INTERIM REMEDIAL MEASURE WORK PLAN

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380 4TH AVENUE BROOKLYN
NEW YORK

NYSDEC BCP Number: C224358
AKRF Project Number: 210226

Prepared for:

New York State Department of Environmental Conservation
Division of Environmental Remediation, Remedial Bureau B
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CERTIFICATIONS

I, Michelle Lapin, P.E., certify that I am currently a New York State registered Professional Engineer as defined in 6 New York Codes, Rules and Regulations Part 375 and that this Interim Remedial Measures 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).

I certify that all information and statements in this certification are true. I understand that a false statement made herein is punishable as Class "A" misdemeanor, pursuant to Section 210.45 of the Penal Law.

MICHELLE LAPIN

Michelle Lapin	12/19/2022	
NYS Professional Engineer #073934-1	Date	Signature

It is a violation of Article 145 of New York State Education Law for any person to alter this document in any way without the express written verification of adoption by any New York State licensed engineer in accordance with Section 7209(2), Article 145, New York State Education Law.

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LIST OF ACRONYMS

Acronym	Definition
111-TCA	1,1,1-trichloroethane
AST	aboveground storage tank
AWQSGV	Ambient Water Quality Standards and Guidance Values
BCP	Brownfield Cleanup Program
bgs	below ground surface
BTEX	benzene, ethylbenzene, toluene, and xylenes
CAMP	Community Air Monitoring Plan
COC	contaminants of concern
cy	cubic yard
C&D	construction and demolition
DD	Decision Document
DER-10	Division of Environmental Remediation Technical Guide 10
DMM	Division of Materials Management
DPP	direct-push probe
DUSR	Data Usability Summary Reports
EC	Engineering Control
ESA	Environmental Site Assessment
FER	Final Engineering Report
HASP	Health and Safety Plan
HREC	Historic Recognized Environmental Conditions
IC	Institutional Control
IRM	Interim Remedial Measure
IRMWP	Interim Remedial Measure Work Plan
MEK	2-butanone
mg/kg	milligram per kilogram
NAPL	non-aqueous phase liquid
NYC	New York City
NYCDOB	New York City Department of Buildings
NYSDEC	New York State Department of Environmental Conservation
NYSDOH	New York State Department of Health
NYSDOT	New York State Department of Transportation
OER	NYC Office of Environmental Remediation
PAH	polycyclic aromatic hydrocarbon
PCB	polychlorinated biphenyl
PCE	tetrachloroethylene
PDI	Pre-Design Investigation
PFAS	per- and polyfluoroalkyl substances
PFOA	perfluorooctanoic acid
PFOS	perfluorooctanesulfonic acid
PGWSCO	Protection of Groundwater Soil Cleanup Objective

Acronym	Definition
PID	photoionization detector
ppb	parts per billion
ppm	parts per million
ppt	parts per trillion
QAPP	Quality Assurance Project Plan
QA/QC	quality assurance/quality control
QEP	Qualified Environmental Professional
RAWP	Remedial Action Work Plan
RE	Remedial Engineer
REC	recognized environmental condition
RI	Remedial Investigation
RIR	Remedial Investigation Report
RIWP	Remedial Investigation Work Plan
RR	Restricted Residential
RRSCO	Restricted Residential Soil Cleanup Objective
SOE	support of excavation
SVOC	semi-volatile organic compound
TAL	Target Analyte List
TCL	Target Compounds List
TCE	trichloroethylene
UST	underground storage tank
UU	Unrestricted Use
UUSCO	Unrestricted Use Soil Cleanup Objective
VEC	Vapor Encroachment Condition
VOC	volatile organic compound
µg/L	microgram per liter
$\mu g/m^3$	microgram per cubic meter

INTERIM REMEDIAL MEASURE WORK PLAN

1.0 INTRODUCTION

This Interim Remedial Measure (IRM) Work Plan (IRMWP) has been prepared by AKRF, Inc. (AKRF) on behalf of 380 4th Avenue Owner, LLC (the "Volunteer") for the approximately 0.459-acre (20,00-square foot) property located in the Gowanus neighborhood of Brooklyn, New York, hereafter referred to as the "Site". The proposed Site name is 380 4th Avenue and includes the addresses 374 to 390 4th Avenue and is identified as New York City Tax Block 980, Lot 77. The Site is designated for redevelopment with a new mixed-use residential and commercial building with one sub-grade level that will function as amenity space, utility rooms, and building storage. The Site location is shown on Figure 1 and a Site Plan is provided as Figure 2.

In Autumn of 2021, the Site and the surrounding area were subject to the Gowanus Neighborhood Rezoning and Related Actions, and the Site was assigned an E-Designation for hazardous materials. In August 2021, a Remedial Investigation (RI) was completed in accordance with a July 2021 RI Work Plan (RIWP) approved by the New York City Mayor's Office of Environmental Remediation (OER). The results of this RI are documented in an October 2021 RI Report (RIR). In December 2021, the Site enrolled in the New York City Voluntary Cleanup Program and in January 2022, a Remedial Action Work Plan (RAWP) was approved by OER.

In early 2022, the Site pursued enrollment into the New York State Department of Environmental Conservation (NYSDEC) Brownfield Program (BCP) and was formally enrolled in the BCP in October 2022. In January and February 2022, an RI of the Site pursuant to NYSDEC Division of Environmental Remediation-10 Technical Guidance for Site Investigation and Remediation was performed to satisfy the requirements of the BCP. A subsequent Pre-Design Investigation (PDI) was performed in July 2022 to further delineate and address data gaps identified during the January and February 2022 RI work. The results of these BCP investigations (along with incorporating the results from the 2021 RI performed for OER) are documented in a draft December 2022 RIR. A draft RAWP was submitted to NYSEC in May 2022, which is currently under review.

The purpose of this IRMWP is to allow the installation of soldier piles along the Site perimeter, which will enable future installation of lagging to facilitate support of excavation (SOE) for remedial excavation of the contaminated soil/fill identified during the previous RIs. The installation of lagging and other SOE elements, and excavation of soil would not commence until issuance of the Decision Document (DD) by NYSDEC. The installation of these soldier piles will not inhibit the remediation proposed under the draft RAWP dated May 2022. This IRMWP will be implemented in accordance with the Site-Specific Health and Safety Plan (HASP) and Community Air Monitoring Plan (CAMP) provided as Appendix A and Appendix B, respectively. A Quality Assurance Project Plan (QAPP) is provided as Appendix C for instances where sampling may be required during the IRM.

2.0 SITE DESCRIPTION AND HISTORY

2.1 Site Description and Surrounding Land Use

The Site is located in the Gowanus section of Brooklyn, NY and is identified as Block 980, Lot 77 on the NYC Tax Map. The approximately 0.459-acre (20,000-square foot) Site most recently consisted of a slab-on-grade, one-story structure that last operated as a taxi business; the building was recently demolished and removed from the Site in anticipation of redevelopment.

The Site is bounded by commercial buildings and a hotel with associated parking lots to the north, followed by 3rd Street; a U-Haul facility parking lot to the south, followed by 6th Street; 4th Avenue, with the NYC Transit D- and R-Line subways beneath 4th Avenue, to the east, followed by commercial and residential buildings; and a U-Haul facility and associated parking lots to the west, followed by 3rd Avenue. The larger surrounding area is occupied by predominantly commercial and auto-related uses, with some residential uses to the east.

A Site Location map is provided as Figure 1 and a Site Plan is provided as Figure 2.

2.2 Contemplated Redevelopment Plan

The remedial action proposed in the draft May 2022 RAWP is intended to make the Site protective of human health and the environment consistent with the contemplated end use. The purpose of this IRMWP is to allow the installation of soldier piles along the Site perimeter. All additional remedial related work will be performed following issuance of the DD. The proposed redevelopment includes construction of a 17-story, mixed residential and commercial building, with one sub-grade level that will function as amenity space, utility rooms, and building storage. The footprint of the foundation will encompass the entire Site. The proposed structure includes 50 affordable units (25%) pursuant to Option 1 of the Mandatory Inclusionary Housing Program and Option A of the 421-a (16) Affordable Housing New York Program.

The current zoning designation of the Site is C4-4D with a residential district equivalent of R9A.

2.3 Site Geology, Hydrogeology and Subsurface Characteristics

According to a topographical survey of the Site, prepared by Boro Land Surveying, P.C. in May 2021, the surface grade ranges from 22.00 to 25.37 feet above the North American Vertical Datum of 1988.

Site stratigraphy consists of an uppermost layer fill material (including sand, silt, wood, brick, metal, cinders, and glass) extending to approximately 26 to 33 feet below ground surface (bgs) along the central and western portions of the Site, and appears to be at shallower depths between 10 and 20 feet bgs beneath the eastern portion of the Site along 4th Avenue. The fill layer is underlain by presumed native soil consisting of clay, silt, sand, and peat to at least 35 feet bgs (terminal RI boring depth). Bedrock was not encountered during the RIs.

Based on Site-specific groundwater measurements, the depth to groundwater beneath the Site is approximately 13 to 15 feet bgs. Based on the surveyed elevations, the inferred direction of shallow groundwater flow at the Site is to the north-northwest towards the Gowanus Canal. The groundwater flow direction beneath the Site can be affected by many factors including pumping at nearby construction sites, subsurface openings, or obstructions such as subway train tunnels, basements, underground utilities, and other factors.

2.4 Nearby Areas of Public Concern

The uses immediately surrounding the Site are predominantly commercial and auto related uses. The proposed future use of the Site after remediation will be restricted-residential use. However, the new development building will comprise a mixed residential and commercial building, with one sub-grade level that will function as amenity space, utility rooms, and building storage.

On-Site Receptors: The Site is currently vacant, and most-recently consisted of a slab-on-grade, one-story structure that last operated as a taxi business. The building was demolished and removed from the Site in the first quarter of 2022 in anticipation of redevelopment. The only current on-site potential receptors are trespassers and any construction workers. The Site is capped with the former building's foundation, which was observed to be in good condition with minimal fractures, breaks, and open areas. Therefore, ingestion, inhalation, or dermal contact with contaminants via soil/fill, groundwater, and/or soil vapor is not a concern. During remediation and redevelopment (including the IRM activities), potential receptors will include construction workers and inspectors. Any potential exposure pathway from contaminated soil/fill to construction workers, inspectors, or other off-site receptors will be controlled by implementation of the HASP and CAMP. Once the Site is redeveloped, potential receptors will include residents, maintenance staff, and workers/customers associated with the future commercial uses.

Off-Site Receptors: Potential off-site receptors within a 0.25-mile radius of the Site include: residents, commercial and construction workers, students, pedestrians, and cyclists, based on the following:

1. Commercial Businesses – existing and future
2. Residential Buildings – existing and future
3. Building Construction/Renovation – existing and future
4. Pedestrians, Cyclists – existing and future
5. Schools – existing and future
6. Daycare Facilities – existing and future

2.5 Site History

According to the NYC Department of Buildings (NYCDOB) records and historical sources (i.e., fire insurance maps and city directories), the Site was historically used for various commercial and light industrial activities that included automobile repair, an automobile garage, and a taxi business. Additionally, the Site historically had five bulk storage tanks, including four 275-gallon aboveground storage tanks (ASTs) used for the storage of motor oil, waste oil, and transmission fluid and one 2,500-gallon underground storage tank (UST) used for the storage of fuel oil. The 2,500-gallon UST was encased in concrete; however, physically aboveground. The ASTs and 2,500-gallon UST were recently removed as part of the former building's demolition process. The Site is currently owned by 374 Fourth Avenue Realty, LLC.

3.0 PREVIOUS INVESTIGATIONS

Various environmental studies have been completed for the Site to date. A Site plan showing previous sampling/testing locations is provided as Figure 2. Previous investigations are summarized below:

Phase I Environmental Site Assessment – 374 4th Avenue, Brooklyn, New York, Nelson Pope Voorhis, December 28, 2020

Nelson Pope Voorhis conducted a Phase I Environmental Site Assessment (ESA) for the Site in December 2020 in accordance with American Society for Testing and Materials E1527-13. The Phase I ESA included a Site inspection, historical research, and a regulatory database review, and identified the following Recognized Environmental Condition (REC), Vapor Encroachment Condition (VEC), and Historic Recognized Environmental Conditions (HRECs):

REC

- The Site building utilized a network of trench drains for the collection of wash water and other fluids that discharged to an oil/water separator prior to ultimate discharge to the municipal sewer system.

VEC

- The proximity of spill incidents in the vicinity of the Site and the use of the Site building for the maintenance of taxi cabs were identified as potential VECs.

HRECs

- The Site was listed in the NYSDEC Petroleum Bulk Storage database (ID No. 2-611328) with four 275-gallon ASTs and one 2,500-gallon UST. The 275-gallon ASTs were utilized for the storage of motor oil, waste oil, and transmission fluid, and the 2,500-gallon UST was used to store heating oil. The 2,500-gallon UST was an encased in-concrete tank that was physically installed aboveground.

RIR – 374 4th Avenue, Brooklyn, NY, AKRF, October 2021

AKRF conducted an RI at the Site in August 2021 in accordance with a July 2021 RIWP prepared by AKRF and approved by the OER. On August 19, 2021, AKRF conducted a Site visit prior to performing the RI and observed a fill port in the sidewalk adjacent to the northeastern side of the building, which indicated the potential presence of an UST. The report noted that the suspected UST may have adversely affected the subsurface.

The RI included: a geophysical survey; a visual inspection of the on-site trench drain and associated piping using a pipe camera to inspect the integrity of the drain/piping and confirm discharge to the on-site oil/water separator; the advancement of 10 soil borings across the Site and collection of 23 soil samples for chemical analysis to evaluate soil quality; the installation of three permanent groundwater monitoring wells with collection of three groundwater samples for chemical analysis to evaluate groundwater quality; and the installation of seven temporary soil vapor points with collection of seven soil vapor samples and one outdoor/ambient air sample for chemical analysis.

Soil borings were advanced across the Site using a direct-push probe (DPP). Soil cores were field-screened using a photoionization detector (PID), which measures relative concentrations of volatile organic compounds (VOCs). At each boring location, one soil sample was collected from the upper 2 feet below existing pavement and a second deeper sample was collected from 10 to 12 or 15 feet bgs. At three borings (SB-03, SB-04, and SB-08) a third sample was collected due to field evidence of suspect contamination (i.e., elevated PID readings and odors). Soil boring SB-08 had the highest PID reading of 112 parts per million (ppm). Groundwater was encountered between approximately 13 and 15 feet bgs. One groundwater sample was collected from each monitoring well.

Soil beneath the Site consisted of fill material (sand, silt, clay, gravel, brick, concrete, wood, and ash) to the terminus of each boring, between 15 and 25 feet bgs. Bedrock was not encountered during the RI.

Seven soil vapor points were installed across the Site. Five points (SV-01, SV-02, SV-05, SV-06, and SV-07) were installed to approximately 10 feet bgs beneath the existing building. Two points (SV-03 and SV-04) were installed at approximately 2 feet bgs beneath an exterior parking area along 4th Avenue.

Soil, groundwater, and soil vapor laboratory analytical results are summarized below:

Soil

- Five VOCs were detected at concentrations above NYSDEC Unrestricted Use Soil Cleanup Objectives (UUSCOs) in up to six samples: acetone [maximum 0.24 milligrams per kilogram (mg/kg)], benzene (maximum 0.27 mg/kg), methylene chloride (estimated 0.08 mg/kg), n-propylbenzene (maximum 5.0 mg/kg), and total xylenes (maximum 0.93 mg/kg). Benzene, n-proplbenzene, and total xylenes were also detected above the Protection of Groundwater Soil Cleanup Objectives (PGWSCOs). No VOCs were detected above their respective Restricted Residential Soil Cleanup Objectives (RRSCOs).
- Eleven semivolatile organic compounds (SVOCs) were detected at concentrations exceeding their UUSCOs and/or RRSCOs in up to 11 samples: 4-methylphenol (maximum 2.2 mg/kg), benzo(a)anthracene (maximum 45 mg/kg), benzo(a)pyrene (maximum 42 mg/kg), benzo(b)fluoranthene (maximum 46 mg/kg), benzo(k)fluoranthene (maximum 15 mg/kg), chrysene (maximum 42 mg/kg), dibenzo(a,h)anthracene (maximum 5.0 mg/kg), dibenzofuran (maximum 8.2 mg/kg), indeno(1,2,3-c,d)pyrene (maximum 19 mg/kg), phenanthrene (maximum 130 mg/kg), and pyrene (maximum 110 mg/kg).
- Seven metals were detected at concentrations exceeding their UUSCOs and/or RRSCOs in up to 17 samples: arsenic (maximum 16.4 mg/kg), chromium (maximum 43.9 mg/kg), copper (maximum 102 mg/kg), lead (maximum 717 mg/kg), mercury (maximum 4.5 mg/kg), nickel (maximum 53.4 mg/kg), and zinc (maximum 881 mg/kg).
- Polychlorinated biphenyls (PCBs) and pesticides were not detected above laboratory detection limits in any of the samples analyzed.

Groundwater

- Two VOCs, benzene and toluene, were detected above their NYSDEC Class GA Ambient Water Quality Standards and Guidance Values (AWQSGVs). Benzene was detected in one sample (MW-03_20210819) at a concentration of 3.0 micrograms per liter (µg/L), above its AWQSGV of 1.0 µg/L. Toluene was detected in two samples (MW-02_20210819 and MW-03_20210819) at concentrations of 310 and 670 µg/L, respectively, above its AWQSGV of 5.0 µg/L.
- Several SVOCs, including benzo(a)anthracene (2.6 µg/L), benzo(a)pyrene (3 µg/L), benzo(b)fluoranthene (3.6 µg/L), benzo(k)fluoranthene (1.3 µg/L), chrysene (2.5 µg/L), and indeno(1,2,3-c,d)pyrene (1.6 µg/L) were detected above their AWQSGVs in one sample (MW-01_20210820).
- Up to three metals (iron, magnesium, and sodium) were detected in both the unfiltered and filtered samples collected from the three monitoring wells. In the filtered (dissolved) samples, iron was detected at a concentration of 4,020 µg/L, above its AWQSGV of 300 µg/L; manganese was detected at concentrations of 308 and 1,090 µg/L, above its AWQSGV of 300 µg/L; and sodium ranged from 110,000 to 316,000 µg/L, above its AWQSGV of 20,000 µg/L.
- No PCBs or pesticides were detected above their respective AWQSGVs.
- Nine of the 21 per- and polyfluoroalkyl substances (PFAS) compounds were detected in the collected samples at concentrations ranging from 2.77 to 52.1 parts per trillion (ppt). Perfluorooctanesulfonic

acid (PFOS) was detected below its NYSDEC PFAS Screening Level of 10 ppt in the samples analyzed; however, perfluorooctanoic acid (PFOA) was detected above its NYSDEC PFAS Screening Level of 10 ppt in each sample at concentrations ranging from 15.1 to 52.1 ppt. 1,4-Dioxane was detected in each sample at estimated concentrations ranging between 0.053 to 0.42 µg/L.

Soil Vapor

- The soil vapor sampling results identified up to 40 VOCs in one or more of the seven soil vapor samples and one ambient air sample at concentrations ranging from 0.52 to 44,000 micrograms per cubic meter (µg/m^3) from a diluted analysis.
- Petroleum-related compounds, including benzene, toluene, ethylbenzene and xylenes (collectively referred to as BTEX), 1,2,4-trimethylbenzene, 2,2,4-trimethylpentane, n-hexane, n-heptane, n-butane, and cyclohexane, were detected at elevated concentrations in all seven soil vapor samples. Of these detections, cyclohexane and butane were detected at concentrations of 40,000 and 44,000 µg/m^3, respectively in soil vapor sample SV-06_20210820 collected in the general proximity of the former 2,500-gallon UST encased in concrete in the southwestern corner of the Site. Chlorinated-related compounds, including carbon tetrachloride, methylene chloride, trichloroethylene (TCE), and tetrachloroethylene (PCE), were detected at concentrations up to 540 µg/m^3 (PCE in sample SV-07_20210820).

The contaminants of concern (COCs) were determined to be VOCs, SVOCs, and metals in soil and groundwater, and VOCs in soil vapor.

RIR – 380 4th Avenue, Brooklyn, NY, AKRF, April 2022 (revised December 2022) (Draft)

AKRF returned to the Site in January and February 2022 to conduct an RI to determine the horizontal and vertical extent of contamination at the Site. Furthermore, a PDI was performed in July 2022 to further delineate and address data gaps identified during the RI work. The scope of the investigation was conducted in in general accordance with NYSDEC DER-10.

Field activities for the RI included the advancement of nine soil borings with collection and analysis of 25 soil samples; the installation of three permanent groundwater monitoring wells (RI-MW-04 through RI-MW-06) with the collection and analysis of six groundwater samples (which included the existing monitoring wells MW-01 through MW-03); and the installation of three temporary soil vapor points with the collection and analysis of four soil vapor samples.

Field activities for the PDI included: advancement of 16 soil borings with collection and analysis of 28 soil samples; installation of one permanent groundwater monitoring well (PDI-MW-07) with the collection and analysis of two groundwater samples (which included the existing monitoring well MW-01); and installation of one temporary soil vapor point with the collection and analysis of one soil vapor sample.

During the RI, PID readings were noted in soil borings RI-SB-18 and RI-SB-19 at depths up to approximately 10 feet bgs with a maximum PID reading of 192 ppm at RI-SB-19. Soil boring RI-SB-11 had elevated PID readings at depths up to approximately 5 feet bgs with a maximum PID reading of 33 ppm; however, no odors were noted. No evidence of free phase product (NAPL) was identified during the RI.

Based on the elevated PID readings, which were corroborated with the analytical data (summarized below), NYSDEC Spill No. 2109963 was reported at the Site on February 24, 2022.

During the PDI, slight petroleum-like odors were noted in soil boring PDI-SB-20 at depths from approximately 5 to 15 feet and 20 to 25 bgs with PID readings up to 492 ppm at approximately 5 to 10 feet bgs. Soil borings PDI-SB-23 through PDI-SB-26 had petroleum-like odors at depths up to approximately 20 feet bgs with PID readings up to 2,850 ppm. A slight petroleum sheen was observed from soil boring

PDI-SB-24 at approximately 17 to 20 feet bgs. No free phase product (NAPL) was identified during the RI and PDI.

Soil results for the RI and PDI were compared to UUSCOs and RRSCOs, and additionally PGWSCOs for VOCs. PFOA and PFOS were compared to their RR and UU Guidance Values.

- Six VOCs [acetone, benzene, ethylbenzene, methyl ethyl ketone (2-butanone), n-propylbenzene, and total xylenes] were detected at concentrations ranging from 0.054 to 6.3 mg/kg, above their respective UUSCOs in 13 samples and three blind duplicate samples. No VOCs were detected above their respective RRSCOs. In addition, acetone, benzene, ethylbenzene, methyl ethyl ketone (2-butanone), n-propylbenzene, and total xylenes were detected above their respective PGWSCOs. Acetone and methyl ethyl ketone (2-butanone) are common laboratory agents; therefore, their detections may not be reflective of on-site contamination. Data Usability Summary Reports (DUSRs) noted that acetone and 2-butanone are common laboratory contaminants, and caution should be used when making decisions based on these detections. Although, the detections in the field samples could not be negated due to a lack of presence in the corresponding blank samples.
- SVOCs consisting of PAHs [including 4-methylphenol (P-Cresol), benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, chrysene dibenzo(a,h)anthracene, dibenzofuran, indeno(1,2,3-cd)pyrene, and phenol] were detected at concentrations ranging up to 36 mg/kg, above their respective, UUSCOs, RRSCOs and/or PGWSCOs in up to 20 soil samples and two blind duplicate samples.
- Pesticides P,P'-DDD and P,P'-DDT were detected at concentrations of 0.0056 and 0.057 mg/kg, respectively, above their respective UUSCOs in one sample.
- No PCB were detected.
- Eight metals (arsenic, cadmium, copper, lead, mercury, nickel, silver, and zinc) were detected at concentrations ranging up to 12,600 mg/kg, above their respective UUSCOs, RRSCOs and/or PGWSCOs in 31 samples and three blind duplicate samples.
- One PFAS compound (PFOA), was detected at a concentration of 0.75 ppb in two samples, above its UU Guidance Value of 0.66 ppb, but below its RR Guidance Value of 33 ppb. The compound 1,4-dioxane was not detected in any of the collected samples.

Groundwater results were compared to AWQSGVs, except PFOS and PFOA, which were compared to their NYSDEC PFAS Screening Levels.

- Six VOCs [benzene, chloroform, isopropylbenzene (cumene) m,p-xylenes, n-propylbenzene and sec-butylbenzene] were detected at concentrations ranging from 2.8 to 54 µg/L, above their respective AWQSGVs in two samples. All other detections were below the AWQSGVs.
- During the RI, SVOCs consisting of PAHs [including benzo(a)anthracene, benzo(a)pyrene, and benzo(b)fluoranthene] were detected at concentrations ranging from 0.8 to 0.98 µg/L, above their respective AWQSGVs in one sample. However, subsequent groundwater sampling during the PDI confirmed no dissolved PAHs were detected in groundwater and previous samples can be attributed to entrained sediment.
- PCBs and pesticides were not detected in any of the groundwater samples.
- Seven metals (arsenic, iron, lead, magnesium, manganese, mercury, and sodium) were detected at concentrations ranging from 2.2 to 331,000 µg/L, above their respective AWQSGVs in all six total (unfiltered) samples and the one blind duplicate sample.

- Four metals (iron, magnesium, manganese, and sodium) were detected at concentrations ranging from 344 to 375,000 µg/L, above their respective AWQSGVs in all six dissolved (filtered) samples and the one blind duplicate sample.
- One PFAS compound (PFOA) was detected at concentrations ranging from 12.2 to 68.2 ppt in all six samples and the one blind duplicate sample above its respective PFAS Screening Levels of 10 ppt.

Soil vapor sample analytical results were:

- Petroleum-related and other VOCs, including BTEX, butane, cyclohexane, n-heptane, n-hexane, n-propylbenzene, tert butyl alcohol, 2,2,4-trimethylpentane, 2-hexanone, 4-ethyltoluene, 1,2,4-trimethylbenzene, 1,3-butadiene, 1,3,5-trimethylbenzene, and cymene were detected in the soil vapor samples at concentrations up to 3,000 µg/m^3 (n-heptane in RI-SV-12_20220126); and solvent-related compounds including acetone, TCE, PCE, 1,1,1-trichloroethane (1,1,1-TCA), carbon disulfide, carbon tetrachloride, methyl isobutyl ketone, methylene chloride, and MEK were detected in the soil vapor samples at concentrations up to 340 µg/m^3 (PCE in RI-SV-11-20220126).
- TCE was detected in sample PDI-SV-13_20220719 at a concentration of 4 µg/m^3, and PCE was detected in PDI-SV-13_20220719 at a concentration of 27 µg/m^3.
- Several chlorofluorocarbon compounds (often used as refrigerants), such as chlorodifluoromethane, chloroform, chloromethane, dichlorodifluoromethane, and trichlorofluoromethane, were detected in the soil vapor samples at concentrations up to 99 µg/m^3 (chloroform in RI-SV-12-20220126).

The Site is contaminated with: VOCs, SVOCs, pesticides, metals, and PFOA in soil; VOCs and metals in groundwater; and petroleum-related and chlorinated-related VOCs in soil vapor. The primary COCs are: VOCs, SVOCs and metals in soil; VOCs in groundwater; and VOCs in soil vapor.

SVOCs, pesticides, and metals (and to a lesser degree PFAS) are present in soil across the Site extending from ground surface to approximately 26 to 33 feet bgs and were attributed to the Site's historic usage. The metals and PFAS compounds in groundwater across the entire Site are likely related to regional conditions, while the SVOCs previously detected in groundwater were confirmed to be attributed to sediment entrained in previous groundwater samples (confirmed with the PDI sampling).

Petroleum-related VOCs present in soil on the eastern portion of the Site and in groundwater on the northeastern, southeastern, and eastern portions of the Site in the vicinity of the suspect and former USTs and ASTs, are likely related to the Site's historic petroleum bulk storage. Based on the elevated PID readings (maximum reading of 2,850 ppm), petroleum-like odors and concentrations of petroleum-related VOCs in soil and groundwater, NYSDEC assigned Spill Number 2109963 to the Site.

Solvent-related and petroleum-related VOCs were detected at varying concentrations in the soil vapor samples collected from the Site. The detections may be related to off-gassing from the VOCs present in the soil and groundwater.

RAWP – 380 4th Avenue, Brooklyn, NY, AKRF, May 2022 (Draft)

AKRF prepared a draft RAWP in May 2022, which outlined the remedial activities and cleanup objectives for the Site. The RAWP proposed excavation and removal of soil/fill to a maximum depth of approximately 15 feet bgs to achieve a Track 2 Cleanup with a contingent Track 4 cleanup; and excavation and removal of any unknown USTs and associated piping encountered during the excavation in accordance with applicable federal, state, and local laws and regulations, as defined by 6 New York Codes, Rules and Regulations (NYCRR) Part 375-6.8. The remedy also included the installation of institutional controls (ICs)/engineering controls (ECs), including a 20-mil thick vapor beneath the new building slab and a composite cover system across the entire Site consisting of a 14-inch thick concrete building slab. NYSDEC approval of the RAWP and issuance of the DD are pending.

4.0 INTERIM REMEDIAL MEASURES

The IRM proposed in this IRMWP consists of the installation soldier piles along the Site perimeter, which upon issuance of the DD, will facilitate installation of lagging for the SOE. This will enable future remedial excavation of the contaminated soil/fill identified during previous RIs performed by AKRF in 2021 and 2022. The installation of these soldier piles will not inhibit the remediation proposed under the May 2022 draft RAWP, as they are located at the Site perimeter and are designed to allow a Site-wide excavation up to 20 feet below grade. No off-site disposal of excavated materials or collection of soil, groundwater, and or soil vapor samples are anticipated during the implementation of this IRMWP.

This section outlines the scope of work and procedures for monitoring, Site controls, and handling of contaminated materials during the implementation of the IRM.

4.1 Site Preparation

A Site construction fence will be installed and all necessary permits pertaining to the installation of the SOE will be procured prior to starting work. Site mobilization involving utility mark-outs will be performed prior to undertaking any excavation. The Volunteer and its contractors will be solely responsible for the identification of utilities that might be affected by excavation work and implementation of all required, appropriate, or necessary health and safety measures.

Permits/Approvals Required

Permit/Approval Type	Issuing Agency
SOE Drilling Permit	NYCDOB
Foundation/Excavation Permit	NYCDOB
IRMWP Approval	NYSDEC

4.2 Support of Excavation

SOE across the Site perimeter is required for the future Site-wide remedial excavation of the contaminated soil/fill identified during RIs performed in 2021 and 2022, and to prevent compromising the structural integrity of adjacent properties, structures, subway structures, and roadways. The proposed SOE will include drilled soldier piles along the northern, southern, eastern, and western Site boundaries, as shown on Figure 3. The work involves the use of conventional drilling equipment to core approximately 12-inch diameter holes along the Site perimeter by advancing augers to depths of approximately 75 feet bgs. The installation of the soldier piles will not affect the proposed remedy included in the May 2022 draft RAWP, as they are located at the Site perimeter and are designed to allow a Site-wide excavation to 20 feet bgs, which is required for both remediation and construction of the new building. Based on the findings of the RI, excavation to a minimum of 15 feet bgs would be required to achieve the proposed remedy in the May 2022 draft RAWP [Track 2 cleanup (with a contingent Track 4 cleanup)]. SOE is required to safely removal contaminated material across the Site without undermining the adjacent roadways, subway tunnel structures, and adjacent building.

No soil excavation is anticipated as part of the IRM; however, soil spoils will be generated during the drilling of the SOE piles. It is anticipated that approximately 100 cubic yards (cy) of spoils will be generated during the drilling work. All soil spoils will be either stockpiled on, and covered with, poly sheeting and remain on-site during the SOE installation work (see Section 4.4 for stockpiling procedures) or shipped off-site for disposal to an approved facility (see Sections 4.5, 4.6, and 4.7 for materials load out, transport, and disposal off-site). The existing Site cap, consisting of the former building's foundation, will remain in place during the SOE installation and will be removed only in localized areas where the soldier piles will be drilled. Excavation for the installation of lagging will be conducted following the approval of the RAWP and issuance of the DD.

4.3 Contingency Plan

A contingency plan has been developed to describe the procedures to be followed upon discovery of an unknown source of contamination that may require remediation (e.g., USTs, stained soil, drums, etc.). The identification of a previously unknown source or unexpected contaminated media discovered by screening during any invasive Site work will be promptly communicated by phone to the NYSDEC project manager. The findings will also be included in daily and monthly progress reports. If USTs or other previously unidentified contaminant sources are found during the SOE drilling, sampling will be performed on product, sediment, and/or surrounding soil/fill, etc., as applicable. Chemical analytical work will be for full scan parameters [Target Compound List (TCL) VOCs, SVOCs, pesticides, PCBs, 1,4-dioxane, PFAS, and Target Analyte List (TAL) metals]. The analyses will not be limited to CP-51 parameters where tanks are identified without prior approval by the NYSDEC project manager.

4.4 Stockpiling Procedures

All drilling spoils generated as part of the SOE drilling will be temporarily staged at the Site. Stockpiled soil will be placed on, and covered with, poly sheeting and secured with large rocks or other appropriate weights to protect against leaching or runoff of contaminants into groundwater or stormwater. In addition, Site erosion and run-off controls will be implemented. A dedicated water hose connected to a fire hydrant will be available on-site for dust control. The location of each stockpile will be tracked on Site drawings and updated, as necessary, at the end of each workday. Copies of Site drawings will be kept in the field logbook. Soil stockpiles will be inspected at a minimum once per week and after every storm event and any damaged tarp covers will be promptly replaced. The stockpiles are expected to either remain at the Site for the duration of the SOE installation work or be shipped off-site for disposal at an approved facility (see Sections 4.5, 4.6, and 4.7 for materials load out, transport, and disposal off-site).

4.5 Materials Load Out

The Remedial Engineer (RE) or a Qualified Environmental Professional (QEP) under her supervision will oversee all invasive work and load-out of all soil spoils generated as part of the SOE drilling.

The Volunteer and its contractors are solely responsible for safe execution of all invasive and other work performed under this IRMWP.

The presence of utilities and easements on the Site has been investigated by the RE. It has been determined that no risk or impediment to the planned work under this IRMWP is posed by utilities or easements on the Site. Loaded vehicles leaving the Site will be appropriately lined, tarped, securely covered, manifested, and placarded in accordance with appropriate federal, state, local, and New York State Department of Transportation (NYSDOT) requirements (and all other applicable transportation requirements). Vehicles leaving the Site will not be overloaded. The RE’s representative will make reasonable efforts to ensure that vehicles are not loaded beyond their NYSDOT weight rating and that all material is secured beneath the truck bed cover.

An outbound-truck inspection station will be set up on Site close to the Site exit. A filter fabric will be placed prior to the installation of the trap rock. Before exiting the Site, trucks will be required to stop at the truck inspection station to be examined for evidence of contaminated soil on the undercarriage, body, and wheels. Soil and debris will be removed from vehicles and equipment using brooms, shovels, and clean water, as necessary, and the material will be shipped off-site with the Site soil during the IRM work. The RE will be responsible for ensuring that all outbound trucks will be washed at the truck wash as necessary before leaving the Site until the IRM is complete.

Locations where vehicles enter or exit the Site will be inspected daily for evidence of off-site sediment tracking.

The RE's representative will be responsible for ensuring that all egress points for truck and equipment transport from the Site will be clean of dirt and other materials derived from the Site during Site remediation and development. Cleaning of the adjacent streets will be performed as needed to maintain a clean condition with respect to Site-derived materials.

The Volunteer and associated parties preparing the IRM documents submitted to the state, and parties performing this work, are completely responsible for the safe performance of all invasive work, the structural integrity of excavations, and for structures that may be affected by excavations (such as building foundations and bridge footings).

The RE will ensure that Site development activities will not interfere with, or otherwise impair or compromise, IRM activities proposed in this IRMWP.

Mechanical processing of historic fill and contaminated soil on-site is prohibited.

All primary contaminant sources (including but not limited to encountered tanks and hotspots) identified during the IRM will be surveyed by a surveyor licensed to practice in the State of New York or located with a GPS survey to obtain exact coordinates on the Site. The survey information will be shown on maps to be reported in the Final Engineering Report (FER).

4.6 Materials Transport Off-Site

All transport of materials will be performed by licensed haulers in accordance with appropriate federal, state, and local regulations, including 6 NYCRR Part 364. Haulers will be appropriately licensed and trucks properly placarded.

Truck transport routes are shown on Figure 4 and as follows:

- Trucks entering the Site will be traveling east on Interstate 278; take the Interstate 278 exit 23 for 38th Street; turn left on 4th Avenue. The Site will be on the left in approximately 1.7 miles.
- Trucks leaving the Site will head southwest on 4th Avenue; turn right onto 15th Street; turn left onto 3rd Avenue; and take the ramp onto Interstate 278 West.

All trucks loaded with Site materials will exit the vicinity of the Site using only the approved truck route. Proposed inbound and outbound truck routes to the Site are shown on Figure 4. This is the most appropriate route and takes into account: (a) limiting transport through residential areas and past sensitive sites; (b) use of city mapped truck routes; (c) prohibiting off-site queuing of trucks entering the facility; (d) limiting total distance to major highways; (e) promoting safety in access to highways; and (f) overall safety in transport.

Trucks will be prohibited from stopping and idling in the neighborhood outside the Site. Egress points for truck and equipment transport from the Site will be kept clean of dirt and other materials during Site remediation and development. Queuing of trucks will be performed on-site to minimize off-site disturbance. Off-site queuing will be prohibited.

Material transported by trucks exiting the Site will be secured with tight-fitting covers. Loose-fitting canvas-type truck covers will be prohibited. If loads contain wet material capable of producing free liquid, truck liners will be used. All trucks will be washed prior to leaving the Site. Truck wash waters will be collected and disposed of off-site in an appropriate manner.

4.7 Materials Disposal Off-Site

The disposal facility(ies) information will be reported to the NYSDEC project manager after completion of waste characterization testing and prior to commencing the disposal activities. Based on the waste characterization results, a properly permitted waste disposal facility will be selected for off-site disposal. The disposal facility information, including location, will be reported to the NYSDEC project manager prior to commencing the disposal activities.

The total quantity of material expected to be disposed off-site as part of the IRM is approximately 100 cubic yards (cy). Final disposal quantities for each waste stream will be included in the FER.

All soil/fill/solid waste excavated and removed from the Site will be treated as contaminated and regulated material and will be disposed in accordance with all Federal, State (including 6 NYCRR Part 360), and local regulations. If disposal of soil/fill from this Site is proposed for unregulated disposal (i.e., clean soil removed for development purposes), a formal request with an associated plan will be made to NYSDEC's project manager. Unregulated off-site management of materials from this Site is prohibited without formal NYSDEC approval.

Material that does not meet Track 1 UUSCOs is prohibited from being taken to a New York State recycling facility (6 NYCRR Part 360-16 Registration Facility).

The following documentation will be obtained and reported by the RE for each disposal location used in this project to fully demonstrate and document that the disposal of material derived from the Site conforms with all applicable laws: (1) a letter from the RE or BCP Volunteer to the receiving facility describing the material to be disposed and requesting formal written acceptance of the material. This letter will state that material to be disposed is contaminated material generated at an environmental remediation Site in New York State. The letter will provide the project identity and the name and phone number of the RE. The letter will include as an attachment a summary of all chemical data for the material being transported (including Site characterization data); and (2) a letter from each receiving facility stating it is in receipt of the correspondence (above) and is approved to accept the material. These documents will be included in the FER.

Non-hazardous historic fill and contaminated soils taken off-site will be handled, at a minimum, as a Municipal Solid Waste per 6 NYCRR Part 360-1.2.

Historic fill and contaminated soils from the Site are prohibited from being disposed at Part 360-16 Registration Facilities (also known as Soil Recycling Facilities).

Soils that are contaminated but non-hazardous and are being removed from the Site are considered by the Division of Materials Management (DMM) in NYSDEC to be construction and demolition (C&D) materials with contamination not typical of virgin soils. These soils may be sent to a permitted Part 360 landfill. They may be sent to a permitted C&D processing facility without permit modifications only upon prior notification of NYSDEC Region 2 DMM. This material is prohibited from being sent or redirected to a Part 360-16 Registration Facility. In this case, as dictated by DMM, special procedures will include, at a minimum, a letter to the C&D facility that provides a detailed explanation that the material is derived from a DER remediation Site, and that the soil material is contaminated and must not be redirected to on-site or off-site Soil Recycling Facilities. The letter will provide the project identity and the name and phone number of the RE. The letter will include as an attachment a summary of all chemical data for the material being transported.

The FER will include an accounting of the destination of all material removed from the Site during this IRM, including soil spoils, excavated soil, contaminated soil, historic fill, solid waste, hazardous waste (if any), non-regulated material, and fluids. Documentation associated with disposal of all material must also include records and approvals for receipt of the material. This information will also be presented in a tabulated form in the FER.

Bill of lading system or equivalent will be used for off-site movement of non-hazardous wastes and contaminated soils. This information will be reported in the FER.

Hazardous wastes, if any, derived from on-site will be stored, transported, and disposed of in full compliance with applicable federal, state, and local regulations.

Appropriately licensed haulers will be used for material removed from this Site and will be in full compliance with all applicable federal, state, and local regulations.

Soil waste characterization will be performed for off-site disposal in a manner suitable to the receiving facility and in conformance with applicable permits. Sampling and analytical methods, sampling frequency, analytical results, and quality assurance/quality control (QA/QC) procedures will be reported in the FER. All data available for soil/material to be disposed at a given facility must be submitted to the disposal facility with suitable explanation prior to shipment and receipt.

4.8 Site Control Measures

The potential off-site transport of sediment, dust and organic vapors potentially generated during SOE drilling activities will be controlled by: covering soil stockpiles and/or open excavations with 6-mil polyethylene sheeting; decontaminating equipment used for drilling or soil excavation/sampling (if any); providing drainage inlet protection for catch basins; and/or the use of odor-controlling spray foam, as warranted. Soil/fill within any open excavations will be screened for contamination with a PID throughout each workday. These measures will be installed according to the requirements of all applicable or relevant and appropriate federal, state and local laws.

4.9 Backfill from Off-Site Sources

Backfill import is not expected during the IRM. However, in the event clean backfill is required all materials proposed for import onto the Site will be approved by the RE and will be in compliance with provisions in this IRMWP prior to receipt at the Site. Material proposed for import shall either be from a NYSDEC-registered certified clean fill facility or other permitted facility. Any facility proposed for import shall undergo a facility history review and background check by the RE. Material from industrial sites, spill sites, other environmental remediation sites, or other potentially contaminated sites will not be imported to the Site. Solid waste will not be imported onto the Site.

Prior to import, soil will be segregated and tested at the source facility for analysis of VOCs, SVOCs, PCBs, pesticides, TAL metals, PFAS, and 1,4-Dioxane at the frequency outlined in Table 5.4(e)10 on page 161 of the DER-10 Technical Guidance for Site Investigation and Remediation and in accordance with NYSDEC Sampling, Analysis, and Assessment of PFAS (January 2021). The analytical results will be compared to Table 375-6.8(b) of 6 NYCRR Part 375 and submitted to NYSDEC for review and approval prior to importation and placement on-site. Virgin quarried stone with less than 10% fines will not require testing.

All imported soils will meet NYSDEC approved backfill or cover soil quality objectives for this Site. These NYSDEC-approved backfill or cover soil quality objectives are the lower of the protection of groundwater and the protection of public health SCOs for Restricted Residential Use as set forth in Table 375-6.8(b) of 6 NYCRR Part 375. Non-compliant soils will not be imported onto the Site without prior approval by NYSDEC. Nothing in this IRMWP or its approval by NYSDEC should be construed as an approval for this purpose.

Soils that meet ‘exempt’ fill requirements under 6 NYCRR Part 360, but do not meet backfill or cover soil objectives for this Site, will not be imported onto the Site without prior approval by NYSDEC. Nothing in this IRMWP should be construed as an approval for this purpose.

The FER will include the following certification by the RE: "I certify that all import of soils from off-site, including source evaluation, approval and sampling, has been performed in a manner that is consistent with the methodology defined in the Interim Remedial Measure Work Plan."

Solid waste will not be imported to the Site.

Trucks entering the Site with imported soils will be securely covered with tight fitting covers.

4.10 Fluids Management

Dewatering is not contemplated during the IRM. However, and if required, all liquids to be removed from the Site, including dewatering fluids (if any), will be handled, transported, and disposed in accordance with applicable federal, state, and local regulations. Liquids discharged into the NYC sewer system will be addressed through approval by NYCDEP. Treatment of dewatering fluids may be required to meet the discharge requirements, as applicable. Dewatering fluids will not be recharged back to the land surface or subsurface of the Site. Discharge of water generated during remedial construction to surface waters (i.e., a local pond, stream, or river) is prohibited without a State Pollutant Discharge Elimination System permit.

4.11 Air Monitoring

Work zone and community air monitoring and will be conducted during all work identified in this IRMWP. The protocol for implementing the work zone and community air monitoring will be completed in accordance with the site-specific HASP and CAMP, provided in Appendix A and Appendix B, respectively. The HASP and CAMP includes special air monitoring requirements when working close to potentially exposed populations or occupied structures (see Section 2.6.2 of Appendix A).

4.12 Quality Assurance/Quality Control

Measures will be taken to provide for QA and maintain QC of environmental sampling (if any) and remedial activities conducted under the IRMWP. A QAPP that describes the QA/QC protocols and procedures that will be followed during implementation of the IRM is included in Appendix C. Adherence to the QAPP will ensure that defensible data will be obtained during the implementation of the IRM.

5.0 REPORTING

Daily and monthly reports will be prepared and submitted to NYSDEC during the IRM work. The reports will include:

- Photographs of Site excavation and SOE installation;
- Air monitoring results and corrective actions taken (if required);
- Locations of work and quantities of material generated during the work, and locations of soil stockpiles;
- A summary of complaints with relevant details (names, phone numbers, etc.);
- A summary of CAMP findings, including exceedances and corrective measures, if applicable; and
- Documentation of source approval and sampling for any imported backfill material (if needed).

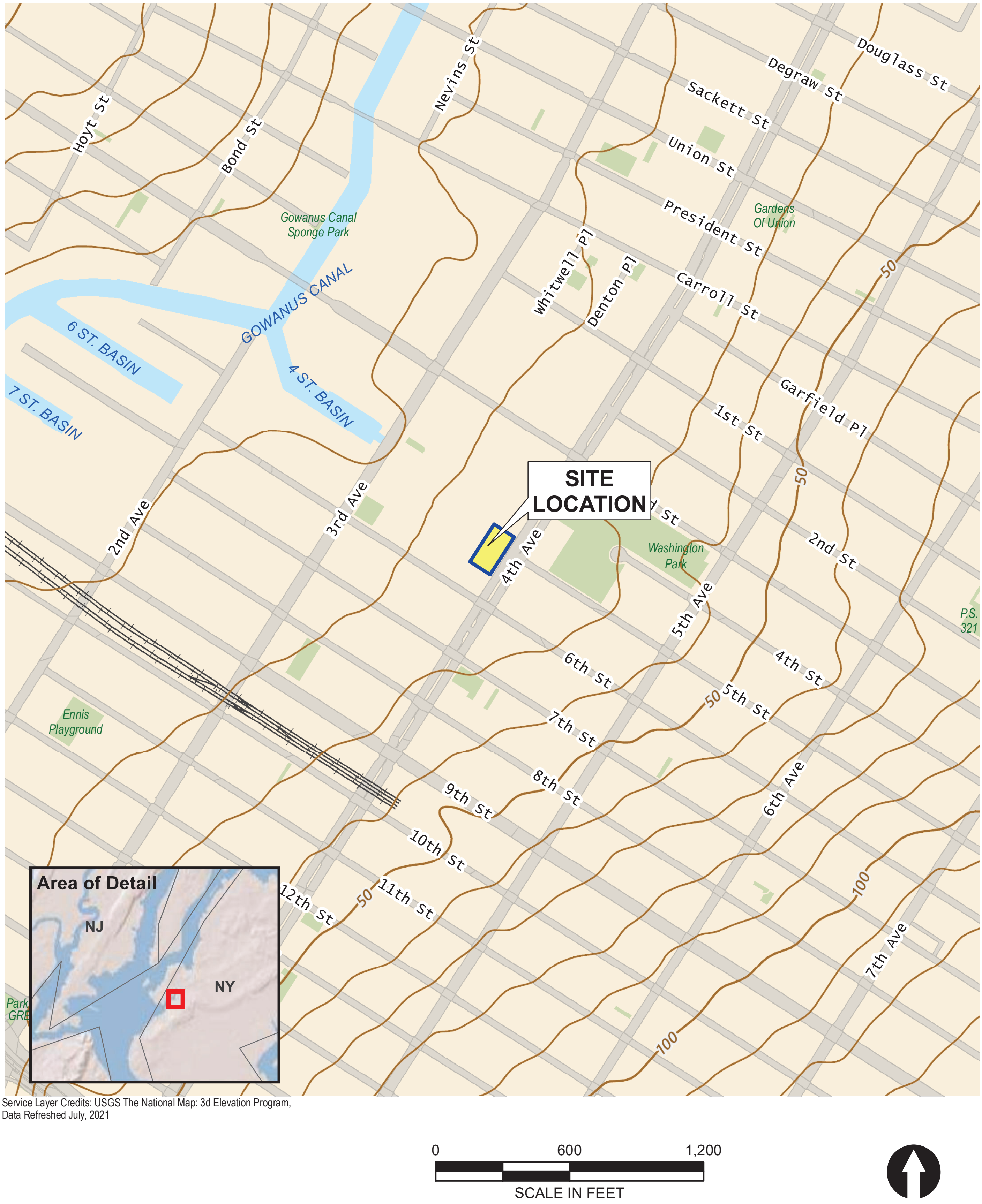
In addition, any CAMP exceedances and corrective action taken will be reported separately (as required) from daily reports within 24 hours of occurring to NYSDEC and New York State Department of Health (NYSDOH).

6.0 SCHEDULE OF WORK

The following tentative schedule has been developed for the project. The schedule would be subject to change to ensure that the data needs of the IRMWP, RAWP, etc. are met to the satisfaction of the NYSDEC.

Activity	Time To Complete
IRMWP Submitted to NYSDEC and NYSDOH	December 2022
NYSDEC Issues comments to the May 2022 draft RAWP	December/January 2022
Start IRM implementation	January 2023
Submission of the revised RAWP	January 2023
NYSDEC Approves RAWP/Issues DD and Remedial Notice Fact Sheet	February 2023
Commence implementation of RAWP	February 2023
Submittal of Environmental Easement Package	By July 1, 2023
Draft SMP Submitted to NYSDEC	By September 1, 2023
Draft FER and Fact Sheet	By October 1, 2023
NYSDEC and NYSDOH Approval of FER and SMP	December 2023
Issue Certificate of Completion	December 2023
Completion of Building (First Occupancy)	2024

FIGURES



Service Layer Credits: USGS The National Map: 3d Elevation Program,
Data Refreshed July, 2021

©2022 AKRF W:\Projects\210226 - QUINLAN E-DESIGNATION 374 4TH AVE\GIS Graphics\SAR\RAWP\210226 Figure 1 BCP site location.mxd5/2/2022 1:17:53 PM mveilleux

AKRF
440 Park Avenue South, New York, NY 10016

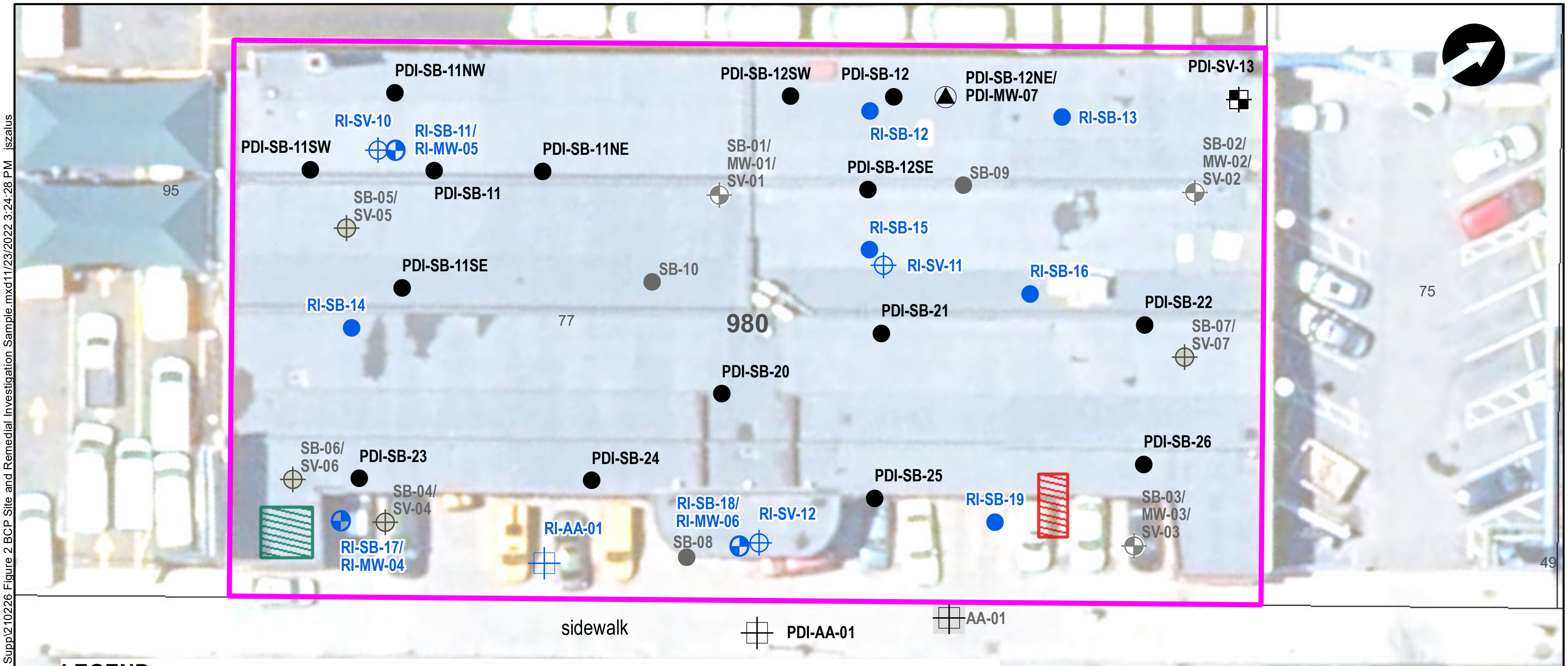
380 4th Avenue
Brooklyn, New York

BCP SITE LOCATION

DATE
5/2/2022

PROJECT NO.
210226

FIGURE
1



LEGEND

- ▭ PROJECT SITE BOUNDARY
- 77 LOT BOUNDARY AND TAX LOT NUMBER
- ▨ FORMER ENCASED IN CONCRETE UNDERGROUND STORAGE TANK (REMOVED FEB. 2022)
- ▨ SUSPECT UNDERGROUND STORAGE TANK
- ● SOIL BORING LOCATION (AUGUST 2021)
- ⊕ SOIL BORING/SOIL VAPOR POINT (AUGUST 2021)
- ⊕ SOIL BORING/MONITORING WELL/SOIL VAPOR POINT (AUGUST 2021)
- ⊞ AMBIENT AIR SAMPLE LOCATION (AUGUST 2021)
- ● RI SOIL BORING LOCATION
- ◕ RI SOIL BORING/MONITORING WELL
- ⊕ RI SOIL VAPOR POINT
- ⊞ RI AMBIENT AIR LOCATION
- ● PDI SOIL BORING
- ▲ PDI SOIL BORING/MONITORING WELL
- ▚ PDI SOIL VAPOR POINT
- ⊞ PDI AMBIENT AIR SAMPLE LOCATION

0 30 60

SCALE IN FEET

Note:
When choosing identification numbers for the Remedial Investigation temporary soil vapor points SV-08 and SV-09 were unintentionally skipped in the sequence. No soil vapor samples are associated with the identification

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440 Park Avenue South, New York, NY 10016

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Brooklyn, New York

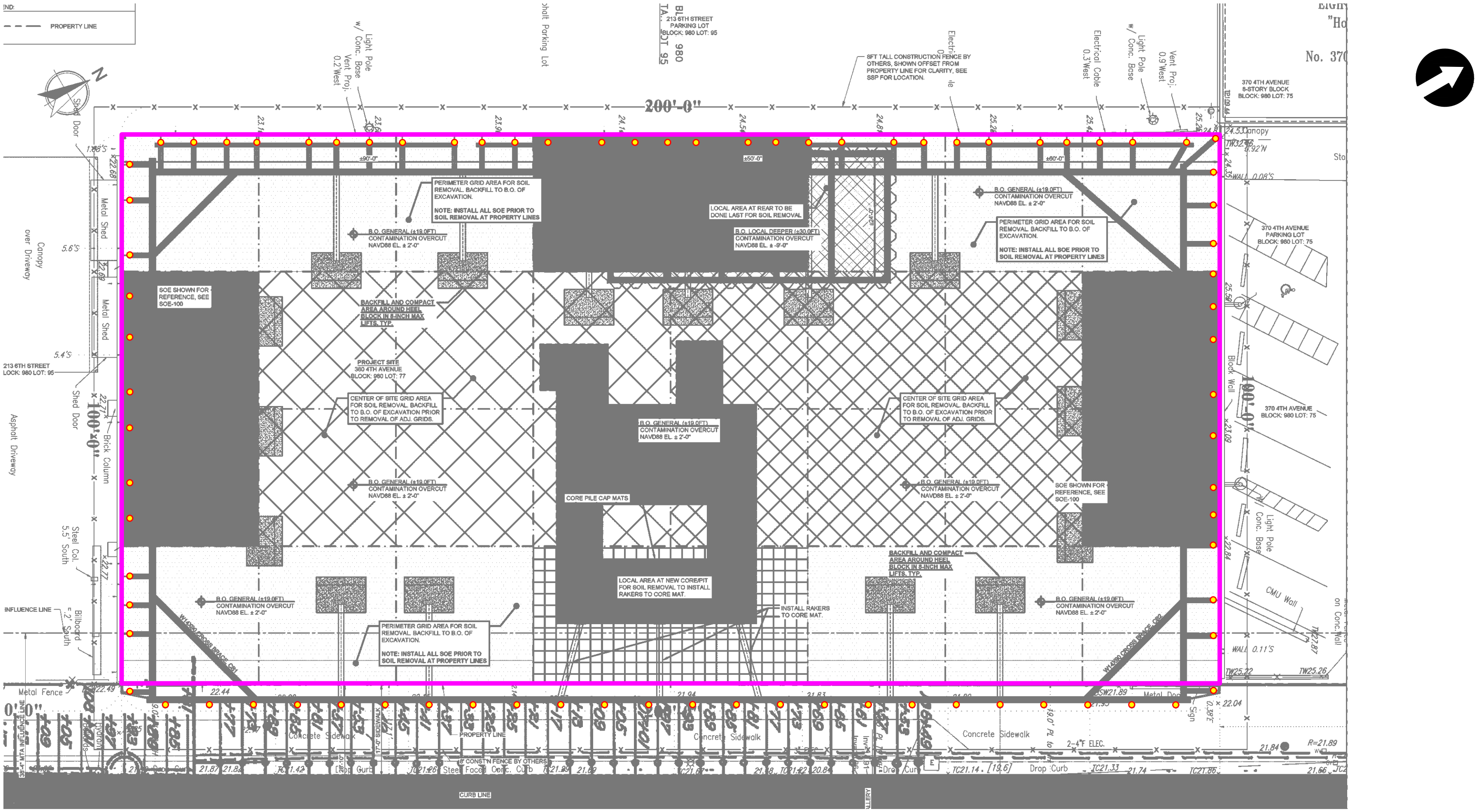
BCP SITE PLAN WITH SAMPLE LOCATIONS

DATE
11/23/2022

PROJECT NO.
210226

FIGURE
2

©2022 AKRF W:\Projects\210226 - QUINLAN E-DESIGNATION 380 4TH AVE\GIS Graphics\SAR\BCP RI Supp\210226 Figure 2 BCP Site and Remedial Investigation Sample.mxd11/23/2022 3:24:28 PM iszalus



LEGEND

▭ PROJECT SITE BOUNDARY

● ● ● PROPOSED SOLDIER PILES TO BE INSTALLED TO FACILITATE SUPPORT OF EXCAVATION

0 15 30 60

SCALE IN FEET

Map Source:
Ancora Engineering "Support of Excavation", Drawing No.: SOE-110.00, Dated 9/28/2022.

AKRF

440 Park Avenue South, New York, NY 10016

380 4th Avenue

Brooklyn, New York

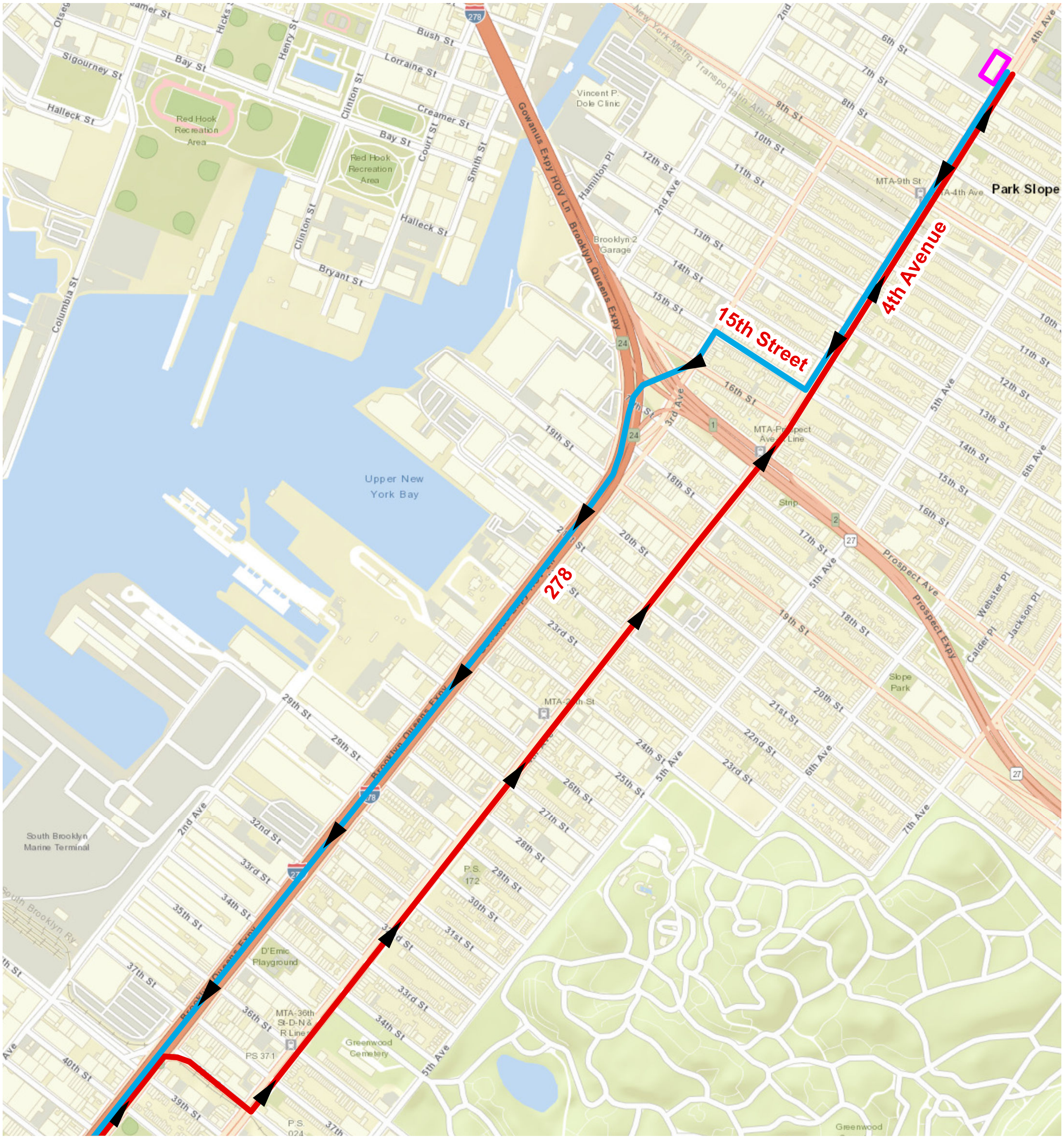
EXTENT OF SUPPORT OF EXCAVATION (SOE)

DATE
12/15/2022

PROJECT NO.
210226

FIGURE
3

©2022 AKRF, Inc Q:\Projects\210226 - QUINLAN E-DESIGNATION 380 4TH AVE\SAR\CAD\210226 Fig 3 Extent of Support of Excavation (SOE).dwg last save: mveilleux 12/15/2022 1:44 PM



LEGEND

PROJECT SITE BOUNDARY

TRUCK ROUTE FROM SITE

TRUCK ROUTE TO SITE

Service Layer Credits:
ESRI World Street Map 2021
City of New York Department of Transportation, April, 2019,
New York City Truck Routes: New York City

0 1,000 2,000
SCALE IN FEET

440 Park Avenue South, New York, NY 10016

380 4th Avenue
Brooklyn, New York

TRUCK ROUTE MAP

DATE
5/3/2022

PROJECT NO.
210026

FIGURE
14

©2022 AKRF W:\Projects\210226 - QUINLAN E-DESIGNATION 374 4TH AVE\GIS Graphics\SAR\RAWP\210226 Figure 14 Truck Route Map.mxd5/3/2022 8:43:23 AM mveilleux

APPENDIX A
HEALTH AND SAFETY PLAN

380 4TH AVENUE

BROOKLYN, NEW YORK

Health and Safety Plan

For

Interim Remedial Measure Work Plan

BCP Site No.: C224358
AKRF Project Number: 210226

Prepared for:

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

Prepared On Behalf Of:

380 4th Avenue Owner, LLC
157 Columbus Avenue, Suite 2E
New York, NY 10023

Prepared by:

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

DECEMBER 2022

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FIGURES

TABLES

ATTACHMENTS

1.0 INTRODUCTION

This environmental Health and Safety Plan (HASP) describes the protocols and procedures that will be followed during implementation of the Interim Remedial Measure Work Plan (IRMWP) at the 380 4th Avenue project site (hereafter referred to as the "Site"). The Site is an approximately 20,000-square foot parcel located at 374 to 390 4th Avenue in the Gowanus neighborhood of Brooklyn, New York and comprises New York City Tax Block 980, Lot 77. The Site is enrolled in the New York State Department of Environmental Conservation (NYSDEC) Brownfield Cleanup Program (BCP) under BCP Site No. C224358 as of October 2022. The Site location is presented on Figure 1.

The Site most recently consisted of a slab-on-grade, one-story structure that last operated as a taxi business; the building was recently demolished and removed from the Site in anticipation of redevelopment. The Site is bounded by: commercial buildings and a hotel with associated parking lots to the north, followed by 3rd Street; a U-Haul facility parking lot to the south, followed by 6th Street; 4th Avenue, with the NYC Transit D- and R-Line subway beneath 4th Avenue to the east, followed by commercial and residential buildings; and a U-Haul facility and associated parking lots to the west, followed by 3rd Avenue. The larger surrounding area is occupied by predominantly commercial and auto-related uses, with some residential uses to the east.

The findings from previous Remedial Investigations identified contaminated soil, groundwater, and soil vapor at the Site. The contaminants of concern include: volatile organic compounds (VOCs), semivolatile organic compounds (SVOCs), and metals in soil; VOCs and metals in groundwater; and VOCs in soil vapor.

The purpose of this HASP is to assign responsibilities, establish personnel protection standards and mandatory safety practices and procedures, and provide for contingencies that may arise during field activities at the Site. The HASP is intended to minimize health and safety risks resulting from the known or potential presence of contaminated materials. This HASP also includes supplemental requirements to minimize potential exposure related to COVID-19, which are presented in Attachment A.

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

2.0 HEALTH AND SAFETY GUIDELINES AND PROCEDURES

2.1 Hazard Evaluation

2.1.1 Hazards of Concern

Table 1
Hazards of Concern

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

2.1.2 Physical Characteristics

Table 2
Physical Characteristics

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

2.1.3 Hazardous Materials

Table 3
Hazardous Materials

Check all that apply				
Chemicals	**Solids**	**Solvents**	**Oils**	**Other**
( ) Acids	(**X**) Ash	( ) Halogens	( ) Transformer	( ) Lab
( ) Caustics	( ) Asbestos	(**X**) Petroleum	( ) Other DF	( ) Pharm
( ) Pesticides	( ) Tailings	(**X**) Chlorinated Solvents	(**X**) Motor or Hydraulic Oil	( ) Hospital
(**X**) Petroleum	(**X**) Other	(**X**) Other	(**X**) Gasoline	( ) Rad
( ) Inks	Fill Material	Freon 12	( ) Fuel Oil	( ) MGP
( ) PCBs				( ) Mold
(**X**) Metals				( ) Cyanide
(**X**)Other: VOCs, SVOCs, and Metals				

2.1.4 Chemicals of Concern

Table 4
Chemicals of Concern

Chemicals	REL/PEL/STEL	Health Hazards
Antimony	REL: 0.5 mg/m^3 PEL: 0.5 mg/m^3	Irritation eyes, skin, nose, throat, mouth; cough; dizziness; headache; nausea, vomiting, diarrhea; stomach cramps; insomnia; anorexia; unable to smell properly.
Arsenic	REL = 0.002 mg/m^3 PEL = TWA 0.010 mg/m^3	Ulceration of nasal septum, dermatitis, gastrointestinal disturbances, peripheral neuropathy, resp irritation, hyperpigmentation of skin, potential occupational 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 = TWA 0.1 ppm PEL = TWA 1 ppm	Irritation eyes, skin, nose, respiratory system; dizziness; headache, nausea, staggered gait; anorexia, lassitude (weakness, exhaustion); dermatitis; bone marrow depression.
Beryllium	REL C: 0.0005 mg/m^3 PEL: 0.002 mg/m^3 PEL C: 0.005 mg/m^3; max peak: 0.025 mg/m^3	Berylliosis (chronic exposure): anorexia, weight loss, lassitude (weakness, exhaustion), chest pain, cough, clubbing of fingers, cyanosis, pulmonary insufficiency; irritation eyes; dermatitis; [potential occupational carcinogen].
Cadmium	PEL = TWA 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].
Chloroform	N STEL: 2 ppm PEL C: 50 ppm	Irritation eyes, skin; dizziness, mental dullness, nausea, confusion; headache, lassitude (weakness, exhaustion); anesthesia; enlarged liver; [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
DDD, DDE, & DDT	REL: 0.5 mg/m^3 PEL: 1 mg/m^3	Irritation eyes, skin; paresthesia tongue, lips, face; tremor; anxiety, dizziness, confusion, malaise (vague feeling of discomfort), headache, lassitude (weakness, exhaustion); convulsions; paresis hands; vomiting; [potential occupational carcinogen].
Ethylbenzene	REL = TWA 100 ppm PEL = TWA 100 ppm	Irritation eyes, skin, mucous membrane; headache; dermatitis; narcosis, coma.
Fuel Oils	REL: 100 mg/m^3	Irritation eyes, skin, nose, throat; burning sensation in chest; headache, nausea, lassitude (weakness, exhaustion), restlessness, incoordination, confusion, drowsiness; vomiting, diarrhea; dermatitis; chemical pneumonitis (aspiration liquid).

Chemicals	**REL/PEL/STEL**	**Health Hazards**
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.
Manganese	REL = 1 mg/m^3 PEL = 0.2 mg/m^3	Manganism; asthenia, insomnia, mental confusion; metal fume fever: dry throat, cough, chest tightness, dyspnea (breathing difficulty), rales, flu-like fever; low-back pain; vomiting; malaise (vague feeling of discomfort); lassitude (weakness, exhaustion); kidney damage.
Methylene Chloride	PEL: 25 ppm O STEL: 125 ppm	Irritation eyes, skin; lassitude (weakness, exhaustion), drowsiness, dizziness; numb, tingle limbs; nausea; [potential occupational carcinogen].
Methyl Ethyl Ketone (2-Butanone)	REL = TWA 200 ppm PEL = TWA 200 ppm	Irritation eyes, skin, nose; headache; dizziness; vomiting; dermatitis.
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 = TWA 10 ppm PEL = TWA 10 ppm	Irritation eyes; headache, confusion, excitement, malaise (vague feeling of discomfort); nausea, vomiting, abdominal pain; irritation bladder; profuse sweating; jaundice; hematuria (blood in the urine), renal shutdown; dermatitis, optical neuritis, corneal damage.
Nickel	REL = TWA 0.015 mg/m^3 PEL = TWA 1 mg/m^3	Sensitization dermatitis, allergic asthma, pneumonitis; [potential occupational carcinogen].
Phenol	REL = TWA 5 ppm (19 mg/m^3) [skin] PEL = TWA 5 ppm (19 mg/m^3) [skin]	Irritation eyes, nose, throat; anorexia, weight loss; lassitude (weakness, exhaustion), muscle ache, pain; dark urine; cyanosis; liver, kidney damage; skin burns; dermatitis; ochronosis; tremor, convulsions, twitching
Polycyclic Aromatic Hydrocarbons (PAHs)	PEL = 5 mg/m^3	Harmful effects to skin, bodily fluids, and ability to fight disease, reproductive problems; potential carcinogen.
Selenium	REL = TWA 0.2 mg/m^3 PEL = TWA 0.2 mg/m^3	Irritation eyes, skin, nose, throat; visual disturbance; headache; chills, fever; dyspnea (breathing difficulty), bronchitis; metallic taste, garlic breath, gastrointestinal disturbance; dermatitis; eye, skin burns
Silver	REL: 0.01 mg/m^3 PEL: 0.01 mg/m^3	Blue-gray eyes, nasal septum, throat, skin; irritation, ulceration skin; gastrointestinal disturbance.
Tetrachloroethylene	PEL: 100 ppm PEL C: 200 ppm; max peak: 300 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].

Chemicals	REL/PEL/STEL	Health Hazards
Thallium	REL: 0.1 mg/m^3 PEL: 0.1 mg/m^3	Nausea, diarrhea, abdominal pain, vomiting; ptosis, strabismus; peri neuritis, tremor; retrosternal (occurring behind the sternum) tightness, chest pain, pulmonary edema; convulsions, chorea, psychosis; liver, kidney damage; alopecia; paresthesia legs.
Toluene	PEL = TWA 200 ppm (750 mg/m^3)	Central nervous system depression, causing fatigue, headache, confusion, paresthesia, dizziness, and muscular incoordination, irritation of the eyes, mucous membranes, and upper respiratory tract.
Trichloroethylene	PEL: 100 ppm PEL C: 200 ppm; 5-min max peak: 300 ppm	Irritation eyes, skin; headache, visual disturbance, lassitude (weakness, exhaustion), dizziness, tremor, drowsiness, nausea, vomiting; dermatitis; cardiac arrhythmias, paresthesia; liver injury; [potential occupational carcinogen].
Xylenes	REL = TWA 435 mg/m^3 PEL = TWA 435 mg/m^3	Irritation eyes, skin, nose, throat; dizziness, excitement, drowsiness, incoordination, staggering gait; corneal vacuolization; anorexia, nausea, vomiting, abdominal pain; dermatitis
Zinc	REL = TWA 5 mg/m^3 PEL = TWA 5 mg/m^3	Metal fume fever: chills, muscle ache, nausea, fever, dry throat, cough; lassitude (weakness, exhaustion); metallic taste; headache; blurred vision; low back pain; vomiting; malaise (vague feeling of discomfort); chest tightness; dyspnea (breathing difficulty), rales, decreased pulmonary function.
Comments: REL = National Institute for Occupational Safety and Health (NIOSH) Recommended Exposure Limit PEL = OSHA Permissible Exposure Limit STEL = OSHA Short Term Exposure Limit N: NIOSH O: OSHA C: Ceiling		

The potential health effects from the on-site contaminants listed above are further described in Attachment B.

2.2 Designated Personnel

AKRF will appoint one of its on-site personnel as the Site Safety Officer (SSO). This individual will be responsible for the implementation of this HASP. The SSO will work under the direction of a Qualified Environmental Professional (QEP) and will be experienced in the implementation of air monitoring and hazardous materials sampling programs. Health and safety training required for the SSO and all field personnel is outlined in Section 2.3 of this HASP.

2.3 Training

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

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

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

2.4 Medical Surveillance Program

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

2.5 Site Work Zones

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

The Exclusion Zone is defined as the area where exposure to impacted media could be encountered. The Contamination Reduction Zone (CRZ) is the area where decontamination procedures take place and is located next to the Exclusion Zone. The Support Zone is the area where support facilities such as vehicles, fire extinguisher, and first aid supplies are located. The emergency staging area (part of the Support Zone) is the area where all workers on-site would assemble in the event of an emergency. A summary of these areas is provided below. These zones may 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.

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

Table 5
Site Work Zones

Task	Exclusion Zone	CRZ	Support Zone
Soil Excavation and Storage Tank Removal Areas (if any)	15 feet from excavation border and excavation equipment or vehicles	15 feet from excavation border and excavation equipment or vehicles	As Needed

2.6 Air Monitoring Program

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

Site-wide monitoring for particulates and VOCs will be conducted during ground intrusive activities, which includes installation of soldier piles along the Site perimeter as part of the support of excavation (SOE) system for the Site-wide foundation excavation, in conformance with the New

York State Department of Health (NYSDOH) Generic Community Air Monitoring Plan (CAMP) (Attachment C). Real-time air monitoring for VOCs and particulate levels will be performed at the perimeter of the work area during ground intrusive activities, and during the handling of contaminated or potentially contaminated media. Ground intrusive activities include, but are not limited to, remedial excavation, site grading, stockpiling soil/fill, and/or loading trucks for off-site disposal.

When the SOE pile installation work area is within 20 feet of potentially exposed populations or occupied structures, the continuous monitoring locations for VOCs and particulates will reflect the nearest potentially exposed individuals and the location of ventilation system intakes for nearby structures. Engineering controls such as temporary vapor/dust barriers, temporary negative-pressure enclosures, and/or special ventilation devices will be considered to prevent exposures related to the work activities and to control dust and odors, if necessary. Consideration will also be given to implementing the planned activities when potentially exposed populations are at a minimum, such as during weekends or evening hours in non-residential settings, if necessary.

2.6.1 Work Zone Air Monitoring

Real time air monitoring of VOCs and particulates will be performed in the work zone during all intrusive Site activities. Work zone air monitoring for VOCs will be performed with a photoionization detector (PID). The PID will be calibrated with 100 parts per million (ppm) isobutylene standard gas in accordance with the manufacturer's instructions at the start of each workday. Work zone air monitoring for particulates will be conducted using a TSI 8530 DustTrak II or equivalent to measure the concentration of airborne respirable particulates less than 10 micrometers in size (PM_{10}).

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

Table 6
Work Zone Air Monitoring Action Levels

Instrument	Action Level	Response Action
PID	Less than 5 ppm in breathing zone	Level D or D-Modified
	Between 5 ppm and 25 ppm	Level C
	More than 25 ppm	Stop work. Resume work when readings are less than 50 ppm
Particulate Monitor (a TSI 8530 DustTrak II or equivalent)	Less than 0.150 mg/m^3 above background in breathing zone	Level D or D-Modified
	More than 0.150 mg/m^3 above background in breathing zone	Stop work. Resume work when readings are less than 0.150 mg/m^3.
Notes: µg/m^3 = micrograms per cubic meter; ppm = parts per million		

2.6.2 Community Air Monitoring Plan

Community air monitoring will be conducted during all intrusive Site activities in compliance with the NYSDOH Generic CAMP and the Site-Specific CAMP, which is presented as Appendix B of the IRMWP.

2.6.3 Personal Protection Equipment

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

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

Table 7
Personal Protection Equipment Requirements

LEVEL OF PROTECTION & PPE		All Tasks
Level D (**X**) Steel Toe Shoes (**X**) Hard Hat (within 25 ft. of excavator) (**X**) Work Gloves	(**X**) Safety Glasses ( ) Face Shield (**X**) Ear Plugs (within 25 ft. of excavator) (**X**) Nitrile Gloves (**X**) Tyvek for tank contractor if NAPL present	Yes
Level C ***(in addition to Level D)*** (**X**) Half-Face Respirator (**X**) Full Face Respirator ( ) Full-Face PAPR	( ) Particulate Cartridge ( ) Organic Cartridge (**X**) Dual Organic/Particulate Cartridge	If PID > 10 ppm or particulate > 150 µg/m^3 in breathing zone
Comments: Cartridges to be changed out at least once per shift unless warranted beforehand (e.g., more difficult to breath or any odors detected). PAPR = powered air purifying respirator		

2.7 General Work Practices

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

- Eating, drinking, chewing gum or tobacco, and smoking are prohibited except in designated areas on the Site. These areas will be designated by the SSO.
- Workers must wash their hands thoroughly on leaving the work area and before eating, drinking, or any other such activity.
- The workers should shower as soon as possible after leaving the Site. Contact with contaminated or suspected surfaces should be avoided.
- The buddy system should always be used; each buddy should watch for signs of fatigue, exposure, and heat/cold stress.
- Supplemental COVID-19 procedures (Appendix A) shall be adhered to during work-related commute and on-site activities, as applicable.

3.0 EMERGENCY PROCEDURES AND EMERGENCY RESPONSE PLAN

The field crew will be equipped with emergency equipment, such as a first aid kit and disposable eye washes. In the case of a medical emergency, the SSO will determine the nature of the emergency and he/she will have someone call for an ambulance, if needed. If the nature of the injury is not serious, i.e., the person can be moved without expert emergency medical personnel, he/she should be driven to the New York – Presbyterian Brooklyn Methodist Hospital by on-site personnel. Directions to the hospital are provided below, and a hospital route map is provided as Figure 2. Report forms are provided in Attachment D. Emergency hand signals are provided in Attachment E.

3.1 Hospital Information

Table 8
Hospital Directions

Hospital Name:	New York – Presbyterian Brooklyn Methodist Hospital
Phone Number:	(718) 780-3000
Address/Location:	506 6th Street, Brooklyn, NY 11215
Directions:	1. Head southwest on 4th Avenue. 2. Turn LEFT onto 7th Street. 3. Turn LEFT onto 8th Avenue. 4. Turn LEFT onto 6th Street. 5. The entrance to the Emergency Room will be on the LEFT.

3.2 Emergency Contacts

Table 9
Emergency Contacts

Company	Individual Name	Title	Contact Number
AKRF	Stephen Malinowski	Project Director, QEP, & Quality Assurance/Quality Control Officer	(631) 574-3724 (Office)
	Kenneth Wiles	Project Manager	(646) 388-9528 (Office)
	Tim Larigan	Deputy Project Manager	(646) 388-9508 (Office)
	Antonio Cardenas	Field Team Leader & Site Safety Officer	(718) 551-7193 (Cell)
380 4th Avenue Owner, LLC	Kyle Cohen	Volunteer's Representative	(914) 886-3056 (Office)
NYSDEC	Michael Sollecito	BCP Project Manager	(518) 402-2198 (Office)
Ambulance, Fire Department & Police Department	-	-	911
NYSDEC Spill Hotline	-	-	800-457-7362

4.0 APPROVAL & ACKNOWLEDGMENTS OF HASP

Signed: ______________________________ Date: ______________________________

AKRF Project Manager

Signed: ______________________________ Date: ______________________________

AKRF Health and Safety Officer

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

AFFIDAVIT

I,_________________________(name), of_______________________________(company name), have read the Health and Safety Plan (HASP) for 380 4th Avenue site located at 374 to 390 4th Avenue in Brooklyn, New York. I agree to conduct all on-site work in accordance with the requirements set forth in this HASP and understand that failure to comply with this HASP could lead to my removal from the Site.

Signed: ________________________ Company: ________________________ Date: __________
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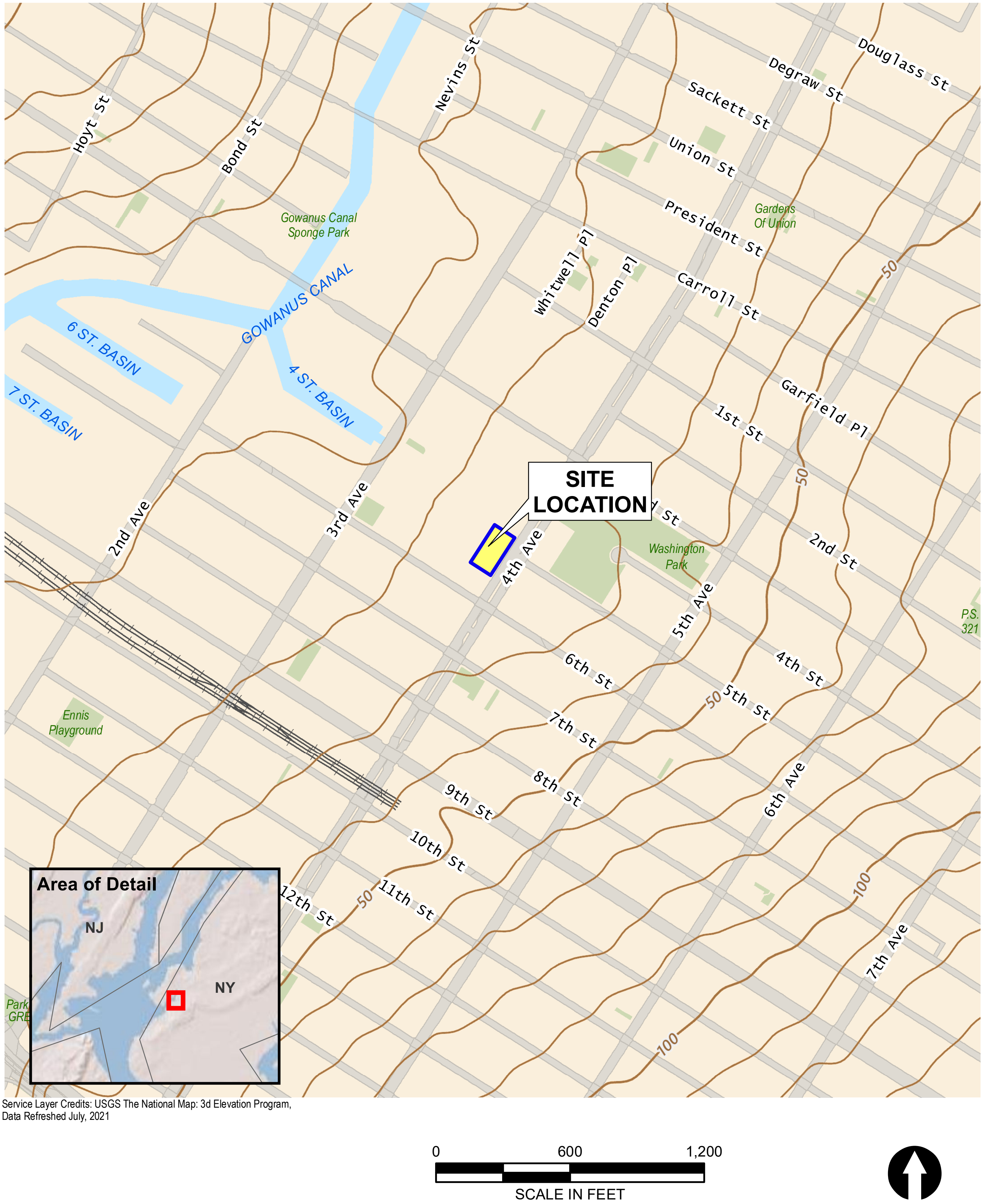
FIGURES



Service Layer Credits: USGS The National Map: 3d Elevation Program,
Data Refreshed July, 2021

AKRF

440 Park Avenue South, New York, NY 10016

380 4th Avenue

Brooklyn, New York

BCP SITE LOCATION

DATE	**5/2/2022**
PROJECT NO.	**210226**
FIGURE	**1**

©2022 AKRF W:\Projects\210226 - QUINLAN E-DESIGNATION 374 4TH AVE\GIS Graphics\SAR\RAWP\210226 Figure 1 BCP site location.mxd5/2/2022 1:17:53 PM mveilleux

Service Layer Credits: ESRI World Street Map 2021

LEGEND

🟨 PROJECT SITE BOUNDARY

— ROUTE TO HOSPITAL

⊕ HOSPITAL LOCATION

NewYork-Presbyterian
Brooklyn Methodist Hospital
NewYork-Presbyterian Brooklyn
Methodist Hospital
506 6th St, Brooklyn, NY 11215

0 500 1,000
SCALE IN FEET

AKRF
440 Park Avenue South, New York, NY 10016

374 4th Avenue
Brooklyn, New York

HOSPITAL ROUTE MAP

DATE
7/20/2021

PROJECT NO.
210226

FIGURE
2

©2021 AKRF W:\Projects\210226 - QUINLAN E-DESIGNATION 374 4TH AVE\GIS Graphics\SAR\210226 Figure 1 Hospital Route Map.mxd7/20/2021 3:53:23 PM jszalus

ATTACHMENT A

COVID-19 PROCEDURES

APPENDIX A

ON-SITE AND OFF-SITE PROCEDURES TO LIMIT CONTAMINATION AND POTENTIAL SPREAD OF COVID-19

Sources: **CDC - COVID-19 Spread and Prevention Information; OSHA - Workplace Preparation Guidance; CDC - Guidance on Extended Use/Limited Reuse of Respiratory Protection**

1) Maintain minimum 6-foot separation from others whenever possible (social distancing). The virus is thought to spread mainly from person-to-person, between people who are in close contact, through respiratory droplets produced when an infected person coughs or sneezes.

2) Wash your hands frequently with soap and water. Wash for at least 20 seconds and, if no soap is present, use a hand sanitizer that contains at least 60% alcohol.

3) Wear nitrile gloves whenever possible and be especially mindful of touching common surfaces.

4) Disinfect commonly touched surfaces frequently, and items frequently used in public immediately upon returning home.

5) Face Coverings and Masks:

   a) On-site: Wear a cloth face covering or mask at all times when there is no issue with maintaining social distancing. N95/KN95 masks or respirators should be reserved for situations where social distancing on-site is difficult or impossible. Appropriate circumstances for donning an N95/KN95 mask or respirator on-site include, but are not necessarily limited to, going inside the Site trailer; and/or entering, exiting, or traversing the Site if proper social distancing cannot be achieved. This tiered approach will help maintain the supply of N95/KN95 masks so they are available for the highest risk scenarios.

   b) Off-site During Work-related Commute: The CDC now recommends wearing cloth face coverings in public settings where other social distancing measures are difficult to maintain (https://www.cdc.gov/coronavirus/2019-ncov/prevent-getting-sick/cloth-face-cover.html). A mask or cloth face covering should worn during your commute to and from the site if you are unable to achieve proper social distancing. Appropriate times to wear a mask or cloth face covering include, but are not necessarily limited to, walking on crowded sidewalks, traveling in a shared vehicle, and/or if you are required to enter an occupied indoor space to acquire supplies for the site.

6) Wear safety glasses or goggles at all times while on-site and some form of eye covering (e.g., sunglasses, prescription and non-prescription glasses, or safety glasses) should be considered when commuting.

7) Avoid touching your face (eyes, nose, and mouth).

8) Cover your nose and mouth when coughing, sneezing, etc./ cough into elbow.

9) Do not spit.

10) Try to take your temperature regularly.

11) Talk to your supervisor if you, your friends or family members that you live with or spend time with have displayed symptoms of COVID-19, tested positive, or are afflicted with even the common cold/flu.

12) Talk to your supervisor if anyone you know at the site tested positive for the COVID-19.

13) Follow any additional health & safety protocols required at the site or elsewhere.

ATTACHMENT B

POTENTIAL HEALTH EFFECTS FROM ON-SITE CONTAMINANTS

ATSDR
AGENCY FOR TOXIC SUBSTANCES
AND DISEASE REGISTRY

ANTIMONY
CAS # 7440-36-0

Agency for Toxic Substances and Disease Registry ToxFAQs **September 1995**

This fact sheet answers the most frequently asked health questions (FAQs) about antimony. 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 antimony occurs in the workplace or from skin contact with soil at hazardous waste sites. Breathing high levels of antimony for a long time can irritate the eyes and lungs, and can cause problems with the lungs, heart, and stomach. This chemical has been found in at least 403 of 1,416 National Priorities List sites identified by the Environmental Protection Agency.

What is antimony?
(Pronounced ăn′tə-mō′nē)

Antimony is a silvery-white metal that is found in the earth’s crust. Antimony ores are mined and then mixed with other metals to form antimony alloys or combined with oxygen to form antimony oxide.

Little antimony is currently mined in the United States. It is brought into this country from other countries for processing. However, there are companies in the United States that produce antimony as a by-product of smelting lead and other metals.

Antimony isn't used alone because it breaks easily, but when mixed into alloys, it is used in lead storage batteries, solder, sheet and pipe metal, bearings, castings, and pewter. Antimony oxide is added to textiles and plastics to prevent them from catching fire. It is also used in paints, ceramics, and fireworks, and as enamels for plastics, metal, and glass.

What happens to antimony when it enters the environment?

- ☐ Antimony is released to the environment from natural sources and from industry.
- ☐ In the air, antimony is attached to very small particles that may stay in the air for many days.
- ☐ Most antimony ends up in soil, where it attaches strongly to particles that contain iron, manganese, or aluminum.
- ☐ Antimony is found at low levels in some rivers, lakes, and streams.

How might I be exposed to antimony?

- ☐ Because antimony is found naturally in the environment, the general population is exposed to low levels of it every day, primarily in food, drinking water, and air.
- ☐ It may be found in air near industries that process or release it, such as smelters, coal-fired plants, and refuse incinerators.
- ☐ In polluted areas containing high levels of antimony, it may be found in the air, water, and soil.
- ☐ Workers in industries that process it or use antimony ore may be exposed to higher levels.

How can antimony affect my health?

Exposure to antimony at high levels can result in a variety of adverse health effects.

Breathing high levels for a long time can irritate your eyes and lungs and can cause heart and lung problems, stomach pain, diarrhea, vomiting, and stomach ulcers.

In short-term studies, animals that breathed very high levels of antimony died. Animals that breathed high levels had lung, heart, liver, and kidney damage. In long-term studies, animals that breathed very low levels of antimony had eye irritation, hair loss, lung damage, and heart problems. Problems with fertility were also noted. In animal studies, problems with fertility have been seen when rats breathed very high levels of antimony for a few months.

Ingesting large doses of antimony can cause vomiting. We don't know what other effects may be caused by ingesting it. Long-term animal studies have reported liver damage and blood changes when animals ingested antimony. Antimony can irritate the skin if it is left on it.

Antimony can have beneficial effects when used for medical reasons. It has been used as a medicine to treat people infected with parasites.

How likely is antimony to cause cancer?

The Department of Health and Human Services, the International Agency for Research on Cancer, and the Environmental Protection Agency (EPA) have not classified antimony as to its human carcinogenicity.

Lung cancer has been observed in some studies of rats that breathed high levels of antimony. No human studies are available. We don't know whether antimony will cause cancer in people.

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

Tests are available to measure antimony levels in the body. Antimony can be measured in the urine, feces, and blood for several days after exposure. However, these tests cannot tell you how much antimony you have been exposed to or whether you will experience any health effects. Some tests are not usually performed in most doctors' offices and may require special equipment to conduct them.

Has the federal government made recommendations to protect human health?

The EPA allows 0.006 parts of antimony per million parts of drinking water (0.006 ppm). The EPA requires that discharges or spills into the environment of 5,000 pounds or more of antimony be reported.

The Occupational Safety and Health Administration (OSHA) has set an occupational exposure limit of 0.5 milligrams of antimony per cubic meter of air (0.5 mg/m^3) for an 8-hour workday, 40-hour workweek.

The American Conference of Governmental Industrial Hygienists (ACGIH) and the National Institute for Occupational Safety and Health (NIOSH) currently recommend the same guidelines for the workplace as OSHA.

Glossary

Carcinogenicity: Ability to cause cancer.
CAS: Chemical Abstracts Service.
Ingestion: Taking food or drink into your body.
Long-term: Lasting one year or more.
Milligram (mg): One thousandth of a gram.
Parasite: An organism living in or on another organism.
ppm: Parts per million.
Short-term: Lasting 14 days or less.

References

Agency for Toxic Substances and Disease Registry (ATSDR). 1992. Toxicological profile for antimony. 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

ARSENIC
CAS # 7440-38-2

Division of Toxicology ToxFAQs™ December 2003

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

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

What is arsenic?

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

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

What happens to arsenic when it enters the environment?

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

How might I be exposed to arsenic?

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

How can arsenic affect my health?

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

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

Skin contact with inorganic arsenic may cause redness and swelling.

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

How likely is arsenic to cause cancer?

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

How can arsenic affect children?

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

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

How can families reduce the risk of exposure to arsenic?

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

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

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

Has the federal government made recommendations to protect human health?

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

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

Source of Information

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

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

ATSDR
AGENCY FOR TOXIC SUBSTANCES
AND DISEASE REGISTRY

BARIUM AND COMPOUNDS

CAS # 7440-39-3

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

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

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

What is barium?

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

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

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

What happens to barium when it enters the environment?

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

How might I be exposed to barium?

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

How can barium affect my health?

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

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

How likely is barium to cause cancer?

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

How can barium affect children?

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

How can families reduce the risks of exposure to barium?

The greatest potential source of barium exposure is through food and drinking water. However, the amount of barium in foods and drinking water are typically too low to be of concern.

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

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

The geometric mean barium level measured in the U.S. general population aged 6 and older is reported by the Centers for Disease Control and Prevention (CDC) as 1.44 µg/g creatinine (measured in urine).

Has the federal government made recommendations to protect human health?

The EPA has set a limit of 2.0 milligrams of barium per liter of drinking water (2.0 mg/L), which is the same as 2 ppm.

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

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

References

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

Where can I get more information? For more information, contact the Agency for Toxic Substances and Disease Registry, Division of Toxicology and Environmental Medicine, 1600 Clifton Road NE, Mailstop F-32, Atlanta, GA 30333. Phone: 1-800-232-4636, FAX: 770-488-4178. ToxFAQs Internet address via WWW is http://www.atsdr.cdc.gov/toxfaq.html. ATSDR can tell you where to find occupational and environmental health clinics. Their specialists can recognize, evaluate, and treat illnesses resulting from exposure to hazardous substances. You can also contact your community or state health or environmental quality department if you have any more questions or concerns.

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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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BERYLLIUM

CAS #7440-41-7

Division of Toxicology ToxFAQs™ **September 2002**

This fact sheet answers the most frequently asked health questions (FAQs) about beryllium. 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: People working or living near beryllium industries have the greatest potential for exposure to beryllium. Lung damage has been observed in people exposed to high levels of beryllium in the air. About 1-15% of all people occupationally-exposed to beryllium in air become sensitive to beryllium and may develop chronic beryllium disease (CBD), an irreversible and sometimes fatal scarring of the lungs. CBD may be completely asymptomatic or begin with coughing, chest pain, shortness of breath, weakness, and/or fatigue. Beryllium has been found in at least 535 of the 1,613 National Priorities List sites identified by the Environmental Protection Agency (EPA).

What is beryllium?

Beryllium is a hard, grayish metal naturally found in mineral rocks, coal, soil, and volcanic dust. Beryllium ore is mined, and the beryllium is purified for use in nuclear weapons and reactors, aircraft and space vehicle structures, instruments, x-ray machines, and mirrors. Beryllium oxide is used to make speciality ceramics for electrical and high-technology applications. Beryllium alloys are used in automobiles, computers, sports equipment (golf clubs), and dental bridges.

What happens to beryllium when it enters the environment?

❑ Beryllium dust enters the air from burning coal and oil. This beryllium dust will eventually settle over the land and water.
❑ It enters water from erosion of rocks and soil, and from industrial waste. Some beryllium compounds will dissolve in water, but most stick to particles and settle to the bottom.
❑ Most beryllium in soil does not dissolve in water and remains bound to soil.
❑ Beryllium does not accumulate in the food chain.

How might I be exposed to beryllium?

❑ The general population is normally exposed to low levels of beryllium in air, food, and water.
❑ People working in industries where beryllium is mined, processed, machined, or converted into metal, alloys, and other chemicals may be exposed to high levels of beryllium. People living near these industries may also be exposed to higher than normal levels of beryllium in air.
❑ People living near uncontrolled hazardous waste sites may be exposed to higher than normal levels of beryllium.

How can beryllium affect my health?

Beryllium can be harmful if you breathe it. The effects depend on how much you are exposed to, for how long, and individual susceptibility. If beryllium air levels are high enough (greater than 1000 ug/m^3), an acute condition can result. This condition resembles pneumonia and is called acute beryllium disease Occupational and community air standards are effective in preventing acute lung damage.

Some exposed workers (1-15%) become sensitive to beryllium. These individuals may develop an inflammatory reaction in the respiratory system. This condition is called chronic beryllium disease (CBD), and can occur years after exposure to higher than normal levels of beryllium (greater than 0.2 ug/m^3). This disease can make you feel weak and tired, and can cause difficulty in breathing. It can also result in anorexia, weight loss, and may also lead to right side heart enlargement and heart disease in advanced cases. Some people who are sensitized to beryllium may not have any symptoms. The general population is unlikely to develop chronic beryllium disease because ambient air levels of beryllium are normally very low (0.00003-0.0002 ug/m^3).

Swallowing beryllium has not been reported to cause effects in humans because very little beryllium is absorbed from the stomach and intestines. Ulcers have been seen in dogs ingesting beryllium in the diet. Beryllium contact with skin that has been scraped or cut may cause rashes or ulcers.

How likely is beryllium to cause cancer?

Long term exposure to beryllium can increase the risk of developing lung cancer in people.

The Department of Health and Human Services (DHHS) and the International Agency for Research on Cancer (IARC) have determined that beryllium is a human carcinogen. The EPA has determined that beryllium is a probable human carcinogen. EPA has estimated that lifetime exposure to 0.04 ug/m^3 beryllium can result in a one in a thousand chance of developing cancer.

How can beryllium affect children?

It is likely that the health effects seen in children exposed to beryllium will be similar to the effects seen in adults. We do not know whether children differ from adults in their susceptibility to beryllium.

We do not know if exposure to beryllium will result in birth defects or other developmental effects in people. The studies on developmental effects in animals are not conclusive.

How can families reduce the risk of exposure to beryllium?

☐ Individuals working at facilities that use beryllium should make sure that contaminated clothing and objects are not brought home.

☐ Children should avoid playing in soils near uncontrolled hazardous waste sites where beryllium may have been discarded.

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

Beryllium can be measured in samples from your blood, urine, skin, or lungs. These tests are rarely done because they are not reliable measures of your exposure over time. Also, these tests do not show if you have become sensitized to beryllium.

Another test, the beryllium lymphocyte proliferation test (BeLPT), can help your doctor decide if you are sensitized to beryllium. This test is only done in a few specialized laboratories, but doctors familiar with the test can collect blood samples and send them for testing by overnight carrier. The BeLPT is most often done for people who work with beryllium. It is also useful for separating chronic beryllium disease from diagnoses that resemble it (for example, sarcoidosis). Depending on your exposure history, clinical findings, and test results, your doctor may also recommend additional specialized testing.

Has the federal government made recommendations to protect human health?

The EPA restricts the amount of beryllium that industries may release into the air to 0.01 ug/m^3, averaged over a 30-day period.

The Occupational Safety and Health Administration (OSHA) sets a limit of 2 ug/m^3 for an 8-hour work shift measured as a personal sample.

References

Agency for Toxic Substances and Disease Registry (ATSDR). 2002. Toxicological Profile for Beryllium 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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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.

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

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.

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CHLOROFORM

CAS # 67-66-3

Agency for Toxic Substances and Disease Registry ToxFAQs September 1997

This fact sheet answers the most frequently asked health questions (FAQs) about chloroform. 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 chloroform can occur when breathing contaminated air or when drinking or touching the substance or water containing it. Breathing chloroform can cause dizziness, fatigue, and headaches. Breathing chloroform or ingesting chloroform over long periods of time may damage your liver and kidneys. It can cause sores if large amounts touch your skin. This substance has been found in at least 717 of the 1,430 National Priorities List sites identified by the Environmental Protection Agency (EPA).

What is chloroform?
(Pronounced klôr′ə-fôrm′)

Chloroform is a colorless liquid with a pleasant, nonirritating odor and a slightly sweet taste. It will burn only when it reaches very high temperatures.

In the past, chloroform was used as an inhaled anesthetic during surgery, but it isn't used that way today. Today, chloroform is used to make other chemicals and can also be formed in small amounts when chlorine is added to water.

Other names for chloroform are trichloromethane and methyl trichloride.

What happens to chloroform when it enters the environment?

- ☐ Chloroform evaporates easily into the air.
- ☐ Most of the chloroform in air breaks down eventually, but it is a slow process.
- ☐ The breakdown products in air include phosgene and hydrogen chloride, which are both toxic.
- ☐ It doesn't stick to soil very well and can travel through soil to groundwater.
- ☐ Chloroform dissolves easily in water and some of it may break down to other chemicals.
- ☐ Chloroform lasts a long time in groundwater.
- ☐ Chloroform doesn't appear to build up in great amounts in plants and animals.

How might I be exposed to chloroform?

- ☐ Drinking water or beverages made using water containing chloroform.
- ☐ Breathing indoor or outdoor air containing it, especially in the workplace.
- ☐ Eating food that contains it.
- ☐ Skin contact with chloroform or water that contains it, such as in swimming pools.

How can chloroform affect my health?

Breathing about 900 parts of chloroform per million parts air (900 ppm) for a short time can cause dizziness, fatigue, and headache. Breathing air, eating food, or drinking water containing high levels of chloroform for long periods of time may damage your liver and kidneys. Large amounts of chloroform can cause sores when chloroform touches your skin.

It isn't known whether chloroform causes reproductive effects or birth defects in people.

Animal studies have shown that miscarriages occurred in rats and mice that breathed air containing 30 to 300 ppm chloroform during pregnancy and also in rats that ate chloroform during pregnancy. Offspring of rats and mice that breathed chloroform during pregnancy had birth defects. Abnormal sperm were found in mice that breathed air containing 400 ppm chloroform for a few days.

How likely is chloroform to cause cancer?

The Department of Health and Human Services (DHHS) has determined that chloroform may reasonably be anticipated to be a carcinogen.

Rats and mice that ate food or drank water with chloroform developed cancer of the liver and kidneys.

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

Although the amounts of chloroform in the air that you exhale and in blood, urine, and body tissues can be measured, there is no reliable test to determine how much chloroform you have been exposed to or whether you will experience any harmful effects.

The measurement of chloroform in body fluids and tissues may help to determine if you have come into contact with large amounts of chloroform, but these tests are useful for only a short time after you are exposed. Chloroform in your body might also indicate that you have come into contact with other chemicals.

Has the federal government made recommendations to protect human health?

The EPA drinking water limit for total trihalomethanes, a class of chemicals that includes chloroform, is 100 micrograms per liter of water (100 µg/L).

The EPA requires that spills or accidental releases of 10 pounds or more of chloroform into the environment be reported to the EPA.

The Occupational Safety and Health Administration (OSHA) has set the maximum allowable concentration of chloroform in workroom air during an 8-hour workday in a 40-hour workweek at 50 ppm.

Glossary

Carcinogenicity: A substance with the ability to cause cancer.

CAS: Chemical Abstracts Service.

Ingesting: Taking food or drink into your body.

Microgram (µg): One millionth of a gram.

Miscarriage: Pregnancy loss.

ppm: Parts per million.

References

This ToxFAQs information is taken from the 1997 Toxicological Profile for Chloroform (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
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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.

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DDT, DDE, AND DDD

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

Division of Toxicology ToxFAQs™ September 2002

This fact sheet answers the most frequently asked health questions (FAQs) about DDT, DDE, and DDD. 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: Exposure to DDT, DDE, and DDD occurs mostly from eating foods containing small amounts of these compounds, particularly meat, fish and poultry. High levels of DDT can affect the nervous system causing excitability, tremors and seizures. In women, DDE can cause a reduction in the duration of lactation and an increased chance of having a premature baby. DDT, DDE, and DDD have been found in at least 441 of the 1,613 National Priorities List sites identified by the Environmental Protection Agency (EPA).

What are DDT, DDE, and DDD?

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

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

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

❏ DDT entered the environment when it was used as a pesticide; it still enters the environment due to current use in other countries.

❏ DDE enters the environment as contaminant or breakdown product of DDT; DDD also enters the environment as a breakdown product of DDT.

❏ DDT, DDE, and DDD in air are rapidly broken down by sunlight. Half of what's in air breaks down within 2 days.

❏ They stick strongly to soil; most DDT in soil is broken down slowly to DDE and DDD by microorganisms; half the DDT in soil will break down in 2-15 years, depending on the type of soil.

❏ Only a small amount will go through the soil into groundwater; they do not dissolve easily in water.

❏ DDT, and especially DDE, build up in plants and in fatty tissues of fish, birds, and other animals.

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

❏ Eating contaminated foods, such as root and leafy vegetables, fatty meat, fish, and poultry, but levels are very low.

❏ Eating contaminated imported foods from countries that still allow the use of DDT to control pests.

❏ Breathing contaminated air or drinking contaminated water near waste sites and landfills that may contain higher levels of these chemicals.

❏ Infants fed on breast milk from mothers who have been exposed.

❏ Breathing or swallowing soil particles near waste sites or landfills that contain these chemicals.

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

DDT affects the nervous system. People who accidentally swallowed large amounts of DDT became excitable and had tremors and seizures. These effects went away after the exposure stopped. No effects were seen in people who took small daily doses of DDT by capsule for 18 months.

A study in humans showed that women who had high amounts of a form of DDE in their breast milk were unable to breast feed their babies for as long as women who had little DDE in the breast milk. Another study in humans showed that women who had high amounts of DDE in breast milk had an increased chance of having premature babies.

In animals, short-term exposure to large amounts of DDT in food affected the nervous system, while long-term exposure to smaller amounts affected the liver. Also in animals, short-term oral exposure to small amounts of DDT or its breakdown products may also have harmful effects on reproduction.

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

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

The Department of Health and Human Services (DHHS) determined that DDT may reasonable be anticipated to be a human carcinogen. The International Agency for Research on Cancer (IARC) determined that DDT may possibly cause cancer in humans. The EPA determined that DDT, DDE, and DDD are probable human carcinogens.

How can DDT, DDE, and DDD affect children?

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

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

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

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

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

☐ Most families will be exposed to DDT by eating food or drinking liquids contaminated with small amounts of DDT.

☐ Cooking will reduce the amount of DDT in fish.

☐ Washing fruit and vegetables will remove most DDT from their surface.

☐ Follow health advisories that tell you about consumption of fish and wildlife caught in contaminated areas.

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

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

Has the federal government made recommendations to protect human health?

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

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

References

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

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

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ETHYLBENZENE

CAS # 100-41-4

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

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

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

What is ethylbenzene?

(Pronounced ĕth′ əl bĕn′ zēn′)

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

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

What happens to ethylbenzene when it enters the environment?

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

How might I be exposed to ethylbenzene?

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

How can ethylbenzene affect my health?

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

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

How likely is ethylbenzene to cause cancer?

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

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

How can ethylbenzene affect children?

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

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

How can families reduce the risk of exposure to ethylbenzene?

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

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

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

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

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

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

Has the federal government made recommendations to protect human health?

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

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

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

References

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

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AND DISEASE REGISTRY

FUEL OILS

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

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

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

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

What are fuel oils?

(Pronounced fyo͞o′əl oilz)

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

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

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

What happens to fuel oils when they enter the environment?

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

How might I be exposed to fuel oils?

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

How can fuel oils affect my health?

Little information is available about the health effects that may be caused by fuel oils. People who use kerosene stoves for cooking do not seem to have any health problems related to their exposure.

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

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

How likely are fuel oils to cause cancer?

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

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

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

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

Has the federal government made recommendations to protect human health?

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

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

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

Glossary

Carcinogenic: Able to cause cancer.

CAS: Chemical Abstracts Service.

Evaporate: To change into a vapor or a gas.

Hydrocarbon: Any compound made up of hydrogen and carbon.

Milligram (mg): One thousandth of a gram.

ppm: Parts per million.

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

References

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

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

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AGENCY FOR TOXIC SUBSTANCES
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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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MANGANESE

CAS # 7439-96-5

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

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

What is manganese?

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

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

What happens to manganese when it enters the environment?

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

How might I be exposed to manganese?

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

How can manganese affect my health?

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

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

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

How likely is manganese to cause cancer?

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

How can manganese affect children?

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

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

How can families reduce the risks of exposure to manganese?

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

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

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

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

Has the federal government made recommendations to protect human health?

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

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

The FDA has determined that the manganese concentration in bottled drinking water should not exceed 0.05 mg/L.

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

References

Agency for Toxic Substances and Disease Registry (ATSDR). 2008. Toxicological Profile for Manganese (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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2-BUTANONE
CAS # 78-93-3

Agency for Toxic Substances and Disease Registry ToxFAQs **September 1995**

This fact sheet answers the most frequently asked health questions (FAQs) about 2-butanone. 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 2-butanone occurs in the workplace or from using consumer products containing it. Mild irritations of the eyes, nose, and throat were seen in people who breathed 2-butanone. This chemical has been found in at least 472 of 1,416 National Priorities List sites identified by the Environmental Protection Agency.

What is 2-butanone?
(Pronounced 2-byo͞o′tə-nōn)

2-Butanone is a manufactured chemical but it is also present in the environment from natural sources. It is a colorless liquid with a sharp, sweet odor. It is also known as methyl ethyl ketone (MEK).

2-Butanone is produced in large quantities. Nearly half of its use is in paints and other coatings because it will quickly evaporate into the air and it dissolves many substances. It is also used in glues and as a cleaning agent.

2-Butanone occurs as a natural product. It is made by some trees and found in some fruits and vegetables in small amounts. It is also released to the air from car and truck exhausts.

What happens to 2-butanone when it enters the environment?

- ☐ 2-Butanone enters the air during production, use and transport, and from hazardous waste sites.
- ☐ In air, one-half of it will break down from sunlight in 1 day or less.
- ☐ It dissolves in water and is broken down more slowly to a simpler chemical form in about 2 weeks.
- ☐ It does not stick to soil and will travel through the soil to the groundwater.
- ☐ Some of the 2-butanone in soil or water will evaporate into the air.
- ☐ It does not deposit in the bottom of rivers or lakes.
- ☐ It is not expected to concentrate in fish or increase in the tissues of animals further up the food chain.

How might I be exposed to 2-butanone?

- ☐ Breathing contaminated air from the production or use of paints, glues, coatings, or cleaning agents containing it.
- ☐ Breathing contaminated air near hazardous waste sites.
- ☐ Breathing cigarette smoke.
- ☐ Sniffing glues.
- ☐ Drinking contaminated water from wells near manufacturing or hazardous waste sites.
- ☐ Skin contact with the liquid during production or use.

How can 2-butanone affect my health?

The known health effects to people from exposure to 2-butanone are irritation of the nose, throat, skin, and eyes. No one has died from breathing 2-butanone alone. If 2-butanone is breathed along with other chemicals that damage health, it can increase the amount of damage that occurs.

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Serious health effects in animals have been seen only at very high levels. When breathed, these effects included birth defects, loss of consciousness, and death.

When swallowed, rats had nervous system effects including drooping eyelids and uncoordinated muscle movements. There was no damage to the ability to reproduce.

Mice who breathed low levels for a short time showed temporary behavioral effects. Mild kidney damage was seen in animals that drank water with lower levels of 2-butanone for a short time.

There are no long-term studies with animals either breathing or drinking 2-butanone.

How likely is 2-butanone to cause cancer?

The Department of Health and Human Services has not classified 2-butanone as to its human carcinogenicity.

The International Agency for Research on Cancer and the Environmental Protection Agency (EPA) have also not classified 2-butanone as to its human carcinogenicity.

Two studies of workers exposed to 2-butanone and other chemicals did not find an increase in cancer. No animal studies are available that examine the potential for 2-butanone to cause cancer.

Is there a medical test to show whether I've been exposed to 2-butanone?

Tests are available to measure 2-butanone or its breakdown products in blood, breath, and urine. These tests are useful only to measure recent exposures because 2-butanone and its breakdown products leave the body rapidly. These tests are not usually performed at your doctor's office, but your doctor can take blood or urine samples and send them to a testing laboratory.

Has the federal government made recommendations to protect human health?

The EPA requires that discharges or spills into the environment of 5,000 pounds of more of 2-butanone be reported.

The Occupational Safety and Health Administration (OSHA) set an occupational exposure limit of 200 parts of 2-butanone per million parts of workplace air (200 ppm) for an 8-hour workday, 40-hour workweek.

The American Conference of Governmental Industrial Hygienists (ACGIH) and the National Institute for Occupational Safety and Health (NIOSH) have established the same guidelines as OSHA for the workplace.

Glossary

Carcinogenicity: Ability to cause cancer.

Evaporate: To change into a vapor or a gas.

ppm: Parts per million.

Long-term: Lasting one year or longer.

Short time: Lasting 14 days or less.

References

Agency for Toxic Substances and Disease Registry (ATSDR). 1992. Toxicological profile for 2-butanone. 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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MERCURY

CAS # 7439-97-6

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

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

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

What is mercury?

(Pronounced mū̃r′kyə-rē)

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

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

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

What happens to mercury when it enters the environment?

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

How might I be exposed to mercury?

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

How can mercury affect my health?

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

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

How likely is mercury to cause cancer?

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

How can mercury affect children?

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

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

How can families reduce the risk of exposure to mercury?

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

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

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

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

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

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

Has the federal government made recommendations to protect human health?

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

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

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

References

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

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

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AGENCY FOR TOXIC SUBSTANCES
AND DISEASE REGISTRY

METHYLENE CHLORIDE

CAS # 75-09-2

Division of Toxicology ToxFAQs™ **February 2001**

This fact sheet answers the most frequently asked health questions (FAQs) about methylene chloride. 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 methylene chloride occurs mostly from breathing contaminated air, but may also occur through skin contact or by drinking contaminated water. Breathing in large amounts of methylene chloride can damage the central nervous system. Contact of eyes or skin with methylene chloride can result in burns. Methylene chloride has been found in at least 882 of 1,569 National Priorities List sites identified by the Environmental Protection Agency (EPA).

What is methylene chloride?

Methylene chloride is a colorless liquid with a mild, sweet odor. Another name for it is dichloromethane. Methylene chloride does not occur naturally in the environment.

Methylene chloride is used as an industrial solvent and as a paint stripper. It may also be found in some aerosol and pesticide products and is used in the manufacture of photographic film.

What happens to methylene chloride when it enters the environment?

❑ Methylene chloride is mainly released to the environment in air. About half of the methylene chloride in air disappears in 53 to 127 days.

❑ Methylene chloride does not easily dissolve in water, but small amounts may be found in drinking water.

❑ We do not expect methylene chloride to build up in plants or animals.

How might I be exposed to methylene chloride?

❑ The most likely way to be exposed to methylene chloride is by breathing contaminated air.

❑ Breathing the vapors given off by products containing methylene chloride. Exposure to high levels of methylene chloride is likely if methylene chloride or a product containing it is used in a room with inadequate ventilation.

How can methylene chloride affect my health?

If you breathe in large amounts of methylene chloride you may feel unsteady, dizzy, and have nausea and a tingling or numbness of your finger and toes. A person breathing smaller amounts of methylene chloride may become less attentive and less accurate in tasks requiring hand-eye coordination. Skin contact with methylene chloride causes burning and redness of the skin.

How likely is methylene chloride to cause cancer?

We do not know if methylene chloride can cause cancer in humans. An increased cancer risk was seen in mice

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

breathing large amounts of methylene chloride for a long time.

The World Health Organization (WHO) has determined that methylene chloride may cause cancer in humans.

The Department of Health and Human Services (DHHS) has determined that methylene chloride can be reasonably anticipated to be a cancer-causing chemical.

The EPA has determined that methylene chloride is a probable cancer-causing agent in humans.

How can methylene chloride affect children?

It is likely that health effects seen in children exposed to high amounts of methylene chloride will be similar to the effects seen in adults. We do not know if methylene chloride can affect the ability of people to have children or if it causes birth defects. Some birth defects have been seen in animals inhaling very high levels of methylene chloride.

How can families reduce the risk of exposure to methylene chloride?

❑ Families may be exposed to methylene chloride while using products such as paint removers. Such products should always be used in well-ventilated areas and skin contact should be avoided.
❑ Children should not be allowed to remain near indoor paint removal activities.

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

❑ Several tests can measure exposure to methylene chloride. These tests are not routinely available in your doctor's office.
❑ Methylene chloride can be detected in the air you breathe out and in your blood. These tests are only useful for detecting exposures that have occurred within a few days.
❑ It is also possible to measure carboxyhemoglobin (a chemical formed in the blood as methylene chloride breaks down in the body) in the blood or formic acid (a breakdown product of methylene chloride) in the urine. These tests are not specific for methylene chloride.

Has the federal government made recommendations to protect human health?

❑ The EPA requires that releases of methylene chloride of 1,000 pounds or more be reported to the federal government.
❑ The EPA recommends that exposure of children to methylene chloride be limited to less than 10 milligrams per liter of drinking water (10 mg/L) for 1 day or 2 mg/L for 10 days.
❑ The Food and Drug Administration (FDA) has established limits on the amounts of methylene chloride that can remain after processing of spices, hops extract, and decaffeinated coffee.
❑ The Occupational Safety and Health Administration (OSHA) has set limits of 25 parts methylene chloride per million parts of workplace air (25 ppm) for 8-hour shifts and 40-hour work weeks.

References

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

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

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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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NICKEL

CAS # 7440-02-0

Division of Toxicology ToxFAQs™ **August 2005**

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

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

What is nickel?

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

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

What happens to nickel when it enters the environment?

❏ Nickel is released into the atmosphere by industries that make or use nickel, nickel alloys, or nickel compounds. It is also released into the atmosphere by oil-burning power plants, coal-burning power plants, and trash incinerators.
❏ In the air, it attaches to small particles of dust that settle to the ground or are taken out of the air in rain or snow; this usually takes many days.
❏ Nickel released in industrial waste water ends up in soil or sediment where it strongly attaches to particles containing iron or manganese.
❏ Nickel does not appear to accumulate in fish or in other animals used as food.

How might I be exposed to nickel?

❏ By eating food containing nickel, which is the major source of exposure for most people.
❏ By skin contact with soil, bath or shower water, or metals containing nickel, as well as by handling coins or touching jewelry containing nickel.
❏ By drinking water that contains small amounts of nickel.
❏ By breathing air or smoking tobacco containing nickel.
❏ Higher exposure may occur if you work in industries that process or use nickel.

How can nickel affect my health?

The most common harmful health effect of nickel in humans is an allergic reaction. Approximately 10-20% of the population is sensitive to nickel. People can become sensitive to nickel when jewelry or other things containing it are in direct contact with the skin for a long time. Once a person is sensitized to nickel, further contact with the metal may produce a reaction. The most common reaction is a skin rash at the site of contact. The skin rash may also occur at a site away from the site of contact. Less frequently, some people who are sensitive to nickel have asthma attacks following exposure to nickel. Some sensitized people react when they consume food or water containing nickel or breathe dust containing it.

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

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

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

How likely is nickel to cause cancer?

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

How can nickel affect children?

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

How can families reduce the risks of exposure to nickel?

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

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

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

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

Has the federal government made recommendations to protect human health?

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

References

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

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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.

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PHENOL

CAS # 108-95-2

Division of Toxicology and Environmental Medicine ToxFAQs™ **September 2006**

This fact sheet answers the most frequently asked health questions (FAQs) about phenol. 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: Phenol is both a manufactured chemical and a natural substance. Phenol is used as a disinfectant and is found in a number of consumer products. Skin exposure to high amounts can produce skin burns, liver damage, dark urine, irregular heart beat, and even death. Ingestion of concentrated phenol can produce internal burns. Phenol has been found in at least 595 of the 1,678 National Priority List (NPL) sites identified by the Environmental Protection Agency (EPA).

What is phenol?

Phenol is both a manufactured chemical and a natural substance. It is a colorless-to-white solid when pure. The commercial product is a liquid. Phenol has a distinct odor that is sickeningly sweet and tarry.

You can taste and smell phenol at levels lower than those that are associated with harmful effects. Phenol evaporates more slowly than water, and a moderate amount can form a solution with water. Phenol can catch fire.

Phenol is used primarily in the production of phenolic resins and in the manufacture of nylon and other synthetic fibers. It is also used in slimicides (chemicals that kill bacteria and fungi in slimes), as a disinfectant and antiseptic, and in medicinal preparations such as mouthwash and sore throat lozenges.

What happens to phenol when it enters the environment?

❑ Following small, single releases, phenol is rapidly removed from the air (generally, half is removed in less than a day).
❑ Phenol generally remains in the soil only about 2 to 5 days.
❑ Phenol can remain in water for a week or more.
❑ Larger or repeated releases of phenol can remain in the air, water, and soil for much longer periods of time.
❑ Small amounts of phenol may be found in organisms that live in contaminated water.
❑ Phenol does not build up in fish, other animals, or plants.

How might I be exposed to phenol?

❑ You may be exposed to phenol if you live near landfills or hazardous waste sites that contain phenol or near facilities manufacturing phenol.
❑ You may be exposed to very low levels in your home because it is found in a number of consumer products, including mouthwashes, gargles, and throat lozenges.
❑ You may be exposed to phenol if you undergo "chemical peels" to remove skin lesions with phenol-containing products or are treated for chronic pain or spasticity with injections of phenol.
❑ Low levels of phenol are found in some foods, including smoked summer sausage, fried chicken, mountain cheese, and some species of fish.
❑ Smoking or inhaling second hand smoke will expose you to phenol.
❑ Low levels of phenol can be present in air and drinking water.

How can phenol affect my health?

Short-term exposure to phenol in the air can cause respiratory irritation, headaches, and burning eyes. People who had skin exposure to high amounts of phenol had skin burns, liver damage, dark urine, irregular heart beat, and some died. Ingestion of high concentrations of phenol has resulted in internal burns and death. The effects of prolonged exposure to low levels of phenol in air or of ingestion of low levels of phenol are uncertain because almost always there has been simultaneous exposure to other chemicals.

In animals, breathing air with high levels of phenol resulted in irritation of the lungs. Repeated exposures induced muscle tremors and loss of coordination. Exposure to high concentrations of phenol in the air for several weeks caused paralysis and severe injury to the heart, liver, kidneys, and lungs, and in some cases, death. Some animals that drank water with very high concentrations of phenol suffered muscle tremors and loss of coordination.

Phenol can have beneficial effects when used medically as an antiseptic or anesthetic.

How likely is phenol to cause cancer?

It is not known if phenol causes cancer in humans. Cancer developed in mice when phenol was applied to the skin several times per week for the lifetime of the animal. Phenol did not cause cancer in mice or rats that drank water containing it for 2 years. The International Agency for Research on Cancer (IARC) and the EPA have determined that phenol is not classifiable as to its carcinogenicity to humans.

How can phenol affect children?

Children are exposed to phenol in the same way adults are, except for exposures of adults at work. However, children are at greater risk of accidentally ingesting or spilling on their skin home products that contain phenol. Vomiting and lethargy were the most frequent signs of toxicity observed in children who accidentally ingested phenol and were treated at a poison control center.

Phenol has caused minor birth defects and low birth weight in animals generally at exposure levels that also were toxic to the pregnant mothers.

How can families reduce the risks of exposure to phenol?

❑ Avoiding environmental tobacco smoke, which contains phenol, will reduce phenol exposures.
❑ Always store household products and over-the-counter medications that contain phenol in their original labeled containers out of the reach of children.

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

There is a urine test that can tell if you have been exposed to phenol recently (within 1 or 2 days). However, the test cannot tell if you were exposed only to phenol because many substances are converted to phenol in the body. The test also cannot tell whether adverse health effects might result from the exposure. The test for phenol is not routinely performed at your doctor's office, but your doctor can take samples and send them to a testing laboratory.

Has the federal government made recommendations to protect human health?

The EPA lifetime health advisory for phenol in water is 2 milligrams per liter (2 mg/L). EPA requires that spills of 1,000 pounds or more of phenol to the environment be reported to the Agency.

The Occupational Safety and Health Administration (OSHA) has set a limit of 5 parts per million (ppm) in air to protect workers during 8-hour work shifts.

The National Institute for Occupational Safety and Health (NIOSH) recommends a limit of 5 ppm for phenol in workroom air over a 10-hour workday and that the concentration of phenol should not exceed 16 ppm during a 15-minute period.

References

Agency for Toxic Substances and Disease Registry (ATSDR). 2006. Toxicological Profile for Phenol (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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SELENIUM

CAS # 7782-49-2

Division of Toxicology ToxFAQs™ September 2003

This fact sheet answers the most frequently asked health questions (FAQs) about selenium. 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: People may be exposed to low levels of selenium daily through food and water. Selenium is a trace mineral needed in small amounts for good health, but exposure to much higher levels can result in neurological effects and brittle hair and deformed nails. Occupational inhalation exposure to selenium vapors may cause dizziness, fatigue, irritation of mucous membranes, and respiratory effects. This substance has been found in at least 508 of the 1,636 National Priorities List sites identified by the Environmental Protection Agency (EPA).

What is selenium?

Selenium is a naturally occurring mineral element that is distributed widely in nature in most rocks and soils. In its pure form, it exists as metallic gray to black hexagonal crystals, but in nature it is usually combined with sulfide or with silver, copper, lead, and nickel minerals. Most processed selenium is used in the electronics industry, but it is also used: as a nutritional supplement; in the glass industry; as a component of pigments in plastics, paints, enamels, inks, and rubber; in the preparation of pharmaceuticals; as a nutritional feed additive for poultry and livestock; in pesticide formulations; in rubber production; as an ingredient in antidandruff shampoos; and as a constituent of fungicides. Radioactive selenium is used in diagnostic medicine.

What happens to selenium when it enters the environment?

❑ Selenium occurs naturally in the environment and can be released by both natural and manufacturing processes.
❑ Selenium dust can enter the air from burning coal and oil. This selenium dust will eventually settle over the land and water.
❑ It also enters water from rocks and soil, and from agricultural and industrial waste. Some selenium compounds will dissolve in water, and some will settle to the bottom as particles.
❑ Insoluble forms of selenium will remain in soil, but soluble forms are very mobile and may enter surface water from soils.
❑ Selenium may accumulate up the food chain.

How might I be exposed to selenium?

❑ The general population is exposed to very low levels of selenium in air, food, and water. The majority of the daily intake comes from food.
❑ People working in or living near industries where selenium is produced, processed, or converted into commercial products may be exposed to higher levels of selenium in the air.
❑ People living in the vicinity of hazardous waste sites or coal burning plants may also be exposed to higher levels of selenium.

How can selenium affect my health?

Selenium has both beneficial and harmful effects. Low doses of selenium are needed to maintain good health. However, exposure to high levels can cause adverse health effects. Short-term oral exposure to high concentrations of selenium may cause nausea, vomiting, and diarrhea. Chronic oral exposure to high concentrations of selenium compounds can produce a disease called selenosis. The major signs of selenosis are hair loss, nail brittleness, and neurological abnormalities (such as numbness and other odd sensations in the extremities).

Brief exposures to high levels of elemental selenium or selenium dioxide in air can result in respiratory tract irritation, bronchitis, difficulty breathing, and stomach pains. Longer-term exposure to either of these air-borne forms can cause respiratory irritation, bronchial spasms, and coughing. Levels of these forms of selenium that would be necessary to produce such effects are normally not seen outside of the workplace.

Animal studies have shown that very high amounts of selenium can affect sperm production and the female reproductive cycle. We do not know if similar effects would occur in humans.

How likely is selenium to cause cancer?

Studies of laboratory animals and people show that most selenium compounds probably do not cause cancer. In fact, studies in humans suggest that lower-than-normal selenium levels in the diet might increase the risk of cancer.

The International Agency for Research on Cancer (IARC) has determined that selenium and selenium compounds are not classifiable as to their carcinogenicity to humans.

The EPA has determined that one specific form of selenium, selenium sulfide, is a probable human carcinogen. Selenium sulfide is not present in foods and is a very different chemical from the organic and inorganic selenium compounds found in foods and in the environment.

How can selenium affect children?

It is likely that the health effects seen in children exposed to selenium will be similar to the effects seen in adults. However, one study found that children may be less susceptible to the health effects of selenium than adults. Selenium compounds have not been shown to cause birth defects in humans or in other mammals.

How can families reduce the risk of exposure to selenium?

❏ Certain dietary supplements and shampoos contain selenium; these should be used according to the manufacturer's directions.

❏ Children living near waste sites that contain selenium or coal burning plants should be encouraged to wash their hands before eating and to avoid putting their unwashed hands in their mouths.

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

Low levels of selenium are normally found in body tissues and urine. Blood and urine tests for selenium are most useful for people who have recently been exposed to high levels. Toenail clippings can be used to determine longer-term exposure. These tests are not usually available at your doctor's office, but your doctor can send the samples to a laboratory that can perform the tests. None of these tests, however, can predict whether you will experience any health effects.

Has the federal government made recommendations to protect human health?

The EPA restricts the amount of selenium allowed in public water supplies to 50 parts total selenium per billion parts of water (50 ppb).

The Occupational Safety and Health Administration (OSHA) sets a limit of 0.2 mg selenium/m^3 of workroom air for an 8-hour work shift.

ATSDR and the EPA have determined that 5 micrograms of selenium per kilogram of body weight taken daily would not be expected to cause any adverse health effects over a lifetime of such intake.

References

Agency for Toxic Substances and Disease Registry (ATSDR). 2003. Toxicological Profile for Selenium (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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AGENCY FOR TOXIC SUBSTANCES
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SILVER
CAS # 7440-22-4

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

This fact sheet answers the most frequently asked health questions (FAQs) about silver. 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: Silver is an element found naturally in the environment. At very high levels, it may cause argyria, a blue-gray discoloration of the skin and other organs. This chemical has been found in at least 27 of the 1,177 National Priorities List sites identified by the Environmental Protection Agency (EPA).

What is silver?
(Pronounced sĭl′vər)

Silver is a naturally occurring element. It is found in the environment combined with other elements such as sulfide, chloride, and nitrate. Pure silver is "silver" colored, but silver nitrate and silver chloride are powdery white and silver sulfide and silver oxide are dark-gray to black. Silver is often found as a by-product during the retrieval of copper, lead, zinc, and gold ores.

Silver is used to make jewelry, silverware, electronic equipment, and dental fillings. It is also used to make photographs, in brazing alloys and solders, to disinfect drinking water and water in swimming pools, and as an antibacterial agent. Silver has also been used in lozenges and chewing gum to help people stop smoking.

What happens to silver when is enters the environment?

☐ Silver may be released into the air and water through natural processes such as the weathering of rocks.

☐ Human activities such as the processing of ores, cement manufacture, and the burning of fossil fuel may release silver into the air.

☐ It may be released into water from photographic processing.

☐ Rain may wash silver out of soil into the groundwater.

☐ Silver does not appear to concentrate to a significant extent in aquatic animals.

How might I be exposed to silver?

☐ Breathing low levels in air.

☐ Swallowing it in food or drinking water.

☐ Carrying out activities such as jewelry-making, soldering, and photography.

☐ Using anti-smoking lozenges or other medicines containing it.

How can silver affect my health?

Exposure to high levels of silver for a long period of time may result in a condition called arygria, a blue-gray discoloration of the skin and other body tissues. Lower-level exposures to silver may also cause silver to be deposited in the skin and other parts of the body; however, this is not known to be harmful. Argyria is a permanent effect, but it appears to be a cosmetic problem that may not be otherwise harmful to health.

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

Exposure to high levels of silver in the air has resulted in breathing problems, lung and throat irritation, and stomach pains. Skin contact with silver can cause mild allergic reactions such as rash, swelling, and inflammation in some people.

Animal studies have shown that swallowing silver results in the deposit of silver in the skin. One study in mice found that the animals exposed to silver in drinking water were less active than unexposed animals.

No studies are available on whether silver affects reproduction or causes developmental problems in people.

How likely is silver to cause cancer?

No studies are available on whether silver may cause cancer in people. The only available animal studies showed both positive and negative results when silver was implanted under the skin.

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

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

Silver can be measured in the blood, urine, feces, and body tissues of exposed people. Silver builds up in the body, and the best way to learn if past exposure has occurred is to look for silver in samples of skin. Tests for silver are not commonly done at a doctor's office because they require special equipment. Although doctors can find out if a person has been exposed to silver by doing these tests, they cannot tell whether any health effects will occur.

Has the federal government made recommendations to protect human health?

The EPA recommends that the concentration of silver in drinking water not exceed 0.10 milligrams per liter of water (0.10 mg/L) because of the skin discoloration that may occur.

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

The Occupational Safety and Health Administration (OSHA) limits silver in workplace air to 0.01 milligrams per cubic meter (0.01 mg/m^3) for an 8-hour workday, 40-hour workweek. The National Institute of Occupational Safety and Health (NIOSH) also recommends that workplace air contain no more that 0.01 mg/m^3 silver.

The American Conference of Governmental Industrial Hygienists (ACGIH) recommends that workplace air contain no more than 0.1 mg/m^3 silver metal and 0.01 mg/m^3 soluble silver compounds.

The federal recommendations have been updated as of July 1999.

Glossary

Carcinogenicity: Ability to cause cancer.

CAS: Chemcial Abstracts Service.

Milligram (mg): One thousandth of a gram.

National Priorities List: A list of the nation's worst hazardous waste sites.

Soluble: Capable of being dissolved in water.

References

Agency for Toxic Substances and Disease Registry (ATSDR). 1990. Toxicological profile for silver. 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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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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THALLIUM
CAS # 7440-28-0

Agency for Toxic Substances and Disease Registry ToxFAQs **September 1995**

This fact sheet answers the most frequently asked health questions (FAQs) about thallium. 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 thallium occurs mainly from eating food. Exposure to higher levels of thallium may occur in the workplace. Breathing high levels of thallium may result in effects on the nervous system, while ingesting high levels of it results in vomiting, diarrhea, temporary hair loss, and other effects. This chemical has been found in at least 210 of 1,416 National Priorities List sites identified by the Environmental Protection Agency.

What is thallium?
(Pronounced thăl′ē-əm)

Pure thallium is a bluish-white metal that is found in trace amounts in the earth’s crust. In the past, thallium was obtained as a by-product from smelting other metals; however, it has not been produced in the United States since 1984. Currently, all the thallium is obtained from imports and from thallium reserves.

In its pure form, thallium is odorless and tasteless. It can also be found combined with other substances such as bromine, chlorine, fluorine, and iodine. When it's combined, it appears colorless-to-white or yellow.

Thallium is used mostly in manufacturing electronic devices, switches, and closures, primarily for the semiconductor industry. It also has limited use in the manufacture of special glass and for certain medical procedures.

What happens to thallium when it enters the environment?

- ☐ Thallium enters the environment primarily from coal-burning and smelting, in which it is a trace contaminant of the raw materials.
- ☐ It stays in the air, water, and soil for a long time and is not broken down.
- ☐ Some thallium compounds are removed from the atmosphere in rain and snow.
- ☐ It's absorbed by plants and enters the food chain.
- ☐ It builds up in fish and shellfish.

How might I be exposed to thallium?

- ☐ Eating food contaminated with thallium may be a major source of exposure for most people.
- ☐ Breathing workplace air in industries that use thallium
- ☐ Smoking cigarettes.
- ☐ Living near hazardous waste sites containing thallium (may result in higher than normal exposures).
- ☐ Touching or, for children, eating soil contaminated with thallium.
- ☐ Breathing low levels in air and water.

How can thallium affect my health?

Exposure to high levels of thallium can result in harmful health effects. A study on workers exposed on the job over several years reported nervous system effects, such as numbness of fingers and toes, from breathing thallium.

Studies in people who ingested large amounts of thallium over a short time have reported vomiting, diarrhea, temporary hair loss, and effects on the nervous system, lungs, heart, liver, and kidneys. It has caused death. It is not known what the effects are from ingesting low levels of thallium over a long time.

Birth defects were not reported in the children of mothers exposed to low levels from eating vegetables and fruits contaminated with thallium. Studies in rats, however, exposed to high levels of thallium, showed adverse developmental effects.

It is not known if breathing or ingesting thallium affects human reproduction. Studies showed that rats that ingested thallium for several weeks had some adverse reproductive effects. Animal data suggest that the male reproductive system may be susceptible to damage by low levels of thallium.

There is no information available on the health effects of skin contact with thallium in people or animals.

How likely is thallium to cause cancer?

The Department of Health and Human Services, the International Agency for Research on Cancer, and the Environmental Protection Agency (EPA) have not classified thallium as to its human carcinogenicity.

No studies are available in people or animals on the carcinogenic effects of breathing, ingesting, or touching thallium.

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

There are medical tests available to measure levels of thallium in urine and hair. In addition, thallium can also be measured in blood; however, this is not a good indicator of exposure since thallium only stays in blood a very short time.

These tests require special equipment that is not usually available in most doctor's offices. In addition, these tests cannot determine if adverse health effects will occur from the exposure to thallium.

Has the federal government made recommendations to protect human health?

The EPA requires that discharges or accidental spills into the environment of 1,000 pounds or more of thallium be reported.

The Occupational Safety and Health Administration (OSHA) has set an exposure limit of 0.1 milligrams per cubic meter (0.1 mg/m^3) for thallium in workplace air. The American Conference of Governmental Industrial Hygienists (ACGIH) has established the same guidelines as OSHA for the workplace.

The National Institute for Occupational Safety and Health (NIOSH) has recommended that 15 mg/m^3 of thallium be considered immediately dangerous to life and health. This is the exposure level of a chemical that is likely to cause permanent health problems or death.

Glossary

Carcinogenicity: Ability to cause cancer.

Ingesting: Taking food or drink into your body.

Milligram (mg): One thousandth of a gram.

References

Agency for Toxic Substances and Disease Registry (ATSDR). 1992. Toxicological profile for thallium. 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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TOLUENE
CAS # 108-88-3

Division of Toxicology ToxFAQs™ February 2001

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

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

What is toluene?

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

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

What happens to toluene when it enters the environment?

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

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

❑ Toluene does not usually stay in the environment long.

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

How might I be exposed to toluene?

❑ Breathing contaminated workplace air or automobile exhaust.

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

❑ Drinking contaminated well-water.

❑ Living near uncontrolled hazardous waste sites containing toluene products.

How can toluene affect my health?

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

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

High levels of toluene may affect your kidneys.

How likely is toluene to cause cancer?

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

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

How can toluene affect children?

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

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

How can families reduce the risk of exposure to toluene?

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

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

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

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

Has the federal government made recommendations to protect human health?

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

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

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

References

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

Where can I get more information? For more information, contact the Agency for Toxic Substances and Disease Registry, Division of Toxicology, 1600 Clifton Road NE, Mailstop F-32, Atlanta, GA 30333. Phone: 1-888-422-8737, FAX: 770-488-4178. ToxFAQs^{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
AND DISEASE REGISTRY

TRICHLOROETHYLENE

CAS # 79-01-6

Division of Toxicology ToxFAQs™ July 2003

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

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

What is trichloroethylene?

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

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

What happens to trichloroethylene when it enters the environment?

- Trichloroethylene dissolves a little in water, but it can remain in ground water for a long time.
- Trichloroethylene quickly evaporates from surface water, so it is commonly found as a vapor in the air.
- Trichloroethylene evaporates less easily from the soil than from surface water. It may stick to particles and remain for a long time.
- Trichloroethylene may stick to particles in water, which will cause it to eventually settle to the bottom sediment.
- Trichloroethylene does not build up significantly in plants and animals.

How might I be exposed to trichloroethylene?

- Breathing air in and around the home which has been contaminated with trichloroethylene vapors from shower water or household products such as spot removers and typewriter correction fluid.
- Drinking, swimming, or showering in water that has been contaminated with trichloroethylene.
- Contact with soil contaminated with trichloroethylene, such as near a hazardous waste site.
- Contact with the skin or breathing contaminated air while manufacturing trichloroethylene or using it at work to wash paint or grease from skin or equipment.

How can trichloroethylene affect my health?

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

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

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

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

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

How likely is trichloroethylene to cause cancer?

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

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

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

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

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

Has the federal government made recommendations to protect human health?

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

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

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

Glossary

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

References

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

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

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AGENCY FOR TOXIC SUBSTANCES
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XYLENE

CAS # 1330-20-7

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

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

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

What is xylene?

(Pronounced zī′lēn)

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

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

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

What happens to xylene when it enters the environment?

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

How might I be exposed to xylene?

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

How can xylene affect my health?

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

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

How likely is xylene to cause cancer?

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

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

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

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

Has the federal government made recommendations to protect human health?

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

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

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

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

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

Glossary

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

Carcinogenic: Having the ability to cause cancer.

CAS: Chemical Abstracts Service.

ppm: Parts per million.

Solvent: A liquid that can dissolve other substances.

References

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

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

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AGENCY FOR TOXIC SUBSTANCES
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ZINC

CAS # 7440-66-6

Division of Toxicology ToxFAQs™ August 2005

This fact sheet answers the most frequently asked health questions (FAQs) about zinc. 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: Zinc is a naturally occurring element. Exposure to high levels of zinc occurs mostly from eating food, drinking water, or breathing workplace air that is contaminated. Low levels of zinc are essential for maintaining good health. Exposure to large amounts of zinc can be harmful. It can cause stomach cramps, anemia, and changes in cholesterol levels. Zinc has been found in at least 985 of the 1,662 National Priority List sites identified by the Environmental Protection Agency (EPA).

What is zinc?

Zinc is one of the most common elements in the earth's crust. It is found in air, soil, and water, and is present in all foods. Pure zinc is a bluish-white shiny metal.

Zinc has many commercial uses as coatings to prevent rust, in dry cell batteries, and mixed with other metals to make alloys like brass, and bronze. A zinc and copper alloy is used to make pennies in the United States.

Zinc combines with other elements to form zinc compounds. Common zinc compounds found at hazardous waste sites include zinc chloride, zinc oxide, zinc sulfate, and zinc sulfide. Zinc compounds are widely used in industry to make paint, rubber, dyes, wood preservatives, and ointments.

What happens to zinc when it enters the environment?

- ❏ Some is released into the environment by natural processes, but most comes from human activities like mining, steel production, coal burning, and burning of waste.
- ❏ It attaches to soil, sediments, and dust particles in the air.
- ❏ Rain and snow remove zinc dust particles from the air.
- ❏ Depending on the type of soil, some zinc compounds can move into the groundwater and into lakes, streams, and rivers.
- ❏ Most of the zinc in soil stays bound to soil particles and does not dissolve in water.
- ❏ It builds up in fish and other organisms, but it does not build up in plants.

How might I be exposed to zinc?

- ❏ Ingesting small amounts present in your food and water.
- ❏ Drinking contaminated water or a beverage that has been stored in metal containers or flows through pipes that have been coated with zinc to resist rust.
- ❏ Eating too many dietary supplements that contain zinc.
- ❏ Working on any of the following jobs: construction, painting, automobile mechanics, mining, smelting, and welding; manufacture of brass, bronze, or other zinc-containing alloys; manufacture of galvanized metals; and manufacture of machine parts, rubber, paint, linoleum, oilcloths, batteries, some kind of glass, ceramics, and dyes.

How can zinc affect my health?

Zinc is an essential element in our diet. Too little zinc can cause problems, but too much zinc is also harmful.

Harmful effects generally begin at levels 10-15 times higher than the amount needed for good health. Large doses taken by mouth even for a short time can cause stomach cramps, nausea, and vomiting. Taken longer, it can cause anemia and decrease the levels of your good cholesterol. We do not know if high levels of zinc affect reproduction in humans. Rats that were fed large amounts of zinc became infertile.

Inhaling large amounts of zinc (as dusts or fumes) can cause a specific short-term disease called metal fume fever. We do not know the long-term effects of breathing high levels of zinc.

Putting low levels of zinc acetate and zinc chloride on the skin of rabbits, guinea pigs, and mice caused skin irritation. Skin irritation will probably occur in people.

How likely is zinc to cause cancer?

The Department of Health and Human Services (DHHS) and the International Agency for Research on Cancer (IARC) have not classified zinc for carcinogenicity. Based on incomplete information from human and animal studies, the EPA has determined that zinc is not classifiable as to its human carcinogenicity.

How can zinc affect children?

Zinc is essential for proper growth and development of young children. It is likely that children exposed to very high levels of zinc will have similar effects as adults. We do not know whether children are more susceptible to the effects of excessive intake of zinc than the adults.

We do not know if excess zinc can cause developmental effects in humans. Animal studies have found decreased weight in the offspring of animals that ingested very high amounts of zinc.

How can families reduce the risks of exposure to zinc?

❑ Children living near waste sites that contain zinc may be exposed to higher levels of zinc through breathing contaminated air, drinking contaminated drinking water, touching or eating contaminated soil.

❑ Discourage your children from eating soil or putting their hands in their mouths and teach them to wash their hands frequently and before eating.

❑ If you use medicines or vitamin supplements containing zinc, make sure you use them appropriately and keep them out of the reach of children.

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

There are tests available to measure zinc in your blood, urine, hair, saliva, and feces. These tests are not usually done in the doctor's office because they require special equipment. High levels of zinc in the feces can mean high recent zinc exposure. High levels of zinc in the blood can mean high zinc consumption and/or high exposure. Tests to measure zinc in hair may provide information on long-term zinc exposure; however, the relationship between levels in your hair and the amount of zinc you were exposed to is not clear.

Has the federal government made recommendations to protect human health?

The EPA recommends that drinking water should contain no more than 5 milligrams per liter of water (5 mg/L) because of taste. The EPA requires that any release of 1,000 pounds (or in some cases 5,000 pounds) into the environment be reported to the agency.

To protect workers, the Occupational Safety and Health Administration (OSHA) has set an average limit of 1 mg/m^3 for zinc chloride fumes and 5 mg/m^3 for zinc oxide (dusts and fumes) in workplace air during an 8-hour workday, 40-hour workweek.

Similarly, the National Institute for Occupational Safety and Health (NIOSH) has set the same standards for up to a 10-hour workday over a 40-hour workweek.

References

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

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

ATTACHMENT C

NEW YORK STATE DEPARTMENT OF HEALTH GENERIC CAMP

Appendix 1A
New York State Department of Health
Generic Community Air Monitoring Plan

Overview

A Community Air Monitoring Plan (CAMP) requires real-time monitoring for volatile organic compounds (VOCs) and particulates (i.e., dust) at the downwind perimeter of each designated work area when certain activities are in progress at contaminated sites. The CAMP is not intended for use in establishing action levels for worker respiratory protection. Rather, its intent is to provide a measure of protection for the downwind community (i.e., off-site receptors including residences and businesses and on-site workers not directly involved with the subject work activities) from potential airborne contaminant releases as a direct result of investigative and remedial work activities. The action levels specified herein require increased monitoring, corrective actions to abate emissions, and/or work shutdown. Additionally, the CAMP helps to confirm that work activities did not spread contamination off-site through the air.

The generic CAMP presented below will be sufficient to cover many, if not most, sites. Specific requirements should be reviewed for each situation in consultation with NYSDOH to ensure proper applicability. In some cases, a separate site-specific CAMP or supplement may be required. Depending upon the nature of contamination, chemical- specific monitoring with appropriately-sensitive methods may be required. Depending upon the proximity of potentially exposed individuals, more stringent monitoring or response levels than those presented below may be required. Special requirements will be necessary for work within 20 feet of potentially exposed individuals or structures and for indoor work with co-located residences or facilities. These requirements should be determined in consultation with NYSDOH.

Reliance on the CAMP should not preclude simple, common-sense measures to keep VOCs, dust, and odors at a minimum around the work areas.

Community Air Monitoring Plan

Depending upon the nature of known or potential contaminants at each site, real-time air monitoring for VOCs and/or particulate levels at the perimeter of the exclusion zone or work area will be necessary. Most sites will involve VOC and particulate monitoring; sites known to be contaminated with heavy metals alone may only require particulate monitoring. If radiological contamination is a concern, additional monitoring requirements may be necessary per consultation with appropriate DEC/NYSDOH staff.

> **Continuous monitoring** will be required for all ground intrusive activities and during the demolition of contaminated or potentially contaminated structures. Ground intrusive activities include, but are not limited to, soil/waste excavation and handling, test pitting or trenching, and the installation of soil borings or monitoring wells.
>
> **Periodic monitoring** for VOCs will be required during non-intrusive activities such as the collection of soil and sediment samples or the collection of groundwater samples from existing monitoring wells. “Periodic” monitoring during sample collection might reasonably consist of taking a reading upon arrival at a sample location, monitoring while opening a well cap or

overturning soil, monitoring during well baling/purging, and taking a reading prior to leaving a sample location. In some instances, depending upon the proximity of potentially exposed individuals, continuous monitoring may be required during sampling activities. Examples of such situations include groundwater sampling at wells on the curb of a busy urban street, in the midst of a public park, or adjacent to a school or residence.

VOC Monitoring, Response Levels, and Actions

Volatile organic compounds (VOCs) must be monitored at the downwind perimeter of the immediate work area (i.e., the exclusion zone) on a continuous basis or as otherwise specified. Upwind concentrations should be measured at the start of each workday and periodically thereafter to establish background conditions, particularly if wind direction changes. The monitoring work should be performed using equipment appropriate to measure the types of contaminants known or suspected to be present. The equipment should be calibrated at least daily for the contaminant(s) of concern or for an appropriate surrogate. The equipment should be capable of calculating 15-minute running average concentrations, which will be compared to the levels specified below.

1. If the ambient air concentration of total organic vapors at the downwind perimeter of the work area or exclusion zone exceeds 5 parts per million (ppm) above background for the 15-minute average, work activities must be temporarily halted and monitoring continued. If the total organic vapor level readily decreases (per instantaneous readings) below 5 ppm over background, work activities can resume with continued monitoring.

2. If total organic vapor levels at the downwind perimeter of the work area or exclusion zone persist at levels in excess of 5 ppm over background but less than 25 ppm, work activities must be halted, the source of vapors identified, corrective actions taken to abate emissions, and monitoring continued. After these steps, work activities can resume provided that the total organic vapor level 200 feet downwind of the exclusion zone or half the distance to the nearest potential receptor or residential/commercial structure, whichever is less - but in no case less than 20 feet, is below 5 ppm over background for the 15-minute average.

3. If the organic vapor level is above 25 ppm at the perimeter of the work area, activities must be shutdown.

4. All 15-minute readings must be recorded and be available for State (DEC and NYSDOH) personnel to review. Instantaneous readings, if any, used for decision purposes should also be recorded.

Particulate Monitoring, Response Levels, and Actions

Particulate concentrations should be monitored continuously at the upwind and downwind perimeters of the exclusion zone at temporary particulate monitoring stations. The particulate monitoring should be performed using real-time monitoring equipment capable of measuring particulate matter less than 10 micrometers in size (PM-10) and capable of integrating over a period of 15 minutes (or less) for comparison to the airborne particulate action level. The equipment must be equipped with an audible alarm to indicate exceedance of the action level. In addition, fugitive dust migration should be visually assessed during all work activities.

1. If the downwind PM-10 particulate level is 100 micrograms per cubic meter (mcg/m^3) greater than background (upwind perimeter) for the 15-minute period or if airborne dust is observed leaving the work area, then dust suppression techniques must be employed. Work may continue with dust suppression techniques provided that downwind PM-10 particulate levels do not exceed 150 mcg/m^3 above the upwind level and provided that no visible dust is migrating from the work area.

2. If, after implementation of dust suppression techniques, downwind PM-10 particulate levels are greater than 150 mcg/m^3 above the upwind level, work must be stopped and a re-evaluation of activities initiated. Work can resume provided that dust suppression measures and other controls are successful in reducing the downwind PM-10 particulate concentration to within 150 mcg/m^3 of the upwind level and in preventing visible dust migration.

3. All readings must be recorded and be available for State (DEC and NYSDOH) and County Health personnel to review.

December 2009

Appendix 1B
Fugitive Dust and Particulate Monitoring

A program for suppressing fugitive dust and particulate matter monitoring at hazardous waste sites is a responsibility on the remedial party performing the work. These procedures must be incorporated into appropriate intrusive work plans. The following fugitive dust suppression and particulate monitoring program should be employed at sites during construction and other intrusive activities which warrant its use:

1. Reasonable fugitive dust suppression techniques must be employed during all site activities which may generate fugitive dust.

2. Particulate monitoring must be employed during the handling of waste or contaminated soil or when activities on site may generate fugitive dust from exposed waste or contaminated soil. Remedial activities may also include the excavation, grading, or placement of clean fill. These control measures should not be considered necessary for these activities.

3. Particulate monitoring must be performed using real-time particulate monitors and shall monitor particulate matter less than ten microns (PM10) with the following minimum performance standards:

(a) Objects to be measured: Dust, mists or aerosols;
(b) Measurement Ranges: 0.001 to 400 mg/m3 (1 to 400,000 :ug/m3);
(c) Precision (2-sigma) at constant temperature: +/- 10 :g/m3 for one second averaging; and +/- 1.5 g/m3 for sixty second averaging;
(d) Accuracy: +/- 5% of reading +/- precision (Referred to gravimetric calibration with SAE fine test dust (mmd= 2 to 3 :m, g= 2.5, as aerosolized);
(e) Resolution: 0.1% of reading or 1g/m3, whichever is larger;
(f) Particle Size Range of Maximum Response: 0.1-10;
(g) Total Number of Data Points in Memory: 10,000;
(h) Logged Data: Each data point with average concentration, time/date and data point number
(i) Run Summary: overall average, maximum concentrations, time/date of maximum, total number of logged points, start time/date, total elapsed time (run duration), STEL concentration and time/date occurrence, averaging (logging) period, calibration factor, and tag number;
(j) Alarm Averaging Time (user selectable): real-time (1-60 seconds) or STEL (15 minutes), alarms required;
(k) Operating Time: 48 hours (fully charged NiCd battery); continuously with charger;
(l) Operating Temperature: -10 to 50^{o} C (14 to 122^{o} F);
(m) Particulate levels will be monitored upwind and immediately downwind at the working site and integrated over a period not to exceed 15 minutes.

4. In order to ensure the validity of the fugitive dust measurements performed, there must be appropriate Quality Assurance/Quality Control (QA/QC). It is the responsibility of the remedial party to adequately supplement QA/QC Plans to include the following critical features: periodic instrument calibration, operator training, daily instrument performance (span) checks, and a record keeping plan.

5. The action level will be established at 150 ug/m3 (15 minutes average). While conservative,

this short-term interval will provide a real-time assessment of on-site air quality to assure both health and safety. If particulate levels are detected in excess of 150 ug/m3, the upwind background level must be confirmed immediately. If the working site particulate measurement is greater than 100 ug/m3 above the background level, additional dust suppression techniques must be implemented to reduce the generation of fugitive dust and corrective action taken to protect site personnel and reduce the potential for contaminant migration. Corrective measures may include increasing the level of personal protection for on-site personnel and implementing additional dust suppression techniques (see paragraph 7). Should the action level of 150 ug/m3 continue to be exceeded work must stop and DER must be notified as provided in the site design or remedial work plan. The notification shall include a description of the control measures implemented to prevent further exceedances.

6. It must be recognized that the generation of dust from waste or contaminated soil that migrates off-site, has the potential for transporting contaminants off-site. There may be situations when dust is being generated and leaving the site and the monitoring equipment does not measure PM10 at or above the action level. Since this situation has the potential to allow for the migration of contaminants off-site, it is unacceptable. While it is not practical to quantify total suspended particulates on a real-time basis, it is appropriate to rely on visual observation. If dust is observed leaving the working site, additional dust suppression techniques must be employed. Activities that have a high dusting potential--such as solidification and treatment involving materials like kiln dust and lime--will require the need for special measures to be considered.

7. The following techniques have been shown to be effective for the controlling of the generation and migration of dust during construction activities:

(a) Applying water on haul roads;
(b) Wetting equipment and excavation faces;
(c) Spraying water on buckets during excavation and dumping;
(d) Hauling materials in properly tarped or watertight containers;
(e) Restricting vehicle speeds to 10 mph;
(f) Covering excavated areas and material after excavation activity ceases; and
(g) Reducing the excavation size and/or number of excavations.

Experience has shown that the chance of exceeding the 150ug/m3 action level is remote when the above-mentioned techniques are used. When techniques involving water application are used, care must be taken not to use excess water, which can result in unacceptably wet conditions. Using atomizing sprays will prevent overly wet conditions, conserve water, and provide an effective means of suppressing the fugitive dust.

8. The evaluation of weather conditions is necessary for proper fugitive dust control. When extreme wind conditions make dust control ineffective, as a last resort remedial actions may need to be suspended. There may be situations that require fugitive dust suppression and particulate monitoring requirements with action levels more stringent than those provided above. Under some circumstances, the contaminant concentration and/or toxicity may require additional monitoring to protect site personnel and the public. Additional integrated sampling and chemical analysis of the dust may also be in order. This must be evaluated when a health and safety plan is developed and when appropriate suppression and monitoring requirements are established for protection of health and the environment.

ATTACHMENT D

REPORT FORMS

WEEKLY SAFETY REPORT FORM

Week Ending: ____________ Project Name/Number: 380 4th Avenue / 210226

Report Date: ____________ Project Manager Name: Ken Wiles

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: 380 4th Avenue Site Location: 380 4th Avenue, Brooklyn, NY

Report Prepared By: ______________________ ______________________
Signature Title

ACCIDENT/INCIDENT CATEGORY (check all that applies)

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

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

____
____
____
____
____
____
____
____
____
____

WITNESS TO ACCIDENT/INCIDENT:

Name:	______________	Company:	______________
Address:	______________	Address:	______________
Phone No.:	______________	Phone No.:	______________
Name:	______________	Company:	______________
Address:	______________	Address:	______________
Phone No.:	______________	Phone No.:	______________

INJURED - ILL:

Name: ____________________ SSN: ____

Address: ____________________ Age: ____

Length of Service: ____________________ Time on Present Job: _____________________________

Time/Classification: ____

SEVERITY OF INJURY OR ILLNESS:

____ Disabling ___ Non-disabling ___ Fatality

____ Medical Treatment ___ First Aid Only

ESTIMATED NUMBER OF DAYS AWAY FROM JOB: ______________________________

NATURE OF INJURY OR ILLNESS: ____

____

____

____

CLASSIFICATION OF INJURY:

__ Abrasions
__ Bites
__ Blisters
__ Bruises
__ Chemical Burns
__ Cold Exposure
__ Concussion
__ Lacerations

_____ Dislocations
_____ Faint/Dizziness
_____ Fractures
_____ Frostbite
_____ Heat Burns
_____ Heat Exhaustion
_____ Heat Stroke

____ Punctures
____ Radiation Burns
____ Respiratory Allergy
____ Sprains
____ Toxic Resp. Exposure
____ Toxic Ingestion
____ Dermal Allergy

Part of Body Affected: ____

Degree of Disability: ____

Date Medical Care was Received: ____

Where Medical Care was Received: ____

Address (if off-site): ____

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

PROPERTY DAMAGE:

Description of Damage: ______________________________

____

Cost of Damage: $ ______________________________

ACCIDENT/INCIDENT LOCATION: ______________________________

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

____

____

____

____

Was weather a factor?: ______________________________

____

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

____

____

____

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

____

____

ON-SITE ACCIDENTS/INCIDENTS:

Level of personal protection equipment required in Site Safety Plan:

____

____

Modifications:

____

Was injured using required equipment?:

____

____

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

____

____

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

ACCIDENT/INCIDENT REPORT REVIEWED BY:

SSO Name Printed SSO Signature

OTHERS PARTICIPATING IN INVESTIGATION:

Signature Title

Signature Title

Signature Title

ACCIDENT/INCIDENT FOLLOW-UP: Date:

Outcome of accident/incident:

Physician's recommendations:

Date injured returned to work:

Follow-up performed by:

Signature Title

ATTACH ANY ADDITIONAL INFORMATION TO THIS FORM

ATTACHMENT E

EMERGENCY HAND SIGNALS

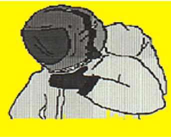
EMERGENCY SIGNALS

In most cases, field personnel will carry mobile cell phones. If this is the case, a call, text message, or other notification that indicates an emergency will take priority over all other calls, texts, or notifications.

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

EMERGENCY HAND SIGNALS

OUT OF AIR, CAN'T BREATH!



Hand gripping throat

LEAVE AREA IMMEDIATELY, NO DEBATE!

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

NEED ASSISTANCE!

Hands on top of head

OKAY! – I'M ALL RIGHT!

- I UNDERSTAND!

Thumbs up

NO! - NEGATIVE!

Thumbs down

APPENDIX B
COMMUNITY AIR MONITORING PLAN

380 4TH AVENUE
BROOKLYN, NEW YORK

Community Air Monitoring Plan

For

Interim Remedial Measure Work Plan

BCP Site No.: C224358
AKRF Project Number: 210226

Prepared for:

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

Prepared On Behalf Of:

380 4th Avenue Owner, LLC
157 Columbus Avenue, Suite 2E
New York, NY 10023

Prepared by:

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

DECEMBER 2022

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1.0 INTRODUCTION

This Community Air Monitoring Plan (CAMP) describes the protocols and procedures that will be followed during implementation of the Interim Remedial Measure Work Plan (IRMWP) at the 380 4th Avenue project site (hereafter referred to as the "Site"). The Site is an approximately 20,000-square foot parcel located at 374 to 390 4th Avenue in the Gowanus neighborhood of Brooklyn, New York and comprises New York City Tax Block 980, Lot 77. The Site is enrolled in the New York State Department of Environmental Conservation (NYSDEC) Brownfield Cleanup Program (BCP) under BCP Site No. C224358 as of October 2022. The Site location is presented on Figure 1.

The Site most recently consisted of a slab-on-grade, one-story structure that last operated as a taxi business; the building was recently demolished and removed from the Site in anticipation of redevelopment. The Site is bounded by: commercial buildings and a hotel with associated parking lots to the north, followed by 3rd Street; a U-Haul facility parking lot to the south, followed by 6th Street; 4th Avenue, with the NYC Transit D- and R-Line subway beneath 4th Avenue to the east, followed by commercial and residential buildings; and a U-Haul facility and associated parking lots to the west, followed by 3rd Avenue. The larger surrounding area is occupied by predominantly commercial and auto-related uses, with some residential uses to the east.

The findings from previous Remedial Investigations identified contaminated soil, groundwater, and soil vapor at the Site. The contaminants of concern include: volatile organic compounds (VOCs), semivolatile organic compounds, metals in soil; VOCs and metals in groundwater; and VOCs in soil vapor.

2.0 AIR MONITORING PROGRAM

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

Site-wide monitoring for particulates and VOCs will be conducted during remedial excavation in conformance with the New York State Department of Health (NYSDOH) Generic CAMP (Attachment A). Real-time air monitoring for VOCs and particulate levels will be performed at the perimeter of the work area during ground intrusive activities, and during the handling of contaminated or potentially contaminated media. Ground intrusive activities include, but are not limited to, installation of soldier piles along the Site perimeter as part of the support of excavation (SOE) system for the Site-wide foundation excavation.

When the SOE pile installation work area is within 20 feet of potentially exposed populations or occupied structures, the continuous monitoring locations for VOCs and particulates will reflect the nearest potentially exposed individuals and the location of ventilation system intakes for nearby structures. Engineering controls such as temporary vapor/dust barriers, temporary negative-pressure enclosures, and/or special ventilation devices will be considered to prevent exposures related to the work activities and to control dust and odors, if necessary. Consideration will also be given to implementing the planned activities when potentially exposed populations are at a minimum, such as during weekends or evening hours in non-residential settings, if necessary.

2.1 Community Air Monitoring Plan

Community air monitoring will be conducted during all intrusive Site activities in compliance with the NYSDOH Generic CAMP and this Site-Specific CAMP. Real-time air monitoring for VOCs and dust at the perimeter of the exclusion zone will be performed as described below. Exceedances of CAMP action levels will be immediately reported to the NYSDEC and NYSDOH project managers, and CAMP reports will be included in the daily reports submitted to NYSDEC and NYSDOH.

2.1.1 Roving Air Monitoring

VOC Monitoring

Continuous monitoring for VOCs will be conducted during all ground intrusive activities, consisting of perimeter pile installation. Upwind concentrations will be measured at the start of each workday and periodically thereafter to establish background concentrations. VOCs will be monitored hourly at the downwind perimeter of the exclusion zone. Monitoring will be conducted with a photoionization detector (PID) equipped with a 10.6 electron Volt (eV) lamp capable of calculating 15-minute running average concentrations.

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

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

Particulate Monitoring

Hourly monitoring for particulates will be conducted during all ground intrusive activities, which will involve the measurement of respirable dust. Community air monitoring for dust particulates will be conducted using a TSI 8530 DustTrak II or equivalent to measure the concentration of airborne respirable particulates less than 10 micrometers in size (PM_{10}). The dust monitor will be capable of calculating 15-minute running average concentrations and equipped with an audible alarm to indicate exceedance of action levels. Background readings and any readings that trigger response actions will be recorded in the project logbook, which will be available on-site for NYSDOH and/or NYSDEC review.

2.1.2 Fixed Air Monitoring Stations

Two fixed air monitoring stations will be utilized at the Site during soil disturbing activities. The fixed monitoring stations will be set up at the upwind and downwind perimeters of the exclusion zone during all ground intrusive activities and will continuously log VOC and particulate levels. Each fixed monitoring station will be fully enclosed and equipped with the following:

- A PID equipped with a 10.6 eV lamp capable of calculating 15-minute running average VOC concentrations;
- A TSI 8530 DustTrak II or equivalent dust monitor capable of measuring the concentration of airborne respirable particulates less than 10 micrometers in size (PM_{10}) and calculating 15-minute running average particulate concentrations; and
- A Netronix™ Thiamus™ ICU-820 or equivalent Global System for Mobile Communication (GSM)/Global Positioning System (GPS) device capable of recording air monitoring and location data.

Each monitoring station will be capable of sending e-mail alerts to the SSO to indicate an exceedance of action levels. Additionally, the SSO will conduct an inspection of the monitoring stations on at least an hourly basis. Upon completion of Site activities, all air monitoring data will be available to download via the Environet® website. All air monitoring data recorded at the fixed monitoring stations will be available for NYSDOH and/or NYSDEC review and will be included in the Final Engineering Report (FER).

2.1.3 Community Air Monitoring Action Levels

VOC Action Levels

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

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

Particulate Action Levels

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

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

Major Vapor Emission Response Plan

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

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

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

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

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

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

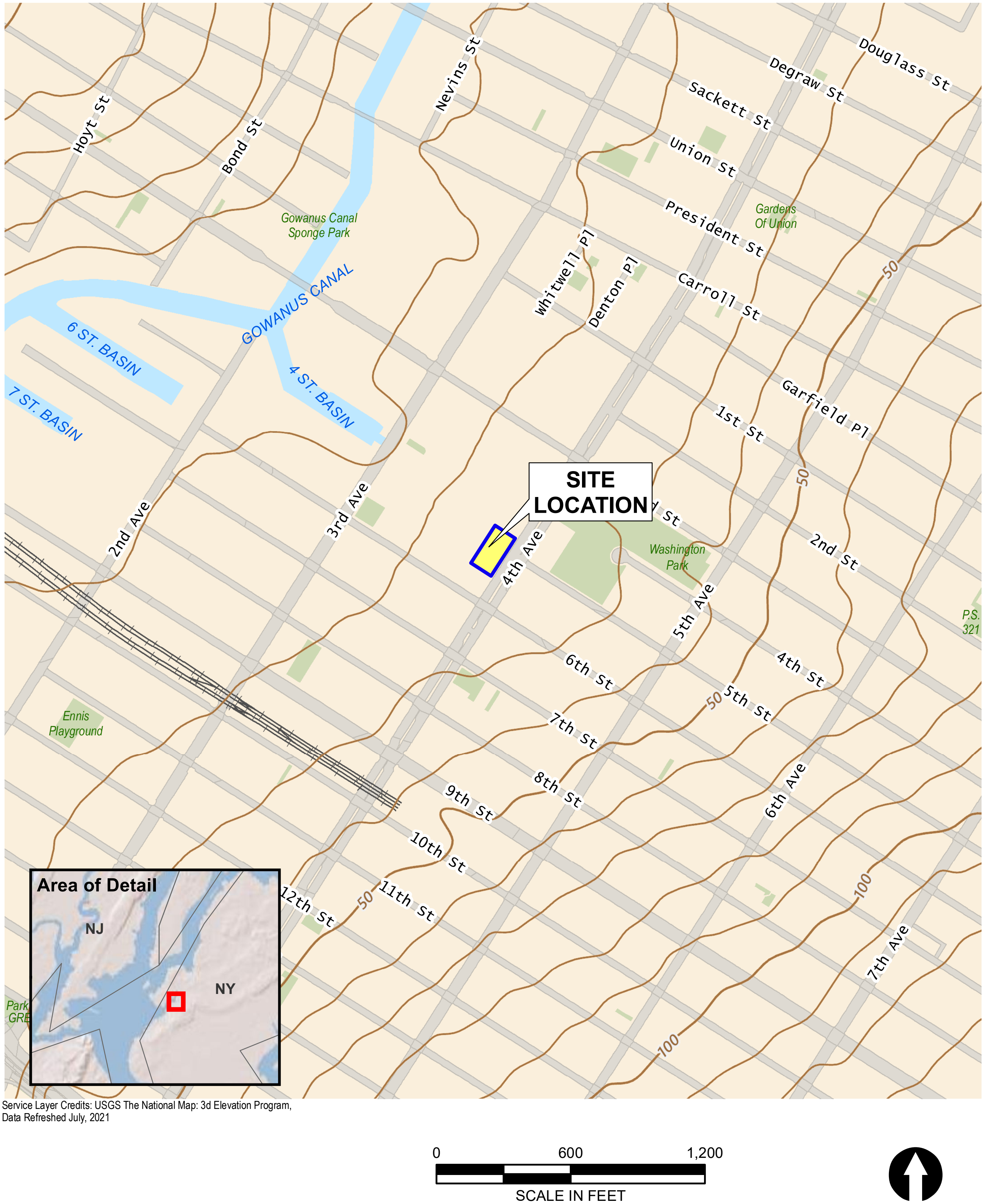
All readings will be recorded and be available for NYSDEC and NYSDOH personnel to review.

2.2 Project Contacts

Table 1
Project Contacts

Company	Individual Name	Title	Contact Number
AKRF	Michelle Lapin	Professional Engineer	(646) 388-9520 (Office)
	Stephen Malinowski	Project Director, QEP, Quality Assurance/Quality Control Officer	(631) 574-3724 (Office)
	Kenneth Wiles	Project Manager	(646) 388-9528 (Office)
	Tim Larigan	Deputy Project Manager	(646) 388-9508 (Office)
	Antonio Cardenas	Field Team Leader/Site Safety Officer	(718) 551-7193 (Cell)
380 4th Avenue Owner, LLC	Kyle Cohen	Participant Representative	(914) 886-3056 (Office)
NYSDEC	Michael Sollecito	BCP Project Manager	(518) 402-2198 (Office)
NYSDOH	TBD	NYSDOH Project Manager	TBD

FIGURE



Service Layer Credits: USGS The National Map: 3d Elevation Program,
Data Refreshed July, 2021

AKRF
440 Park Avenue South, New York, NY 10016

380 4th Avenue
Brooklyn, New York

BCP SITE LOCATION

DATE	**5/2/2022**
PROJECT NO.	**210226**
FIGURE	**1**

©2022 AKRF W:\Projects\210226 - QUINLAN E-DESIGNATION 374 4TH AVE\GIS Graphics\SAR\RAWP\210226 Figure 1 BCP site location.mxd5/2/2022 1:17:53 PM mveilleux

ATTACHMENT A

NEW YORK STATE DEPARTMENT OF HEALTH GENERIC CAMP

Appendix 1A
New York State Department of Health
Generic Community Air Monitoring Plan

Overview

A Community Air Monitoring Plan (CAMP) requires real-time monitoring for volatile organic compounds (VOCs) and particulates (i.e., dust) at the downwind perimeter of each designated work area when certain activities are in progress at contaminated sites. The CAMP is not intended for use in establishing action levels for worker respiratory protection. Rather, its intent is to provide a measure of protection for the downwind community (i.e., off-site receptors including residences and businesses and on-site workers not directly involved with the subject work activities) from potential airborne contaminant releases as a direct result of investigative and remedial work activities. The action levels specified herein require increased monitoring, corrective actions to abate emissions, and/or work shutdown. Additionally, the CAMP helps to confirm that work activities did not spread contamination off-site through the air.

The generic CAMP presented below will be sufficient to cover many, if not most, sites. Specific requirements should be reviewed for each situation in consultation with NYSDOH to ensure proper applicability. In some cases, a separate site-specific CAMP or supplement may be required. Depending upon the nature of contamination, chemical- specific monitoring with appropriately-sensitive methods may be required. Depending upon the proximity of potentially exposed individuals, more stringent monitoring or response levels than those presented below may be required. Special requirements will be necessary for work within 20 feet of potentially exposed individuals or structures and for indoor work with co-located residences or facilities. These requirements should be determined in consultation with NYSDOH.

Reliance on the CAMP should not preclude simple, common-sense measures to keep VOCs, dust, and odors at a minimum around the work areas.

Community Air Monitoring Plan

Depending upon the nature of known or potential contaminants at each site, real-time air monitoring for VOCs and/or particulate levels at the perimeter of the exclusion zone or work area will be necessary. Most sites will involve VOC and particulate monitoring; sites known to be contaminated with heavy metals alone may only require particulate monitoring. If radiological contamination is a concern, additional monitoring requirements may be necessary per consultation with appropriate DEC/NYSDOH staff.

Continuous monitoring will be required for all ground intrusive activities and during the demolition of contaminated or potentially contaminated structures. Ground intrusive activities include, but are not limited to, soil/waste excavation and handling, test pitting or trenching, and the installation of soil borings or monitoring wells.

Periodic monitoring for VOCs will be required during non-intrusive activities such as the collection of soil and sediment samples or the collection of groundwater samples from existing monitoring wells. “Periodic” monitoring during sample collection might reasonably consist of taking a reading upon arrival at a sample location, monitoring while opening a well cap or overturning soil, monitoring during well baling/purging, and taking a reading prior to leaving a sample location. In some instances, depending upon the proximity of potentially exposed individuals, continuous monitoring may be required during sampling activities. Examples of such situations include groundwater sampling at wells on the curb of a busy urban street, in the midst of a public park, or adjacent to a school or residence.

VOC Monitoring, Response Levels, and Actions

Volatile organic compounds (VOCs) must be monitored at the downwind perimeter of the immediate work area (i.e., the exclusion zone) on a continuous basis or as otherwise specified. Upwind concentrations should be measured at the start of each workday and periodically thereafter to establish background conditions, particularly if wind direction changes. The monitoring work should be performed using equipment appropriate to measure the types of contaminants known or suspected to be present. The equipment should be calibrated at least daily for the contaminant(s) of concern or for an appropriate surrogate. The equipment should be capable of calculating 15-minute running average concentrations, which will be compared to the levels specified below.

1. If the ambient air concentration of total organic vapors at the downwind perimeter of the work area or exclusion zone exceeds 5 parts per million (ppm) above background for the 15-minute average, work activities must be temporarily halted and monitoring continued. If the total organic vapor level readily decreases (per instantaneous readings) below 5 ppm over background, work activities can resume with continued monitoring.

2. If total organic vapor levels at the downwind perimeter of the work area or exclusion zone persist at levels in excess of 5 ppm over background but less than 25 ppm, work activities must be halted, the source of vapors identified, corrective actions taken to abate emissions, and monitoring continued. After these steps, work activities can resume provided that the total organic vapor level 200 feet downwind of the exclusion zone or half the distance to the nearest potential receptor or residential/commercial structure, whichever is less - but in no case less than 20 feet, is below 5 ppm over background for the 15-minute average.

3. If the organic vapor level is above 25 ppm at the perimeter of the work area, activities must be shutdown.

4. All 15-minute readings must be recorded and be available for State (DEC and NYSDOH) personnel to review. Instantaneous readings, if any, used for decision purposes should also be recorded.

Particulate Monitoring, Response Levels, and Actions

Particulate concentrations should be monitored continuously at the upwind and downwind perimeters of the exclusion zone at temporary particulate monitoring stations. The particulate monitoring should be performed using real-time monitoring equipment capable of measuring particulate matter less than 10 micrometers in size (PM-10) and capable of integrating over a period of 15 minutes (or less) for comparison to the airborne particulate action level. The equipment must be equipped with an audible alarm to indicate exceedance of the action level. In addition, fugitive dust migration should be visually assessed during all work activities.

1. If the downwind PM-10 particulate level is 100 micrograms per cubic meter (mcg/m^3) greater than background (upwind perimeter) for the 15-minute period or if airborne dust is observed leaving the work area, then dust suppression techniques must be employed. Work may continue with dust suppression techniques provided that downwind PM-10 particulate levels do not exceed 150 mcg/m^3 above the upwind level and provided that no visible dust is migrating from the work area.

2. If, after implementation of dust suppression techniques, downwind PM-10 particulate levels are greater than 150 mcg/m^3 above the upwind level, work must be stopped and a re-evaluation of activities initiated. Work can resume provided that dust suppression measures and other controls are successful in reducing the downwind PM-10 particulate concentration to within 150 mcg/m^3 of the upwind level and in preventing visible dust migration.

3. All readings must be recorded and be available for State (DEC and NYSDOH) and County Health personnel to review.

December 2009

Appendix 1B
Fugitive Dust and Particulate Monitoring

A program for suppressing fugitive dust and particulate matter monitoring at hazardous waste sites is a responsibility on the remedial party performing the work. These procedures must be incorporated into appropriate intrusive work plans. The following fugitive dust suppression and particulate monitoring program should be employed at sites during construction and other intrusive activities which warrant its use:

1. Reasonable fugitive dust suppression techniques must be employed during all site activities which may generate fugitive dust.

2. Particulate monitoring must be employed during the handling of waste or contaminated soil or when activities on site may generate fugitive dust from exposed waste or contaminated soil. Remedial activities may also include the excavation, grading, or placement of clean fill. These control measures should not be considered necessary for these activities.

3. Particulate monitoring must be performed using real-time particulate monitors and shall monitor particulate matter less than ten microns (PM10) with the following minimum performance standards:

(a) Objects to be measured: Dust, mists or aerosols;
(b) Measurement Ranges: 0.001 to 400 mg/m3 (1 to 400,000 :ug/m3);
(c) Precision (2-sigma) at constant temperature: +/- 10 :g/m3 for one second averaging; and +/- 1.5 g/m3 for sixty second averaging;
(d) Accuracy: +/- 5% of reading +/- precision (Referred to gravimetric calibration with SAE fine test dust (mmd= 2 to 3 :m, g= 2.5, as aerosolized);
(e) Resolution: 0.1% of reading or 1g/m3, whichever is larger;
(f) Particle Size Range of Maximum Response: 0.1-10;
(g) Total Number of Data Points in Memory: 10,000;
(h) Logged Data: Each data point with average concentration, time/date and data point number
(i) Run Summary: overall average, maximum concentrations, time/date of maximum, total number of logged points, start time/date, total elapsed time (run duration), STEL concentration and time/date occurrence, averaging (logging) period, calibration factor, and tag number;
(j) Alarm Averaging Time (user selectable): real-time (1-60 seconds) or STEL (15 minutes), alarms required;
(k) Operating Time: 48 hours (fully charged NiCd battery); continuously with charger;
(l) Operating Temperature: -10 to 50^o C (14 to 122^o F);
(m) Particulate levels will be monitored upwind and immediately downwind at the working site and integrated over a period not to exceed 15 minutes.

4. In order to ensure the validity of the fugitive dust measurements performed, there must be appropriate Quality Assurance/Quality Control (QA/QC). It is the responsibility of the remedial party to adequately supplement QA/QC Plans to include the following critical features: periodic instrument calibration, operator training, daily instrument performance (span) checks, and a record keeping plan.

5. The action level will be established at 150 ug/m3 (15 minutes average). While conservative,

this short-term interval will provide a real-time assessment of on-site air quality to assure both health and safety. If particulate levels are detected in excess of 150 ug/m3, the upwind background level must be confirmed immediately. If the working site particulate measurement is greater than 100 ug/m3 above the background level, additional dust suppression techniques must be implemented to reduce the generation of fugitive dust and corrective action taken to protect site personnel and reduce the potential for contaminant migration. Corrective measures may include increasing the level of personal protection for on-site personnel and implementing additional dust suppression techniques (see paragraph 7). Should the action level of 150 ug/m3 continue to be exceeded work must stop and DER must be notified as provided in the site design or remedial work plan. The notification shall include a description of the control measures implemented to prevent further exceedances.

6. It must be recognized that the generation of dust from waste or contaminated soil that migrates off-site, has the potential for transporting contaminants off-site. There may be situations when dust is being generated and leaving the site and the monitoring equipment does not measure PM10 at or above the action level. Since this situation has the potential to allow for the migration of contaminants off-site, it is unacceptable. While it is not practical to quantify total suspended particulates on a real-time basis, it is appropriate to rely on visual observation. If dust is observed leaving the working site, additional dust suppression techniques must be employed. Activities that have a high dusting potential--such as solidification and treatment involving materials like kiln dust and lime--will require the need for special measures to be considered.

7. The following techniques have been shown to be effective for the controlling of the generation and migration of dust during construction activities:

(a) Applying water on haul roads;
(b) Wetting equipment and excavation faces;
(c) Spraying water on buckets during excavation and dumping;
(d) Hauling materials in properly tarped or watertight containers;
(e) Restricting vehicle speeds to 10 mph;
(f) Covering excavated areas and material after excavation activity ceases; and
(g) Reducing the excavation size and/or number of excavations.

Experience has shown that the chance of exceeding the 150ug/m3 action level is remote when the above-mentioned techniques are used. When techniques involving water application are used, care must be taken not to use excess water, which can result in unacceptably wet conditions. Using atomizing sprays will prevent overly wet conditions, conserve water, and provide an effective means of suppressing the fugitive dust.

8. The evaluation of weather conditions is necessary for proper fugitive dust control. When extreme wind conditions make dust control ineffective, as a last resort remedial actions may need to be suspended. There may be situations that require fugitive dust suppression and particulate monitoring requirements with action levels more stringent than those provided above. Under some circumstances, the contaminant concentration and/or toxicity may require additional monitoring to protect site personnel and the public. Additional integrated sampling and chemical analysis of the dust may also be in order. This must be evaluated when a health and safety plan is developed and when appropriate suppression and monitoring requirements are established for protection of health and the environment.

APPENDIX C
QUALITY ASSURANCE PROJECT PLAN

380 4TH AVENUE

BROOKLYN, NEW YORK

Quality Assurance Project Plan

For

Interim Remedial Measure Work Plan

BCP Site No.: C224358
AKRF Project Number: 210226

Prepared for:

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

Prepared On Behalf Of:

380 4th Avenue Owner, LLC
157 Columbus Avenue, Suite 2E
New York, NY 10023

Prepared by:

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

DECEMBER 2022

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FIGURES

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1.0 INTRODUCTION

This Quality Assurance Project Plan (QAPP) describes the protocols and procedures that will be followed during any environmental sampling needed during implementation of the Interim Remedial Measure (IRM) Work Plan (IRMWP) at the 380 4th Avenue project site, hereafter referred to as the "Site." The Site is an approximately 20,000-square foot parcel located at 374 to 390 4th Avenue in the Gowanus neighborhood of Brooklyn, New York and comprises Tax Block 980, Lot 77. A Site Location map is provided as Figure 1.

The objective of this QAPP is to provide for Quality Assurance (QA) and maintain Quality Control (QC) of environmental investigative, sampling, and remedial activities conducted under the New York State Department of Environmental Conservation (NYSDEC) oversight in the Brownfield Cleanup Program (BCP). The Site is enrolled in the NYSDEC BCP under BCP Site No. C224358 as of October 2022. Adherence to the QAPP will ensure that defensible data will be obtained during all environmental work conducted at the Site as part of the IRM. Figure 2 shows the extent of support of excavation (SOE) to be installed under this IRMWP.

2.0 PROJECT TEAM

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

2.1 Remedial Engineer

The Remedial Engineer (RE) for this project will be Michelle Lapin, P.E. The RE will have primary direct responsibility for implementation of the IRM for the Site. The RE will coordinate the work of other contractors and subcontractors involved in all aspects of interim remedial construction, including drilling, stockpiling, characterization, removal and disposal, air monitoring, emergency spill response services, and management of waste transport and disposal. The RE will be responsible for all appropriate communication with NYSDEC and New York State Department of Health (NYSDOH). Ms. Lapin's resume is included in Attachment A.

2.2 Quality Assurance/Quality Control Officer

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

2.3 Project Manager

The project manager will be responsible for directing and coordinating all elements of the IRMWP. The project manager will review reports and participate in meetings with the Site owner, Volunteer, and/or the NYSDEC. Kenneth Wiles will serve as the project manager for the IRMWP. Mr. Wiles' resume is included in Attachment A.

2.4 Deputy Project Manager

The deputy project manager will be responsible for managing the day-to-day field activities and coordinating with the construction team during the IRM. The deputy project manager will prepare reports and participate in meetings with the Site owner, Volunteer, and/or the NYSDEC. Tim Larigan will serve as the deputy project manager for the IRMWP. Mr. Larigan's resume is included in Attachment A.

2.5 Field Team Leader, Field Technician, and Site Safety Officer

The field team leader will be responsible for supervising the daily sampling and health and safety activities in the field and will ensure adherence to the work plan and Health and Safety Plan (HASP), included in Appendix A of the IRMWP. The field team leader will also act as the field technician and Site Safety Officer (SSO) and will report to the project manager or project manager alternate on a regular basis regarding daily progress and any deviations from the work plan. The field team leader will be a qualified and responsible person able to act professionally and promptly during environmental work at the Site. Antonio Cardenas will be the field team leader. The field team leader alternates are Brian Quinn and Hank Westly of AKRF. Mr. Cardenas', Mr. Quinn's, and Mr. Westly's resumes are included in Attachment A.

2.6 Laboratory Quality Assurance/Quality Control Officer

The laboratory QA/QC officer will be Carl Armbruster of Eurofins-TestAmerica Laboratories (Eurofins-TestAmerica), the NYSDOH Environmental Laboratory Approval Program (ELAP)-certified laboratory being employed for all environmental sampling at the Site. The laboratory QA/QC officer will be responsible for quality control procedures and checks in the laboratory and ensuring adherence to laboratory protocols. He will track the movement of samples from the time they are checked in at the laboratory to the time that analytical results are issued. He will also conduct a final check on the analytical calculations and sign off on the laboratory reports.

2.7 Thirty-Party Data Validator

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

3.0 STANDARD OPERATING PROCEDURES

The following sections describe the standard operating procedures for the remedial activities included in the IRMWP. During these operations, safety monitoring will be performed as described in the HASP, included as Appendix A of the IRMWP.

3.1 Installation of Support of Excavation

SOE across the Site perimeter is required for the future Site-wide remedial excavation of the contaminated soil/fill identified during RIs performed in 2021 and 2022, and to prevent compromising the structural integrity of adjacent properties, structures, subway structures, and roadways. The proposed SOE will include drilled soldier piles along the northern, southern, eastern, and western Site boundaries, as shown on Figure 2.

No soil excavation or soil sampling is anticipated as part of the IRM; however, soil spoils will be generated during the drilling of the SOE piles. All soil spoils will be either stockpiled on, and covered with, poly sheeting and remain on-site during the SOE installation work or shipped off-site for disposal to an approved facility. If additional waste characterization is required to dispose of the soil spoils, sampling will be required.

3.2 Contingency Plan

If underground storage tanks (USTs) or other previously unidentified contaminant sources are discovered during the SOE drilling, sampling will be performed on product, sediment, and/or surrounding soil/fill, etc., as applicable (refer to Section 3.3). Chemical analytical work will be for full scan parameters: Target Compound List (TCL) volatile organic compounds (VOCs), semivolatile organic compounds (SVOCs), pesticides, polychlorinated biphenyls (PCBs), 1,4-dioxane, per- and polyfluoroalkyl substances (PFAS), and Target Analyte List (TAL) metals. The analyses will not be limited to CP-51 parameters where tanks are identified without prior approval by the NYSDEC project manager.

3.3 Soil Sampling

3.3.1 Soil Screening

During IRM activities, soil/fill material from drilling spoils will be inspected by AKRF field personnel for evidence of contamination (i.e., separate phase liquid, staining, sheening and/or odors) and field-screened using a photoionization detector (PID) calibrated at the start of each day in accordance with the manufacturer's instructions. In the event that previously unidentified contaminant sources are discovered during SOE solider pile drilling, the location will be adequately documented, and proper measures will be taken under the IRMWP until the contaminant sources can be addressed during remedial excavation under the RAWP, or immediate action under consultation with NYSDEC.

3.3.2 Soil Sampling (if necessary)

Depending upon conditions encountered during SOE installation and monitoring of the Site, soil sampling may be necessary. Any soil sampling will be conducted according to the following procedures:

- Characterize the sample according to the modified Burmister soil classification system.
- Collect an aliquot of soil from each sampling location and place in a labeled sealable plastic bag. The bag should be labeled with the soil boring number and the depth the

sample was collected. Place the plastic bag in a chilled cooler to await selection of samples for laboratory analysis.

- After selecting which samples will be analyzed in the laboratory, fill the required laboratory-supplied sample jars with the soil from the selected sampling location or labeled sealable plastic bags. Seal and label the sample jars as described in Section 4.6.1 of this QAPP and place in an ice-filled cooler.
- Decontaminate any soil sampling equipment between sample locations as described in Section 3.4 of this QAPP.

Record boring number, sample depth and sample observations (evidence of contamination, PID readings, soil classification) in field logbook and boring log data sheet, if applicable.

3.4 Decontamination of Sampling Equipment

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

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

3.5 Excavation Backfill (if necessary)

Backfill import is not expected during the IRM. However, if necessary, any imported soil will meet the backfill and cover soil quality standards established in 6 New York Codes, Rules, and Regulations (NYCRR) 375-6.7(a). Approval will also be based on an evaluation of the land use, protection of groundwater, and protection of ecological resources criteria. Soil will be considered appropriate for use as on-site imported backfill if contaminant concentrations are below the lesser of the 6 NYCRR Part 375 Unrestricted Use Soil Cleanup Objectives (UUSCOs) for proposed Track 1 Cleanup areas or Restricted Residential Use Soil Cleanup Objectives (RRSCOs) for proposed Track 2 areas, and the Protection of Groundwater Soil Cleanup Objectives (PGWSCOs). Soil that meets the ‘exempt’ fill requirements under 6 NYCRR Part 360 but does not meet backfill or cover soil objectives for this Site, will not be imported to the Site without prior approval by NYSDEC. Solid waste will not be imported to the Site.

Native material from a virgin quarry source need not be sampled prior to use as backfill on the Site. All other imported material will be tested via collection of one composite sample per 1,000 cubic yards of material from each source. Samples will be analyzed for VOCs by EPA Method 8260, SVOCs by EPA Method 8270, TAL metals by EPA Method 6000/7000 series, PCBs by EPA Method 8082, pesticides by EPA Method 8081, 1,4-dioxane by EPA Method 8270, and PFAS compounds by EPA Method 1633.

3.6 Material Reuse On-Site (if necessary)

No Site-wide excavation or material reuse is proposed under the IRMWP. If necessary, soil that does not exhibit evidence of contamination during field screening and is free of demolition debris will be stockpiled and tested at a frequency of one sample per 1,000 cubic yards and characterized if reuse is contemplated. Organic matter (wood, roots, stumps, etc.) or other solid is prohibited for reuse on-site. Each sample will be tested for VOCs by EPA Method 8260, TCL SVOCs by EPA Method 8270, PCBs by EPA Method 8082, pesticides by EPA Method 8081, TAL metals by EPA Method 6000/7000 series, 1,4-dioxane by EPA Method 8270, and PFAS compounds by EPA Method 1633. Samples will be shipped to the laboratory with appropriate chain-of-custody documentation. The samples will be analyzed in a laboratory following NYSDOH Analytical Services Protocol (ASP) Category B deliverables.

3.7 Management Of Investigation Derived Waste

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

4.0 SAMPLING AND LABORATORY PROCEDURES

4.1 Soil Sampling (if necessary)

Soil sampling will be conducted according to the following procedures:

- Characterize the sample according to the modified Burmister soil classification system.
- Field-screen the sample for evidence of contamination (e.g., odors, staining,) using visual and olfactory methods and screen for using a photoionization detector (PID) equipped with a 10.6 electron volt (eV) lamp.
- Collect an aliquot of soil from each proposed sample location, place in laboratory-supplied glassware, label the sample in accordance with Section 4.6.1 of this QAPP, and place in an ice-filled cooler for shipment to the laboratory.
- Complete the proper chain of custody paperwork and seal the cooler.
- Record sample location, sample depth, and sample observations (evidence of contamination, PID readings, soil classification, etc.) in field logbook and boring log data sheet, if applicable.
- Decontaminate any soil sampling equipment between sample locations as described in Section 3.4 of this QAPP.
- Sampling for emerging contaminants will be conducted in accordance with the January 2021 NYSDEC-issued sampling protocol (Sampling, Analysis, and Assessment of PFAS).

4.2 Groundwater Sampling (if necessary)

If groundwater samples need to be collected, low-flow sampling techniques will be used, as described in U.S. EPA's Ground-Water Sampling Guidelines for Superfund and RCRA Project Managers (EPA 542-S-02-001, May 2002). Sampling will be conducted according to the following procedure:

- Prepare the sampling area by placing plastic sheeting over the well. Cut a hole in the sheeting to provide access to the well cover.
- Slowly remove the locking cap and immediately measure the vapor concentrations in the well with a PID calibrated to the manufacturer's specifications.
- Measure the depth to water and total well depth, and check for the presence of non-aqueous phase liquid (NAPL) using an oil/water interface probe. Measure the thickness of NAPL, if any, and record in field book and well log. Collect a sample of NAPL using a disposable plastic weighted bailer or similar collection device. Groundwater samples will not be collected from wells containing measurable NAPL.
- Use the water level and total well depth measurements to calculate the length of the mid-point of the water column within the screened interval. For example, for a well where the total depth is 20 feet, screened interval is 10 to 20 feet, and depth to water is 14 feet, the mid-point of the water column within the screened interval would be 17 feet.
- For a two-inch well, connect dedicated tubing to either a submersible or a bladder pump and lower the pump such that the intake of the pump is set at the mid-point of the water column within the screened interval of the well. Connect the discharge end of the tubing to the flow-through cell of a Horiba Quanta multi-parameter (or equivalent) meter. Connect tubing to the output of the cell and place the discharge end of the tubing in a 5-gallon bucket.

- Activate the pump at the lowest flow rate setting of the pump.
- Measure the depth to water within the well. The pump flow rate may be increased such that the water level measurements do not change by more than 0.3 foot as compared to the initial static reading. The well-purging rate should be adjusted so as to produce a smooth, constant (laminar) flow rate and so as not to produce excessive turbulence in the well. The expected targeted purge rate will be approximately 0.5 liter and will be no greater than 3.8 liters/minute.
- Transfer discharged water from the 5-gallon buckets to 55-gallon drums designated for well-purge water.
- During purging, collect periodic samples and analyze for water quality indicators (e.g., turbidity, pH, temperature, dissolved oxygen, reduction-oxidation potential, and specific conductivity) with measurements collected approximately every five minutes.
- Continue purging the well until turbidity is less than 50 nephthalometric turbidity units (NTU) and water quality indicators have stabilized to the extent practicable. The criteria for stabilization will be three successive readings for the following parameters and criteria:

Table 1
Stabilization Criteria

Parameter	Stabilization Criteria
PH	+/- 0.1 pH units
Specific Conductance	+/- 3% mS/cm
ORP/Eh	+/- 10mV
Turbidity	<50 NTU
Dissolved Oxygen	+/- 0.3 mg/l

Notes: mS/cm = millisievert per centimeter
mV = millivolts
NTU = nephthalometric turbidity units
mg/l = milligrams per liter

- If the water quality parameters do not stabilize and/or turbidity is greater than 50 NTU within two hours, purging may be discontinued. Efforts to stabilize the water quality for the well must be recorded in the field book, and samples may then be collected as described herein.
- After purging, disconnect the tubing to the inlet of the flow-through cell. Collect groundwater samples directly from the discharge end of the tubing and place into the required sample containers as described in Section 4.4 of this QAPP. Label the containers as described in Section 4.6.1 of this QAPP and place in an ice-filled cooler for shipment to the laboratory.
- Collect one final field sample and analyze for turbidity and water quality parameters (pH, temperature, dissolved oxygen, reduction-oxidation potential, and specific conductivity).
- Once sampling is complete, remove the pump and tubing from the well. Disconnect the tubing and place it back in the well for reuse during the next sampling event. Dispose of the sample filter in a 55-gallon drum designated for disposable sampling materials and personal protective equipment (PPE). The purge water will be managed as described in Section 4.2 of this QAPP.
- Decontaminate the pump, oil/water interface probe, and flow-through cell, as described in Section 3.4 of this QAPP.

- Record all measurements (depth to water, depth to NAPL, water quality parameters, turbidity), calculations (well volume), and observations in the project logbook and field data sheet, if applicable.
- Sampling for emerging contaminants will be conducted in accordance with the January 2021 NYSDEC-issued sampling protocol ("Sampling, Analysis, and Assessment of PFAS"), with the exception that a low-density polyethylene (LDPE) bladder will be used as no industry-approved high-density polyethylene (HDPE) alternative currently exists. If necessary, well sampling details will be noted on groundwater sampling logs, included as an appendix to the FER.

4.3 Vapor Sampling (if necessary)

If necessary, vapor samples will be collected as follows:

- Connect vapor sampling tubing between the low-flow air pump inlet port and sampling point.
- Connect the low-flow air pump discharge port to the inlet of a calibrated PID using tubing. Turn the pump on at an approximately flowrate of approximately 0.5 liter per minute. Record the PID measurement after 1 minute. Turn the pump off and disconnect the PID.
- Connect the tubing of the low-flow air pump discharge port to a new 1-liter Tedlar® bag.
- Fill the Tedlar® bag at an approximately flowrate of approximately 0.5 liter per minute.
- After the Tedlar® bag is full, close the valve on the Tedlar® bag, turn off the pump, and close the sample port.
- Place the Tedlar® bag in a cooler for shipment to the laboratory. Do NOT place ice in the cooler.
- Complete the proper chain of custody paperwork and seal the cooler.

4.4 Laboratory Methods

Table 2 summarizes the laboratory methods that may be used to analyze field samples and the sample container type, preservation, and applicable holding times. Eurofins-TestAmerica of Edison, New Jersey, a NYSDOH ELAP-certified laboratory subcontracted to AKRF, will be used for all chemical analyses, except for PFAS and TO-15 vapor analyses. Eurofins-TestAmerica of Lancaster, Pennsylvania, a NYSDOH ELAP-certified laboratory subcontracted to AKRF, will be used for PFAS analyses. Eurofins-TestAmerica of Burlington, Vermont, a NYSDOH ELAP-certified laboratory subcontracted to AKRF, will be used for TO-15 vapor analyses. The laboratory methods will be in accordance with the Division of Environmental Remediation (DER)-10 2.1(b) and 2.1(f) with Category B Deliverables.

Table 2
Laboratory Analytical Methods for Analysis Groups

Matrix	Analysis	EPA Method	Bottle Type	Preservative	Hold Time
Soil	VOCs	8260C	EnCore® or Core N' One® samplers (3) or Terracore samplers and 2 oz. plastic jar	≤ 6 ºC	48 hours to extract; 14 days to analyze
	SVOCs	8270D	8 oz. Glass jar	≤ 6 ºC	14 days to extract; 40 days to analyze
	TAL Metals, and Hexavalent Chromium	6000/7000 Series, and 7196A	8 oz. Glass jar	≤ 6 ºC	6 months holding time; Mercury 28 days holding time; Hexavalent chromium 30 days to extract, 7 days to analyze
	Pesticides	8081B	8 oz. Glass Jar	≤ 6 ºC	14 days to extract; 40 days to analyze
	PCBs	8082A	8 oz. Glass Jar	≤ 6 ºC	14 days to extract; 40 days to analyze
	PFAS	1633	4 oz. or 8oz. HDPE jar	≤ 6 oC	90 days to extract; 20-25 days to analyze
Groundwater	VOCs	8260C	5 40 mL Glass vials	HCl to pH < 2 and ≤ 6 ºC	48 hours to extract; 14 days to analyze
	SVOCs	8270D	2,000 mL Amber jar	≤ 6 ºC	7 days to extract; 40 days to analyze
	TAL Metals	6000/7000 Series	2,000 mL Amber jar	HNO_3 to pH <2	6 months for metals; 28 days for mercury; 24 hours for hexavalent chromium
	Pesticides	8081B	2,000 mL Amber jar	≤ 6 ºC	7 days to extract; 40 days to analyze
	PCBs	8082A	2,000 mL Amber jar	≤ 6 ºC	7 days to extract; 40 days to analyze
	PFAS	1633	2x 500 mL HDPE plastic bottle	≤ 6 ºC	28 days to extract; 20-25 days to analyze
Vapor	VOCs	TO-15	1 L Tedlar® bag	None	14 days
Note: EPA - Environmental Protection Agency					

4.5 Quality Control Sampling

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

4.6 Sample Handling

4.6.1 Sample Identification

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

Additional Waste Classification/ Tank Excavation Soil Sampling (if necessary)

In addition to the nomenclature detailed above, any confirmatory endpoint samples collected from a tank excavation will be identified by the excavation grid area and the cardinal direction of the sidewalls. The sample(s) collected from the bottom of the excavation will be amended with a "B-", followed by the number of bottom samples collected from the excavation in sequential order. Any additional waste classification samples will be amended with "WC-" and the alphanumeric grid identification. Additionally, samples will be amended with the depth the sample was collected in feet below grade in parentheses. Table 4 provides examples of the sampling identification scheme for proposed waste classification samples and any hotspot or tank excavation samples.

Table 4
Waste Classification/Hotspot/Tank Excavation Sample Nomenclature

Sample Description	Sample Designation
Waste classification composite sample collected between grade and 5 feet below grade in grid A1 on January 15, 2023	WC-A1-C_0-5_20221115
Waste classification grab sample collected between grade and 5 feet below grade in grid A1 on January 31, 2023	WC-A1-G_0-5_20221115
Soil sample collected from the northern sidewall of a tank grave encountered at 4 feet below grade on February 12, 2023	UST-N_4_20230115

Sample Labeling and Shipping

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

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

Once the samples are collected and labeled, they will be placed in chilled coolers (for soil and groundwater samples) and stored in a cool area away from direct sunlight to await shipment to the laboratory. All samples will be shipped to the laboratory within 24 hours of collection. At the start and end of each workday, field personnel will add ice to the cooler(s) as needed. Coolers used to store the vapor samples Tedlar® bags will NOT be filled with ice.

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

Sample Custody

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

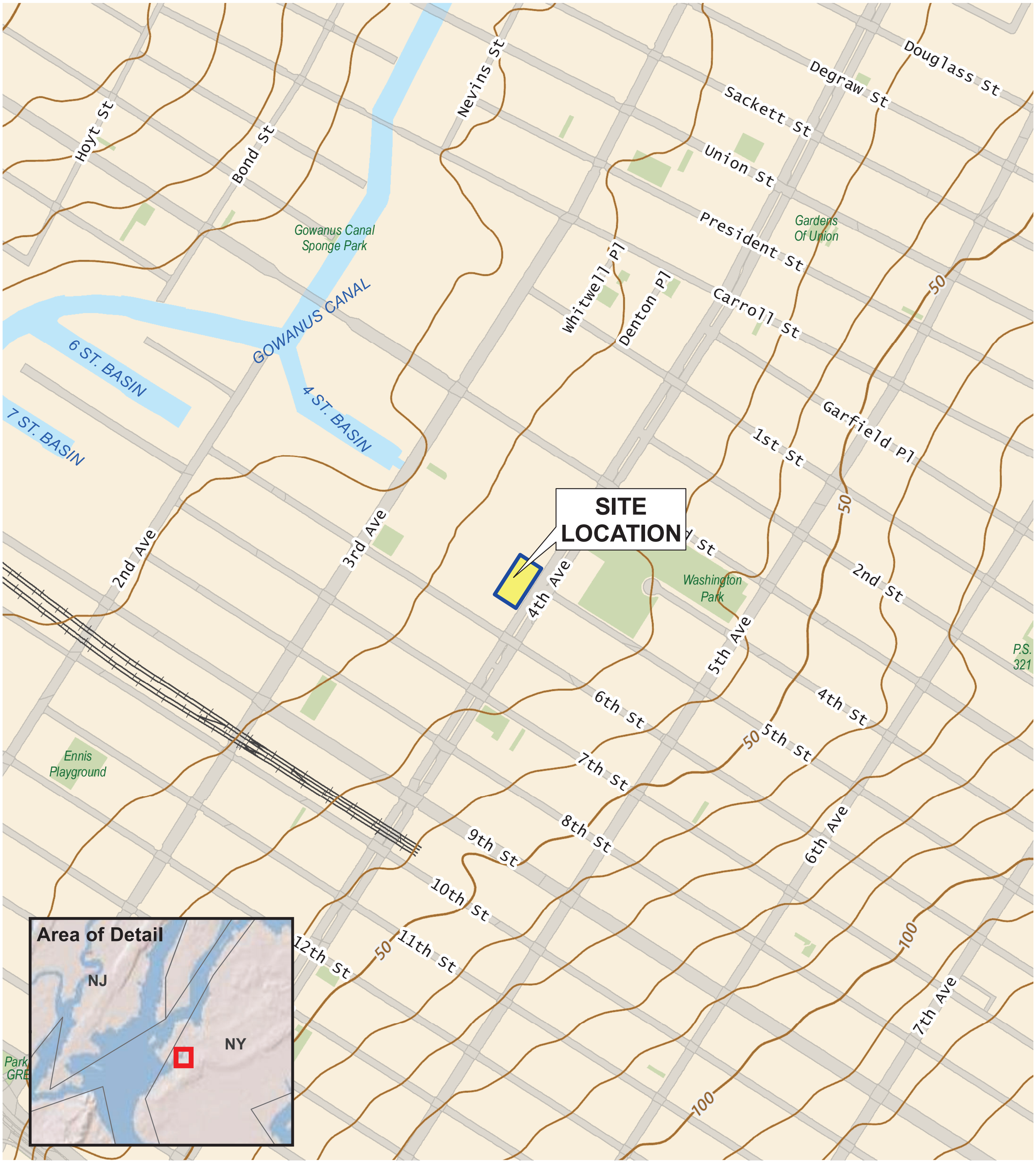
4.7 Field Instrumentation

Field personnel will be trained in the proper operation of all field instruments at the start of the field program. Instruction manuals for the equipment will be on file at the Site for referencing proper operation, maintenance, and calibration procedures. The equipment will be calibrated according to manufacturer specifications at the start of each day of fieldwork. If an instrument fails calibration, the project manager or QA/QC officer will be contacted immediately to obtain a replacement instrument. A calibration log will be maintained to record the date of each calibration, any failure to calibrate and corrective actions taken. The PID will be equipped with a 10.6 eV lamp and will be calibrated each day using 100 parts per million isobutylene standard gas in accordance with the manufacturer's standards.

4.8 Quality Assurance

All sample laboratory analytical data will be reviewed by a third-party validator and a DUSR will be prepared to document the usability and validity of the data. The Final Engineering Report will include a detailed description of endpoint sampling activities, data summary tables, concentration map showing endpoint sample locations and concentrations, DUSR, and laboratory reports.

FIGURES



Service Layer Credits: USGS The National Map: 3d Elevation Program,
Data Refreshed July, 2021

0 600 1,200
SCALE IN FEET

AKRF
440 Park Avenue South, New York, NY 10016

380 4th Avenue
Brooklyn, New York

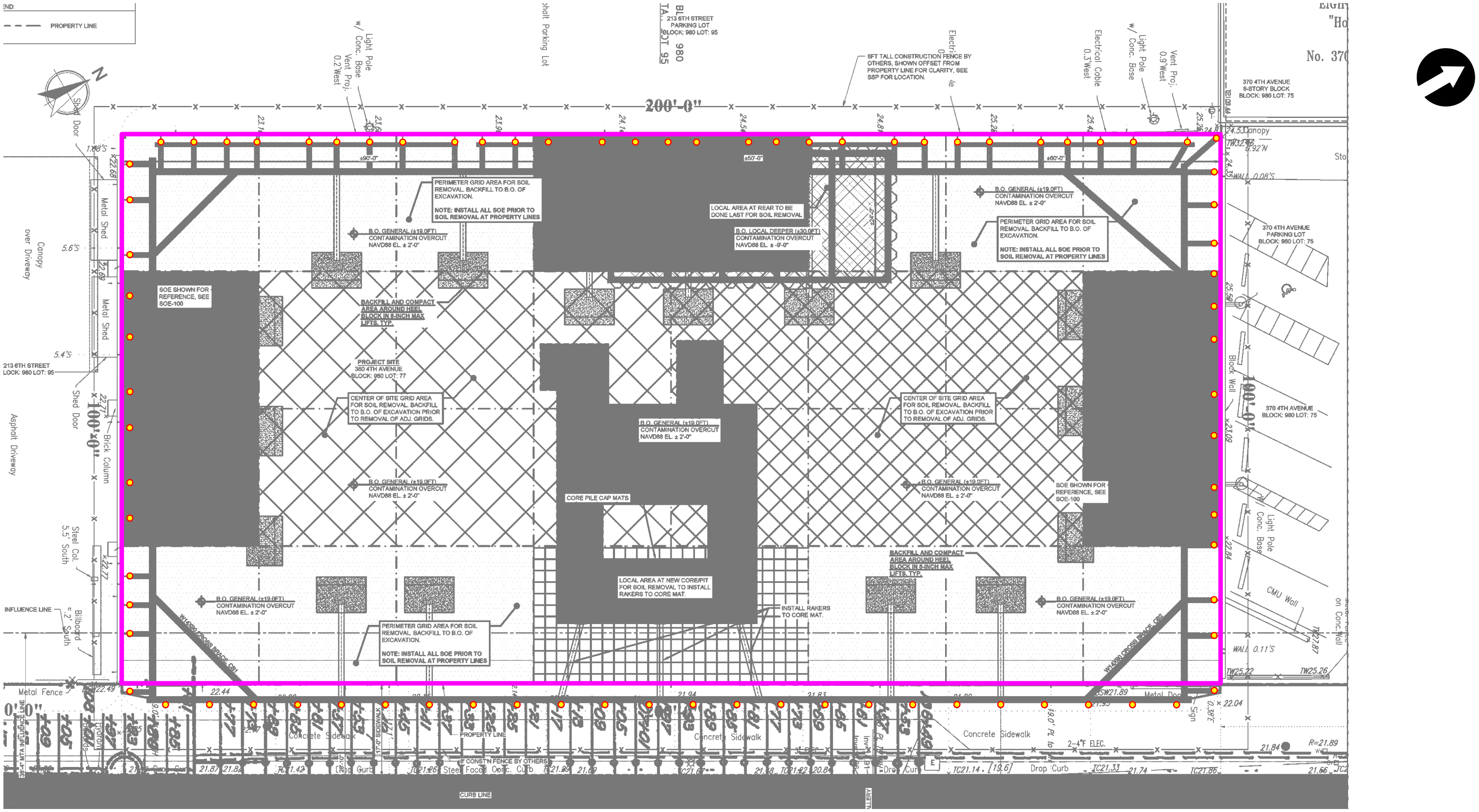
BCP SITE LOCATION

DATE
5/2/2022

PROJECT NO.
210226

FIGURE
1

©2022 AKRF W:\Projects\210226 - QUINLAN E-DESIGNATION 374 4TH AVE\GIS Graphics\SAR\RAWP\210226 Figure 1 BCP site location.mxd5/2/2022 1:17:53 PM mveilleux



LEGEND

▭ PROJECT SITE BOUNDARY

● ● ● PROPOSED SOLDIER PILES TO BE INSTALLED TO FACILITATE SUPPORT OF EXCAVATION

0 15 30 60

SCALE IN FEET

Map Source:
Ancora Engineering "Support of Excavation", Drawing No.: SOE-110.00, Dated 9/28/2022.

AKRF

440 Park Avenue South, New York, NY 10016

380 4th Avenue

Brooklyn, New York

EXTENT OF SUPPORT OF EXCAVATION (SOE)

DATE
12/15/2022

PROJECT NO.
210226

FIGURE
2

©2022 AKRF, Inc Q:\Projects\210226 - QUINLAN E-DESIGNATION 380 4TH AVE\SAR\CAD\210226 Fig 3 Extent of Support of Excavation (SOE).dwg last save: mveilleux 12/15/2022 1:44 PM

ATTACHMENT A

RESUMES OF REMEDIAL ENGINEER, QA/QC OFFICER, PROJECT MANAGERS, AND FIELD TEAM LEADERS

MICHELLE LAPIN, PE

SENIOR VICE PRESIDENT

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

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

BACKGROUND

Education

MS, Syracuse University, Civil Engineering, 1985
BS, Clarkson University, Civil Engineering, 1983

Licenses/Certifications

Professional Engineer, CT - PEN.0018603
Professional Engineer, NY - 16 073934
OSHA 40 Hour HAZWOPER
OSHA 8 Hour Refresher,

Professional Memberships

Member, National Society of Professional Engineers
Member, American Society of Civil Engineers
Member; Council Member, Connecticut Business & Industry Association, Environmental Policies Council
Board Member, New York City Brownfield Partnership,

Years of Experience

36 years in the industry
28 years with AKRF

RELEVANT EXPERIENCE

YMCA of Greater New York, Northeast Bronx YMCA, Bronx, NY

AKRF was retained by YMCA of Greater New York to assist the YMCA of Greater New York in its response to a request for proposals by the Economic Development Corporation for the development of a site in the Edenwald section of the Bronx into a community center. AKRF provided site assessment and remediation services and site-civil engineering due diligence services on the site. The YMCA was successful in winning the development rights, and AKRF prepared an Environmental Assessment for the site. AKRF continued assisting the YMCA in their development with site assessment and remediation services and geotechnical services for the new development at 1250 East 229th Street in the Bronx for the construction of the two-story, 30,000-square foot building. Michelle Lapin is leading the efforts for the Site Assessment and Remediation services, which includes a Remedial Action Plan and Construction Health and Safety Plan, field monitoring and subsequent Closure Report submitted to the New York City Department of Environmental Protection.

Atlantic Chestnut, Brooklyn, NY

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

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

Michelle Lapin directed the firm's hazardous materials work for this mixed-use development in Manhattan. The Algin Management Company hired AKRF to prepare an environmental impact statement (EIS) for the proposed rezoning of the western portion of the block between West 60th and 61st Streets, between Amsterdam and West End Avenues. The purpose of the proposed action was to facilitate the development of two 30-story residential towers with accessory parking spaces, and landscaped open space. The EIS examined a "worst case" condition for rezoning the block, which allowed Algin to build a residential building of approximately 375,000 square feet at their site. The building now contains 475 apartments, 200 accessory parking spaces, a health club, and community facility space. This site, with the services of AKRF, entered into New York State's Brownfield Cleanup Program (BCP). On-site issues included underground storage tanks remaining from previous on-site buildings, petroleum contamination from these tanks and possibly from off-site sources, and other soil contaminants (metals, semi-volatile organic compounds, etc.) from fill materials and previous on-site buildings. AKRF oversaw the adherence to the Construction Health and Safety Plan (HASP), which was submitted to and approved by the New York State Department of Environmental Conservation (NYSDEC), and monitored the waste streams, to ensure that the different types of waste were disposed of at the correct receiving facilities. This oversight also included confirmation and characteristic soil sampling for the receiving facilities and NYSDEC. A "Track 1" Clean up of the majority of the property (the portion including the buildings) was completed and the final Engineering Report was approved by the NYSDEC. AKRF has also completed a smaller portion of the property as a "Track 4" cleanup, which includes a tennis court and landscaped areas. Ms. Lapin continues to manage the annual inspections for the property owner in accordance with the Brownfield Cleanup Agreement.

2477 Third Avenue, Bronx, NY

AKRF conducted the investigation and remediation of the former 2477 Third Avenue gasoline station property under the New York State Department of Environmental Conservation's (NYSDEC's) Brownfield Cleanup Program (BCP). The work included shallow and deep aquifer groundwater testing, delineation of known areas of soil contamination, soil vapor analyses, and investigation and delineation of non-aqueous phase liquid (DNAPL) from past industrial activities. Upon NYSDEC approval of the Remedial Action Work Plan (RAWP), AKRF conducted the removal of the nine on-site underground storage tanks (USTs) and 1,100 tons of petroleum-contaminated soil, the application of six in-situ chemical oxidation (ISCO) groundwater treatments, and the implementation of four Enhanced Fluid Recovery (EFR) events to remove desorbed gasoline-related hydrocarbons in the groundwater. The site received a Certificate of Completion (COC) from the BCP and a Notice of Satisfaction (NOS) from the Mayor's Office of Environmental Remediation (OER) in connection with the hazardous materials E-Designation assigned to the property. Michelle Lapin was the professional engineer of record, responsible for the remediation design elements and overall adherence to the NYSDEC and New York City Office of Environmental Remediation (OER) regulations and continues to manage the required inspections and reporting for the property owner in accordance with the Brownfield Cleanup Agreement..

443 Greenwich Street, Manhattan, NY

This Site was assigned an E-Designation for hazardous materials (and air quality and noise) during the North Tribeca Rezoning in 2010, which requires environmental testing and, if necessary, remediation to the satisfaction of the New York City Mayor's Office of Environmental Remediation (OER). After years of public opposition to the original redevelopment scheme calling for a boutique hotel, this former manufacturing building and its current developer gained acceptance through the Department of City Planning and the Landmarks Preservation Commission to move forward with redevelopment as residential lofts. The redevelopment process began in 2012 and led to initial re-occupancy in 2016 after overcoming several regulatory challenges while seeking LEED® certification.

Once trichloroethene (TCE) was identified on-site, the typically straight forward assignment of delineating contaminant sources for AKRF became much more complex following the identification of an off-site TCE groundwater plume. Based on the completion of several rounds of additional sampling and investigation activities including a compound specific isotopic analysis (CSIA) of the chlorinated volatile organic compounds (VOCs) detected in the central portion of the Site and the off-site monitor wells south of the Site, the presence of two separate releases (one originating on-site and one originating off-site) of TCE was confirmed. Based on the confirmation that the Site was not the contamination source associated with the off-site plume, the redevelopment of the Site proceeded under the review of the OER, and did not require direct or continued oversight from the New York State Department of Environmental Conservation (NYSDEC). Furthermore, the developer of the Site, who had become the owner, was not deemed responsible to complete additional off-site investigation or remediation associated with the separate, off-site TCE groundwater plume. For this project, AKRF utilized forensic-based analysis of chlorinated VOC plumes and was one of the first projects that included a groundwater treatment technology managed by the OER in its E-Designation program. The Site also includes an engineered cap to prevent exposure to underlying soil/fill, a vapor barrier/waterproofing system beneath the building slab and along foundation sidewalls, and the operation of an active sub-slab depressurization (SSD) system. The project was awarded the 2017 Environmental Protection award by the New York City Brownfield Partnership. Michelle Lapin was the professional engineer of record, responsible for the remediation design and adherence of the remediation and remediation systems installation and ongoing operation.

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

AKRF assisted RXR Realty with enrolling the 1.1-acre Larkin Plaza site in the New York State Department of Environmental Conservation's (NYSDEC's) Brownfield Cleanup Program (BCP). Since being accepted into the program, AKRF conducted an extensive remedial investigation, prepared the necessary remedial action plans, managed the citizen participation tasks, and is in the process of conducting the remediation in conjunction with NYSDEC oversight. To date, the remedial work has included in-situ chemical oxidation (ISCO) treatments, contaminated soil removal, and petroleum product recovery. AKRF also assisted RXR with various construction-related services, including dewatering discharge permitting, soil disposal characterization testing, and stormwater pollution prevention plan (SWPPP) preparation. AKRF's Cultural Resources department is in the process of preparing a submission to the State Historic Preservation Office (SHPO) on behalf of RXR related to the acquisition of additional public funding sources.

MICHELLE LAPIN, PE

SENIOR VICE PRESIDENT

Michelle Lapin is the professional engineer of record, responsible for the remediation design elements and adherence to the NYSDEC-approved work plans and remediation design.

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

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

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

The remediation was completed in compliance with the OER-approved RAWP and the spill was closed by the NYSDEC. The project received a Notice of Satisfaction from the OER.

Personnel Resume

Carl Armbruster
QA Manager

Qualifications Summary

Mr. Armbruster has over 30 years of experience in the environmental laboratory and engineering industry that includes extensive technical, management/leadership experience in all aspects of the laboratory business. He is an action-oriented manager dedicated to ensuring the laboratory maintains a quality program that holds the highest credentials in PT scores, accreditations and customer satisfaction. His unique experience lends itself to working successfully with employees, managers and clients at all levels.

Professional Experience

Quality Assurance Manager – TestAmerica Edison - 2005 to Present

Mr. Armbruster is responsible for establishing and implementing the quality assurance program at the Edison facility; and for interfacing with the corporate Quality Assurance Director to ensure adherence with the overall Quality Management Plan. He is also responsible for monitoring implementation and compliance with NELAC and TestAmerica’s QMP, conducting annual management system audits and data audits, as well as providing regulatory updates and technical support to the Laboratory Director, Operations Manager, Client Services and Sales department.

Project Manager/Assistant Technical Director – STL Edison --2000 to 2005

Laboratory Director − STL Whippany − 1998 to 2000

Account Manager − Clean Harbors Environmental Services − 1997 to 1998

Laboratory Manager − Waste Management Inc., and Chemical Waste Management Inc − 1988 to 1997

Environmental Scientist − ICF Technology − 1987 to 1988

Analytical Chemist − IT Corporation – 1985 to 1987

Analytical Chemist − Hess Environmental Laboratories – 1983 to 1985

Education

- MS in Biology – East Stroudsburg University, 1984
- BS in Environmental Studies - East Stroudsburg University, 1980

STEPHEN T. MALINOWSKI, QEP

SENIOR VICE PRESIDENT- SITE ASSESSMENT AND REMEDIATION

Stephen Malinowski is a Senior Vice President with more than 25 years of professional experience in assessment, investigation, and remediation of environmental contamination-related issues. Steve has managed all aspects of environmental projects with multi-disciplinary teams, including public agencies, developers, property owners, architects, and construction managers to navigate regulatory programs efficiently and achieve project objectives. His projects fall under the regulatory oversight of the USEPA, NYSDEC, NYCDEP and NYCOER including the Federal and New York State Superfund, New York State Brownfield Cleanup Program (BCP) and petroleum spills, RCRA/IUC closures, New York City Voluntary Cleanup Program (VCP) and E-Designation program, and Nassau and Suffolk County regulatory programs. His proficiency in the development of custom scopes of work and accurate cost estimates coupled with his field-experience, knowledge of regulations, and excellent rapport with regulatory personnel allow him to provide turnkey environmental consulting for remediation, development, infrastructure improvement, and coastal resiliency projects.

Mr. Malinowski's experience includes the design, implementation, and management of environmental assessment, investigation and remediation projects in the New York Metropolitan Area and across Long Island. These projects have involved soil, soil vapor and groundwater investigation, monitoring, and sampling programs, Brownfield and hazardous waste site investigations, and underground storage tank studies, including soil contamination delineation, classification, waste removal and disposal. He has overseen and conducted hundreds of Phase I Environmental Site Assessments (ESAs) and Phase II investigations in a variety of environmental settings, ranging from industrial sites to sites in challenging urban areas, many of them in conjunction with site redevelopment and property transaction-related activities. In addition, he has designed and implemented indoor air and soil vapor intrusion surveys at industrial, commercial and residential properties in accordance with NYSDOH protocols, some requiring sub-slab depressurization systems.

BACKGROUND

Education

B.A., Environmental Science, State University of New York at Plattsburgh

Licenses/Certifications

Qualified Environmental Professional from the Institute of Professional Environmental Practice (IPEP)
New York State Professional Geologist #000422
Certified Brownfield Professional by New York City Office of Environmental Remediation
Health and Safety Operations at Hazardous Materials Sites 29 CFR 1910.120
OSHA 10 Hour Occupational Construction Safety and Health

Professional Memberships

Member, Long Island Association of Professional Geologists (LIAPG)
Member, Institute of Professional Environmental Practice (IPEP)

Awards

Big Apple Brownfield Award recipient as part of the 4697 Third Avenue redevelopment team 2021
Big Apple Brownfield Award recipient as part of the Front and York redevelopment team 2020
Big Apple Brownfield Award recipient as part of the Third Avenue redevelopment team 2018
Big Apple Brownfield Award recipient as part of the Flushing Commons redevelopment team 2017
Big Apple Brownfield Award recipient as part of the Jamaica 94th Avenue redevelopment team 2017

Big Apple Brownfield Award recipient as part of the Cornerstone B1 (LaTerraza) redevelopment team 2011

Years of Experience

28 years in the industry
8 years with AKRF

RELEVANT EXPERIENCE

J2 147-07 94th Avenue LLC, Queens, NY

This historical meat refrigeration facility is enrolled in the Brownfield Cleanup Program to remediate the property and construct a 23-story affordable residential building. Although the site has an E-Designation for hazardous materials, noise, and air quality, AKRF assisted with applying for entry into the NYSDEC Brownfield Cleanup Program, due to the presence of contaminated soil and soil vapor beneath the site.

Mr. Malinowski directed all Phases of this NYS Brownfield Cleanup Program (BCP) project located within the Jamaica Brownfield Opportunity Area. Mr. Malinowski has been responsible for overseeing the implementation of a Phase I Environmental Site Assessment and asbestos survey of this former industrial property adjacent to the Long Island Rail Road tracks. Since the site had an E-Designation for hazardous materials, noise and air quality, Mr. Malinowski coordinated with the New York City Office of Environmental Remediation (NYCOER) to ensure that all technical deliverables would also satisfy NYCOER's predevelopment requirements in order to obtain a Notice to Proceed from the NYC Department of Buildings. In doing so, he designed a scope of work for the Remedial Investigation that would satisfy both OER and the NYSDEC BCP.

Upon the receipt of results indicating the presence of contaminated soil and soil vapor beneath the site, the client decided to apply for the NYS BCP. Mr. Malinowski was responsible for preparation and submission of a BCP Application simultaneously with the Remedial Investigation Report and a Remedial Action Work Plan (RAWP) to expedite the approval process and enable implementation of the remediation concurrently with construction. Mr. Malinowski prepared a remedial estimate for the activities required by the RAWP, allowing the client to obtain financing for construction. Mr. Malinowski designed a testing program to pre-characterize approximately 15,000 cubic yards of soil underlying the existing building for disposal during the remedial excavation. The disposal testing identified a hotspot containing hazardous levels of lead, which Mr. Malinowski coordinated with the EPA to remediate at the onset of construction. The remedial excavation was completed during the height of the COVID outbreak with Mr. Malinowski's team providing environmental oversight, community air monitoring with NYSDEC. Upon completion of the work, Mr. Malinowski prepared a Final Engineering report and the Client received a Certificate of Completion from NYSDEC in 2020. A Notice of Satisfaction is anticipated from NYCOER after installation of the windows and façade are complete.

Front and York at 85 Jay Street, Brooklyn, NY

AKRF provided environmental consulting services for Front and York at 85 Jay Street in Brooklyn, a Brownfield redevelopment project bringing 728 apartments and 150,000 square feet of amenities to the neighborhood. Mr. Malinowski was responsible for preparation and implementation of a NYSDEC-approved Remedial Action Work Plan for this approximately three-acre former industrial site that encompasses an entire city-block. The remediation was conducted under the NYSDEC Brownfield Cleanup Program, primarily due to high levels of lead associated with former smelting operations. His responsibilities included overseeing an in-situ soil pre-characterization testing program to obtain pre-approval from the disposal of approximately 170,000 cubic yards of soil during the foundation excavation. Stephen assisted with the review and procurement of bids for the off-site transport and disposal of multiple soil waste streams. As part of the approval process, he oversaw extensive testing to delineate the extent of lead and other hot spot areas of contamination.

Mr. Malinowski was responsible for preparation and implementation of a NYSDEC-approved Remedial Action Work Plan for this approximately three-acre former industrial site that encompasses an entire city-block. The remediation is being conducted under the NYSDEC Brownfield Cleanup Program, primarily due to high levels of lead associated with former smelting operations. His responsibilities included overseeing an in-situ soil pre-characterization testing program to obtain pre-approval from the disposal of approximately 170,000 cubic yards of soil during the foundation excavation. As part of the approval process, Mr. Malinowski oversaw extensive testing to delineate the extent of lead and other hot spot areas of contamination.

The testing program included the development of a bench-scale study to condition the lead in-situ with a patented product to reduce its leachability from the soil and lower disposal costs. Based on the results of the bench tests, a Soil Stabilization Plan detailing an in-situ pilot study followed by wide-scale implementation was prepared and approved by NYSDEC. Upon receipt of the pilot test results, the soil conditioning program was approved for implementation for 40,000 tons of lead contaminated material. Mr. Malinowski assisted with the review and procurement of bids for the off-site transport and disposal of multiple soil waste streams and oversaw a soil conditioning program, the excavation monitoring with community and work-zone air monitoring, and the daily and monthly reporting obligation to NYSDEC. Mr. Malinowski was responsible for preparation of the Final Engineering Report (FER). The FER was approved by NYSDEC and the project received a certificate of completion in December 2019 for a Track I cleanup.

Alvista Towers (94-02 148th Street), Jamaica, NY
Mr. Malinowski was responsible for directing the assessment and preconstruction investigation activities for a former industrial property with an E-Designation for Hazardous Materials and Noise located within the Jamaica Brownfield Opportunity Area (BOA). Mr. Malinowski was responsible for designing the scope of the Remedial Investigation to satisfy the hazardous materials E-Designation, as well as for coordinating the pre-demolition asbestos survey and the noise survey to obtain the Notice to Proceed from the New York City Mayor's Office of Environmental Remediation's (NYCOER).

The Remedial Investigation revealed the presence of contaminated soil and soil vapor beneath the site, and the developer entered the New York State Department of Environmental Conservation (NYSDEC) Brownfield Cleanup Program (BCP) through NYCOER's JumpStart program. The remediation consisted of soil excavation and the removal of seven underground storage tanks. The site achieved an unrestricted use Track 2 cleanup and was the first project to receive a Certificate of Completion under the post-2015 amendment BCP.

Elton Crossing - Melrose Commons North Site C, Bronx, NY
AKRF provided environmental consulting services in connection with the purchase and redevelopment of the Elton Crossing site at 899 Elton Avenue in the Bronx, NY. The work initially involved the preparation of a Phase II subsurface investigation including soil and soil vapor testing to determine if the site would be eligible for the New York State Brownfield Cleanup Program (NYSBCP). Upon completion of the investigation, AKRF prepared a NYCBCP Application and the site was accepted into the NYSBCP. AKRF managed all aspects of the brownfield cleanup including; development of Investigation Work Plans, performing Remedial Investigations and Reports, preparation of Phase I ESAs, preparation of a Citizen Participation Plan, distribution of public notices, preparation and implementation of a Remedial Action Work Plan (RAWP), design of a sub-slab depressurization system, preparation of the Final Engineering Report and Site Management Plan, and sampling and management of soil disposal. AKRF is in the midst of implementing the Site Management Plan.

Mr. Malinowski was responsible for overseeing the implementation of the NYSDEC-approved Remedial Action Work Plan for this former industrial property. His responsibilities included the in-situ testing of all site soil to obtain pre-approval from facilities for 15,000 tons of soil disposal during the foundation excavation. Mr. Malinowski secured approval and procured bids for the off-site transport and disposal for six different classifications of soil. During excavation, Mr. Malinowski coordinated the transport and disposal of excavated material with the foundation contractor, while on-site personnel working under his direction managed the excavation and manifests for each truckload leaving the site. Mr. Malinowski was the regulatory and technical lead for the remediation, which involved providing guidance for the closure of two petroleum spills; the registration, removal, and closure of five petroleum storage tanks encountered during excavation; and the delineation of soil contaminants, including hazardous lead, petroleum, and pesticides. His efforts prior to construction and his strong communication skills allowed the foundation excavation to advance with minimal delays from environmental matters.

Additionally, Mr. Malinowski oversaw the implementation of the Community Air Monitoring Program (CAMP) during soil excavation activities and developed a soil-testing program that allowed the client to reuse certain material on-site, avoiding delays and soil import fees. The site was remediated to achieve Track 4 site-specific cleanup criteria and received a Certificate of Completion in 2016.

5 Manhattan West (450 West 33rd Street), New York, NY

AKRF is providing environmental consulting services to Brookfield Office Properties in connection with the Manhattan West development site, which encompasses an entire city-block above the Amtrak approach to Penn Station. The four towers that comprise the Manhattan west development site are being remediated as four different sites under the New York City Mayor's Office of Environmental Remediation (OER), due to an E-Designation for hazardous materials, air quality, and noise attenuation. 5 Manhattan West is a 15-story, 1.7-million-square-foot office tower.

Mr. Malinowski oversaw the preparation of Remedial Investigation work plans and the initiation and reporting of the Remedial Investigations (RIs). Each RI included soil, groundwater, and soil vapor sampling to identify potential contamination. Based on the results of each RI, Mr. Malinowski oversaw the preparation of a site-specific Remedial Action Work Plan (RAWP) for building foundation elements located within a subterranean railroad and active Amtrak rail lines. The RAWP included site-wide soil excavation, the removal of underground oil tanks, and the installation of a vapor barrier beneath the entire building. Due to the presence of PCBs, the subterranean work was conducted under a Self-Implementing Cleanup Plan prepared by AKRF and approved by the USEPA. Upon approval of the remedial plans, Mr. Malinowski oversaw the remediation activities to ensure compliance with the OER RAPs. Mr. Malinowski also designed and conducted an extensive in-situ testing of soil to pre-classify the material for disposal. He continues to work with the USEPA as the foundation for the Southeast Tower is completed. Mr. Malinowski managed all aspects of the work required for the OER E-Designation at the Southwest Tower site to achieve a Notice of Satisfaction (NOS), and is currently managing the OER-related work for the Northwest and Southeast Towers.

13th and 14th Street Realty, NYS Brownfield Redevelopment, New York, NY

Mr. Malinowski directed all phases of this NYS Brownfield project, including the initial investigation as well as the submittal of a BCP Application simultaneously with a Remedial Investigation Work Plan and an Interim Remedial Measures Work Plan, which enabled the investigation and remediation to be implemented concurrently with planned site redevelopment activities. The site consisted of an approximately 20,000 square foot property in Manhattan comprised of 100 year old dilapidated buildings. The presence of perchloroethene (PCE) contamination associated with a former dry cleaner prevented the property owner from selling. The developer applied to the New York State Brownfield Cleanup Program (BCP) as a "Volunteer" to eliminate off-site liability. Prior to the client securing its construction loan, all plans were approved by NYSDEC and a detailed remedial estimate was approved for financing by the client's lending institutions.

The investigation included soil and soil vapor testing as well as the installation and sampling of groundwater monitoring wells. The remediation activities included the removal of underground oil tanks, soil waste classification testing, and removal of approximately 15,000 tons of non-hazardous petroleum and lead contaminated soil as well as 200 tons of hazardous soil containing PCE. A water-proofing membrane was installed beneath the entire building to eliminate the exposure pathway for PCE into the new eight-story residential building. The investigation and remedial work was performed under a construction health and safety plan that included a community air monitoring program. The client received approximately $6,000,000 in tax credits from NYS for the Track 2 cleanup of this underutilized contaminated property.

New York City Department of Design and Construction, East Side Coastal Resiliency, Manhattan, NY
Mr. Malinowski leads the environmental investigation and related support for a multidisciplinary design team selected by the New York City agency partnership of DDC, DPR, and ORR for the Feasibility Study and Pre-Scoping Services for the East Side Coastal Resiliency (ESCR) project. The AKRF Team is providing design services for 100+ year storm protection and for the anticipated sea level rise along the east side of Lower Manhattan. The ESCR subsurface exploration programs involved a review of available utility plans and environmental reports concerning manufactured gas plant (MGP) and potential petroleum-related contamination along a 2.5 mile study area from Montgomery Street to East 25th Street in order to develop a Subsurface Investigation Work Plan to investigate soil and groundwater quality in areas of disturbance.

The testing program were conducted under the regulatory oversight of the NYCDEP and included both public and private utility mark-out services across vast areas of the project site containing critical infrastructure in order to enable the installation of numerous soil borings and groundwater wells. Mr. Malinowski was in charge of all aspects of management and implementation of the investigation program. As the design of the flood protection project was advanced, Mr. Malinowski designed a supplemental subsurface testing program to evaluate subsurface conditions for infrastructure improvements and to further define areas impacted with MPG-related wastes. He was also responsible for interpreting the wide-range of chemical parameters to evaluate critical cost and environmental impacts for the City and design team, and to prepare technical reports for submission and approval by the NYCDEP to satisfy City Environmental Quality Review (CEQR) requirements.

In addition, he continues to support the design and environmental review team by preparing the Hazmat Chapter for the Environmental Impact Statement, overseeing a hydrogeological study, developing interim remedial measures for MGP-contamination, developing estimating cost impacts to the project for design and cost recovery purposes, developing a Soil Management Plan and preparing presentations to the NYC team as well as OER, NYSDEC, and Con Edison.

KENNETH A. WILES

ENVIRONMENTAL SCIENTIST – SENIOR TECHNICAL DIRECTOR

Kenneth Wiles is an Environmental Scientist with twelve years of environmental assessment and remediation experience. He has performed and managed numerous site and remedial investigations, supervised and developed work plans for subsurface soil, groundwater, and soil vapor intrusion investigations; and remedial actions, and underground storage tank (UST) removals for a wide variety of clients and property types. Kenneth has been a critical member managing large profile projects, in addition to smaller projects, and responsible for project/client/contract management, preparing proposals, and preparing compliance reports, for several environmental remediation projects. He is certified in Occupational Safety and Health Administration Hazardous Waste Operations and Emergency Response (OSHA HAZWOPER) and is knowledgeable in Geographic Information System (GIS), AutoCAD, and Microsoft Project. Kenneth is experienced in numerous field activities, including environmental sampling, monitoring well installation and advancement of soil boring oversight, and contractor oversight.

BACKGROUND

Education

MS, Lehigh University, Earth and Environmental Sciences, 2010
BS, Juniata College, Environmental Science, 2008

Licenses/Certifications

OSHA 10 Hour Construction Safety & Health Course
OSHA 40 Hour HAZWOPER
OSHA 8 Hour Refresher

Professional Memberships

North Carolina Association of Environmental Professionals

Years of Experience

12 years in the industry
7 years with AKRF

RELEVANT EXPERIENCE

100 Franklin Street, New York, NY

AKRF completed a Phase I Environmental Site Assessment, Phase II Environmental Site Investigation, prepared a Remedial Action Work Plan, a NYCDEP Dewatering Application and Permit, and performed soil waste classification sampling (which required the preparation of a NYC Transit Subsurface Investigation Permit to perform the associated soil borings) for the proposed redevelopment for a 29,564-square foot, eight-story mixed-use building with a cellar. AKRF completed a Phase I Environmental Site Assessment (ESA), Phase II ESI, prepared a Remedial Action Work Plan, a NYCDEP Dewatering Application and Permit, and performed soil waste classification sampling (which required the preparation of a NYC Transit Subsurface Investigation Permit to perform the associated soil borings) for the proposed redevelopment for a 29,564-square foot, eight-story mixed-use building with a cellar.

Kenneth Wiles served as Deputy Project Manager and coordinated with the client and contactors, supervised field staff during on-site remediation activities, and compiled and evaluated field data to prepare associated project reports and permits.

1100 Myrtle Avenue, Brooklyn, NY

AKRF prepared a Remedial Investigation Work Plan (RIWP) for New York City Mayor's Office of Environmental Remediation (OER) and performed the associated Remedial Investigation. Following, the site was accepted into the New York State Department of Environmental Conservation (NYSDEC) Brownfield Cleanup Program (BCP), which AKRF prepared the application. AKRF also prepared the BCP RIWP.

As the Project Manager, Kenneth Wiles coordinated with the client and subcontractors, supervised field staff during on-site investigation activities, and prepared the project's reports.

29 Jay Street, Brooklyn, NY

AKRF has provided site assessment/remediation, air quality, and noise E-Designation services to obtain approval for the remediation and start of construction on a new commercial office building at 29 Jay Street in the DUMBO neighborhood of Brooklyn, NY. We will continue to be on-site daily to conduct community air monitoring and oversee the removal of petroleum and hazardous-lead contaminated soil. Kenneth Wiles served as Project Manager.

East Side Coastal Resiliency (ESCR) Preliminary & Final Design, New York, NY

AKRF is leading a multidisciplinary design team that was selected by the New York City agency partnership of NYCDDC, New York City Department of Parks and Recreation (NYCDPR), New York City Department of Transportation, and the Mayor's Office of Recovery and Resiliency (ORR) to provide engineering, planning, landscape architecture, urban design and community engagement services for the Preliminary and Final Design Services for East Side Coastal Resiliency (ESCR).

Kenneth Wiles' responsibilities included preparing the Supplemental Subsurface Investigation Work Plan, managing the associated field investigation activities, compiling and evaluating the field data to prepare the Supplemental Subsurface Investigation Report, spearheaded the effort for generating environmental cross-sections throughout the project site, and preparing the Mitigation Work Plan and supporting reports for NAPL recovery via several recovery wells.

Rego Park Home Depot, Ridgewood, NY

Solvent contamination was encountered during retail development of a former industrial property in Rego Park, Queens, New York. The site work included an extensive investigation and a multi-phase remediation performed under the NYSDEC Voluntary Cleanup Program (VCP). Remediation included removal of aboveground and underground storage tanks (ASTs and USTs) and hotspot soil removal. An Air Sparging/Soil Vapor Extraction (AS/SVE) groundwater remediation system designed by AKRF was installed as part of the building construction. Continued remediation work included upgrading and expanding the AS/SVE system after the store was opened. AKRF continues operations, maintenance, and monitoring under the NYSDEC-approved Site Management Plan.

Kenneth Wiles prepared the Remedial Optimization Work Plan (ROWP) and associated work plan update and assisted in the preparation and implementation of the ROWP, including the procurement of the subcontractors.

609-611 West 56th Street (823 Eleventh Avenue), New York, NY

AKRF is providing site assessment and remediation services for 611 West 56th Street (aka 823 Eleventh Avenue), a 37-story, 80-unit condominium building in Hell's Kitchen, Manhattan. We facilitated the 10,000-square-foot site's enrollment in the New York City Voluntary Brownfield Cleanup Program. AKRF performed a remedial investigation to compile and evaluate data and information necessary to develop a Remedial Action Work Plan; performed the required sampling and prepared the application package to obtain a NYCDEP construction dewatering permit; performed waste classification sampling to characterize the soil for off-site disposal; and oversaw construction excavation activities to ensure compliance with the Remedial Action Work Plan.

As Project Manager, Kenneth Wiles was responsible for coordinating/directing field staff for construction oversight, preparing the NYCDEP dewatering permit, managing the waste characterization sampling event and preparing the associated report, and assisting in the preparation of the RAWP.

Gowanus Canal First Street Turn Basin, New York, NY

AKRF performed professional services for the remedial design for restoration of the Filled-in Former First Street Turning Basin adjacent to the Gowanus Canal in Brooklyn, New York. The remediation is being conducted as part of an Order of Consent between the City of New York and USEPA for the Gowanus Canal Superfund Site. The remedial design will include removal of fill and sediment within the filled-in turning basin in an approximately 475-foot by 50-foot area and the creation of a wetland shelf. Design considerations include geotechnical concerns related to adjacent buildings and new and existing bulkheads; soil and water management; landscape design; and access/construction logistics. The project design is anticipated to be completed in 2020.

Kenneth Wiles manages the design team subconsultants, prepares report submittals, compiles and integrates several report components into larger report submittals, coordinates the implementation of field activities, and coordinates requirements pertaining to the prime contract with NYC Department of Design and Construction (DDC).

New York City School Construction Authority (NYCSCA) On-Call Contract for Environmental Consulting Services, Various Sites in New York, NY

AKRF provides the NYCSCA environmental consulting services for schools undergoing design and development. As Environmental Scientist, Kenneth Wiles prepares contract specifications and reviews contractor submittals for compliance with the specification requirements. The work has also included the investigation of underground storage tanks (USTs) 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.

The Max at 606 West 57th Street, New York, NY

AKRF was been retained by TF Cornerstone to provide environmental services for the redevelopment of a portion of the block bounded by Eleventh and Twelfth Avenues and West 56th and 57th Streets. AKRF prepared an Environmental Impact Statement (EIS) for the NYC 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. After completion of the EIS, the client enrolled in the NYC Voluntary Brownfield Cleanup Program to investigate and remediate the 83,260-square foot site for planned redevelopment. A remedial investigation was performed to compile and evaluate data and information necessary to develop a Remedial Action Work Plan (RAWP) pertaining to the planned development. AKRF performed oversight of the construction excavation activities to ensure compliance with the RAWP.

Kenneth Wiles was responsible for coordinating/directing field staff for construction oversight activities for compliance with the RAWP, and assisting in the preparation of the Remedial Closure Report.

432 East 14th Street, Environmental Management Specifications, Design Coordination and Pre-Characterization of Soil for Off-site Disposal, New York, NY

AKRF completed a Phase II Environmental Site Investigation, prepared a Remedial Action Work Plan, UST Removal Report, and performed soil waste classification sampling for the redevelopment of the site, which formerly consisted of a 23,000-square foot, two-story United States Postal Service office. The soil waste characterization sampling identified hazardous soil, which was successfully managed and disposed of at a licensed facility.

Kenneth Wiles served as Deputy Project Manager and coordinated with the client and contractors, supervised field staff during day-to-day on-site remediation activities, reviewed contractor submittals, and prepared compliance reports including the remedial closure report.

West Side Federation for Senior and Supportive Housing, WSFSSH West 108th Street, New York, NY

AKRF performed a Phase I Environmental Site Assessments and Phase II Environmental Site Investigation (ESI), on behalf of the NYC Office of Environmental Remediation for the proposed redevelopment of four lots. The Phase II ESI Work Plan consisted of an EPA compliant Quality Assurance Project Plan (QAPP). AKRF additionally prepared a Remedial Action Work Plan (RAWP) and supplemental Phase II ESI.

Kenneth Wiles supervised field staff during on-site investigation activities, provided review of the Phase II ESI and RAWP, and drafted contractor specifications for the redevelopment.

New York City Department of Design & Construction, On-Call Contract (HWEARC03), New York, NY

As part of a joint venture, AKRF has been awarded a contract to provide on-call EASs and engineering support to the DDC infrastructure division for various projects throughout the city. The services provided under this contract vary from EASs, property acquisition support, stormwater drainage and water quality analysis to traffic studies, preparation of PDI reports, mapping, roadway design, and ULURP support. AKRF's primary responsibilities include implementation and monitoring of the task orders issued under the contract, and the firm is directly responsible for project management, staffing, schedule, and budgetary requirements of the contract, as well as completing roadway and infrastructure designs, preparing ULURP maps and applications, EASs, PDIs and Damage and Acquisition Maps.

Kenneth Wiles' responsibilities included preparing the Supplemental Subsurface Investigation Work Plan, managing the associated field investigation activities, compiling and evaluating the field data to prepare the Supplemental Subsurface Investigation Report, spearheaded the effort for generating environmental cross-sections throughout the project site, and preparing the Mitigation Work Plan and supporting reports for NAPL recovery via several recovery wells.

New York City School Construction Authority, On-Call Environmental Consulting, New York, NY

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.

Kenneth Wiles prepared contract specifications and reviews contractor submittals for compliance with the specification requirements. The work has also included the investigation of underground storage tanks (USTs) for existing schools.

TIMOTHY G. LARIGAN

SENIOR PROFESSIONAL

Timothy G. Larigan is an environmental scientist with 7 years of experience in environmental remediation/compliance, Phase I/Phase II Environmental Assessments; project management; technical reporting; data analysis; field sampling; contractor oversight; wetlands delineation and permitting. He has directed environmental remediation, due diligence, asbestos, and wetlands projects and completed them within the proposed timeframe and budget. Mr. Larigan has also managed client and regulatory agency interactions. He has performed various field activities such as soil, groundwater, and vapor sampling and wetlands delineation. He has a working knowledge of GIS software and SAS statistical software.

BACKGROUND

Education

BS, Stockton University, Environmental Science, 2015

Licenses/Certifications

Regulatory Training in Underground Storage Tanks Certificate
Wetlands Delineation Certificate
OSHA 40 Hour HAZWOPER
OSHA 30 Hour Construction

Years of Experience

7 years in the industry
3 years with AKRF

RELEVANT EXPERIENCE

Site 9 DSA Owner LLC, Essex Crossing Site 9, New York, NY

Environmental Scientist. This approximately 20,300 square foot property has been developed with mixed-use residential and commercial/industrial buildings (e.g. printer shop, machine shop, photo shop) since the late-1800s. The site was later redeveloped as the Essex Street Market, which operated until 2019. Mr. Larigan is responsible for performing a remedial investigation consisting of soil, groundwater, and soil vapor sample collection, and assisting with applying for entry into the New York State Department of Environmental Conservation (NYSDEC) Brownfield Cleanup Program. Additionally, Mr. Larigan is responsible for performing a Phase I Environmental Site Assessment (ESA) and preparing a Phase I ESA Report.

DLANDstudio Architecture + Landscape Architecture pllc, Stapleton Playground, Staten Island, NY

Environmental Scientist. This public park and historical gasoline filling station has been closed to the public and undergoing renovations since 2019. During excavation for park improvements, petroleum-contaminated soil was discovered and spill was reported to the New York State Department of Environmental Conservation (NYSDEC). Mr. Larigan is responsible for overseeing the installation of groundwater monitoring wells, performing quarterly groundwater monitoring/sampling events, and preparing quarterly groundwater evaluation reports as part of an environmental investigation at the site related to the spill.

TIMOTHY G. LARIGAN

PROFESSIONAL II

4NYCHousing Inc., 201-207 Seventh Avenue, New York, NY

Environmental Scientist. This historical mixed-use residential and commercial/industrial property was developed in the late-1800s, and has been vacant since 2018. Mr. Larigan is responsible for conducting soil, groundwater, and vapor sample collection as part of a Phase II investigation, along with preparing a subsurface investigation report, documenting the findings of the Phase II investigation.

J2 147-07 94th Avenue LLC, Alvista Towers, Queens, NY

Environmental Scientist. This historical meat refrigeration facility is enrolled in the Brownfield Cleanup Program to remediate the property and construct a 23-story affordable residential building. Although the site has an E-Designation for hazardous materials, noise, and air quality, AKRF assisted with applying for entry into the New York State Department of Environmental Conservation (NYSDEC) Brownfield Cleanup Program, due to the presence of contaminated soil and soil vapor beneath the site. AKRF is providing environmental consulting services throughout the project. Mr. Larigan is responsible for performing a Phase I Environmental Site Assessment (ESA) and preparing a Phase I ESA Report.

PREVIOUS EXPERIENCE

Atlantic Environmental Solutions, Inc., Hoboken, NJ
Project Manager/Senior Environmental Scientist
While at another firm, Mr. Larigan was responsible for the following:

- Managed site remediation projects, underground storage tank removal projects, and Phase I/Phase II environment assessments
- Directed asbestos surveys, mold assessments, and wetlands delineation/permitting projects
- Prepared proposals, bids, and work authorizations for environmental services with detailed scopes of work, schedules, and cost estimates
- Performed technical review, data analysis, and problem solving for site remediation projects and managed client and regulatory agency interactions

Brinkerhoff Environmental Services, Inc., Manasquan, NJ
Environmental Scientist
While at another firm, Mr. Larigan was responsible for the following:

- Performed soil, groundwater, and vapor sampling in accordance with State technical requirements;
- Prepared environmental reports, including Phase I/Phase II ESAs, Remedial Investigation and Remedial Action reports, and environmental permit applications in accordance with State requirements;
- Directed and oversaw in-situ chemical oxidation (ISCO) treatments, and installation of sub-slab vapor mitigation systems and other presumptive remedies/engineering controls in accordance with State technical requirements
- Performed geophysical surveys utilizing Ground Penetrating Radar (GPR) and Electromagnetic technology.

ANTONIO CARDENAS

PROJECT SCIENTIST – PROFESSIONAL II

Antonio Cardenas is a Project Scientist in AKRF's Site Assessment & Remediation group. He earned a Bachelor of Science degree in Geology from City College of the City University of New York. Antonio is proficient in ArcGIS, PHREEQC, ENVI, and Matlab, as well as Microsoft Word, Excel and PowerPoint. He speaks fluent Spanish.

BACKGROUND

Education

BS, City College of the City University of New York, Geology, 2017

Licenses/Certifications

AMFER Certificate, US EPA Air Monitoring for Emergency Response Training Program
OSHA 30 Hour Construction
OSHA 40 Hour HAZWOPER
OSHA 8 Hour Refresher

Years of Experience

5 years in the industry
3 years with AKRF

RELEVANT EXPERIENCE

1100 Myrtle Avenue, Brooklyn, NY

AKRF prepared a Remedial Investigation Work Plan (RIWP) for New York City Mayor's Office of Environmental Remediation (OER) and performed the associated Remedial Investigation. Following, the site was accepted into the New York State Department of Environmental Conservation (NYSDEC) Brownfield Cleanup Program (BCP), which AKRF prepared the application. AKRF also prepared the BCP RIWP. Antonio Cardenas served as Environmental Scientist.

141 Willoughby Street, Brooklyn, NY

AKRF provided environmental planning and site assessment/remediation services for a new 24-story office building at 141 Willoughby Street in Downtown Brooklyn. We prepared the Environmental Assessment Statement pursuant to CEQR requirements along with two subsequent technical memoranda, and are now providing site assessment/remediation services to oversee excavation activities. Antonio Cardenas served as Environmental Scientist.

202 Broome Street (Essex Site 3) and 180 Broome Street (Essex Site 4), New York, NY

The Market Line and other vibrant retail properties joins 175,000 square feet of Class A office space and 83 luxury condominiums at 202 Broome Street (aka One Essex Crossing) on the Lower East Side of Manhattan. AKRF is leading civil engineering and permitting for the site and provided geotechnical engineering for a subterranean pedestrian tunnel connecting 202 Broome Street and 180 Broome Street. We prepared a Construction Protection Plan for the building, and provided site assessment and remediation services. We also prepared an Environmental Assessment Statement as part of the New York City Department of Transportation's Community Reassessment, Impact & Amelioration Statement process for the temporary closure of Suffolk Street between Delancey and Broome Streets during construction.

The Artisan at 180 Broome Street is a 25-story residential and office building at the entrance to the Williamsburg Bridge on the Lower East Side of Manhattan. The tower includes 263 residential apartments (121 units are affordable housing) and access to The Market Line, an expansive bazaar-like marketplace running underneath three city blocks. AKRF is leading civil engineering and permitting for the site and provided geotechnical engineering for subgrade pedestrian tunnels. We prepared a Construction Protection Plan for the building, and provided site assessment and remediation services. We also prepared an Environmental Assessment Statement as part of the New York City Department of Transportation's Community Reassessment, Impact & Amelioration Statement process for the temporary closure of Suffolk Street between Delancey and Broome Streets during construction. AKRF previously prepared the Generic Environmental Impact Statement pursuant to City Environmental Quality Review guidelines for the overall Seward Park/Essex Crossing redevelopment project. Antonio Cardenas served as Environmental Scientist.

Rego Park Home Depot, Ridgewood, NY

Solvent contamination was encountered during retail development of a former industrial property in Rego Park, Queens, New York. The site work included an extensive investigation and a multi-phase remediation performed under the NYSDEC Voluntary Cleanup Program (VCP). Remediation included removal of aboveground and underground storage tanks (ASTs and USTs) and hotspot soil removal. An Air Sparging/Soil Vapor Extraction (AS/SVE) groundwater remediation system designed by AKRF was installed as part of the building construction. Continued remediation work included upgrading and expanding the AS/SVE system after the store was opened. AKRF continues operations, maintenance, and monitoring under the NYSDEC-approved Site Management Plan. Antonio Cardenas served as Environmental Scientist.

Lambert Houses Redevelopment, Bronx, NY

AKRF performed an Environmental Impact Statement (EIS) of the Lambert Houses affordable housing complex located in the West Farms section of the Bronx, NY. Lambert Houses consisted of multi-story apartment buildings, parking garage, and a multi-tenant retail/commercial building alongside the elevated NYC subway. AKRF also conducted a Phase I ESA with a vapor intrusion screen of the Property to satisfy U.S. Department of Housing and Urban Development (HUD)'s vapor intrusion requirements. The Phase I and vapor intrusion screens were prepared in accordance with ASTM E1527-05, ASTM E2600, and U.S. Environmental Protection Agency (EPA)'s All Appropriate Inquiry (AAI) rule. After completion of the EIS, an E-designation for hazardous materials was placed on the site. A subsurface investigation was conducted and a Remedial Action Work Plan (RAWP) was prepared under New York City Office of Environmental Remediation (OER) oversight. The site was subsequently entered in the NYC Voluntary Cleanup Program. AKRF is in the midst of implementing the RAWP, which includes remediation of a hydraulic oil spill. Antonio Cardenas serves as Environmental Scientist.

American Museum of Natural History Gilder Center Expansion, New York, NY

AKRF is preparing this Environmental Impact Statement (EIS) to assess the potential environmental impacts associated with an approximately 220,000 square-foot expansion of the American Museum of Natural History. This expansion would largely take the form of a new building, the Richard Gilder Center for Science, Education, and Innovation, located on the Columbus Avenue side of the Museum campus. Antonio Cardenas serves as Environmental Scientist.

Avalon Yonkers PCW, Yonkers, NY

AKRF performed professional services for the preparation and submission of the Remedial Investigation Report (RIR), which included multiple phases of remedial investigation for the former research and development (R&D) site, a NYSDEC Brownfield redevelopment project along the Hudson River. The RIR included soil, groundwater and soil vapor environmental sampling as well as LNAPL and DNAPL source identification and evaluation. As part of the remedial investigation efforts, TarGOST drilling techniques (laser induced fluorescence) and modeling were utilized to determine the extent of LNAPL and DNAPL. Antonio Cardenas served as Environmental Scientist.

Avalon Yonkers PCE, Yonkers, NY

AKRF performed professional services for the preparation and submission of a supplemental remedial investigation for the site, a NYSDEC Brownfield redevelopment project along Alexander Street. The investigation included soil, groundwater and vapor environmental sampling as well as direct correspondence with NYSDEC project management. Antonio Cardenas served as Environmental Scientist.

29 Jay Street, Brooklyn, NY

AKRF has provided site assessment/remediation, air quality, and noise E-Designation services to obtain approval for the remediation and start of construction on a new commercial office building at 29 Jay Street in the DUMBO neighborhood of Brooklyn, NY. We will continue to be on-site daily to conduct community air monitoring and oversee the removal of petroleum and hazardous-lead contaminated soil. Antonio Cardenas served as Environmental Scientist.

Manhattan West, New York, NY

AKRF first prepared the Environmental Assessment Statement and supplemental studies pursuant to New York City Environmental Quality Review requirements for Manhattan West, as well as an economic and fiscal benefits analysis. The towers that comprise Manhattan West are being remediated individually under New York City Mayor's Office of Environmental Remediation requirements for an E-Designation for hazardous materials, air quality, and noise attenuation. AKRF has provided site assessment/remediation services for Pendry Manhattan West, The Lofts, The Eugene, and Two Manhattan West. We also performed air quality and noise E-Designation services for Manhattan West's retail podium and secured the final New York City approvals for One Manhattan West. Additionally, we provided site assessment/remediation services for polychlorinated biphenyls at Five Manhattan West under a USEPA Self-Implementing Cleanup Plan. AKRF implemented a Community Air Monitoring Plan for the street-grade and track-level excavation portion of the site, and provided a series of civil engineering services for the development. Antonio Cardenas served as Environmental Scientist.

Urban League Empowerment Center at 121-163 West 125th Street, New York, NY

AKRF is providing site assessment/remediation services for a 17-story, $240 million mixed-use development on West 125th Street in Harlem, Manhattan, that will include a 42,000-square-foot headquarters for the National Urban League; a civil rights museum; the National Urban League Institute for Race, Equity and Justice conference center; 170 units of affordable housing; and below-market-rate office space for nonprofit groups. The building will also house a Target store and Trader Joe's grocery. Antonio Cardenas serves as Environmental Scientist.

Northlight at Edge-on-Hudson, Sleepy Hollow, NY

AKRF was retained by Hines Development for design and construction related geotechnical engineering services for the redevelopment of Parcel F at Lighthouse Landing (aka, Edge-on-Hudson) with a five-story, 246-unit residential building. AKRF reviewed previous subsurface exploration information (by others), prepared and completed a new subsurface exploration for this project, and developed construction documents for construction. During construction, AKRF was responsible for the special inspection for installing and testing deep foundations, as well as filling and compacting for foundation construction. Antonio Cardenas served as Environmental Scientist.

BRIAN QUINN

ENVIRONMENTAL PROFESSIONAL I – SITE ASSESSMENT AND REMEDIATION

Brian Quinn is an Environmental Professional I in AKRF's Site Assessment and Remediation group, with experience in environmental sampling and monitoring during site remediation, subsurface and vapor intrusion investigations, and groundwater remediation system operation and maintenance.

BACKGROUND

Role in Project
Field Technician

EDUCATION

B.A. Environmental Studies, Bucknell University, May 2020

CERTIFICATIONS

OSHA 40-hour Hazardous Waste Operations and Emergency Response Training

OSHA 30-hour Construction Safety Training

YEARS OF EXPERIENCE

Date started at AKRF: March 2022

Prior industry experience: Greenstar Environmental Solutions: February 2021- February 2022 (1 year)

RELEVANT EXPERIENCE - AKRF

Construction Oversight and Community Air Monitoring – American Museum of Natural History, Manhattan, New York

AKRF prepared and is implementing a NYCDEP-approved RAP during construction of the new Gilder Center for Science, Education, and Innovation at the AMNH. Mr. Quinn serves as an on-site environmental monitor during construction to ensure compliance with the RAP. His duties include community and work zone air monitoring, overseeing excavation and export of contaminated soil, and documenting the import of environmentally clean backfill.

RELEVANT EXPERIENCE – GREENSTAR ENVIRONMENTAL SOLUTIONS, SOMERSET, NJ

As an Environmental Scientist at Greenstar, Mr. Quinn conducted Phase II subsurface investigations, low-flow groundwater sampling and soil vapor intrusion assessments, and prepared associated technical reports. He also conducted routine O&M of a large groundwater treatment system, and oversaw installation of new extraction wells for system upgrades

HENRY WESTLY

GEOLOGIST/PROFESSIONAL I

Henry Westly is a Geologist/Professional I in the AKRF, Inc. Site Assessment and Remediation department with experience in remedial oversight, community air monitoring (CAMP), soil sampling, well gauging/monitoring, and technical reporting.

BACKGROUND

Role in Project

Field Technician

Education

B.S., Environmental Geology, Beloit College, December 2021

Certifications

OSHA 40-hour HAZWOPER Certified
OSHA 30-hour Construction Safety Training

Years of experience

Date started at AKRF: March 2022 (5 months)
Prior industry experience: Yukon River Inter-Tribal Watershed Council, Geologist Intern

RELEVANT EXPERIENCE – AKRF

Remediation Oversight and Community Air Monitoring – 142-150 South Portland Avenue, Brooklyn; 1100 Myrtle Avenue, Brooklyn; 360 Bowery, Manhattan; 1600 Macombs Road, Bronx; BUD North, Queens, NY

AKRF performed Remedial Investigations and prepared Remedial Action Work Plans (RAWPs) and Remedial Action Plans (RAPs) for these NYSDEC Brownfield Cleanup Program and OER E-Designated Program projects. Mr. Westly served as an on-site environmental monitor during remediation/construction at the project sites to ensure compliance with the RAWPs/RAPs. His duties included community and work zone air monitoring, overseeing excavation and export of contaminated soil, documenting the import/placement of environmentally clean backfill, inspection installation of sub-slab depressurization system piping; and preparation of daily reports for submission to the regulatory agencies.

Livingston Avenue Bridge Replacement, Albany-Rensselaer, NY – Soil Sampling

As part of a consultant team under contract with the New York State Department of Transportation, AKRF is providing environmental planning, permitting, and design support services for replacement of the Livingston Avenue railroad bridge, which spans the Hudson River between Albany and Rensselaer, New York. Mr. Westly completed environmental screening and logging of soil cores and collected select samples for laboratory analysis during a geotechnical investigation along the proposed new bridge alignment.

L.A.B. Validation Corp., 14 West Point Drive, East Northport, New York 11731

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

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

Requester's name and address (optional)

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

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. 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.

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

ATTACHMENT B

SAMPLE CHAIN OF CUSTODY

>> Select a Laboratory or Service Center <<

#N/A
#N/A
#N/A
#N/A

Chain of Custody Record

eurofins | Environment Testing
TestAmerica

Regulatory Program: ☐DW ☐NPDES ☐RCRA ☐Other:

TestAmerica Laboratories, Inc. d/b/a Eurofins TestAmerica

	Project Manager:			COC No:
Client Contact	**Email:**	**Site Contact:**	**Date:**	_______ of ______ COCs
Your Company Name here	**Tel/Fax:**	**Lab Contact:**	**Carrier:**	TALS Project #:
Address	**Analysis Turnaround Time**			Sampler:
City/State/Zip	☐ CALENDAR DAYS ☐ WORKING DAYS			**For Lab Use Only:**
(xxx) xxx-xxxx Phone	TAT if different from Below __________			Walk-in Client:
(xxx) xxx-xxxx FAX	☐ 2 weeks			Lab Sampling:
Project Name:	☐ 1 week			
Site:	☐ 2 days			Job / SDG No.:
P O #	☐ 1 day			

Sample Identification	Sample Date	Sample Time	Sample Type (C=Comp, G=Grab)	Matrix	# of Cont.	Filtered Sample (Y / N)	Perform MS / MSD (Y / N)																		Sample Specific Notes:

Preservation Used: 1= Ice, 2= HCl; 3= H2SO4; 4=HNO3; 5=NaOH; 6= Other _____________

Possible Hazard Identification:
Are any samples from a listed EPA Hazardous Waste? Please List any EPA Waste Codes for the sample in the Comments Section if the lab is to dispose of the sample.

☐Non-Hazard ☐Flammable ☐Skin Irritant ☐Poison B ☐Unknown

Sample Disposal (A fee may be assessed if samples are retained longer than 1 month)

☐Return to Client ☐Disposal by Lab ☐Archive for__________ Months

Special Instructions/QC Requirements & Comments:

Custody Seals Intact: ☐ Yes ☐ No
Custody Seal No.:
Cooler Temp. (^{o}C): Obs'd:_________ Corr'd:__________ Therm ID No.:____________

Relinquished by:	Company:	Date/Time:	Received by:	Company:	Date/Time:
Relinquished by:	Company:	Date/Time:	Received by:	Company:	Date/Time:
Relinquished by:	Company:	Date/Time:	Received in Laboratory by:	Company:	Date/Time:

Form No. CA-C-WI-002, Rev. 4.33, dated 5/4/2020