ATLANTIC CHESTNUT – LOT 3

275 CHESTNUT STREET
BROOKLYN, NEW YORK

Draft Supplemental Remedial Investigation Work Plan

NYSDEC BCP Site Number: C224236
AKRF Project Number: 12184

Prepared for:

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1.0 INTRODUCTION

This Supplemental Remedial Investigation (SRI) Work Plan (SRIWP) has been prepared by AKRF, Inc. (AKRF) on behalf of Atlantic Chestnut Affordable Housing LLC (the Volunteer) for the Atlantic Chestnut – Lot 3 site, located at 275 Chestnut Street in Brooklyn, New York, hereafter referred to as "the Site". The legal definition of the Site is Brooklyn Borough Tax Block 4143, Lot 3. Historically, Lot 1 encompassed the entirety of Block 4143, but was apportioned into three lots (Lots 1, 2, and 3) in 2016. It is noted that the New York City Tax Map has not yet been updated to reflect the tax lot apportionment. A Site Location Map is provided as Figure 1.

Atlantic Chestnut Affordable Housing LLC entered into a Brownfield Cleanup Agreement (BCA) (BCA Index No. C224235-05-16) with the New York State Department of Environmental Conservation (NYSDEC) on May 26, 2016. The Site is identified as Brownfield Cleanup Program (BCP) Site No. C224235. A BCA Amendment application was submitted to NYSDEC in August 2017 to document the change of address from 3301 Atlantic Avenue to 275 Chestnut Street, as recently filed with the New York City Department of Buildings (NYCDOB) and to document the alteration of the northern property boundary, resulting in an acreage increase from approximately 1.0475 acres to approximately 1.2020 acres. The BCA Amendment was executed on October 24, 2017. The former and current BCP Site boundaries, the RI sample locations, and the Remedial Design Investigation (RDI) nested groundwater monitoring well location are shown on Figure 2.

Based on an evaluation of the data and information from the December 2015 Subsurface (Phase II) Investigation and the December 2016 RI, there is contaminated soil, groundwater, and soil vapor present at the Site. This SRIWP has been prepared to further delineate known soil and groundwater contamination at the Site. The data compiled from this SRI, and the Subsurface (Phase II) Investigation and RI, will be used to design a remedy and prepare a Remedial Action Work Plan (RAWP).

The SRI will be completed in accordance with this SRIWP, which includes a Quality Assurance Project Plan (QAPP), provided as Appendix A, and a Health and Safety Plan (HASP), provided as 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, groundwater monitoring well installation and development, and groundwater sampling.

2.0 SITE DESCRIPTION AND HISTORY

2.1 Site Description and Surrounding Land Use

The Site currently consists of an approximately 52,360-square foot concrete- and asphalt-paved vacant lot. The northern portion of the Site was formerly developed with a series of vacant, fire-damaged factory buildings that extended to the north-adjacent properties (NYSDEC BCP Site Nos. C224234 and C224235). The buildings were demolished between July and December 2016. The surrounding area is developed primarily with residential, commercial, manufacturing, transportation, and industrial uses. The elevated J and Z Metropolitan Transit Authority (MTA) subway tracks run along Fulton Street to the north and the Long Island Railroad (LIRR) tracks are located beneath Atlantic Avenue to the south.

2.2 Site Geology, Hydrogeology, and Subsurface Characteristics

During the RI, groundwater was encountered at depths ranging from 29.95 to 32.71 feet below sidewalk grade or 8.0 to 8.2 feet above North American Vertical Datum (NAVD), an approximation of mean sea level. Based on the well elevation survey of the Site and adjoining lots, groundwater flows in a southerly direction beneath the Site and surrounding area. Groundwater in this part of Brooklyn is not used as a potable source. There are no surface water bodies or streams on or immediately adjacent to the Site.

The stratigraphy of the Site, from the surface down, generally consisted of fill comprising sand, silt, and gravel with varying amounts of concrete, brick, coal ash, and asphalt up to 10 feet below grade, underlain by apparent native sand with varying amounts of gravel and silt to 40 feet below grade (the terminus of the soil borings).

2.3 Site History

Historic records indicated that the Site was developed with residences and a road in 1887 and 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 Site buildings on the northeastern portion of the Site. Demolition of the Site buildings was completed between July and December 2016.

Past owners of the Site include: Columbia Electric Realty, Inc. in 1980; Avnal, Inc. from 1980 to 1984; Blue Ridge Farms, Inc. from 1984 to 2004; 3301 Atlantic Avenue, LLC from 2004 to 2013; Sapphire Luxury Estates, LLC from 2013 to 2014; Atlantic Chestnut, LLC from 2014 to 2015; and Atlantic Chestnut Affordable Housing, LLC from 2015 to present.

3.0 PREVIOUS ENVIRONMENTAL REPORTS

Subsurface (Phase II) Investigation Report – Blue Ridge Farms, 3301 Atlantic Avenue, 84 Dinsmore Place, and 111 Dinsmore Place, Brooklyn, New York, AKRF, Inc. (AKRF), May 2001

AKRF conducted a Subsurface (Phase II) Investigation of a larger area including the Site in May 2001. At the time of this investigation, the Site was developed with food processing and storage buildings. The Subsurface (Phase II) Investigation included the performance of a geophysical survey across exterior portions of the Site and the advancement of four soil borings with the collection and analysis of soil and groundwater samples. The scope of the investigation was based on a December 2000 Phase I Environmental Site Assessment (ESA) of the Site by IVI Environmental, Inc.

Due to reinforced concrete across the Site, the geophysical survey was inconclusive. Soil consisted of fill material (brick, concrete, asphalt, clay, silt, sand, and gravel) up to 6 feet below grade, underlain by native soil (sand, gravel, silt, and clay) to 16 feet below grade. Groundwater was encountered at approximately 32 feet below grade.

Petroleum-related VOCs and the SVOC naphthalene were detected above NYSDEC Recommended Soil Cleanup Objectives (RSCOs) listed in the NYSDEC Technical and Administrative Guidance Memorandum (TAGM) in the soil samples collected, the applicable soil cleanup objectives at the time of the investigation. Solvent and petroleum-related VOCs and metals were detected above Ambient Water Quality Standards (AWQS) and Guidance Values listed in the NYSDEC Division of Water Technical and Operational Guidance Series (TOGS) Memo in the groundwater sample collected from the south adjacent property. VOCs were detected above TOGS in pre- and post- process water samples. Based on elevated photoionization detector (PID) detections and laboratory analytical data from the soil borings surrounding the on-site tank system, Spill No. 0101620 was assigned to the historic address 3301 Atlantic Avenue.

AKRF recommended preparation of a work plan to be submitted to the NYSDEC to further delineate, excavate, and dispose of petroleum-contaminated soil at the Site to close Spill No. 0101620.

Phase I Environmental Site Assessment (ESA) Report – 3301 Atlantic Avenue, 3238 Fulton Street, 226-296 Euclid Avenue, and 215-279 Chestnut Street, Brooklyn, New York, Property Solutions, Inc. (PSI), June 2010

PSI conducted a Phase I ESA of a larger area including the Site in April 2014. 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; records indicating that five USTs were previously located on the Site; and Historic Recognized Environmental Conditions (HRECs) at the Site including the Site's listing in the Leaking Underground Storage Tank (LUST) and Spills databases. 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.

Asbestos Investigation and Bulk Sample/Laboratory Analysis – 3301 Atlantic Avenue, Brooklyn, New York, Safety Environmental, Co. of NY, Inc. (Safety), July 2013

Safety conducted an asbestos survey of the buildings located on the southern portion of the Site and south-adjacent to the Site in July 2013. A total of 131 samples were collected for laboratory analysis from on-site and off-site portions of the buildings. Asbestos-containing material (ACM) 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 ACM prior to demolition of the Site buildings.

Phase I Environmental Site Assessment (ESA) Report – 3301 Atlantic Avenue (Block 4143, Lot 1), Brooklyn, New York, Legette, Brashears, & Graham, Inc. (LBG), March 2014

LBG conducted a Phase I ESA of the Site and the south-adjoining area in April 2014. The Phase I ESA identified RECs associated with former uses at the Site, including: blacksmithing and stamping, a machine and iron works shop, an electric cable manufacturer, a gasoline filling station, and listings in the Spills database. The report 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 that contaminated soil discovered during redevelopment of the Site should be handled according to applicable federal, state, and local regulations.

Chain of Title Summary Report – 3301 Atlantic Avenue and 242 Chestnut Street, Brooklyn, New York, Phipps Houses, 2015

A Chain of Title Summary Report was compiled by Phipps Houses, which outlined ownership of the Site and north-adjoining 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-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.

Phase I Environmental Site Assessment (ESA) Report – 3301 Atlantic Avenue and 242 Chestnut Street, Brooklyn, New York, AKRF, Inc. (AKRF), 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:

- Historic on-site industrial operations, including the Columbia Machine Works and Malleable Iron Company, and the Columbia Cable and Electric Corporation. 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 USTs and ASTs; CERCLIS; CBS; Spill database; TRIS; and Air Discharge databases. These listings may have been related to the Site and/or north-adjacent property(ies).
- The former interconnected factory buildings on the northeastern portion of the Site 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.
- 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 northeastern 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 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.

Subsurface (Phase II) Investigation Report – 3301 Atlantic Avenue, Brooklyn, New York, AKRF, Inc. (AKRF), January 2016

AKRF conducted a Subsurface (Phase II) Investigation at the Site in December 2015. The investigation included: the advancement of three soil borings with the collection and laboratory analysis of six soil samples; the installation of two temporary, one-inch diameter groundwater monitoring wells at two of the boring locations with the collection and laboratory analysis of two groundwater samples; and the installation of two temporary soil vapor points with the collection and laboratory analysis of two soil vapor samples. An ambient air sample was collected from the northern portion of Block 4143 for comparison and quality assurance/quality control (QA/QC) purposes.

Historic fill materials (including sand, gravel, silt, concrete, brick, and asphalt) were observed from just below the surface to approximately three feet below grade within the soil borings, underlain by apparent native sand and gravel to termination depths. PID readings were not detected in the soil borings advanced during the investigation.

No free phase product was detected in either of the monitoring wells during the sampling event. A slight sheen was observed on the groundwater in monitoring well L3-SI-MW-1 during sampling. Results of the soil sample analysis were as follows:

- The VOC cis-1,2-dichlorethylene was detected in soil sample L3-SI-SB-4 (14-15) at a concentration above its UUSCO but below its RRSCO. TCE was detected in soil samples L3-SI-SB-1 (0-2) and L3-SI-SB-4 (14-15) at concentrations exceeding its UUSCO and RRSCO. Cis-1,2-dichloroethylene and TCE are chlorinated solvents, which were likely used during historic operations at the Site.
- Zinc was detected in soil sample L3-SI-SB-4 (0-2) at a concentration exceeding its UUSCO, but below its RRSCO. This metal detection is likely related to historic filling and/or historic operations at the Site.
- PCBs were not detected above laboratory reporting limits, and SVOCs and pesticides were not detected above applicable standards in any of the soil samples analyzed.

Results of the groundwater sample analyses were as follows:

- The VOCs trans-1,2-dichloroethene and vinyl chloride were detected in groundwater sample L3-SI-GW-1 at concentrations above their respective AWQSs. TCE was detected in both of the groundwater samples (L3-SI-GW-1 and L3-SI-GW-4) at concentrations above its AWQS. These detections are likely related to historic operations at the Site.

- The SVOCs benzo(a)anthracene and chrysene were detected in groundwater sample L3-SI-GW-1 at estimated concentrations above their respective AWQS. These detections are likely related to historic operations at the Site.
- Nickel was detected in unfiltered groundwater sample L3-SI-GW-4 at a concentration exceeding its AWQS. Sodium was detected in both of the unfiltered groundwater samples L3-SI-GW-1 and L3-SI-GW-4 at concentrations above its AWQS. Sodium was also detected in the filtered groundwater samples L3-SI-GW-1 and L3-SI-GW-4 in concentrations above its AWQS.
- PCBs and pesticides were not detected above laboratory reporting limits in any of the groundwater samples analyzed.

Results of the soil vapor sample analyses were as follows:

- Petroleum-related compounds were detected in each of the soil vapor samples at individual concentrations up to 422 µg/m^3. Solvent-related compounds were detected at individual concentrations up to 9,190 µg/m^3. PCE and TCE were detected in both of the soil vapor samples at concentrations above their respective AGVs. According to 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. PCE and TCE are chlorinated solvents, which were likely used during historic operations at the Site.

The Subsurface (Phase II) Investigation Report concluded that based on an evaluation of the data and information from the investigation there is solvent-related contamination in soil, groundwater, and soil vapor and petroleum-related contamination in soil vapor present at the Site. These detections appear to be related to historic use at the Site.

Remedial Investigation – 275 Chestnut Street, Brooklyn, New York, AKRF, Inc. (AKRF), October 2017

AKRF conducted an RI at the Site in December 2016. The investigation included: the advancement of 13 soil borings with the collection and laboratory analysis of 29 soil samples; the installation of 7 permanent, two-inch diameter groundwater monitoring wells at 7 of the boring locations with the collection and laboratory analysis of 7 groundwater samples; and the installation of 7 temporary soil vapor points with the collection and laboratory analysis of 7 soil vapor samples. The groundwater monitoring wells were surveyed to determine groundwater flow beneath the Site and surrounding area. The RI identified the following:

- Historic fill materials (including sand, silt, and gravel with varying amounts of concrete, brick, coal ash, and asphalt) were observed from grade to up to 10 feet below grade, underlain by apparent native sand with gravel and silt to termination depths (up to 40 feet below grade).
- Groundwater was encountered during the investigation at depths ranging from 28.95 to 32.71 feet below grade or 8.0 to 8.2 feet above NGVD.
- Based on the well elevation survey, groundwater flows in a southerly direction beneath the Site and surrounding area.
- Field evidence of contamination (petroleum-like odors, dark staining, and/or elevated PID readings) was observed in three of the soil borings (L3-RI-SB-1, L3-RI-SB-2, and L3-RI-SB-3). PID readings up to 7.5 parts ppm were detected in soil boring L3-RI-SB-1

between 25 and 30 feet below grade; up to 19.1 ppm in soil boring L3-RI-SB-2 between 5 and 27 feet below grade; and up to 42.9 ppm in soil boring L3-RI-SB-3 between the surface and 10 feet below grade. Evidence of contamination was not identified in the groundwater monitoring wells.

Results of the soil sample analysis were as follows:

- The chlorinated solvent volatile organic compound (VOC) trichloroethene (TCE) was detected above its Unrestricted Use Soil Cleanup Objective (UUSCO), Restricted Residential Soil Cleanup Objective (RRSCO), and/or Protection of Groundwater Soil Cleanup Objective (PGWSCO) in six soil samples on the northern and southern portions of the Site. TCE was detected in soil sample L3-RI-SB-3 (2-3') 20161205 at a concentration of 87.6 milligrams per kilogram (mg/kg), above its UUSCO and PGWSCO of 0.47 mg/kg, and its RRSCO of 21 mg/kg. TCE was detected in the soil samples L3-RI-SB-2 (10-11') 20161205, L3-RI-SB-2 (12-13') 20161205, L3-RI-SB-2 (30-31') 20161205, L3-RI-SB-6 (12-13') 20161207, and blind duplicate sample L3-RI-SB-X (12-13') 20161205 at concentrations of 3.77 mg/kg, 4.31 mg/kg, 0.823 mg/kg, 5.47 mg/kg, and 5.04 mg/kg, respectively, above its UUSCO and PGWSCO, but below its RRSCO. The VOC cis-1,2-dichloroethene was detected in soil sample L3-RI-SB-6 (12-13') 20161207 at a concentration of 0.263 mg/kg, above its UUSCO and PGWSCO of 0.25 mg/kg, but below its RRSCO of 100 mg/kg. Acetone was detected in two soil samples at concentrations of 0.0888 mg/kg and 0.0512 mg/kg, above its UUSCO and PGWSCO of 0.05 mg/kg, but below its RRSCO of 100 mg/kg. The metals arsenic, copper, and hexavalent chromium were detected in one or more soil samples at concentrations above their respective UUSCOs and/or RRSCOs. Metal concentrations above UUSCOs and/or RRSCOs ranged between 1.4 mg/kg and 99.1 mg/kg.

Results of the groundwater sample analysis were as follows:

- The chlorinated solvent VOCs 1,1-dichloroethene, cis-1,2-dichloroethene, trans-1,2-dichloroethene, chloroform, and vinyl chloride were detected in at least one groundwater sample at concentrations ranging between 9.6 micrograms per liter (µg/L) and 646 µg/L, exceeding their AWQSs. PCE was detected in groundwater samples L3-RI-MW-1 20161214 and L3-RI-MW-2 20161214 at concentrations of 6.4 µg/L and 5.2 µg/L, respectively, above its AWQS of 5 µg/L. TCE was detected in each of the groundwater samples and blind duplicate groundwater sample L3-RI-MW-X 20161214 at concentrations of 122 µg/L, 1,070 µg/L, 22 µg/L, 89.7 µg/L, 6.9 µg/L, 112 µg/L, and 2.1 µg/L, respectively, above its AWQS of 5 µg/L. Four metals (iron, sodium, nickel, and manganese) were detected in at least one of the groundwater samples in both the total and dissolved analyses at concentrations exceeding their AWQSs. Metal concentrations above AWQSs ranged between 408 µg/L and 65,800 µg/L.

Results of the soil vapor sample analysis were as follows:

- Petroleum-related VOCs were detected in soil vapor at individual concentrations up to 45.2 micrograms per cubic meter (µg/m^3). Chlorinated solvent-related VOCs were detected at individual concentrations up to 8,070 µg/m^3. PCE was detected in soil vapor samples L3-RI-SV-3 20161212, L3-RI-SV-4 20161212, and L3-RI-SV-5 20161212 at concentrations of 46 µg/m^3, 8,070 µg/m^3, and 101 µg/m^3, respectively, above its Air Guidance Value (AGV) of 30 µg/m^3. According to NYSDOH Soil Vapor/Indoor Air Matrix B, the applicable matrix for PCE, sub-slab soil vapor concentrations below 100 µg/m^3 result in a "no further action" or "identify source(s) and resample or mitigate" action, depending on indoor air concentrations. Sub-slab concentrations between 100 µg/m^3 and 999 µg/m^3 result in a "no further action", "monitor", or "mitigate" action, depending on indoor air concentrations. Sub-slab concentrations of 1,000 µg/m^3 or above result in "mitigate" actions, regardless of indoor air concentrations. TCE was detected in all soil vapor samples (L3-RI-SV-1 through L1-RI-SV-6) at concentrations of 4,630 µg/m^3, 3,230 µg/m^3, 4,440 µg/m^3, 448 µg/m^3, 7,690 µg/m^3, and 4,280 µg/m^3, respectively, above its AGV of 2 µg/m^3. According to NYSDOH Soil Vapor/Indoor Air Matrix A, the applicable matrix for TCE, sub-slab soil vapor concentrations above 59 µg/m^3 result in a "mitigate" action, regardless of indoor air concentrations.

The RI data will be reported with the SRI data in a Remedial Investigation Report (RIR), as described in Section 4.0 of this SRIWP.

Brownfield Cleanup Program Amendment Application – 3301 Atlantic Avenue, Brooklyn, New York, AKRF, Inc. (AKRF), August 2017

AKRF prepared a BCA Amendment Application in August 2017 to document the change of address from 3301 Atlantic Avenue to 275 Chestnut Street, as recently filed with the New York City Department of Buildings (NYCDOB); and to document the alteration of the northern property boundary, resulting in an acreage increase from approximately 1.0475 acres to approximately 1.2020 acres. The BCA was executed on October 24, 2017.

4.0 FIELD PROGRAM

The SRI field program will focus on collecting soil and groundwater data to determine the vertical and horizontal extent of Site contamination and to aid in the design of the proposed remedy.

4.1 Field Program Summary

The field sampling scope of work (SOW) includes: the advancement of 23 soil borings with the collection and laboratory analysis of soil samples from each boring; and the installation of 7 nested groundwater monitoring wells and 4 groundwater monitoring wells with the collection and laboratory analysis of 19 groundwater samples from the proposed groundwater monitoring wells. In addition, 6 groundwater samples will be collected from the 6 monitoring wells (L3-RI-MW-1 through L3-RI-MW-5 and L2-RI-MW-4) installed during the December 2016 RI. The proposed soil borings and nested groundwater monitoring well locations, and the existing groundwater monitoring wells are shown on Figure 2.

4.2 Soil Boring Installation and Soil Sampling

A Geoprobe™ direct-push drill rig will be used to advance soil borings L3-SRI-SB-12 through L3-SRI-SB-23 and a Rotosonic drill rig will be used to advance soil borings L3-SRI-SB-1 through L3-SRI-SB-11 at the approximate locations shown on Figure 2. For soil borings drilled using a Geoprobe™, soil cores will be collected in four-foot long, two-inch diameter, stainless steel macrocore piston rod samplers fitted with internal, dedicated acetate liners. For soil borings drilled using a Rotosonic drill rig, soil cores will be collected in four-foot long, four-inch diameter dedicated plastic bags. Soil samples will be inspected by AKRF field personnel for evidence of contamination (e.g., odors and staining), screened for the presence of VOCs with a PID equipped with an 11.7 electron volt (eV) lamp, and logged using the modified Burmister soil classification system. The PID will be calibrated daily in accordance with manufacturer's recommendations prior to sampling.

The rationale for the proposed soil sample locations is summarized in Table 1.

Table 1
Proposed Soil Sample Locations and Rationale

Sample Location	On-Site Location	Sample Intervals (feet below grade)	Rationale
L3-SRI-SB-1	West-central portion of the Site	4-5', 5-7', 7-9', 9-11', 11-13', 13-15'	To assess CVOCs in soil
L3-SRI-SB-2	Central portion of the Site	4-5', 5-7', 7-9', 9-11', 11-13', 13-15', 15-17' 17-19', 19-21', 21-23', 23-25', 25-27', 27-29' 29-31', 31-33'*	To assess CVOCs in soil
L3-SRI-SB-3	Northeastern portion of the Site	4-5', 5-7', 7-9', 9-11', 11-13', 13-15'	To assess CVOCs in soil
L3-SRI-SB-4	Southwestern portion of the Site	4-5', 5-7', 7-9', 9-11', 11-13', 13-15'	To assess CVOCs in soil
L3-SRI-SB-5	Southeastern portion of the Site	4-5', 5-7', 7-9', 9-11', 11-13', 13-15'	To assess CVOCs in soil
L3-SRI-SB-6	Southwestern portion of the Site	4-5', 5-7', 7-9', 9-11', 11-13', 13-15'	To assess CVOCs in soil

Sample Location	On-Site Location	Sample Intervals (feet below grade)	Rationale
L3-SRI-SB-7	West-central portion of the Site	4-5’, 5-7’, 7-9’, 9-11’, 11-13’, 13-15’	To assess CVOCs, PAHs, and heavy metals in soil
L3-SRI-SB-8	East-central portion of the Site	4-5’, 5-7’, 7-9’, 9-11’, 11-13’, 13-15’	To assess CVOCs, PAHs, and heavy metals in soil
L3-SRI-SB-9	Northwestern portion of the Site	4-5’, 5-7’, 7-9’, 9-11’, 11-13’, 13-15’	To assess CVOCs in soil
L3-SRI-SB-10	North-central portion of the Site	4-5’, 5-7’, 7-9’, 9-11’, 11-13’, 13-15’, 15-17’ 17-19’, 19-21’, 21-23’, 23-25’, 25-27’, 27-29’ 29-31’, 31-33’*	To assess CVOCs in soil identified south of soil boring L2-RI-SB-10 advanced during the Remedial Investigation
L3-SRI-SB-11	Southern portion of the Site	4-5’, 5-7’, 7-9’, 9-11’, 11-13’, 13-15’	To assess CVOCs in soil
L3-SRI-SB-12 through L3-SRI-SB-19	Northern portion of the Site	4-5’, 5-7’, 7-9’, 9-11’, 11-13’, 13-15’	To assess CVOCs in soil
L3-SRI-SB-20	Western portion of the Site	4-5’, 5-7’, 7-9’, 9-11’, 11-13’, 13-15’	To assess CVOCs, PAHs, and heavy metals in soil
L3-SRI-SB-21	Central portion of the Site	4-5’, 5-7’, 7-9’, 9-11’, 11-13’, 13-15’	To assess CVOCs, PAHs, and heavy metals in soil
L3-SRI-SB-22	Southeastern portion of the Site	4-5’, 5-7’, 7-9’, 9-11’, 11-13’, 13-15’	To assess CVOCs, PAHs, and heavy metals in soil
L3-SRI-SB-23	Southeastern portion of the Site	4-5’, 5-7’, 7-9’, 9-11’, 11-13’, 13-15’	To assess CVOCs, PAHs, and heavy metals in soil

Notes:
* Sampling will continue in successive two-foot intervals until saturated soils are reached.
CVOC – chlorinated volatile organic compound
PAHs – polycyclic aromatic hydrocarbons

At soil borings L3-SRI-SB-1, L3-SRI-SB-3 through L3-SRI-SB-9, and L3-SRI-SB-11 through L3-SRI-SB-23, one soil sample will be collected from each soil boring from 4 to 5 feet below grade and 13 to 15 feet below grade. Additional soil samples will be collected from each two-foot interval between 5 and 13 feet below grade (i.e., 5 to 7 feet below grade, 7 to 9 feet below grade, etc.) and will be placed on hold pending laboratory analytical results of the 4 to 5 foot and 13 to 15 foot samples in each boring. At soil borings L3-SRI-SB-2 and L3-SRI-SB-10, soil samples will be collected from 4 to 5 feet below grade and from 13 to 15 feet below grade. Additional soil samples will be collected from each two-foot interval between 5 feet below grade and the saturated zone, expected to be encountered between approximately 30 and 33 feet below grade.

Soil samples slated for laboratory analysis (including soil samples placed on hold) 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 United States Environmental Protection Agency (EPA) protocols to a NYSDOH Environmental Laboratory Approval Program (ELAP)-certified laboratory. The soil samples will be analyzed for CVOCs by EPA Method 8260. The soil samples collected from the 13 to 15 foot interval in soil borings L3-SRI-SB-7, L3-SRI-SB-8, and L3-SRI-SB-20 through L2-SRI-SB-23 will be additionally analyzed for polycyclic aromatic hydrocarbons (PAHs) by EPA Method 8270, and Resource Conservation and Recovery Act (RCRA) metals by EPA Method 6000/7000 series. The soil samples placed on hold will be activated as necessary to further delineate any concentrations above RRSCOs or PGWSCOs. Category B deliverables will be requested from the laboratory.

At a minimum, one blind duplicate, field blank, trip blank and matrix spike/matrix spike duplicate (MS/MSD) will be collected for quality assurance/quality control (QA/QC) purposes for every 20 field samples collected. The QA/QC samples, with the exception of the trip blanks, will be analyzed for the testing parameters of the associated collected samples. Trip blanks will be analyzed for CVOCs 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) and will be measured off of fixed points in the field.

4.3 Groundwater Monitoring Well Installation and Development

Seven permanent, nested groundwater monitoring wells (denoted as L3-SRI-MW-1 through L3-SRI-MW-5, L3-SRI-MW-9, and L3-SRI-MW-10) and four permanent groundwater wells (denoted as L3-SRI-MW-6 through L3-SRI-MW-8 and L3-SRI-MW-11) will be installed using a Rotosonic drill rig at the approximate locations shown on Figure 2. The groundwater monitoring well locations, screened intervals, and analytical parameters are shown on Table 2.

Table 2
Groundwater Monitoring Well Construction Details

Groundwater Monitoring Well ID	On-Site Location	Screened Intervals (feet below grade)	Analytes
L3-SRI-MW-1I	Northwestern portion of the Site	55-60’	CVOCs, 1,4-dioxane, PFOA, and PFOS
L3-SRI-MW-1D		75-80’	CVOCs, 1,4-dioxane, PFOA, and PFOS
L3-SRI-MW-2I	Central portion of the Site	55-60’	CVOCs, 1,4-dioxane, PFOA, and PFOS
L3-SRI-MW-2D		75-80’	CVOCs, 1,4-dioxane, PFOA, and PFOS
L3-SRI-MW-3I	Northeastern portion of the Site	55-60’	CVOCs, 1,4-dioxane, PFOA, and PFOS
L3-SRI-MW-3D		75-80’	CVOCs, 1,4-dioxane, PFOA, and PFOS
L3-SRI-MW-4I	Southwestern portion of the Site	55-60’	CVOCs, 1,4-dioxane, PFOA, and PFOS
L3-SRI-MW-4D		75-80’	CVOCs, 1,4-dioxane, PFOA, and PFOS
L3-SRI-MW-5I	Southeastern portion of the Site	55-60’	CVOCs, 1,4-dioxane, PFOA, and PFOS
L3-SRI-MW-5D		75-80’	CVOCs, 1,4-dioxane, PFOA, and PFOS
L3-SRI-MW-6I	Southwestern portion of the Site	55-60’	To assess CVOCs, 1,4-dioxane, PFOA, and PFOS in groundwater
L3-SRI-MW-7S	West-central	25-35’*	CVOCs, 1,4-dioxane, PFOA, and

Groundwater Monitoring Well ID	On-Site Location	Screened Intervals (feet below grade)	Analytes
	portion of the Site		PFOS
L3-SRI-MW-8S	East-central portion of the Site	25-35'*	CVOCs, 1,4-dioxane, PFOA, and PFOS
L3-SRI-MW-9I	Northwestern portion of the Site	55-60'	CVOCs, 1,4-dioxane, PFOA, and PFOS
L3-SRI-MW-9D		75-80'	
L3-SRI-MW-10S	North-central portion of the Site	25-35'*	CVOCs, 1,4-dioxane, PFOA, and PFOS
L3-SRI-MW-10I		55-60'	CVOCs, 1,4-dioxane, PFOA, and PFOS
L3-SRI-MW-10D		75-80'	CVOCs, 1,4-dioxane, PFOA, and PFOS
L3-SRI-MW-11S	Southern portion of the Site	25-35'*	CVOCs, 1,4-dioxane, PFOA, and PFOS

Notes:
* Screened interval may change depending on observed groundwater table.
CVOC – chlorinated volatile organic compound
PFOA – perfluorooctanoic acid
PFOS – perfluorooctanesulfonic acid

To collect groundwater samples from varying depths beneath the Site, one, two, or three, 2-inch diameter polyvinyl chloride (PVC) groundwater monitoring wells will be installed within each borehole. The intermediate and deep wells will be constructed with five feet of screen from 55 to 60 feet below grade, and 75 to 80 feet below grade to sample intermediate and deep groundwater, respectively. Groundwater monitoring wells installed to sample shallow groundwater will be constructed with 10 feet of screen straddling the water table, expected to be encountered at approximately 30 feet below grade. All wells will be constructed with 0.020-inch slotted PVC well screen with solid PVC riser installed to the ground surface.

At each well, a No. 2 morie sandpack will be installed to 2 feet above the well screen. The annular space around the solid well riser will be sealed with approximately two feet of bentonite followed by a non-shrinking cement mixture to approximately one foot below grade. Each of the wells will be finished with locking j-plugs and a flush-mounted protective locking well cover. Well construction logs will be prepared and included as an appendix to the RIR.

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

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. Elevation measurements will be taken at each newly installed well location: the at-grade elevation; and the elevation of the top of each of the PVC casings (north sides, at marking), to further define shallow groundwater flow and determine intermediate and deep groundwater flow. The elevation datum for the sampling points will be based on NAVD 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 newly installed groundwater wells will be sampled one to two weeks following development using a submersible pump. In addition, L3-RI-MW-1 through L3-RI-MW-6 and L2-RI-MW-4 will also be sampled. 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.

Groundwater samples will be placed in laboratory-supplied containers and shipped in accordance with appropriate EPA protocols to a NYSDOH ELAP-certified laboratory. The samples collected from the newly installed wells will be analyzed for 1,4-dioxane by EPA Method modified 8260C Selective Ion Monitoring (SIM), Perfluorooctanoic Acid (PFOA) and Perfluorooctane Sulfonate (PFOS) by EPA Method Modified 537, and CVOCs by EPA Method 8260 using Category B deliverables. The samples collected from the existing wells will be analyzed for 1,4-dioxane by EPA Method modified 8260C SIM, PFOA and PFOS by EPA Method Modified 537 only.

One blind duplicate, field blank, trip blank and MS/MSD will be collected for QA/QC purposes for every 20 field samples collected. The QA/QC samples will be analyzed for the same analytes as the samples with the exception of the trip blanks, which will be analyzed for CVOCs and 1,4-dioxane 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 Quality Assurance/Quality Control (QA/QC)

Additional analysis will be included for quality control measures, as required by the Category B sampling protocols. The QA/QC samples for soil and groundwater will include at least 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 soil samples will be analyzed for CVOCs by EPA Method 8260, PAHs by EPA Method 8270, and RCRA Metals by EPA Method 6000/7000 series using Category B deliverables. The field blank, blind duplicate, and MS/MSD groundwater samples will be analyzed for CVOCs by EPA Method 8260, 1,4-Dioxane by EPA Method modified 8260C SIM, and PFOA and PFOS by EPA Method 537. The laboratory-prepared trip blank(s) will be submitted for analysis of CVOCs and 1,4-dioxane to determine the potential for cross-contamination. The QAPP describes the QA/QC protocols and procedures that will be followed during implementation of this RDIWP. The QAPP is included as Appendix A.

4.7 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 lab-certified perfluoridated compound (PFC)-free water/Alconox® solution.
2. Rinse with lab-certified PFC-free water.
3. Scrub again with a bristle brush using a lab-certified PFC-free water /Alconox® solution.
4. Rinse with lab-certified PFC-free water.
5. Rinse with lab-certified PFC-free water.
6. Air-dry the equipment.

4.8 Management of Investigation-Derived Waste (IDW)

After each soil boring is completed, the hole will be filled with bentonite chips (hydrated) and patched with asphalt or concrete to match existing surface conditions. Soil cuttings and development, purge, and sampling groundwater will be containerized in properly labeled Department of Transportation (DOT)-approved 55-gallon drums for future off-site disposal at a permitted facility. 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. 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.

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; and discuss conclusions and recommendations drawn from the results of the RI and the SRI.

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 illustrate 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 Qualitative Human Health Exposure Assessment (QHHEA)

A QHHEA will be performed in accordance with DER-10 Section 3.3. The assessment will be included in the RIR.

6.0 CERTIFICATION

I, Deborah Shapiro, QEP, certify that I am currently a Qualified Environmental Professional as defined in 6 NYCRR Part 375 and that this Supplemental 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	DRAFT	11/03/2017
Name	***Signature***	***Date***

7.0 REFERENCES

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2. Remedial Investigation Work Plan – Atlantic Chestnut – Lot 3, 3301 Atlantic Avenue, Brooklyn, New York, AKRF, November 2016.
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18. Data Usability Summary Report (DUSR) – Data Validation Summary for Soil Vapor Samples Collected December 12, 2016, Atlantic Chestnut – Lot 3, 3301 Atlantic Avenue, Brooklyn, New York, L.A.B. Validation Corp., January 9, 2017.

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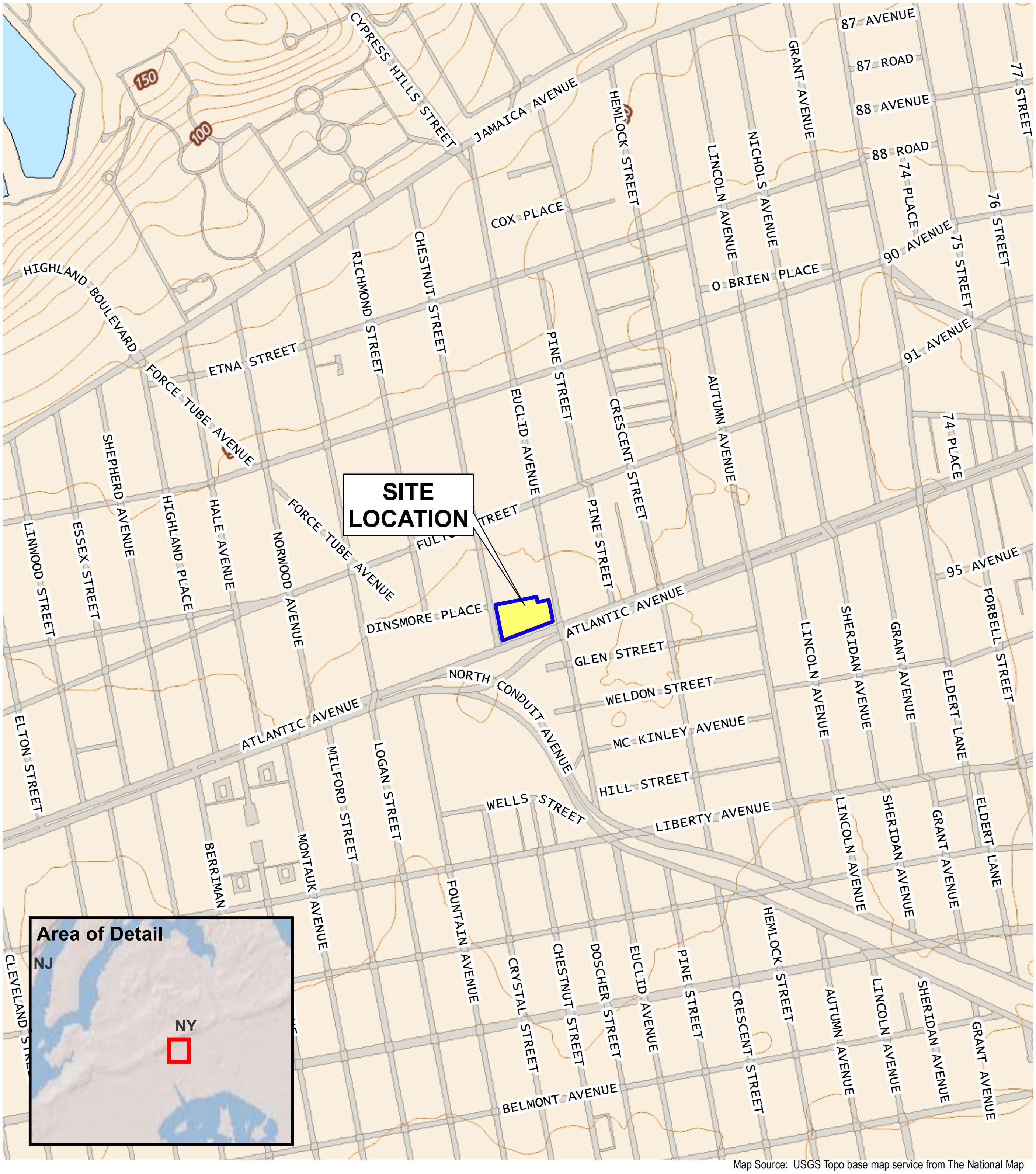
FIGURES



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

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©2017 AKRF W:\Projects\12184 - PHIPPS 3301 ATLANTIC\Technical\GIS and Graphics\hazmat\12184 Fig 1 Site Loc Map.mxd4/12/2017 2:05:26 PM mveilleux

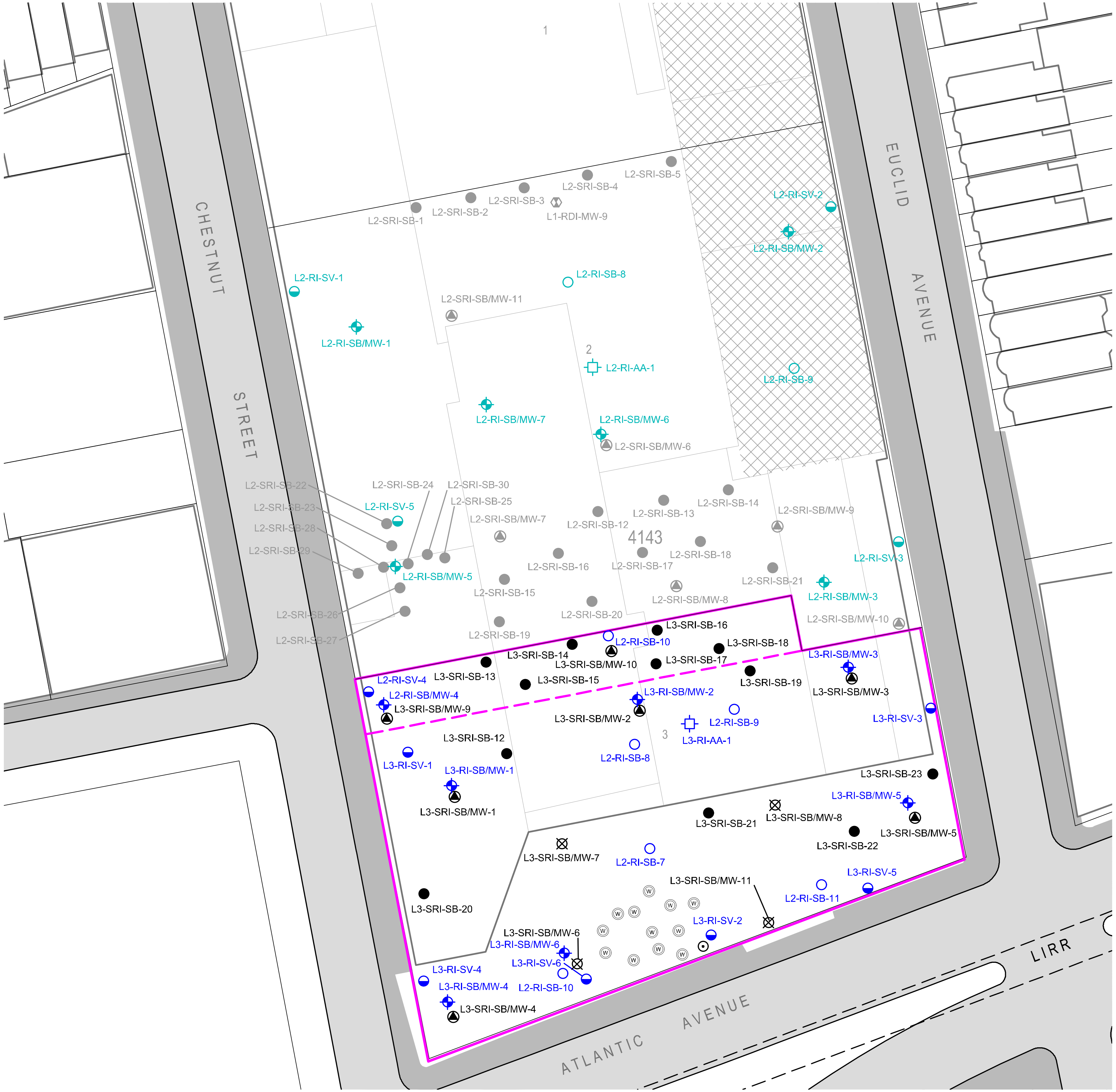
AKRF

440 Park Avenue South, New York, NY 10016

Atlantic Chestnut - Lot 3
3301 Atlantic Avenue
Brooklyn, New York

SITE LOCATION

DATE	**4/12/2017**
PROJECT NO.	**12184**
FIGURE	**1**



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

LEGEND

━	BCP SITE BOUNDARY
╌	FORMER BCP SITE BOUNDARY
3	LOT BOUNDARY
4143	BLOCK NUMBER
─	FORMER BUILDING LINE
╌	LIRR SUBTERRANEAN TRACKS
▨	APPROXIMATE EXTENT OF FORMER PARTIAL CELLAR
●	PROPOSED SUPPLEMENTAL REMEDIAL INVESTIGATION SOIL BORING LOCATION
◭	PROPOSED SUPPLEMENTAL REMEDIAL INVESTIGATION SOIL BORING/NESTED GROUNDWATER MONITORING WELL LOCATION
⊠	PROPOSED SUPPLEMENTAL REMEDIAL INVESTIGATION SOIL BORING/GROUNDWATER MONITORING WELL LOCATION
○	REMEDIAL INVESTIGATION SOIL BORING LOCATION (2016)
⊕	REMEDIAL INVESTIGATION SOIL BORING/GROUNDWATER MONITORING WELL LOCATION (2016)
◒	REMEDIAL INVESTIGATION TEMPORARY SOIL VAPOR POINT LOCATION (2016)
⌖	REMEDIAL INVESTIGATION AMBIENT AIR SAMPLE LOCATION (2016)
⊙	GROUNDWATER MONITORING WELL LOCATION (INSTALLED SOMETIME PRIOR TO 2015)
ⓦ	CHEMICAL OXIDATION INJECTION WELL LOCATION (INSTALLED SOMETIME PRIOR TO 2015)
⊗	OFF-SITE REMEDIAL DESIGN INVESTIGATION NESTED GROUNDWATER WELL LOCATION (2017)
●	OFF-SITE PROPOSED SUPPLEMENTAL REMEDIAL INVESTIGATION SOIL BORING LOCATION
◭	OFF-SITE PROPOSED SUPPLEMENTAL REMEDIAL INVESTIGATION SOIL BORING/NESTED GROUNDWATER MONITORING WELL LOCATION
○	OFF-SITE REMEDIAL INVESTIGATION SOIL BORING LOCATION (2016)
⊕	OFF-SITE REMEDIAL INVESTIGATION SOIL BORING/GROUNDWATER MONITORING WELL LOCATION (2016)
◒	OFF-SITE REMEDIAL INVESTIGATION TEMPORARY SOIL VAPOR POINT LOCATION (2016)
⌖	OFF-SITE REMEDIAL INVESTIGATION AMBIENT AIR SAMPLE LOCATION (2016)

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AKRF
440 Park Avenue South, New York, NY 10016

Atlantic Chestnut - Lot 3
275 Chestnut Street
Brooklyn, New York

PROPOSED SAMPLE LOCATION PLAN

DATE
11/9/2017
PROJECT NO.
12184
FIGURE
2

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APPENDIX A

ATLANTIC CHESTNUT – LOT 3

275 CHESTNUT STREET
BROOKLYN, NEW YORK

Quality Assurance Project Plan

NYSDEC BCP Site Number: C224236
AKRF Project Number: 12184

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 2017

TABLE OF CONTENTS

TABLES

ATTACHMENT

1.0 INTRODUCTION

This Quality Assurance Project Plan (QAPP) describes the protocols and procedures that will be followed during implementation of all environmental sampling at the Atlantic Chestnut – Lot 3 site, hereafter referred to as "the Site". The Site is an approximately 52,360-square foot parcel located at 275 Chestnut Street in the East New York neighborhood of Brooklyn, New York. The Site is legally identified as Brooklyn Borough Tax Block 4143, Lot 3. Historically, Lot 1 encompassed the entirety of Block 4143; however, the New York City Department of Finance (NYSDOF) issued a tax lot apportionment in January 2016, which redefined Lot 1 as Lots 1, 2, and 3. It is noted that the New York City Tax Map has not been updated to reflect the tax lot apportionment.

The objective of this QAPP is to provide for Quality Assurance (QA) and maintain Quality Control (QC) of environmental investigative, sampling, and remedial activities conducted under the New York State Department of Environmental Conservation (NYSDEC) oversight in the Brownfield Cleanup Program (BCP) (BCP Site No. C224236). Adherence to the QAPP will ensure that defensible data will be obtained during all environmental work at the Site.

2.0 PROJECT TEAM

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

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

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

2.2 Project Manager

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

2.3 Project Manager Alternate

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

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

The field team leader will be responsible for supervising the daily sampling and health and safety activities in the field and will ensure adherence to the work plan and Health and Safety Plan (HASP), provided as Appendix B of the SRIWP. The field team leader will also act as the field technician and Site safety officer (SSO), and will report to the project manager or project manager alternate on a regular basis regarding daily progress and any deviations from the work plan. The field team leader will be a qualified and responsible person able to act professionally and promptly during environmental work at the Site. Elizabeth Matamoros will be the field team leader. The field team leader alternate is Adrianna Bosco of AKRF. Ms. Matamoros' and Ms. Bosco's resumes are included in Attachment A.

2.5 Laboratory Quality Assurance/Quality Control (QA/QC) Officer

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

3.0 STANDARD OPERATING PROCEDURES (SOPS)

The following sections describe the SOPs for sampling at the Site. During these operations, safety monitoring will be performed as described in the HASP, provided as Appendix B of the SRIWP.

3.1 Decontamination of Sampling Equipment

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

1. Scrub equipment with a bristle brush using a lab-certified perfluoridated compound (PFC)-free water/Alconox® solution.
2. Rinse with lab-certified PFC-free water.
3. Scrub again with a bristle brush using a lab-certified PFC-free water /Alconox® solution.
4. Rinse with lab-certified PFC-free water.
5. Rinse with lab-certified PFC-free water.
6. Air-dry the equipment.

3.2 Management of Investigation-Derived Waste (IDW)

IDW will be containerized in New York State Department of Transportation (NYSDOT)-approved 55-gallon drums or disposed of via tri-axel trucks during excavation activities. The drums will be sealed at the end of each work day and labeled with the date, the sample location, the type of waste (i.e., drill cuttings), and the name and phone number of an AKRF point-of-contact. All IDW exhibiting field evidence of contamination will be disposed of or treated according to applicable federal, state, and local regulations.

4.0 SAMPLING AND LABORATORY PROCEDURES

4.1 Soil Sampling

Soil sampling will be conducted according to the following procedures:

- Characterize the sample according to the modified Burmister soil classification system.
- Field screen the sample for evidence of contamination (e.g., odors, staining,) using visual and olfactory methods and screen for volatile organic compounds (VOCs) using a photoionization detector (PID) equipped with an 11.7 electron Volt (eV) lamp.
- Collect an aliquot of soil from each proposed sample location, place in laboratory-supplied glassware, label the sample in accordance with Section 4.4.1, Table 2 of this QAPP, and place in an ice-filled cooler for shipment to the laboratory.
- Complete the proper chain of custody paperwork and seal the cooler.
- Record sample location, sample depth, and sample observations (evidence of contamination, PID readings, soil classification, etc.) in field log book and boring log data sheet, if applicable.
- Decontaminate any soil sampling equipment between sample locations as described in Section 3.1 of this QAPP.

4.2 Laboratory Methods

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

Table 1
Laboratory Analytical Methods for Analysis Groups

Matrix	Analysis	EPA Method	Bottle Type	Preservative	Hold Time
Soil	Chlorinated Volatile Organic Compounds (VOCs)	8260C	EnCore samplers (3) and 2 oz. plastic jar	≤ 6 °C	48 hours to extract; 14 days to analyze
	Semivolatile Organic Compounds (SVOCs)	8270D	8 oz. Glass Jar	≤ 6 °C	14 days to extract; 40 days to analyze
	RCRA Metals, and Hexavalent Chromium	6000/7000 Series, 6010C, and 7196A	8 oz. Glass Jar	≤ 6 °C	6 months holding time; Mercury 28 days holding time; Hexavalent chromium 30 days to extract, 7 days to analyze
Groundwater	CVOCs and 1,4-Dioxane	8260C plus Selective Ion Monitoring (SIM) for 1,4-Dioxane	5 40 mL Glass Vials	HCl to pH < 2 and ≤ 6 °C	48 hours to extract; 14 days to analyze
	Perfluorooctanoic Acid (PFOA) and Perfluorooctane Sulfonate (PFOS)	Modified 537	3 250mL Polypropylene Bottles	≤ 6 °C, Trizma	14 days to analyze

Notes:
EPA - Environmental Protection Agency
RCRA – Resource Conservation and Recovery Act

4.3 Quality Control (QC) Sampling

In addition to the laboratory analysis of the soil samples, additional analysis will be included for QC measures, as required by the Category B sampling techniques. These samples will include field blank, trip blank, matrix spike/matrix spike duplicate (MS/MSD), and blind duplicate samples at a frequency of one sample per 20 field samples collected or per sample digestion group (SDG). QC samples will be analyzed for the same parameters as the accompanying samples, with the exception of any trip blanks, which will be analyzed for the CVOC list only.

4.4 Sample Handling

4.4.1 Sample Identification

All samples will be consistently identified in all field documentation, chain of custody (COC) documents, and laboratory reports. All samples will be amended with "L3" at the beginning of the sample name and the collection date at the end of the sample same in a year, month, day (YYYYMMDD) format. Blind duplicate sample nomenclature will consist of the sample type, followed by an "X"; MS/MSD samples nomenclature will consist of the parent sample name, followed by "MS/MSD"; and trip and field blanks will consist of "TB-" and "FB-", respectively, followed by a sequential number of the trip/field blanks collected within the sample digestion group (SDG). Special characters, including primes/apostrophes ('), will not be used for sample nomenclature.

4.4.1.1. Supplemental Remedial Investigation (SRI) Sample Identification

In addition to the nomenclature detailed in this section, soil and groundwater samples collected during the SRI will be identified with "SRI-", "SB-" for soil borings or "MW-" for groundwater monitoring wells, and the soil boring or groundwater monitoring well number. Soil samples will also be amended with the depth interval the same was collected from in parentheses. Additionally, groundwater monitoring wells screened at shallow, intermediate, and deep intervals will be appended with "S", "I", or "D", respectively, after the groundwater monitoring well number. Table 2 provides examples of the sampling identification scheme for samples collected during the SRI.

Table 2
SRI Sample Nomenclature

Sample Description	Sample Designation
Groundwater sample collected from groundwater monitoring well L3-SRI-MW-7 from the shallow-screened casing on December 1, 2017	L3-SRI-MW-7S 20171201
Matrix spike/matrix spike duplicate sample of groundwater sample collected from groundwater monitoring well L3-SRI-MW-7 from the intermediate-screened casing on December 1, 2017	L3-SRI-MW-7I MS/MSD 20171201
Blind duplicate sample of groundwater sample collected from groundwater monitoring well L3-SRI-MW-7 from the deep-screened casing on December 1, 2017	L3-SRI-MW-XD 20171201
Second field blank collected with SDG during the SRI on December 1, 2017	L3-SRI-FB-2 20171201
Soil sample collected from soil boring L3-SRI-SB-12 between 12 and 13 feet below grade on December 1, 2017	L3-SRI-SB-12 (12-13) 20171201
Blind duplicate sample of soil sample collected from soil boring L3-SRI-SB-12 between 12 and 13 feet below grade on August 1, 2017	L3-SRI-SB-X (12-13) 20170801

Sample Labeling and Shipping

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

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

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

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

Sample Custody

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

4.5 Field Instrumentation

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

4.6 Quality Assurance (QA)

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

ATTACHMENT A

RESUMES OF RESUMES FOR QA/QC MANAGER, PROJECT MANAGER, PROJECT MANAGER ALTERNATE, AND FIELD TEAM LEADERS

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.

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)

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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.

ELIZABETH MATAMOROS

ENVIRONMENTAL SCIENTIST/PLANNER

Elizabeth Matamoros is an Environmental Scientist in AKRF's Hazardous Materials group. She is a recent graduate from Harvard University with a degree in Environmental Science and Public Policy. She is responsible for conducting Phase I Environmental Site Assessments (ESAs), and supporting the hazardous materials group in preparing Phase II Subsurface Investigations and hazardous materials assessments for EASs and EISs; remediation planning and oversight; and developing Remedial Action Plans and Health and Safety Plans. Elizabeth also works as a Planner in AKRF's Environmental Assessment and Planning Group in their Hudson Valley Office. She provides SEQR support to municipal and private clients, assists in the preparation of Master Plans, and participates in public engagement efforts.

BACKGROUND

Role in Project

Junior Environmental Scientist

Education

B.A., Environmental Science and Public Policy, Earth and Planetary Sciences Minor Harvard College, 2014

Certifications

OSHA 40-hour Health & Safety Training for Hazardous Waste Operations, November 2014
NYSDEC Soil & Sediment Erosion Control - SWPPP Inspector, March 2015
OSHA 8-hour Health & Safety Training for Hazardous Waste Site Personnel Refresher, September 2015OSHA 10-hour Construction Safety Training, November 2015

Years of experience

Date started at AKRF: June 2014

RELEVANT EXPERIENCE - AKRF

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

AKRF has undertaken various assignments under two consecutive hazardous materials on-call contracts, 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. Matamoros conducts Phase I ESAs, Phase II subsurface investigations, plumbing disinfections, indoor air quality investigations, and SSDS inspections as part of this contract.

Various Phase I ESAs

Ms. Matamoros prepared Phase I ESAs in accordance with ASTM E1527-13 and EPA's All Appropriate Inquiry (AAI) rule, which included conducting site visits, reviewing federal and state regulatory databases, and collecting historical fire insurance maps and building records from the municipality for review in determining possible hazardous environmental conditions. Representative projects include:

- Manhattan College (various), Bronx, New York
- Columbia University (various), New York, New York
- 37 Otsego Street, Brooklyn, New York
- West 108th Street, New York, New York
- St. Luke's Hospital, Cornwall, New York
- 9 Wilton Avenue, Norwalk, Connecticut
- 2 Soundview Drive, Greenwich, Connecticut
- 164 Mason Street, Greenwich, Connecticut
- 10 East Evergreen, New City, New York
- Amy's Kitchen Proposed Facility, Goshen, New York
- Proposed Soccer Training Facility, Orangetown, New York

Phase II Subsurface Investigations

Ms. Matamoros conducted Phase II Subsurface Investigations for sites being developed including:

- Amy's Kitchen Proposed Facility, Goshen, New York
- Proposed Soccer Training Facility, Orangetown, New York
- 37 Otsego Street, Brooklyn, New York
- Manhattan College (various), Bronx, New York

Crestwood 300-308 Columbus Avenue, Tuckahoe, NY – Environmental Monitoring

Investigation and remediation of the former gasoline filling station is being conducted under the New York State Brownfield Cleanup Program (BCP). AKRF completed a Phase I Environmental Site Assessment, Phase II Subsurface Investigation, and prepared a Remedial Action Plan (RAP) to address subsurface contamination during site redevelopment. For this project, Ms. Matamoros served as an on-site environmental monitor who conducted work zone and community air monitoring, and oversaw excavation and export of soil.

DEP Property, Carmel, NY – Soil, Sediment and Surface Water Sampling

This project was a continuation of ongoing work conducted by AKRF for a private client. Ms. Matamoros took soil, sediment, and surface water samples for part of an off-site investigation.

87 Gedney Way, White Plains NY – Groundwater Sampling

This project was a continuation of ongoing work conducted by AKRF for the City of White Plains, which previously included a landfill closure. Ms. Matamoros screened wells for methane, measured depth to groundwater, and took groundwater samples from the site.

APPENDIX B

ATLANTIC CHESTNUT – LOT 3

275 CHESTNUT STREET

BROOKLYN, NEW YORK

Health and Safety Plan and Community Air Monitoring Plan

AKRF Project Number: 12184
BCP Site Number: C224236

Prepared for:

NYSDEC Region 2
1 Hunter's Point Plaza
47-40 21st Street
Long Island City, New York 11101

On Behalf Of:

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

Prepared by:

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

NOVEMBER 2017

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APPENDICES

1.0 INTRODUCTION

This Health and Safety Plan (HASP) and Community Air Monitoring Plan (CAMP) were prepared by AKRF, Inc. (AKRF) on behalf of Atlantic Chestnut Affordable Housing LLC (the Volunteer) for the Atlantic Chestnut – Lot 3 site, located at 275 Chestnut Street in Brooklyn, New York, hereafter referred to as "the Site". The legal definition of the Site is Brooklyn Borough Tax Block 4143, Lot 3. Historically, Lot 1 encompassed the entirety of Block 4143, but was apportioned into three lots (Lots 1, 2, and 3) in 2016. It is noted that the New York City Tax Map has not yet been updated to reflect the tax lot apportionment. A Site Location Map is provided as Figure 1.

The Site currently consists of an approximately 52,360-square foot concrete- and asphalt-paved vacant lot. The Site was formerly developed with a series of vacant, fire-damaged factory buildings that extended to the north-adjacent properties [New York State Department of Environmental Conservation (NYSDEC) Brownfield Cleanup Program (BCP) Site Nos. C224234 and C224235]. The former Site buildings were demolished between July and December 2016. The surrounding area is developed primarily with residential, commercial, manufacturing, transportation, and industrial uses. The elevated J and Z Metropolitan Transit Authority (MTA) subway tracks run along Fulton Street to the north and the Long Island Railroad (LIRR) tracks are located beneath Atlantic Avenue to the south.

Historic records indicated that the Site was developed with residences and a road in 1887 and 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 been vacant since a July 2012 fire caused severe structural damage to the former Site buildings. The Site buildings were demolished between July and December 2016.

Based on an evaluation of the data and information from the investigation, there is contaminated soil, groundwater, and soil vapor present at the Site that is likely attributable to historic Site usage, including industrial and manufacturing uses. The presence of copper, hexavalent chromium, lead, mercury, and zinc in shallow fill and the elevated detections of polycyclic aromatic hydrocarbons (PAHs), a class of semivolatile organic compounds (SVOCs), are most likely attributable to historic filling, undocumented discharges due to a fire in 2012, and/or historic operations at the Site. The presence of petroleum-related compounds in soil vapor may be related to the former storage tank(s). The presence of the solvent-related compounds TCE (in soil, groundwater, and soil vapor), PCE (in groundwater and soil vapor), and chloroform (in groundwater) are likely related to the historic manufacturing operations at the Site.

2.0 HEALTH AND SAFETY GUIDELINES AND PROCEDURES

2.1 Hazard Evaluation

2.1.1 Hazards of Concern

Table 1
Hazards of Concern

X	Organic Chemicals	X	Inorganic Chemicals		Radiological
	Biological	X	Explosive/Flammable		Oxygen Deficient Atm.
X	Heat Stress	X	Cold Stress		Carbon Monoxide
Comment: No personnel without confined space entry permits may to enter confined spaces.					

2.1.2 Physical Characteristics

Table 2
Physical Characteristics

X	Liquid	X	Solid		Sludge
X	Vapors		Unknown		Other

2.1.3 Hazardous Materials

Table 3
Hazardous Materials

Chemicals		**Solids**		**Solvents**		**Oils**	
	Acids	X	Ash		Halogens		Transformer
	Caustics	X	Asbestos		Petroleum		Motor
X	Pesticides		Tailings	X	Chlorinated Solvents	X	Hydraulic
X	Petroleum	X	Fill			X	Gasoline
	Inks					X	Fuel
	PCBs						Waste
X	Metals						
X	SVOCs						
	Ammonia						

2.1.4 Chemicals of Concern

Table 4
Chemicals Of Concern

Chemicals	REL/PEL/STEL (ppm)	Health Hazards
Arsenic	REL = 0.002 mg/m^3 PEL = 0.01 mg/m^3	Ulceration of nasal septum, dermatitis, gastrointestinal disturbances, peripheral neuropathy, respiratory irritation, hyperpigmentation of skin; potential occupational carcinogen.
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.
Copper	REL = 0.1 mg/m^3 PEL = 0. 1 mg/m^3	Irritation eyes, upper respiratory system; metal fume fever: chills, muscle ache, nausea, fever, dry throat, cough, lassitude (weakness, exhaustion); metallic or sweet taste; discoloration skin, hair.
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.
Chromium	REL = 0.5 mg/m^3 PEL = 0.5 mg/m^3	Irritation eyes; sensitization dermatitis.
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.
Polycyclic Aromatic Hydrocarbons (PAHs)	PEL = 5 mg/m^3	Harmful effects to skin, bodily fluids, and ability to fight disease, reproductive problems; [potential occupational carcinogen].
Trichloroethylene (TCE)	PEL = 100 ppm	Lassitude (weakness, exhaustion), dizziness, tremor, drowsiness, nausea, vomiting; dermatitis; cardiac arrhythmias, paresthesia; liver injury; [potential occupational carcinogen].
Tetrachloroethylene (PCE)	PEL = 100 ppm STEL = 200 ppm	Irritation eyes, skin, nose, throat, respiratory system; nausea; flush face, neck; dizziness, poor coordination; headache, drowsiness; skin erythema (skin redness); liver damage; potential occupational carcinogen.
Toluene	REL = 100 ppm PEL = 200 ppm STEL = 300 ppm	Irritation eyes, nose; lassitude, confusion, euphoria, dizziness, headache; dilated pupils, lacrimation (discharge of tears); anxiety, muscle fatigue, insomnia; paresthesia

Table 4
Chemicals Of Concern

Chemicals	REL/PEL/STEL (ppm)	Health Hazards
		(skin tingling or numbness); 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.
Zinc	REL = 5 mg/m^3 PEL = 5 mg/m^3	Metal fume fever: chills, muscle ache, nausea, fever, dry throat, cough; lassitude (weakness, exhaustion); metallic taste; headache; blurred vision; low back pain; vomiting; malaise (vague feeling of discomfort); chest tightness; dyspnea (breathing difficulty), rales, decreased pulmonary function.
Particulates	PEL = 15 mg/m^3 (total) PEL = 5 mg/m^3 (respirable)	Irritation eyes, skin, throat, upper respiratory system.

Notes:
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 this HASP. The SSO will have a 4-year college degree in occupational safety or a related 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 is outlined in Section 2.3 of this HASP.

2.3 Training

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

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

Each member of the field crew will be instructed in these objectives before 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 Zone is the 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 changed by SSO, depending on that day's activities. All field personnel will be informed of the location of these zones before work begins.

Appropriate barriers will be set up to secure the area and prevent any unauthorized personnel from approaching within 15 feet of the work area.

Table 5
Site Work Zones

Task	Exclusion Zone	CRZ	Support Zone
Soil boring and monitoring well installation	15 feet from drill rig	15 feet from drill rig	As Needed

2.6 Air Monitoring Program

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

2.6.1 Work Zone Air Monitoring

Real time air monitoring of volatile organic compounds (VOCs) and particulates will be performed in the work zone during all intrusive Site activities. Work zone air monitoring for VOCs will be performed with a photoionization detector (PID). The PID will be calibrated with 100 parts per million (ppm) isobutylene standard in accordance with the manufacturer's instructions at the start of each work day. Work zone air monitoring for particulates will be conducted using a MIE 1000 Personal DataRam or equivalent to measure the concentration of airborne respirable particulates less than 10 micrometers in size (PM_{10}).

The SSO shall set up the equipment and confirm that it is working properly. His/her designee may oversee the air measurements during the day. Measurements will be taken prior to commencement of work and continuously during the work. Measurements will be made as close to the workers as practicable and at the breathing height of the workers. The action levels and required responses are listed in the following table:

Table 6
Work Zone Air Monitoring Action Levels

Instrument	Action Level	Response Action
PID	Less than 10 ppm in breathing zone	Level D or D-Modified
	Between 10 ppm and 50 ppm	Level C
	More than 50 ppm	Stop work. Resume work when readings are less than 50 ppm
Particulate Monitor (MIE 1000 Personal DataRam™ or equivalent)	Less than 1.25 $\mu g/m^3$ above background in breathing zone	Level D or D-Modified
	More than 1.25 $\mu g/m^3$ above background in breathing zone	Stop work. Resume work when readings are less than 1.25 mg/m^3.
Notes: $\mu g/m^3$ = micrograms per cubic meter; ppm = parts per million		

2.6.2 Community Air Monitoring Plan

Community air monitoring will be conducted during all intrusive Site activities in compliance with the New York State Department of Health (NYSDOH) Generic Community Air Monitoring Plan (CAMP). Real-time air monitoring for volatile compounds and dust at the perimeter of the exclusion zone will be performed as described below.

2.6.2.1. Roving Air Monitoring

VOC Monitoring

Periodic monitoring for VOCs will be conducted during non-intrusive activities such as the collection of excavation endpoint soil samples. Periodic monitoring may include obtaining measurements upon arrival at a location and upon leaving the location.

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

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

Particulate Monitoring

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

2.6.2.2. Community Air Monitoring Action Levels

VOC Action Levels

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

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

Particulate Action Levels

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

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

- If particulate levels persist at 150 µg/m^3 above the background, work must be stopped until dust suppression measures bring particulate levels to below 150 µg/m^3 above background.

Major Vapor Emission Response Plan

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

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

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

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

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

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

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

2.6.3 Personal Protection Equipment (PPE)

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

AKRF field personnel and other Site personnel shall wear, at a minimum, Level D PPE. The protection will be based on the air monitoring described in this section.

Table 7
Personal Protection Equipment Requirements

LEVEL OF PROTECTION & PPE		All Tasks
Level D (**X**) Steel Toe Shoes (**X**) Hard Hat (within 25 ft. of excavator) (**X**) Work Gloves	(**X**) Safety Glasses ( ) Face Shield (**X**) Ear Plugs (within 25 ft. of excavator) (**X**) Nitrile Gloves (**X**) Tyvek for tank contractor if NAPL present	Yes
Level C ***(in addition to Level D)*** (**X**) Half-Face Respirator (**X**) Full Face Respirator ( ) Full-Face PAPR	( ) Particulate Cartridge ( ) Organic Cartridge (**X**) Dual Organic/ Particulate Cartridge	If PID > 10 ppm or particulate > 5 µg/m^3 in breathing zone
Comments: Cartridges to be changed out at least once per shift unless warranted beforehand (e.g., more difficult to breath or any odors detected). PAPR = powered air purifying respirator		

2.7 General Work Practices

To protect their health and safety, all 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 driven to the Brookdale University Hospital by on-site personnel. Directions to the hospital are provided below, and a hospital route map is provided as Figure 1.

3.1 Hospital Directions

Table 8
Hospital Directions

Hospital Name:	Brookdale University Hospital
Phone Number:	718-240-5363
Address/Location:	1 Brookdale Plaza, Brooklyn, New York 11212
Directions:	1. Turn right onto Atlantic Avenue. 2. Make a U-turn at Logan Street. 3. Use the right lane to continue on South Conduit Boulevard West. 4. Slight right onto Euclid Avenue. 5. Continue on Linden Boulevard to East 98th Street/Brookdale Plaza. 6. Turn right onto Linden Boulevard. 7. Slight left onto Linden Boulevard. 8. Turn right at the first cross street onto Thomas S Boyland Street. 9. Turn left onto Hegeman Avenue. 10. Turn left onto East 98th Street/Brookdale Plaza. 11. Destination will be on the right.

3.2 Emergency Contacts

Table 9
Emergency Contacts

Company	Individual Name	Title	Contact Number
AKRF	Michelle Lapin, P.E.	QA/QC Officer	646-388-9520 (office)
	Deborah Shapiro, QEP	Project Manager	646-388-9544 (office)
	Amy Jordan	Project Manager Alternate	646-388-9864 (office)
	Elizabeth Matamoros	Site Safety Officer (SSO)	347-328-3567 (cell)
	Adrianna Bosco	Site Safety Officer (SSO) Alternate	914-874-3358 (cell)
Atlantic Chestnut Affordable Housing LLC	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

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 HASP for the Atlantic Chestnut – Lot 3 Site located at 275 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: ________
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ATTACHMENT 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 AND COMPOUNDS

CAS # 7440-39-3

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.

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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.

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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 µg/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.

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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.

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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.

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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.

U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES, Public Health Service
Agency for Toxic Substances and Disease Registry

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.

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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.

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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.

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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.

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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

U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES, Public Health Service
Agency for Toxic Substances and Disease Registry

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.

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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.

U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES, Public Health Service
Agency for Toxic Substances and Disease Registry

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.

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AGENCY FOR TOXIC SUBSTANCES
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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.

ATTACHMENT 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 Center for Disease Control (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.

ATTACHMENT C

REPORT FORMS

WEEKLY SAFETY REPORT FORM

Week Ending: ________________ Project Name/Number: Atlantic Chestnut – Lot

Report Date: ________________ Project Manager Name: Deborah Shapiro/Amy Jordan

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: Atlantic Chestnut – Lot 1 Site Location: 3264 Fulton Street, Brooklyn, NY

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.

____
____
____
____
____
____
____
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____
____

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

ATTACHMENT D

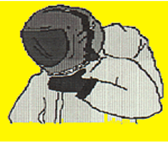
EMERGENCY HAND SIGNALS

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 BREATH!	 **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**

FIGURE

AKRF 440 Park Avenue South, New York, NY 10016	Atlantic Chestnut - Lot 3 275 Chestnut Street Brooklyn, New York
	HOSPITAL LOCATION MAP

DATE
11/9/2017

PROJECT NO.
12184

FIGURE
1