressure ("Hg)	Interior Temp (F)	Sampler Init.				

Turnaround Time (Business days)			Data Deliverable Information		Comments / Remarks
Standard - 15 Days	☐		All NJDEP TO-15 is mandatory Full T1		
10 Day	☐	Approved By: ________	Comm A	☐	
5 Day	☐		Comm B	☐	
3 Day	☐		Reduced T2	☐	
2 Day	☐	Date: ________	Full T1	☐	
1 Day	☐		Other:	☐	
Other	☐		DKQP reporting		Sample inventory is verified upon receipt in the Laboratory

Sample Custody must be documented below each time samples change possession, including courier delivery.

Relinquished by Laboratory: 1	Date Time:	Received By: 1	Relinquished By: 2	Date Time:	Received By: 2
Relinquished by: 3	Date Time:	Received By: 3	Relinquished By: 4	Date Time:	Received By: 4
Relinquished by: 5	Date Time:	Received By: 5	Custody Seal #		



SGS ACCUTEST

CHAIN OF CUSTODY

SGS Accutest - Dayton
2235 Route 130, Dayton, NJ 08810
TEL. 732-329-0200 FAX: 732-329-3499/3480
www.accutest.com

PAGE ___ OF ___

FED-EX Tracking #
Bottle Order Control #
SGS Accutest Quote #
SGS Accutest Job #

Client / Reporting Information
Company Name
Street Address
City State Zip
Project Contact E-mail
Phone # Fax #
Sampler(s) Name(s) Phone #

Project Information
Project Name:
Street
City State
Project #
Client Purchase Order #
Project Manager

Billing Information (if different from Report to)
Company Name
Street Address
City State Zip
Attention:

Requested Analysis (see TEST CODE sheet)

Matrix Codes
DW - Drinking Water
GW - Ground Water
WW - Water
SW - Surface Water
SO - Soil
SL- Sludge
SED-Sediment
OI - Oil
LIQ - Other Liquid
AIR - Air
SOL - Other Solid
WP - Wipe
FB-Field Blank
EB-Equipment Blank
RB- Rinse Blank
TB-Trip Blank

SGS Accutest Sample # | Field ID / Point of Collection | MEOH/DI Vial # | Collection: Date, Time, Sampled by | Matrix | # of bottles | Number of preserved Bottles: HCl, NaOH, HNO3, H2SO4, NONE, DI Water, MEOH, ENCORE | LAB USE ONLY

Turnaround Time (Business days)
Approved By (SGS Accutest PM): / Date:
☐ Std. 10 Business Days ________
☐ 5 Day RUSH ________
☐ 3 Day RUSH ________
☐ 2 Day RUSH ________
☐ 1 Day RUSH ________
☐ other ________ ________
Emergency & Rush T/A data available VIA Lablink

Data Deliverable Information
☐ Commercial "A" (Level 1)
☐ Commercial "B" (Level 2)
☐ FULLT1 (Level 3+4)
☐ NJ Reduced
☐ Commercial "C"
☐ *NJ Data of Known Quality Protocol Reporting*
☐ NYASP Category A
☐ NYASP Category B
☐ State Forms
☐ EDD Format ________
☐ Other ________
Commercial "A" = Results Only, Commercial "B" = Results + QC Summary
NJ Reduced = Results + QC Summary + Partial Raw data

Comments / Special Instructions
Sample inventory is verified upon receipt in the Laboratory

Sample Custody must be documented below each time samples change possession, including courier delivery.

Relinquished by Sampler: 1 | Date Time: | Received By: 1 | Relinquished By: 2 | Date Time: | Received By: 2
Relinquished by Sampler: 3 | Date Time: | Received By: 3 | Relinquished By: 4 | Date Time: | Received By: 4
Relinquished by: 5 | Date Time: | Received By: 5 | Custody Seal # | ☐ Intact ☐ Not intact | Preserved where applicable ☐ | On Ice ☐ | Cooler Temp.

Upon receipt at the laboratory, the condition of each sample will be checked to ensure that the sample integrity has not been compromised. Any discrepancy between the samples and the chain-of-custody information, any broken or leaking sample bottles, or any other abnormal situations will be reported by the laboratory project manager to the AKRF Project Manager. If required, corrective action options will be discussed and implemented. Notations of the problem and resolution will be made in the laboratory analytical report.

Once samples are in the custody of the laboratory, sample integrity will be maintained. Each sample batch will be assigned a unique project number by the laboratory and each sample will be assigned a unique laboratory identification number. When samples are required for preparation and/or analysis, the sample custodian or designee will distribute the samples to the appropriate analysts. An internal chain-of-custody form will be signed by the individual to whom the samples are relinquished to track the samples internally.

14.0 DATA MANAGEMENT AND DOCUMENTATION

Field Sample Collection Documents and Records	Analytical Laboratory Documents and Records	Data Assessment Documents and Records	Project File
• Field books • Boring logs • Well construction diagrams • Chain-of-Custody (COC) forms • Well Development Forms • Well Sampling Forms • Photos • Air Sampling Logs • Soil Vapor Sampling Logs	• Sample receipt logs • Internal and external COC forms • Equipment calibration logs • Sample preparation worksheets/logs • Sample analysis worksheets/run logs • Corrective action documentation	• Data validation report • Field inspection forms • Corrective action documentation • Electronic Data Deliverables (EDD) compatible with EQuIS.	• Project files will be stored for one year in AKRF main office • Project files will be stored for seven years by the City of New York • After minimum of one year, hard copy files archived off-site • EDDs archived on AKRF corporate server

15.0 PROJECT REPORTS

Type of Report	Frequency (Daily, weekly, monthly, quarterly, annually, etc.)	Projected Delivery Date(s)	Person(s) Responsible for Report Preparation (Title and Organizational Affiliation)	Report Recipient(s) (Title and Organizational Affiliation)
Remedial Investigation Report	N/A	12/31/2016	Michelle Lapin, P.E. Senior Vice President AKRF, Inc. and Deborah Shapiro, QEP Senior Technical Director AKRF, Inc.	Manfred Magloire New York City Department of Environmental Conservation Justin Deming New York City Department of Health

Project delivery date is based on timing of work plan approval and implementation, as outlined in Section 5.0.

16.0 PROJECT DATA VERIFICATION (STEP I)

Step I is a completeness check. The following processes will be followed to verify project data:

Verification Input	**Description**	**Internal/ External**	**Responsible for Verification (Name, Organization)**
Field book	All entries complete, signed, corrections properly initialed, sample list corresponds to COC.	I	Deborah Shapiro, Project Manager, AKRF
Chain of Custody forms	Field COC is completed with legible sample ID, dates, times, all analytical parameters correctly entered, preservatives noted, signatures. Lab COC indicates any errors, signatures signifying acceptance of custody.	I E	Deborah Shapiro, Project Manager, AKRF Lab sample custodian, SGS Accutest
Sample receiving document	Lab verified against COC.	E	Lab sample custodian, SGS Accutest
Draft lab results	All samples have results as requested, IDs match COC, all QC present and reported as per QAPP.	I	Deborah Shapiro, Project Manager, AKRF
Analytical data package	Verify data package for completeness including the presence of Laboratory case narrative, sample receipt form, holding times record, sample results, blank results, MS/MSD summary forms, LCS summary forms, surrogate and internal summary forms (where appropriate), initial and continuing calibration summary and raw data.	E	Third Party Validator
Lab originated NCRs/CARS	When required, properly completed with appropriate corrective action specifies and signatues where required; properly filed.	I	Deborah Shapiro, Project Manager, AKRF
Memo regarding QAPP modifications or deviations	When required, document all QAPP modifications.	I	Deborah Shapiro, Project Manager, AKRF
Analytical EQuIS EDDs	Verify that all SDGs are reported in Excel format.	I	Deborah Shapiro, Project Manager, AKRF

Acronyms: COC – Chain of Custody; MS/MSD – Matrix Spike/Matrix Spike Duplicate; LCS – Laboratory Control Sample; NCRs – Nonconformance Reports; CARs – Corrective Action Reports; EDDs – Electronic Data Deliverables; SDGs –Sample Delivery Groups

17.0 PROJECT DATA VALIDATION PROCESS (STEPS IIA AND IIB)

The following processes will be followed to validate project data under Step IIa (Compliance with Methods Procedures and Contracts) and Step IIb (Comparison with Performance Criteria in this QAPP).

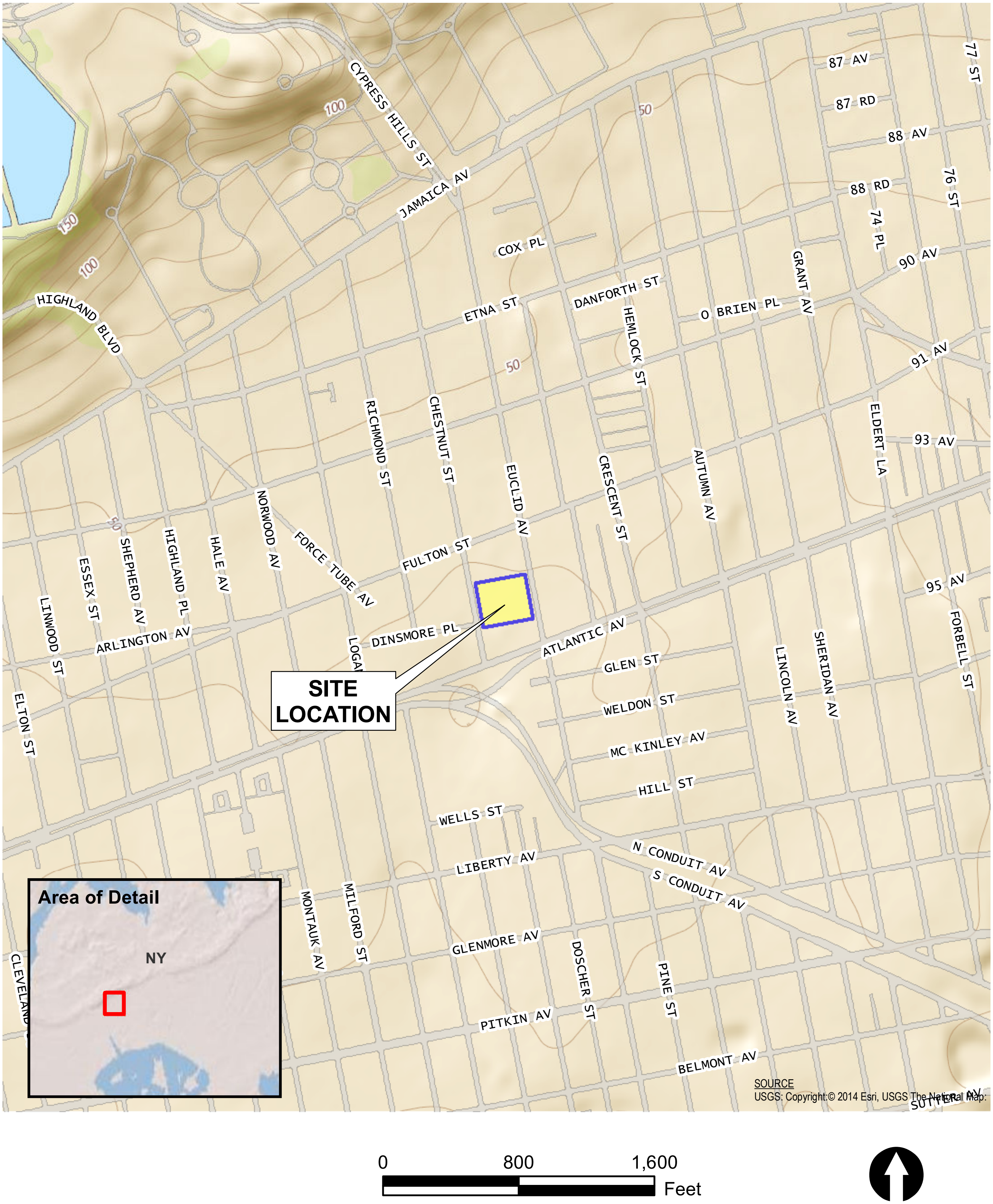
Step IIa or IIb	Validation Input	Description	Responsible for Validation (Name, Organization)
IIa/IIb	Field book and field data sheets	Ensure that the sampling protocols and SOPs outlined in the QAPP were followed and that any deviations were noted/approved, appropriate QC samples collected, proper sample preservation.	Deborah Shapiro, Project Manager AKRF
IIa/IIb	Field originated NCRs/CARS	All issues properly documented, corrective actions were implemented and effective.	Deborah Shapiro Project Manager AKRF
IIa	Chain of Custody forms; sample receiving document	Examine COC forms against QAPP and laboratory requirements (analytical methods, sample, samples have data reported for requested analysis).	Third Party Validator
IIa	Analytical data package Lab SOPs/ Reference methods QAPP MPC	Holding times met all method criteria.	Third Party Validator
IIa		Review of dilutions and re-analyses results against reported data; when multiple analyses appropriate run was reported, proper units are reported.	Third Party Validator
IIa/IIb		Calibrations were analyzed at required frequency and met criteria.	Third Party Validator
IIa/IIb		Comparison of QC sample results (surrogate, internal standards, spikes, blanks, etc) all match criteria in metod and QAPP (Worksheets 12, 15, 28).	Third Party Validator
IIa/IIb		Blanks are free of contamination; if analytes present > RDL samples properly quallified if sample concentration < 10x Blank concentration.	Third Party Validator
IIb		Detection limits, project action limits were met.	Third Party Validator
IIa/IIb	Lab originated NCRs/CARS	When required, document all issues property and confirm corrective actions were implemented and effective.	Deborah Shapiro Project Manager AKRF
IIb	Memo regarding QAPP modifications	When required, document all QAPP modifications and corrective actions.	Deborah Shapiro Project Manager AKRF
IIb	Analytical EDDs	All data reported in excel format; EDD verified against hard copy lab report.	Deborah Shapiro Project Manager AKRF

Acronyms: MPC – Measurement Performance Criteria; NCRs – Nonconformance Reports; CARs – Corrective Action Reports; EDDs – Electronic Data Deliverables (EQuIS compatible)

18.0 PROJECT MATRIX AND ANALYTICAL VALIDATION (STEPS IIA AND IIB) SUMMARY

Step IIa/IIb	**Matrix**	**Analytical Group**	**Concentration Level**	**Validation Criteria**	**Data Validator (title and organizational affiliation)**
IIa	Soil	VOCs, SVOCs, PCBs, Pesticides, TAL Metals, and Hexavalent Chromium	Low	SW846/EPA Method criteria; Laboratory SOPs and control limits	Third Party Data Validator
IIb	Soil	VOCs, SVOCs, PCBs, Pesticides, TAL Metals, and Hexavalent Chromium	Low	QAPP Templates 5c, 5d, 8 and 10	Third Party Data Validator
IIa	GW	VOCs, SVOCs, PCBs, Pesticides, TAL Metals	Low	SW846/EPA Method criteria; Laboratory SOPs and control limits	Third Party Data Validator
IIb	GW	VOCs, SVOCs, PCBs, Pesticides, TAL Metals (total and dissolved)	Low	QAPP Templates 5c, 5d, 8 and 10	Third Party Data Validator
IIa	Air	VOCs	Low	SW846/EPA Method criteria; Laboratory SOPs and control limits	Third Party Data Validator
IIb	Air	VOCs	Low	QAPP Templates 5c, 5d, 8 and 10	Third Party Data Validator

FIGURES



SOURCE
USGS: Copyright:© 2014 Esri, USGS The National Map:

W:\Projects\12184 - PHIPPS 3301 ATLANTIC\Technical\Hazmat\Phase II\235 Chestnut Street (Middle Lot)\GIS\12184 Fig 1 site loc map.mxd

235 Chestnut Street
Brooklyn, New York

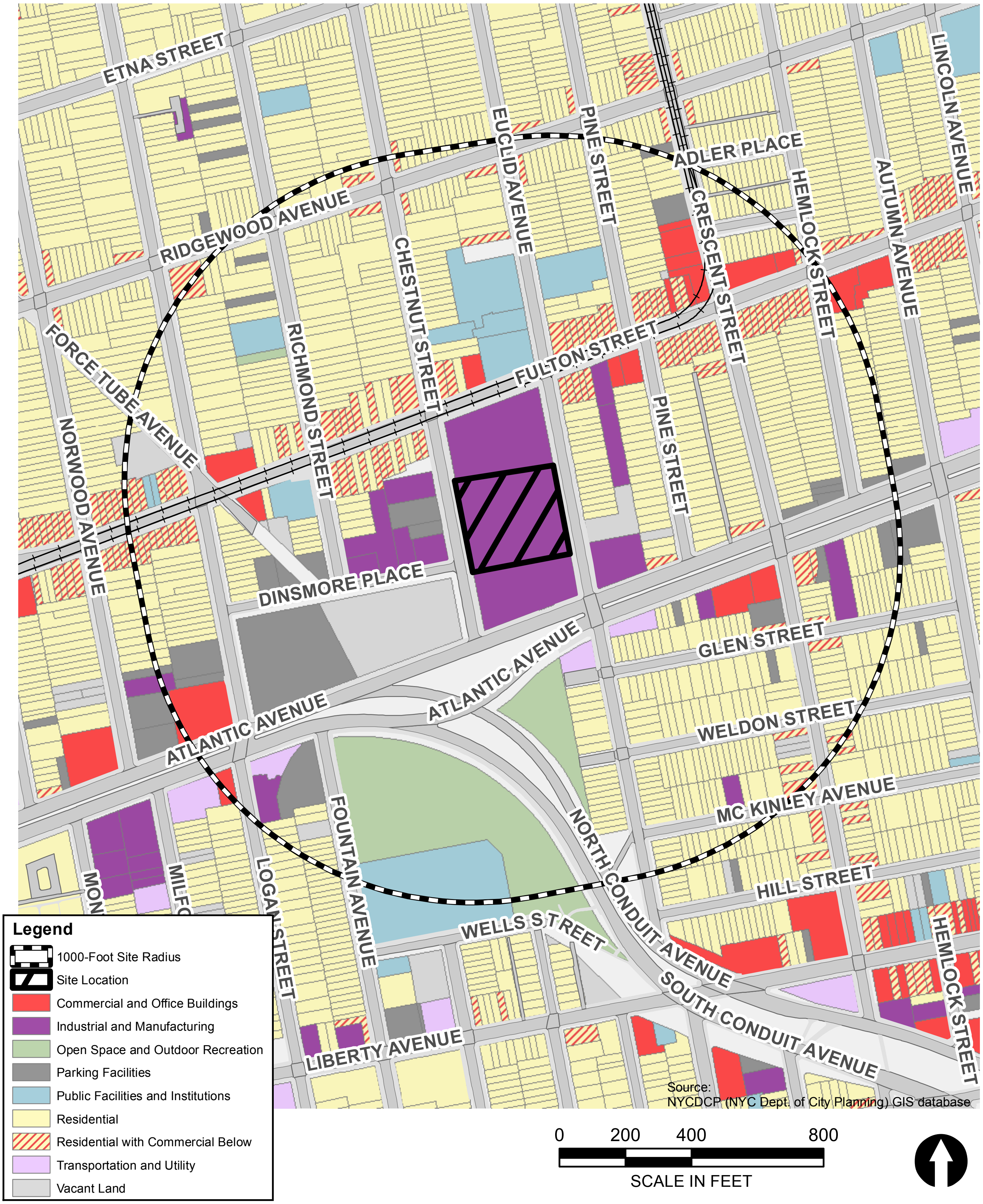
SITE LOCATION

AKRF
Environmental Consultants
440 Park Avenue South, New York, NY 10016

DATE
12/28/2015

PROJECT No.
12184

FIGURE
1



Legend

- ▭ 1000-Foot Site Radius
- ▨ Site Location
- 🟥 Commercial and Office Buildings
- 🟪 Industrial and Manufacturing
- 🟩 Open Space and Outdoor Recreation
- ⬛ Parking Facilities
- 🟦 Public Facilities and Institutions
- 🟨 Residential
- ▨ Residential with Commercial Below
- 🟪 Transportation and Utility
- ⬜ Vacant Land

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

235 Chestnut Street
Brooklyn, New York

SURROUNDING LAND USE

AKRF
Environmental Consultants
440 Park Avenue South, New York, NY 10016

DATE
11/8/2016

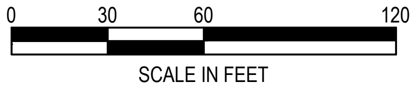
PROJECT NO.
12493

FIGURE
2

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

LEGEND:

━	PROJECT SITE BOUNDARY
☐ 2	LOT BOUNDARY
4143	BLOCK NUMBER
──	BUILDING LINE
┼┼┼┼┼┼┼┼	MTA RAILROAD ELEVATED TRACKS
– – – –	LIRR SUBTERRANEAN TRACKS
▨	APPROXIMATE EXTENT OF PARTIAL CELLAR
● L2-SI-SB-7	2015 PHASE II SOIL BORING LOCATION
⌖ L2-SI-SB/GW-2	2015 PHASE II SOIL BORING/GROUNDWATER SAMPLE LOCATION
⊙ L2-SI-SV-2	2015 PHASE II SOIL VAPOR SAMPLE LOCATION
● ⌖ ⊙	2015 PHASE II OFF-SITE SAMPLE LOCATIONS (IDENTIFIED IN GREY)
○	PROPOSED SOIL BORING LOCATION
⊠	PROPOSED SOIL BORING/GROUNDWATER SAMPLE LOCATION
◒	PROPOSED SOIL VAPOR SAMPLE LOCATION
⌖	PROPOSED AMBIENT AIR SAMPLE LOCATION



AKRF
Environmental Consultants
440 Park Avenue South, New York, N.Y. 10016

Atlantic Chestnut - Lot 2
235 Chestnut Street
Brooklyn, New York

PROPOSED SAMPLE LOCATION PLAN

DATE
11/2/2016

PROJECT NO.
12492

FIGURE
3

©2016 AKRF, Inc W:\Projects\12493 - PHIPPS 235 CHESTNUT LOT 2\Technical\Hazmat\CAD\12493 Fig 6 Prop Sample Plan.dwg last save: mveilleux 11/2/2016 1:57 PM

APPENDIX A
RESUMES OF KEY PERSONNEL

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
Member, NAIOP, a Commercial Real Estate Development Association

Years of Experience

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

RELEVANT EXPERIENCE

Memorial Sloan Kettering Cancer Center-CUNY 74th Street EIS, New York, NY

AKRF was engaged by Memorial Sloan-Kettering Cancer Center (MSK) and CUNY-Hunter College (CUNY) to prepare an EIS for a proposed joint facility located on a New York City-owned parcel located between East 73rd Street and East 74th Street adjacent to the FDR Drive in Manhattan. The proposed facility was formerly occupied by the Department of Sanitation, and had included over 41 underground storage tanks, will include an ambulatory medical care center for MSK and educational and medical research facilities for CUNY.

Ms. Lapin is leading the hazardous materials work which includes the preparation of the Phase I and II environmental site assessments, remedial action work plans (RAWPs), and construction health and safety plans (CHASPs) for submission to the New York City Office of Environmental Remediation (OER) for the Voluntary Cleanup Program (VCP) and to the New York State Department of Environmental Conservation (NYSDEC) for remediation of a petroleum spill. The RAWPs and CHASPs included provisions for excavation of contaminated soil and rock, removal of tanks and environmental monitoring during the construction activities. AKRF also performed a pre-demolition asbestos survey of the remaining concrete foundation structures and prepared specifications for asbestos abatement, soil management and underground storage tank removal and disposal.

Brooklyn Bridge Park, Brooklyn, NY

AKRF prepared an Environmental Impact Statement (EIS) and is continuing to provide technical and planning support services for Brooklyn Bridge Park, which revitalizing the 1.3-mile stretch of the East River waterfront between Jay Street on the north and Atlantic Avenue on the south. The new park, allows public access to the water's edge, allowing people to enjoy the spectacular views of the Manhattan skyline and New York Harbor. It also provides an array of passive and active recreational opportunities, including lawns, pavilions, and a marina. As with many waterfront sites around New York City, the lands along the Brooklyn waterfront have a long history of industrial activities. Some of these industries used dangerous chemicals and generated toxic by-products that could have entered the soil and groundwater. In addition, landfilling activities along the shoreline also used ash and other waste materials from industrial processes. Based on site inspections, historical maps, government records, and other sources, AKRF has been investigating the potential for the presence for hazardous materials in the park. This information was compiled into a Phase 1 Environmental Site Assessment report. AKRF has also provided and continues to support to the design team related to designing the project to minimize costs related to remediating hazardous materials where possible. Ms. Lapin is serving as senior manager for the hazardous materials investigations.

Columbia University Manhattanville Academic Mixed-Use Development, New York, NY

Ms. Lapin served as Hazardous Materials Task Leader on this Environmental Impact Statement (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 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 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 Environmental Impact Statement (EIS). Based on the Phase I studies, AKRF conducted a subsurface (Phase II) investigation in accordance with a New York City Department of Environmental Protection (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 was used to estimate costs to remediate contaminated soil and groundwater, and underground storage tanks and hazardous building materials, including lead-based paint and asbestos-containing materials.

Albert Einstein College of Medicine Center for Genetic and Translational Medicine, Bronx, NY

Ms. Lapin directed the firm's hazardous materials work in connection with the construction a new Center for Genetics and Translational Medicine (CGTM) building on the Bronx campus of the Albert Einstein College of Medicine of Yeshiva University. AKRF prepared an Environmental Assessment Statement (EAS) that examined such issues as land use, zoning, air quality, urban design and visual resources, hazardous materials, traffic, noise, and air quality. Ms. Lapin's work included analysis of the existing conditions and potential impacts that the construction could cause to the environment and human health.

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. Ms. Lapin continues to manage the annual inspections for the property owner in accordance with the Brownfield Cleanup Agreement.

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 has overseen preparation and implementation of additional soil and groundwater investigations [working with both the New York State Department of Environmental Conservation (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 Environmental Impact Statements (EIS) 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 New York State Department of Environmental Conservation (NYSDEC), the New York State Department of Health (NYSDOH), the New York State Education Department (NYSED) and the local school district. The project was approved, and construction/renovation for the new middle school completed such that the school opened for the Fall 2008 semester as planned.

Fiterman Hall Deconstruction and Decontamination Project, New York, NY

The 15-story Fiterman Hall building, located at 30 West Broadway between Barclay and Murray Streets, 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, attack on the World Trade Center (WTC) 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, however, extensive mold and WTC dust contaminants remain within the building, which must be taken down. The project required the preparation of two Environmental Assessment Statements (EASs) for the redevelopment of Fiterman Hall—one for the deconstruction and decontamination of the building 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 deconstruction and decontamination plans for the EAS. The cleanup plan was submitted to the United States Environmental Protection Agency (USEPA).

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 Environmental Site 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 Davids Island, the largest undeveloped island on the Long Island Sound in Westchester County. The 80-acre island features pre- and post-Civil War military buildings and parade grounds, and is viewed as a major heritage, tourism, and recreational amenity. The island, formerly known as Fort Slocum, was used by the U.S. military, beginning in the 19th century, as an Army base, hospital, and training center. The island was planned for county park purposes. The investigation included a Phase I Environmental Site Assessment, with historical research going back 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 has included Phase I Environmental Site Assessments, subsurface investigations, and construction health and safety plans.

Cross Westchester (I-287) Expressway Phases V and VI, Westchester County, NY

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

Supermarket Redevelopment, New Fairfield, CT

AKRF provided consulting services to the developer and owner of a nine-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 (CTDEP) 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.

Broad Street, Stamford, CT [former Project name: Target Stamford)

AKRF originally completed a Phase I Environmental Site Assessment (ESA) for a developer of this property, located at southeastern corner of Broad Street and Washington Boulevard in downtown Stamford, Connecticut, for a proposed residential development. Four years later, an update of this Phase I ESA was conducted for a proposed Target retail development. The study area included the current Target site and the west-adjacent site which was subsequently developed as a luxury residential tower. Following the Phase I report, a subsurface (Phase II) investigation was conducted, which included soil borings, groundwater monitor wells, soil and groundwater sample collection and analysis. The results of the Phase II investigation were used to develop a remediation strategy. An additional Phase I/Phase II investigation was conducted of the adjacent former transmission repair facility, which included a site inspection, review of local and state records, an underground storage tank markout survey, advancement of soil borings, and collection of soil samples for laboratory analysis. AKRF also conducted asbestos surveys prior to abatement and demolition of the former Broad Street and Washington Boulevard buildings.

EPA Brownfields Assessment Program, Naugatuck, CT

Ms. Lapin is currently serving as the Principal-in-Charge for a USEPA Brownfields Assessment program project in Naugatuck, Connecticut. She is overseeing the assessment and investigation of key development parcels, including Work Plan and QAPP preparation, and conducting community outreach tasks to communicate site risks and the project process. Mr. Stefaniak plays the lead role in administering the USEPA Cooperative Agreement on behalf of the Borough.

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.

Former Macy's Site, White Plains, NY

While assisting Tishman Speyer with plans to redevelop this site, Ms. Lapin managed the pre-demolition work, which included a Phase I site assessment; subsurface investigation (Phase II), including the analysis of soil and groundwater samples for contamination; a comprehensive asbestos, lead paint, and PCB investigation; radon analysis; and coordination and oversight of the removal of hazardous materials left within the building by previous tenants. Work also included asbestos abatement specifications and specifications for the removal of two 10,000-gallon vaulted fuel-oil underground storage tanks.

Storage Deluxe, Various Locations, NY

Ms. Lapin manages the firm's ongoing work with Storage Deluxe, which includes Phase I Environmental Site Assessments and Phase II Subsurface Investigations, underground storage tank removals and associated remediation, asbestos surveys and abatement oversight, and contaminated soil removal and remediation for sites in Connecticut, the Bronx, Brooklyn, Manhattan, Westchester County, and Long Island.

Home Depot, Various Locations, NY and CT

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, II, and III 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 phases of this residential development, including 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.

Mill Basin, Gerritsen Inlet, and Paerdegat Basin Bridges, Final Design, Shore Parkway, Brooklyn, NY

Following the preparation of the Generic Environmental Impact Statement (GEIS) for the Belt Parkway Bridges Project, the firm was retained for supplemental work during the final design phase of the project. This included National Environmental Policy Act (NEPA) and State Environmental Quality Review Act (SEQRA) documentation for three of the bridges—Mill Basin, Gerritsen Inlet, and Paerdegat Basin—which will be federally funded. Ms. Lapin managed the contaminated materials investigation that included a detailed subsurface contaminated materials assessment, both subaqueous and along the upland approaches.

NYSDOT Transportation Management Center (TMC), Hawthorne, NY

AKRF conducted environmental studies for the New York State Department of Transportation (NYSDOT) at the current troopers' headquarters in Hawthorne, NY. The property is the proposed site of a new Transportation

Management Center. AKRF completed a comprehensive asbestos survey of the on-site building and prepared asbestos abatement specifications; performed a Phase I site assessment; conducted an electromagnetic (EM) survey that located two fuel oil underground storage tanks, and developed removal specifications for the two underground storage tanks and an aboveground storage tank.

Metro-North Railroad Poughkeepsie Intermodal Station/Parking Improvement Project, Poughkeepsie, NY

Ms. Lapin served as Project Manager of the hazardous materials investigation in connection with AKRF's provision of planning and environmental services for parking improvement projects at this station along the Hudson Line. The project included an approximately 600-space garage, additional surface parking, and an intermodal station to facilitate bus, taxi, and kiss-and-ride movements. Ms. Lapin conducted Phase I and II contaminated materials assessments and worked with the archaeologists to locate an historical roundhouse/turntable.

Metro-North Railroad Golden's Bridge Station Parking Project, Westchester County, New York

For Metro-North Railroad, Ms. Lapin managed a Phase I Environmental Site Assessment of a property that has since become the new parking area, used by the existing Golden's Bridge train station. Ms. Lapin also conducted a subsurface (Phase II) investigation of the original parking area, track area, and existing platform for the potential impact of moving tracks in the siding area to extend the existing parking area and adding an access from a proposed overhead walkway (connecting the train station to the new parking area over a highway). The study also included an assessment for lead-based paint and asbestos on the platform structures.

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). The proposed complex was to occupy an underutilized portion of the Bellevue Hospital campus between East 30th Street and approximately East 28th Street, immediately south of NYU's campus. As originally contemplated, Phase I was to include 618,000 square feet of development, including a clinical practice and research building, a biotech center, 220 housing units for post-doctorate staff, a child care center, and a conference center. This phase would include reuse of the former Bellevue Psychiatric Building, a historic structure on East 30th Street east of First Avenue. Phase II was to include a second biotech building with a library to serve NYU and Bellevue at the eastern end of the block between 29th and 30th Streets. Phase III was to include a third biotech building and parking. The project's EIS considered a full range of issues, including land use, socioeconomics, shadows, historic resources, open space, traffic and transportation, air quality, noise, and construction. The firm also prepared all of the traffic and transportation studies for the urban design and master planning efforts. Ms. Lapin managed the Phase I Environmental Site Assessment and other hazardous materials-related issues.

Events relating to September 11, 2001 put a hold on the project for a number of years. When the project resurfaced, it had a new developer and a decreased scope. Ms. Lapin updated the hazardous materials issues for the new developer and consulted with them 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 the former psychiatric hospital building, laundry building and parking areas associated with Bellevue Hospital. The new development includes a biotechnology center (Commercial Life Science Research and Office Park) comprising two buildings (combined 550,000 square feet), street level retail, and an elevated plaza.

68, 76 and 78 Forest Street and 96-98 Grove Street, Stamford, CT

Ms. Lapin led this project, for which AKRF was retained to complete a Phase I Environmental Site Assessment (ESA) of five residential properties, and asbestos surveys and lead-based paint surveys of the five multi-family residential structures prior to a real estate transaction. The investigations were completed to allow demolition of the residential structures and prepare the properties for development into the Highgrove high rise condominium complex. AKRF represented the purchaser and site developer during the due diligence process, identified areas of environmental concern, and completed underground storage tank closure activities prior to initiating site development. In addition, AKRF conducted a Phase I ESA of a property on Summer Street that was being used by the developer as a "temporary" office building and a parking area utilized as a sales center and apartment model for the Highgrove residential development.

Shelton Storage Deluxe, Shelton, CT

AKRF completed Phase I, Phase II and Tank Removal/Remediation services for a storage facility in Shelton, Connecticut. Based on this information from the Phase I ESA, AKRF conducted a Phase II study that revealed groundwater impact (gasoline), possibly from an off-site source. Additional testing was then conducted to determine the source of the gasoline contamination. Testing of a wood block floor revealed concentrations of volatile and semivolatile organic compounds and total petroleum hydrocarbons; therefore, disposal of this material had to be as a petroleum-contaminated waste. The additional testing included upstream and downstream surface water samples, and on-site detention pond water and sediment samples. Subsequent to the Phase II testing, a 4,000-gallon on-site underground storage tank was removed. Upon removal, contaminated soil and groundwater were observed and a spill was called into the Connecticut Department of Environmental Protection (CTDEP). Following completion of remedial activities and submission of a closure report, the spill was closed by the CTDEP. Ms. Lapin directed the firm's efforts to complete this project.

DPR Soundview Park Playgrounds and Open Space, Bronx, NY

AKRF is part of a team working on the reconstruction of this 212-acre NYCDPR public park located along the Bronx River in the Bronx, New York. The park was identified as an underutilized park and is being improved in accordance with the goals of PlaNYC. Ms. Lapin is overseeing AKRF's hazardous materials investigations including environmental and remediation-related work. AKRF prepared the Environmental Assessment Statement (EAS) and the project has moved into the design and construction phase. The remediation/construction of multiple phases of the development is currently underway.

164 Kent Avenue, Brooklyn, NY (AKA Northside Piers and 1 North 4th Place)

The project was a multi-phase development consisting of a large waterfront block in the Williamsburg Rezoning Area. The project site has been developed with a mixed-use residential-commercial high rise towers with an esplanade and a pier along the East River. AKRF provided acquisition and development support, including performing Phase I and II environmental site assessments, and preparation of Remedial Action Plans (RAPs) and Construction Health and Safety Plan (CHASPs) for approval by DEP and OER. AKRF provided assistance with construction oversight during soil handling activities and managing the Community Air Monitoring Plan (CAMP) activities. To date, closure reports have been prepared and occupancy achieved for three of the four buildings. Ms. Lapin is the Professional Engineer (P.E.) of record for the DEP and OER RAPs, CHASPs and Remedial Closure Reports (RCRs).

Rego Park Home Depot, Queens, NY

Solvent contamination was encountered during retail development of a former industrial property in Rego Park, Queens, New York. The site work included an extensive investigation and a multi-phase remediation performed under the NYSDEC Voluntary Cleanup Program (BCP). Remediation included removal of aboveground and underground storage tanks (ASTs and USTs) and hotspot soil removal. An Air Sparging/Soil Vapor Extraction (AS/SVE) groundwater remediation system designed by AKRF was installed as part of the building construction. Continued remediation work included upgrading and expanding the AS/SVE system after the store was opened. AKRF prepared the Final Engineering Report and obtained closure with a Release and Covenant Not to Sue issued by NYSDEC in 2013. AKRF continues operations, maintenance, and monitoring under the NYSDEC-approved Site Management Plan. Ms. Lapin is the Professional Engineer (P.E.) of record for the remediation design and implementation in accordance with the NYSDEC Brownfield Cleanup Program (BCP).

250 North 10th Street, LLC., Residential Redevelopment Site, Brooklyn, NY

AKRF was retained to investigate and remediate this former industrial property in the Williamsburg section of Brooklyn, New York in connection with site redevelopment. The site is approximately 50,000 square feet, and redevelopment included a six story residential building and parking garage. The work was completed to satisfy the requirements of the NYC E-designation Program and NYC Voluntary Cleanup Program (NYC VCP). AKRF completed a Remedial Investigation (RI) to evaluate the nature and extent of site contamination, and developed a Remedial Action Work Plan (RAWP) to properly address site contamination during redevelopment. Remediation included removal of underground storage tanks, more than 7,500 tons of contaminated soil, and installation of a vapor barrier and site cap across the entire property. The remediation was completed under oversight of the NYC Office of Environmental Remediation (OER), and in a manner that has rendered the Site protective of public health and the environment consistent with residential use of the property. Ms. Lapin is the Professional Engineer (P.E.) of record for the remedial effort in accordance with the OER Voluntary Cleanup Program (VCP).

AP-Williamsburg, LLC, 50 North 5th Street Development, Brooklyn, NY

AKRF directed the remedial program at a 55,000-square foot site located in the Williamsburg section of Brooklyn, New York. The site had an industrial and manufacturing history for over 100 years that included a barrel making factory, use of kilns, and a carpet and flooring materials warehouse. AKRF completed a Remedial Investigation (RI) to evaluate the nature and extent of site contamination, and developed a Remedial Action Work Plan (RAWP) to properly address site contamination during redevelopment. Remediation included removal of more than 5,000 tons of contaminated soil, and installation of a vapor barrier and sub-slab depressurization system (SSDS) beneath the site building. The remediation was completed in a manner that has rendered the Site protective of public health and the environment consistent with commercial and residential use of the property, and in accordance with the requirements of the NYC OER E-designation program. The site includes a seven story residential apartment building with street level retail space and a parking garage. Ms. Lapin is the Professional Engineer (P.E.) of record for the NYC OER RAWP and Remedial Closure Report (RCR).

New York City School Construction Authority (SCA), Environmental Consulting Hazardous Materials Services

The SCA was established by the New York State government to construct school facilities to reduce overcrowding and to provide new schools in growing neighborhoods. Focusing on the environmental consulting services, dating back to the 1980s and the days of the New York City Board of Education, the firm continues to provide broad support to SCA's effort, including environmental assessments in meeting the requirements of the State Environmental Quality Review Act (SEQRA), and site selection and property acquisition support for potential new sites. AKRF is currently serving under three individual on-call contracts for site acquisition and environmental consulting services, hazardous materials consulting services, and architectural and engineering services.

AKRF has undertaken various assignments under two consecutive hazardous materials on-call contract, including environmental assessment, remedial design, and plumbing disinfection consulting tasks. For potential new school sites, assignments include initial due diligence, Phase I environmental site assessments (ESAs) and multi-media subsurface investigation of soil, groundwater, and soil vapor to determine the suitability of a site for development as a school, likely remediation requirements, and associated costs. For sites undergoing design and development, assignments include preparation of remediation plans, design of sub-slab depressurization systems (SSDS) and contract specifications, and construction oversight. The work has also included conducting Phase I ESAs and indoor air quality testing, preparation of specifications, supervision of storage tank removals, and investigation and remediation of spills for existing schools. Due to the sensitivity of school sites, work under this contract is often conducted on short notice and during non-school hours. Ms. Lapin is the QA/QC officer for all of the SCA hazardous materials assignments and the Professional Engineer (P.E.) of record for the various remediation systems, including sub-slab depressurization systems (SSDS).

DEBORAH SHAPIRO, QEP

TECHNICAL DIRECTOR

Deborah Shapiro is a Technical Director with more than 16 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 was also a panelist at the Northeast Sustainable Communities Workshop that was held in May 2012.

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

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

Bradhurst Cornerstone II Residences, Manhattan, NY

AKRF, Inc. prepared a Part 58 Environmental Assessment and a City Environmental Quality Review Environmental Assessment Statement for the Bradhurst Cornerstone II Apartments project. Issues of concern for the environmental review included the identification of project commitments for certain of the four sites related to historic resources, hazardous materials, air quality, and building attenuation. As part of the mitigation of hazardous materials, AKRF conducted a Phase II investigation, and prepared a Remedial Action Plan and Construction Health and Safety Plan.

Lambert Houses, Bronx, NY

AKRF performed a Phase I ESA of the Lambert Houses affordable housing complex located in the West Farms section of the Bronx, NY. Lambert Houses consisted of multi-story apartment buildings, parking garage, and a multi-tenant retail/commercial building alongside the elevated NYC subway. AKRF also conducted a vapor intrusion screen of the Property to satisfy HUD's vapor intrusion requirements. The Phase I and vapor intrusion screens were prepared in accordance with ASTM E1527-05, ASTM E2600, and EPA's All Appropriate Inquiry (AAI) rule.

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.

Brook 156, Bronx, NY

AKRF performed a Phase I ESA of two lots located at the northeast intersection of Brook Avenue and East 156th Street in the Bronx, NY. One lot was a NYC-owned former gasoline service station and the other lot was a former railroad. In addition, AKRF conducted a vapor intrusion screen of the Property to satisfy HUD's vapor intrusion requirements. The Phase I and vapor intrusion screens were prepared in accordance with ASTM E1527-05, ASTM E2600, and EPA's All Appropriate Inquiry (AAI) rule.

La Terrazza, Cornerstone Site B-1, Bronx, NY

Ms. Shapiro provided environmental consulting services to an affordable housing developer who purchased a property in the Melrose Commons section of the Bronx, New York. The Phase I ESA revealed that a portion of the Property was historically used as a drycleaner. The Phase II showed that tetrachloroethene (PCE) was present in the soil gas beneath the building, within perched groundwater and groundwater within the bedrock fractures at levels indicating possible DNAPL. Based on the results of the Phase II, a NYSDEC Brownfield Cleanup Program (BCP) Application was completed on behalf of the developer as a "Volunteer" to eliminate off-site liability. The redevelopment site consisted of three adjacent lots; however only two were accepted into the BCP and included in the BCP Agreement. A remedial action work plan (RAWP) was completed and approved by NYSDEC within a few months to enable redevelopment work for a new affordable housing complex with underground parking and retail on the first floor. The RAWP included the removal of aboveground storage tanks, excavation of soil to 15 feet below grade site wide, in-situ chemical oxidation injections, a multi-well pump and treat system for the recovery of non-aqueous and dissolved phase contamination in groundwater within the bedrock fractures, and installation of a composite cover system. Ms. Shapiro directed the remedial activities and monitoring for additional potential contamination during construction. The groundwater remediation system was installed during site development and began operation once development was complete. Although only two lots were accepted into the program, intuitional and engineering control measures were incorporated into the entire redevelopment site to protect future building occupants. The Certificate of Completion (COC) for this site was received within two years after conducting the Phase II. The COC enabled the developer to receive tax credits from NYS. In addition, this project was the recipient of the 2011 Big Apple Brownfield Award.

Tenant Inspection Program, Multiple Locations, NY

Ms. Shapiro directed a Tenant Inspection Program for a landlord who owned 1.2 million square feet of multi-tenanted industrial and commercial properties located in Queens, Nassau, and Suffolk counties for nearly a decade. The Tenant Inspection Program was a compliance program established to address concerns that certain tenant's operations may have been negatively impacting the property. The program included an annual inspection of each tenant space to determine their processes, chemical usage, waste disposal habits, current permits, and fire safety procedures. In addition, each sanitary system was sampled for chemical constituents identified during the inspections and approximately 300 exterior storm drains were inspected for evidence of illegal discharges or dumping. Based on the results of the inspection and sampling, letter reports were sent to the tenants informing them of any issues and educating them on best practices. Each tenant was assisted with regulatory compliance, permitting, and health and safety. The landlord received a report for each building detailing the findings of the inspection and sampling, and any follow-up actions. The landlord became educated on environmental issues and was able to incorporate the cost for this program and environmental compliance requirements into their leases as common area maintenance (CAM) charges. This resulted in a direct improvement in tenant housekeeping practices and enabled the landlord to obtain a comprehensive environmental insurance policy covering the entire property portfolio.

Federal Express at JFK Airport, Jamaica, NY

Ms. Shapiro served as a senior scientist during the investigation and remediation of a petroleum spill at the Federal Express Hanger located at JFK Airport. The investigation included the installation and sampling of a network of monitoring wells located within the hanger as well as on the tarmac. A remedial action work plan (RAWP) was completed and approved by the New York State Department of Environmental Conservation (NYSDEC). The RAWP included the removal of free-floating petroleum products and installation and operation of an air sparge/soil vapor extraction system.

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 5 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

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.

JENNIFER PENSKY

ENVIRONMENTAL SCIENTIST

Jennifer Pensky is an Environmental Scientist in AKRF's Hazardous Materials Department with experience in preparing Phase I environmental site assessments; soil, soil vapor, and groundwater sampling; and construction monitoring and oversight. Ms. Pensky also has environmental fieldwork experience from research projects at Columbia University's Lamont-Doherty Earth Observatory.

BACKGROUND

Role in Project
Field Technician

Education
B.A., Environmental Science, Barnard College of Columbia University, 2015

Certifications
OSHA 40-hour Health & Safety Training for Hazardous Waste Operations, August 2015 (to be completed)
OSHA 10-hour Construction Safety & Health Course, June 2015

Years of experience
Date started at AKRF: June 2015
Prior industry experience: Lamont-Doherty Earth Observatory – Research Intern (1 year)
Columbia University Department of Earth and Environmental Science – Teaching Assistant for Earth's Environmental Systems: Solid Earth (introductory geology) (1 year)

RELEVANT EXPERIENCE - AKRF

2 North 6th Place, Williamsburg, Brooklyn, NY – Environmental Monitoring

Investigation and remediation of the Site is being conducted under the New York City Office of Environmental Remediation. AKRF completed a Phase I Environmental Site Assessment, Phase II Subsurface Investigation, and prepared a Remedial Action Plan (RAP) and Construction Health and Safety Plan. For this project, Ms. Pensky served as an on-site environmental monitor who sampled soil, oversaw soil excavation and export, conducted air quality monitoring and airborne dust screening, and prepared daily summary reports for submittal to the OER project manager.

606 West 57th Street, Manhattan, NY – Environmental Monitoring

Investigation and remediation of the Site is being conducted under the New York City Office of Environmental Remediation. AKRF completed a Phase I Environmental Site Assessment, Phase II Subsurface Investigation, and prepared a Remedial Action Plan (RAP) and Construction Health and Safety Plan. For this project, Ms. Pensky served as an on-site environmental monitor who oversaw soil excavation and export and conducted air quality monitoring and airborne dust screening.

NYU Langone Medical Center, Manhattan, NY – Environmental Monitoring

Investigation and remediation of the Site is being conducted under the New York City Office of Environmental Remediation. AKRF completed a Phase I Environmental Site Assessment, Phase II Subsurface Investigation, and prepared a Remedial Action Plan (RAP) and Construction Health and Safety Plan. For this project, Ms. Pensky served as an on-site environmental monitor who oversaw soil excavation and export and conducted air quality monitoring and airborne dust screening.

Various Sites - Environmental Monitoring

Ms. Pensky served as an on-site environmental monitor at additional construction sites in the Bronx, Manhattan, and Staten Island. In this role, she oversaw soil excavation and export and conducted air quality monitoring and airborne dust screening.

Lambert Houses, Bronx, NY – Phase I ESA

Ms. Pensky helped to prepare a Phase I Environmental Site Assessment for the Lambert Houses. As part of the assessment, Ms. Pensky attended the site inspection, reviewed federal and state regulatory databases, and evaluated historical fire insurance maps and building records from the City of New York to identify recognized environmental conditions (RECs) and environmental concerns.

Metropolitan Museum of Art, Manhattan, NY – Phase I ESA

Ms. Pensky helped to prepare a Phase I Environmental Site Assessment for the Museum. As part of the assessment, Ms. Pensky conducted a site visit, reviewed federal and state regulatory databases, and evaluated historical fire insurance maps and building records from the City of New York to identify recognized environmental conditions (RECs) and environmental concerns.

American Museum of Natural History, Manhattan, NY – Phase I ESA

Ms. Pensky helped to prepare a Phase I Environmental Site Assessment for the Museum. As part of the assessment, Ms. Pensky conducted a site visit, reviewed federal and state regulatory databases, and evaluated historical fire insurance maps and building records from the City of New York to identify recognized environmental conditions (RECs) and environmental concerns.

111-12 Astoria Boulevard, Queens, NY – Phase I ESA

Ms. Pensky helped to prepare a Phase I Environmental Site Assessment for this warehouse and vacant commercial property. As part of the assessment, Ms. Pensky conducted a site visit, reviewed federal and state regulatory databases, and evaluated historical fire insurance maps and building records from the City of New York to identify recognized environmental conditions (RECs) and environmental concerns.

163 Columbia Street, Brooklyn, NY – Phase II ESI

Ms. Pensky assisted with soil, soil vapor, and groundwater sampling as part of a Phase II Environmental Site Investigation done by AKRF.

621 86th Street, Brooklyn, NY – Phase II ESI

Ms. Pensky assisted with soil and soil vapor sampling as part of a Phase II Environmental Site Investigation done by AKRF.

Seward Park, Manhattan, NY – Waste Characterization Soil Sampling

Ms. Pensky assisted with soil sampling as part of a waste characterization report prepared by AKRF.

1227 Broadway, Manhattan, NY – Waste Characterization Soil Sampling

Ms. Pensky assisted with soil sampling as part of a waste characterization report prepared by AKRF.

525-545 East 73rd Street, Manhattan, NY – Groundwater Well Monitoring, Sampling, and Vacuum Extraction

Ms. Pensky assisted with monitoring groundwater wells as part of spill closure activities done by AKRF for the New York City Department of Environmental Conservation. As a part of the monitoring, Ms. Pensky gauged groundwater well levels, took groundwater samples, and provided oversight during Vacuum Enhanced Fluid Recovery.

P.S. 391M, Manhattan, NY – Training for Water Disinfection and Sampling Oversight

AKRF provided oversight of disinfection and water quality testing for the NYCSCA at P.S. 391M, Manhattan, New York. Ms. Pensky assisted with oversight of the disinfection and sampling of the new interior domestic water lines at this school.

P.S. 343M, Manhattan, NY – Training for Water Disinfection and Sampling Oversight

AKRF provided oversight of disinfection and water quality testing for the NYCSCA at P.S. 343M, Manhattan, New York. Ms. Pensky assisted with oversight of the water quality testing of the new interior domestic water lines at this school.

P.S. 445M, Manhattan, NY – Training for Water Disinfection and Sampling Oversight

AKRF provided oversight of disinfection and water quality testing for the NYCSCA at P.S. 343M, Manhattan, New York. Ms. Pensky assisted with oversight of the water quality testing of the new interior domestic water lines at this school.

P.S. 90K, Brooklyn, NY – Training for Water Disinfection and Sampling Oversight

AKRF provided oversight of disinfection and water quality testing for the NYCSCA at P.S. 391M, Manhattan, New York. Ms. Pensky assisted with oversight of the disinfection and sampling of the new interior domestic water lines at this school.

P.S. 170K, Brooklyn, NY – Training for Water Disinfection and Sampling Oversight

AKRF provided oversight of disinfection and water quality testing for the NYCSCA at P.S. 391M, Manhattan, New York. Ms. Pensky assisted with oversight of the water quality testing of the new interior domestic water lines at this school.

ADRIANNA BOSCO

PROFESSIONAL II

Adrianna Bosco is a Professional II in AKRF's Hazardous Materials Department. She has experience in Phase I and Phase II site investigations and remediation/construction monitoring and oversight, as well as project management and reporting. Ms. Bosco is a 2011 graduate of Manhattan College, where she studied Environmental Engineering. She worked as an Environmental Scientist for PS&S Engineering, Inc. prior to joining AKRF.

BACKGROUND

Education

B.S., Environmental Engineering, Manhattan College, Bronx, New York, 2011

Licenses/Certifications

40 Hour OSHA HAZWOPER Certified, September 2011

10 Hour OSHA Construction Program Certified, October 2013

Years of Experience

Date started at AKRF: July 2014

Prior industry experience: PS&S Engineering, Inc. December 2011 – July 2014 (2 years, 7 months)

Office Address

440 Park Avenue S, 7th Floor, New York, NY 10016

Phone

646.388.9576

Fax

212.726.0942

Email

abosco@akrf.com

RELEVANT EXPERIENCE

541 West 37th Street, Manhattan, NY

Ms. Bosco conducted a Phase I Environmental Site Assessment (ESA) and Subsurface (Phase II) Investigation for this vacant property in the Hell's Kitchen section of Manhattan. The investigation has been conducted under OER as the site lots have an E Designation for hazardous materials. Ms. Bosco prepared the Remedial Action Work Plan for the proposed remediation of the site for the anticipated future use as a hotel and residential building.

Elton Crossing, Bronx, NY

This project consists of the remediation of an approximately 0.73-acre site formerly utilized for various industrial and automotive uses under the New York State Department of Environmental Conservation (NYSDEC) Brownfield Cleanup Program (BCP). Ms. Bosco provided remedial oversight during soil excavation, confirmatory endpoint sampling, sub-slab depressurization system (SSDS) piping installation and inspections, vapor barrier installation, and air monitoring for particulates and volatile organic compounds (VOCs).

145 West Street, Greenpoint, Brooklyn, NY

Investigation and remediation of this site of a high-rise residential building on the Greenpoint waterfront has been conducted under the NYSDEC BCP, and remediation for redevelopment was also conducted under New York City Office of Environmental Remediation (OER) as the site lots have an E Designation for hazardous materials. For this project, Ms. Bosco conducted a supplemental remedial investigation, including soil and groundwater sampling, and several rounds of waste characterization soil sampling. Ms. Bosco also performed remedial oversight during activities such as soil excavation and off-site disposal, underground storage tank (UST) removal, SSDS piping installation and testing, and routine air monitoring. Ms. Bosco also aided in the preparation of the Final Engineering Report (FER) and Site Management Plan (SMP).

Soundview Park, Bronx, NY

This project consists of reconstruction and enhancement of a 205-acre park in the Bronx. The site was historically a landfill and later backfilled with sanitation fill material prior to park construction. Remediation of this site included the excavation and disposal of contaminated soil and placement of clean fill. Ms. Bosco performed environmental monitoring in compliance with the Construction Health and Safety Plan (CHASP) and Remedial Action Plan (RAP) during the excavation and disposal of historic fill and solid waste. Ms. Bosco was also responsible for conducting air quality monitoring for volatiles and particulates during all soil disturbance activities.

Former Laundry/Dry Cleaning Plant, Harlem, New York

This former dry cleaning property, now a privately owned commercial facility, is the only NYSDEC listed hazardous waste site in Manhattan. The final Remedial Action Work Plans for the site were approved in 2012 and 2013. Remedial work includes removal of contaminated building materials, installation of a soil vapor extraction (SVE) system and SSDS, and in-situ soil and groundwater treatment with chemical-oxidation injection. Ms. Bosco performed remedial action oversight, including SSDS piping installation inspections and Health and Safety Plan (HASP) air monitoring for volatiles and particulates.

PS&S Engineering, Inc. (PS&S), Yonkers, NY

Before joining AKRF, Ms. Bosco was an Environmental Scientist I in the Environmental Department at PS&S. She was responsible for conducting site investigations and providing construction oversight for remediation projects in New York and New Jersey. As a staff scientist, she was responsible for the on-site supervision of subcontractors and interacting with project managers and client representatives. Ms. Bosco also prepared technical reports, work plans, monitoring logs, and Phase I Environmental Site Assessments.

NICHOLAS C. STRACCIONE

24 Apple Way
Marlton, NJ 08053
609-580-9756
nick.straccione@gmail.com

QUALIFICATIONS:

More than fifteen years of diversified laboratory experience ● Emphasis in the environmental field ● International and multiple site responsibility ● Budget planning and budget responsible ● Chemical analysis ● Quality assurance ● Extensive management experience ● Project management ● Interact and prepare reports for a diversity of government agencies ● Knowledge of OSHA, HAZMAT, EPA, DOD, and various federal and state requirements ● Data Integrity training ● Client relations ● Internal and external audits ● Train and evaluate personnel ● Maintain laboratory test equipment ● Volatile and semi-volatile departments ● Operations and production management ● Marketing via printed media, trade shows, events, and internet ● Field sampling ● Purchasing including vendor negotiations ● Known among my peers and employers for my organizational skills and ability to perform multiple projects

- Created a mobile laboratory concept which allowed on-site testing and immediate analyzation of results for site remediation.
- Effective trainer, mentor, and teacher. Train personnel in diversified testing procedures, use or laboratory equipment, Software usage, client relations, and corporate protocol.

EXPERIENCE:

SGS ACCUTEST Inc. DAYTON, NJ
An environmental testing laboratory.
Quality Assurance Manager 2013- Present

- Responsible for daily quality assurance activities of Dayton, NJ laboratory.
- Manage all aspects of Quality system: Corrective action database, Training (local and corporate), Data Integrity and Ethics training and monitoring, Data Integrity Investigations, Internal and external audits, Laboratory Traceability, Client complaints, Document Control, Update Quality System Manual, Create Annual Management Review for CEO/Directors, Maintain and update Standard Operating Procedure Directory, Review Quality Assurance Plans for accuracy, Certification requirements, MDL studies and verifications, Method revisions, Control limits, Proficiency tests, Metrics certifications, Demonstration of capability tracking, Electronic monitoring for data validation, Enforce safety procedures.
- Manage a staff of five Quality Assurance personnel.
- Assist other laboratories in Accutest's network on Quality assurance matters. Including travel to network laboratories to implement corrective actions plans that will satisfy state or other regulatory programs.
- Coordinate ongoing improvement of corporate Quality Assurance programs.
- Participate on state and regulatory committee's to maintain current with standard method requirements.
    - New Jersey Department of Environmental Protection (NJDEP) - Environmental Laboratory Advisory Committee (ELAC), Secretary.
    - The NELAC Institute (TNI) -Associate Member, Laboratory Accreditation System Executive Committee (LASEC).
    - NJDEP - Groundwater Quality Standards Rule Stakeholder.

XENCO LABORATORY LLC MIAMI LAKES, FL/MARLTON, NJ
An environmental testing laboratory.
Regional Manager 2005 to 2013
Operations Manager/Mobile Laboratory Supervisor 2001 to 2005

- Collaborated in the start-up of a major multiservice laboratory serving Florida and the Caribbean. Developed new methods and procedures based on EPA guidelines.

- Assisted with integrating acquisition laboratories to Xenco's network. Trained new personnel on Xenco's system, supported client services for major clients during transitional phase and provided additional support with daily operations.

- Sent to other facilities to improve operating procedures and relieve shortages of personnel.

- Methods and instrumentation run at multiple laboratories: SW8260/8021 Volatiles by GC-MS/GC-PID, SW 8270 Semi-volatiles by GC-MS, SW 8081/8082 Pesticides/PCB's by GC-ECD, SW 8015 Total Petroleum Hydrocarbons by GC-FID, SW 8310 PAH's by HPLC, E300 Anions - Metrohm IC, Metals SW6020 – ICP-MS, Various Wet Chemistry parameters: COD (chemical oxygen demand), BOD (biological oxygen demand), pH, Temperature, Total coliform, Hexavalent Chromium, responsible for Contract Laboratory Program (CLP) reporting format.

SOUTHERN GROUTS AND MORTARS POMPANO BEACH, FL
A manufacturer of concrete pool liners.
Project Manager & QC Manager 2000 to 2001
Research Assistant 1999 to 2000

- Quality control manager for 3 facilities in Florida. Responsible for making sure production material met quality control limits. Tested product complaint material for all 3 facilities to verify or negate consumers complaint.
- Lead Project manager for new large scale production of blue colored quartz project. Assisted in development in laboratory of blue quartz and implemented into large scale production.

- Research and development assistant that re-formulated current products to make more efficient and cost effective. Create new products as industry needed.

SPECTRUM LABORATORIES POMPANO BEACH, FL
An environmental testing laboratory.
Laboratory Technician 1997 to 1999

- Assisted in Metals Department using ICP and AA (atomic absorption) instrumentation.

- Performed extractions and assisted in Wet Chemistry areas

NOVA SOUTHEASTERN UNIVERSITY DAVIE, FL
A four year college.
Teaching Assistant,
General and Organic Laboratories, part-time 1998 to 2001

EDUCATION:

NOVA SOUTHEASTERN UNIVERSITY FT. LAUDERDALE, FL
Master of Science Degree: Marine Biology 2001

RICHARD STOCKTON COLLEGE POMONA, NJ
Bachelor of Science Degree: Marine Biology 1998
Included studies abroad at University of Wollongong Australia in the Fall of 1996.

*References available upon request

Form **W-9**
(Rev. December 2011)
Department of the Treasury
Internal Revenue Service

Request for Taxpayer Identification Number and Certification

Give Form to the requester. Do not send to the IRS.

Print or type
See Specific Instructions on page 2.

Name (as shown on your income tax return): L.A.B VALIDATION CORP

Business name/disregarded entity name, if different from above:

Check appropriate box for federal tax classification:
☐ Individual/sole proprietor ☐ C Corporation ☒ S Corporation ☐ Partnership ☐ Trust/estate

☐ Limited liability company. Enter the tax classification (C=C corporation, S=S corporation, P=partnership) ▶

☐ Other (see instructions) ▶

☐ Exempt payee

Address (number, street, and apt. or suite no.): 14 WEST POINT DRIVE

City, state, and ZIP code: EAST NORTHPORT, New York 11731

Requester's name and address (optional):

List account number(s) here (optional):

Part I Taxpayer Identification Number (TIN)

Enter your TIN in the appropriate box. The TIN provided must match the name given on the "Name" line to avoid backup withholding. For individuals, this is your social security number (SSN). However, for a resident alien, sole proprietor, or disregarded entity, see the Part I instructions on page 3. For other entities, it is your employer identification number (EIN). If you do not have a number, see *How to get a TIN* on page 3.

Note. If the account is in more than one name, see the chart on page 4 for guidelines on whose number to enter.

Social security number

_ _ _ - _ _ - _ _ _ _

Employer identification number

58 - 2381714

Part II Certification

Under penalties of perjury, I certify that:

1. The number shown on this form is my correct taxpayer identification number (or I am waiting for a number to be issued to me), and
2. I am not subject to backup withholding because: (a) I am exempt from backup withholding, or (b) I have not been notified by the Internal Revenue Service (IRS) that I am subject to backup withholding as a result of a failure to report all interest or dividends, or (c) the IRS has notified me that I am no longer subject to backup withholding, and
3. I am a U.S. citizen or other U.S. person (defined below).

Certification instructions. You must cross out item 2 above if you have been notified by the IRS that you are currently subject to backup withholding because you have failed to report all interest and dividends on your tax return. For real estate transactions, item 2 does not apply. For mortgage interest paid, acquisition or abandonment of secured property, cancellation of debt, contributions to an individual retirement arrangement (IRA), and generally, payments other than interest and dividends, you are not required to sign the certification, but you must provide your correct TIN. See the instructions on page 4.

Sign Here Signature of U.S. person ▶ Lori A. Berger Date ▶ 01/18/13

General Instructions

Section references are to the Internal Revenue Code unless otherwise noted.

Purpose of Form

A person who is required to file an information return with the IRS must obtain your correct taxpayer identification number (TIN) to report, for example, income paid to you, real estate transactions, mortgage interest you paid, acquisition or abandonment of secured property, cancellation of debt, or contributions you made to an IRA.

Use Form W-9 only if you are a U.S. person (including a resident alien), to provide your correct TIN to the person requesting it (the requester) and, when applicable, to:

1. Certify that the TIN you are giving is correct (or you are waiting for a number to be issued),

2. Certify that you are not subject to backup withholding, or

3. Claim exemption from backup withholding if you are a U.S. exempt payee. If applicable, you are also certifying that as a U.S. person, your allocable share of any partnership income from a U.S. trade or business is not subject to the withholding tax on foreign partners' share of effectively connected income.

Note. If a requester gives you a form other than Form W-9 to request your TIN, you must use the requester's form if it is substantially similar to this Form W-9.

Definition of a U.S. person. For federal tax purposes, you are considered a U.S. person if you are:

- An individual who is a U.S. citizen or U.S. resident alien,
- A partnership, corporation, company, or association created or organized in the United States or under the laws of the United States,
- An estate (other than a foreign estate), or
- A domestic trust (as defined in Regulations section 301.7701-7).

Special rules for partnerships. Partnerships that conduct a trade or business in the United States are generally required to pay a withholding tax on any foreign partners' share of income from such business. Further, in certain cases where a Form W-9 has not been received, a partnership is required to presume that a partner is a foreign person, and pay the withholding tax. Therefore, if you are a U.S. person that is a partner in a partnership conducting a trade or business in the United States, provide Form W-9 to the partnership to establish your U.S. status and avoid withholding on your share of partnership income.

Lori A. Beyer

SUMMARY: General Manager/Laboratory Director with a solid technical background combined with Management experience in environmental testing industry. Outstanding organizational, leadership, communication and technical skills. Customer focused, quality oriented professional with consistently high marks in customer/employee satisfaction.

EXPERIENCE:

1998-Present L.A.B. Validation Corporation, 14 West Point Drive, East Northport, NY
President

- Perform Data Validation activities relating to laboratory generated Organic and Inorganic Environmental Data.

1998-Present American Analytical Laboratories, LLC. 56 Toledo Street, Farmingdale, NY
Laboratory Director/Technical Director

- Plan, direct and control the operation, development and implementation of programs for the entire laboratory in order to meet AAL's financial and operational performance standards.
- Ensures that all operations are in compliance with AAL's QA manual and other appropriate regulatory requirements.
- Actively maintains a safe and healthy working environmental that is demanded by local laws/regulations.
- Monitors and manages group's performance with respect to data quality, on time delivery, safety, analyst development/goal achievement and any other key performance indices.
- Reviews work for accuracy and completeness prior to release of results to customers.

1996-1998 Nytest Environmental, Inc. (NEI) Port Washington, New York
General Manager

- Responsible for controlling the operation of an 18,000 square foot facility to meet NEI's financial and operational performance standards.
- Management of 65 FTEs including Sales and Operations
- Ensure that all operations are in compliance with NEI's QA procedures
- Ensures that productivity indicators, staffing levels and other cost factors are held within established guidelines
- Maintains a quantified model of laboratory's capacity and uses this model as the basis for controlling the flow of work into and through the lab so as to ensure that customer requirements and lab's revenue and contribution targets are achieved.

1994-1996 Nytest Environmental, Inc. (NEI) Port Washington, New York
Technical Project Manager

- Responsible for the coordination and implementation of environmental testing programs requirements between NEI and their customers
- Supervise Customer Service Department
- Assist in the development of major proposals
- Complete management of all Federal and State Contracts and assigned commercial contracts
- Provide technical assistance to the customer, including data validation and interpretation
- Review and implement Project specific QAPP's.

1995-1996 Nytest Environmental, Inc. (NEI) Port Washington, New York
Corporate QA/QC Officer

- Responsible for the implementation of QA practices as required in the NJDEP and EPA Contracts
- Primary contact for NJDEP QA/QC issues including SOP preparation, review and approval
- Responsible for review, verification and adherence to the Contract requirements and NEI QA Plan

1992-1994 Nytest Environmental, Inc. (NEI) Port Washington, New York
Data Review Manager

- Responsible for the accurate compilation, review and delivery of analytical data to the company's customers. Directly and effectively supervised a department of 22 personnel.
- Managed activities of the data processing software including method development, form creation, and production
- Implement new protocol requirements for report and data management formats
- Maintained control of data storage/archival areas as EPA/CLP document control officer

1987-1991 Nytest Environmental, Inc. (NEI) Port Washington, New York
Data Review Specialist

- Responsible for the review of GC, GC/MS, Metals and Wet Chemistry data in accordance with regulatory requirements
- Proficient with USEPA, NYSDEC, NJDEP and NEESA requirements
- Review data generated in accordance with SW846, NYSDEC ASP, EPA/CLP and 40 CFR Methodologies

1986-1987 Nytest Environmental, Inc (NEI) Port Washington, New York
GC/MS VOA Analyst

EDUCATION:

1982-1985 State University of New York at Stony Brook, New York; BS Biology/Biochemistry
1981-1982 University of Delaware; Biology/Chemistry
5/91 Rutgers University; Mass Spectral Data Interpretation Course, GC/MS Training
8/92 Westchester Community College; Organic Data Validation Course
9/93 Westchester Community College; Inorganic Data Validation Course

Westchester Community College
Professional Development Center

Awards this Certificate of Achievement To

LORI BEYER

for Successfully Completing

ORGANIC DATA VALIDATION COURSE (35 HOURS)

Dr. John Samuelian

Date AUGUST 1992

Assistant Dean
Professional Development Center

President

The Professional
Development Center

SUNY
WESTCHESTER COMMUNITY COLLEGE
Valhalla, New York 10595

Westchester Community College
Professional Development Center

Awards this Certificate of Achievement To

LORI BEYER

for Successfully Completing

INORGANIC DATA VALIDATION

Instructor: Dale Boshart

Date MARCH 1993

Assistant Dean
Professional Development Center

President

The Professional
Development Center

SUNY
WESTCHESTER COMMUNITY COLLEGE
Valhalla, New York 10595

New York State Department of Environmental Conservation
50 Wolf Road, Albany, New York 12233

Thomas C. Jorling
Commissioner

July 8, 1992

Ms. Elaine Sall
Program Coordinator
Westchester Community College
Valhalla, NY 10595-1698

Dear Elaine,

Thank you for your letter of June 29, 1992. I have reviewed the course outline for organic data validation, qualifications for teachers and qualifications for students. The course that you propose to offer would be deemed equivalent to that which is offered by EPA. The individuals who successfully complete the course and pass the final written exam would be acceptable to perform the task of organic data validation for the Department of Environmental Conservation, Division of Hazardous Waste Remediation.

As we have discussed in our conversation of July 7, 1992, you will forward to me prior to the August course deadline, the differences between the EPA SOW/90 and the NYSDEC ASP 12/91. You stated these differences will be compiled by Mr. John Samulian.

I strongly encourage you to offer an inorganic data validation course. I anticipate the same list of candidates would be interested in an inorganic validation course as well, since most of the data to be validated consists of both organic and inorganic data.

Thank you for you efforts and please contact me if I can be of any further assistance.

Sincerely,

Maureen P. Serafini

Maureen P. Serafini
Environmental Chemist II
Division of Hazardous Waste
Remediation

The Professional Development Center
AT
WESTCHESTER COMMUNITY COLLEGE

914 285-6619

October 2, 1992

Ms. Lori Beyer
3 sparkill Drive
East Northport, NY 11731

Dear Ms. Beyer:

Congratulations upon successful completion of the Organic Data Validation course held August 17 - 21, 1992, through Westchester Community College, Professional Development Center. This course has been deemed by New York State Department of Environmental Conservation as equivalent to EPA's Organic Data Validation Course.

Enclosed is your Certificate. Holders of this Certificate are deemed competent to perform organic data validation for the New York State DEC Division of Hazardous Waste Remediation.

The Professional Development Center at Westchester Community College plans to continue to offer courses and seminars which will be valuable to environmental engineers, chemists and related personnel. Current plans include a TCLP seminar on November 17th and a conference on Environmental Monitoring Regulations on November 18th.

We look forward to seeing you again soon at another environmental program or event. Again, congratulations.

Very truly yours,

Passing Grade is 70%
Your Grade is 99%

Elaine Sall
Program Coordinator

ES/bf

The Professional
Development Center
AT
WESTCHESTER COMMUNITY COLLEGE

914 285-6619

June 21, 1993

Dear Ms. Beyer:

Enclosed is your graded final examination in the Inorganic Data Validation course you completed this past March. A score of 70% was required in order to receive a certificate of satisfactory completion. Persons holding this certificate are deemed acceptable to perform Inorganic Data Validation for the New York State Department of Environmental Conservation, Division of Hazardous Waste Remediation.

I am also enclosing a course evaluation for you to complete if you have not already done so. The information you provide will greatly aid us in structuring further courses. We wish to make these course offerings as relevant, targeted and comprehensive as possible. Your evaluation is vital to that end.

Congratulations on your achievement. I look forward to seeing you again at another professional conference or course. We will be co-sponsoring an environmental monitoring conference on October 21, 1993 with the New York Water Pollution Control Association, Lower Hudson Chapter, at IBM's Yorktown Heights, NY site. Information regarding this event will be going out in August.

Very truly yours,

Elaine Sall

Elaine Sall
Program Coordinator

ES/bf

Enclosures

SUNY
WESTCHESTER COMMUNITY COLLEGE
Valhalla, New York 10595

APPENDIX B

HEALTH AND SAFETY PLAN

Atlantic Chestnut – Lot 2

235 Chestnut Street

BROOKLYN, NEW YORK

Health and Safety Plan

BCP Site #: C224235
AKRF Project Number: 12493

Prepared for:

Atlantic Chestnut Affordable Housing, LLC
902 Broadway, 13th Floor
New York, New York 10010

Prepared by:

AKRF

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

NOVEMBER 2016

TABLE OF CONTENTS

FIGURES

APPENDICES

1.0 INTRODUCTION

This environmental Health and Safety Plan (HASP) has been developed for implementation of Remedial Investigation (RI) activities conducted by all personnel on-site, both AKRF employees and others, at the redevelopment site (the "Site"). The Site is located at 235 Chestnut Street in the Cypress Hills neighborhood of Brooklyn, New York. The legal definition of the Site is Tax Block 4143, Lot 2. A Site Location plan is provided as Figure 1.

Phase I Environmental Site Assessments (ESA) were conducted at a larger parcel which included the Site by Property Solutions, Inc. (PSI) in June 2010, by Legette, Brashears & Graham, Inc. in March 2014, and by AKRF in September 2015. The ESAs indicated historical uses at the Site included a machine and iron works facility, an electrical cable manufacturer, a gasoline filling station, and a food processing plant. Records also indicated that five underground storage tanks (USTs) were located previously on the Site and the Site was listed in the Leaking Underground Storage Tank (LUST) and Spills databases. Additionally, interconnected factory buildings on the southern portion of the Site were damaged by a fire in 2012. Based on the documented storage of petroleum and chemicals, undocumented discharges due to the fire may have affected the subsurface conditions at the Site.

AKRF's January 2016 Phase II Subsurface Investigation conducted north-adjacent of the Site detected contaminated soil, groundwater, and soil vapor beneath the ground surface. The soil had been contaminated with the chlorinated solvents trichloroethylene (TCE), tetrachloroethylene (PCE), semi-volatile organic compounds, and certain metals including lead and mercury. TCE and PCE were also detected in the groundwater. Petroleum-related and chlorinated solvents were detected in the soil vapor sample with elevated concentrations of the chlorinated solvent TCE, PCE and carbon tetrachloride. The presence of chlorinated solvents in the soil, groundwater and soil vapor samples is likely associated with the historic uses at the Site.

This HASP does not discuss other 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 Company'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
Comments:		

2.1.3 Hazardous Materials

Check all that apply					
Chemicals	**Solids**	**Sludges**	**Solvents**	**Oils**	**Other**
( ) Acids	(**X**) Ash	( ) Paints	( ) Halogens	( ) Transformer	( ) Lab
( ) Caustics	( ) Asbestos	( ) Metals	(**X**) Petroleum	( ) Other DF	( ) Pharm
(**X**) Pesticides	( ) Tailings	( ) POTW	( ) Other	(**X**) Motor or Hydraulic Oil	( ) Hospital
(**X**) Petroleum	(**X**) Other	( ) Other		(**X**) Gasoline	( ) Rad
( ) Inks	Fill material			(**X**) Fuel Oil	( ) MGP
(**X**) PCBs					( ) Mold
(**X**) Metals					( ) Cyanide
(**X**)Other: VOCs & SVOCs					

2.1.4 Chemicals of Concern

Chemicals	REL/PEL/STEL (ppm)	Health Hazards
Barium	PEL = 0.5 mg/m^3 REL = 0.5 mg/m^3	Irritation 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].
Chromium	REL = 0.5 mg/m^3 PEL - 1 mg/m^3	Irritation eyes, skin; lung fibrosis (histologic).
Copper	REL = 1 mg/m^3 PEL = 1 mg/m^3	Irritation eyes, nose, pharynx; nasal septum perforation; metallic taste; dermatitis; in animals: lung, liver, kidney damage; anemia
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 = 0.05 mg/m^3 PEL = 0.05 mg/m^3	Lassitude (weakness, exhaustion), insomnia; facial pallor; anorexia, weight loss, malnutrition; constipation, abdominal pain, colic; anemia; gingival lead line; tremor; paralysis wrist, ankles; encephalopathy; kidney disease; irritation eyes; hypertension.
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.
Polycyclic Aromatic Hydrocarbons (PAHs)	PEL = 5 mg/m^3	Harmful effects to skin, bodily fluids, and ability to fight disease, reproductive problems; potential carcinogen.
Tetrachloroethylene	PEL = 100 ppm	Irritation eyes, skin, nose, throat, respiratory system; nausea; flush face, neck; dizziness, incoordination; headache, drowsiness; skin erythema (skin redness); liver damage; [potential occupational carcinogen].
Trichloroethylene	PEL = 100 ppm	Irritation lung; headaches, dizziness, poor coordination and difficulty concentrating; kidney and liver damage, impaired heart function; impaired immune system function and fetal development in pregnant women [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.
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.

Chemicals	REL/PEL/STEL (ppm)	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 and 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 he/she goes onto the Site. 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
Subsurface Investigation	10 ft from Drill Rig	25 ft 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 Air Monitoring

The purpose of the air monitoring program is to identify any exposure of the field personnel to potential environmental hazards in the soil and groundwater. Results of the air monitoring will be used to determine the appropriate response action, if needed.

2.6.1 Volatile Organic Compounds and Particulates

A photoionization detection (PID) will be used to perform air monitoring during soil disturbance activities to determine airborne levels of total VOCs and a Dust Trak will be used to perform air monitoring during soil disturbance activities to determine airborne levels of particulate (dust). The air monitoring equipment will be calibrated prior to the start of work each day in accordance with the manufacturer's specifications.

2.6.2 Work Zone Air Monitoring

Real time air monitoring will be performed with the PID and Dust Trak. Measurements will be taken prior to commencement of work and continuously during the work, as outlined in the following table. Measurements will be made as close to the workers as practicable and at the breathing height of the workers. The SSO shall set up the equipment and confirm that it is working properly. His/her designee may oversee the air measurements during the day. The initial measurement for the day will be performed before the start of work and will establish the background level for that day. The final measurement for the day will be performed after the end of work. The action levels and required responses are listed in the following table:

Instrument	Action Level	Response Action
PID	Less than 5 ppm in breathing zone	Level D or D-Modified
	Between 5 ppm and 10 ppm	Level C
	More than 10 ppm	Stop work. Resume work when readings are less than 10 ppm.
Dust Trak	Less than 1.25 mg/m^3 above background in breathing zone	Level D or D-Modified
	More than 1.25 mg/m^3 above background in breathing zone	Stop work. Resume work when readings are less than 1.25 mg/m^3.

Instrument	Action Level	Response Action
mg/m^3 = micrograms per cubic meter ppm = parts per million		

2.7 Personal Protection Equipment

The personal protection equipment 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		Excavation/ Sampling
Level D (**X**) Steel Toe Shoes (**X**) Hard Hat (within 25 ft of drill rig) (**X**) Work Gloves	(**X**) Safety Glasses ( ) Face Shield (**X**) Ear Plugs (within 25 ft 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).		

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 provided as Figure 2.

3.1 Hospital Directions

Hospital Name:	Brookdale Hospital
Phone Number:	718-240-5363
Address/Location:	1235 Linden Boulevard, Brooklyn, NY 11212
Directions:	1. Head north on Chestnut Street towards Fulton Street. 2. Turn right onto Fulton Street. 3. Turn right onto Euclid Avenue. 4. Turn right onto Atlantic Avenue. 5. Use the right lane to continue on South Conduit Boulevard W. 6. Slight right onto Euclid Avenue. 7. Continue on Linden Boulevard to East 98th Street/Brookdale Plaza. 8. Turn right onto Linden Boulevard. 9. Slight left onto Linden Boulevard. 10. Turn right at the first cross street onto Thomas S Boyland Street. 11. Turn left onto Hegeman Avenue. 12. Turn left onto East 98th Street/Brookdale Plaza. 13. Destination will be on the right.

3.2 Emergency Contacts

Company	Individual Name	Title	Contact Number
AKRF	Deborah Shapiro	Project Manager	646-388-9529 (office)
	Amy Jordan	Alternate Project Manager	610-405-2847 (cell)
	Jenny Pensky	Site Safety Officer (SSO)	440-867-8810 (cell)
	Adrianna Bosco	SSO Alternate	914-874-3358 (cell)
Phipps Houses	Michael Wadman	Client Representative	646-388-8216
Ambulance, Fire Department & Police Department	-	-	911
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 property located at 235 Chestnut Street in Brooklyn, 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: __________

Signed: __________________________ Company: ________________________ Date: __________

Signed: __________________________ Company: ________________________ Date: __________

Signed: __________________________ Company: ________________________ Date: __________

Signed: __________________________ Company: ________________________ Date: __________

Signed: __________________________ Company: ________________________ Date: __________

Signed: __________________________ Company: ________________________ Date: __________

Signed: __________________________ Company: ________________________ Date: __________

Signed: __________________________ Company: ________________________ Date: __________

Signed: __________________________ Company: ________________________ Date: __________

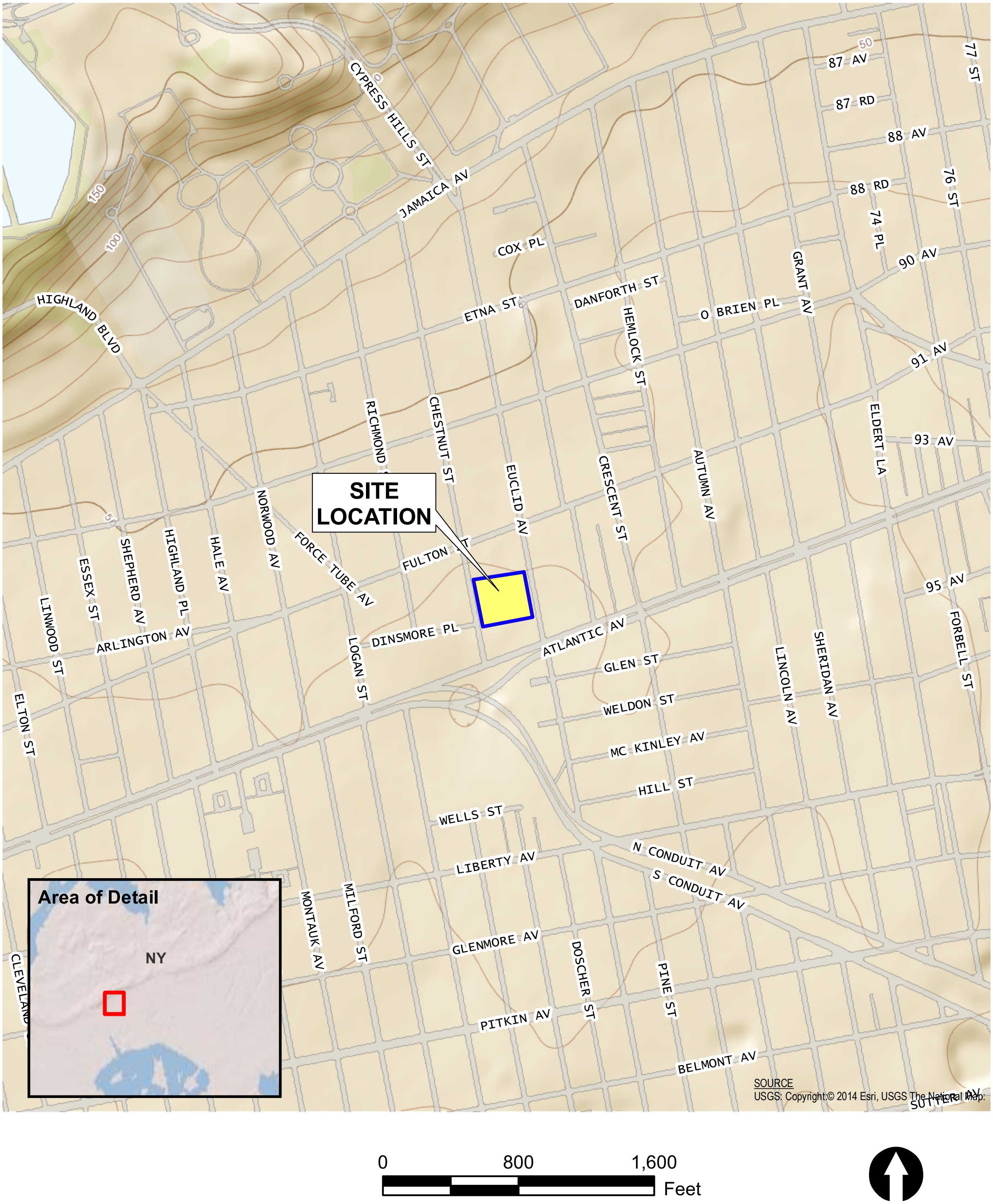
Signed: __________________________ Company: ________________________ Date: __________

Signed: __________________________ Company: ________________________ Date: __________

Signed: __________________________ Company: ________________________ Date: __________

__________________________ ________________________ __________

FIGURES



SOURCE
USGS: Copyright:© 2014 Esri, USGS The National Map:

W:\Projects\12493 - PHIPPS 235 CHESTNUT LOT 2\Technical\GIS and Graphics\hazmat\12493 Fig 1 site loc map chesnut.mxd

235 Chesnut Street
Brooklyn, New York

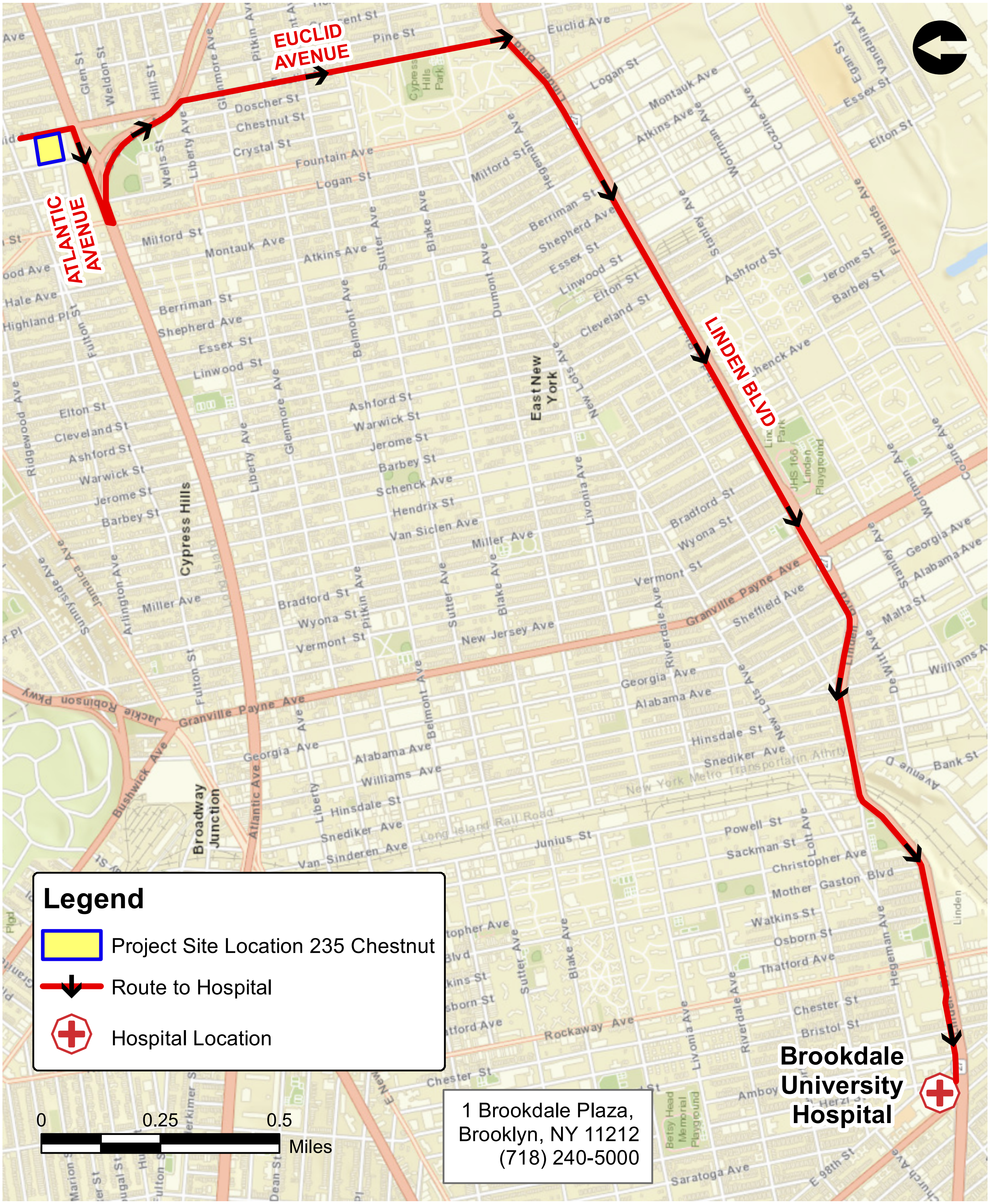
SITE LOCATION

AKRF
Environmental Consultants
440 Park Avenue South, New York, NY 10016

DATE
7/12/2016

PROJECT No.
12493

FIGURE
1



235 Chestnut Street
Brooklyn, New York

HOSPITAL LOCATION MAP

AKRF
Environmental Consultants
440 Park Avenue South, New York, NY 10016

DATE
7/22/2016

PROJECT No.
12493

FIGURE
2

APPENDIX A

POTENTIAL HEALTH EFFECTS FROM ON-SITE CONTAMINANTS

ATSDR
AGENCY FOR TOXIC SUBSTANCES
AND DISEASE REGISTRY

ARSENIC
CAS # 7440-38-2

Division of Toxicology ToxFAQs™ December 2003

This fact sheet answers the most frequently asked health questions (FAQs) about arsenic. 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.

HIGHLIGHTS: Exposure to higher than average levels of arsenic occurs 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 at 1,014 of the 1,598 National Priority List 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. Organic arsenic compounds are used as pesticides, primarily on cotton plants.

What happens to arsenic when it enters the environment?

☐ Arsenic cannot be destroyed in the environment. It can only change its form.
☐ Arsenic in air will settle to the ground or is washed out of the air by rain.
☐ Many arsenic compounds can dissolve in water.
☐ Fish and shellfish can accumulate arsenic, but the arsenic in fish is mostly in a form that is not harmful.

How might I be exposed to arsenic?

☐ Eating food, drinking water, or breathing air containing arsenic.
☐ Breathing contaminated workplace air.
☐ Breathing sawdust or burning smoke from wood treated with arsenic.
☐ Living near uncontrolled hazardous waste sites containing arsenic.
☐ Living in areas with unusually high natural levels of arsenic in rock.

How can arsenic affect my health?

Breathing high levels of inorganic arsenic can give you a sore throat or irritated lungs. Ingesting high levels of inorganic arsenic can result in death. Lower levels of arsenic 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.

Organic arsenic compounds are less toxic than inorganic arsenic compounds. Exposure to high levels of some organic arsenic compounds may cause similar effects as inorganic arsenic.

How likely is arsenic to cause cancer?

Several studies have shown that inorganic arsenic can increase the risk of lung cancer, skin cancer, bladder cancer, liver cancer, kidney cancer, and prostate cancer. The World Health Organization (WHO), the Department of Health and Human Services (DHHS), and the EPA have determined that inorganic arsenic is a human carcinogen.

How can arsenic affect children?

We do not know if exposure to arsenic will result in birth defects or other developmental effects in people. Birth defects have been observed in animals exposed to inorganic arsenic.

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

How can families reduce the risk 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.

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

There are tests to measure the level of arsenic in blood, urine, hair, or 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 or 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 how the arsenic levels in your body will affect your health.

Has the federal government made recommendations to protect human health?

EPA has set limits on the amount of arsenic that industrial sources can release to the environment and has restricted or canceled many 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 has set limits of 10 µg arsenic per cubic meter of workplace air (10 $\mu g/m^3$) for 8 hour shifts and 40 hour work weeks.

Source of Information

Agency for Toxic Substances and Disease Registry (ATSDR). 2000. Toxicological Profile for Arsenic. 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 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.

ATSDR
AGENCY FOR TOXIC SUBSTANCES
AND DISEASE REGISTRY

BARIUM AND COMPOUNDS

CAS # 7440-39-3

Division of Toxicology and Environmental Medicine ToxFAQs™ August 2007

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 risks 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 1.44 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.

Where can I get more information? For more information, contact the Agency for Toxic Substances and Disease Registry, Division of Toxicology and Environmental Medicine, 1600 Clifton Road NE, Mailstop F-32, Atlanta, GA 30333. Phone: 1-800-232-4636, 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.

ATSDR
AGENCY FOR TOXIC SUBSTANCES
AND DISEASE REGISTRY

BENZENE
CAS # 71-43-2

Agency for Toxic Substances and Disease Registry ToxFAQs **September 1997**

This fact sheet answers the most frequently asked health questions (FAQs) about benzene. 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. 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: Benzene is a widely used chemical formed from both natural processes and human activities. Breathing benzene can cause drowsiness, dizziness, and unconsciousness; long-term benzene exposure causes effects on the bone marrow and can cause anemia and leukemia. Benzene has been found in at least 813 of the 1,430 National Priorities List sites identified by the Environmental Protection Agency (EPA).

What is benzene?
(Pronounced bĕn′zēn′)

Benzene is a colorless liquid with a sweet odor. It evaporates into the air very quickly and dissolves slightly in water. It is highly flammable and is formed from both natural processes and human activities.

Benzene is widely used in the United States; it ranks in the top 20 chemicals for production volume. Some industries use benzene to make other chemicals which are used to make plastics, resins, and nylon and synthetic fibers. Benzene is also used to make some types of rubbers, lubricants, dyes, detergents, drugs, and pesticides. Natural sources of benzene include volcanoes and forest fires. Benzene is also a natural part of crude oil, gasoline, and cigarette smoke.

What happens to benzene when it enters the environment?

- ❑ Industrial processes are the main source of benzene in the environment.
- ❑ Benzene can pass into the air from water and soil.
- ❑ It reacts with other chemicals in the air and breaks down within a few days.
- ❑ Benzene in the air can attach to rain or snow and be carried back down to the ground.
- ❑ It breaks down more slowly in water and soil, and can pass through the soil into underground water.
- ❑ Benzene does not build up in plants or animals.

How might I be exposed to benzene?

- ❑ Outdoor air contains low levels of benzene from tobacco smoke, automobile service stations, exhaust from motor vehicles, and industrial emissions.
- ❑ Indoor air generally contains higher levels of benzene from products that contain it such as glues, paints, furniture wax, and detergents.
- ❑ Air around hazardous waste sites or gas stations will contain higher levels of benzene.
- ❑ Leakage from underground storage tanks or from hazardous waste sites containing benzene can result in benzene contamination of well water.
- ❑ People working in industries that make or use benzene may be exposed to the highest levels of it.
- ❑ A major source of benzene exposures is tobacco smoke.

How can benzene affect my health?

Breathing very high levels of benzene can result in death, while high levels can cause drowsiness, dizziness, rapid heart rate, headaches, tremors, confusion, and unconsciousness. Eating or drinking foods containing high levels of benzene can cause vomiting, irritation of the stomach, dizziness, sleepiness, convulsions, rapid heart rate, and death.

The major effect of benzene from long-term (365 days or longer) exposure is on the blood. Benzene causes harmful effects on the bone marrow and can cause a decrease in red blood cells leading to anemia. It can also cause excessive bleeding and can affect the immune system, increasing the chance for infection.

Some women who breathed high levels of benzene for many months had irregular menstrual periods and a decrease in the size of their ovaries. It is not known whether benzene exposure affects the developing fetus in pregnant women or fertility in men.

Animal studies have shown low birth weights, delayed bone formation, and bone marrow damage when pregnant animals breathed benzene.

How likely is benzene to cause cancer?

The Department of Health and Human Services (DHHS) has determined that benzene is a known human carcinogen. Long-term exposure to high levels of benzene in the air can cause leukemia, cancer of the blood-forming organs.

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

Several tests can show if you have been exposed to benzene. There is test for measuring benzene in the breath; this test must be done shortly after exposure. Benzene can also be measured in the blood, however, since benzene disappears rapidly from the blood, measurements are accurate only for recent exposures.

In the body, benzene is converted to products called metabolites. Certain metabolites can be measured in the urine. However, this test must be done shortly after exposure and is not a reliable indicator of how much benzene you have been exposed to, since the metabolites may be present in urine from other sources.

Has the federal government made recommendations to protect human health?

The EPA has set the maximum permissible level of benzene in drinking water at 0.005 milligrams per liter (0.005 mgL). The EPA requires that spills or accidental releases into the environment of 10 pounds or more of benzene be reported to the EPA.

The Occupational Safety and Health Administration (OSHA) has set a permissible exposure limit of 1 part of benzene per million parts of air (1 ppm) in the workplace during an 8-hour workday, 40-hour workweek.

Glossary

Anemia: A decreased ability of the blood to transport oxygen.

Carcinogen: A substance with the ability to cause cancer.

CAS: Chemical Abstracts Service.

Chromosomes: Parts of the cells responsible for the development of hereditary characteristics.

Metabolites: Breakdown products of chemicals.

Milligram (mg): One thousandth of a gram.

Pesticide: A substance that kills pests.

References

This ToxFAQs information is taken from the 1997 Toxicological Profile for Benzene (update) produced by the Agency for Toxic Substances and Disease Registry, Public Health Service, U.S. Department of Health and Human Services, Public Health Service in Atlanta, GA.

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 E-29, Atlanta, GA 30333. Phone: 1-888-422-8737, FAX: 404-498-0093. 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.

ATSDR
AGENCY FOR TOXIC SUBSTANCES
AND DISEASE REGISTRY

CADMIUM
CAS # 7440-43-9

Agency for Toxic Substances and Disease Registry ToxFAQs **June 1999**

This fact sheet answers the most frequently asked health questions (FAQs) about cadmium. 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.

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 lungs, can cause kidney disease, and may irritate the digestive tract. This substance has been found in at least 776 of the 1,467 National Priorities List sites identified by the Environmental Protection Agency (EPA).

What is cadmium?

(Pronounced kăd′mē-əm)

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 air from mining, industry, and burning coal and household wastes.
- ☐ Cadmium particles in air can travel long distances before falling to the ground or water.
- ☐ It enters water and soil from waste disposal and spills or leaks at hazardous waste sites.
- ☐ It binds strongly to soil particles.
- ☐ Some cadmium dissolves in water.
- ☐ It doesn't break down in the environment, but can change forms.
- ☐ Fish, plants, and animals take up cadmium from the environment.
- ☐ Cadmium stays in the body a very long time and can build up from many years of exposure to low levels.

How might I be exposed to cadmium?

- ☐ Breathing contaminated workplace air (battery manufacturing, metal soldering or welding).
- ☐ Eating foods containing it; low levels in all foods (highest in shellfish, liver, and kidney meats).
- ☐ Breathing cadmium in cigarette smoke (doubles the average daily intake).
- ☐ Drinking contaminated water.
- ☐ Breathing contaminated air near the burning of fossil fuels or municipal waste.

How can cadmium affect my health?

Breathing high levels of cadmium severely damages the lungs and can cause death. 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. Animals given cadmium in food or water had high blood pressure, iron-poor blood, liver disease, and nerve or brain damage.

We don't know if humans get any of these diseases from eating or drinking cadmium. Skin contact with cadmium is not known to cause health effects in humans or animals.

How likely is cadmium to cause cancer?

The Department of Health and Human Services (DHHS) has determined that cadmium and cadmium compounds may reasonably be anticipated to be carcinogens.

How can cadmium affect children?

The health effects in children are expected to be similar to those in adults (kidney, lung and intestinal damage).

We don't know if cadmium causes birth defects in people. Cadmium does not readily go from a pregnant woman's body into the developing child, but some portion can cross the placenta. It can also be found in breast milk. The babies of animals exposed to high levels of cadmium during pregnancy had changes in behavior and learning ability. Cadmium may also affect birth weight and the skeleton in developing animals.

Animal studies also indicate that more cadmium is absorbed into the body if the diet is low in calcium, protein, or iron, or is high in fat. A few studies show that younger animals absorb more cadmium and are more likely to lose bone and bone strength than adults.

How can families reduce the risk of exposure to cadmium?

In the home, store substances that contain cadmium safely, and keep nickel-cadmium batteries out of reach of young children. 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 show whether I've been exposed to cadmium?

Tests are available in some medical laboratories that measure cadmium in blood, urine, hair, or nails. Blood levels show recent exposure to cadmium, and urine levels show both recent and earlier exposure. The reliability of tests for cadmium levels in hair or nails is unknown.

Has the federal government made recommendations to protect human health?

The EPA has set a limit of 5 parts of cadmium per billion parts of drinking water (5 ppb). EPA doesn't allow cadmium in pesticides.

The Food and Drug Administration (FDA) limits the amount of cadmium in food colors to 15 parts per million (15 ppm).

The Occupational Safety and Health Administration (OSHA) limits workplace air to 100 micrograms cadmium per cubic meter (100 $\mu g/m^3$) as cadmium fumes and 200 µg cadmium/m^3 as cadmium dust.

References

Agency for Toxic Substances and Disease Registry (ATSDR). 1999. 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, 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.

ATSDR
AGENCY FOR TOXIC SUBSTANCES
AND DISEASE REGISTRY

CHROMIUM

CAS # 7440-47-3

Division of Toxicology and Environmental Medicine ToxFAQs™ **September 2008**

This fact sheet answers the most frequently asked health questions (FAQs) about chromium. 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 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 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 to chromium(VI) or chromium(III). Allergic reactions consisting of severe redness and swelling of the skin have been noted.

How likely is chromium to cause cancer?

The Department of Health and Human Services (DHHS), the International Agency for Reseach 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 risks 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 determined that exposure to chromium 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 FDA has determined that the chromium concentration in bottled drinking water should not exceed 1 mg/L.

The Occupational Health and Safety Administration (OSHA) has limited workers' exposure to an average of 0.0005 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). 2008. Toxicological Profile for Chromium (Draft for Public Comment). 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 Environmental Medicine, 1600 Clifton Road NE, Mailstop F-32, Atlanta, GA 30333. Phone: 1-800-232-4636, 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.

ATSDR
AGENCY FOR TOXIC SUBSTANCES
AND DISEASE REGISTRY

COPPER

CAS # 7440-50-8

Division of Toxicology ToxFAQs™ September 2002

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 reddish metal that occurs naturally in the environment. It also occurs naturally 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 crumps, and nausea. Copper has been found in at least 884 of the 1,613 National Priorities List sites identified by the Environmental Protection Agency (EPA).

What is copper?

Copper is a reddish metal that occurs naturally in rocks, soil, water, and air. Copper also occurs naturally in plants and animals.

Metallic copper can be easily molded or shaped. Metallic copper can be found in the U.S. penny, electrical wiring, and some water pipes. Metallic copper is also found in mixtures (called alloys) with other metals such as brass and bronze. Copper is also found as part of other compounds forming salts. Copper salts occur naturally, but are also manufactured. The most common copper salt is copper sulfate. Most copper compounds are blue-green in color. 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 can enter the environment from the mining of copper and other metals and from factories that make or use metallic copper or copper compounds.

☐ It can also enter the environment through domestic waste water, combustion of fossil fuels and wastes, wood production, phosphate fertilizer production, and natural sources (e.g., windblown dust from soils, volcanoes, decaying vegetation, forest fires, and sea spray).

☐ Copper in soil strongly attaches to organic material and minerals.

☐ Copper that dissolves in water becomes rapidly bound to particles suspended in the water.

☐ Copper does not typically enter groundwater.

☐ Copper carried by particles emitted from smelters and ore processing plants is carried back to the ground by gravity or in rain or snow.

☐ Copper does not break down in the environment.

How might I be exposed to copper?

☐ Breathing air, drinking water, eating food, and by skin contact with soil, water, or other copper-containing substances.

☐ Some copper in the environment can be taken up by plants and animals.

☐ Higher exposure may occur if your water is corrosive and you have copper plumbing and brass water fixtures. ☐ You may be exposed to higher amounts of copper if you drink water or swim in lakes or reservoirs recently treated with copper to control algae or receive cooling water from a power plant that may have high amounts of dissolved copper.

☐ Using some garden products (e.g., fungicides) to control plant diseases.

☐ Living near bronze and brass production facilities may expose you to higher copper levels in soil.

☐ You may breathe copper-containing dust or have skin contact if you work in the industry of mining copper or processing the ore. You may breathe high levels if you grind or weld copper metal.

How can copper affect my health?

Copper is essential for good health, but high amounts can be harmful. Long-term exposure to copper dust can irritate your nose, mouth, and eyes, and cause headaches, dizziness, nausea, and diarrhea.

Drinking water with higher than normal levels of copper may cause vomiting, diarrhea, stomach cramps, and nausea. Intentionally high intakes of copper can cause liver and kidney damage and even 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 carcinogenicity.

How can copper affect children?

Exposure to high levels of copper will result in the same type of effects in children and adults. Studies in animals suggest that the young children may have more severe effects than adults; we do not 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 ingestion of high levels of copper may cause a decrease in fetal growth.

How can families reduce the risk of exposure to copper?

☐ The greatest potential source of copper exposure is through drinking water, especially in water that is first drawn in the morning after sitting in copper pipes and brass faucets overnight.

☐ To reduce exposure, run the water for at least 15-30 seconds before using it.

☐ If you are exposed to copper at work, you may carry copper home on your skin, clothes, or tools. You can avoid this by showering, and changing 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 copper?

Copper is normally found in all tissues of the body, blood, urine, feces, hair, and nails. High levels of copper in these samples can show that you have been exposed to higher than normal levels of copper. Tests to measure copper levels in the body are not routinely available at the doctor's office because they require special equipment. These tests cannot tell the extent of exposure or whether you will experience harmful effects.

Has the federal government made recommendations to protect human health?

The EPA has determined that drinking water should not contain more than 1.3 milligrams of copper per liter of water (1.3 mg/L).

The Occupational Safety and Health Administration (OSHA) has set a limit of 0.1 mg per cubic meter (0.1 mg/m^3) of copper fumes (vapor generated from heating copper) and 1 mg/m^3 of copper dusts (fine metallic copper particles) and mists (aerosol of soluble copper) in workroom air during an 8-hour work shift, 40-hour workweek.

The Food and Nutrition Board of the Institute of Medicine recommends dietary allowances (RDAs) of 340 micrograms (340 µg) of copper per day for children aged 1-3 years, 440 µg/day for children aged 4-8 years, 700 µg/day for children aged 9-13 years, 890 µg/day for children aged 14-18 years, and 900 µg/day for adults.

References

Agency for Toxic Substances and Disease Registry (ATSDR). 2002. Toxicological Profile for Copper (Draft for Public Comment). 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.

ATSDR
AGENCY FOR TOXIC SUBSTANCES
AND DISEASE REGISTRY

ETHYLBENZENE

CAS # 100-41-4

Agency for Toxic Substances and Disease Registry ToxFAQs **June 1999**

This fact sheet answers the most frequently asked health questions (FAQs) about ethylbenzene. 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.

HIGHLIGHTS: Ethylbenzene is a colorless liquid found in a number of products including gasoline and paints. Breathing very high levels can cause dizziness and throat and eye irritation. Ethylbenzene has been found in at least 731 of the 1,467 National Priorities List sites identified by the Environmental Protection Agency (EPA).

What is ethylbenzene?

(Pronounced ĕth′ əl bĕn′ zēn′)

Ethylbenzene is a colorless, flammable liquid that smells like gasoline. It is found in natural products such as coal tar and petroleum and is also found in manufactured products such as inks, insecticides, and paints.

Ethylbenzene is used primarily to make another chemical, styrene. Other uses include as a solvent, in fuels, and to make other chemicals.

What happens to ethylbenzene when it enters the environment?

- ❑ Ethylbenzene moves easily into the air from water and soil.
- ❑ It takes about 3 days for ethylbenzene to be broken down in air into other chemicals.
- ❑ Ethylbenzene may be released to water from industrial discharges or leaking underground storage tanks.
- ❑ In surface water, ethylbenzene breaks down by reacting with other chemicals found naturally in water.
- ❑ In soil, it is broken down by soil bacteria.

How might I be exposed to ethylbenzene?

- ❑ Breathing air containing ethylbenzene, particularly in areas near factories or highways.
- ❑ Drinking contaminated tap water.
- ❑ Working in an industry where ethylbenzene is used or made.
- ❑ Using products containing it, such as gasoline, carpet glues, varnishes, and paints.

How can ethylbenzene affect my health?

Limited information is available on the effects of ethylbenzene on people's health. The available information shows dizziness, throat and eye irritation, tightening of the chest, and a burning sensation in the eyes of people exposed to high levels of ethylbenzene in air.

Animals studies have shown effects on the nervous system, liver, kidneys, and eyes from breathing ethylbenzene in air.

How likely is ethylbenzene to cause cancer?

The EPA has determined that ethylbenzene is not classifiable as to human carcinogenicity.

No studies in people have shown that ethylbenzene exposure can result in cancer. Two available animal studies suggest that ethylbenzene may cause tumors.

How can ethylbenzene affect children?

Children may be exposed to ethylbenzene through inhalation of consumer products, including gasoline, paints, inks, pesticides, and carpet glue. We do not know whether children are more sensitive to the effects of ethylbenzene than adults.

It is not known whether ethylbenzene can affect the development of the human fetus. Animal studies have shown that when pregnant animals were exposed to ethylbenzene in air, their babies had an increased number of birth defects.

How can families reduce the risk of exposure to ethylbenzene?

Exposure to ethylbenzene vapors from household products and newly installed carpeting can be minimized by using adequate ventilation.

Household chemicals should be stored out of reach of children to prevent accidental poisoning. Always store household chemicals in their original containers; never store them in containers children would find attractive to eat or drink from, such as old soda bottles. Gasoline should be stored in a gasoline can with a locked cap.

Sometimes older children sniff household chemicals, including ethylbenzene, in an attempt to get high. Talk with your children about the dangers of sniffing chemicals.

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

Ethylbenzene is found in the blood, urine, breath, and some body tissues of exposed people. The most common way to test for ethylbenzene is in the urine. This test measures substances formed by the breakdown of ethylbenzene. This test needs to be done within a few hours after exposure occurs, because the substances leave the body very quickly.

These tests can show you were exposed to ethylbenzene, but cannot predict the kind of health effects that might occur.

Has the federal government made recommendations to protect human health?

The EPA has set a maximum contaminant level of 0.7 milligrams of ethylbenzene per liter of drinking water (0.7 mg/L).

The EPA requires that spills or accidental releases into the environment of 1,000 pounds or more of ethylbenzene be reported to the EPA.

The Occupational Safety and Health Administration (OSHA) has set an occupational exposure limit of 100 parts of ethylbenzene per million parts of air (100 ppm) for an 8-hour workday, 40-hour workweek.

References

Agency for Toxic Substances and Disease Registry (ATSDR). 1999. Toxicological profile for ethylbenzene. 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.

ATSDR
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

Agency for Toxic Substances and Disease Registry ToxFAQs **September 1996**

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 E-29, Atlanta, GA 30333. Phone:1-888-422-8737, FAX: 404-498-0093. 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.

ATSDR
AGENCY FOR TOXIC SUBSTANCES
AND DISEASE REGISTRY

LEAD

CAS # 7439-92-1

Division of Toxicology and Environmental Medicine ToxFAQs™ August 2007

This fact sheet answers the most frequently asked health questions (FAQs) about lead. 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 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 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.

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 considers a blood lead level of 10 μg/dL to be a level of concern for children.

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 Environmental Medicine, 1600 Clifton Road NE, Mailstop F-32, Atlanta, GA 30333. Phone: 1-800-232-4636, 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.

ATSDR
AGENCY FOR TOXIC SUBSTANCES
AND DISEASE REGISTRY

MERCURY

CAS # 7439-97-6

Agency for Toxic Substances and Disease Registry ToxFAQs **April 1999**

This fact sheet answers the most frequently asked health questions (FAQs) about mercury. 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.

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 sites identified by the Environmental Protection Agency.

What is mercury?

(Pronounced mū̃r′kyə-rē)

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, 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 fuels.
- ☐ Release of mercury from dental work and medical treatments.
- ☐ Breathing contaminated workplace air or skin contact during use in the workplace (dental, health services, chemical, and other industries that use mercury).
- ☐ 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.

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. It can also can 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 be passed from the mother to 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 show 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, 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.

ATSDR
AGENCY FOR TOXIC SUBSTANCES
AND DISEASE REGISTRY

NAPHTHALENE
CAS # 91-20-3

1-METHYLNAPHTHALENE
CAS # 90-12-0

2-METHYLNAPHTHALENE
CAS # 91-57-6

Division of Toxicology ToxFAQs™ August 2005

This fact sheet answers the most frequently asked health questions (FAQs) about naphthalene, 1-methylnaphthalene, and 2-methylnaphthalene. 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 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 naphthalene, 1-methylnaphthalene, or 2-methylnaphthalene happens mostly from breathing air contaminated from the burning of wood, tobacco, or fossil fuels, industrial discharges, or moth repellents. Exposure to large amounts of naphthalene may damage or destroy some of your red blood cells. Naphthalene has caused cancer in animals. Naphthalene, 1-methylnaphthalene, and 2-methylnaphthalene have been found in at least 687, 36, and 412, respectively, of the 1,662 National Priority List sites identified by the Environmental Protection Agency (EPA).

What are naphthalene, 1-methylnaphthalene, and 2-methylnaphthalene?

Naphthalene is a white solid that evaporates easily. Fuels such as petroleum and coal contain naphthalene. It is also called white tar, and tar camphor, and has been used in mothballs and moth flakes. Burning tobacco or wood produces naphthalene. It has a strong, but not unpleasant smell. The major commercial use of naphthalene is in the manufacture of polyvinyl chloride (PVC) plastics. Its major consumer use is in moth repellents and toilet deodorant blocks.

1-Methylnaphthalene and 2-methylnaphthalene are naphthalene-related compounds. 1-Methylnaphthalene is a clear liquid and 2-methylnaphthalene is a solid; both can be smelled in air and in water at very low concentrations.

1-Methylnaphthalene and 2-methylnaphthalene are used to make other chemicals such as dyes and resins. 2-Methylnaphthalene is also used to make vitamin K.

What happens to naphthalene, 1-methylnaphthalene, and 2-methylnaphthalene when they enter the environment?

❏ Naphthalene enters the environment from industrial and domestic sources, and from accidental spills.

❏ Naphthalene can dissolve in water to a limited degree and may be present in drinking water from wells close to hazardous waste sites and landfills.

❏ Naphthalene can become weakly attached to soil or pass through soil into underground water.

❏ In air, moisture and sunlight break it down within 1 day. In water, bacteria break it down or it evaporates into the air.

❏ Naphthalene does not accumulate in the flesh of animals or fish that you might eat.

❏ 1-Methylnaphthalene and 2-methylnaphthalene are expected to act like naphthalene in air, water, or soil because they have similar chemical and physical properties.

How might I be exposed to naphthalene, 1-methylnaphthalene, and 2-methylnaphthalene?

❏ Breathing low levels in outdoor air.

❏ Breathing air contaminated from industrial discharges or smoke from burning wood, tobacco, or fossil fuels.

❏ Using or making moth repellents, coal tar products, dyes or inks could expose you to these chemicals in the air.

❏ Drinking water from contaminated wells.

❏ Touching fabrics that are treated with moth repellents containing naphthalene.

❏ Exposure to naphthalene, 1-methylnaphthalene and 2-methylnaphthalene from eating foods or drinking beverages is unlikely.

How can naphthalene, 1-methylnaphthalene, and 2-methylnaphthalene affect my health?

Exposure to large amounts of naphthalene may damage or destroy some of your red blood cells. This could cause you to have too few red blood cells until your body replaces the destroyed cells. This condition is called hemolytic anemia. Some symptoms of hemolytic anemia are fatigue, lack of appetite, restlessness, and pale skin. Exposure to large amounts of naphthalene may also cause nausea, vomiting, diarrhea, blood in the urine, and a yellow color to the skin. Animals sometimes develop cloudiness in their eyes after swallowing high amounts of naphthalene. It is not clear whether this also develops in people. Rats and mice that breathed naphthalene vapors daily for a lifetime developed irritation and inflammation of their nose and lungs. It is unclear if naphthalene causes reproductive effects in animals; most evidence says it does not.

There are no studies of humans exposed to 1-methylnaphthalene or 2-methylnaphthalene.

Mice fed food containing 1-methylnaphthalene and 2-methylnaphthalene for most of their lives had part of their lungs filled with an abnormal material.

How likely are naphthalene, 1-methylnaphthalene, or 2-methylnaphthalene to cause cancer?

There is no direct evidence in humans that naphthalene, 1-methylnaphthalene, or 2-methylnaphthalene cause cancer. However, cancer from naphthalene exposure has been seen in animal studies. Some female mice that breathed naphthalene vapors daily for a lifetime developed lung tumors. Some male and female rats exposed to naphthalene in a similar manner also developed nose tumors.

Based on the results from animal studies, the Department of Health and Humans Services (DHHS) concluded that naphthalene is reasonably anticipated to be a human carcinogen. The International Agency for Research on Cancer (IARC) concluded that naphthalene is possibly carcinogenic to humans. The EPA determined that naphthalene is a possible human carcinogen (Group C) and that the data are inadequate to assess the human carcinogenic potential of 2-methylnaphthalene.

How can naphthalene, 1-methylnaphthalene, or 2-methylnaphthalene affect children?

Hospitals have reported many cases of hemolytic anemia in children, including newborns and infants, who either ate naphthalene mothballs or deodorants cakes or who were in close contact with clothing or blankets stored in naphthalene mothballs. Naphthalene can move from a pregnant woman's blood to the unborn baby's blood. Naphthalene has been detected in some samples of breast milk from the general U.S. population, but not at levels that are expected to be of concern.

There is no information on whether naphthalene has affected development in humans. No developmental abnormalities were observed in the offspring from rats, mice, and rabbits fed naphthalene during pregnancy.

We do not have any information on possible health effects of 1-methylnaphthalene or 2-methylnaphthalene on children.

How can families reduce the risks of exposure to naphthalene, 1-methylnaphthalene, and 2-methylnaphthalene?

❏ Families can reduce the risks of exposure to naphthalene, 1-methylnaphthalene, and 2-methylnaphthalene by avoiding smoking tobacco, generating smoke during cooking, or using fireplaces or heating appliances in the their homes.

❏ If families use naphthalene-containing moth repellents, the material should be enclosed in containers that prevent vapors from escaping, and kept out of the reach from children.

❏ Blankets and clothing stored with naphthalene moth repellents should be aired outdoors to remove naphthalene odors and washed before they are used.

❏ Families should inform themselves of the contents of air deodorizers that are used in their homes and refrain from using deodorizers with naphthalene.

Is there a medical test to determine whether I've been exposed to naphthalene, 1-methylnaphthalene, and 2-methylnaphthalene?

Tests are available that measure levels of these chemicals and their breakdown products in samples of urine, feces, blood, maternal milk, or body fat. These tests are not routinely available in a doctor's office because they require special equipment, but samples can be sent to special testing laboratories. These tests cannot determine exactly how much naphthalene, 1-methylnaphthalene, or 2-methylnaphthalene you were exposed to or predict whether harmful effects will occur. If the samples are collected within a day or two of exposure, then the tests can show if you were exposed to a large or small amount of naphthalene, 1-methylnaphthalene, or 2-methylnaphthalene.

Has the federal government made recommendations to protect human health?

The EPA recommends that children not drink water with over 0.5 parts per million (0.5 ppm) naphthalene for more than 10 days or over 0.4 ppm for any longer than 7 years. Adults should not drink water with more than 1 ppm for more than 7 years. For water consumed over a lifetime (70 years), the EPA suggests that it contain no more than 0.1 ppm naphthalene.

The Occupational Safety and Health Administration (OSHA) set a limit of 10 ppm for the level of naphthalene in workplace air during an 8-hour workday, 40-hour workweek. The National Institute for Occupational Safety and Health (NIOSH) considers more than 500 ppm of naphthalene in air to be immediately dangerous to life or health. This is the exposure level of a chemical that is likely to impair a worker's ability to leave a contaminate area and therefore, results in permanent health problems or death.

References

Agency for Toxic Substances and Disease Registry (ATSDR). 2005. Toxicological Profile for Naphthalene, 1-Methylnaphthalene, and 2-Methylnaphthalene (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, 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.

ATSDR
AGENCY FOR TOXIC SUBSTANCES
AND DISEASE REGISTRY

POLYCYCLIC AROMATIC HYDROCARBONS (PAHs)

Agency for Toxic Substances and Disease Registry ToxFAQs September 1996

This fact sheet answers the most frequently asked health questions (FAQs) about polycyclic aromatic hydrocarbons (PAHs). 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. 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.

SUMMARY: 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 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.

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, 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.

ATSDR
AGENCY FOR TOXIC SUBSTANCES
AND DISEASE REGISTRY

TRICHLOROETHYLENE

CAS # 79-01-6

Division of Toxicology ToxFAQs™ **July 2003**

This fact sheet answers the most frequently asked health questions (FAQs) about trichloroethylene. 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. 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: Trichloroethylene is a colorless liquid which is used as a solvent for cleaning metal parts. Drinking or breathing high levels of trichloroethylene may cause nervous system effects, liver and lung damage, abnormal heartbeat, coma, and possibly death. Trichloroethylene has been found in at least 852 of the 1,430 National Priorities List sites identified by the Environmental Protection Agency (EPA).

What is trichloroethylene?

Trichloroethylene (TCE) is a nonflammable, colorless liquid with a somewhat sweet odor and a sweet, burning taste. It is used mainly as a solvent to remove grease from metal parts, but it is also an ingredient in adhesives, paint removers, typewriter correction fluids, and spot removers.

Trichloroethylene is not thought to occur naturally in the environment. However, it has been found in underground water sources and many surface waters as a result of the manufacture, use, and disposal of the chemical.

What happens to trichloroethylene when it enters the environment?

❑ Trichloroethylene dissolves a little in water, but it can remain in ground water for a long time.

❑ Trichloroethylene quickly evaporates from surface water, so it is commonly found as a vapor in the air.

❑ Trichloroethylene evaporates less easily from the soil than from surface water. It may stick to particles and remain for a long time.

❑ Trichloroethylene may stick to particles in water, which will cause it to eventually settle to the bottom sediment.

❑ Trichloroethylene does not build up significantly in plants and animals.

How might I be exposed to trichloroethylene?

❑ Breathing air in and around the home which has been contaminated with trichloroethylene vapors from shower water or household products such as spot removers and typewriter correction fluid.

❑ Drinking, swimming, or showering in water that has been contaminated with trichloroethylene.

❑ Contact with soil contaminated with trichloroethylene, such as near a hazardous waste site.

❑ Contact with the skin or breathing contaminated air while manufacturing trichloroethylene or using it at work to wash paint or grease from skin or equipment.

How can trichloroethylene affect my health?

Breathing small amounts may cause headaches, lung irritation, dizziness, poor coordination, and difficulty concentrating.

Breathing large amounts of trichloroethylene may cause impaired heart function, unconsciousness, and death. Breathing it for long periods may cause nerve, kidney, and liver damage.

Drinking large amounts of trichloroethylene may cause nausea, liver damage, unconsciousness, impaired heart function, or death.

Drinking small amounts of trichloroethylene for long periods may cause liver and kidney damage, impaired immune system function, and impaired fetal development in pregnant women, although the extent of some of these effects is not yet clear.

Skin contact with trichloroethylene for short periods may cause skin rashes.

How likely is trichloroethylene to cause cancer?

Some studies with mice and rats have suggested that high levels of trichloroethylene may cause liver, kidney, or lung cancer. Some studies of people exposed over long periods to high levels of trichloroethylene in drinking water or in workplace air have found evidence of increased cancer. Although, there are some concerns about the studies of people who were exposed to trichloroethylene, some of the effects found in people were similar to effects in animals.

In its 9th Report on Carcinogens, the National Toxicology Program (NTP) determined that trichloroethylene is "reasonably anticipated to be a human carcinogen." The International Agency for Research on Cancer (IARC) has determined that trichloroethylene is "probably carcinogenic to humans."

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

If you have recently been exposed to trichloroethylene, it can be detected in your breath, blood, or urine. The breath test, if it is performed soon after exposure, can tell if you have been exposed to even a small amount of trichloroethylene.

Exposure to larger amounts is assessed by blood and urine tests, which can detect trichloroethylene and many of its breakdown products for up to a week after exposure. However, exposure to other similar chemicals can produce the same breakdown products, so their detection is not absolute proof of exposure to trichloroethylene. This test isn't available at most doctors' offices, but can be done at special laboratories that have the right equipment.

Has the federal government made recommendations to protect human health?

The EPA has set a maximum contaminant level for trichloroethylene in drinking water at 0.005 milligrams per liter (0.005 mg/L) or 5 parts of TCE per billion parts water.

The EPA has also developed regulations for the handling and disposal of trichloroethylene.

The Occupational Safety and Health Administration (OSHA) has set an exposure limit of 100 parts of trichloroethylene per million parts of air (100 ppm) for an 8-hour workday, 40-hour workweek.

Glossary

Carcinogenicity: The ability of a substance to cause cancer.
CAS: Chemical Abstracts Service.
Evaporate: To change into a vapor or gas.
Milligram (mg): One thousandth of a gram.
Nonflammable: Will not burn.
ppm: Parts per million.
Sediment: Mud and debris that have settled to the bottom of a body of water.
Solvent: A chemical that dissolves other substances.

References

This ToxFAQs information is taken from the 1997 Toxicological Profile for Trichloroethylene (update) produced by the Agency for Toxic Substances and Disease Registry, Public Health Service, U.S. Department of Health and Human Services, Public Health Service in Atlanta, GA.

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 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.

ATSDR
AGENCY FOR TOXIC SUBSTANCES
AND DISEASE REGISTRY

TETRACHLOROETHYLENE

CAS # 127-18-4

Agency for Toxic Substances and Disease Registry ToxFAQs **September 1997**

This fact sheet answers the most frequently asked health questions (FAQs) about tetrachloroethylene. 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.

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, confusion, nausea, difficulty in speaking and walking, unconsciousness, and death. Tetrachloroethylene has been found in at least 771 of the 1,430 National Priorities List sites identified by the Environmental Protection Agency (EPA).

What is tetrachloroethylene?

(Pronounced tĕt′rə-klôr′ ō-ĕth′ə-lēn′)

Tetrachloroethylene is a manufactured chemical that is widely used for dry cleaning of fabrics and for metal-degreasing. It is also used to make other chemicals and is used in some consumer products.

Other names for tetrachloroethylene include perchloroethylene, PCE, and tetrachloroethene. It is a nonflammable liquid at room temperature. It evaporates easily into the air and has a sharp, sweet odor. Most people can smell tetrachloroethylene when it is present in the air at a level of 1 part tetrachloroethylene per million parts of air (1 ppm) or more, although some can smell it at even lower levels.

What happens to tetrachloroethylene when it enters the environment?

- ☐ Much of the tetrachloroethylene that gets into water or soil evaporates into the air.
- ☐ Microorganisms can break down some of the tetrachloroethylene in soil or underground water.
- ☐ In the air, it is broken down by sunlight into other chemicals or brought back to the soil and water by rain.
- ☐ It does not appear to collect in fish or other animals that live in water.

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.

How can tetrachloroethylene affect my health?

High concentrations of tetrachloroethylene (particularly in closed, poorly ventilated areas) can cause dizziness, headache, sleepiness, confusion, nausea, difficulty in speaking and walking, unconsciousness, and death.

Irritation may result from repeated or extended skin contact with it. These symptoms occur almost entirely in work (or hobby) environments when people have been accidentally exposed to high concentrations or have intentionally used tetrachloroethylene to get a "high."

In industry, most workers are exposed to levels lower than those causing obvious nervous system effects. The health effects of breathing in air or drinking water with low levels of tetrachloroethylene are not known.

Results from some studies suggest that women who work in dry cleaning industries where exposures to tetrachloroethylene can be quite high may have more menstrual problems and spontaneous abortions than women who are not exposed. However, it is not known if tetrachloroethylene was responsible for these problems because other possible causes were not considered.

Results of animal studies, conducted with amounts much higher than those that most people are exposed to, show that tetrachloroethylene can cause liver and kidney damage. Exposure to very high levels of tetrachloroethylene can be toxic to the unborn pups of pregnant rats and mice. Changes in behavior were observed in the offspring of rats that breathed high levels of the chemical while they were pregnant.

How likely is tetrachloroethylene to cause cancer?

The Department of Health and Human Services (DHHS) has determined that tetrachloroethylene may reasonably be anticipated to be a carcinogen. Tetrachloroethylene has been shown to cause liver tumors in mice and kidney tumors in male rats.

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

One way of testing for tetrachloroethylene exposure is to measure the amount of the chemical in the breath, much the same way breath-alcohol measurements are used to determine the amount of alcohol in the blood.

Because it is stored in the body's fat and slowly released into the bloodstream, tetrachloroethylene can be detected in the breath for weeks following a heavy exposure.

Tetrachloroethylene and trichloroacetic acid (TCA), a breakdown product of tetrachloroethylene, can be detected in the blood. These tests are relatively simple to perform. These tests aren't available at most doctors' offices, but can be performed at special laboratories that have the right equipment.

Because exposure to other chemicals can produce the same breakdown products in the urine and blood, the tests for breakdown products cannot determine if you have been exposed to tetrachloroethylene or the other chemicals.

Has the federal government made recommendations to protect human health?

The EPA maximum contaminant level for the amount of tetrachloroethylene that can be in drinking water is 0.005 milligrams tetrachloroethylene per liter of water (0.005 mg/L).

The Occupational Safety and Health Administration (OSHA) has set a limit of 100 ppm for an 8-hour workday over a 40-hour workweek.

The National Institute for Occupational Safety and Health (NIOSH) recommends that tetrachloroethylene be handled as a potential carcinogen and recommends that levels in workplace air should be as low as possible.

Glossary

Carcinogen: A substance with the ability to cause cancer.

CAS: Chemical Abstracts Service.

Milligram (mg): One thousandth of a gram.

Nonflammable: Will not burn.

References

This ToxFAQs information is taken from the 1997 Toxicological Profile for Tetrachloroethylene (update) produced by the Agency for Toxic Substances and Disease Registry, Public Health Service, U.S. Department of Health and Human Services, Public Health Service in Atlanta, GA.

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.

ATSDR
AGENCY FOR TOXIC SUBSTANCES
AND DISEASE REGISTRY

TOLUENE
CAS # 108-88-3

Division of Toxicology ToxFAQs™ **February 2001**

This fact sheet answers the most frequently asked health questions (FAQs) about toluene. 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.

HIGHLIGHTS: Exposure to toluene occurs from breathing contaminated workplace air, in automobile exhaust, some consumer products paints, paint thinners, fingernail polish, lacquers, and adhesives. Toluene affects the nervous system. Toluene has been found at 959 of the 1,591 National Priority List sites identified by the Environmental Protection Agency

What is toluene?

Toluene is a clear, colorless liquid with a distinctive smell. Toluene occurs naturally in crude oil and in the tolu tree. It is also produced in the process of making gasoline and other fuels from crude oil and making coke from coal.

Toluene is used in making paints, paint thinners, fingernail polish, lacquers, adhesives, and rubber and in some printing and leather tanning processes.

What happens to toluene when it enters the environment?

❑ Toluene enters the environment when you use materials that contain it. It can also enter surface water and groundwater from spills of solvents and petrolieum products as well as from leasking underground storage tanks at gasoline stations and other facilities.

❑ When toluene-containing products are placed in landfills or waste disposal sites, the toluene can enter the soil or water near the waste site.

❑ Toluene does not usually stay in the environment long.

❑ Toluene does not concentrate or buildup to high levels in animals.

How might I be exposed to toluene?

❑ Breathing contaminated workplace air or automobile exhaust.

❑ Working with gasoline, kerosene, heating oil, paints, and lacquers.

❑ Drinking contaminated well-water.

❑ Living near uncontrolled hazardous waste sites containing toluene products.

How can toluene affect my health?

Toluene may affect the nervous system. Low to moderate levles can cause tiredness, confusion, weakness, drunken-type actions, memory loss, nausea, loss of appetite, and hearing and color vision loss. These symptoms usually disappear when exposure is stopped.

Inhaling High levels of toluene in a short time can make you feel light-headed, dizzy, or sleepy. It can also cause unconsciousness, and even death.

High levels of toluene may affect your kidneys.

How likely is toluene to cause cancer?

Studies in humans and animals generally indicate that toluene does not cause cancer.

The EPA has determined that the carcinogenicity of toluene can not be classified.

How can toluene affect children?

It is likely that health effects seen in children exposed to toluene will be similar to the effects seen in adults.
Some studies in animals suggest that babies may be more sensitive than adults.

Breathing very high levels of toluene during pregnancy can result in children with birth defects and retard mental abilities, and growth. We do not know if toluene harms the unborn child if the mother is exposed to low levels of toluene during pregnancy.

How can families reduce the risk of exposure to toluene?

☐ Use toluene-containing products in well-ventilated areas.

☐ When not in use, toluene-containing products should be tightly covered to prevent evaporation into the air.

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

There are tests to measure the level of toluene or its breakdown products in exhaled air, urine, and blood. To determine if you have been exposed to toluene, your urine or blood must be checked within 12 hours of exposure. Several other chemicals are also changed into the same breakdown products as toluene, so some of these tests are not specific for toluene.

Has the federal government made recommendations to protect human health?

EPA has set a limit of 1 milligram per liter of drinking water (1 mg/L).

Discharges, releases, or spills of more than 1,000 pounds of toluene must be reported to the National Response Center.

The Occupational Safety and Health Administration has set a limit of 200 parts toluene per million of workplace air (200 ppm).

References

Agency for Toxic Substances and Disease Registry (ATSDR). 2000. Toxicological Profile for Toluene. 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 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.

ATSDR
AGENCY FOR TOXIC SUBSTANCES
AND DISEASE REGISTRY

XYLENE

CAS # 1330-20-7

Agency for Toxic Substances and Disease Registry ToxFAQs **September 1996**

This fact sheet answers the most frequently asked health questions (FAQs) about xylene. 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: Exposure to xylene occurs in the workplace and when you use paint, gasoline, paint thinners and other products that contain it. People who breathe high levels may have dizziness, confusion, and a change in their sense of balance. This substance has been found in at least 658 of the 1,430 National Priorities List sites identified by the Environmental Protection Agency (EPA).

What is xylene?

(Pronounced zī′lēn)

Xylene is a colorless, sweet-smelling liquid that catches on fire easily. It occurs naturally in petroleum and coal tar and is formed during forest fires. You can smell xylene in air at 0.08–3.7 parts of xylene per million parts of air (ppm) and begin to taste it in water at 0.53–1.8 ppm.

Chemical industries produce xylene from petroleum. It's one of the top 30 chemicals produced in the United States in terms of volume.

Xylene is used as a solvent and in the printing, rubber, and leather industries. It is also used as a cleaning agent, a thinner for paint, and in paints and varnishes. It is found in small amounts in airplane fuel and gasoline.

What happens to xylene when it enters the environment?

- Xylene has been found in waste sites and landfills when discarded as used solvent, or in varnish, paint, or paint thinners.
- It evaporates quickly from the soil and surface water into the air.
- In the air, it is broken down by sunlight into other less harmful chemicals.
- It is broken down by microorganisms in soil and water.
- Only a small amount of it builds up in fish, shellfish, plants, and animals living in xylene-contaminated water.

How might I be exposed to xylene?

- Breathing xylene in workplace air or in automobile exhaust.
- Breathing contaminated air.
- Touching gasoline, paint, paint removers, varnish, shellac, and rust preventatives that contain it.
- Breathing cigarette smoke that has small amounts of xylene in it.
- Drinking contaminated water or breathing air near waste sites and landfills that contain xylene.
- The amount of xylene in food is likely to be low.

How can xylene affect my health?

Xylene affects the brain. High levels from exposure for short periods (14 days or less) or long periods (more than 1 year) can cause headaches, lack of muscle coordination, dizziness, confusion, and changes in one's sense of balance. Exposure of people to high levels of xylene for short periods can also cause irritation of the skin, eyes, nose, and throat; difficulty in breathing; problems with the lungs; delayed reaction time; memory difficulties; stomach discomfort; and possibly changes in the liver and kidneys. It can cause unconsciousness and even death at very high levels.

Studies of unborn animals indicate that high concentrations of xylene may cause increased numbers of deaths, and delayed growth and development. In many instances, these same concentrations also cause damage to the mothers. We do not know if xylene harms the unborn child if the mother is exposed to low levels of xylene during pregnancy.

How likely is xylene to cause cancer?

The International Agency for Research on Cancer (IARC) has determined that xylene is not classifiable as to its carcinogenicity in humans.

Human and animal studies have not shown xylene to be carcinogenic, but these studies are not conclusive and do not provide enough information to conclude that xylene does not cause cancer.

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

Laboratory tests can detect xylene or its breakdown products in exhaled air, blood, or urine. There is a high degree of agreement between the levels of exposure to xylene and the levels of xylene breakdown products in the urine. However, a urine sample must be provided very soon after exposure ends because xylene quickly leaves the body. These tests are not routinely available at your doctor's office.

Has the federal government made recommendations to protect human health?

The EPA has set a limit of 10 ppm of xylene in drinking water.

The EPA requires that spills or accidental releases of xylenes into the environment of 1,000 pounds or more must be reported.

The Occupational Safety and Health Administration (OSHA) has set a maximum level of 100 ppm xylene in workplace air for an 8-hour workday, 40-hour workweek.

The National Institute for Occupational Safety and Health (NIOSH) and the American Conference of Governmental Industrial Hygienists (ACGIH) also recommend exposure limits of 100 ppm in workplace air.

NIOSH has recommended that 900 ppm of xylene be considered immediately dangerous to life or health. This is the exposure level of a chemical that is likely to cause permanent health problems or death.

Glossary

Evaporate: To change from a liquid into a vapor or a gas.

Carcinogenic: Having the ability to cause cancer.

CAS: Chemical Abstracts Service.

ppm: Parts per million.

Solvent: A liquid that can dissolve other substances.

References

Agency for Toxic Substances and Disease Registry (ATSDR). 1995. Toxicological profile for xylenes (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, 1600 Clifton Road NE, Mailstop E-29, Atlanta, GA 30333. Phone:1-888-422-8737, FAX: 404-498-0093. 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.

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

__ Bites

__ Blisters

__ Bruises

__ Chemical Burns

__ Cold Exposure

__ Concussion

__ Lacerations

_____ Dislocations

_____ Faint/Dizziness

_____ Fractures

_____ Frostbite

_____ Heat Burns

_____ Heat Exhaustion

_____ Heat Stroke

____ Punctures

____ Radiation Burns

____ Respiratory Allergy

____ Sprains

____ Toxic Resp. Exposure

____ Toxic Ingestion

____ Dermal Allergy

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