85 JAY STREET

BROOKLYN, NEW YORK

Remedial Investigation Work Plan

BCP Site #: C224248
AKRF Project Number: 12519

Prepared for:

85 Jay Street (Brooklyn), LLC
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MARCH 2017

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APPENDICES

1.0 INTRODUCTION

This Remedial Investigation Work Plan (RIWP) has been prepared by AKRF, Inc. (AKRF) on behalf of 85 Jay Street (Brooklyn), LLC (the Volunteer) for the proposed 85 Jay Street, New York State Department of Environmental Conservation (NYSDEC) Brownfield Cleanup Program (BCP) Site, located at 85 Jay Street in Brooklyn, New York (Site). The legal definition of the Site is Brooklyn Borough Tax Block 54, Lot 1. Lot 1 occupies the full tax block, but historically the block included Tax Lots 4, 12, 19, 22, and 38. The approximately 135,000-square foot Site is bound by Front Street to the north, Bridge Street to the east, York Street to the south, and Jay Street to the west. The Site currently consists of a private parking lot enclosed in fencing. A Site Location Map is provided as Figure 1 and a Site Plan is provided as Figure 2.

85 Jay Street (Brooklyn), LLC submitted an application to NYSDEC for entry into a Brownfield Cleanup Program (BCP) on October 11, 2016. A 2004 Phase II Investigation and 2016 Supplemental Subsurface (Phase II) Investigation Report were submitted to the NYSDEC as part of the Brownfield Cleanup Program (BCP) application. The investigations concluded that there is semivolatile organic compound (SVOC), polychlorinated biphenyl (PCB), and metal contamination in soil and metal, petroleum, and tetrachloroethene (PCE) contamination in groundwater beneath the Site. This RIWP describes the procedures to be used to fill in data gaps from the previous subsurface investigations and to further define the nature and extent of the contamination in on-site soil, groundwater, and soil vapor. The data compiled from the Remedial Investigation (RI) will be used to complete a Remedial Action Work Plan (RAWP). All work will be completed in accordance with this RIWP, which includes a Quality Assurance Project Plan (QAPP) (Appendix A) and a Health and Safety Plan (HASP) (Appendix B). The Community Air Monitoring Plan (CAMP) detailed in the HASP will be implemented during all subsurface disturbance activities at the Site, including, but not limited to, soil boring advancement, soil sampling, and backfilling of boreholes.

2.0 SITE DESCRIPTION AND HISTORY

2.1 Site Description and Surrounding Land Use

The approximately 135,000-square foot Site is located at 85 Jay Street in the Dumbo neighborhood of Brooklyn, New York. The Site consists of a private parking lot enclosed in fencing. The F line Metropolitan Transit Authority (MTA) subway tracks are located beneath Jay Street to the west. The surrounding area is developed with residential, commercial, manufacturing, and industrial uses. A Site Plan that shows the surrounding land usage is provided as Figure 2.

2.2 Site Geology, Hydrogeology, and Subsurface Characteristics

Surface topography at the Site slopes downward toward the northeast, resulting in an approximately 20-foot grade change across the Site. Based on reports compiled by the U.S. Geological Survey (Brooklyn Quadrangle), the Site lies at an elevation of approximately 30 to 40 feet above the National Geodetic Vertical Datum of 1988 (an approximation of sea level).

Site lithology consists of sand and silt, with varying amounts of gravel. Historic fill constituents, including brick, asphalt, concrete, and glass, were encountered in borings advanced at the Site to a maximum depth of 15 feet below grade. A clay layer (silty clay and clayey silt) was encountered in some borings between approximately 8 and 12 feet below grade.

During a previous investigation, groundwater was encountered from approximately 23 to 35 feet below grade at the Site. Groundwater is assumed to flow in an approximately north-northwesterly direction toward the East River. However, the MTA tracks are located in an underground tunnel west-adjacent to the Site and the presence of this tunnel, as well as other subsurface utilities in the vicinity of the Site, may influence groundwater flow direction.

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

2.3 Nearby Areas of Public Concern

Upon acceptance into the BCP, a Citizen Participation Plan (CPP) for the Site will be drafted to identify major issues of public concern related to the Site and surrounding area. Potential remediation and construction-related issues include handling of contaminated soil and generation of vapors and/or dust during excavation activities, truck traffic, and noise, will be addressed in the CPP. The CPP, which will be submitted to and approved by NYSDEC, provides this information to the public and allows for involvement regarding the environmental investigation and cleanup of the Site.

2.4 Site History

Historic records indicated that the Site was developed with industrial and manufacturing uses by at least 1887. A lead works occupied the Site from at least 1887 to 1989. The Bradley White Lead Company and Lenox Smelting historically occupied the Site between 1887 and 1989 and in 1887, respectively. Additionally, an electrical substation occupied the western portion of the Site from circa 1904 to 1950. A brewery, a paper goods company, and an electrical repair company also historically occupied the Site. The current owner (Watchtower Bible & Tract Society of New York) has owned the Site since circa 1986, and the Site has been used as a private parking lot. The Applicant closed on the purchase of the Site in December 2016 and has no affiliation with the previous owners and/or occupants.

3.0 PREVIOUS INVESTIGATIONS

3.1 Phase I ESA – November 2002

AKRF performed a Phase I Environmental Site Assessment (ESA) in November 2002 in accordance with ASTM Standard E1527-00, *Standard Practice for Environmental Site Assessments: Phase I Environmental Site Assessment Practice*, which was the standard at the time. Assessment findings included:

- Historical Sanborn maps identified an over 100-year history of industrial and manufacturing uses at the Site, including a lead works from circa 1887 to 1989, an electrical substation on the western portion of the Site from at least 1904 to 1950, and a smelting company, a brewery, a paper goods factory, and an electrical repair company.
- The Site was reported to be listed on the Comprehensive Environmental Response, Compensation and Liability Information System (CERCLIS) with two sites (Bradley White Lead Company and Lenox Smelting) investigated simultaneously. Both facilities were listed as No Further Remedial Investigation Planned (NFRAP) after the initial investigation from 1981 to 1987. Nonetheless, the Site may have been impacted by these operations. Although the Phase I ESA identified CERCLIS listings for the Site, an updated database search conducted in 2016 indicated this may have been an erroneous reporting.
- The surrounding area was historically occupied by manufacturing and industrial uses, including a manufactured gas plant (MGP) on the east-adjacent block from circa 1887 to sometime between 1938 and 1950 and a thermoplastic company on the south-adjacent block that was listed in the CERCLIS database with NFRAP status.
- A concrete pad with four steel plates was observed on the southern perimeter of the Site during reconnaissance, which may be associated with the presence or historical presence of underground storage tanks (USTs).

Based on their findings, AKRF recommended conducting a subsurface investigation to determine if soil and/or groundwater contamination was present at the Site.

3.2 Phase II Investigation – March 2004

Based on the findings of the November 2002 Phase I ESA, AKRF conducted a subsurface investigation at the Site. The scope of work included the collection and laboratory analysis of 12 soil samples and 5 groundwater samples. The scope of work was submitted to the New York City Department of Environmental Protection (NYCDEP) and revised based on the comments provided. Findings of the investigation included:

- Numerous SVOCs were detected in soil above their respective NYSDEC Part 375 Restricted Residential Soil Cleanup Objectives (RRSCOs). The SVOCs detected primarily included polycyclic aromatic hydrocarbons (PAHs) that are commonly found in fill material. SVOC concentrations exceeding RRSCOs were generally typical of historical fill material, but total SVOCs were detected in one soil sample [B-7(0-2)] at a concentration of 822.7 milligrams per kilogram (mg/kg), which may be associated with historical Site operations. Lead was detected in one soil boring at shallow and deep depths with a maximum concentration of 2,720 mg/kg, exceeding the RRSCO of 400 mg/kg. Polychlorinated biphenyls (PCBs) were detected in one soil sample at a concentration above the total PCB RRSCO. No volatile organic compounds (VOCs) or pesticides were detected above applicable RRSCOs.

- Four VOCs were detected in groundwater samples above the NYSDEC Class GA Groundwater Standard: 1,2,4-trimethylbenzene, 1,3,5-trimethylbenzene, m,p-xylene, and tetrachloroethene. Several metals were detected above the Class GA Standards in the unfiltered groundwater samples, but only lead, thallium, and selenium were detected above Class GA Standards in filtered groundwater. No SVOCs, pesticides, or PCBs were detected in exceedance of the Class GA Standards.

3.3 Phase II Investigation – October 2016

To support the BCP application for the Site, AKRF conducted a Supplemental Phase II Environmental Site Investigation. The scope of work included the advancement of 10 soil borings with the collection of 20 soil samples.

Lead was detected at concentrations above the RRSCO in six soil samples, with a maximum concentration of 10,000 mg/kg. Four SVOCs were detected in exceedance of their respective RRSCOs in two soil samples and the blind duplicate soil sample. No VOCs or PCBs were detected in the soil samples at concentrations exceeding their respective RRSCOs.

Summaries of soil concentrations exceeding the RRSCOs and groundwater concentrations exceeding the AWQSs are provided as Figures 3 and 4, respectively.

4.0 FIELD PROGRAM

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

4.1 Field Program Summary

The field sampling scope of work consists of: the advancement of 60 soil borings with the collection and analysis of 5 to 8 soil samples per boring, the installation of 7 temporary monitoring wells with the collection and analysis of 7 groundwater samples, and the installation of 7 soil vapor points with the collection and analysis of 7 soil vapor samples and one ambient air sample. The proposed sample locations are shown on Figure 5. The following sections describe the methods that will be used to complete the scope of work.

The rationale for the proposed soil sample locations is summarized in Table 1. The rationale for the proposed groundwater and soil vapor sampling is summarized in Table 2.

4.2 Soil Sampling

A Geoprobe™ direct-push drill rig will be used to advance soil borings at the approximate locations shown on Figure 5 to assess soil quality throughout the Site. Soil samples will be collected continuously at each boring either until groundwater interface (for borings co-located with temporary wells) or to approximate excavation depth or refusal (for soil boring locations without associated temporary wells), whichever is shallower. Soil will be collected in 5-foot long, 2-inch diameter, stainless steel macrocore piston rod samplers fitted with an internal acetate liner. Soil samples will be inspected by AKRF field personnel for evidence of contamination (e.g., odors, staining), screened for the presence of volatile organics with a photoionization detector (PID) equipped with a 10.6 electron volt (eV) lamp, and logged using the modified Burmister soil classification system. The PID will be calibrated in accordance with manufacturer's recommendations prior to sampling.

Five to eight soil samples will be collected from each soil boring. One soil sample will be collected from each 5-foot interval for analysis of polycyclic aromatic hydrocarbons (PAHs) by EPA Method 8270 and RCRA Metals by EPA Method 6000/7000 series. Forty of these samples, as described in Table 1, will be analyzed for an expanded analyte list of semivolatile organic compounds-base neutrals (SVOCs-BN) and TAL metals.

Additionally, 56 soil samples from 13 soil borings will be analyzed for volatile organic compounds (VOCs) by EPA Method 8260 and 44 soil samples from 13 soil borings will be analyzed for polychlorinated biphenyls (PCBs) by EPA Method 8082, as described in Table 1. One soil sample will be collected from a 2-foot interval between 0-5 feet below grade and one soil sample will be collected from a discrete 2-foot interval from each 10-foot interval after the top 5 feet below grade. If field evidence of contamination (visual, olfactory, or elevated PID reading) is observed in soil borings that are not proposed to be analyzed for VOCs, an additional soil sample will be collected in the respective interval exhibiting the highest contamination. All sampling equipment (e.g., drilling rods and casing, macrocore samplers and probe rods) will be either dedicated or decontaminated between sampling locations.

Soil samples slated for laboratory analysis will be labeled and placed in laboratory-supplied containers and shipped to the laboratory via courier with appropriate chain of custody documentation in accordance with appropriate USEPA protocols to a New York State

Department of Health (NYSDOH) Environmental Laboratory Approval Program (ELAP)-certified laboratory. A standard turnaround time will be requested from the laboratory.

One blind duplicate, field blank, trip blank, and matrix spike/matrix spike duplicate (MS/MSD) will be collected for quality control/quality assurance (QA/QC) purposes for every 20 field samples collected. It is anticipated that 20 field blanks, 20 blind duplicates, 20 matrix spike/matrix spike duplicates (MS/MSDs) and 20 trip blanks will be required during the soil portion of the field investigation. Three QA/QC samples, besides trip blanks, will be analyzed for VOCs, SVOCs-BN, TAL metals, and PCBs: 17 QA/QC sample sets will be analyzed for PAHs and RCRA metals only. Trip blanks will be analyzed for VOCs only. The data will be reviewed by a third-party validator, and a Data Usability Summary Report (DUSR) will be prepared to document the usability and validity of the data. The soil boring locations will be surveyed using the Global Positioning System (GPS).

After each boring is completed, the soil boring holes will be filled with on-site materials (if not noticeably contaminated) and patched with asphalt or concrete to match existing surface conditions. Soil cuttings to be managed will be containerized in properly labeled DOT approved 55-gallon drums for future off-site disposal at a permitted facility. All boreholes that require drill cutting disposal would be filled with bentonite chips (hydrated) and concrete capping. Disposable sampling equipment, including spoons, gloves, bags, paper towels, etc. that come in contact with environmental media will be double bagged and disposed of as municipal trash in a facility trash dumpster as non-hazardous refuse.

4.3 Temporary Well Installation

Temporary well points (TW-1 through TW-7) will be installed in the locations of the soil borings SSB-A1, SSB-B6, SSB-D4, SSB-E1, SSB-F5, SSB-H6, and SSB-J1, using the Geoprobe™drill rig. The temporary wells will be installed approximately 10 feet into the shallow groundwater table, expected to be encountered between 23 to 35 feet below grade. Procedures for field screening and groundwater sample collection will be consistent with those described in Section 4.2 and the QAPP included as Appendix A. Well construction will consist of 10 feet of 0.020-inch slotted PVC monitoring well screen installed into the water table; solid PVC riser will be placed to ground surface. The proposed temporary well locations are shown on Figure 5.

4.4 Groundwater Sampling

Groundwater samples will be collected using modified low-flow sampling protocols. Prior to sampling, an electronic interface meter will be used to measure water levels and thickness of separate phase product, if any. All wells will be purged of at least three well volumes prior to sampling. The purge water will be monitored for turbidity and water quality indicators (i.e., pH, dissolved oxygen, oxidation-reduction potential, temperature, and specific conductivity) with measurements collected approximately every five minutes. The criteria for stabilization will be three successive readings within ±10% for pH, temperature, and specific conductivity. Purge water needing to be managed on-site will be containerized in properly labeled, DOT-approved 55-gallon drums for off-site disposal at a permitted facility.

Groundwater samples slated for laboratory analysis will be placed in laboratory-supplied containers and shipped in accordance with appropriate EPA protocols to an NYSDOH Environmental Laboratory Approval Program (ELAP)-certified laboratory. The samples will be analyzed for VOCs using EPA Method 8260, SVOCs using EPA Method 8270, PCBs via EPA Method 8082, and total and dissolved TAL metals via EPA Method 6000/7000 series using

Category B deliverables. Filtering will occur in the field. A standard turnaround time will be requested from the laboratory.

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

4.5 Soil Vapor and Ambient Air Sampling

Soil vapor sampling will be performed in accordance with the guidelines provided in the NYSDOH document entitled, "Guidance for Evaluating Soil Vapor Intrusion in the State of New York, October 2006". Seven soil vapor samples will be collected from seven temporary monitoring points installed to a depth of 15 feet below grade, as shown on Figure 5. Each soil vapor probe location will be surveyed using GPS to determine their accurate location.

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

The soil vapor samples will be collected over a 2-hour time period from each monitoring point using a 6-liter (6L), batch-certified SUMMA canister equipped with a vacuum gauge and flow regulator set at a maximum rate of 0.2 liters per minute. Prior to sample collection, the sampling points will be purged of three sample volumes using a peristaltic pump. During purging, an inverted 5-gallon bucket will be placed over the sampling point and helium gas will be introduced through a small hole in the bucket to saturate the atmosphere around the sample port with helium gas. Purged vapors will be collected into a Tedlar bag and field-screened for organic vapors using a PID and for methane using a landfill gas meter or similar instrument. The purged air will also be monitored using a portable helium detector to check for short-circuiting of ambient air into the vapor sampling point. If the purged soil vapor contains greater than 10% helium, additional bentonite will used to enhance the surface seal, and the point will be retested.

Following purging, a soil vapor sample will be collected using the vacuum from the SUMMA canister. Immediately after opening the flow control valve equipped with a 2-hour regulator, the initial SUMMA canister vacuum (inches of mercury) will be noted. After 2 hours, the flow controller valve will be closed, the final vacuum noted, and the canister placed in a shipping carton for delivery to the laboratory.

One ambient air sample will be collected for QA/QC purposes and to provide a general assessment of ambient air quality in the site vicinity. The ambient sample will be collected over a 2-hour period using a 6L batch-certified SUMMA canister.

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

4.6 Quality Assurance / Quality Control (QA/QC)

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

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

4.8 Management of Investigation-Derived Waste

Investigation-derived waste (IDW) that does not exhibit of evidence of contamination (e.g., staining, presence of ash, oily sheens, odors, etc.) will be discharged to the ground. IDW exhibiting evidence of contamination will be containerized in Department of Transportation (DOT)-approved 55-gallon drums. The drums will be sealed at the end of each work day and labeled with the date, the well or boring number(s), the type of waste (i.e., drill cuttings, decontamination fluids, development water, or purge water) and the name of an AKRF point-of-contact. All drums will be labeled "pending analysis" until laboratory data is available and will only be stored at the Site if the Site can be fully secured. All IDW will be disposed of or treated according to applicable local, state, and federal regulations.

5.0 REPORTING REQUIREMENTS

5.1 Remedial Investigation Report

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

5.1.1 Description of Field Activities

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

5.1.2 Soil Boring Assessment

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

5.1.3 Groundwater Assessment

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

5.1.4 Soil Vapor and Ambient Air Assessment

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

5.1.5 Qualitative Human Health Exposure Assessment

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

6.0 SCHEDULE OF WORK

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

Activity	Time To Complete
Submittal of Remedial Investigation Work Plan (RIWP) and Fact Sheet	January 2017
Public Comment Period is Initiated	January 2017
Public Comment Period Ends	February 2017
Final RIWP Submitted/DEC Approves Work Plan	March 2017
Remedial Investigation is Initiated	April 2017
Remedial Investigation is Completed	April 2017
Remedial Investigation Report (RIR) Submitted to NYSDEC	June 2017
Remedial Action Work Plan (RAWP) Submitted to NYSDEC	July 2017
45-day Public Comment Period for RAWP is Initiated	July 2017
Public Comment Period for RIR and RAWP Ends	September 2017
Final RAWP Submitted/DEC Approves and Issues Decision Document	September 2017
Issue Remedial/Construction Notice Fact Sheet	September 2017
Begin Redevelopment (Construction) with Implementation of RAWP	October 2017
Draft Site Management Plan (SMP) Submitted to NYSDEC	October 2018
Execution of Environmental Easement	30 days after SMP approval
Draft Final Engineering Report and Fact Sheet	December 2018
Certificate of Completion and Fact Sheet	March 2019

7.0 CERTIFICATION

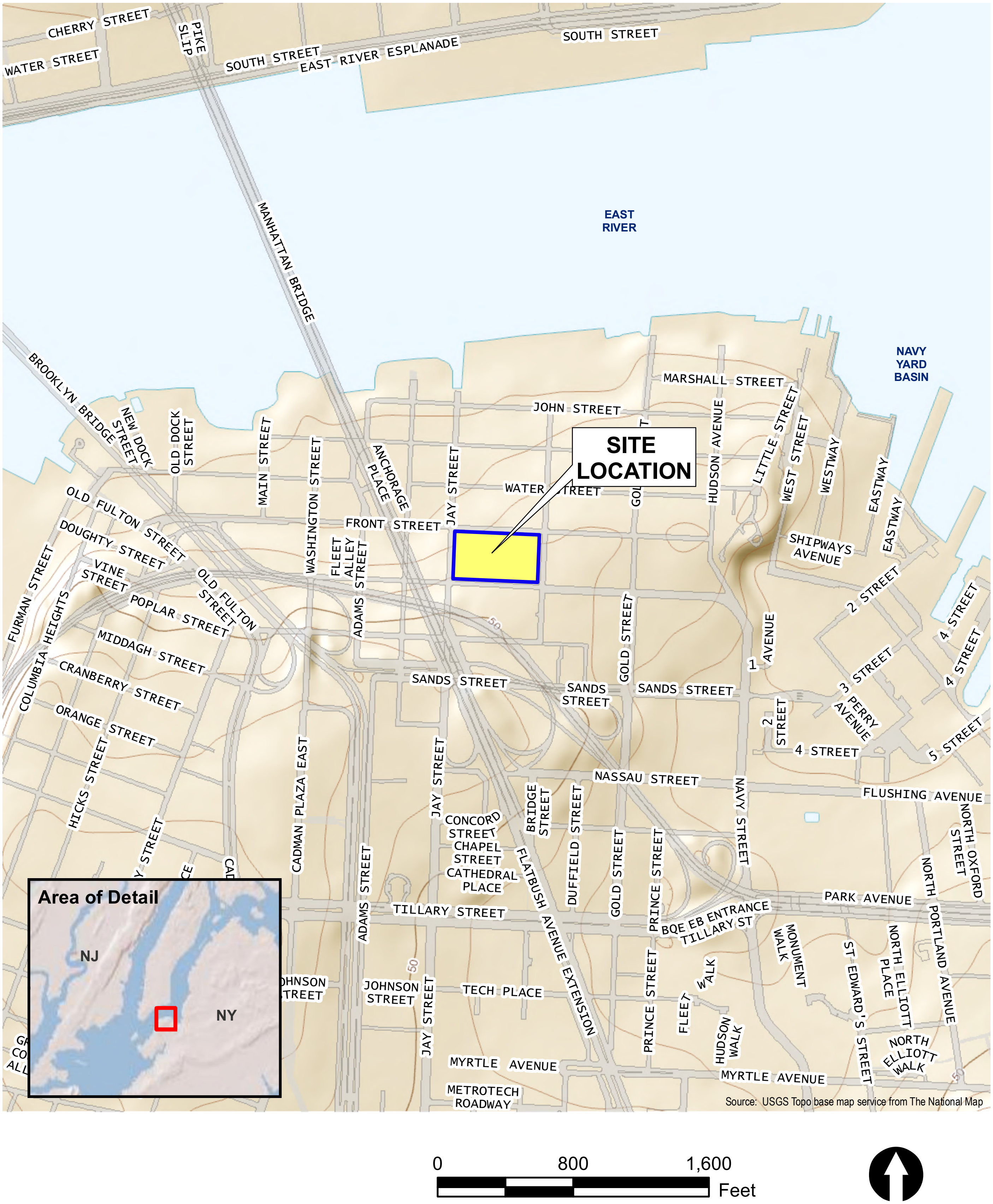
I, Marc Godick, QEP, certify that I am currently a Qualified Environmental Professional as defined in 6 NYCRR Part 375 and that this Remedial Investigation Work Plan was prepared in accordance with all applicable statutes and regulations and in substantial conformance with the DER Technical Guidance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

Marc Godick		March 21, 2017
Name	***Signature***	***Date***

8.0 REFERENCES

- U.S. Geological Survey, *Brooklyn, New York Quadrangle*, 7.5 minute Series (Topographic), Scale 1:24,000, 2013.
- Phase I Environmental Site Assessment, 85 Jay Street, Brooklyn, New York, AKRF, Inc., November 2002.
- Phase II Environmental Investigation Report, 85 Jay Street, Brooklyn Heights, Brooklyn, New York, AKRF, Inc., March 2004.
- Supplemental Phase II Environmental Site Investigation, 85 Jay Street, Brooklyn, New York, AKRF, Inc., October 2016.
- NYSDEC, 6 NYCRR Section 375-6: *Remedial Program Soil Cleanup Objectives (SCOs)*, December 14, 2006.
- NYSDEC, *DER-10/Technical Guidance for Site Investigation and Remediation*, May 3, 2010.

FIGURES



Source: USGS Topo base map service from The National Map

85 Jay Street
Brooklyn, New York

SITE LOCATION

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

DATE
9/12/2016

PROJECT No.
12519

FIGURE
1

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0 30 60 120
SCALE IN FEET

LEGEND:

—	PROJECT SITE BOUNDARY
● SB-9	APPROXIMATE SOIL SAMPLING LOCATION, 2016 SUPPLEMENTAL PHASE II
● B-4	APPROXIMATE SOIL SAMPLING LOCATION, 2004 PHASE II
⊕ B5	APPROXIMATE SOIL AND GROUNDWATER SAMPLING LOCATION, 2004 PHASE II

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

85 JAY STREET
BROOKLYN, NEW YORK

SITE PLAN WITH SAMPLE LOCATIONS

DATE
9/20/2016

PROJECT NO.
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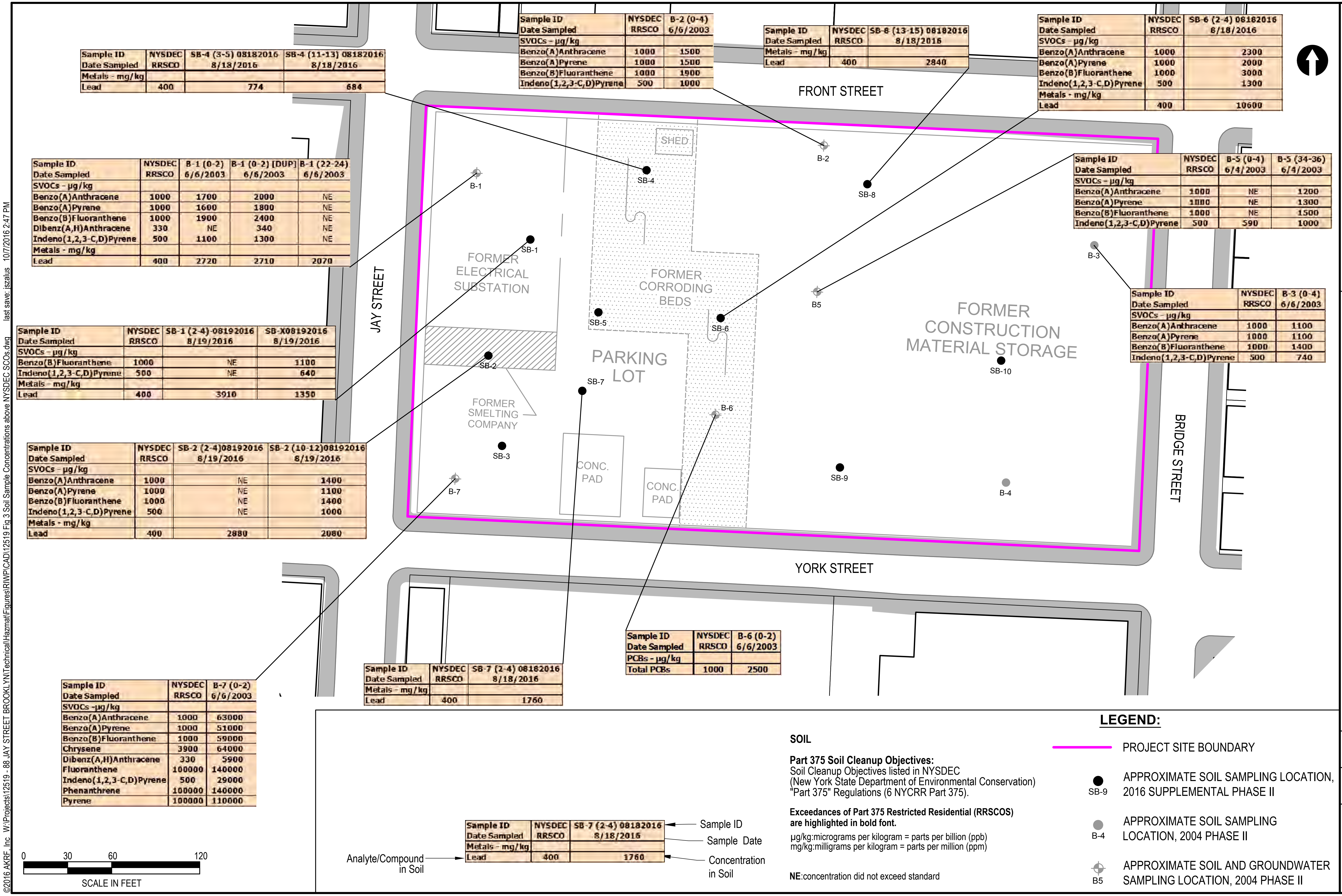
FIGURE
2

©2016 AKRF, Inc W:\Projects\12519 - 88 JAY STREET BROOKLYN\Technical\Hazmat\Figures\phase II sup\CAD\12519 Fig Site Plan & Soil Sample Concentrations above NYSDEC SCOs.dwg last save: jszalus 9/20/2016 1:50 PM



Sample ID Date Sampled	NYSDEC RRSCO	SB-4 (3-5) 08182016 8/18/2016	SB-4 (11-13) 08182016 8/18/2016
Metals - mg/kg			
Lead	400	774	684

Sample ID Date Sampled	NYSDEC RRSCO	B-2 (0-4) 6/6/2003
SVOCs - µg/kg		
Benzo(A)Anthracene	1000	1500
Benzo(A)Pyrene	1000	1500
Benzo(B)Fluoranthene	1000	1900
Indeno(1,2,3-C,D)Pyrene	500	1000

Sample ID Date Sampled	NYSDEC RRSCO	SB-8 (13-15) 08182016 8/18/2016
Metals - mg/kg		
Lead	400	2840

Sample ID Date Sampled	NYSDEC RRSCO	SB-6 (2-4) 08182016 8/18/2016
SVOCs - µg/kg		
Benzo(A)Anthracene	1000	2300
Benzo(A)Pyrene	1000	2000
Benzo(B)Fluoranthene	1000	3000
Indeno(1,2,3-C,D)Pyrene	500	1300
Metals - mg/kg		
Lead	400	10600

Sample ID Date Sampled	NYSDEC RRSCO	B-1 (0-2) 6/6/2003	B-1 (0-2) [DUP] 6/6/2003	B-1 (22-24) 6/6/2003
SVOCs - µg/kg				
Benzo(A)Anthracene	1000	1700	2000	NE
Benzo(A)Pyrene	1000	1600	1800	NE
Benzo(B)Fluoranthene	1000	1900	2400	NE
Dibenz(A,H)Anthracene	330	NE	340	NE
Indeno(1,2,3-C,D)Pyrene	500	1100	1300	NE
Metals - mg/kg				
Lead	400	2720	2710	2070

Sample ID Date Sampled	NYSDEC RRSCO	B-5 (0-4) 6/4/2003	B-5 (34-36) 6/4/2003
SVOCs - µg/kg			
Benzo(A)Anthracene	1000	NE	1200
Benzo(A)Pyrene	1000	NE	1300
Benzo(B)Fluoranthene	1000	NE	1500
Indeno(1,2,3-C,D)Pyrene	500	590	1000

Sample ID Date Sampled	NYSDEC RRSCO	B-3 (0-4) 6/6/2003
SVOCs - µg/kg		
Benzo(A)Anthracene	1000	1100
Benzo(A)Pyrene	1000	1100
Benzo(B)Fluoranthene	1000	1400
Indeno(1,2,3-C,D)Pyrene	500	740

Sample ID Date Sampled	NYSDEC RRSCO	SB-1 (2-4)-08192016 8/19/2016	SB-X08192016 8/19/2016
SVOCs - µg/kg			
Benzo(B)Fluoranthene	1000	NE	1100
Indeno(1,2,3-C,D)Pyrene	500	NE	640
Metals - mg/kg			
Lead	400	3910	1350

Sample ID Date Sampled	NYSDEC RRSCO	SB-2 (2-4)08192016 8/19/2016	SB-2 (10-12)08192016 8/19/2016
SVOCs - µg/kg			
Benzo(A)Anthracene	1000	NE	1400
Benzo(A)Pyrene	1000	NE	1100
Benzo(B)Fluoranthene	1000	NE	1400
Indeno(1,2,3-C,D)Pyrene	500	NE	1000
Metals - mg/kg			
Lead	400	2880	2080

Sample ID Date Sampled	NYSDEC RRSCO	B-6 (0-2) 6/6/2003
PCBs - µg/kg		
Total PCBs	1000	2500

Sample ID Date Sampled	NYSDEC RRSCO	SB-7 (2-4) 08182016 8/18/2016
Metals - mg/kg		
Lead	400	1760

Sample ID Date Sampled	NYSDEC RRSCO	B-7 (0-2) 6/6/2003
SVOCs -µg/kg		
Benzo(A)Anthracene	1000	63000
Benzo(A)Pyrene	1000	51000
Benzo(B)Fluoranthene	1000	59000
Chrysene	3900	64000
Dibenz(A,H)Anthracene	330	5900
Fluoranthene	100000	140000
Indeno(1,2,3-C,D)Pyrene	500	29000
Phenanthrene	100000	140000
Pyrene	100000	110000

Sample ID Date Sampled	NYSDEC RRSCO	SB-7 (2-4) 08182016 8/18/2016
Metals - mg/kg		
Lead	400	1760

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

SOIL

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

Exceedances of Part 375 Restricted Residential (RRSCOS) are highlighted in bold font.

µg/kg:micrograms per kilogram = parts per billion (ppb)
mg/kg:milligrams per kilogram = parts per million (ppm)

NE:concentration did not exceed standard

LEGEND:

━	PROJECT SITE BOUNDARY
● SB-9	APPROXIMATE SOIL SAMPLING LOCATION, 2016 SUPPLEMENTAL PHASE II
● B-4	APPROXIMATE SOIL SAMPLING LOCATION, 2004 PHASE II
⌖ B5	APPROXIMATE SOIL AND GROUNDWATER SAMPLING LOCATION, 2004 PHASE II

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

85 JAY STREET
BROOKLYN, NEW YORK

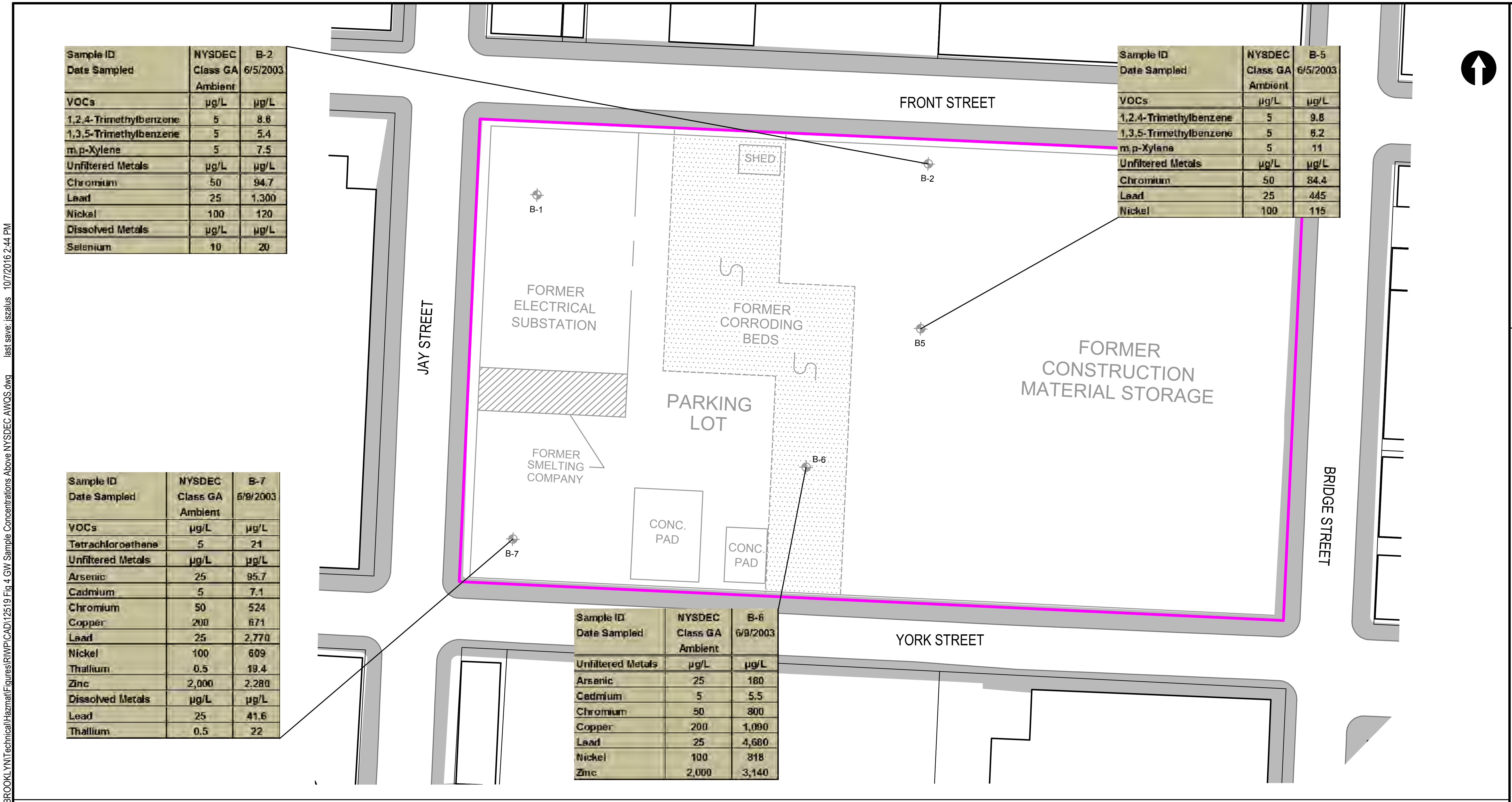
SOIL SAMPLE CONCENTRATIONS ABOVE NYSDEC RRSCOs

DATE
10/7/2016

PROJECT NO.
12519

FIGURE
3

©2016 AKRF, Inc W:\Projects\12519 - 88 JAY STREET BROOKLYN\Technical\Hazmat\Figures\RIWP\CAD\12519 Fig 3 Soil Sample Concentrations above NYSDEC SCOs.dwg last save: jszalus 10/7/2016 2:47 PM



Sample ID Date Sampled	NYSDEC Class GA Ambient	B-2 6/5/2003
VOCs	µg/L	µg/L
1,2,4-Trimethylbenzene	5	8.6
1,3,5-Trimethylbenzene	5	5.4
m,p-Xylene	5	7.5
Unfiltered Metals	µg/L	µg/L
Chromium	50	94.7
Lead	25	1,300
Nickel	100	120
Dissolved Metals	µg/L	µg/L
Selenium	10	20

Sample ID Date Sampled	NYSDEC Class GA Ambient	B-5 6/5/2003
VOCs	µg/L	µg/L
1,2,4-Trimethylbenzene	5	9.8
1,3,5-Trimethylbenzene	5	6.2
m,p-Xylene	5	11
Unfiltered Metals	µg/L	µg/L
Chromium	50	84.4
Lead	25	445
Nickel	100	115

Sample ID Date Sampled	NYSDEC Class GA Ambient	B-7 6/9/2003
VOCs	µg/L	µg/L
Tetrachloroethene	5	21
Unfiltered Metals	µg/L	µg/L
Arsenic	25	95.7
Cadmium	5	7.1
Chromium	50	524
Copper	200	671
Lead	25	2,770
Nickel	100	609
Thallium	0.5	19.4
Zinc	2,000	2,280
Dissolved Metals	µg/L	µg/L
Lead	25	41.6
Thallium	0.5	22

Sample ID Date Sampled	NYSDEC Class GA Ambient	B-6 6/9/2003
Unfiltered Metals	µg/L	µg/L
Arsenic	25	180
Cadmium	5	5.5
Chromium	50	800
Copper	200	1,090
Lead	25	4,680
Nickel	100	818
Zinc	2,000	3,140

0 30 60 120
SCALE IN FEET

Sample ID Date Sampled	NYSDEC Class GA Ambient	B-6 6/9/2003
Unfiltered Metals	µg/L	µg/L
Arsenic	25	180
Cadmium	5	5.5
Chromium	50	800
Copper	200	1,090
Lead	25	4,680
Nickel	100	818
Zinc	2,000	3,140

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

GROUNDWATER

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

Exceedances of NYSDEC Class GA Ambient Standards are highlighted in bold font.

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

LEGEND:

▬	PROJECT SITE BOUNDARY
⌖ B5	APPROXIMATE SOIL AND GROUNDWATER SAMPLING LOCATION, 2004 PHASE II

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

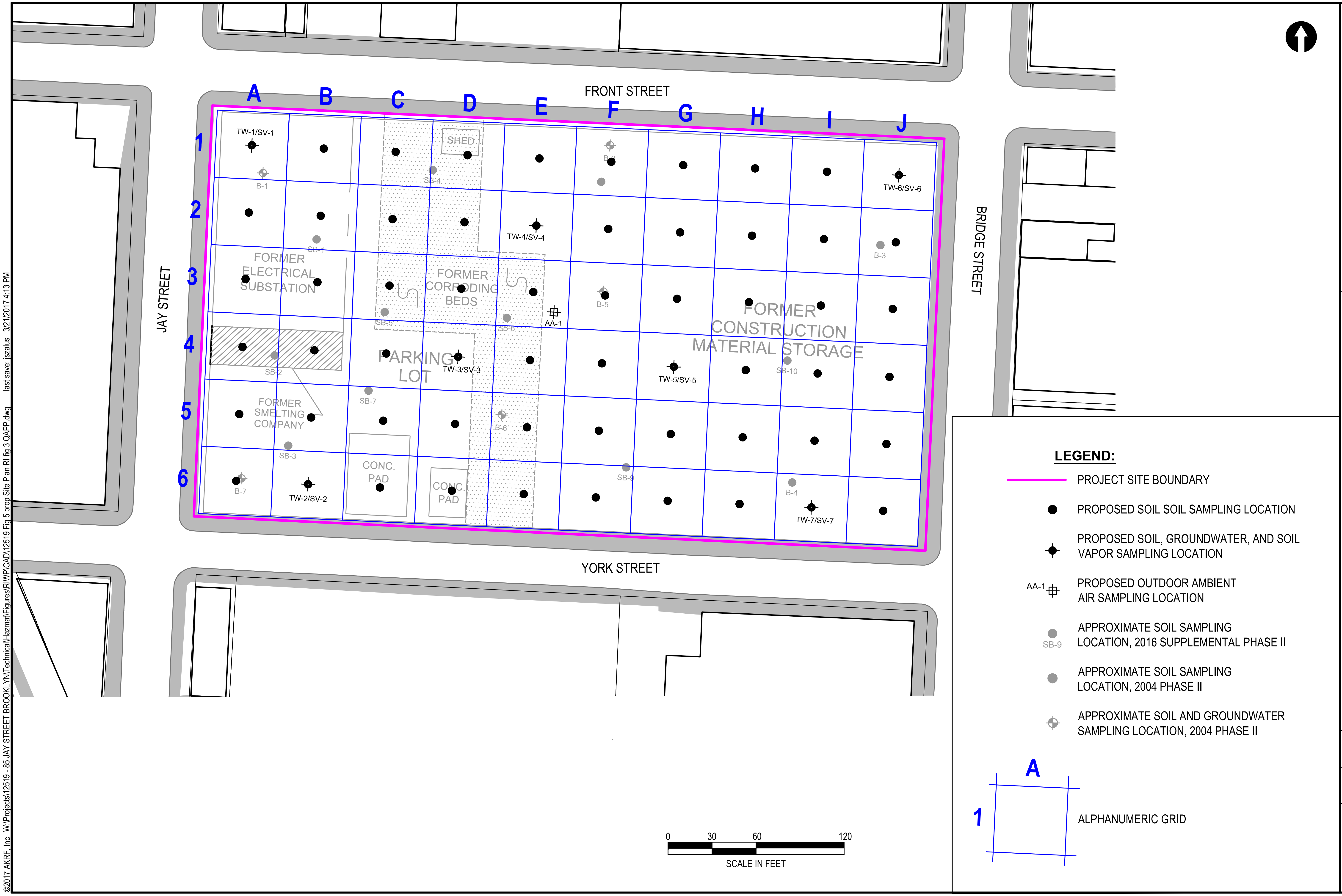
85 JAY STREET
BROOKLYN, NEW YORK

GROUNDWATER SAMPLE CONCENTRATIONS ABOVE NYSDEC AWQS

DATE
10/7/16

PROJECT NO.
12519

FIGURE
4



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85 JAY STREET
BROOKLYN, NEW YORK

SITE PLAN WITH PROPOSED SAMPLE LOCATIONS

DATE
3/21/2017

PROJECT NO.
12519

FIGURE
5

©2017 AKRF, Inc W:\Projects\12519 - 85 JAY STREET BROOKLYN\Technical\Hazmat\Figures\RIWP\CAD\12519 Fig 5 prop Site Plan RI fig 3 QAPP.dwg last save: iszalus 3/21/2017 4:13 PM

TABLES

Table 1
Soil Sampling Rationale
85 Jay Street, Brooklyn, NY

Cell ID	Surface elevatio	Excavation elevation	Cell thickness	No. of samples	Summary of RECs/AOCs	Parameters			
						PAHs	Metals	VOCs	PCBs
A1	25.70	3.85	21.85	5	shallow and deep (22-24) lead	x	x		x
A2	27.30	3.85	23.45	5	shallow and deep (22-24) lead	x	x		x
A3	27.30	3.85	23.45	5	Historical electrical substation	x	x		x
A4	27.30	3.85	23.45	5	Historical electrical substation (N) and smelting company (S), shallow (2-4) and deep (10-12) lead, deep PAHs	x	x		x
A5	29.40	3.85	25.55	6	On-site surrounding uses	x	x	x	
A6	38.40	3.85	34.55	7	shallow (0-2) SVOC hotspot (total SVOCs = 823 ppm), PCE in GW, metals in GW	x	x	x	x
B1	26.44	3.85	22.59	5	Historical electrical substation	x	x		x
B2	27.00	3.85	23.15	5	Historical electrical substation, shallow (2-4) PAHs and lead	x	x		x
B3	27.50	3.85	23.65	5	Historical electrical substation, shallow (2-4) PAHs and lead	x	x		x
B4	28.20	3.85	24.35	5	Historical electrical substation (N) and smelting company (S), shallow (2-4) and deep (10-12) lead, deep PAHs	x	x		x
B5	29.90	3.85	26.05	6	On-site surrounding uses	x	x		
B6	31.70	3.85	27.85	6	On-site surrounding uses	x	x	x	
C1	28.70	3.85	24.85	5	historical corroding beds, shallow (3-5) and deep (11-13) lead, PID reading = 65 ppm	x	x	x	
C2	27.70	3.85	23.85	5	historical corroding beds	x	x		
C3	28.40	3.85	24.55	5	historical corroding beds	x	x		
C4	29.10	3.85	25.25	6	historical corroding beds, shallow (2-4) lead	x	x		
C5	31.20	3.85	27.35	6	shallow (2-4) lead	x	x		
C6	32.50	3.85	28.65	6	On-site surrounding uses	x	x		
D1	29.80	3.85	25.95	6	historical corroding beds, shallow (3-5) and deep (11-13) lead, PID reading = 65 ppm	x	x	x	
D2	28.70	3.85	24.85	5	historical corroding beds	x	x		
D3	29.25	3.85	25.40	6	historical corroding beds	x	x		
D4	29.80	3.85	25.95	6	historical corroding beds	x	x		x
D5	31.50	3.85	27.65	6	historical corroding beds	x	x		x
D6	33.70	3.85	29.85	6	historical corroding beds	x	x		
E1	30.20	3.85	26.35	6	On-site surrounding uses	x	x		
E2	30.10	3.85	26.25	6	On-site surrounding uses	x	x		
E3	30.47	3.85	26.62	6	historical corroding beds, shallow (2-4) PAHs	x	x		
E4	31.20	3.85	27.35	6	historical corroding beds, shallow (2-4) PAHs	x	x		x
E5	33.10	3.85	29.25	6	historical corroding beds, shallow (0-2) PCBs, unfiltered metals in GW	x	x		x
E6	35.10	3.85	31.25	7	historical corroding beds	x	x		
F1	33.00	3.85	29.15	6	shallow (0-4) PAHs, deep (13-15) lead, petro VOCs in GW, metals in GW	x	x	x	
F2	33.40	3.85	29.55	6	On-site surrounding uses	x	x		
F3	35.35	3.85	31.50	7	shallow (0-4)and deep (34-36) PAHs, petro VOCs in GW, unfiltered metals in GW	x	x	x	
F4	35.20	3.85	31.35	7	On-site surrounding uses	x	x		
F5	37.30	3.85	33.45	7	On-site surrounding uses	x	x		
F6	39.80	3.85	35.95	8	On-site surrounding uses	x	x		
G1	35.20	3.85	31.35	7	deep (13-15) lead	x	x		
G2	35.50	3.85	31.65	7	On-site surrounding uses	x	x		
G3	35.35	3.85	31.50	7	On-site surrounding uses	x	x		
G4	35.20	3.85	31.35	7	On-site surrounding uses	x	x		
G5	37.63	3.85	33.78	7	On-site surrounding uses	x	x		
G6	39.80	3.85	35.95	8	On-site surrounding uses	x	x		
H1	37.30	3.85	33.45	7	On-site surrounding uses	x	x		
H2	37.90	3.85	34.05	7	On-site surrounding uses	x	x		
H3	37.85	3.85	34.00	7	On-site surrounding uses	x	x		
H4	37.80	3.85	33.95	7	On-site surrounding uses	x	x		

Table 1
Soil Sampling Rationale
85 Jay Street, Brooklyn, NY

Cell ID	Surface elevatio	Excavation elevation	Cell thickness	No. of samples	Summary of RECs/AOCs	Parameters			
						PAHs	Metals	VOCs	PCBs
H5	37.90	3.85	34.05	7	On-site surrounding uses	x	x		
H6	41.20	3.85	37.35	8	On-site surrounding uses	x	x		
I1	38.40	3.85	34.55	7	On-site surrounding uses	x	x		
I2	38.60	3.85	34.75	7	On-site surrounding uses	x	x		
I3	38.65	3.85	34.80	7	On-site surrounding uses	x	x		
I4	38.70	3.85	34.85	7	On-site surrounding uses	x	x		
I5	39.20	3.85	35.35	8	On-site surrounding uses	x	x		
I6	41.20	3.85	37.35	8	On-site surrounding uses	x	x		
J1	38.60	3.85	34.75	7	On-site surrounding uses, east-adjacent historical MGP	x	x	x	
J2	39.30	3.85	35.45	8	shallow (0-4) PAHs, east-adjacent historical MGP	x	x	x	
J3	40.15	3.85	36.30	8	On-site surrounding uses, east-adjacent historical MGP	x	x	x	
J4	40.50	3.85	36.65	8	On-site surrounding uses, east-adjacent historical MGP	x	x	x	
J5	41.50	3.85	37.65	8	On-site surrounding uses, east-adjacent historical MGP	x	x	x	
J6	43.12	3.85	39.27	8	On-site surrounding uses, east-adjacent historical MGP	x	x	x	
					Field Sample Quantity	**388**	**388**	**56**	**44**
					Total Borings Sampled	**60**	**60**	**13**	**13**

Table 2
Groundwater and Soil Vapor Sampling Rationale
85 Jay Street, Brooklyn, NY

Sampling Locations	Location	Analytical Group	Rationale
TW-1/SV-1	Northwestern portion of Site	Groundwater: VOCs, SVOCs, PCBs, and Metals Soil vapor: VOCs	- To fill in data gaps and assess groundwater and soil vapor quality in the northwestern portion of the Site.
TW-2/SV-2	Southwestern portion of Site	Groundwater: VOCs, SVOCs, PCBs, and Metals Soil vapor: VOCs	- To fill in data gaps and assess groundwater and soil vapor quality in the southwestern portion of the Site. - To further assess/delineate the extent of the SVOC hotspot and PCE groundwater contamination near Phase II soil boring B-7.
TW-3/SV-3	West-central portion of Site	Groundwater: VOCs, SVOCs, PCBs, and Metals Soil vapor: VOCs	- To fill in data gaps and assess groundwater and soil vapor quality in the west-central portion of the Site.
TW-4/SV-4	North-central portion of Site	Groundwater: VOCs, SVOCs, PCBs, and Metals Soil vapor: VOCs	- To fill in data gaps and assess groundwater and soil vapor quality in the north-central portion of the Site.
TW-5/SV-5	South-central portion of Site	Groundwater: VOCs, SVOCs, PCBs, and Metals Soil vapor: VOCs	- To fill in data gaps and assess groundwater and soil vapor quality in the south-central portion of the Site.
TW-6/SV-6	Northeastern portion of Site	Groundwater: VOCs, SVOCs, PCBs, and Metals Soil vapor: VOCs	- To fill in data gaps and assess up-gradient groundwater and soil vapor quality in the northeast portion of the Site.
TW-7/SV-7	Southeastern portion of Site	Groundwater: VOCs, SVOCs, PCBs, and Metals Soil vapor: VOCs	- To fill in data gaps and assess up-gradient groundwater and soil vapor quality in the southeast portion of the Site.
AA-1	Central portion of Site	Ambient Air: VOCs	- To provide comparative data for soil vapor samples.

APPENDIX A

QUALITY ASSURANCE PROJECT PLAN

85 Jay Street
BROOKLYN, NEW YORK

Site-Specific Quality Assurance Project Plan

BCP Site #: C224248
AKRF Project Number: 12519

Prepared for:

85 Jay Street (Brooklyn), LLC
666 Fifth Avenue, 15th Floor
New York, New York 10103

Prepared by:

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

MARCH 2017

TABLE OF CONTENTS

FIGURES

TABLES

APPENDIX

TITLE AND APPROVAL PAGE

Title: Remedial Investigation – 85 Jay Street Quality Assurance Project Plan (QAPP)
Project Name/Property Name: Remedial Investigation/ 85 Jay Street (Brooklyn), LLC
Property/Site Location: 85 Jay Street, Brooklyn, NY 11201

Date: March 21, 2017
Brownfield Cleanup Agreement Number: TBD

85 Jay Street (Brooklyn), LLC
Brownfield Cleanup Program Volunteer (Applicant)

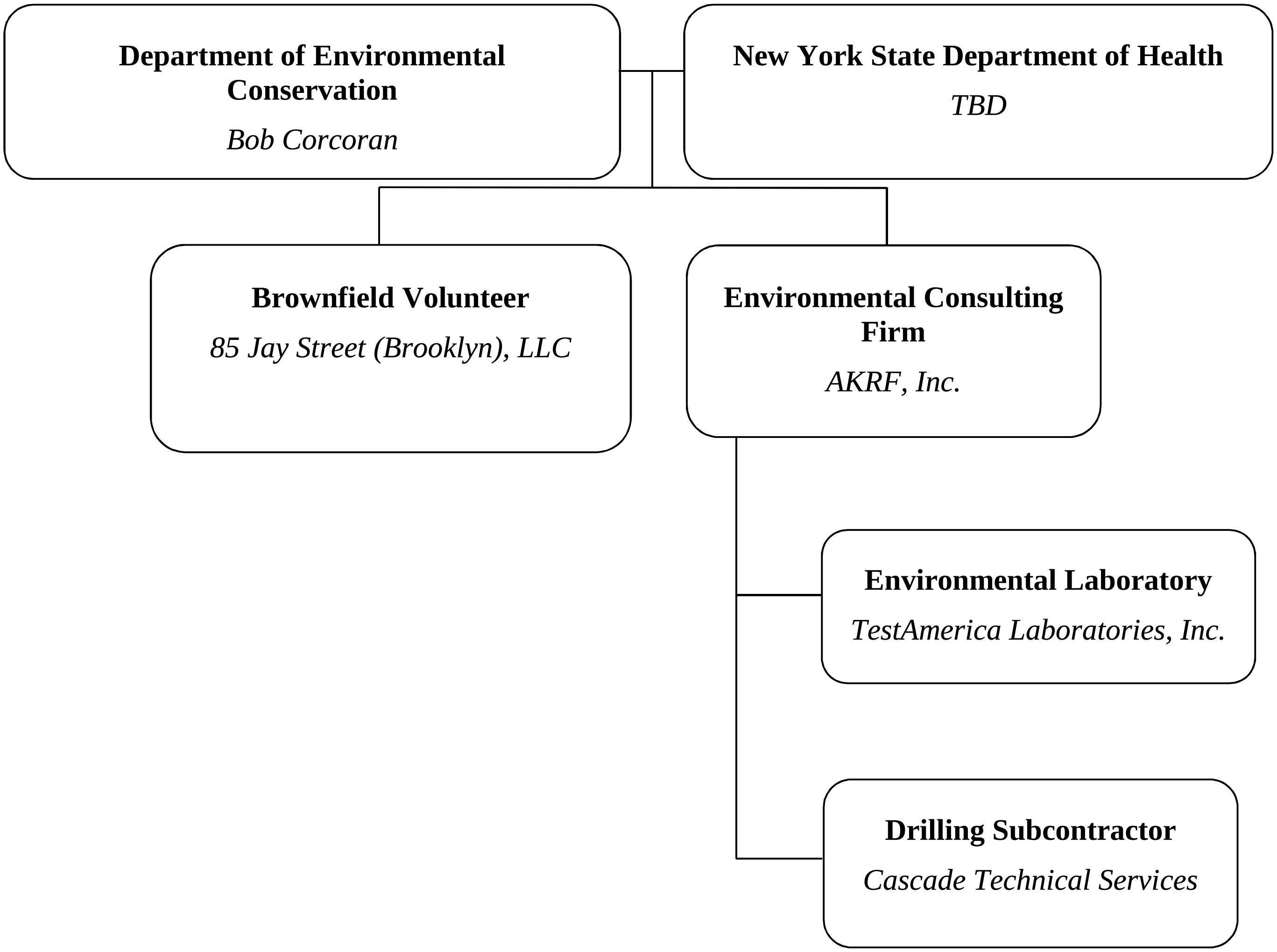
Marc S. Godick
AKRF, Inc.
440 Park Avenue South, 7th Floor, New York, NY 10016
914-922-2356, mgodick@akrf.com
Preparer's Name and Organizational Affiliation
Preparer's Address, Telephone Number, and E-mail Address

March 21, 2017
Preparation Date (Day/Month/Year)

Environmental Consultant Quality Assurance
Officer (QAO)

Marc S. Godick/AKRF, Inc./ March 21, 2017
Printed Name/Organization/Date

1.0 PROJECT ORGANIZATION CHART



2.0 PERSONNEL RESPONSIBILITIES

Name	Title	Organization	Telephone Number	Responsibilities
Bob Corcoran	BCP Manager	NYSDEC	518-402-9764	Review all technical and schedule aspects of the project. Communicate regularly with AKRF and NYSDOH to ensure project in compliance with project work plans.
Marc Godick, QEP	Project Director and Quality Assurance Officer	AKRF, Inc.	914-922-2356	General oversight of all aspects of the project. Communicate regularly with all members of the AKRF project team to ensure a smooth flow of information between involved parties.
Margo Davis	Project Manager	AKRF, Inc.	646-388-954470	Coordinate the implementation of all aspects of the technical scope, and communicate with NYSDEC. Interpretation of laboratory results and preparation of report.
Ashutosh Sharma	Alternate Project Manager	AKRF, Inc.	646-388-9865	Coordinate the implementation of all aspects of the technical scope, and communicate with NYSDEC. Interpretation of laboratory results and preparation of report.
Carl Armbruster	Laboratory QA/QC Officer	TestAmerica	732-549-3900	Responsible for quality control procedures and checks in the laboratory and ensuring adherence to laboratory protocols. Conduct a final check on the analytical calculations and sign off on the laboratory reports.
Lori Beyer	DUSR Preparer	Lab Validation Corp.	631-454-6100	Responsible for third-party data validation and DUSR preparation.
Margo Davis	Field Team Leader	AKRF, Inc.	646-388-9570	Oversee installation of soil borings, monitoring wells, and soil vapor probes; collect soil samples, groundwater samples, and sub-slab vapor samples.
Matt Levy	Field Team Leader Alternate	AKRF, Inc.	646-388-9546	Oversee installation of soil borings, monitoring wells, and soil vapor probes; collect soil samples, groundwater samples, and sub-slab vapor samples.

Resumes of key personnel are provided as Appendix A.

3.0 PROBLEM DEFINITION/PROJECT DESCRIPTION

3.1 Problem Definition

Historical records indicated that the Site was developed with industrial and manufacturing uses, including Bradley White Lead Company, Lenox Smelting, a paper goods factory, an electrical substation, and an electrical repair company between 1887 and 1989. Site buildings were subsequently demolished and the Site is currently used as a private parking lot.

Based on an evaluation of the available data and information from AKRF's March 2004 Phase II Investigation and October 2016 Supplemental Phase II Investigation, on-site soil has been contaminated with lead, polychlorinated biphenyls (PCBs), and semivolatile organic compounds (SVOCs) above the New York State Department of Environmental Conservation (NYSDEC) 6 NYCRR Part 375 Restricted Residential Soil Cleanup Objectives (RRSCOs). Heavy metals, including lead, were also detected in groundwater samples. The chlorinated solvent tetrachloroethene (PCE) was detected in one groundwater sample above Ambient Water Quality Standards (AWQS), and some petroleum-related compounds were also detected slightly above their respective AWQSs.

The environmental questions being asked are:

(1) Are there contaminants in the soil and/or groundwater that exceed NYSDEC criteria and may impact human health and the environment?

(2) What is the extent of the soil and groundwater contamination identified in previous investigations?

(3) Are there VOCs in the soil vapor at the Site that may impact indoor air quality during future use of the Site?

3.2 Project Description

3.2.1 Site Location and Description

The approximately 135,000-square foot Site is located at 85 Jay Street in the Dumbo neighborhood of Brooklyn, New York. The Site currently consists of a private parking lot enclosed in fencing. The F line Metropolitan Transit Authority (MTA) subway tracks are located beneath Jay Street to the west. The surrounding area is developed with residential, commercial, manufacturing, and industrial uses. The Site location is provided as Figure 1, and a Site Plan that shows the surrounding land usage is provided as Figure 2.

Surface topography at the Site slopes downward toward the northeast, resulting in an approximately 20-foot grade change across the Site. Based on reports compiled by the U.S. Geological Survey (Brooklyn Quadrangle), the Site lies at an elevation of approximately 30 to 40 feet above the National Geodetic Vertical Datum of 1988 (an approximation of sea level). Site lithology consists of sand and silt, with varying amounts of gravel. Historic fill constituents, including brick, asphalt, concrete, and glass, were encountered in borings advanced at the Site to a maximum depth of 15 feet below grade. A clay layer (silty clay and clayey silt) was encountered in some borings between approximately 8 and 12 feet below grade. During a previous investigation, groundwater was encountered from approximately 23 to 35 feet below grade at the Site. Groundwater is assumed to flow in an approximately north-northwesterly direction toward the East River. However, the MTA tracks are located in an underground tunnel west-adjacent to the Site and the presence of this tunnel, as well as other subsurface utilities in the vicinity of the Site, may influence groundwater flow direction.

Proposed soil, groundwater, and soil vapor sample locations are shown on Figure 3. AKRF and their subcontractors will be responsible for installing the soil borings, temporary groundwater wells, and soil vapor sampling points. AKRF will collect soil, groundwater, and soil vapor samples and submit them for laboratory analysis for the contaminants of concern. The field sampling scope of work consists of: the advancement of 60 soil borings with the collection and analysis of 5 to 8 soil samples per boring, the installation of 7 temporary groundwater wells with the collection and analysis of 7 groundwater samples, and the installation of 7 soil vapor points with the collection and analysis of 7 soil vapor samples.

3.2.2 Site History

Historical records indicated that the Site was developed with industrial and manufacturing uses, including Bradley White Lead Company, Lenox Smelting, a paper goods factory, an electrical substation, and an electrical repair company between 1887 and 1989. These prior uses appear to have led to Site contamination. Site buildings were subsequently demolished and the Site is currently used as a private parking lot.

3.3 Project Decision Statements

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

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

4.0 PROJECT QUALITY OBJECTIVES

The overall project objectives for the RI include:

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

To meet these objectives, soil and groundwater samples will be analyzed for regulated hazardous substances including VOCs by EPA Method 8260C, SVOCs-base neutrals (BNs) or Polycyclic Aromatic Hydrocarbons (PAHs) by EPA Method 8270D, PCBs by EPA Method 8081B, and/or Target Analyte List (TAL) metals or Resource Conservation and Recovery Act (RCRA) 8 metals by EPA Method 6010C/7471B. Soil vapor samples will be analyzed for VOCs by EPA Method TO-15.

Who will use the data?

The collected data will be used by NYSDEC, New York State Department of Health (NYSDOH), 85 Jay Street (Brooklyn), LLC, and AKRF to be implemented to determine what remedial action will be necessary to redevelop the Site.

What types of data are needed?

- Soil samples will be collected from soil borings and analyzed at an off-site laboratory for PAHs or SVOCs-BNs by EPA Method 8270D and RCRA 8 metals or TAL metals by EPA Method 6000/7000 series. Select samples will also be analyzed for VOCs by EPA Method 8260C and PCBs by EPA Method 8081B. Sampling and analysis will use Category B deliverables.
- Groundwater samples will be collected from temporary wells using modified low-flow groundwater sampling techniques and analyzed at an off-site laboratory for VOCs using EPA Method 8260C, SVOCs by EPA Method 8270D, PCBs by EPA Method 8081B, and total and dissolved (filtered) TAL metals by EPA Method 6000/7000 series using Category B deliverables.
- Soil vapor samples and an ambient air sample will be collected in Summa canisters and analyzed for VOCs by Method TO-15 using Category B deliverables.

How much data are needed?

- Five to eight soil samples from 60 soil borings will be collected and analyzed.
- Seven groundwater samples will be collected and analyzed.
- Seven soil vapor samples and one ambient air sample will be collected.
- For soil and groundwater samples - one field blank, one blind duplicate, one matrix spike/matrix spike duplicate (MS/MSD), and one trip blank at a sample frequency of one sample per 20 field samples per media.

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

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

- Soil samples will be recovered from the soil borings, which will be advanced to groundwater interface (for soil borings co-located with temporary wells) or to proposed excavation depth or refusal, whichever is shallower. Five to eight soil samples will be collected from each soil boring. One soil sample will be collected each 5-foot interval for analysis of PAHs and RCRA Metals. Forty of those samples will be analyzed for an expanded analyte list of SVOCs-BNs and TAL metals.

  Additionally, 56 soil samples from 13 soil borings will be analyzed for VOCs by EPA Method 8260 and 44 soil samples from 13 soil borings will be analyzed for PCBs by EPA Method 8082, as described in Table 1. One soil sample will be collected from a 2-foot interval between 0-5 feet below grade and one soil sample will be collected from a discrete 2-foot interval from each 10-foot interval after the top 5 feet below grade. If field evidence of contamination (visual, olfactory, or elevated PID reading) is observed in soil borings that are not proposed to be analyzed for VOCs, an additional soil sample will be collected in the respective interval exhibiting the highest indication of contamination.
- Groundwater samples will be collected from seven temporary wells to be installed as part of this investigation.
- Soil vapor and ambient air samples will be collected in Summa canisters over an approximately 2-hour sampling period.

Who will collect and generate the data?

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

How will the data be reported?

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

How will the data be archived?

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

5.0 PROJECT SCHEDULE/TIMELINE

Activities	Organization	Dates (MM/DD/YY)		Deliverable	Deliverable Due Date
		Anticipated Date(s) of Initiation	Anticipated Date of Completion		
Preparation of Work Plan and QAPP	AKRF, Inc.	1/12/17	3/21/17	Work Plan	3/21/17
Preparation of Health and Safety Plan	AKRF, Inc.	1/12/17	3/21/17	HASP	3/21/17
Procurement of Equipment	AKRF, Inc.	3/15/17	3/31/17	N/A	N/A
Laboratory Request	AKRF, Inc.	3/9/17	3/31/17	N/A	N/A
Field Reconnaissance/ Access	AKRF, Inc.	1/6/17	1/6/17	N/A	N/A
Collection of Field Samples	AKRF, Inc.	4/3/17	4/21/17	N/A	N/A
Laboratory Package Received	AKRF, Inc.	4/21/17	5/5/17	Unvalidated data package	5/5/17
Validation of Laboratory Results	L.A.B Validation Corp.	5/5/17	5/19/17	Validated data Package	5/19/17
Data Evaluation/ Preparation of Final Report	AKRF, Inc.	4/21/17	6/30/17	Final Report	6/30/17

6.0 SAMPLING METHODS AND LOCATIONS

Samples will be collected from soil borings, monitoring wells, and soil vapor points at the Site to provide information on general conditions at the Site. AKRF will use a Geoprobe™ direct-push probe (DPP) drill rig to advance soil borings at the approximate locations shown on Figure 3. Soil cores will be collected in 5-foot long, 2-inch diameter, stainless steel macrocore piston rod samplers fitted with an internal acetate liner.

Soil samples will be inspected by AKRF field personnel for evidence of contamination (e.g., odors, staining) and field-screened for presence of volatile organics using a photoionization detector (PID). Soil samples being collected for analysis of VOCs will be taken consistent with Method 5035A. Seven borings will be converted into one-inch diameter temporary groundwater wells. The wells will be purged and sampled utilizing modified low-flow sampling methodology. In addition, one trip blank, one field blank, one blind duplicate, and one matrix spike/matrix spike duplicate will be collected at a frequency of one sample per 20 samples. The Geoprobe™ DPP unit will be used to collect soil vapor samples from seven proposed locations to adequately evaluate soil vapor. Samples will be collected using 6-liter stainless steel Summa canisters.

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

Tables 1 and 2 summarize the sampling locations, analytical groups, number of samples, section reference for sampling SOP, and rationale for sampling locations.

6.1 Soil Boring Installation

The 60 proposed soil boring locations are depicted on Figure 3. Utility mark-outs are required by law and the drilling contractor is required to call Dig Safely New York at least two days prior to intrusive work. If there are any questions regarding locations of utilities in the sidewalk, the respective utility(s) will be contacted to clarify any concerns and/or the sampling location would be adjusted following consultation with NYSDEC.

Borings will be advanced using a Geoprobe DPP unit at the approximate locations shown on Figure 3. Soil will be inspected for evidence of contamination (e.g., odors, staining), screened for the presence of volatile organics with a photoionization detector (PID) equipped with a 10.6 electron volt (eV) lamp, and logged using the modified Burmister soil classification system. The PID will be calibrated prior to sampling in accordance with the manufacturer’s recommendations. NYSDEC will be contacted immediately if evidence of contamination is identified during the sampling activities. Each soil boring location will be surveyed using a Global Positioning System (GPS) handheld device to determine their accurate location. At each boring location, AKRF field personnel will record and document subsurface conditions.

6.2 Soil Sampling

Soil is being sampled as part of this RI to: (1) fill in data gaps from previous investigations to determine the nature and extent of potentially affected media; (2) determine whether potentially impacted soil may require special handling requirements relating to construction worker health and safety; and (3) determine the potential for a soil to soil vapor to indoor air pathway. Five to eight soil samples from each boring will be submitted for laboratory analysis, as shown in Table 1.

The proposed locations of the soil borings are shown on Figure 3. At each boring location, one soil sample will be collected from each 5-foot interval for analysis PAHs by EPA Method 8270 and RCRA Metals by EPA Method 6000/7000 series. Forty of these samples, as described in Table 1, will be analyzed for an expanded analyte list of SVOCs-BN and TAL metals.

Additionally, 56 soil samples from 13 soil borings will be analyzed for VOCs by EPA Method 8260 and 44 soil samples from 13 soil borings will be analyzed for PCBs by EPA Method 8082, as described in Table 1. One soil sample will be collected from a 2-foot interval between 0-5 feet below grade and one soil sample will be collected from a discrete 2-foot interval from each 10-foot interval after the top 5 feet below grade. If field evidence of contamination (visual, olfactory, or elevated PID reading) is observed in soil borings that are not proposed to be analyzed for VOCs, an additional soil sample will be collected in the respective interval exhibiting the highest indication of contamination.

All sampling equipment (e.g., drilling rods and casing, macro core samplers and probe rods) will be either dedicated or decontaminated between sampling locations.

One field blank, one blind duplicate, one MS/MSD, and one trip blank will be collected for quality control/quality assurance (QA/QC) purposes to determine the potential for cross-contamination at a frequency of one sample per 20 samples. It is anticipated that 20 field blanks, 20 blind duplicates, 20 MS/MSDs and 20 trip blanks will be required during the soil portion of the field investigation. Three QA/QC samples, besides trip blanks, will be analyzed for VOCs, SVOCs-BN, TAL metals, and PCBs: 17 QA/QC sample sets will be analyzed for PAHs and RCRA metals only. Trip blanks will be analyzed for VOCs only. All samples will be analyzed by a NYSDOH certified laboratory with Category B deliverables.

6.3 Temporary Well Installation

Temporary wells will be installed in the locations of SSB-1 thruogh SSB-7 using the Geoprobe™ drill rig. The temporary wells will be installed 10 feet into the groundwater table, expected to be encountered between 23 to 35 feet below grade. The wells will be constructed with 1-inch diameter polyvinyl chloride (PVC) casing with a 0.020-inch slotted well screen installed 10 feet into the water table; solid PVC riser will be placed to ground surface. The proposed temporary well locations are provided on Figure 3. All wells will be purged of at least three well volumes prior to sampling. The purge water will be monitored for turbidity and water quality indicators (i.e., pH, dissolved oxygen, oxidation-reduction potential, temperature, and specific conductivity) with measurements collected approximately every five minutes. The criteria for stabilization will be three successive readings within ±10% for pH, temperature, and specific conductivity. Purge water needing to be managed on-site will be containerized in properly labeled, DOT-approved 55-gallon drums for off-site disposal at a permitted facility. Depth to groundwater will be measured to the nearest 1/100th of a foot.

6.4 Groundwater Sampling

One groundwater sample will be collected from each of the wells in accordance with modified low-flow sampling techniques. The expected targeted purge rate will be around 500 mililiters per minute (ml/min) and water quality parameters will be monitored during purging. Prior to collecting any samples, the depth to groundwater will be measured in the temporary wells using an electronic oil/water interface probe attached to a measuring tape accurate to 0.01 feet.

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

- VOCs by EPA Method 8260C;
- SVOCs by EPA Method 8270D;
- PCBs by EPA Method 8081B; and
- TAL Metals by EPA Method 6010/7470 (filtered and unfiltered).

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

6.5 Soil Vapor and Ambient Air Sampling

One soil vapor sample will be collected from each of the seven temporary vapor monitoring points. The soil vapor samples will be collected from approximately 15 feet below grade. Each soil vapor probe location will be surveyed using a GPS handheld device to determine its accurate location. The proposed soil vapor and ambient air sampling locations are shown on Figure 3.

The soil vapor monitoring points will be installed by advancing an expendable drive point using a Geoprobe™ direct-push drilling rig to approximately 15 feet below grade. A 6-inch stainless steel screen implant, connected to Teflon tubing will be installed through the drilling rods and threaded into the drive points. The sampling tubing will extend from the end of the screen to above grade. The push probe rods will then be removed and the borings will be backfilled with clean silica sand to 3 to 6 inches above the screen. Hydrated bentonite will be used to fill the remaining void around the sampling tubing to the ground surface.

The soil vapor samples will be collected over an approximately 2-hour time period using a 6-liter (6L), batch-certified SUMMA canister equipped with a vacuum gauge and flow regulator set at a maximum of 0.2 liters per minute. Prior to sample collection, the sampling point will be purged of three sample volumes using a peristaltic pump. During purging, an inverted 5-gallon bucket will be placed over the sampling point and helium gas will be introduced through a small hole in the bucket to saturate the atmosphere around the sample port with helium gas. Purged vapors will be collected into a Tedlar bag and field-screened for organic vapors using a PID and for helium using a portable helium detector to check for short-circuiting of ambient air into the vapor sampling point. If the purged soil vapor contains greater than 10% helium, additional bentonite will used to enhance the surface seal, and the point will be retested.

Following purging, a soil vapor sample will be collected using the vacuum from the SUMMA canister. Immediately after opening the flow control valve equipped with a two-hour regulator, the initial SUMMA canister vacuum (inches of mercury) will be noted. After approximately two hours, the flow controller valve will be closed, the final vacuum noted, and the canister placed in a shipping carton for delivery to the laboratory.

One ambient air sample will be collected concurrently with the soil vapor samples for QA/QC purposes and to provide a general assessment of ambient air quality in the Site vicinity. The ambient air sample will be collected over a 2-hour period using a 6-liter (6L) batch-certified SUMMA canister.

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

6.6 Decontamination of Sampling Equipment

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

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

6.7 Management of Investigation-Derived Waste

Investigation-derived waste (IDW) fluids that do not exhibit of evidence of contamination (e.g., staining, presence of ash, oily sheens, odors, etc.) will be discharged to the ground. Soil cuttings will be put back into borings following sampling if they are not noticeably contaminated. IDW exhibiting evidence of contamination will be containerized in Department of Transportation (DOT)-approved 55-gallon drums. The drums will be sealed at the end of each work day and labeled with the date, the well or boring number(s), the type of waste (i.e., drill cuttings, decontamination fluids, development water, or purge water) and the name of an AKRF point-of-contact. All drums will be labeled "pending analysis" until laboratory data is available and will only be stored at the Site if the Site can be fully secured. All IDW will be disposed of or treated according to applicable local, state, and federal regulations.

7.0 ANALYTICAL METHODS AND REQUIREMENTS

Test America of Edison, New Jersey will perform analyses on soil and groundwater. Test America of Burlington, Vermont will perform analyses on soil vapor.

Matrix	Analytical Group	Conc. Level	Analytical and Preparation Method	Sample Volume *	Containers	Preservation Requirement	Max. Hold Time
Soil	VOCs	Low	SW5035 SW8260C	17 oz.	3 terracores and % Solid	Methanol, 4 °C	48 hours
Soil	SVOCs	Low	SW846 SW8270D	8 oz.	1, 8-oz Clear Glass	4 °C	14 days
Soil	PCBs	Low	SW3546 SW8082A	8 oz.	1, 8-oz Clear Glass	4 °C	14 days
Soil	Metals	Low	SW3020B SW6010C	8 oz.	1, 8-oz Clear Glass	4°C	6 months
Soil	Mercury	Low	SW7471B	8 oz.	1, 8-oz Clear Glass	4°C	28 days
Groundwater	VOCs	Low	SW5035 SW8260C	120 mL	3, 40-ml VOAs	HCl, 4 °C	14 days
Groundwater	SVOCs	Low	SW846 SW8270D	2 L	250 mL Amber Glass	4°C	7 days
Groundwater	PCBs	Low	SW3546 SW8082A	1L	250 mL Amber Glass	4°C	7 days
Groundwater	Metals	Low	SW3020B SW6010C	250 mL	250 mL, Plastic	Nitric Acid, 4°C	6 months
Groundwater	Mercury	Low	SW7470A	250 mL	250 mL, Plastic	Nitric Acid, 4°C	28 days
Soil Vapor	VOCs	Low	TO-15	6 L	6-L Summa Canister	None	30 days
Air	VOCs	Low	TO-15	6L	6-L Summa Canister	None	30 days

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

8.0 ANALYTICAL LABORATORY SENSITIVITY AND PROJECT CRITERIA

Laboratory performance criteria are provided in this Section.

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

Analytical Method/SOP	Data Quality Indicators (DQIs)	Measurement Performance Criteria	QC Sample and/or Activity Used to Assess Measurement Performance	QC Sample Assesses Error for Sampling (S), Analytical (A) or Both (S&A)
8260C	Precision – Lab	RPD ≤ 30% for soils RPD ≤ 20% for aqueous	MS/MSD	A
	Precision – Overall Representativeness	RPD < 30% for aqueous or RPD ≤ 50% for soils w/results > 2x RL; Professional judgment for results < 2xRL	Field Duplicates	S&A
	Accuracy	Recovery within lab statistical QC limits provided in Table 1	LCS	A
	Accuracy	Recovery within lab statistical QC limits provided in Table 1	MS/MSD	A
	Accuracy	Per lab limits provided in Table 1	Surrogate spike	A
	Sensitivity	< QL	Low point calibration standard	A

Matrix Aqueous and Soil
Analytical Group SVOC
Concentration Level Low

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

Matrix Aqueous and Soil
Analytical Group Metals and Mercury
Concentration Level Low

Analytical Method/SOP	**Data Quality Indicators (DQIs)**	**Measurement Performance Criteria**	**QC Sample and/or Activity Used to Assess Measurement Performance**	**QC Sample Assesses Error for Sampling (S), Analytical (A) or Both (S&A)**
6010C and 7471B	Precision – Lab	RPD < 20% if conc > 5*QL	Laboratory Duplicates	A
	Precision – Overall Representativeness	RPD < 30% for compounds w/ concentrations >5*QL	Field Duplicates	S&A
	Accuracy	% Recovery 80-120%	LCS	A
	Accuracy	80-120% or as per lab limits provided in Table 1	MS/MSD	A
	Accuracy	80-120% or as per lab limits provided in Table 1	PDS	A
	Sensitivity	< QL	Low point calibration standard	A

Matrix Aqueous and Soil
Analytical Group PCBs
Concentration Level Low

Analytical Method/SOP	**Data Quality Indicators (DQIs)**	**Measurement Performance Criteria**	**QC Sample and/or Activity Used to Assess Measurement Performance**	**QC Sample Assesses Error for Sampling (S), Analytical (A) or Both (S&A)**
SW8082A	Precision – Lab	RPD < 40%	MS/MSD	A
	Precision – Overall Representativeness	RPD < 40% for compounds w/ concentrations > OL	Field Duplicates	S&A
	Accuracy	Recovery within lab statistical QC limits provided in Table 1	LCS	A
	Accuracy	Recovery within lab statistical QC limits provided in Table 1; 40 % RPD	MS/MSD	A
	Accuracy	Per lab limits provided in Table 1	Surrogate spike	A
	Sensitivity	< QL	Low point calibration standard	A

Matrix Soil vapor and Air
Analytical Group VOC
Concentration Level Low

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

9.0 SECONDARY DATA CRITERIA AND LIMITATIONS

Table 1

Secondary Data	Data Source (Originating Organization, Report Title, and Date)	Data Generator(s) (Originating Org., Data Types, Data Generation/ Collection Dates)	How Data Will Be Used	Limitations on Data Use
Phase I Environmental Site Assessment	Phase I Environmental Site Assessment of the Site, prepared by AKRF in November 2002	General information on Recognized Environmental Conditions	Indicated possible locations of contaminant sources; may be used to position sampling locations	Qualitative data
Subsurface Investigations	Subsurface Investigations of the Site, conducted by AKRF, Inc., in March 2004 and September 2016	Soil and groundwater data	Preliminary delineation of contaminants	Quantitative data

10.0 FIELD EQUIPMENT CALIBRATION, MAINTENANCE, TESTING, AND INSPECTION

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

Note: Equivalent equipment may also be used as available.

11.0 ANALYTICAL LABORATORY INSTRUMENTS AND EQUIPMENT

11.1 Analytical Laboratory Instruments and Equipment Maintenance, Testing and Inspection

Instrument/ Method/ SOP	Maintenance Activity	Testing Activity	Inspection Activity	Frequency	Acceptance Criteria	Corrective Action	Responsible Person
GC/MS SW8260C SW8270D TO-15 1A 2A 16A	Check for leaks, replace gas line filters, recondition or replace trap, replace column, clean injection port/liner, replace Electron Multiplier	Tune (BFB or DFTPP), Calibration	Monitor instrument performance via tuning mass criteria, and Calibration criteria	See following table	See following table	Replace connections, replace gas line filters, replace trap, replace GC column, clip column, replace injection port liner, clean injection port, replace Electron Multiplier ; repeat calibration or CCV	Lab chemist
GC/ECD SW8082A 10A 11A	Check for leaks, replace gas line filters, recondition or replace column, clean injection port/liner	Calibration	Monitor instrument performance via Calibration criteria	See following table	See following table	Replace connections, replace gas line filters, replace GC column, clip column, replace injection port liner, clean injection port; repeat calibration or Continuing Calibration – Verification (CCV)	Lab chemist
ICP –MS SW6010 C 5A	Perform leak test, change pump tubing, change torch and window, clean filters	Initial Calibration Verification and Initial Calibration (ICAL) Blank	Monitor instrument performance via Initial Calibration Verification and IC Blank	See following table	See following table	Replace pump tubing, replace torch and window, clean all filters ;repeat calibration or CCV	Lab chemist
CVAA SW7471B SW7470A 6A	Perform leak test, change tubing, clean window, clean filters	Initial Calibration Verification and ICAL Blank	Monitor instrument performance via Initial Calibration Verification and IC Blank	See following table	See following table	Replace connections, replace pump tubing, clean all filters; repeat calibration or CCV	Lab chemist

11.2 Analytical Laboratory Instrument Calibration

Instrument/ Method/SOP	Calibration Procedure	Frequency of Calibration	Acceptance Criteria	Corrective Action (CA)	Person Responsible for CA
GC/MS 8260C 1A, 2A	Initial Calibration (ICAL)	Initially and when CCAL fails	Minimum 5-standards; must contain all targets and lowest standard ≤RL; Full Scan: %RSD ≤ 20% for all compounds or "r" ≥ 0.99; SIM: %RSD ≤ 20% or "r" ≥ 0.99 for all compounds	Recalibrate as required by method; analysis cannot proceed without a valid initial calibration	Lab chemist
	Continuing Calibration – Verification (CCV)	Once every 12 hours prior to sample analysis	Concentration level near mid-point of ICAL curve containing all target compounds; Full Scan and SIM: min RRF criteria met: %D or %Drift ≤ 20% and minimum RF met or "r" 0.99 for all compounds	Recalibrate as required by method; note outliers in narrative	Lab chemist
GC/MS 8270D 1A, 2A	Initial Calibration (ICAL)	Initially and when CCAL fails	Minimum 5-standards; must contain all targets and lowest standard ≤RL; Full Scan: minimum RF met; %RSD ≤ 20% for all compounds or "r" ≥ 0.99; SIM: %RSD ≤ 20% or "r" ≥ 0.99 for all compounds	Recalibrate as required by method; analysis cannot proceed without a valid initial calibration	Lab chemist
	Continuing Calibration – Verification (CCV)	Once every 12 hours prior to sample analysis	Concentration level near mid-point of ICAL curve containing all target compounds; Full Scan: %D or %Drift ≤ 20% for CCCs and ≤ 30% for all other compounds; SIM: %D or %Drift ≤ 30%	Recalibrate as required by method; note outliers in narrative	Lab chemist
GC/MS TO-15 16A	Initial 5-point Calibration 0.05/0.10 to 20 ppbv	As needed	RSD ≤ 30% Allow 2 excursions	If the daily calibration technical acceptance criteria are not met, inspect the system for problems. It will be necessary to rerun daily calibration sample	Lab chemist
	Continuing calibration – mid-level standard, LCS mid-level WC	Every 24 hours duplicate	70-130% D for compounds on compendium list; 50-150% for others	Recalibrate and report non-conforming compounds in case narrative	Lab chemist
GC/ECD 8082A 10A, 11A	Initial Calibration (ICAL)	Initially and when CCAL fails	Minimum 5-levels for Aroclors 1016 and 1260 and single-level at midpoint concentration for other Aroclors; 3-5 peaks or each Aroclor evaluated using peak height or peak area; lowest level ≤ RL; other Aroclors may be warranted for 5 point calibration if PCB contamination is known. %RSD ≤ 20% or "r" ≥ 0.99 for Aroclors 1016 and 1260; regression analysis, if used, must not be forced through the origin.	Recalibrate as required by method; analysis cannot proceed without a valid initial calibration	Lab chemist
	Continuing Calibration – Verification (CCV)	Prior to sample, every 12 hours or every 20 samples, whichever is more frequent and at the end of the analytical sequence	Concentration level near mid-point of ICAL curve containing Aroclors 1016 and 1260; %D ≤ ± 20% and analytes fall within expected retention time windows; Aroclors other than 1016 and 1260 must be verified within 12 hours of being detected in a sample (unless I.S. quant technique is used).	Recalibrate as required by method; note outliers in narrative	Lab chemist
ICP-MS 6010C 5A	Initial calibration	Daily following tuning prior to sample analysis	Minimum of 3 calibration levels plus blank; RL and Linear Range (LR) standards may be included in calibration levels; minimum of 3 integrations for each QC and field sample; linear curve fir r ≤ 0.998; if not including RL and LR standards then LLCV and HLCV check standards need to be analyzed.	Re-optimize instrument an recalibrate, repeat until successful	Lab chemist
	Continuing Calibration – Verification (CCV)	Every 10 samples and at end of run	Same source as initial calibration standards; Must contain all target analytes at the mid-range of the calibration curve CCV: 90-110% recovery	Reanalyze. If still out, recalibrate and reanalyze. All samples since last acceptable CCV.	Lab chemist
CVAA 7471B 6A	Initial Calibration (ICAL)	Daily prior to sample analysis	Minimum of 5 calibration levels plus blank; low level standard at level of RL; linear regression with correlation coefficient r ≥ 0.995	Reanalyze continuing calibration standard. If still outside limits, recalibrate and reanalyze all samples since last complaint calibration standard.	Lab chemist

	Continuing Calibration – Verification (CCV)	Every 10 samples and at end of run	Same source as calibration standards; concentration near mid-point of calibration curve; CCV: -80-120 % recovery	Reanalyze continuing calibration standard . If still outside limits, recalibrate and reanalyze all samples since last complaint calibration standard.	Lab chemist

12.0 SAMPLE HANDLING SYSTEM

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

13.0 SAMPLE CUSTODY REQUIREMENTS

13.1 Sample Identification

All samples will be consistently identified in all field documentation, chain-of-custody documents and laboratory reports using an alpha-numeric code. The samples will be identified by a prefix of "SSB," "TW," "SV," or "AA" to designate the type of sample followed by the soil boring or monitoring well number with sample depth interval in parenthesis (for soil samples only).

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

The following table presents the sampling identification scheme.

Sample Description	Sample Designation
Soil sample collected from 3 to 5 feet at cell A1 on January 9, 2017	SSB-A1 (3-5) 20170109
Groundwater sample collected from temporary well TW-4 on January 9, 2017	TW-4 20170109
MS/MSD groundwater sample collected from TW-4 on January 9, 2017	TW-4-MS/MSD 20170109
Duplicate soil sample from 3 to 5 feet at cell D4 on January 9, 2017	SSB-X (3-5) 20170109
Soil vapor sample collected at SV-1 on January 9, 2017	SV-1 20170109
Ambient air sample collected at AA-1 on January 9, 2017	AA-1 20170109
Trip Blank submitted with samples collected on January 9, 2017	TB 20170109
Field Blank submitted with samples collected on January 9, 2017	FB 20170109

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

13.2 Sample Labeling and Shipping

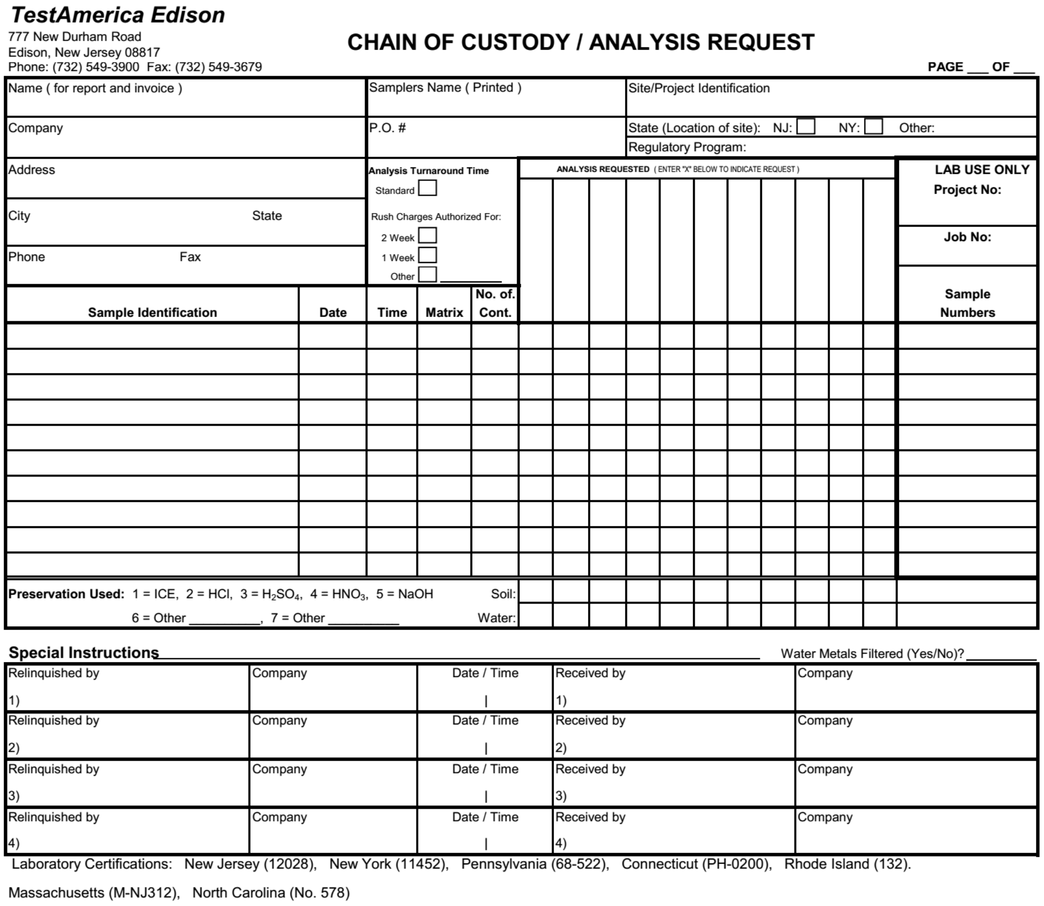
All sample containers will be provided with labels containing the following information:

- Project identification
- Sample identification
- Date and time of collection
- Analysis(es) to be performed
- Sampler's initials

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

13.3 Sample Custody

Field personnel will be responsible for maintaining the sample containers in a secured location until they are picked up and/or sent to the laboratory. The record of possession of samples from the time they are obtained in the field to the time they are delivered to the laboratory or shipped off-site will be documented on COC forms. The COC forms will contain the following information: project name; names of sampling personnel; sample number; date and time of collection and matrix; signatures of individuals involved in sample transfer; and the dates and times of transfers. Blanks and example COCs for soil and groundwater and air are provided on the following pages.



TestAmerica Edison
777 New Durham Road
Edison, New Jersey 08817
Phone: (732) 549-3900 Fax: (732) 549-3679

CHAIN OF CUSTODY / ANALYSIS REQUEST

PAGE ___ OF ___

Name (for report and invoice)	Samplers Name (Printed)	Site/Project Identification
Company	P.O. #	State (Location of site): NJ: ☐ NY: ☐ Other: Regulatory Program:
Address City State Phone Fax	**Analysis Turnaround Time** Standard ☐ Rush Charges Authorized For: 2 Week ☐ 1 Week ☐ Other ☐ __________	**ANALYSIS REQUESTED** (ENTER "X" BELOW TO INDICATE REQUEST)

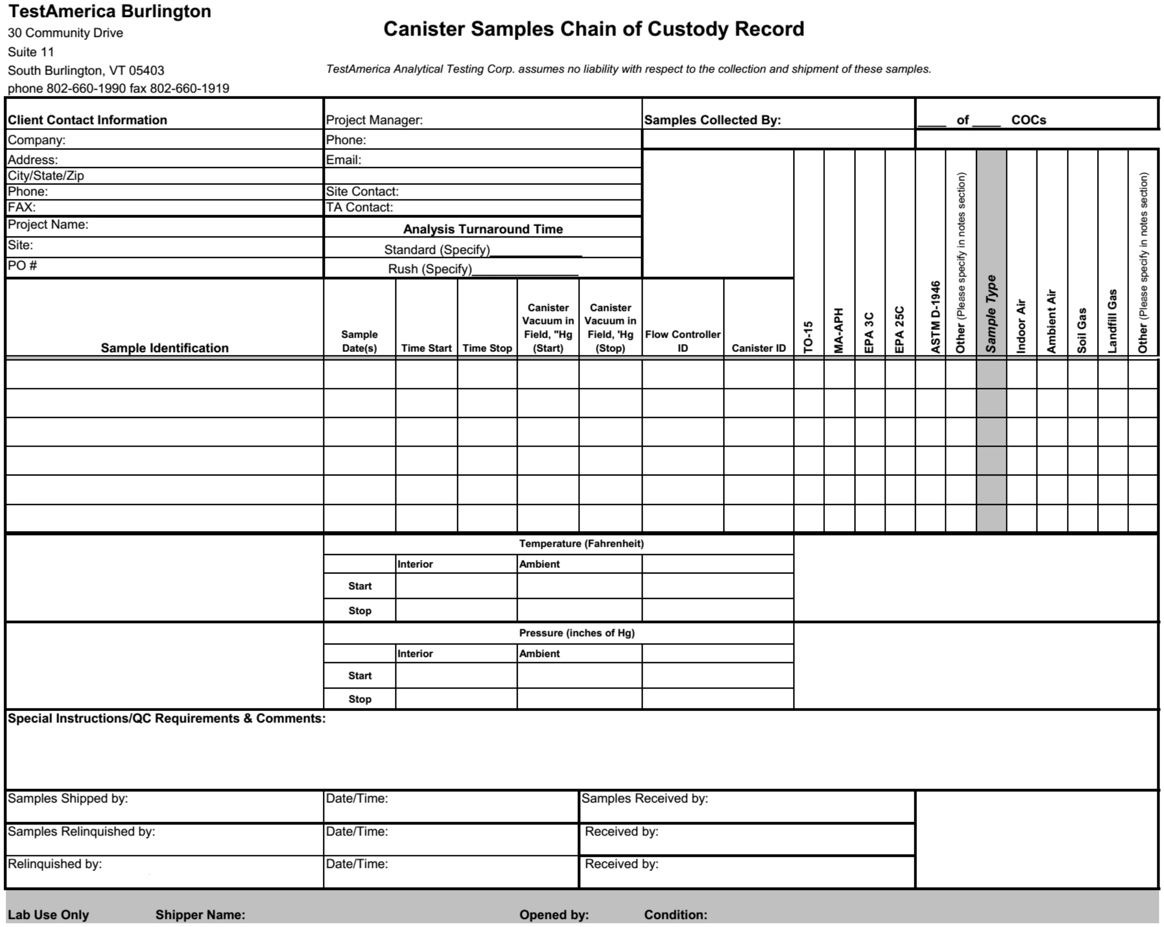
LAB USE ONLY
Project No:
Job No:

Sample Identification	**Date**	**Time**	**Matrix**	**No. of. Cont.**												**Sample Numbers**
Preservation Used: 1 = ICE, 2 = HCl, 3 = H_2SO_4, 4 = HNO_3, 5 = NaOH				Soil:												
6 = Other __________, 7 = Other __________				Water:												

Special Instructions____ Water Metals Filtered (Yes/No)?__________

Relinquished by 1)	Company	Date / Time |	Received by 1)	Company
Relinquished by 2)	Company	Date / Time |	Received by 2)	Company
Relinquished by 3)	Company	Date / Time |	Received by 3)	Company
Relinquished by 4)	Company	Date / Time |	Received by 4)	Company

Laboratory Certifications: New Jersey (12028), New York (11452), Pennsylvania (68-522), Connecticut (PH-0200), Rhode Island (132).
Massachusetts (M-NJ312), North Carolina (No. 578)



TestAmerica Burlington
30 Community Drive
Suite 11
South Burlington, VT 05403
phone 802-660-1990 fax 802-660-1919

Canister Samples Chain of Custody Record

TestAmerica Analytical Testing Corp. assumes no liability with respect to the collection and shipment of these samples.

Client Contact Information	Project Manager:	**Samples Collected By:**	____ **of** ____ **COCs**
Company:	Phone:		
Address:	Email:		
City/State/Zip			
Phone:	Site Contact:		
FAX:	TA Contact:		
Project Name:	**Analysis Turnaround Time**		
Site:	Standard (Specify)_____________		
PO #	Rush (Specify)_______________		

Sample Identification	**Sample Date(s)**	**Time Start**	**Time Stop**	**Canister Vacuum in Field, "Hg (Start)**	**Canister Vacuum in Field, 'Hg (Stop)**	**Flow Controller ID**	**Canister ID**	**TO-15**	**MA-APH**	**EPA 3C**	**EPA 25C**	**ASTM D-1946**	**Other** (Please specify in notes section)	***Sample Type***	**Indoor Air**	**Ambient Air**	**Soil Gas**	**Landfill Gas**	**Other** (Please specify in notes section)

Temperature (Fahrenheit)

	Interior	**Ambient**	
Start			
Stop			

Pressure (inches of Hg)

	Interior	**Ambient**	
Start			
Stop			

Special Instructions/QC Requirements & Comments:

Samples Shipped by:	Date/Time:	Samples Received by:
Samples Relinquished by:	Date/Time:	Received by:
Relinquished by:	Date/Time:	Received by:

Lab Use Only **Shipper Name:** **Opened by:** **Condition:**

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

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

14.0 DATA MANAGEMENT AND DOCUMENTATION

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

15.0 PROJECT REPORTS

Type of Report	Frequency (Daily, weekly, monthly, quarterly, annually, etc.)	Projected Delivery Date(s)	Person(s) Responsible for Report Preparation (Title and Organizational Affiliation)	Report Recipient(s) (Title and Organizational Affiliation)
Remedial Investigation Report	N/A	June 2017	Marc S. Godick, LEP Senior Vice President AKRF, Inc. and Margo Davis Environmental Scientist AKRF, Inc.	Project Manager TBD New York State Department of Environmental Conservation Project Manager TBD New York State Department of Health

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

16.0 PROJECT DATA VERIFICATION (STEP I)

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

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

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

17.0 PROJECT DATA VALIDATION PROCESS (STEPS IIA AND IIB)

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

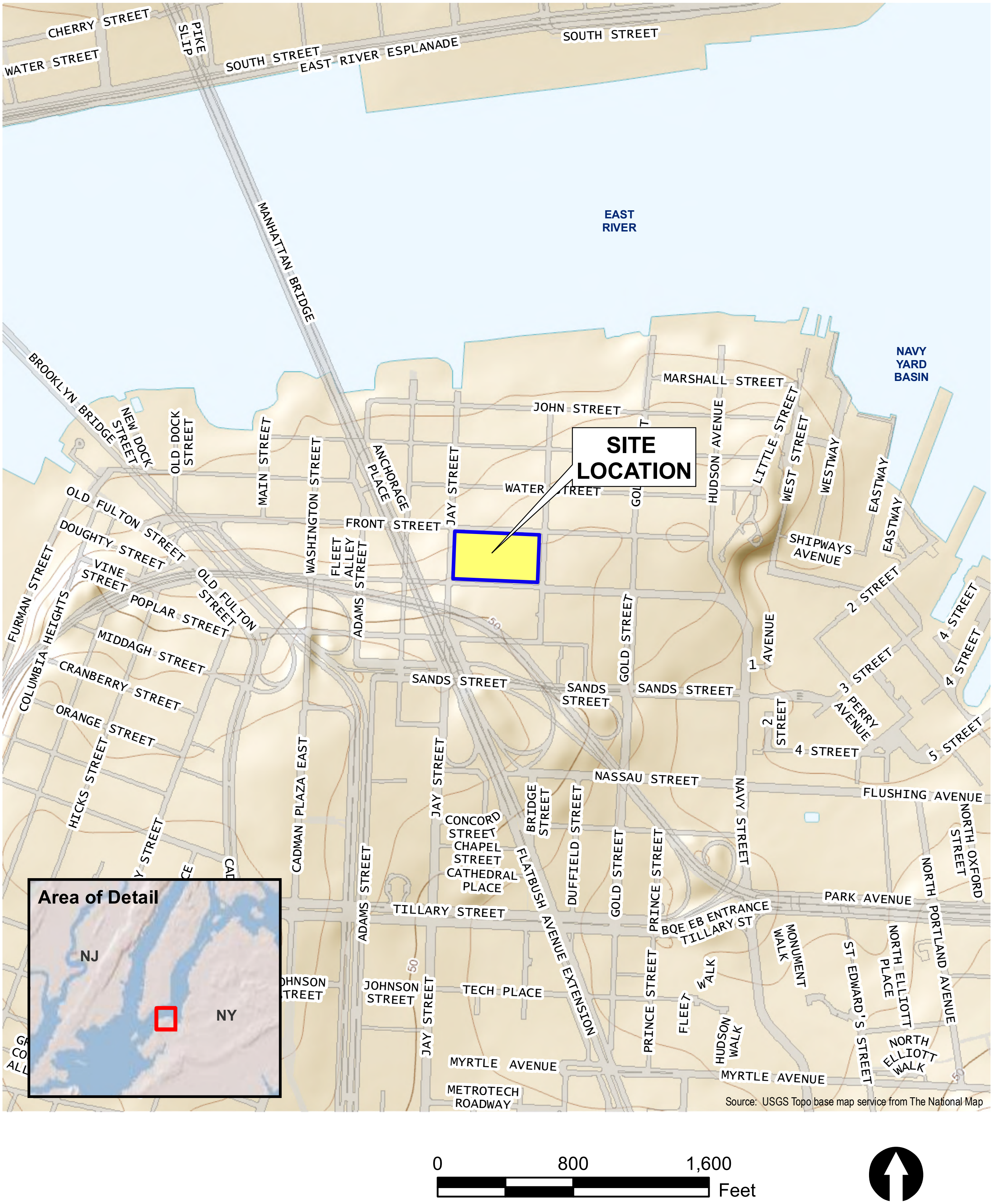
Step IIa or IIb	**Validation Input**	**Description**	**Responsible for Validation (Name, Organization)**
IIa/IIb	Field book and field data sheets	Ensure that the sampling protocols and SOPs outlined in the QAPP were followed and that any deviations were noted/approved, appropriate QC samples collected,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

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

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

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

FIGURES



Source: USGS Topo base map service from The National Map

85 Jay Street
Brooklyn, New York

SITE LOCATION

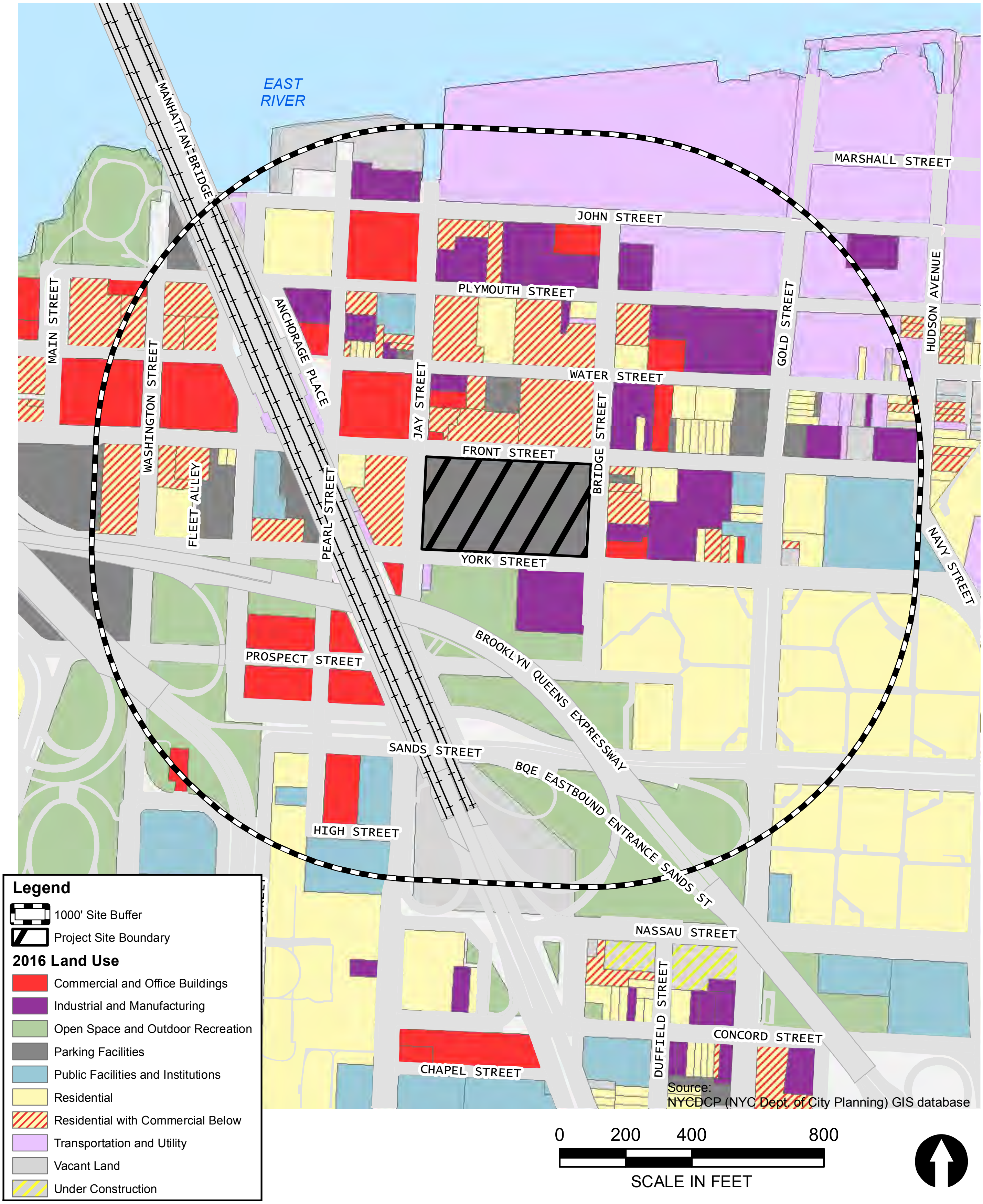
AKRF
Environmental Consultants
440 Park Avenue South, New York, NY 10016

DATE
9/12/2016

PROJECT No.
12519

FIGURE
1

W:\Projects\12519 - 88 JAY STREET BROOKLYN\Technical\GIS and Graphics\hazmat\12519 Fig 1 site loc map.mxd



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

85 Jay Street
Brooklyn, New York

SURROUNDING LAND USE

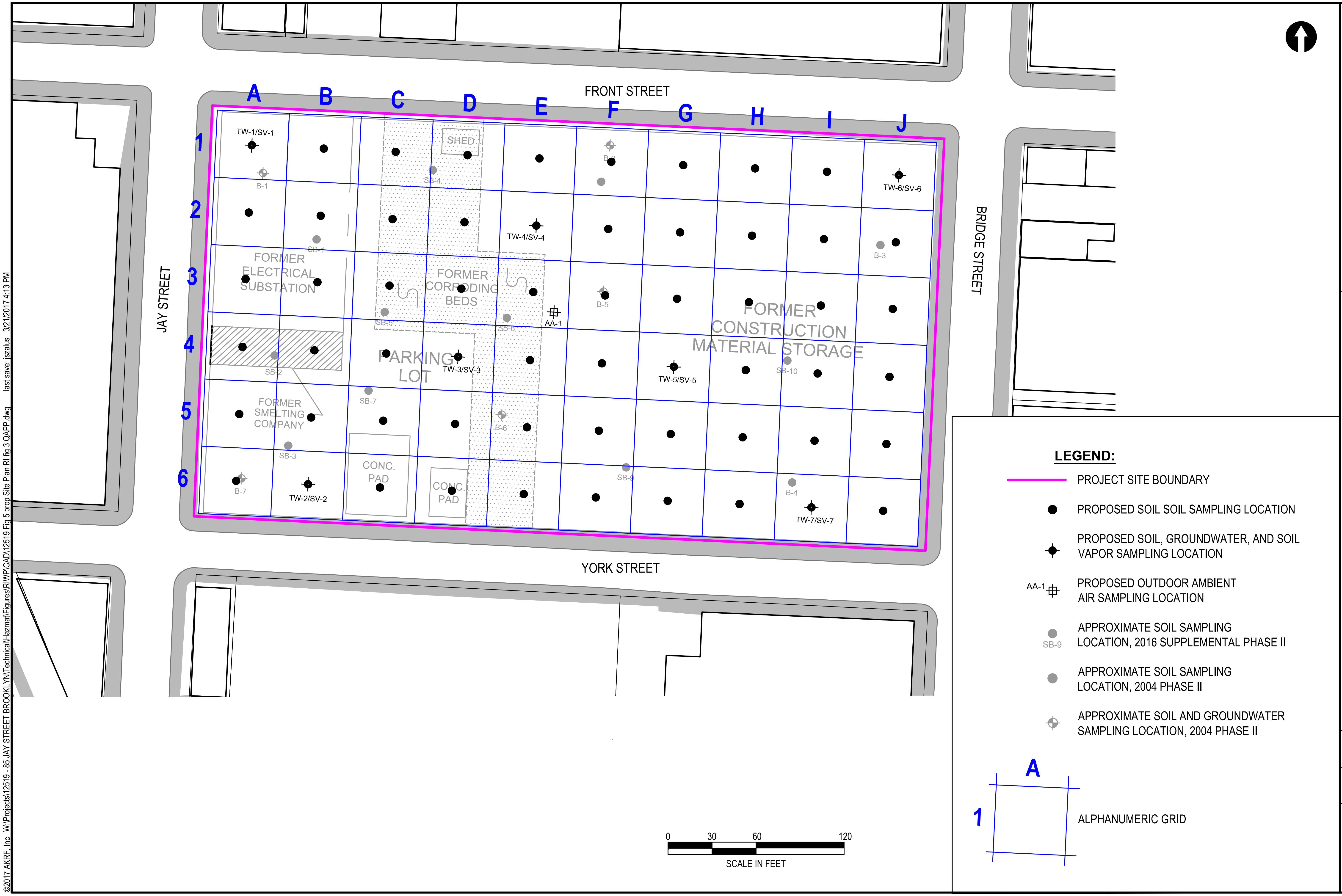
AKRF
Environmental Consultants
440 Park Avenue South, New York, NY 10016

DATE
10/7/2016

PROJECT NO.
12519

FIGURE
2

W:\Projects\12519 - 88 JAY STREET BROOKLYN\Technical\GIS and Graphics\hazmat\12519 Fig 2 Surrounding Land Use map RI.mxd



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

85 JAY STREET
BROOKLYN, NEW YORK

SITE PLAN WITH PROPOSED SAMPLE LOCATIONS

DATE
3/21/2017

PROJECT NO.
12519

FIGURE
3

©2017 AKRF, Inc W:\Projects\12519 - 85 JAY STREET BROOKLYN\Technical\Hazmat\Figures\RIWP\CAD\12519 Fig 5 prop Site Plan RI fig 3 QAPP.dwg last save: jszalus 3/21/2017 4:13 PM

TABLES

Table 1
Soil Sampling Rationale
85 Jay Street, Brooklyn, NY

Cell ID	Surface elevatio	Excavation elevation	Cell thickness	No. of samples	Summary of RECs/AOCs	Parameters			
						PAHs	Metals	VOCs	PCBs
A1	25.70	3.85	21.85	5	shallow and deep (22-24) lead	x	x		x
A2	27.30	3.85	23.45	5	shallow and deep (22-24) lead	x	x		x
A3	27.30	3.85	23.45	5	Historical electrical substation	x	x		x
A4	27.30	3.85	23.45	5	Historical electrical substation (N) and smelting company (S), shallow (2-4) and deep (10-12) lead, deep PAHs	x	x		x
A5	29.40	3.85	25.55	6	On-site surrounding uses	x	x	x	
A6	38.40	3.85	34.55	7	shallow (0-2) SVOC hotspot (total SVOCs = 823 ppm), PCE in GW, metals in GW	x	x	x	x
B1	26.44	3.85	22.59	5	Historical electrical substation	x	x		x
B2	27.00	3.85	23.15	5	Historical electrical substation, shallow (2-4) PAHs and lead	x	x		x
B3	27.50	3.85	23.65	5	Historical electrical substation, shallow (2-4) PAHs and lead	x	x		x
B4	28.20	3.85	24.35	5	Historical electrical substation (N) and smelting company (S), shallow (2-4) and deep (10-12) lead, deep PAHs	x	x		x
B5	29.90	3.85	26.05	6	On-site surrounding uses	x	x		
B6	31.70	3.85	27.85	6	On-site surrounding uses	x	x	x	
C1	28.70	3.85	24.85	5	historical corroding beds, shallow (3-5) and deep (11-13) lead, PID reading = 65 ppm	x	x	x	
C2	27.70	3.85	23.85	5	historical corroding beds	x	x		
C3	28.40	3.85	24.55	5	historical corroding beds	x	x		
C4	29.10	3.85	25.25	6	historical corroding beds, shallow (2-4) lead	x	x		
C5	31.20	3.85	27.35	6	shallow (2-4) lead	x	x		
C6	32.50	3.85	28.65	6	On-site surrounding uses	x	x		
D1	29.80	3.85	25.95	6	historical corroding beds, shallow (3-5) and deep (11-13) lead, PID reading = 65 ppm	x	x	x	
D2	28.70	3.85	24.85	5	historical corroding beds	x	x		
D3	29.25	3.85	25.40	6	historical corroding beds	x	x		
D4	29.80	3.85	25.95	6	historical corroding beds	x	x		x
D5	31.50	3.85	27.65	6	historical corroding beds	x	x		x
D6	33.70	3.85	29.85	6	historical corroding beds	x	x		
E1	30.20	3.85	26.35	6	On-site surrounding uses	x	x		
E2	30.10	3.85	26.25	6	On-site surrounding uses	x	x		
E3	30.47	3.85	26.62	6	historical corroding beds, shallow (2-4) PAHs	x	x		
E4	31.20	3.85	27.35	6	historical corroding beds, shallow (2-4) PAHs	x	x		x
E5	33.10	3.85	29.25	6	historical corroding beds, shallow (0-2) PCBs, unfiltered metals in GW	x	x		x
E6	35.10	3.85	31.25	7	historical corroding beds	x	x		
F1	33.00	3.85	29.15	6	shallow (0-4) PAHs, deep (13-15) lead, petro VOCs in GW, metals in GW	x	x	x	
F2	33.40	3.85	29.55	6	On-site surrounding uses	x	x		
F3	35.35	3.85	31.50	7	shallow (0-4)and deep (34-36) PAHs, petro VOCs in GW, unfiltered metals in GW	x	x	x	
F4	35.20	3.85	31.35	7	On-site surrounding uses	x	x		
F5	37.30	3.85	33.45	7	On-site surrounding uses	x	x		
F6	39.80	3.85	35.95	8	On-site surrounding uses	x	x		
G1	35.20	3.85	31.35	7	deep (13-15) lead	x	x		
G2	35.50	3.85	31.65	7	On-site surrounding uses	x	x		
G3	35.35	3.85	31.50	7	On-site surrounding uses	x	x		
G4	35.20	3.85	31.35	7	On-site surrounding uses	x	x		
G5	37.63	3.85	33.78	7	On-site surrounding uses	x	x		
G6	39.80	3.85	35.95	8	On-site surrounding uses	x	x		
H1	37.30	3.85	33.45	7	On-site surrounding uses	x	x		
H2	37.90	3.85	34.05	7	On-site surrounding uses	x	x		
H3	37.85	3.85	34.00	7	On-site surrounding uses	x	x		
H4	37.80	3.85	33.95	7	On-site surrounding uses	x	x		

Table 1
Soil Sampling Rationale
85 Jay Street, Brooklyn, NY

Cell ID	Surface elevatio	Excavation elevation	Cell thickness	No. of samples	Summary of RECs/AOCs	Parameters			
						PAHs	Metals	VOCs	PCBs
H5	37.90	3.85	34.05	7	On-site surrounding uses	x	x		
H6	41.20	3.85	37.35	8	On-site surrounding uses	x	x		
I1	38.40	3.85	34.55	7	On-site surrounding uses	x	x		
I2	38.60	3.85	34.75	7	On-site surrounding uses	x	x		
I3	38.65	3.85	34.80	7	On-site surrounding uses	x	x		
I4	38.70	3.85	34.85	7	On-site surrounding uses	x	x		
I5	39.20	3.85	35.35	8	On-site surrounding uses	x	x		
I6	41.20	3.85	37.35	8	On-site surrounding uses	x	x		
J1	38.60	3.85	34.75	7	On-site surrounding uses, east-adjacent historical MGP	x	x	x	
J2	39.30	3.85	35.45	8	shallow (0-4) PAHs, east-adjacent historical MGP	x	x	x	
J3	40.15	3.85	36.30	8	On-site surrounding uses, east-adjacent historical MGP	x	x	x	
J4	40.50	3.85	36.65	8	On-site surrounding uses, east-adjacent historical MGP	x	x	x	
J5	41.50	3.85	37.65	8	On-site surrounding uses, east-adjacent historical MGP	x	x	x	
J6	43.12	3.85	39.27	8	On-site surrounding uses, east-adjacent historical MGP	x	x	x	
					Field Sample Quantity	**388**	**388**	**56**	**44**
					Total Borings Sampled	**60**	**60**	**13**	**13**

Table 2
Groundwater and Soil Vapor Sampling Rationale
85 Jay Street, Brooklyn, NY

Sampling Locations	Location	Analytical Group	Rationale
TW-1/SV-1	Northwestern portion of Site	Groundwater: VOCs, SVOCs, PCBs, and Metals Soil vapor: VOCs	- To fill in data gaps and assess groundwater and soil vapor quality in the northwestern portion of the Site.
TW-2/SV-2	Southwestern portion of Site	Groundwater: VOCs, SVOCs, PCBs, and Metals Soil vapor: VOCs	- To fill in data gaps and assess groundwater and soil vapor quality in the southwestern portion of the Site. - To further assess/delineate the extent of the SVOC hotspot and PCE groundwater contamination near Phase II soil boring B-7.
TW-3/SV-3	West-central portion of Site	Groundwater: VOCs, SVOCs, PCBs, and Metals Soil vapor: VOCs	- To fill in data gaps and assess groundwater and soil vapor quality in the west-central portion of the Site.
TW-4/SV-4	North-central portion of Site	Groundwater: VOCs, SVOCs, PCBs, and Metals Soil vapor: VOCs	- To fill in data gaps and assess groundwater and soil vapor quality in the north-central portion of the Site.
TW-5/SV-5	South-central portion of Site	Groundwater: VOCs, SVOCs, PCBs, and Metals Soil vapor: VOCs	- To fill in data gaps and assess groundwater and soil vapor quality in the south-central portion of the Site.
TW-6/SV-6	Northeastern portion of Site	Groundwater: VOCs, SVOCs, PCBs, and Metals Soil vapor: VOCs	- To fill in data gaps and assess up-gradient groundwater and soil vapor quality in the northeast portion of the Site.
TW-7/SV-7	Southeastern portion of Site	Groundwater: VOCs, SVOCs, PCBs, and Metals Soil vapor: VOCs	- To fill in data gaps and assess up-gradient groundwater and soil vapor quality in the southeast portion of the Site.
AA-1	Central portion of Site	Ambient Air: VOCs	- To provide comparative data for soil vapor samples.

APPENDIX A

MARC S. GODICK, LEP

PRINCIPAL-IN-CHARGE

Marc S. Godick, a Senior Vice President of the firm, has over 25 years of experience in the environmental consulting industry. Mr. Godick will serve as Principal-in-Charge for this effort and has broad-based environmental experience includes expertise in brownfield redevelopment, site assessment, remedial investigation, design and implementation of remedial measures, compliance assessment, and litigation support.

Education

M.E., Engineering Science/Environmental Engineering, Pennsylvania State University, 1998

B.S., Chemical Engineering, Carnegie Mellon University, 1989

Licenses/Certifications

Licensed Environmental Professional (License # 396) – State of Connecticut – 2003 - Present

40 Hour HAZWOPER and Annual Refresher Training, 1990 - Present

Supervisors of Hazardous Waste Operations (8 Hour), 1990

Professional Memberships

Chairman, Village of Larchmont/Town of Mamaroneck Coastal Zone Management Commission, 1997 – Present

Member, Westchester County Stormwater Advisory Board, 2011 – Present

Chairman/Member, Westchester County Soil and Water Conservation District, 2005 - 2010

Board of Directors, Sheldrake Environmental Center, Larchmont, New York, 2006 - 2008

Member, NYSDEC Risk-Based Corrective Action (RBCA) Advisory Group for Petroleum-Impacted Sites, 1997

Community Leadership Alliance, Pace University School of Law, 2001

Years of Experience

Year started in company: 2002

Year started in industry: 1990

RELEVANT EXPERIENCE

On-Call Environmental Consulting (Various Locations), New York City School Construction Authority

Mr. Godick is managing an on-call contract with the SCA for environmental assessment, remedial design, and plumbing disinfection. For new school sites, initial due diligence involves conducting Phase I environmental site assessments (ESAs) and multi-media sampling of soil, groundwater, and soil vapor to determine the suitability of a site for development as a school and remediation requirements and associated costs. Once design for a school is underway, AKRF would prepare remediation plans and construction specifications and oversee the construction activities. For existing school sites, the work can involve conducting Phase I ESAs and indoor air quality testing, preparation of specifications, supervision of storage tank removals, investigation and remediation of spills, and development of remediation cost estimates. AKRF also oversees plumbing disinfection work, which is required prior to new plumbing being placed into service. The assignments involve reviewing and commenting on disinfection plans, supervision of the disinfection and confirmation testing, and preparation of a report documenting the work was conducted in accordance with the specifications and applicable requirements. Due to the sensitivity of school sites, work under this contract is often conducted on short notice and during non-school hours.

Litigation Support & Remediation, 3200 Jerome Avenue, Bronx, NY (Former PS 151)

Mr. Godick managed the investigation and remediation of a former public school in the Bronx under the New York State Department of Environmental Conservation (NYSDEC) Brownfields Cleanup Program (BCP). The site was contaminated with trichloroethylene (TCE) from historic operations at the property prior to use as a school. The remedial investigation included soil, groundwater, and vapor intrusion assessment both on-site and off-site. The remedial design included excavation of the source area, in-situ chemical oxidation of groundwater, and installation of a sub-slab depressurization system (SSDS) to address to potential vapor intrusion. Implementation of the remedy was complete in late 2014. The completed remediation allows for future multi-family residential, educational, childcare, and/or medical uses. Mr. Godick has also been providing litigation support and will serve as a fact witness and potentially an expert witness in connection with a cost recovery claim against the former operator of the site.

Litigation Support & Remediation, Queens West Project, Avalon Bay Communities, Queens, NY

For over 20 years, AKRF has played a key role in advancing the Queens West development, which promises to transform an underused industrial waterfront property into one of largest and most vibrant mixed-use communities just across the East River from the United Nations. AKRF prepared an Environmental Impact Statement (EIS) that examines issues pertaining to air quality, land use and community character, economic impacts, historic and archaeological resources, and infrastructure. As part of this project, Mr. Godick managed one of the largest remediation projects completed under the New York State Department of Environmental Conservation (NYSDEC) Brownfields Cleanup Program (BCP) that was contaminated by coal tar and petroleum. The remedy included the installation of a hydraulic barrier (sheet pile cut off wall), excavation of contaminated soil under a temporary structure to control odors during remediation, a vapor mitigation system below the buildings, and implementation of institution controls. The investigation, remediation design, and remedy implementation, and final sign-off (issuance of Certificate of Completion) were completed in two years. Total remediation costs were in excess of $13 million. Following completion of the remediation, Mr. Godick developed a cost allocation model and provided litigation support for a cost recovery action against a former operator of the site, including participation in a deposition as a fact witness prior to settlement between the parties.

Remediation, Former Industrial Laundry/Dry Cleaning Plant, New York, NY

Mr. Godick managed the assessment, cleanup and post-remedial operations, maintenance and monitoring of the only NYSDEC listed inactive hazardous waste (State Superfund) site in Manhattan, a former laundry/dry cleaning plant in Harlem. Remedial investigation included evaluation of soil, groundwater, soil vapor, indoor air, and building materials. Interim remediation included the removal of contaminated building materials and operation of a sub-slab vapor extraction system retrofitted into the existing building. Mr. Godick coordinated with the regulatory agencies, site owner and occupants; and managed the investigation, remedial design, and remedial implementation activities. Phase 1 of the Remedial Action Work Plan consisted of further removal of contaminated building materials. Phase 2 of the remediation included a sub-slab depressurization system (SSDS) retrofitted into the existing building, soil vapor extraction (SVE) system, and chemical oxidation injection. Remedial action work was completed in 2014 and documented in a Final Engineering Report. NYSDEC issued Certificate of Completion in January 2015 and the site has been reclassified to a “Class 4” site (site properly closed – requires continued management). Mr. Godick continues to manage the project, including operations, maintenance and monitoring of the SSDS and SVE system under the NYSDEC-approved Site Management Plan.

164 Kent Avenue, Brooklyn, NY (AKA Northside Piers and 1 North 4th Place), RD Management, L&M Development, Toll Brothers, and Douglaston Development

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 development of remedial cost estimates for development, 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 now achieved for all four buildings under the project.

606 West 57th Street, New York, NY, TF Cornerstone

AKRF has been retained by TF Cornerstone to provide environmental services for the proposed redevelopment of a portion of the block bounded by Eleventh and Twelfth Avenues and West 56th and 57th Streets. The proposed actions included a zoning map amendment, zoning text amendments, a special permit, and an authorization to facilitate development of approximately 1.2 million square feet of residential and retail space. AKRF prepared an Environmental Impact Statement (EIS) for the New York City Department of City Planning (DCP) to analyze the effects of the proposed actions and development of the proposed building. The EIS addressed the full range of environmental impacts associated with the proposed development.

Mr. Godick was responsible for the elements of the EIS pertaining to hazardous materials, including coordination of a Phase I ESA and summarizing pertinent site information for the hazardous materials and construction chapters. Mr. Godick provided pre-acquisition support to TF Cornerstone, which included development of a remedial cost estimate report to outline remediation cost during site development. Mr. Godick also managed work related to the subsurface investigation, localized remediation (chemical injection and limited excavation beneath the building basement) and regulatory closure of a petroleum spill on a portion of the project site to satisfy NYSDEC requirements. After EIS certification, Mr. Godick coordinated approvals with NYCOER, the regulatory agency overseeing remedial measures related to the redevelopment of the site. The Site has an (E) Designation and is participating in the New York City Voluntary Cleanup Program. Mr. Godick managed the preparation of a Phase II Investigation Work Plan, Remedial Investigation Report, Remedial Action Work Plan, and contractor specifications for soil management and tank and hydraulic lift removal. Mr. Godick is continuing to manage the project during remediation and construction.

National Grid – Halesite Manufactured Gas Plant Site Remediation, Town of Huntington, NY

Mr. Godick managed the remedial design and engineering work associated with remediation of National Grid's former manufactured gas plant (MGP) located in the Town of Huntington. The site is situated in a sensitive location along the waterfront, surrounded by commercial and residential properties, and half the property where the remediation was conducted was a steep slope. The remedy consisted of soil removal, oxygen injection, and non-aqueous phase liquid recovery. Mr. Godick was responsible for the development of the remedial work plans, design/construction documents, landscape architecture, confirmatory sampling, air monitoring, supervision, and preparation of close-out documentation in accordance with NYSDEC requirements.

Landfill Closure & Compost Facility Application, White Plains, NY

Mr. Godick managed the closure of a formal ash landfill, which is currently being utilized as a leaf and yard waste compost facility by the City of White Plains. The landfill closure required additional assessment to define the extent of methane and solvent contamination. The closure entailed remediation of a chlorinated solvent plume, placement of landfill cap, and methane recovery. Mr. Godick also managed the preparation of the compost facility permit application, which required modification to the facility’s operations necessary to close the landfill and address other regulatory requirements.

Underground Storage Tank Closure and Site Remediation–Program Management, Con Edison, New York, NY

Mr. Godick provided technical assistance to Con Edison in developing technical submittals and budgets associated with tank closures at over 50 facilities. Technical summaries were prepared for submittal of contractor-prepared closure reports to the NYSDEC. The summaries included a review of historic pre-closure assessments, tank closure data, and provided recommendations for additional assessment, remediation or closure. Subsequently, a three-year program budget was developed for implementation of the UST investigation/remedial program, which Con Edison utilized for internal budgeting purposes.

Site Investigation–Over 20 Facilities, Con Edison, New York, NY

Mr. Godick managed site investigations associated with petroleum, dielectric fluid, and PCB releases at over 20 Con Edison facilities including service centers, substations, generating stations, and underground transmission and distribution systems. Site investigations have included due diligence site reviews, soil boring installation, monitoring well installation, hydrogeologic testing, and water quality sampling. Risk-based closures were proposed for several sites.

Verizon, Investigation & Remediation, Various Locations, NY, PA and DE

Mr. Godick managed over 50 environmental investigations and remediation projects related to petroleum releases at various facilities. Responsibilities included annual budgeting, day-to-day project management, development and implementation of soil and ground water investigation workplans, ground water modeling, risk evaluation, remedial action work plans, remedial design, system installation, waste disposal, well abandonment, and operation and maintenance. Many of the assessment and remedial projects followed a risk-based approach. Remedial technologies implemented included air sparging, soil vapor extraction, bioremediation, pump and treat, soil excavation, and natural attenuation.

Storage Tank Management, Verizon, Various Locations, NY, PA, DE, and MA

Mr. Godick managed the removal and replacement of underground and aboveground storage tank systems for Verizon in New York, Pennsylvania, Delaware, and Massachusetts. Responsibilities included the management of design, preparation of specifications, contractor bidding, construction oversight, project budget, and documentation. For selected AST sites, managed the development of Spill Control, Contingency and Countermeasures (SPCC) plans.

Litigation Support, Cost Recovery Action, Federal Superfund Site, New York

Mr. Godick is currently providing technical support to one of the 40+ potential responsible parties (PRPs) associated with a Federal Superfund site in New York State, which includes conducting a liability assessment for the various parties and development of a cost allocation model.

Litigation Support, Cost Recovery Action, New York State Superfund Site

Mr. Godick provided technical support for the former owner of a New York State Superfund site in upstate New York. Current owner of the property brought a cost recovery action against client as a potential responsibility party. Completed technical review of draft Remedial Investigation/Feasibility Study prepared by opposing party's consultant to develop more cost effective remedial strategy and to better position the client for liability allocation as part of future settlement negotiations. Developed cost allocation paper and model for settlement negotiations, as well as participated in mediation.

Litigation Support & Remediation, Former Service Station, Brooklyn, New York

Mr. Godick took over management of remediation of an inactive service station (formerly conducted by another firm). His approach outlined additional characterization and remediation efforts which resulted in successful closure of the spill by NYSDEC within two years. Mr. Godick testified as an expert witness at a hearing in the New York State Supreme Court of Kings County to determine the adequacy of the remediation efforts.

Litigation Support, Cost Recovery Action, Town of Carmel, New York

Mr. Godick served as an expert witness representing the owner of a property in a landlord-tenant dispute, which was used as a gasoline station and oil change facility. Mr. Godick prepared exhibits, testified, and participated in meetings with NYSDEC to support the landlord's claim that the oil change tenant's practices were poor and were adversely affecting the environment and the overall facility systems at the site.

Litigation Support, Cost Recovery Action, New York State Petroleum Spill Site, New York, NY

Mr. Godick provided technical support for the former owner of a New York City multi-unit residential apartment building. The State of New York brought a cost recovery action against our client as a result of a previous spill from a former underground storage tank. Reviewed invoices and project documentation to dispute work performed by the NYSDEC, which provided the basis for settlement at a fraction of the initial claim.

Litigation Support, Class Action Lawsuit, Confidential Client, NJ

Mr. Godick provided technical support for a class action suit involving a petroleum-impacted community water supply in southern New Jersey. The technical assistance included analysis of expert testimony and coordination with legal counsel in preparing for cross-examination of the opposing party's lead expert witness.

MARGO DAVIS

ENVIRONMENTAL SCIENTIST

Margo Davis is an Environmental Scientist in AKRF's Hazardous Materials group. She is a recent graduate from Colorado College with a degree in Environmental Science. 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.

BACKGROUND

Education

Bachelor of Arts, Environmental Science, Anthropology Minor, Colorado College, 2013

Professional Licenses/Certifications

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

Years of Experience

Year started in company: 2014
Year started in industry: 2014

RELEVANT EXPERIENCE

Various Phase I ESAs

Ms. Davis supports AKRF's Phase I Environmental Site Assessments, hundreds of Phase II subsurface investigations and numerous other studies of individual properties, corridors, and larger areas.

New York City School Construction Authority (SCA), Environmental Consulting Hazardous Materials 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. Davis conducts Phase I ESAs as part of this contract.

ADC-Genesis Y15 Resyndication, New York, New York

AKRF performed a Phase I ESA of 31-parcels with 28 buildings located in the Central Harlem section of Manhattan, NY. The Phase I ESA was prepared in accordance with ASTM E1527-13 and EPA's All Appropriate Inquiry (AAI) rule.

ASHUTOSH SHARMA

ENVIRONMENTAL SCIENTIST

Ashutosh Sharma is an Environmental Scientist providing expertise in Phase I and Phase II (subsurface) site investigation, remediation and cleanup of contaminated sites, and construction oversight. He has experience with subsurface soil, groundwater and sub-slab air/vapor sampling procedures, coordinating and running Community Air Monitoring Plans (CAMP) and is familiar with relevant United States Environmental Protection Agency (USEPA), New York State Department of Environmental Conservation (NYSDEC), and New York City Department of Environmental Protection (NYCDEP) environmental laws and regulations.

BACKGROUND

Education

M.S., Environmental Science, New Jersey Institute of Technology, 2007
B.Tech, Dr. B.R. Ambedkar National Institute of Technology, India, 2005

Years of Experience

Year started in industry: 2007
Year started in company: 2007

RELEVANT EXPERIENCE

Whitney Museum of American Art, NY

Mr. Sharma provided assistance with subsurface soil and groundwater investigation, construction oversight and soil disposal management during the remediation phase of the project. The project included the construction of approximately 230,000-square foot museum building with one sub-grade level with exhibition galleries, administrative offices, accessory use (café and bookstore), storage space, and an approximately 4,000-square foot restaurant.

New York City School Construction Authority, Various Locations, NY

Under contract with the School Construction Authority (SCA) of New York City, AKRF is providing assistance with water disinfection projects for new schools and for plumbing upgrades for existing school buildings. Mr. Sharma has been providing assistance with contractor oversight work during the disinfection process as per the contract agreement.

Yankee Stadium Demolition, Bronx, NY

The New York City Economic Development Corporation (NYCEDC) project include demolition of the old Yankee Stadium and construction of a ball field known as Heritage Field. Mr. Sharma provided air monitoring and remedial action plan (RAP) oversight during the demolition and soil disturbance work.

East River Science Park, New York, NY

The New York City Economic Development Corporation (NYCEDC) proposed to construct two seventeen-story buildings to serve as a biomedical research center. The space between the two towers included an elevated atrium and an outdoor plaza on top of a parking garage. Mr. Sharma provided construction oversight during site excavation, coordination and management of soil removal and fill material imports, oversight of the on-site air monitoring program, identification and proper management of contamination encountered during excavation work, and maintenance of critical paperwork and preparation of the final closure report.

W 61st Street Site, NY

Mr. Sharma provided assistance with construction oversight during site excavation activities and helped prepare the final closure report for the site which, as part of the Brownfield Cleanup Program (BCP), was slated for redevelopment as two residential buildings with a courtyard and a tennis court.

164 Kent Avenue, Brooklyn, NY

The site was developed as mixed-use residential-commercial high rise towers with an esplanade and a pier on the East River. Mr. Sharma provided assistance with construction oversight during soil handling activities and running the Community Air Monitoring Plan (CAMP).

285 Jay Street, Brooklyn, NY

Under contract with the Dormitory Authority of the State New York (DASNY), AKRF completed a Phase II Subsurface investigation at the site of a proposed CUNY educational building to satisfy New York City E-designation requirements. As part of the work AKRF performed at the site, Mr. Sharma conducted sub-surface soil and groundwater investigation work and coordinated with the driller and the property owner for successful completion of the work.

MTA Long Island Railroad, East Side Access Project, New York, NY

The Metropolitan Transportation Authority (MTA) sponsored the East Side Access project to connect the Long Island Railroad to the Grand Central Terminal, thereby allowing Long Island commuters direct access to the East Side of Manhattan. Mr. Sharma provided assistance with the execution of the Community Air Monitoring Plan (CAMP) at various locations during the construction phase.

2341–2357 Adam Clayton Powell Jr. Boulevard, New York, NY

AKRF performed a Phase II study to meet the requirements of the New York City Department of Environmental Protection (NYCDEP) and to determine whether subsurface conditions had been affected by the on-site and/or off-site petroleum storage tanks and to ascertain whether current or former on- or off-site activities had adversely affected the subject property. Mr. Sharma conducted sub-surface soil and groundwater investigation at the abandoned site slated for future development. He was responsible for coordinating with the driller and the property owner for successful completion of the work.

WILLIAM GROSSETT

ENVIRONMENTAL ENGINEER

Mr. Grossett is an environmental engineer with over eight years of technical experience performing soil and groundwater testing, overseeing subsurface drilling techniques, conducting soil vapor intrusion investigations, and managing remedial compliance and air dispersion modeling. Current responsibilities include initiation of environmental site assessments, investigations, and remediation actions, supervising the installation of engineering controls and systems, and preparation of remedial work plans to ensure public health and regulatory compliance. Project experience extends across large and small-scale developments and infrastructure improvement projects throughout the New York City metropolitan area. Mr. Grossett maintains extensive knowledge of local regulatory practices and codes, including NYCDEP, NYSDEC, and NYCOER. Mr. Grossett is a certified erosion and sedimentation control inspector and routinely conducts stormwater pollution prevention inspections. He is OSHA 10-Hour and OSHA 40-Hour (HAZWOPER) trained.

BACKGROUND

Education

B.S.E. Earth Systems Science & Engineering: Atmospheric Science, University of Michigan, Ann Arbor, MI, 2007

Licenses/Certifications

OSHA: 10-Hour Construction Standard

OSHA: 40-Hour HAZWOPER Standard

Certified SWPPP inspector

Engineer-in-Training certified (NY)

Years of Experience

Year started in company: 2013

Year started in the industry: 2008

RELEVANT EXPERIENCE

443 Greenwich Street, Manhattan, NY

The project involved the remediation of a 35,000-square foot site located in Manhattan, New York. Redevelopment of the site included a full conversion of the existing commercial/industrial building into residential loft space. Tasks included supervising an in-situ chemical oxidation (ISCO) groundwater treatment program requiring 66 soil borings to depths of approximately 10 to 15 feet using a direct push-probe rig for injection of a sodium persulfate solution to neutralize environmental contaminants present in on-site groundwater. Mr. Grossett helped manage soil excavation and disposal, groundwater removal, and the installation of a soil vapor barrier system to confirm compliance with the design during the construction phase. Mr. Grossett prepared a Remedial Closure Report to document all relevant site activity and satisfy regulatory requirements.

East Side Coastal Resiliency, FDR Drive, Manhattan, NY

This project involves subsurface soil and groundwater characterization in support of a proposed flood risk reduction system established across 7,700 linear feet of waterfront parkland boundary with the intent of minimizing flooding from the adjacent East River during periods of severe weather. Mr. Grossett directly supervised the advancement of 68 deep borings to a depth of 40 feet below surface grade and over 450 shallow borings to a depth of 5 feet below grade to adequately characterize the soil and fill encountered throughout East River Parkland near Pier 42. Mr. Grossett was responsible for managing the identification, sampling and disposal of investigation derived wastes, including petroleum and coal tar wastes. A subsurface investigation report was prepared to identify the findings, including soil and groundwater analytical results, and identified the area where contaminants could affect design and construction of the flood protection system.

New York City College of Technology – Academic Building Project, Brooklyn, NY

The proposed redevelopment plan for this project consisted of the demolition of an existing brick and concrete building on a 63,500-square foot site, excavation of soil at depths of approximately 36 to 39 feet below surface grade across the site to install the new structural foundation, and construction of a new College of Technology building on the City Tech campus. For this project, Mr. Grossett performed the waste characterization study, which required the advancement of 36 soil borings using a rotary sonic drill rig to the anticipated depths of excavation to retrieve samples for laboratory analysis. Mr. Grossett provided oversight of the drilling team, following an approved health and safety program, clearing the surrounding area of subsurface utilities, and containerizing contaminated drill cuttings. During the waste characterization testing, roving PID measurements were taken to monitor dust and vapors to protect workers and the surrounding community.

Flushing Commons, Queens, NY

The project consisted of the construction of two mixed use buildings with a footprint area of 41,875 square feet and four levels of subgrade parking within an existing parking lot. The construction plan includes a full build-out of the site with excavation extending up to 50 feet below grade for the buildings' spread footings. Approximately 119,000 cubic yards or 178,000 tons of soil required excavation and off-site disposal during the foundation excavation. Mr. Grossett's tasks involved implementation of a comprehensive sampling program for a wide range of parameters. The work included the advancement of 28 borings using a direct-push rig to depths between 30 and 50 feet below grade to collect waste samples to characterize each 800 cubic yards of material for disposal. The sampling allowed AKRF's client to obtain firm pricing during contract negotiations for transport and disposal of the material. Contractors bidding on the project utilized the report to obtain disposal approval for site materials prior to commencing excavation.

225 Pennsylvania Avenue, Brooklyn, NY

A 47,600-square foot excavated site required the implementation of a remedial management strategy for proper handling and disposal of solid waste in addition to recommendations for the potential containment of petroleum-impacted soil vapor. Mr. Grossett's responsibilities included implementing a remedial program during the excavation and off-site disposal of 30,000 cubic yards of material. He was responsible for conducting a supplemental investigation to obtain soil vapor samples, and instituting an OSHA-compliant health and safety plan.

New Roadway Construction, Queens, NY

The construction of a new 750-foot long, 60-foot wide public access roadway took place within a NYSDEC designated Inactive Hazardous Waste Disposal Site (i.e., State Superfund). Historical contaminants present beneath the construction area included solid wastes containing PCBs, petroleum, semivolatile organic compounds and metals. Mr. Grossett's tasks included supervising the construction of a NYSDEC-approved cap and confirming the placement of 8 inches of concrete with a 3-inch asphalt top layer, and conducting work zone monitoring for dust and vapor as well as monitoring upwind and downwind air monitoring stations. Other activities included confirming installation of utility and roadway structures as mandated by NYCDOT Builders Pavement Plan standards and conducting Stormwater Pollution Protection Plan (SWPPP) inspections to mitigate stormwater runoff into nearby waterbodies. Mr. Grossett prepared daily technical reports summarizing progress towards project objectives.

118 East 59th Street, Manhattan, NY

This site consisted of a 5,000-square foot vacant tax lot that was formerly occupied by an approximately 12,500-square foot, four-story brick and concrete commercial/office building with a cellar, which was demolished in June 2015. Responsibilities for the project included supervising soil excavation and disposal, enforcement of a Construction Health and Safety Plan, project management, and field coordination. Mr. Grossett's duties also included UST tank removal oversight and end-point sampling, in accordance with NYSDEC protocols.

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

Request for Taxpayer Identification Number and Certification

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

Print or type
See Specific Instructions on page 2.

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

Business name/disregarded entity name, if different from above

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

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

☐ Other (see instructions) ▶

☐ Exempt payee

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

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

Requester's name and address (optional)

List account number(s) here (optional)

Part I Taxpayer Identification Number (TIN)

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

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

Social security number
_ _ _ - _ _ - _ _ _ _

Employer identification number
58-2381714

Part II Certification

Under penalties of perjury, I certify that:

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

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

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

General Instructions

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

Purpose of Form

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

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

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

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

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

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

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

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

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

Lori A. Beyer

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

EXPERIENCE:

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

EDUCATION:

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

Westchester Community College
Professional Development Center

Awards this Certificate of Achievement To

LORI BEYER

for Successfully Completing

ORGANIC DATA VALIDATION COURSE (35 HOURS)

Dr. John Samuelian

Date AUGUST 1992

Assistant Dean
Professional Development Center

President

The Professional
Development Center

SUNY
WESTCHESTER COMMUNITY COLLEGE
Valhalla, New York 10595

Westchester Community College
Professional Development Center

Awards this Certificate of Achievement To

LORI BEYER

for Successfully Completing

INORGANIC DATA VALIDATION

Instructor: Dale Boshart

Date MARCH 1993

Assistant Dean
Professional Development Center

President

The Professional
Development Center

SUNY
WESTCHESTER COMMUNITY COLLEGE
Valhalla, New York 10595

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

Thomas C. Jorling
Commissioner

July 8, 1992

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

Dear Elaine,

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

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

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

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

Sincerely,

Maureen P. Serafini

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

The Professional Development Center
AT
WESTCHESTER COMMUNITY COLLEGE

914 285-6619

October 2, 1992

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

Dear Ms. Beyer:

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

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

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

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

Very truly yours,

Passing Grade is 70%
Your Grade is 99%

Elaine Sall
Program Coordinator

ES/bf

SUNY
WESTCHESTER COMMUNITY COLLEGE
Valhalla, New York 10595

The Professional
Development Center
AT
WESTCHESTER COMMUNITY COLLEGE

914 285-6619

June 21, 1993

Dear Ms. Beyer:

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

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

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

Very truly yours,

Elaine Sall

Elaine Sall
Program Coordinator

ES/bf

Enclosures

SUNY
WESTCHESTER COMMUNITY COLLEGE
Valhalla, New York 10595

Personnel Resume

Raymond J. Frederici
Director of Quality and Client Advocacy

Qualifications Summary

Mr. Frederici is highly experienced with 29 years in the environmental testing industry and extensive leadership and management expertise. He possesses excellent abilities for financial management, strategic planning, performance monitoring, policy development and enforcement. As a strong and decisive decision-maker, he takes personal responsibility for ethics, quality and customer service awareness and leading organizational improvements. Through concise communication, presentation, technical writing and technology/computer expertise, he is an organizational change agent.

Professional Experience

Director of Quality and Client Advocacy – Aug 2008 to Present

Responsible for establishing, implementing, monitoring and enforcing company-wide quality assurance and ethics programs. Maintains oversight on all laboratory QA programs and monitors the Quality System of each operation. Through a quality performance metrics system; monitors, measures and drives continuous improvement for the entire company.

Director of Client Advocacy – Oct 2007 to Aug 2008

Responsibilities include defining the basic principles that underscore client interaction and communication for the entire organization – which is “excellent customer service drives client’s purchasing decisions”. In this role, the he evaluates, make recommendations for, and oversees any approved changes to the organization to achieve the desired emphasis on enhancing the customer experience in every interaction with the company. Duties include providing guidance to customer service staff on the implementation of standardized key performance indicators as ongoing measures of performance. Also, designs and implements customer service training modules for current and new staff as well as effective mechanisms to routinely track and measure customer feedback across the company on Customer Service throughout the organization.

Corporate Quality Director – 2001 to Oct 2007

Severn Trent Laboratories – University Park, IL -- 2001 – Oct 2007

Responsibilities include implementation, administration and enforcement of company-wide strategy, policies, and ethics programs. This includes the direction and leadership of thirty Quality Assurance Managers across laboratory facilities and the enforcement of the Corporate Ethics Program. This includes planning and developing program and project plans, training initiatives and KPI quality metrics to drive quality process improvements corporate-wide.

Quality Manager
STL Chicago (formerly Roy F. Weston and Recra Environmental Laboratories) – University Park, IL --1999 to 2001

Corporate Quality Director
Roy F. Weston Laboratories and RECRA Environmental (Currently TestAmerica's Chicago Laboratory) – University Park, IL --1989 to 1999

Quality Director
Gulf Coast Laboratories and Roy F. Weston Laboratories (Currently TestAmerica's Chicago Laboratory) – University Park, IL --1985 to 1989

Analytical Chemist
Gulf Coast Laboratories, Inc. (Currently the TestAmerica's Chicago Laboratory) – University Park, IL --1981 to 1985

Education

- M.B.A. Masters in Business Administration – Olivet Nazarene University – Kankakee, IL -- 1994
- BS in Environmental Biology – Eastern Illinois University – Charleston, IL –1982

Key Business Projects – Past 10 years

Root Cause Analysis and Lessons Learned initiative - Developed policies, procedures, process and training materials to drive a problem analysis and resolution to the root cause of issues, including training Client Service, Project management and Quality Assurance Managers.

Quality Management Training - Developed, implemented, and organized a 40hr quality Management course for new, experienced and senior quality management staff. The course was designed to provide quality managers with the knowledge and tools to effectively manage large complex environmental laboratories requiring multiple regulatory oversight and compliance.

Client First Initiative - Co-leader in the development of a client service awareness program that defined the basic principles of client interaction and communication: "excellent customer service drives client's purchasing decisions". Designed and implemented customer service training modules for current and new staff as well as effective mechanisms to routinely track and measure customer feedback throughout the company.

Quality System KPI (Metrics System) Developer of a key performance Indicator reporting system to monitor, measure and improve quality systems across a multiple laboratory (30) company.

Client Complaint handling and Service Recovery – developed a system for documenting client complaint handling and trained 220 staff in its use.

Tall University
This is a central repository for all company training materials and corporate knowledge. Lead the initiative to create this online resource and library of technical and informational presentations. This site provides all employees access to training presentations and materials in one centrally located webpage and enables self directed learning.

ACIL Data Integrity Initiative; Authored several parts of an industry wide self compliance ethics manual for the environmental testing industry.

Corporate-wide Ethics program development, implementation and training.
I worked with a core group of senior managers to develop an ethics and data integrity program. Held workshops with General Managers and Laboratory Directors to refine the program and launch training to all company staff. Also, I implemented remote training technologies to ensure training of employees working outside fixed laboratory facilities.

Organization Assessment Teams
I participated in cross-functional organizational assessment teams for evaluating laboratory performance, management, leadership, client service, quality systems and information technology. This included the following facilities: Denver, ST. Louis, Houston, Austin, Valparaiso, Edison, San Francisco and Savannah

Laboratory Pre-assessment and planning for Laboratory Information Management System (LIMS) Implementation: Co-led a group of technical experts to evaluate laboratories current operations in preparation for a LIMS implementation. This included developing the implementation plan and resource schedule; identifying unique laboratory needs and translating them into programming requests.

Laboratory Information Management System (LIMS) Implementation: Co-Leader for the implementation of a comprehensive LIMS system for the TSL Chicago laboratory. This included maintaining the implementation and resource schedule; maintenance of the programming and development list; assessment of training needs and coordinating training activities; translating laboratory needs into program requests; coordination of multi-user conference calls for program development group.

Note: *additional key projects can be provided on request*

Professional Affiliations

American Society for Quality
Institute for National Environmental Laboratory Accreditation
National Environmental Laboratory Accreditation Conference
Illinois Association of Environmental Laboratories
American Council of Independent Laboratories, Environmental Data Integrity Initiative
Department of Defense Environmental Data Quality Workgroup

Publications

- Frederici, R., Fall 2006. “Complaint Handling and Service recovery”, training for 220 Project Managers, Customer Service Managers, and Sales and Marketing Staff.

- Frederici, R., June 2005. “Laboratory Ethics: Do’s and Don’ts”, Presented to the California Water and Environment Association
- “Comprehensive Ethics Training, for Managers, All Staff, and Technical Staff”, presented for several years 2003-2006 with annual refresher. Automated voice over presentation format included
- Frederici, R., August 2004. “Detecting and Preventing Unethical Laboratory Practices”, Presented at NY Association of Approved Environmental Laboratories’ Annual Convention and Exposition

Note: More than 20 additional presentations and materials have been produced and a more comprehensive listing is available.

APPENDIX B

HEALTH AND SAFETY PLAN

85 JAY STREET

BROOKLYN, NEW YORK

Health and Safety Plan

BCP Site #: C224248
AKRF Project Number: 12519

Prepared for:

85 Jay Street (Brooklyn), LLC
666 Fifth Avenue, 15th Floor
New York, New York 10103

Prepared by:

AKRF

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

MARCH 2017

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1.0 INTRODUCTION

This environmental Health and Safety Plan (HASP) has been developed for implementation of Remedial Investigation (RI) activities conducted by all personnel on-site, both AKRF employees and others, at the 85 Jay Street site (the "Site"). The Site is located at 85 Jay Street in the Dumbo neighborhood of Brooklyn, New York. The legal definition of the Site is Tax Block 54, Lot 1. A Site Location plan is provided as Figure 1.

A Phase I Environmental Site Assessment (ESA) was conducted in March 2004 by AKRF. The ESA indicated historical uses at the Site included lead works and smelting, a paper goods factory, an electrical substation, and an electrical repair company.

AKRF conducted a Subsurface (Phase II) Investigation of the Site in March 2004. The Subsurface (Phase II) Investigation included the advancement of six soil borings with the collection and analysis of soil and groundwater samples. The scope of the investigation was based on the March 2004 Phase I ESA. Lead, polychlorinated biphenyls (PCBs) and semivolatile organic compounds (SVOCs) were detected in soil above applicable standards. Petroleum-related volatile organic compounds (VOCs) and the solvent tetrachloroethene (PCE) were detected in groundwater above the applicable standards.

AKRF's October 2016 Supplemental Phase II Environmental Site Investigation conducted at the Site included the advancement of ten soil borings with the collection and analysis of soil sample. The investigation identified lead and SVOC contamination in soil samples.

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

2.0 HEALTH AND SAFETY GUIDELINES AND PROCEDURES

2.1 Hazard Evaluation

2.1.1 Hazards of Concern

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

2.1.2 Physical Characteristics

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

2.1.3 Hazardous Materials

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

2.1.4 Chemicals of Concern

Chemicals	REL/PEL/STEL (ppm)	Health Hazards
Arsenic	PEL = 0.01 ppm	Irritated lungs; nausea, vomiting; decreased production of red and white blood cells; abnormal heart rhythm, damage to blood vessels; skin redness and swelling; darkening of skin and appearance of small "corns" or "warts" on palms, soles or torso ;known human carcinogen.
Barium	PEL = 0.5 mg/m^3 REL = 0.5 mg/m^3	Irritation eyes, skin, upper respiratory system; skin burns; gastroenteritis; muscle spasm; slow pulse, extrasystoles; hypokalemia
Benzene	REL = 0.1 ppm PEL = 1 ppm STEL = 5 ppm	Irritation eyes, skin, nose, respiratory system; dizziness; headache, nausea, staggered gait; anorexia, lassitude, dermatitis; bone marrow depression, potential occupational carcinogen.
Cadmium	PEL = 0.005 mg/m^3	Pulmonary edema, dyspnea (breathing difficulty), cough, chest tightness, substernal (occurring beneath the sternum) pain; headache; chills, muscle aches; nausea, vomiting, diarrhea; anosmia (loss of the sense of smell), emphysema, proteinuria, mild anemia; [potential occupational carcinogen].
Chromium	REL = 0.5 mg/m^3 PEL - 1 mg/m^3	Irritation eyes, skin; lung fibrosis (histologic).
Copper	REL = 1 mg/m^3 PEL = 1 mg/m^3	Irritation eyes, nose, pharynx; nasal septum perforation; metallic taste; dermatitis; in animals: lung, liver, kidney damage; anemia
Ethylbenzene	REL = 100 ppm PEL = 100 ppm	Irritation eyes, skin, mucous membrane; headache; dermatitis; narcosis, coma.
Fuel Oil	REL = 350 mg/m^3 PEL = 400 ppm	Nausea, irritation – eyes, hypertension, headache, light-headedness, loss of appetite, poor coordination; long-term exposure – kidney damage, blood clotting problems; potential carcinogen.
Lead	REL = 0.05 mg/m^3 PEL = 0.05 mg/m^3	Lassitude (weakness, exhaustion), insomnia; facial pallor; anorexia, weight loss, malnutrition; constipation, abdominal pain, colic; anemia; gingival lead line; tremor; paralysis wrist, ankles; encephalopathy; kidney disease; irritation eyes; hypertension.
Mercury	REL = 0.1 mg/m^3 PEL = 0.05 mg/m^3	Irritation eyes, skin; cough, chest pain, dyspnea (breathing difficulty), bronchitis, pneumonitis; tremor, insomnia, irritability, indecision, headache, lassitude (weakness, exhaustion); stomatitis, salivation; gastrointestinal disturbance, anorexia, weight loss; proteinuria.
Naphthalene	REL = 15 ppm PEL = 10 ppm	Irritation eyes; headache, confusion, excitement, malaise (vague feeling of discomfort); nausea, vomiting, abdominal pain; irritation bladder; profuse sweating; jaundice; hematuria (blood in the urine), renal shutdown; dermatitis, optical neuritis, corneal damage.
Polycyclic Aromatic Hydrocarbons (PAHs)	PEL = 5 mg/m^3	Harmful effects to skin, bodily fluids, and ability to fight disease, reproductive problems; potential carcinogen.
Polychorinated Biphenyls (PCBs)	REL = 0.001 mg/m3 PEL = 0.5 mg/m3 (skin)	Irritation eyes, chloracne; liver damage; reproductive effects; [potential occupational carcinogen].
Tetrachloroethylene	PEL = 100 ppm	Irritation eyes, skin, nose, throat, respiratory system; nausea; flush face, neck; dizziness, incoordination; headache, drowsiness; skin erythema (skin redness); liver damage; [potential occupational carcinogen].
Trichloroethylene	PEL = 100 ppm	Irritation lung; headaches, dizziness, poor coordination and difficulty concentrating; kidney and liver damage, impaired heart function; impaired immune system function and fetal development in pregnant women [potential occupational carcinogen].

Chemicals	REL/PEL/STEL (ppm)	Health Hazards
Toluene	REL = 100 ppm PEL = 200 ppm STEL = 300 ppm	Irritation eyes, nose; lassitude, confusion, euphoria, dizziness, headache; dilated pupils, lacrimation (discharge of tears); anxiety, muscle fatigue, insomnia; paresthesia; dermatitis; liver, kidney damage.
Vinyl Chloride	PEL = 1 ppm	Dizziness; liver changes, nerve damage and immune reactions; skin numbness, redness and blisters; birth defects, damage to sperm and testes: known carcinogen
Xylenes	REL = 100 ppm PEL = 100 ppm	Irritation eyes, skin, nose, throat; dizziness, excitement, drowsiness, poor coordination, staggering gait; corneal vacuolization; anorexia, nausea, vomiting, abdominal pain; dermatitis.
Comments: REL = National Institute for Occupational Safety and Health (NIOSH) Recommended Exposure Limit PEL = OSHA Permissible Exposure Limit STEL = OSHA Short Term Exposure Limit		

2.2 Designated Personnel

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

2.3 Training

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

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

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

2.4 Medical Surveillance Program

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

2.5 Site Work Zones

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

The Exclusion Zone is defined as the area where exposure to impacted media could be encountered. The Contamination Reduction Zone (CRZ) is the area where decontamination procedures take place and is located next to the Exclusion Zone. The Support is the zone area where support facilities such as vehicles, fire extinguisher, and first aid supplies are located. The emergency staging area (part of the Support Zone) is the area where all workers on-site would assemble in the event of an emergency. A summary of these areas is provided below. These zones may be changed by the SSO, depending on that day's activities. All field personnel will be informed of the location of these zones before work begins.

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

2.6 Air Monitoring

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

2.6.1 Volatile Organic Compounds and Particulates

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

2.6.2 Work Zone Air Monitoring

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

Instrument	Action Level	Response Action
PID	Less than 5 ppm in breathing zone	Level D or D-Modified
	Between 5 ppm and 50 ppm	Level C
	More than 50 ppm	Stop work. Resume work when readings are less than 50 ppm.
Dust Trak	Less than 1.25 mg/m^3 above background in breathing zone	Level D or D-Modified
	Less than 1.25 mg/m^3 above background in breathing zone	Stop work. Resume work when readings are less than 1.25 mg/m^3.
mg/m^3 = micrograms per cubic meter ppm = parts per million		

2.7 Personal Protection Equipment

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

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

LEVEL OF PROTECTION & PPE		Excavation/ Sampling
Level D (**X**) Steel Toe Shoes (**X**) Hard Hat (within 25 ft of drill rig) (**X**) Work Gloves	(**X**) Safety Glasses ( ) Face Shield (**X**) Ear Plugs (within 25 ft of drill rig) (**X**) Nitrile Gloves (**X**) Tyvek for drill rig operator if NAPL present	Yes
Level C ***(in addition to Level D)*** (**X**) Half-Face Respirator OR (**X**) Full-Face Respirator ( ) Full-Face PAPR	( ) Particulate Cartridge ( ) Organic Cartridge (**X**) Dual Organic/ Particulate Cartridge	If PID > 5 ppm (breathing zone)
Comments: Cartridges to be changed out at least once per shift unless warranted beforehand (e.g., more difficult to breathe or any odors detected).		

2.8 General Work Practices

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

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

3.0 EMERGENCY PROCEDURES AND EMERGENCY RESPONSE PLAN

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

3.1 Hospital Directions

Hospital Name:	The Brooklyn Hospital Center
Phone Number:	718-250-8075
Address/Location:	121 Dekalb Avenue, Brooklyn, NY 11201
Directions:	1. Head north on Jay Street toward Front Street. 2. Turn right onto Front Street. 3. Turn right onto Hudson Avenue. 4. Continue on Hudson Avenue to Navy Street. 5. Turn left onto Myrtle Avenue. 6. Turn right onto Washington Park. 7. Turn right onto Dekalb Avenue. 8. Hospital entrance will be on the right.

3.2 Emergency Contacts

Company	Individual Name	Title	Contact Number
AKRF	Marc Godick	Project Director	914-922-2356 (office)
	Margo Davis	Project Manager and Site Safety Officer (SSO)	646-388-9570 (office)
	Ashutosh Sharma	Alternate Project Manager	646-388-9865 (office)
	William Grossett	Alternate SSO	734-904-1054 (cell)
85 Jay Street (Brooklyn), LLC	Jenny Bernell	Client Representative	917-881-5278
Ambulance, Fire Department & Police Department	-	-	911
NYSDEC Spill Hotline	-	-	800-457-7362

4.0 APPROVAL & ACKNOWLEDGEMENTS OF HASP

APPROVAL

Signed: ____________________________________ Date: ______________________________________

AKRF Project Manager

Signed: ____________________________________ Date: ______________________________________

AKRF Health and Safety Officer

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

AFFIDAVIT

I,_________________________(name), of______________________________(company name), have read the Health and Safety Plan (HASP) for the property located at 85 Jay Street in Brooklyn, New York. I agree to conduct all on-site work in accordance with the requirements set forth in this HASP and understand that failure to comply with this HASP could lead to my removal from the site.

Signed: ___________________________ Company: _________________________ Date: _________

Signed: ___________________________ Company: _________________________ Date: _________

Signed: ___________________________ Company: _________________________ Date: _________

Signed: ___________________________ Company: _________________________ Date: _________

Signed: ___________________________ Company: _________________________ Date: _________

Signed: ___________________________ Company: _________________________ Date: _________

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Signed: ___________________________ Company: _________________________ Date: _________

Signed: ___________________________ Company: _________________________ Date: _________

Signed: ___________________________ Company: _________________________ Date: _________

___________________________ _________________________ _________

FIGURES

APPENDIX A

POTENTIAL HEALTH EFFECTS FROM ON-SITE CONTAMINANTS

APPENDIX B

WEST NILE VIRUS/ST. LOUIS ENCEPHALITIS PREVENTION

WEST NILE VIRUS/ST. LOUIS ENCEPHALITIS PREVENTION

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

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

APPENDIX C

REPORT FORMS

WEEKLY SAFETY REPORT FORM

Week Ending: ________________ Project Name/Number: ________________

Report Date: ________________ Project Manager Name: ________________

Summary of any violations of procedures occurring that week:

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

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

Comments:

Name: ________________ Company: ________________

Signature: ________________ Title: ________________

INCIDENT REPORT FORM

Date of Report: ______________________________

Injured: ______________________________

Employer: ______________________________

Site: ______________________________ Site Location: ______________________________

Report Prepared By: ______________________________ ______________________________
Signature Title

ACCIDENT/INCIDENT CATEGORY (check all that applies)

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

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

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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

APPENDIX D

EMERGENCY HAND SIGNALS

EMERGENCY SIGNALS

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

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

EMERGENCY HAND SIGNALS

OUT OF AIR, CAN'T BREATHE!	 **Hand gripping throat**
LEAVE AREA IMMEDIATELY, NO DEBATE!	**(No Picture) Grip partner's wrist or place both hands around waist**
NEED ASSISTANCE!	**Hands on top of head**
OKAY! – I'M ALL RIGHT! **- I UNDERSTAND!**	 **Thumbs up**
NO! - NEGATIVE!	 **Thumbs down**

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FIGURES

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1.0 INTRODUCTION

This environmental Health and Safety Plan (HASP) has been developed for implementation of Remedial Investigation (RI) activities conducted by all personnel on-site, both AKRF employees and others, at the 85 Jay Street site (the "Site"). The Site is located at 85 Jay Street in the Dumbo neighborhood of Brooklyn, New York. The legal definition of the Site is Tax Block 54, Lot 1. A Site Location plan is provided as Figure 1.

A Phase I Environmental Site Assessment (ESA) was conducted in March 2004 by AKRF. The ESA indicated historical uses at the Site included lead works and smelting, a paper goods factory, an electrical substation, and an electrical repair company.

AKRF conducted a Subsurface (Phase II) Investigation of the Site in March 2004. The Subsurface (Phase II) Investigation included the advancement of six soil borings with the collection and analysis of soil and groundwater samples. The scope of the investigation was based on the March 2004 Phase I ESA. Lead, polychlorinated biphenyls (PCBs) and semivolatile organic compounds (SVOCs) were detected in soil above applicable standards. Petroleum-related volatile organic compounds (VOCs) and the solvent tetrachloroethene (PCE) were detected in groundwater above the applicable standards.

AKRF's October 2016 Supplemental Phase II Environmental Site Investigation conducted at the Site included the advancement of ten soil borings with the collection and analysis of soil sample. The investigation identified lead and SVOC contamination in soil samples.

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

2.0 HEALTH AND SAFETY GUIDELINES AND PROCEDURES

2.1 Hazard Evaluation

2.1.1 Hazards of Concern

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

2.1.2 Physical Characteristics

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

2.1.3 Hazardous Materials

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

2.1.4 Chemicals of Concern

Chemicals	REL/PEL/STEL (ppm)	Health Hazards
Arsenic	PEL = 0.01 ppm	Irritated lungs; nausea, vomiting; decreased production of red and white blood cells; abnormal heart rhythm, damage to blood vessels; skin redness and swelling; darkening of skin and appearance of small "corns" or "warts" on palms, soles or torso ;known human carcinogen.
Barium	PEL = 0.5 mg/m^3 REL = 0.5 mg/m^3	Irritation eyes, skin, upper respiratory system; skin burns; gastroenteritis; muscle spasm; slow pulse, extrasystoles; hypokalemia
Benzene	REL = 0.1 ppm PEL = 1 ppm STEL = 5 ppm	Irritation eyes, skin, nose, respiratory system; dizziness; headache, nausea, staggered gait; anorexia, lassitude, dermatitis; bone marrow depression, potential occupational carcinogen.
Cadmium	PEL = 0.005 mg/m^3	Pulmonary edema, dyspnea (breathing difficulty), cough, chest tightness, substernal (occurring beneath the sternum) pain; headache; chills, muscle aches; nausea, vomiting, diarrhea; anosmia (loss of the sense of smell), emphysema, proteinuria, mild anemia; [potential occupational carcinogen].
Chromium	REL = 0.5 mg/m^3 PEL - 1 mg/m^3	Irritation eyes, skin; lung fibrosis (histologic).
Copper	REL = 1 mg/m^3 PEL = 1 mg/m^3	Irritation eyes, nose, pharynx; nasal septum perforation; metallic taste; dermatitis; in animals: lung, liver, kidney damage; anemia
Ethylbenzene	REL = 100 ppm PEL = 100 ppm	Irritation eyes, skin, mucous membrane; headache; dermatitis; narcosis, coma.
Fuel Oil	REL = 350 mg/m^3 PEL = 400 ppm	Nausea, irritation – eyes, hypertension, headache, light-headedness, loss of appetite, poor coordination; long-term exposure – kidney damage, blood clotting problems; potential carcinogen.
Lead	REL = 0.05 mg/m^3 PEL = 0.05 mg/m^3	Lassitude (weakness, exhaustion), insomnia; facial pallor; anorexia, weight loss, malnutrition; constipation, abdominal pain, colic; anemia; gingival lead line; tremor; paralysis wrist, ankles; encephalopathy; kidney disease; irritation eyes; hypertension.
Mercury	REL = 0.1 mg/m^3 PEL = 0.05 mg/m^3	Irritation eyes, skin; cough, chest pain, dyspnea (breathing difficulty), bronchitis, pneumonitis; tremor, insomnia, irritability, indecision, headache, lassitude (weakness, exhaustion); stomatitis, salivation; gastrointestinal disturbance, anorexia, weight loss; proteinuria.
Naphthalene	REL = 15 ppm PEL = 10 ppm	Irritation eyes; headache, confusion, excitement, malaise (vague feeling of discomfort); nausea, vomiting, abdominal pain; irritation bladder; profuse sweating; jaundice; hematuria (blood in the urine), renal shutdown; dermatitis, optical neuritis, corneal damage.
Polycyclic Aromatic Hydrocarbons (PAHs)	PEL = 5 mg/m^3	Harmful effects to skin, bodily fluids, and ability to fight disease, reproductive problems; potential carcinogen.
Polychorinated Biphenyls (PCBs)	REL = 0.001 mg/m3 PEL = 0.5 mg/m3 (skin)	Irritation eyes, chloracne; liver damage; reproductive effects; [potential occupational carcinogen].
Tetrachloroethylene	PEL = 100 ppm	Irritation eyes, skin, nose, throat, respiratory system; nausea; flush face, neck; dizziness, incoordination; headache, drowsiness; skin erythema (skin redness); liver damage; [potential occupational carcinogen].
Trichloroethylene	PEL = 100 ppm	Irritation lung; headaches, dizziness, poor coordination and difficulty concentrating; kidney and liver damage, impaired heart function; impaired immune system function and fetal development in pregnant women [potential occupational carcinogen].

Chemicals	REL/PEL/STEL (ppm)	Health Hazards
Toluene	REL = 100 ppm PEL = 200 ppm STEL = 300 ppm	Irritation eyes, nose; lassitude, confusion, euphoria, dizziness, headache; dilated pupils, lacrimation (discharge of tears); anxiety, muscle fatigue, insomnia; paresthesia; dermatitis; liver, kidney damage.
Vinyl Chloride	PEL = 1 ppm	Dizziness; liver changes, nerve damage and immune reactions; skin numbness, redness and blisters; birth defects, damage to sperm and testes: known carcinogen
Xylenes	REL = 100 ppm PEL = 100 ppm	Irritation eyes, skin, nose, throat; dizziness, excitement, drowsiness, poor coordination, staggering gait; corneal vacuolization; anorexia, nausea, vomiting, abdominal pain; dermatitis.
Comments: REL = National Institute for Occupational Safety and Health (NIOSH) Recommended Exposure Limit PEL = OSHA Permissible Exposure Limit STEL = OSHA Short Term Exposure Limit		

2.2 Designated Personnel

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

2.3 Training

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

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

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

2.4 Medical Surveillance Program

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

2.5 Site Work Zones

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

The Exclusion Zone is defined as the area where exposure to impacted media could be encountered. The Contamination Reduction Zone (CRZ) is the area where decontamination procedures take place and is located next to the Exclusion Zone. The Support is the zone area where support facilities such as vehicles, fire extinguisher, and first aid supplies are located. The emergency staging area (part of the Support Zone) is the area where all workers on-site would assemble in the event of an emergency. A summary of these areas is provided below. These zones may be changed by the SSO, depending on that day's activities. All field personnel will be informed of the location of these zones before work begins.

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

2.6 Air Monitoring

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

2.6.1 Volatile Organic Compounds and Particulates

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

2.6.2 Work Zone Air Monitoring

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

Instrument	Action Level	Response Action
PID	Less than 5 ppm in breathing zone	Level D or D-Modified
	Between 5 ppm and 50 ppm	Level C
	More than 50 ppm	Stop work. Resume work when readings are less than 50 ppm.
Dust Trak	Less than 1.25 mg/m^3 above background in breathing zone	Level D or D-Modified
	Less than 1.25 mg/m^3 above background in breathing zone	Stop work. Resume work when readings are less than 1.25 mg/m^3.
mg/m^3 = micrograms per cubic meter ppm = parts per million		

2.7 Personal Protection Equipment

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

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

LEVEL OF PROTECTION & PPE		Excavation/ Sampling
Level D (**X**) Steel Toe Shoes (**X**) Hard Hat (within 25 ft of drill rig) (**X**) Work Gloves	(**X**) Safety Glasses ( ) Face Shield (**X**) Ear Plugs (within 25 ft of drill rig) (**X**) Nitrile Gloves (**X**) Tyvek for drill rig operator if NAPL present	Yes
Level C ***(in addition to Level D)*** (**X**) Half-Face Respirator OR (**X**) Full-Face Respirator ( ) Full-Face PAPR	( ) Particulate Cartridge ( ) Organic Cartridge (**X**) Dual Organic/ Particulate Cartridge	If PID > 5 ppm (breathing zone)
Comments: Cartridges to be changed out at least once per shift unless warranted beforehand (e.g., more difficult to breathe or any odors detected).		

2.8 General Work Practices

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

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

3.0 EMERGENCY PROCEDURES AND EMERGENCY RESPONSE PLAN

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

3.1 Hospital Directions

Hospital Name:	The Brooklyn Hospital Center
Phone Number:	718-250-8075
Address/Location:	121 Dekalb Avenue, Brooklyn, NY 11201
Directions:	1. Head north on Jay Street toward Front Street. 2. Turn right onto Front Street. 3. Turn right onto Hudson Avenue. 4. Continue on Hudson Avenue to Navy Street. 5. Turn left onto Myrtle Avenue. 6. Turn right onto Washington Park. 7. Turn right onto Dekalb Avenue. 8. Hospital entrance will be on the right.

3.2 Emergency Contacts

Company	Individual Name	Title	Contact Number
AKRF	Marc Godick	Project Director	914-922-2356 (office)
	Margo Davis	Project Manager and Site Safety Officer (SSO)	646-388-9570 (office)
	Ashutosh Sharma	Alternate Project Manager	646-388-9865 (office)
	William Grossett	Alternate SSO	734-904-1054 (cell)
85 Jay Street (Brooklyn), LLC	Jenny Bernell	Client Representative	917-881-5278
Ambulance, Fire Department & Police Department	-	-	911
NYSDEC Spill Hotline	-	-	800-457-7362

4.0 APPROVAL & ACKNOWLEDGEMENTS OF HASP

APPROVAL

Signed: ______________________________ Date: ______________________________

AKRF Project Manager

Signed: ______________________________ Date: ______________________________

AKRF Health and Safety Officer

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

AFFIDAVIT

I,_________________________(name), of______________________________(company name), have read the Health and Safety Plan (HASP) for the property located at 85 Jay Street in Brooklyn, New York. I agree to conduct all on-site work in accordance with the requirements set forth in this HASP and understand that failure to comply with this HASP could lead to my removal from the site.

Signed: ________________________ Company: ______________________ Date: __________

Signed: ________________________ Company: ______________________ Date: __________

Signed: ________________________ Company: ______________________ Date: __________

Signed: ________________________ Company: ______________________ Date: __________

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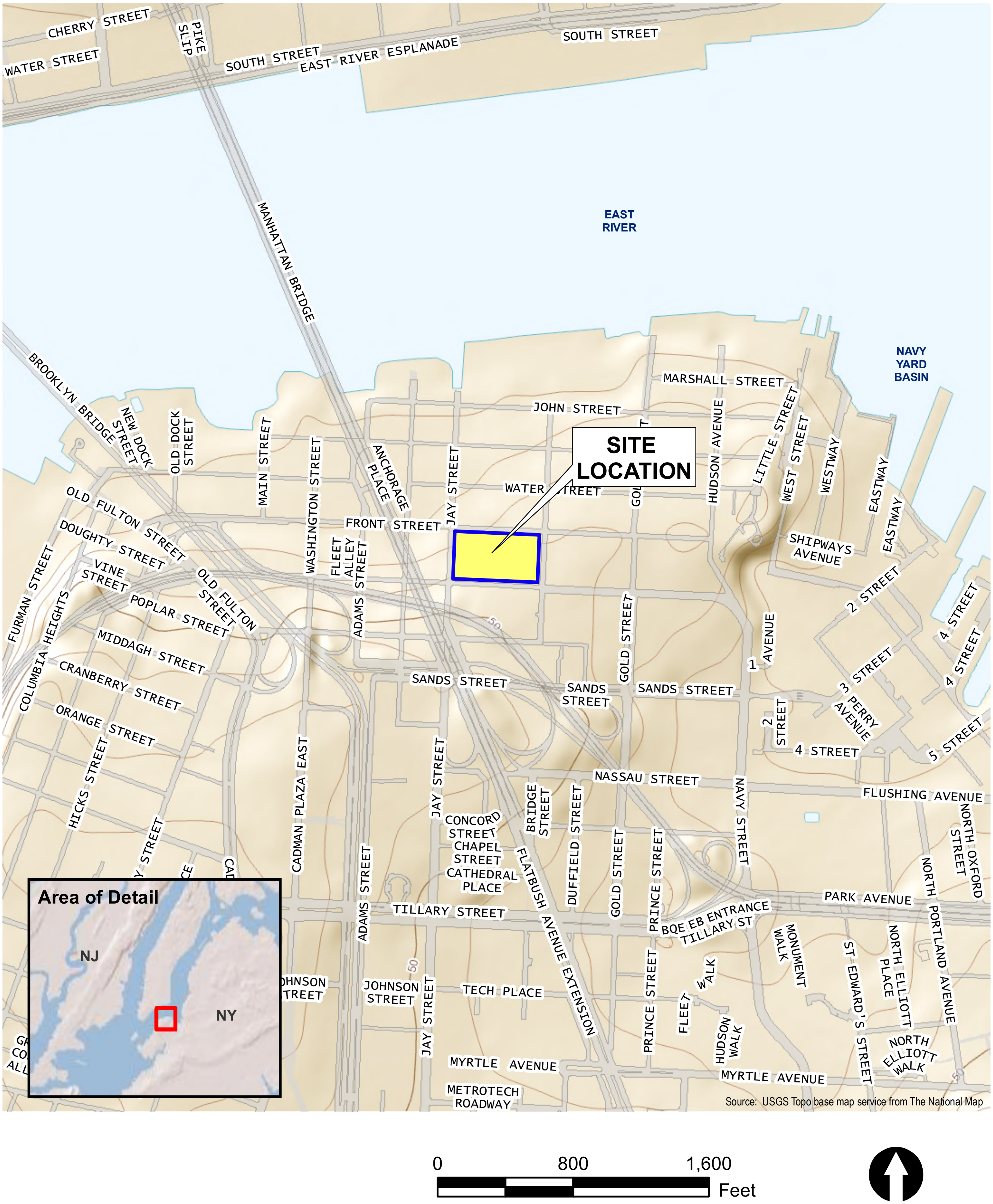
Signed: ________________________ Company: ______________________ Date: __________

Signed: ________________________ Company: ______________________ Date: __________

________________________ ______________________ __________

FIGURES



Source: USGS Topo base map service from The National Map

85 Jay Street
Brooklyn, New York

SITE LOCATION

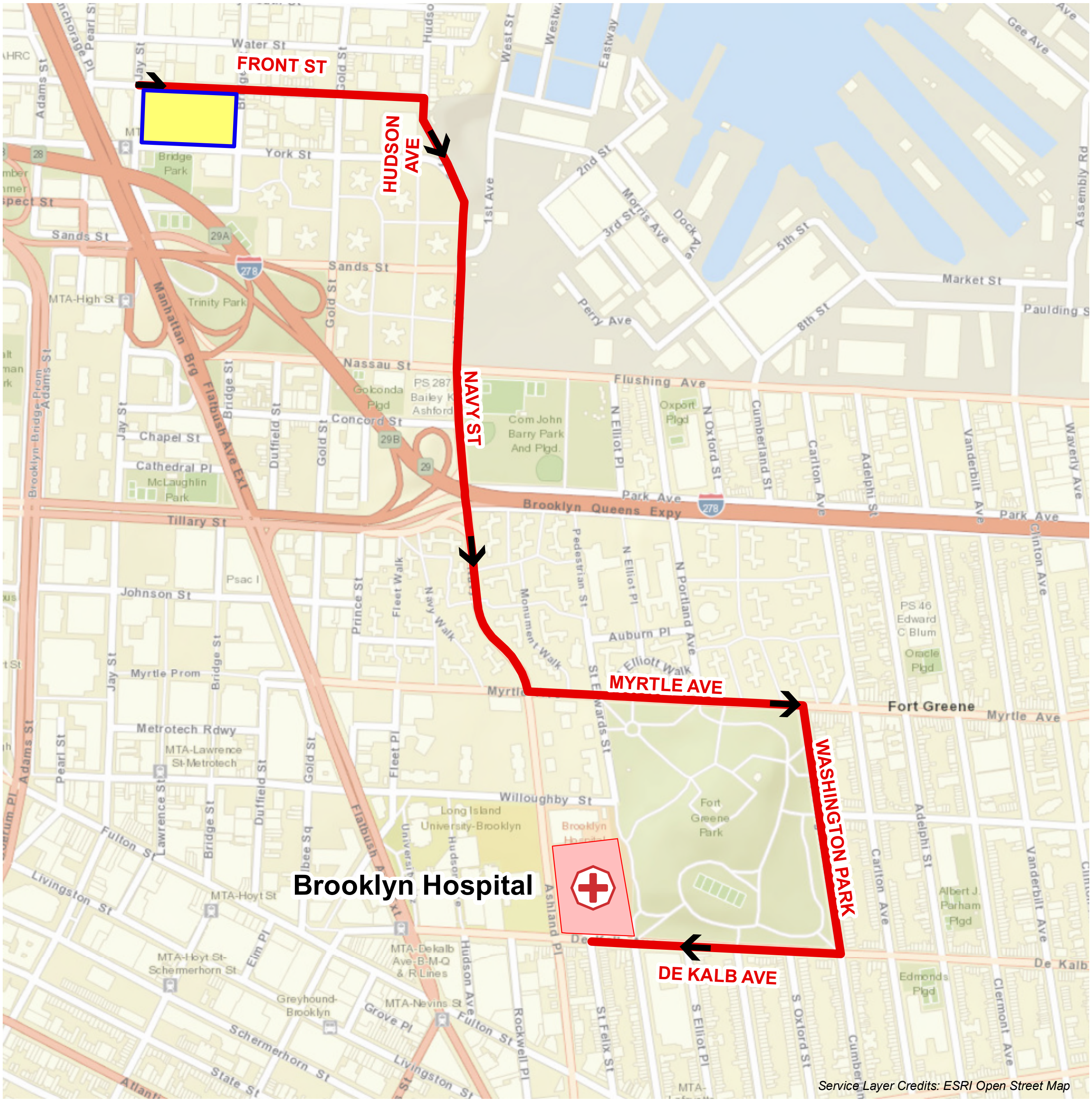
AKRF
Environmental Consultants
440 Park Avenue South, New York, NY 10016

DATE
9/12/2016

PROJECT No.
12519

FIGURE
1

W:\Projects\12519 - 88 JAY STREET BROOKLYN\Technical\GIS and Graphics\hazmat\12519 Fig 1 site loc map.mxd



Service Layer Credits: ESRI Open Street Map

Legend

🟨 Project Site Boundary

← Route to Hospital

✚ Hospital Location

0 800 1,600
Feet

Brooklyn Hospital
121 Dekalb Avenue
Brooklyn, NY

85 Jay Street
Brooklyn, New York

HOSPITAL LOCATION MAP

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

DATE
10/10/2016

PROJECT No.
12519

FIGURE
2

W:\Projects\12519 - 88 JAY STREET BROOKLYN\Technical\GIS and Graphics\hazmat\12519 Route to Hospital.mxd

APPENDIX A

POTENTIAL HEALTH EFFECTS FROM ON-SITE CONTAMINANTS

ATSDR
AGENCY FOR TOXIC SUBSTANCES
AND DISEASE REGISTRY

ARSENIC
CAS # 7440-38-2

Division of Toxicology ToxFAQs™ **December 2003**

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

HIGHLIGHTS: Exposure to higher than average levels of arsenic occurs mostly in the workplace, near hazardous waste sites, or in areas with high natural levels. At high levels, inorganic arsenic can cause death. Exposure to lower levels for a long time can cause a discoloration of the skin and the appearance of small corns or warts. Arsenic has been found at 1,014 of the 1,598 National Priority List sites identified by the Environmental Protection Agency (EPA).

What is arsenic?

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

Inorganic arsenic compounds are mainly used to preserve wood. Organic arsenic compounds are used as pesticides, primarily on cotton plants.

What happens to arsenic when it enters the environment?

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

How might I be exposed to arsenic?

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

How can arsenic affect my health?

Breathing high levels of inorganic arsenic can give you a sore throat or irritated lungs. Ingesting high levels of inorganic arsenic can result in death. Lower levels of arsenic can cause nausea and vomiting, decreased production of red and white blood cells, abnormal heart rhythm, damage to blood vessels, and a sensation of "pins and needles" in hands and feet.

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

Skin contact with inorganic arsenic may cause redness and swelling.

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

How likely is arsenic to cause cancer?

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

How can arsenic affect children?

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

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

How can families reduce the risk of exposure to arsenic?

☐ If you use arsenic-treated wood in home projects, you should wear dust masks, gloves, and protective clothing to decrease exposure to sawdust.
☐ If you live in an area with high levels of arsenic in water or soil, you should use cleaner sources of water and limit contact with soil.

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

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

Has the federal government made recommendations to protect human health?

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

The Occupational Safety and Health Administration has set limits of 10 µg arsenic per cubic meter of workplace air (10 $\mu g/m^3$) for 8 hour shifts and 40 hour work weeks.

Source of Information

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

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

ATSDR
AGENCY FOR TOXIC SUBSTANCES
AND DISEASE REGISTRY

BARIUM AND COMPOUNDS

CAS # 7440-39-3

Division of Toxicology and Environmental Medicine ToxFAQs™ **August 2007**

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

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

What is barium?

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

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

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

What happens to barium when it enters the environment?

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

How might I be exposed to barium?

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

How can barium affect my health?

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

BARIUM 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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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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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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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 mũr′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 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

POLYCHLORINATED BIPHENYLS

Division of Toxicology ToxFAQs™ February 2001

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

What are polychlorinated biphenyls?

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

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

What happens to PCBs when they enter the environment?

❏ PCBs entered the air, water, and soil during their manufacture, use, and disposal; from accidental spills and leaks during their transport; and from leaks or fires in products containing PCBs.

❏ PCBs can still be released to the environment from hazardous waste sites; illegal or improper disposal of industrial wastes and consumer products; leaks from old electrical transformers containing PCBs; and burning of some wastes in incinerators.

❏ PCBs do not readily break down in the environment and thus may remain there for very long periods of time. PCBs can travel long distances in the air and be deposited in areas far away from where they were released. In water, a small amount of PCBs may remain dissolved, but most stick to organic particles and bottom sediments. PCBs also bind strongly to soil.

❏ PCBs are taken up by small organisms and fish in water. They are also taken up by other animals that eat these aquatic animals as food. PCBs accumulate in fish and marine mammals, reaching levels that may be many thousands of times higher than in water.

How might I be exposed to PCBs?

❏ Using old fluorescent lighting fixtures and electrical devices and appliances, such as television sets and refrigerators, that were made 30 or more years ago. These items may leak small amounts of PCBs into the air when they get hot during operation, and could be a source of skin exposure.

❏ Eating contaminated food. The main dietary sources of PCBs are fish (especially sportfish caught in contaminated lakes or rivers), meat, and dairy products.

❏ Breathing air near hazardous waste sites and drinking contaminated well water.

❏ In the workplace during repair and maintenance of PCB transformers; accidents, fires or spills involving transformers, fluorescent lights, and other old electrical devices; and disposal of PCB materials.

How can PCBs affect my health?

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

Animals that ate food containing large amounts of PCBs for short periods of time had mild liver damage and some died. Animals that ate smaller amounts of PCBs in food over several weeks or months developed various kinds of health effects, including anemia; acne-like skin conditions; and liver, stomach, and thyroid gland injuries. Other effects of PCBs in animals include changes in the immune system, behavioral alterations, and impaired reproduction. PCBs are not known to cause birth defects.

How likely are PCBs to cause cancer?

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

How can PCBs affect children?

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

How can families reduce the risk of exposure to PCBs?

❏ You and your children may be exposed to PCBs by eating fish or wildlife caught from contaminated locations. Certain states, Native American tribes, and U.S. territories have issued advisories to warn people about PCB-contaminated fish and fish-eating wildlife. You can reduce your family's exposure to PCBs by obeying these advisories.

❏ Children should be told not play with old appliances, electrical equipment, or transformers, since they may contain PCBs.

❏ Children should be discouraged from playing in the dirt near hazardous waste sites and in areas where there was a transformer fire. Children should also be discouraged from eating dirt and putting dirty hands, toys or other objects in their mouths, and should wash hands frequently.

❏ If you are exposed to PCBs in the workplace it is possible to carry them home on your clothes, body, or tools. If this is the case, you should shower and change clothing before leaving work, and your work clothes should be kept separate from other clothes and laundered separately.

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

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

Has the federal government made recommendations to protect human health?

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

References

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

Where can I get more information? For more information, contact the Agency for Toxic Substances and Disease Registry, Division of Toxicology, 1600 Clifton Road NE, Mailstop E-29, Atlanta, GA 30333. Phone: 1-888-422-8737, FAX: 404-498-0093. ToxFAQs^{TM} 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
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TRICHLOROETHYLENE

CAS # 79-01-6

Division of Toxicology ToxFAQs™ July 2003

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

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

What is trichloroethylene?

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

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

What happens to trichloroethylene when it enters the environment?

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

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

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

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

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

How might I be exposed to trichloroethylene?

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

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

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

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

How can trichloroethylene affect my health?

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

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

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

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

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

How likely is trichloroethylene to cause cancer?

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

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

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

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

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

Has the federal government made recommendations to protect human health?

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

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

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

Glossary

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

References

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

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

ATSDR

AGENCY FOR TOXIC SUBSTANCES
AND DISEASE REGISTRY

TETRACHLOROETHYLENE

CAS # 127-18-4

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

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

HIGHLIGHTS: Tetrachloroethylene is a manufactured chemical used for dry cleaning and metal degreasing. Exposure to very high concentrations of tetrachloroethylene can cause dizziness, headaches, sleepiness, confusion, nausea, difficulty in speaking and walking, unconsciousness, and death. Tetrachloroethylene has been found in at least 771 of the 1,430 National Priorities List sites identified by the Environmental Protection Agency (EPA).

What is tetrachloroethylene?

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

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

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

What happens to tetrachloroethylene when it enters the environment?

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

How might I be exposed to tetrachloroethylene?

- ❑ When you bring clothes from the dry cleaners, they will release small amounts of tetrachloroethylene into the air.
- ❑ When you drink water containing tetrachloroethylene, you are exposed to it.

How can tetrachloroethylene affect my health?

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

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

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

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

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

How likely is tetrachloroethylene to cause cancer?

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

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

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

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

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

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

Has the federal government made recommendations to protect human health?

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

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

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

Glossary

Carcinogen: A substance with the ability to cause cancer.

CAS: Chemical Abstracts Service.

Milligram (mg): One thousandth of a gram.

Nonflammable: Will not burn.

References

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

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

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AGENCY FOR TOXIC SUBSTANCES
AND DISEASE REGISTRY

XYLENE

CAS # 1330-20-7

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

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

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

What is xylene?

(Pronounced zī′lēn)

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

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

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

What happens to xylene when it enters the environment?

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

How might I be exposed to xylene?

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

How can xylene affect my health?

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

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

How likely is xylene to cause cancer?

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

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

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

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

Has the federal government made recommendations to protect human health?

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

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

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

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

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

Glossary

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

Carcinogenic: Having the ability to cause cancer.

CAS: Chemical Abstracts Service.

ppm: Parts per million.

Solvent: A liquid that can dissolve other substances.

References

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

Where can I get more information? For more information, contact the Agency for Toxic Substances and Disease Registry, Division of Toxicology, 1600 Clifton Road NE, Mailstop E-29, Atlanta, GA 30333. Phone:1-888-422-8737, FAX: 404-498-0093. ToxFAQs Internet address via WWW is http://www.atsdr.cdc.gov/toxfaq.html ATSDR can tell you where to find occupational and environmental health clinics. Their specialists can recognize, evaluate, and treat illnesses resulting from exposure to hazardous substances. You can also contact your community or state health or environmental quality department if you have any more questions or concerns.

APPENDIX B

WEST NILE VIRUS/ST. LOUIS ENCEPHALITIS PREVENTION

WEST NILE VIRUS/ST. LOUIS ENCEPHALITIS PREVENTION

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

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

APPENDIX C

REPORT FORMS

WEEKLY SAFETY REPORT FORM

Week Ending: ____________ Project Name/Number: ______________________

Report Date: ____________ Project Manager Name: ______________________

Summary of any violations of procedures occurring that week:

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

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

Comments:

Name: ____________________ Company: ____________________

Signature: ____________________ Title: ____________________

INCIDENT REPORT FORM

Date of Report: ______________________________

Injured: ______________________________

Employer: ______________________________

Site: ____________________ Site Location: ____________________

Report Prepared By: ____________________ ____________________
Signature Title

ACCIDENT/INCIDENT CATEGORY (check all that applies)

___Injury
__ Property Damage
__ On-site Equipment
__ Mechanical

___ Illness
___ Fire
___ Motor Vehicle
___ Spill

___ Near Miss
___ Chemical Exposure
___ Electrical
___ Other

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

____
____
____
____
____
____
____
____
____
____

WITNESS TO ACCIDENT/INCIDENT:

Name: ____________________ Company: ____________________
Address: ____________________ Address: ____________________
Phone No.: ____________________ Phone No.: ____________________
Name: ____________________ Company: ____________________
Address: ____________________ Address: ____________________
Phone No.: ____________________ Phone No.: ____________________

INJURED - ILL:

Name: ____________________ SSN: ____

Address: ____________________ Age: ____

Length of Service: ____________________ Time on Present Job: ____________________________

Time/Classification: ____

SEVERITY OF INJURY OR ILLNESS:

____ Disabling

____ Medical Treatment

___ Non-disabling

___ First Aid Only

___ Fatality

ESTIMATED NUMBER OF DAYS AWAY FROM JOB: ______________________________

NATURE OF INJURY OR ILLNESS: ____

____

____

____

CLASSIFICATION OF INJURY:

__ Abrasions

__ Bites

__ Blisters

__ Bruises

__ Chemical Burns

__ Cold Exposure

__ Concussion

__ Lacerations

_____ Dislocations

_____ Faint/Dizziness

_____ Fractures

_____ Frostbite

_____ Heat Burns

_____ Heat Exhaustion

_____ Heat Stroke

____ Punctures

____ Radiation Burns

____ Respiratory Allergy

____ Sprains

____ Toxic Resp. Exposure

____ Toxic Ingestion

____ Dermal Allergy

Part of Body Affected: ____

Degree of Disability: ____

Date Medical Care was Received: ____

Where Medical Care was Received: ____

Address (if off-site): ____

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

PROPERTY DAMAGE:

Description of Damage: ______________________________

____

Cost of Damage: $ ______________________________

ACCIDENT/INCIDENT LOCATION: ______________________________

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

____

____

____

____

Was weather a factor?:______________________________

____

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

____

____

____

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

____

____

ON-SITE ACCIDENTS/INCIDENTS:

Level of personal protection equipment required in Site Safety Plan:

____

____

Modifications:

____

Was injured using required equipment?:

____

____

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

____

____

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

ACCIDENT/INCIDENT REPORT REVIEWED BY:

SSO Name Printed	SSO Signature

OTHERS PARTICIPATING IN INVESTIGATION:

Signature	Title
Signature	Title
Signature	Title

ACCIDENT/INCIDENT FOLLOW-UP: Date:

Outcome of accident/incident:

Physician's recommendations:

Date injured returned to work:

Follow-up performed by:

Signature	Title

ATTACH ANY ADDITIONAL INFORMATION TO THIS FORM

APPENDIX D

EMERGENCY HAND SIGNALS

EMERGENCY SIGNALS

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

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

EMERGENCY HAND SIGNALS

OUT OF AIR, CAN'T BREATHE!

Hand gripping throat

LEAVE AREA IMMEDIATELY, NO DEBATE!

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

NEED ASSISTANCE!

Hands on top of head

OKAY! – I'M ALL RIGHT!

- I UNDERSTAND!

Thumbs up

NO! - NEGATIVE!

Thumbs down