236-246 Gold Street Remedial Action Work Plan

236-246 Gold Street - Brooklyn, NY
Block 121, Lots 33, 35, 36, & 37
BCP Site #C224413

Submitted to:
New York State Department of Environmental Conservation
Division of Environmental Remediation
Region 2
47-40 21st Street
Long Island City, NY 11101

Prepared for:
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&
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January 2025

CERTIFICATIONS

I, Matthew M. Carroll, certify that I am currently a registered professional engineer licensed by the State of New York and that this Remedial Action 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).

091629		
NYS Professional Engineer #	Date	Matthew M. Carroll, P.E. 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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AGV	NYSDOH Air Guidance Value
AOC	area of concern
AS	air sparging
BCA	Brownfield Cleanup Agreement
BCP	Brownfield Cleanup Program
ECL	Environmental Conservation Law
BTEX	benzene, toluene, ethylbenzene and xylenes
CAMP	Community Air Monitoring Program
C&D	construction and demolition
CDS	construction dewatering system
Class GA Standards	NYSDEC TOGS 1.1.1 Class GA Ambient Water Quality Standards and Guidance Values
CEQR	City Environmental Quality Review
CFR	Code of Federal Regulations
CPP	Citizen Participation Plan
COC	Certificate of Completion
DCE	Dichloroethylene
DER-10	NYSDEC Division of Environmental Remediation (DER), DER-10 / Technical Guidance for Site Investigation and Remediation
DRO	diesel range organics
DOC	dissolved organic carbon
DUSR	Data Usability Summary Report
EC	Engineering Control
ESA	Environmental Site Assessment
EZ	exclusion zone
FB	field blanks
FER	Final Engineering Report
ft-bs	feet below building slab
ft-bg	feet below sidewalk grade
ft-msl	feet above mean sea level
GPM	Gallons per minute
HASP	Health and Safety Plan
HSA	Hollow Stem Auger
HSO	Health and Safety Officer
IC	Institutional Control
ISCO	*in-situ* chemical oxidation
IRM	Interim Remedial Measure
MW	monitoring well
NAVD	North American Vertical Datum of 1988
NGVD	National Geodetic Vertical Datum of 1929
NIOSH	National Institute for Occupational Safety and Health
NYCDEP	New York City Department of Environmental Protection
NYCDEP Limits	NYCDEP Limitations for Effluent to Sanitary or Combined Sewers
NYCDOB	New York City Department of Buildings
NYCDOT	New York City Department of Transportation
NYCRR	New York Codes, Rules and Regulations
NYSDEC	New York State Department of Environmental Conservation

NYSDOH	New York State Department of Health
NYSDOH-ELAP	NYSDOH Environmental Laboratory Approval Program
O&M Plan	Operations and Maintenance Plan
OSHA	Occupational Safety and Health Association
PCB	polychlorinated biphenyl
PCE	perchloroethylene, aka tetrachloroethylene
PID	photoionization detector
PGWSCOs	6 NYCRR 375-6.8(b) and CP-51 Protection of Groundwater Soil Cleanup Objectives
PP Metals	Priority Pollutant Metals
PPE	personal protective equipment
QA/QC	quality assurance / quality control
QAPP	Quality Assurance Project Plan
RAWP	Remedial Action Work Plan
RCNY	Rules of the City of New York
RAO	Remedial Action Objective
RE	Remedial Engineer
RI	Remedial Investigation
RSCOs	Recommended Soil Cleanup Objectives
RCSCOs	6 NYCRR 375-6.8(b) and CP-51 Track 2 – Restricted Commercial Use Soil Cleanup Objectives
SB	soil boring
SCGs	Standards, Criteria and Guidance
SV	soil vapor
SMP	Site Management Plan
SMMP	Soil/Material Management Plan
SSDS	sub-slab depressurization system
SVE	soil vapor extraction
SVOC	semi-volatile organic compound
TAL	Target Analyte List
TAGM 4046	NYSDEC Technical and Administrative Guidance Memorandum #4046
TB	trip blanks
TCE	Trichloroethylene
TCL	Target Compound List
TCLP	Toxicity Characteristic Leaching Procedure
TCLP Limits	USEPA Maximum Concentrations of Contaminants for the Toxicity Characteristic
TOC	total organic carbon
USEPA	United States Environmental Protection Agency
USGS	United States Geological Survey
UST	underground storage tank
UUSCOs	6 NYCRR 375-6.8(a) Track 1 Unrestricted Use Soil Cleanup Objectives
VOC	volatile organic compound

EXECUTIVE SUMMARY

SITE DESCRIPTION/PHYSICAL SETTING/SITE HISTORY

On behalf of 236 Gold LLC, 242 Gold St LLC, 244 Gold LLC, and 236-246 Gold St LLC (collectively, the "Volunteers"), Tenen Environmental, LLC (Tenen), has prepared this Remedial Action Work Plan (RAWP) for the property located at 236-246 Gold Street (Block 121, Lots 33, 35, 36 and 37) in the Borough of Brooklyn, New York City, New York (the Site). The Site location and boundaries are identified on Figures 1 and 2, respectively. Unrestricted use is proposed for the property. When completed, the Site will contain a new mixed-use commercial and residential building with a full cellar that will encompass approximately the front 59 feet of the Site lots. The remaining area of the Site outside of the building footprint will be occupied by an at-grade rear yard. Architectural drawings are not yet available for the property, as the building is currently being redesigned in response to the 'City of Yes' December 2024 update to NYC's zoning code.

This Remedial Action Work Plan (RAWP) summarizes the nature and extent of contamination as determined from data gathered during the Remedial Investigation (RI) as described below. It provides an evaluation of a Track 1 cleanup and other applicable Remedial Action alternatives, their associated costs, and the recommended and preferred remedy. The remedy described in this document is consistent with the procedures defined in 6 NYCRR Part 375 and DER-10, and complies with all applicable standards, criteria and guidance. The remedy described in this document also complies with all applicable Federal, State and local laws, regulations and requirements. The NYSDEC and New York State Department of Health (NYSDOH) have determined that the Site does not pose a significant threat to human health and the environment. The RI for this Site did not identify fish and wildlife resources.

SUMMARY OF THE REMEDIAL INVESTIGATION

Tenen conducted remedial investigation activities at the Site in November 2024. The results of the remedial investigation were documented in a draft Remedial Investigation Report (RIR) dated December 2024.

The RI consisted of the installation of soil borings and collection of soil samples, installation and sampling of groundwater monitoring wells, and sampling of soil vapor. Based on the results of the RI and previous investigations, the following summary has been prepared:

Site History

- Previous non-residential Site uses included a blacksmith, a wagon builder and a waste materials corporation. All former onsite buildings were demolished by 1969 and the Site was most recently utilized for parking.

Geology/Hydrogeology

- The Site is covered by five to ten feet of historic fill material, underlain by native brown, fine- to coarse-grained sand and silt to at least 25 feet below grade (ft-bg).
- Groundwater was encountered at approximately 24 to 26 ft-bg and flows to the north.

Soil

- A variety of historic fill-related SVOCs, specifically polycyclic aromatic hydrocarbons (PAHs), were detected in exceedance of Unrestricted Use and Restricted-Residential Use Soil Cleanup Objectives (SCOs) in five soil samples, with the highest concentrations occurring in TSB-2 (0-2), located in the eastern portion of Lot 36.

- Four pesticides, dieldrin, 4,4'-DDD, 4,4'-DDE, and 4,4'-DDT, were detected in exceedance of Unrestricted Use SCOs, but below Restricted-Residential Use SCOs, in two soil samples collected from TSB-5 located in the eastern portion of Lot 35.
- A variety of metals, specifically arsenic, barium, cadmium, copper, lead, nickel, zinc, mercury, hexavalent chromium, and trivalent chromium were detected in exceedance of Unrestricted Use SCOs in one or more soil samples. Of these, arsenic, barium, copper, lead, and mercury were also detected in exceedance of Restricted-Residential Use SCOs in one or more samples.
- Three hazardous lead hotspots have been identified and delineated at the Site: two on Lot 33 and one on Lot 36. One hotspot in the southwestern corner of Lot 33 is approximately 320 SF in size and extends to a maximum depth of seven ft-bg; one hotspot in the northern portion of Lot 33 is approximately 845 SF in size and extends to a maximum depth of twelve ft-bg; and, one hotspot in the western portion of Lot 36 is approximately 400 SF in size and extends to a maximum depth of two ft-bg.
- Per- and polyfluoroalkyl substances (PFAS), specifically perfluorooctanoic acid (PFOA) perfluorooctanesulfonic acid (PFOS), were detected in soil samples collected from various depths in exceedance of the proposed Unrestricted Use SCOs from the NYSDEC *Guidelines for Sampling, Analysis, and Assessment of PFAS Under NYSDEC's Part 375 Remedial Programs* (PFAS Guidelines), April 2023, but below the proposed Restricted-Residential Use SCOs.
- VOCs, polychlorinated biphenyls (PCBs), herbicides and 1,4-dioxane were not detected in exceedance of applicable SCOs in any soil samples.

Groundwater

- One metal, lead, was detected in exceedance of the NYSDEC TOGS 1.1.1 Class GA Ambient Water Quality Standards and Guidance Values (AWQS) in one total groundwater sample, MW-1. Lead was not detected in exceedance of AWQS in any dissolved groundwater samples.
- Selenium was detected in one dissolved groundwater sample, MW-3, slightly in exceedance of the Class GA Standard.
- Naturally-occurring earth metals manganese and sodium, were detected in total and dissolved groundwater samples across the Site.
- PFAS, PFOA and PFOS, were detected in exceedance of the AWQS in two groundwater samples and the duplicate sample.
- VOCs, SVOCs, pesticides, herbicides, PCBs and 1,4-dioxane were not detected in exceedance of the AWQS in any groundwater samples.

Soil Vapor

- A variety of chlorinated VOCs (cVOCs), specifically tetrachloroethene (PCE), trichloroethene (TCE), cis-1,2-dichloroethene (cis-1,2-DCE), 1,1,1-trichloroethane (1,1,1-TCA), carbon tetrachloride, 1,1-dichloroethene (1,1-DCE), methylene chloride and chloroform, were detected in exceedance of background concentrations in one or more soil vapor samples. The highest concentrations of cVOCs in soil vapor samples were generally detected in TSV-1 and TSV-5, collected from Lots 37 and 33, respectively.
- A variety of petroleum-related VOCs, specifically toluene, ethylbenzene, p/m-xylene, o-xylene, 1,2,4-trimethylbenzene, 1,3,5-trimethylbenzene, n-hexane and 4-ethyltoluene, were detected soil vapor samples across the Site, with the highest concentrations generally occurring in TSV-2, located on Lot 36.

  A variety of other VOCs, including dichlorodifluoromethane, trichlorofluoromethane, propylene, styrene, 4-methyl-2-pentanone, acetone, carbon disulfide, acrylonitrile, benzyl chloride, 2-butanone, methyl methacrylate and n-heptane were detected in exceedance of background concentrations in one or more soil vapor samples.

QUALITATIVE EXPOSURE ASSESSMENT

The results of the remedial investigations provided sufficient data to complete a Qualitative Exposure Assessment, which identified several potential exposure pathways that include:

- direct contact with subsurface soils (and incidental ingestion);
- direct contact with groundwater;
- inhalation of volatile groundwater constituents; and
- inhalation of vapors.

The potential exposure pathways associated with the remediation/construction phase of the redevelopment are temporary and of limited duration. Worker exposure to impacted groundwater and soil vapor and particulates will be addressed by adherence to health and safety protocols as described in the Construction Health and Safety Plan (CHASP) included in Appendix B. Potential exposure of neighborhood residents and other offsite populations will be addressed through compliance with the Community Air Monitoring Plan (CAMP). A summary of the CAMP is included in Appendix A of this Remedial Action Work Plan (RAWP). Potential for exposure of building occupants through soil vapor intrusion to indoor air will be minimized by removal of soil to at least twelve ft-bg across the Site, installation of a chemical-resistant vapor barrier beneath the new building, and implementation of long-term institutional controls in the form of an environmental easement and Site Management Plan (SMP).

SUMMARY OF THE REMEDIAL ACTIONS

The preferred Track 2 remedy, which is intended to address all environmental issues associated with the Site, consists of the following:

- Excavation and offsite disposal of all onsite soils which exceed the Restricted-Residential Use SCOs, as defined by 6 NYCRR Part 375-6.8(b), to a maximum depth of 15 ft-bg throughout the Site. Based on previous sampling data, the remedial excavation would extend to a depth of twelve ft-bg within the building footprint and to a depth of two ft-bg in the rear yard. In addition, hotspot excavation would be completed in the vicinity of 2024 Limited Phase II ESI soil boring 246G_SB-1 to a depth of three ft-bg, in the vicinity of 2022 RI soil boring 236G_SB and 2023 RI soil boring 242G_SB-4 to a depth of six ft-bg, and in the vicinity of 2024 RI soil boring TSB-4 to a depth of seven ft-bg. Additionally, two hazardous lead hotspots would also be excavated in the rear yard below two ft-bg: one to approximately seven ft-bg and one to approximately twelve ft-bg;
- Off-site disposal of excavated materials from the Site in accordance with all Federal, State and local rules and regulations for handling, transport and disposal;
- Collection and analysis of post-remedial end-point samples to document remaining concentrations of contaminants. Samples will be evaluated for attainment of Restricted-Residential Use SCOs, which would support a Track 2 remedy;
- Import of materials to be used for backfill and cover in compliance with: (1) 6 NYCRR Part 375-6.7(d), and (2) all Federal, State and local rules and regulations for handling and transport of material;
- Removal and disposal any unidentified/unknown underground storage tanks (USTs) that are encountered during development in compliance with all applicable Federal, State and local rules and regulations;

- Installation of an active SSDS beneath the new onsite building to mitigate the potential for soil vapor intrusion. A blower test will be performed for the system to determine the final fan size required to meet the system design parameters. A SSDS Design Document for the Site system will be submitted under separate cover to NYSDEC and the New York State Department of Health (NYSDOH) for approval which will include recommendation for effluent sampling as necessary;
- Efficacy of the active SSDS will be confirmed via pressure differential testing throughout the sub-slab;
- Post-remedial (one month following SSDS start-up) indoor air sampling will be conducted for additional evaluation of the active SSDS;
- Preparation of a Final Engineering Report (FER) to document the implemented remedial actions;
- Development of a Site Management Plan (SMP) for long-term management of potential residual contamination as required by an Environmental Easement, including plans for: (1) long-term Institutional and Engineering Controls, (2) monitoring, and (3) reporting; and
- Recording of an Environmental Easement to restrict use of the site and require compliance with the SMP.

Remedial activities will be performed at the Site in accordance with this NYSDEC-approved RAWP. Any deviations from the RAWP will be promptly reported to NYSDEC for approval and detailed in the FER.

REMEDIAL ACTION WORK PLAN

1.0 INTRODUCTION

On behalf of 236 Gold LLC, 242 Gold St LLC, 244 Gold LLC, and 236-246 Gold St LLC (collectively, the "Volunteers"), Tenen Environmental, LLC (Tenen), has prepared this Remedial Action Work Plan (RAWP) for the property located at 236-246 Gold Street (Block 121, Lots 33, 35, 36 and 37) in the Borough of Brooklyn, New York City, New York (the Site). The Site location and boundaries are identified on Figures 1 and 2, respectively. Unrestricted use is proposed for the property. When completed, the Site will contain a new mixed-use commercial and residential building with a full cellar that will encompass approximately the front 59 feet of the Site lots. The remaining area of the Site outside of the building footprint will be occupied by an at-grade rear yard. Architectural drawings are not yet available for the property, as the building is currently being redesigned in response to the 'City of Yes' December 2024 update to NYC's zoning code.

This Remedial Action Work Plan (RAWP) summarizes the nature and extent of contamination as determined from data gathered during the Remedial Investigation (RI) as described below. It provides an evaluation of a Track 1 cleanup and other applicable Remedial Action alternatives, their associated costs, and the recommended and preferred remedy. The remedy described in this document is consistent with the procedures defined in 6 NYCRR Part 375 and DER-10, and complies with all applicable standards, criteria and guidance. The remedy described in this document also complies with all applicable Federal, State and local laws, regulations and requirements. The NYSDEC and New York State Department of Health (NYSDOH) have determined that the Site does not pose a significant threat to human health and the environment. The RI for this Site did not identify fish and wildlife resources.

1.1 Site Location and Description

The Site, located at 236-246 Gold Street, Brooklyn, New York (Tax Block 121, Lots 33, 35, 36, and 37), is a rectangular-shaped parcel located on the western side of Gold Street, between Concord Street and Tillary Street, in the Downtown Brooklyn section of Brooklyn. The Site is approximately 11,054 square feet (SF), has approximately 125 feet of frontage along Gold Street, and is approximately 88 feet deep. The Site is currently vacant, with the majority capped with asphalt. The Site was most recently utilized for automobile parking.

The Site is currently unimproved with any structures and vacant. The area surrounding the Site is predominantly commercial and residential. A location map for the Site is provided as Figure 1. A map of the Site boundary is included as Figure 2.

1.2 Proposed Site Plan

The Remedial Actions being performed under the RAWP are intended to make the Site protective of human health and the environment consistent with the contemplated end use of the Site. The Requestor is proposing to redevelop the Site with a new mixed-use commercial and residential building with a full cellar that will encompass approximately the front 59 feet of the Site lots. The remaining area of the Site outside of the building footprint will be occupied by an at-grade rear yard. Architectural drawings are not yet available for the property, as the building is currently being redesigned in response to the 'City of Yes' December 2024 update to NYC's zoning code. However, it is anticipated that the development project will require excavation to approximately 12 feet below grade (ft-bg) within the Site footprint, with localized deeper excavation to approximately 14 ft-bg for installation of foundational elements and the elevator pit. As part of the redevelopment, the four Site lots will be merged into one lot.

1.3 Description of Surrounding Property

The surrounding area is predominantly commercial and residential, commercial uses, with some public facilities and institutions, open space and outdoor recreation areas, and light manufacturing uses. The adjacent properties consist of commercial and residential buildings to the north and east, and residential buildings to the south and west. The Site lots are zoned R6B, denoting a medium-density residential area.

Based on a review of the New York City Office of Environmental Remediation (OER) Searchable Property Environmental E-Database (SPEED), one day care, Changing Tomorrow Child Care LLC, is located approximately 135 feet to the east. In addition, one school, the Urban Assembly School of Music and Art, is located approximately 330 feet to the northwest. No other sensitive receptors, such as hospital facilities, are located within a 500-foot radius of the Site.

2.0 DESCRIPTION OF REMEDIAL INVESTIGATION FINDINGS

The Site was investigated in accordance with the scope of work described in the October 2024 Remedial Investigation Work Plan (RIWP), which was approved by NYSDEC. This section presents the findings of the previous investigations conducted on-Site as well as the findings of the 2024 Remedial Investigation (RI) performed by Tenen Environmental, LLC (Tenen) as documented in the draft RIR dated December 2024.

2.1 Site History

Based on a review of Sanborn Fire Insurance Maps, the Site was developed as early as 1887 with a two-story commercial building identified as the Brooklyn Fire Department and a tin smith at Lot 33 on the northeastern portion of the Site. Five two- to four-story residential buildings, a three-story structure, and a shed were identified on the remainder of the Site. By 1904, the three-story structure has been identified as a residential property and the fire department and tin smith were reidentified as a wagon house. By 1915, the wagon house has been labelled as a wagon builder, Additionally, the southernmost residential building had been identified as commercial, and in 1938 the building had been demolished. By 1950, the wagon builder had been identified as ‘rags’. By 1969, all buildings at the Site had been demolished and the lots remained unchanged until 2003, when parking had been identified throughout the Site. City directory listings document historic commercial and residential use of the Site, with commercial uses including a blacksmith, a wagon builder, and a waste materials corporation.

2.2 Site Geology / Hydrogeology

Site Topography

The surface topography is relatively flat and gently slopes downward to the east. Based on the U.S. Geological Survey (Brooklyn, New York Quadrangle and Jersey City, New Jersey Quadrangle) topographic maps, the property lies at an elevation of approximately 31 feet above mean sea level (ft-amsl).

Site Geology and Hydrogeology

The Site is underlain by a historic fill layer (sand, silt, gravel, coal ash, cinders, wood, concrete, tile fragments, glass, and brick fragments) ranging in depth from five to ten ft-bg. The fill layer is underlain by native material consisting of brown, fine- to coarse-grained sand and silt. Groundwater at the Site was measured at approximately 24 to 26 ft-bg and groundwater flow has been measured to be toward the northeast, as shown in Figure 3.

Previous investigations at the Site have documented groundwater concentrations above the NYSDEC TOGS 1.1.1 Class GA Standards in groundwater. There are no known wellhead protection areas or specifically designated groundwater recharge areas in the vicinity of the Site. Groundwater in this area is not used as a source of potable water. Potable water is provided to residents by the New York City Department of Environmental Protection (NYC DEP) from upstate watersheds.

2.3 Summary of Remedial Investigation

This section presents the findings of the previous investigations conducted onsite by Tenen and others as well as the findings of the 2024 Remedial Investigation conducted by Tenen.

2.3.1 Summary of Data

Investigations and sampling efforts conducted at the Site are described in the following reports:

- *Phase I Environmental Site Assessment Report, 236 Gold Street, Brooklyn, NY,* Tenen

Environmental, LLC, July 2022.

- *Remedial Investigation Report, 236 Gold Street, Brooklyn, New York,* Tenen Environmental, LLC, October 2022.
- *Phase I Environmental Site Assessment Report, 242 Gold Street, Brooklyn, New York,* Tenen Environmental, LLC, March 2023.
- *Draft Remedial Investigation Report, 242 Gold Street, Brooklyn, New York,* Tenen Environmental, LLC, June 2023.
- *Phase I Environmental Site Assessment Report, 236-246 Gold Street, Brooklyn, New York,* Matrix New World Engineering, Land Surveying and Landscape Architecture, P.C., March 2024.
- *Limited Phase II Environmental Site Investigation, 244-246 Gold Street, Brooklyn, New York,* Tenen Environmental, LLC, May 1, 2024.
- *Draft Remedial Investigation Report, 236-246 Gold Street, Brooklyn, New York,* Tenen Environmental, LLC, December 2024.

Summaries of the above-mentioned reports are provided below.

Phase I Environmental Site Assessment Report, 236 Gold Street, Brooklyn, NY, Tenen Environmental, LLC, July 2022.

Tenen prepared a Phase I Environmental Site Assessment (ESA) for Lot 33 in July 2022. The Phase I ESA identified the following Recognized Environmental Conditions (RECs) in association with Lot 33:

- Historic use of Lot 33 for metalworking.

Tenen also noted Lot 33 has a Hazardous Materials E-Designation (E-117) placed by the New York City Department of City Planning and indicating the potential for encountering contaminated materials during Site redevelopment.

Remedial Investigation Report, 236 Gold Street, Brooklyn, New York, Tenen Environmental, LLC, October 2022.

Tenen completed a Remedial Investigation at Lot 33 under NYC OER's E-Designation program in September 2022 (report dated October 2022) to evaluate the quality of soil, groundwater, and soil vapor across the lot. The scope of work performed during the RI included the installation of five soil borings, the collection of eleven soil samples, the installation of three temporary groundwater monitoring wells, the collection of three groundwater samples, the installation of three temporary soil vapor sample points, and the collection of three soil vapor samples. All soil and groundwater samples were analyzed for volatile organic compounds (VOCs), semivolatile organic compounds (SVOCs), target analyte list (TAL) metals (total and dissolved for groundwater), pesticides, and polychlorinated biphenyls (PCBs); one soil sample and three groundwater samples were analyzed for 1,4-dioxane and PFAS; and, all soil vapor samples were analyzed for VOCs. In addition, soil characterization sampling was conducted across the lot to characterize soil proposed for offsite disposal. A summary of the RI results on Lot 33 is included below:

Soil Results

- VOCs were not detected in exceedance of Unrestricted Use or Restricted-Residential Use Soil Cleanup Objectives (SCOs) in any soil samples.
- Several SVOCs, specifically polycyclic aromatic hydrocarbons (PAHs), were detected in exceedance of Unrestricted Use SCOs in one or more soil samples, including benzo(a)anthracene [max. 6.2 parts-per-million (ppm)], benzo(a)pyrene [max. 5.4 ppm], benzo(b)fluoranthene [max.

6.7 ppm], benzo(k)fluoranthene [max. 2.3 ppm], chrysene [max. 5.7 ppm], dibenzo(a,h)anthracene [max. 1.2 ppm], and indeno(1,2,3-cd)pyrene [max. 3.3 ppm]. All of the above-mentioned analytes were also detected above Restricted-Residential Use SCOs in one or more samples. The concentrations of SVOCs detected in soil are consistent with the presence of historic fill material across the Site.

- Various metals were detected in exceedance of Unrestricted Use SCOs in one or more soil samples, including arsenic [max. 18.5 ppm], barium [max. 473 ppm], cadmium [max. 3.74 ppm], copper [max. 51.6 ppm], lead [max. 2,380 ppm], mercury [max. 4.26 ppm], nickel [max. 39.1 ppm], and zinc [max. 555 ppm]. Of these, arsenic, barium, lead, and mercury were also detected in exceedance of their Restricted-Residential Use SCOs in one or more samples.
- Three composite soil samples were collected and analyzed for toxicity characteristic leachate procedure (TCLP) metals as part of waste characterization sampling at Lot 33 in February 2023. Two of the three samples contained concentrations of TCLP lead exceeding the US EPA Allowable Limit of 5 milligrams per liter (mg/L), indicating the material is hazardous for lead. Subsequently in March 2023, delineation sampling was conducted on Lot 33 to horizontally and vertically delineate the hazardous lead detected during waste characterization sampling. The delineation sampling identified two separate hazardous lead hotspots in the western portion of Lot 33. One hotspot in the southwestern corner of the lot is approximately 320 square feet (SF) in size and extends to a maximum depth of seven ft-bg, and one hotspot in the northern portion of the lot is approximately 845 SF in size and extends to a maximum depth of twelve ft-bg. TCLP lead concentrations on Lot 33 exceeding the US EPA Allowable Limit ranged from 6.01 mg/L to 21.3 mg/L.
- Several pesticides were detected in exceedance of Unrestricted Use SCOs, but below Restricted-Residential Use SCOs, in one or more samples, including dieldrin [max. 0.00554 ppm], 4,4'-DDE [max. 0.13 ppm], 4,4'-DDD [max. 0.00858 ppm], 4,4'-DDT [max. 0.473 ppm], and cis-chlordane [max. 0.0989 ppm].
- One PCB, aroclor 1260, was detected at a concentration of 0.124 ppm in one soil sample, slightly in exceedance of the Unrestricted Use SCO. PCBs were not detected in exceedance of Restricted-Residential Use SCOs in any soil samples.
- Two PFAS, perfluorooctanoic acid (PFOA) and perfluorooctane sulfonic acid (PFOS), were detected in exceedance of their proposed Unrestricted Use SCOs, but below the proposed Restricted-Residential Use SCOs, in the soil sample that was analyzed. PFOA was detected at a concentration of 1.17 parts-per-billion (ppb) and PFOS was detected at a concentration of 2.41 ppb. 1,4-Dioxane was not detected in the soil sample analyzed.

<u>Groundwater Results</u>

- VOCs, pesticides, and PCBs were not detected in exceedance of the NYSDEC Technical and Operational Guidance Series (TOGS) 1.1.1 Class GA Ambient Water Quality Standards and Guidance Values (Class GA Standards)
- Several SVOCs, specifically PAHs, were detected in exceedance of Class GA Standards in one or more groundwater samples, including benzo(a)anthracene [max. 0.5 ppb], benzo(a)pyrene [max. 0.42 ppb], benzo(b)fluoranthene [max. 0.59 ppb], benzo(k)fluoranthene [max. 0.16 ppb], chrysene [max. 0.5 ppb], hexachlorobenzene [concentration of 0.07 ppb], and indeno(1,2,3-cd)pyrene [max. 0.31 ppb].
- Several metals were detected in exceedance of Class GA Standards in one or more unfiltered groundwater samples, including lead [max. 614.2 ppb], mercury [max. 0.91 ppb], and nickel [max. 115.9 ppb]. None of the above-mentioned analytes were detected in exceedance of Class GA Standards in any dissolved groundwater samples. One metal, antimony, was detected in

exceedance of its Class GA Standard in one filtered groundwater sample only, at a concentration of 6.51 ppb.
- A variety of naturally-occurring earth metals, including iron, magnesium, manganese, and sodium, were detected in exceedance of Class GA Standards in unfiltered groundwater across the Site. Of these, magnesium, manganese, and sodium also exceeded Class GA Standards in filtered groundwater.
- Two PFAS, PFOA and PFOS, were detected in exceedance of their Class GA Standards in groundwater across the Site. PFOA was detected at a max. concentration of 96.2 parts-per-trillion (ppt) and PFOS was detected at a max. concentration of 42.5 ppt. 1,4-Dioxane was not detected in any groundwater samples.

Soil Vapor Results
- Chlorinated VOCs (cVOCs) were detected in all three soil vapor samples, including tetrachloroethene (PCE) [max. 18.9 micrograms per cubic meter (ug/m^3)], trichloroethene (TCE) [max. 42.1 ug/m^3], and 1,1,1-trichloroethane (1,1,1-TCA) [concentration of 3.03 ug/m^3]. No other cVOCs included on the NYSDOH Soil Vapor Intrusion Matrices were detected in any soil vapor samples, including 1,1-dichloroethene, carbon tetrachloride, cis-1,2-dichloroethene, methylene chloride, and vinyl chloride.
- A variety of petroleum-related VOCs were detected in all three soil vapor samples, including benzene [max. 3.45 ug/m^3], ethylbenzene [max. 10.1 ug/m^3], total xylenes [max. 54 ug/m^3], and toluene [max. 28 ug/m^3].

Phase I Environmental Site Assessment Report, 242 Gold Street, Brooklyn, NY, Tenen Environmental, LLC, March 2023.

Tenen prepared a Phase I ESA for Lot 35 in March 2023. The Phase I ESA identified the following RECs in association with Lot 35:

- Historic use of the north adjoining property (Lot 33) for metalworking.

Tenen also noted Lot 35 has a Hazmat, Air, and Noise E-Designation (E-117).

Draft Remedial Investigation Report, 242 Gold Street, Brooklyn, New York, Tenen Environmental, LLC, June 2023.

Tenen completed a Remedial Investigation at Lot 35 under NYC OER's E-Designation program in May 2023 (report dated June 2023) to evaluate the quality of soil, groundwater, and soil vapor across the lot. The scope of work performed during the RI included the installation of five soil borings, the collection of eleven soil samples, the installation of three temporary groundwater monitoring wells, the collection of three groundwater samples, the installation of four temporary soil vapor sample points, and the collection of four soil vapor samples. All soil and groundwater samples were analyzed for volatile organic compounds (VOCs), semivolatile organic compounds (SVOCs), target analyte list (TAL) metals (total and dissolved for groundwater), pesticides, and polychlorinated biphenyls (PCBs); one soil sample and three groundwater samples were analyzed for 1,4-dioxane and PFAS; and, all soil vapor samples were analyzed for VOCs. A summary of the RI results on Lot 35 is included below:

Soil Results
- VOCs and PCBs were not detected in exceedance of Unrestricted Use or Restricted-Residential Use SCOs in any soil samples.

- Several SVOCs, specifically PAHs, were detected in exceedance of Unrestricted Use SCOs in one or more soil samples, including benzo(a)anthracene [max. 7.1 ppm], benzo(a)pyrene [max. 6.1 ppm], benzo(b)fluoranthene [max. 8.3 ppm], chrysene [max. 6.8 ppm], dibenzo(a,h)anthracene [max. 0.96 ppm], and indeno(1,2,3-cd)pyrene [max. 4.8 ppm]. All of the above-mentioned analytes were also detected above Restricted-Residential Use SCOs in one or more samples. The concentrations of SVOCs detected in soil are consistent with the presence of historic fill material across the Site.
- Various metals were detected in exceedance of Unrestricted Use SCOs in one or more soil samples, including arsenic [max. 15.2 ppm], barium [max. 701 ppm], cadmium [max. 5.42 ppm], copper [max. 215 ppm], lead [max. 2,880 ppm], mercury [max. 4.04 ppm], nickel [max. 52.2 ppm], and zinc [max. 1,240 ppm]. Of these, barium, cadmium, lead, and mercury were also detected in exceedance of their Restricted-Residential Use SCOs in one or more samples.
- Several pesticides were detected in exceedance of Unrestricted Use SCOs in one or more samples, including dieldrin [max. 0.055 ppm], 4,4’-DDE [max. 0.674 ppm], 4,4’-DDD [max. 0.619 ppm], and 4,4’-DDT [max. 24 ppm]. Of these, 4,4’-DDT was also detected in exceedance of its Restricted-Residential Use SCO in one soil sample.
- One PFAS, PFOS, was detected in exceedance of the proposed Unrestricted Use SCO, but below the proposed Restricted-Residential Use SCO, in the soil sample that was analyzed. PFOS was detected at a concentration of 1.68 ppb. 1,4-Dioxane was not detected in the soil sample analyzed.

<u>Groundwater Results</u>

- VOCs, pesticides, and PCBs were not detected in exceedance of the Class GA Standards.
- Several SVOCs, specifically PAHs, were detected in exceedance of Class GA Standards in one or more groundwater samples, including benzo(a)anthracene [max. 0.14 ppb], benzo(a)pyrene [max. 0.1 ppb], benzo(b)fluoranthene [max. 0.52 ppb], benzo(k)fluoranthene [max. 0.3 ppb], chrysene [max. 0.2 ppb], and indeno(1,2,3-cd)pyrene [max. 0.3 ppb].
- Two metals were detected in exceedance of Class GA Standards in one or more unfiltered groundwater samples, including lead [max. 25.83 ppb] and nickel [max. 100.7 ppb]. None of the above-mentioned analytes were detected in exceedance of Class GA Standards in any dissolved groundwater samples.
- A variety of naturally-occurring earth metals, including iron, magnesium, manganese, and sodium, were detected in exceedance of Class GA Standards in unfiltered groundwater across the Site. Of these, magnesium, manganese, and sodium also exceeded Class GA Standards in filtered groundwater.
- Two PFAS, PFOA and PFOS, were detected in exceedance of their Class GA Standards in one or more groundwater samples. PFOA was detected at a max. concentration of 193 ppt and PFOS was detected at a max. concentration of 26 ppt. 1,4-Dioxane was not detected in any groundwater samples.

<u>Soil Vapor Results</u>

- All cVOCs included on the NYSDOH Soil Vapor Intrusion Matrices were not detected in any soil vapor samples, including PCE, TCE, 1,1,1-TCA, 1,1-dichloroethene, carbon tetrachloride, cis-1,2-dichloroethene, methylene chloride, and vinyl chloride.
- A variety of petroleum-related VOCs were detected in three of four soil vapor samples, ethylbenzene [max. 14.8 ug/m^3], total xylenes [max. 81.4 ug/m^3], and toluene [max. 40.7 ug/m^3].
- All soil vapor samples contained elevated concentrations of 2-butanone (max. 2,400 ug/m^3), 2-hexanone (max. 161 ug/m^3), and acetone (max. 903 ug/m^3). Of these, acetone is a common laboratory artifact.

Phase I Environmental Site Assessment Report, 236-246 Gold Street, Brooklyn, NY, Matrix New York Engineering, Land Surveying and Landscape Architecture, P.C., March 2024.

Matrix New World Engineering, Land Surveying and Landscape Architecture, P.C. (Matrix) prepared a Phase I ESA for the entire Site in March 2024. The Phase I ESA identified the following RECs in association with the Site:

- Historic Fill (Site-Wide): The review of historic topographic maps identified a change in the configuration of contour lines between the years 1947 and 1956. It is apparent that the land, including adjoining and surrounding areas, was likely filled in between the years 1947 and 1956 during urban development. Historic fill in New York City is typically characterized by contaminated soil and groundwater including heavy metals, SVOCs, pesticides, and PCBs. According to RIRs for Lots 33 and 35, historic fill is present at the Site up to ten feet below ground surface, including but not limited to elevated levels of SVOCs and metals to at least six feet below ground surface.
- Adjoining, Upgradient, and Cross-Gradient Automotive Operations: Several historic automotive repair shops were identified adjoining, upgradient, and cross-gradient of the Site. These facilities were identified by the regulatory database review, historic Sanborn maps, and city directories. The potential exists for petroleum and/or hazardous chemicals used by and stored at these facilities to have been released and migrated to the Site.
- Adjoining, Upgradient, and Cross-Gradient Industrial Operations: Several historic industrial operations were identified adjoining, upgradient, and cross-gradient of the Site. These facilities were identified by the review of historic Sanborn maps and city directories. The potential exists for hazardous chemicals and substances used by and stored at these facilities to have been released and migrated to the Site.

Limited Phase II Environmental Site Investigation, 244-246 Gold Street, Brooklyn, New York, Tenen Environmental, LLC, May 1, 2024.

Tenen completed a Limited Phase II Environmental Site Investigation (ESI) on Lots 36 and 37 in April 2024 (report dated May 1, 2024) to evaluate the quality of soil, groundwater, and soil vapor across both lots. The scope of work performed during the Limited Phase II ESI included the installation of four soil borings, the collection of four soil samples, the installation of two temporary groundwater monitoring wells, the collection of two groundwater samples, the installation of two temporary soil vapor sample points, and the collection of two soil vapor samples. All soil and groundwater samples were analyzed for VOCs, SVOCs, TAL metals, pesticides, and PCBs, and all soil vapor samples were analyzed for VOCs. A summary of the Limited Phase II ESI results on Lots 36 and 37 is included below:

Soil Results

- VOCs were not detected in exceedance of Unrestricted Use or Restricted-Residential Use SCOs in any soil samples.
- SVOCs, specifically PAHs, were detected in exceedance of Unrestricted Use and/or Restricted-Residential Use SCOs in three of four soil samples.
- A variety of metals, specifically arsenic, barium, copper, lead, mercury, and zinc, were detected in exceedance of Unrestricted Use SCOs in one or more soil samples. Of these, barium, lead, and mercury were also detected in exceedance of Restricted-Residential Use SCOs in one soil sample. This sample was also analyzed for TCLP barium and lead, of which the concentration of lead was detected in exceedance of the EPA Allowable Limit, indicating the material is hazardous for lead.
- The pesticides 4,4’-DDT, 4,4’-DDE, 4,4’-DDD, and dieldrin were detected in one or more soil samples in exceedance of Unrestricted Use SCOs, but below Restricted-Residential Use SCOs.

- Total PCBs were detected in exceedance of the Unrestricted Use SCO, but below the Restricted-Residential Use SCO, in one soil sample.

Groundwater Results

- VOCs, SVOCs, pesticides, and PCBs were not detected in exceedance of Class GA Standards in any groundwater samples.
- One metal, selenium, was detected slightly in exceedance of its Class GA Standard in total and dissolved groundwater samples collected from one monitoring well.
- A variety of naturally-occurring earth metals were detected in exceedance of Class GA Standards in total and dissolved groundwater samples collected from both monitoring wells.

Soil Vapor Results

- Three cVOCs, PCE, TCE, and carbon tetrachloride, were detected in one or more soil vapor samples at low concentrations.
- A variety of petroleum-related VOCs were detected in both soil vapor samples, with the highest concentrations generally occurring in the sample collected from Lot 37.

Draft Remedial Investigation Report, 236-246 Gold Street, Brooklyn, New York, Tenen Environmental, LLC, December 2024.

Tenen completed a Remedial Investigation at Lots 33, 35, 36 and 37 under the NYSDEC Division of Environmental Remediation (DER) Technical Guidance for Site Investigation and Remediation (DER-10, May 3, 2010) in November 2024 (report dated December 2024) to further evaluate the quality of soil, groundwater, and soil vapor across the Site. The scope of work performed during the RI included the installation of seven soil characterization borings, the collection of 23 soil samples from soil characterization borings (including quality assurance/quality control [QA/QC] samples), the installation of five lead delineation borings, the collection of 14 soil samples from lead delineation borings, the installation of five permanent groundwater monitoring wells, the collection of four groundwater samples, the installation of six temporary soil vapor sample points, and the collection of six soil vapor samples and one ambient air sample. All soil samples collected from soil characterization borings were analyzed for VOCs, SVOCs, pesticides, herbicides, PCBs TAL metals, total cyanide, trivalent/hexavalent chromium, 1,4-dioxane, and PFAS; five soil samples collected from onsite lead delineation borings for TCLP lead (the remaining samples were placed on hold); all groundwater samples were analyzed for VOCs, SVOCs, total and dissolved metals, pesticides, herbicides, PCBs, total cyanide, trivalent/hexavalent chromium, 1,4-dioxane, and PFAS; and, all soil vapor samples and the ambient air sample were analyzed for VOCs. A summary of the RI results on the Site is included below:

Soil Results

- VOCs, PCBs, and herbicides were not detected in exceedance of Unrestricted Use or Restricted-Residential Use SCOs in any soil samples.
- A variety of historic fill-related SVOCs, specifically PAHs, were detected in exceedance of Unrestricted Use and Restricted-Residential Use SCOs in five soil samples, with the highest concentrations occurring in TSB-2 (0-2) located in the eastern portion of Lot 36.
- Four pesticides, dieldrin, 4,4'-DDD, 4,4'-DDE, and 4,4'-DDT, were detected in exceedance of Unrestricted Use SCOs, but below Restricted-Residential Use SCOs, in both soil samples collected from TSB-5.
- A variety of metals, specifically arsenic, barium, cadmium, copper, lead, nickel, zinc, mercury, hexavalent chromium, and trivalent chromium were detected in exceedance of Unrestricted Use

SCOs in one or more soil samples. Of these, arsenic, barium, copper, lead, and mercury were also detected in exceedance of Restricted-Residential Use SCOs in one or more samples.

- A TCLP lead hotspot detected in the western portion of Lot 36 during the April 2024 Limited Phase II ESI was horizontally and vertically delineated as part of this RI. The TCLP lead hotspot in the western portion of Lot 36 is approximately 400 SF in size and extends to a maximum depth of 2 ft-bg.
- 1,4-dioxane was not detected in any soil samples.
- Two PFAS analytes, PFOA and PFOS, were detected slightly in exceedance of their proposed Unrestricted Use and Protection of Groundwater SCOs, but below their proposed Restricted-Residential Use SCOs, in soil samples collected from various depths.

<u>Groundwater Results</u>

- No VOCs, SVOCs, pesticides, herbicides, or PCBs were detected above Class GA Standards in any groundwater samples.
- One metal, lead, was detected in one total groundwater sample, MW-1, slightly in exceedance of the Class GA Standard. Lead was not detected in exceedance of its Class GA Standard in any dissolved groundwater samples. Selenium was detected in one dissolved groundwater sample, MW-3, slightly in exceedance of the Class GA Standard.
- Naturally occurring earth metals manganese and sodium, were detected in total and dissolved groundwater samples across the Site.
- PFAS were detected in groundwater samples across the Site. PFOA was detected in exceedance of the Class GA Standard in all four groundwater samples and the duplicate sample and PFOS was detected in exceedance of the Class GA Standard in two groundwater samples and the duplicate sample.
- 1,4-dioxane was not detected in any groundwater samples.

<u>Soil Vapor Results</u>

- A variety of cVOCs, specifically PCE, TCE, cis-1,2-DCE, 1,1,1-TCA, carbon tetrachloride, 1,1-DCE, methylene chloride, and chloroform, were detected in exceedance of background concentrations in one or more soil vapor samples. The highest concentrations of cVOCs in soil vapor samples were generally detected in TSV-1 and TSV-5, collected from Lots 37 and 33, respectively.
- A variety of petroleum-related VOCs, specifically toluene, ethylbenzene, p/m-xylene, o-xylene, 1,2,4-trimethylbenzene, 1,3,5-trimethylbenzene, n-hexane, and 4-ethyltoluene, were detected soil vapor samples across the Site, with the highest concentrations generally occurring in TSV-2, located on Lot 36.
- A variety of other VOCs, including dichlorodifluoromethane, trichlorofluoromethane, propylene, styrene, 4-methyl-2-pentanone, acetone, carbon disulfide, acrylonitrile, benzyl chloride, 2-butanone, methyl methacrylate, and n-heptane were detected in exceedance of background concentrations in one or more soil vapor samples.

2.4 Significant Threat

The NYSDEC, in conjunction with NYSDOH have not yet determined if the Site poses a significant threat to human health and the environment. The RI for this Site did not identify fish and wildlife resources.

3.0 CONTAMINATION CONDITIONS

3.1 Conceptual Model of Site Contamination

The Site is not improved with any structures and is vacant; there have not been any structures on the Site since at least 1969. Most recently, the Site was utilized for automobile parking. Other prior non-residential uses include a blacksmith, a wagon builder, and a waste materials corporation

Based on the results of the prior investigations, the contaminants of concern at the Site include heavy metals, specifically lead, barium, and mercury, historic-fill related SVOCs, chlorinated VOCs and petroleum-related VOCs.

The soil is impacted with heavy metals, specifically lead, barium and mercury, likely due to historic onsite metalworking operations. Three hazardous lead hotspots have been identified and delineated across the Site: two on Lot 33 and one on Lot 36. One hotspot in the southwestern corner of Lot 33 is approximately 320 SF in size and extends to a maximum depth of seven ft-bg; one hotspot in the northern portion of Lot 33 is approximately 845 SF in size and extends to a maximum depth of twelve ft-bg; and, one hotspot in the western portion of Lot 36 is approximately 400 SF in size and extends to a maximum depth of two ft-bg.

Historic fill material has been identified across the Site varying in depth from five to ten ft-bg. Soil samples collected from the historic fill material indicate that historic fill material across the Site contains SVOCs, metals and pesticides above the Unrestricted Use and/or Restricted-Residential Use SCOs.

Soil vapor is impacted with chlorinated VOCs and petroleum-related VOCs. The highest concentrations of chlorinated VOCs were generally detected on Lots 33 and 37, while the highest concentrations of petroleum-related VOCs were generally detected on Lot 36. While no indoor air sampling was possible, a review of the detected concentrations indicates that mitigation will be required based on the NYSDOH Decision Matrices.

Chlorinated VOCs, specifically PCE and TCE, are present at elevated concentrations in soil vapor at the Site, with the highest concentration of PCE occurring in TSV-1, collected from the southern perimeter of Lot 37, and the highest concentration of TCE occurring in TSV-5, collected from the northeastern corner of Lot 33. PCE and TCE were not detected in any soil or groundwater samples collected during this RI. Since TSV-1 and TSV-5 were collected along boundaries of the Site and cVOCs were not detected in any soil or groundwater samples collected onsite, it is Tenen's opinion that the cVOCs detected in soil vapor are due to one or more offsite sources. Historic industrial operations have been documented at offsite properties adjoining the Site and cross- or upgradient of the Site.

Petroleum-related VOCs are present at elevated concentrations in soil vapor across the Site, with the highest concentrations generally occurring on Lot 36. Petroleum-related VOCs were generally not detected or detected at very low concentrations in soil and groundwater samples collected during this RI. It is Tenen's opinion that elevated concentrations of petroleum-related VOCs in soil vapor are due to one or more offsite sources. Historic auto repair has been documented at offsite properties adjoining the Site and cross- or upgradient of the Site.

Table 1 presents the Part 375 Unrestricted Use SCOs. Table 2 presents the Part 375 Restricted-Residential Use SCOs. Table 3 presents the TOGS 1.1.1 Ambient Class GA Water Quality Standards. Figures depicting soil, groundwater, and soil vapor concentrations detected in exceedance of applicable standards can be found in RIR Figures 9, 11, and 12, respectively.

4.0 ENVIRONMENTAL AND PUBLIC HEALTH ASSESSMENTS

4.1 Qualitative Exposure Assessment

A qualitative exposure assessment (QEA) has been completed in accordance with Section 3.3(c)4 of DER-10 and the NYSDOH guidance for performing a QEA (NYSDEC DER-10; Technical Guidance for Site Investigation and Remediation; Appendix 3 B). The QEA evaluates the potential for populations to be exposed to Site contaminants.

An exposure pathway describes the means by which an individual may be exposed to contaminants originating from a site. An exposure pathway has five elements: (1) a contaminant source; (2) contaminant release and transport mechanisms to an exposed population; (3) a receptor population; (4) a route of exposure; and (5) a point of exposure to a receptor population. Potential contaminant receptors include the following populations:

- Site workers (primarily environmental professionals and contractors)
- Construction workers, visitors or trespassers
- Future building occupants and commercial workers
- Future on-Site workers and utility workers
- Off-Site residents/building occupants
- Off-Site maintenance workers

The following potential exposure routes are considered incomplete:

Groundwater Ingestion

Potable water is provided from reservoirs in upstate New York by the New York City Department of Environmental Protection (NYCDEP), and New York City code prohibits the use of groundwater for potable purposes. This pathway is incomplete.

Inhalation of Vapors by Future Building Employees and Residents

Remediation as part of Site redevelopment will include installation of a vapor barrier and a temporary, active sub-slab depressurization system (SSDS), which will minimize the potential for soil vapor intrusion into the new onsite building.

The following potential exposure routes are considered complete:

Inhalation of Vapors and Particulates by On-Site Environmental and Construction Workers (and incidental ingestion).

During excavation and soil handling, on-Site personnel and construction workers may be exposed to dust and vapors via inhalation (and incidental ingestion). Potential exposures will be addressed by implementation of the Community Air Monitoring Plan (CAMP), referenced in Section 7.4 of this RAWP and included as Appendix A, and adherence to the Health and Safety Plan (HASP), included as Appendix B.

Dermal Contact with Soil by On-Site Environmental and Construction Workers

During excavation and soil handling, on-Site personnel and construction workers may be exposed to contaminants in soil via dermal contact. This exposure would be mitigated by adherence to the HASP, included in Appendix C, during ground intrusive activities.

Dermal Contact with Groundwater by On-Site Environmental and Construction Workers

During excavation and foundation installation, on-Site personnel and construction workers may be exposed to contaminants in groundwater via dermal contact. In addition, environmental professionals collecting groundwater samples for environmental analysis may be exposed to contaminants in groundwater via dermal contact. These exposures would be mitigated by adherence to the HASP, included in Appendix B, during sampling activities.

Inhalation of Vapors and Particulates by Off-Site Residents/Building Workers

During Site redevelopment, soil excavation and removal may generate dust and vapors that could be inhaled by off-Site residents/building occupants and maintenance personnel.

The above potential exposures are limited to the remediation/construction phase of the proposed remedial action. Adherence to health and safety protocols described in the HASP included as Appendix B will address environmental and construction worker exposure to contaminated soil vapors, particulates and groundwater. Potential exposure of off-Site residents and building occupants will be addressed by implementation of the CAMP referenced in Section 7.4 of this RAWP and included as Appendix A.

4.2 Remedial Action Objectives

The goals of remediation are to remove the on-Site sources of heavy metals and fill with elevated PAHs, metals, pesticides, and PCBs to allow for the Site's redevelopment for residential and commercial use and reduce the concentrations of contaminants in groundwater and soil vapor to levels below applicable Standards, Criteria and Guidance (SCGs). Based on the results of the Remedial Investigation conducted at the Site, the following Remedial Action Objectives (RAOs) have been identified:

4.2.1 Soil

Heavy metals, specifically barium, lead and mercury, were detected in soil across the Site in exceedance of Unrestricted Use and/or Restricted-Residential Use SCOs, likely due to historic onsite metalworking operations and/or filling. Three hazardous lead hotspots have been identified and delineated across the Site: two on Lot 33 and one on Lot 36. One hotspot in the southwestern corner of Lot 33 is approximately 320 SF in size and extends to a maximum depth of seven ft-bg; one hotspot in the northern portion of Lot 33 is approximately 845 SF in size and extends to a maximum depth of twelve ft-bg; and, one hotspot in the western portion of Lot 36 is approximately 400 SF in size and extends to a maximum depth of two ft-bg. Various SVOCs (specifically PAHs), various metals and pesticides were detected in soil collected from historic fill material at the Site in exceedance of Unrestricted Use SCOs and/or Restricted-Residential Use SCOs. PFAS, specifically PFOA and PFOS, were detected in soil samples collected from historic fill and native material in exceedance of the proposed Unrestricted Use SCOs.

RAOs for Public Health Protection

- Prevent ingestion/direct contact with contaminated soil.

RAOs for Environmental Protection

- Prevent migration of contaminants that would result in groundwater or surface water contamination.

4.2.2 Groundwater

One heavy metal, lead, was detected in one total groundwater sample slightly in exceedance of the AWQS, but was not detected in exceedance of the AWQS in any dissolved groundwater samples. One metal, selenium, was detected in one dissolved groundwater sample slightly in exceedance of the AWQS. Total and dissolved metals, consistent with typical earth metals attributable to the conditions of the aquifer, were also detected above applicable AWQS in groundwater across the Site. PFAS, specifically PFOA and PFOS, were detected in groundwater across the Site above applicable AWQS.

RAOs for Public Health Protection

- Prevent ingestion of groundwater containing contaminant levels exceeding drinking water standards.

RAOs for Environmental Protection

- Remove the source of groundwater or surface water contamination.

4.2.3 Soil Vapor

Elevated concentrations of cVOCs and petroleum-related VOCs were detected in soil vapor across the Site, with the highest concentrations of cVOCs generally occurring on Lots 33 and 37 and the highest concentrations of petroleum-related VOCs occurring on Lot 36.

RAOs for Public Health Protection

- Mitigate impacts to public health resulting from existing, or the potential for, soil vapor intrusion into buildings at the Site.

5.0 DESCRIPTION OF REMEDIAL ACTION WORK PLAN

5.1 Evaluation of Remedial Alternatives

Two remedial alternatives were considered to address heavy metals and historic fill-related impacts to soil and cVOC and petroleum-related VOC concentrations in soil vapor. The alternatives considered to address contamination in soil and soil vapor are discussed below.

5.1.1 Alternative 1 – Track 2 Remedy

Soil. Excavation as part of the Site redevelopment would allow for the removal of the bulk of the contaminant mass at the Site. The remedial excavation would extend to a depth of twelve ft-bg within the building footprint and to a depth of two ft-bg in the rear yard to remove soil exceeding Restricted-Residential Use SCOs and soil containing hazardous concentrations of lead. In addition, hotspot excavation would be completed in the vicinity of 2024 Limited Phase II ESI soil boring 246G_SB-1 to a depth of three ft-bg, in the vicinity of 2022 RI soil boring 236G_SB and 2023 RI soil boring 242G_SB-4 to a depth of six ft-bg, and in the vicinity of 2024 RI soil boring TSB-4 to a depth of seven ft-bg for removal of soil exceeding Restricted-Residential Use SCOs. Two hazardous lead hotspots would also be excavated in the rear yard below two ft-bg: one to approximately seven ft-bg and one to approximately twelve ft-bg. Approximately 3,900 CY of soil will be generated during excavation (approximately 3,800 CY will be excavated and disposed of offsite for remedial purposes, and approximately 100 CY of additional soil will be excavated and disposed offsite for development purposes). The excavated rear yard hotspot areas would be backfilled with clean soil or fill and capped. All imported fill would be sampled and analyzed prior to importation to the Site to ensure that the material meets Restricted-Residential Use SCOs.

End-point samples would be collected to document that Restricted-Residential Use SCOs have been achieved across the Site. At remedial excavation depth, end-point samples will be collected from the bottom of the excavation and sidewalls of the excavation (where sidewalls are not inaccessible due to support of excavation elements) and will be analyzed for target compound list (TCL) VOCs, TCL SVOCs, TAL metals, pesticides, PCBs, 1,4-dioxane, and PFAS. If the end-point sample concentrations do not meet the Restricted-Residential Use SCOs, additional excavation and end-point sampling will continue until the appropriate SCOs are met, to a maximum depth of 15 ft-bg.

The extent of remedial excavation is depicted on Figure 4. Proposed post-excavation end-point sample locations are depicted on Figure 5. Track 2 Restricted-Residential Use SCOs are included in Table 1.

A CAMP (Appendix A) and Soil/Materials Management Plan (Appendix C) will be implemented during the invasive Site activities to prevent or minimize potential impacts to human health and the environment. End-point samples will confirm the removal of soil to concentrations below Restricted-Residential SCOs, to a maximum depth of 15 ft-bg.

Soil Vapor. Installation of an active sub-slab depressurization system (SSDS) within the new building would mitigate the potential for elevated concentrations of cVOCs and petroleum-related VOCs in soil vapor beneath the building slab to migrate into the interior of the building. The active SDSS would create a negative pressure beneath the building slab, resulting in the collection of any VOCs that might otherwise migrate into the interior of the building. The system would connect to an exterior blower that will release trapped VOCs into the atmosphere above the building's roofline, to be diluted with ambient air. Exhaust of VOC impacted soil vapor would conform to the requirements set forth in the NYSDOH Soil Vapor Guidance. It is anticipated that the system will run continuously for less than five years.

A Design Document will be submitted to NYSDEC for approval prior to installation of the SSDS at the Site. Confirmation testing would be performed following the installation of the SSDS to verify that the system is achieving the depressurization goal set by the Remedial Engineer. If the test shows a sub-slab vacuum below the depressurization goal, NYSDEC would be notified and corrective measures would be implemented. Possible corrective measures include adjusting flow rates of individual soil vapor suction points, increasing the size of the suction point, adding additional suction points, and adding an additional blower.

Baseline indoor air samples will be collected onsite prior to the start-up of the SSDS, with post-remedial indoor air samples collected onsite one month after the system start-up to evaluate the effect of the onsite SSDS on cVOC and petroleum-related VOC concentrations in indoor air. In general, four indoor air samples will be collected from the lowest level of the new onsite building during each sampling event. Indoor air samples will be analyzed for VOCs via EPA Method TO-15. The results of the indoor air sampling will be presented in tabular form and discussed in the Final Engineering Report (FER). In addition, prior to any petition to shut down the SSDS, co-located sub-slab soil vapor and indoor air sampling would be conducted over two consecutive heating seasons after system start-up to evaluate if the remedial goals have been achieved and if the system can be decommissioned. The co-located sub-slab soil vapor and indoor air sampling locations and sampling methodology will be included in a Site Management Plan (SMP).

Long-term institutional and engineering controls for this Alternative would include recordation of an environmental easement, maintenance of the active SSDS, annual inspection and certification of the active SSDS by a professional engineer, submission of PRRs to NYSDEC, and general site management activities pursuant to a NYSDEC-approved SMP. A design document for the SSDS will be submitted to NYSDEC for approval prior to the implementation of the Remedial Action.

5.1.2 Alternative 2 – Track 1 Remedy

Soil. Excavation of all soil with concentrations above Unrestricted Use SCOs would be completed across the Site. Based on previous investigations completed at the Site, this Alternative 2 would include similar excavation depths to Alternative 1, with additional remedial excavation in across the rear yard to approximately twelve ft-bg, in the vicinity of RI soil borings TSB-1 and TSB-6 to approximately 24 ft-bg for removal of nickel/PFOA hotspots exceeding Unrestricted Use SCOs, and in the vicinity of RI soil borings TSB-2 and TSB-4 to approximately 24 ft-bg for removal of nickel hotspots exceeding Unrestricted Use SCOs. The excavated rear yard and nickel and/or PFOA hotspot areas would be backfilled with clean soil or fill and capped with a concrete building slab. All imported fill would be sampled and analyzed prior to importation to the Site to ensure that the material meets Unrestricted Use SCOs. Redevelopment of the Site would be implemented as described in Alternative 1.

End-point samples would be collected to confirm Unrestricted Use SCOs have been achieved across the Site. At remedial excavation depth, end-point samples will be collected from the bottom of the excavation and sidewalls of the excavation (where sidewalls are not inaccessible due to support of excavation elements) and will be analyzed for Part 375 TCL VOCs, TCL SVOCs, TAL metals, pesticides, PCBs, 1,4-dioxane and PFAS. If the end-point sample concentrations do not meet the Unrestricted Use SCOs, additional excavation and end-point sampling will continue until the appropriate SCOs are met.

The extent of remedial excavation under this Alternative is depicted on Figure 6. Post-excavation end-point sample locations are depicted on Figure 7. Track 1 Unrestricted Use SCOs are included in Table 1.

A CAMP (Appendix A) and Soil/Materials Management Plan (Appendix C) will be implemented during the invasive Site activities to prevent or minimize potential impacts to human health and the environment. End-point samples will confirm the removal of soil to concentrations below Unrestricted Use SCOs.

Soil Vapor. Installation of an active SSDS within the new building would mitigate the potential for elevated concentrations of cVOCs and petroleum-related VOCs in soil vapor beneath the building slab to migrate into the interior of the building. The active SDSS would create a negative pressure beneath the building slab, resulting in the collection of any VOCs that might otherwise migrate into the interior of the building. The system would connect to an exterior blower that will release trapped VOCs into the atmosphere above the building's roofline, to be diluted with ambient air. Exhaust of VOC impacted soil vapor would conform to the requirements set forth in the NYSDOH Soil Vapor Guidance. It is anticipated that the system will run continuously for less than five years.

A Design Document will be submitted to NYSDEC for approval prior to installation of the SSDS at the Site. Confirmation testing would be performed following the installation the SSDS to verify that the systems are achieving the depressurization goal set by the Remedial Engineer. If the test shows a sub-slab vacuum below the depressurization goal, NYSDEC would be notified and corrective measures would be implemented. Possible corrective measures include adjusting flow rates of individual soil vapor suction points, increasing the size of the suction point, adding additional suction points, and adding an additional blower.

Baseline indoor air samples will be collected onsite prior to the start-up of the SSDS, with post-remedial indoor air samples collected onsite one month after the system start-up to evaluate the effect of the onsite SSDS on cVOC and petroleum-related VOC concentrations in indoor air. In general, four indoor air samples will be collected from the lowest level of the new onsite building during each post-remedial sampling event. Indoor air samples will be analyzed for VOCs via EPA Method TO-15. The results of the indoor air sampling will be presented in tabular form and discussed in the FER. In addition, prior to any petition to shut down the SSDS, co-located sub-slab soil vapor and indoor air sampling would be conducted over two consecutive heating seasons and within five years after system start-up to evaluate if the remedial goals have been achieved and if the system can be decommissioned. The co-located sub-slab soil vapor and indoor air sampling locations and sampling methodology will be included in a SMP.

Long-term engineering or institutional controls would not be required under this Alternative.

Short-term institutional and engineering controls for this Alternative would include maintenance of the active SSDS, annual inspection and certification of the active SSDS by a professional engineer, submission of PRRs to NYSDEC, and general site management activities pursuant to a NYSDEC-approved SMP. A design document for the SSDS will be submitted to NYSDEC for approval prior to the implementation of the Remedial Action.

5.2 Standards, Criteria and Guidance (SCGs)

The Remedial Action SCGs are listed below.

SCG	Scope / Application
NYSDEC Brownfield Cleanup Program Guide (draft 2004)	General program guidance
NYSDEC CP-51 / Soil Cleanup Guidance (2010)	Restricted Use SCOs for soil
NYSDEC DER-10 Technical Guidance for Site Investigation and Remediation (2010)	End-point sampling methodology; underground storage tank (UST) closure
NYSDEC DER-31 Green Remediation (2011)	Green remediation components

SCG	Scope / Application
NYSDEC TOGS 1.1.1 Ambient Water Quality Standards and Guidance Values and Groundwater Effluent Limitations (1998)	Class GA Standards for groundwater
NYSDOH Guidance for Evaluating Soil Vapor Intrusions in the State of New York (2006)	Soil vapor guidance
NYSDOH Generic Community Air Monitoring Plan	Plan for monitoring dust and volatile organics resulting from construction activities
New York State Codes, Rules and Regulations (NYCRR) Title 6 Part 360 – Solid Waste Management Facilities	Offsite disposal of waste for facilities in NYC
New York State Codes, Rules and Regulations (NYCRR) Title 6 Part 364 – Waste Transporter Permits	Transporter requirements for offsite disposal of waste
6 NYCRR Part 370 – Hazardous Waste Management System	Disposal of hazardous waste, if encountered
6 NYCRR Part 375 – Environmental Remediation Programs (December 2006)	General administrative guidance
6 NYCRR Part 376 – Land Disposal Restrictions	Disposal of hazardous waste, if encountered
6 NYCRR Part 750 – State Pollutant Discharge Elimination System (SPDES) Regulations	Discharge of wastewater and stormwater
Code of Federal Regulations (CFR) Title 29 Part 1910.120 - Hazardous Waste Operations and Emergency Response Standard	Worker safety
29 CFR Title 29 Part 1926 - Safety and Health Regulations for Construction	Worker safety
40 CFR Parts 144 and 146 – Underground Injection Control Program	Injection of chemicals into the groundwater
Title 15, Rules of the City of New York (RCNY), Chapter 19 - Use of the Public Sewers	Discharge of groundwater to the municipal sewer system
NYCDEP Limitations for Effluent to Sanitary or Combined Sewers	Discharge of groundwater to the municipal sewer system

5.3 Evaluation of Alternatives

The remedial alternatives for soil and soil vapor are discussed below. Each alternative was evaluated based on the following remedy selection factors (as defined in DER-10, Section 4.2):

- Protection of human health and the environment
- Conformance with standards, criteria and guidelines
- Short-term effectiveness and performance
- Long-term effectiveness and performance
- Reduction in toxicity, mobility or volume
- Implementability
- Cost effectiveness
- Community acceptance
- Green and sustainable remediation (including climate resiliency)
- Land use

5.3.1 Protection of Human Health and the Environment

Each alternative would be protective of human health and the environment. Under Alternative 2, soil/fill would be excavated to meet Unrestricted Use SCOs, and under Alternative 1, soil/fill would be excavated to meet Track 2 Restricted-Residential Use SCOs to a maximum depth of 15 ft-bg, consistent with the proposed future residential use of the Site. Groundwater in this area is not used as a source of drinking water. An active SSDS would be installed under both Alternatives to mitigate the potential for soil vapor intrusion into the new onsite building.

A Health and Safety Plan (HASP), including monitoring/management for particulates and volatiles will be implemented during remedial activities.

5.3.2 Conformance with Standards, Criteria and Guidelines

Each alternative would conform to the SCGs. Both alternatives would remove the bulk of historic fill-related impacts to soil. In addition, Alternative 2 (Track 1) would also remove four deep nickel and/or PFOA hotspots detected across the Site during the RI.

Onsite construction safety will conform to the HASP requirements, which incorporate Occupational Safety and Health Administration (OSHA) requirements.

5.3.3 Short-Term Effectiveness and Performance

Each alternative would be effective over a short-term time horizon. The alternatives are consistent with the proposed use. Alternative 2 (Track 1) is associated with the most significant short-term impacts, related to the increased duration associated with more extensive and deeper soil removal. These impacts include the potential for particulate and volatile impacts and additional truck traffic for a longer period of time. To a slightly lesser extent, Alternative 1 (Track 2) would have similar potential impacts over a shorter timescale. These potential impacts are addressed in the various control plans included in this RAWP.

5.3.4 Long-Term Effectiveness and Performance

Each alternative would be effective over a long-term time horizon. Alternative 2 (Track 1) would be consistent with the proposed use without long-term engineering or institutional controls, and Alternative 1 (Track 2) would be consistent with the proposed use with long-term engineering and institutional controls. Groundwater in this area is not used as a source of drinking water, and the suspected onsite source of potential impacts to soil vapor would be removed during redevelopment.

5.3.5 Reduction in Toxicity, Mobility or Volume

Each alternative would reduce the toxicity, mobility, and volume of the contaminants present onsite. In particular, both Alternatives 1 (Track 2) and 2 (Track 1) would remove the bulk of the impacts present at the Site.

5.3.6 Implementability

Each alternative would be implementable. Alternatives 1 (Track 2) and 2 (Track 1) can be implemented as part of the Site remedial action utilizing standard environmental and construction means and methods.

5.3.7 Cost Effectiveness

The implementation of Alternative 1 (Track 2) is estimated at approximately $195,000, as shown in Table 4. Additional reporting and long-term monitoring costs of approximately $55,000 would also be incurred. The costs to implement Alternative 2 (Track 1) are higher than the costs to implement Alternative 1 (Track 2) due to the additional excavation and extensive support of excavation system.

5.3.8 Community Acceptance

Each alternative eliminates potential exposure pathways and will result in a decrease in toxicity, mobility and volume of Site contaminants (see Section 5.3.5). These considerations, in conjunction with the future proposed residential/commercial use of the Site and acknowledgement that groundwater is not used as a potable source of water in this area of Queens, should result in acceptance by the community.

The short-term impacts (see Section 5.3.3) are greater due to the additional construction impacts, although these will be addressed by the various control plans in this RAWP. The selected remedy will be subject to a 45-day public comment period in accordance with the Citizen Participation Plan. Any substantive public comments received will be addressed before the remedy is approved.

5.3.9 Green and Sustainable Remediation

Both alternatives implement a variety of green remediation principles and techniques (see Section 5.4). An environmental footprint analysis was conducted for both remedial alternatives. The same volume of hazardous waste will be disposed of offsite at a landfill, while approximately 1,700 tons of additional non-hazardous waste will be disposed of offsite at a landfill under Alternative 2 (Track 1) compared to Alternative 1 (Track 2). In addition, Alternative 2 (Track 1) will result in slightly more air emissions than Alternative 1 (Track 2) due to the additional excavation and offsite disposal required. The environmental footprint analyses are included in Appendix F.

5.3.10 Land Use

Each of the proposed alternatives is compatible with the proposed land use at the Site, which has been documented in the BCP Application and in Section 1.3.

The following findings, based on a review of previous environmental and public documents, support the compatibility of the proposed Site land use with that of the surrounding area:

1. The use proposed for the Site conforms to applicable zoning laws or maps or the reasonably anticipated future use of the Site.
2. The proposed use conforms to historical and/or recent development patterns in the area.
3. According to the New York City Planning Commission Zoning Map, the Site is located in an R6B zoning district, a designation that typically denotes medium density areas and typical row house districts with buildings set back from the street and small front yards.
4. The Site is located in an urban setting characterized by residential, commercial, and industrial uses. There are no areas zoned for agricultural use in the vicinity of the Site.
5. According to the NYSDEC database for environmental justice concerns, the Site is outside of a Potential Environmental Justice Area (PEJA).
6. There are no Federal or State land designations.
7. The population growth patterns and projections support the proposed land use.
8. The Site is accessible to existing infrastructure.

9. The Site is not located in close proximity to important Federal, State or local natural resources, including waterways, wildlife refuges, wetlands, or critical habitats of endangered or threatened species.
10. Municipal water supply wells are not present in this area of New York City; therefore, groundwater from the Site cannot affect municipal water supply wells or recharge areas.
11. The Federal Emergency Management Agency (FEMA) flood insurance rate map for the Site (Map Number 3604970203F) indicates that the Site is not located within the 0.2% annual chance floodplain (500-year flood).

5.4 Selection of the Preferred Remedial Actions

The preferred remedy, intended to address all environmental issues associated with the Site, consists of the following: Alternative 1 (Track 2). The preferred remedy is further described below:

- Excavation and offsite disposal of all onsite soils which exceed the Restricted-Residential Use SCOs, as defined by 6 NYCRR Part 375-6.8(b), to a maximum depth of 15 ft-bg throughout the Site. Based on previous sampling data, the remedial excavation would extend to a depth of twelve ft-bg within the building footprint and to a depth of two ft-bg in the rear yard. In addition, hotspot excavations would be completed in the vicinity of 2024 Limited Phase II ESI soil boring 246G_SB-1 to a depth of three ft-bg, in the vicinity of 2022 RI soil boring 236G_SB and 2023 RI soil boring 242G_SB-4 to a depth of six ft-bg, and in the vicinity of 2024 RI soil boring TSB-4 to a depth of seven ft-bg. Additionally, two hazardous lead hotspots would also be excavated in the rear yard below two ft-bg: one to approximately seven ft-bg and one to approximately twelve ft-bg;
- Off-site disposal of excavated materials from the Site in accordance with all Federal, State and local rules and regulations for handling, transport and disposal;
- Collection and analysis of post-remedial end-point samples to document remaining concentrations of contaminants. Samples will be evaluated for attainment of Restricted-Residential Use SCOs, which would support a Track 2 remedy;
- Import of materials to be used for backfill and cover in compliance with: (1) 6 NYCRR Part 375-6.7(d), and (2) all Federal, State and local rules and regulations for handling and transport of material;
- Removal and disposal any unidentified/unknown underground storage tanks (USTs) that are encountered during development in compliance with all applicable Federal, State and local rules and regulations;
- Installation of an active SSDS beneath the new onsite building to mitigate the potential for soil vapor intrusion. A blower test will be performed for the system to determine the final fan size required to meet the system design parameters. A SSDS Design Document for the Site system will be submitted under separate cover to NYSDEC and the New York State Department of Health (NYSDOH) for approval which will include recommendation for effluent sampling as necessary;
- Efficacy of the active SSDS will be confirmed via pressure differential testing throughout the sub-slab;
- Post-remedial (one month following SSDS start-up) indoor air sampling will be conducted for additional evaluation of the active SSDS;
- Preparation of a Final Engineering Report (FER) to document the implemented remedial actions;
- Development of a Site Management Plan (SMP) for long-term management of potential residual contamination as required by an Environmental Easement, including plans for: (1) long-term Institutional and Engineering Controls, (2) monitoring, and (3) reporting; and
- Recording of an Environmental Easement to restrict use of the site and require compliance with the SMP.

Remedial activities will be performed at the Site in accordance with this NYSDEC-approved RAWP and the Department-issued Decision Document. All deviations from the RAWP and/or Decision Document will be promptly reported to NYSDEC for approval and fully explained in the FER. Following excavation, site soils will meet the Restricted-Residential Use SCOs across the Site to a maximum depth of 15 ft-bg and end-point sampling will confirm target SCOs are met. Potential soil vapor impacts will be mitigated by installation of an active SSDS.

The following land-use factors were considered in selecting these remedial measures. Land Use Factor	Remedy Evaluation Result
Zoning	Remedy is consistent
Applicable comprehensive community master plans or land use plans	Remedy is consistent
Surrounding property uses	Remedy is consistent
Citizen participation	Remedy is consistent; CPP requirements implemented regardless of selected remedy
Environmental justice concerns	Remedy is consistent
Land use designations	Remedy is consistent
Populations growth patterns	Remedy is consistent
Accessibility to existing infrastructure	Remedy is consistent
Proximity to cultural resources	None identified
Proximity to natural resources	None identified
Off-Site groundwater impacts	None identified
Proximity to floodplains	Site is outside the 500-year flood zone.
Geography and geology of the Site	Remedy is consistent
Current Institutional Controls	None currently present

Green remediation principles and techniques will be implemented to the extent feasible in the design, implementation, and site management of the remedy as per DER-31. The major green remediation components are as follows;

- Installation of a minimum 20-mil vapor barrier and waterproofing membrane beneath the foundation slab and on the exterior of all foundation sidewalls, to grade, as an element of foundation construction;
- Considering the environmental impacts of treatment technologies and remedy stewardship over the long term;
- Reducing direct and indirect greenhouse gases and other emissions;
- Increasing energy efficiency and minimizing use of non-renewable energy;
- Conserving and efficiently managing resources and materials;
- Reducing waste, increasing recycling, and increasing reuse of materials which would otherwise be considered a waste;
- Maximizing habitat value and creating habitat when possible;
- Fostering green and healthy communities and working landscapes which balance ecological, economic and social goals; and
- Integrating the remedy with the end use where possible.

6.0 REMEDIAL ACTION PROGRAM

6.1 Governing Documents

6.1.1 Site-Specific Health and Safety Plan

A Site-Specific HASP has been created for the Site and is included in Appendix B. All remedial work performed under this plan will be in full compliance with governmental requirements, including Site and worker safety requirements mandated by Federal OSHA. An emergency contact sheet with names and phone numbers is included in Table 1 of the HASP and defines the specific project contacts for use by NYSDEC and NYSDOH in the case of a day or night emergency. The HASP and requirements defined in this RAWP pertain to all remedial and invasive work performed at the Site until the issuance of a Certificate of Completion.

6.1.2 Quality Assurance Project Plan

A Quality Assurance Project Plan (QAPP) has been created for the site to address quality control and quality assurance procedures for all site sampling, including post excavation end-point sampling, and is included in Appendix D.

6.1.3 Soil/Materials Management Plan

The Soil/Materials Management Plan (SMMP) includes plans for managing all soils/materials that are disturbed at the Site. The SMMP includes provisions for sediment and erosion control and stormwater management.

The SMMP, which describes procedures for excavation, handling, storage, and transport and disposal, is included in Appendix C.

6.1.4 Storm-Water Pollution Prevention Plan (SWPPP)

The Site is less than one acre in size and a Storm-Water Pollution Prevention Plan (SWPPP) is not required.

6.1.5 Community Air Monitoring Plan

The purpose of the Community Air Monitoring Plan (CAMP) is to protect downwind receptors (e.g., residences, businesses, schools, nearby workers, and the public) from potential airborne contaminants released as a direct result of the Remedial Action being performed at the Site. A summary of the CAMP plan is included in Appendix A.

6.1.6 Citizen Participation Plan

The Citizen Participation Plan (CPP) enables citizens to participate more fully in decisions that affect their health, environment, and social well-being. The CPP will be updated throughout the Remedial Action in response to any community feedback.

A certification of mailing will be sent by the Applicant to the NYSDEC project manager following the distribution of all Fact Sheets and notices that includes: (1) certification that the Fact Sheets were mailed, (2) the date they were mailed; (3) a copy of the Fact Sheet, (4) a list of recipients (contact list); and (5) a statement that the repository was inspected on (specific date) and that it contained all applicable project documents.

No changes will be made to approved Fact Sheets authorized for release by NYSDEC without written consent of the NYSDEC. No other information, such as brochures and flyers, will be included with the Fact Sheet mailing.

The approved Citizen Participation Plan for this project is attached in Appendix E.

An electronic document repository is available through DECinfo Locator: https://www.dec.ny.gov/data/DecDocs/C224413

In addition, paper document repositories have been established at the following locations and contain all applicable project documents:

Brooklyn Community Board #2
350 Jay Street, 8th Floor
Brooklyn, NY 11201-2921
Phone: 718-596-5410
Hours: Monday – Friday : 9 AM – 5 PM
Saturday and Sunday: Closed

Brooklyn Public Library – Central Branch
10 Grand Army Plaza
Brooklyn, NY 11238
Phone: 718-230-2100
Hours: Monday – Thursday: 9 AM – 8 PM
Friday & Saturday: 9 AM – 6 PM
Sunday: 1 PM – 5 PM

6.1.7 Site Operations Plan

The Remedial Engineer is responsible for ensuring that all submittals for this remedial project, including contractor and sub-contractor document submittals, are in compliance with this RAWP. All remedial documents will be submitted to NYSDEC and NYSDOH in a timely manner and prior to the start of work.

6.2 General Remedial Construction Information

6.2.1 Project Organization and Emergency Contacts

The following are the principal personnel who will be assist in the management, oversight and completion of this project. A table of project contacts is also included as Table 6.

Remedial Engineer
Matthew M. Carroll, PE
1085 Sackett Avenue, Bronx, NY 10461
(917) 510-6767

Tenen Environmental, LLC
121 West 27th Street, Suite 702, New York, NY 10001
(646) 606-2332

- Mohamed Ahmed, Professional Geologist: responsible for overall coordination and management of the project.

- Alana Carroll, Professional Geologist: responsible for quality assurance of sampling procedures and laboratory data.
- Ashley Platt, Project Geologist: responsible for the day-to-day field monitoring activities, including soil excavation and load-out, dust monitoring and PID monitoring. Report preparation will be the function of a Project Geologist from Tenen.

Subcontractors
Laboratory:
York Analytical Laboratories, 132-02 89th Avenue in Richmond Hill, NY
(800) 306-9675
NYSDOH Environmental Laboratory Approval Program (ELAP) Certification No. 10854 for solid and hazardous waste

Data Validation:
L.A.B Validation Corp., 14 West Point Drive, East Northport, NY 11731
(516) 523-7891

Remedial Party:
236 Gold LLC / 242 Gold St LLC / 244 Gold LLC / 236-242 Gold St LLC
31 Spencer Street, Suite 502, Brooklyn, NY 11205
Attn: Yochanan Tennenhaus
(917) 612-8851

Resumes of key personnel involved in the Remedial Action are presented in the QAPP, included as Appendix D.

6.2.2 Remedial Engineer

The Remedial Engineer (RE) for this project will be Matthew M. Carroll, PE. The RE is a registered professional engineer (PE) licensed by the State of New York. The RE will have primary direct responsibility for implementation of the remedial program for 236-246 Gold Street Site (NYSDEC BCA Index No. C224413-09-24; Site No. C224413). The RE will certify in the Final Engineering Report (FER) that the remedial activities were observed by qualified environmental professionals under his supervision and that the remediation requirements set forth in the RAWP and any other relevant provisions of ECL 27-1419 have been achieved in conformance with that Plan. Other RE certification requirements are listed later in this RAWP.

The RE will coordinate the work of other contractors and subcontractors involved in all aspects of remedial construction, including soil excavation, stockpiling, characterization, removal, air monitoring, emergency spill response, import of back fill material (if any), and management of waste transport and disposal. The RE will be responsible for all appropriate communication with NYSDEC and NYSDOH.

The RE will review all pre-remedial plans submitted by contractors for compliance with this RAWP and will certify compliance in the FER.

6.2.3 Remedial Action Construction Schedule

A general Remedial Action construction schedule is included in Table 5.

6.2.4 Work Hours

The hours for operation of remedial construction will conform to the New York City Department of Buildings construction code requirements or according to specific variances issued by that agency. NYSDEC will be notified by the Applicant of any variances issued by the Department of Buildings. NYSDEC reserves the right to deny alternate remedial construction hours.

6.2.5 Mobilization

Mobilization includes field personnel orientation, equipment mobilization (including CAMP equipment), marking/staking sampling locations and utility mark-outs. Each field team member will attend an orientation meeting to become familiar with the general operation of the Site, health and safety requirements, and field procedures. The contractor will mobilize all necessary materials and equipment on Site directly prior to the initiation of any remedial activities. Material stockpile and equipment decontamination areas will be designated.

6.2.6 Erosion and Sedimentation Controls

The SMMP, as included in Appendix C, includes provisions for sediment and erosion control and stormwater management, which will be in conformance with requirements presented in the New York State Guidelines for Urban Erosion and Sediment Control. This includes silt fencing along Gold Street, as well as protection of nearby catch basins.

6.2.7 Stabilized Construction Entrances

One stabilized construction entrance is proposed at a gate along Gold Street.

6.2.8 Equipment and Material Staging

All equipment and materials will be stored at the Site in accordance with the requirements of this RAWP, manufacturer's recommendations, and in conformity to applicable statutes, ordinances, regulations, and rulings of the public authority having jurisdiction. The Contractor shall maintain accurate records documenting the measures taken to protect each equipment item. The Contractor shall not store materials or encroach upon private property without the written consent of the owners of such private property. No work shall commence until Notice to Commence work is provided by the Remedial Engineer.

6.2.9 Decontamination Area

Truck and equipment decontamination pads will be constructed at the proposed gate along Gold Street. These are the same as the construction entrance/exit pads, which limit the tracking of Site-derived soils outside the Site.

The pads will be constructed using 1.5-inch to six-inch crushed stone and shall be a minimum of eight-inches thick. The construction zone exit pad will be constructed in accordance with the New York Standards and Specifications for Erosion and Sediment Control.

All construction equipment exiting the contamination reduction zone must first be decontaminated regardless of whether the equipment has come in contact with contaminated materials.

During remediation, soil and liquids adhered to construction vehicles and equipment will be removed in the decontamination area prior to such vehicles and equipment leaving the Site.

After wetting with potable water, brooms or shovels will be utilized for the gross removal of soil from vehicles and equipment. The decontamination procedure for the removal of the remaining soil and liquids will consist of washing with potable water. Soil generated by the decontamination process will be stockpiled and tested in accordance with the SMMP included in Appendix C and transported offsite for disposal.

Decontamination liquids will percolate through the truck wash pad and be treated along with the Site groundwater.

6.2.10 Sheeting and Shoring

Appropriate management of structural stability of onsite or offsite structures during onsite activities including excavation is the sole responsibility of the Applicant and its contractors. The Applicant and its contractors are solely responsible for safe execution of all invasive and other work performed under this Plan. The Applicant and its contractors must obey any local, State or Federal permits or approvals that may be required to perform work under this Plan. Further, the Applicant and its contractors are solely responsible for the implementation of all required, appropriate, or necessary health and safety measures during performance of work under the approved Plan.

6.2.11 Utility Markout and Easement Layout

The Applicant and its contractors are solely responsible for the identification of utilities that might be affected by work under the RAWP and implementation of all required, appropriate, or necessary health and safety measures during performance of work under this RAWP. The Applicant and its contractors are solely responsible for safe execution of all invasive and other work performed under this RAWP. The Applicant and its contractors must obtain any local, State or Federal permits or approvals pertinent to such work that may be required to perform work under this RAWP. Approval of this RAWP by NYSDEC does not constitute satisfaction of these requirements.

6.2.12 Required Permits

A complete list of all local, regional and national governmental permits, certificates or other approvals or authorizations required to perform the remedial and development work will be included with the FER. This list includes a citation of the law, statute or code to be complied with, the originating agency, and a contact name and phone number in that agency.

6.2.13 Site Security

A construction fence will be installed around the Site and will be maintained and expanded as required throughout the Remedial Action. Sidewalks adjacent to the Site will be maintained with barriers to protect the public.

6.2.14 Pre-Construction Meeting with NYSDEC

The NYSDEC project manager will be invited to attend a pre-remedial action meeting at the Site with all parties involved in the remedial process prior to implementation of the RAWP.

6.2.15 Estimated Remedial Action Costs

The estimated cost to implement the Remedial Action is approximately $195,000. Additional costs of approximately $55,000 would be incurred for reporting and long-term monitoring. An itemized summary of estimated costs is included as Table 4. This table will be revised based on actual costs and included in the FER.

6.2.16 Deviations from the Remedial Action Plan

During the implementation of the RAWP, any material deviation from the RAWP will be noted and immediately brought to the attention of the RE. The RE or his/her representative will contact the NYSDEC Project Manager and determine if the deviation necessitates a formal RAWP modification and NYSDEC approval. If no formal RAWP modification is required, the deviation will be noted in the Site reports and explained in the FER.

6.2.17 Demobilization

Disturbed areas resulting from remediation activities will be restored or addressed during construction activities. This includes removal of the construction fence and installation of a new concrete sidewalk along Gold Street, as necessary. Restoration of disturbed access areas to pre-remediation conditions will include decommissioning of any temporary curb supports for equipment access, if applicable.

Sediment and erosion control measures will be removed upon completion of the remediation activities.

Equipment decontamination will take place onsite in order to prevent dispersion of any Site-derived contaminating materials.

All remediation and construction materials will be disposed of in accordance with the applicable rules and regulations. General refuse will be handled in accordance with the rules and regulations of the New York City Department of Sanitation.

6.3 Reporting

6.3.1 Daily Reporting

Daily reports will be submitted to the NYSDEC Project Manager by the end of each day following the reporting period and will include:

- An update of progress made during each day;
- Locations of work and quantities of material imported and exported from the Site;
- A summary of any and all complaints with relevant details (names, phone numbers);
- A summary of CAMP findings, including excursions; and
- An explanation of notable Site conditions.

Daily reporting will be conducted during active Site remediation periods including soil excavation, air monitoring, soil segregation, off-Site disposal of material, UST removal (if any), end-point sampling, and pouring of the concrete foundation slab.

Daily reports are not intended to be the mode of communication for notification to the NYSDEC of emergencies (accident, spill, etc.), requests for changes to the Remedial Action Plan or other sensitive or time critical information. However, such conditions must also be included in the daily reports. Emergency conditions and changes to the Remedial Action Plan will be addressed directly to NYSDEC Project Manager via personal communication.

Daily reports will include a description of daily activities keyed to a map for the Site that identifies work areas. These reports will include a summary of air sampling results, odor and dust problems and corrective actions, and any complaints received from the public. All complaints received will immediately be reported to NYSDEC.

The NYSDEC assigned project number will appear on all reports.

6.3.2 Monthly Reporting

Monthly reports will be submitted to NYSDEC Project Manager by the 10th day of the following month and will include:

- Activities relative to the Site during the previous reporting period and those anticipated for the next reporting period, including a quantitative presentation of work performed (e.g., tons of material exported and imported, etc.);
- Photographs of the work completed during the reporting period;
- Description of approved activity modifications, including changes to work scope and/or schedule;
- Sampling results received following internal data review and validation, as applicable; and
- An update of the remedial schedule including the percentage of project completion, unresolved delays encountered or anticipated that may affect the future schedule, and efforts made to mitigate such delays.

6.3.3 Other Reporting

Photographs will be taken of all remedial activities and submitted to NYSDEC in digital (JPEG) format. Photos will illustrate all remedial program elements and will be of acceptable quality. Representative photos of the Site prior to any Remedial Actions will be provided. Representative photos will be provided of each contaminant source, source area and Site structures before, during and after remediation. Photos will be included in the daily reports as needed, and a comprehensive collection of photos will be included in the Final Engineering Report.

Job-site recordkeeping for all remedial work will be appropriately documented. These records will be maintained on-Site at all times during the project and be available for inspection by NYSDEC staff.

6.3.4 Complaint Management

All complaints received will be logged by the Site Superintendent and reported in the daily report. Each complaint will be investigated as to its validity, the source determined, and a resolution adopted. Once a remedy has been put in place it will be recorded with the original complaint and reported in the daily report.

7.0 REMEDIAL ACTION IMPLEMENTATION: EXCAVATION AND OFFSITE DISPOSAL

As discussed in Section 5.3, the components of the remedial action include the excavation and offsite disposal of soil for attainment of Restricted-Residential Use SCOs to a maximum depth of 15 ft-bg across the Site. The applicable SCOs are presented in Table 2. The proposed remedial excavation extents for Alternative 1 are depicted on Figure 4.

Excavation as part of the Site redevelopment would allow for the removal of the bulk of the contaminant mass at the Site. The remedial excavation would extend to a depth of twelve ft-bg within the building footprint and to a depth of two ft-bg in the rear yard to remove soil exceeding Restricted-Residential Use SCOs and soil containing hazardous concentrations of lead. In addition, hotspot excavation would be completed in the vicinity of 2024 Limited Phase II ESI soil boring 246G_SB-1 to a depth of three ft-bg, in the vicinity of 2022 RI soil boring 236G_SB and 2023 RI soil boring 242G_SB-4 to a depth of six ft-bg, and in the vicinity of 2024 RI soil boring TSB-4 to a depth of seven ft-bg for removal of soil exceeding Restricted-Residential Use SCOs. Two hazardous lead hotspots would also be excavated in the rear yard below two ft-bg: one to approximately seven ft-bg and one to approximately twelve ft-bg. Additional localized excavation for development for installation of foundational elements and the elevator pit would be completed to a maximum depth of 14 ft-bg within the building footprint. As further described below, the major components of this part of the remedial action include characterization for disposal, implementation of the SMMP and CAMP, excavation and offsite disposal of impacted materials, closure of any encountered unknown USTs, and end-point sampling.

7.1 Estimated Material Removal Quantities

The estimated volume of material being excavated for remedial purposes that does not meet applicable Track 2 Restricted-Residential Use SCOs is approximately 3,800 CY. Approximately 100 CY of additional material will be excavated and disposed of offsite for development purposes.

7.2 Waste Characterization

All soil will be disposed in accordance with NYSDEC requirements, which requires characterization sampling. Waste characterization sampling on Lot 33 was completed on February 9, 2023; waste characterization sampling on Lot 35 was completed on March 25, 2023; and, waste characterization sampling on Lots 36 and 37 was completed on November 15, 2024 during implementation of the RI. A total of eight waste characterization samples were collected: three samples each from Lots 33 and 35 (one from the shallow fill layer, one from the deep fill layer, and one from the native fill layer) and two samples from Lots 36 and 37 (one from grade to seven ft-bg and one from seven to 14 ft-bg across the lots). Discrete and composite samples were collected and analyzed in accordance with typical disposal facility requirements in order to characterize the soil. Samples were field composited (as necessary), labeled and submitted for laboratory analysis. A field record, including PID readings, was kept to document the materials encountered and support all sampling decisions. All samples collected were analyzed for VOCs, SVOCs, pesticides, PCBs, and metals on the New York Part 375 SCOs and CP-51 lists and the New Jersey combined Soil Cleanup Criteria lists, as well as total petroleum hydrocarbons (TPH), toxicity characteristic leachate procedure (TCLP) metals, Resource Conservation and Recovery Act (RCRA) characteristics, and paint filter test (PFT). These analytes are commonly required by regulated disposal facilities.

Approximately 3,900 CY of soil will be generated during excavation (approximately 3,800 CY will be excavated and disposed of offsite for remedial purposes, and approximately 100 CY will be excavated and disposed offsite for development purposes). Soil characterization samples were collected at a rate of approximately one sample per 1,000 CY in order to characterize the volume of the soil. The sampling frequency of the historic fill layer reflects typical disposal facility requirements for soils generated in New York City. Please note that there is no standard number of waste characterization samples or analytes required for all facilities and, therefore, additional samples or analytes may be required at a later date.

7.3 Soil/Materials Management Plan (SMMP)

Soil and materials management on-Site will be conducted in accordance with the SMMP and as described below. The main goal of the SMMP is to handle all potentially contaminated soil and manage activities associated with soil in a manner that prevents contamination from reaching the community, workers, future occupants and workers, and the environment. Contaminated soil must be managed in a manner that ensures removal, transport and disposal such that it fulfills applicable regulatory requirements. The means and methods to meet this goal are included in the SMMP, included as Appendix C.

7.4 Community Air Monitoring Plan (CAMP)

The main goal of the CAMP is to keep objectionable odors, VOCs, and/or particulates from reaching the surrounding community. The NYSDOH Generic CAMP, which includes monitoring for VOCs and particulates, will be implemented.

Should objectionable odors be produced during excavation, the area to be disturbed at any one time will be limited and, if necessary, foam cover will be utilized (Rusmar Incorporated AC-645 Long Duration Foam or approved equivalent), following the manufacturer's recommended application rate.

The CAMP is included as Appendix A.

7.5 Materials Transport and Disposal Off-Site

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

Gold Street is a two-way street, with traffic flow to the north and south. For westbound destinations, trucks leaving the Site will turn left onto Gold Street, then turn left onto Sands Street, then turn left onto Jay Street and make a left onto Sands Street, then continue straight onto the ramp to the Brooklyn-Queens Expressway (I-278 West), which is a truck through route.

For eastbound destinations, trucks leaving the Site will turn right onto Gold Street, then make the first left onto Tillary Street and continue straight and take the ramp on the left to the Brooklyn-Queens Expressway (I-278 East), which is a truck through route.

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) limiting total distance to major highways; (d) promoting safety in access to highways; and (e) overall safety in transport. All trucks loaded with Site materials will exit the vicinity of the Site using only the most current New York City Department of Transportation (NYCDOT)-approved truck routes (currently the 2022 New York City Truck Route Map). A truck route map is included as Figure 8.

Trucks will be prohibited from stopping and idling in the neighborhood outside the project 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.

Materials transported by trucks exiting the Site will be secured with tightly fitting covers. If loads contain wet material capable of producing free liquid, truck liners will be used.

7.6 Dewatering and Fluids Management

Groundwater at the Site is approximately 24 to 26 ft-bg and is not anticipated to be encountered during the course of the Remedial Action. As such, dewatering is not anticipated during the course of this Remedial Action.

7.7 Contingency Plan

If underground tanks or other previously unidentified contaminant sources are found during on-Site remedial excavation or development related construction, sampling will be performed on product, sediment and surrounding soils, etc. Chemical analytical work will be for full scan parameters (TAL metals; TCL volatiles and semi-volatiles, TCL pesticides, PCBs, and PFAS). Newly encountered unknown USTs will be registered and closed in conformance with all applicable Federal, State and local regulations, including those defined in DER-10 and 6 NYCRR Parts 612 and 613.

Any newly encountered USTs will be registered with NYSDEC. USTs will be removed by a contractor licensed by the New York City Fire Department (FDNY) in accordance with the procedures set forth in the American Petroleum Institute (API) Recommended Practice 1604, entitled “Removal and Disposal of Used Underground Storage Tanks.”

Identification of unknown or unexpected contaminated media identified by screening during invasive Site work will be promptly communicated by phone to NYSDEC’s Project Manager. These findings will also be included in daily and periodic electronic media reports.

7.8 Monitoring Well Decommissioning

Existing monitoring wells will be decommissioned prior to implementing remedial excavation in accordance with NYSDEC Groundwater Monitoring Well Decommissioning Policy (CP-43), dated November 3, 2009.

7.9 Remedial Performance Evaluation

Post-Excavation End-Point Sampling

End-point samples will be collected from the base of the excavation every 900 square feet (SF) and from the sidewalls of the excavation every 30 linear feet (LF). At remedial excavation depth, end-point samples will be collected from the bottom of the remedial excavation and sidewalls of the remedial excavation (where possible, based on support of excavation methods) and will be analyzed for Part 375 VOCs, SVOCs, TAL metals, pesticides, PCBs, and PFAS. It is anticipated that a total of 12 base of excavation end-point samples and 14 sidewall end-point samples will be collected following implementation of the Remedial Action. Sidewall end-point samples will only be collected if the excavation sidewalls are accessible and not obstructed by support of excavation elements. Figure 5 presents a generalized post-excavation sampling location map for Alternative 1.

Chemical labs used for all end-point sample results will be NYSDOH ELAP certified.

All post-excavation sample results will be compared with the Restricted-Residential Use SCOs. Any soils not meeting the applicable SCOs within the excavation will be removed, to a maximum depth of 15 ft-bg, and the area backfilled with clean fill meeting the criteria outlined in this RAWP. The Restricted-Residential Use SCOs are listed in Table 2.

7.9.1 Quality Assurance / Quality Control (QA/QC)

A Quality Assurance Project Plan (QAPP) detailing the frequency of sample collection, analytical methods and the quality standards that must be achieved by the analytical laboratory is included as Appendix D.

The QAPP includes provisions for trip blanks, field blanks, duplicates, matrix spike and matrix spike duplicate (MS/MSD) samples. The QAPP also describes field sampling procedures.

7.9.2 Data Usability Summary Report (DUSR)

A qualified data validator will prepare a Data Usability Summary Report (DUSR). The DUSR will be prepared according to the guidelines contained in Appendix 2B of DER-10.

7.9.3 Reporting of End-Point Data in FER

The FER will provide a tabular and map summary of all end-point sample results and any exceedances of SCOs.

7.10 Import of Materials

Import of materials for backfill is anticipated for the gas permeable layer of the active SSDS and to backfill hotspot excavations to final development grade. Import materials will be in compliance with: (1) 6 NYCRR Part 375-6.7(d,) and (2) all Federal, State and local rules and regulations for handling and transport of material, and is further discussed in Section 1.9 of the SMMP in Appendix C.

A "Request to Import/Reuse Fill Material" form will be filed with the NYSDEC project manager for review and approval prior to reuse or import to the site. A copy of the form is presented in Appendix G.

8.0 REMEDIAL ACTION IMPLEMENTATION: ACTIVE SUB-SLAB DEPRESSURIZATION SYSTEM

As discussed in Section 5.3, the components of the remedial action to address soil vapor impacts include the installation of an active SSDS within the new onsite building. The active SSDS will be a long-term engineering control for the Site. In addition, in order to comply with green remediation principles, a vapor barrier system will be installed beneath the foundation slab of the new onsite building and on all foundation sidewalls as an element of development.

Final design for the SSDS will be submitted for approval to NYSDEC under separate cover via a SSDS Design Document.

8.1 Sub-Slab Depressurization System

An active SSDS will be installed in conjunction with the construction of the new building to minimize the potential for vapor intrusion and will generally consist of perforated or slotted PVC pipes set horizontally within subgrade trenches consisting of six inches of stone aggregate, topped by geotextile fabric and a concrete foundation slab. Multiple pressure monitoring points will be installed throughout the slab within the cellar to confirm the system is achieving its design goals.

The layout of the proposed system and pressure monitoring points will be provided to NYSDEC for approval under separate cover via a SSDS Design Document that will be prepared prior to installation.

A six-inch diameter steel riser pipe will connect to the subgrade system and extend through the building to the roof where it will be connected to a blower fan for exhaust. The final location of all vertical riser piping, header piping, and roof mounts will be determined by a Professional Engineer in consultation with the building owner.

A blower capable of creating the required flow will be mounted on the roof. In order to size the blower, a blower test (described below) will be performed after the sub-grade components are installed under the building slab.

To avoid entry of extracted subsurface vapors into the building, the vent pipe's exhaust will conform to the NYSDOH Soil Vapor Intrusion Guidance, specifically *Section 4.2.2, System-specific recommendations*, which reads:

To avoid entry of extracted subsurface vapors into the building, the vent pipe's exhaust should be:

- i. Above the eave of the roof (preferably above the highest eave of the building at least 12 inches above the surface of the roof),
- ii. At least 10 feet above ground level,
- iii. At least 10 feet away from any opening that is less than 2 feet below the exhaust point, and
- iv. 10 feet from any adjoining or adjacent building, or HVAC intakes or supply registers.

The exhaust location, labeling, alarms and system components have been designed in general accordance with the NYSDOH Soil Vapor Guidance.

Following the installation of the SSDS, a blower test will be completed in order to size the blower. A regenerative blower will be mobilized to the Site and a step-test will be completed to determine the flows from each suction pit to depressurize below the slab at least -0.02 in-wc. The above-grade head losses will be modeled using the Darcy-Weisbach equation.

Initial Startup

After the System has been installed, the following will be completed in order to ensure that the system meets the remedial goal of a -0.02 in-wc or greater pressure differential.

- Visual inspection of the building slab for any cracks or holes. If any are identified, they will be sealed.
- Measurement of the sub-slab pressure at temporary and permanent pressure-monitoring points to ensure that the remedial goal of -0.02 in-wc has been achieved. If the startup is not conducted during the heating season, the pressure differential will also be measured during the heating season to ensure the remedial goal of -0.02 in-wc has been achieved.
- If appliances that rely on natural draft for exhaust of carbon monoxide and other combustion gases are identified, the potential for back draft will be tested. The potential for back draft will be determined using a carbon monoxide detector. If any back draft is identified, it will be corrected.

An alarm system will be installed that will notify the building management if a drop in pressure indicates that the system is not operating as designed. In general, a pressure switch will be placed on the main riser with a field-set switch point. The alarm will be a horn-strobe mounted in the building. If a full-time attendant is not assigned to oversee the performance of the SSDS, a telemetry system will be installed that is capable of notifying building management of any operational issues via electronic communication.

A Site Management Plan (SMP) will be prepared that includes an Operations, Maintenance and Monitoring (OM&M) Plan and submitted to NYSDEC upon completion of the Remedial Action. The OM&M Plan will be used to determine the efficacy of the SSDS after system startup.

8.2 Remedial Performance Evaluation

Post-Remedial Indoor Air Sampling

Efficacy of the active SSDS will be confirmed via pressure monitoring points achieving the required -0.02 in-wc depressurization throughout the sub-slab. Baseline (prior to SSDS startup) and post-remedial (one month following SSDS start-up) indoor air sampling will be conducted for additional evaluation of the onsite SSDS and vapor barrier system. It is anticipated that four indoor air samples will be collected from the Site basement during each sampling event. In addition, prior to any petition to shut down the SSDS, co-located sub-slab soil vapor and indoor air sampling would be conducted over two consecutive heating seasons after system start-up to evaluate if the remedial goals have been achieved and if the system can be decommissioned. The co-located sub-slab soil vapor and indoor air sampling locations and sampling methodology will be included in a SMP.

Chemical labs used for all indoor air sample results will be NYSDOH ELAP certified.

All indoor air samples will be analyzed for EPA Method TO-15 VOCs and sample results will be compared with the NYSDOH Air Guideline Values (AGVs) as listed in the NYSDOH Soil Vapor Guidance.

8.2.1 Quality Assurance / Quality Control (QA/QC)

A QAPP detailing the frequency of sample collection, analytical methods and the quality standards that must be achieved by the analytical laboratory is included as Appendix D.

The QAPP includes provisions for trip blanks, field blanks, duplicates, and MS/MSD samples. The QAPP also describes field sampling procedures.

8.2.2 Data Usability Summary Report (DUSR)

A qualified data validator will prepare a Data Usability Report (DUSR). The DUSR will be prepared according to the guidelines contained in Appendix 2B of DER-10.

8.2.3 Reporting of Post-Remedial Indoor Air Data in FER

The FER will provide a tabular and map summary of all indoor air sample results and any exceedances of AGVs.

9.0 REMAINING CONTAMINATION TO REMAIN ON-SITE

The successful implementation of the Remedial Action will result in the following:

- All soil left onsite to a depth of 15 ft-bg will meet the Restricted-Residential Use SCOs throughout the Site.
- Contamination may remain in groundwater and soil vapor but the bulk of the contaminant mass will be removed, resulting in lower concentrations of contaminants in groundwater and soil vapor over time.
- Soil vapor will be mitigated within the new building by an active SSDS, with design goals of preventing soil vapor intrusion within the building.

Since residual contaminated soil, groundwater, and soil vapor may remain after the remedy is complete, long-term Engineering Controls and Institutional Controls (ECs and ICs) are required to protect human health and the environment. These ECs and ICs are described below. Long-term management of ECs/ICs and of residual contamination will be executed under a Site-Specific Site Management Plan (SMP) that will be developed and included in the FER.

Long-term ECs and ICs will be implemented to protect public health and the environment by appropriately managing residual contamination. The Controlled Property (the Site) will have one primary EC system:

- Active Sub-Slab Depressurization System

The SSDS would remain as a long-term EC until confirmatory sub-slab soil vapor and indoor air sampling has shown the system is no longer necessary and NYSDEC and NYSDOH provide approval to shut down the system in writing.

Long-term ICs will be implemented to assure the operation and integrity of the EC and to address potential public health exposures during the Site Management period:

- Site Management Plan (SMP)
- Environmental Easement

The SMP will identify ECs and establish operations, monitoring, maintenance, and reporting requirements to ensure that all long-term ECs and ICs for the Site remain effective. The Environmental Easement will be recorded against title to the Site to memorialize the remedial action and to ensure current and future owners of the Site continue to maintain all long-term ECs and ICs required by the SMP. The Environmental Easement may only be amended or extinguished by NYSDEC pursuant to Article 71 Title 36 of the Environmental Conservation Law.

10.0 ENGINEERING CONTROLS

10.1 Engineering Control Systems

As discussed above, one long-term engineering control (EC) will be utilized at the Site: an active SSDS. The EC will be identified in an Environmental Easement recorded against title to the property by the owner and will be maintained pursuant to a NYSDEC-approved SMP. The conceptual approach, general system design, operation, maintenance and monitoring (OM&M) requirements and criteria for termination of the SSDS is described below.

10.1.1 Description of Engineering Controls

10.1.1.1 *Sub-Slab Depressurization System*

An active SSDS will be installed within the new building to minimize the potential for vapor intrusion and offsite vapor migration. The proposed system design and layout will be provided to NYSDEC for approval under separate cover via a SSDS Design Document. The principal components of the SSDS are a number of perforated or slotted PVC pipes set horizontally within subgrade trenches connected to a steel riser pipe that will extend through the building to the roof where it will be connected to a blower fan for exhaust. Multiple vapor pressure monitoring points will be installed throughout the cellar slab to confirm the system is achieving its design goals.

The goal of an active system is to create a pressure differential of at least -0.02 in-wc between the indoor and sub-slab environments. An alarm system will be installed that will notify the building management if a drop in pressure occurs, indicating that the system is not operating as designed. If a full-time attendant is not assigned to oversee the performance of the SSDS, a telemetry system will be installed that is capable of notifying building management of any operational issues via electronic communication. The system will be designed in general accordance with NYSDOH’s Soil Vapor Guidance.

A written record of the annual monitoring for the system will be kept with the SMP. If any of the above items suggest that the SSDS may have been impacted beyond the need for routine maintenance, the building management will contact an environmental professional. If the operation of the SSDS has been impacted, NYSDEC will be contacted. If non-routine maintenance or repairs are required based on the annual inspection or an alarm condition, the system will be restarted as described in the “Initial Startup” section (RAWP Section 8.1).

10.1.2 Criteria for Termination of Remedial Systems

10.1.2.1 *Sub-Slab Depressurization System*

The active SSD system will not be discontinued without written approval by NYSDEC and NYSDOH. A proposal to discontinue the active SSD system may be submitted by the property owner based on confirmatory data that justifies such request. Systems will remain in place and operational until permission to discontinue use is granted in writing by NYSDEC and NYSDOH.

11.0 INSTITUTIONAL CONTROLS

Long-term Institutional Controls (ICs) will be required to manage residual contamination on-Site and off-Site and to ensure that the long-term EC remains protective of public health and the environment. The long-term ICs consist of two elements designed to ensure continual and proper management of residual contamination in perpetuity: an Environmental Easement and a Site Management Plan.

An Environmental Easement, as defined in Article 71 Title 36 of the Environmental Conservation Law, will be recorded with the Queens County Office of the New York City Register for the Site to provide an enforceable means of ensuring the continual and proper management of residual contamination and protection of public health and the environment in perpetuity or until released in writing by NYSDEC. It requires that the grantor of the Environmental Easement and the grantor's successors and assigns adhere to all long-term Engineering and Institutional Controls (ECs/ICs) placed on this Site by this NYSDEC-approved remedy. ICs provide restrictions on Site usage and mandate operation, maintenance, monitoring and reporting measures for all ECs and ICs. The Site Management Plan (SMP) describes appropriate methods and procedures to ensure compliance with all ECs and ICs that are required by the Environmental Easement. Once the SMP has been approved by the NYSDEC, compliance with the SMP is required by the grantor of the Environmental Easement and grantor's successors and assigns.

11.1 Environmental Easement

The Environmental Easement renders the Site and any property requiring mitigation as Controlled Properties. The Environmental Easement must be recorded with the Kings County Office of the New York City Register before the Certificate of Completion can be issued by NYSDEC. A series of long-term Institutional Controls are required under this remedy to implement, maintain and monitor the Engineering Control system, prevent future exposure to residual contamination by controlling disturbances of the subsurface soil and restricting the use of the Site to residential, commercial, or industrial uses only. These Institutional Controls are requirements or restrictions placed on the Site that are listed in, and required by, the Environmental Easement. Institutional Controls can generally be subdivided between controls that support Engineering Controls and those that place general restrictions on Site usage or other requirements. Institutional Controls in both of these groups are closely integrated with the Site Management Plan, which provides all of the methods and procedures to be followed to comply with this remedy.

The long-term Institutional Controls that support Engineering Controls are:

- Compliance with the Environmental Easement by the Grantee and the Grantee's successors and adherence of all elements of the SMP is required;
- All Engineering Controls must be operated and maintained as specified in the SMP;
- All Engineering Controls on the Controlled Property must be inspected and certified at a frequency and in a manner defined in the SMP;
- Groundwater and other environmental or public health monitoring must be performed as defined in the SMP;
- Data and information pertinent to Site Management for the Controlled Property must be reported at the frequency and in a manner defined in the SMP;
- Onsite environmental monitoring devices, including but not limited to groundwater monitoring wells and soil vapor extraction monitoring points, must be protected and replaced as necessary to ensure proper functioning in the manner specified in the SMP; and
- Engineering Controls may not be discontinued without an amendment or extinguishment of the Environmental Easement.

Adherence to these long-term Institutional Controls for the Site is mandated by the Environmental Easement and will be implemented under the Site Management Plan (discussed in the next section). The Controlled Property (Site) will also have a series of long-term Institutional Controls in the form of Site restrictions and requirements. The Site restrictions that apply to the Controlled Property are:

- Use of groundwater underlying the Controlled Property is prohibited without treatment rendering it safe for intended purpose;
- All future activities on the Controlled Property that will disturb residual contaminated material are prohibited unless they are conducted in accordance with the soil management provisions in the Site Management Plan;
- The Controlled Property may be used for restricted-residential, commercial, or industrial use only, provided the long-term Engineering and Institutional Controls included in the Site Management Plan are employed;
- The Controlled Property may not be used for a higher level of use, such as unrestricted use or residential use (single family), without an amendment or extinguishment of the Environmental Easement by NYSDEC; and
- Grantor agrees to submit to NYSDEC a written statement that certifies, under penalty of perjury, that: (1) controls employed at the Controlled Property are unchanged from the previous certification or that any changes to the controls were approved by the NYSDEC; and (2) nothing has occurred that impairs the ability of the controls to protect public health and environment or that constitute a violation or failure to comply with the SMP. NYSDEC retains the right to access such Controlled Property at any time in order to evaluate the continued maintenance of any and all controls. This certification shall be submitted annually, or following an alternate period of time that NYSDEC may allow. This annual statement must be certified by an expert that the NYSDEC finds acceptable.

The Environmental Easement will incorporate the long-term ICs required to implement, maintain and monitor the ECs, prevent future exposure to residual contamination by controlling disturbances of the subsurface soil and restrict the use of the Site to restricted-residential, commercial, or industrial uses only, unless discontinued or modified with the approval of NYSDEC.

The Environmental Easement for the controlled property will include the following requirements:

- The remedial party or Site owner must complete and submit to NYSDEC a periodic certification of institutional and engineering controls in accordance with Part 375-1.8 (h)(3);
- The use and development of the controlled property is allowed for restricted-residential, commercial, and industrial uses as defined by Part 375-1.8(g), although land use is subject to local zoning laws;
- The use of groundwater as a source of potable or process water, without necessary water quality treatment as determined by the NYSDOH or the New York City Department of Health and Mental Hygiene (NYCDOHMH) is restricted; and
- Compliance with the NYSDEC-approved SMP is required.

11.2 Site Management Plan

Site Management is the last phase of remediation and begins with the approval of the Final Engineering Report and issuance of the Certificate of Completion (COC) for the Remedial Action. The SMP is submitted as part of the FER but will be written as a complete and independent document. Site management requirements continue in perpetuity or until released in writing by NYSDEC. The property owner is responsible to ensure that all Site and offsite management responsibilities defined in the Environmental Easement and SMP are performed.

The SMP is intended to provide a detailed description of the procedures required to manage residual contamination left in place at the Site and offsite properties requiring mitigation following completion of the Remedial Action in accordance with the BCA with the NYSDEC. This includes: (1) development, implementation, and management of all long-term Engineering and Institutional Controls; (2) development of a plan to operate and maintain any treatment, collection, containment, or recovery systems (including, where appropriate, preparation of an Operation and Maintenance Manual); and (3) submittal of Site Management Reports, performance of inspections and certification of results, and demonstration of proper communication of Site information to NYSDEC.

To address these needs, this SMP will include four plans: (1) an Engineering and Institutional Control Plan for implementation and management of long-term EC/ICs; (2) a Monitoring Plan for implementation of site monitoring; (3) an Operation, Maintenance and Monitoring (OM&M) Plan for implementation of remedial containment systems; and (4) a Site Management Reporting Plan for submittal of data, information, recommendations, and certifications to NYSDEC.

Site management activities, reporting, and EC/IC certification will be scheduled on a certification period basis; the certification period will be annually. The Periodic Review Report (PRR) submitted under the SMP will be based on a calendar year. The first PRR will be submitted to the NYSDEC within 16 months after the date of COC issuance. Any lapses in the engineering or institutional controls noted in the PRR will be required to be corrected expeditiously and the NYSDEC notified of the correction. The SMP will include the following:

1. Introduction with purpose, summary of remediation and site conditions;
2. Institutional and Engineering Control Plan;
3. OM&M Plan;
4. Site Monitoring Plan;
5. Site maintenance requirements;
6. Citizen Participation Plan;
7. Personnel organization and responsibilities;
8. Health and Safety Plan;
9. Records and forms;
10. Emergency Contingency Plan; and
11. Copies of Environmental Easement and applicable Site plans, including electronic versions.

The Institutional and Engineering Control Plan will include, but is not limited to:

- descriptions of the provisions of the environmental easement including any land use and groundwater use restrictions;
- a provision for evaluation of the potential for soil vapor intrusion for any buildings developed on the site, including a provision for implementing actions recommended to address exposures related to soil vapor intrusion;
- provisions for the management and inspection of the identified engineering controls;
- maintaining site access controls and NYSDEC notification; and
- the steps necessary for the periodic reviews and certification of the long-term institutional and/or engineering controls.

The OM&M Plan will include, but is not limited to:

- compliance monitoring of treatment systems to ensure proper OM&M as well as providing the data for any necessary permit or permit-equivalent reporting;
- maintaining site access controls and NYSDEC notification; and
- providing NYSDEC access to the site and OM&M records.

The Site Monitoring Plan will include, but is not limited to:

- a schedule of monitoring and frequency of submittals to NYSDEC; and
- monitoring for soil vapor intrusion for any buildings developed on the site, as may be required by the Institutional and Engineering Control Plan discussed above.

The Site Management Reporting Plan will include, but is not limited to:

- Details regarding post-COC reporting requirements, including a schedule.
- The contents of the annual report, including:
    - an evaluation of the long-term EC/ICs, EC/IC certifications, results of period Site inspections and deliverables to be generated;
    - frequency and type of the EC/IC and Site inspections;
    - inspection forms, sampling data and maintenance reports;
    - an evaluation of records and reporting; and
    - corrective measure plans.

12.0 FINAL ENGINEERING REPORT

A Final Engineering Report (FER) will be submitted to the NYSDEC Project Manager within 90 days of completing the remedial action. The FER provides documentation that the remedial work required under this RAWP has been completed and has been performed in compliance with this Plan. The FER will provide a comprehensive account of the locations and characteristics of all material removed from the Site including the surveyed map(s) of all sources. The Final Engineering Report will include as-built drawings for all constructed elements, calculation and manufacturer documentation for treatment systems, certifications, manifests, bills of lading as well as the complete Site Management Plan (formerly the Operation and Maintenance Plan). The FER will provide a description of the changes in the Remedial Action from the elements provided in the RAWP. The FER will provide a tabular summary of all performance evaluation sampling results and all material characterization results and other sampling and chemical analysis performed as part of the Remedial Action. The FER will provide test results demonstrating that all mitigation and remedial systems are functioning properly. The FER will be prepared in conformance with DER-10.

The Final Engineering Report will include written and photographic documentation of all remedial work performed under this remedy. Photographs will be taken of all remedial activities and submitted to NYSDEC in digital format after completion of active Site remediation. Photos will illustrate all remedial program elements and will be of acceptable quality. Representative photos of the Site prior to any Remedial Actions will be provided. Representative photos will be provided of each contaminant source, source area and Site structures before, during and after remediation. Photos will be submitted to NYSDEC on CD or other acceptable electronic media and will be sent to NYSDEC's Project Manager (2 copies) and to NYSDOH's Project Manager (1 copy). Each CD will have a label and a general file inventory structure that separates photos into directories and sub-directories according to logical Remedial Measure components. A photo log keyed to photo file ID numbers will be prepared to provide explanation for all representative photos.

The FER will include an itemized tabular description of actual costs incurred during all aspects of the Remedial Action.

The FER will provide a thorough summary of all remaining contamination left on the Site after the remedy is complete if Track 1 Unrestricted Use SCOs are not met. Remaining contamination includes all contamination that exceeds the Track 1 Unrestricted Use SCOs in 6 NYCRR Part 375-6. A table that shows exceedances from Track 1 Unrestricted Use SCOs for all soil/fill remaining at the Site after the Remedial Action and a map that shows the location and summarizes exceedances from Track 1 Unrestricted Use SCOs for all soil/fill remaining at the Site after the Remedial Action will be included in the FER. Remaining contamination in groundwater and soil vapor, if applicable, will also be discussed in the FER.

The Final Engineering Report will include an accounting of the destination of all material removed from the Site, including excavated contaminated soil, historic fill, solid waste, hazardous waste, non-regulated material, and fluids. Documentation associated with disposal of all material must also include records and approvals for receipt of the material. It will provide an accounting of the origin and chemical quality of all material imported onto the Site.

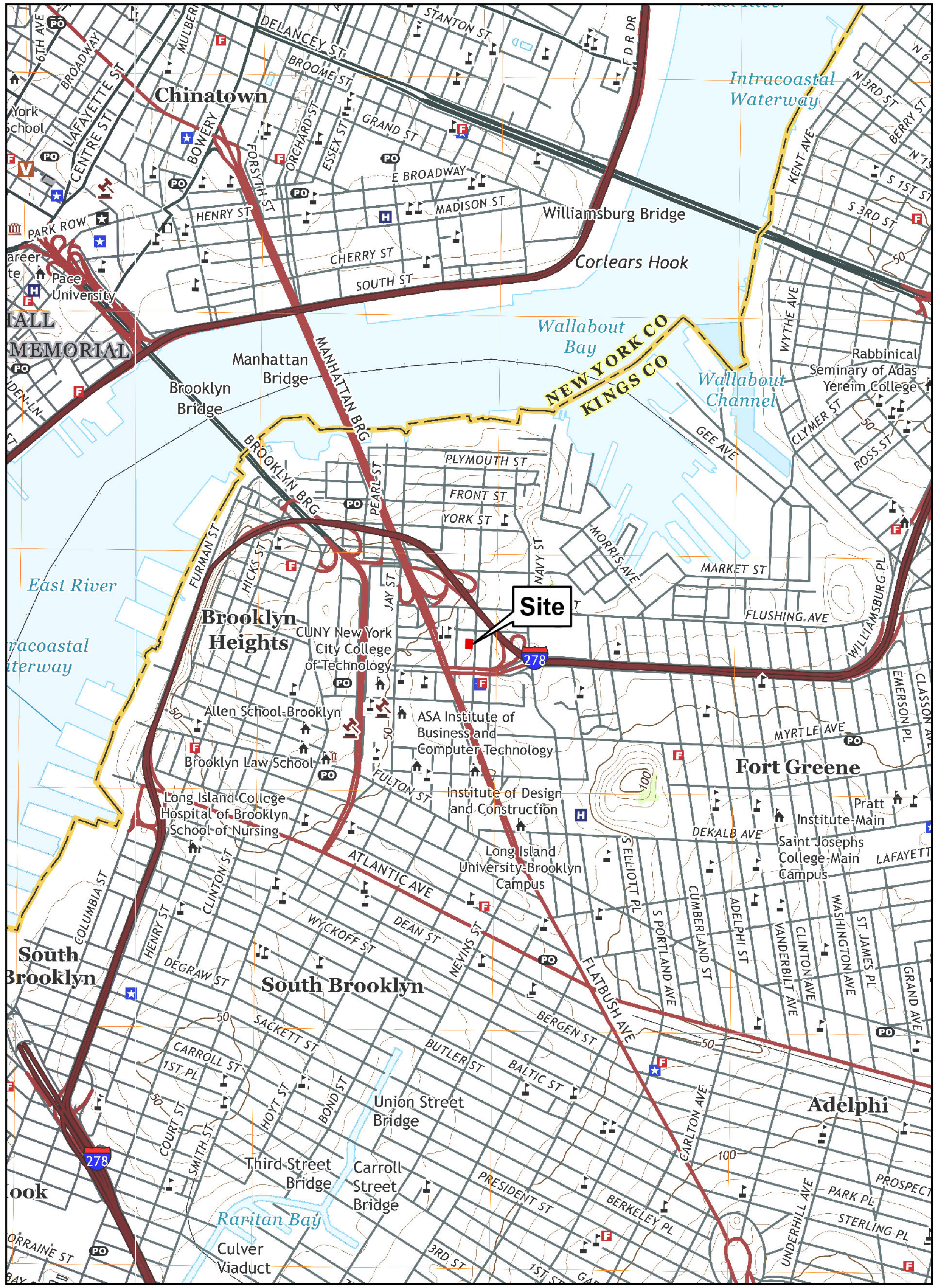
This FER will include the following:

1. Certification by the RE that the data generated is useable and meets the remedial requirements;
2. Certification by the RE that any financial assurance mechanisms required by the NYSDEC have been executed;
3. Certification by the RE that the remedial work conformed to the RAWP;

4. Certification by the RE that dust, odor, and vapor control measures were implemented during invasive work and conformed with the RAWP;
5. Certification by the RE that all the remedial waste was transported and disposed in accordance with the RAWP;
6. Certification by the RE that the source approval and sampling of imported acceptable fill was completed in a manner consistent with the methodology of the RAWP;
7. Summary of the remedy and all remedial actions completed;
8. Description of any problems encountered and their resolutions;
9. Description of the deviations from the approved RAWP;
10. Listing of waste streams, quantity of materials disposed, and where they were disposed;
11. Analytical QA/QC completed for the environmental media sampling during the remedial activities, including DUSR or other data validation;
12. List of the remediation standards applied to the remedial actions;
13. List of all applicable local, regional, and national governmental permits, certificates, or other approvals required for the remedial and development work;
14. Tables and figures containing all pre- and post-remedial data, including volumes of soil removed (as applicable);
15. Description of source and quality of fill (as applicable);
16. “As-built” drawings including remediation areas;
17. Air quality and dust monitoring data, including any supporting documentation on the decisions made based on the data;
18. Copies of all the submitted periodic reports; and
19. Copies of all manifests of offsite transport of waste material.

Before approval of a FER and issuance of a Certificate of Completion, all documents and reports will be submitted to the NYSDEC both in hard copy and in digital format on CD. These digital documents shall be in PDF form and, where appropriate, supplemented by photos and Microsoft Excel files. Laboratory analytical data will be submitted in an electronic data deliverable (EDD) format that complies with the NYSDEC’s electronic data warehouse standards.

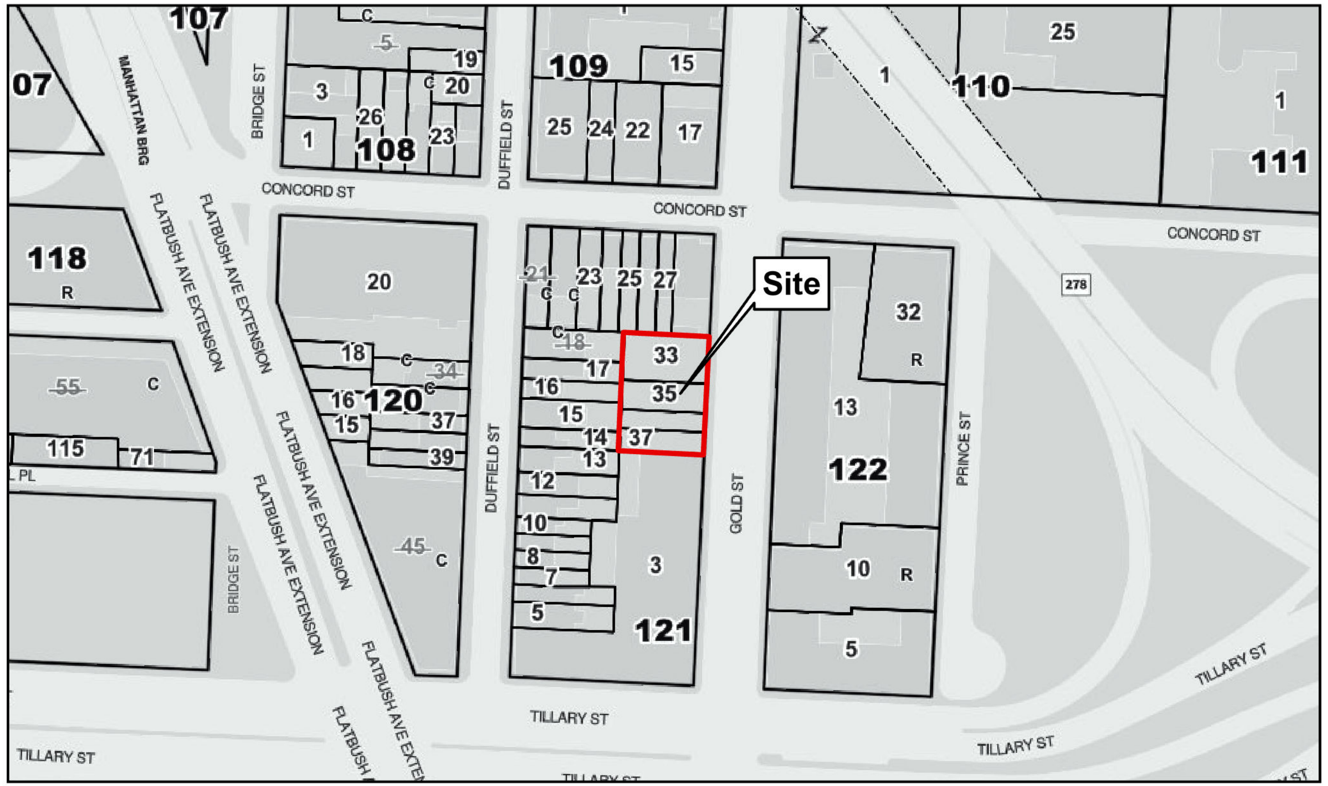
Figures



Basemap: USGS Topographic Map, 7.5 Minute Quadrangle: Brooklyn, NY; Jersey City, NJ

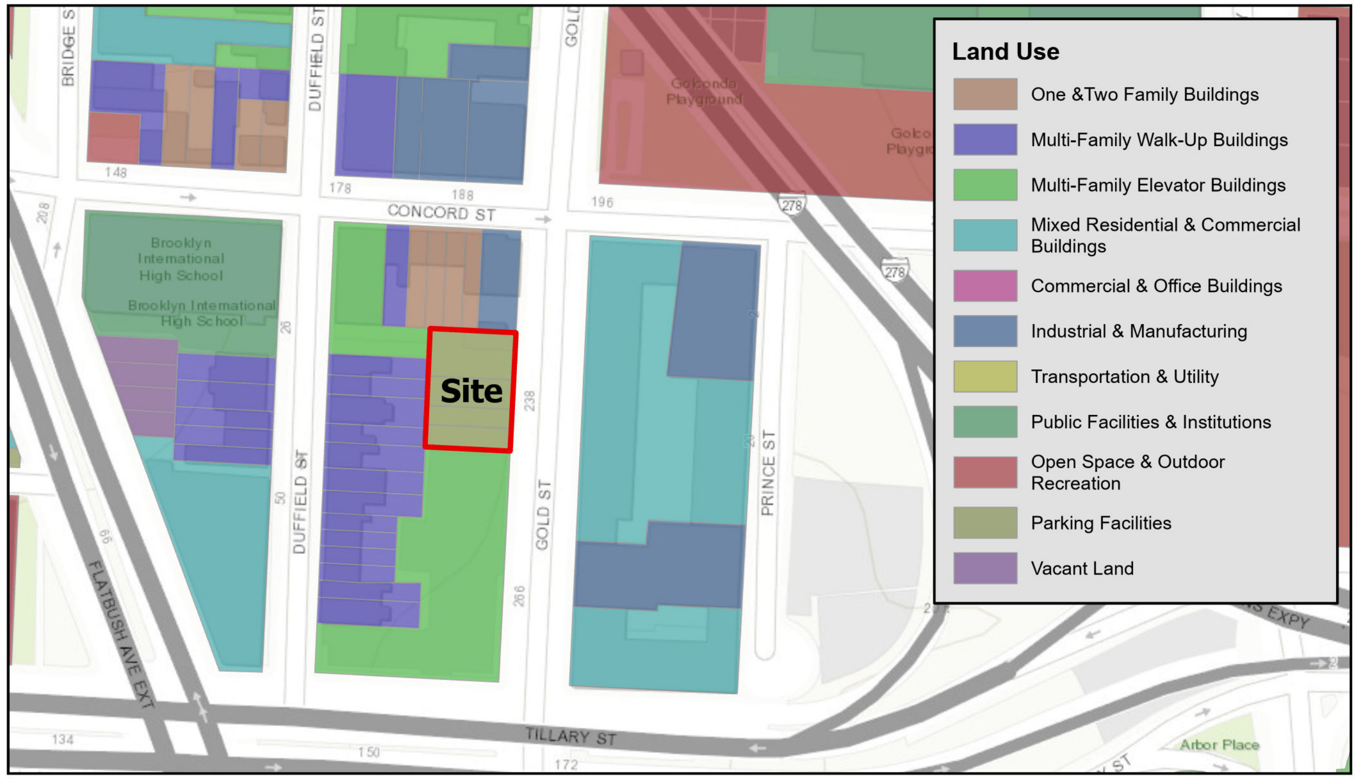
Site Location

0 2,000 4,000 Feet



propertyinformationportal.nyc.gov

NYC Department of Finance Digital Tax Map



NYC OpenData, State of New Jersey, Esri, HERE, Garmin, INCREMENT P, Intermap, USGS, METI/NASA, EPA, USDA

Department of City Planning MapPluto 2024 v1

0 200 400 Feet

236-246 Gold Street
Brooklyn, New York
Block 121, Lots 33, 35, 36 & 37

TENEN ENVIRONMENTAL

Tenen Environmental, LLC
121 West 27th Street, Suite 702
New York, NY 10001
O: (646) 606-2332; F: (646) 606-2379

Drawn By LM
Checked By AP
Date December 2024
Scale As Noted

Drawing Title Site Location Map
Drawing No. Figure 1

Reference:
NYC Department of Finance Property Information Portal

236-246 Gold Street
Brooklyn, New York
Block 121, Lots 33, 35, 36 & 37

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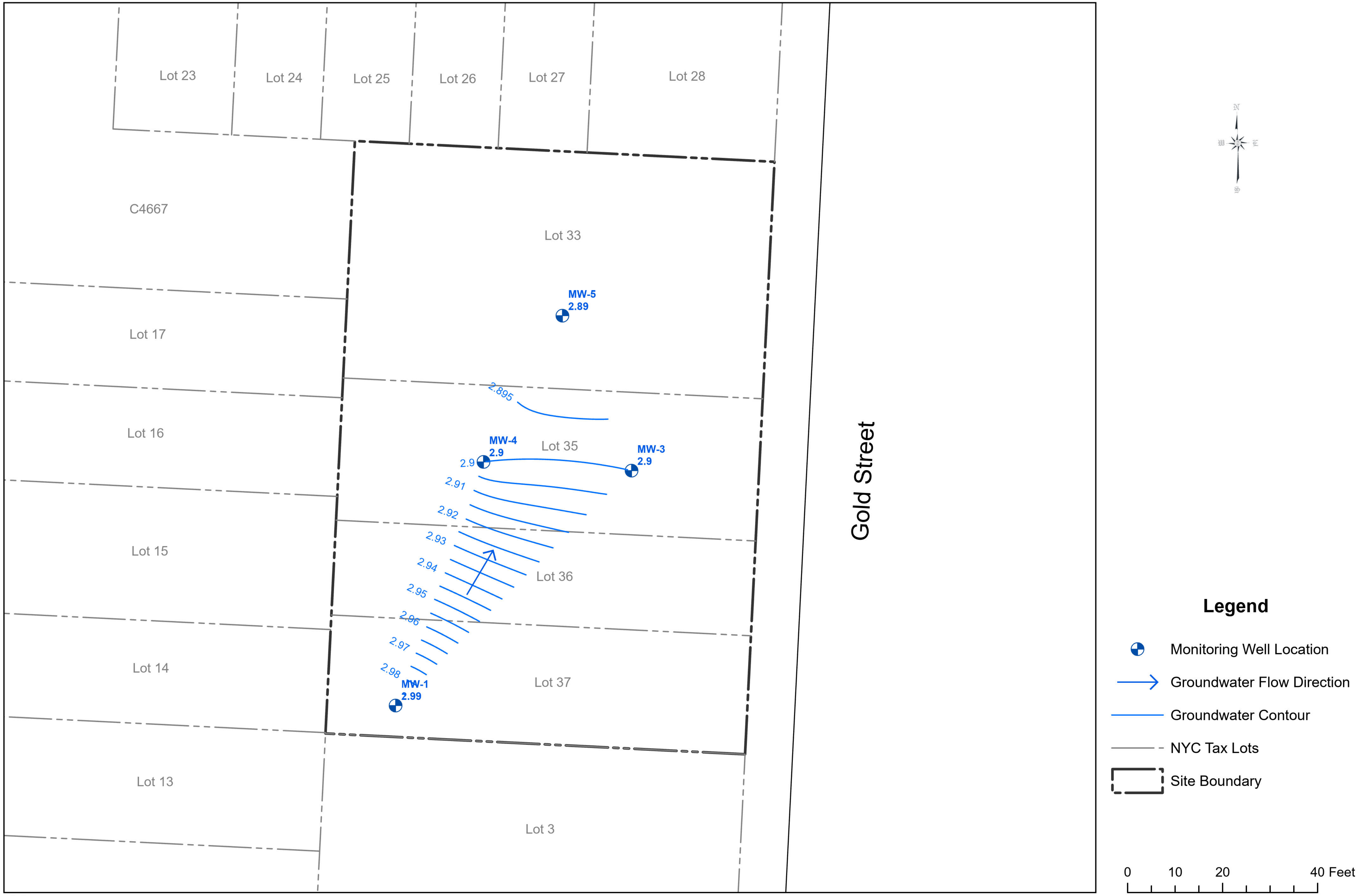
Drawn By	LM
Checked By	AP
Date	December 2024
Scale	As Noted
Drawing Title	Site Boundary Map
Drawing No.	Figure 2



Reference:
NYC Department of Finance Property Information Portal

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Drawn By LM

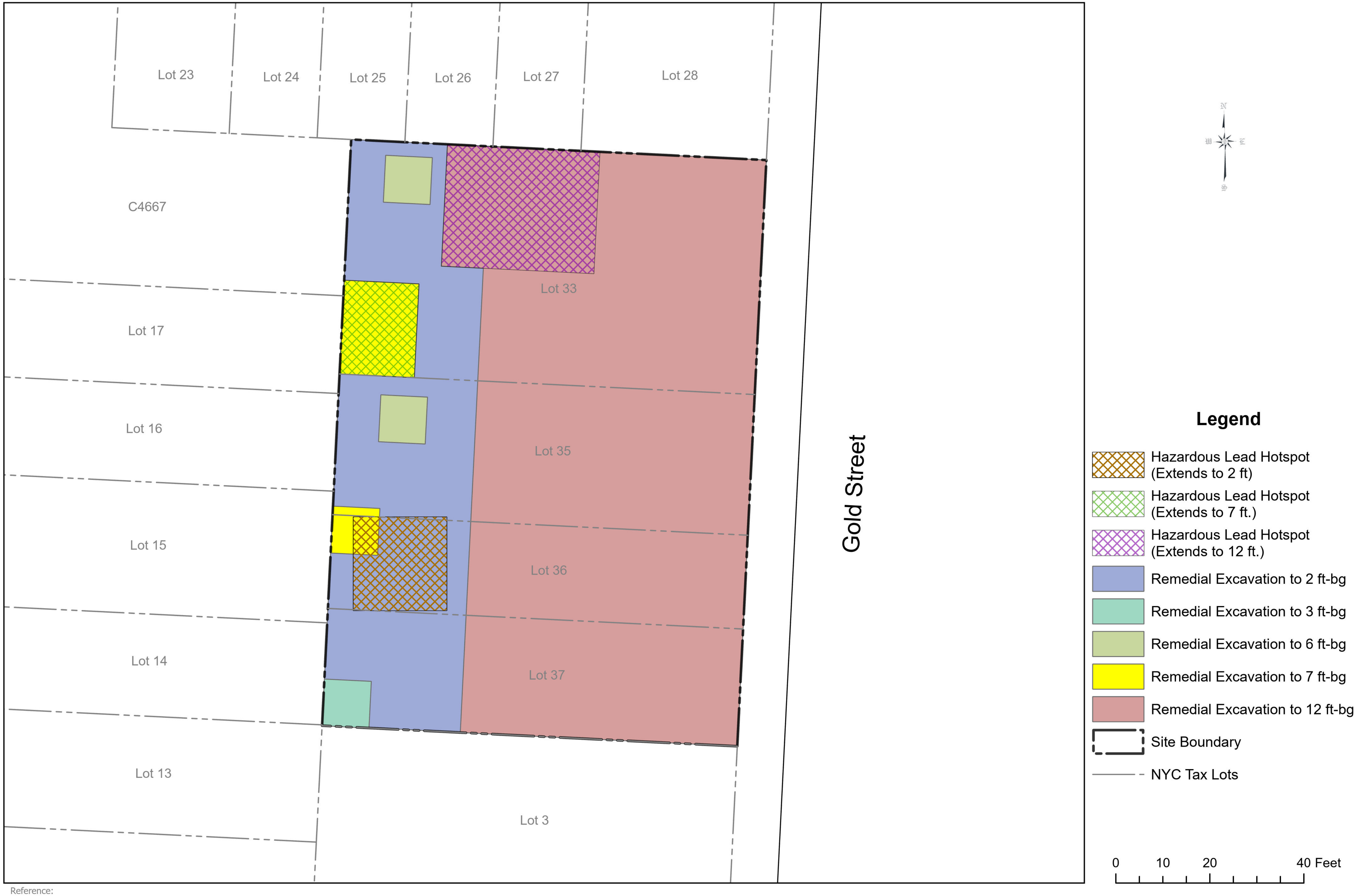
Checked By AP

Date December 2024

Scale As Noted

Drawing Title Groundwater Contour Map

Drawing No. Figure 3



Reference:
NYC Department of Finance Property Information Portal

236-246 Gold Street
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Drawn By LM

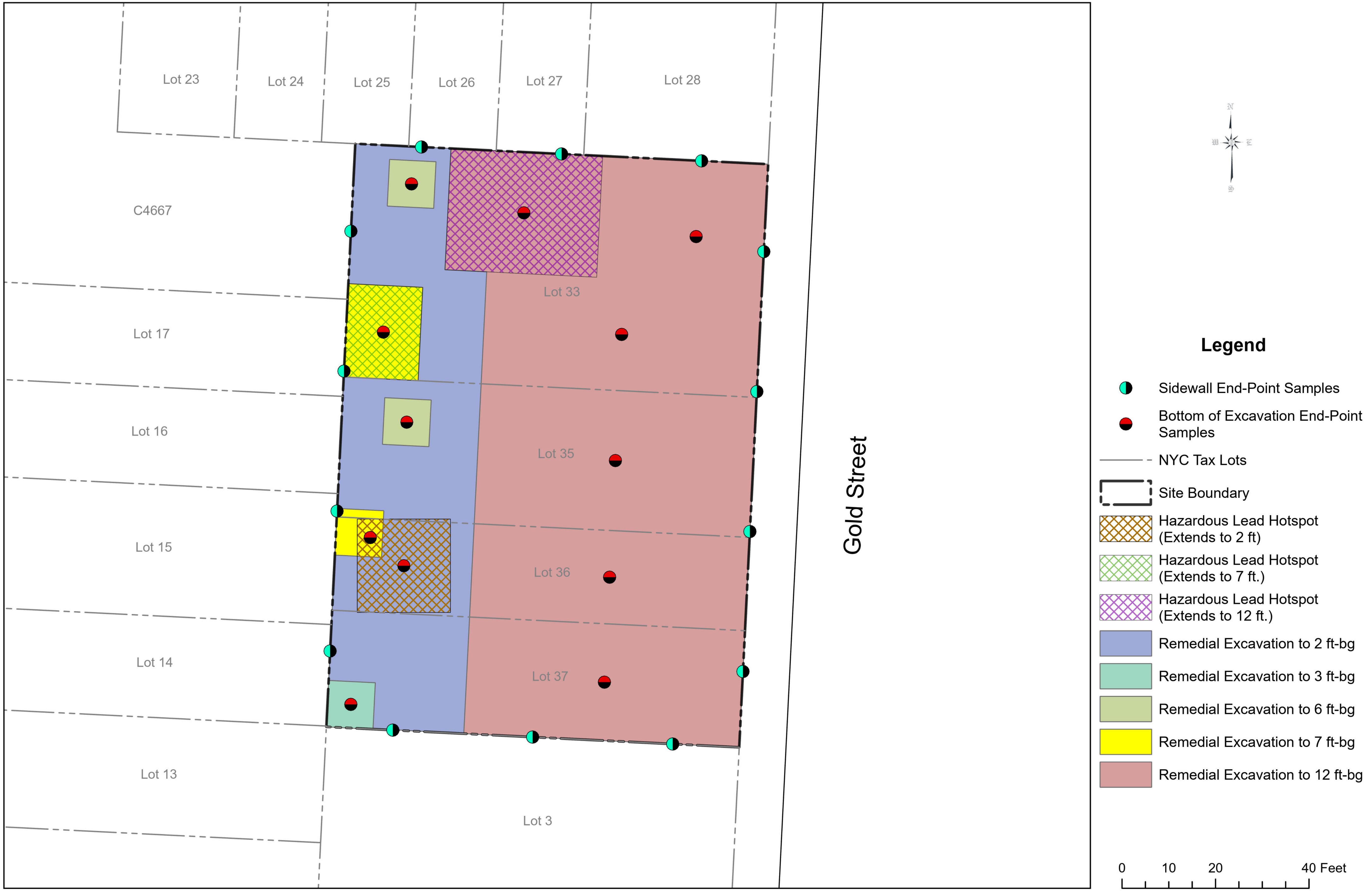
Checked By AP

Date January 2025

Scale As Noted

Drawing Title Proposed Excavation Extent (Alternative 1 - Track 2)

Drawing No. Figure 4



Reference:
NYC Department of Finance Property Information Portal

236-246 Gold Street
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Block 121, Lots 33, 35, 36 & 37

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Drawn By	LM
Checked By	AP
Date	January 2025
Scale	As Noted

Drawing Title
Proposed End-Point Sample Locations
(Alternative 1 - Track 2)

Drawing No.
Figure 5

Reference:
NYC Department of Finance Property Information Portal

236-246 Gold Street
Brooklyn, New York
Block 121, Lots 33, 35, 36 & 37

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Drawn By	LM
Checked By	AP
Date	December 2024
Scale	As Noted
Drawing Title	Proposed Excavation Extent (Alternative 2 - Track 1)
Drawing No.	Figure 6

Reference:
NYC Department of Finance Property Information Portal

236-246 Gold Street
Brooklyn, New York
Block 121, Lots 33, 35, 36 & 37

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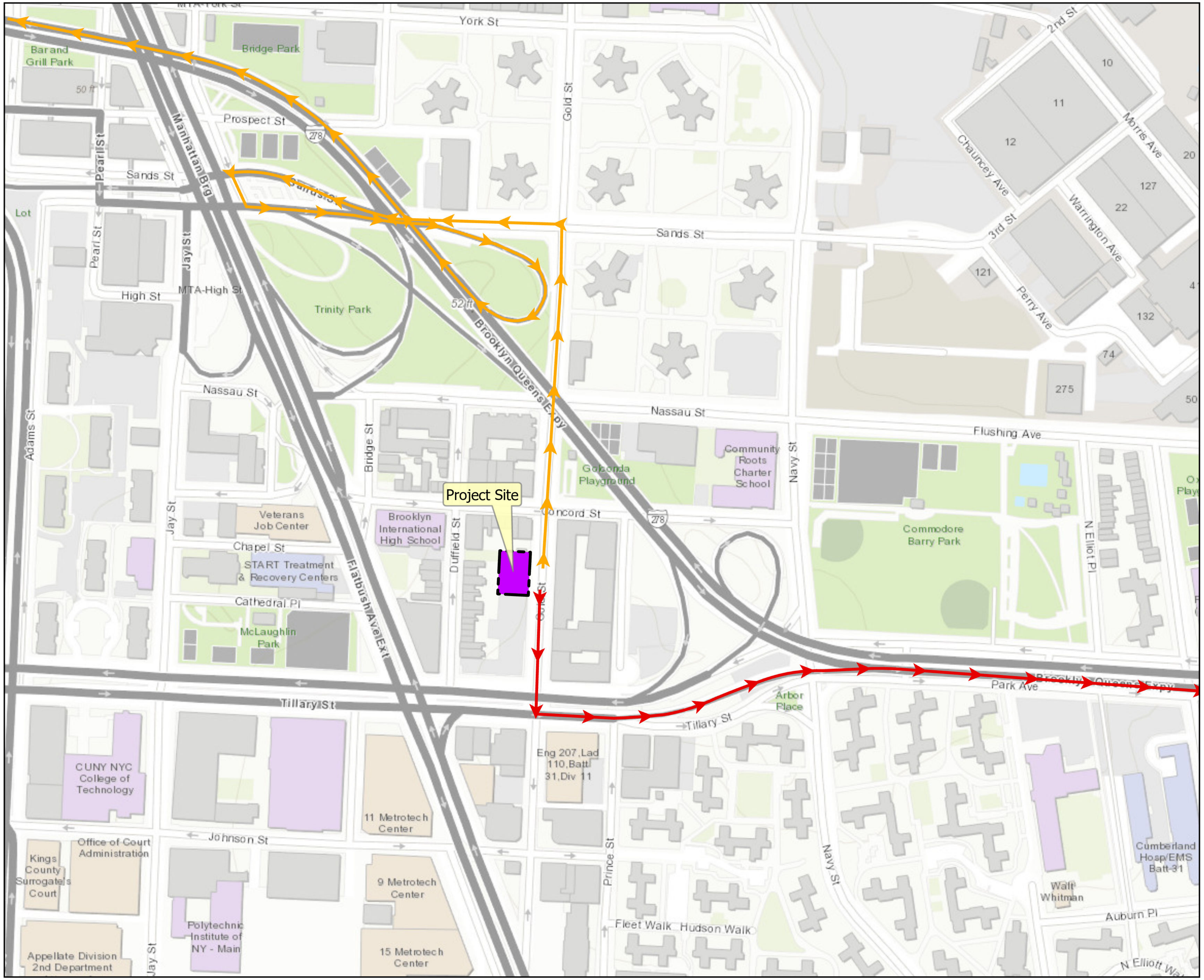
Drawn By LM
Checked By AP
Date December 2024
Scale As Noted

Drawing Title
Proposed End-Point Sample Locations
(Alternative 2 - Track 1)

Drawing No.
Figure 7



Source: NYC OpenData, State of New Jersey, Esri, HERE, Garmin, INCREMENT P, USGS, EPA, USDA

Legend

🟥	To the Brooklyn-Queens Expy (I-278 East)
🟧	To the Brooklyn-Queens Expy (I-278 West)

0 310 620 Feet

236-246 Gold Street
Brooklyn, New York
Block 121, Lots 33, 35, 36 & 37

TENEN
ENVIRONMENTAL

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New York, NY 10001
O: (646) 606-2332; F: (646) 606-2379

Drawn By LM
Checked By AP
Date December 2024
Scale As Noted

Drawing Title Truck Route Map
Drawing No. Figure 8

Tables

Table 1.
Unrestricted Use Soil Cleanup Objectives
Remedial Action Work Plan
236-246 Gold Street - Brooklyn, NY
BCP #C224413

From Table 375-6.8(a) Unsrestricted Use Soil Cleanup Objectives

Contaminant	CAS Number	SCO
Metals		
Arsenic	7440-38-2	13[c]
Barium	7440-39-3	350[c]
Beryllium	7440-41-7	7.2
Cadmium	7440-43-9	2.5[c]
Chromium, hexavalent[e]	18540-29-9	1[b]
Chromium, trivalent[e]	16065-83-1	30[c]
Copper	7440-50-8	50
Total Cyanide[e,f]		27
Lead	7439-92-1	63[c]
Manganese	7439-96-5	1,600[c]
Total Mercury		0.18[c]
Nickel	7440-02-0	30
Selenium	7782-49-2	3.9[c]
Silver	7440-22-4	2
Zinc	7440-66-6	109[c]
PCBs/Pesticides		
2,4,5-TP Acid (Silvex)[f]	93-72-1	3.8
4,4'-DDE	72-55-9	0.0033[b]
4,4'-DDT	50-29-3	0.0033[b]
4,4'-DDD	72-54-8	0.0033[b]
Aldrin	309-00-2	0.005[c]
alpha-BHC	319-84-6	0.02
beta-BHC	319-85-7	0.036
Chlordane (alpha)	5103-71-9	0.094
delta-BHC[g]	319-86-8	0.04
Dibenzofuran[f]	132-64-9	7
Dieldrin	60-57-1	0.005[c]
Endosulfan I[d,f]	959-98-8	2.4
Endosulfan Ii[d,f]	33213-65-9	2.4
Endosulfan sulfate[d,f]	1031-07-8	2.4
Endrin	72-20-8	0.014
Heptachlor	76-44-8	0.042
Lindane	58-89-9	0.1
Polychlorinated biphenyls	1336-36-3	0.1

Contaminant	CAS Number	SCO
Semivolatiles		
Acenaphthene	83-32-9	20
Acenapthylene[f]	208-96-8	100[a]
Anthracene[f]	120-12-7	100[a]
Benz(a)anthracene[f]	56-55-3	1[c]
Benzo(a)pyrene	50-32-8	1[c]
Benzo(b)fluoranthene[f]	205-99-2	1[c]
Benzo(g,h,i)perylene[f]	191-24-2	100
Benzo(k)fluoranthene[f]	207-08-9	0.8[c]
Chrysene[f]	218-01-9	1[c]
Dibenz(a,h)anthracene[f]	53-70-3	0.33[b]
Fluoranthene[f]	206-44-0	100[a]
Fluorene[f]	86-73-7	30
Indeno(1,2,3-cd)pyrene[f]	193-39-5	0.5[c]
m-Cresol[f]	108-39-4	0.33[b]
Naphthalene[f]	91-20-3	12
o-Cresol[f]	95-48-7	0.33[b]
p-Cresol[f]	106-44-5	0.33[b]
Pentachlorophenol	87-86-5	0.8[b]
Phenanthrene[f]	85-01-8	100
Phenol	108-95-2	0.33[b]
Pyrene[f]	129-00-0	100
Volatiles		
1,1,1-Trichloroethane[f]	71-55-6	0.68
1,1-Dichloroethane[f]	75-34-3	0.27
1,1-Dichloroethene[f]	75-35-4	0.33
1,2-Dichlorobenzene[f]	95-50-1	1.1
1,2-Dichloroethane	107-06-2	0.2[c]
cis-1,2-Dichloroethene[f]	156-59-2	0.25
trans-1,2-Dichloroethene[f]	156-60-5	0.19
1,3-Dichlorobenzene[f]	541-73-1	2.4
1,4-Dichlorobenzene	106-46-7	1.8
1,4-Dioxane	123-91-1	0.1[b]
Acetone	67-64-1	0.05
Benzene	71-43-2	0.06
n-Butylbenzene[f]	104-51-8	12
Carbon tetrachloride[f]	56-23-5	0.76
Chlorobenzene	108-90-7	1.1
Chloroform	67-66-3	0.37
Ethylbenzene[f]	100-41-4	1
Hexachlorobenzene[f]	118-74-1	0.33[b]
Methyl ethyl ketone	78-93-3	0.12
Methyl tert-butyl ether[f]	1634-04-4	0.93
Methylene chloride	75-09-2	0.05
n-Propylbenzene[f]	103-65-1	3.9
sec-Butylbenzene[f]	135-98-8	11
tert-Butylbenzene[f]	98-06-6	5.9
Tetrachloroethene	127-18-4	1.3
Toluene	108-88-3	0.07
Trichloroethene	79-01-6	0.47
1,2,4-Trimethylbenzene[f]	95-63-6	3.6
1,3,5- Trimethylbenzene[f]	108-67-8	8.4
Vinyl chloride[f]	75-01-4	0.02
Xylene (mixed)	1330-20-7	0.26

Notes:
All soil cleanup objectives (SCOs) are in parts per million (ppm). NS=Not specified.
Footnotes (designations are from Table in Part 375). See Technical Support Document (TSD).
a The SCOs for unrestricted use were capped at a maximum value of 100 ppm. See TSD section 9.3.
b For constituents where the calculated SCO was lower than the contract required quantitation limit (CRQL), the CRQL is used as the Track 1 SCO value.
c For constituents where the calculated SCO was lower than the rural soil background concentration, as determined by the Department and Department of Health rural soil survey, the rural soil background concentration is used as the Track 1 SCO value for this use of the site.
d SCO is the sum of endosulfan I, endosulfan II and endosulfan sulfate.
e The SCO for this specific compound (or family of compounds) is considered to be met if the analysis for the total species of this contaminant is below the specific SCO.
f Protection of ecological resources SCOs were not developed for contaminants identified in Table 375-6.8(b) with "NS". Where such contaminants appear in Table 375-6.8(a), the applicant may be required by the Department to calculate a protection of ecological resources SCO according to the TSD.

Table 2.
Restricted-Residential Use Soil Cleanup Objectives
Remedial Action Work Plan
236-246 Gold Street - Brooklyn, NY
BCP #C224413

From Table 375-6.8(b) or CP-51 Table 1: Restricted-Residential Use Soil Cleanup Objectives.

Contaminant	CAS Number	Restricted-Residential
Metals		
Arsenic	7440-38-2	16[f]
Barium	7440-39-3	400
Beryllium	7440-41-7	72
Cadmium	7440-43-9	4.3
Chromium, hexavalent[h]	18540-29-9	110
Chromium, trivalent[h]	16065-83-1	180
Copper	7440-50-8	270
Total Cyanide[h]		27
Lead	7439-92-1	400
Manganese	7439-96-5	2,000[f]
Total Mercury		0.81[j]
Nickel	7440-02-0	310
Selenium	7782-49-2	180
Silver	7440-22-4	180
Zinc	7440-66-6	10,000[d]
PCBs/Pesticides		
2,4,5-TP Acid (Silvex)	93-72-1	100[a]
4,4'-DDE	72-55-9	8.9
4,4'-DDT	50-29-3	7.9
4,4'-DDD	72-54-8	13
Aldrin	309-00-2	0.097
alpha-BHC	319-84-6	0.48
beta-BHC	319-85-7	0.36
Chlordane (alpha)	5103-71-9	4.2
delta-BHC	319-86-8	100[a]
Dibenzofuran	132-64-9	59
Dieldrin	60-57-1	0.2
Endosulfan I	959-98-8	24[i]
Endosulfan II	33213-65-9	24[i]
Endosulfan sulfate	1031-07-8	24[i]
Endrin	72-20-8	11
Heptachlor	76-44-8	2.1
Lindane	58-89-9	1.3
Polychlorinated biphenyls	1336-36-3	1

Contaminant	CAS Number	Restricted-Residential
Semivolatiles		
Acenaphthene	83-32-9	100[a]
Acenapthylene	208-96-8	100[a]
Anthracene	120-12-7	100[a]
Benz(a)anthracene	56-55-3	1[f]
Benzo(a)pyrene	50-32-8	1[f]
Benzo(b)fluoranthene	205-99-2	1[f]
Benzo(g,h,i)perylene	191-24-2	100[a]
Benzo(k)fluoranthene	207-08-9	3.9
Chrysene	218-01-9	3.9
Dibenz(a,h)anthracene	53-70-3	0.33[e]
Fluoranthene	206-44-0	100[a]
Fluorene	86-73-7	100[a]
Indeno(1,2,3-cd)pyrene	193-39-5	0.5[f]
m-Cresol	108-39-4	100[a]
Naphthalene	91-20-3	100[a]
o-Cresol	95-48-7	100[a]
p-Cresol	106-44-5	100[a]
Pentachlorophenol	87-86-5	6.7
Phenanthrene	85-01-8	100[a]
Phenol	108-95-2	100[a]
Pyrene	129-00-0	100[a]

Contaminant	CAS Number	Restricted-Residential
Volatiles		
1,1,1-Trichloroethane	71-55-6	100[a]
1,1-Dichloroethane	75-34-3	26
1,1-Dichloroethene	75-35-4	100[a]
1,2-Dichlorobenzene	95-50-1	100[a]
1,2-Dichloroethane	107-06-2	3.1
cis-1,2-Dichloroethene	156-59-2	100[a]
trans-1,2-Dichloroethene	156-60-5	100[a]
1,3-Dichlorobenzene	541-73-1	49
1,4-Dichlorobenzene	106-46-7	13
1,4-Dioxane	123-91-1	13
Acetone	67-64-1	100[b]
Benzene	71-43-2	4.8
n-Butylbenzene	104-51-8	100[a]
Carbon tetrachloride	56-23-5	2.4
Chlorobenzene	108-90-7	100[a]
Chloroform	67-66-3	49
Ethylbenzene	100-41-4	41
Hexachlorobenzene	118-74-1	1.2
Methyl ethyl ketone	78-93-3	100[a]
Methyl tert-butyl ether	1634-04-4	100[a]
Methylene chloride	75-09-2	100[a]
n-Propylbenzene	103-65-1	100[a]
sec-Butylbenzene	135-98-8	100[a]
tert-Butylbenzene	98-06-6	100[a]
Tetrachloroethene	127-18-4	19
Toluene	108-88-3	100[a]
Trichloroethene	79-01-6	21
1,2,4-Trimethylbenzene	95-63-6	52
1,3,5- Trimethylbenzene	108-67-8	52
Vinyl chloride	75-01-4	0.9
Xylene (mixed)	1330-20-7	100[a]

Notes:
All soil cleanup objectives (SCOs) are in parts per million (ppm). NS=Not specified.
Footnotes (designations are from Table in Part 375). See Technical Support Document (TSD).
b the SCOs for commercial use were capped at a maximum value of 500 ppm. See TSD section 9.3.
d The SCOs for metals were capped at a maximum value of 10,000 ppm. See TSD section 9.3.
e For constituents where the calculated SCO was lower than the contract required quantitation limit (CRQL), the CRQL is used as the SCO value.
f For constituents where the calculated SCO was lower than the rural soil background concentration as determined by the Department and Department of Health rural soil survey, the rural soil background concentration is used as the Track 2 SCO value for this use of the site.
i This SCO is for the sum of endosulfan I, endosulfan II, and endosulfan sulfate.
j This SCO is the lower of the values for mercury (elemental) or mercury (inorganic salts). See TSD Table 5.6-1.

Table 3.
NYSDEC Division of Water TOGS 1.1.1 Class GA Standards
Remedial Action Work Plan
236-246 Gold Street - Brooklyn, NY
BCP #C224413

From Table 1: New York State Ambient Water Quality Standards and Guidance Values
(Division of Water Technical and Operational Guidance Series (1.1.1), June 1998)

Contaminant	CAS Number	Class GA Standard
Volatiles		
1,1,1,2-Tetrachloroethane	630-20-6	5*
1,1,1-Trichloroethane	71-55-6	5*
1,1,2,2-Tetrachloroethane	79-34-5	5*
1,1,2-Trichloroethane	79-00-5	1
1,1-Dichloroethane	75-34-3	5*
1,1-Dichloroethene	75-35-4	5*
1,1-Dichloropropene	563-58-6	5*
1,2,3-Trichloropropane	96-18-4	0.04
1,2,4,5-Tetramethylbenzene	95-93-2	5*
1,2,4-Trimethylbenzene	95-63-6	5*
1,2-Dibromo-3-chloropropane	96-12-8	0.04
1,2-Dichlorobenzene	95-50-1	3
1,2-Dichloroethane	107-06-2	0.6
1,2-Dichloropropane	78-87-5	1
1,3,5-Trimethylbenzene	108-67-8	5*
1,3-Dichlorobenzene	541-73-1	3
1,3-Dichloropropane	142-28-9	5*
1,4-Dichlorobenzene	106-46-7	3
2,2-Dichloropropane	594-20-7	5*
2-Hexanone	591-78-6	50**
Acetone	67-64-1	50**
Acrylonitrile	107-13-1	5*
Benzene	71-43-2	1
Bromobenzene	108-86-1	5*
Bromochloromethane	74-97-5	5*
Bromodichloromethane	75-27-4	50**
Bromoform	75-25-2	50**
Bromomethane	74-83-9	5*
Butylbenzene	104-51-8	5*
Carbon tetrachloride	56-23-5	5
Chlorobenzene	108-90-7	5*
Chloroethane	75-00-3	5*
Chloroform	75-34-3	7
Chloromethane (Methyl Chloride)	74-87-3	5*
cis-1,2-Dichloroethene	156-59-2	5*
Dibromochloromethane	124-48-1	50**
Dibromomethane	74-95-3	5*
Dichlorodifluoromethane	75-71-8	5*
Ethylbenzene	100-41-4	5*
Hexachlorobenzene	87-68-3	0.04
Hexachlorobutadiene	87-68-3	0.5
Isopropylbenzene	98-82-8	5*
Methylene chloride	75-09-2	5*
m-Xylene (1,3-Xylene)	108-38-3	5*
Naphthalene	91-20-3	10**
n-Propylbenzene	103-65-1	5*
o-Chlorotoluene	95-49-8	5*
o-Xylene (1,2-Xylene)	95-47-6	5*
p-Chlorotoluene	106-43-4	5*
p-Isopropyltoluene	99-87-6	5*
p-Xylene (1,4-Xylene)	106-42-3	5*
sec-Butylbenzene	135-98-8	5*
Styrene	100-42-5	5*
tert-Butylbenzene	98-06-6	5*
Tetrachloroethene	127-18-4	5*
Toluene	108-88-3	5*

Contaminant	CAS Number	Class GA Standard
Volatiles		
Total 1,3-Dichloropropene	542-75-6	0.4 (1)
trans-1,2-Dichloroethene	156-60-5	5*
trans-1,4-Dichloro-2-butene	110-57-6	5*
Trichloroethene	79-01-6	5*
Trichlorofluoromethane	75-69-4	5*
Vinyl chloride	75-01-4	2

Semivolatiles		
1,2,4,5-Tetrachlorobenzene	95-94-3	5*
1,2-Dichlorobenzene	95-50-1	3
1,3-Dichlorobenzene	541-73-1	3
1,4-Dichlorobenzene	106-46-7	3
3,3'-Dichlorobenzidine	91-94-1	5*
2,4-Dichlorophenol	120-83-2	5*
2,4-Dimethylphenol	105-67-9	50**
2,4-dinitrophenol	51-28-5	10**
2,4-Dinitrotoluene	121-14-2	5*
2,6-Dinitrotoluene	606-20-2	5*
2-Chloronaphthalene	91-58-7	10**
2-Nitroaniline	88-74-4	5*
3-Nitroaniline	99-09-2	5*
4-Chloroaniline	106-47-8	5*
4-Nitroaniline	100-01-6	5*
Acenaphthene	83-32-9	20**
Aniline	62-53-3	5*
Anthracene	120-12-7	50**
Benzo(a)anthracene	56-55-3	0.002**
Benzo(a)pyrene	50-32-8	0
Benzo(b)fluoranthene	205-99-2	0.002**
Benzo(k)fluoranthene	207-08-9	0.002**
Biphenyl	92-52-4	5*
Bis(2-chloroethoxy)methane	111-91-1	5*
Bis(2-chloroethyl)ether	111-44-4	1.0
Bis(2-Ethylhexyl)phthalate	117-81-7	5
Butyl benzyl phthalate	85-68- 7	50**
Chrysene	218-01-9	0.002
Diethyl phthalate	84-66-2	50**
Dimethyl phthalate	131-11-3	50**
Di-n-butylphthalate	84-74-2	50
Di-n-octylphthalate	117-84-0	50**
Fluoranthene	206-44-0	50**
Fluorene	86-73-7	50**
Hexachlorobenzene	118-74-1	0.04
Hexachlorobutadiene	87-68-3	0.5
Hexachlorocyclopentadiene	77-47-4	5*
Hexachloroethane	67-72-1	5*
Indeno(1,2,3-cd)Pyrene	193-39-5	0.002
Isophorone	78-59-1	50**
Naphthalene	91-20-3	10**
Nitrobenzene	98-95-3	0.4
NitrosoDiPhenylAmine(NDPA)/DPA	86-30-6	50**
Pentachlorophenol	87-86-5	1(2)
Phenanthrene	85-01-8	50**
Phenol	108-95-2	1 (2)
Pyrene	129-00-0	50**

Notes:
All Class GA Standards are in micrograms per liter (ug/l). Compounds without standards or guideline values are not shown.
*The principal organic contaminant standard for groundwater of 5 ug/l applies to this substance.
** The value shown is a Guidance Value
(1) refers to sum of cis- and trans-1,3-dichloropropene.
(2) refers to the sum of Total Phenols (phenolic compounds)

Table 4. Estimated Remedial Costs

236-246 Gold Street - Brooklyn, NY
Remedial Action Work Plan
BCP #C224413

Alternative 1: Track 2 Soil Cleanup Objectives (SCOs) and Sub-Slab Depressurization System (SSDS)		
Remedial Tasks		
Remedial Oversight	$85,000	Implementation of CAMP and daily reporting
End-Point Samples	$40,000	Collection and analysis of 26 end-point samples (plus QA/QC samples), data validation, and preparation of EDDs
Engineering Design for SSDS	$15,000	Engineering design and preparation of Design Document
SSDS	$45,000	Installation and startup
Post-Remedial Indoor Air Samples	$5,000	Collection and analysis of 4 post-remedial indoor air samples, data validation, and preparation of EDDs
Operation & Maintenance of SSDS	$5,000	Ongoing operation and maintenance of SSDS
Post-Remedial Reporting and Annual Inspections		
Reporting (FER, SMP)	$40,000	Reporting
Annual Inspections of Engineering Controls reporting (PRR)	$15,000	Annual Inspections and annual reporting

Estimated Remedial Costs	$195,000
Estimated Reporting and Long-Term Monitoring Costs	$55,000
Total Estimated Remedial Costs	$250,000

Table 5. Remedial Construction Schedule
236-246 Gold Street - Brooklyn, NY
BCP Site #C224413

Task	Task Description	Dec-24	Jan-25	Feb-25	Mar-25	Apr-25	May-25	Jun-25	Jul-25	Aug-25	Sep-25	Oct-25	Nov-25
1	Submit Draft RIR and RAWP	🟪											
2	Department Review of Draft RIR and RAWP	⬜	⬜										
3	45-Day Public Comment Period on RAWP		🟩	🟩									
4	Complete RIR and RAWP Edits		🟪										
5	Submit Revised RIR and RAWP			🟪									
6	Department Approval of RIR and RAWP and Issuance of Decision Document				🟦								
7	Mobilization				🟧								
8	Remedial Action Implementation (Bulk excavation, endpoint sample collection, SSDS installation, and foundation installation)				🟧	🟧	🟧	🟧					
9	Prepare Draft SMP and FER						🟪	🟪	🟪				
10	Prepare DUSRs and EDDs for endpoint soil samples							🟥					
11	Submit Draft SMP and FER									🟪			
12	Department Review of Draft SMP and FER									⬜	⬜	⬜	
13	Collect baseline indoor air samples and start-up SSDS										🟧		
14	Collect post-remedial indoor air samples											🟧	
15	Prepare DUSRs and EDDs for baseline and post-remedial indoor air samples											🟥	
16	Complete SMP and FER Edits											🟪	🟪
17	Department Review of Revised SMP and FER												⬜
18	Department Approval of SMP and FER and Issuance of COC												🟦

Key Map	
🟧	Fieldwork
🟥	Lab Analysis/Validation/EDDs
🟪	Report Writing
⬜	Agencies Review
🟦	Agency Acceptance
🟩	Public Comment Period

Table 6. Project Organization and Emergency Contacts
236-246 Gold Street - Brooklyn, NY
BCP # C224413

Tenen Staff	Title	Role
Mohamed Ahmed, PG	Project Manager and Qualified Environmental Professional	Responsible for overall coordination and management of the project
Matthew Carroll, PE	Project Professional Engineer	Responsible for work plan, report and EC/IC certifications.
Alana Carroll, PG	Quality Assurance Officer	Responsible for quality assurance of sampling procedures and laboratory data
Ashley Platt	Project Geologist	Responsible for the day-to-day field monitoring and sampling activities, including dust monitoring, PID monitoring, and soil sampling.

Subcontractor	Phone Number	Role
York Analytical Laboratories	(800) 306-9675	Responsible for analysis of all soil and indoor air samples collected as part of the Remedial Action
L.A.B. Validation Corp	(516) 523-7891	Responsible for preparation of DUSRs for all analytical data collected as part of the Remedial Action

Name	Organization	Phone Number
Matthew Carroll, PE	Tenen Environmental, LLC	(646) 606-2332
Mohamed Ahmed, PG	Tenen Environmental, LLC	(646) 606-2332
Israel Spielman	236 Gold LLC / 242 Gold St LLC / 244 Gold LLC / 236-242 Gold St Ll	(718) 222-3822
Michael Sollecito, NYSDEC Project Manager	New York State Department of Environmental Conservation	(518) 402-2198
Anthony Perretta, NYSDOH Project Manager	New York State Department of Health	(518) 402-1365

Appendix A

NYSDOH Generic Community Air Monitoring Plan

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 B
Construction Health and Safety Plan

Construction Health and Safety Plan
for
236-246 Gold Street
Remedial Action Work Plan

236-246 Gold Street - Brooklyn, NY
Block 121, Lots 33, 35, 36, & 37
BCP Site #C224413

Submitted to:
New York State Department of Environmental Conservation
Division of Environmental Remediation
Remedial Bureau A
625 Broadway, 12th Floor
Albany, NY 12233-7016

Prepared for:
236 Gold LLC / 242 Gold St LLC / 244 Gold LLC / 236-242 Gold St LLC
31 Spencer Street, Suite 502
Brooklyn, NY 11205

Prepared by:
TENEN ENVIRONMENTAL
121 West 27th Street, Suite 702
New York, NY 10001

JANUARY 2025

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Appendices

1.0 INTRODUCTION

This Construction Health and Safety Plan (CHASP) has been prepared in conformance with the Occupational Safety and Health Administration (OSHA) standards and guidance that govern site investigation activities, other applicable regulations, and Tenen Environmental LLC (Tenen) health and safety policies and procedures. The purpose of this CHASP is the protection of Tenen field personnel and others during the implementation of a Remedial Action Work Plan.

The Site is located at 236-246 Gold Street in the Downtown Brooklyn section in Brooklyn, New York and is identified as Block 121 and Lots 33, 35, 36 and 37 on the New York City Tax Map. The Site is 11,054 -square feet and is bounded by residential and commercial buildings followed by Concord Street to the north; a residential building followed by Tillary Street to the south; Gold Street to the east; and residential buildings followed by Duffield Street to the west. The Site is currently vacant and the majority of the Site is capped with asphalt.

The proposed development project consists of the construction of a new mixed-use commercial and residential building with a full cellar occupying the front 59 feet of the Site. The remainder of the Site will be occupied by an at-grade rear yard. The proposed construction will require excavation to a depth of approximately 12 feet below grade surface (ft-bg) within the building footprint, with localized deeper excavation to approximately 14 ft-bg to foundational elements.

1.1 Scope of CHASP

This CHASP includes safety procedures to be used by Tenen staff during the following activities:

- Implementation of remedial oversight and community air monitoring activities; and,
- Collection of post-remedial end-point soil samples and post-remedial indoor air samples.

Contractors performing remedial construction work will ensure that performance of the work is in compliance with this CHASP and applicable laws and regulations. The CHASP pertains to remedial and invasive work performed at the Site.

2.0 PROJECT SAFETY AUTHORITY

The following personnel are responsible for project health and safety under this CHASP.

- Project Manager, Mohamed Ahmed
- Health and Safety Officer (HSO), Matthew Carroll

In addition, each individual working at the Site will be responsible for compliance with this CHASP and general safe working practices. All Site workers will have the authority to stop work if a potentially hazardous situation or event is observed.

2.1 Designated Personnel

The Project Manager is responsible for the overall operation of the project, including compliance with the CHASP and general safe work practices. The Project Manager may also act as the Health and Safety Officer (HSO) for this project.

Tenen will appoint one of its on-site personnel as the on-site HSO. This individual will be responsible for the implementation of the CHASP. The HSO will have a 4-year college degree in occupational safety or a related science/engineering field, and at least two (2) years of experience in implementation of air monitoring and hazardous materials sampling programs. The HSO will have completed a 40-hour training course that meets OSHA requirements of 29 CFR Part 1910, Occupational Safety and Health Standards.

The HSO will be present on-site during all field operations involving drilling or other subsurface disturbance, and will be responsible for all health and safety activities and the delegation of duties to the field crew. The HSO has stop-work authorization, which he/she will execute on his/her determination of an imminent safety hazard, emergency situation, or other potentially dangerous situation. If the HSO must be absent from the field, a replacement who is familiar with the Construction Health and Safety Plan, air monitoring and personnel protective equipment (PPE) will be designated.

3.0 HAZARD ASSESSMENT AND CONTROL MEASURES

Environmental investigations conducted to date at the Site are described in the following reports:

- *Phase I Environmental Site Assessment Report, 236 Gold Street, Brooklyn, NY,* Tenen Environmental, LLC, July 2022.
- *Remedial Investigation Report, 236 Gold Street, Brooklyn, New York,* Tenen Environmental, LLC, October 2022.
- *Phase I Environmental Site Assessment Report, 242 Gold Street, Brooklyn, New York,* Tenen Environmental, LLC, March 2023.
- *Draft Remedial Investigation Report, 242 Gold Street, Brooklyn, New York,* Tenen Environmental, LLC, June 2023.
- *Phase I Environmental Site Assessment Report, 236-246 Gold Street, Brooklyn, New York,* Matrix New World Engineering, Land Surveying and Landscape Architecture, P.C., March 2024.
- *Limited Phase II Environmental Site Investigation, 244-246 Gold Street, Brooklyn, New York,* Tenen Environmental, LLC, May 1, 2024.
- *Draft Remedial Investigation Report, 236-246 Gold Street, Brooklyn, New York,* Tenen Environmental, LLC, December 2024.

Summaries of the above-mentioned reports are provided below.

Phase I Environmental Site Assessment Report, 236 Gold Street, Brooklyn, NY, Tenen Environmental, LLC, July 2022.

Tenen prepared a Phase I Environmental Site Assessment (ESA) for Lot 33 in July 2022. The Phase I ESA identified the following Recognized Environmental Conditions (RECs) in association with Lot 33:

- Historic use of Lot 33 for metalworking.

Tenen also noted Lot 33 has a Hazmat, Air, and Noise E-Designation (E-117).

Remedial Investigation Report, 236 Gold Street, Brooklyn, New York, Tenen Environmental, LLC, October 2022.

Tenen completed a Remedial Investigation at Lot 33 under NYC OER's E-Designation program in September 2022 (report dated October 2022) to evaluate the quality of soil, groundwater, and soil vapor across the lot. The scope of work performed during the RI included the installation of five soil borings, the collection of eleven soil samples, the installation of three temporary groundwater monitoring wells, the collection of three groundwater samples, the installation of three temporary soil vapor sample points, and the collection of three soil vapor samples. All soil and groundwater samples were analyzed for volatile organic compounds (VOCs), semivolatile organic compounds (SVOCs), target analyte list (TAL) metals (total and dissolved for groundwater), pesticides, and polychlorinated biphenyls (PCBs); one soil sample and three groundwater samples were analyzed for 1,4-dioxane and PFAS; and, all soil vapor samples were analyzed for VOCs. In addition, soil characterization sampling was conducted across the lot to characterize soil proposed for offsite disposal. A summary of the RI results on Lot 33 is included below:

Soil Results

- VOCs were not detected in exceedance of Unrestricted Use or Restricted-Residential Use Soil Cleanup Objectives (SCOs) in any soil samples.
- Several SVOCs, specifically polycyclic aromatic hydrocarbons (PAHs), were detected in exceedance of Unrestricted Use SCOs in one or more soil samples, including benzo(a)anthracene

[max. 6.2 parts-per-million (ppm)], benzo(a)pyrene [max. 5.4 ppm], benzo(b)fluoranthene [max. 6.7 ppm], benzo(k)fluoranthene [max. 2.3 ppm], chrysene [max. 5.7 ppm], dibenzo(a,h)anthracene [max. 1.2 ppm], and indeno(1,2,3-cd)pyrene [max. 3.3 ppm]. All of the above-mentioned analytes were also detected above Restricted-Residential Use SCOs in one or more samples. The concentrations of SVOCs detected in soil are consistent with the presence of historic fill material across the Site.

- Various metals were detected in exceedance of Unrestricted Use SCOs in one or more soil samples, including arsenic [max. 18.5 ppm], barium [max. 473 ppm], cadmium [max. 3.74 ppm], copper [max. 51.6 ppm], lead [max. 2,380 ppm], mercury [max. 4.26 ppm], nickel [max. 39.1 ppm], and zinc [max. 555 ppm]. Of these, arsenic, barium, lead, and mercury were also detected in exceedance of their Restricted-Residential Use SCOs in one or more samples.
- Three composite soil samples were collected and analyzed for toxicity characteristic leachate procedure (TCLP) metals as part of waste characterization sampling at Lot 33 in February 2023. Two of the three samples contained concentrations of TCLP lead exceeding the US EPA Allowable Limit of 5 milligrams per liter (mg/L), indicating the material is hazardous for lead. Subsequently in March 2023, delineation sampling was conducted on Lot 33 to horizontally and vertically delineate the hazardous lead detected during waste characterization sampling. The delineation sampling identified two separate hazardous lead hotspots in the western portion of Lot 33. One hotspot in the southwestern corner of the lot is approximately 320 square feet (SF) in size and extends to a maximum depth of seven ft-bg, and one hotspot in the northern portion of the lot is approximately 845 SF in size and extends to a maximum depth of twelve ft-bg. TCLP lead concentrations on Lot 33 exceeding the US EPA Allowable Limit ranged from 6.01 mg/L to 21.3 mg/L.
- Several pesticides were detected in exceedance of Unrestricted Use SCOs, but below Restricted-Residential Use SCOs, in one or more samples, including dieldrin [max. 0.00554 ppm], 4,4'-DDE [max. 0.13 ppm], 4,4'-DDD [max. 0.00858 ppm], 4,4'-DDT [max. 0.473 ppm], and cis-chlordane [max. 0.0989 ppm].
- One PCB, aroclor 1260, was detected at a concentration of 0.124 ppm in one soil sample, slightly in exceedance of the Unrestricted Use SCO. PCBs were not detected in exceedance of Restricted-Residential Use SCOs in any soil samples.
- Two PFAS, perfluorooctanoic acid (PFOA) and perfluorooctane sulfonic acid (PFOS), were detected in exceedance of their proposed Unrestricted Use SCOs, but below the proposed Restricted-Residential Use SCOs, in the soil sample that was analyzed. PFOA was detected at a concentration of 1.17 parts-per-billion (ppb) and PFOS was detected at a concentration of 2.41 ppb. 1,4-Dioxane was not detected in the soil sample analyzed.

Groundwater Results

- VOCs, pesticides, and PCBs were not detected in exceedance of the NYSDEC Technical and Operational Guidance Series (TOGS) 1.1.1 Class GA Ambient Water Quality Standards and Guidance Values (Class GA Standards)
- Several SVOCs, specifically PAHs, were detected in exceedance of Class GA Standards in one or more groundwater samples, including benzo(a)anthracene [max. 0.5 ppb], benzo(a)pyrene [max. 0.42 ppb], benzo(b)fluoranthene [max. 0.59 ppb], benzo(k)fluoranthene [max. 0.16 ppb], chrysene [max. 0.5 ppb], hexachlorobenzene [concentration of 0.07 ppb], and indeno(1,2,3-cd)pyrene [max. 0.31 ppb].
- Several metals were detected in exceedance of Class GA Standards in one or more unfiltered groundwater samples, including lead [max. 614.2 ppb], mercury [max. 0.91 ppb], and nickel [max. 115.9 ppb]. None of the above-mentioned analytes were detected in exceedance of Class GA Standards in any dissolved groundwater samples. One metal, antimony, was detected in

exceedance of its Class GA Standard in one filtered groundwater sample only, at a concentration of 6.51 ppb.
- A variety of naturally-occurring earth metals, including iron, magnesium, manganese, and sodium, were detected in exceedance of Class GA Standards in unfiltered groundwater across the Site. Of these, magnesium, manganese, and sodium also exceeded Class GA Standards in filtered groundwater.
- Two PFAS, PFOA and PFOS, were detected in exceedance of their Class GA Standards in groundwater across the Site. PFOA was detected at a max. concentration of 96.2 parts-per-trillion (ppt) and PFOS was detected at a max. concentration of 42.5 ppt. 1,4-Dioxane was not detected in any groundwater samples.

Soil Vapor Results
- Chlorinated VOCs (cVOCs) were detected in all three soil vapor samples, including tetrachloroethene (PCE) [max. 18.9 micrograms per cubic meter (ug/m^3)], trichloroethene (TCE) [max. 42.1 ug/m^3], and 1,1,1-trichloroethane (1,1,1-TCA) [concentration of 3.03 ug/m^3]. No other cVOCs included on the NYSDOH Soil Vapor Intrusion Matrices were detected in any soil vapor samples, including 1,1-dichloroethene, carbon tetrachloride, cis-1,2-dichloroethene, methylene chloride, and vinyl chloride.
- A variety of petroleum-related VOCs were detected in all three soil vapor samples, including benzene [max. 3.45 ug/m^3], ethylbenzene [max. 10.1 ug/m^3], total xylenes [max. 54 ug/m^3], and toluene [max. 28 ug/m^3].

Phase I Environmental Site Assessment Report, 242 Gold Street, Brooklyn, NY, Tenen Environmental, LLC, March 2023.

Tenen prepared a Phase I ESA for Lot 35 in March 2023. The Phase I ESA identified the following RECs in association with Lot 35:

- Historic use of the north adjoining property (Lot 33) for metalworking.

Tenen also noted Lot 35 has a Hazmat, Air, and Noise E-Designation (E-117).

Draft Remedial Investigation Report, 242 Gold Street, Brooklyn, New York, Tenen Environmental, LLC, June 2023.

Tenen completed a Remedial Investigation at Lot 35 under NYC OER's E-Designation program in May 2023 (report dated June 2023) to evaluate the quality of soil, groundwater, and soil vapor across the lot. The scope of work performed during the RI included the installation of five soil borings, the collection of eleven soil samples, the installation of three temporary groundwater monitoring wells, the collection of three groundwater samples, the installation of four temporary soil vapor sample points, and the collection of four soil vapor samples. All soil and groundwater samples were analyzed for volatile organic compounds (VOCs), semivolatile organic compounds (SVOCs), target analyte list (TAL) metals (total and dissolved for groundwater), pesticides, and polychlorinated biphenyls (PCBs); one soil sample and three groundwater samples were analyzed for 1,4-dioxane and PFAS; and, all soil vapor samples were analyzed for VOCs. A summary of the RI results on Lot 35 is included below:

Soil Results
- VOCs and PCBs were not detected in exceedance of Unrestricted Use or Restricted-Residential Use SCOs in any soil samples.
- Several SVOCs, specifically PAHs, were detected in exceedance of Unrestricted Use SCOs in one

or more soil samples, including benzo(a)anthracene [max. 7.1 ppm], benzo(a)pyrene [max. 6.1 ppm], benzo(b)fluoranthene [max. 8.3 ppm], chrysene [max. 6.8 ppm], dibenzo(a,h)anthracene [max. 0.96 ppm], and indeno(1,2,3-cd)pyrene [max. 4.8 ppm]. All of the above-mentioned analytes were also detected above Restricted-Residential Use SCOs in one or more samples. The concentrations of SVOCs detected in soil are consistent with the presence of historic fill material across the Site.

- Various metals were detected in exceedance of Unrestricted Use SCOs in one or more soil samples, including arsenic [max. 15.2 ppm], barium [max. 701 ppm], cadmium [max. 5.42 ppm], copper [max. 215 ppm], lead [max. 2,880 ppm], mercury [max. 4.04 ppm], nickel [max. 52.2 ppm], and zinc [max. 1,240 ppm]. Of these, barium, cadmium, lead, and mercury were also detected in exceedance of their Restricted-Residential Use SCOs in one or more samples.
- Several pesticides were detected in exceedance of Unrestricted Use SCOs in one or more samples, including dieldrin [max. 0.055 ppm], 4,4'-DDE [max. 0.674 ppm], 4,4'-DDD [max. 0.619 ppm], and 4,4'-DDT [max. 24 ppm]. Of these, 4,4'-DDT was also detected in exceedance of its Restricted-Residential Use SCO in one soil sample.
- One PFAS, PFOS, was detected in exceedance of the proposed Unrestricted Use SCO, but below the proposed Restricted-Residential Use SCO, in the soil sample that was analyzed. PFOS was detected at a concentration of 1.68 ppb. 1,4-Dioxane was not detected in the soil sample analyzed.

Groundwater Results

- VOCs, pesticides, and PCBs were not detected in exceedance of the Class GA Standards.
- Several SVOCs, specifically PAHs, were detected in exceedance of Class GA Standards in one or more groundwater samples, including benzo(a)anthracene [max. 0.14 ppb], benzo(a)pyrene [max. 0.1 ppb], benzo(b)fluoranthene [max. 0.52 ppb], benzo(k)fluoranthene [max. 0.3 ppb], chrysene [max. 0.2 ppb], and indeno(1,2,3-cd)pyrene [max. 0.3 ppb].
- Two metals were detected in exceedance of Class GA Standards in one or more unfiltered groundwater samples, including lead [max. 25.83 ppb] and nickel [max. 100.7 ppb]. None of the above-mentioned analytes were detected in exceedance of Class GA Standards in any dissolved groundwater samples.
- A variety of naturally-occurring earth metals, including iron, magnesium, manganese, and sodium, were detected in exceedance of Class GA Standards in unfiltered groundwater across the Site. Of these, magnesium, manganese, and sodium also exceeded Class GA Standards in filtered groundwater.
- Two PFAS, PFOA and PFOS, were detected in exceedance of their Class GA Standards in one or more groundwater samples. PFOA was detected at a max. concentration of 193 ppt and PFOS was detected at a max. concentration of 26 ppt. 1,4-Dioxane was not detected in any groundwater samples.

Soil Vapor Results

- All cVOCs included on the NYSDOH Soil Vapor Intrusion Matrices were not detected in any soil vapor samples, including PCE, TCE, 1,1,1-TCA, 1,1-dichloroethene, carbon tetrachloride, cis-1,2-dichloroethene, methylene chloride, and vinyl chloride.
- A variety of petroleum-related VOCs were detected in three of four soil vapor samples, ethylbenzene [max. 14.8 ug/m^3], total xylenes [max. 81.4 ug/m^3], and toluene [max. 40.7 ug/m^3].
- All soil vapor samples contained elevated concentrations of 2-butanone (max. 2,400 ug/m^3), 2-hexanone (max. 161 ug/m^3), and acetone (max. 903 ug/m^3). Of these, acetone is a common laboratory artifact.

Phase I Environmental Site Assessment Report, 236-246 Gold Street, Brooklyn, NY, Matrix New York Engineering, Land Surveying and Landscape Architecture, P.C., March 2024.

Matrix New World Engineering, Land Surveying and Landscape Architecture, P.C. (Matrix) prepared a Phase I ESA for the entire Site in March 2024. The Phase I ESA identified the following RECs in association with the Site:

- Historic Fill (Site-Wide): The review of historic topographic maps identified a change in the configuration of contour lines between the years 1947 and 1956. It is apparent that the land, including adjoining and surrounding areas, was likely filled in between the years 1947 and 1956 during urban development. Historic fill in New York City is typically characterized by contaminated soil and groundwater including heavy metals, SVOCs, pesticides, and PCBs. According to RIRs for Lots 33 and 35, historic fill is present at the Site up to ten feet below ground surface, including but not limited to elevated levels of SVOCs and metals to at least six feet below ground surface.
- Adjoining, Upgradient, and Cross-Gradient Automotive Operations: Several historic automotive repair shops were identified adjoining, upgradient, and cross-gradient of the Site. These facilities were identified by the regulatory database review, historic Sanborn maps, and city directories. The potential exists for petroleum and/or hazardous chemicals used by and stored at these facilities to have been released and migrated to the Site.
- Adjoining, Upgradient, and Cross-Gradient Industrial Operations: Several historic industrial operations were identified adjoining, upgradient, and cross-gradient of the Site. These facilities were identified by the review of historic Sanborn maps and city directories. The potential exists for hazardous chemicals and substances used by and stored at these facilities to have been released and migrated to the Site.

Limited Phase II Environmental Site Investigation, 244-246 Gold Street, Brooklyn, New York, Tenen Environmental, LLC, May 1, 2024.

Tenen completed a Limited Phase II Environmental Site Investigation (ESI) on Lots 36 and 37 in April 2024 (report dated May 1, 2024) to evaluate the quality of soil, groundwater, and soil vapor across both lots. The scope of work performed during the Limited Phase II ESI included the installation of four soil borings, the collection of four soil samples, the installation of two temporary groundwater monitoring wells, the collection of two groundwater samples, the installation of two temporary soil vapor sample points, and the collection of two soil vapor samples. All soil and groundwater samples were analyzed for VOCs, SVOCs, TAL metals, pesticides, and PCBs, and all soil vapor samples were analyzed for VOCs. A summary of the Limited Phase II ESI results on Lots 36 and 37 is included below:

Soil Results

- VOCs were not detected in exceedance of Unrestricted Use or Restricted-Residential Use SCOs in any soil samples.
- SVOCs, specifically PAHs, were detected in exceedance of Unrestricted Use and/or Restricted-Residential Use SCOs in three of four soil samples.
- A variety of metals, specifically arsenic, barium, copper, lead, mercury, and zinc, were detected in exceedance of Unrestricted Use SCOs in one or more soil samples. Of these, barium, lead, and mercury were also detected in exceedance of Restricted-Residential Use SCOs in one soil sample. This sample was also analyzed for TCLP barium and lead, of which the concentration of lead was detected in exceedance of the EPA Allowable Limit, indicating the material is hazardous for lead.
- The pesticides 4,4’-DDT, 4,4’-DDE, 4,4’-DDD, and dieldrin were detected in one or more soil samples in exceedance of Unrestricted Use SCOs, but below Restricted-Residential Use SCOs.
- Total PCBs were detected in exceedance of the Unrestricted Use SCO, but below the Restricted-Residential Use SCO, in one soil sample.

Groundwater Results

- VOCs, SVOCs, pesticides, and PCBs were not detected in exceedance of Class GA Standards in any groundwater samples.
- One metal, selenium, was detected slightly in exceedance of its Class GA Standard in total and dissolved groundwater samples collected from one monitoring well.
- A variety of naturally-occurring earth metals were detected in exceedance of Class GA Standards in total and dissolved groundwater samples collected from both monitoring wells.

Soil Vapor Results

- Three cVOCs, PCE, TCE, and carbon tetrachloride, were detected in one or more soil vapor samples at low concentrations.
- A variety of petroleum-related VOCs were detected in both soil vapor samples, with the highest concentrations generally occurring in the sample collected from Lot 37.

Draft Remedial Investigation Report, 236-246 Gold Street, Brooklyn, New York, Tenen Environmental, LLC, November 2024.

Tenen completed a Remedial Investigation at Lots 33, 35, 36 and 37 under the NYSDEC Division of Environmental Remediation (DER) Technical Guidance for Site Investigation and Remediation (DER-10, May 3, 2010) November 2024 (report dated November 2024) to further evaluate the quality of soil, groundwater, and soil vapor across the lot. The scope of work performed during the RI included the installation of seven soil characterization borings, the collection of 23 soil samples from soil characterization borings (including quality assurance/quality control [QA/QC] samples), the installation of five lead delineation borings, the collection of 14 soil samples from lead delineation borings, the installation of five permanent groundwater monitoring wells, the collection of five groundwater samples, the installation of six temporary soil vapor sample points, and the collection of six soil vapor samples and one ambient air sample. All soil samples collected from soil characterization borings were analyzed for VOCs, SVOCs, pesticides, herbicides, PCBs TAL metals, total cyanide, trivalent/hexavalent chromium, 1,4-dioxane, and PFAS; five soil samples collected from onsite lead delineation borings for TCLP lead (the remaining samples were placed on hold); and all groundwater samples were analyzed for volatile organic compounds (VOCs), semivolatile organic compounds (SVOCs), target analyte list (TAL) metals (total and dissolved for groundwater), pesticides, and polychlorinated biphenyls (PCBs); all groundwater samples were analyzed for VOCs, SVOCs, total and dissolved metals, pesticides, herbicides, PCBs, total cyanide, trivalent/hexavalent chromium, 1,4-dioxane, and PFAS; and, all soil vapor samples were analyzed for VOCs. A summary of the RI results on the Site is included below:

Soil Results

- VOCs, PCBs, and herbicides were not detected in exceedance of Unrestricted Use or Restricted-Residential Use SCOs in any soil samples.
- A variety of historic fill-related SVOCs, specifically PAHs, were detected in exceedance of Unrestricted Use and Restricted-Residential Use SCOs in five soil samples, with the highest concentrations occurring in TSB-2 (0-2) located in the eastern portion of Lot 36.
- Four pesticides, dieldrin, 4,4'-DDD, 4,4'-DDE, and 4,4'-DDT, were detected in exceedance of Unrestricted Use SCOs, but below Restricted-Residential Use SCOs, in both soil samples collected from TSB-5.
- A variety of metals, specifically arsenic, barium, cadmium, copper, lead, nickel, zinc, mercury, hexavalent chromium, and trivalent chromium were detected in exceedance of Unrestricted Use SCOs in one or more soil samples. Of these, arsenic, barium, copper, lead, and mercury were also detected in exceedance of Restricted-Residential Use SCOs in one or more samples.

- A TCLP lead hotspot detected in the western portion of Lot 36 during the April 2024 Limited Phase II ESI was horizontally and vertically delineated as part of this RI. The TCLP lead hotspot in the western portion of Lot 36 is approximately 400 SF in size and extends to a maximum depth of 2 ft-bg.
- 1,4-dioxane was not detected in any soil samples.
- Two PFAS analytes, PFOA and PFOS, were detected slightly in exceedance of their proposed Unrestricted Use and Protection of Groundwater SCOs, but below their proposed Restricted-Residential Use SCOs, in soil samples collected from various depths.

Groundwater Results

- No VOCs, SVOCs, pesticides, herbicides, or PCBs were detected above Class GA Standards in any groundwater samples.
- One metal, lead, was detected in one total groundwater sample, MW-1, slightly in exceedance of the Class GA Standard. Lead was not detected in exceedance of its Class GA Standard in any dissolved groundwater samples. Selenium was detected in one dissolved groundwater sample, MW-3, slightly in exceedance of the Class GA Standard.
- Naturally occurring earth metals manganese and sodium, were detected in total and dissolved groundwater samples across the Site.
- PFAS were detected in groundwater samples across the Site. PFOA was detected in exceedance of the Class GA Standard in all four groundwater samples and the duplicate sample and PFOS was detected in exceedance of the Class GA Standard in two groundwater samples and the duplicate sample.
- 1,4-dioxane was not detected in any groundwater samples.

Soil Vapor Results

- A variety of cVOCs, specifically PCE, TCE, cis-1,2-DCE, 1,1,1-TCA, carbon tetrachloride, 1,1-DCE, methylene chloride, and chloroform, were detected in exceedance of background concentrations in one or more soil vapor samples. The highest concentrations of cVOCs in soil vapor samples were generally detected in TSV-1 and TSV-5, collected from Lots 37 and 33, respectively.
- A variety of petroleum-related VOCs, specifically toluene, ethylbenzene, p/m-xylene, o-xylene, 1,2,4-trimethylbenzene, 1,3,5-trimethylbenzene, n-hexane, and 4-ethyltoluene, were detected soil vapor samples across the Site, with the highest concentrations generally occurring in TSV-2, located on Lot 36.
- A variety of other VOCs, including dichlorodifluoromethane, trichlorofluoromethane, propylene, styrene, 4-methyl-2-pentanone, acetone, carbon disulfide, acrylonitrile, benzyl chloride, 2-butanone, methyl methacrylate, and n-heptane were detected in exceedance of background concentrations in one or more soil vapor samples.

3.1 Human Exposure Pathways

The media of concern at the Site include potentially-impacted soil, groundwater and soil vapor. Potential exposure pathways include dermal contact, incidental ingestion and inhalation of vapors. The risk of dermal contact and incidental ingestion will be minimized through general safe work practices, a personal hygiene program and the use of PPE. The risk of inhalation will be minimized through the use of an air monitoring program for VOCs and particulates.

3.2 Chemical Hazards

Based on historic uses and the RI, the following contaminants of concern may be present at the Site:

Chlorinated Solvents and/or Solvent-Related VOCs
- PCE
- TCE

Other VOCs (including petroleum-related)
- Benzene
- Ethylbenzene
- Toluene
- Xylenes

Semivolatile Organic Compounds
- Polycyclic Aromatic Hydrocarbons

Pesticides
- 4,4-DDE; 4,4-DDD; 4,4-DDT
- Dieldrin

Polychlorinated Biphenyls

Heavy Metals
- Arsenic
- Barium
- Copper
- Lead
- Mercury

PFAS
- PFOA
- PFOS

Material Safety Data Sheets (MSDSs) for each contaminant of concern are included in Appendix C. All personnel are required to review the MSDSs included in this CHASP.

3.3 Physical Hazards

The physical hazards associated with the field activities likely present a greater risk of injury than the chemical constituents at the Site. Activities within the scope of this project shall comply with New York State and Federal OSHA construction safety standards.

Head Trauma
To minimize the potential for head injuries, field personnel will be required to wear National Institutes of Occupational Safety and Health (NIOSH)-approved hard hats during field activities. Hats must be worn properly and not altered in any way that would decrease the degree of protection provided.

Foot Trauma
To avoid foot injuries, field personnel will be required to wear steel-toed safety shoes while field activities are being performed. To afford maximum protection, all safety shoes must meet American National Standards Institute (ANSI) standards.

Eye Trauma
Field personnel will be required to wear eye protection (safety glasses with side shields) while field activities are being performed to prevent eye injuries caused by contact with chemical or physical agents.

Noise Exposure
Field personnel will be required to wear hearing protection (ear plugs or muffs) in high noise areas (noise

from heavy equipment) while field activities are being performed.

Buried Utilities and Overhead Power Lines
Boring locations will be cleared by an underground utility locator service. In addition, prior to intrusive activities, the drilling subcontractor will contact the One Call Center to arrange for a utility mark-out, in accordance with New York State requirements. Protection from overhead power lines will be accomplished by maintaining safe distances of at least 15 feet at all times.

Thermal Stress
The effects of ambient temperature can cause physical discomfort, personal injury, and increase the probability of accidents. In addition, heat stress due to lack of body ventilation caused by protective clothing is an important consideration. Heat-related illnesses commonly consist of heat stroke and heat exhaustion.

The symptoms of heat stroke include: sudden onset; change in behavior; confusion; dry, hot and flushed skin; dilated pupils; fast pulse rate; body temperature reaching 105° or more; and/or, deep breathing later followed by shallow breathing.

The symptoms of heat exhaustion include: weak pulse; general weakness and fatigue; rapid shallow breathing; cold, pale and clammy skin; nausea or headache; profuse perspiration; unconsciousness; and/or, appearance of having fainted.

Heat-stress monitoring will be conducted if air temperatures exceed 70 degrees Fahrenheit. The initial work period will be set at 2 hours. Each worker will check his/her pulse at the wrist for 30 seconds early in each rest period. If the pulse rate exceeds 110 beats per minute, the next work period will be shortened by one-third.

One or more of the following precautions will reduce the risk of heat stress on the Site:

- Provide plenty of liquids to replace lost body fluids; water, electrolytic drinks, or both will be made available to minimize the risk of dehydration and heat stress
- Establish a work schedule that will provide appropriate rest periods
- Establish work regimens consistent with the American Conference of Governmental Industrial Hygienists (ACGIH) guidelines
- Provide adequate employee training on the causes of heat stress and preventive measures

In the highly unlikely event of extreme low temperatures, reasonable precautions will be made to avoid risks associated with low temperature exposure.

Traffic
Field activities will occur near public roadways. As a result, vehicular traffic will be a potential hazard during these activities and control of these areas will be established using barricades or traffic cones. Additional staff will be assigned, as warranted, for the sole purpose of coordinating traffic. Personnel will also be required to wear high-visibility traffic vests while working in the vicinity of the public roadways and local requirements for lane closure will be observed as needed. All work in public rights-of-way will be coordinated with local authorities and will adhere to their requirements for working in traffic zones.

Hazardous Weather Conditions
All Site workers will be made aware of hazardous weather conditions, specifically including extreme heat, and will be requested to take the precautions described herein to avoid adverse health risks. All workers are encouraged to take reasonable, common sense precautions to avoid potential injury associated with possible rain or high wind, sleet, snow or freezing.

Slip, Trip and Fall
Areas at the Site may be slippery from mud or water. Care should be taken by all Site workers to avoid slip, trip, and fall hazards. Workers shall not enter areas that do not have adequate lighting. Additional portable lighting will be provided at the discretion of the HSO.

Biological Hazards
Drugs and alcohol are prohibited from the Site. Any on-site personnel violating this requirement will be immediately expelled from the site.

Any worker or oversight personnel with a medical condition that may require attention must inform the HSO of such condition. The HSO will describe appropriate measures to be taken if the individual should become symptomatic.

Due to the Site location in an urban area, it is highly unlikely that poisonous snakes, spiders, plants and insects will be encountered. However, other animals (dogs, cats, etc.) may be encountered and care should be taken to avoid contact.

4.0 COVID-19 HEALTH AND SAFETY

The following requirements apply to all Tenen employees working on project sites for the duration of the COVID-19 pandemic. These guidelines are based on information provided by the Centers for Disease Control, the Occupational Safety and Health Administration, the New York State "New York Forward" Covid-19 management plans and the December 13, 2021 Order issued by the Commissioner of the New York City Department of Health and Mental Hygiene. Information regarding the health status of Tenen employees will be kept confidential, with the exception of required notifications to health authorities. The following are guidelines. **As with any potential workplace hazard, employees should report any concerns related to potential Covid-19 exposure to the Project Manager.**

Communication/Reporting:

Employees should not report to work and should notify the Project Manager immediately in the event of the following:

- You are exhibiting flu-like symptoms (fever, body aches, cough, difficulty breathing). Contact your health care provider and follow their instructions.
- You do not exhibit symptoms but have a sick (i.e., diagnosed with Covid-19 or exhibiting flu-like symptoms) family member at home. Remember that the virus can be spread by asymptomatic individuals.
- You have been exposed to someone who has been diagnosed with Covid-19.

In each of the above cases, inform your Project Manager regarding others who may have been exposed in order to facilitate any necessary notification or contact tracing efforts.

Hygiene

- Wash hands frequently with soap and water for at least 20 seconds or use hand sanitizer with at least 60% alcohol if soap and water are not available. Key times for employees to clean their hands include:
    - Before and after work shifts
    - Before and after work breaks
    - After blowing the nose, coughing, or sneezing
    - After using the restroom
    - Before eating or preparing food
    - After putting on, touching, or removing face coverings
- Avoid touching the eyes, nose, and mouth with unwashed hands.
- Practice good respiratory etiquette, including covering coughs and sneezes.
- To the extent possible, avoid sharing tools and sampling equipment. Shared tools and equipment should be regularly disinfected.

Physical Distancing

- Minimize contact with others, maintaining a distance of at least six feet to the extent possible
- Employees should wear masks over their nose and mouth to prevent spread of the virus; this is especially important when a minimum 6-foot distance cannot be maintained.

- Maintain the 6-foot distance to the extent possible during sampling efforts and pickup and delivery of sampling equipment and containers.
- Keep job site meetings to a minimum and of short duration; limit the number of people involved and maintain social distance.

5.0 AIR MONITORING

The NYSDOH Generic Community Air Monitoring Plan (CAMP), included as Appendix 1A of DER-10, will be implemented during all ground-intrusive sampling activities if work is performed after approval of the RIWP.

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 should be performed using equipment appropriate for 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 shut down.
4. All 15-minute readings must be recorded and be available for OER 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/m3) 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/m3 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/m3 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/m3 of the upwind level and in preventing visible dust migration.

3. All readings must be recorded and be available for OER personnel to review.

6.0 PERSONAL PROTECTIVE EQUIPMENT

The personal protection equipment required for various kinds of site investigation tasks is based on 29 CFR 1910.120, Hazardous Waste Operations and Emergency Response, “General Description and Discussion of the Levels of Protection and Protective Gear” and the Centers for CDC COVID-19 “Guidelines on How to Protect Yourselves and Others”.

Tenen field personnel and other site personnel will wear Modified Level D-1 personal protective equipment. During activities such as drilling, well installation, or sampling, where there is a chance of contact with contaminated materials, Modified Level D-2 equipment will be worn. The protection will be upgraded to Level C if warranted by the results of the air monitoring. A six-foot minimum distance between individuals (both workers and non-workers) will be maintained at all times. A description of the personnel protective equipment for Levels D and C is provided below.

Modified Level D-1
Respiratory Protection: Cloth face covering
Protective Clothing: Hard hat, steel-toed shoes, long pants, nitrile gloves

Modified Level D-2
Respiratory Protection: Cloth face covering
Protective Clothing: Hard hat, steel-toed shoes, coveralls/tyvek, nitrile gloves

Level C
Respiratory Protection: Air purifying respirator with organic vapor cartridges and filters.
Protective Clothing: Same as Modified Level D-2

7.0 EXPOSURE MONITORING

7.1 Hazardous Materials

Selective monitoring of workers in the exclusion area may be conducted, as determined by the HSO, if sources of hazardous materials are identified. Personal monitoring may be conducted in the breathing zone at the discretion of the Project Manager or HSO. All monitoring will comply with the CDCs Guidance on Social Distancing.

7.2 COVID-19

For any employee that may have come into contact with a person who has COVID-19, the CDC states the following (via Media Statement, dated December 27, 2021):

If you test positive for COVID-19, isolate, regardless of vaccination status.

- Stay home for 5 days
- If you have no symptoms or your symptoms are resolving after 5 days, you can leave your house
- Continue to wear a mask around others for 5 additional days
- If you have a fever, continue to stay home until your fever resolves

If you were exposed to someone with COVID-19, quarantine.

If you:
Have been boosted
OR
Completed the primary series of Pfizer or Moderna vaccine within the last 6 months
OR
Completed the primary series of J&J vaccine within the last 2 months

- Wear a mask around others for 10 days
- Test on day 5, if possible
- If you develop symptoms get a test and stay home

If you:
Completed the primary series of Pfizer or Moderna vaccine over 6 months ago and are not boosted
OR
Completed the primary series of J&J over 2 months ago and are not boosted
OR
Are unvaccinated

- Stay home for 5 days. After that continue to wear a mask around others for 5 additional days
- If you can’t quarantine you must wear a mask for 10 days
- Test on day 5 if possible
- If you develop symptoms get a test and stay home

8.0 SITE ACCESS

Access to the Site during the investigation will be controlled by the Project Manager or HSO. Unauthorized personnel will not be allowed access to the sampling areas.

9.0 WORK AREAS

During any activities involving drilling or other subsurface disturbance, the work area must be divided into various zones to prevent the spread of contamination, clarify the type of protective equipment needed, and provide an area for decontamination.

The Exclusion Zone is defined as the area where potentially contaminated materials are generated as the result of drilling, sampling, or similar activities. The Contamination Reduction Zone (CRZ) is the area where decontamination procedures take place and is located adjacent to the Exclusion Zone. The Support Zone is the area where support facilities such as vehicles, a field phone, fire extinguisher and/or first aid supplies are located. The emergency staging area (part of the Support Zone) is the area where all Site workers will assemble in the event of an emergency. These zones shall be designated daily, depending on that day's activities. All field personnel will be informed of the location of these zones before work begins.

Control measures such as "Caution" tape and traffic cones will be placed around the perimeter of the work area when work is being done in the areas of concern (i.e., areas with exposed soil) to prevent unnecessary access.

10.0 DECONTAMINATION PROCEDURES

Personnel Decontamination

Personnel decontamination (decon), if deemed necessary by the HSO, will take place in the designated decontamination area delineated for each sampling location. Personnel decontamination will consist of the following steps:

- Soap and potable water wash and potable water rinse of gloves;
- Tyvek removal;
- Glove removal;
- Disposable clothing removal; and
- Field wash of hands and face.

Equipment Decontamination

Sampling equipment, such as split-spoons and bailers, will be decontaminated in accordance with U.S. Environmental Protection Agency methodologies, as described in the work plan.

Disposal of Materials

Purged well water, water used to decontaminate any equipment and well cuttings will be containerized and disposed off-site in accordance with federal, state and local regulations.

11.0 GENERAL SAFE WORK PRACTICES

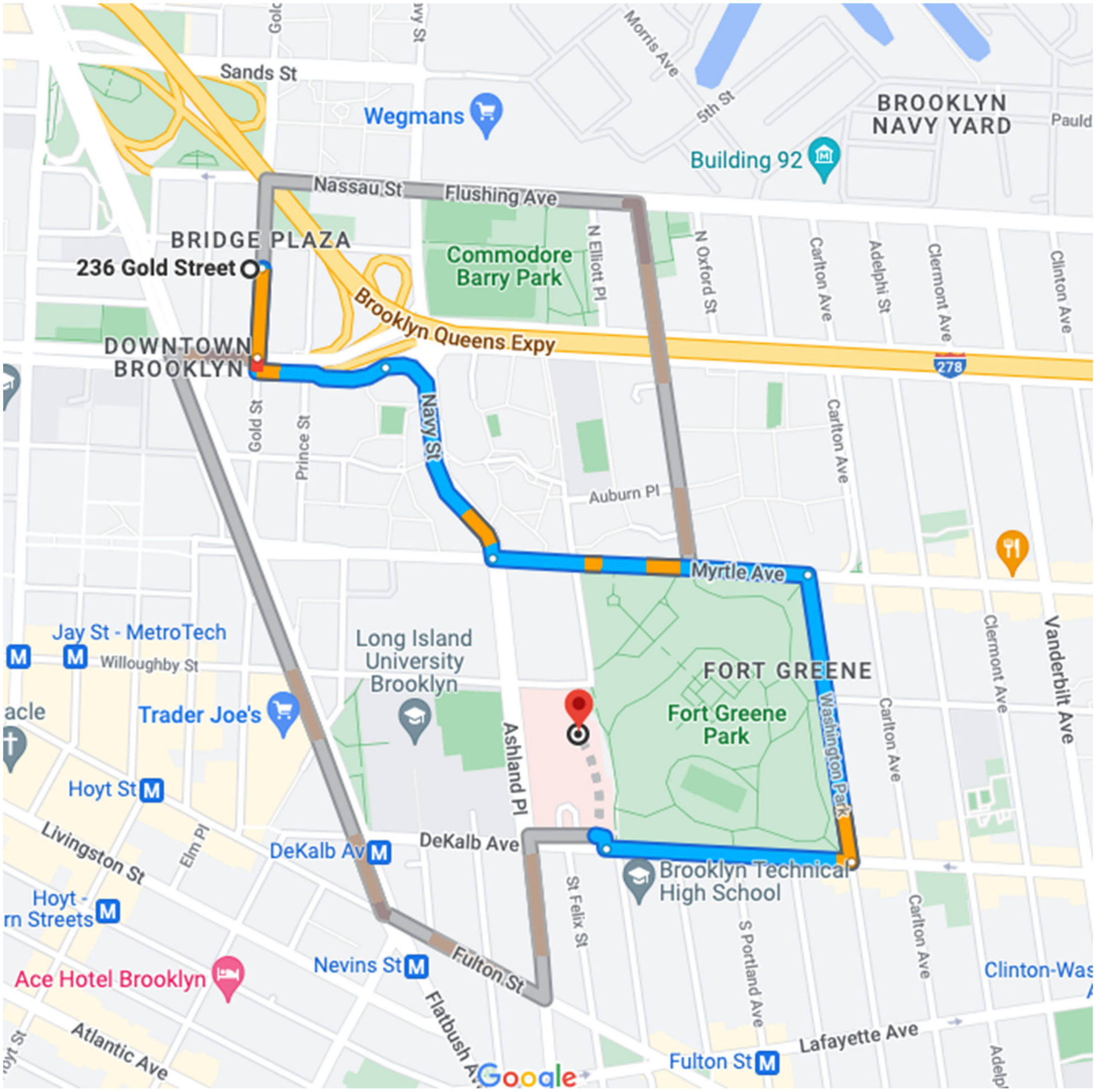
To protect the health and safety of the field personnel, all field personnel will adhere to the guidelines listed below during activities involving subsurface disturbance.

- Eating, drinking, chewing gum or tobacco, and smoking are prohibited, except in designated areas on the site. These areas will be designated by the HSO.
- Workers must wash their hands and face 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.
- Removal of potential contamination from PPE and equipment by blowing, shaking or any means that may disperse materials into the air is prohibited.
- 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 stress.
- Personnel will be cautioned to inform each other of symptoms of chemical exposure such as headache, dizziness, nausea, and irritation of the respiratory tract and heat stress.
- No excessive facial hair that interferes with a satisfactory fit of the face-piece of the respirator to the face will be allowed on personnel required to wear respiratory protective equipment.
- On-site personnel will be thoroughly briefed about the anticipated hazards, equipment requirements, safety practices, emergency procedures, and communications methods.

12.0 EMERGENCY PROCEDURES

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 HSO will determine the nature of the emergency and 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—onsite personnel should drive injured person to a hospital. **The nearest emergency room is located at The Brooklyn Hospital Center located at 121 DeKalb Avenue, Brooklyn, NY 11201. The phone number is (718) 250-8000.** The route to the hospital is shown and detailed on the next page.

12.1 Route to Hospital



Driving directions to **The Brooklyn Hospital Center: Emergency Room** from **236-246 Gold Street, Brooklyn, New York.**

Driving Directions

1. Head SOUTH on Gold Street (420 feet);
2. Turn LEFT onto Tillary Street (0.1 mile);
3. Turn RIGHT onto Navy Street (0.2 mile);
4. Turn LEFT onto Myrtle Avenue (0.3 mile);
5. Turn RIGHT onto Washington Park (0.3 mile);
6. Turn RIGHT onto DeKalb Avenue (0.2 mile); and,
7. Destination will be on the RIGHT (95 feet).

12.2 Emergency Contacts

There will be an on-site field phone. Emergency and contact telephone numbers are listed below:

Table 1 – Emergency Contacts

Ambulance	911
Emergency Room	(718) 983-8000
NYSDEC Spill Hotline	(800) 457-7362
Project Manager, Mohamed Ahmed	(917) 612-6018
On-site Personnel, Ashley Platt	(908) 892-1354

13.0 TRAINING

All personnel performing the field activities described in this CHASP will have received the initial safety training required by 29 CFR, 1910.120. Current refresher training status also will be required for all personnel engaged in field activities.

All those who enter the work area while intrusive activities are being performed must recognize and understand the potential hazards to health and safety. All field personnel must attend a training program covering the following areas:

- potential hazards that may be encountered;
- the knowledge and skills necessary for them to perform the work with minimal risk to health and safety;
- the purpose and limitations of safety equipment; and
- protocols to enable field personnel to safely avoid or escape from emergencies.

Each member of the field crew will be instructed in the above objectives before he/she goes onto the site. The HSO will be responsible for conducting the training program.

14.0 MEDICAL SURVEILLANCE

All Tenen and subcontractor personnel performing field work involving drilling or other subsurface disturbance at the site are required to have passed a complete medical surveillance examination in accordance with 29 CFR 1910.120 (f). The medical examination for Tenen employees will, at a minimum, be provided annually and upon termination of hazardous waste site work.

Appendix A

Acknowledgement of CHASP

ACKNOWLEDGMENT OF CHASP

Below is an affidavit that must be signed by all Tenen Environmental employees who enter the site. A copy of the CHASP must be on-site at all times and will be kept by the HSO.

AFFIDAVIT

I have read the Construction Health and Safety Plan (CHASP) for the 236-246 Gold Street site in Brooklyn, NY. I agree to conduct all on-site work in accordance with the requirements set forth in this CHASP and understand that failure to comply with this CHASP could lead to my removal from the site.

Signature: ________________________________ Date: _________________
Signature: ________________________________ Date: _________________
Signature: ________________________________ Date: _________________
Signature: ________________________________ Date: _________________
Signature: ________________________________ Date: _________________

Appendix B

Injury Reporting Form (OSHA Form 300)

How to Fill Out the Log

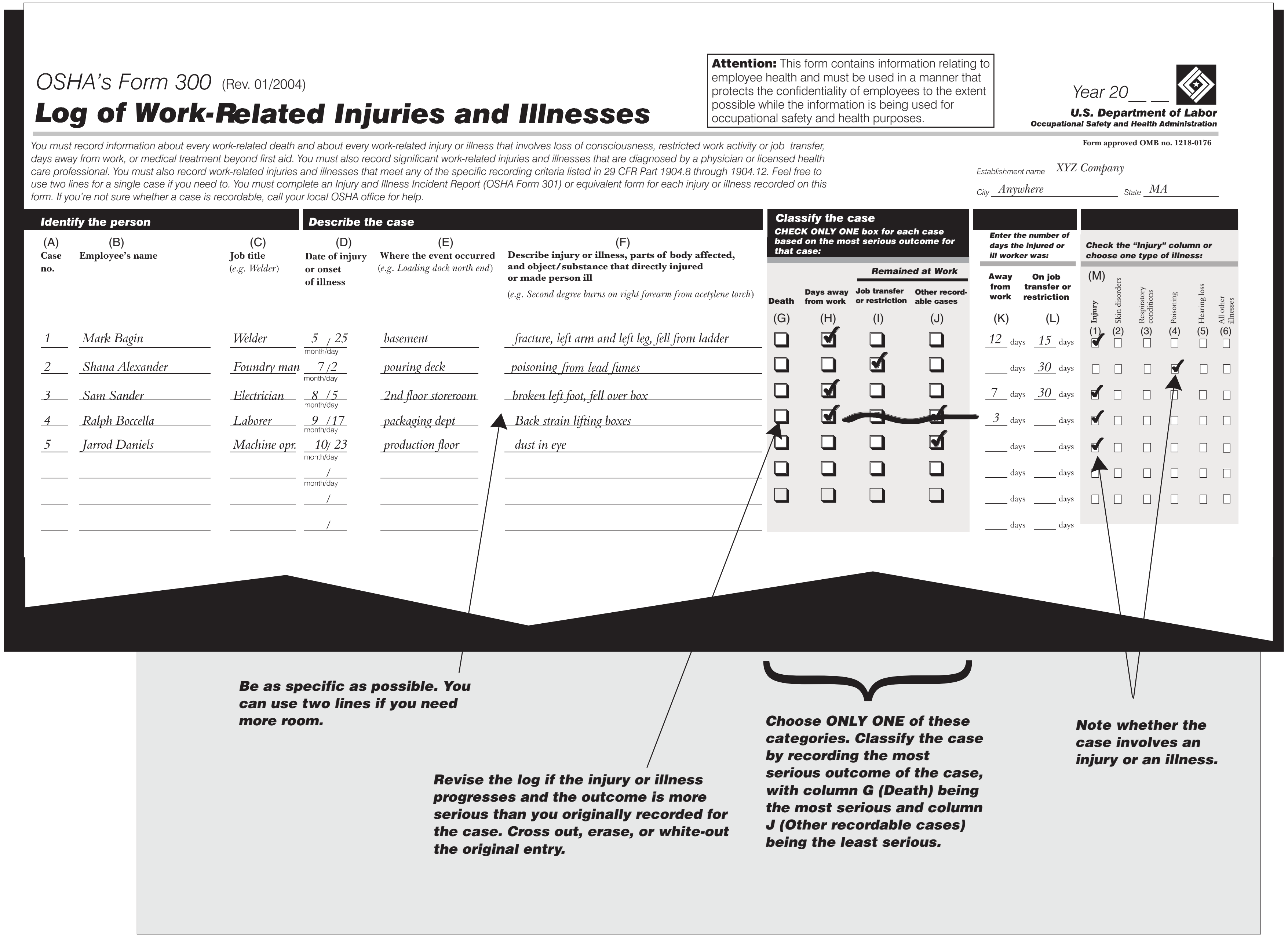
The *Log of Work-Related Injuries and Illnesses* is used to classify work-related injuries and illnesses and to note the extent and severity of each case. When an incident occurs, use the *Log* to record specific details about what happened and how it happened.

If your company has more than one establishment or site, you must keep separate records for each physical location that is expected to remain in operation for one year or longer.

We have given you several copies of the *Log* in this package. If you need more than we provided, you may photocopy and use as many as you need.

The *Summary* — a separate form — shows the work-related injury and illness totals for the year in each category. At the end of the year, count the number of incidents in each category and transfer the totals from the *Log* to the *Summary*. Then post the *Summary* in a visible location so that your employees are aware of injuries and illnesses occurring in their workplace.

You don't post the Log. You post only the Summary at the end of the year.



OSHA's Form 300 (Rev. 01/2004)

Log of Work-Related Injuries and Illnesses

Attention: This form contains information relating to employee health and must be used in a manner that protects the confidentiality of employees to the extent possible while the information is being used for occupational safety and health purposes.

Year 20__ __

U.S. Department of Labor
Occupational Safety and Health Administration

Form approved OMB no. 1218-0176

You must record information about every work-related death and about every work-related injury or illness that involves loss of consciousness, restricted work activity or job transfer, days away from work, or medical treatment beyond first aid. You must also record significant work-related injuries and illnesses that are diagnosed by a physician or licensed health care professional. You must also record work-related injuries and illnesses that meet any of the specific recording criteria listed in 29 CFR Part 1904.8 through 1904.12. Feel free to use two lines for a single case if you need to. You must complete an Injury and Illness Incident Report (OSHA Form 301) or equivalent form for each injury or illness recorded on this form. If you're not sure whether a case is recordable, call your local OSHA office for help.

Establishment name XYZ Company
City Anywhere State MA

Identify the person			Describe the case			Classify the case — CHECK ONLY ONE box for each case based on the most serious outcome for that case:				Enter the number of days the injured or ill worker was:		Check the "Injury" column or choose one type of illness:					
								Remained at Work				(M)					
(A) Case no.	(B) Employee's name	(C) Job title (e.g. Welder)	(D) Date of injury or onset of illness	(E) Where the event occurred (e.g. Loading dock north end)	(F) Describe injury or illness, parts of body affected, and object/substance that directly injured or made person ill (e.g. Second degree burns on right forearm from acetylene torch)	Death (G)	Days away from work (H)	Job transfer or restriction (I)	Other record-able cases (J)	Away from work (K)	On job transfer or restriction (L)	Injury (1)	Skin disorders (2)	Respiratory conditions (3)	Poisoning (4)	Hearing loss (5)	All other illnesses (6)
1	Mark Bagin	Welder	5 / 25 month/day	basement	fracture, left arm and left leg, fell from ladder	☐	☑	☐	☐	12 days	15 days	☑	☐	☐	☐	☐	☐
2	Shana Alexander	Foundry man	7 /2 month/day	pouring deck	poisoning from lead fumes	☐	☐	☑	☐	__ days	30 days	☐	☐	☐	☑	☐	☐
3	Sam Sander	Electrician	8 /5 month/day	2nd floor storeroom	broken left foot, fell over box	☐	☑	☐	☐	7 days	30 days	☑	☐	☐	☐	☐	☐
4	Ralph Boccella	Laborer	9 /17 month/day	packaging dept	Back strain lifting boxes	☐	☑	~~☐~~	~~☑~~	3 days	__ days	☑	☐	☐	☐	☐	☐
5	Jarrod Daniels	Machine opr.	10/ 23 month/day	production floor	dust in eye	☐	☐	☐	☑	__ days	__ days	☑	☐	☐	☐	☐	☐
			/ month/day			☐	☐	☐	☐	__ days	__ days	☐	☐	☐	☐	☐	☐
			/			☐	☐	☐	☐	__ days	__ days	☐	☐	☐	☐	☐	☐
			/							__ days	__ days						

Be as specific as possible. You can use two lines if you need more room.

Revise the log if the injury or illness progresses and the outcome is more serious than you originally recorded for the case. Cross out, erase, or white-out the original entry.

Choose ONLY ONE of these categories. Classify the case by recording the most serious outcome of the case, with column G (Death) being the most serious and column J (Other recordable cases) being the least serious.

Note whether the case involves an injury or an illness.

OSHA's Form 300 (Rev. 01/2004)

Log of Work-Related Injuries and Illnesses

Attention: This form contains information relating to employee health and must be used in a manner that protects the confidentiality of employees to the extent possible while the information is being used for occupational safety and health purposes.

Year 20__ __

U.S. Department of Labor
Occupational Safety and Health Administration

Form approved OMB no. 1218-0176

You must record information about every work-related death and about every work-related injury or illness that involves loss of consciousness, restricted work activity or job transfer, days away from work, or medical treatment beyond first aid. You must also record significant work-related injuries and illnesses that are diagnosed by a physician or licensed health care professional. You must also record work-related injuries and illnesses that meet any of the specific recording criteria listed in 29 CFR Part 1904.8 through 1904.12. Feel free to use two lines for a single case if you need to. You must complete an Injury and Illness Incident Report (OSHA Form 301) or equivalent form for each injury or illness recorded on this form. If you're not sure whether a case is recordable, call your local OSHA office for help.

Establishment name ______________________

City ______________ *State* __________

Identify the person			***Describe the case***			***Classify the case***											
						CHECK ONLY ONE box for each case based on the most serious outcome for that case:				***Enter the number of days the injured or ill worker was:***		***Check the "Injury" column or choose one type of illness:***					
								Remained at Work				(M)					
(A) Case no.	(B) Employee's name	(C) Job title (*e.g., Welder*)	(D) Date of injury or onset of illness	(E) Where the event occurred (*e.g., Loading dock north end*)	(F) Describe injury or illness, parts of body affected, and object/substance that directly injured or made person ill (*e.g., Second degree burns on right forearm from acetylene torch*)	**Death** (G)	**Days away from work** (H)	**Job transfer or restriction** (I)	**Other record-able cases** (J)	**Away from work** (K)	**On job transfer or restriction** (L)	**Injury** (1)	Skin disorder (2)	Respiratory condition (3)	Poisoning (4)	Hearing loss (5)	All other illnesses (6)
____	________	________	___/___ month/day	________	________	☐	☐	☐	☐	____ days	____ days	☐	☐	☐	☐	☐	☐
____	________	________	___/___ month/day	________	________	☐	☐	☐	☐	____ days	____ days	☐	☐	☐	☐	☐	☐
____	________	________	___/___ month/day	________	________	☐	☐	☐	☐	____ days	____ days	☐	☐	☐	☐	☐	☐
____	________	________	___/___ month/day	________	________	☐	☐	☐	☐	____ days	____ days	☐	☐	☐	☐	☐	☐
____	________	________	___/___ month/day	________	________	☐	☐	☐	☐	____ days	____ days	☐	☐	☐	☐	☐	☐
____	________	________	___/___ month/day	________	________	☐	☐	☐	☐	____ days	____ days	☐	☐	☐	☐	☐	☐
____	________	________	___/___ month/day	________	________	☐	☐	☐	☐	____ days	____ days	☐	☐	☐	☐	☐	☐
____	________	________	___/___ month/day	________	________	☐	☐	☐	☐	____ days	____ days	☐	☐	☐	☐	☐	☐
____	________	________	___/___ month/day	________	________	☐	☐	☐	☐	____ days	____ days	☐	☐	☐	☐	☐	☐
____	________	________	___/___ month/day	________	________	☐	☐	☐	☐	____ days	____ days	☐	☐	☐	☐	☐	☐
____	________	________	___/___ month/day	________	________	☐	☐	☐	☐	____ days	____ days	☐	☐	☐	☐	☐	☐
____	________	________	___/___ month/day	________	________	☐	☐	☐	☐	____ days	____ days	☐	☐	☐	☐	☐	☐
____	________	________	___/___ month/day	________	________	☐	☐	☐	☐	____ days	____ days	☐	☐	☐	☐	☐	☐
					Page totals➤	____	____	____	____	____	____	____	____	____	____	____	____
												Injury (1)	Skin disorder (2)	Respiratory condition (3)	Poisoning (4)	Hearing loss (5)	All other illnesses (6)

Be sure to transfer these totals to the Summary page (Form 300A) before you post it.

Public reporting burden for this collection of information is estimated to average 14 minutes per response, including time to review the instructions, search and gather the data needed, and complete and review the collection of information. Persons are not required to respond to the collection of information unless it displays a currently valid OMB control number. If you have any comments about these estimates or any other aspects of this data collection, contact: US Department of Labor, OSHA Office of Statistical Analysis, Room N-3644, 200 Constitution Avenue, NW, Washington, DC 20210. Do not send the completed forms to this office.

Page ___ ***of*** ___

OSHA's Form 300A (Rev. 01/2004)

Summary of Work-Related Injuries and Illnesses

Year 20__ __

U.S. Department of Labor
Occupational Safety and Health Administration

Form approved OMB no. 1218-0176

All establishments covered by Part 1904 must complete this Summary page, even if no work-related injuries or illnesses occurred during the year. Remember to review the Log to verify that the entries are complete and accurate before completing this summary.

Using the Log, count the individual entries you made for each category. Then write the totals below, making sure you've added the entries from every page of the Log. If you had no cases, write "0."

Employees, former employees, and their representatives have the right to review the OSHA Form 300 in its entirety. They also have limited access to the OSHA Form 301 or its equivalent. See 29 CFR Part 1904.35, in OSHA's recordkeeping rule, for further details on the access provisions for these forms.

Number of Cases

Total number of deaths	Total number of cases with days away from work	Total number of cases with job transfer or restriction	Total number of other recordable cases
____________	____________	____________	____________
(G)	(H)	(I)	(J)

Number of Days

Total number of days away from work	Total number of days of job transfer or restriction
____________	____________
(K)	(L)

Injury and Illness Types

Total number of . . .
(M)

(1) Injuries	______	(4) Poisonings	______
(2) Skin disorders	______	(5) Hearing loss	______
(3) Respiratory conditions	______	(6) All other illnesses	______

Post this Summary page from February 1 to April 30 of the year following the year covered by the form.

Public reporting burden for this collection of information is estimated to average 58 minutes per response, including time to review the instructions, search and gather the data needed, and complete and review the collection of information. Persons are not required to respond to the collection of information unless it displays a currently valid OMB control number. If you have any comments about these estimates or any other aspects of this data collection, contact: US Department of Labor, OSHA Office of Statistical Analysis, Room N-3644, 200 Constitution Avenue, NW, Washington, DC 20210. Do not send the completed forms to this office.

Establishment information

Your establishment name ______________________________

Street ______________________________

City ____________________ State ______ ZIP ________

Industry description (*e.g., Manufacture of motor truck trailers*)

____

Standard Industrial Classification (SIC), if known (*e.g., 3715*)

___ ___ ___ ___

OR

North American Industrial Classification (NAICS), if known (e.g., 336212)

___ ___ ___ ___ ___ ___

Employment information

(If you don't have these figures, see the Worksheet on the back of this page to estimate.)

Annual average number of employees ____________

Total hours worked by all employees last year ____________

Sign here

Knowingly falsifying this document may result in a fine.

I certify that I have examined this document and that to the best of my knowledge the entries are true, accurate, and complete.

______________________________ ______________
Company executive Title

( ) - / /
Phone Date

Optional

Worksheet to Help You Fill Out the Summary

At the end of the year, OSHA requires you to enter the average number of employees and the total hours worked by your employees on the summary. If you don't have these figures, you can use the information on this page to estimate the numbers you will need to enter on the Summary page at the end of the year.

How to figure the average number of employees who worked for your establishment during the year:

❶ ***Add*** the total number of employees your establishment paid in all pay periods during the year. Include all employees: full-time, part-time, temporary, seasonal, salaried, and hourly.

The number of employees paid in all pay periods = ❶ ____________

❷ ***Count*** the number of pay periods your establishment had during the year. Be sure to include any pay periods when you had no employees.

The number of pay periods during the year = ❷ ____________

❸ ***Divide*** the number of employees by the number of pay periods.

$\frac{❶}{❷}$ ____________ = ❸ ____________

❹ ***Round the answer*** to the next highest whole number. Write the rounded number in the blank marked *Annual average number of employees.*

The number rounded = ❹ ____________

For example, Acme Construction figured its average employment this way:

For pay period...	**Acme paid this number of employees...**
1	10
2	0
3	15
4	30
5	40
▼	▼
24	20
25	15
26	+10
	830

Number of employees paid = 830 ❶

Number of pay periods = 26 ❷

$\frac{830}{26}$ = 31.92 ❸

31.92 rounds to 32 ❹

32 is the annual average number of employees

How to figure the total hours worked by all employees:

Include hours worked by salaried, hourly, part-time and seasonal workers, as well as hours worked by other workers subject to day to day supervision by your establishment (e.g., temporary help services workers).

Do not include vacation, sick leave, holidays, or any other non-work time, even if employees were paid for it. If your establishment keeps records of only the hours paid or if you have employees who are not paid by the hour, please estimate the hours that the employees actually worked.

If this number isn't available, you can use this optional worksheet to estimate it.

Optional Worksheet

____________ ***Find*** the number of full-time employees in your establishment for the year.

X ____________ ***Multiply*** by the number of work hours for a full-time employee in a year.

____________ This is the number of full-time hours worked.

\+ ____________ ***Add*** the number of any overtime hours as well as the hours worked by other employees (part-time, temporary, seasonal)

____________ ***Round*** the answer to the next highest whole number. Write the rounded number in the blank marked *Total hours worked by all employees last year.*

U.S. Department of Labor
Occupational Safety and Health Administration

OSHA's Form 301
Injury and Illness Incident Report

Attention: This form contains information relating to employee health and must be used in a manner that protects the confidentiality of employees to the extent possible while the information is being used for occupational safety and health purposes.

U.S. Department of Labor
Occupational Safety and Health Administration

Form approved OMB no. 1218-0176

This *Injury and Illness Incident Report* is one of the first forms you must fill out when a recordable work-related injury or illness has occurred. Together with the *Log of Work-Related Injuries and Illnesses* and the accompanying *Summary*, these forms help the employer and OSHA develop a picture of the extent and severity of work-related incidents.

Within 7 calendar days after you receive information that a recordable work-related injury or illness has occurred, you must fill out this form or an equivalent. Some state workers' compensation, insurance, or other reports may be acceptable substitutes. To be considered an equivalent form, any substitute must contain all the information asked for on this form.

According to Public Law 91-596 and 29 CFR 1904, OSHA's recordkeeping rule, you must keep this form on file for 5 years following the year to which it pertains.

If you need additional copies of this form, you may photocopy and use as many as you need.

Completed by ______________________________

Title ______________________________

Phone (_______)________--___________ **Date** ____/ ____/ ____

Information about the employee

1) **Full name** ______________________________

2) **Street** ______________________________

City ____________________ **State** ________ **ZIP** __________

3) **Date of birth** _____ / _____ / _____

4) **Date hired** _____ / _____ / _____

5) ☐ **Male**
☐ **Female**

Information about the physician or other health care professional

6) **Name of physician or other health care professional** ______________________________

____

7) **If treatment was given away from the worksite, where was it given?**

Facility ______________________________

Street ______________________________

City ____________________ **State** ________ **ZIP** __________

8) **Was employee treated in an emergency room?**
☐ **Yes**
☐ **No**

9) **Was employee hospitalized overnight as an in-patient?**
☐ **Yes**
☐ **No**

Information about the case

10) **Case number from the *Log*** __________________ *(Transfer the case number from the Log after you record the case.)*

11) **Date of injury or illness** _____ / _____ / _____

12) **Time employee began work** __________________ **AM / PM**

13) **Time of event** __________________ **AM / PM** ☐ **Check if time cannot be determined**

14) ***What was the employee doing just before the incident occurred?*** **Describe the activity, as well as the tools, equipment, or material the employee was using. Be specific. *Examples:* "climbing a ladder while carrying roofing materials"; "spraying chlorine from hand sprayer"; "daily computer key-entry."**

15) ***What happened?*** **Tell us how the injury occurred. *Examples:* "When ladder slipped on wet floor, worker fell 20 feet"; "Worker was sprayed with chlorine when gasket broke during replacement"; "Worker developed soreness in wrist over time."**

16) ***What was the injury or illness?*** **Tell us the part of the body that was affected and how it was affected; be more specific than "hurt," "pain," or sore." *Examples:* "strained back"; "chemical burn, hand"; "carpal tunnel syndrome."**

17) ***What object or substance directly harmed the employee?*** ***Examples:*** **"concrete floor"; "chlorine"; "radial arm saw."** ***If this question does not apply to the incident, leave it blank.***

18) ***If the employee died, when did death occur?*** Date of death _____ / _____ / _____

Public reporting burden for this collection of information is estimated to average 22 minutes per response, including time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Persons are not required to respond to the collection of information unless it displays a current valid OMB control number. If you have any comments about this estimate or any other aspects of this data collection, including suggestions for reducing this burden, contact: US Department of Labor, OSHA Office of Statistical Analysis, Room N-3644, 200 Constitution Avenue, NW, Washington, DC 20210. Do not send the completed forms to this office.

If You Need Help...

If you need help deciding whether a case is recordable, or if you have questions about the information in this package, feel free to contact us. We'll gladly answer any questions you have.

- ▼ **Visit us online at www.osha.gov**
- ▼ **Call your OSHA Regional office and ask for the recordkeeping coordinator**

or

- ▼ **Call your State Plan office**

Federal Jurisdiction

Region 1 - 617 / 565-9860
Connecticut; Massachusetts; Maine; New Hampshire; Rhode Island

Region 2 - 212 / 337-2378
New York; New Jersey

Region 3 - 215 / 861-4900
DC; Delaware; Pennsylvania; West Virginia

Region 4 - 404 / 562-2300
Alabama; Florida; Georgia; Mississippi

Region 5 - 312 / 353-2220
Illinois; Ohio; Wisconsin

Region 6 - 214 / 767-4731
Arkansas; Louisiana; Oklahoma; Texas

Region 7 - 816 / 426-5861
Kansas; Missouri; Nebraska

Region 8 - 303 / 844-1600
Colorado; Montana; North Dakota; South Dakota

Region 9 - 415 / 975-4310

Region 10 - 206 / 553-5930
Idaho

State Plan States

Alaska - 907 / 269-4957

Arizona - 602 / 542-5795

California - 415 / 703-5100

*Connecticut - 860 / 566-4380

Hawaii - 808 / 586-9100

Indiana - 317 / 232-2688

Iowa - 515 / 281-3661

Kentucky - 502 / 564-3070

Maryland - 410 / 527-4465

Michigan - 517 / 322-1848

Minnesota - 651 / 284-5050

Nevada - 702 / 486-9020

*New Jersey - 609 / 984-1389

New Mexico - 505 / 827-4230

*New York - 518 / 457-2574

North Carolina - 919 / 807-2875

Oregon - 503 / 378-3272

Puerto Rico - 787 / 754-2172

South Carolina - 803 / 734-9669

Tennessee - 615 / 741-2793

Utah - 801 / 530-6901

Vermont - 802 / 828-2765

Virginia - 804 / 786-6613

Virgin Islands - 340 / 772-1315

Washington - 360 / 902-5554

Wyoming - 307 / 777-7786

*Public Sector only

U.S. Department of Labor
Occupational Safety and Health Administration

Appendix C

Material Safety Data Sheets (MSDS)

Arsenic - ToxFAQs™

CAS # 7440-38-2

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

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

What is arsenic?

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

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

What happens to arsenic when it enters the environment?

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

How might I be exposed to arsenic?

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

How can arsenic affect my health?

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

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

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

Skin contact with inorganic arsenic may cause redness and swelling.

Almost nothing is known regarding health effects of organic arsenic compounds in humans. Studies in animals show that some simple organic arsenic compounds are less toxic than inorganic forms. Ingestion of methyl and dimethyl compounds can cause diarrhea and damage to the kidneys.

How likely is arsenic to cause cancer?

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

How can arsenic affect children?

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

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

How can families reduce the risks of exposure to arsenic?

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

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

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

Has the federal government made recommendations to protect human health?

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

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

References

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

Where can I get more information?

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

Phone: 1-800-232-4636

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

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

ATSDR
AGENCY FOR TOXIC SUBSTANCES
AND DISEASE REGISTRY

BARIUM

CAS # 7440-39-3

Division of Toxicology and Human Health Sciences ToxFAQs™ June 2013

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

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

What is barium?

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

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

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

What happens to barium when it enters the environment?

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

How might I be exposed to barium?

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

How can barium affect my health?

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

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

How likely is barium to cause cancer?

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

How can barium affect children?

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

How can families reduce the risk of exposure to barium?

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

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

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

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

Has the federal government made recommendations to protect human health?

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

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

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

References

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

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

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

Benzene - ToxFAQs™

What is benzene?

Benzene is a colorless liquid with a petroleum-like odor. It evaporates into the air very quickly and dissolves in water. It is highly flammable. Benzene is made naturally in the environment from burning wood and volcanic activity. It is also found in human-made sources like cigarette smoke and motor vehicle exhaust.

Benzene is used in industry as a solvent and to make other products such as plastics, nylon resins, detergents, paint removers, and rubber goods. Benzene is especially important for unleaded gasoline because of its anti-knock characteristics.

What happens to benzene in the environment?

Benzene can enter the environment naturally from forest fires, volcanic activity, or oil coming to the earth's surface. Benzene also gets into the environment from motor vehicle exhaust, tobacco smoke, gas station operations, and industries that use or make benzene.

In the air, benzene breaks down within a few days. It may also be removed from the air by rain or snow and go back to the ground. Benzene quickly evaporates from surface water and soil into the air. Benzene is able to travel through the soil and can get into groundwater. It is not expected to accumulate in plants or animals.

How can I be exposed to benzene?

The most common ways to be exposed to benzene are by smoking cigarettes or breathing in cigarette smoke from other people (second-hand smoke). Motor vehicle exhaust and gasoline contain benzene, so if you breathe in contaminated air, particularly in areas with heavy motor vehicle traffic or around gas stations, you may be exposed to benzene. Inside your home, benzene can be released from gas stoves and ovens, and from fuel or wood-based heat sources such as fireplaces.

If you live around manufacturing plants that produce or use benzene, or around landfills and hazardous waste sites that contain benzene, you may be exposed. Underground fuel tanks can leak and release benzene vapors that can move into homes. Firefighters, gasoline station workers, and dry cleaners maybe be exposed to higher levels of benzene.

How can benzene affect my health?

Breathing in benzene for a long period of time can affect your blood cells and bone marrow. Reduced numbers of red blood cells and white blood cells have been seen in workers exposed to benzene. This can lead to anemia and reduce your ability to fight off diseases and infections. These changes were also seen in animals after breathing in benzene and after eating benzene for a long period of time.

Exposure to benzene can decrease the number of red and white blood cells. Long-term exposure may also cause leukemia.

Benzene

Can benzene cause cancer?

In people, exposure to benzene for a long period of time can result in bone marrow cancers, including acute myelogenous leukemia.

Studies in animals show that rats and mice exposed to benzene develop tumors at many sites in their body, and like humans, can develop leukemia.

The U.S. Department of Health and Human Services (DHHS) considers benzene as a known human carcinogen (able to cause cancer).

The U.S. Environmental Protection Agency (EPA) has classified benzene as a known human carcinogen.

The International Agency for Research on Cancer (IARC) has classified benzene as carcinogenic to humans.

Can I get a medical test to check for benzene?

There is a test for measuring benzene in the breath; this test must be done shortly after exposure. Benzene and its breakdown products can also be detected in the urine. These tests cannot predict whether you will have health problems from the exposure. Doctor's offices do not routinely offer these tests. If you think you have been exposed to benzene, or any other chemical, talk to your doctor or nurse or call poison control.

How can I protect myself and my family from benzene?

Avoid smoking and keep away from areas where your or your children may be exposed to secondhand smoke. If you have an attached garage to your house, do not store gasoline cans in the garage. Avoid breathing in smoke from fires. Try to limit your time in heavily traffic areas to minimize exposure to automobile exhaust. Do not allow your children to play near a facility that uses benzene or around landfills.

For more information:

Call **CDC-INFO** at 1-800-232-4636, or submit your question online at https://wwwn.cdc.gov/dcs/ContactUs/Form

Go to ATSDR's Toxicological Profile for Benzene: https://wwwn.cdc.gov/TSP/ToxProfiles/ToxProfiles.aspx?id=40&tid=14

Go to ATSDR's Toxic Substances Portal: https://wwwn.cdc.gov/TSP/index.aspx

Find & contact your ATSDR Regional Representative at http://www.atsdr.cdc.gov/DRO/dro_org.html

Copper - ToxFAQs™

What is copper?

Copper (Cu) is an element and metal. It is found in rocks, soils, water, and air. Copper is an essential nutrient for humans and is in many foods. It is also essential to animals and plants. Copper and substances containing copper are used in many industries in the United States. Copper can be found in materials and products such as wiring, plumbing, pesticides, cookware, and dietary supplements, among others. Copper scrap can be combined with other metals to make brass and bronze pipes. In the United States, copper is mined and recovered from metal through smelting.

What happens to copper in the environment?

- Copper is released from natural sources, such as windblown dusts and decaying vegetation, and from human activities like municipal solid waste management and fossil fuel burning.
- In air, copper usually attaches to particles (particulate matter) and can travel far from its source.
- In water, copper will usually attach to soils if possible, or dissolve.
- Copper attaches to soils, where it can be taken up by plants.
- Mollusks, such as clams and oysters, can build up copper in their bodies.
- Copper does not break down in the environment.

Ingesting copper in food is necessary for human health. Too much copper can be harmful.

How can I be exposed to copper?

- People ingest copper from drinking water and food, inhale copper from air, and may touch copper or products that contain copper.
- Drinking water can contain high levels of copper if your home has copper pipes and acidic water. This is more likely to occur in new or recently renovated buildings/homes using copper plumbing.
- Blue copper sulfate crystals can be used to control algae in ponds and have been accidentally ingested by people who confused them for candy or toys.
- You may be exposed to copper particles in air if you work or live near a site that uses copper in mining or agriculture or in a facilitity that processes copper.
- Soils near mines, processing facilities, or waste dump sites may have a lot of copper.

How can copper affect my health?

It is essential for people to ingest small amounts of copper every day in food and water. Ingesting too much or too little copper can lead to illness and/or disease. Ingesting a high amount of copper, usually in drinking water, can cause vomiting, nausea, abdominal pain, and/or diarrhea. Ingesting higher than recommended amounts of copper every day over time, such as in water or in copper supplements, can lead to severe illness, such as kidney and liver damage.

Breathing in copper dusts, sprays, or crystals can irritate your nose and throat and cause dizziness and headaches. People who have ingested these substances have gotten very sick and/or died.

Copper is essential to the development of babies and children and is found in breast milk. Babies and children are expected to have symptoms similar to adults when exposed to high levels of copper in air, water, or food. If you have a disorder that causes copper to build up in your body, like Wilson's disease, you may be especially vulnerable to high copper levels in air, food, or water.

Copper

Can copper cause cancer?

The U.S. Department of Health and Human Services (DHHS) has not evaluated the carcinogenicity (whether it causes cancer) of copper.

The U.S. Environmental Protection Agency (EPA) has not evaluated the carcinogenicity of copper.

The International Agency for Research on Cancer (IARC) has not evaluated the carcinogenicity of copper. IARC lists copper 8-hydroxyquinoline as a group 3 agent, indicating that the carcinogenicity in humans cannot be classified due to lack of cancer studies in humans and animals.

Can I get a medical test to check for copper?

There are tests to measure the amount of copper in your blood, urine, nails, and hair. Your medical provider can help decide if a test is needed and which is the most appropriate for you. High levels of copper in these tests can show if you have been exposed to a lot of copper or if there is a problem with copper regulation in the body. These tests will not predict if you will have health problems. These tests are not part of standard health tests that are done at your doctor's office and are done through a special lab. If you think you may have been exposed to high levels of copper, talk to your doctor, nurse, or clinic, or call poison control.

How can I protect my family from copper exposure?

If your water is metallic or bitter in taste or smell and/or is green-blue in color, this may be a sign that there is too much copper in your drinking water. If you have copper piping, it can leach into water if your home is new or recently renovated or if your water is corrosive (acidic). Regularly cleaning or flushing out your system can help avoid this. There are tests available to check if your water is acidic or if copper levels in your water are high.

Safely store copper powders, crystals, or dusts away from children, pets, or other adults.

Monitor your copper intake if you are adding more copper to your diet, such as by taking dietary supplements with copper, to make sure you are not eating too much. Talk to your doctor, nurse, or clinic to figure out if you are taking the proper amount of copper.

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

For more information:

Call **CDC-INFO** at 1-800-232-4636, or submit your question online at https://wwwn.cdc.gov/dcs/ContactUs/Form

Go to ATSDR's Toxicological Profile for Copper: https://wwwn.cdc.gov/TSP/ToxProfiles/ToxProfiles.aspx?id=206&tid=37

Go to ATSDR's Toxic Substances Portal: http://www.atsdr.cdc.gov/substances/index.asp

Find & contact your ATSDR Regional Representative at http://www.atsdr.cdc.gov/DRO/dro_org.html

DDT, DDE, and DDD - ToxFAQs™

What are DDT, DDE, and DDD?

DDT (dichlorodiphenyltrichloroethane) is a man-made chemical that does not occur naturally in the environment. It is a white, crystalline solid with no odor or taste. DDE (dichlorodiphenyldichloroethylene) and DDD (dichlorodiphenyldichloroethane) are chemicals similar to DDT that can form when DDT breaks down.

DDT is a pesticide that was once widely used to control insects in agriculture and insects that carry diseases such as malaria. Its use was banned in 1972 because of damage to wildlife but is still used in a limited number of countries where diseases such as malaria are a major health problem. 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 to treat cancer of the adrenal gland.

What happens to DDT, DDE, and DDD in the environment?

DDT can get into the environment when it is used as a pesticide. DDE and DDD form when DDT breaks down. These chemicals can evaporate into the air from water and moist soil and may then be carried to locations very far from the original source. They can be removed from the air by rain and snow or be broken down by sunlight. DDT, DDE, and DDD stick strongly to the soil and are not likely to move into the groundwater. Microorganisms in the soil slowly break down DDT (it can take anywhere from 2 to 15 years to break down half of the DDT). DDT does not dissolve easily in water and is mostly found in the sediment on the bottom of bodies of water. DDT, DDE, and DDD can build up in plants and animals.

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

Most people are not likely to be exposed to DDT, DDE, or DDD. The most common way to be exposed to small amounts of these chemicals is from eating contaminated food such as meat, fish, poultry, and dairy products. If you live near a hazardous waste site, you might be exposed to DDT, DDE, and DDD from contaminated air, dirt, or water.

Since DDT was banned in 1972, exposure to DDT, DDE, and DDD has decreased dramatically. Small amounts may still be found in some food.

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

People who accidentally swallowed large amounts of DDT had tremors, headaches, nausea, and seizures. These effects went away after the exposure stopped. No effects were seen in volunteers who took a small daily dose of DDT by capsule for 18 months. Studies have shown that women with high amounts of DDE in their blood were more likely to have a premature baby or a baby with a wheeze. Exposure to DDT may also increase chances of developing Type II diabetes mellitus in some groups of people.

Animal studies generally used higher amounts of DDT, DDE, and DDD than you would likely be exposed to in the United States. In studies where animals were fed DDT, DDE, or DDD, harmful effects were seen on their nervous system, liver, and reproductive system (including decreased fertility).

Can DDT, DDE, and DDD cause cancer?

Studies have shown that people with higher levels of DDT in their blood have an increased risk of developing liver cancer. Liver cancer was also seen in animals that were fed DDT over a long period of time.

The U.S. Department of Health and Human Services (DHHS) has determined that DDT may reasonably be anticipated to be a human carcinogen (causing cancer in people).

The U.S. Environmental Protection Agency (EPA) has classified DDT, DDE, and DDD as probable human carcinogens.

The International Agency for Research on Cancer (IARC) determined DDT may possibly cause cancer in humans.

Can I get a medical test to check for DDT, DDE, and DDD?

Tests are available to measure levels of DDT, DDE, and DDD in the blood, hair, and breast milk.

These tests cannot predict whether you will have health problems from the exposure to DDT, DDE, and DDD. Doctor's offices do not routinely offer these tests.

How can I protect myself and my family from DDT, DDE, and DDD?

Most people don't need to take any special steps to avoid DDT, DDE, and DDD in their daily lives. Washing fruits and vegetable that come from foreign countries will remove most DDT if any is present. Children should avoid playing in dirt or water near hazardous waste sites to avoid coming in contact with these chemicals.

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

For more information:

Call **CDC-INFO** at 1-800-232-4636, or submit your question online at https://wwwn.cdc.gov/dcs/ContactUs/Form

Go to ATSDR's Toxicological Profile for DDT, DDE, and DDD: https://wwwn.cdc.gov/TSP/ToxProfiles/ToxProfiles.aspx?id=81&tid=20

Go to ATSDR's Toxic Substances Portal: https://wwwn.cdc.gov/TSP/index.aspx

Find & contact your ATSDR Regional Representative at http://www.atsdr.cdc.gov/DRO/dro_org.html

Aldrin and Dieldrin - ToxFAQs™

What are aldrin and dieldrin?

Aldrin and dieldrin are insecticides (products that kill insects) that are very similar. They are also called pesticides because they kill insects that are pests, such as termites. Pure aldrin and dieldrin are white powders with a mild chemical odor. They are not found naturally in the environment. Aldrin quickly breaks down to dieldrin in the body and also in the environment.

Aldrin and dieldrin were widely used as pesticides for crops like corn, cotton, and citrus fruit from the 1950s until 1970. They were also used to control termites until 1989. These chemicals have not been manufactured or approved for used since 1990.

What happens to aldrin and dieldrin in the environment?

Low levels of aldrin and dieldrin have been measured in soil, sediment, surface water, and groundwater. Sunlight and bacteria change aldrin to dieldrin so that we mostly find dieldrin in the environment.

Aldrin and dieldrin bind tightly to soil and slowly evaporate to the air. Dieldrin in soil and water breaks down very slowly. Plants take in and store aldrin and dieldrin from the soil.

How can I be exposed to aldrin and dieldrin?

Most people are not likely to be exposed to aldrin and dieldrin. The most likely way you could be exposed to small amounts of these chemicals is from eating food (root crops, dairy products, and meat) grown in contaminated soil, drinking contaminated water, or possibly through lactation. Homes treated for termites before 1989 with aldrin or dieldrin may still have low levels of these chemicals in the soil. In these cases, there is a potential for movement from soil into indoor air through cracks and crevices in foundation structure. If you live near a hazardous waste site, you might be exposed to aldrin and dieldrin from contaminated air, dirt, or water.

Most people are not likely to be exposed to aldrin or dieldrin

How can aldrin and dieldrin affect my health?

People who on purpose or accidently ate large amounts of aldrin or dieldrin have suffered convulsions (spasms), and some died. Workers who were exposed to lower amounts of these chemicals, but for a longer period of time, had headaches, dizziness, irritability, vomiting, and uncontrolled muscle movement. Once they were away from exposure to these chemicals, the workers got better quickly. Because these chemicals can build up in the body, health effects can happen after a longer period of exposure, even to smaller amounts.

In animal studies, animals fed high and low amounts of aldrin or dieldrin had convulsions, tremors, learning problems, liver damage, and reproduction problems. When pregnant animals were fed aldrin or dieldrin, their pups (babies) were less likely to survive. It is not known if these same effects would happen in people. The amount of aldrin or dieldrin that causes these effects in animals is much higher than is expected to be found in the environment.

Aldrin and Dieldrin

Can aldrin and dieldrin cause cancer?

In animals, aldrin and dieldrin have been shown to cause liver cancer when fed to mice.

The U.S. Department of Health and Human Services (DHHS) has not evaluated the carcinogenicity of aldrin or dieldrin.

The U.S. Environmental Protection Agency (EPA) has classified aldrin and dieldrin as *probable human carcinogens* (Group B2).

The International Agency for Research on Cancer (IARC) has categorized dieldrin and aldrin metabolized to dieldrin as *probably carcinogenic to humans* (Group 2A).

Can I get a medical test to check for exposure to aldrin and dieldrin?

Aldrin is quickly changed into dieldrin in the body, so the amount of dieldrin is usually measured. Tests to measure the amount of dieldrin in the blood might help see if someone was exposed.

These tests cannot predict whether you will have health problems from the exposure to aldrin or dieldrin. Doctor's offices do not routinely offer these tests. If you think you have been exposed, call your doctor, nurse, or poison control.

How can I protect myself and my family from aldrin and dieldrin?

Most people don't need to take any special steps to avoid aldrin and dieldrin in their daily lives. People living near sites contaminated with aldrin or dieldrin can reduce their exposure by washing their hands, scrubbing vegetables grown close to the ground, and limiting intake of vegetables grown in contaminated soil. Keep children from playing in the dirt or water near hazardous waste sites to avoid coming in contact with these chemicals.

For more information:

Call **CDC-INFO** at 1-800-232-4636, or submit your question online at https://wwwn.cdc.gov/dcs/ContactUs/Form

Go to ATSDR's Toxicological Profile for Aldrin and Dieldrin:

https://wwwn.cdc.gov/TSP/ToxProfiles/ToxProfiles.aspx?id=317&tid=56

Go to ATSDR's Toxic Substances Portal: https://wwwn.cdc.gov/TSP/index.aspx

Find & contact your ATSDR Regional Representative at http://www.atsdr.cdc.gov/DRO/dro_org.html

Ethylbenzene- ToxFAQs™

CAS # 100-41-4

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

HIGHLIGHTS: 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. Breathing lower levels has resulted in hearing effects and kidney damage in animals. Ethylbenzene has been found in at least 829 of 1,699 National Priorities List (NPL) sites identified by the Environmental Protection Agency (EPA).

What is ethylbenzene?

Ethylbenzene is a colorless, flammable liquid that smells like gasoline.

It is naturally found in coal tar and petroleum and is also found in manufactured products such as inks, pesticides, 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.
- In surface water, ethylbenzene breaks down by reacting with other chemicals found naturally in water.
- Ethylbenzene can move through soil into groundwater.
- In soil, it is broken down by bacteria.

How might I be exposed to ethylbenzene?

- If you live in a city or near many factories or heavily traveled highways, you may be exposed to ethylbenzene in air.
- Releases of ethylbenzene into the air occur from burning oil, gas, and coal and from industries using ethylbenzene.
- Ethylbenzene is not often found in drinking water. Higher levels may be found in residential drinking water wells near landfills, waste sites, or leaking underground fuel storage tanks.
- Exposure can occur if you work in an industry where ethylbenzene is used or made.
- Exposure can occur if you use products containing it, such as gasoline, carpet glues, varnishes, and paints.

How can ethylbenzene affect my health?

Exposure to high levels of ethylbenzene in air for short periods can cause eye and throat irritation. Exposure to higher levels can result in dizziness.

Irreversible damage to the inner ear and hearing has been observed in animals exposed to relatively low concentrations of ethylbenzene for several days to weeks.

Exposure to relatively low concentrations of ethylbenzene in air for several months to years causes kidney damage in animals.

How likely is ethylbenzene to cause cancer?

The International Agency for Research on Cancer (IARC) has determined that ethylbenzene is a possible human carcinogen.

CS265956-A

Ethylbenzene

CAS # 100-41-4

How does ethylbenzene affect children?

There are no studies evaluating the effects of ethylbenzene exposure on children or immature animals. It is likely that children would have the same health effects as adults. We do not know whether children would be more sensitive than adults to the effects of ethylbenzene.

We do not know if ethylbenzene will cause birth defects in humans. Minor birth defects and low birth weight have occurred in newborn animals whose mothers were exposed to ethylbenzene in air during pregnancy.

How can families reduce the risk of exposure to ethylbenzene?

- Use adequate ventilation to reduce exposure to ethylbenzene vapors from consumer products such as gasoline, pesticides, varnishes and paints, and newly installed carpeting.
- Sometimes older children sniff household chemicals, including ethylbenzene, in an attempt to get high. Talk with your children about the dangers of sniffing chemicals.
- 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 that 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.

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. Because these substances leave the body very quickly, this test needs to be done within a few hours after exposure occurs.

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 determined that exposure to ethylbenzene in drinking water at concentrations of 30 mg/L for 1 day or 3 mg/L for 10 days is not expected to cause any adverse effects in a child.

The EPA has determined that lifetime exposure to 0.7 mg/L ethylbenzene is not expected to cause any adverse effects.

The Occupational Health and Safety Administration (OSHA) has limited workers' exposure to an average of 100 ppm for an 8-hour workday, 40-hour workweek.

References

Agency for Toxic Substances and Disease Registry (ATSDR). 2010. Toxicological Profile for Ethylbenzene. Atlanta, GA: U.S. Department of Health and Human Services, Public Health Service.

Where can I get more information?

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

Phone: 1-800-232-4636

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

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

Lead - ToxFAQs™

What is lead?

Lead is a metal found naturally in the earth's crust. It can be found in all parts of our environment, including air, water, and soil. Lead can combine with other chemicals to make different compounds.

Lead is used in the production of batteries, ammunition, and metal products (solder and pipes). Because of health concerns, the use of lead in paints, ceramic products, caulking, and pipe solder has been dramatically reduced. The use of lead as an additive to automobile gasoline was banned in 1996 in the United States.

What happens to lead in the environment?

- Lead is an element, so it does not break down.
- When lead is released into the air, it may be transported long distances before it lands and stays on the ground.
- Once on the ground, lead can often stick to soil particles.
- Lead in soil can get into groundwater, but the amount of lead that moves into groundwater will depend on the lead compound and soil type.

How can I be exposed to lead?

- Eating food or drinking water that contains lead.
- Drinking water from pipes that were soldered with lead can cause exposure.
- Spending time or living in homes with lead-based paints can result in exposure when the paint breaks down and forms dust, which can get on your hands, or into your mouth and nose and be swallowed.
- Spending time in areas where the soil is contaminated with lead.
- Working in a job where lead is used or participating in certain hobbies where lead is used, such as making stained glass.
- Using healthcare products from other countries, alternative treatments, or folk remedies.

Lead can cause health problems in almost every organ and system in your body.

How can lead affect my health?

The effects of lead are the same whether it enters the body by breathing it in or eating it. Lead can affect almost every organ and system in your body. The nervous system is the main target for lead poisoning in children and adults. Long-term exposure can result in decreased learning, memory, and attention, and weakness in fingers, wrists, or ankles. Lead exposure can cause anemia (low iron in the blood) and damage to the kidneys. It can also cause increases in blood pressure, particularly in middle-aged and older individuals. Exposure to high lead levels can severely damage the brain and kidneys and can cause death. In pregnant women, exposure to high levels of lead may cause a miscarriage. In men, it can cause damage to reproductive organs.

Lead

How can lead affect children?

Children are more vulnerable to lead poisoning than adults because their nervous system is still developing. Children can be exposed to lead in their environment and before birth from lead in their mother's body. At lower levels of exposure, lead can decrease mental development, especially learning, intelligence, and behavior. Physical growth may also be decreased. A child who swallows large amounts of lead may develop anemia, severe stomachache, muscle weakness, and brain damage. Exposure to lead during pregnancy can also result in premature births. Some effects of lead poisoning in a child may continue into adulthood.

Can lead cause cancer?

Several agencies and organizations both in the United States and internationally have reviewed studies and made an assessment about whether lead can cause cancer.

- The Department of Health and Human Services (HHS) has determined that lead and lead compounds are reasonably anticipated to be human carcinogens (causing cancer in people).
- The U.S. Environmental Protection Agency (EPA) has classified lead as 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.

Can I get a medical test to check for lead?

A blood test is available to measure the amount of lead in your blood. Blood tests are commonly used to screen children for lead poisoning. Your doctor can draw blood samples and send them to appropriate laboratories for analysis. If you think you or anyone in your family has been exposed to lead, contact your doctor, nurse, or poison control center.

How can I protect my family from lead exposure?

- 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 your home contains lead-based paint (built before 1978), or if 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 to remove lead dust and lead tracked in soil.
- Certain water pipes may contain lead, so if you know that pipes have lead solder, you should avoid drinking from that source.
- Check for lead in some products such as toys and jewelry and avoid such products.
- Lead is sometimes in candies imported from other countries or traditional home remedies; find out if yours has any lead and avoid using these products or giving them to children.
- You can learn more about preventing lead poisoning here: https://www.cdc.gov/nceh/lead/faqs/lead-faqs.htm

Want more information?

Call **CDC-INFO** at 1-800-232-4636, or submit your question online at https://wwwn.cdc.gov/dcs/ContactUs/Form

Go to ATSDR's Toxicological Profile for Lead

CDC Lead Poisoning Prevention Program https://www.cdc.gov/nceh/lead/default.htm

Environmental Protection Agency https://www.epa.gov/lead/protect-your-family-exposures-lead

Go to ATSDR's Toxic Substances Portal: https://wwwn.cdc.gov/TSP/index.aspx

If you have any more questions or concerns, you can also find & contact your ATSDR Regional Representative at http://www.atsdr.cdc.gov/DRO/dro_org.html

Mercury - ToxFAQs™

What is mercury?

Mercury is a naturally occurring element with a chemical symbol of Hg. Elemental mercury is a silver liquid at room temperature that can also evaporate into the air as a gas or become a solid at very low temperatures. It can combine with other substances to form solid compounds that are categorized into two groups: inorganic mercury salts and organic mercury compounds. Mercury and mercury compounds are odorless.

Mercury is used in a number of industries and products. It is primarily used in the manufacture of electronics, fluorescent-lighting, and production of chlorine-caustic soda. It is also used in dental products (fillings), although uses in dentistry are being phased-out. Other historical uses of mercury (batteries; thermometers and other scientific and medical devices; electronic switches and lighting applications; paints and pigments; fungicides and pesticides) have been eliminated or drastically reduced.

What happens to mercury in the environment?

Because mercury is a naturally occurring element, it can be found in the air, water, or soil. It can also be found in the environment due to industrial releases to air and water. Industrial releases to air have steadily decreased over the past few decades.

Mercury does not break down in the environment. In air, mercury may spread far from where it was released. Mercury seldom appears as a silver liquid in the environment. In water, mercury can evaporate into the air. In soil, it can adhere (stick) to soil and sediments (dirt deposits at the bottom of bodies of water). One type of organic mercury compound called methylmercury can build up in plants and fish.

How can I be exposed to mercury?

Most people are exposed to organic mercury compounds (typically methylmercury) in food (such as fish, seafood, rice) or to elemental mercury from dental fillings. Food is the most common form of exposure. Most people are not exposed to inorganic mercury salts. Industrial and dental workers who use mercury are primarily exposed to elemental mercury. Some cultures use mercury in traditional medicines or religious practices, although this is not recommended or approved for use in the United States.

How can mercury affect my health?

All forms of mercury can affect the nervous system and the kidneys. Workers exposed to elemental mercury vapor and people who eat foods with high levels of methylmercury experienced tremors, incoordination, impaired vision, impaired learning and memory, and mood changes. Some children born in communities that ate food with high levels of organic mercury had learning, sensory, and movement problems. In people exposed to high levels of methylmercury in their diets, birth defects have occurred. Some humans and animals that ate mercury compounds had high blood pressure and alterations in their immune systems. Animals that breathed elemental mercury vapor or ate organic or inorganic mercury compounds in their diets showed nervous system effects and/or kidney damage. Animals that ate high levels of mercury compounds showed decreased fertility and/or birth defects.

Mercury can affect the nervous system and kidneys. The health effects from exposure to mercury depend on a number of factors including the amount and form of mercury, route and length of exposure, and age.

Can mercury cause cancer?

Rats that ate an inorganic mercury compound for a long period of time developed stomach or thyroid cancer. Rats and mice that aate organic mercury compounds for a long period of time developed kidney cancer.

The U.S. Department of Health and Human Services (DHHS) has not evaluated the potential of mercury or mercury compounds to cause cancer in people.

The U.S. Environmental Protection Agency (EPA) has determined that mercuric chloride (inorganic mercury salt) and methylmercury (organic mercury compound) are possible human carcinogens (cause cancer). The EPA did not classify the potential of elemental mercury to cause cancer in humans.

The International Agency for Research on Cancer (IARC) classified methylmercury compounds as possibly carcinogenic to humans. IARC designated inorganic mercury and elemental mercury as not classifiable for causing cancer in humans.

Can I get a medical test to check for mercury?

Mercury can be measured in your blood, urine, hair, or toenails. However, tests cannot determine which form of mercury you were exposed to. Tests also cannot predict whether you will have health problems. If you think you have been exposed to mercury, call your doctor, nurse, or poison control center.

How can I protect myself and my family from mercury?

People should avoid eating fish that contain high levels of methylmercury. This is particularly important for pregnant women and children. Follow your state's health advisories that tell you about whether it is okay to eat fish or wildlife caught in contaminated areas. Avoid all contact with spills of the liquid form of elemental mercury (the type of mercury found in old thermometers). If a spill occurs, refer to https://www.atsdr.cdc.gov/dontmesswithmercury for safe clean-up practices. Most people don't need to take any special steps to avoid exposure to inorganic mercury salts in their daily lives. Keep children from playing in areas near hazardous waste sites to avoid coming in contact with mercury.

For more information:

Call **CDC-INFO** at 1-800-232-4636, or submit your question online at https://wwwn.cdc.gov/dcs/ContactUs/Form

Go to ATSDR's Toxicological Profile for mercury: https://wwwn.cdc.gov/TSP/ToxProfiles/ToxProfiles.aspx?id=115&tid=24

Go to ATSDR's Toxic Substances Portal: https://wwwn.cdc.gov/TSP/index.aspx

Find & contact your ATSDR Regional Representative at http://www.atsdr.cdc.gov/DRO/dro_org.html

Polycyclic Aromatic Hydrocarbons (PAHs) - ToxFAQs™

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

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

What are polycyclic aromatic hydrocarbons?

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

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

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

What happens to PAHs when they enter the environment?

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

How might I be exposed to PAHs?

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

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

How can PAHs affect my health?

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

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

How likely are PAHs to cause cancer?

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

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

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

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

Has the federal government made recommendations to protect human health?

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

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

Glossary

Carcinogen: A substance that can cause cancer.

Ingest: Take food or drink into your body.

References

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

Where can I get more information?

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

Phone: 1-800-232-4636.

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

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

Tetrachloroethylene - ToxFAQs™

CAS # 127-18-4

This fact sheet answers the most frequently asked health questions (FAQs) about tetrachloroethylene. For more information, call the 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: Tetrachloroethylene is a manufactured chemical used for dry cleaning and metal degreasing and in the aerospace industry. Exposure to very high concentrations of tetrachloroethylene can cause dizziness headaches, sleepiness, incoordination confusion, nausea, unconsciousness, and even death. Tetrachloroethylene has been found in at least 949 of the 1,854 National Priorities List sites identified by U.S. Environmental Protection Agency (EPA).

What is tetrachloroethylene?

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

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

What happens to tetrachloroethylene when it enters the environment?

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

How might I be exposed to tetrachloroethylene?

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

How can tetrachloroethylene affect my health?

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

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

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

Tetrachloroethylene

CAS # 127-18-4

How likely is tetrachloroethylene to cause cancer?

Studies in humans suggest that exposure to tetrachloroethylene might lead to a higher risk of getting bladder cancer, multiple myeloma, or non-Hodgkin's lymphoma.

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

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

How can tetrachloroethylene affect children?

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

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

How can families reduce the risk of exposure to tetrachloroethylene?

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

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

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

Has the federal government made recommendations to protect human health?

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

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

Reference

This ToxFAQs™ information is taken from the 2019 Toxicological Profile for Tetrachloroethylene 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 and Human Health Sciences, 1600 Clifton Road NE, Mailstop F-57, Atlanta, GA 30329-4027.

Phone: 1-800-232-4636

ToxFAQs™ on the web: www.atsdr.cdc.gov/ToxFAQs

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.

Trichloroethylene - ToxFAQs™

CAS # 79-01-6

This fact sheet answers the most frequently asked health questions (FAQs) about trichloroethylene. 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: Trichloroethylene is used as a solvent for cleaning metal parts. Exposure to very high concentrations of trichloroethylene can cause dizziness headaches, sleepiness, incoordination, confusion, nausea, unconsciousness, and even death. Trichloroethylene has been found in at least 1,051 of the 1,854 National Priorities List sites identified by the Environmental Protection Agency (EPA).

What is trichloroethylene?

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

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

What happens to trichloroethylene when it enters the environment?

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

How might I be exposed to trichloroethylene?

- Breathing trichloroethylene in contaminated air.

- Drinking contaminated water.

- Workers at facilities using this substance for metal degreasing are exposed to higher levels of trichloroethylene.

- If you live near such a facility or near a hazardous waste site containing trichloroethylene, you may also have higher exposure to this substance.

How can trichloroethylene affect my health?

Trichloroethylene was once used as an anesthetic for surgery. Exposure to moderate amounts of trichloroethylene may cause headaches, dizziness, and sleepiness; large amounts may cause coma and even death. Eating or breathing high levels of trichloroethylene may damage some of the nerves in the face. Exposure to high levels can also result in changes in the rhythm of the heartbeat, liver damage, and evidence of kidney damage. Skin contact with concentrated solutions of trichloroethylene can cause skin rashes. There is some evidence exposure to trichloroethylene in the work place may cause scleroderma (a systemic autoimmune disease) in some people. Some men occupationally-exposed to trichloroethylene and other chemicals showed decreases in sex drive, sperm quality, and reproductive hormone levels.

How likely is trichloroethylene to cause cancer?

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

The Department of Health and Human Services (DHHS) considers trichloroethylene to be a known human carcinogen. The International Agency for Research on Cancer (IARC) classified trichloroethylene as carcinogenic to humans. The EPA has characterized trichloroethylene as carcinogenic to humans by all routes of exposure.

Trichloroethylene

CAS # 79-01-6

How can trichloroethylene affect children?

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

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

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

How can families reduce the risk of exposure to trichloroethylene?

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

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

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

Has the federal government made recommendations to protect human health?

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

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

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

Reference

This ToxFAQs™ information is taken from the 2019 Toxicological Profile for Trichloroethylene 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 and Human Health Sciences, 1600 Clifton Road NE, Mailstop F-57, Atlanta, GA 30329-4027.

Phone: 1-800-232-4636

ToxFAQs™ on the web: www.atsdr.cdc.gov/ToxFAQs

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.

Toluene - ToxFAQs™

What is toluene?

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

Toluene is a good solvent (a substance that can dissolve other substances). It is used in making paints, paint thinners, fingernail polish, lacquers, adhesives, and rubber and in some printing and leather tanning processes. Toluene is also used in the manufacture of other chemicals, nylon, and plastics. It is also added to gasoline along with benzene and xylene to improve octane ratings.

What happens to toluene in the environment?

Toluene can enter the air from car exhaust or when materials that contain it (such as paints or fingernail polish) are used. It can get into surface waters (like lakes and streams), groundwater, or soil if solvents or petroleum products are accidently spilled, or from leaking underground storage tanks at gasoline stations and other facilities. When toluene-containing products are placed in landfills or waste disposal sites, toluene can enter the soil or water near the waste site.

Toluene does not usually stay in the environment long. In surface water or soil, it will readily evaporate into the air or be degraded by bacteria. In the air, toluene rapidly breaks down by reacting with other chemicals or oxygen in the air. Below the surface, microorganisms will break down toluene.

How can I be exposed to toluene?

You may be exposed to toluene by breathing contaminated air or touching products that contain this chemical. Car exhaust contains toluene; therefore, if you spend time in or near vehicles or traffic, you may be exposed to this chemical. People who work with gasoline, paint, or dyes may be exposed to higher levels of toluene than most people.

Toluene is not frequently detected in drinking water or food. People that abuse (inhale) certain products such as glue or paint thinner can be exposed to toluene.

How can toluene affect my health?

Toluene may affect the nervous system. Low to moderate levels can cause headaches, dizziness, tiredness, confusion, weakness, drunken-type actions, memory loss, nausea, and loss of appetite. These symptoms usually disappear when exposure stops.

Toluene can be found in gasoline products, paints, stain removers, and fingernail polish. Breathing toluene can cause headaches, dizziness, and nausea.

Long-term daily exposure to toluene in the workplace may cause some hearing and color vision loss. Repeatedly breathing toluene from glue or paint thinners may permanently damage the brain.

Exposure to high levels of toluene during pregnancy, such as those associated with solvent abuse, may lead to developmental effects, such as reduced mental abilities and growth in children.

In animal studies, the effects of toluene were similar to those seen in humans. In addition, it was found that animals that drank toluene also had decreased immune responses.

Toluene

Can toluene cause cancer?

Studies in workers and animals exposed to toluene generally show that toluene does not cause cancer.

The U.S. Department of Health and Human Services (DHHS) has not evaluated the carcinogenicity (ability to cause cancer) of toluene.

The U.S. Environmental Protection Agency (EPA) has determined that there is inadequate information to assess the carcinogenicity of toluene.

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

Can I get a medical test to check for toluene?

Toluene and its breakdown products can be measured in blood and urine. These tests are only useful if done within several days after exposure. These tests cannot predict whether you will have health problem from exposure to toluene.

How can I protect myself and my family from toluene?

To reduce exposure to toluene, you should use products that contain it (such as paints, nail polish, glues, inks, and stain removers) in well-ventilated areas. When not in use, these products should be tightly covered to prevent evaporation into the air and, if possible, stored in a shed or an outside location. Always store household chemicals in their original labeled containers.

Have your tap water tested if you are concerned it may have toluene and, if necessary, take steps to protect yourself. Keep children from eating or playing in the dirt if you live near a waste site.

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

For more information:

Call **CDC-INFO** at 1-800-232-4636, or submit your question online at https://wwwn.cdc.gov/dcs/ContactUs/Form

Go to ATSDR's Toxicological Profile for Toluene: https://wwwn.cdc.gov/TSP/ToxProfiles/ToxProfiles.aspx?id=161&tid=29

Go to ATSDR's Toxic Substances Portal: https://wwwn.cdc.gov/TSP/index.aspx

Find & contact your ATSDR Regional Representative at http://www.atsdr.cdc.gov/DRO/dro_org.html

ATSDR
AGENCY FOR TOXIC SUBSTANCES
AND DISEASE REGISTRY

XYLENE

CAS # 1330-20-7

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

This fact sheet answers the most frequently asked health questions (FAQs) about xylene. 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 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. Xylene has been found in at least 840 of the 1,684 National Priority List sites identified by the Environmental Protection Agency (EPA).

What is xylene?

There are three forms of xylene in which the methyl groups vary on the benzene ring: *meta*-xylene, *ortho*-xylene, and *para*-xylene (*m*-, *o*-, and *p*-xylene). These different forms are referred to as isomers.

Xylene is a colorless, sweet-smelling liquid that catches on fire easily. It occurs naturally in petroleum and coal tar. Chemical industries produce xylene from petroleum. It is 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 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 in a couple of days.
☐ It is broken down by microorganisms in soil and water.
☐ Only a small amount of it builds up in fish, shellfish, plants, and other animals living in xylene-contaminated water.

How might I be exposed to xylene?

☐ Using a variety of consumer products including gasoline, paint varnish, shellac, rust preventatives, and cigarette smoke. Xylene can be absorbed through the respiratory tract and through the skin.
☐ Ingesting xylene-contaminated food or water, although these levels are likely to be very low.
☐ Working in a job that involves the use of xylene such as painters, paint industry workers, biomedical laboratory workers, automobile garage workers, metal workers, and furniture refinishers.

How can xylene affect my health?

No health effects have been noted at the background levels that people are exposed to on a daily basis.

High levels of exposure for short or long periods 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.

How likely is xylene to cause cancer?

Both the International Agency for Research on Cancer (IARC) and the EPA have found that there is insufficient information to determine whether or not xylene is carcinogenic.

How can xylene affect children?

The effects of xylene have not been studied in children, but it is likely that they would be similar to those seen in exposed adults. Although there is no direct evidence, children may be more sensitive to acute inhalation exposure than adults because their narrower airways would be more sensitive to swelling effects.

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 can families reduce the risks of exposure to xylene?

☐ Exposure to xylene as solvents (in paints or gasoline) can be reduced if the products are used with adequate ventilation and if they are stored in tightly closed containers out of the reach of small children.
☐ Sometimes older children sniff household chemicals in attempt to get high. Talk with your children about the dangers of sniffing xylene.
☐ If products containing xylene are spilled on the skin, then the excess should be wiped off and the area cleaned with soap and water.

Is there a medical test to determine 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 because they require special equipment.

Has the federal government made recommendations to protect human health?

The EPA set a limit of 10 parts xylene per million parts drinking water (10 ppm).

The Occupational Safety and Health Administration (OSHA) has set limits of 100 parts xylene per million parts of workplace air (100 ppm) for 8 hour shifts and 40 hour work weeks.

References

Agency for Toxic Substances and Disease Registry (ATSDR). 2007. Toxicological Profile for Xylene (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.

United States
Environmental Protection
Agency

Technical Fact Sheet – Perfluorooctane Sulfonate (PFOS) and Perfluorooctanoic Acid (PFOA)

November 2017

At a Glance

- Manmade chemicals not naturally found in the environment.
- Fluorinated compounds that repel oil and water.
- Used in a variety of industrial and consumer products, such as carpet and clothing treatments and firefighting foams.
- Extremely persistent in the environment.
- Known to bioaccumulate in humans and wildlife.
- Readily absorbed after oral exposure. Accumulate primarily in the blood serum, kidney and liver.
- Toxicological studies on animals indicate potential developmental, reproductive and systemic effects.
- Health-based advisories or screening levels have been developed by EPA and state agencies.
- EPA has not issued a Maximum Contaminant Level (MCL) for drinking water.
- Standard analytical methods use high-performance liquid chromatography coupled with tandem mass spectrometry.
- Resistant to most chemical and microbial conventional treatment technologies. Most common groundwater treatment method is extraction and filtration through granular activated carbon filters.

Introduction

This fact sheet, developed by the U.S. Environmental Protection Agency (EPA) Federal Facilities Restoration and Reuse Office (FFRRO), provides a summary of two contaminants of emerging concern, perfluorooctane sulfonate (PFOS) and perfluorooctanoic acid (PFOA), including physical and chemical properties; environmental and health impacts; existing federal and state guidelines; detection and treatment methods; and additional sources of information. This fact sheet is intended for use by site managers who may address these chemicals at cleanup sites or in drinking water supplies and for those in a position to consider whether these chemicals should be added to the analytical suite for site investigations.

PFOS and PFOA are part of a larger group of chemicals called per- and polyfluoroalkyl substances (PFASs). PFASs, which are highly fluorinated aliphatic molecules, have been released to the environment through industrial manufacturing and through use and disposal of PFAS-containing products (Liu and Mejia Avendano 2013). PFOS and PFOA are the most widely studied of the PFAS chemicals. PFOS and PFOA are persistent in the environment and resistant to typical environmental degradation processes. As a result, they are widely distributed across all trophic levels and are found in soil, air and groundwater at sites across the United States. The toxicity, mobility and bioaccumulation potential of PFOS and PFOA result in potential adverse effects on the environment and human health.

What are PFOS and PFOA?

- They are human-made compounds that do not occur naturally in the environment (ATSDR 2015; EPA 2009b).
- PFOS and PFOA are fully fluorinated, organic compounds. They are the two PFASs that have been produced in the largest amounts within the United States (ATSDR 2015; EFSA 2008).
- PFOS and PFOA are part of a subset of PFASs known as perfluorinated alkyl acids (PFAAs).

Disclaimer: The U.S. EPA prepared this fact sheet using the most recent publicly-available scientific information; additional information can be obtained from the source documents. This fact sheet is not intended to be used as a primary source of information and is not intended, nor can it be relied on, to create any rights enforceable by any party in litigation with the United States. Mention of trade names or commercial products does not constitute endorsement or recommendation for use.

PFAS Chemistry

- The PFAS group is made up of two subgroups: perfluoroalkyl substances and polyfluoroalkyl substances.
- PFOS and PFOA are **perfluoroalkyl substances** (compounds for which all hydrogens on all carbons (except for carbons associated with functional groups) have been replaced by fluorines).
- **Polyfluoroalkyl substances** are compounds for which some hydrogens (but not all) on the carbon atoms have been replaced by fluorines.
- PFASs are extremely persistent in the environment primarily because the chemical bond between the carbon and fluorine atoms is extremely strong and stable.

Source: Buck and others 2011

- PFOS and PFOA can also be formed by environmental degradation or by metabolism in larger organisms from a large group of related PFASs or precursor compounds (ATSDR 2015; UNEP 2006).
- PFOS and PFOA are stable chemicals that are comprised of chains of eight carbons. Because of their unique ability to repel oil and water, these chemicals have been used in: surface protection products such as carpet and clothing treatments; coatings for paper, cardboard packaging and leather products; industrial surfactants, emulsifiers, wetting agents, additives and coatings; processing aids in the manufacture of fluoropolymers such as nonstick coatings on cookware; membranes for clothing that are both waterproof and breathable; electrical wire casing; fire and chemical resistant tubing; and plumbing thread seal tape (ATSDR 2015).
- Through 2001, PFOS and other PFAS chemicals were used in the manufacture of aqueous film forming foam (AFFF), which is used to extinguish liquid hydrocarbon fires (ASTSWMO 2015; EPA 2016f; DoD SERDP 2014; Place and Field 2012). Manufacturers of AFFF in the United States now use PFASs other than PFOS; however, existing stocks of PFOS-based AFFF remain in use.
- By 2002, the primary U.S. manufacturer of PFOS voluntarily phased out production of PFOS. In 2006, eight major companies in the PFASs industry voluntarily agreed to phase out production of PFOA and PFOA-related chemicals by 2015. EPA is concerned about a limited number of ongoing uses of PFOA-related chemicals, which are still available in existing stocks and from companies not participating in the PFOA Stewardship Program. In addition, exposure could occur via goods imported from countries where PFOS and PFOA are still used (EPA 2016b, 2016c, 2016f).

Exhibit 1: Physical and Chemical Properties of PFOS and PFOA (ATSDR 2015; EFSA 2008; EPA 2016b, 2016c)

Property	PFOS (Free Acid)	PFOA (Free Acid)
Chemical Abstracts Service (CAS) number	1763-23-1	335-67-1
Physical description (physical state at room temperature and atmospheric pressure)	White powder (potassium salt)	White powder/ waxy white solid
Molecular weight (g/mol)	500	414
Water solubility at 25°C (mg/L)	680	9.5×10^3
Melting point (°C)	No data	54
Boiling point (°C)	258–260	192
Vapor pressure at 25°C (mm Hg)	0.002	0.525
Organic carbon partition coefficient (K_{oc})	2.57	2.06
Henry's law constant (atm-m^3/mol)	Not measurable	Not measurable

Abbreviations: g/mol – grams per mole; mg/L – milligrams per liter; °C – degree Celsius; mm Hg – millimeters of mercury; atm-m^3/mol – atmosphere-cubic meters per mole

Existence of PFOS and PFOA in the environment

- During manufacturing processes, PFASs were released to the air, water and soil in and around manufacturing facilities (ATSDR 2015). Recently, PFOS and PFOA contamination has also been observed in facilities using PFAS products to manufacture other products (secondary manufacturing facilities).
- PFOS has been detected in surface water and sediment downstream of production facilities and in wastewater treatment plant effluent, sewage sludge and landfill leachate at a number of cities in the United States (OECD 2002; Oliaei and others 2013).
- The environmental release of PFOS-based AFFF may also occur from tank and supply line leaks, use of aircraft hangar fire suppression systems, firefighting training activities, and use at airplane crash sites (DoD SERDP 2014).
- PFOS and PFOA products often contain residuals from manufacturing and formulation that are PFASs. PFOS- and PFOA-based products often contain impurities and residuals which may be precursors to PFOS and PFOA. Biological and abiotic environmental processes have been shown to transform these precursors into PFOS and PFOA (Liu and Mejia Avendano 2013; Buck and others 2011; Conder and others 2010).
- In general, PFOS and PFOA are stable in the environment and resist typical environmental degradation processes. As a result, these chemicals are persistent in the environment (OECD 2002; ATSDR 2015).
- PFOS and PFOA are detected in environmental media and biota in many parts of the world, including oceans and the Arctic, indicating that long-range transport is possible (ATSDR 2015).
- The wide distribution of perfluoroalkyl substances, such as PFOS, in higher trophic level organisms is strongly suggestive of the potential for bioaccumulation and/or bioconcentration (EPA 2015; UNEP 2006).
- PFOS has been shown to accumulate to levels of concern in fish. The estimated bioconcentration factor in fish ranges from 1,000 to 4,000 (EFSA 2008; MDH 2017a). PFOA has been shown to bioaccumulate in air breathing species, including humans, but not in fish (Vierke and others 2012).

What are the routes of exposure and the potential health effects of PFOS and PFOA?

- Studies have found PFOS and PFOA in the blood samples of the general human population and wildlife, indicating that exposure to the chemicals is widespread (ATSDR 2015; EPA 2015).
- Reported data indicate that blood serum concentrations of PFOS and PFOA are higher in workers and individuals living near facilities that use or produce PFASs than for the general population (ATSDR 2015; EPA 2009b).
- Potential exposure pathways include ingestion of food and water, use of consumer products or inhalation of PFAS-containing particulate matter (e.g., soils and dust) or vapor phase precursors (ATSDR 2015; EPA 2009b).
- PFOA and PFOS have been found in drinking water supplies, typically associated with manufacturing locations, industrial use or disposal.
- Human epidemiological studies found associations between PFOA exposure and high cholesterol, increased liver enzymes, decreased vaccination response, thyroid disorders, pregnancy-induced hypertension and preeclampsia, and cancer (testicular and kidney) (EPA 2016e).
- Human epidemiological studies found associations between PFOS exposure and high cholesterol and adverse reproductive and developmental effects (EPA 2016d).
- PFOS and PFOA are toxic to laboratory animals, producing reproductive, developmental and systemic effects in laboratory tests (Austin and others 2003; EPA 2016d, 2016e; Post and others 2012).
- EPA found that there is suggestive evidence that PFOS and PFOA may cause cancer (EPA 2016d, 2016e).
- The American Conference of Governmental Industrial Hygienists (ACGIH) has classified PFOA as a Group A3 carcinogen – confirmed animal carcinogen with unknown relevance to humans (ATSDR 2015).
- The World Health Organization’s International Agency for Research on Cancer has found that PFOA is possibly carcinogenic to humans (Group 2B) (IARC 2016).
- In 2009, the Stockholm Convention on Persistent Organic Pollutants added PFOS to Annex B, restricting its production and use. PFOA was proposed for listing in 2015 (Stockholm Convention 2016).

Are there any federal and state guidelines and health standards for PFOS and PFOA?

- EPA derived oral non-cancer reference doses (RfDs) of 0.00002 mg/kg/day for both PFOS and PFOA (EPA 2016d, 2016e). The RfD is an estimate of the daily exposure level that is likely to be without harmful effects over a lifetime.
- In May 2016, EPA established drinking water health advisories of 70 parts per trillion (0.07 micrograms per liter (µg/L)) for the combined concentrations of PFOS and PFOA. Above these levels, EPA recommends that drinking water systems take steps to assess contamination, inform consumers and limit exposure. The health advisory levels are based on the RfDs (EPA 2016b, 2016c).
- EPA found that there are insufficient data to derive inhalation non-cancer reference concentrations (RfCs) for PFOS and PFOA (EPA 2016d, 2016e).
- For PFOA, EPA estimated a cancer slope factor of 0.07 $(\text{mg/kg/day})^{-1}$. Based on this slope factor, EPA calculated that a PFOA drinking water concentration of 0.5 µg/L would correspond to a one-in-a-million increased risk of cancer (EPA 2016c, 2016e).
- EPA has not issued a Maximum Contaminant Level (MCL) for drinking water.
- Various states have established drinking water and groundwater guidelines, including the following:

State	Guideline (µg/L)		Source
	PFOA	PFOS	
Delaware	0.4	0.2	DNREC 2016
Maine	0.13	0.56	MDEP 2016
Michigan	0.42	0.011	MDEQ 2015
Minnesota	0.035	0.027	MDH 2017b
New Jersey	0.04	NA	NJDEP 2016
North Carolina	2	NA	NCDEQ 2013
Texas	0.3	0.6	TCEQ 2016
Vermont	0.02	NA	VTDEC 2016

- Some states have fish consumption advisories for certain water bodies where PFOS has been detected in fish (MDH 2017c; MDHHS 2016).
- PFOS and PFOA are included on the fourth drinking water contaminant candidate list, which is a list of unregulated contaminants that are known to, or anticipated to, occur in public water systems and may require regulation under the Safe Drinking Water Act (EPA 2016a).

What detection and site characterization methods are available for PFOS and PFOA?

- Detection methods for PFOS and PFOA are primarily based on high-performance liquid chromatography (HPLC) coupled with tandem mass spectrometry (MS/MS) (ATSDR 2015).
- EPA Method 537, Version 1.1, is a liquid chromatography/tandem mass spectrometry (LC-MS/MS) method used to analyze PFOS, PFOA and other PFAAs in finished drinking water. While most sampling protocols for organic compounds require sample collection in glass, this method requires plastic sample bottles because PFASs are known to adhere to glass (ATSDR 2015; EPA 2009a). In addition, the method notes that analytes are found in common lab supplies and equipment such as PTFE (polytetrafluoroethylene) products, LC solvent lines, solid phase extraction sample transfer lines, methanol and aluminum foil (EPA 2009a).
- Currently, there are no standard EPA methods for analyzing PFASs in groundwater, surface water, wastewater or solids. EPA is developing analytical methods for these media. EPA expects to have draft methods for water and solids by fall 2017. EPA will also develop standard operating procedures for field sampling (EPA 2017).
- ASTM has published standards for analyzing PFAAs in soil (D7968-14) and in water, sludge, influent, effluent and wastewater (D7979-15). Both standards use LC-MS/MS (ASTM 2014, 2015). These methods have not been multi-lab validated.
- The available detection methods report sensitivities of low picograms per cubic meter (pg/m^3) levels in air, high picograms per liter (pg/L) to low ng/L levels in water, and high picograms per gram to low ng/g levels in soil (ATSDR 2015).
- Experimental techniques are available to measure PFASs in air samples. Some studies have used gas chromatography mass spectrometry (GC/MS) to measured PFASs in air samples (ATSDR 2015). In addition, some precursor chemicals and transformation products are measured by GC/MS/MS or LC/MS/MS (Liu and Mejia Avendano 2013). An oxidative technique has been proposed to estimate precursor levels by LC/MS/MS (Houtz and Sedlak 2012).

- Researchers are developing a new analytical method that uses particle induced gamma emission (PIGE) to quickly and non-destructively detect the presence of PFASs in consumer products and other solid materials (National Science Foundation 2015).

What technologies are being used to treat PFOS and PFOA?

- Chapter 10 of the PFOS and PFOA health advisories discuss the performance of common drinking water technologies to treat these chemicals (EPA 2016b, 2016c). In general, PFOS and PFOA resist most conventional chemical and microbial treatment technologies. Technologies with demonstrated effectiveness include granular activated carbon sorption and ion exchange resins (EPA 2016b, 2016c).
- PFAAs can be formed when precursor chemicals are transformed in the environment or in the body (EPA 2016b, 2016c). Therefore, if precursors are not addressed during remediation, over time they may be transformed to PFAAs, such as PFOS and PFOA. The presence of other contaminants, including PFAS precursors, can also impact design and performance of remedial technologies.
- The most common groundwater treatment is extraction and filtration through granular activated carbon. However, because PFOA and PFOS have moderate adsorbability, the design specifics are very important in obtaining acceptable treatment (EPA 2016b, 2016c). Other potential adsorbents include: ion exchange resins, organo-clays, clay minerals and carbon nanotubes (EPA 2016b, 2016c; Espana and others 2015). Evaluation of these sorbents needs to consider regeneration, as the cost and effort required may be substantial (EPA 2016b, 2016c).
- Other ex situ treatments including nanofiltration and reverse osmosis units have been shown to remove PFASs from water (EPA 2016b, 2016c). Incineration of the concentrated waste would be needed for the complete destruction of PFASs (MDH 2008; Vecitis and others 2009).
- Research into other treatment approaches for PFOS and PFOA in groundwater is ongoing (DoD SERDP 2016).
- One soil management approach is excavation and off-site disposal. Capping may also be an option.
- High-temperature incineration can also be used to destroy PFOS and PFOA (ASTSWMO 2015).
- Stabilization methods for PFAS-contaminated soil may be effective (Kupryianchyk and others 2016).

Where can I find more information about PFOS and PFOA?

- ATSDR. 2015. “Draft Toxicological Profile for Perfluoroalkyls.” www.atsdr.cdc.gov/toxprofiles/tp200.pdf
- ASTM. 2014. “D7968-14, Standard Test Method for Determination of Perfluorinated Compounds in Soil by Liquid Chromatography Tandem Mass Spectrometry (LC/MS/MS).” www.astm.org
- ASTM. 2015. “D7979-15e1, Standard Test Method for Determination of Perfluorinated Compounds in Water, Sludge, Influent, Effluent and Wastewater by Liquid Chromatography Tandem Mass Spectrometry (LC/MS/MS).” www.astm.org
- Association of State and Territorial Solid Waste Management Officials (ASTSWMO). 2015. Perfluorinated Chemicals (PFCs): Perfluorooctanoic Acid (PFOA) & Perfluorooctane Sulfonate (PFOS): Information Paper. clu-in.org/download/contaminantfocus/pops/POPs-ASTSWMO-PFCs-2015.pdf
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Contact Information

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Appendix C

Soils/Materials Management Plan

SOIL/MATERIALS MANAGEMENT PLAN

for
236-246 Gold Street
Remedial Action Work Plan

236-246 Gold Street
Brooklyn, NY
Block 121, Lots 33, 35, 36, & 37
BCP Site #C224413

Submitted to:
New York State Department of Environmental Conservation
Division of Environmental Remediation
Remedial Bureau B
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1.0 INTRODUCTION

This Soil/Materials Management Plan (SMMP) has been developed for the Remedial Action Work Plan (RAWP) prepared for 236-246 Gold Street (the Site).

The Site, located at 236-246 Gold Street in the Downtown Brooklyn section of Brooklyn, New York, is a rectangular-shaped parcel of land located on the western side of Gold Street, between Concord Street and Tillary Street. The Site is bounded by commercial and residential buildings to the north, a residential building to the south, residential buildings to the west, and Gold Street to the east. The Site is unimproved with any structures and vacant. Previously, the Site was used for automobile parking. The Site is an approximate 11,054 square foot parcel of land and is generally identified as Block 121 and Lots 33, 35, 36, and 37 on the New York City Tax Map. A Site location map is included as Figure 1 of the RAWP. A Site boundary map is included as Figure 2 of the RAWP.

1.1 Soil Screening Methods

Visual, olfactory and PID soil screening and assessment will be performed by a qualified environmental professional or experienced field geologist under the supervision of the Remedial Engineer (RE) and will be reported in the Final Engineering Report (FER). Soil Screening will be performed during all remedial excavations into known or potentially contaminated material regardless of when the invasive work is done prior to issuance of a COC.

1.2 Soil Staging Methods

Excavated soil from suspected areas of contamination will be stockpiled separately and will be segregated from clean soil and construction materials. Stockpiles will be used only when necessary and will be removed as soon as practicable. While stockpiles are in place, they will be inspected daily, and before and after every storm event. Results of inspections will be recorded in a logbook, maintained at the Site and available for inspection by the New York State Department of Environmental Conservation (NYSDEC). Excavated soils will be stockpiled on double layers of 8-mil minimum-thickness sheeting, at a minimum. Stockpiles will be kept covered when not in use with appropriately anchored plastic tarps and will be routinely inspected. Broken or ripped tarps will be promptly replaced.

All stockpile management will be compliant with applicable laws and regulations. Soil stockpile areas will be appropriately graded to control run-off in accordance with applicable laws and regulations. Stockpiles of excavated soils and other materials shall be located at least 50 feet from the property boundaries, where possible. Hay bales or equivalent will surround soil stockpiles except for areas where access by equipment is required. Silt fencing and hay bales will be used as needed near catch basins, surface waters and other discharge points.

1.3 Characterization of Excavated Materials

Soil/fill or other excavated media that is transported off the Site for disposal will be sampled in a manner required by the receiving facility, and in compliance with applicable laws and regulations. Soils are not proposed for reuse on-Site.

1.4 Materials Excavation, Load-Out and Departure

The RE overseeing the remedial activities, or a qualified environmental professional under his/her supervision, will:

- Oversee remedial work and the excavation and load-out of excavated material;
- Ensure that there is a party responsible for the safe execution of invasive and other work performed under this Remedial Action Work Plan;
- Ensure that Site development activities and development-related grading cuts will not interfere with, or otherwise impair or compromise remedial activities at the Site;
- Ensure that the presence of utilities and easements on the Site has been investigated and that any identified risks from work proposed under this Remedial Action Work Plan are properly addressed by appropriate parties;
- Ensure that all loaded outbound trucks are inspected and cleaned if necessary before leaving the Site;
- Ensure that all egress points for truck and equipment transport from the Site will be kept clean of Site-derived materials during Site remediation.

Locations where vehicles exit the Site shall be inspected daily for evidence of soil tracking off premises. Cleaning of the adjacent streets will be performed as needed to maintain a clean condition with respect to Site-derived materials. Mechanical processing of historical fill and contaminated soil on the Site is prohibited.

1.5 Off-Site Materials Transport

Loaded vehicles leaving the Site will comply with all applicable materials transportation requirements (including appropriate covering, manifests, and placards) in accordance with applicable laws and regulations, including use of licensed haulers in accordance with 6 NYCRR Part 364. If loads contain wet material capable of causing leakage from trucks, truck liners will be used. Queuing of trucks will be performed on the Site, when possible in order to minimize offsite disturbance. Offsite queuing will be minimized.

Gold Street is a two-way street, with traffic flow to the north and south. For westbound destinations, trucks leaving the Site will turn left onto Gold Street, then turn left onto Sands Street, then turn left onto Jay Street and make a left onto Sands Street, then continue straight onto the ramp to the Brooklyn-Queens Expressway (I-278 West), which is a truck through route.

For eastbound destinations, trucks leaving the Site will turn right onto Gold Street, then make the first left onto Tillary Street and continue straight and take the ramp on the left to the Brooklyn-Queens Expressway (I-278 East), which is a truck through route.

This is the most appropriate route and take into account: (a) limiting transport through residential areas and past sensitive sites; (b) use of city mapped truck routes; (c) limiting total distance to major highways; (d) promoting safety in access to highways; and (e) overall safety in transport. All trucks loaded with Site materials will exit the vicinity of the Site using only the most-current New York City Department of Transportation (NYCDOT)-approved truck routes (currently the 2015 New York City Truck Route Map).

Trucks will be prohibited from stopping and idling in the neighborhood outside the project 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.

Material transported by trucks exiting the Site will be secured with tight-fitting covers. If loads contain wet material capable of producing free liquid, truck liners will be used.

1.6 Materials Disposal Off-Site

To document that the disposal of regulated material exported from the Site complies with applicable laws and regulations, the following documentation will be established and reported by the RE for each disposal destination used in this project:

(1) a letter from the RE or Applicant to each disposal facility describing the material to be disposed and requesting written acceptance of the material. This letter will state that material to be disposed is regulated material generated at an environmental remediation Site in New York under a governmental remediation program. The letter will provide the project identity and the name and phone number of the RE or Applicant, and will include as an attachment a summary of all chemical data for the material being transported; and
(2) a letter from each disposal facility stating it is in receipt of the correspondence, (1) above, and is approved to accept the material.

These documents will be included in the FER.

The FER will include an itemized account of the destination of all material removed from the Site during remedial activities. Documentation associated with disposal of all material will include records and approvals for receipt of the material. This information will be presented in the FER.

All soil, fill and other waste excavated and removed from the Site will be managed as regulated material (municipal solid waste per 6 NYCRR Part 360-1.2) and will be disposed in accordance with applicable laws and regulations. Historic fill and material that does not meet Track 1 Unrestricted Use soil cleanup objectives (SCOs) is prohibited from being taken to a New York State recycling facility (6 NYCRR Part 360-16 Registration Facility). Historic fill and contaminated soils taken off-Site will be handled as solid waste and will not be disposed at a Part 360-16 Registration Facility (also known as a Soil Recycling Facility).

Approximately 3,900 cubic yards (CY) of soil is proposed for off-Site disposal (approximately 3,800 CY will be excavated and disposed of offsite for remedial purposes, and approximately 100 CY will be excavated and disposed offsite for development purposes). Final disposal facilities will be identified to NYSDEC prior to shipping material to any facility. Waste characterization was performed for off-Site disposal in a manner required by the receiving facilities and in conformance with applicable permits. Waste characterization sampling and analytical methods, sampling frequency, analytical results and QA/QC will be reported in the FER. A manifest system for off-Site transportation of exported materials will be employed. Manifest information will be reported in the FER. Hazardous wastes derived from on-Site will be stored, transported and disposed of in compliance with applicable laws and regulations.

If disposal of soil and fill from this Site is proposed for unregulated disposal (i.e., clean soil removed for development purposes), including transport to a Part 360-16 Registration Facility, a formal request will be made for approval by NYSDEC with an associated plan compliant with 6 NYCRR Part 360-16. This request and plan will include the location, volume and a description of the material to be recycled, including verification that the material is not impacted by site uses and that the material complies with receipt requirements for recycling under 6 NYCRR Part 360. This material will be appropriately handled on-Site to prevent mixing with impacted material.

1.7 Materials Reuse On-Site

"Reuse on-Site" means material that is excavated during the remedy or development does not leave the property, and is relocated within the same property and on comparable soil/fill material, and addressed pursuant to Engineering Controls. The RE will ensure that reused materials are segregated from other materials to be exported from the Site and that procedures defined for material reuse in this SMMP are followed. Soil reuse is not proposed. Reused soil must be non-hazardous and meet the Use-based SCOs and Protection of Groundwater SCOs in accordance with the predetermined beneficial use determination listed in 6 NYCRR Part 360-1.15(b). If any of the waste materials are used for an end use specified in 6 NYCRR Part 360-1.15(b), it will not be considered a solid waste. Reuse of soil will be coordinated in advance with the NYSDEC project manager.

Organic matter (wood, roots, stumps, etc.) or other waste derived from clearing and grubbing the Site will not be buried onsite. Soil and fill excavated from the Site for grading or other purposes will not be reused within a cover soil layer or within landscaping berms.

1.8 Import of Backfill Soil from Off-Site Sources

Import of soil is not anticipated on this project. However, if materials are imported, they will be in compliance with: (1) 6 NYCRR 375-6.7(d) and (2) all Federal, State and local rules and regulations for handling and transport of material.

The following presents the requirements for imported fill materials to be used below the cover layer and within the clean soil cover layer. The backfill and cover soil quality objectives will be the Restricted-Residential Use SCOs.

A process will be established to evaluate sources of backfill and cover soil to be imported to the Site, and will include an examination of source location, current and historical use(s), and any applicable documentation. Material from industrial sites, spill sites, environmental remediation sites or other potentially contaminated sites will not be imported to the Site.

The following potential sources may be used pending attainment of backfill and cover soil quality objectives:

- Clean soil from construction projects at non-industrial sites in compliance with applicable laws and regulations;
- Clean soil from roadway or other transportation-related projects in compliance with applicable laws and regulations;
- Clean recycled concrete aggregate (RCA) from facilities permitted or registered by the regulations of NYSDEC.

All materials received for import to the Site will be approved by a PE/QEP and will be in compliance with applicable City, State and Federal laws and requirements. The source of the fill, evidence that an inspection was performed on the source, chemical sampling results, frequency of testing, and a Site map indicating the locations where backfill or soil cover was placed will be reported to NYSDEC at the end of construction activities and before obtaining a Certificate of Occupancy or Department of Building Letter of Completion.

Source Screening and Testing

Inspection of imported fill material will include visual, olfactory and PID screening for evidence of contamination. Materials imported to the Site will be subject to inspection, as follows:

- Trucks with imported fill material will be in compliance with applicable laws and regulations and will enter the Site at designated locations;
- The PE/QEP is responsible to ensure that every truck load of imported material is inspected for evidence of contamination; and
- Fill material will be free of solid waste including pavement materials, debris, stumps, roots, and other organic matter, as well as ashes, oil, perishables or foreign matter.

Composite and discrete samples of imported material will be taken consistent with Table 5.4(e)10 of DER-10. Once it is determined that the fill material meets imported backfill or cover soil chemical requirements and is non-hazardous, and lacks petroleum contamination, the material will be loaded onto trucks for delivery to the Site.

Recycled concrete aggregate (RCA) will be imported from facilities permitted or registered by NYSDEC. Facilities will be reported to NYSDEC at the end of construction activities and before obtaining a Certificate of Occupancy or Department of Building Letter of Completion. A PE/QEP is responsible for ensuring that the facility is compliant with 6 NYCRR Part 360 registration and permitting requirements for the period of acquisition of RCA. RCA imported from compliant facilities will not require additional testing, unless required by NYSDEC under its terms for operation of the facility. RCA imported to the Site must be derived from recognizable and uncontaminated concrete. RCA material is not acceptable for, and will not be used, as cover material.

1.10 Fluids Management

All liquids to be removed from the Site will be handled, transported and disposed in accordance with applicable laws and regulations. Excavation into the water table will be required for installation of the elevator pits, and dewatering is anticipated for the elevator pits only. Liquids discharged into the New York City sewer system will receive prior approval by the New York City Department of Environmental Protection (NYC DEP). The NYC DEP regulates discharges to the New York City sewers under Title 15, Rules of the City of New York Chapter 19. Discharge to the New York City sewer system will require an authorization and sampling data demonstrating that the groundwater meets the City's discharge criteria. The dewatering fluid will be pretreated as necessary to meet the NYC DEP discharge criteria. If discharge to the City sewer system is not appropriate, the dewatering fluids will be managed by transportation and disposal at an offsite treatment facility.

Discharge of water generated during remedial construction to surface waters (i.e., a stream or river) is prohibited without a SPDES permit issued by NYSDEC.

1.11 Stormwater Pollution Prevention

Applicable laws and regulations pertaining to stormwater pollution prevention will be addressed during the remedial program. A Stormwater Pollution Prevention Plan (SWPPP) will be submitted to NYCDEP for review and MS4 certification, followed by submittal of a Notice of Intent (NOI) to NYSDEC for coverage under the SPDES General Permit. NYCDEP review is expected to be completed by October 2023, after which the NOI will be submitted.

1.12 Erosion and Sediment Control Measures

Erosion and sediment control measures identified in this Soil/Materials Management Plan will be installed around the entire perimeter of the remedial construction area and inspected one a week and after every storm event to ensure that they are operating appropriately. Discharge locations will be inspected to determine whether erosion control measures are effective in preventing significant impacts to receptors. Results of inspections will be recorded in a logbook, maintained at the Site and available for inspection by NYSDEC. All necessary repairs shall be made immediately. Accumulated sediments will be removed as required to keep the barrier and hay bale check functional. Undercutting or erosion off the silt fence anchor will be repaired immediately with appropriate backfill materials. Manufacturer's recommendations will be followed for replacing silt fencing damaged due to weathering.

1.13 Contingency Plan

This contingency plan is developed for the remedial construction to address the discovery of unknown structures or contaminated media during excavation. Identification of unknown contamination source areas during invasive Site work will be promptly communicated to the NYSDEC Project Manager. Petroleum spills will be reported to the NYSDEC Spill Hotline. These findings will be included in applicable daily report(s). If previously unidentified contaminant sources are found during on-Site remedial excavation or development-related excavation, sampling will be performed on contaminated source material and surrounding soils and reported to NYSDEC. Analysis will be performed for Full List volatiles and semi-volatiles, pesticides/PCBs, and TAL metals, as appropriate.

1.14 Odor, Dust and Nuisance Control

A Site-specific Community Air Monitoring Plan (CAMP) is included as Appendix B of the Remedial Action Work Plan.

Odor Control

All necessary means will be employed to prevent on- and off-Site odor nuisances. At a minimum, procedures will include: (a) limiting the area of open excavations; (b) shrouding open excavations with tarps and other covers; and may include (c) use of foams to cover exposed odorous soils. If odors develop and cannot otherwise be controlled, additional means to eliminate odor nuisances will include: (d) live loading of soils into trucks for off-Site disposal; and (e) use of chemical odorants in spray or misting systems.

This odor control plan is capable of controlling emissions of nuisance odors. If nuisance odors are identified, work will be halted and the source of odors will be identified and corrected. Work will not resume until all nuisance odors have been abated. NYSDEC will be notified of all odor complaint events. Implementation of all odor controls, including halt of work, will be the responsibility of the Remedial Engineer (RE), who is responsible for certifying the FER.

Dust Control

Dust management during invasive on-Site work will include, as necessary:

- Use of a dedicated water spray method for roads, excavation areas, and stockpiles;
- Use of properly anchored tarps to cover stockpiles;
- Exercise of extra care during dry and high-wind periods; and
- Use of gravel or recycled concrete aggregate on egress and other roadways to provide a clean and dust-free road surface.

This dust control plan is capable of controlling emissions of dust. If nuisance dust emissions are identified, work will be halted and the source of dusts will be identified and corrected. Work will not resume until all nuisance dust emissions have been abated. NYSDEC will be notified of all dust complaint events. Implementation of all dust controls, including halt of work, will be the responsibility of the RE.

Other Nuisances

Noise control will be exercised during the remedial program. All remedial work will conform, at a minimum, to NYC noise control standards.

Rodent control will be provided during Site clearing and grubbing, and during the remedial program, as necessary, to prevent nuisances.

1.15 Import of Clean Cover and Fill Material

Soil import is not anticipated. If fill material is imported, any imported soil will be uncontaminated soil that meets the lower of the appropriate NYSDEC 6 NYCRR Part 375-6.8(a) Unrestricted Use soil cleanup objectives (SCOs) and the NYSDEC 6 NYCRR Part 375-6.8(b) Protection of Groundwater SCOs.

Any imported uncontaminated soil cover will be from an approved source/facility and will be evaluated by the RE to ensure the following:

(1) That a segregated stockpile for less than 750 tons (500 cubic yards) is properly maintained at the source and will not be comingled with any other material prior to importing and grading the clean soil material at the Site;
(2) That the material does not include any solid waste, including construction and demolition material, as prohibited;
(3) That screening for evidence of contamination by visual, olfactory and PID soil screening practices prior to testing at the source, as well as upon importing to the Site for grading, is completed; and
(4) That a maximum five-part composite sample will be collected from the segregated stockpile at the source at a minimum frequency of one sample per 250 cubic yards and analyzed for the following Full List parameters:
    - VOCs by EPA Method 8260C
    - SVOCs by EPA Method 8270D
    - Pesticides by EPA Method 8081B
    - PCBs by EPA Method 8082A
    - TAL Metals by EPA Method 6010C/7471B

Upon receipt of the segregated stockpile analytical results collected at the source, a Clean Soil Sampling Report will be submitted to NYSDEC for review/approval prior to importing. The report will include the following:

(1) A summary of the sample quantities collected and analyzed, tabulated data and comparison to the Unrestricted Use SCOs;
(2) Analytical data sheets and chain-of-custody (COC) documentation;
(3) Estimate of the amount of soil/material stockpiled in tons and cubic yards;

(4) Photographs from the segregated stockpile at the source with sample point locations identified;
(5) An affidavit from the source/facility on company letterhead stating that the segregated stockpile has been properly maintained at the source and complies with the requirements listed above; and
(6) A copy of the source/facility NYSDEC permit(s).

If fill material is imported, a highly visible demarcation barrier (i.e., orange geo-synthetic material or equivalent) will be installed beneath the clean soil/fill surface cover. Upon importing and grading any NYSDEC-approved clean soil cover on top of a highly visible demarcation barrier, the following documentation will be presented in the FER:

(1) Copies of purchase invoices;
(2) Truck transportation slips from the source to the Site;
(3) Confirmation of the number of tons and cubic yards of NYSDEC-approved clean soil cover material imported and graded at the Site on top of a highly visible demarcation barrier;
(4) A Site plan depicting all areas where the NYSDEC-approved clean soil cover has been placed; and
(5) Photographs documenting the importing and grading of the NYSDEC-approved clean soil cover across the Site with the underlying highly visible demarcation barrier (i.e., orange geo-synthetic material or equivalent).

Appendix D

Quality Assurance Project Plan

Quality Assurance Project Plan

for
236-246 Gold Street
Remedial Action Work Plan

236-246 Gold Street
Brooklyn, NY
Block 121, Lots 33, 35, 36, & 37
BCP Site #C224413

Submitted to:
New York State Department of Environmental Conservation
Division of Environmental Remediation
Remedial Bureau B
625 Broadway, 12th Floor
Albany, NY 12233-7016

Prepared for:
236 Gold LLC / 242 Gold St LLC / 244 Gold LLC / 236-242 Gold St LLC
31 Spencer Street, Suite 502
Brooklyn, NY 11205

Prepared by:
TENEN ENVIRONMENTAL
121 West 27th Street, Suite 702
New York, NY 10001

January 2025

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Appendix C – PFAS Compounds to be Analyzed and Associated MDLs
Appendix D – Laboratory Standard Operating Procedures for PFAS Analysis

1.0 INTRODUCTION

This Quality Assurance Project Plan (QAPP) has been developed for the Remedial Action Work Plan (RAWP) prepared for the 236-246 Gold Street property (the Site).

The Site, located at 236-246 Gold Street in the Downtown Brooklyn section of Brooklyn, New York, is a rectangular-shaped parcel of land located on the western side of Gold Street, between Concord Street and Tillary Street. The Site is bounded by commercial and residential buildings to the north, a residential building to the south, residential buildings to the west, and Gold Street to the east. The Site is unimproved with any structures and vacant. Previously, the Site was used for automobile parking. The Site is an approximate 11,054 square foot parcel of land and is generally identified as Block 121 and Lots 33, 35, 36, and 37 on the New York City Tax Map.

1.1 Project Scope and QAPP Objective

The proposed scope of work includes the following:

- Excavation and disposal of soil and installation of an active sub-slab depressurization system; and
- Collection of post-remedial bottom of excavation and sidewall end-point samples and post-remedial indoor air samples.

The objective of the QAPP is to detail the policies, organization, objectives, functional activities and specific quality assurance/quality control activities designed to achieve the data quality goals or objectives of the Remedial Action Work Plan. This QAPP addresses how the acquisition and handling of samples and the review and reporting of data will be documented for quality control (QC) purposes. Specifically, this QAPP addresses the following:

- The procedures to be used to collect, preserve, package, and transport samples;
- Field data collection and record keeping;
- Data management;
- Chain-of-custody procedures; and,
- Determination of precision, accuracy, completeness, representativeness, decision rules, comparability and level of quality control effort.

2.0 PROJECT ORGANIZATION

The personnel detailed are responsible for the implementation of the QAPP. Tenen Environmental, LLC (Tenen) will implement the RAWP on behalf of 236 Gold LLC / 242 Gold St LLC / 244 Gold LLC / 236-242 Gold St LLC (collectively, the Applicants) once it has been approved by the New York State Department of Environmental Conservation (NYSDEC).

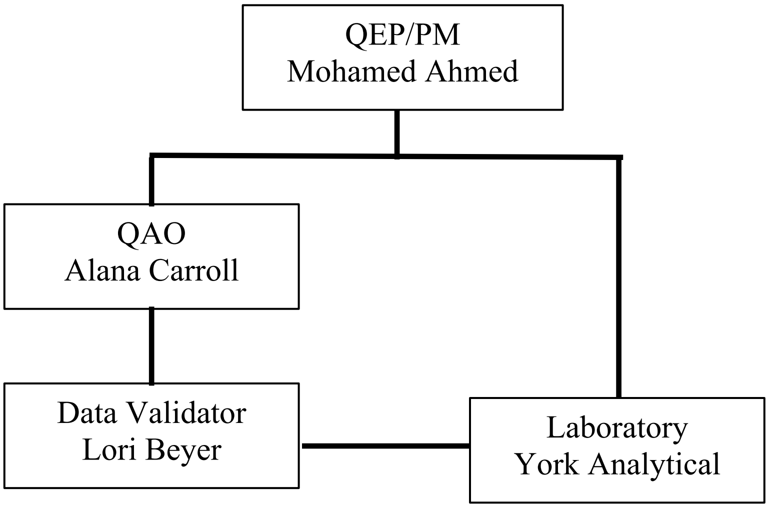
The Project Manager and Qualified Environmental Professional (QEP) will be Mohamed Ahmed, Ph.D., CPG, principal at Tenen. Dr. Ahmed is a certified professional geologist with over 20 years of experience in the New York City metropolitan area. He has designed and implemented subsurface investigations and is proficient in groundwater modeling, design of groundwater treatment systems, and soil remediation. He has managed numerous projects focused on compliance with the requirements of the New York State Brownfield Cleanup Program and spills programs and the New York City E-designation program. Dr. Ahmed also has extensive experience in conducting regulatory negotiations with the New York State Department of Environmental Conservation, the New York City Department of Environmental Protection, the NYC Office of Housing Preservation and Development, and the Mayor's Office of Environmental Remediation. Dr. Ahmed holds advanced degrees in geology and Earth and Environmental Sciences from Brooklyn College and the Graduate Center of the City University of New York; his resume is included in Appendix A.

The Quality Assurance Officer will be Mrs. Alana Carroll, CPG, managing scientist at Tenen. Mrs. Carroll is a certified professional geologist with experience in all aspects of site assessment, development and implementation of remedial strategies. Her experience involves projects from inception through investigation, remediation and closure. Her expertise includes soil, soil vapor and groundwater remediation; remedial selection and design; field/health and safety oversight and preparation of work plans and reports to satisfy the requirements of various regulatory agencies. Mrs. Carroll received her BS in Geology from Hofstra University; her resume is included in Appendix A.

In addition, Tenen will utilize subcontractors for laboratory services (York Analytical Laboratories of Richmond Hill) and data validation (L.A.B. Validation Corp. of East Northport, NY). The resume for the DUSR preparer, Ms. Lori Beyer, is included in Appendix A.

Contact Information
Remedial Party (236 Gold LLC / 242 Gold St LLC / 244 Gold LLC / 236-242 Gold St LLC), Yochi Tennenhaus, 718.222.3822
Tenen Environmental, Mohamed Ahmed or Alana Carroll, 646.606.2332

An organization chart for the implementation of the Remedial Action Work Plan and QAPP is below.



3.0 SAMPLING AND DECONTAMINATION PROCEDURES

A detailed description of the procedures to be used during this program for collection of the soil and indoor air samples is provided below. Proposed end-point sample locations are shown on Figure 5 of the Remedial Action Work Plan. An Analytical Methods/Quality Assurance Summary is provided in Table 1, included in Section 3.9.

3.1 Level of Effort for QC Samples

Field blank, trip blank, field duplicate and matrix spike (MS) / matrix spike duplicate (MSD) samples will be analyzed to assess the quality of the data resulting from the field sampling and analytical programs. Each type of QC sample is discussed below.

- Field and trip blanks consisting of distilled water will be submitted to the analytical laboratories to provide the means to assess the quality of the data resulting from the field-sampling program. Field (equipment) blank samples are analyzed to check for procedural chemical constituents that may cause sample contamination. Trip blanks are used to assess the potential for contamination of samples due to contaminant migration during sample shipment and storage.

- Duplicate samples are analyzed to check for sampling and analytical reproducibility.

- MS/MSD samples provide information about the effect of the sample matrix on the digestion and measurement methodology.

The general level of QC effort will be one field duplicate and one field blank (when non-dedicated equipment is used) for every 20 or fewer investigative samples of a given matrix. Additional sample volume will also be provided to the laboratory to allow one site-specific MS/MSD for every 20 or fewer investigative samples of a given matrix. One trip blank will be included along with each sample delivery group of volatile organic compound (VOC) samples. One equipment blank will be collected at a frequency of one per day that PFAS samples are collected for a given matrix.

The analytical laboratory, York Analytical Laboratories, is certified under the New York State Department of Health (NYSDOH) Environmental Laboratory Approval Program (ELAP) as Lab IDs 10854 and 12058. NYSDEC Analytical Services Protocol (ASP) Category B deliverables will be prepared by the laboratory.

3.2 Sample Handling

Samples will either be picked up by the laboratory, delivered to the laboratory in person by the sampler, or transported to the laboratory by overnight courier. All samples will be shipped to the laboratory to arrive within 48 hours after collection, and the laboratory will adhere to the analytical holding times for these analyses, as listed in the current version of the New York State ASP.

3.3 Custody Procedures

Sample custody will be controlled and maintained through the chain-of-custody procedures. The chain of custody is the means by which the possession and handling of samples is tracked from the site to the laboratory. Sample containers will be cleaned and preserved at the laboratory before shipment to the Site. The following sections (Sections 3.4 and 3.5) describe procedures for maintaining sample custody from the time samples are collected to the time they are received by the analytical laboratory.

3.4 Sample Storage

Samples will be stored in secure limited-access areas. Walk-in coolers or refrigerators will be maintained at 4°C, +/- 2°C, or as required by the applicable regulatory program. The temperatures of all refrigerated storage areas are monitored and recorded a minimum of once per day. Deviations of temperature from the applicable range require corrective action, including moving samples to another storage location, if necessary.

3.5 Sample Custody

Sample custody is defined by this QAPP as the following:

- The sample is in someone’s actual possession;
- The sample is in someone’s view after being in his or her physical possession;
- The sample was in someone’s possession and then locked, sealed, or secured in a manner that prevents unsuspected tampering; or,
- The sample is placed in a designated and secured area.

Samples will be removed from storage areas by the sample custodian or laboratory personnel and transported to secure laboratory areas for analysis. Access to the laboratory and sample storage areas is restricted to laboratory personnel and escorted visitors only; all areas of the laboratory are therefore considered secure.

Laboratory documentation used to establish chain of custody and sample identification may include the following:

- Field chains of custody or other paperwork that arrives with the sample;
- Laboratory chain of custody;
- Sample labels or tags attached to each sample container;
- Sample custody seals;
- Sample preparation logs (i.e., extraction and digestion information) recorded in hardbound laboratory books, filled out in legible handwriting, and signed and dated by the chemist;
- Sample analysis logs (e.g., metals, GC/MS, etc.) information recorded in hardbound laboratory books that are filled out in legible handwriting, and signed and dated by the chemist;
- Sample storage log (same as the laboratory chain of custody); and,

- Sample disposition log, which documents sample disposal by a contracted waste disposal company.

3.6 Sample Tracking

All samples will be maintained in the appropriate coolers prior to and after analysis. Laboratory analysts will remove and return their samples, as needed. Samples that require internal chain of custody procedures will be relinquished to the analysts by the sample custodians. The analyst and sample custodian will sign the original chain of custody relinquishing custody of the samples from the sample custodian to the analyst. When the samples are returned, the analyst will sign the original chain of custody returning sample custody to the sample custodian. Sample extracts will be relinquished to the instrumentation analysts by the preparatory analysts. Each preparation department will track internal chain of custody through their logbooks/spreadsheets.

Any change in the sample during the time of custody will be noted on the chain of custody (e.g., sample breakage or depletion).

3.7 Post-Excavation End-Point Sampling Methodology

End-point samples will be collected from the base of the excavation every 900 square feet (SF) and from the sidewalls of the excavation every 30 linear feet (LF). At remedial excavation depth, end-point samples will be collected from the bottom of the excavation and sidewalls of the excavation (where possible, based on support of excavation methods). It is anticipated that a total of 12 base of excavation end-point samples and 14 sidewall end-point samples will be collected following implementation of the Remedial Action. Figure 5 of the RAWP presents a generalized post-excavation sampling location map.

All post-excavation sample results will be compared with the Restricted-Residential Use SCOs. Any soils not meeting the Restricted-Residential Use SCOs within the excavation will be removed and the area backfilled with clean fill meeting the criteria outlined in the RAWP.

All end-point samples will be analyzed for the following analytes on the Part 375 list with a Category B deliverable package:

- Target Compound List (TCL) VOCs by EPA Method 8260C;
- TCL Semivolatile Organic Compounds (SVOCs) by EPA Method 8270C;
- Polychlorinated Biphenyls (PCBs) by EPA Method 8082A;
- Pesticides by EPA Method 8081B;
- Target Analyte List (TAL) Metals by EPA Method 6010C / 7471B;
- PFAS by EPA Method 1633 [reporting limit of 0.5 parts per billion (ppb)]; and,
- 1,4-Dioxane by EPA Method 8270.

Field methods can impact the analysis of PFAS. PFAS samples will be collected using dedicated disposable sampling equipment when possible. If dedicated disposable sampling equipment cannot be used, samples will be collected with stainless steel tools (spoons, bowls, etc.) and decontaminated using detergent (Alconox) and clean, PFAS-free water. Sampling containers for PFAS will be made of high-density polyethylene (HDPE) with caps that will not be lined with polytetrafluoroethylene (PTFE). PFAS sampling containers will be kept in separate coolers from all other sampling containers and only regular ice will be used to cool the samples. Field staff conducting the sampling will not wear clothing that contains PTFE material or that has been waterproofed with PFAS material during sampling and all clothing worn will be laundered multiple times. Any bug spray or sunscreen utilized by field staff conducting the sampling will be PFAS free.

The following PFAS will be analyzed by EPA Method 1633:
- Perfluorobutanoic Acid (PFBA)
- Perfluoropentanoic Acid (PFPeA)
- Perfluorobutanesulfonic Acid (PFBS)
- 1H,1H,2H,2H-Perfluorohexanesulfonic Acid (4:2FTS)
- Perfluorohexanoic Acid (PFHxA)
- Perfluoropentanesulfonic Acid (PFPeS)
- Perfluoroheptanoic Acid (PFHpA)
- Perfluorohexanesulfonic Acid (PFHxS)
- Perfluorooctanoic Acid (PFOA)
- 1H,1H,2H,2H-Perfluorooctanesulfonic Acid (6:2FTS)
- Perfluoroheptanesulfonic Acid (PFHpS)
- Perfluorononanoic Acid (PFNA)
- Perfluorooctanesulfonic Acid (PFOS)
- Perfluorodecanoic Acid (PFDA)
- 1H,1H,2H,2H-Perfluorodecanesulfonic Acid (8:2FTS)
- Perfluorononanesulfonic Acid (PFNS)
- N-Methyl Perfluorooctanesulfonamidoacetic Acid (NMeFOSAA)
- Perfluoroundecanoic Acid (PFUnA)
- Perfluorodecanesulfonic Acid (PFDS)
- Perfluorooctanesulfonamide (FOSA)
- N-Ethyl Perfluorooctanesulfonamidoacetic Acid (NEtFOSAA)
- Perfluorododecanoic Acid (PFDoA)
- Perfluorotridecanoic Acid (PFTrDA)
- Perfluorotetradecanoic Acid (PFTA)
- 2,3,3,3-Tetrafluoro-2-[1,1,2,2,3,3,3-Heptafluoropropoxy]-Propanoic Acid (HFPO-DA)
- 4,8-Dioxa-3h-Perfluorononanoic Acid (ADONA)
- Perfluorododecane Sulfonic Acid (PFDoDS)
- 9-Chlorohexadecafluoro-3-Oxanone-1-Sulfonic Acid (9Cl-PF3ONS)
- 11-Chloroeicosafluoro-3-Oxaundecane-1-Sulfonic Acid (11Cl-PF3OUdS)
- N-Methyl Perfluorooctane Sulfonamide (NMeFOSA)
- N-Ethyl Perfluorooctane Sulfonamide (NEtFOSA)
- N-Methyl Perfluorooctanesulfonamido Ethanol (NMeFOSE)

- N-Ethyl Perfluorooctanesulfonamido Ethanol (NEtFOSE)
- Perfluoro-3-Methoxypropanoic Acid (PFMPA)
- Perfluoro-4-Methoxybutanoic Acid (PFMBA)
- Perfluoro(2-Ethoxyethane)Sulfonic Acid (PFEESA)
- Nonafluoro-3,6-Dioxaheptanoic Acid (NFDHA)
- 3-Perfluoropropyl Propanoic Acid (3:3FTCA)
- 2H,2H,3H,3H-Perfluorooctanoic Acid (5:3FTCA)
- 3-Perfluoroheptyl Propanoic Acid (7:3FTCA)

A sampling guide is included in Appendix B. A list of PFAS compounds to be analyzed and associated MDLs is included in Appendix C. Alpha Analytical, an ELAP-certified lab for PFAS by EPA Method 1633, will be performing all PFAS analyses of soil. The laboratory standard operating procedures for PFAS analysis is included in Appendix D.

3.8 Baseline and Post-Remedial Indoor Air Sampling Methodology

All baseline and post-remedial indoor air samples will be collected in accordance with the NYSDOH Soil Vapor Guidance. Some sample locations may be adjusted based on field observations or conditions.

Four indoor air samples will be collected from breathing height (three to five feet above the floor) from within the Site building during the baseline and post-remedial sampling events; one ambient air sample will be collected during each sampling event. The sampling flow rate will not exceed 0.2 L/min. Sampling will occur for eight hours in commercial structures. A sample log sheet will be maintained summarizing sample identification, date and time of sample collection, identity of samplers, sampling methods and devices, vacuum of canisters before and after the samples are collected, apparent moisture content of the sampling zone, and chain-of-custody protocols.

Baseline and post-remedial indoor air samples will be collected in laboratory-supplied 6-liter Summa canisters using eight-hour regulators in commercial structures or 24-hour regulators in residential structures. Indoor and ambient air samples will be analyzed for VOCs using EPA Method TO-15.

3.9 Analytical Methods/Quality Assurance Summary Table

A summary of the analytical methods and quality assurance methods are included in Table 1, below.

Table 1
Analytical Methods/Quality Assurance Summary

Matrix	Proposed Samples	QA/QC Samples					Total # Samples	Analytical Parameter	Method	Preservative	Holding Times	Container
		TB	FB	DUP	MS/MSD	EB						
Soil	26	2	2	2	2 / 2	0	36	VOCs	8260C	Cool to 4°C, No Headspace	14 days	(3) Encore samplers; (1) 2-oz plastic bottle
	26	0	2	2	2 / 2	0	34	SVOCs	8270D	Cool to 4°C		(1) 4-oz amber glass bottle
	26	0	2	2	2 / 2	0	34	Pesticides	8081B			
	26	0	2	2	2 / 2	0	34	PCBs	8082A			
	26	0	2	2	2 / 2	0	34	TAL Metals	8151A, 7196A, 3050B, 7471B, 9010C/9012B/ 9014, 3060A/7196		28 days for mercury; 6 months for all others	
	26	0	2	2	2 / 2	0	34	1,4-Dioxane	8270		14 days	
	26	0	2	2	2 / 2	1 per day	34	PFAS	1633		14 days to extraction, 28 days following extraction	(1) 8-oz HDPE bottle
Indoor Air	4 (per sampling event)	0	0	0	0	0	4	VOCs	TO-15	None	30 days	(1) 6-L Summa
Ambient Air	1 (per sampling event)	0	0	0	0	0	1					

TB – Trip Blank
FB – Field Blank

DUP – Duplicate
EB – Equipment Blank
°C – degrees Celsius

3.10 Decontamination

Where possible, samples will be collected using new, dedicated sampling equipment so that decontamination is not required. All non-dedicated drilling tools and equipment will be decontaminated between boring locations using potable tap water and a phosphate-free detergent (e.g., Alconox) and/or a steam cleaner. All non-dedicated sampling equipment will also have a final rinse with deionized water. Decontamination water will be collected and disposed as investigation-derived waste (IDW).

3.11 Data Review and Reporting

The NYSDEC ASP Category B data package will be validated by an independent data validation subconsultant and a DUSR summarizing the results of the data validation process will be prepared. All reported analytical results will be qualified as necessary by the data validation and will be reviewed and compared against background concentrations and/or applicable New York State criteria:

Soil – Restricted-Residential Use Soil Cleanup Objectives (SCOs) as listed in 6 NYCRR Part 375; and,
Indoor Air – NYSDOH Matrices and Air Guideline Values (AGVs).

All end-point and indoor air analytical results will be documented in the Final Engineering Report (FER), which will describe Site conditions and document applicable observations made during the sample collection. In addition, the FER will include a description of the sampling procedures, tabulated sample results and an assessment of the data and conclusions. The laboratory data packages, DUSR, and field notes will be included in the FER as appendices. All data will also be submitted electronically to NYSDEC via the Environmental Information Management System (EIMS) in EqUIS format.

Appendix A

Resumes

Matthew Carroll, P.E.
Environmental Engineer/Principal

Experience Summary

Matthew Carroll is an environmental engineer experienced in all aspects of site assessment and development and implementation of remedial strategies. He has managed projects from inception through investigation, remediation and closure. His expertise includes soil, soil gas, and groundwater remediation, preparation of cost estimates, remedial alternative selection and design, soil characterization for disposal, field safety oversight, and preparation of work plans and reports to satisfy New York and New Jersey state requirements, and New York City "e" designation and restrictive declarations. Mr. Carroll's project management experience includes past management of a New York City School Construction Authority hazardous materials contract. He is responsible for all engineering work performed by Tenen and is currently the project manager and remedial engineer for several New York State Brownfield Cleanup Program sites.

Selected Project Experience

470 Kent Avenue, Brooklyn
As project manager, supported the client in due diligence and transactional activities, including a Phase I ESA, preliminary site investigation, and remedial cost estimate; preparation of BCP application and remedial investigation work plan. The former manufactured gas plant, sugar refinery and lumberyard will be developed as a mixed-use project with market rate and affordable housing and public waterfront access. As remedial engineer, will be responsible for development of remedial alternatives and oversight and certification of all remedial activities.

500 Exterior Street, Bronx
Designed and implemented the investigation of this former lumberyard and auto repair shop that will be redeveloped as mixed use development with an affordable housing component; prepared BCP application and subsequent work plans and reports. Designed a remedial strategy incorporating both interim remedial measures (IRMs) and remediation during the development phase.

Gateway Elton I and II, Brooklyn
Conducted soil disposal characterization, prepared Remedial Action Work Plans and designed methane mitigation systems for two phases of a nine-building residential development and commercial space; prepared and oversaw implementation of a Stormwater Pollution Prevention Plan during construction and prepared and certified the remedial closure reports for the project.

Affordable Housing Development, Rye, NY
Consultant to the City of Rye on environmental issues pertaining to a county-owned development site slated for an afford senior housing; reviewed environmental documentation for the project and prepared summary memorandum for City Council review; recommended engineering controls to address potential exposure to petroleum constituents, presented report findings at public meetings and currently providing ongoing environmental support during project implementation.

Queens West Development BCP Site, Long Island City, New York
Assistant Project Manager for two developers involved in the site.

- Responsible for oversight of remediation under the New York State Brownfield Cleanup Program
- Technical review of work plans and reports and coordination of the Applicant's investigation and oversight efforts
- Provided input for mass calculations and well placement for an in-situ oxidation remedy implemented on a proposed development parcel and within a City street
- Conducted technical review of work pertaining to a former refinery. Documents reviewed included work plans for characterization and contaminant delineation; pilot test (chemical oxidation); remediation (excavation and groundwater treatment). Managed field personnel conducting full time oversight and prepared progress summaries for distribution to project team
- Following implementation of remedial action, implemented the Site Management Plan and installation/design of engineering controls (SSDS, vapor barrier/concrete slab, NAPL recovery). Also responsible for coordination with NYSDEC

Brownfield Cleanup Program Redevelopment Sites – West Side, New York City
Managed remediation of a development consisting of four parcels being addressed under one or more State and city regulatory programs (NYS Brownfield Cleanup Program, NYS Spills, and NYC "e" designation program). Remediation includes soil removal, screening and disposal; treatment of groundwater during construction dewatering and implementation of a worker health and safety plan and community air monitoring plan (HASP/CAMP)

Managed an additional BCP site, supported the Applicant in coordination with MTA to create station access for the planned No. 7 subway extension; also provided support the client in coordination with Amtrak to obtain access for remedial activities on the portion of the site that is within an Amtrak easement. The site will eventually be used for construction of a mixed-use high-rise building.

BCP Site, Downtown Brooklyn, New York
Performed investigation on off-site properties and designed an SSDS for an adjacent building, retrofitting the system within the constraints of the existing structure; coordinated the installation of the indoor HVAC controls and vapor barrier; provided input to the design of a SVE system to address soil vapor issues on the site.

West Chelsea Brownfield Cleanup Program Site
Designed an in-situ remediation program and sub-slab depressurization system to address contamination remaining under the High Line Viaduct; SSDS design included specification of sub-grade components, fan modeling and selection, identifying exhaust location within building constraints and performance modeling; prepared the Operations Maintenance and Monitoring Plan and Site Management Plan sections pertaining to the SSDS.

Historic Creosote Spill Remediation – Queens, New York – New York State Voluntary Cleanup Program
Modeled contamination volume and extent and prepared mass estimates of historic fill constituents and creosote-related contamination; designed a soil vapor extraction (SVE) and dewatering system to address historic creosote release both above and below static

water table; coordinated with the Metropolitan Transit Authority and prepared drawings to secure approval to drill in the area of MTA subway tunnels.

NYSDEC Spill Site– Far West Side, Manhattan
Provided support to client during negotiations with a major oil company regarding allocation of remedial costs. Worked with client's attorney to develop a regulatory strategy to address the client's obligations under the NYSDEC Spills Program and the New York City "e" designation requirements.

Affordable Housing Site, Brooklyn, New York
Modified prior work plans for soil, soil vapor and groundwater investigation to address requirements for site entry into the New York City Brownfield Cleanup Program. Prepared technical basis for use of prior data previously disallowed by OER. Currently conducting site investigation.

New York City School Construction Authority Hazardous Materials Contract
Provided work scopes and cost estimates, managed and implemented concurrent projects, including Phase I site assessments, Phase II soil, groundwater and soil gas investigations, review of contractor bid documents, preparation of SEQR documents, specifications and field oversight for above- and underground storage tank removal, and emergency response and spill control.

Former Manufacturing Facility, Hoboken, New Jersey
Evaluated site investigation data to support a revision of the current property use to unrestricted; modified the John & Ettinger vapor intrusion model to apply the model to a site-specific, mixed use commercial/residential development; implemented a Remedial Action Work Plan that included the characterization, removal and separation of 9,500 cubic yards of historic fill; designed and implemented a groundwater characterization/delineation program using a real-time Triad approach; designed and implemented an innovative chemical oxidation technology for the property.

F**ormer Varnish Manufacturer – Newark, New Jersey**
Prepared a Phase I environmental site assessment; implemented soil and groundwater sampling to assess presence of petroleum and chlorinated compounds; prepared alternate cost remediation scenarios for settlement purposes and implemented a groundwater investigation plan, including pump tests and piezometer installation to assess the effect of subsurface utilities and unique drainage pathways upon contaminant transport.

Education and Certifications

Professional Engineer, New York
Bachelor of Engineering, Environmental; Stevens Institute of Technology, 2002
Bachelor of Science, Chemistry, New York University, 2002
Technical and Regulatory Training in Underground Storage Tanks, Cook College, Rutgers University, 2006

Mohamed Ahmed, Ph.D., C.P.G.
Sr. Geologist/Principal

Experience Summary

Mohamed Ahmed is a certified professional geologist with nearly 23 years of experience in the New York City metropolitan area. He has designed and implemented subsurface investigations and is proficient in groundwater modeling, design of groundwater treatment systems and soil remediation. He has managed numerous projects focused on compliance with the New York State Brownfield Cleanup and Spills programs and the New York City "e" designation program. Dr. Ahmed also has extensive experience in conducting regulatory negotiations with the New York State Department of Environmental Conservation, the NYC Office of Housing Preservation and Development, and the Mayor's Office of Environmental Remediation.

Selected Project Experience

Willoughby Square, Downtown Brooklyn

As Project Manager, directs all regulatory interaction and investigation on this joint public-private sector redevelopment that will include a public park and four-level underground parking garage. Prepared the remedial investigation work plan and remedial action work plan, conducted investigation activities and waste characterization, and negotiated with the NYC Department of Environmental Protection and the Mayor's Office of Environmental Remediation to transition the site into the NYC Voluntary Cleanup Program.

School Facility, Borough Park, Brooklyn

Managed all regulatory agency coordination, work plan and report preparation and remedial oversight; worked with OER to determine measures to retroactively address the hazardous materials and air quality E-designations on a previously constructed school building and prepared supporting documentation to justify the use of electrical units rather than natural gas.

LGA Hotel Site, East Elmhurst, Queens

Project manager for all work conducted at this former gasoline service station which is being remediated under the NYS Brownfield Cleanup Program; technical oversight of work plans, reports, and design and implementation of field and soil disposal characterization.

436 10th Avenue, Manhattan

As project manager and technical lead, assisted client in developing remedial cost estimates used for property transaction, developed regulatory strategy to address NYS Spills and NYC E-designation requirements, and currently overseeing remedial activities which include removal and disposal of petroleum-contaminated bedrock and dewatering and disposal of impacted groundwater.

Brownfield Cleanup Program Site, Downtown Brooklyn

Managed investigation and remediation under the BCP program for a proposed mixed-use development; designed the remedial investigation and prepared the remedial action work plan which includes an SVE system monitored natural attenuation. Prepared remedial cost estimates for several scenarios. The project will include a 53-story mixed-use structure and parking garage.

Queens West Development, Long Island City
Directed project team and subcontractors for soil investigation/remediation studies on multiple properties; provided technical support for negotiations with NYSDEC during investigation and remediation.

Former Creosote Site, Long Island City
Designed and implemented a complex investigation to assess the nature and extent of historic creosote contamination at this former industrial site; conducted studies to optimize recovery of LNAPL and DNAPL and developed strategies using bioremediation and natural attenuation in conjunction with conventional remedial approaches. Performed pilot tests for soil vapor extraction system design and coordinated with NYSDEC and NYSDOH to implement sub-slab soil vapor sampling.

NYSDEC Spill Site – Far West Side, Manhattan
Developed a detailed remedial cost estimate for to support client negotiations with a major oil company. The estimate included costs pertaining to: chipping, removal and disposal of petroleum-impacted bedrock; removal/disposal of recycled concrete; costs for dewatering and disposal of impacted groundwater during construction; and design and installation of a vapor barrier below the redevelopment.

Active Industrial Facility, Newburgh, New York
Designed remedial investigation of soil and groundwater contaminated with trichloroethane; performed soil vapor pilot test and pump test to aid in design of soil and groundwater remediation alternatives; conducted sub-slab vapor sampling in accordance with NYSDOH guidance.

Former Dry Cleaning Facility, New York City
Conducted soil and groundwater investigations, designed and installed a soil vapor extraction system and performed extensive testing of indoor air. Negotiated the scope of the RI and IRM with NYSDEC.

Waterfront Redevelopment, Yonkers, NY
Designed and performed geophysics survey of six parcels to determine locations of subsurface features; supervised test pit excavation to confirm geophysics results and evaluate and classify soil conditions prior to development activities.

Prince's Point, Staten Island, New York
Performed soil, groundwater and sediment sampling to delineate the extent of contamination; used field-screening techniques to control analytical costs and supervised soil excavation and disposal.

Apartment Complex, New York City, New York
Coordinated with Con Edison, the owner of the adjacent property and NYSDEC to determine oil recovery protocol; assessed hydrogeological conditions and conducted pilot tests to design cost-effective recovery system; designed and supervised installation of recovery system.

Publications

“Impact of Toxic Waste Dumping on the Submarine Environment: A Case Study from the New York Bight”. Northeastern Geology and Environmental Sciences, V. 21, No. 12, p. 102-120. (With G. Friedman)

Metals Fluxes Across the Water/Sediment Interface and the Influence of pH. Northeastern Geology and Environmental Sciences, in press. (With G. Friedman)

“Water and Organic Waste Near Dumping Ground in the New York Bight”. International Journal of Coal Geology, volume 43. (With G. Friedman)

Education and Certifications

Ph.D., Earth and Environmental Sciences, Graduate Center of the City of New York (2001)
M.Ph., Earth and Environmental Sciences, City University of New York (1998)
M.A. Geology, Brooklyn College (1993)
B.S. Geology, Alexandria University, Egypt (1982)

American Institute of Professional Geologists, Certified Professional Geologist, 1997-2015

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

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

Appendix B

PFAS Field Sampling Guidelines

YORK
ANALYTICAL LABORATORIES INC

PFAS Field Sampling Guidelines for Groundwater and Soil

For Waters: 2 x 125 mL Bottles per sample filled to the neck of the bottle

PLEASE READ THESE INSTRUCTIONS PRIOR TO CONDUCTING SAMPLING

Sampling for PFAS for determination using EPA 537m can be challenging due to the prevalence of these compounds in consumer products. The following guidelines reflect current knowledge and are recommended when conducting sampling.

Consider Sampling for PFAS First...

Sample containers for other methods may have PFAS present on their sampling containers which could cross-contaminate your sample(s). We are analyzing down to the low parts-per-trillion (ppt) range so cross-contamination prevention is an important consideration.

SAMPLING

All Sampling done with Nitrile Gloves, provided by YORK

SAMPLE CONTAINERS

All sample containers - PP ONLY (Target list of 21 PFAS) Caps are unlined and made of PP (no Teflon® lined caps) Bottles are Batch Certified to be Target PFAS-free (< Reporting Limit)

FIELD EQUIPMENT

-Must not contain Teflon® (aka PTFE) or LDPE materials

-All sampling materials must be made from stainless steel, HDPE, acetate, silicone, or polypropylene

-No waterproof field notebooks can be used

-No plastic clipboards, binders, or the like

-No adhesives (e.g.Post-It® Notes, Duct tape) can be used

-Sharpies and permanent markers not allowed; regular ball point pens are acceptable

-Aluminum foil must not be used

-Keep PFAS samples in separate cooler, away from sampling containers that may contain PFAS

-Coolers filled with regular ice only - Do not use chemical (blue) ice packs

EQUIPMENT DECON

-"PFAS-free" water (e.g. Poland Spring*)-on-site for decontamination

-Only Alconox and Liquinox can be used for decontamination

* *Poland Spring has been demonstrated to be PFAS -free when freshly opened*

FIELD SAMPLING CLOTHING CONSIDERATIONS

Do not use fabric softener on clothing to be worn in field

Do not used cosmetics, moisturizers, hand cream, or other related products the morning of sampling

Do not use sunscreen or insect repellants

No materials containing Tyvek®

All safety boots made from polyurethane and PVC

No clothing or boots containing Gore-Tex®

Wet weather gear made of polyurethane and PVC only

FOOD CONSIDERATIONS

No food or drink when PFAS Sampling with exception of bottled water and/or hydration drinks (i.e., Gatorade and Powerade) that is available for consumption only in the staging area.

SAMPLE CONTAINER HANDLING

-For **AQUEOUS** Samples: Each sample set contains 2 x 125 mL containers. Fill each container to the neck

-For **SOILS**-1 x 250 mL container, FILL HALF WAY ONLY

-No preservative is necessary for this appliction at this time.

-Place closed, labeled Sample bottles into ZipLock bag.

-Dispose of Nitrile gloves in provided waste bag.

-Place in separate cooler from other samples, WET ICE only

-Follow instructions on next page for more detail.

-If you have a Quality Assurance Project Plan follow that guidance

PFAS -Recommended Field Sampling Guidelines

PLEASE READ INSTRUCTIONS ENTIRELY PRIOR TO SAMPLING EVENT

Sampler should wash hands before wearing nitrile gloves in order to limit contamination during sampling. Each sample set* requires a set of containers to comply with the method as indicated below. **Sample set is composed of samples collected from the same sample site and at the same time.* **A pair of Nitrile gloves is included with each sample Zip-lock bag/bottle set. One Field Blank set per day is provided.**

Note: PP is Polypropylene

Sample Containers	Bottle Type	Preservation
2 Sampling Containers - Empty- per sample-Waters **SOILS- 1 Container-fill only half way**	125 mL PP container-Waters 250 mL PP for Soils	None, Cool <6C
1 PP Bottle with PFAS-free Water for Field Blank	125 mL PP container	None, Cool <6C
1 Field Blank (FRB) - Empty-per sampling day	125 mL PP container	None, Cool <6C
2 - Empty PP bottles for MS/DUP when needed (Soils MS/DUP come from same Bottle)	125 mL PP container	None, Cool <6C

NOTE: Sampling containers for WATERS must be filled to the neck. **SOILS, fill bottle only 1/2 full**

FIELD BLANK and MS/DUP Bottles are labeled with NEON GREEN LABELS

Field blanks are required per sampling event day and the containers have been provided. Follow the instructions below.

Field Blank Instructions:

1. Locate the PFAS Field Blank bottle (empty, labeled) supplied The PFAS Field Blank Water container is pre-filled at YORK with PFAS-free water to transfer to the empty PFAS Field Blank bottle.
2. Locate the empty container labeled "Field Blank" with Neon green labels
3. Open both containers and proceed to transfer contents of the "PFAS FIELD BLANK WATER" container into the "PFAS FIELD BLANK" Bottle
4. Field Blanks to be analyzed must be listed on the Chain-of-Custody.
5. Both the empty Field Blank water container and the filled Field Blank container must be returned to YORK along with the samples taken.

Matrix Spike/ Matrix Dup Instructions: Note: S**oil MS/MSD** can be from the same container as the sample

1. Locate the PFAS MS and DUP bottles (empty, labeled-NEON GREEN) supplied -normally 1 set per 20 field samples
2. Transfer chosen Field MS /Dup as a normal sample and indicate sample ID on container and on Chain-of-Custody

Sampling Instructions: ALL SAMPLE BOTTLES HAVE NEON YELLOW LABELS

1. Do not overfill or rinse the container. Any sample(s) for Matrix Spike and Matrix Duplicates are treated similarly.
2. Close containers securely. Label legibly and place containers in ZipLoc® bags, and in a separate cooler (no other container types).
3. Ensure Chain-of-Custody and all sample labels contain required information. Place all samples in separate coolers (separate from other samples for different parameters). Place wet ice (bagged) on samples for return to YORK. Samples should be kept at 4°C ±2. Samples must not exceed 10°C during first 48 hours after collection. **Hold time is 14 days.**

York Analytical Laboratories, Inc. ***Emerging Contaminants Laboratory***
132-02 89th Avenue SUITE 217 Richmond Hill, NY 11418

Appendix C

PFAS Compounds to be Analyzed and Associated MDLs

Appendix C
PFAS Compounds to be Analyzed and Associated MDLs

Analyte	Soil MDL (ng/g)	Groundwater MDL (ng/l)
Perfluorobutanoic Acid (PFBA)	0.0504	0.512
Perfluoropentanoic Acid (PFPeA)	0.056	0.428
Perfluorobutanesulfonic Acid (PFBS)	0.0432	0.268
1H,1H,2H,2H-Perfluorohexanesulfonic Acid (4:2FTS)	0.0808	0.836
Perfluorohexanoic Acid (PFHxA)	0.0464	0.236
Perfluoropentanesulfonic Acid (PFPeS)	0.0232	0.14
Perfluoroheptanoic Acid (PFHpA)	0.0232	0.16
Perfluorohexanesulfonic Acid (PFHxS)	0.0592	0.192
Perfluorooctanoic Acid (PFOA)	0.052	0.348
1H,1H,2H,2H-Perfluorooctanesulfonic Acid (6:2FTS)	0.28	1.08
Perfluoroheptanesulfonic Acid (PFHpS)	0.0368	0.216
Perfluorononanoic Acid (PFNA)	0.0784	0.252
Perfluorooctanesulfonic Acid (PFOS)	0.0792	0.364
Perfluorodecanoic Acid (PFDA)	0.0752	0.324
1H,1H,2H,2H-Perfluorodecanesulfonic Acid (8:2FTS)	0.3872	1.244
Perfluorononanesulfonic Acid (PFNS)	0.0424	0.248
N-Methyl Perfluorooctanesulfonamidoacetic Acid (NMeFOSAA)	0.1	0.436
Perfluoroundecanoic Acid (PFUnA)	0.0512	0.348
Perfluorodecanesulfonic Acid (PFDS)	0.032	0.184
Perfluorooctanesulfonamide (FOSA)	0.0432	0.216
N-Ethyl Perfluorooctanesulfonamidoacetic Acid (NEtFOSAA)	0.0824	0.432
Perfluorododecanoic Acid (PFDoA)	0.0408	0.368
Perfluorotridecanoic Acid (PFTrDA)	0.0528	0.3
Perfluorotetradecanoic Acid (PFTA)	0.1064	0.212
2,3,3,3-Tetrafluoro-2-[1,1,2,2,3,3,3-Heptafluoropropoxy]-Propanoic Acid (HFPO-DA)	0.0984	0.448
4,8-Dioxa-3h-Perfluorononanoic Acid (ADONA)	0.1464	0.504
Perfluorododecane Sulfonic Acid (PFDoDS)	0.0384	0.304
9-Chlorohexadecafluoro-3-Oxanone-1-Sulfonic Acid (9Cl-PF3ONS)	0.196	0.66
11-Chloroeicosafluoro-3-Oxaundecane-1-Sulfonic Acid (11Cl-PF3OUdS)	0.1672	0.66
N-Methyl Perfluorooctane Sulfonamide (NMeFOSA)	0.1	0.348
N-Ethyl Perfluorooctane Sulfonamide (NEtFOSA)	0.112	0.368
N-Methyl Perfluorooctanesulfonamido Ethanol (NMeFOSE)	0.2504	1.88
N-Ethyl Perfluorooctanesulfonamido Ethanol (NEtFOSE)	0.5104	0.98
Perfluoro-3-Methoxypropanoic Acid (PFMPA)	0.0408	0.228
Perfluoro-4-Methoxybutanoic Acid (PFMBA)	0.0312	0.212
Perfluoro(2-Ethoxyethane)Sulfonic Acid (PFEESA)	0.0832	0.176
Nonafluoro-3,6-Dioxaheptanoic Acid (NFDHA)	0.0952	0.944
3-Perfluoropropyl Propanoic Acid (3:3FTCA)	0.144	1.32
2H,2H,3H,3H-Perfluorooctanoic Acid (5:3FTCA)	0.5048	4.68
3-Perfluoroheptyl Propanoic Acid (7:3FTCA)	1.76	3.156

Appendix D

Laboratory Standard Operating Procedures for PFAS Analysis

Standard Operating Procedure

Determination of Target Per- and Polyfluoroalkyl Substances (PFAS) in Aqueous and Solid matrices by Isotope Dilution Analysis by HPLC/MS-MS
According to EPA Method 1633 Draft 3

Approvals

Laboratory Director/QA Officer

____
Krys Trafalski

General Manager

Scott R. Hall
____
Scott Hall

UNCONTROLLED COPY

Controlled Copy No. PFAS_LCMSMS1633, Rev 1.2-____

Issued to: NA

1. SCOPE AND APPLICATION

This method is used to identify and quantitate specific PFAS compounds in extracts of non-potable water and solid (soil/sediment) samples using HPLC/MS-MS (High Pressure Liquid Chromatography/Tandem Mass Spectrometry). Currently the compounds (40) that are measured by this methodology are listed in Table 1.0 below.

Table 1.0-Target PFAS

Perfluoroalkyl carboxylic acids		
Perfluorobutanoic acid	PFBA	375-22-4
Perfluoropentanoic acid	PFPeA	2706-90-3
Perfluorohexanoic acid	PFHxA	307-24-4
Perfluoroheptanoic acid	PFHpA	375-85-9
Perfluorooctanoic acid	PFOA	335-67-1
Perfluorononanoic acid	PFNA	375-95-1
Perfluorodecanoic acid	PFDA	335-76-2
Perfluoroundecanoic acid	PFUnA	2058-94-8
Perfluorododecanoic acid	PFDoA	307-55-1
Perfluorotridecanoic acid	PFTrDA	72629-94-8
Perfluorotetradecanoic acid	PFTeDA	376-06-7
Perfluoroalkyl sulfonic acids Acid Form		
Perfluorobutanesulfonic acid	PFBS	375-73-5
Perfluoropentansulfonic acid	PFPeS	2706-91-4
Perfluorohexanesulfonic acid	PFHxS	355-46-4
Perfluoroheptanesulfonic acid	PFHpS	375-92-8
Perfluorooctanesulfonic acid	PFOS	1763-23-1
Perfluorononanesulfonic acid	PFNS	68259-12-1
Perfluorodecanesulfonic acid	PFDS	335-77-3
Perfluorododecanesulfonic acid	PFDoS	79780-39-5
Fluorotelomer sulfonic acids		
1*H*,1*H*, 2*H*, 2*H*-Perfluorohexane sulfonic acid	4:2FTS	757124-72-4
1*H*,1*H*, 2*H*, 2*H*-Perfluorooctane sulfonic acid	6:2FTS	27619-97-2
1*H*,1*H*, 2*H*, 2*H*-Perfluorodecane sulfonic acid	8:2FTS	39108-34-4
Perfluorooctane sulfonamides		
Perfluorooctanesulfonamide	PFOSA	754-91-6
N-methyl perfluorooctanesulfonamide	NMeFOSA	31506-32-8
N-ethyl perfluorooctanesulfonamide	NEtFOSA	4151-50-2
Perfluorooctane sulfonamidoacetic acids		
N-methyl perfluorooctanesulfonamidoacetic acid	NMeFOSAA	2355-31-9
N-ethyl perfluorooctanesulfonamidoacetic acid	NEtFOSAA	2991-50-6
Perfluorooctane sulfonamide ethanols		
N-methyl perfluorooctanesulfonamidoethanol	NMeFOSE	24448-09-7
N-ethyl perfluorooctanesulfonamidoethanol	NEtFOSE	1691-99-2
Per- and Polyfluoroether carboxylic acids		
Hexafluoropropylene oxide dimer acid	HFPO-DA	13252-13-6
4,8-Dioxa-3*H*-perfluorononanoic acid	ADONA	919005-14-4
Perfluoro-3-methoxypropanoic acid	PFMPA	377-73-1
Perfluoro-4-methoxybutanoic acid	PFMBA	863090-89-5
Nonafluoro-3,6-dioxaheptanoic acid	NFDHA	151772-58-6
Ether sulfonic acids		
9-Chlorohexadecafluoro-3-oxanonane-1-sulfonic acid	9Cl-PF3ONS	756426-58-1
11-Chloroeicosafluoro-3-oxaundecane-1-sulfonic acid	11Cl-PF3OUdS	763051-92-9
Perfluoro(2-ethoxyethane)sulfonic acid	PFEESA	113507-82-7

Fluorotelomer carboxylic acids		
3-Perfluoropropyl propanoic acid	3:3FTCA	356-02-5
2*H*,2*H*,3*H*,3*H*-Perfluorooctanoic acid	5:3FTCA	914637-49-3
3-Perfluoroheptyl propanoic acid	7:3FTCA	812-70-4

The estimated reporting limits (MRL) based upon the preparation/analysis parameters herein at the time of this revision are approximately 2.0 - 25.0 ng/L (ppt) for aqueous samples and 0.5 - 5.0 µg/kg for solids. The linear range for these PFAS can be extended by dilution. These MRLs are based upon a volume of 250 mL - 500 mL extracted for aqueous samples and 2 - 5 g for solids. Please refer to *Appendix 1: Target Compound Reporting Limits* for limits of detection and quantitation based on a 5 g extract and 500 mL extract for soils and waters, respectively. Please note, MDL/LOD values are based on the initial November 2022 study and are subject to change based on ongoing study data. The most up-to-date study data will be kept on file by the Quality Department and readily available in the test code section(s) of Element LIMS.

This method is “performance-based,” which means that modifications may be made without additional EPA review to improve performance (e.g., overcome interferences, or improve the sensitivity, accuracy, or precision of the results) *provided that all* performance criteria in this method are met. Requirements for establishing equivalency are in Section 9.1.2 and include 9.1.2.2c. For Clean Water Act (CWA) uses, additional flexibility is described at 40 CFR 136.6. Changes in performance, sensitivity, selectivity, precision, recovery, etc., that result from modifications within the scope of 40 CFR Part 136.6, and Section 9.0 of this method must be documented, as well as how these modifications compare to the specifications in this method. Changes outside the scope of 40 CFR Part 136.6 and Section 9.0 of this method may require prior review or approval.

2. SUMMARY

Environmental samples are prepared and extracted using method-specific procedures. Sample extracts are subjected to cleanup procedures designed to remove interferences. Analyses of the sample extracts are conducted by HPLC-MS/MS in the multiple reaction monitoring (MRM) mode. Sample concentrations are determined by isotope dilution or extracted internal standard quantification (see Section 10.3) using isotopically labeled compounds added to the samples before extraction.

2.1 Extraction

2.1.1 Aqueous samples are spiked with isotopically labeled standards, extracted using solid-phase extraction (SPE) cartridges and undergo cleanup using carbon before analysis.

2.1.2 Solid samples are spiked with isotopically labeled standards, extracted into basic methanol, and cleaned up by carbon and SPE cartridges before analysis.

2.2 Analysis

2.2.1 Extracts are analyzed by HPLC-MS/MS in MRM mode. Extracts contain Non-extracted Internal Standards (NIS) to monitor instrument performance and are used for quantitative analysis.

2.2.2 Individual PFAS analytes are identified through peak analysis of the quantification and confirmation ions (Precursor and product ions) where applicable.

2.2.3 The concentration of each analyte is calculated using the isotope dilution technique. This approach corrects the target analyte concentration based on recovery of isotopic analogues and essentially behave like extracted internal standards (EIS). For QC purposes, the percent recoveries of the isotope dilution analogues are calculated using the integrated peak areas of isotope performance standards, which are added to the final extract and function as traditional internal standards (non-extracted internal standards), exclusively applied to the isotope dilution analogues.

3. DEFINITIONS

3.1 ANALYTICAL SEQUENCE – A set of samples that are analyzed on the same instrument continuously over a period, typically a 24 hours. An analytical sequence may consist of multiple extraction batches and various matrices and is bracketed by method specific quality control analyses.

3.2 CALIBRATION STANDARD (CAL) – A solution of the method analytes, isotope dilution analogues, and isotope performance standards (Internal standards) prepared from primary dilution and stock standards. The calibration standards are used to calibrate the instrument response with respect to analyte concentration.

3.3 CONTINUING CALIBRATION VERIFICATION (CCV) – A calibration standard containing target compounds, isotopic analogues, and internal standards. The CCV is analyzed periodically to verify the accuracy of an existing calibration.

3.4 EXTRACTION BATCH – A set of up to 20 Field Samples (not including quality control samples) extracted together by the same person(s) during a workday using the same lot of standards and reagents.

3.5 FIELD DUPLICATES – Separate samples collected at the same time and sampling location, shipped, and stored under identical conditions. Method precision, including the contribution from sample collection procedures, is estimated from the analysis of Field Duplicates. Field Duplicates may be used to prepare duplicate QC samples.

3.6 FIELD BLANK (FB) – An aliquot of reagent water free of constituents of concern that is placed in a sample container in the during field sampling and treated as a sample in all respects. This includes shipment to the sampling site, exposure to sampling site conditions, storage, preservation, and all analytical procedures. The purpose of the FB is to determine if method analytes or other interferences are introduced to the sample from shipping, storage, and the field environment.

3.7 ISOTOPE DILUTION ANALOGUES - Isotopically labeled analogues of the method analytes that are added to the sample prior to extraction in a known amount. Note: Not all target PFAS currently have an isotopically labeled analogue. In these cases, an alternate isotopically labeled analogue is used as detailed in this SOP and reference method.

3.8 ISOTOPE DILUTION TECHNIQUE - An analytical technique for measuring analyte concentration using the ratio of the peak area of a native analyte to that of an isotopically labeled analogue. The analogue is added to a sample in a known amount and carried through the entire analytical procedure. The ration is used to determine a correction factor that is applied to the native compound’s result.

3.9 ISOTOPE PERFORMANCE STANDARDS (Internal Standards) - Quality control compounds that are added to all standard solutions and extracts in a known amount and used to measure the relative response of the isotopically labelled analogues that are components of the same solution. For this method, the isotope performance standards are three isotopically labeled analogues of the method analytes. The isotope performance standards are indicators of instrument performance and are used to calculate the recovery of the isotope dilution analogues through the extraction procedure. In this method, the isotope performance standards are not used in the calculation of the recovery of the native analytes.

3.10 METHOD BLANK – An aliquot of reagent water to which known quantities of the method analytes and isotope dilution analogues are added. The results of the MBLK verify method performance in the absence of sample matrix.

3.11 MATRIX SPIKE/MATRIX SPIKE DUPLICATE (MS/MSD) – Aliquots of field samples that have been fortified with a known concentration of target compounds, prior to sample preparation and extraction, and analyzed to measure the effect of matrix interferences. The use of MS/MSD samples is generally not required in isotope dilution methods because the labeled compounds added to every sample provide more performance data than spiking a single sample in each preparation batch.

3.11 SAMPLE DUPLICATE (DUP) – A duplicate aliquot of a field sample analyzed in the same manner as a parent sample to measure reproducibility.

3.12 LIMIT OF QUANTITATION (LOQ) – The smallest concentration that produces a quantitative result with known and recorded precision and bias. The LOQ shall be set at or above the concentration of the lowest initial calibration standard (the lowest calibration standard must fall within the linear range). Determined by matrix through the entire preparation and analysis process.

3.13 METHOD DETECTION LIMIT (MDL) – The minimum measured concentration of a substance that can be reported with 99% confidence that the measured analyte concentration is distinguishable from method blank results (40 CFR 136, Appendix B).

3.14 MINIMUM LEVEL OF QUANTITATION (ML) – The lowest level at which the entire analytical system must give a recognizable signal and acceptable calibration point for the analyte. The ML represents the lowest concentration at which an analyte can be measured with a known level of confidence. It may be equivalent to the concentration of the lowest calibration standard, assuming that all method-specified sample weights, volumes, and cleanup procedures have been employed. Alternatively, the ML may be established by multiplying the MDL (pooled or not pooled, as appropriate) by 3.18 and rounding the result to the number nearest to 1, 2, or 5 x 10n, where n is zero or an integer (see 68 FR 11770).

3.15 PRECURSOR ION – For the purpose of this method, the precursor ion is the deprotonated molecule ($[M-H]^-$) of the method analyte (except for HFPO-DA, in which the precursor ion is formed by decarboxylation). In MS/MS, the precursor ion is mass selected and fragmented by collisionally activated dissociation to produce distinctive product ions of smaller *m/z*.

3.16 PRIMARY DILUTION STANDARD (PDS) SOLUTION – A solution containing the analytes prepared in the laboratory from stock standard solutions and diluted as needed to prepare calibration solutions and other needed analyte solutions.

3.17 PRODUCT ION – For the purpose of this method, a product ion is one of the fragment ions produced in MS/MS by collisionally activated dissociation of the precursor ion.

3.18 INITIAL CALIBRATION VERIFICATION (ICV) – A calibration standard prepared independently from the primary calibration solutions. For this method, the ICV is a repeat of the entire dilution scheme starting with the same stock materials (neat compounds or purchased stock solutions) used to prepare the primary calibration solutions. Independent sources and separate lots of the starting materials are not required, provided the laboratory has obtained the purest form of the starting materials commercially available. The purpose of the ICV is to verify the integrity of the primary calibration standards.

3.19 QUANTITATIVE STANDARD - A quantitative standard of assayed concentration and purity traceable to a Certificate of Analysis.

3.20 STOCK STANDARD SOLUTION - A concentrated solution containing one or more method analytes prepared in the laboratory using assayed reference materials or purchased from a reputable commercial source with a Certificate of Analysis.

3.21 TECHNICAL GRADE STANDARD – As defined for this method, a technical-grade standard includes a mixture of the branched and linear isomers of a method analyte. For the purposes of this method, technical-grade standards are used to identify retention times of branched and linear isomers of method analytes.

3.22 ANALYTE – A PFAS compound included in this method. The analytes are listed in Table 1.

3.23 CALIBRATION STANDARD (CS) – A solution prepared from a secondary standard and/or stock solutions and used to calibrate the response of the LC-MS/MS instrument.

3.24 CONTINUING CALIBRATION VERIFICATION (CCV) STANDARD – The mid-point calibration standard that is used to verify calibration.

3.25 CFR – Code of Federal Regulations

3.26 EXTRACTED INTERNAL STANDARD (EIS) QUANTIFICATION – The response of the target compound is compared to the response of the labeled analog of another compound in the same LOC.

3.27 INSTRUMENT SENSITIVITY CHECK – solution used to check the sensitivity of the instrument. The solution contains the native compounds at the concentration of the LOQ.

3.28 IPR – INITIAL PRECISION AND RECOVERY; four aliquots of a reference matrix spiked with the analytes of interest and labeled compounds and analyzed to establish the ability of the laboratory to generate acceptable precision and recovery. An IPR is performed prior to the first time this method is used and any time the method or instrumentation is modified.

3.29 OPR - ONGOING PRECISION AND RECOVERY- – Ongoing precision and recovery standard (OPR); a method blank spiked with known quantities of analytes. The OPR is analyzed exactly like a sample. Its purpose is to ensure that the results produced by the laboratory remain within the limits specified in this method for precision and recovery. Applies to OPR and LLOPR (low level OPR at **2x** the LOQ level).

3.30 SPE – SOLID PHASE EXTRACTION; a technique in which an analyte is extracted from an aqueous solution or a solid extract by passage over or through a material capable of reversibly adsorbing an analyte. Also termed liquid-solid extraction.

4. INTERFERENCES

LC-MS/MS data from blanks, samples, and spikes must be evaluated for interferences. If any interferences are present, take corrective action if necessary. Do not use aluminum foil because PFAAs can be potentially transferred from the aluminum foil to the glassware. Only aluminum foil rinsed with LC/MS grade methanol can be used where necessary.

4.1 PFAS have been used in a wide variety of manufacturing processes, and laboratory supplies should be considered potentially contaminated until they have been tested and shown to be otherwise. The materials and supplies used during the method validation process have been tested and shown to be clean. These items are listed in the Reagents section.

4.2 Method interferences may be caused by contaminants in solvents, reagents (including DI water), sample bottles and caps, and other sample processing hardware that lead to discrete artifacts and/or elevated baselines in the chromatograms. All items such as these must be routinely demonstrated to be free from interferences (less than 1/2 the Reporting Limit), under the conditions of the analysis by analyzing Method Blanks. Subtracting blank values from sample results is not permitted.

4.3 PTFE products can be a source of PFAS (PFOA) contamination. The use of PTFE in the procedure should be avoided. Polypropylene (PP) or polyethylene (PE, HDPE) products may be used in place of PTFE products to minimize PFOA contamination.

4.3.1 Standards and samples are injected from polypropylene autosampler vials with polypropylene or polyolefin snap caps, once. Multiple injections may be performed on Primers when conditioning the instrument for analysis.

4.3.2 Random evaporation losses have been observed with the polypropylene caps causing high Internal Std. recovery after the vial was punctured and sample re-injected. For this reason, it is best to inject standards and samples once in the analytical sequence, then recap with polyolefin caps for storage.

4.3.2 Teflon-lined screw caps have detected PFAS at low concentrations. Repeated injection from the same Teflon-lined screw cap have detected PFNA at increasing concentration as each repeated injection was performed, therefore, it is best to use polypropylene snap caps.

4.3.3 Aqueous samples should not come in contact with any glass containers or pipettes as PFAS analytes can potentially adsorb to glass surfaces. Standards dissolved in organic solvent may be purchased in glass ampoules. These standards in organic solvent are acceptable and subsequent transfers may be performed using glass syringes and pipets. Following extraction, the eluate must be collected in a polypropylene tube prior to concentration to dryness. Concentration to dryness in glass tubes may cause poor recovery.

4.4 LC/MS grade methanol must be used for all steps where methanol is used in this method. HPLC grade methanol has been demonstrated to be acceptable if tested prior to use.

4.5 Matrix interferences may be caused by contaminants that are co-extracted from a sample. The extent of matrix interferences will vary considerably from source to source, depending upon the nature of the sample.

4.5.1 Co-extracted Organic Material - Under normal HPLC conditions matrix effects due to co-extracted organic material enhanced the ionization of 4:2 FTS appreciably. Total organic carbon (TOC) is a good indicator of humic content of the sample.

4.5.2 Solid phase extraction cartridges may be a source of interferences. The analysis of field and laboratory reagent blanks can provide important information regarding the presence or absence of such interferences. SPE cartridges should be sealed while in storage to prevent ambient contamination of the SPE sorbent.

4.6 Contamination by carryover can occur whenever a high-concentration and low concentration samples are sequentially analyzed. To reduce carryover, the sample syringe in automatically rinsed with solvent between injections. These operations are programmed into the LC multi-sampler system.

4.7 Volumetric glassware and syringes are difficult to clean after being used for solutions containing high levels of PFOA. These items should be labeled for use only with similarly concentrated solutions or verified clean prior to re-use. To the extent possible, disposable labware is used.

4.8 Both branched and linear PFAS isomers can potentially be found in the environment. Linear and branched isomers are known to exist for PFOS, PFOA, PFHxS, and PFBS, based upon scientific literature. We have also seen branched isomers for PFHpA, NMeFOSAA, NEtFOSAA and PFNA. If multiple isomers are present for one of these PFAS they likely are adjacent peaks that completely resolve or not, but usually with a deflection point resolved during peak integration. The later of these peaks matches the retention time of its labeled linear analog. In general, earlier peaks are the branched isomers and are not the result of peak splitting.

Currently, all these species are available as linear isomers. Some available branched and linear reference standards of the technical mixtures for these specific PFAS are used to ensure that all appropriate peaks are included during peak integration. These species currently include PFOA, PFHxS, NMeFOSAA, and NEtFOSAA. These branched isomers elute before the linear isomer and are integrated and reported as total for those species. Others are also included at this time such as those listed in section 7.3.4.

4.9 In an attempt to reduce PFOS bias, it is required that *m/z* 499>80 transition be used as the quantitation transition.

5. SAMPLE HANDLING

5.1 **Aqueous Samples** - samples are collected by our clients in 250 or 500ml HDPE bottles with unlined HDPE or polypropylene caps and filled to the neck. Each sample submitted should be submitted in triplicate-with one used for determination of Suspended solids and possible pre-screening. Sub-sampling should be avoided whenever possible. When historical data are available indicating high levels of PFAS, sub-sampling may be an advisable option.

5.2 **Soil Samples** – samples are collected in wide mouth 125- or 250-mL HDPE bottles with PP unlined caps.

5.3 SAMPLE SHIPMENT AND STORAGE/HOLDING TIMES – Maintain all aqueous samples protected from light at 0 - 6 ºC from the time of collection until shipped to the laboratory. Samples must be shipped as soon as practical with sufficient ice to maintain the sample temperature below 6 ºC during transport. Samples are to be received by the laboratory within 48 hours of collection. The laboratory must confirm that the sample temperature is 0 - 6 ºC upon receipt. Once received by the laboratory, the samples may be stored at ≤ -20 ºC, or at 0 - 6 ºC, until sample preparation. However, the allowable holding time for samples depends on the storage temperature, as described below:

5.3.1 Aqueous samples may be held in the laboratory for up to 90 days from collection, when stored at ≤ -20 ºC and protected from the light. When stored at 0 - 6 ºC and protected from the light, aqueous samples may be held for up to **28 days**, with the caveat that issues were observed with certain perfluorooctane sulfonamide ethanols and perfluorooctane sulfonamidoacetic acids after **7 days**. These issues are more likely to elevate the observed concentrations of other PFAS compounds via the transformation of these precursors if they are present in the sample.

5.3.2 Solid samples (soils and sediments) may be held for up to 90 days, if stored in the dark at either 0 - 6 ºC or ≤ -20 ºC, with the caveat that samples may need to be extracted as soon as possible (within 7 days) if NFDHA is designated as an important analyte by the customer.

5.4 **SAMPLE EXTRACT HOLDING TIMES** – Store sample extracts in the dark at less than 0 - 4 ºC until analyzed. If stored in the dark at less than 0 - 4 ºC, sample extracts may be stored for up to 90 days, with the caveat that issues were observed for some ether sulfonates after 28 days. These issues may elevate the observed concentrations of the ether sulfonates in the extract over time. Samples may need to be extracted as soon as possible if NFDHA is an important analyte.

6. APPARATUS AND MATERIALS (as listed or demonstrated equivalents)

6.1 250 - 500 mL polypropylene bottles with polypropylene caps. VWR Scientific or equivalent: Part no. 414004-125, 12 pk. Alternate: White PP unlined lid L238WH and 16oz. clarified PP single wall jar 70-400 neck, item J066-Containers and Packaging.com or equivalent.

6.2 Transport Tube: Virgin Polypropylene, White, Plastic, 10 mL Capacity, 16 mm OD, 93 mm Overall Lg, Self-Standing, 250 PK, Item 710Z420, Gamut.com (Grainger), with PP cap or equivalent.

6.3 Graduated cylinders, 50, 100, 250, 500 and 1000mL, Polypropylene, VWR Scientific or equivalent

6.4 Analytical Balance, 0.0001g., checked for accuracy each day of use with Class S weights, certified annually by an outside service.

6.5 Extract concentrators: Organomation Model N-EVAP 112, 24 position concentrator with water batch control and nitrogen supply controls or equivalent

6.6 3.1 Micron in-line filters, Promochrom only

6.7 1.0-2.0 mL polypropylene snap cap vials, Agilent part no. 5182-0567 or equivalent

6.8 Snap caps, polypropylene or olefin, 11 mm, 11/9k, Agilent Part no. 5182-0542

6.9 Solid Phase Extraction Tubes: for EPA 1633: WAX (weak anion exchange mixed mode polymeric sorbent – Phenomenex No. 8B-S038-HCH 200 mg or Waters Oasis 150 mg Cat. # 186002493. Must have a pKa > 8 to remain positively charged during the extraction. Alternate is Agilent Bond Elute WAX 200 mg-cat. No. 5610-2151

6.10 Syringes, Hamilton or equivalent 5.0 µL, 10 µL 25 µL, 100 µL, 250 µL, 500 µL, Teflon free

6.11 Solid Phase Extraction System-automated-Promochrom 8 position autosampler system for 6 mL capacity SPE tubes. System retrofit to remove all PTFE components and replaced with PEEK tubing or PFAS free tubing. Automated bottle rinsing feature required with 3.1 um in line PP filters.

6.12 Nitrogen Evaporation System- TurboVap nitrogen evaporation system operated at less than 55C.

6.13 LC/MS-MS system- Agilent 1260 or 1290 HPLC system interfaced to an Agilent 6470A or 6460C Triple Quadrupole system. The instrument control and qualitative/quantitative software is Mass Hunter versions B.8.0 and B.9.0 or later.

6.13.1 HPLC System-Agilent 1260 or 1290 Infinity II

6.13.1.1 The Agilent 1260 or 1290 Infinity II HPLC system is configured with temperature-controlled column oven compartment. 4 column configuration, temperature controlled (refrigerated) auto sampler compartments, injection valve, proportioning valves, variable flow controls and variable injection capabilities.

6.13.1.2 The delay column (PFAS and other interference removal) is an Agilent Eclipse Plus C18, 4.6mm x 50 mm, 3.5 um-Part no. 959943-902 or equivalent.

6.13.1.3 The analytical column is a Restek Raptor C18 part no. 9304252 50mm x 2.1 mm ID, 1.8 u particle size or equivalent.

6.13.2 Agilent LC/MS-MS- Agilent 6470AAR/6460C

6.14.2.1 Agilent model 6470AAR/6460C triple Quadrupole system with Agilent Jet Stream ESI source. UHP nitrogen is used as cell gas and High purity nitrogen is delivered for the sheath gas from a Peak Scientific nitrogen generator system.

6.14 Vortex Mixer- Benchmark Industries or equivalent

6.15 Variable Speed shaker table, 18” x 12”- Orbital Shaker- Jiangau Tenlin Instr. Co., Ltd., Model no. TLSK-III 20-230 RPM, 0-999 min, or equivalent
6.16 Centrifuge, 50 mL, Premiere Model XC-2450 Series Centrifuge 6 x 50 mL, 3500 RPM max., or equivalent
6.17 Mechanical Pipettors- 10-100 µL; 100-1000 µL; 1000-5000 µL-4 E’S Scientific or equivalent, calibrated quarterly.
6.18 Vortex Mixer- Benchmark Industries or equivalent

6.19 pH paper, short range 6-8 and full range with 0.5 pH readability- VWR Scientific or equivalent
6.20 15 mL PP or HDPE Centrifuge tubes, Corning Part no. 430791
6.21 3 mL Disposable Transfer pipets, PE, VWR part no. 16001-176
6.22 1.0 mL polypropylene snap cap vials, Agilent part no. 5182-0567
6.23 Snap caps, polypropylene, 11 mm, 11/9k, Agilent Part no. 5182-0542
6.24 2mL self-standing PP microcentrifuge snap cap tubes, SKS Scientific part no. 0747-17
6.25 Collection tubes, 15 mL graduated PP or HDPE Centrifuge tubes, Corning Part no. 430791
6.26 Disposable 10 mg scoops, PP
6.27 Ultrasonic mixer
6.28 10 mL disposable syringes, PP or HDPE, luer fitting
6.29 13mm or 25 mm 0.2 um Nylon membrane filters, PALL Acrodisc or equivalent

7. REAGENTS AND STANDARDS (as listed or demonstrated equivalents)

7.1 ALL REAGENTS and STANDARDS MUST BE LOGGED INTO THE ELEMENT LIMS SYSTEM. This includes lot numbers, expiration, open and prepared dates, receipt date, Certification/traceability documents from supplier(s) if provided and preparer.

7.2 SOLVENTS and REAGENTS-all as listed or equivalents

7.2.1 Methanol, hypergrade for LC/MS. (Merck) from Sigma Aldrich Part no. 1060354000 or equivalent (HPLC Plus grade is an acceptable alternate)

7.2.2 Water, hypergrade for LC/MS. (Merck) from Sigma Aldrich Part no. 1153334000 or equivalent (HPLC plus grade is an acceptable alternate). Alternatively, York PFAS free water demonstrated ion and PFAS free can be used.

7.2.3 Acetic Acid, glacial. ACS grade or equivalent.

7.2.4 Ammonium Hydroxide, conc. Cert. ACS grade, 28-30% in water, Sigma Aldrich part no.1054231000, or equivalent

7.2.5 Methanolic Potassium Hydroxide (0.05 M) – add 3.3 g of KOH to 1L MeOH.

7.2.6 Sodium Hydroxide, pellets, ACS grade- Sigma Aldrich part no. 221465-500G, or equivalent

7.2.7 Potassium Hydroxide, pellets, ACS grade

7.2.8 Ammonium Acetate – ACS grade or better, Ammonium Acetate, HPLC or cert. ACS grade. Sigma Aldrich Part no. 73594-100-G-F or equivalent.

7.2.9 Ammonium Acetate 5 mM for HPLC in aqueous solution: HPLC gradient A-- Weigh 0.3854 g (+ 0.0005) Ammonium Acetate and add to 1-liter hypergrade Water. Mix until dissolved then sonicate for 5 mins. To remove air bubbles. Stability - 2 weeks.

7.2.10 **Methanolic Ammonium Hydroxide 0.3 %** - take 2.5 mL of conc. ammonium hydroxide into 247 mL MeOH (measure the 247 mL in a PP graduated cylinder-they are under QQ1 somewhere). Use a mechanical pippetor to add the 2.5 mL (not strictly quantitative FYI)-**<u>Make 4 bottles of this</u>**. *<u>Used for soil extractions</u>*. - 1 month shelf life.

7.2.11 **Methanolic Ammonium Hydroxide 1.0 %** - take 8.25 mL of conc. ammonium hydroxide into 242 mL MeOH (measure the 242 mL in a PP graduated cylinder-they are under QQ1 somewhere). Use a mechanical pipet to add the 8.25 mL (not strictly quantitative FYI)- **Make 4 bottles of this -***used in Promochrom-*1 month life.

7.2.12 **Aqueous Ammonium Hydroxide 3%-** take 24.8 mL of ammonium hydroxide and add 242 mL PFAS free water. 3-month life- *used for pH adjustment*

7.2.13 **Methanol with 4% water, 1% ammonium hydroxide and 0.625% acetic acid** – add ammonium hydroxide (3.3 mL, 30%), reagent water (1.7 mL) and acetic acid (0.625 mL) to methanol (92 mL), store at room temperature, replace after 1 month. **This solution is used to prepare the instrument blank, calibration standards, and is used to dilute the extracts of samples that exceed the calibration range.**

7.2.14 **Formic Acid 0.1M-aqueous** – add 873 µL formic acid into 250 mL PFAS free water- **Make 2 bottles of this-***used to prepare 7.2.16 below.* 2-year life

7.2.15 **Formic Acid, 0.3M**-aqueous- add 2.62 mL (2619 µL) into 250 mL PFAS free water- **Make 4 bottles of this -***used in Promochrom-*2 year life

7.2.16 **Formic Acid methanolic 1:1, 0.1M formic acid**- mix equal volumes of Methanol and 0.1 M formic acid- **Make 4 bottles of this -***used in Promochrom-*2 year life

7.2.17 **Formic Acid 5% aqueous**- add 12.5 mL Formic acid into 250 mL PFAS free water. *Used for pH adjustment.* 2-year shelf life

7.3 Stock Standards

Stock Standards are purchased in mid to high concentration levels from Wellington Laboratories, Inc. Guelph, ONT, CA. Currently, Wellington is the preferred supplier of these materials. As a second source verification, prepare a mid-level from the stock independently from the preparation used for initial calibration. Document this preparation in Element. See Attachments 1,2, and 3 for detailed information.

7.3.1 Internal Standards (7-Non-Extracted –NIS)) used for the method are MPFOA, MPFOS, M3PFBA, MPFDA, MPFHxA, MPFHxS and MPFNA. These are purchased at 250 - 1000 ng/mL depending upon the ISTD in a mixture. This mixture is purchased from Wellington Labs in 1.2 mL volumes with the following **part no.: MPFAC-HIF-IS**. Stored at 4C or less unopened this solution has a 5-year shelf life. Once opened, the life is one year from open date.

7.3.2 Isotopic Surrogate Analogs (24 isotopes) are purchased for the method described from Wellington Labs at 250-5000 ng/mL levels, depending upon the isotope. Part no. is **MPFAC-HIF-ES**.

7.3.3 Stock Standard mixtures of both linear and branched isomers of the EPA 1633 40 compound list are purchased from Wellington Labs at varying concentrations in 5 different mixtures under part nos. PFAC-MXJ, PFAS-MXI, PFAC-MXH, PFAC-MXG, PFAC-MXF.

7.3.4 Second source standard mixture of both linear and branched isomers of the EPA 1633 40 compound list is purchased from Absolute Standards at 2 µg/mL under part no. 65735.

7.3.5 Qualitative branched isomers mix- individual available branched and linear mixes for the following PFAS are used daily to allow for qualitative knowledge of the PFAS branched isomers so they are integrated/included in quantitative analysis: T-PFOA, lp-PFNA, br-FOSA, br-NEtFOSA, br-NMeFOSA, br-NEtFOSE and br-NMeFOSE. These are purchased at 50,000 ng/mL levels from Wellington Labs-the names above are the Catalogue nos. These have a 5-year life at stock concentrations.

Make a 100 ng/mL Intermediate mix by adding 2.0 µL of the individual stocks up to 1.0 mL with MeOH.

Make a working solution by taking 200 µL of the 100 ng/mL intermediate into 750 µL of cal matrix solution (7.2.13) and add 50 µL of 1:10 EIS mix.

Transfer 300 µL to an autosampler vials, add 3 µL of ISTD working mix, cap vortex, and store until needed. Shelf life is 1 year.

The summary below details the procurement requirements for this method - All from Wellington Laboratories, Inc. except the second source from Absolute Standards:

Description	Part nos.	Comes in
40 Compound Target 1633 list targets	PFAC-MXJ PFAS-MXI PFAC-MXH PFAC-MXG PFAC-MXF	4 Days – 1.2 mL
Isotopic Surrogates-24	MPFAC-HIF-ES	4 Days – 1.2 mL
EPA 1633 – 7 Internal Std.	MPFAC-HIF-IS	4 Days – 1.2 mL
Method 1633 PFCs – Cal Std.	65735	2 days – 1.2 mL

7.4 Preparation of Standards

7.4.1 Preparation of Working Standards and Intermediates from STOCK Materials

All stock standards are prepared by the vendor in methanol containing a bit of sodium hydroxide to prevent losses of target PFAS compounds due to potential esterification in methanolic solution. The stocks come prepared with 4 molar equivalents (a 3x excess) of sodium hydroxide for stocks at the 50 µg/mL levels. This insures their stability with respect to potential loss due to esterification. The basic solution ensures that any acidic sites on the glass ampules or acidic impurities in the methanol are neutralized to prevent ester formation and forms the sodium salt of the PFAS to stabilize it.

When preparing any intermediate level standards, the dilution must be prepared in alkaline methanol to prevent the above from occurring.

To do this, prepare a 5.0 mM NaOH in Hypergrade Methanol (or LC/MSMS grade) by dissolving 0.02 g. of sodium hydroxide into 100 mL of MeOH. This has a 2-week life.

For intermediate standards that are made to 10 mL final volume, add 100 µL of 5.0 mM NaOH/MeOH as part of the preparation. This results in a final concentration of NaOH at 0.05 mM.

For intermediate standards prepared to a final volume of 1.0 mL. add 10 µL of the 5.0 mM NaOH/MeOH.

For working calibration standards/CCV/SCV made to 500 µL final volume, using the mixture detailed in section 7.1.13 (MeOH/Water/acetic acid/ammonium hydroxide). This approximates the matrix of the final extracts for analysis.

7.4.2 Storage and Handling of Standards

All working standards should be stored at either room temperature or 4 °C provided the containers are sealed properly.

Stock Standards may be stored at 4 - 10 °C but before using must sit to allow equilibration to room temperature followed by either vigorous vortex mixing or sonication for 3-5 mins.

7.4.3 Detailed Standards Preparation Procedure-EPA 1633

7.4.4 Internal Standards-*See Attachment 1*

Internal Standards are purchased as a **stock mixture** at 250-1000 ng/mL.

These as transferred to a snap cap vial that has been pre-rinsed with 5 mM NaOH/MeOH then allowed to dry.

7.4.4.1 Working level of Non-Extracted Internal Standard (NIS) – make a 1:1 dilution of the stock by taking 500 µL of the Stock and adding 500 µL MeOH.

Use as is by adding 3 µL to 300 µL volumes for QC samples, or calibration.

7.4.5 Isotopic Surrogates (Extracted Internal Standards)- *See Attachment 2*

7.4.5.1 Stock Surrogates are purchased as a mixture at 250-5000 ng/mL. These are transferred to a snap cap vial that has been pre-rinsed with 5 mM NaOH/MeOH then allowed to dry.

Option 1- Use Stock as received and add 25 µL to all samples/QC to be extracted.

Option 2- Prepare **2** mL of Working EIS by preparing a 1:2 dilution to yield 125-2500 ng/mL for use as follows:

Take 1000 µL of the Surrogate Stock, plus 25 µL of 5 mM NaOH/MeOH and 975 µL MeOH to give 2.0 mL final volume**. 50 µL are added to ALL preparation blanks, samples, and QC**. This is sufficient for approx. 40 x 50 µL additions to all blanks, QC, and samples.

This corresponds to adding 5 to 100 ng of EIS compounds to the initial samples and QC. The final volume of extractions will typically be 5.0 ml so this yields 1-20 ng/mL of the isotope EISs in the final extract for analysis.

For calibration, the Stock mix at 250-5000 ng/mL is used by adding 100 uL up to 1.0 mL final volume to yield 25/500 ng/mL in each calibration level as directed in the calibration section 7.4.7.1.

7.4.6 Target Analytes- EPA 1633- *See Attachment 3*

The target analytes for this method are purchased commercially from Wellington Labs using the five part numbers described in Section 7.3.3. They contain the method target analytes only at varying concentrations. These mixtures are transferred from their glass ampules to snap cap vials that have been pre-rinsed with 5 mM NaOH/MeOH then allowed to dry. Again, these are the nominal concentrations and the actual anion concentrations for those present as salts are listed in the documentation and are reflected in both Mass Hunter and Element.

Preparation of a 1.0 mL volume of a 10x intermediate of each of the 5 mixes for Calibration. Some of the higher levels on the curve use aliquots of the stock as shown in Figure 2.

Scale the volume accordingly if less is desired. Note that the EPA 1633 mixes come 1.2 mL per vial so this recipe may consume one vial quickly.

7.4.6.1 OPR and LLOPR - these are a mid-level blank spike and low-level blank spike (at 2x the LOQ). These are prepared as follows from the EPA 1633 Target mixtures (5 components) by taking 200 µL of each STOCK into a snap cap vial giving 1.0 mL final volume.

1. Element ID Y22B199 - PFAC-MXF mix 200 µL.
2. Element ID Y22B200 - PFAC-MXG mix 200 µL.
3. Element ID Y22B201 - PFAC-MXH mix 200 µL.
4. Element ID Y22B204 - PFAC-MXI mix 200 µL.
5. Element ID Y22B205 - PFAC-MXJ mix 200 µL.

For OPR (BS) at mid-level add 100 µL to each matrix for the batch OPR and for the **LLOPR add 20 µL** of the spike mix and process through all steps of the specific matrix preparation.

7.4.7 Second Source Standard

The Second Source intermediate standard is prepared in a similar manner to Target Analytes detailed in the previous section whereby a 10x intermediate is prepared by diluting 100 µL of stock obtained from Absolute Standards (2 µg/mL) in 1.0 mL of solvent. The final concentration of this standard is nominally 200 ng/mL.

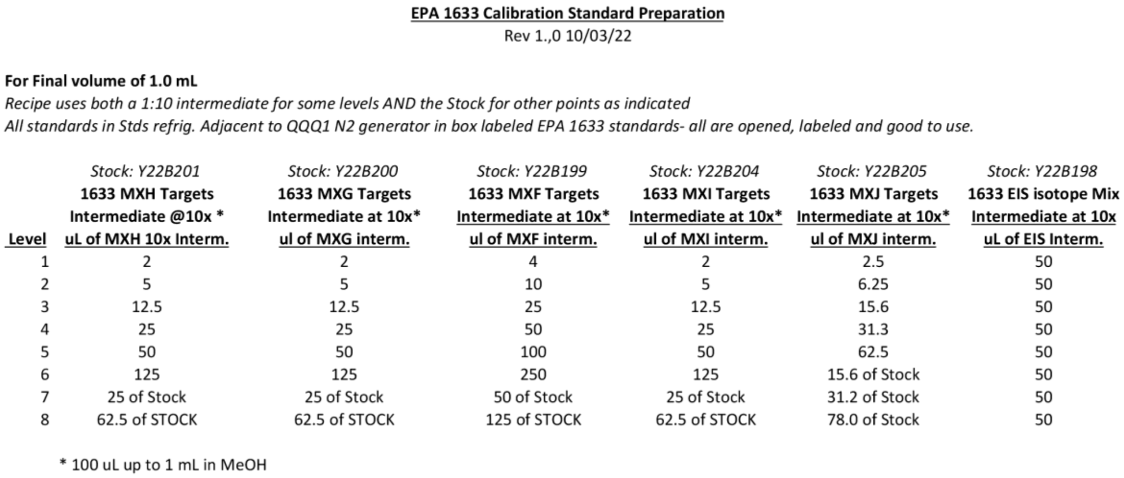
7.4.8 Calibration

Calibration of the LC-MSMS systems is done by an eight-level calibration covering the range 0.2 to 1650 ng/mL, nominal. Various PFAS species are present as salts and at differing concentrations and these are reflected in Mass Hunter and Element as their actual concentrations. Six to eight levels are prepared depending upon the analyte. These levels are prepared as directed below using the internal standards, surrogates, and target analytes from above.
This is made to a final volume of 1000 µL in the matrix described in section 7.1.13 (MeOH/Water/acetic acid/ammonium hydroxide)

This preparation excludes the ISTD in the initial preparation. After preparation as directed, withdraw 300 µL of each level into a 500 µL PP vial and add 3 µL of ISTD before analysis, cap, and vortex to mix.
These are stored at <10C and are stable for 6 months when prepared as directed.

7.4.7.1 Calibration Curve Preparation - Based upon a final volume of 1.0 mL in CAL Matrix Solution*

See Attachment 4 for details.



EPA 1633 Calibration Standard Preparation
Rev 1.,0 10/03/22

For Final volume of 1.0 mL
Recipe uses both a 1:10 intermediate for some levels AND the Stock for other points as indicated
All standards in Stds refrig. Adjacent to QQQ1 N2 generator in box labeled EPA 1633 standards- all are opened, labeled and good to use.

Level	*Stock: Y22B201* **1633 MXH Targets Intermediate @10x *** **uL of MXH 10x Interm.**	*Stock: Y22B200* **1633 MXG Targets Intermediate at 10x*** **ul of MXG interm.**	*Stock: Y22B199* **1633 MXF Targets Intermediate at 10x*** **ul of MXF interm.**	*Stock: Y22B204* **1633 MXI Targets Intermediate at 10x*** **ul of MXI interm.**	*Stock: Y22B205* **1633 MXJ Targets Intermediate at 10x*** **ul of MXJ interm.**	*Stock: Y22B198* **1633 EIS isotope Mix Intermediate at 10x** **uL of EIS Interm.**
1	2	2	4	2	2.5	50
2	5	5	10	5	6.25	50
3	12.5	12.5	25	12.5	15.6	50
4	25	25	50	25	31.3	50
5	50	50	100	50	62.5	50
6	125	125	250	125	15.6 of Stock	50
7	25 of Stock	25 of Stock	50 of Stock	25 of Stock	31.2 of Stock	50
8	62.5 of STOCK	62.5 of STOCK	125 of STOCK	62.5 of STOCK	78.0 of Stock	50

* 100 uL up to 1 mL in MeOH

*CAL MATRIX: Methanol with 4% water, 1% ammonium hydroxide and 0.625% acetic acid – Prepared by adding ammonium hydroxide (3.3 mL, 30%), reagent water (1.7 mL) and acetic acid (0.625 mL) to methanol (92 mL), store at room temperature, replace after 1 month. This solution is used to prepare the instrument blank and is used to dilute the extracts of samples that exceed the calibration range.

Amount of CAL Matrix to make up to 1.0 mL Final volumes:

CAL LEVEL	µL of CAL Matrix
1	937.5
2	918.8
3	871.9
4 *	793.7
5	637.5
6	309.0
7	843.8
8	609.5

INTERNAL STANDARD MIX (non-extracted IS-NIS). Mix 500 µL of STOCK ISTD at 250-1000 ng/mL with 500 µL of Methanol. This results in 125-500 ng/mL Intermediate ISTD. See 7.4.4.1.

Add 3.0 µL to 300 µL of each level 1-8 in a 500 µL PP autosampler vials and cap with polyolefin cap, vortex to mix and run. Add 3 µL to 300 µL of all sample/QC extracts before analysis.

*Level 4 is also used as the CCV for each analysis sequence run initially, then after every 10 samples and at the end of the sequence. Multiple vials should be prepared for this level.

7.4.9 Checking the Efficacy of the Surrogate/Spike Mixes

On a monthly basis the surrogate (EIS) and spike mixes from the vials used for spiking are assayed to ensure stability. These are prepared for the analysis by taking 3.0 µL of the surrogate (EIS) mix and 3 µL of the Spike mix into 294 µL MeOH/Water/Acetic Acid/Ammonium hydroxide from 7.1.13, then add 3 µL of NIS (ISTD). This yields a 1:100 dilution of the EIS and Spike mixes. Use 100 as the dilution factor in the Mass Hunter worklist.

7.4.10 Second Source - Initial Calibration Verification (ICV)

The initial calibration verification is prepared in a similar manner to calibration standards whereby 50 µL of intermediate stock is diluted in 1.0 mL of solvent. The final concentration of this standard is nominally 10 ng/mL.

8. PROCEDURE

8.1 Preventative and Routine Maintenance

HPLC/MS/MS Preventative Maintenance	
As Needed: Change pump seals. Change in-line filters in autosampler (HPLC). Check/replace in-line frit if excessive pressure or poor performance. Replace column if no change following in- line frit change. Clean needle. Replace or clean Capillary Replace fused silica tube in ESI interface. Clean lenses. Clean skimmer. Ballast rough pump 30 minutes. Check Nozzle flow pattern	**Daily (When in use)** Check solvent reservoirs for sufficient level of solvent. Verify that pump is primed, operating pulse free. (ripple < 1%) Check needle wash reservoir for sufficient solvent. Verify capillary heater temperature functioning. Verify vaporizer heater temperature. Verify rough pump oil levels. Verify turbo-pump functioning. Verify nitrogen pressure for auxiliary and sheath gasses. Possible Checktune
Semi-Annually Replace oil mist and odor elements. Replace activated alumina filter if applicable	**Annually** Vacuum system components including fans and fan covers. Clean/replace fan filters, if applicable.

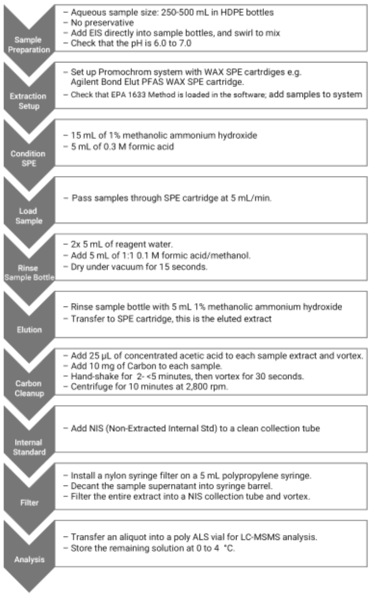
8.2 Sample Preparation (Extraction, Clean-up and Concentration)-Aqueous Matrices

A summary of the steps for the steps related to aqueous samples are shown in Figure 1.0 and in the summary below.

1. Determine % Suspended Solids – 10.0 mL ± 0.02 mL through a tared 0.2 um PP filter. Dry filter ≥ 12 hours @ 105C, cool in desiccator. Calc % TSS.
2. Check pH with short range pH paper to insure pH = 6.5 ± 0.5. Adjust as necessary with either 5% aqueous formic acid to lower pH or with 3% aqueous ammonium hydroxide to raise pH.
3. Weigh sample bottle as is to ± 0.1 g.-remove cap first since that will not be weighed later since autosampler caps are used.
4. Homogenize sample by inversion 3-4 x-place full volume on Promochrom System using WAX SPE cartridges.
5. Set up MBLK, OPR at 2x LOQ (low LCS) and mid-level OPR (mid-level LCS)-spike with 10 µL of Spike mix for LLOPR and 100 µL of spike mix for mid-OPR.
6. Spike all with 25 µL EIS solution (isotopic surrogates)

7. Follow Promochrom method for EPA 1633
8. Initiate SPE program EPA1633AQ on the Promochrom system
9. Once the program is finished there will be 5 ml in the collection tube. If less, make up to exactly 5.0 mL with MeOH.
10. Remove the sample bottle from the Promochrom system and weigh the empty bottle. That will determine the weight (volume for water) assume 1 g = 1.0 mL. Enter this value into the element bench sheet and the initial volume.
11. Add 25 µL of concentrated acetic acid to each collection tube and vortex to mix.
12. Add 10 mg of activated carbon to all samples and QC. Hand mix and vortex mix for no more than 2 minutes.
13. Centrifuge at 2800 rpm for approx. 10 minutes.
14. Filter the final volume through 0.2 um nylon filter using a syringe.
15. If the client provides only 250 mL of sample, in order to meet reporting limits, it may be required to concentrate the unfiltered extract by a factor of at least 2 on a TurboVap at 1.2 Liters/min with nitrogen at <55 °C. For example, if the final volume is 5.0 mL, concentrate to 2.0 mL final volume (2.5 x concentration). If 500 mL is provided, skip this step.
16. Enter the final volume achieved into the bench sheet in Element.
17. Transfer a portion of the final extract to a 2 mL snap cap, labeled.
18. Take a 300 µL portion of the extract into a 500 µL PP autosampler vial, add 3 µL of NIS (non-extracted internal std.). Cap, vortex, store at <6 °C.
19. Sample is ready for analysis.

Figure 1.0 Aqueous Sample Preparation Steps



Sample Preparation
- Aqueous sample size: 250-500 mL in HDPE bottles
- No preservative
- Add EIS directly into sample bottles, and swirl to mix
- Check that the pH is 6.0 to 7.0

Extraction Setup
- Set up Promochrom system with WAX SPE cartrdiges e.g. Agilent Bond Elut PFAS WAX SPE cartridge.
- Check that EPA 1633 Method is loaded in the software; add samples to system

Condition SPE
- 15 mL of 1% methanolic ammonium hydroxide
- 5 mL of 0.3 M formic acid

Load Sample
- Pass samples through SPE cartridge at 5 mL/min.

Rinse Sample Bottle
- 2x 5 mL of reagent water.
- Add 5 mL of 1:1 0.1 M formic acid/methanol.
- Dry under vacuum for 15 seconds.

Elution
- Rinse sample bottle with 5 mL 1% methanolic ammonium hydroxide
- Transfer to SPE cartridge, this is the eluted extract

Carbon Cleanup
- Add 25 µL of concentrated acetic acid to each sample extract and vortex.
- Add 10 mg of Carbon to each sample.
- Hand-shake for 2- <5 minutes, then vortex for 30 seconds.
- Centrifuge for 10 minutes at 2,800 rpm.

Internal Standard
- Add NIS (Non-Extracted Internal Std) to a clean collection tube

Filter
- Install a nylon syringe filter on a 5 mL polypropylene syringe.
- Decant the sample supernatant into syringe barrel.
- Filter the entire extract into a NIS collection tube and vortex.

Analysis
- Transfer an aliquot into a poly ALS vial for LC-MSMS analysis.
- Store the remaining solution at 0 to 4 °C.

8.2.1 To measure sample initial volume for aqueous samples, remove the cap and weight the bottle and record the weight in the sample weight. For MBLK, LLOPR and OPR use 250-500 mL volumes). After SPE processing, be sure the empty bottle is dry and weight to determine the amount of sample in grams (essentially equal to volume in mL). Use that number for the initial volume in Element LIMS.

8.2.2 For every 20 field samples (Field blanks are considered field samples in as they are treated as such), a blank (MBLK), blank spikes, (2 levels-LLOPR and OPR as BS1 and BS2 respectively. A matrix spike is not necessary since isotope dilution is used. If an MS/MSD is required by a specific project, spike 100 µL of the mid-level BS mix (OPR).

8.2.3 All polypropylene equipment including graduated cylinders and sample transfer lines/reservoirs should be washed prior to using with extraction solvent (Methanol).

8.2.4 Add 25 µL of EIS (isotopic surrogates) (250/5000 ng/mL) to each sample and QC sample, recap, and invert to mix well.

8.2.5 Add, 20 µl (low level spike), 100 µL (mid-level spike)

8.2.6 Using the Promochrom automated system, run a cleaning run. Be sure the reservoirs of LC/MS grade methanol and HPLC plus grade water or equivalent are full. Prime all lines and align all components.

8.2.7. Load in the EPA1633 method and adjust the sample volume to 10 mL more than the highest volume container measured by visual comparison to a calibrated bottle of the same size. Please refer to *Appendix 2: Promochrom Method* detailing the automated SPE extraction method on the Promochrom system.

8.2.8 The SPE method solvents for extractions are as follows:

- Solvent 1 = MeOH
- Solvent 2 = H_2O
- Solvent 3 = 0.3 M Formic acid,
- Solvent 4 = 1:1 0.1M Formic Acid/MeOH,
- Solvent 5 = MeOH with 1% ammonium hydroxide (“Basic MeOH”) W1 = Aqueous waste, W2 = Organic waste

8.2.9 Place labeled 15 mL graduated collection vessels in the sample collection tray and use Element labels to identify the vials at this point. Print 2 sets of labels for each since they will be used after the concentration step as well. These are graduated.

8.2.10 Connect the bottles to the automated system.

8.2.12 Initiate the EPA1633Aq SPE Extraction Program. Each run is approximately 1 hour 45 minutes.

8.2.13 **Evaporation Options** - Aqueous Samples

N-EVAP systems

8.2.13.1 The resulting 5 mL extracts are not further concentrated unless Work Plan reporting limits need to be lower than standard RLs. When this is required by the Work Plan, the extracts and QC are transferred to the N-EVAP concentrator systems operated at 50-55 degrees C (never more than 55C) in their original collection vials. The nitrogen flow is initiated at 1.2 ml/min and adjusted on each individual sample to provide a gentle stream causing a slight disturbance at the surface of the methanol extracts.

8.2.13.2 As this evaporation proceeds the walls of each vessel are rinsed with methanol when the volume is approximately 2.5 mL and then again when the volume is reduced to just below 2.0 mL. Then Bring up the final volume to 2.5 mL. This is a 2x concentration when needed.

8.2.14 Swirl final extract, make up to 2.0 mL with methanol. Using a disposable polypropylene pipet, carefully transfer to a 2 mL PP snap cap vial.

8.2.15 Withdraw an aliquot of 300 µL into a 500 µL autosampler vial (PP) and add 3.0 µL of ISTD (NIS) mix.

8.2.16 Cap with polyolefin flexible caps and vortex to mix.

8.2.17 Store Extracts at <6^{o}C until analysis.

8.3 Sample Preparation (Extraction, Clean-up, and Concentration) - Soil Matrices

1. Determine % solids: use 5 grams; dry at 110C ≥ 12 hours.
2. Mix sample with a stainless-steel spatula to homogenize-exclude Sticks, vegetation, rocks and the like.
3. Remove 5.0 g. from the homogenized sample container. Add to a tared 50 mL centrifuge tube. Determine the weight ± 0.01 g.
4. Prepare QC using clean matrix (Ottawa Sand) wetted with 1 mL PFAS free water in 50 mL centrifuge tubes.
5. For all samples, QC blanks and LCSs (LLOPR and ML OPR) and a 25 µL aliquot of EIS onto the soil. The current Element standard ID is Y22J305. For the OPRs add

appropriate amount of spike solution (20 µL for LLOPR and 100 µL for OPR. The current Element Std ID is Y22J304.

6. Swirl the samples to mix then let sit for 30 minutes.
7. Add 10 mL of 0.3% methanolic ammonium hydroxide to each centrifuge tube.
8. Vortex to mix then shake on the shaker table for 30 minutes.
9. Next, centrifuge at 3500 rpm for 5 minutes or 2800 rpm for 10 minutes.
10. Transfer the supernatant liquid to a clean 50 mL centrifuge tube
11. Add 15 mL of 0.3% methanolic ammonium hydroxide to each of the original centrifuge tubes.
12. Vortex to mix then shake on the shaker table for 30 minutes.
13. Next, centrifuge at 3500 rpm for 5 minutes or 2800 rpm for 10 minutes.
14. Transfer the supernatant liquid to the centrifuge tubes from 10.0 above.
15. Add another 5 mL of 0.3% methanolic ammonium hydroxide to each of the original centrifuge tubes.
16. Vortex to mix then shake on shaker table for 30 minutes.
17. Next, centrifuge at 3500 rpm for 5 minutes or 2800 rpm for 10 minutes.
18. Transfer the supernatant liquid to the centrifuge tubes from 10.0 above.
19. Add 10 mg of activated carbon to the combined extract using a 10 mg scoop and hand swirl for 2 minutes (never more than 5 minutes of losses of Target PFAS will occur)
20. Centrifuge at 3500 rpm for 5 minutes or 2800 rpm for 10 minutes
21. Immediately Decant into a 50 mL centrifuge tube.
22. Place in TurboVap or on the N-EVAP system and concentrate at 55 deg. C to a final volume of approx. 7 mL at a nitrogen flow of 1.2 mL/min.
23. Add 35-40 mL of PFAS free water to the tube and vortex to mix.
24. Check the pH= 6.5 ± 0.5 if not adjust accordingly using 5% formic acid to lower pH or 3% aqueous ammonium hydroxide to raise pH to within this range.
25. Set up the soil EPA 1633 method on the Promochrom be sure volume is set to 50 ml for sample size. Please refer to *Appendix 2: Promochrom Method* detailing the automated SPE extraction method on the Promochrom system.
26. Place samples and QC centrifuge tubes on the autosampler
27. Once the program is finished, note the final volume and use that in the Element bench sheet as final volume. Should be 5.0 mL. If less make up to 5.0 mL with MeOH.
28. Add 25 µL of concentrated acetic acid to each collection tube and vortex to mix.
29. Add 10 mg of carbon to all samples and QC and mix for 2 minutes (no more than 5 minutes).
30. Immediately centrifuge at 2800 rpm for 10 minutes.

31. Filter the extract through a 0.2 um nylon membrane using a syringe and filter into a 2 mL snap cap vial.
32. When ready for analysis, remove 300 µL of extract and transfer to a 500 µL autosampler vial. Add 3 µL of NIS (internal standard), vortex to mix. Cap with polyolefin flexible caps and vortex to mix.
33. Store Extracts at <6°C until analysis
34. Samples/QC are now ready for analysis.

8.4 Sample Analysis--Running Samples/QC - Acquisition Method

The acquisition method is detailed in Attachment 4 (HPLC) and Attachment 5 (MS/MS) of this SOP. The method is an HPLC with dynamic MRM method with precursor and product ions with specific acquisition parameters to maximize sensitivity and specificity. This list may be modified to add other PFAS target analytes as necessary.

8.3.1 The triple Quadrupole (QQQ) system must be optimized for each target analyte (including surrogates and internal standards) using the Mass Hunter Optimizer program. This program determines the most abundant precursor and product ions for each compound and their abundances. These data are then used to build an MRM (multiple reaction monitor) method for acquisition. This is done initially or after any major maintenance procedures are performed to the triple quadrupole system. A high-level standard is used for this in the $[M-H]^-$ mode or M-COOH for HFPO-DA.

8.3.2 The MS/MS is checked for tuning on a weekly basis (if necessary) before analysis using the Tune context by selecting the CHECKTUNE radio button. This is done only in negative ion mode since that is what we are operating under. If the Checktune fails, run the Autotune program-note: this takes approx. 45 mins. in negative mode. After autotune or any tuning adjustment, a re-calibration of the instrument is required.

8.3.3 Before any QC or samples can be run, the HPLC must be allowed to purge for at least thirty minutes. This purge must be done using the initial mobile phase conditions used in the method must be allowed to run for 15 minutes or until pressure has stabilized (ripple must be < 1%)

8.3.4 An instrument sequence (Worklist) is then made. It should begin with a blank, a primer (5 ng/mL) followed by a blank with ISTD to establish system cleanliness.

8.3.5 After a successful initial calibration has been completed, the analytical sequence for a batch of samples analyzed during the same time period is as follows. Standards and sample extracts must be brought to room temperature and vortexed prior to aliquoting into an instrument vial in order to ensure homogeneity of the extract.

8.3.6 **Analysis Sequence**

1. Instrument Blank *
2. Instrument Sensitivity Check –**LOQ Standard Level (SEQ-CAL 1) S/N > 3:1**
3. Calibration Verification Standard (CCV)
4. Qualitative Identification Standards –Branched PFAS
   PFOA, PFNA, PFOSA, NMeFOSA, NEtFOSA, NEtFOSE, and NMeFOSE.
5. Instrument Blank (SEQ-CCB) *
6. Method Blank (Batchxxxx-BLK1)
7. Low-level OPR (LLOPR) (Batchxxxx-BS1)
8. OPR (Batchxxxx-BS2)
9. Field Samples (10 or fewer)
10. Calibration Verification Standard (SEQ-CCVn)
11. Instrument Blank (SEQ-CCBn) *
12. Field Samples (10 or fewer)
13. Calibration Verification Standard (SEQ-CCVn)
14. Instrument Blank (SEQ-CCBn) *

* Contains solvent system for calibration, NIS, and EIS

8.3.7 The run can end with a script to put the instrument into standby mode.

8.4 Daily Sample Preparation/Analysis Sequence

- Prepare extracts for analysis by placing a 300 µl aliquot of sample extract containing 3 µL of internal standards into a PP auto-sampler vial. Apply Polyolefin cap.
- Confirm that the samples loaded on the auto-sampler were entered correctly in the injection log. Make any necessary corrections.
- Run instrument CCV checks at the RL (0.25-0.5 ng/mL), then at a mid-level and high level rotating every ten samples (5, 25 ng/mL) and ending with a mid-level CCV.
- Enter the Worklist (<u>injection sequence</u>) into the instrument software and load samples onto the auto-sampler in the order shown above in Section 8.3.6

8.5 Data Review

The Agilent Mass Hunter Quantitation program is used to review all data. All identifications are based upon retention time (RT) of the transition of the precursor to product ion represented by a peak. Retention times should not vary more than ± 0.5 minutes as compared to the initial CCV analyzed for an analytical sequence. All positive detections of target PFAS must be less than the high point concentration of the calibration curve.

8.5.1 Since certain PFAS species are manufactured by different processes the presence of branched as well as linear isomers may be found. To properly quantitate these species, the analyst must sum the related branched and linear isomers. This affects the following species: PFOS, PFHxS, PFOA, PFNA, PFOSA, NMeFOSA, NEtFOSA, NEtFOSE, and NMeFOSE.

8.5.2 Any detection greater than the upper limit of the calibration curve requires dilution into the upper half of the curve, where possible.

9. CALIBRATION

9.1 Initial Calibration

The initial calibration covers the range 0.20 ng/mL to 1560 ng/mL nominal conc. or higher depending upon the linearity of the PFAS species. After acquisition, the data are quantitated in Mass Hunter and the default calibration model for target compounds is generated using Quadratic regression, FORCED through the origin where applicable. All same level species (EIS) used average response factor model. Depending upon the response and accuracy at each level as shown in the Mass Hunter program, use Linear, Forced, weighted (1/x) or quadratic, Forced, with or without weighting to achieve the best fit which is based upon the best accuracy on a compound-by-compound basis. In any case, the correlation coefficient must be greater than 0.990. Average Response Factor (RF) or Relative Standard Deviation (RSD) should be $\leq$ 20% where used.

9.1.1 The calibration levels as shown in Section 7.4.7 use 8 levels. All points are included in the calibration with the exception of some species that saturate at levels 7 and 8.

9.2 Calibration Verification

9.2.1 Relative Standard Error (RSE): For calibrations using an average RF curve fit, the relative standard deviation (RSD) is the measure of relative error. However, if a quadratic regression is used RSE should be calculated for calibration curve. RSE is calculated by the Mass Hunter software. The RSE for all method analytes should be ≤ 20% to establish instrument linearity.

9.2.2 An independently prepared Initial Calibration Verification must be run immediately following initial calibration. The concentration of this standard should be in the middle of the calibration range (e.g., 5.0 ng/mL) and prepared from a separate preparation as that of the calibration. Unless project-specific data quality objectives are required, the values from the second-source check should be ± 30% of the expected concentration.

9.2.2.1 **Corrective Action**: Quantitative sample analyses should not proceed for a failing ICV. Recalibrate and re-run the ICV if necessary.

An independently prepared Initial Calibration Verification must be run immediately following initial calibration. The concentration of this standard should be in the middle of the calibration range (e.g., 5.0 ng/mL) and prepared from a separate preparation as that of the calibration. Unless project-specific data quality objectives are required, the values from the second-source check should be ± 30% of the expected concentration.

Corrective Action: Quantitative sample analyses should not proceed for a failing ICV. Recalibrate and re-run the ICV if necessary.

9.3 Continuing Calibration Verification

The first CCV is at a mid-level and analyzed every 10 client samples including a closing CCV.

The mid-Level CCV must be ± 30% of the true value.

Corrective Action: If any of the required calibration check criteria fail, the system must be evaluated, and any appropriate instrument repair or maintenance must be performed. Sample data are unacceptable and must be rerun. Reinjection of the standard may be done. If the calibration check standard still fails, the system must be recalibrated.

10. Quality Control

10.1 Initial Demonstration of Capability (IDOC)

10.1.1 The initial demonstration requirement of EPA 1633 must be acceptable before analysis of samples may begin. To establish the ability to generate acceptable precision and recovery, the laboratory must perform the following operations for each sample matrix type to which the method will be applied by that laboratory.

The IDOC includes the following key elements:

- Initial Demonstration of Precision and Recovery (IPR)
- MDL determination

10.1.2 Initial Demonstration of Precision and Recovery-IPR

- Extract, concentrate, and analyze four aliquots of aqueous and soil matrices spiked with 100 µL of the native spike solution OPR Mix Y22J304, 50 µL of the EIS solution no. Y22J305. At least one method blank, matching the matrix being analyzed, must be prepared with the IPR batches by matrix. All sample processing steps that are used for processing samples, including preparation and extractions, cleanup and concentration, must be included in this test.

- Using results of the set of four analyses, compute the average percent recovery (R) of the extracts and the relative standard deviation (RSD) of the concentration for each target and EIS compound.
- For each native and isotopically labeled compound, compare RSD and % recovery with the corresponding limits for initial precision and recovery in Table 5. If RSD and R for all compounds meet the acceptance criteria, system performance is acceptable, and analysis of blanks and samples may begin. *Note these acceptance criteria are not finalized and are based upon a single lab validation. Data for this table is derived from the single-laboratory validation study and are only provided as examples for this draft method. The data will be updated to reflect the inter-laboratory study results in a subsequent revision. Therefore, these criteria will change after inter-laboratory validation. Several sections of this method state that Table 5 criteria are required, this is standard language that will be applicable when the method is finalized.*

10.1.3 MDL Determination

MDL Determination –In order to perform the MDL study, 7 total extractions are performed on 3 different days (Extraction Day 1= 3 LRBs and 3 LFBs, Extraction Day 2 is 2 of each, and Extraction Day 3 is also 2 of each).

The levels extracted represent approx. 3-5 x the expected LOQ.

Once extracted, the analyses are conducted on 3 separate days the MDL is determined according to the EPA MDL protocol defined in Definition and

Procedure of the Determination of the Method Detection Limit, Revision 2 Dec. 2016 as detailed below:

Make all computations as specified in the analytical method and express the final results in the method-specified reporting units.

Calculate the sample standard deviation (SD) of the replicate spiked sample measurements and the sample standard deviation of the replicate method blank measurements from all instruments to which the MDL will be applied.

Compute the MDLs (the MDL based on spiked samples) as follows:

MDL_s = 3.143 x SD (for seven replicates; SD = Standard Deviation)

Compute the MDL_b (MDL based on method blanks-LRBs) as follows:

- If none of the blanks give numerical results, then the MDL_b does not apply.
- If only some of the blanks (but not all) give a result, set the MDL_b to the highest result found.
- If ALL method blanks show a detection, then use the following calculation to determine MDL_b:

MDL_b = Average of Blank Detections + (3.143 x Std. Dev.)

Calculate the final MDL by selecting the greater of MDL_s or MDL_b.

10.2 On-going QC Requirements

Preparation Batches are defined at the sample preparation step. Batches should be kept together through the whole analytical process as far as possible, but it is not mandatory to analyze prepared extracts on the same instrument or in the same sequence.

The quality control batch is a set of up to 20 samples of the same matrix processed using the same procedure and reagents within the same time period. The quality control batch may contain a matrix spike/matrix spike duplicate (MS/MSD), two laboratory control samples (LCS-LLOPR and OPR) and a method blank. Laboratory generated QC samples (Blank, LLOPR, OPR, MS/MSD) do not count toward the maximum 20 samples in a batch. Field QC samples are included in the batch count. In some cases, at client request, the MS/MSD may be replaced with a matrix spike and sample duplicate.

10.2.1 METHOD BLANK - One method blank must be extracted with every prep batch of similar matrix, not to exceed twenty (20) samples. For aqueous samples the matrix is Lab reagent water. For Soils the method blank matrix is

Ottawa sand. Criteria:

- The method blank must not contain any analyte at or above 1/2 the LOQ (Reporting Limit).
- Re-extraction and reanalysis of samples associated with an unacceptable method blank is required when reportable concentrations are determined in the samples.

10.2.2 <u>LABORATORY CONTROL SAMPLES</u> (LCS- also called OPR and LLOPR) must be extracted with every process batch of similar matrix, not to exceed twenty (20) samples. The LCS is an aliquot of laboratory matrix (e.g., water for aqueous spiked with analytes of known identity and concentration and isotopic surrogate analogs. The OPRs must be processed in the same manner and at the same time as the associated samples. Recovery for Aqueous low level OPR target analytes are 40-150% until more data are derived. For all other Aqueous OPR levels recovery targets are 50-150%. These data are based upon EPA 1633 draft ranges that will change and are not used for acceptance/rejection but are reported until such time that fully validated acceptance ranges are provided in the final version of the method.

10.2.3 <u>Matrix spike/Matrix spike duplicate</u> (MS/MSD or MS/MSD). <u>These are not typically required since each sample contains isotopic PFAS analogues that correct for any matrix effects</u>. If the client requests them, then they are processed accordingly but are not a requirement of this method. If done they are by matrix, not to exceed twenty (20) samples. An MS/MSD pair is aliquots of a selected field sample spiked with analytes of known identity and concentration. The MS/MSD pair must be processed in the same manner and at the same time as the associated samples. Spiked analytes with recoveries or precision outside of the Laboratory control limits are flagged accordingly. Until enough statistical data per matrix is available, no criteria are offered. If a specific QA Project Plan has required limits, this is preempted. Any outliers must be qualified accordingly.

10.2.4 <u>Initial calibration verification (ICV)</u> –A second source standard is not required for this method. A second independently prepared mid-level standard is prepared and used for this purpose and analyzed after the ICAL. The concentration should be at the mid-range of the curve and must recover within 70-130 % of expected value.

Corrective actions for the ICV include:

- Rerun the ICV
- Remake or acquire a new ICV.
- Evaluate the instrument conditions.

- Evaluate the initial calibration standards.
- Rerun the initial calibration.

10.2.5 Internal Standard- The Non-extracted Internal Standard (NIS) is added to each field and QC sample prior to analysis. The IS response (peak area) must not deviate by more than 50-200% from the mean response (peak area) of the initial calibration. If the areas are low for all the field samples and QC samples in the batch, it suggests a loss of instrument sensitivity, while low areas in only some field or QC samples suggests a possible bad injection.

Corrective action includes:

- Reinject the questionable samples.
- Verifying the CCV NIS areas are compliant with the range, if so, this suggests either matrix effects or may require a small dilution to mitigate interference if only some of the NIS compounds are affected.
- Qualify affected data.

10.3 Initial Demonstration of Capability (IDC)

Initial Demonstration of Capability involves the following processes listed ion Table 1.0 as follows.

Table 1.0 - Initial Demonstration of Capability (IDC)

Requirement	Specification and Frequency	Acceptance Criteria
Initial Demonstration of Precision and Recovery (IPR)	Extract, concentrate, and analyze four aliquots of the matrix (aqueous and soil) spiked with target native standard solution, EIS solution and finally the NIS (ISTD). Extract a method blank of each matrix with each matrix IPR batch. All steps that are used for processing samples, including preparation and extraction must be included.	Using results of the set of four analyses, compute the average percent recovery (R) of the extracts and the relative standard deviation (RSD) of the concentration for each target and EIS compound.
		For each native and isotopically labeled compound, compare RSD and % recovery with the corresponding limits for initial precision and recovery in Table 5. If RSD and R for all compounds meet the acceptance criteria, system performance is acceptable, and analysis of blanks and samples may begin.
Method Detection Limit (MDL)	Method detection limit (MDL) - Each laboratory must also establish MDLs for all the analytes using the MDL procedure at 40 CFR Part 136, Appendix B. An MDL determination must be performed for all target compounds.	The minimum level of quantification (ML) can be calculated by multiplying the MDL by 3.18 and rounding to the nearest integer

Calibration Verification (ICV or SCV) *Section 9.1.5*	Analyze a mid-level ICV, each time a new calibration is performed or at a minimum, quarterly. The ICV must be an independent dilution beginning with the common starting materials used for ICAL. No 2nd source is required due to availability.	Results must be 70-130% of true value.

10.4 **QC Requirements**

Ongoing QC requirements are detailed in Table 3.0 as follows.

Table 3.0 QC Requirements

Summary of Quality Control **Method Reference**	**Requirement**	**Specification and Frequency**
Section 10.1	Mass Calibration	Annually and on as-needed basis
Section 10.1.7	Mass Calibration Verification	After mass calibration
Section 10.3	Initial Calibration (ICAL)	Minimum 6 calibration standards for linear models and 7 calibration standards for non-linear models.
Sections 10.2.2, 14.4	Retention Time (RT) window	After ICAL and at the beginning of analytical sequence
Sections 7.3.1, 9.4	Extracted Internal Standard (EIS) Analytes	All CAL standards, batch QC and field samples
Sections 7.3.2	Non-extracted Internal Standards (NIS)	All CAL standards, batch QC and field samples
Sections 7.3.4, 10.3.1, 13.3	Instrument Sensitivity Check (ISC)	Daily, prior to analysis
Section 14.2	Calibration Verification (CV) (CCV)	At the beginning and every 10 samples and at the end
Section 14.6	Instrument Blank	Daily prior to analysis and after high standards
Sections 9.1.3, 9.5, 14.7	Method Blank (MB)	One per preparation batch
Section 14.5	Ongoing Precision Recovery (OPR)	One per preparation batch
Section 11.0	Limit of Quantitation Verification (LLOPR)	Prior to analyzing samples
Section 11.0	Matrix Spike (MS/MSD)	One per preparation batch (if required) Normally not needed, since Isotope dilution is employed

11.0 DATA REVIEW, CALCULATIONS AND REPORTING

Samples concentrations are determined using either linear regression or quadratic regression FORCED through the origin. Weighted ($1/x$ or $1/x^2$) may assist with low level accuracy and is recommended where necessary. All calibration curves have greater than 6 points. Any target analyte exceeding the calibration range will require dilution.

11.1 Data interpretation

All sample data calculations are performed by the Agilent Mass Hunter software in ng/mL and then final data are calculated considering final extract volumes and the initial sample volumes extracted which are entered into the Element bench sheet.

11.2 Linear and Branched Isomers are addressed in Section 8.5 and are reported for the noted species as Total which is a sum of the linear and branched isomers for affected species.

11.3 All Data are uploaded into Element LIMS and all final concentration calculations and associated recoveries are detailed. All pdfs of Mass Hunter Quant reports are uploaded to the Element Raw Data drive for association with ICALs and all batch and analysis sequence runs. Data are set to Analyzed status once uploaded and initially reviewed, then locked.

11.4 The Data is then evaluated using the York Qualinator ™ data review tool which evaluates all data CCVs, QC, ISTDS, Recoveries, etc. and automatically assigns outlier qualifiers for review and acceptance by the reviewer. The accepted data are then uploaded to Element and final reviewed in Laboratory Data Entry/Review module. Once reviewed, the status is set to Reviewed indicating the data are ready to be Reported by the Reporting Group.

12. HEALTH AND SAFETY

12.1 General safety considerations and requirements are detailed in the York Laboratory Safety and Health Standard Operating Procedure No. Safety011600.

Specific safety rules applying to the conduct of this analysis requiring the following:

- When handling standards and samples, latex gloves are required.
- Also, when handling neat materials, a fume hood and safety glasses are required.
- When handling samples, gloves and glasses are required.
- Highly odorous samples must be handled in a fume hood.
- Refer to SDSs for specific safety/health information.

12.2 The analysts must exercise normal care and be supervised and trained to work in an analytical chemistry laboratory. The analysts will be handling fragile glassware, needles, syringes, volatile and flammable chemicals, toxic chemicals, and corrosive chemicals.

- No smoking or open flames are allowed.
- No food or food products may be brought into the laboratory.

Solvents should not be left uncovered on the laboratory benches.
All solvent transfers should be done in the hoods.

Hood doors must be kept in a position which yields approx. 100 fpm face velocity.
Solvent evaporation must be done in the hood with exhaust elevated and in the rear.

Waste containers that had solvents must be vented to a hood until all solvents have evaporated.

Safety glasses are provided and must always be worn in the laboratory.
Gloves are provided and must be worn when working with chemicals.
Laboratory coats are provided and should be worn to protect the analysts’ clothes.
Syringes and needles must be kept in their original cases when not in use.
Care must be exercised in using and handling syringes to avoid injury.
Report any sticking with a needle immediately to your supervisor.

12.3 Specific Safety Concerns

12.3.1 Preliminary toxicity studies indicate that PFAS could have significant toxic effects. In the interest of keeping exposure levels as low as reasonably achievable, PFAS must be handled in the laboratory as hazardous and toxic chemicals.

12.3.2 Exercise caution when using syringes with attached filter disc assemblies. Application of excessive force has, upon occasion, caused a filter disc to burst during the process.

12.3.3 Laboratory procedures such as repetitive use of pipets, repetitive transferring of extracts and manipulation of filled separatory funnels and other glassware represent a significant potential for repetitive motion or other ergonomic injuries. Laboratory associates performing these procedures are in the best position to realize when they are at risk for these types of injuries.

12.3.4 Eye protection, laboratory coat, and nitrile gloves must be worn while handling samples, standards, solvents, and reagents. Disposable gloves that have been contaminated will be removed and discarded; other gloves will be cleaned immediately.

12.3.5 Perfluorocarboxylic acids are acids and are not compatible with strong bases.

12.3.6 Primary Materials Used- The following is a list of the materials used in this method, which have a serious or significant hazard rating. NOTE: This list does not include all materials used in the method. The table contains a summary of the primary hazards listed in the SDS for each of the materials listed in the table. A complete list of materials used in the method can be found in the reagents and materials section. Employees must review the information in the SDS for each material before using it for the first time or when there are major changes to the SDS.

Methanol	-Flammable Poison -Irritant	200 ppm (TWA)	A slight irritant to the mucous membranes. Toxic effects exerted upon nervous system, particularly the optic nerve. Symptoms of overexposure may include headache, drowsiness and dizziness. Methyl alcohol is a defatting agent and may cause skin to become dry and cracked. Skin absorption can occur; symptoms may parallel inhalation exposure. Irritant to the eyes.
Acetic Acid, Glacial	-Flammable liquid and vapor. -Irritation	10 ppm TWA; 25 mg/m3 TWA	**Eye:** Causes severe eye irritation. Contact with liquid or vapor causes severe burns and possible irreversible eye damage. **Skin:** Causes skin burns. May be harmful if absorbed through the skin. Contact with the skin may cause blackening and hyperkeratosis of the skin of the hands. **Ingestion:** May cause severe and permanent damage to the digestive tract. Causes severe pain, nausea, vomiting, diarrhea, and shock. May cause polyuria, oliguria (excretion of a diminished amount of urine in relation to the fluid intake) and anuria (complete suppression of urination). Rapidly absorbed from the gastrointestinal tract. **Inhalation:** Effects may be delayed. Causes chemical burns to the respiratory tract. Exposure may lead to bronchitis, pharyngitis, and dental erosion. May be absorbed through the lungs. **Chronic:** Chronic exposure to acetic acid may cause erosion of dental enamel, bronchitis, eye irritation, darkening of the skin, and chronic inflammation of the respiratory tract. Acetic acid can cause occupational asthma. One case of a delayed asthmatic response to glacial acetic acid has been reported in a person with bronchial asthma. Skin sensitization to acetic acid is rare, but has
Ammonium Hydroxide, conc. 28-30%	- Inhalation hazard - Skin Corrosion -Eye Damage and Irritation	OSHA PEL: 35 mg/m3 ; 50 ppm OSHA TWA: 18 mg/m3; 25 ppm	Ammonia is an irritant and corrosive to the skin, eyes, respiratory tract and mucous membranes. May cause severe chemical burns to the eyes, lungs and skin. Skin and respiratory related diseases could be aggravated by exposure. The extent of injury produced by exposure to ammonia depends on the duration of the exposure, the concentration of the liquid or vapor and the depth of inhalation. Exposure Routes: Inhalation (vapors), skin and/or eye contact (vapors, liquid), ingestion (liquid).

Formic Acid, conc.	-Flammable liquid and vapor -Harmful if swallowed -Causes severe skin burns and eye damage -Toxic if inhaled -May cause respiratory irritation	OSHA TWA: 5 ppm or 9 mg/m3 OSHA PEL: 10 ppm	Formic acid is an irritant and corrosive to the skin, eyes, respiratory tract and mucous membranes. May cause severe chemical burns to the eyes, lungs and skin. Skin and respiratory related diseases could be aggravated by exposure. The extent of injury produced by exposure to ammonia depends on the duration of the exposure, the concentration of the liquid or vapor and the depth of inhalation. Exposure Routes: Inhalation (vapors), skin and/or eye contact (vapors, liquid), ingestion (liquid).

13. WASTE MANAGEMENT/POLLUTION PREVENTION

Neat Materials

Waste management procedures require the prudent use of neat materials. The ordering of neat standards and materials must be done to minimize unused material which would result in storage or handling of excess material. Quantities ordered should be sufficient to provide for necessary standards with consideration to shelf life. When ordering a unique material for a standard, be sure to order the smallest practical quantity.

Solvents

The solvents used at York for this procedure include isopropanol and Methanol. These solvents are used for sample extraction or LC cleanup, all amounts are either consumed during concentration or placed in one-liter amber jars in the hood areas for evaporation. Any remaining solvent/water is transferred to a drum designated for solvent waste.

Acids and Bases

The acids and bases used for this procedure include Acetic Acid and Formic Acid. The bases used are Ammonium hydroxide, sodium hydroxide and potassium hydroxide. Store concentrated base and acids separately whether waste or neat material.

Samples

Unused or remaining water samples are returned to the sample control room for continued storage for proper disposal by the sample control group.

14. REFERENCES

1. EPA METHOD 1633 Draft 3 December, 2022- Analysis of Per- and Polyfluoroalkyl Substances (PFAS) in Aqueous, Solid, Biosolids, and Tissue Samples by LC-MS/MS; EPA 821-D-22-001

15. REVISION HISTORY

Revision 1.0	10/24/2022	First issue.
Revision 1.1	02/10/2023	Modified LLOPR in Section 7.4.6.1 to reflect 2x the MRL
Revision 1.2	06/23/2023	Added *Appendix 1: Target Compound Reporting Limits*. Updated Section 9.2 to add acceptable limits for ICAL RSE. Described the Promochrom extraction method in Sections 8.2, 8.3, and added *Appendix 2: Promochrom Method*. Redefined analytical batch as analytical sequence. Updated Reference to EPA 1633 Draft 3. Added reference to and preparation procedures for a second source standard in Section 7. Revised qualitative identification requirements for analytes in Section 8. Minor formatting edits.

Appendix 1 – Target Compound Reporting Limits

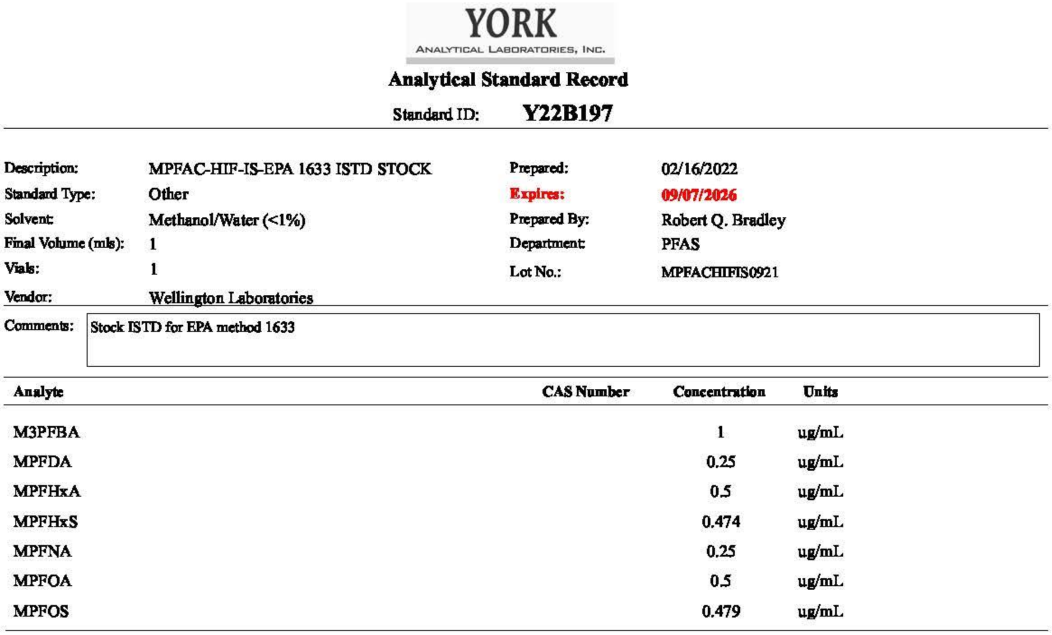
Target Compoud	Soil		Water	
	MDL/LOD	RL/LOQ	MDL/LOD	RL/LOQ
	ng/L	ng/L	µg/kg	µg/kg
Perfluorobutanesulfonic acid (PFBS)	0.111	0.177	0.47	1.77
Perfluorohexanoic acid (PFHxA)	0.053	0.200	0.35	2.00
Perfluoroheptanoic acid (PFHpA)	0.105	0.200	0.71	2.00
Perfluorohexanesulfonic acid (PFHxS)	0.179	0.183	0.68	1.83
Perfluorooctanoic acid (PFOA)	0.172	0.200	0.42	2.00
Perfluorooctanesulfonic acid (PFOS)	0.167	0.186	0.82	1.86
Perfluorononanoic acid (PFNA)	0.189	0.200	0.52	2.00
Perfluorodecanoic acid (PFDA)	0.191	0.200	0.75	2.00
Perfluoroundecanoic acid (PFUnA)	0.198	0.200	1.13	2.00
Perfluorododecanoic acid (PFDoA)	0.163	0.200	0.88	2.00
Perfluorotridecanoic acid (PFTrDA)	0.125	0.200	0.74	2.00
Perfluorotetradecanoic acid (PFTA)	0.103	0.200	0.69	2.00
N-MeFOSAA	0.148	0.200	0.79	2.00
N-EtFOSAA	0.194	0.200	1.03	2.00
Perfluoropentanoic acid (PFPeA)	0.109	0.400	0.23	4.00
Perfluoro-1-octanesulfonamide (FOSA)	0.146	0.200	0.88	2.00
Perfluoro-1-heptanesulfonic acid (PFHpS)	0.155	0.200	0.91	1.91
Perfluoro-1-decanesulfonic acid (PFDS)	0.191	0.193	1.32	1.93
1H,1H,2H,2H-Perfluorooctanesulfonic acid (6:2 FTS)	0.595	0.760	1.06	7.60
1H,1H,2H,2H-Perfluorodecanesulfonic acid (8:2 FTS)	0.755	0.768	2.05	7.68
Perfluoro-n-butanoic acid (PFBA)	0.109	0.800	0.33	8.00
Perfluoro(2-ethoxyethane)sulfonic acid (PFEESA)	0.139	0.356	0.50	3.56
Perfluoro-3,6-dioxaheptanoic acid (NFDHA)	0.193	0.400	2.14	4.00
Perfluoro-4-oxapentanoic acid (PFMPA)	0.062	0.400	0.25	4.00
Perfluoro-5-oxahexanoic acid (PFMBA)	0.096	0.400	0.37	4.00
Perfluoro-1-pentanesulfonate (PFPeS)	0.157	0.188	0.76	1.88
1H,1H,2H,2H-Perfluorohexanesulfonic acid (4:2 FTS)	0.595	0.750	1.79	7.50
HFPO-DA (Gen-X)	0.608	0.800	3.23	8.00
11CL-PF3OUdS	0.311	0.756	1.38	7.56
9CL-PF3ONS	0.246	0.748	0.70	7.48
ADONA	0.174	0.756	0.53	7.56
Perfluorododecanesulfonic acid (PFDoS)	0.169	0.194	0.93	1.94
Perfluoro-1-nonanesulfonic acid (PFNS)	0.124	0.192	0.86	1.92
3-Perfluoropropyl propanoic acid (FPrPA or 3:3FTCA)	0.634	1.000	2.03	5.00
3-Perfluoropentyl propanoic acid (FPePA or 5:3 FTCA)	2.098	5.000	7.33	25.00
3-Perfluoroheptyl propanoic acid (FHpPA or 7:3FTCA)	1.500	5.000	9.47	25.00
N-MeFOSE	0.611	2.000	3.99	20.00
N-MeFOSA	0.180	0.200	1.58	2.00
N-EtFOSE	0.697	2.000	3.99	20.00
N-EtFOSA	0.198	0.200	1.80	2.00

Appendix 2: Promochrom Method

Step	Action	Inlet 1	Inlet 2	Flow (mL/min)	Volume (mL)	Target
1	Elute	1% Basic Methanol	-	8	15	Waste
2	Elute	0.3M Formic Acid	-	8	5	Waste
3	Add Sample	Sample Inlet	-	10	60 or 510*	Waste
4	Rinse Sample	Water	Air (20%)	70	2.5	Sample Container
5	Add Sample	Sample Inlet	-	5	5	Waste
6	Rinse Sample	Water	Air (20%)	70	5	Sample Container
7	Add Sample	Sample Inlet	-	5	5	Waste
8	Rinse Sample	Water	Air (20%)	70	5	Sample Container
9	Add Sample	Sample Inlet	-	5	5	Waste
10	Rinse Sample	1:1 0.1M Formic Acid/Methanol	Air (20%)	70	1.3	Sample Container
11	Add Sample	Sample Inlet	-	5	3	Waste
12	Rinse Sample	1:1 0.1M Formic Acid/Methanol	Air (20%)	70	5	Sample Container
13	Add Sample	Sample Inlet	-	5	5	Waste
14	Air Purge	SPE Cartridge	-	5	5 Minutes	
15	Add Sample	Sample Inlet	-	5	5	Waste
16	Blow N2	Sample Inlet	-	5	1 Minute	
17	Rinse Sample	1% Basic Methanol	Air (20%)	70	1.3	Sample Container
18	Collect	Sample Inlet	-	5	3	Centrifuge Tube
19	Rinse Sample	1% Basic Methanol	Air (20%)	70	5	Sample Container
20	Collect	Sample Inlet	-	5	5	Centrifuge Tube
21	Collect	Sample Inlet	-	5	5	Centrifuge Tube

*60 mL is used for soil matrices and 510 mL is used for aqueous matrices.

Attachment 1 – Non-Extracted Internal Standards (NIS)



YORK
ANALYTICAL LABORATORIES, INC.

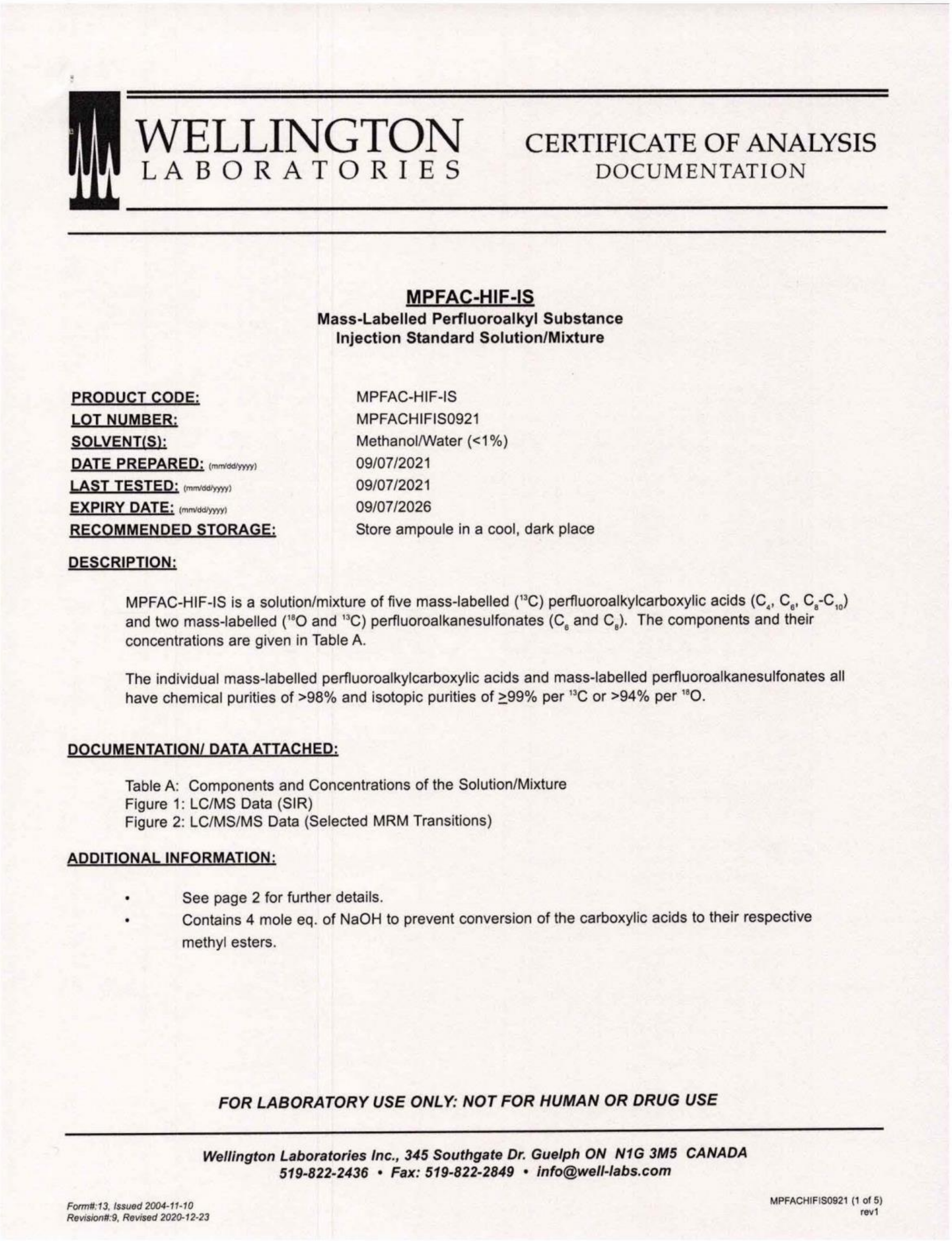
Analytical Standard Record

Standard ID: **Y22B197**

Description:	MPFAC-HIF-IS-EPA 1633 ISTD STOCK	**Prepared:**	02/16/2022
Standard Type:	Other	**Expires:**	**09/07/2026**
Solvent:	Methanol/Water (<1%)	**Prepared By:**	Robert Q. Bradley
Final Volume (mls):	1	**Department:**	PFAS
Vials:	1	**Lot No.:**	MPFACHIFIS0921
Vendor:	Wellington Laboratories		

Comments: Stock ISTD for EPA method 1633

Analyte	CAS Number	Concentration	Units
M3PFBA		1	ug/mL
MPFDA		0.25	ug/mL
MPFHxA		0.5	ug/mL
MPFHxS		0.474	ug/mL
MPFNA		0.25	ug/mL
MPFOA		0.5	ug/mL
MPFOS		0.479	ug/mL



WELLINGTON
LABORATORIES

CERTIFICATE OF ANALYSIS
DOCUMENTATION

MPFAC-HIF-IS
Mass-Labelled Perfluoroalkyl Substance Injection Standard Solution/Mixture

PRODUCT CODE:	MPFAC-HIF-IS
LOT NUMBER:	MPFACHIFIS0921
SOLVENT(S):	Methanol/Water (<1%)
DATE PREPARED: (mm/dd/yyyy)	09/07/2021
LAST TESTED: (mm/dd/yyyy)	09/07/2021
EXPIRY DATE: (mm/dd/yyyy)	09/07/2026
RECOMMENDED STORAGE:	Store ampoule in a cool, dark place

DESCRIPTION:

MPFAC-HIF-IS is a solution/mixture of five mass-labelled (^{13}C) perfluoroalkylcarboxylic acids (C_4, C_6, C_8-C_{10}) and two mass-labelled (^{18}O and ^{13}C) perfluoroalkanesulfonates (C_6 and C_8). The components and their concentrations are given in Table A.

The individual mass-labelled perfluoroalkylcarboxylic acids and mass-labelled perfluoroalkanesulfonates all have chemical purities of >98% and isotopic purities of $\geq$99% per ^{13}C or >94% per ^{18}O.

DOCUMENTATION/ DATA ATTACHED:

Table A: Components and Concentrations of the Solution/Mixture
Figure 1: LC/MS Data (SIR)
Figure 2: LC/MS/MS Data (Selected MRM Transitions)

ADDITIONAL INFORMATION:

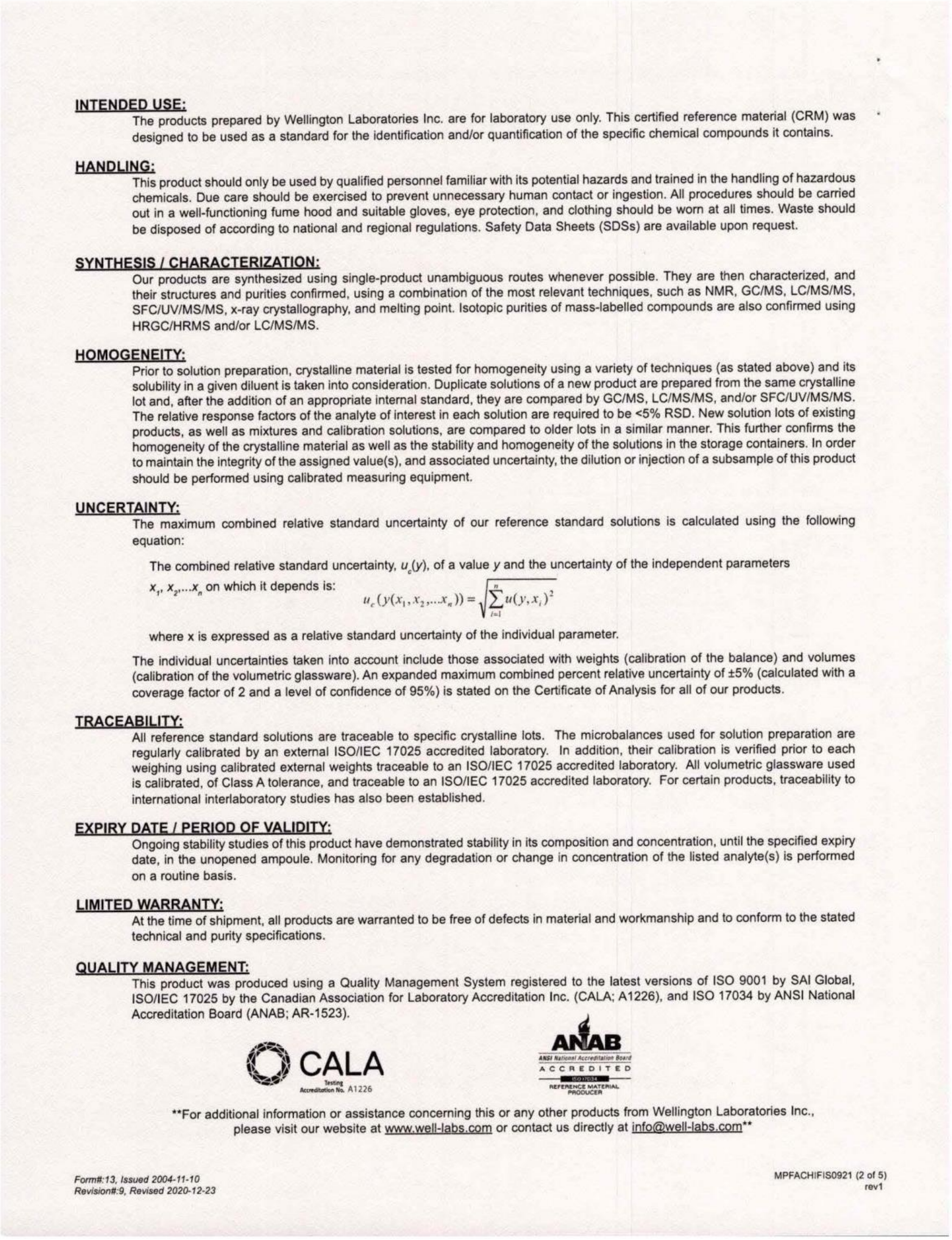
- See page 2 for further details.
- Contains 4 mole eq. of NaOH to prevent conversion of the carboxylic acids to their respective methyl esters.

FOR LABORATORY USE ONLY: NOT FOR HUMAN OR DRUG USE

Wellington Laboratories Inc., 345 Southgate Dr. Guelph ON N1G 3M5 CANADA
519-822-2436 • Fax: 519-822-2849 • info@well-labs.com

Form#:13, Issued 2004-11-10
Revision#:9, Revised 2020-12-23

MPFACHIFIS0921 (1 of 5)
rev1



INTENDED USE:

The products prepared by Wellington Laboratories Inc. are for laboratory use only. This certified reference material (CRM) was designed to be used as a standard for the identification and/or quantification of the specific chemical compounds it contains.

HANDLING:

This product should only be used by qualified personnel familiar with its potential hazards and trained in the handling of hazardous chemicals. Due care should be exercised to prevent unnecessary human contact or ingestion. All procedures should be carried out in a well-functioning fume hood and suitable gloves, eye protection, and clothing should be worn at all times. Waste should be disposed of according to national and regional regulations. Safety Data Sheets (SDSs) are available upon request.

SYNTHESIS / CHARACTERIZATION:

Our products are synthesized using single-product unambiguous routes whenever possible. They are then characterized, and their structures and purities confirmed, using a combination of the most relevant techniques, such as NMR, GC/MS, LC/MS/MS, SFC/UV/MS/MS, x-ray crystallography, and melting point. Isotopic purities of mass-labelled compounds are also confirmed using HRGC/HRMS and/or LC/MS/MS.

HOMOGENEITY:

Prior to solution preparation, crystalline material is tested for homogeneity using a variety of techniques (as stated above) and its solubility in a given diluent is taken into consideration. Duplicate solutions of a new product are prepared from the same crystalline lot and, after the addition of an appropriate internal standard, they are compared by GC/MS, LC/MS/MS, and/or SFC/UV/MS/MS. The relative response factors of the analyte of interest in each solution are required to be <5% RSD. New solution lots of existing products, as well as mixtures and calibration solutions, are compared to older lots in a similar manner. This further confirms the homogeneity of the crystalline material as well as the stability and homogeneity of the solutions in the storage containers. In order to maintain the integrity of the assigned value(s), and associated uncertainty, the dilution or injection of a subsample of this product should be performed using calibrated measuring equipment.

UNCERTAINTY:

The maximum combined relative standard uncertainty of our reference standard solutions is calculated using the following equation:

The combined relative standard uncertainty, $u_c(y)$, of a value y and the uncertainty of the independent parameters $x_1, x_2,...x_n$ on which it depends is:

$$u_c(y(x_1, x_2,...x_n)) = \sqrt{\sum_{i=1}^{n} u(y, x_i)^2}$$

where x is expressed as a relative standard uncertainty of the individual parameter.

The individual uncertainties taken into account include those associated with weights (calibration of the balance) and volumes (calibration of the volumetric glassware). An expanded maximum combined percent relative uncertainty of ±5% (calculated with a coverage factor of 2 and a level of confidence of 95%) is stated on the Certificate of Analysis for all of our products.

TRACEABILITY:

All reference standard solutions are traceable to specific crystalline lots. The microbalances used for solution preparation are regularly calibrated by an external ISO/IEC 17025 accredited laboratory. In addition, their calibration is verified prior to each weighing using calibrated external weights traceable to an ISO/IEC 17025 accredited laboratory. All volumetric glassware used is calibrated, of Class A tolerance, and traceable to an ISO/IEC 17025 accredited laboratory. For certain products, traceability to international interlaboratory studies has also been established.

EXPIRY DATE / PERIOD OF VALIDITY:

Ongoing stability studies of this product have demonstrated stability in its composition and concentration, until the specified expiry date, in the unopened ampoule. Monitoring for any degradation or change in concentration of the listed analyte(s) is performed on a routine basis.

LIMITED WARRANTY:

At the time of shipment, all products are warranted to be free of defects in material and workmanship and to conform to the stated technical and purity specifications.

QUALITY MANAGEMENT:

This product was produced using a Quality Management System registered to the latest versions of ISO 9001 by SAI Global, ISO/IEC 17025 by the Canadian Association for Laboratory Accreditation Inc. (CALA; A1226), and ISO 17034 by ANSI National Accreditation Board (ANAB; AR-1523).

CALA
Testing Accreditation No. A1226

ANAB
ANSI National Accreditation Board
ACCREDITED
ISO 17034
REFERENCE MATERIAL PRODUCER

For additional information or assistance concerning this or any other products from Wellington Laboratories Inc., please visit our website at www.well-labs.com or contact us directly at info@well-labs.com

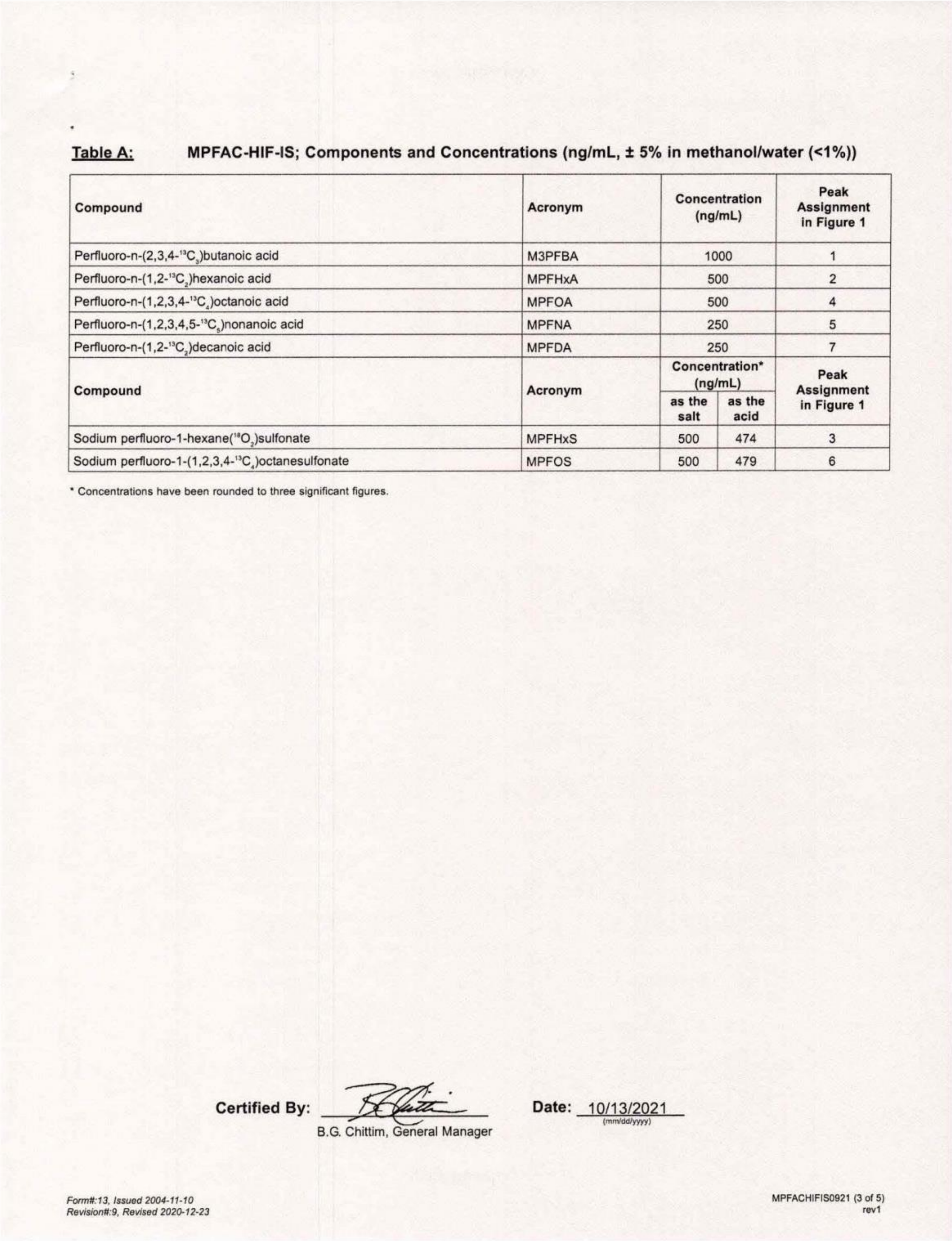


Table A: **MPFAC-HIF-IS; Components and Concentrations (ng/mL, ± 5% in methanol/water (<1%))**

Compound	Acronym	Concentration (ng/mL)		Peak Assignment in Figure 1
Perfluoro-n-(2,3,4-$^{13}C_3$)butanoic acid	M3PFBA	1000		1
Perfluoro-n-(1,2-$^{13}C_2$)hexanoic acid	MPFHxA	500		2
Perfluoro-n-(1,2,3,4-$^{13}C_4$)octanoic acid	MPFOA	500		4
Perfluoro-n-(1,2,3,4,5-$^{13}C_5$)nonanoic acid	MPFNA	250		5
Perfluoro-n-(1,2-$^{13}C_2$)decanoic acid	MPFDA	250		7
Compound	**Acronym**	**Concentration* (ng/mL)**		**Peak Assignment in Figure 1**
		as the salt	**as the acid**	
Sodium perfluoro-1-hexane($^{18}O_2$)sulfonate	MPFHxS	500	474	3
Sodium perfluoro-1-(1,2,3,4-$^{13}C_4$)octanesulfonate	MPFOS	500	479	6

* Concentrations have been rounded to three significant figures.

Certified By: ____________ **Date:** 10/13/2021
B.G. Chittim, General Manager (mm/dd/yyyy)

Form#:13, Issued 2004-11-10
Revision#:9, Revised 2020-12-23

MPFACHIFIS0921 (3 of 5)
rev1

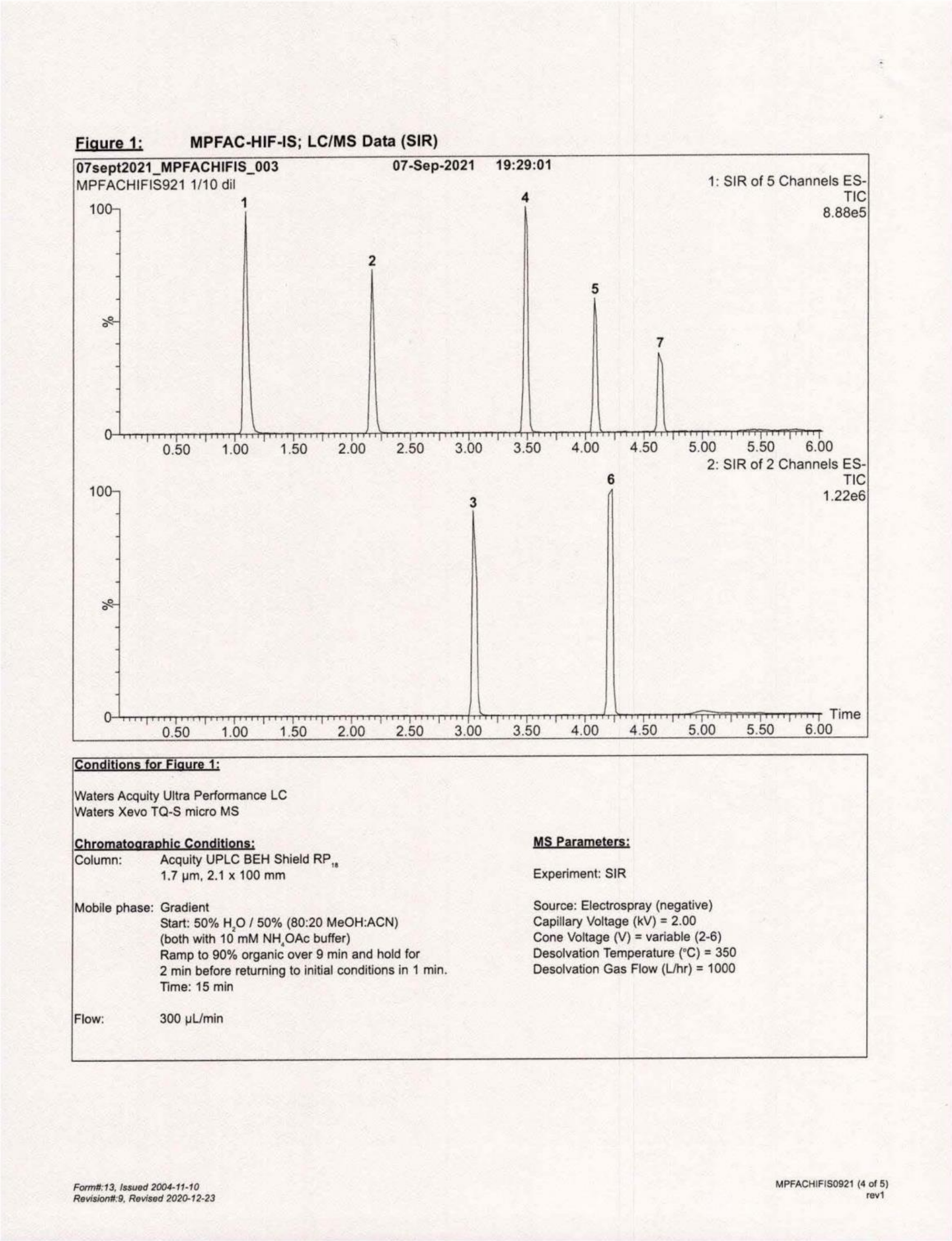


Figure 1: **MPFAC-HIF-IS; LC/MS Data (SIR)**

Conditions for Figure 1:

Waters Acquity Ultra Performance LC
Waters Xevo TQ-S micro MS

Chromatographic Conditions:

Column: Acquity UPLC BEH Shield RP_{18}
1.7 µm, 2.1 x 100 mm

Mobile phase: Gradient
Start: 50% H_2O / 50% (80:20 MeOH:ACN)
(both with 10 mM NH_4OAc buffer)
Ramp to 90% organic over 9 min and hold for
2 min before returning to initial conditions in 1 min.
Time: 15 min

Flow: 300 µL/min

MS Parameters:

Experiment: SIR

Source: Electrospray (negative)
Capillary Voltage (kV) = 2.00
Cone Voltage (V) = variable (2-6)
Desolvation Temperature (°C) = 350
Desolvation Gas Flow (L/hr) = 1000

Form#:13, Issued 2004-11-10
Revision#:9, Revised 2020-12-23

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rev1

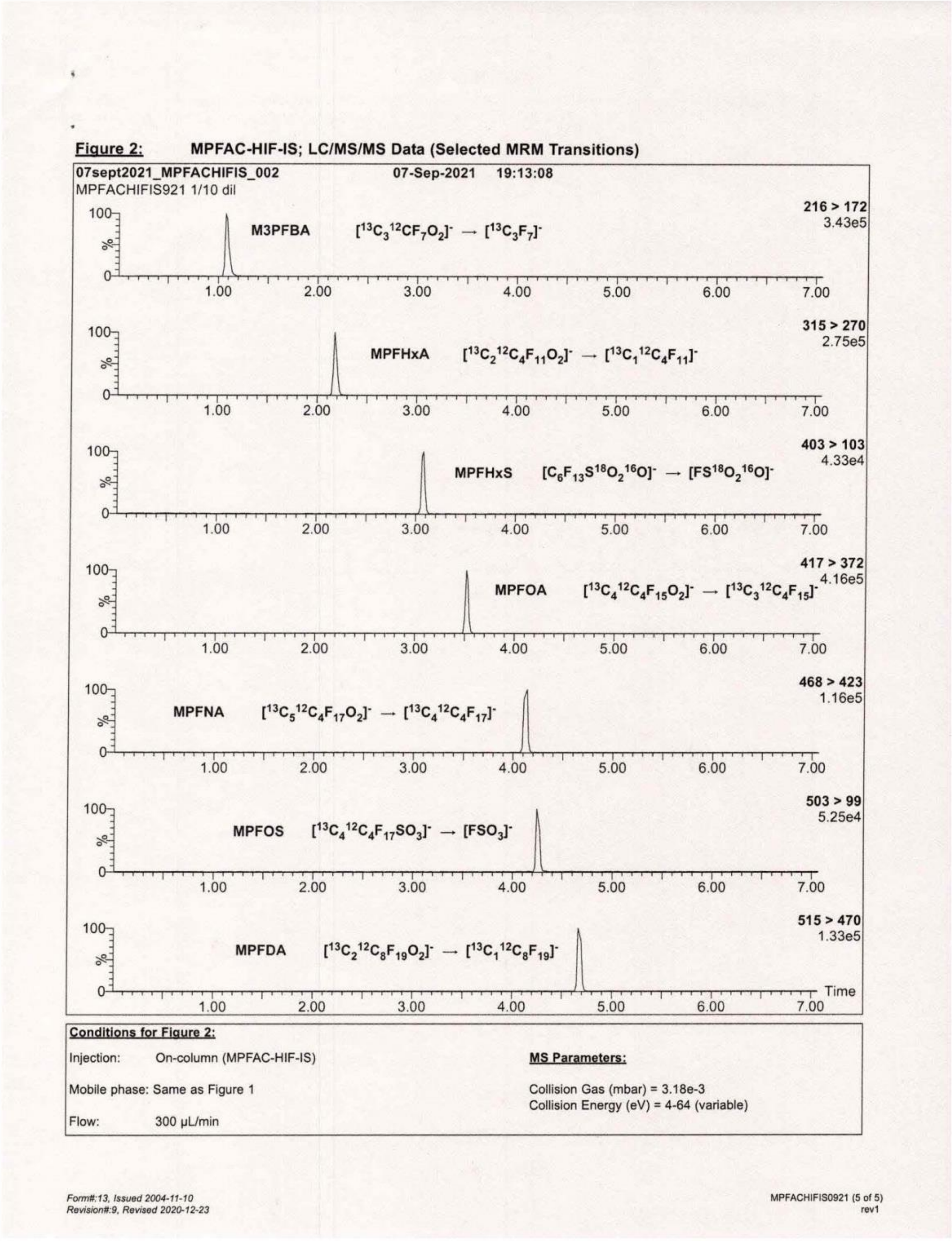


Figure 2: **MPFAC-HIF-IS; LC/MS/MS Data (Selected MRM Transitions)**

Conditions for Figure 2:

Injection: On-column (MPFAC-HIF-IS)

Mobile phase: Same as Figure 1

Flow: 300 µL/min

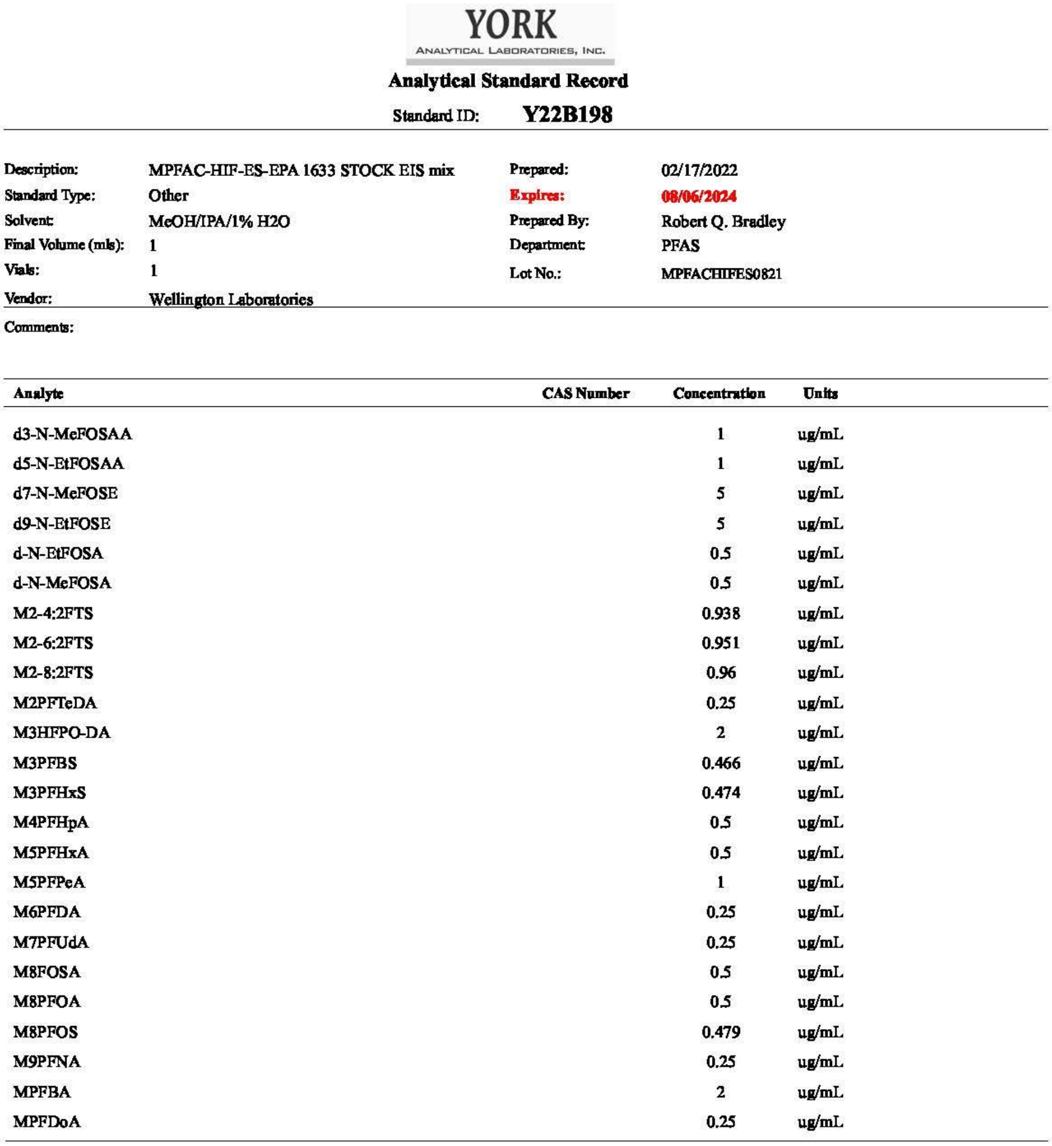
MS Parameters:

Collision Gas (mbar) = 3.18e-3
Collision Energy (eV) = 4-64 (variable)

Form#:13, Issued 2004-11-10
Revision#:9, Revised 2020-12-23

MPFACHIFIS0921 (5 of 5)
rev1

Attachment 2 – Extracted Internal Standards (EIS)



YORK
ANALYTICAL LABORATORIES, INC.

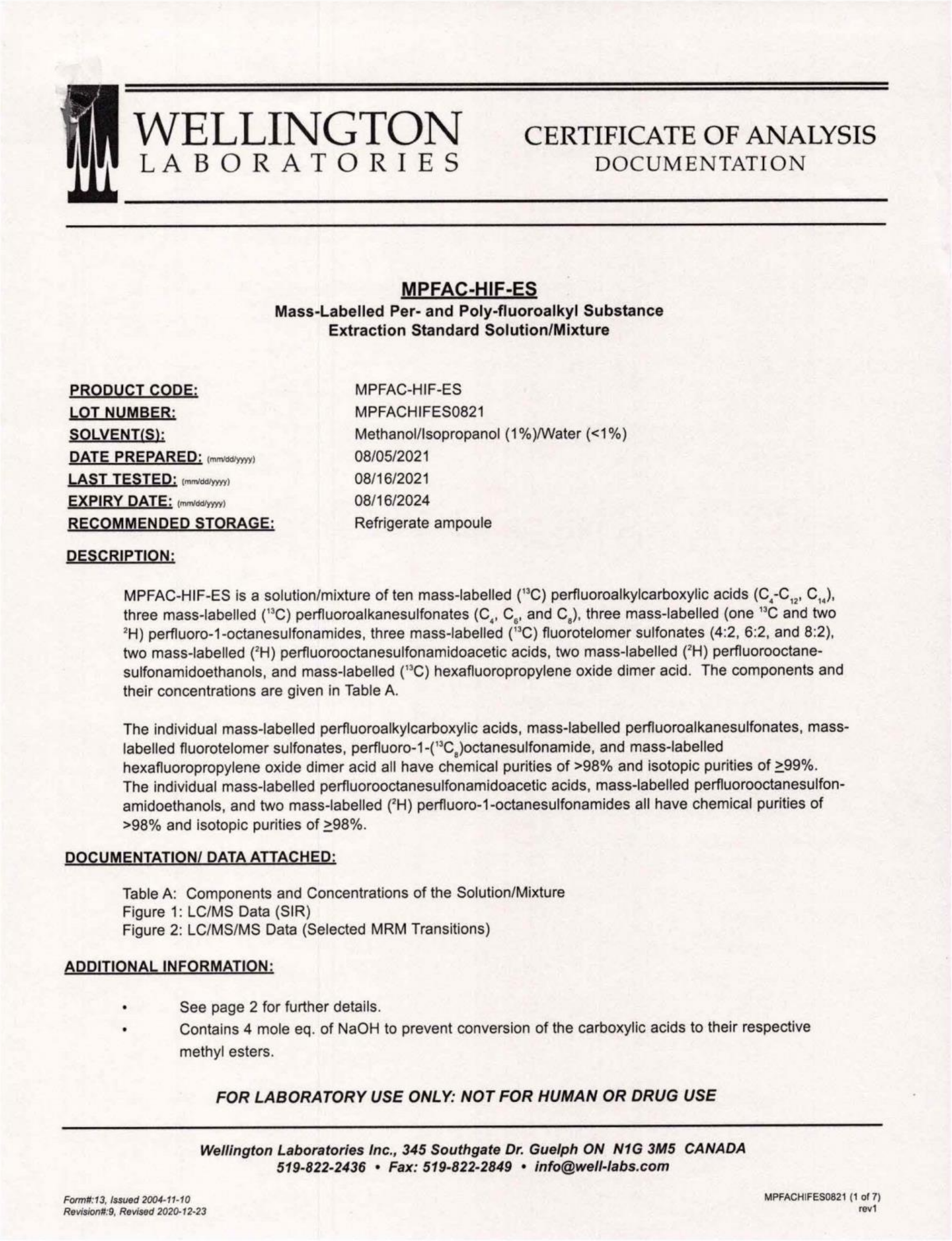
Analytical Standard Record

Standard ID: **Y22B198**

Description:	MPFAC-HIF-ES-EPA 1633 STOCK EIS mix	**Prepared:**	02/17/2022
Standard Type:	Other	**Expires:**	08/06/2024
Solvent:	MeOH/IPA/1% H2O	**Prepared By:**	Robert Q. Bradley
Final Volume (mls):	1	**Department:**	PFAS
Vials:	1	**Lot No.:**	MPFACHIFES0821
Vendor:	Wellington Laboratories		

Comments:

Analyte	CAS Number	Concentration	Units
d3-N-MeFOSAA		1	ug/mL
d5-N-EtFOSAA		1	ug/mL
d7-N-MeFOSE		5	ug/mL
d9-N-EtFOSE		5	ug/mL
d-N-EtFOSA		0.5	ug/mL
d-N-MeFOSA		0.5	ug/mL
M2-4:2FTS		0.938	ug/mL
M2-6:2FTS		0.951	ug/mL
M2-8:2FTS		0.96	ug/mL
M2PFTeDA		0.25	ug/mL
M3HFPO-DA		2	ug/mL
M3PFBS		0.466	ug/mL
M3PFHxS		0.474	ug/mL
M4PFHpA		0.5	ug/mL
M5PFHxA		0.5	ug/mL
M5PFPeA		1	ug/mL
M6PFDA		0.25	ug/mL
M7PFUdA		0.25	ug/mL
M8FOSA		0.5	ug/mL
M8PFOA		0.5	ug/mL
M8PFOS		0.479	ug/mL
M9PFNA		0.25	ug/mL
MPFBA		2	ug/mL
MPFDoA		0.25	ug/mL



WELLINGTON
LABORATORIES

CERTIFICATE OF ANALYSIS
DOCUMENTATION

MPFAC-HIF-ES

Mass-Labelled Per- and Poly-fluoroalkyl Substance
Extraction Standard Solution/Mixture

PRODUCT CODE:	MPFAC-HIF-ES
LOT NUMBER:	MPFACHIFES0821
SOLVENT(S):	Methanol/Isopropanol (1%)/Water (<1%)
DATE PREPARED: (mm/dd/yyyy)	08/05/2021
LAST TESTED: (mm/dd/yyyy)	08/16/2021
EXPIRY DATE: (mm/dd/yyyy)	08/16/2024
RECOMMENDED STORAGE:	Refrigerate ampoule

DESCRIPTION:

MPFAC-HIF-ES is a solution/mixture of ten mass-labelled (^{13}C) perfluoroalkylcarboxylic acids (C$_4$-C$_{12}$, C$_{14}$), three mass-labelled (^{13}C) perfluoroalkanesulfonates (C$_4$, C$_6$, and C$_8$), three mass-labelled (one ^{13}C and two ^{2}H) perfluoro-1-octanesulfonamides, three mass-labelled (^{13}C) fluorotelomer sulfonates (4:2, 6:2, and 8:2), two mass-labelled (^{2}H) perfluorooctanesulfonamidoacetic acids, two mass-labelled (^{2}H) perfluorooctanesulfonamidoethanols, and mass-labelled (^{13}C) hexafluoropropylene oxide dimer acid. The components and their concentrations are given in Table A.

The individual mass-labelled perfluoroalkylcarboxylic acids, mass-labelled perfluoroalkanesulfonates, mass-labelled fluorotelomer sulfonates, perfluoro-1-(^{13}C$_8$)octanesulfonamide, and mass-labelled hexafluoropropylene oxide dimer acid all have chemical purities of >98% and isotopic purities of ≥99%. The individual mass-labelled perfluorooctanesulfonamidoacetic acids, mass-labelled perfluorooctanesulfonamidoethanols, and two mass-labelled (^{2}H) perfluoro-1-octanesulfonamides all have chemical purities of >98% and isotopic purities of ≥98%.

DOCUMENTATION/ DATA ATTACHED:

Table A: Components and Concentrations of the Solution/Mixture
Figure 1: LC/MS Data (SIR)
Figure 2: LC/MS/MS Data (Selected MRM Transitions)

ADDITIONAL INFORMATION:

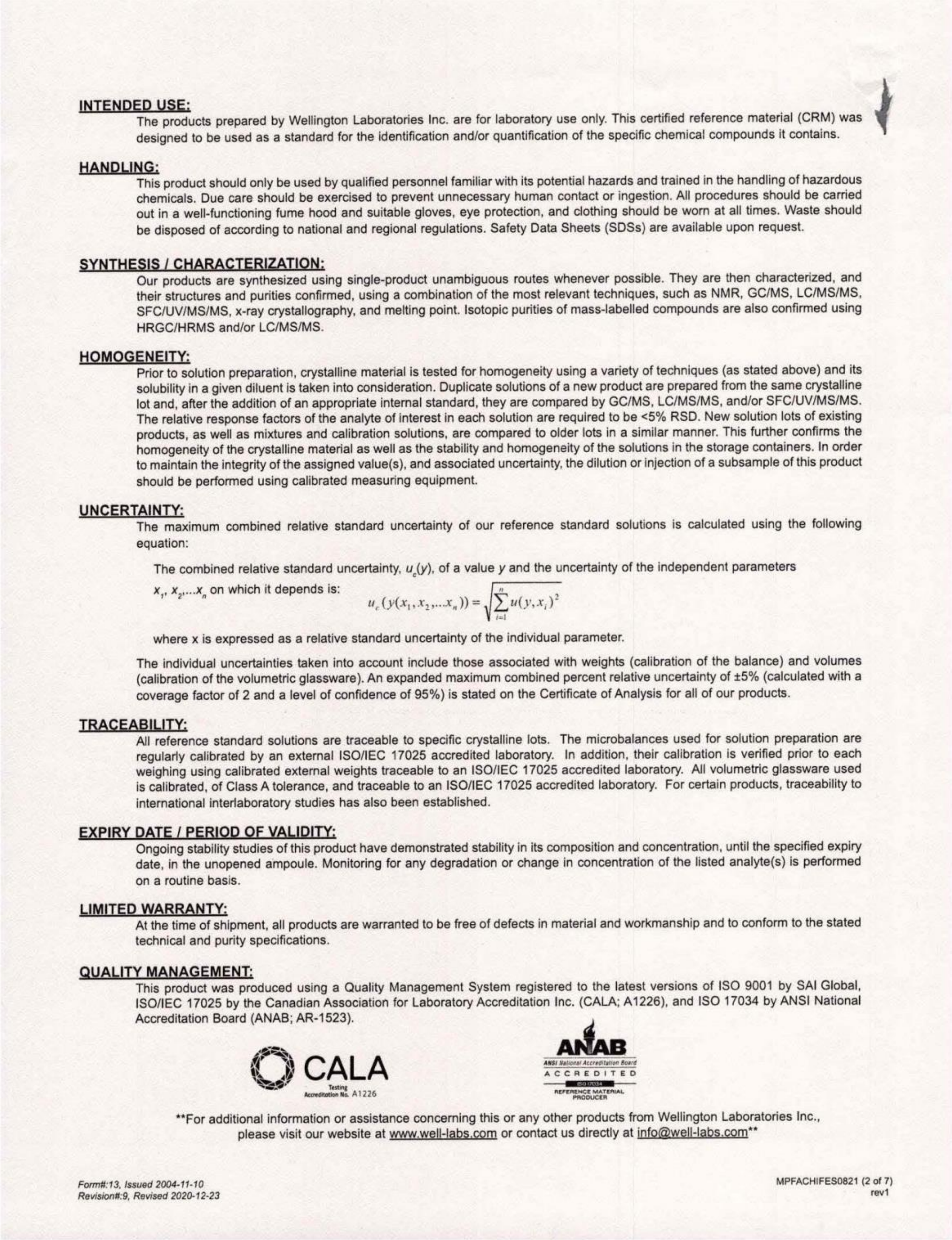
- See page 2 for further details.
- Contains 4 mole eq. of NaOH to prevent conversion of the carboxylic acids to their respective methyl esters.

FOR LABORATORY USE ONLY: NOT FOR HUMAN OR DRUG USE

Wellington Laboratories Inc., 345 Southgate Dr. Guelph ON N1G 3M5 CANADA
519-822-2436 • Fax: 519-822-2849 • info@well-labs.com

Form#:13, Issued 2004-11-10
Revision#:9, Revised 2020-12-23

MPFACHIFES0821 (1 of 7)
rev1



INTENDED USE:

The products prepared by Wellington Laboratories Inc. are for laboratory use only. This certified reference material (CRM) was designed to be used as a standard for the identification and/or quantification of the specific chemical compounds it contains.

HANDLING:

This product should only be used by qualified personnel familiar with its potential hazards and trained in the handling of hazardous chemicals. Due care should be exercised to prevent unnecessary human contact or ingestion. All procedures should be carried out in a well-functioning fume hood and suitable gloves, eye protection, and clothing should be worn at all times. Waste should be disposed of according to national and regional regulations. Safety Data Sheets (SDSs) are available upon request.

SYNTHESIS / CHARACTERIZATION:

Our products are synthesized using single-product unambiguous routes whenever possible. They are then characterized, and their structures and purities confirmed, using a combination of the most relevant techniques, such as NMR, GC/MS, LC/MS/MS, SFC/UV/MS/MS, x-ray crystallography, and melting point. Isotopic purities of mass-labelled compounds are also confirmed using HRGC/HRMS and/or LC/MS/MS.

HOMOGENEITY:

Prior to solution preparation, crystalline material is tested for homogeneity using a variety of techniques (as stated above) and its solubility in a given diluent is taken into consideration. Duplicate solutions of a new product are prepared from the same crystalline lot and, after the addition of an appropriate internal standard, they are compared by GC/MS, LC/MS/MS, and/or SFC/UV/MS/MS. The relative response factors of the analyte of interest in each solution are required to be <5% RSD. New solution lots of existing products, as well as mixtures and calibration solutions, are compared to older lots in a similar manner. This further confirms the homogeneity of the crystalline material as well as the stability and homogeneity of the solutions in the storage containers. In order to maintain the integrity of the assigned value(s), and associated uncertainty, the dilution or injection of a subsample of this product should be performed using calibrated measuring equipment.

UNCERTAINTY:

The maximum combined relative standard uncertainty of our reference standard solutions is calculated using the following equation:

The combined relative standard uncertainty, $u_c(y)$, of a value y and the uncertainty of the independent parameters $x_1, x_2, \ldots x_n$ on which it depends is:

$$u_c(y(x_1, x_2, \ldots x_n)) = \sqrt{\sum_{i=1}^{n} u(y, x_i)^2}$$

where x is expressed as a relative standard uncertainty of the individual parameter.

The individual uncertainties taken into account include those associated with weights (calibration of the balance) and volumes (calibration of the volumetric glassware). An expanded maximum combined percent relative uncertainty of ±5% (calculated with a coverage factor of 2 and a level of confidence of 95%) is stated on the Certificate of Analysis for all of our products.

TRACEABILITY:

All reference standard solutions are traceable to specific crystalline lots. The microbalances used for solution preparation are regularly calibrated by an external ISO/IEC 17025 accredited laboratory. In addition, their calibration is verified prior to each weighing using calibrated external weights traceable to an ISO/IEC 17025 accredited laboratory. All volumetric glassware used is calibrated, of Class A tolerance, and traceable to an ISO/IEC 17025 accredited laboratory. For certain products, traceability to international interlaboratory studies has also been established.

EXPIRY DATE / PERIOD OF VALIDITY:

Ongoing stability studies of this product have demonstrated stability in its composition and concentration, until the specified expiry date, in the unopened ampoule. Monitoring for any degradation or change in concentration of the listed analyte(s) is performed on a routine basis.

LIMITED WARRANTY:

At the time of shipment, all products are warranted to be free of defects in material and workmanship and to conform to the stated technical and purity specifications.

QUALITY MANAGEMENT:

This product was produced using a Quality Management System registered to the latest versions of ISO 9001 by SAI Global, ISO/IEC 17025 by the Canadian Association for Laboratory Accreditation Inc. (CALA; A1226), and ISO 17034 by ANSI National Accreditation Board (ANAB; AR-1523).

CALA
Testing Accreditation No. A1226

ANAB
ANSI National Accreditation Board
ACCREDITED
ISO 17034
REFERENCE MATERIAL PRODUCER

For additional information or assistance concerning this or any other products from Wellington Laboratories Inc., please visit our website at www.well-labs.com or contact us directly at info@well-labs.com

Form#:13, Issued 2004-11-10
Revision#:9, Revised 2020-12-23

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rev1

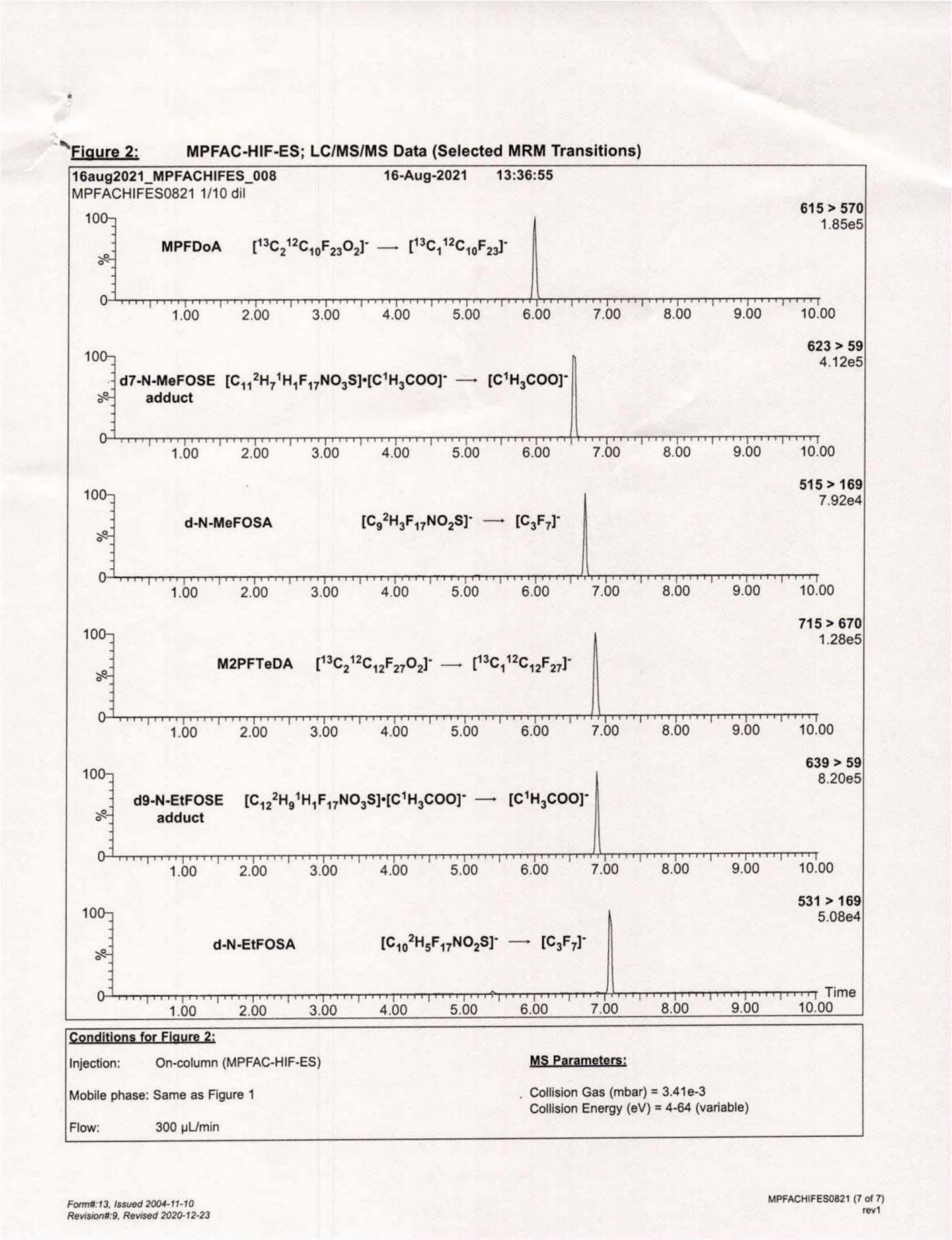

Figure 2: **MPFAC-HIF-ES; LC/MS/MS Data (Selected MRM Transitions)**

16aug2021_MPFACHIFES_008 **16-Aug-2021** **13:36:55**
MPFACHIFES0821 1/10 dil

Conditions for Figure 2:

Injection: On-column (MPFAC-HIF-ES)

Mobile phase: Same as Figure 1

Flow: 300 µL/min

MS Parameters:

Collision Gas (mbar) = 3.41e-3
Collision Energy (eV) = 4-64 (variable)

Form#:13, Issued 2004-11-10
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rev1

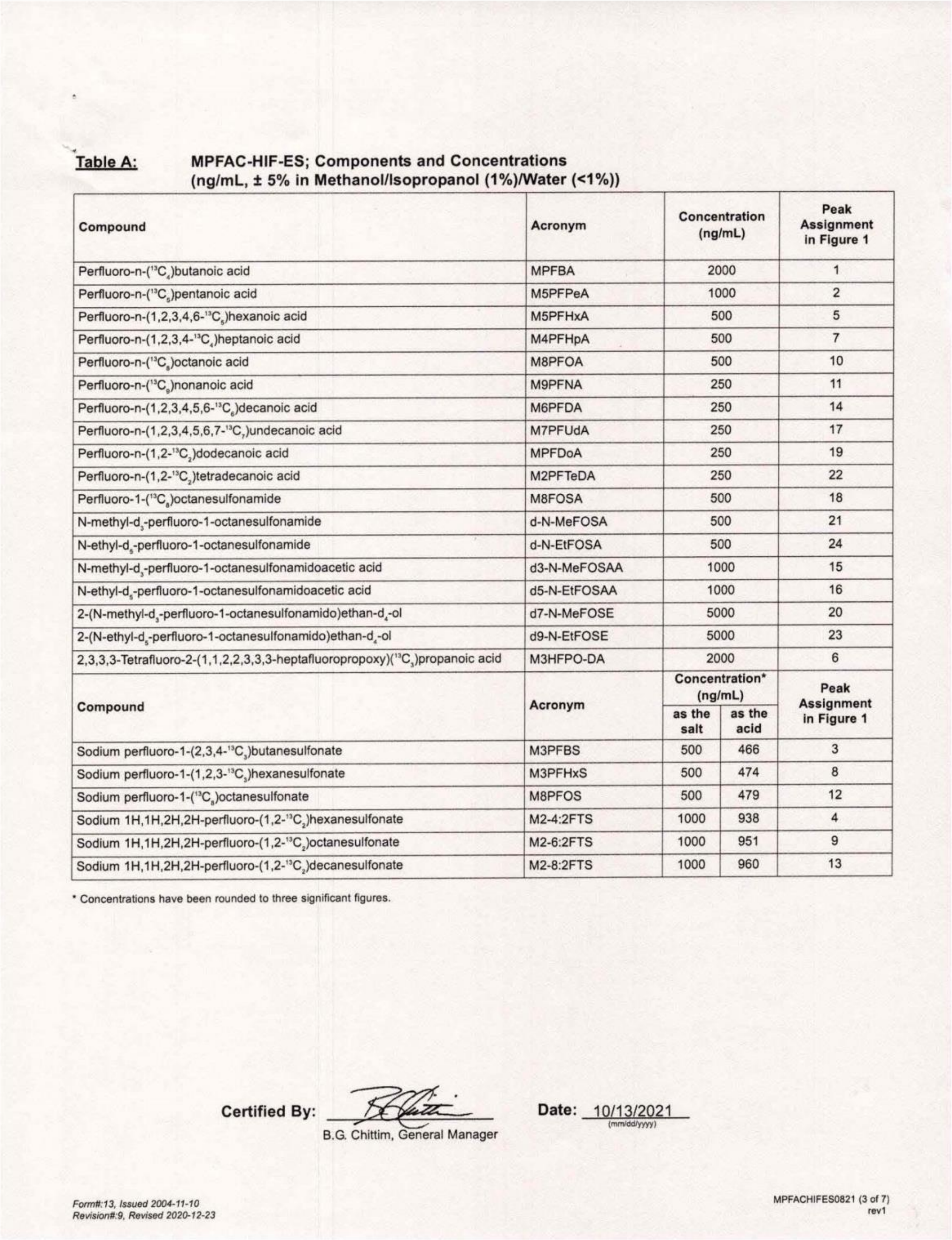

Table A: **MPFAC-HIF-ES; Components and Concentrations (ng/mL, ± 5% in Methanol/Isopropanol (1%)/Water (<1%))**

Compound	Acronym	Concentration (ng/mL)	Peak Assignment in Figure 1
Perfluoro-n-($^{13}C_4$)butanoic acid	MPFBA	2000	1
Perfluoro-n-($^{13}C_5$)pentanoic acid	M5PFPeA	1000	2
Perfluoro-n-(1,2,3,4,6-$^{13}C_5$)hexanoic acid	M5PFHxA	500	5
Perfluoro-n-(1,2,3,4-$^{13}C_4$)heptanoic acid	M4PFHpA	500	7
Perfluoro-n-($^{13}C_8$)octanoic acid	M8PFOA	500	10
Perfluoro-n-($^{13}C_9$)nonanoic acid	M9PFNA	250	11
Perfluoro-n-(1,2,3,4,5,6-$^{13}C_6$)decanoic acid	M6PFDA	250	14
Perfluoro-n-(1,2,3,4,5,6,7-$^{13}C_7$)undecanoic acid	M7PFUdA	250	17
Perfluoro-n-(1,2-$^{13}C_2$)dodecanoic acid	MPFDoA	250	19
Perfluoro-n-(1,2-$^{13}C_2$)tetradecanoic acid	M2PFTeDA	250	22
Perfluoro-1-($^{13}C_8$)octanesulfonamide	M8FOSA	500	18
N-methyl-d_3-perfluoro-1-octanesulfonamide	d-N-MeFOSA	500	21
N-ethyl-d_5-perfluoro-1-octanesulfonamide	d-N-EtFOSA	500	24
N-methyl-d_3-perfluoro-1-octanesulfonamidoacetic acid	d3-N-MeFOSAA	1000	15
N-ethyl-d_5-perfluoro-1-octanesulfonamidoacetic acid	d5-N-EtFOSAA	1000	16
2-(N-methyl-d_3-perfluoro-1-octanesulfonamido)ethan-d_4-ol	d7-N-MeFOSE	5000	20
2-(N-ethyl-d_5-perfluoro-1-octanesulfonamido)ethan-d_4-ol	d9-N-EtFOSE	5000	23
2,3,3,3-Tetrafluoro-2-(1,1,2,2,3,3,3-heptafluoropropoxy)($^{13}C_3$)propanoic acid	M3HFPO-DA	2000	6

Compound	Acronym	Concentration* (ng/mL)		Peak Assignment in Figure 1
		as the salt	as the acid	
Sodium perfluoro-1-(2,3,4-$^{13}C_3$)butanesulfonate	M3PFBS	500	466	3
Sodium perfluoro-1-(1,2,3-$^{13}C_3$)hexanesulfonate	M3PFHxS	500	474	8
Sodium perfluoro-1-($^{13}C_8$)octanesulfonate	M8PFOS	500	479	12
Sodium 1H,1H,2H,2H-perfluoro-(1,2-$^{13}C_2$)hexanesulfonate	M2-4:2FTS	1000	938	4
Sodium 1H,1H,2H,2H-perfluoro-(1,2-$^{13}C_2$)octanesulfonate	M2-6:2FTS	1000	951	9
Sodium 1H,1H,2H,2H-perfluoro-(1,2-$^{13}C_2$)decanesulfonate	M2-8:2FTS	1000	960	13

* Concentrations have been rounded to three significant figures.

Certified By: B.G. Chittim, General Manager

Date: 10/13/2021
(mm/dd/yyyy)

Form#:13, Issued 2004-11-10
Revision#:9, Revised 2020-12-23

MPFACHIFES0821 (3 of 7)
rev1

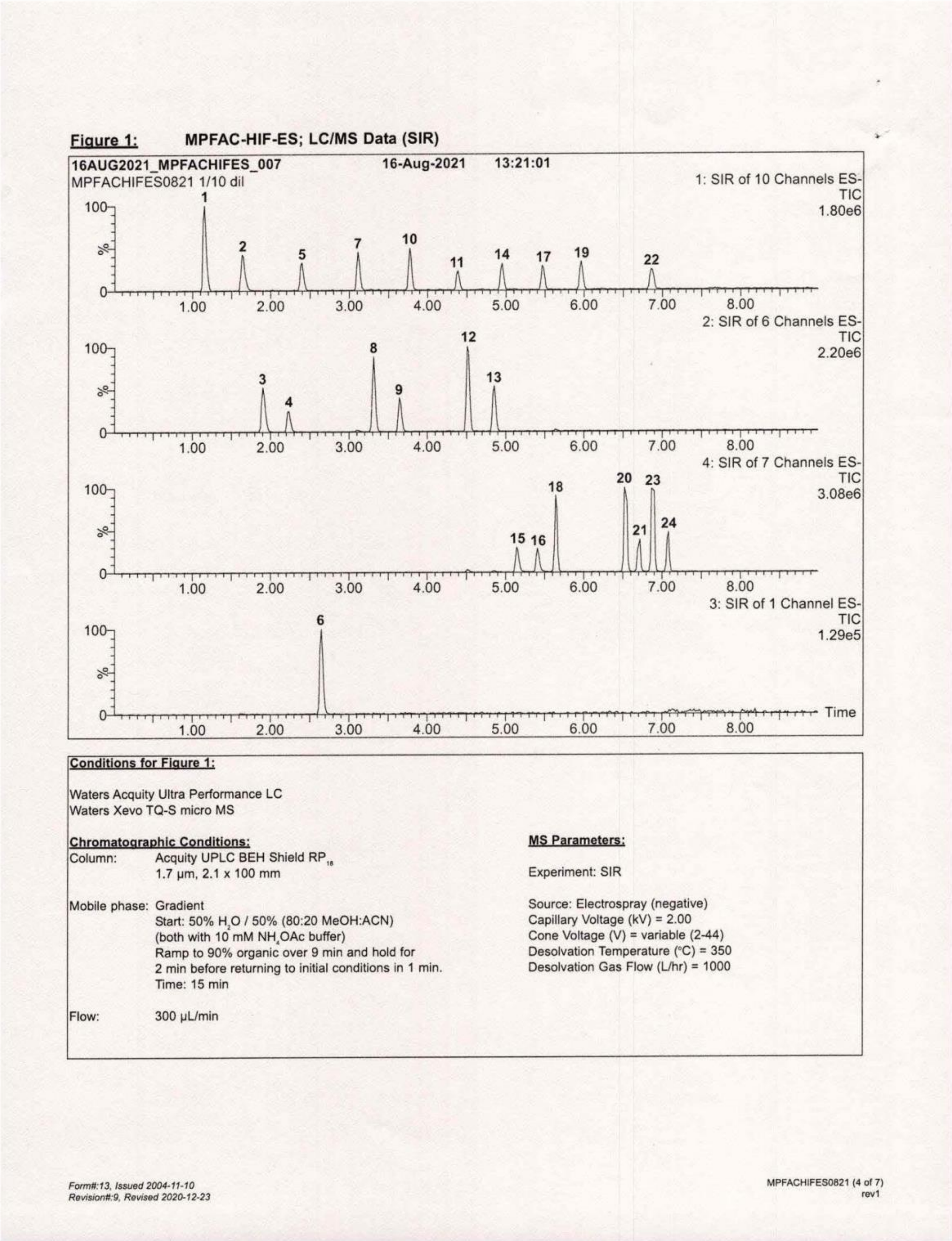

Figure 1: **MPFAC-HIF-ES; LC/MS Data (SIR)**

Conditions for Figure 1:

Waters Acquity Ultra Performance LC
Waters Xevo TQ-S micro MS

Chromatographic Conditions:

Column: Acquity UPLC BEH Shield RP_{18}
1.7 µm, 2.1 x 100 mm

Mobile phase: Gradient
Start: 50% H_2O / 50% (80:20 MeOH:ACN)
(both with 10 mM NH_4OAc buffer)
Ramp to 90% organic over 9 min and hold for
2 min before returning to initial conditions in 1 min.
Time: 15 min

Flow: 300 µL/min

MS Parameters:

Experiment: SIR

Source: Electrospray (negative)
Capillary Voltage (kV) = 2.00
Cone Voltage (V) = variable (2-44)
Desolvation Temperature (°C) = 350
Desolvation Gas Flow (L/hr) = 1000

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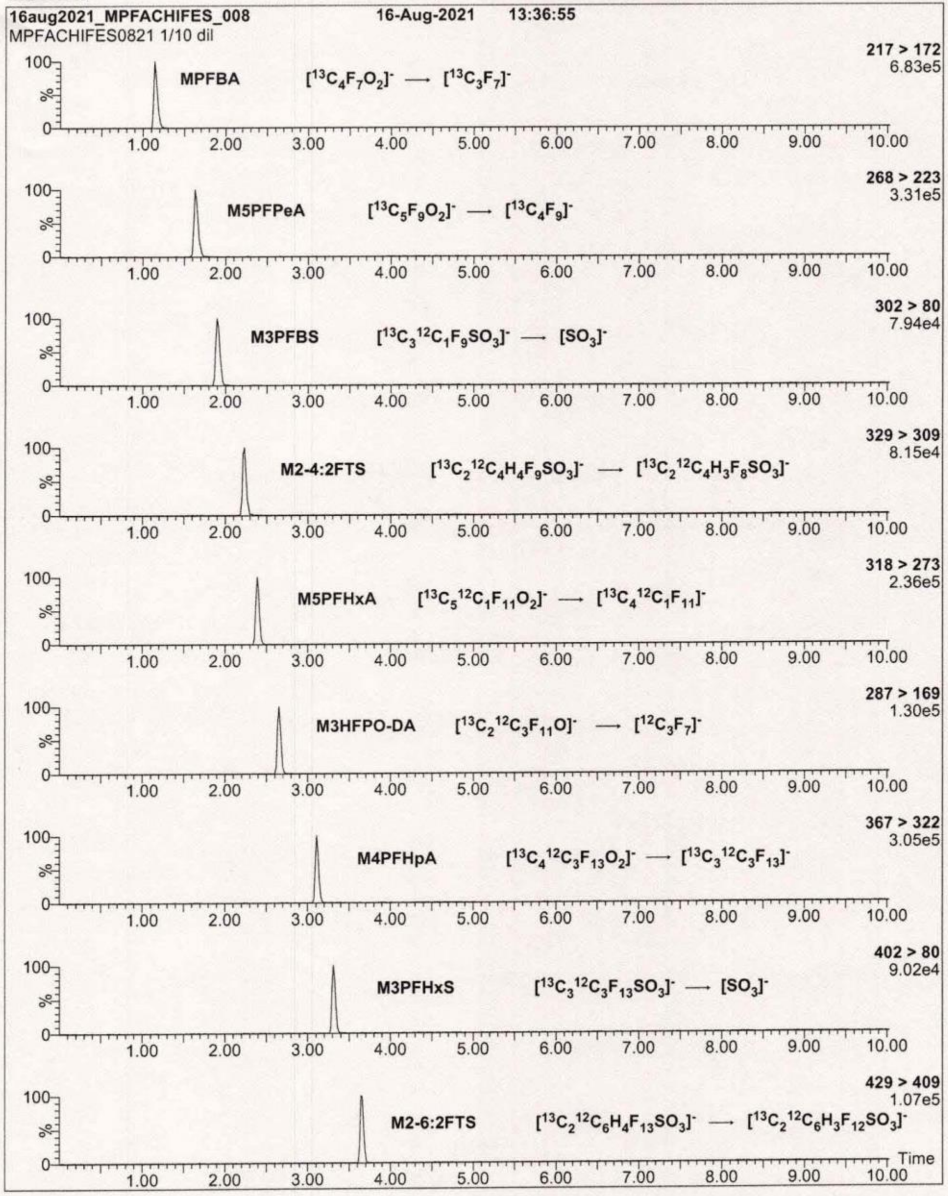
rev1

Figure 2: **MPFAC-HIF-ES; LC/MS/MS Data (Selected MRM Transitions)**



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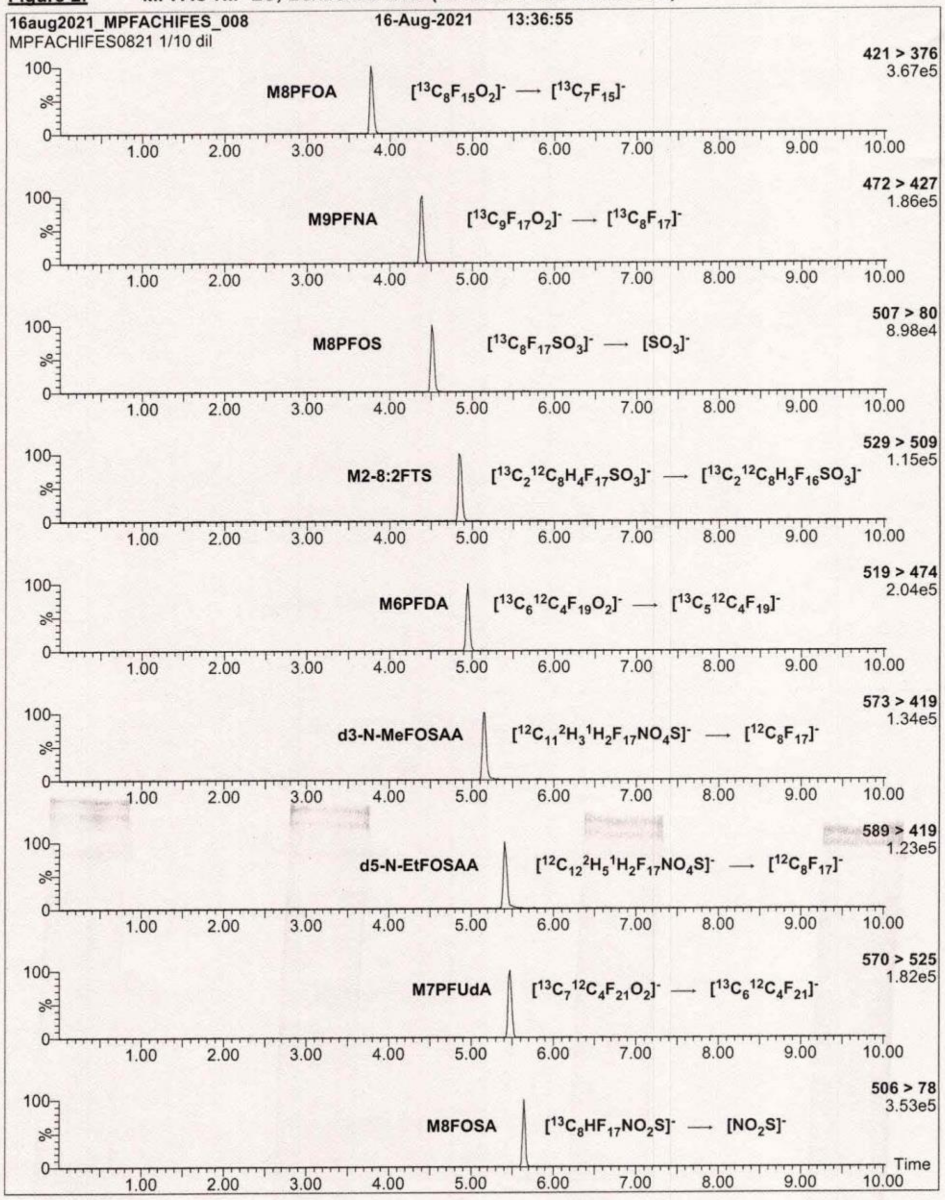
Revision#:9, Revised 2020-12-23

MPFACHIFES0821 (5 of 7)
rev1

Figure 2: MPFAC-HIF-ES; LC/MS/MS Data (Selected MRM Transitions)



Form#:13, Issued 2004-11-10
Revision#:9, Revised 2020-12-23

MPFACHIFES0821 (6 of 7)
rev1

Attachment 3 – Target Analyte Mixtures

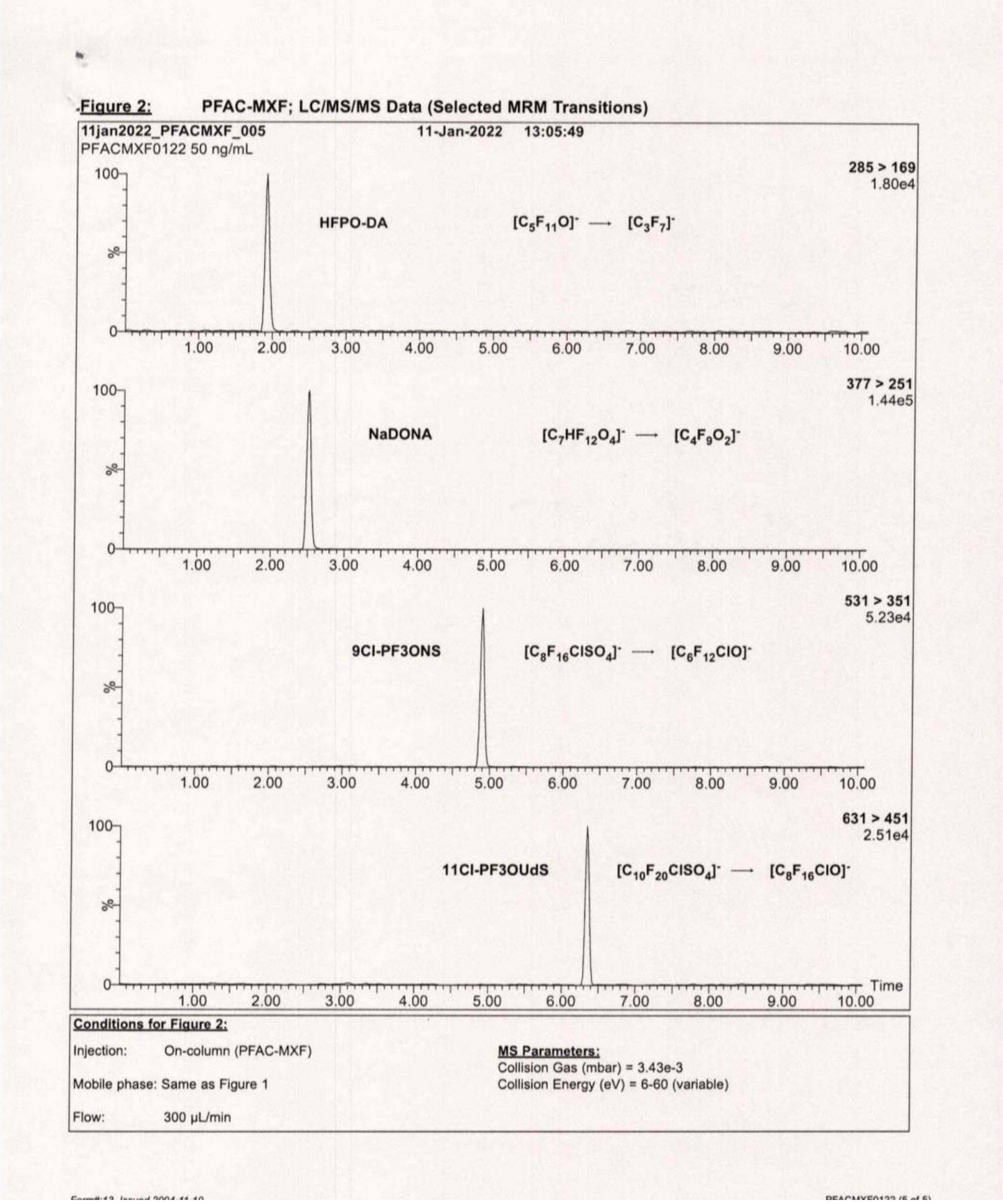


Figure 2: **PFAC-MXF; LC/MS/MS Data (Selected MRM Transitions)**

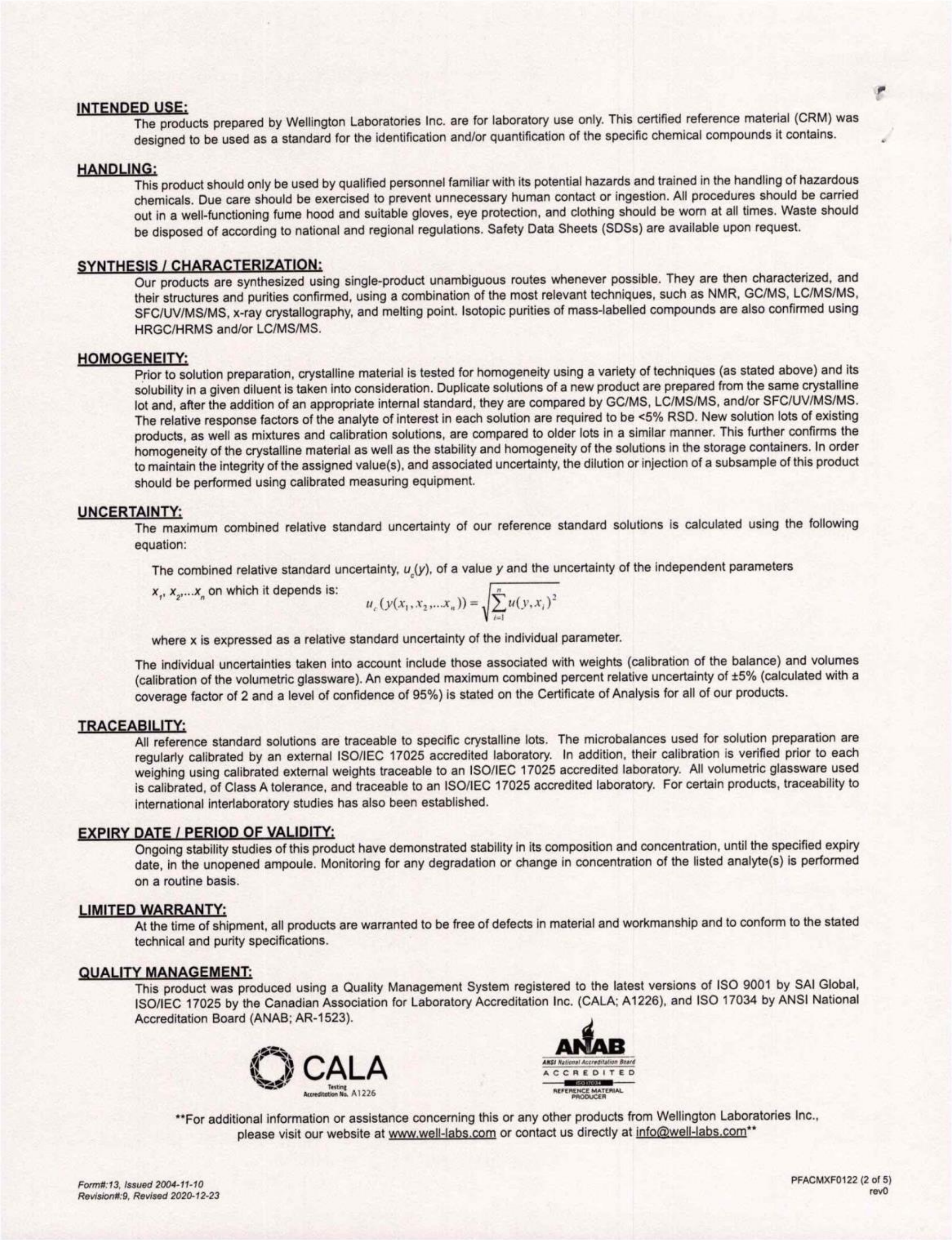
Conditions for Figure 2:

Injection: On-column (PFAC-MXF)

Mobile phase: Same as Figure 1

Flow: 300 µL/min

MS Parameters:
Collision Gas (mbar) = 3.43e-3
Collision Energy (eV) = 6-60 (variable)



INTENDED USE:

The products prepared by Wellington Laboratories Inc. are for laboratory use only. This certified reference material (CRM) was designed to be used as a standard for the identification and/or quantification of the specific chemical compounds it contains.

HANDLING:

This product should only be used by qualified personnel familiar with its potential hazards and trained in the handling of hazardous chemicals. Due care should be exercised to prevent unnecessary human contact or ingestion. All procedures should be carried out in a well-functioning fume hood and suitable gloves, eye protection, and clothing should be worn at all times. Waste should be disposed of according to national and regional regulations. Safety Data Sheets (SDSs) are available upon request.

SYNTHESIS / CHARACTERIZATION:

Our products are synthesized using single-product unambiguous routes whenever possible. They are then characterized, and their structures and purities confirmed, using a combination of the most relevant techniques, such as NMR, GC/MS, LC/MS/MS, SFC/UV/MS/MS, x-ray crystallography, and melting point. Isotopic purities of mass-labelled compounds are also confirmed using HRGC/HRMS and/or LC/MS/MS.

HOMOGENEITY:

Prior to solution preparation, crystalline material is tested for homogeneity using a variety of techniques (as stated above) and its solubility in a given diluent is taken into consideration. Duplicate solutions of a new product are prepared from the same crystalline lot and, after the addition of an appropriate internal standard, they are compared by GC/MS, LC/MS/MS, and/or SFC/UV/MS/MS. The relative response factors of the analyte of interest in each solution are required to be <5% RSD. New solution lots of existing products, as well as mixtures and calibration solutions, are compared to older lots in a similar manner. This further confirms the homogeneity of the crystalline material as well as the stability and homogeneity of the solutions in the storage containers. In order to maintain the integrity of the assigned value(s), and associated uncertainty, the dilution or injection of a subsample of this product should be performed using calibrated measuring equipment.

UNCERTAINTY:

The maximum combined relative standard uncertainty of our reference standard solutions is calculated using the following equation:

The combined relative standard uncertainty, $u_c(y)$, of a value y and the uncertainty of the independent parameters x_1, x_2,...x_n on which it depends is:

$$u_c(y(x_1, x_2, ... x_n)) = \sqrt{\sum_{i=1}^{n} u(y, x_i)^2}$$

where x is expressed as a relative standard uncertainty of the individual parameter.

The individual uncertainties taken into account include those associated with weights (calibration of the balance) and volumes (calibration of the volumetric glassware). An expanded maximum combined percent relative uncertainty of ±5% (calculated with a coverage factor of 2 and a level of confidence of 95%) is stated on the Certificate of Analysis for all of our products.

TRACEABILITY:

All reference standard solutions are traceable to specific crystalline lots. The microbalances used for solution preparation are regularly calibrated by an external ISO/IEC 17025 accredited laboratory. In addition, their calibration is verified prior to each weighing using calibrated external weights traceable to an ISO/IEC 17025 accredited laboratory. All volumetric glassware used is calibrated, of Class A tolerance, and traceable to an ISO/IEC 17025 accredited laboratory. For certain products, traceability to international interlaboratory studies has also been established.

EXPIRY DATE / PERIOD OF VALIDITY:

Ongoing stability studies of this product have demonstrated stability in its composition and concentration, until the specified expiry date, in the unopened ampoule. Monitoring for any degradation or change in concentration of the listed analyte(s) is performed on a routine basis.

LIMITED WARRANTY:

At the time of shipment, all products are warranted to be free of defects in material and workmanship and to conform to the stated technical and purity specifications.

QUALITY MANAGEMENT:

This product was produced using a Quality Management System registered to the latest versions of ISO 9001 by SAI Global, ISO/IEC 17025 by the Canadian Association for Laboratory Accreditation Inc. (CALA; A1226), and ISO 17034 by ANSI National Accreditation Board (ANAB; AR-1523).

CALA Testing Accreditation No. A1226

ANAB ANSI National Accreditation Board ACCREDITED ISO 17034 REFERENCE MATERIAL PRODUCER

For additional information or assistance concerning this or any other products from Wellington Laboratories Inc., please visit our website at www.well-labs.com or contact us directly at info@well-labs.com

Form#:13, Issued 2004-11-10
Revision#:9, Revised 2020-12-23

PFACMXF0122 (2 of 5)
rev0

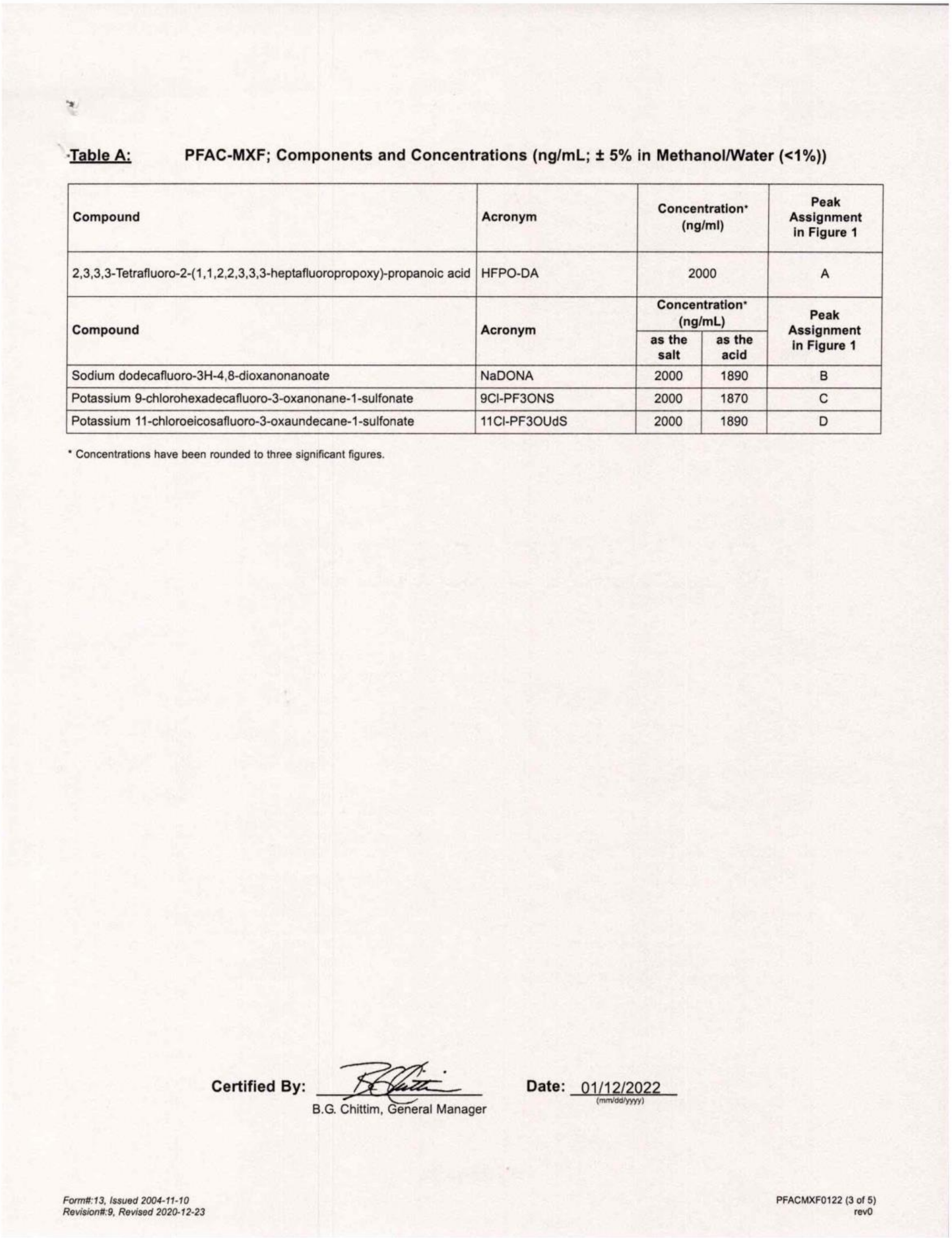


Table A: **PFAC-MXF; Components and Concentrations (ng/mL; ± 5% in Methanol/Water (<1%))**

Compound	Acronym	Concentration* (ng/ml)	Peak Assignment in Figure 1
2,3,3,3-Tetrafluoro-2-(1,1,2,2,3,3,3-heptafluoropropoxy)-propanoic acid	HFPO-DA	2000	A

Compound	Acronym	Concentration* (ng/mL)		Peak Assignment in Figure 1
		as the salt	as the acid	
Sodium dodecafluoro-3H-4,8-dioxanonanoate	NaDONA	2000	1890	B
Potassium 9-chlorohexadecafluoro-3-oxanonane-1-sulfonate	9Cl-PF3ONS	2000	1870	C
Potassium 11-chloroeicosafluoro-3-oxaundecane-1-sulfonate	11Cl-PF3OUdS	2000	1890	D

* Concentrations have been rounded to three significant figures.

Certified By: B.G. Chittim, General Manager **Date:** 01/12/2022 (mm/dd/yyyy)

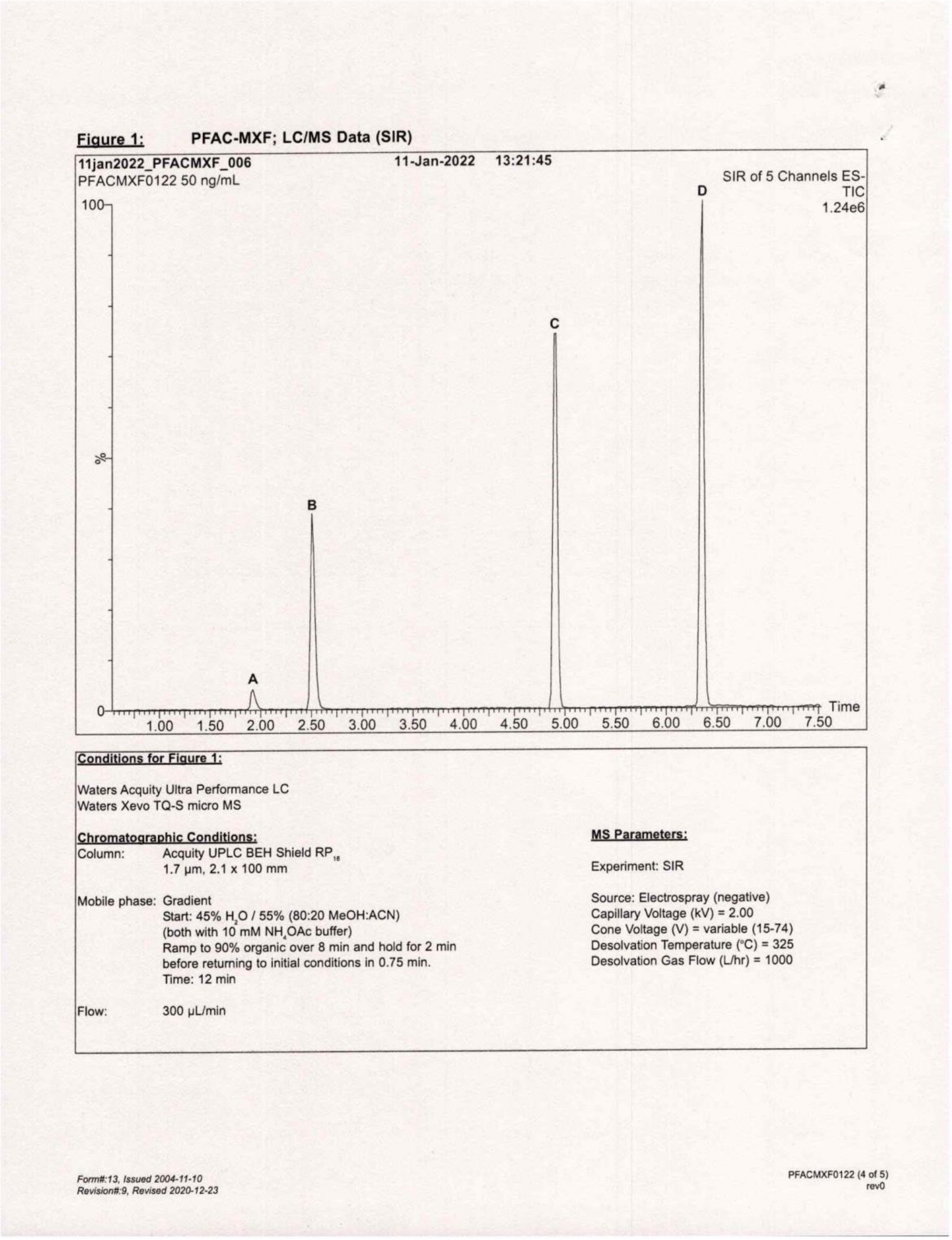


Figure 1: **PFAC-MXF; LC/MS Data (SIR)**

11jan2022_PFACMXF_006 **11-Jan-2022** **13:21:45**
PFACMXF0122 50 ng/mL

Conditions for Figure 1:

Waters Acquity Ultra Performance LC
Waters Xevo TQ-S micro MS

Chromatographic Conditions:

Column: Acquity UPLC BEH Shield RP_{18}
1.7 µm, 2.1 x 100 mm

Mobile phase: Gradient
Start: 45% H_2O / 55% (80:20 MeOH:ACN)
(both with 10 mM NH_4OAc buffer)
Ramp to 90% organic over 8 min and hold for 2 min
before returning to initial conditions in 0.75 min.
Time: 12 min

Flow: 300 µL/min

MS Parameters:

Experiment: SIR

Source: Electrospray (negative)
Capillary Voltage (kV) = 2.00
Cone Voltage (V) = variable (15-74)
Desolvation Temperature (°C) = 325
Desolvation Gas Flow (L/hr) = 1000

Form#:13, Issued 2004-11-10
Revision#:9, Revised 2020-12-23

PFACMXF0122 (4 of 5)
rev0

YORK
ANALYTICAL LABORATORIES, INC.

Analytical Standard Record

Standard ID: **Y22B199**

Description:	PFAC-MXF-Native Repl.STOCK EPA 1633 PFAS	Prepared:	02/17/2022
Standard Type:	Other	**Expires:**	**01/11/2025**
Solvent:	MeOH/H20	Prepared By:	Robert Q. Bradley
Final Volume (mls):	1	Department:	PFAS
Vials:	1	Lot No.:	PFACMXF0122
Vendor:	Wellington Laboratories		

Comments:

Analyte	**CAS Number**	**Concentration**	**Units**
11CL-PF3OUdS	763051-92-9	1.89	ug/mL
9CL-PF3ONS	756426-58-1	1.87	ug/mL
ADONA	919005-14-4	1.89	ug/mL
HFPO-DA (Gen-X)	13252-13-6	2	ug/mL

Reviewed By Date

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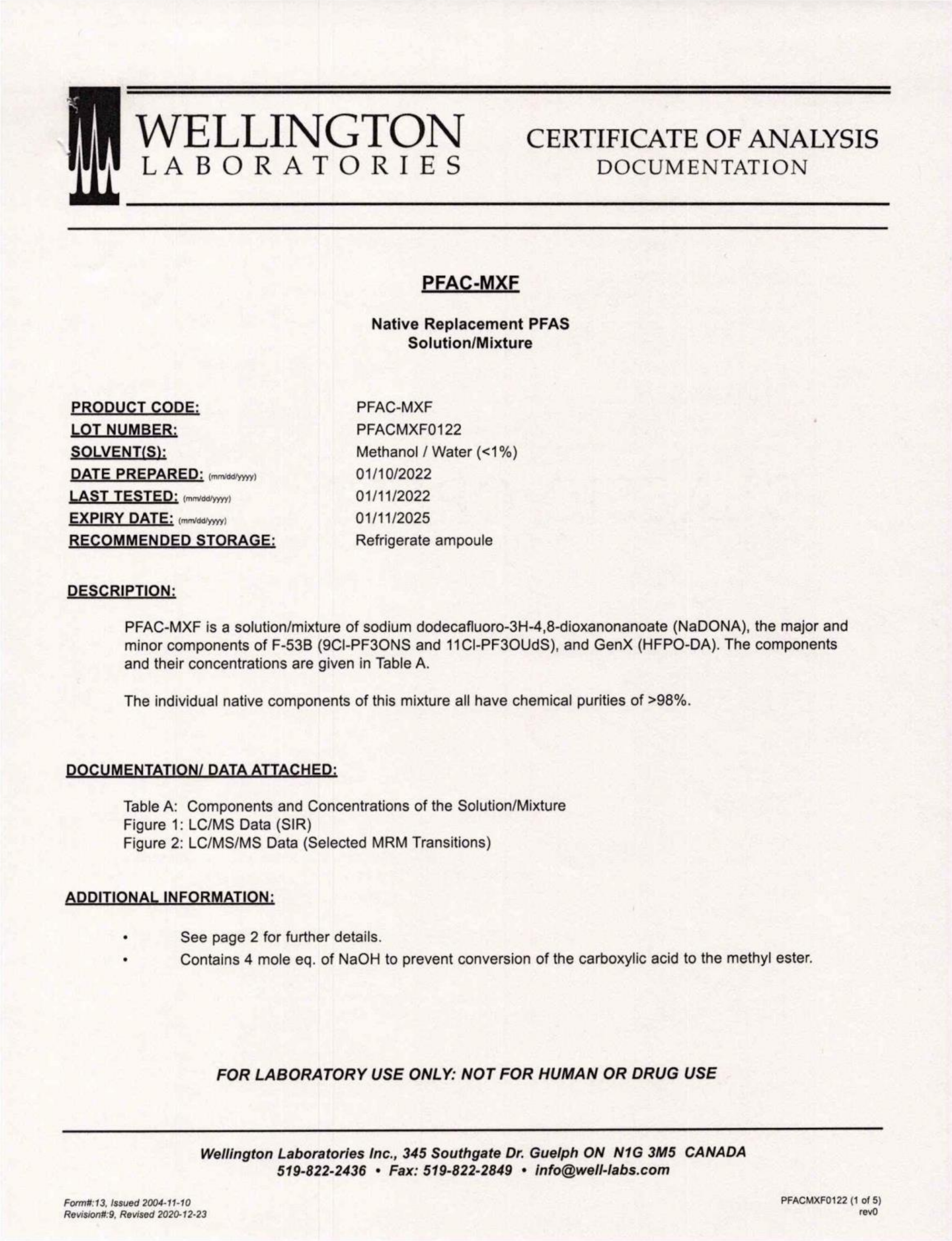

WELLINGTON
LABORATORIES

CERTIFICATE OF ANALYSIS
DOCUMENTATION

PFAC-MXF

Native Replacement PFAS
Solution/Mixture

PRODUCT CODE:	PFAC-MXF
LOT NUMBER:	PFACMXF0122
SOLVENT(S):	Methanol / Water (<1%)
DATE PREPARED: (mm/dd/yyyy)	01/10/2022
LAST TESTED: (mm/dd/yyyy)	01/11/2022
EXPIRY DATE: (mm/dd/yyyy)	01/11/2025
RECOMMENDED STORAGE:	Refrigerate ampoule

DESCRIPTION:

PFAC-MXF is a solution/mixture of sodium dodecafluoro-3H-4,8-dioxanonanoate (NaDONA), the major and minor components of F-53B (9Cl-PF3ONS and 11Cl-PF3OUdS), and GenX (HFPO-DA). The components and their concentrations are given in Table A.

The individual native components of this mixture all have chemical purities of >98%.

DOCUMENTATION/ DATA ATTACHED:

Table A: Components and Concentrations of the Solution/Mixture
Figure 1: LC/MS Data (SIR)
Figure 2: LC/MS/MS Data (Selected MRM Transitions)

ADDITIONAL INFORMATION:

- See page 2 for further details.
- Contains 4 mole eq. of NaOH to prevent conversion of the carboxylic acid to the methyl ester.

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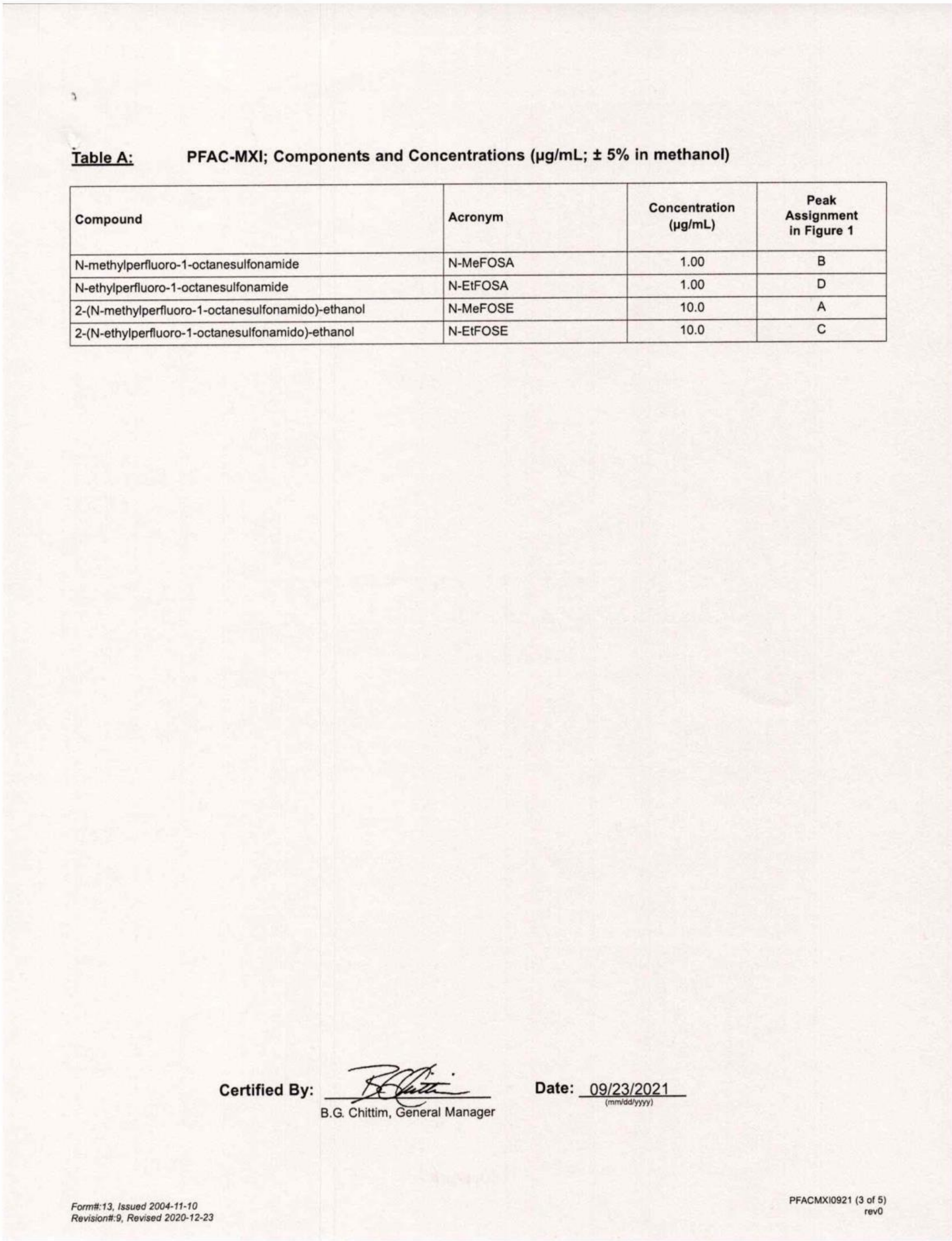

Table A: **PFAC-MXI; Components and Concentrations (µg/mL; ± 5% in methanol)**

Compound	Acronym	Concentration (µg/mL)	Peak Assignment in Figure 1
N-methylperfluoro-1-octanesulfonamide	N-MeFOSA	1.00	B
N-ethylperfluoro-1-octanesulfonamide	N-EtFOSA	1.00	D
2-(N-methylperfluoro-1-octanesulfonamido)-ethanol	N-MeFOSE	10.0	A
2-(N-ethylperfluoro-1-octanesulfonamido)-ethanol	N-EtFOSE	10.0	C

Certified By: ____________________ **Date:** 09/23/2021
B.G. Chittim, General Manager (mm/dd/yyyy)

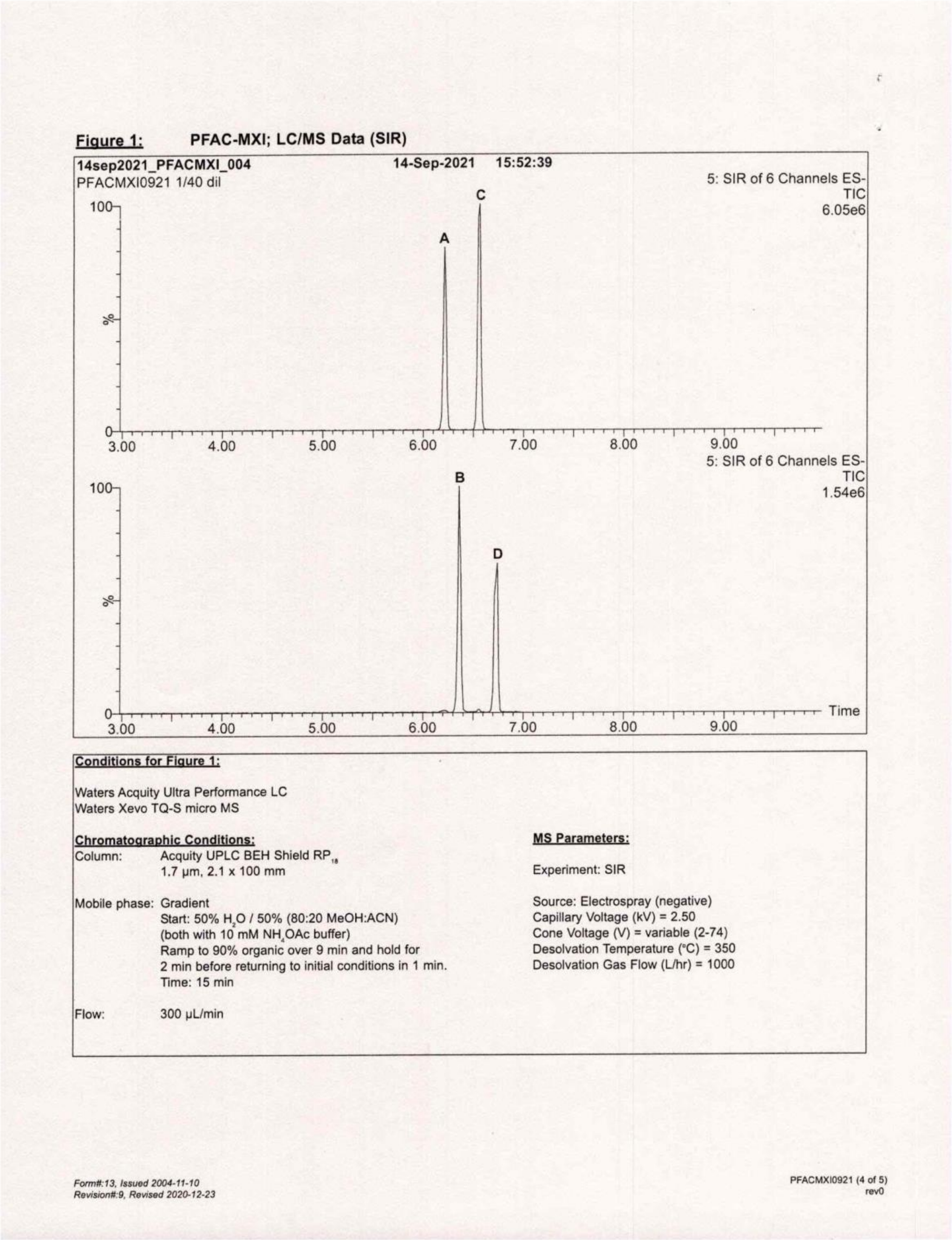

Figure 1: **PFAC-MXI; LC/MS Data (SIR)**

Conditions for Figure 1:

Waters Acquity Ultra Performance LC
Waters Xevo TQ-S micro MS

Chromatographic Conditions:

Column: Acquity UPLC BEH Shield RP$_{18}$
1.7 µm, 2.1 x 100 mm

Mobile phase: Gradient
Start: 50% H_2O / 50% (80:20 MeOH:ACN)
(both with 10 mM NH_4OAc buffer)
Ramp to 90% organic over 9 min and hold for
2 min before returning to initial conditions in 1 min.
Time: 15 min

Flow: 300 µL/min

MS Parameters:

Experiment: SIR

Source: Electrospray (negative)
Capillary Voltage (kV) = 2.50
Cone Voltage (V) = variable (2-74)
Desolvation Temperature (°C) = 350
Desolvation Gas Flow (L/hr) = 1000

Form#:13, Issued 2004-11-10
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PFACMXI0921 (4 of 5)
rev0

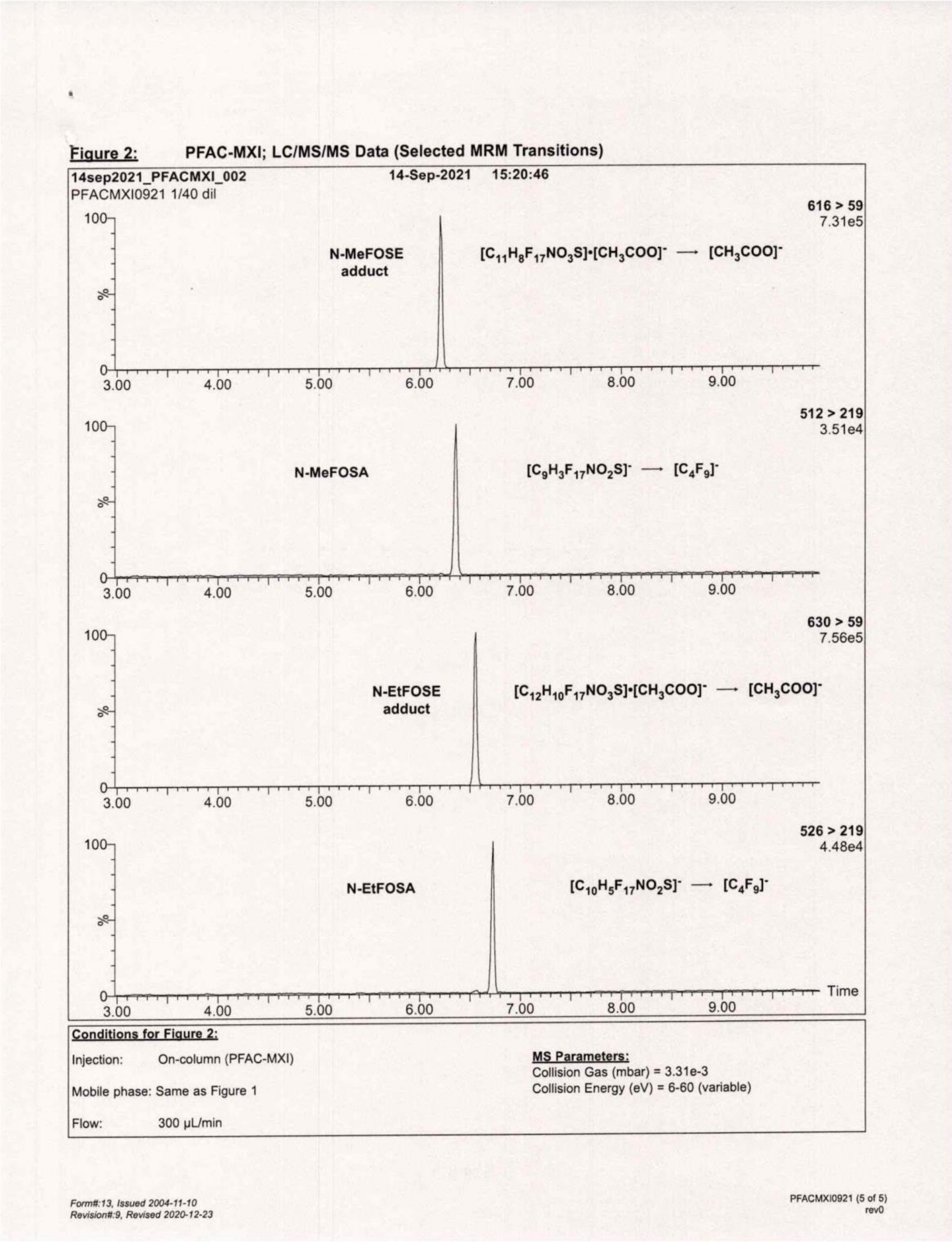

Figure 2: **PFAC-MXI; LC/MS/MS Data (Selected MRM Transitions)**

14sep2021_PFACMXI_002 **14-Sep-2021 15:20:46**
PFACMXI0921 1/40 dil

Conditions for Figure 2:

Injection: On-column (PFAC-MXI)

Mobile phase: Same as Figure 1

Flow: 300 µL/min

MS Parameters:
Collision Gas (mbar) = 3.31e-3
Collision Energy (eV) = 6-60 (variable)

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PFACMXI0921 (5 of 5)
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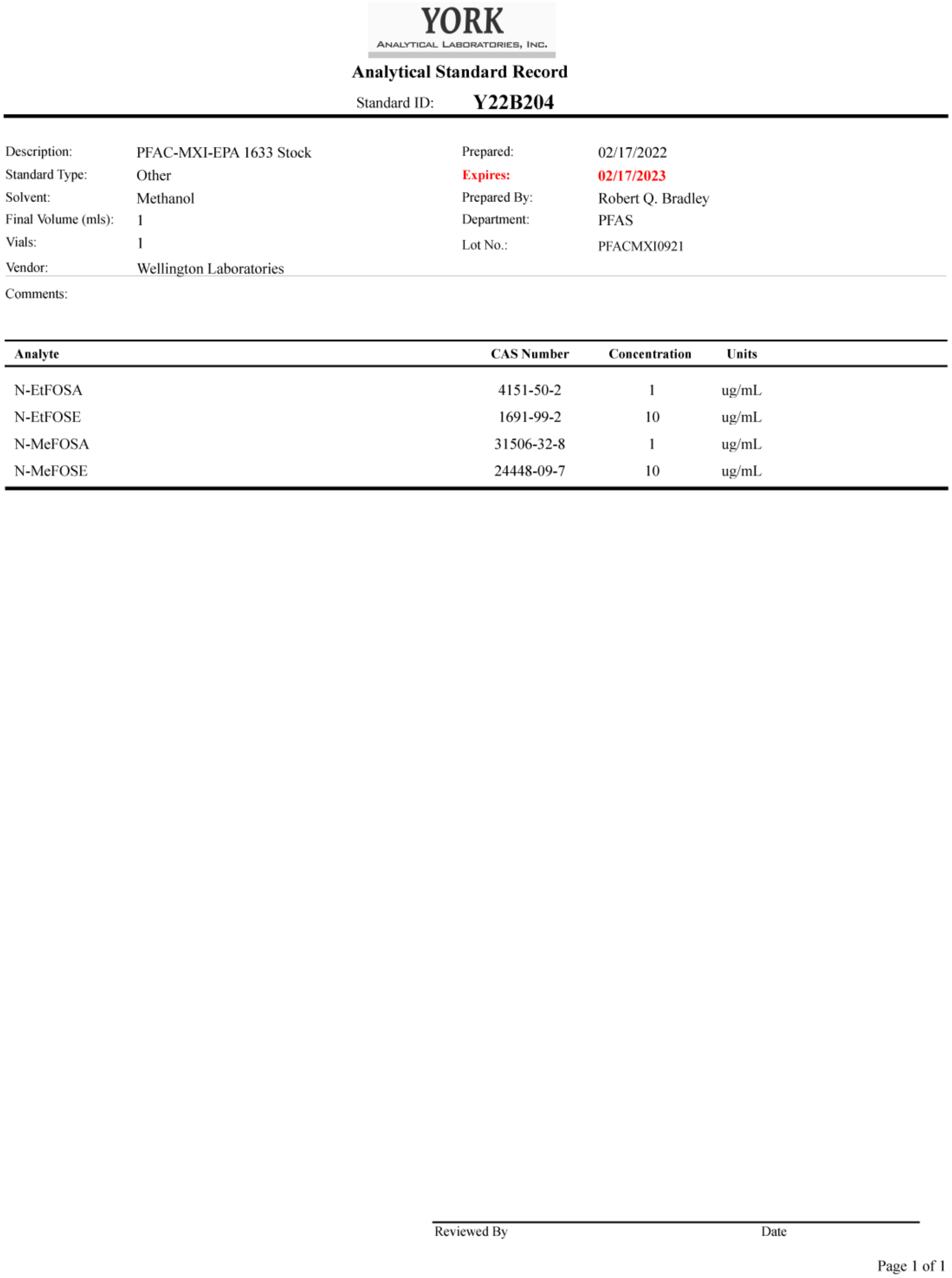

YORK
ANALYTICAL LABORATORIES, INC.

Analytical Standard Record

Standard ID: **Y22B204**

Description:	PFAC-MXI-EPA 1633 Stock	Prepared:	02/17/2022
Standard Type:	Other	**Expires:**	**02/17/2023**
Solvent:	Methanol	Prepared By:	Robert Q. Bradley
Final Volume (mls):	1	Department:	PFAS
Vials:	1	Lot No.:	PFACMXI0921
Vendor:	Wellington Laboratories		

Comments:

Analyte	**CAS Number**	**Concentration**	**Units**
N-EtFOSA	4151-50-2	1	ug/mL
N-EtFOSE	1691-99-2	10	ug/mL
N-MeFOSA	31506-32-8	1	ug/mL
N-MeFOSE	24448-09-7	10	ug/mL

Reviewed By Date

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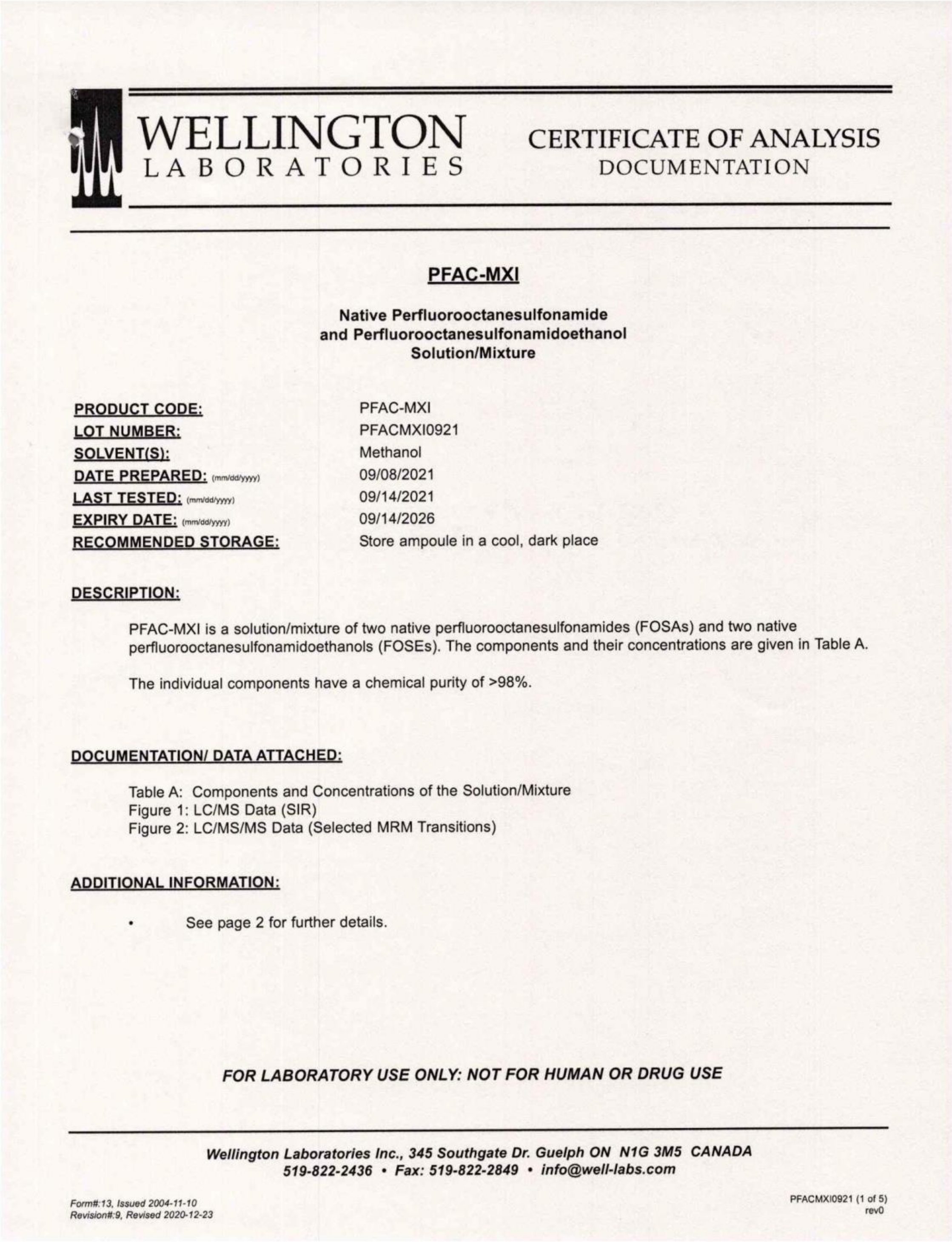

WELLINGTON
LABORATORIES

CERTIFICATE OF ANALYSIS
DOCUMENTATION

PFAC-MXI

Native Perfluorooctanesulfonamide and Perfluorooctanesulfonamidoethanol Solution/Mixture

PRODUCT CODE:	PFAC-MXI
LOT NUMBER:	PFACMXI0921
SOLVENT(S):	Methanol
DATE PREPARED: (mm/dd/yyyy)	09/08/2021
LAST TESTED: (mm/dd/yyyy)	09/14/2021
EXPIRY DATE: (mm/dd/yyyy)	09/14/2026
RECOMMENDED STORAGE:	Store ampoule in a cool, dark place

DESCRIPTION:

PFAC-MXI is a solution/mixture of two native perfluorooctanesulfonamides (FOSAs) and two native perfluorooctanesulfonamidoethanols (FOSEs). The components and their concentrations are given in Table A.

The individual components have a chemical purity of >98%.

DOCUMENTATION/ DATA ATTACHED:

Table A: Components and Concentrations of the Solution/Mixture
Figure 1: LC/MS Data (SIR)
Figure 2: LC/MS/MS Data (Selected MRM Transitions)

ADDITIONAL INFORMATION:

- See page 2 for further details.

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Revision#:9, Revised 2020-12-23

PFACMXI0921 (1 of 5)
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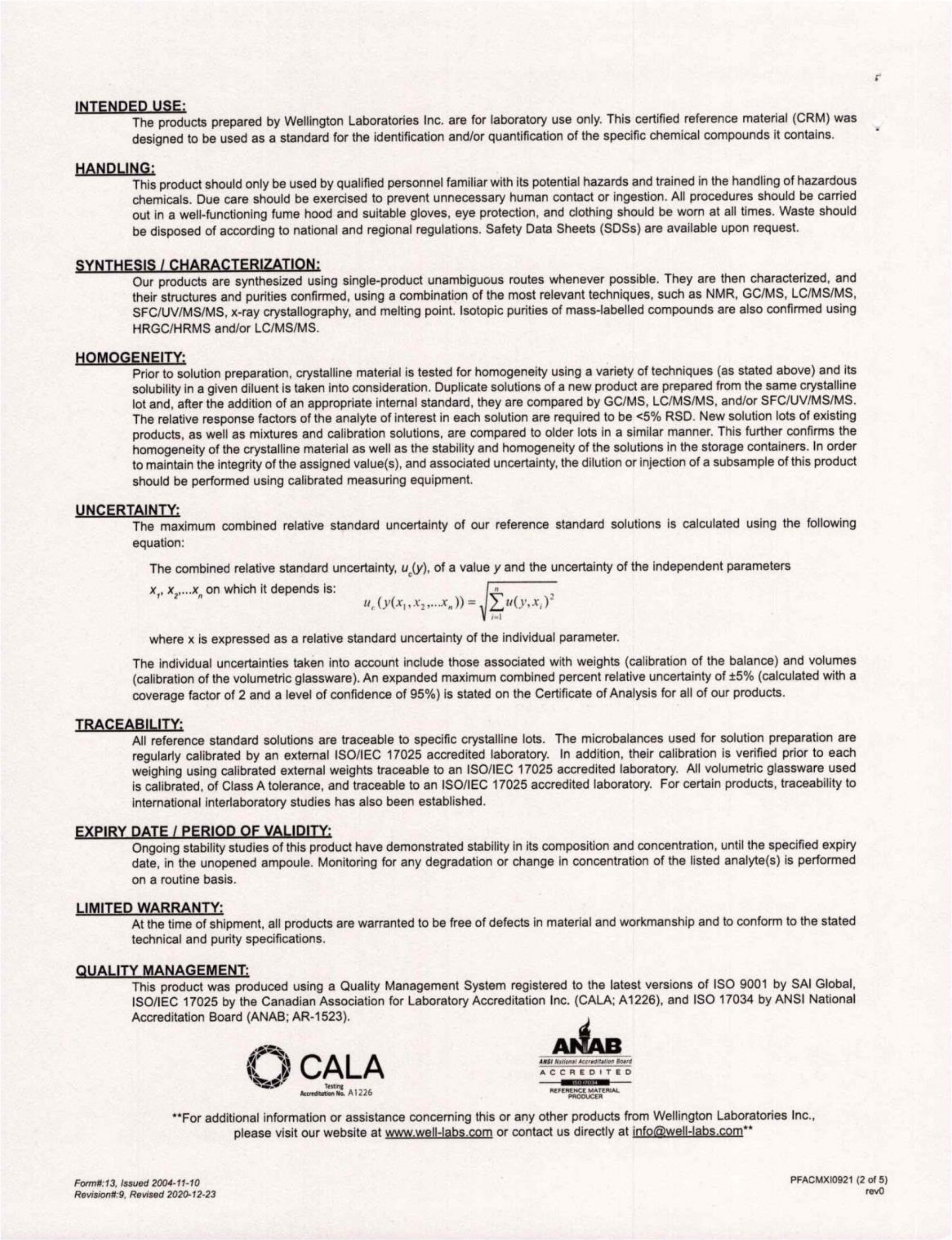

INTENDED USE:

The products prepared by Wellington Laboratories Inc. are for laboratory use only. This certified reference material (CRM) was designed to be used as a standard for the identification and/or quantification of the specific chemical compounds it contains.

HANDLING:

This product should only be used by qualified personnel familiar with its potential hazards and trained in the handling of hazardous chemicals. Due care should be exercised to prevent unnecessary human contact or ingestion. All procedures should be carried out in a well-functioning fume hood and suitable gloves, eye protection, and clothing should be worn at all times. Waste should be disposed of according to national and regional regulations. Safety Data Sheets (SDSs) are available upon request.

SYNTHESIS / CHARACTERIZATION:

Our products are synthesized using single-product unambiguous routes whenever possible. They are then characterized, and their structures and purities confirmed, using a combination of the most relevant techniques, such as NMR, GC/MS, LC/MS/MS, SFC/UV/MS/MS, x-ray crystallography, and melting point. Isotopic purities of mass-labelled compounds are also confirmed using HRGC/HRMS and/or LC/MS/MS.

HOMOGENEITY:

Prior to solution preparation, crystalline material is tested for homogeneity using a variety of techniques (as stated above) and its solubility in a given diluent is taken into consideration. Duplicate solutions of a new product are prepared from the same crystalline lot and, after the addition of an appropriate internal standard, they are compared by GC/MS, LC/MS/MS, and/or SFC/UV/MS/MS. The relative response factors of the analyte of interest in each solution are required to be <5% RSD. New solution lots of existing products, as well as mixtures and calibration solutions, are compared to older lots in a similar manner. This further confirms the homogeneity of the crystalline material as well as the stability and homogeneity of the solutions in the storage containers. In order to maintain the integrity of the assigned value(s), and associated uncertainty, the dilution or injection of a subsample of this product should be performed using calibrated measuring equipment.

UNCERTAINTY:

The maximum combined relative standard uncertainty of our reference standard solutions is calculated using the following equation:

The combined relative standard uncertainty, $u_c(y)$, of a value y and the uncertainty of the independent parameters x_1, x_2,...x_n on which it depends is:

$$u_c(y(x_1, x_2, \ldots x_n)) = \sqrt{\sum_{i=1}^{n} u(y, x_i)^2}$$

where x is expressed as a relative standard uncertainty of the individual parameter.

The individual uncertainties taken into account include those associated with weights (calibration of the balance) and volumes (calibration of the volumetric glassware). An expanded maximum combined percent relative uncertainty of ±5% (calculated with a coverage factor of 2 and a level of confidence of 95%) is stated on the Certificate of Analysis for all of our products.

TRACEABILITY:

All reference standard solutions are traceable to specific crystalline lots. The microbalances used for solution preparation are regularly calibrated by an external ISO/IEC 17025 accredited laboratory. In addition, their calibration is verified prior to each weighing using calibrated external weights traceable to an ISO/IEC 17025 accredited laboratory. All volumetric glassware used is calibrated, of Class A tolerance, and traceable to an ISO/IEC 17025 accredited laboratory. For certain products, traceability to international interlaboratory studies has also been established.

EXPIRY DATE / PERIOD OF VALIDITY:

Ongoing stability studies of this product have demonstrated stability in its composition and concentration, until the specified expiry date, in the unopened ampoule. Monitoring for any degradation or change in concentration of the listed analyte(s) is performed on a routine basis.

LIMITED WARRANTY:

At the time of shipment, all products are warranted to be free of defects in material and workmanship and to conform to the stated technical and purity specifications.

QUALITY MANAGEMENT:

This product was produced using a Quality Management System registered to the latest versions of ISO 9001 by SAI Global, ISO/IEC 17025 by the Canadian Association for Laboratory Accreditation Inc. (CALA; A1226), and ISO 17034 by ANSI National Accreditation Board (ANAB; AR-1523).

CALA
Testing
Accreditation No. A1226

ANAB
ANSI National Accreditation Board
ACCREDITED
ISO 17034
REFERENCE MATERIAL PRODUCER

**For additional information or assistance concerning this or any other products from Wellington Laboratories Inc.,
please visit our website at www.well-labs.com or contact us directly at info@well-labs.com**

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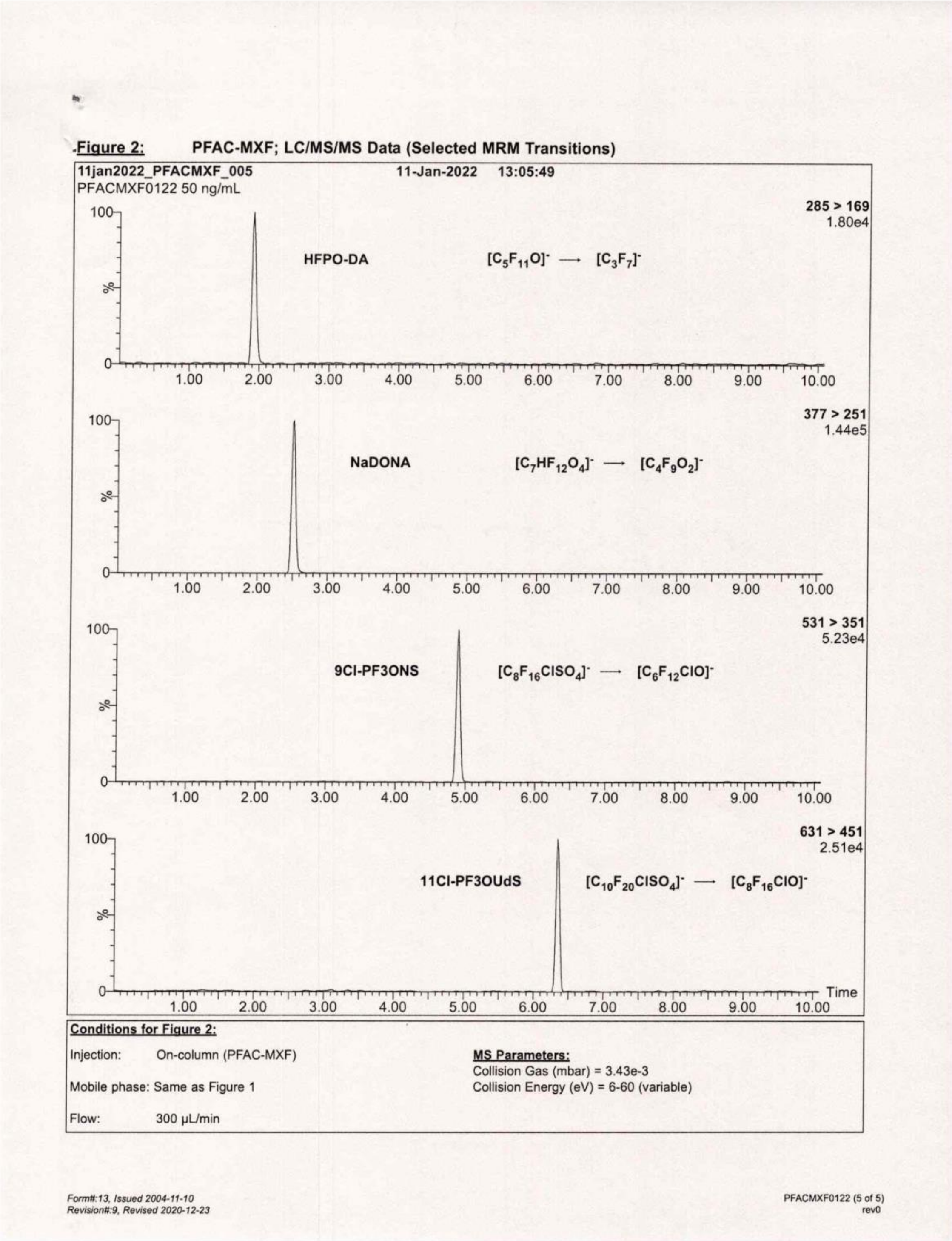

Figure 2: **PFAC-MXF; LC/MS/MS Data (Selected MRM Transitions)**

Conditions for Figure 2:

Injection: On-column (PFAC-MXF)

Mobile phase: Same as Figure 1

Flow: 300 µL/min

MS Parameters:
Collision Gas (mbar) = 3.43e-3
Collision Energy (eV) = 6-60 (variable)

Form#:13, Issued 2004-11-10
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PFACMXF0122 (5 of 5)
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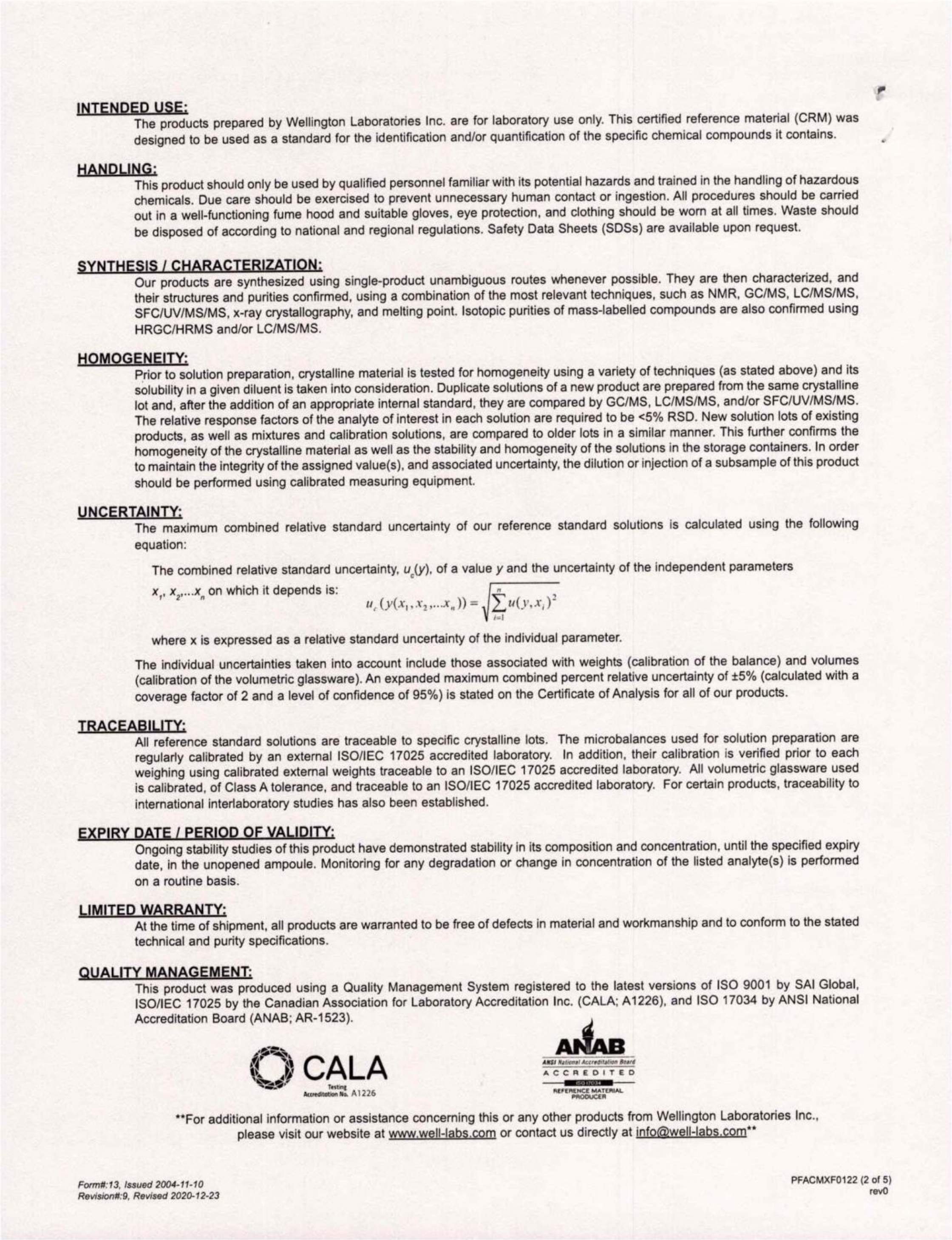

INTENDED USE:

The products prepared by Wellington Laboratories Inc. are for laboratory use only. This certified reference material (CRM) was designed to be used as a standard for the identification and/or quantification of the specific chemical compounds it contains.

HANDLING:

This product should only be used by qualified personnel familiar with its potential hazards and trained in the handling of hazardous chemicals. Due care should be exercised to prevent unnecessary human contact or ingestion. All procedures should be carried out in a well-functioning fume hood and suitable gloves, eye protection, and clothing should be worn at all times. Waste should be disposed of according to national and regional regulations. Safety Data Sheets (SDSs) are available upon request.

SYNTHESIS / CHARACTERIZATION:

Our products are synthesized using single-product unambiguous routes whenever possible. They are then characterized, and their structures and purities confirmed, using a combination of the most relevant techniques, such as NMR, GC/MS, LC/MS/MS, SFC/UV/MS/MS, x-ray crystallography, and melting point. Isotopic purities of mass-labelled compounds are also confirmed using HRGC/HRMS and/or LC/MS/MS.

HOMOGENEITY:

Prior to solution preparation, crystalline material is tested for homogeneity using a variety of techniques (as stated above) and its solubility in a given diluent is taken into consideration. Duplicate solutions of a new product are prepared from the same crystalline lot and, after the addition of an appropriate internal standard, they are compared by GC/MS, LC/MS/MS, and/or SFC/UV/MS/MS. The relative response factors of the analyte of interest in each solution are required to be <5% RSD. New solution lots of existing products, as well as mixtures and calibration solutions, are compared to older lots in a similar manner. This further confirms the homogeneity of the crystalline material as well as the stability and homogeneity of the solutions in the storage containers. In order to maintain the integrity of the assigned value(s), and associated uncertainty, the dilution or injection of a subsample of this product should be performed using calibrated measuring equipment.

UNCERTAINTY:

The maximum combined relative standard uncertainty of our reference standard solutions is calculated using the following equation:

The combined relative standard uncertainty, $u_c(y)$, of a value y and the uncertainty of the independent parameters $x_1, x_2, ... x_n$ on which it depends is:

$$u_c(y(x_1, x_2, ... x_n)) = \sqrt{\sum_{i=1}^{n} u(y, x_i)^2}$$

where x is expressed as a relative standard uncertainty of the individual parameter.

The individual uncertainties taken into account include those associated with weights (calibration of the balance) and volumes (calibration of the volumetric glassware). An expanded maximum combined percent relative uncertainty of ±5% (calculated with a coverage factor of 2 and a level of confidence of 95%) is stated on the Certificate of Analysis for all of our products.

TRACEABILITY:

All reference standard solutions are traceable to specific crystalline lots. The microbalances used for solution preparation are regularly calibrated by an external ISO/IEC 17025 accredited laboratory. In addition, their calibration is verified prior to each weighing using calibrated external weights traceable to an ISO/IEC 17025 accredited laboratory. All volumetric glassware used is calibrated, of Class A tolerance, and traceable to an ISO/IEC 17025 accredited laboratory. For certain products, traceability to international interlaboratory studies has also been established.

EXPIRY DATE / PERIOD OF VALIDITY:

Ongoing stability studies of this product have demonstrated stability in its composition and concentration, until the specified expiry date, in the unopened ampoule. Monitoring for any degradation or change in concentration of the listed analyte(s) is performed on a routine basis.

LIMITED WARRANTY:

At the time of shipment, all products are warranted to be free of defects in material and workmanship and to conform to the stated technical and purity specifications.

QUALITY MANAGEMENT:

This product was produced using a Quality Management System registered to the latest versions of ISO 9001 by SAI Global, ISO/IEC 17025 by the Canadian Association for Laboratory Accreditation Inc. (CALA; A1226), and ISO 17034 by ANSI National Accreditation Board (ANAB; AR-1523).

CALA Testing Accreditation No. A1226

ANAB ANSI National Accreditation Board ACCREDITED ISO 17034 REFERENCE MATERIAL PRODUCER

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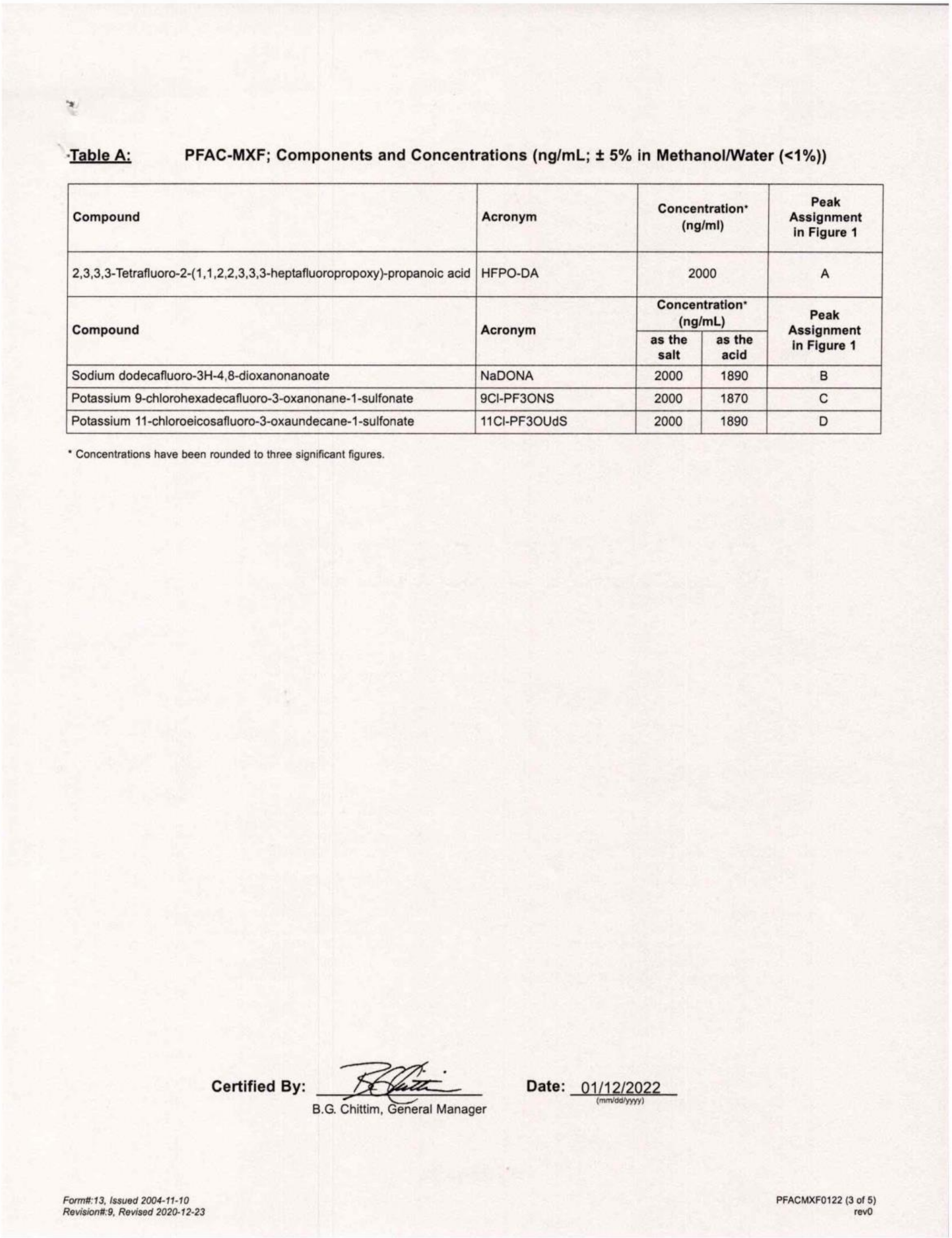

Table A: **PFAC-MXF; Components and Concentrations (ng/mL; ± 5% in Methanol/Water (<1%))**

Compound	Acronym	Concentration* (ng/ml)	Peak Assignment in Figure 1
2,3,3,3-Tetrafluoro-2-(1,1,2,2,3,3,3-heptafluoropropoxy)-propanoic acid	HFPO-DA	2000	A

Compound	Acronym	Concentration* (ng/mL)		Peak Assignment in Figure 1
		as the salt	as the acid	
Sodium dodecafluoro-3H-4,8-dioxanonanoate	NaDONA	2000	1890	B
Potassium 9-chlorohexadecafluoro-3-oxanonane-1-sulfonate	9Cl-PF3ONS	2000	1870	C
Potassium 11-chloroeicosafluoro-3-oxaundecane-1-sulfonate	11Cl-PF3OUdS	2000	1890	D

* Concentrations have been rounded to three significant figures.

Certified By: B.G. Chittim, General Manager **Date:** 01/12/2022 (mm/dd/yyyy)

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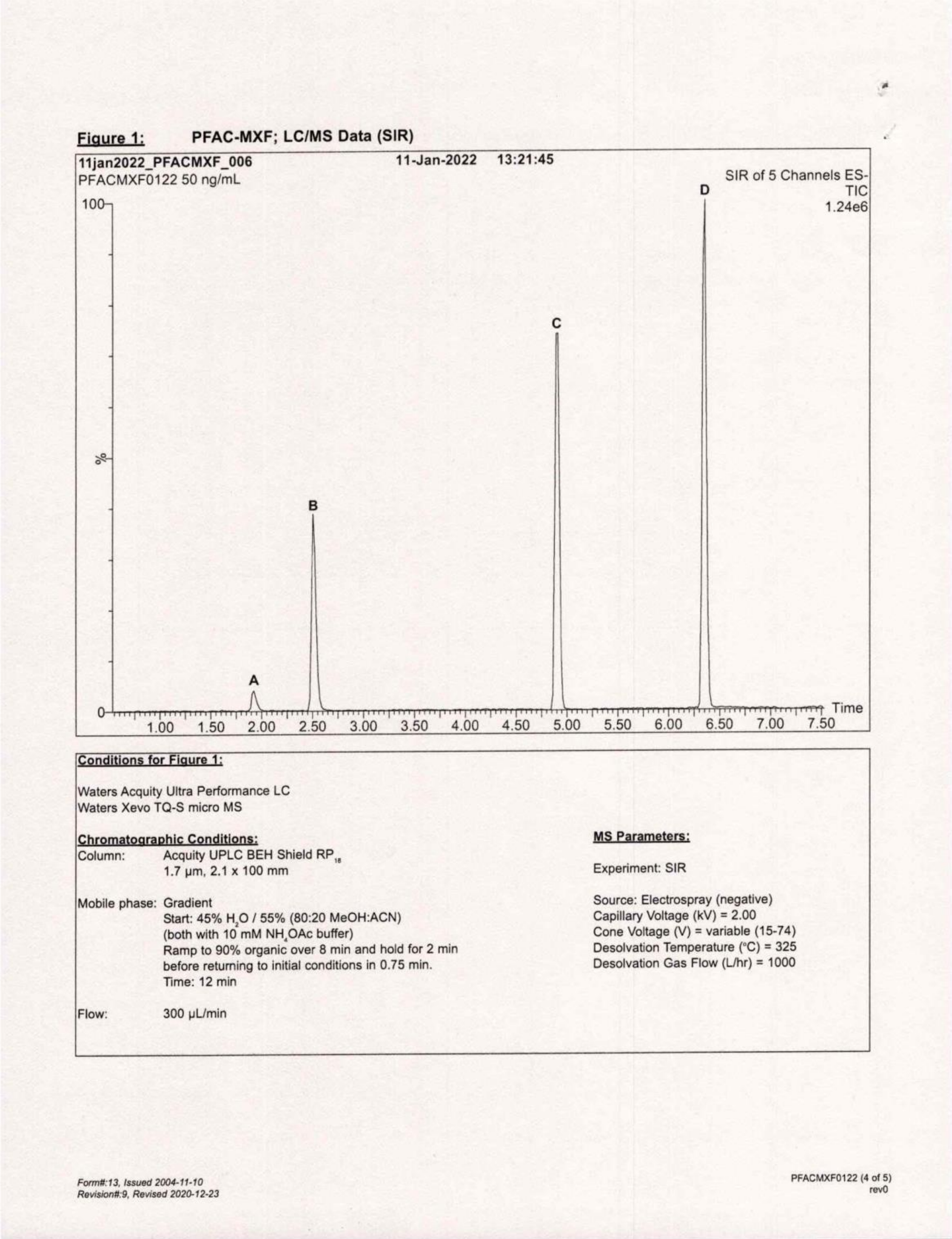

Figure 1: **PFAC-MXF; LC/MS Data (SIR)**

Conditions for Figure 1:

Waters Acquity Ultra Performance LC
Waters Xevo TQ-S micro MS

Chromatographic Conditions:

Column: Acquity UPLC BEH Shield RP_{18}
1.7 µm, 2.1 x 100 mm

Mobile phase: Gradient
Start: 45% H_2O / 55% (80:20 MeOH:ACN)
(both with 10 mM NH_4OAc buffer)
Ramp to 90% organic over 8 min and hold for 2 min
before returning to initial conditions in 0.75 min.
Time: 12 min

Flow: 300 µL/min

MS Parameters:

Experiment: SIR

Source: Electrospray (negative)
Capillary Voltage (kV) = 2.00
Cone Voltage (V) = variable (15-74)
Desolvation Temperature (°C) = 325
Desolvation Gas Flow (L/hr) = 1000

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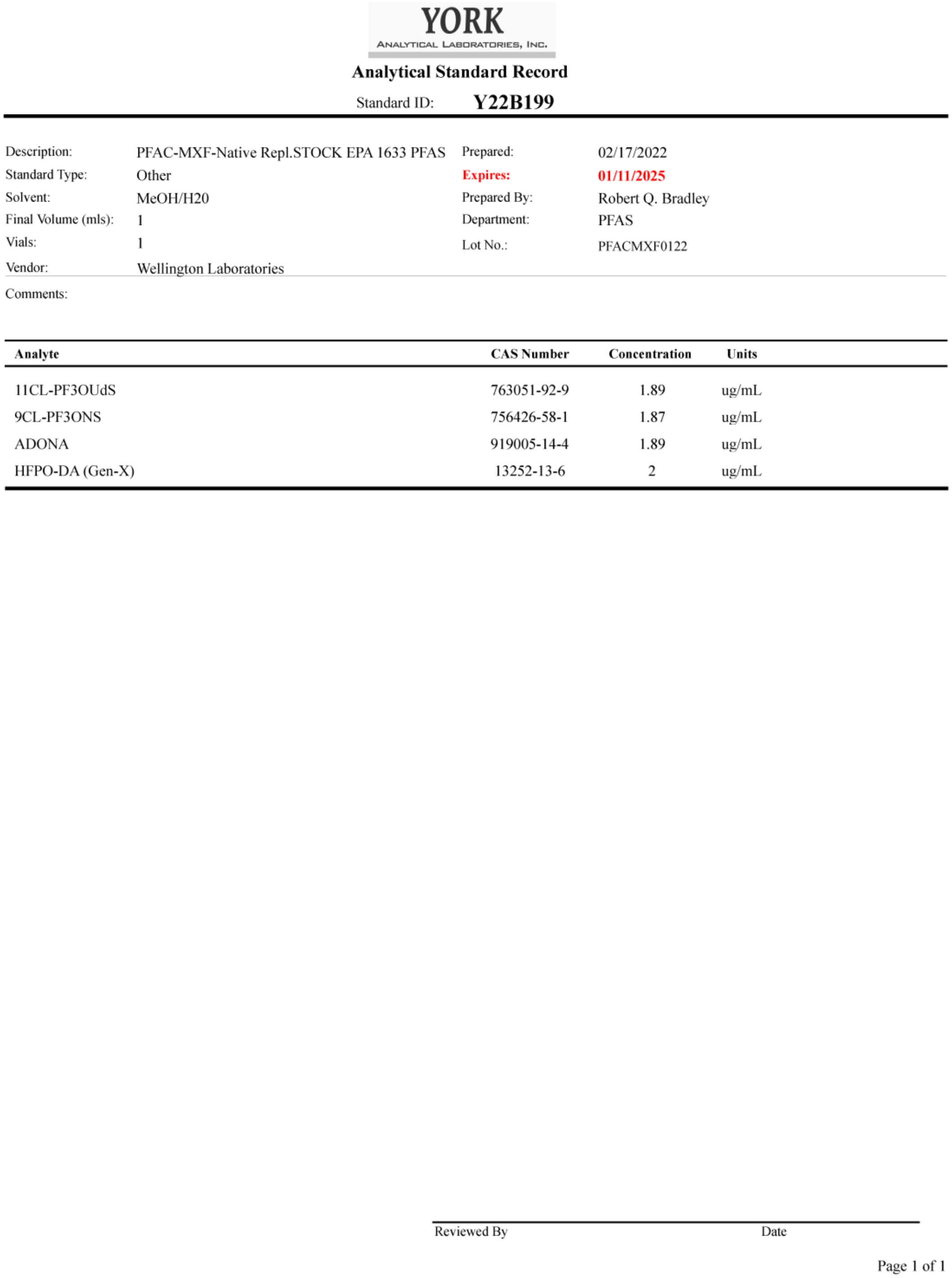
PFACMXF0122 (4 of 5)
rev0



YORK
ANALYTICAL LABORATORIES, INC.

Analytical Standard Record

Standard ID: **Y22B199**

Description:	PFAC-MXF-Native Repl.STOCK EPA 1633 PFAS	Prepared:	02/17/2022
Standard Type:	Other	**Expires:**	**01/11/2025**
Solvent:	MeOH/H20	Prepared By:	Robert Q. Bradley
Final Volume (mls):	1	Department:	PFAS
Vials:	1	Lot No.:	PFACMXF0122
Vendor:	Wellington Laboratories		

Comments:

Analyte	CAS Number	Concentration	Units
11CL-PF3OUdS	763051-92-9	1.89	ug/mL
9CL-PF3ONS	756426-58-1	1.87	ug/mL
ADONA	919005-14-4	1.89	ug/mL
HFPO-DA (Gen-X)	13252-13-6	2	ug/mL

Reviewed By　　　　　　Date

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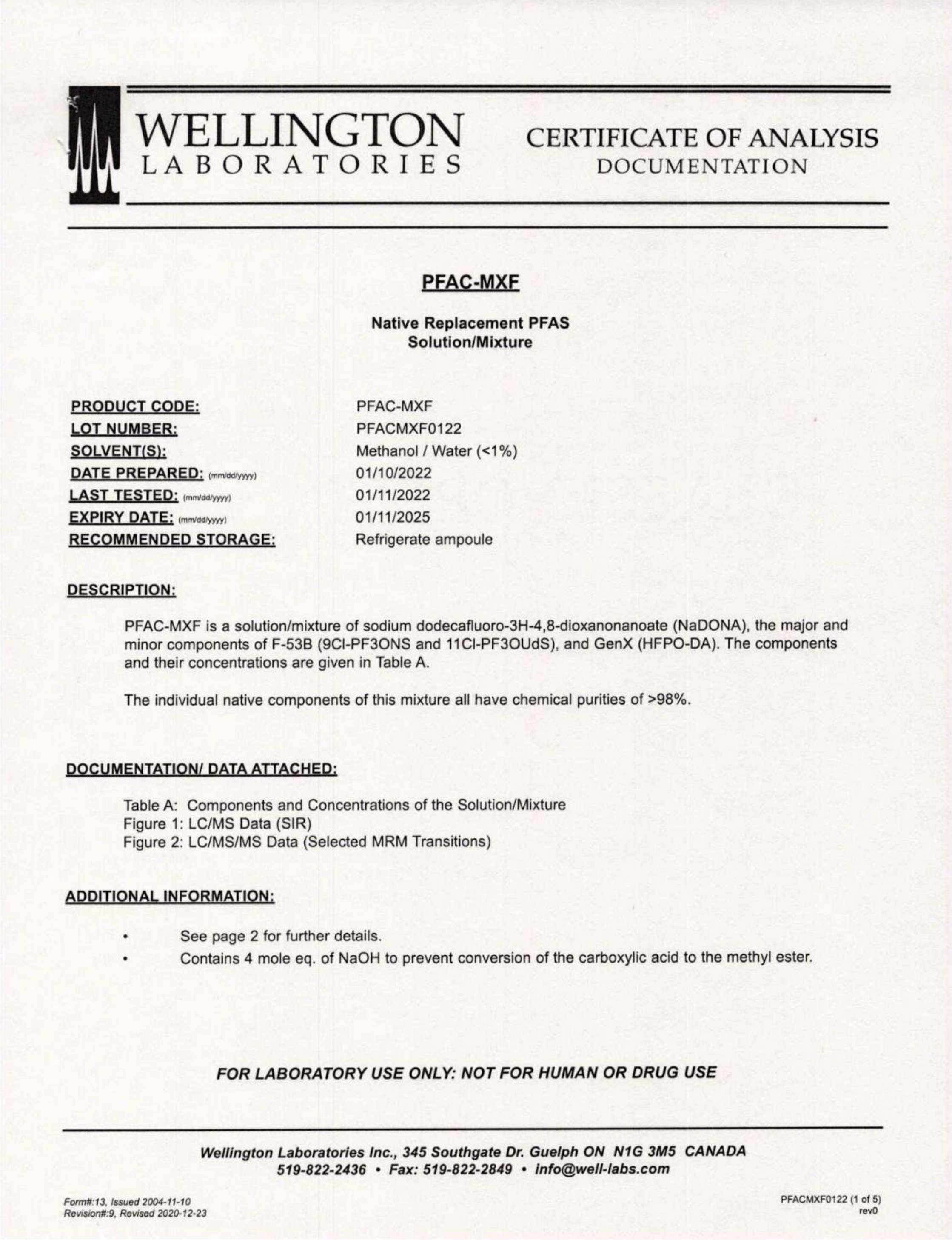

WELLINGTON
LABORATORIES

CERTIFICATE OF ANALYSIS
DOCUMENTATION

PFAC-MXF

Native Replacement PFAS
Solution/Mixture

PRODUCT CODE:	PFAC-MXF
LOT NUMBER:	PFACMXF0122
SOLVENT(S):	Methanol / Water (<1%)
DATE PREPARED: (mm/dd/yyyy)	01/10/2022
LAST TESTED: (mm/dd/yyyy)	01/11/2022
EXPIRY DATE: (mm/dd/yyyy)	01/11/2025
RECOMMENDED STORAGE:	Refrigerate ampoule

DESCRIPTION:

PFAC-MXF is a solution/mixture of sodium dodecafluoro-3H-4,8-dioxanonanoate (NaDONA), the major and minor components of F-53B (9Cl-PF3ONS and 11Cl-PF3OUdS), and GenX (HFPO-DA). The components and their concentrations are given in Table A.

The individual native components of this mixture all have chemical purities of >98%.

DOCUMENTATION/ DATA ATTACHED:

Table A: Components and Concentrations of the Solution/Mixture
Figure 1: LC/MS Data (SIR)
Figure 2: LC/MS/MS Data (Selected MRM Transitions)

ADDITIONAL INFORMATION:

- See page 2 for further details.
- Contains 4 mole eq. of NaOH to prevent conversion of the carboxylic acid to the methyl ester.

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Revision#:9, Revised 2020-12-23

PFACMXF0122 (1 of 5)
rev0

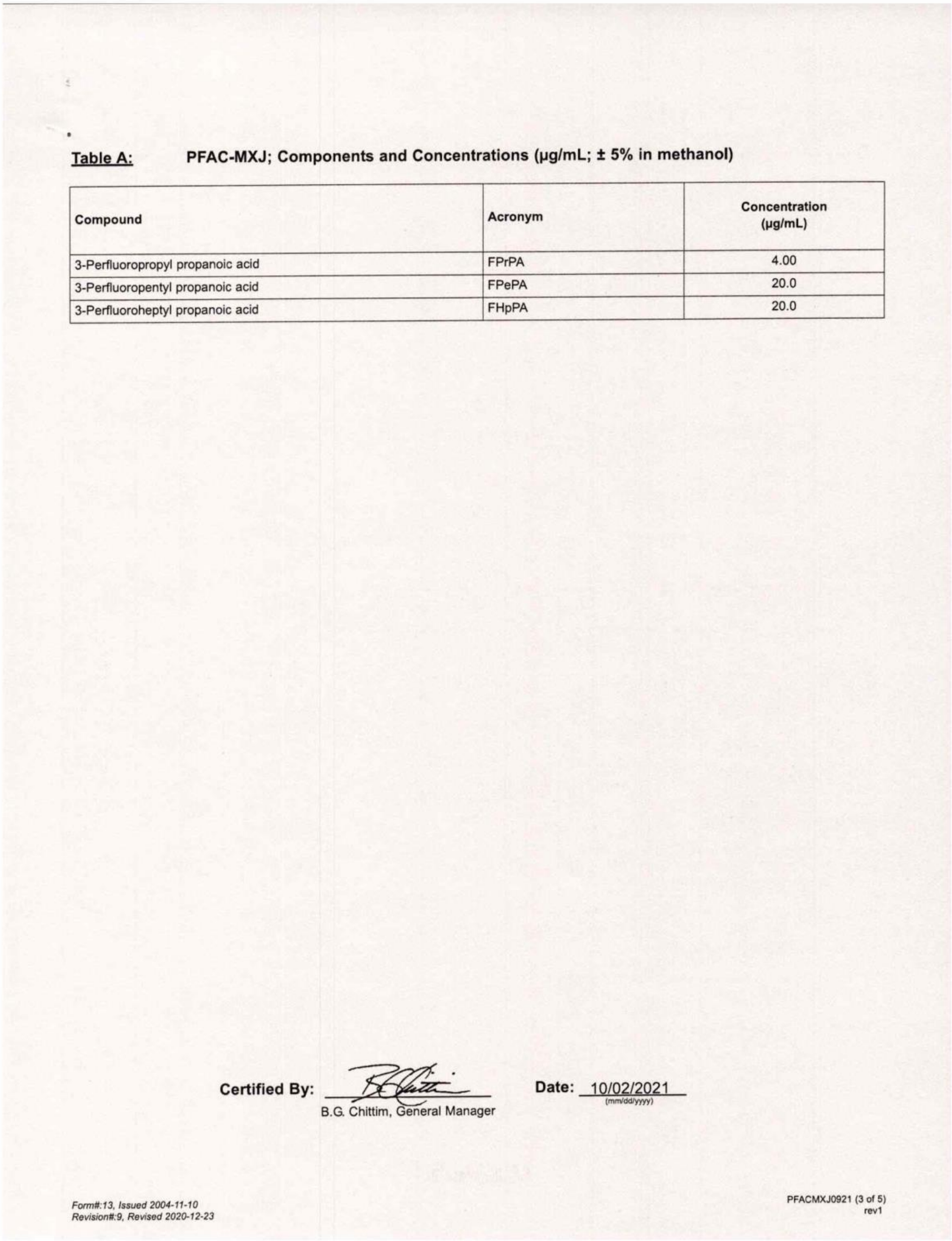

Table A: **PFAC-MXJ; Components and Concentrations (µg/mL; ± 5% in methanol)**

Compound	Acronym	Concentration (µg/mL)
3-Perfluoropropyl propanoic acid	FPrPA	4.00
3-Perfluoropentyl propanoic acid	FPePA	20.0
3-Perfluoroheptyl propanoic acid	FHpPA	20.0

Certified By: B.G. Chittim, General Manager

Date: 10/02/2021
(mm/dd/yyyy)

Form#:13, Issued 2004-11-10
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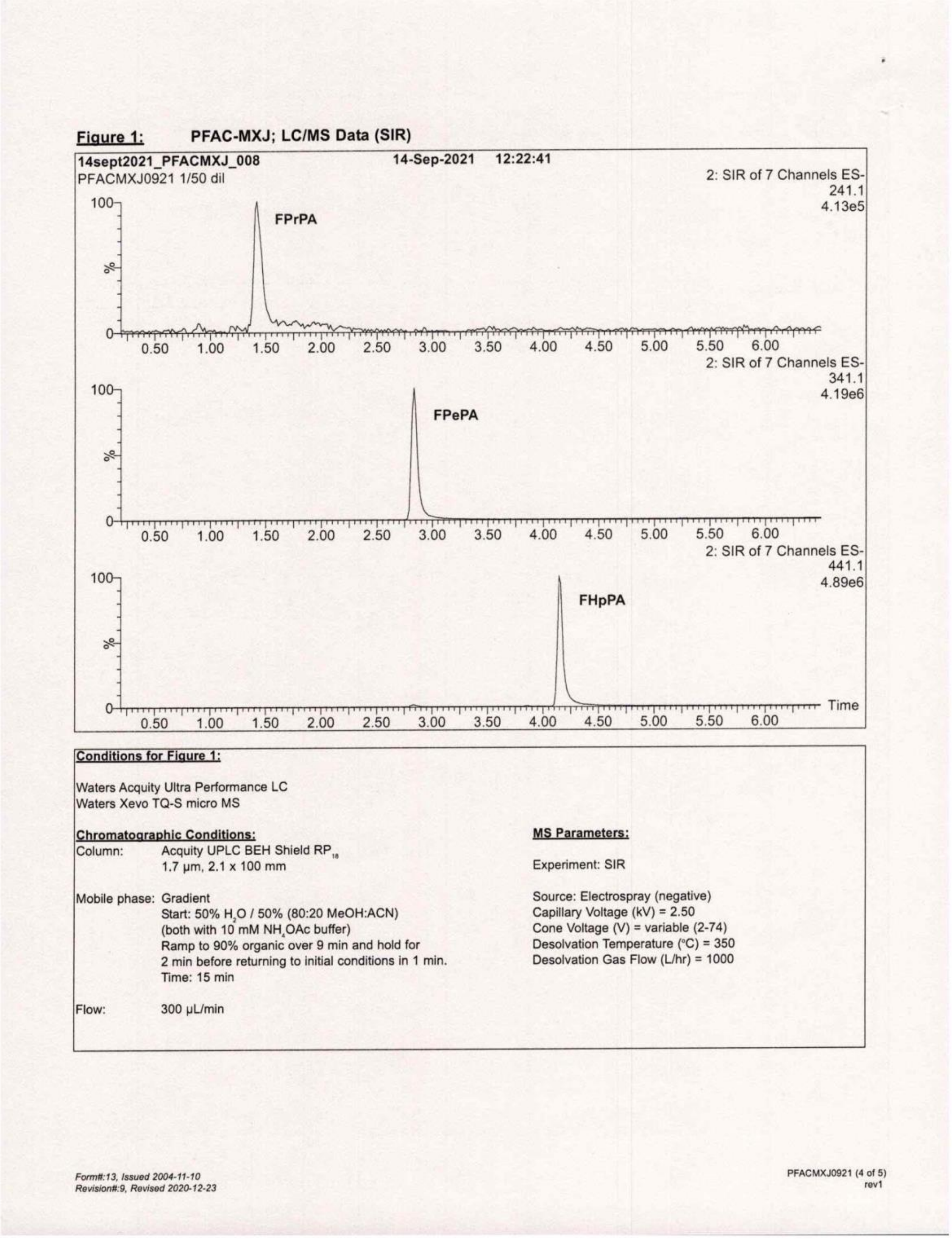


Figure 1: PFAC-MXJ; LC/MS Data (SIR)

Conditions for Figure 1:

Waters Acquity Ultra Performance LC
Waters Xevo TQ-S micro MS

Chromatographic Conditions:

Column: Acquity UPLC BEH Shield RP_{18}
1.7 µm, 2.1 x 100 mm

Mobile phase: Gradient
Start: 50% H_2O / 50% (80:20 MeOH:ACN)
(both with 10 mM NH_4OAc buffer)
Ramp to 90% organic over 9 min and hold for
2 min before returning to initial conditions in 1 min.
Time: 15 min

Flow: 300 µL/min

MS Parameters:

Experiment: SIR

Source: Electrospray (negative)
Capillary Voltage (kV) = 2.50
Cone Voltage (V) = variable (2-74)
Desolvation Temperature (°C) = 350
Desolvation Gas Flow (L/hr) = 1000

Form#:13, Issued 2004-11-10
Revision#:9, Revised 2020-12-23

PFACMXJ0921 (4 of 5)
rev1

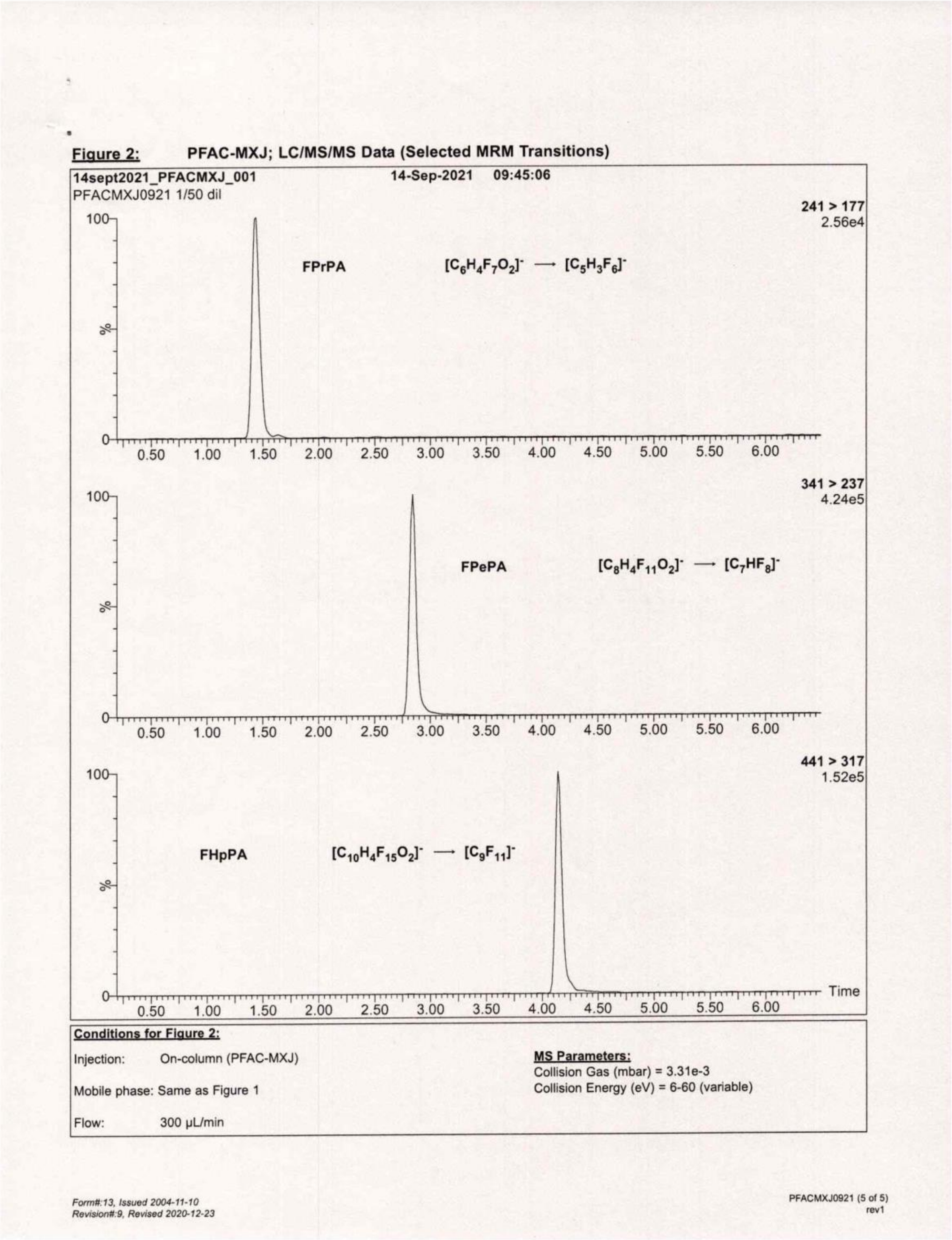


Figure 2: **PFAC-MXJ; LC/MS/MS Data (Selected MRM Transitions)**

Conditions for Figure 2:

Injection: On-column (PFAC-MXJ)

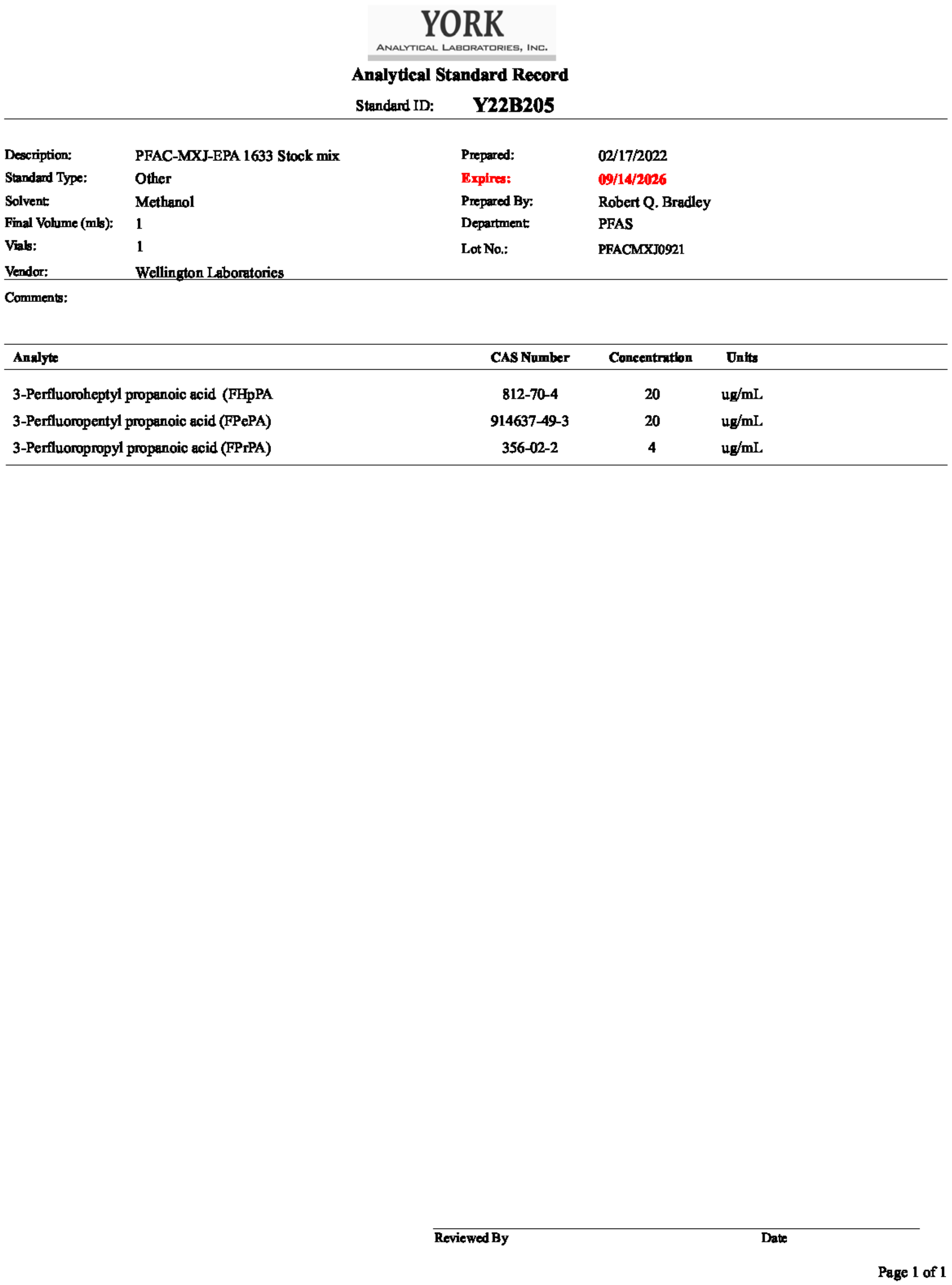
Mobile phase: Same as Figure 1

Flow: 300 µL/min

MS Parameters:
Collision Gas (mbar) = 3.31e-3
Collision Energy (eV) = 6-60 (variable)

Form#:13, Issued 2004-11-10
Revision#:9, Revised 2020-12-23

PFACMXJ0921 (5 of 5)
rev1



YORK
ANALYTICAL LABORATORIES, INC.

Analytical Standard Record

Standard ID: **Y22B205**

Description:	PFAC-MXJ-EPA 1633 Stock mix	**Prepared:**	02/17/2022
Standard Type:	Other	**Expires:**	**09/14/2026**
Solvent:	Methanol	**Prepared By:**	Robert Q. Bradley
Final Volume (mls):	1	**Department:**	PFAS
Vials:	1	**Lot No.:**	PFACMXJ0921
Vendor:	Wellington Laboratories		

Comments:

Analyte	**CAS Number**	**Concentration**	**Units**
3-Perfluoroheptyl propanoic acid (FHpPA	812-70-4	20	ug/mL
3-Perfluoropentyl propanoic acid (FPePA)	914637-49-3	20	ug/mL
3-Perfluoropropyl propanoic acid (FPrPA)	356-02-2	4	ug/mL

Reviewed By **Date**

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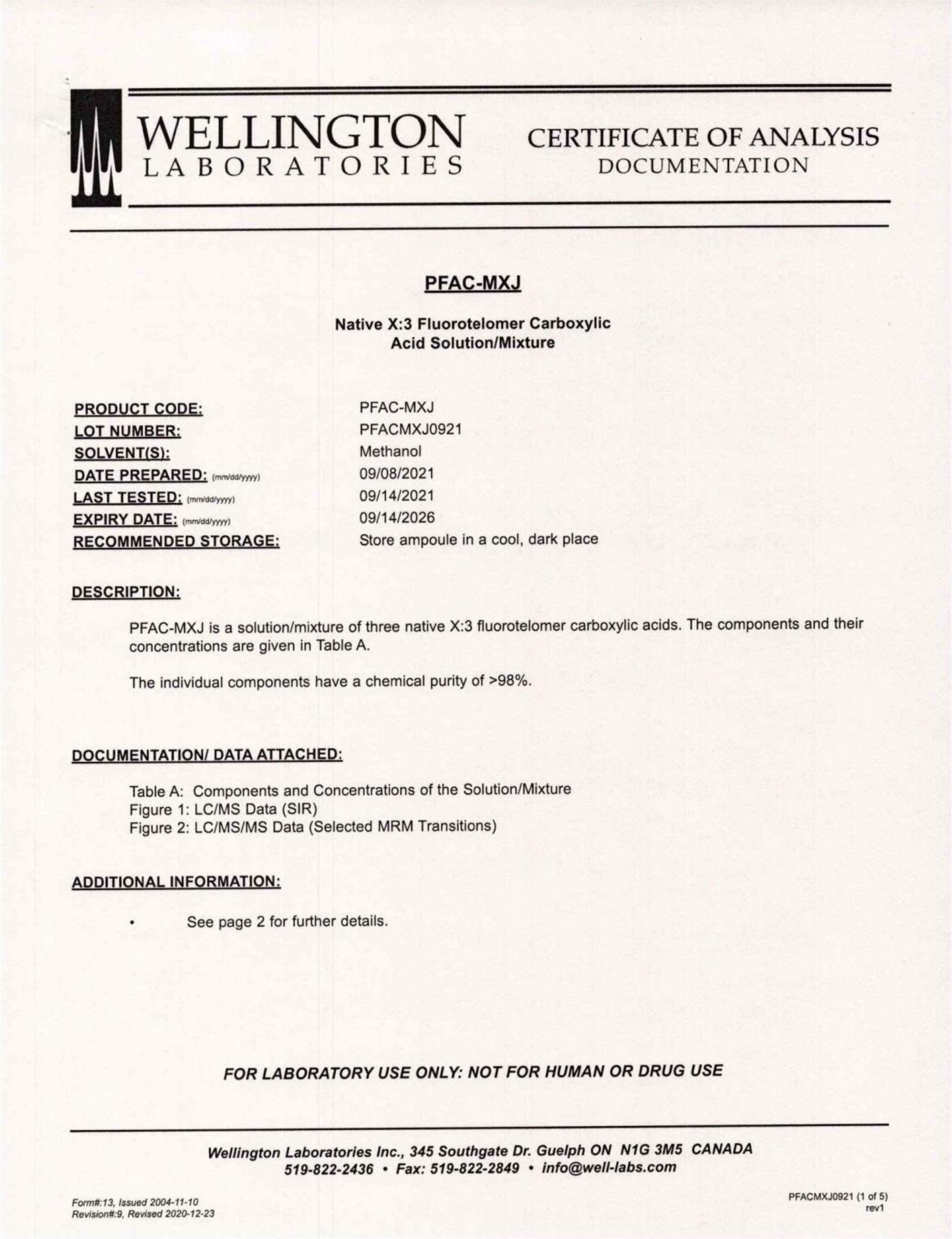

WELLINGTON
LABORATORIES

CERTIFICATE OF ANALYSIS
DOCUMENTATION

PFAC-MXJ

Native X:3 Fluorotelomer Carboxylic Acid Solution/Mixture

PRODUCT CODE:	PFAC-MXJ
LOT NUMBER:	PFACMXJ0921
SOLVENT(S):	Methanol
DATE PREPARED: (mm/dd/yyyy)	09/08/2021
LAST TESTED: (mm/dd/yyyy)	09/14/2021
EXPIRY DATE: (mm/dd/yyyy)	09/14/2026
RECOMMENDED STORAGE:	Store ampoule in a cool, dark place

DESCRIPTION:

PFAC-MXJ is a solution/mixture of three native X:3 fluorotelomer carboxylic acids. The components and their concentrations are given in Table A.

The individual components have a chemical purity of >98%.

DOCUMENTATION/ DATA ATTACHED:

Table A: Components and Concentrations of the Solution/Mixture
Figure 1: LC/MS Data (SIR)
Figure 2: LC/MS/MS Data (Selected MRM Transitions)

ADDITIONAL INFORMATION:

- See page 2 for further details.

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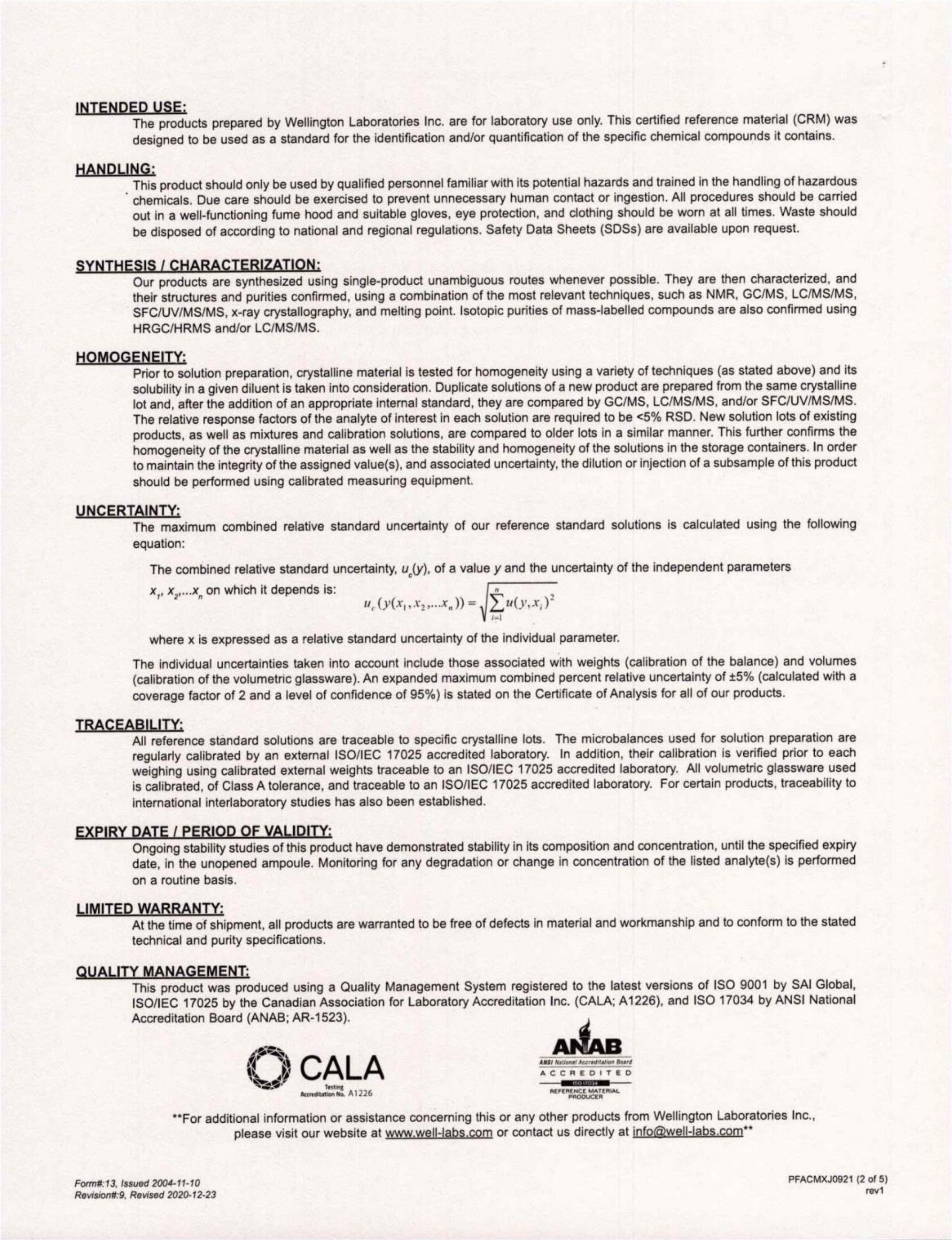
Revision#:9, Revised 2020-12-23

PFACMXJ0921 (1 of 5)
rev1



INTENDED USE:

The products prepared by Wellington Laboratories Inc. are for laboratory use only. This certified reference material (CRM) was designed to be used as a standard for the identification and/or quantification of the specific chemical compounds it contains.

HANDLING:

This product should only be used by qualified personnel familiar with its potential hazards and trained in the handling of hazardous chemicals. Due care should be exercised to prevent unnecessary human contact or ingestion. All procedures should be carried out in a well-functioning fume hood and suitable gloves, eye protection, and clothing should be worn at all times. Waste should be disposed of according to national and regional regulations. Safety Data Sheets (SDSs) are available upon request.

SYNTHESIS / CHARACTERIZATION:

Our products are synthesized using single-product unambiguous routes whenever possible. They are then characterized, and their structures and purities confirmed, using a combination of the most relevant techniques, such as NMR, GC/MS, LC/MS/MS, SFC/UV/MS/MS, x-ray crystallography, and melting point. Isotopic purities of mass-labelled compounds are also confirmed using HRGC/HRMS and/or LC/MS/MS.

HOMOGENEITY:

Prior to solution preparation, crystalline material is tested for homogeneity using a variety of techniques (as stated above) and its solubility in a given diluent is taken into consideration. Duplicate solutions of a new product are prepared from the same crystalline lot and, after the addition of an appropriate internal standard, they are compared by GC/MS, LC/MS/MS, and/or SFC/UV/MS/MS. The relative response factors of the analyte of interest in each solution are required to be <5% RSD. New solution lots of existing products, as well as mixtures and calibration solutions, are compared to older lots in a similar manner. This further confirms the homogeneity of the crystalline material as well as the stability and homogeneity of the solutions in the storage containers. In order to maintain the integrity of the assigned value(s), and associated uncertainty, the dilution or injection of a subsample of this product should be performed using calibrated measuring equipment.

UNCERTAINTY:

The maximum combined relative standard uncertainty of our reference standard solutions is calculated using the following equation:

The combined relative standard uncertainty, $u_c(y)$, of a value y and the uncertainty of the independent parameters $x_1, x_2, \dots x_n$ on which it depends is:

$$u_c(y(x_1, x_2, \dots x_n)) = \sqrt{\sum_{i=1}^{n} u(y, x_i)^2}$$

where x is expressed as a relative standard uncertainty of the individual parameter.

The individual uncertainties taken into account include those associated with weights (calibration of the balance) and volumes (calibration of the volumetric glassware). An expanded maximum combined percent relative uncertainty of ±5% (calculated with a coverage factor of 2 and a level of confidence of 95%) is stated on the Certificate of Analysis for all of our products.

TRACEABILITY:

All reference standard solutions are traceable to specific crystalline lots. The microbalances used for solution preparation are regularly calibrated by an external ISO/IEC 17025 accredited laboratory. In addition, their calibration is verified prior to each weighing using calibrated external weights traceable to an ISO/IEC 17025 accredited laboratory. All volumetric glassware used is calibrated, of Class A tolerance, and traceable to an ISO/IEC 17025 accredited laboratory. For certain products, traceability to international interlaboratory studies has also been established.

EXPIRY DATE / PERIOD OF VALIDITY:

Ongoing stability studies of this product have demonstrated stability in its composition and concentration, until the specified expiry date, in the unopened ampoule. Monitoring for any degradation or change in concentration of the listed analyte(s) is performed on a routine basis.

LIMITED WARRANTY:

At the time of shipment, all products are warranted to be free of defects in material and workmanship and to conform to the stated technical and purity specifications.

QUALITY MANAGEMENT:

This product was produced using a Quality Management System registered to the latest versions of ISO 9001 by SAI Global, ISO/IEC 17025 by the Canadian Association for Laboratory Accreditation Inc. (CALA; A1226), and ISO 17034 by ANSI National Accreditation Board (ANAB; AR-1523).

CALA Testing Accreditation No. A1226

ANAB ANSI National Accreditation Board ACCREDITED ISO 17034 REFERENCE MATERIAL PRODUCER

For additional information or assistance concerning this or any other products from Wellington Laboratories Inc., please visit our website at www.well-labs.com or contact us directly at info@well-labs.com

Form#:13, Issued 2004-11-10
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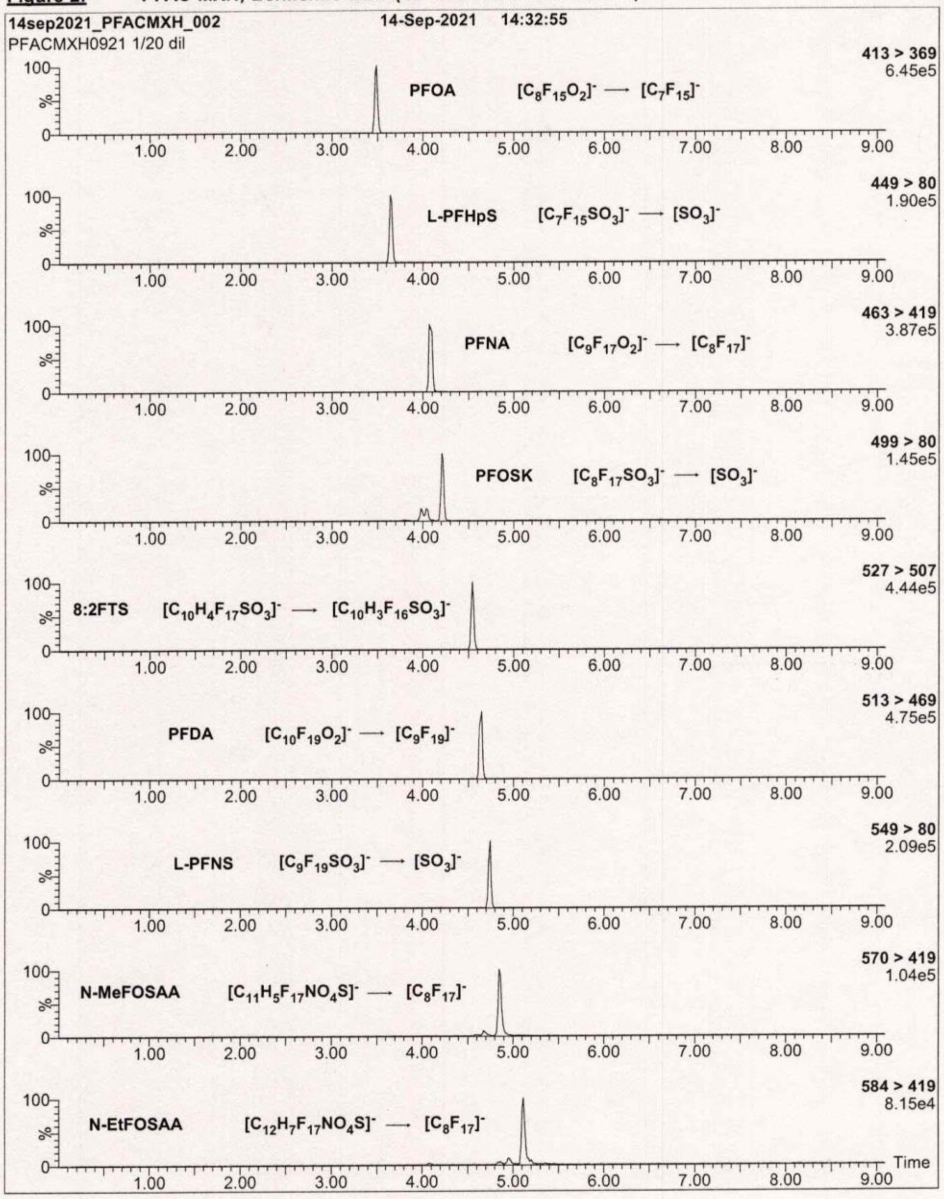
PFACMXJ0921 (2 of 5)
rev1

Figure 2: PFAC-MXH; LC/MS/MS Data (Selected MRM Transitions)



Form#:13, Issued 2004-11-10
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PFACMXH0921 (10 of 11)
rev0

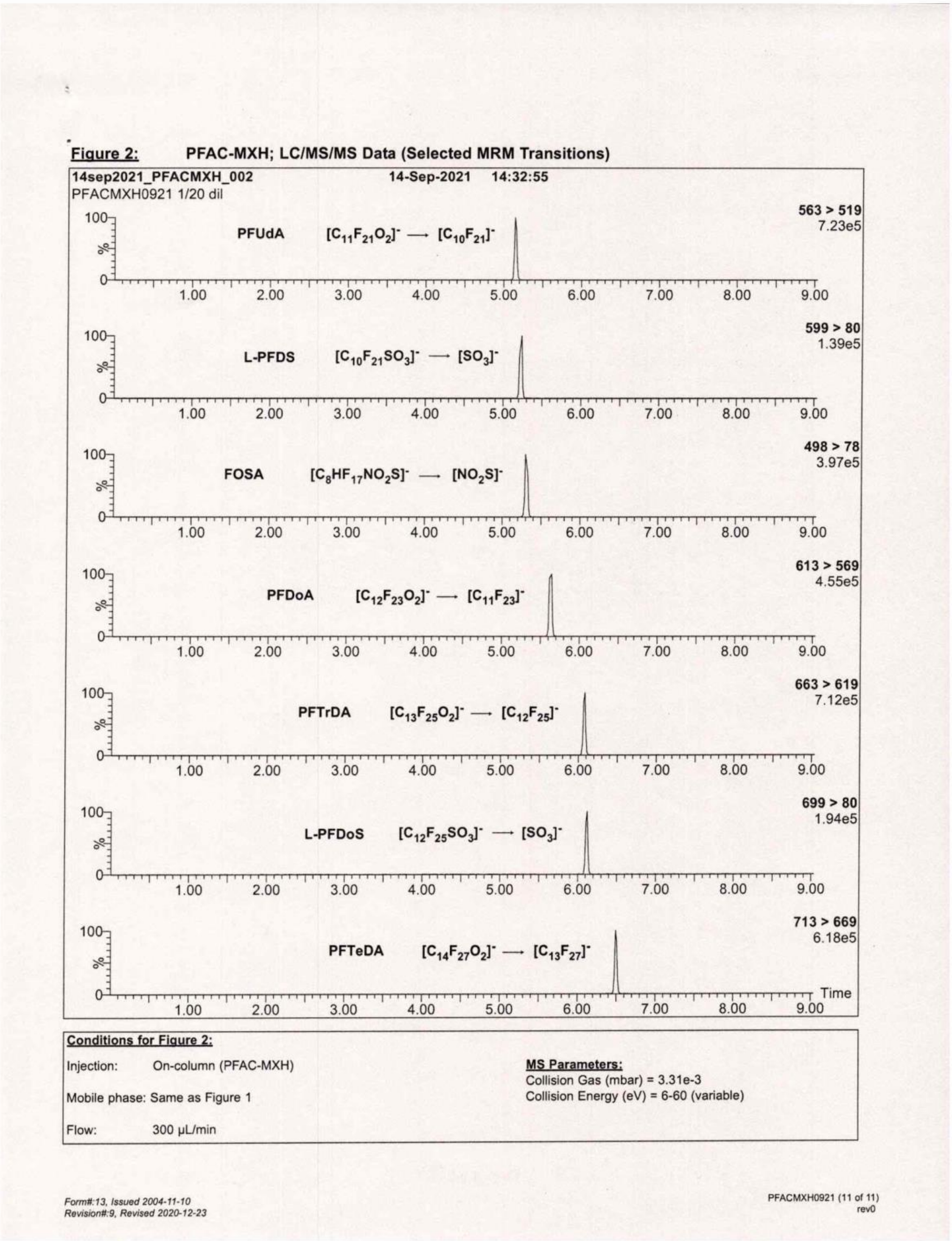

Figure 2: **PFAC-MXH; LC/MS/MS Data (Selected MRM Transitions)**

14sep2021_PFACMXH_002 **14-Sep-2021** **14:32:55**
PFACMXH0921 1/20 dil

Conditions for Figure 2:

Injection: On-column (PFAC-MXH)

Mobile phase: Same as Figure 1

Flow: 300 µL/min

MS Parameters:
Collision Gas (mbar) = 3.31e-3
Collision Energy (eV) = 6-60 (variable)

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Revision#:9, Revised 2020-12-23

PFACMXH0921 (11 of 11)
rev0

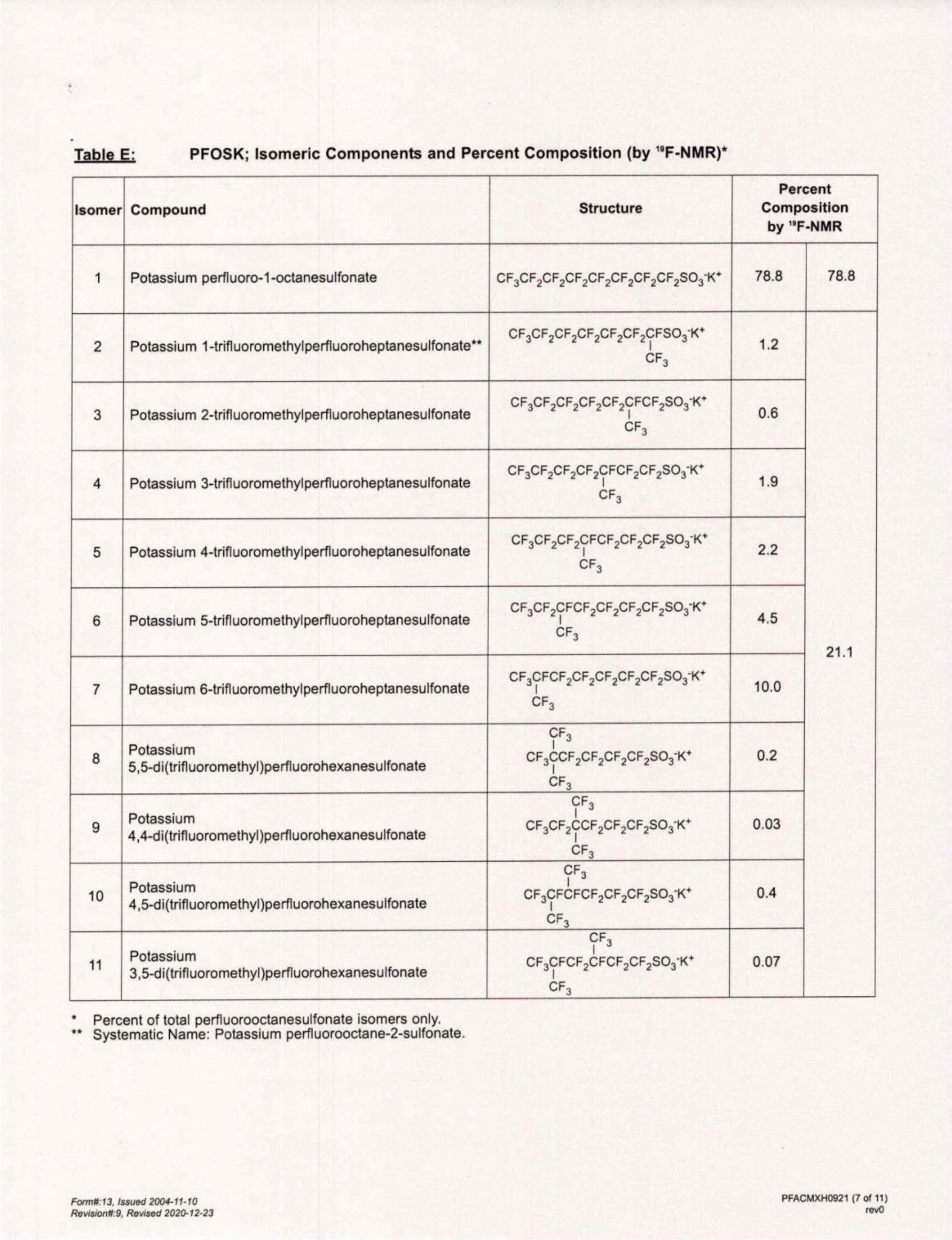

Table E: **PFOSK; Isomeric Components and Percent Composition (by ^{19}F-NMR)***

Isomer	Compound	Structure	Percent Composition by ^{19}F-NMR	
1	Potassium perfluoro-1-octanesulfonate	$CF_3CF_2CF_2CF_2CF_2CF_2CF_2CF_2SO_3^-K^+$	78.8	78.8
2	Potassium 1-trifluoromethylperfluoroheptanesulfonate**	$CF_3CF_2CF_2CF_2CF_2CF_2\underset{CF_3}{C}FSO_3^-K^+$	1.2	21.1
3	Potassium 2-trifluoromethylperfluoroheptanesulfonate	$CF_3CF_2CF_2CF_2CF_2\underset{CF_3}{C}FCF_2SO_3^-K^+$	0.6	
4	Potassium 3-trifluoromethylperfluoroheptanesulfonate	$CF_3CF_2CF_2CF_2\underset{CF_3}{C}FCF_2CF_2SO_3^-K^+$	1.9	
5	Potassium 4-trifluoromethylperfluoroheptanesulfonate	$CF_3CF_2CF_2\underset{CF_3}{C}FCF_2CF_2CF_2SO_3^-K^+$	2.2	
6	Potassium 5-trifluoromethylperfluoroheptanesulfonate	$CF_3CF_2\underset{CF_3}{C}FCF_2CF_2CF_2CF_2SO_3^-K^+$	4.5	
7	Potassium 6-trifluoromethylperfluoroheptanesulfonate	$CF_3\underset{CF_3}{C}FCF_2CF_2CF_2CF_2CF_2SO_3^-K^+$	10.0	
8	Potassium 5,5-di(trifluoromethyl)perfluorohexanesulfonate	$CF_3\overset{CF_3}{\underset{CF_3}{C}}CF_2CF_2CF_2CF_2SO_3^-K^+$	0.2	
9	Potassium 4,4-di(trifluoromethyl)perfluorohexanesulfonate	$CF_3CF_2\overset{CF_3}{\underset{CF_3}{C}}CF_2CF_2CF_2SO_3^-K^+$	0.03	
10	Potassium 4,5-di(trifluoromethyl)perfluorohexanesulfonate	$CF_3\underset{CF_3}{C}F\overset{CF_3}{C}FCF_2CF_2CF_2SO_3^-K^+$	0.4	
11	Potassium 3,5-di(trifluoromethyl)perfluorohexanesulfonate	$CF_3\underset{CF_3}{C}FCF_2\overset{CF_3}{C}FCF_2CF_2SO_3^-K^+$	0.07	

* Percent of total perfluorooctanesulfonate isomers only.
** Systematic Name: Potassium perfluorooctane-2-sulfonate.

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rev0

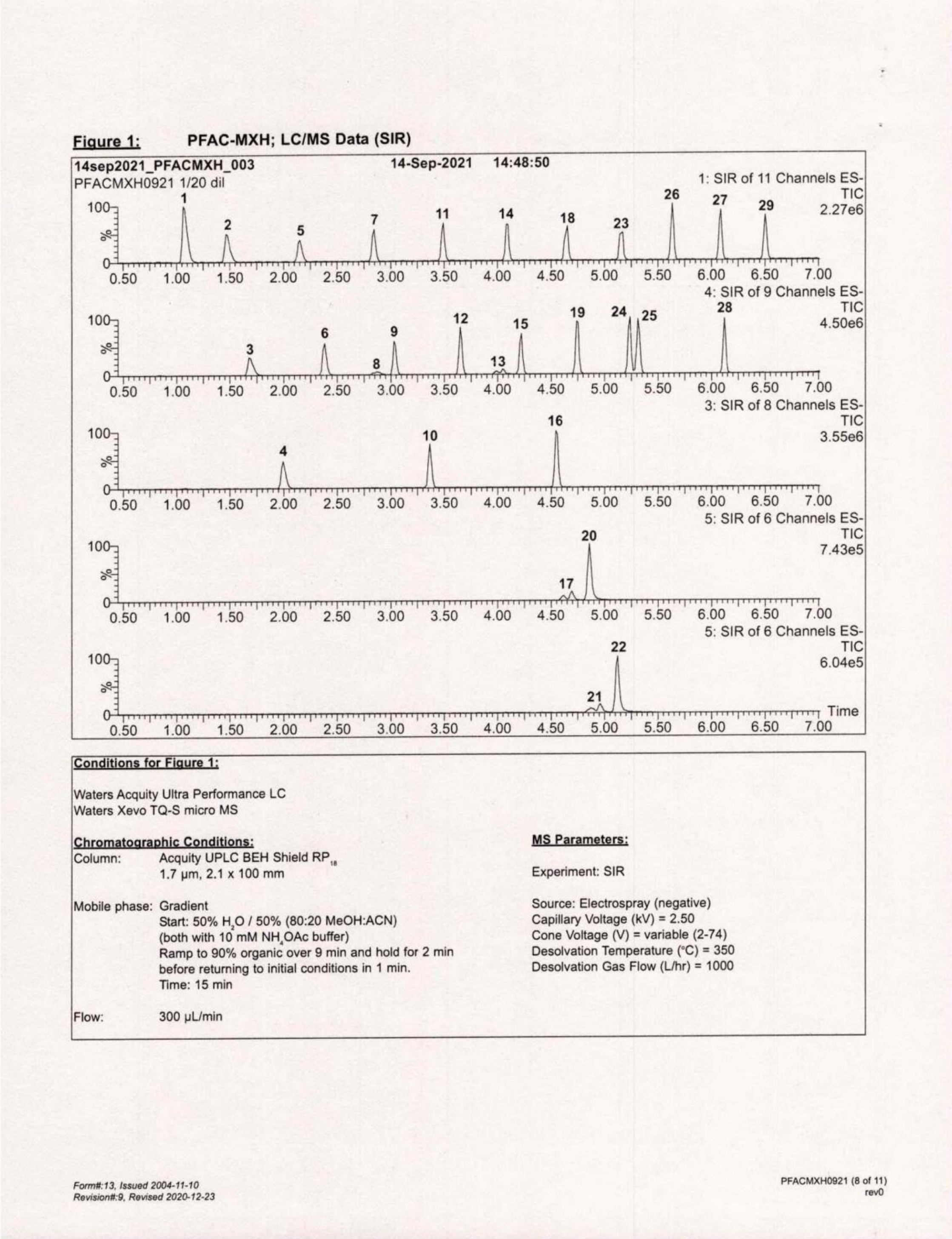

Figure 1: **PFAC-MXH; LC/MS Data (SIR)**

Conditions for Figure 1:

Waters Acquity Ultra Performance LC
Waters Xevo TQ-S micro MS

Chromatographic Conditions:

Column: Acquity UPLC BEH Shield RP_{18}
1.7 µm, 2.1 x 100 mm

Mobile phase: Gradient
Start: 50% H_2O / 50% (80:20 MeOH:ACN)
(both with 10 mM NH_4OAc buffer)
Ramp to 90% organic over 9 min and hold for 2 min
before returning to initial conditions in 1 min.
Time: 15 min

Flow: 300 µL/min

MS Parameters:

Experiment: SIR

Source: Electrospray (negative)
Capillary Voltage (kV) = 2.50
Cone Voltage (V) = variable (2-74)
Desolvation Temperature (°C) = 350
Desolvation Gas Flow (L/hr) = 1000

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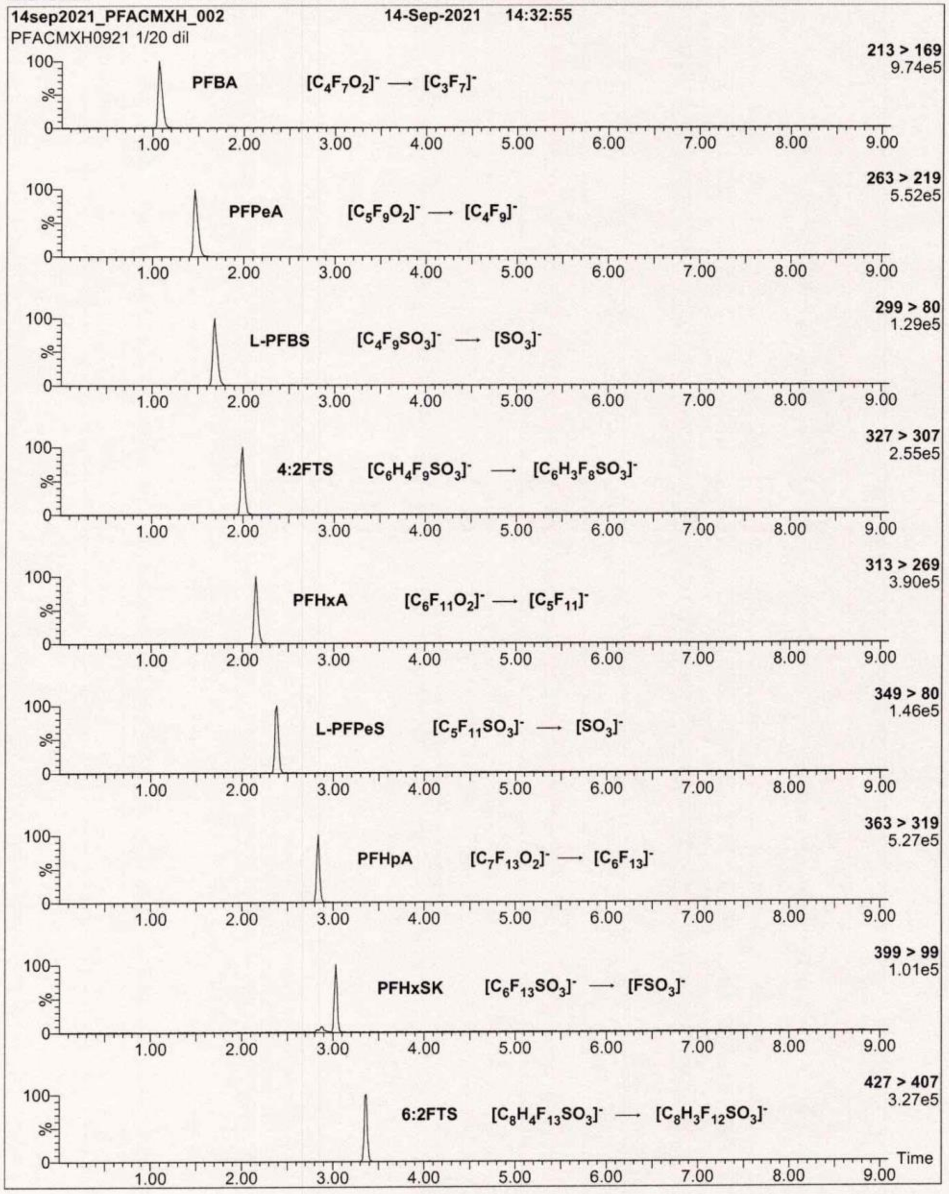
Figure 2: **PFAC-MXH; LC/MS/MS Data (Selected MRM Transitions)**



Form#:13, Issued 2004-11-10
Revision#:9, Revised 2020-12-23

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rev0

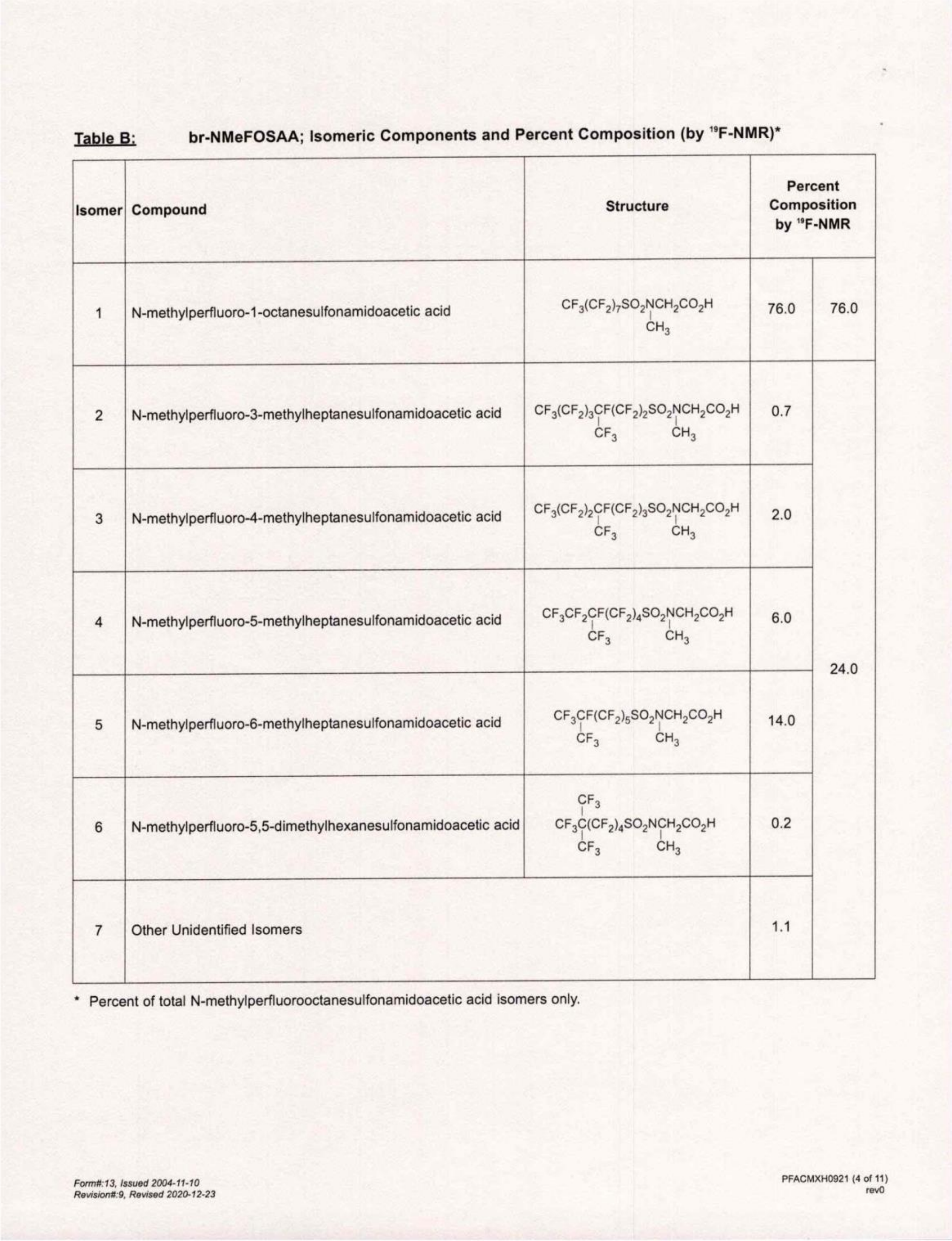

Table B: **br-NMeFOSAA; Isomeric Components and Percent Composition (by ^{19}F-NMR)***

Isomer	Compound	Structure	Percent Composition by ^{19}F-NMR	
1	N-methylperfluoro-1-octanesulfonamidoacetic acid	$CF_3(CF_2)_7SO_2\underset{CH_3}{\underset{\vert}{N}}CH_2CO_2H$	76.0	76.0
2	N-methylperfluoro-3-methylheptanesulfonamidoacetic acid	$CF_3(CF_2)_3\underset{CF_3}{\underset{\vert}{C}}F(CF_2)_2SO_2\underset{CH_3}{\underset{\vert}{N}}CH_2CO_2H$	0.7	24.0
3	N-methylperfluoro-4-methylheptanesulfonamidoacetic acid	$CF_3(CF_2)_2\underset{CF_3}{\underset{\vert}{C}}F(CF_2)_3SO_2\underset{CH_3}{\underset{\vert}{N}}CH_2CO_2H$	2.0	
4	N-methylperfluoro-5-methylheptanesulfonamidoacetic acid	$CF_3CF_2\underset{CF_3}{\underset{\vert}{C}}F(CF_2)_4SO_2\underset{CH_3}{\underset{\vert}{N}}CH_2CO_2H$	6.0	
5	N-methylperfluoro-6-methylheptanesulfonamidoacetic acid	$CF_3\underset{CF_3}{\underset{\vert}{C}}F(CF_2)_5SO_2\underset{CH_3}{\underset{\vert}{N}}CH_2CO_2H$	14.0	
6	N-methylperfluoro-5,5-dimethylhexanesulfonamidoacetic acid	$CF_3\overset{CF_3}{\overset{\vert}{\underset{CF_3}{\underset{\vert}{C}}}}(CF_2)_4SO_2\underset{CH_3}{\underset{\vert}{N}}CH_2CO_2H$	0.2	
7	Other Unidentified Isomers		1.1	

* Percent of total N-methylperfluorooctanesulfonamidoacetic acid isomers only.

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rev0

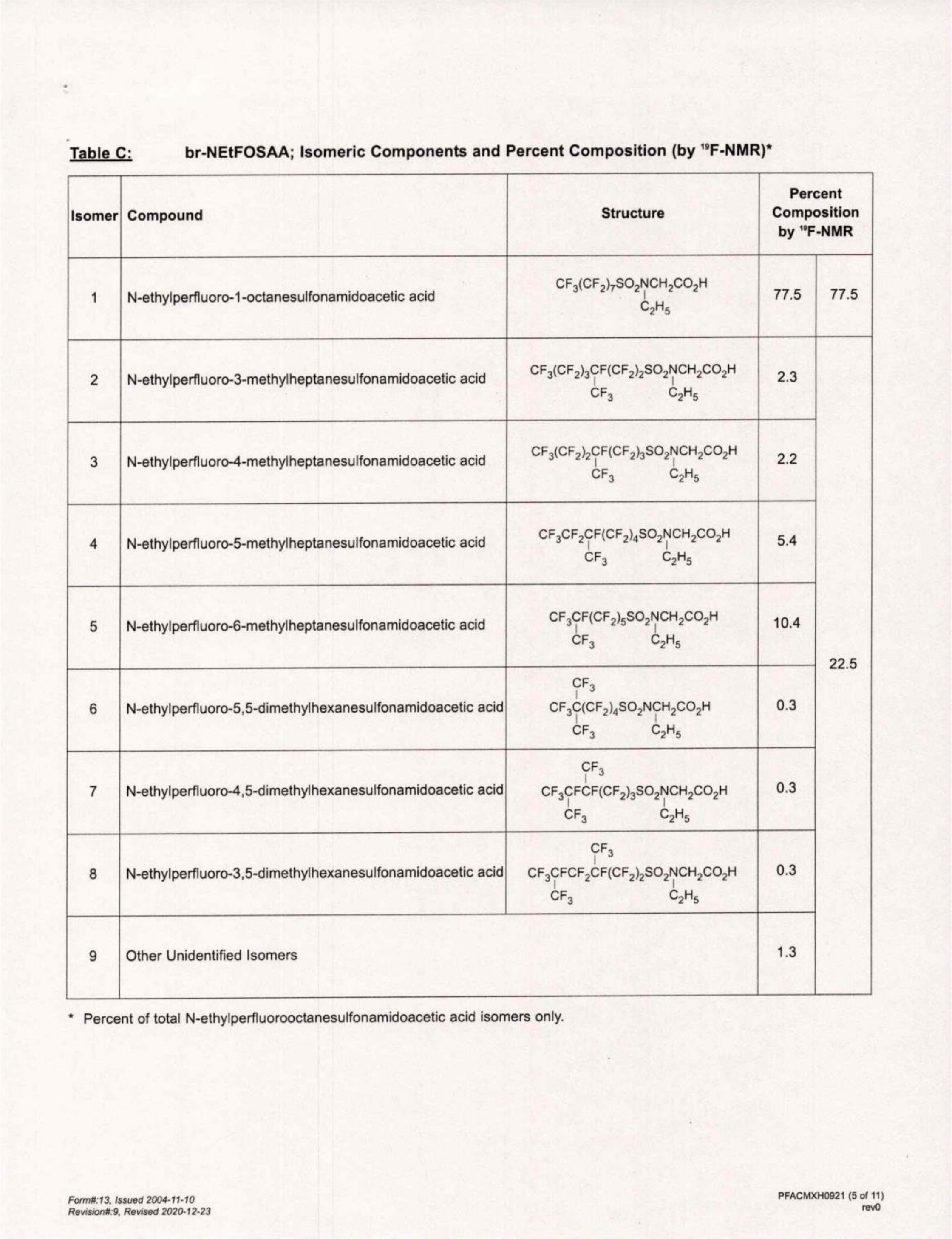

Table C: **br-NEtFOSAA; Isomeric Components and Percent Composition (by ^{19}F-NMR)***

Isomer	Compound	Structure	Percent Composition by ^{19}F-NMR	
1	N-ethylperfluoro-1-octanesulfonamidoacetic acid	$CF_3(CF_2)_7SO_2\underset{C_2H_5}{N}CH_2CO_2H$	77.5	77.5
2	N-ethylperfluoro-3-methylheptanesulfonamidoacetic acid	$CF_3(CF_2)_3\underset{CF_3}{C}F(CF_2)_2SO_2\underset{C_2H_5}{N}CH_2CO_2H$	2.3	22.5
3	N-ethylperfluoro-4-methylheptanesulfonamidoacetic acid	$CF_3(CF_2)_2\underset{CF_3}{C}F(CF_2)_3SO_2\underset{C_2H_5}{N}CH_2CO_2H$	2.2	
4	N-ethylperfluoro-5-methylheptanesulfonamidoacetic acid	$CF_3CF_2\underset{CF_3}{C}F(CF_2)_4SO_2\underset{C_2H_5}{N}CH_2CO_2H$	5.4	
5	N-ethylperfluoro-6-methylheptanesulfonamidoacetic acid	$CF_3\underset{CF_3}{C}F(CF_2)_5SO_2\underset{C_2H_5}{N}CH_2CO_2H$	10.4	
6	N-ethylperfluoro-5,5-dimethylhexanesulfonamidoacetic acid	$CF_3\overset{CF_3}{\underset{CF_3}{C}}(CF_2)_4SO_2\underset{C_2H_5}{N}CH_2CO_2H$	0.3	
7	N-ethylperfluoro-4,5-dimethylhexanesulfonamidoacetic acid	$CF_3\underset{CF_3}{C}F\overset{CF_3}{C}F(CF_2)_3SO_2\underset{C_2H_5}{N}CH_2CO_2H$	0.3	
8	N-ethylperfluoro-3,5-dimethylhexanesulfonamidoacetic acid	$CF_3\underset{CF_3}{C}FCF_2\overset{CF_3}{C}F(CF_2)_2SO_2\underset{C_2H_5}{N}CH_2CO_2H$	0.3	
9	Other Unidentified Isomers		1.3	

* Percent of total N-ethylperfluorooctanesulfonamidoacetic acid isomers only.

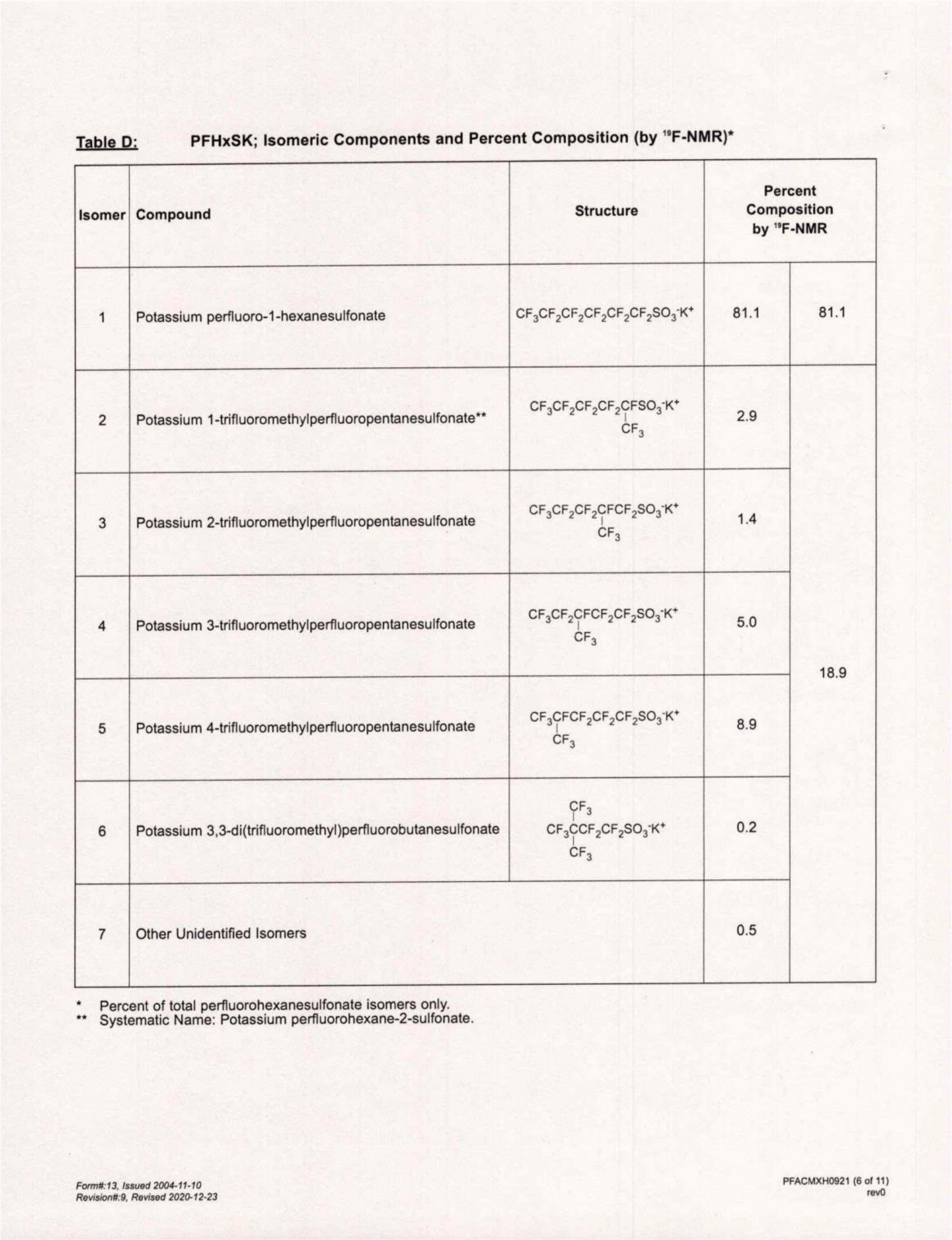

Table D: **PFHxSK; Isomeric Components and Percent Composition (by ^{19}F-NMR)***

Isomer	Compound	Structure	Percent Composition by ^{19}F-NMR	
1	Potassium perfluoro-1-hexanesulfonate	$CF_3CF_2CF_2CF_2CF_2CF_2SO_3^-K^+$	81.1	81.1
2	Potassium 1-trifluoromethylperfluoropentanesulfonate**	$CF_3CF_2CF_2CF_2\underset{CF_3}{\underset{\vert}{C}}FSO_3^-K^+$	2.9	18.9
3	Potassium 2-trifluoromethylperfluoropentanesulfonate	$CF_3CF_2CF_2\underset{CF_3}{\underset{\vert}{C}}FCF_2SO_3^-K^+$	1.4	
4	Potassium 3-trifluoromethylperfluoropentanesulfonate	$CF_3CF_2\underset{CF_3}{\underset{\vert}{C}}FCF_2CF_2SO_3^-K^+$	5.0	
5	Potassium 4-trifluoromethylperfluoropentanesulfonate	$CF_3\underset{CF_3}{\underset{\vert}{C}}FCF_2CF_2CF_2SO_3^-K^+$	8.9	
6	Potassium 3,3-di(trifluoromethyl)perfluorobutanesulfonate	$CF_3\overset{CF_3}{\overset{\vert}{\underset{CF_3}{\underset{\vert}{C}}}}CF_2CF_2SO_3^-K^+$	0.2	
7	Other Unidentified Isomers		0.5	

* Percent of total perfluorohexanesulfonate isomers only.
** Systematic Name: Potassium perfluorohexane-2-sulfonate.

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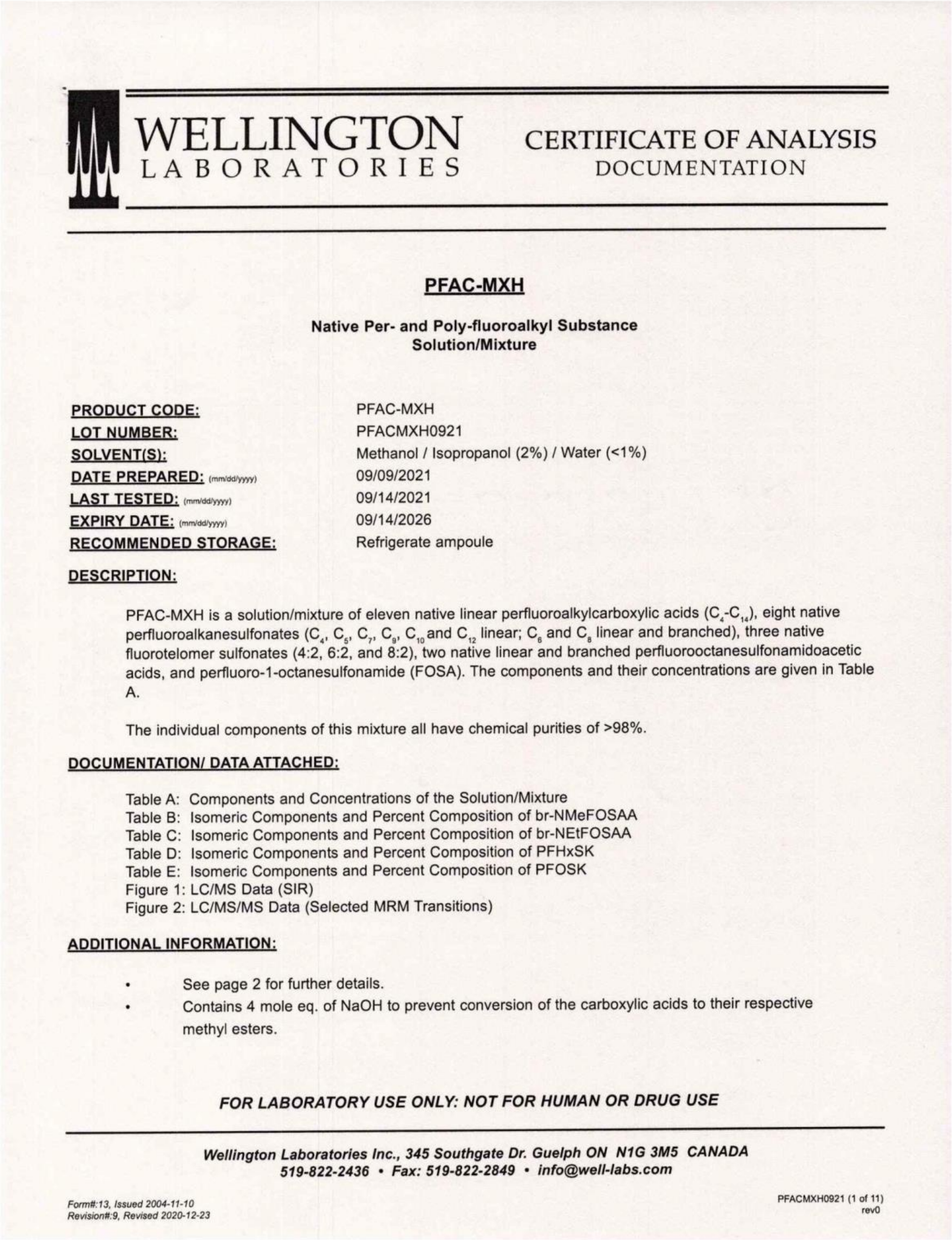

WELLINGTON
LABORATORIES

CERTIFICATE OF ANALYSIS
DOCUMENTATION

PFAC-MXH

Native Per- and Poly-fluoroalkyl Substance Solution/Mixture

PRODUCT CODE:	PFAC-MXH
LOT NUMBER:	PFACMXH0921
SOLVENT(S):	Methanol / Isopropanol (2%) / Water (<1%)
DATE PREPARED: (mm/dd/yyyy)	09/09/2021
LAST TESTED: (mm/dd/yyyy)	09/14/2021
EXPIRY DATE: (mm/dd/yyyy)	09/14/2026
RECOMMENDED STORAGE:	Refrigerate ampoule

DESCRIPTION:

PFAC-MXH is a solution/mixture of eleven native linear perfluoroalkylcarboxylic acids (C_4-C_{14}), eight native perfluoroalkanesulfonates (C_4, C_5, C_7, C_9, C_{10} and C_{12} linear; C_6 and C_8 linear and branched), three native fluorotelomer sulfonates (4:2, 6:2, and 8:2), two native linear and branched perfluorooctanesulfonamidoacetic acids, and perfluoro-1-octanesulfonamide (FOSA). The components and their concentrations are given in Table A.

The individual components of this mixture all have chemical purities of >98%.

DOCUMENTATION/ DATA ATTACHED:

Table A: Components and Concentrations of the Solution/Mixture
Table B: Isomeric Components and Percent Composition of br-NMeFOSAA
Table C: Isomeric Components and Percent Composition of br-NEtFOSAA
Table D: Isomeric Components and Percent Composition of PFHxSK
Table E: Isomeric Components and Percent Composition of PFOSK
Figure 1: LC/MS Data (SIR)
Figure 2: LC/MS/MS Data (Selected MRM Transitions)

ADDITIONAL INFORMATION:

- See page 2 for further details.
- Contains 4 mole eq. of NaOH to prevent conversion of the carboxylic acids to their respective methyl esters.

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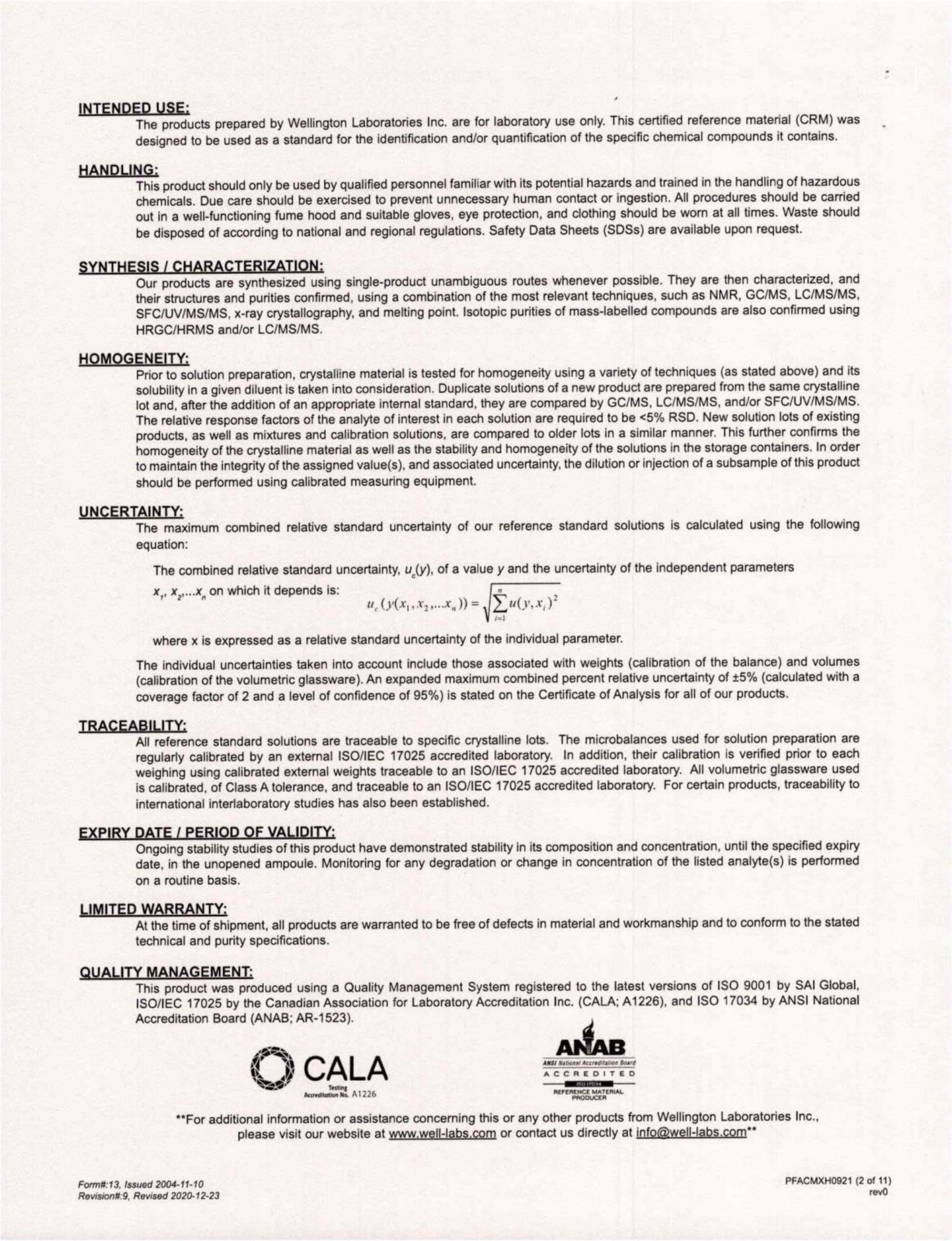
rev0



INTENDED USE:

The products prepared by Wellington Laboratories Inc. are for laboratory use only. This certified reference material (CRM) was designed to be used as a standard for the identification and/or quantification of the specific chemical compounds it contains.

HANDLING:

This product should only be used by qualified personnel familiar with its potential hazards and trained in the handling of hazardous chemicals. Due care should be exercised to prevent unnecessary human contact or ingestion. All procedures should be carried out in a well-functioning fume hood and suitable gloves, eye protection, and clothing should be worn at all times. Waste should be disposed of according to national and regional regulations. Safety Data Sheets (SDSs) are available upon request.

SYNTHESIS / CHARACTERIZATION:

Our products are synthesized using single-product unambiguous routes whenever possible. They are then characterized, and their structures and purities confirmed, using a combination of the most relevant techniques, such as NMR, GC/MS, LC/MS/MS, SFC/UV/MS/MS, x-ray crystallography, and melting point. Isotopic purities of mass-labelled compounds are also confirmed using HRGC/HRMS and/or LC/MS/MS.

HOMOGENEITY:

Prior to solution preparation, crystalline material is tested for homogeneity using a variety of techniques (as stated above) and its solubility in a given diluent is taken into consideration. Duplicate solutions of a new product are prepared from the same crystalline lot and, after the addition of an appropriate internal standard, they are compared by GC/MS, LC/MS/MS, and/or SFC/UV/MS/MS. The relative response factors of the analyte of interest in each solution are required to be <5% RSD. New solution lots of existing products, as well as mixtures and calibration solutions, are compared to older lots in a similar manner. This further confirms the homogeneity of the crystalline material as well as the stability and homogeneity of the solutions in the storage containers. In order to maintain the integrity of the assigned value(s), and associated uncertainty, the dilution or injection of a subsample of this product should be performed using calibrated measuring equipment.

UNCERTAINTY:

The maximum combined relative standard uncertainty of our reference standard solutions is calculated using the following equation:

The combined relative standard uncertainty, $u_c(y)$, of a value y and the uncertainty of the independent parameters $x_1, x_2, \ldots x_n$ on which it depends is:

$$u_c(y(x_1, x_2, \ldots x_n)) = \sqrt{\sum_{i=1}^{n} u(y, x_i)^2}$$

where x is expressed as a relative standard uncertainty of the individual parameter.

The individual uncertainties taken into account include those associated with weights (calibration of the balance) and volumes (calibration of the volumetric glassware). An expanded maximum combined percent relative uncertainty of ±5% (calculated with a coverage factor of 2 and a level of confidence of 95%) is stated on the Certificate of Analysis for all of our products.

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All reference standard solutions are traceable to specific crystalline lots. The microbalances used for solution preparation are regularly calibrated by an external ISO/IEC 17025 accredited laboratory. In addition, their calibration is verified prior to each weighing using calibrated external weights traceable to an ISO/IEC 17025 accredited laboratory. All volumetric glassware used is calibrated, of Class A tolerance, and traceable to an ISO/IEC 17025 accredited laboratory. For certain products, traceability to international interlaboratory studies has also been established.

EXPIRY DATE / PERIOD OF VALIDITY:

Ongoing stability studies of this product have demonstrated stability in its composition and concentration, until the specified expiry date, in the unopened ampoule. Monitoring for any degradation or change in concentration of the listed analyte(s) is performed on a routine basis.

LIMITED WARRANTY:

At the time of shipment, all products are warranted to be free of defects in material and workmanship and to conform to the stated technical and purity specifications.

QUALITY MANAGEMENT:

This product was produced using a Quality Management System registered to the latest versions of ISO 9001 by SAI Global, ISO/IEC 17025 by the Canadian Association for Laboratory Accreditation Inc. (CALA; A1226), and ISO 17034 by ANSI National Accreditation Board (ANAB; AR-1523).

For additional information or assistance concerning this or any other products from Wellington Laboratories Inc., please visit our website at www.well-labs.com or contact us directly at info@well-labs.com

Form#:13, Issued 2004-11-10
Revision#:9, Revised 2020-12-23

PFACMXH0921 (2 of 11)
rev0

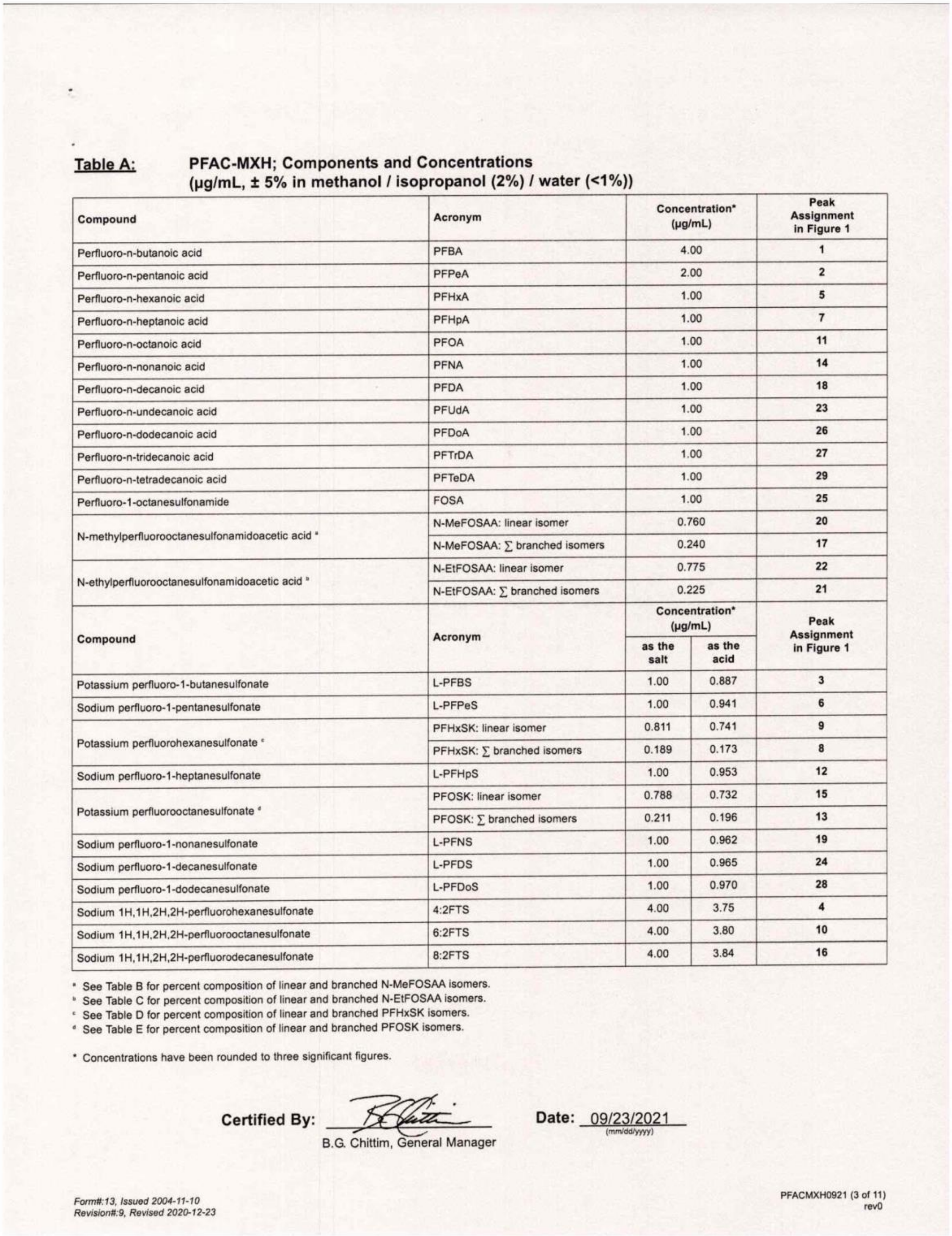

Table A: **PFAC-MXH; Components and Concentrations (µg/mL, ± 5% in methanol / isopropanol (2%) / water (<1%))**

Compound	Acronym	Concentration* (µg/mL)	Peak Assignment in Figure 1
Perfluoro-n-butanoic acid	PFBA	4.00	**1**
Perfluoro-n-pentanoic acid	PFPeA	2.00	**2**
Perfluoro-n-hexanoic acid	PFHxA	1.00	**5**
Perfluoro-n-heptanoic acid	PFHpA	1.00	**7**
Perfluoro-n-octanoic acid	PFOA	1.00	**11**
Perfluoro-n-nonanoic acid	PFNA	1.00	**14**
Perfluoro-n-decanoic acid	PFDA	1.00	**18**
Perfluoro-n-undecanoic acid	PFUdA	1.00	**23**
Perfluoro-n-dodecanoic acid	PFDoA	1.00	**26**
Perfluoro-n-tridecanoic acid	PFTrDA	1.00	**27**
Perfluoro-n-tetradecanoic acid	PFTeDA	1.00	**29**
Perfluoro-1-octanesulfonamide	FOSA	1.00	**25**
N-methylperfluorooctanesulfonamidoacetic acid [a]	N-MeFOSAA: linear isomer	0.760	**20**
	N-MeFOSAA: ∑ branched isomers	0.240	**17**
N-ethylperfluorooctanesulfonamidoacetic acid [b]	N-EtFOSAA: linear isomer	0.775	**22**
	N-EtFOSAA: ∑ branched isomers	0.225	**21**

Compound	Acronym	Concentration* (µg/mL)		Peak Assignment in Figure 1
		as the salt	as the acid	
Potassium perfluoro-1-butanesulfonate	L-PFBS	1.00	0.887	**3**
Sodium perfluoro-1-pentanesulfonate	L-PFPeS	1.00	0.941	**6**
Potassium perfluorohexanesulfonate [c]	PFHxSK: linear isomer	0.811	0.741	**9**
	PFHxSK: ∑ branched isomers	0.189	0.173	**8**
Sodium perfluoro-1-heptanesulfonate	L-PFHpS	1.00	0.953	**12**
Potassium perfluorooctanesulfonate [d]	PFOSK: linear isomer	0.788	0.732	**15**
	PFOSK: ∑ branched isomers	0.211	0.196	**13**
Sodium perfluoro-1-nonanesulfonate	L-PFNS	1.00	0.962	**19**
Sodium perfluoro-1-decanesulfonate	L-PFDS	1.00	0.965	**24**
Sodium perfluoro-1-dodecanesulfonate	L-PFDoS	1.00	0.970	**28**
Sodium 1H,1H,2H,2H-perfluorohexanesulfonate	4:2FTS	4.00	3.75	**4**
Sodium 1H,1H,2H,2H-perfluorooctanesulfonate	6:2FTS	4.00	3.80	**10**
Sodium 1H,1H,2H,2H-perfluorodecanesulfonate	8:2FTS	4.00	3.84	**16**

[a] See Table B for percent composition of linear and branched N-MeFOSAA isomers.
[b] See Table C for percent composition of linear and branched N-EtFOSAA isomers.
[c] See Table D for percent composition of linear and branched PFHxSK isomers.
[d] See Table E for percent composition of linear and branched PFOSK isomers.

* Concentrations have been rounded to three significant figures.

Certified By: ____________ **Date:** 09/23/2021 (mm/dd/yyyy)
B.G. Chittim, General Manager

Form#:13, Issued 2004-11-10
Revision#:9, Revised 2020-12-23

PFACMXH0921 (3 of 11)
rev0

YORK
ANALYTICAL LABORATORIES, INC.

Analytical Standard Record

Standard ID: **Y22B201**

Description:	PFAC-MXH STOCK PFAS EPA 1633	Prepared:	02/17/2022
Standard Type:	Other	**Expires:**	**09/14/2026**
Solvent:	MeOH/IPA/H2O	Prepared By:	Robert Q. Bradley
Final Volume (mls):	1	Department:	PFAS
Vials:	1	Lot No.:	PFACMXH0921
Vendor:	Wellington Laboratories		

Comments:

Analyte	CAS Number	Concentration	Units
1H,1H,2H,2H-Perfluorodecanesulfonic acid	39108-34-4	3.84	ug/mL
1H,1H,2H,2H-Perfluorohexanesulfonic acid	757124-72-4	3.75	ug/mL
1H,1H,2H,2H-Perfluorooctanesulfonic acid	27619-97-2	3.8	ug/mL
N-EtFOSAA	2991-50-6	1	ug/mL
N-MeFOSAA	2355-31-9	1	ug/mL
Perfluoro-1-decanesulfonic acid (PFDS)	335-77-3	0.965	ug/mL
Perfluoro-1-heptanesulfonic acid (PFHpS)	375-92-8	0.953	ug/mL
Perfluoro-1-nonanesulfonic acid (PFNS)	68259-12-1	0.962	ug/mL
Perfluoro-1-octanesulfonamide (FOSA)	754-91-6	1	ug/mL
Perfluoro-1-pentanesulfonate (PFPeS)	2706-91-4	0.941	ug/mL
Perfluorobutanesulfonic acid (PFBS)	375-73-5	0.887	ug/mL
Perfluorodecanesulfonic acid(PFDS)	335-77-3	0.965	ug/mL
Perfluorodecanoic acid (PFDA)	335-76-2	1	ug/mL
Perfluorododecanoic acid (PFDoA)	307-55-1	1	ug/mL
Perfluoroheptanoic acid (PFHpA)	375-85-9	1	ug/mL
Perfluorohexanesulfonic acid (PFHxS)	355-46-4	0.914	ug/mL
Perfluorohexanoic acid (PFHxA)	307-24-4	1	ug/mL
Perfluoro-n-butanoic acid (PFBA)	375-22-4	4	ug/mL
Perfluorononanoic acid (PFNA)	375-95-1	1	ug/mL
Perfluorooctanesulfonic acid (PFOS)	1763-23-1	0.928	ug/mL
Perfluorooctanoic acid (PFOA)	335-67-1	1	ug/mL
Perfluoropentanoic acid (PFPeA)	2706-90-3	1	ug/mL
Perfluorotetradecanoic acid (PFTA)	376-06-7	1	ug/mL
Perfluorotridecanoic acid (PFTrDA)	72629-94-8	1	ug/mL
Perfluoroundecanoic acid (PFUnA)	2058-94-8	1	ug/mL

Reviewed By Date

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Attachment 4 – Calibration Concentrations, nominal

Calibration Solutions (ng/mL) Compound

CS1 (LOQ) CS2 Perfluoroalkyl carboxylic			**CS3**	**CS4 (CV[1])**	**CS5**	**CS6**	**CS7[2]**
acids							
PFBA	0.8	2	5	10	20	50	250
PFPeA	0.4	1	2.5	5	10	25	125
PFHxA	0.2	0.5	1.25	2.5	5	12.5	62.5
PFHpA	0.2	0.5	1.25	2.5	5	12.5	62.5
PFOA	0.2	0.5	1.25	2.5	5	12.5	62.5
PFNA	0.2	0.5	1.25	2.5	5	12.5	62.5
PFDA	0.2	0.5	1.25	2.5	5	12.5	62.5
PFUnA	0.2	0.5	1.25	2.5	5	12.5	62.5
PFDoA	0.2	0.5	1.25	2.5	5	12.5	62.5
PFTrDA	0.2	0.5	1.25	2.5	5	12.5	62.5
PFTeDA	0.2	0.5	1.25	2.5	5	12.5	62.5
Perfluoroalkyl sulfonic acids							
PFBS	0.2	0.5	1.25	2.5	5	12.5	62.5
PFPeS	0.2	0.5	1.25	2.5	5	12.5	62.5
PFHxS	0.2	0.5	1.25	2.5	5	12.5	62.5
PFHpS	0.2	0.5	1.25	2.5	5	12.5	62.5
PFOS	0.2	0.5	1.25	2.5	5	12.5	62.5
PFNS	0.2	0.5	1.25	2.5	5	12.5	62.5
PFDS	0.2	0.5	1.25	2.5	5	12.5	62.5
PFDoS	0.2	0.5	1.25	2.5	5	12.5	62.5
Fluorotelomer sulfonic acids							
4:2FTS	0.8	2	5	10	20	50	NA
6:2FTS	0.8	2	5	10	20	50	NA
8:2FTS	0.8	2	5	10	20	50	NA
Perfluorooctane sulfonamides							
PFOSA	0.2	0.5	1.25	2.5	5	12.5	62.5
NMeFOSA	0.2	0.5	1.25	2.5	5	12.5	62.5
NEtFOSA	0.2	0.5	1.25	2.5	5	12.5	62.5
Perfluorooctane sulfonamidoacetic acids							
NMeFOSAA	0.2	0.5	1.25	2.5	5	12.5	62.5
NEtFOSAA	0.2	0.5	1.25	2.5	5	12.5	62.5
Perfluorooctane sulfonamide ethanols							
NMeFOSE	2	5	12.5	25	50	125	625
NEtFOSE	2	5	12.5	25	50	125	625
Per- and polyfluoroether carboxylic acids							
HFPO-DA	0.8	2	5	10	20	50	250
ADONA	0.8	2	5	10	20	50	250
PFMPA	0.4	1	2.5	5	10	25	125
PFMBA	0.4	1	2.5	5	10	25	125
NFDHA	0.4	1	2.5	5	10	25	125
Ether sulfonic acids							
9Cl-PF3ONS	0.8	2	5	10	20	50	250
11Cl-PF3OUdS	0.8	2	5	10	20	50	250
PFEESA	0.4	1	2.5	5	10	25	125

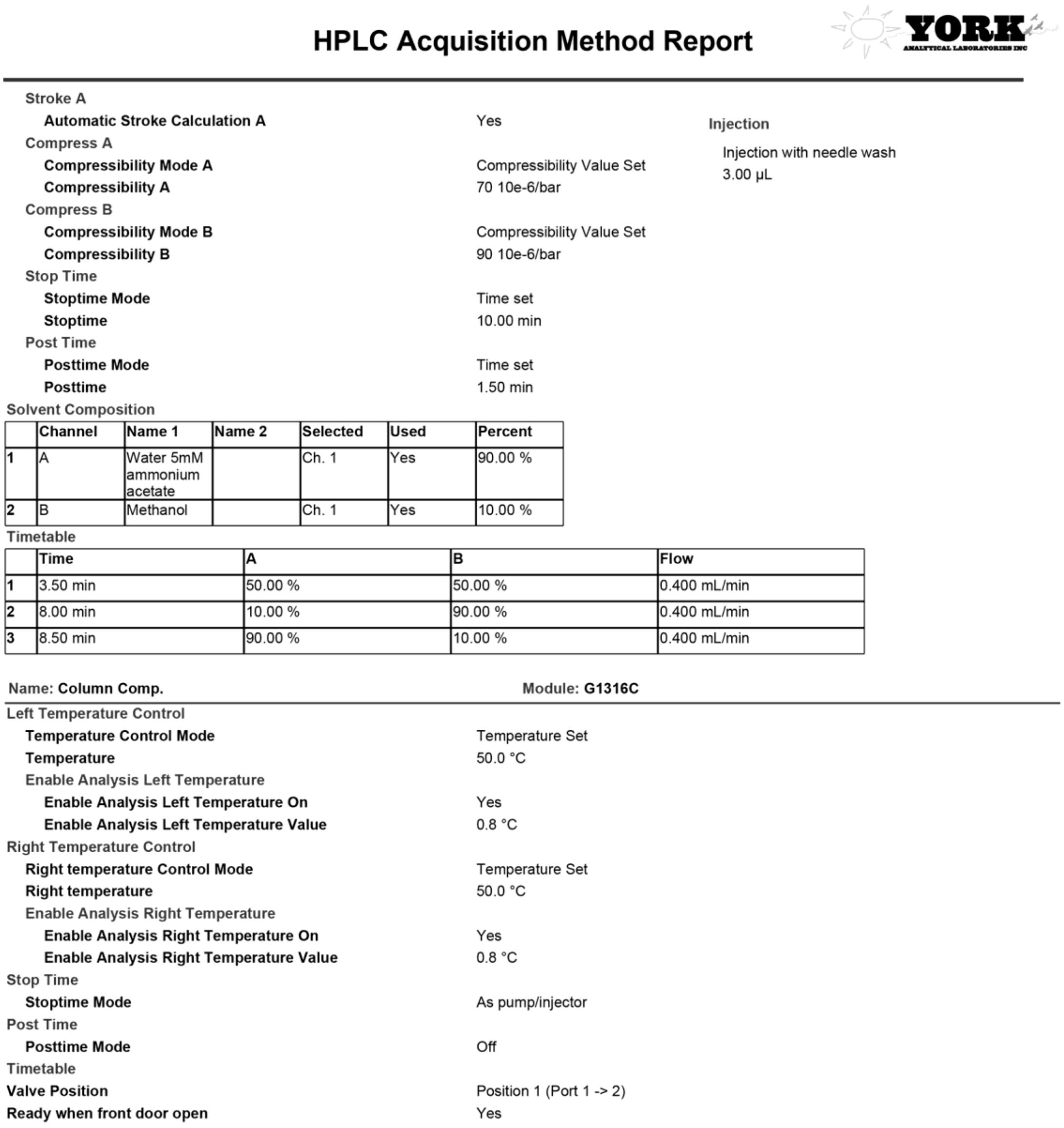
Calibration Solutions (ng/mL) Compound

CS1 (LOQ) CS2 Fluorote	**lomer carboxylic**		**CS3**	**CS4 (CV[1])**	**CS5**	**CS6**	**CS7[2]**
acids							
3:3FTCA	1.0	2.5	6.26	12.5	25	62.4	312
5:3FTCA	5.0	12.5	31.3	62.5	125	312	1560
7:3FTCA	5.0	12.5	31.3	62.5	125	312	1560
Extracted Internal Standard (EIS) Analytes							
$^{13}C_4$-PFBA	10	10	10	10	10	10	10
$^{13}C_5$-PFPeA	5	5	5	5	5	5	5
$^{13}C_5$-PFHxA	2.5	2.5	2.5	2.5	2.5	2.5	2.5
$^{13}C_4$-PFHpA	2.5	2.5	2.5	2.5	2.5	2.5	2.5
$^{13}C_8$-PFOA	2.5	2.5	2.5	2.5	2.5	2.5	2.5
$^{13}C_9$-PFNA	1.25	1.25	1.25	1.25	1.25	1.25	1.25
$^{13}C_6$-PFDA	1.25	1.25	1.25	1.25	1.25	1.25	1.25
$^{13}C_7$-PFUnA	1.25	1.25	1.25	1.25	1.25	1.25	1.25
$^{13}C_2$-PFDoA	1.25	1.25	1.25	1.25	1.25	1.25	1.25
$^{13}C_2$-PFTeDA	1.25	1.25	1.25	1.25	1.25	1.25	1.25
$^{13}C_3$-PFBS	2.5	2.5	2.5	2.5	2.5	2.5	2.5
$^{13}C_3$-PFHxS	2.5	2.5	2.5	2.5	2.5	2.5	2.5
$^{13}C_8$-PFOS	2.5	2.5	2.5	2.5	2.5	2.5	2.5
$^{13}C_2$-4:2FTS	5	5	5	5	5	5	5
$^{13}C_2$-6:2FTS	5	5	5	5	5	5	5
$^{13}C_2$-8:2FTS	5	5	5	5	5	5	5
$^{13}C_8$-PFOSA	2.5	2.5	2.5	2.5	2.5	2.5	2.5
D_3-NMeFOSA	2.5	2.5	2.5	2.5	2.5	2.5	2.5
D_5-NEtFOSA	2.5	2.5	2.5	2.5	2.5	2.5	2.5
D_3-NMeFOSAA	5	5	5	5	5	5	5
D_5-NEtFOSAA	5	5	5	5	5	5	5
D_7-NMeFOSE	25	25	25	25	25	25	25
D_9-NEtFOSE	25	25	25	25	25	25	25
$^{13}C_3$-HFPO-DA	10	10	10	10	10	10	10
Non-extracted Internal Standard (NIS) Analytes							
$^{13}C_3$-PFBA	5	5	5	5	5	5	5
$^{13}C_2$-PFHxA	2.5	2.5	2.5	2.5	2.5	2.5	2.5
$^{13}C_4$-PFOA	2.5	2.5	2.5	2.5	2.5	2.5	2.5
$^{13}C_5$-PFNA	1.25	1.25	1.25	1.25	1.25	1.25	1.25
$^{13}C_2$-PFDA	1.25	1.25	1.25	1.25	1.25	1.25	1.25
$^{18}O_2$-PFHxS	2.5	2.5	2.5	2.5	2.5	2.5	2.5
$^{13}C_4$-PFOS	2.5	2.5	2.5	2.5	2.5	2.5	2.5

[1] This calibration point is used as the calibration verification (CV)

[2] A minimum of six contiguous calibrations standards are required for linear models and a minimum of seven calibration standards are required for second-order models.

Attachment 5 -HPLC Method Parameters



HPLC Acquisition Method Report

Stroke A
Automatic Stroke Calculation A Yes
Compress A
Compressibility Mode A Compressibility Value Set
Compressibility A 70 10e-6/bar
Compress B
Compressibility Mode B Compressibility Value Set
Compressibility B 90 10e-6/bar
Stop Time
Stoptime Mode Time set
Stoptime 10.00 min
Post Time
Posttime Mode Time set
Posttime 1.50 min

Injection
Injection with needle wash
3.00 µL

Solvent Composition

	Channel	Name 1	Name 2	Selected	Used	Percent
1	A	Water 5mM ammonium acetate		Ch. 1	Yes	90.00 %
2	B	Methanol		Ch. 1	Yes	10.00 %

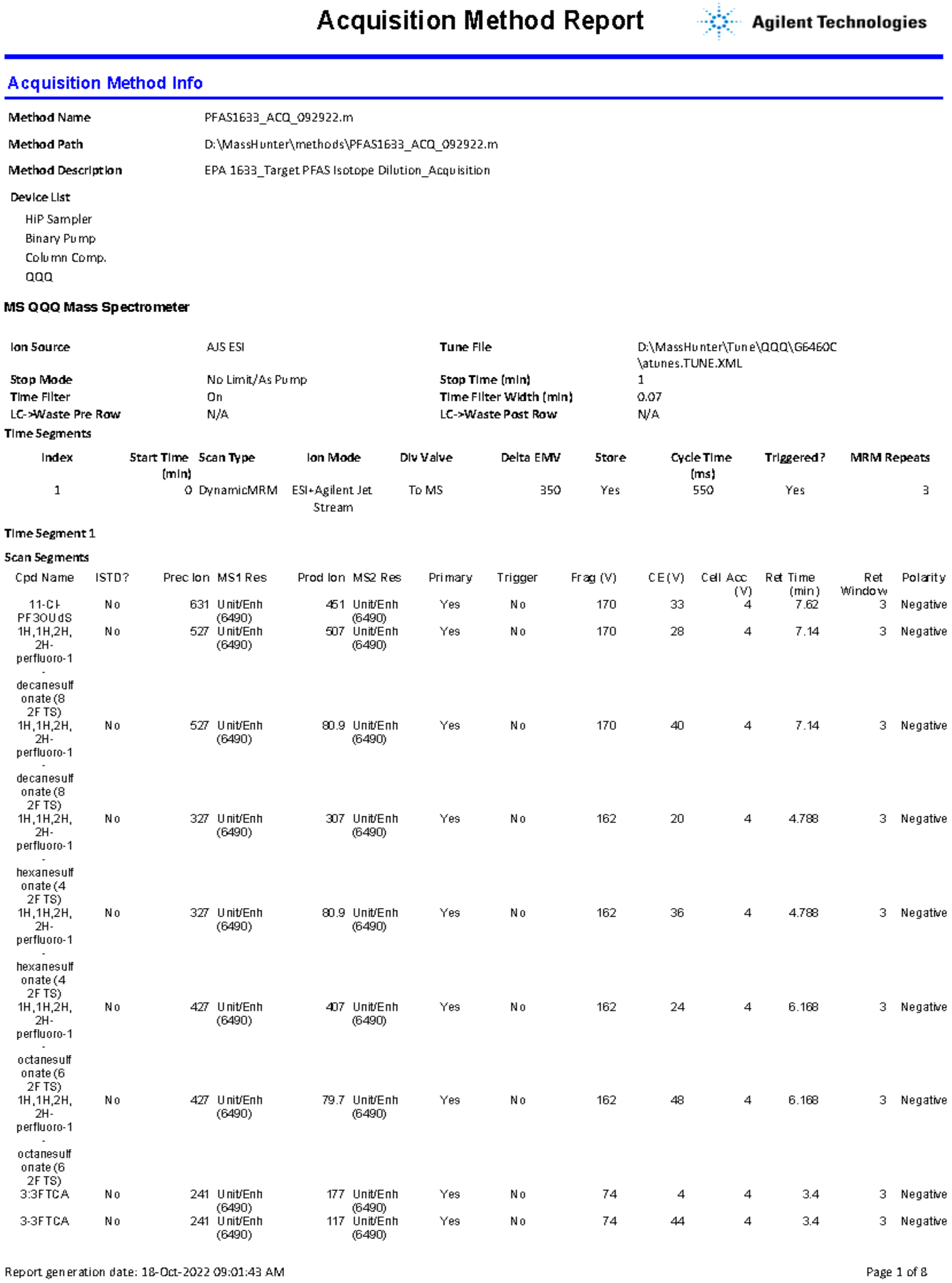
Timetable

	Time	A	B	Flow
1	3.50 min	50.00 %	50.00 %	0.400 mL/min
2	8.00 min	10.00 %	90.00 %	0.400 mL/min
3	8.50 min	90.00 %	10.00 %	0.400 mL/min

Name: **Column Comp.** Module: **G1316C**

Left Temperature Control
Temperature Control Mode Temperature Set
Temperature 50.0 °C
Enable Analysis Left Temperature
Enable Analysis Left Temperature On Yes
Enable Analysis Left Temperature Value 0.8 °C
Right Temperature Control
Right temperature Control Mode Temperature Set
Right temperature 50.0 °C
Enable Analysis Right Temperature
Enable Analysis Right Temperature On Yes
Enable Analysis Right Temperature Value 0.8 °C
Stop Time
Stoptime Mode As pump/injector
Post Time
Posttime Mode Off
Timetable
Valve Position Position 1 (Port 1 -> 2)
Ready when front door open Yes

Attachment 6 - Triple Quadrupole Acquisition Method



Acquisition Method Report

Agilent Technologies

Acquisition Method Info

Method Name	PFAS1633_ACQ_092922.m
Method Path	D:\MassHunter\methods\PFAS1633_ACQ_092922.m
Method Description	EPA 1633_Target PFAS Isotope Dilution_Acquisition

Device List

- HiP Sampler
- Binary Pump
- Column Comp.
- QQQ

MS QQQ Mass Spectrometer

Ion Source	AJS ESI	**Tune File**	D:\MassHunter\Tune\QQQ\G6460C \atunes.TUNE.XML
Stop Mode	No Limit/As Pump	**Stop Time (min)**	1
Time Filter	On	**Time Filter Width (min)**	0.07
LC->Waste Pre Row	N/A	**LC->Waste Post Row**	N/A

Time Segments

Index	Start Time (min)	Scan Type	Ion Mode	Div Valve	Delta EMV	Store	Cycle Time (ms)	Triggered?	MRM Repeats
1	0	DynamicMRM	ESI+Agilent Jet Stream	To MS	350	Yes	550	Yes	3

Time Segment 1

Scan Segments

Cpd Name	ISTD?	Prec Ion	MS1 Res	Prod Ion	MS2 Res	Primary	Trigger	Frag (V)	CE(V)	Cell Acc (V)	Ret Time (min)	Ret Window	Polarity
11-Cl-PF3OUdS	No	631	Unit/Enh (6490)	451	Unit/Enh (6490)	Yes	No	170	33	4	7.62	3	Negative
1H,1H,2H,2H-perfluoro-1-decanesulfonate (8 2FTS)	No	527	Unit/Enh (6490)	507	Unit/Enh (6490)	Yes	No	170	28	4	7.14	3	Negative
1H,1H,2H,2H-perfluoro-1-decanesulfonate (8 2FTS)	No	527	Unit/Enh (6490)	80.9	Unit/Enh (6490)	Yes	No	170	40	4	7.14	3	Negative
1H,1H,2H,2H-perfluoro-1-hexanesulfonate (4 2FTS)	No	327	Unit/Enh (6490)	307	Unit/Enh (6490)	Yes	No	162	20	4	4.788	3	Negative
1H,1H,2H,2H-perfluoro-1-hexanesulfonate (4 2FTS)	No	327	Unit/Enh (6490)	80.9	Unit/Enh (6490)	Yes	No	162	36	4	4.788	3	Negative
1H,1H,2H,2H-perfluoro-1-octanesulfonate (6 2FTS)	No	427	Unit/Enh (6490)	407	Unit/Enh (6490)	Yes	No	162	24	4	6.168	3	Negative
1H,1H,2H,2H-perfluoro-1-octanesulfonate (6 2FTS)	No	427	Unit/Enh (6490)	79.7	Unit/Enh (6490)	Yes	No	162	48	4	6.168	3	Negative
3:3FTCA	No	241	Unit/Enh (6490)	177	Unit/Enh (6490)	Yes	No	74	4	4	3.4	3	Negative
3-3FTCA	No	241	Unit/Enh (6490)	117	Unit/Enh (6490)	Yes	No	74	44	4	3.4	3	Negative

Report generation date: 18-Oct-2022 09:01:43 AM

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Acquisition Method Report

Agilent Technologies

Cpd Name	ISTD?	Prec Ion	MS1 Res	Prod Ion	MS2 Res	Primary	Trigger	Frag (V)	CE(V)	Cell Acc (V)	Ret Time (min)	Ret Window	Polarity
5-3FTCA	No	341	Unit/Enh (6490)	237	Unit/Enh (6490)	Yes	No	84	12	4	5.73	3	Negative
5-3FTCA	No	341	Unit/Enh (6490)	217	Unit/Enh (6490)	Yes	No	84	24	4	5.73	3	Negative
7-3FTCA	No	441	Unit/Enh (6490)	337	Unit/Enh (6490)	Yes	No	76	12	4	6.7	3	Negative
7-3FTCA	No	441	Unit/Enh (6490)	317	Unit/Enh (6490)	Yes	No	76	24	4	6.7	3	Negative
9-Cl-PF3ONS	No	531	Unit/Enh (6490)	351	Unit/Enh (6490)	Yes	No	175	29	4	6.89	3	Negative
ADONA	No	377	Unit/Enh (6490)	251	Unit/Enh (6490)	Yes	No	103	9	4	5.62	3	Negative
ADONA	No	377	Unit/Enh (6490)	85	Unit/Enh (6490)	Yes	No	103	37	4	5.62	3	Negative
d3-NMeFOSA	No	515	Unit/Enh (6490)	219	Unit/Enh (6490)	Yes	No	134	20	4	7.17	3	Negative
d3-N-MeFOSAA	No	572.99	Unit/Enh (6490)	418.8	Unit/Enh (6490)	Yes	No	130	20	4	7.17	3	Negative
d5-NEtFOSA	No	531	Unit/Enh (6490)	219	Unit/Enh (6490)	Yes	No	150	20	4	8.52	3	Negative
d5-NEtFOSA	No	531	Unit/Enh (6490)	169	Unit/Enh (6490)	Yes	No	150	20	4	8.52	3	Negative
d5-N-EtFOSAA	No	589.02	Unit/Enh (6490)	530.9	Unit/Enh (6490)	Yes	No	130	20	4	7.36	3	Negative
d5-N-EtFOSAA	No	589.02	Unit/Enh (6490)	418.8	Unit/Enh (6490)	Yes	No	130	20	4	7.36	3	Negative
d7-NMeFOSE	No	623	Unit/Enh (6490)	310	Unit/Enh (6490)	Yes	No	150	15	4	8.28	3	Negative
d7-NMeFOSE	No	623	Unit/Enh (6490)	59	Unit/Enh (6490)	Yes	No	88	15	4	8.28	3	Negative
d9-NEtFOSE	No	639	Unit/Enh (6490)	59	Unit/Enh (6490)	Yes	No	150	15	4	8.6	3	Negative
HFPO-DA	No	285	Unit/Enh (6490)	169.1	Unit/Enh (6490)	Yes	No	100	20	4	4.95	3	Negative
M2-4-2FTS	No	329	Unit/Enh (6490)	309	Unit/Enh (6490)	Yes	No	156	20	4	4.787	3	Negative
M2-4-2FTS	No	329	Unit/Enh (6490)	81	Unit/Enh (6490)	Yes	No	156	28	4	4.787	3	Negative
M2-6-2FTS	No	429	Unit/Enh (6490)	409	Unit/Enh (6490)	Yes	No	162	24	4	6.01	3	Negative
M2-6-2FTS	No	429	Unit/Enh (6490)	81	Unit/Enh (6490)	Yes	No	162	40	4	6.01	3	Negative
M2-8-2FTS	No	529	Unit/Enh (6490)	509	Unit/Enh (6490)	Yes	No	165	28	4	6.98	3	Negative
M2-8-2FTS	No	529	Unit/Enh (6490)	81	Unit/Enh (6490)	Yes	No	165	40	4	6.98	3	Negative
M2PFTeDA	No	715	Unit/Enh (6490)	670	Unit/Enh (6490)	Yes	No	62	12	4	8.25	3	Negative
M3-HFPO-DA	No	287	Unit/Enh (6490)	169	Unit/Enh (6490)	Yes	No	90	5	4	4.99	3	Negative
M3PFBA	Yes	216	Unit/Enh (6490)	172	Unit/Enh (6490)	Yes	No	90	5	4	1.2	2	Negative
M3PFBS	No	302	Unit/Enh (6490)	98.9	Unit/Enh (6490)	Yes	No	114	32	4	3.94	3	Negative
M3PFBS	No	302	Unit/Enh (6490)	79.9	Unit/Enh (6490)	Yes	No	114	40	4	3.94	3	Negative
M3PFHxS	No	402	Unit/Enh (6490)	98.9	Unit/Enh (6490)	Yes	No	165	40	4	5.55	3	Negative
M3PFHxS	No	402	Unit/Enh (6490)	80	Unit/Enh (6490)	Yes	No	165	48	4	5.55	3	Negative
M4PFHpA	No	367	Unit/Enh (6490)	322	Unit/Enh (6490)	Yes	No	124	8	4	5.601	3	Negative
M5PFHxA	No	318	Unit/Enh (6490)	273	Unit/Enh (6490)	Yes	No	70	4	4	5.47	3	Negative
M5PFHxA	No	318	Unit/Enh (6490)	120	Unit/Enh (6490)	Yes	No	70	4	4	5.47	3	Negative
M6PFDA	No	519	Unit/Enh (6490)	473.9	Unit/Enh (6490)	Yes	No	59	8	4	6.99	3	Negative
M7PFUdA	No	570	Unit/Enh (6490)	525	Unit/Enh (6490)	Yes	No	64	8	4	7.38	3	Negative
MPFDA	Yes	514.98	Unit/Enh (6490)	469.8	Unit/Enh (6490)	Yes	No	94	5	4	6.972	2	Negative
MPFHxA	Yes	314.99	Unit/Enh (6490)	269.8	Unit/Enh (6490)	Yes	No	86	4	4	4.705	2	Negative
MPFHxA	Yes	314.99	Unit/Enh (6490)	120	Unit/Enh (6490)	Yes	No	86	4	4	4.705	2	Negative
MPFHxS	Yes	403	Unit/Enh (6490)	103	Unit/Enh (6490)	Yes	No	110	37	4	5.63	2	Negative
MPFHxS	Yes	403	Unit/Enh (6490)	84	Unit/Enh (6490)	Yes	No	110	40	4	5.63	2	Negative
MPFNA	Yes	468	Unit/Enh (6490)	423	Unit/Enh (6490)	Yes	No	66	4	4	6.541	2	Negative
MPFOA	Yes	417	Unit/Enh (6490)	372	Unit/Enh (6490)	Yes	No	84	4	4	6.03	2	Negative
MPFOS	Yes	502.96	Unit/Enh (6490)	99	Unit/Enh (6490)	Yes	No	148	48	4	6.57	3	Negative

Report generation date: 18-Oct-2022 09:01:43 AM

Acquisition Method Report

Agilent Technologies

Cpd Name	ISTD?	Prec Ion	MS1 Res	Prod Ion	MS2 Res	Primary	Trigger	Frag (V)	CE(V)	Cell Acc (V)	Ret Time (min)	Ret Window	Polarity
MPFOS	Yes	502.96	Unit/Enh (6490)	80	Unit/Enh (6490)	Yes	No	148	54	4	6.57	3	Negative
NEtFOSA	No	526	Unit/Enh (6490)	219	Unit/Enh (6490)	Yes	No	120	20	4	8.528	3	Negative
NEtFOSA	No	526	Unit/Enh (6490)	169	Unit/Enh (6490)	Yes	No	120	20	4	8.528	3	Negative
N-EtFOSAA	No	584	Unit/Enh (6490)	525.9	Unit/Enh (6490)	Yes	No	130	20	4	7.521	3	Negative
N-EtFOSAA	No	584	Unit/Enh (6490)	418.8	Unit/Enh (6490)	Yes	No	130	20	4	7.521	3	Negative
NEtFOSE	No	630	Unit/Enh (6490)	59	Unit/Enh (6490)	Yes	No	120	20	4	8.301	3	Negative
NFDHA	No	295	Unit/Enh (6490)	201.1	Unit/Enh (6490)	Yes	No	92	2	4	4.641	3	Negative
NFDHA	No	295	Unit/Enh (6490)	84.9	Unit/Enh (6490)	Yes	No	92	34	4	4.641	3	Negative
NMeFOSA	No	512	Unit/Enh (6490)	219	Unit/Enh (6490)	Yes	No	120	20	4	8.298	3	Negative
NMeFOSA	No	512	Unit/Enh (6490)	169	Unit/Enh (6490)	Yes	No	120	20	4	8.298	3	Negative
N-MeFOSAA	No	570	Unit/Enh (6490)	511.9	Unit/Enh (6490)	Yes	No	150	20	4	7.335	3	Negative
N-MeFOSAA	No	570	Unit/Enh (6490)	418.9	Unit/Enh (6490)	Yes	No	150	20	4	7.335	3	Negative
NMeFOSE	No	616	Unit/Enh (6490)	59	Unit/Enh (6490)	Yes	No	120	20	4	8.301	3	Negative
Perfluoro-1-[13C8]octanesulfonamide (M8FOSA)	No	506	Unit/Enh (6490)	78	Unit/Enh (6490)	Yes	No	162	48	4	7.59	3	Negative
Perfluoro-1-[13C8]octanesulfonic acid (M8PFOS)	No	507	Unit/Enh (6490)	98.9	Unit/Enh (6490)	Yes	No	174	48	4	6.59	3	Negative
Perfluoro-1-[13C8]octanesulfonic acid (M8PFOS)	No	507	Unit/Enh (6490)	80	Unit/Enh (6490)	Yes	No	174	54	4	6.59	3	Negative
Perfluoro-1-decanesulfonate (L-PFDS)	No	598.9	Unit/Enh (6490)	98.9	Unit/Enh (6490)	Yes	No	156	50	4	7.546	3	Negative
Perfluoro-1-decanesulfonate (L-PFDS)	No	598.9	Unit/Enh (6490)	98.9	Unit/Enh (6490)	Yes	No	100	60	4	7.546	3	Negative
Perfluoro-1-heptanesulfonate (L-PFHpS)	No	448.9	Unit/Enh (6490)	98.9	Unit/Enh (6490)	Yes	No	162	48	4	6.252	3	Negative
Perfluoro-1-heptanesulfonate (L-PFHpS)	No	448.9	Unit/Enh (6490)	80	Unit/Enh (6490)	Yes	No	162	48	4	6.252	3	Negative
Perfluoro-1-octanesulfonamide (FOSA)	No	497.9	Unit/Enh (6490)	478	Unit/Enh (6490)	Yes	No	156	100	4	7.651	3	Negative
Perfluoro-1-octanesulfonamide (FOSA)	No	497.9	Unit/Enh (6490)	78	Unit/Enh (6490)	Yes	No	156	40	4	7.651	3	Negative
Perfluoro-1-pentanesulfonate (L-PFPeS)	No	348.9	Unit/Enh (6490)	98.9	Unit/Enh (6490)	Yes	No	150	36	4	5.042	3	Negative
Perfluoro-1-pentanesulfonate (L-PFPeS)	No	348.9	Unit/Enh (6490)	79.9	Unit/Enh (6490)	Yes	No	150	40	4	5.042	3	Negative

Acquisition Method Report

Agilent Technologies

Cpd Name	ISTD?	Prec Ion	MS1 Res	Prod Ion	MS2 Res	Primary	Trigger	Frag (V)	CE (V)	Cell Acc (V)	Ret Time (min)	Ret Window	Polarity
Perfluorobutanesulfonic acid (PFBS)	No	298.9	Unit/Enh (6490)	98.9	Unit/Enh (6490)	Yes	No	150	32	4	4.042	3	Negative
Perfluorobutanesulfonic acid (PFBS)	No	298.9	Unit/Enh (6490)	79.9	Unit/Enh (6490)	Yes	No	150	36	4	4.042	3	Negative
Perfluorodecanoic acid (PFDA)	No	513	Unit/Enh (6490)	468.8	Unit/Enh (6490)	Yes	No	90	8	4	7.158	3	Negative
Perfluorodecanoic acid (PFDA)	No	513	Unit/Enh (6490)	268.8	Unit/Enh (6490)	Yes	No	90	16	4	7.158	3	Negative
Perfluorododecanesulfonic acid (PFDoS)	No	699	Unit/Enh (6490)	99	Unit/Enh (6490)	Yes	No	100	60	4	7.984	3	Negative
Perfluorododecanesulfonic acid (PFDoS)	No	699	Unit/Enh (6490)	80	Unit/Enh (6490)	Yes	No	156	50	4	7.984	3	Negative
Perfluorododecanoic acid (PFDoA)	No	613	Unit/Enh (6490)	568.8	Unit/Enh (6490)	Yes	No	90	12	4	7.876	3	Negative
Perfluorododecanoic acid (PFDoA)	No	613	Unit/Enh (6490)	168.7	Unit/Enh (6490)	Yes	No	90	28	4	7.876	3	Negative
Perfluoroheptanoic acid (PFHpA)	No	363	Unit/Enh (6490)	318.8	Unit/Enh (6490)	Yes	No	90	8	4	5.601	3	Negative
Perfluoroheptanoic acid (PFHpA)	No	363	Unit/Enh (6490)	168.9	Unit/Enh (6490)	Yes	No	90	16	4	5.601	3	Negative
Perfluorohexanesulfonic acid (PFHxS)	No	398.9	Unit/Enh (6490)	98.9	Unit/Enh (6490)	Yes	No	150	40	4	5.685	3	Negative
Perfluorohexanesulfonic acid (PFHxS)	No	398.9	Unit/Enh (6490)	79.9	Unit/Enh (6490)	Yes	No	150	44	4	5.685	3	Negative
Perfluorohexanoic acid (PFHxA)	No	313	Unit/Enh (6490)	268.9	Unit/Enh (6490)	Yes	No	70	4	4	4.856	3	Negative
Perfluorohexanoic acid (PFHxA)	No	313	Unit/Enh (6490)	119	Unit/Enh (6490)	Yes	No	70	20	4	4.856	3	Negative
Perfluoro-n-[1,2-13C2]dodecanoic acid (MPFDoA)	No	615	Unit/Enh (6490)	570	Unit/Enh (6490)	Yes	No	53	8	4	7.71	3	Negative
Perfluoro-n-[13C4]butanoic acid (MPFBA)	No	217	Unit/Enh (6490)	172	Unit/Enh (6490)	Yes	No	59	4	4	1.22	3	Negative
Perfluoro-n-[13C54]pentanoic acid (M5PFPeA)	No	268	Unit/Enh (6490)	223	Unit/Enh (6490)	Yes	No	62	4	4	3.44	3	Negative
Perfluoro-n-[13C8]octanoic acid (M8PFOA)	No	421	Unit/Enh (6490)	376	Unit/Enh (6490)	Yes	No	59	4	4	6.05	3	Negative
Perfluoro-n-[13C8]octanoic acid (M8PFOA)	No	421	Unit/Enh (6490)	172	Unit/Enh (6490)	Yes	No	59	16	4	6.05	3	Negative

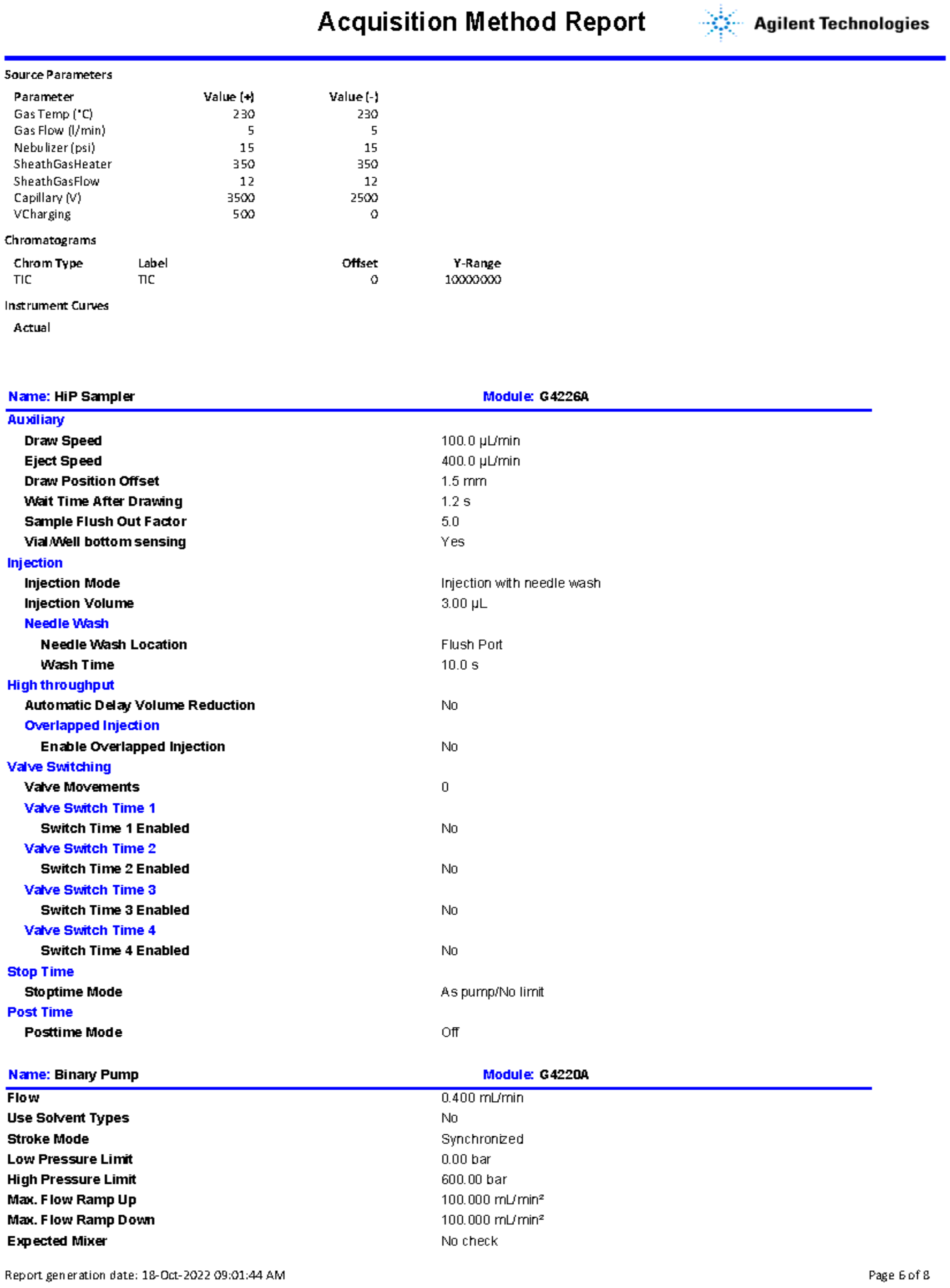
Acquisition Method Report

Agilent Technologies

Cpd Name	ISTD?	Prec Ion	MS1 Res	Prod Ion	MS2 Res	Primary	Trigger	Frag (V)	CE (V)	Cell Acc (V)	Ret Time (min)	Ret Window	Polarity
Perfluoro-n-[13C9]nonanoic acid (M9PFNA)	No	472	Unit/Enh (6490)	427	Unit/Enh (6490)	Yes	No	59	8	4	6.56	3	Negative
Perfluoro-n-[13C9]nonanoic acid (M9PFNA)	No	472	Unit/Enh (6490)	223	Unit/Enh (6490)	Yes	No	59	16	4	6.56	3	Negative
Perfluoro-n-butanoic acid (PFBA)	No	213	Unit/Enh (6490)	168.9	Unit/Enh (6490)	Yes	No	70	4	4	1.246	3	Negative
Perfluorononanesulfonate (L-PFNS)	No	548.9	Unit/Enh (6490)	98.9	Unit/Enh (6490)	Yes	No	159	48	4	7.174	3	Negative
Perfluorononanesulfonate (L-PFNS)	No	548.9	Unit/Enh (6490)	79.9	Unit/Enh (6490)	Yes	No	159	48	4	7.174	3	Negative
Perfluorononanoic acid (PFNA)	No	463	Unit/Enh (6490)	418.8	Unit/Enh (6490)	Yes	No	90	8	4	6.718	3	Negative
Perfluorononanoic acid (PFNA)	No	463	Unit/Enh (6490)	218.8	Unit/Enh (6490)	Yes	No	90	16	4	6.718	3	Negative
Perfluoro-n-pentanoic acid (PFPeA)	No	263	Unit/Enh (6490)	219	Unit/Enh (6490)	Yes	No	62	4	4	3.526	3	Negative
Perfluorooctanesulfonic acid (PFOS)	No	498.9	Unit/Enh (6490)	98.9	Unit/Enh (6490)	Yes	No	150	44	4	6.743	3	Negative
Perfluorooctanesulfonic acid (PFOS)	No	498.9	Unit/Enh (6490)	79.9	Unit/Enh (6490)	Yes	No	150	84	4	6.743	3	Negative
Perfluorooctanoic acid (PFOA)	No	413	Unit/Enh (6490)	368.8	Unit/Enh (6490)	Yes	No	90	8	4	6.202	3	Negative
Perfluorooctanoic acid (PFOA)	No	413	Unit/Enh (6490)	168.9	Unit/Enh (6490)	Yes	No	90	16	4	6.202	3	Negative
Perfluorotetradecanoic acid (PFTA)	No	713	Unit/Enh (6490)	669	Unit/Enh (6490)	Yes	No	110	12	4	8.414	3	Negative
Perfluorotetradecanoic acid (PFTA)	No	713	Unit/Enh (6490)	168.8	Unit/Enh (6490)	Yes	No	110	28	4	8.414	3	Negative
Perfluorotridecanoic acid (PFTrDA)	No	663	Unit/Enh (6490)	618.8	Unit/Enh (6490)	Yes	No	90	12	4	8.164	3	Negative
Perfluoroundecanoic acid (PFUnA)	No	563	Unit/Enh (6490)	519	Unit/Enh (6490)	Yes	No	90	8	4	7.538	3	Negative
Perfluoroundecanoic acid (PFUnA)	No	563	Unit/Enh (6490)	169	Unit/Enh (6490)	Yes	No	90	24	4	7.538	3	Negative
PFEESA	No	315	Unit/Enh (6490)	135	Unit/Enh (6490)	Yes	No	112	26	4	4.464	3	Negative
PFEESA	No	315	Unit/Enh (6490)	83	Unit/Enh (6490)	Yes	No	112	14	4	4.464	3	Negative
PFMBA	No	279	Unit/Enh (6490)	85	Unit/Enh (6490)	Yes	No	75	18	4	4.011	3	Negative
PFMPA	No	229	Unit/Enh (6490)	85	Unit/Enh (6490)	Yes	No	59	6	4	2.15	3	Negative

Scan Parameters

Data Stg	Threshold
Centroid	0



Acquisition Method Report

Agilent Technologies

Source Parameters

Parameter	Value (+)	Value (-)
Gas Temp (°C)	230	230
Gas Flow (l/min)	5	5
Nebulizer (psi)	15	15
SheathGasHeater	350	350
SheathGasFlow	12	12
Capillary (V)	3500	2500
VCharging	500	0

Chromatograms

Chrom Type	Label	Offset	Y-Range
TIC	TIC	0	10000000

Instrument Curves

Actual

Name: HiP Sampler **Module:** G4226A

Auxiliary	
Draw Speed	100.0 µL/min
Eject Speed	400.0 µL/min
Draw Position Offset	1.5 mm
Wait Time After Drawing	1.2 s
Sample Flush Out Factor	5.0
Vial/Well bottom sensing	Yes
Injection	
Injection Mode	Injection with needle wash
Injection Volume	3.00 µL
Needle Wash	
Needle Wash Location	Flush Port
Wash Time	10.0 s
High throughput	
Automatic Delay Volume Reduction	No
Overlapped Injection	
Enable Overlapped Injection	No
Valve Switching	
Valve Movements	0
Valve Switch Time 1	
Switch Time 1 Enabled	No
Valve Switch Time 2	
Switch Time 2 Enabled	No
Valve Switch Time 3	
Switch Time 3 Enabled	No
Valve Switch Time 4	
Switch Time 4 Enabled	No
Stop Time	
Stoptime Mode	As pump/No limit
Post Time	
Posttime Mode	Off

Name: Binary Pump **Module:** G4220A

Flow	0.400 mL/min
Use Solvent Types	No
Stroke Mode	Synchronized
Low Pressure Limit	0.00 bar
High Pressure Limit	600.00 bar
Max. Flow Ramp Up	100.000 mL/min²
Max. Flow Ramp Down	100.000 mL/min²
Expected Mixer	No check

Report generation date: 18-Oct-2022 09:01:44 AM

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Appendix E

Citizen Participation Plan

NEW YORK STATE | Department of Environmental Conservation

Brownfield Cleanup Program

Citizen Participation Plan
for
236 Gold Street, Brooklyn, NY 11201

September 2024

BCP Site No. C224413
236-246 Gold Street
Brooklyn, NY 11201

Contents

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Note: The information presented in this Citizen Participation Plan was current as of the date of its approval by the New York State Department of Environmental Conservation. Portions of this Citizen Participation Plan may be revised during the site's investigation and cleanup process.

Applicant: **236 Gold LLC / 242 Gold St LLC / 244 Gold LLC / 236-242 Gold St LLC (“Applicants”)**
Site Name: **236-246 Gold Street (“Site”)**
Site Address: **236-246 Gold Street, Brooklyn, NY 11201**
Site County: **Kings County**
Site Number: **C224413**

1. What is New York’s Brownfield Cleanup Program?

New York’s Brownfield Cleanup Program (BCP) works with private developers to encourage the voluntary cleanup of contaminated properties known as “brownfields” so that they can be reused and developed. These uses include recreation, housing, and business.

A *brownfield* is any real property that is difficult to reuse or redevelop because of the presence or potential presence of contamination. A brownfield typically is a former industrial or commercial property where operations may have resulted in environmental contamination. A brownfield can pose environmental, legal, and financial burdens on a community. If a brownfield is not addressed, it can reduce property values in the area and affect economic development of nearby properties.

The BCP is administered by the New York State Department of Environmental Conservation (NYSDEC) which oversees Applicants who conduct brownfield site investigation and cleanup activities. An Applicant is a person who has requested to participate in the BCP and has been accepted by NYSDEC. The BCP contains investigation and cleanup requirements, ensuring that cleanups protect public health and the environment. When NYSDEC certifies that these requirements have been met, the property can be reused or redeveloped for the intended use.

For more information about the BCP, go online at:
http://www.dec.ny.gov/chemical/8450.html .

2. Citizen Participation Activities

Why NYSDEC Involves the Public and Why It Is Important

NYSDEC involves the public to improve the process of investigating and cleaning up contaminated sites, and to enable citizens to participate more fully in decisions that affect their health, environment, and social well-being. NYSDEC provides opportunities for citizen involvement and encourages early two-way communication with citizens before decision-makers form or adopt final positions.

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Involving citizens affected and interested in site investigation and cleanup programs is important for many reasons. These include:

- Promoting the development of timely, effective site investigation and cleanup programs that protect public health and the environment

- Improving public access to, and understanding of, issues and information related to a particular site and that site's investigation and cleanup process

- Providing citizens with early and continuing opportunities to participate in NYSDEC's site investigation and cleanup process

- Ensuring that NYSDEC makes site investigation and cleanup decisions that benefit from input that reflects the interests and perspectives found within the affected community

- Encouraging dialogue to promote the exchange of information among the affected/interested public, State agencies, and other interested parties that strengthens trust among the parties, increases understanding of site and community issues and concerns, and improves decision making.

This Citizen Participation (CP) Plan provides information about how NYSDEC will inform and involve the public during the investigation and cleanup of the site identified above. The public information and involvement program will be carried out with assistance, as appropriate, from the Applicant.

Project Contacts

Appendix A identifies NYSDEC project contact(s) to whom the public should address questions or request information about the site's investigation and cleanup program. The public's suggestions about this CP Plan and the CP program for the site are always welcome. Interested people are encouraged to share their ideas and suggestions with the project contacts at any time.

Locations of Reports and Information

The locations of the reports and information related to the site's investigation and cleanup program also are identified in Appendix A. These locations provide convenient access to important project documents for public review and comment. Some documents may be placed on the NYSDEC web site. If this occurs, NYSDEC will inform the public in fact sheets distributed about the site and by other means, as appropriate.

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Site Contact List

Appendix B contains the site contact list. This list has been developed to keep the community informed about, and involved in, the site's investigation and cleanup process. The site contact list will be used periodically to distribute fact sheets that provide updates about the status of the project. These will include notifications of upcoming activities at the site (such as fieldwork), as well as availability of project documents and announcements about public comment periods.
The site contact list includes, at a minimum:

- Chief executive officer and planning board chairperson of each county, city, town and village in which the site is located;
- Residents, owners, and occupants of the site and properties adjacent to the site;
- The public water supplier which services the area in which the site is located;
- Any person who has requested to be placed on the site contact list;
- The administrator of any school or day care facility located on or near the site for purposes of posting and/or dissemination of information at the facility;
- Location(s) of reports and information.

The site contact list will be reviewed periodically and updated as appropriate. Individuals and organizations will be added to the site contact list upon request. Such requests should be submitted to the NYSDEC project contact(s) identified in Appendix A. Other additions to the site contact list may be made at the discretion of the NYSDEC project manager, in consultation with other NYSDEC staff as appropriate.

Note: The first site fact sheet (usually related to the draft Remedial Investigation Work Plan) is distributed both by paper mailing through the postal service and through DEC Delivers, its email listserv service. The fact sheet includes instructions for signing up with the appropriate county listserv to receive future notifications about the site. See http://www.dec.ny.gov/chemical/61092.html .

Subsequent fact sheets about the site will be distributed exclusively through the listserv, except for households without internet access that have indicated the need to continue to receive site information in paper form. Please advise the NYSDEC site project manager identified in Appendix A if that is the case. Paper mailings may continue during the investigation and cleanup process for some sites, based on public interest and need.

CP Activities

The table at the end of this section identifies the CP activities, at a minimum, that have been and will be conducted during the site's investigation and cleanup program. The flowchart in Appendix D shows how these CP activities integrate with the site investigation and cleanup process. The public is informed about these CP activities through fact sheets and notices distributed at significant points during the program. Elements of the investigation and cleanup process that match up with the CP activities are explained briefly in Section 5.

- **Notices and fact sheets** help the interested and affected public to understand contamination issues related to a site, and the nature and progress of efforts to investigate and clean up a site.

- **Public forums, comment periods and contact with project managers** provide opportunities for the public to contribute information, opinions and perspectives that have potential to influence decisions about a site's investigation and cleanup.

The public is encouraged to contact project staff at any time during the site's investigation and cleanup process with questions, comments, or requests for information.

This CP Plan may be revised due to changes in major issues of public concern identified in Section 3 or in the nature and scope of investigation and cleanup activities. Modifications may include additions to the site contact list and changes in planned citizen participation activities.

Technical Assistance Grant

NYSDEC must determine if the site poses a significant threat to public health or the environment. This determination generally is made using information developed during the investigation of the site, as described in Section 5.

If the site is determined to be a significant threat, a qualifying community group may apply for a Technical Assistance Grant (TAG). The purpose of a TAG is to provide funds to the qualifying group to obtain independent technical assistance. This assistance helps the TAG recipient to interpret and understand existing environmental information about the nature and extent of contamination related to the site and the development/implementation of a remedy.

An eligible community group must certify that its membership represents the interests of the community affected by the site, and that its members' health, economic well-being or enjoyment of the environment may be affected by a release or threatened release of contamination at the site.

As of the date the declaration (page 2) was signed by the NYSDEC project manager, the significant threat determination for the site had not yet been made.

To verify the significant threat status of the site, the interested public may contact the NYSDEC project manager identified in Appendix A.

For more information about TAGs, go online at
https://dec.ny.gov/regulatory/regulations/technical-assistance-grant-tag-guidance-handbook-der-14

Note: The table identifying the citizen participation activities related to the site's investigation and cleanup program follows on the next page:

Citizen Participation Activities	Timing of CP Activity(ies)
Application Process:	
• Prepare site contact list • Establish document repository(ies)	At time of preparation of application to participate in the BCP.
• Publish notice in Environmental Notice Bulletin (ENB) announcing receipt of application and 30-day public comment period • Publish above ENB content in local newspaper • Mail above ENB content to site contact list • Conduct 30-day public comment period	When NYSDEC determines that BCP application is complete. The 30-day public comment period begins on date of publication of notice in ENB. End date of public comment period is as stated in ENB notice. Therefore, ENB notice, newspaper notice, and notice to the site contact list should be provided to the public at the same time.
After Execution of Brownfield Site Cleanup Agreement (BCA):	
• Prepare Citizen Participation (CP) Plan	Before start of Remedial Investigation **Note:** Applicant must submit CP Plan to NYSDEC for review and approval within 20 days of the effective date of the BCA.
Before NYSDEC Approves Remedial Investigation (RI) Work Plan:	
• Distribute fact sheet to site contact list about proposed RI activities and announcing 30-day public comment period about draft RI Work Plan • Conduct 30-day public comment period	Before NYSDEC approves RI Work Plan. If RI Work Plan is submitted with application, public comment periods will be combined and public notice will include fact sheet. Thirty-day public comment period begins/ends as per dates identified in fact sheet.
After Applicant Completes Remedial Investigation:	
• Distribute fact sheet to site contact list that describes RI results	Before NYSDEC approves RI Report
Before NYSDEC Approves Remedial Work Plan (RWP):	
• Distribute fact sheet to site contact list about draft RWP and announcing 45-day public comment period • Public meeting by NYSDEC about proposed RWP (if requested by affected community or at discretion of NYSDEC project manager) • Conduct 45-day public comment period	Before NYSDEC approves RWP. Forty-five day public comment period begins/ends as per dates identified in fact sheet. Public meeting would be held within the 45-day public comment period.
Before Applicant Starts Cleanup Action:	
• Distribute fact sheet to site contact list that describes upcoming cleanup action	Before the start of cleanup action.
After Applicant Completes Cleanup Action:	
• Distribute fact sheet to site contact list that announces that cleanup action has been completed and that NYSDEC is reviewing the Final Engineering Report • Distribute fact sheet to site contact list announcing NYSDEC approval of Final Engineering Report and issuance of Certificate of Completion (COC)	At the time the cleanup action has been completed. **Note:** The two fact sheets are combined when possible if there is not a delay in issuing the COC.

3. Major Issues of Public Concern

This section of the CP Plan identifies major issues of public concern that relate to the site. Additional major issues of public concern may be identified during the course of the site's investigation and cleanup process.

No shallow groundwater use exists in the area or vicinity of the Site. This eliminates potential wellhead issues. Groundwater contamination at the Site does not include volatile organic compounds (VOCs), therefore, adjacent buildings' susceptibility to vapor intrusion is minimal. New York City does not permit the use of groundwater for potable purposes and potable water is provided to residents by the New York City Department of Environmental Protection from upstate watersheds. There may also be impacts with regards to noise, odor and truck traffic. The Site is located within a Potential Environmental Justice Area.

Environmental justice is defined as the fair treatment and meaningful involvement of all people regardless of race, color, national origin, or income with respect to the development, implementation, and enforcement of environmental laws, regulations, and policies.

Environmental justice efforts focus on improving the environment in communities, specifically minority and low-income communities, and addressing disproportionate adverse environmental impacts that may exist in those communities.

The Site is located just outside of an Environmental Justice Area, but within an area with a sizable Hispanic-American, African-American and Asian-American population nearby. Therefore, all future fact sheets will be translated into Spanish and Chinese.

For additional information, visit: https://statisticalatlas.com/tract/New-York/Kings-County/001500/Overview

4. Site Information

Appendix C contains a map identifying the location of the site.

Site Description

The Site, located at 236-246 Gold Street in Brooklyn, NY (Tax Block 121, Lots 33, 35, 36, and 37), is a rectangular shaped parcel located on the western side of Gold Street, between Concord Street and Tillary Street. The Site is approximately 11,054 SF and has approximately 125 feet of frontage along Gold Street and is approximately 88 feet deep. The Site is currently unimproved with any structures and vacant. All four Site lots are zoned R6B, denoting a built-up, medium-density residential area. The Site is bounded by a mixed-use residential and commercial building followed by Concord Street to the north; a residential building followed by Tillary Street to the south; Gold Street to the east; and residential buildings followed by Duffield Street to the west.

History of Site Use, Investigation, and Cleanup

The Site was historically used for residential and commercial uses, with commercial uses including a blacksmith, a wagon builder, and a waste material corporation.

Environmental investigations conducted at the site between 2022 and 2024 have included sampling and analysis of soil, soil vapor and groundwater.

Previous Environmental Studies

Phase I Environmental Site Assessment (March 2024)

A Phase I Environmental Site Assessment (ESA) was prepared for Lots 33, 35, 36, and 37 in 2024. Based upon a review of historical information, the following Recognized Environmental Conditions (RECs) were identified as having potential for negative environmental impacts:

- The presence of historic fill material across the Site;
- The presence of adjoining and surrounding up- and cross-gradient historic automotive repair shops and gasoline service stations; and,
- The presence of adjoining and surrounding up- and cross-gradient historic industrial/manufacturing facilities.

Remedial Investigations and Limited Phase II Environmental Site Investigation (2022-2024)

Three subsurface investigations have been completed at the Site to date to identify any potential impacts due to on- or offsite historic operations. A Remedial Investigation (RI) was completed on Lot 33 in September 2022; a RI was completed on Lot 35 in May 2023; and a Limited Phase II Environmental Site Investigation (ESI) was completed on Lots 36 and 37 in April 2024.

The investigations consisted of the collection of a total of 26 soil samples from 14 soil borings, ten groundwater samples from eight groundwater monitoring wells, and nine soil vapor samples from nine temporary soil vapor sampling points. All soil and groundwater samples were analyzed for VOCs, semivolatile organic compounds (SVOCs), target analyte list (TAL) metals, pesticides, and polychlorinated biphenyls (PCBs). In addition, two soil samples and six groundwater samples were also analyzed for per- and polyfluoroalkyl substances (PFAS). All soil vapor samples were analyzed for VOCs.

The results of the sample analysis showed concentrations of SVOCs, specifically polyaromatic hydrocarbons (PAHs), and metals in shallow and deep soil samples. Concentrations of metals detected in soil on Lots 33 and 36 showed that some shallow soil on these lots is hazardous for lead. Pesticides were also detected in shallow soil at several locations. VOCs, PCBs, and PFAS were not detected in any soil samples at concentrations exceeding applicable cleanup standards. Groundwater sampling identified PAHs, metals, and PFAS in groundwater samples across the Site. Several chlorinated VOCs and petroleum-related VOCs were also detected in one or more soil vapor samples, with the highest concentrations of chlorinated VOCs detected on Lot 33 and the highest concentrations of petroleum-related VOCs detected on Lot 35.

5. Investigation and Cleanup Process

Application

The Applicant has applied for and been accepted into New York's Brownfield Cleanup Program as a **Volunteer**. This means that the Applicant was not responsible for the disposal or discharge of the contaminants or whose ownership or operation of the site took place after the discharge or disposal of contaminants. The Volunteer must fully characterize the nature and extent of contamination onsite, and must conduct a "qualitative exposure assessment," a process that characterizes the actual or potential exposures of people, fish and wildlife to contaminants on the site and to contamination that has migrated from the site.

The Applicant in its Application proposes that the site will be used for **unrestricted** purposes.

To achieve this goal, the Applicant will conduct investigation and cleanup activities at the site with oversight provided by NYSDEC. The Brownfield Cleanup Agreement executed by NYSDEC and the Applicant sets forth the responsibilities of each party in conducting these activities at the site.

Investigation

The Applicant will conduct an investigation of the site officially called a "remedial investigation" (RI). This investigation will be performed with NYSDEC oversight. The Applicant must develop a remedial investigation workplan, which is subject to public comment.

The site investigation has several goals:

1) Define the nature and extent of contamination in soil, surface water, groundwater and any other parts of the environment that may be affected;
2) Identify the source(s) of the contamination;

3) Assess the impact of the contamination on public health and the environment; and
4) Provide information to support the development of a proposed remedy to address the contamination or the determination that cleanup is not necessary.

The Applicant submits a draft “Remedial Investigation Work Plan” to NYSDEC for review and approval. NYSDEC makes the draft plan available to the public review during a 30-day public comment period.

When the investigation is complete, the Applicant will prepare and submit a report that summarizes the results. This report also will recommend whether cleanup action is needed to address site-related contamination. The investigation report is subject to review and approval by NYSDEC.

NYSDEC will use the information in the investigation report to determine if the site poses a significant threat to public health or the environment. If the site is a “significant threat,” it must be cleaned up using a remedy selected by NYSDEC from an analysis of alternatives prepared by the Applicant and approved by NYSDEC. If the site does not pose a significant threat, the Applicant may select the remedy from the approved analysis of alternatives.

Interim Remedial Measures

An Interim Remedial Measure (IRM) is an action that can be undertaken at a site when a source of contamination or exposure pathway can be effectively addressed before the site investigation and analysis of alternatives are completed. If an IRM is likely to represent all or a significant part of the final remedy, NYSDEC will require a 30-day public comment period.

Remedy Selection

When the investigation of the site has been determined to be complete, the project likely would proceed in one of two directions:

1. The Applicant may recommend in its investigation report that no action is necessary at the site. In this case, NYSDEC would make the investigation report available for public comment for 45 days. NYSDEC then would complete its review, make any necessary revisions, and, if appropriate, approve the investigation report. NYSDEC would then issue a “Certificate of Completion” (described below) to the Applicant.

or

2. The Applicant may recommend in its investigation report that action needs to be

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taken to address site contamination. After NYSDEC approves the investigation report, the Applicant may then develop a cleanup plan, officially called a “Remedial Work Plan”. The Remedial Work Plan describes the Applicant’s proposed remedy for addressing contamination related to the site.

When the Applicant submits a draft Remedial Work Plan for approval, NYSDEC would announce the availability of the draft plan for public review during a 45-day public comment period.

Cleanup Action

NYSDEC will consider public comments, and revise the draft cleanup plan if necessary, before approving the proposed remedy. The New York State Department of Health (NYSDOH) must concur with the proposed remedy. After approval, the proposed remedy becomes the selected remedy. The selected remedy is formalized in the site Decision Document.

The Applicant may then design and perform the cleanup action to address the site contamination. NYSDEC and NYSDOH oversee the activities. When the Applicant completes cleanup activities, it will prepare a Final Engineering Report (FER) that certifies that cleanup requirements have been achieved or will be achieved within a specific time frame. NYSDEC will review the report to be certain that the cleanup is protective of public health and the environment for the intended use of the site.

Certificate of Completion

When NYSDEC is satisfied that cleanup requirements have been achieved or will be achieved for the site, it will approve the FER. NYSDEC then will issue a Certificate of Completion (COC) to the Applicant. The COC states that cleanup goals have been achieved, and relieves the Applicant from future liability for site-related contamination, subject to certain conditions. The Applicant would be eligible to redevelop the site after it receives a COC.

Site Management

The purpose of site management is to ensure the safe reuse of the property if contamination will remain in place. Site management is the last phase of the site cleanup program. This phase begins when the COC is issued. Site management incorporates any institutional and engineering controls required to ensure that the remedy implemented for the site remains protective of public health and the environment. All significant activities are detailed in a Site Management Plan (SMP).

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An *institutional control* is a non-physical restriction on use of the site, such as a deed restriction that would prevent or restrict certain uses of the property. An institutional control may be used when the cleanup action leaves some contamination that makes the site suitable for some, but not all uses.

An *engineering control* is a physical barrier or method to manage contamination. Examples include caps, covers, barriers, fences, and treatment of water supplies.

Site management also may include the operation and maintenance of a component of the remedy, such as a system that pumps and treats groundwater. Site management continues until NYSDEC determines that it is no longer needed.

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Appendix A -
Project Contacts and Locations of Reports and Information

Project Contacts

For information about the site's investigation and cleanup program, the public may contact any of the following project staff:

New York State Department of Environmental Conservation (NYSDEC):

Michael Sollecito
Project Manager
NYSDEC
Division of Environmental Remediation
625 Broadway, 12th Floor
Albany, NY 12233-7016
Phone: 518-402-2198
Email: michael.sollecito@dec.ny.gov

Thomas V. Panzone
Public Participation Specialist
NYSDEC
Division of Communications, Education and Engagement
47-40 21st Street
Long Island City, NY 11101
Phone: 718-482-4953
Email: Thomas.panzone@dec.ny.gov

New York State Department of Health (NYSDOH):

Anthony Perretta
Project Manager
NYSDOH
Bureau of Environmental Exposure Investigation
Empire State Plaza
Corning Tower Room 1787
Albany, NY 12237
Phone: 518-402-1365
Email: beei@health.ny.gov

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Locations of Reports and Information

The facilities identified below are being used to provide the public with convenient access to important project documents:

Brooklyn Public Library – Central Branch
10 Grand Army Plaza
Brooklyn, NY 11238
Attn: Jennifer Gellmann, Assistant Division Manager, Societies, Sciences, and Technology
Phone: 718-230-2100
Hours:
Monday – Thursday: 9 AM – 8 PM
Friday & Saturday: 9 AM – 6 PM
Sunday: 1 PM – 5 PM

Brooklyn Community Board 2
350 Jay Street, 8th Floor
Brooklyn, NY 11201-2921
Attn: Taya Mueller, District Manager
Lenue H. Singletary III – Chairperson
Chairperson: Brandon Smith – Health, Environment &Social Services
Phone: 718-596-5410
Email: bk02@cb.nyc.gov
Hours:
Monday – Friday: 9 AM – 5 PM
Saturday & Sunday: Closed

Project documents can also be accessed through the DECinfo Locator:

https://www.dec.ny.gov/data/DecDocs/C224413/

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Appendix B - Site Contact List

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Contact List Information

1. The Chief Executive Officer And Planning Board Chairperson Of Each County, City, Town And Village In Which The Property Is Located.

Mayor Eric Adams
City Hall
260 Broadway Avenue
New York, New York 10007

Hon. Brad Lander
NYC Comptroller
1 Centre Street Room 517
New York, NY 10007

Hon. Jumaane D. Williams
Public Advocate
1 Centre Street 15th Floor North
New York, NY 10007

David Gold, Esq.
Commissioner
NYC Department of City Planning
120 Broadway, 31st Floor
New York, NY 10271

Rohit Aggarwala, Commissioner – Public Water Supplier
New York City Department of Environmental Protection
59-17 Junction Boulevard
Flushing, NY 11373

Shaminder Chawla, Acting Director
Mayor’s Office of Environmental Remediation
100 Gold Street, 2nd Floor
New York, NY 10038

Hon. Antonio Reynoso
Brooklyn Borough President
Brooklyn Borough Hall
209 Joralemon Street
Brooklyn, NY 11201

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Alex Sommer
NYC Department of City Planning
Brooklyn Office Director
16 Court Street, 7th Floor
Brooklyn, NY 11241-0103

Hon. Lincoln Restler
NYC Council Member, District 33
410 Atlantic Avenue
Brooklyn, NY 11217

Hon. Jo Anne Simon
NYS Assembly Member, District 52
341 Smith Street
Brooklyn, NY 11231

Hon. Andrew Gounardes
New York State Senator, District 26
497 Carroll St Suite 31
Brooklyn, NY 11215

Hon. Nydia M. Velazquez
U.S. House of Representatives
Brooklyn District Office
266 Broadway, Suite 201
Brooklyn, NY 11211

Hon. Charles Schumer
U.S. Senator
780 Third Avenue, Suite 2301
New York, NY 10017

Hon. Kirsten Gillibrand
U.S. Senator
780 Third Avenue, Suite 2601
New York, NY 10017
Nancy T. Sunshine, County Clerk
Kings County Clerk's Office
360 Adams Street, Room 189
Brooklyn, NY 11201

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2. Residents, Owners And Occupants Of The Property And Properties Adjacent To The Property.

Site Owner – 236 Gold Street
236 Gold LLC
31 Spencer Street, Suite 502
Brooklyn, NY 11205

Site Owner – 242 Gold Street
242 Gold St LLC
31 Spencer Street, Suite 502
Brooklyn, NY 11205

Site Owner – 244-246 Gold Street
244 Gold LLC
31 Spencer Street, Suite 502
Brooklyn, NY 11205

67 Duffield Street
Residential building owned by: KRE BKLYNER 260 Gold LLC
Owner Address: 67 Duffield Street, Brooklyn, NY 11201
Occupied by 260 Gold
Occupant Address: 260 Gold Street, Brooklyn, NY 11201

47 Duffield Street
Residential building owned by: Karen Carillo
Owner Address: 47 Duffield Street, Brooklyn, NY 11201

45 Duffield Street
Residential building owned by: Townhouse Rental, L.L.C.
Owner Address: 45 Duffield Street, Brooklyn, NY 11201

43 Duffield Street
Residential building owned by 43 Duffield LLC
Owner Address: 43 Duffield Street, Brooklyn, NY 11201

41 Duffield Street
Residential building owned by: William Vinicombe
Owner Address: 41 Duffield Street, Brooklyn, NY 11201

39 Duffield Street
Residential building owned by: Nicolo Del Greco Irrevocable Trust
Owner Address: 39 Duffield Street, Brooklyn, NY 11201

35 Duffield Street
Condominium building operated by 180 Concord LLC
Operator Address: 35 Duffield Street, Brooklyn, NY 11201

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188 Concord Street
Residential building owned by: Kurt Gustafsson
Owner Address: 188 Concord Street, Brooklyn, NY 11201

190 Concord Street
Residential building owned by: Valentino Foster
Owner Address: 190 Concord Street, Brooklyn, NY 11201

192 Concord Street
Residential building owned by: Juliette Ibelli
Owner Address: 192 Concord Street, Brooklyn, NY 11201

194 Concord Street
Mixed residential and commercial building owned by: Florrie B. Nebiol
Owner Address: 194 Concord Street, Brooklyn, NY 11201
Operated by: AirFlo Window Contracting Corp.
Operator Address: 194 Concord Street, Brooklyn, NY 11201

257 Gold Street
Mixed residential and commercial building owned by: Brooklyn Gold SPE LLC
Owner Address: 257 Gold Street, Brooklyn, NY 11201
Occupied by: Changing Tomorrow Academy
Occupant Address: 257 Gold Street, Brooklyn, NY 11201
Occupied by: Gold Street Market
Occupant Address: 257 Gold Street, Brooklyn, NY 11201
Occupied by: iPark
Occupant Address: 235 Gold Street, Brooklyn, NY 11201

3. Local News Media From Which The Community Typically Obtains Information.

Brooklyn Eagle
195 Montague Street, Suite 1414
Brooklyn, NY 11201

Brooklyn Papers
1 Metrotech Center
Brooklyn, NY 11201

Courier-Life Publications
1 Metrotech Center #10T
Brooklyn, NY 11201

New York Daily News
PO Box 7180
New York, NY 10008

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New York Post
1211 Avenue of the Americas
New York, NY 10036

Hoy Nueva York
Impremedia, 41 Flatbush Avenue 1st Floor
Brooklyn, NY 11217

El Diario NY
Impremedia, 41 Flatbush Avenue 1st Floor
Brooklyn, NY 11217

World Journal (Chinese)
141-07 20th Avenue
Whitestone, NY 11357

Sing Tao Daily
5510 8th Avenue, Room 202
Brooklyn, NY 11220

4. Any Person Who Has Requested To Be Placed On The Contact List.

We are unaware of any requests for inclusion on the contact list.

5. The Administrator Of Any School Or Day Care Facility Located On Or Near The Property.

Brooklyn International High School
President/Executive Director/Principal
http://www.mybihs.org/
49 Flatbush Avenue Extension
Brooklyn, NY 11201
(718) 643-9315

Brooklyn Friends School
President/Executive Director/Principal
https://brooklynfriends.org/
375 Pearl Street
Brooklyn, NY 11201
718-852-1029

BASIS Independent Brooklyn (Lower School)
President/Executive Director/Principal
https://basisindependent.com/schools/ny/brooklyn/
405 Gold Street
Brooklyn, NY 11201

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929-295-5124
Brooklyn Friends School Upper School
President/Executive Director/Principal
https://brooklynfriends.org/
116 Lawrence Street
Brooklyn, NY 11201
(718) 852-1029

P369K@P67
President/Executive Director/Principal
http://www.369k.org/
51 Saint Edwards St.
Brooklyn, NY 11205
718.855.6838

P369K@A.I.L.
President/Executive Director/Principal
http://www.369k.org/
283 Adams St
Brooklyn, NY 11201
718.260.2440
MS915 Middle SchoolPresident/Executive Director/Principal
https://www.ms915brooklyn.org/map/
105 Johnson Street,
Brooklyn, NY 11201
718.875.1021

K605 George Westinghouse Career and Technical Education High School
President/Executive Director/Principal
https://www.westinghousehs.org/
718-625-6130
105 Tech Place
Brooklyn, NY 11201

Dr. Susan S. McKinney Secondary School of the Arts
President/Executive Director/Principal
https://www.mckinneyssa.com/
101 Park Avenue
Brooklyn, NY 11205
718-834-6760

Brooklyn Prospect Downtown Elementary School
President/Executive Director/Principal
https://www.brooklynprospect.org/our-schools/downtown-elementary/
80 Willoughby Street
Brooklyn, NY 11201

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718-722-7634

Brooklyn Prospect Charter School Offices (Treehouse)
President/Executive Director/Principal
397 Bridge St,
Brooklyn, NY 11201
(718) 643-1086

Community High School
President/Executive Director/Principal
https://communityhighschoolbk.org/
250 Jay Street
Brooklyn, NY 11201
917-893-3999

City Tech - Adult Learning Center (Free HSE/GED /ESL Classes)
President/Executive Director/Principal
Howard Building, 25 Chapel St 4th floor,
Brooklyn, NY 11201
(718) 552-1140

Lightbridge Academy
President/Executive Director/Principal
https://lightbridgeacademy.com/downtown-brooklyn-ny/
237 Duffield St,
Brooklyn, NY 11201
(718) 643-9800

Lovey's Little Angels Family Daycare
President/Executive Director/Principal
https://alfka.org/loveys-little-angels-family-daycare
77 Sands St,
Brooklyn, NY 11201
(833) 552-5522

Imagine Early Learning Centers @ Dumbo
President/Executive Director/Principal
85 Adams St,
Brooklyn, NY 11201
(718) 522-2263

Imagine Brooklyn Bridge Child Development Center
President/Executive Director/Principal
101 Willoughby St,
Brooklyn, NY 11201

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(718) 855-9725

Vivvi Dumbo | Child Care and Early Learning
President/Executive Director/Principal
https://go.vivvi.com/dumbo-landing-page
55 Prospect St,
Brooklyn, NY 11201
646 343 9889

Petits Poussins Dumbo Daycare and Preschool
President/Executive Director/Principal
https://www.ppdumbo.com/
151 York St,
Brooklyn, NY 11201
718-690-7101

Duffield Children Center
President/Executive Director/Principal
180 Myrtle Ave,
Brooklyn, NY 11201
(718) 522-5296

Brooklyn Kindergarten Society
President/Executive Director/Principal
https://bksny.org/
25 Chapel St Suite 900,
Brooklyn, NY 11201
(718) 623-9803

BCS Laurie A. Cumbo Children's Enrichment Center
President/Executive Director/Principal
https://myrtleavenue.org/explore/myrtle-merchants/the-laurie-a-cumbo-childrens-enrichment-center/
180 Myrtle Ave,
Brooklyn, NY 11201
(718) 310-5600

Building Bridges Brooklyn Preschool
President/Executive Director/Principal
250 Cadman Plz W,
Brooklyn, NY 11201
(347) 334-6474

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P.S. 287 – The Dr. Bailey K. Ashford School
President/Executive Director/Principal
50 Navy Street
Brooklyn, NY 11201
(718) 834-4745

Changing Tomorrow Academy
President/Executive Director/Principal
257 Gold Street
Brooklyn, NY 11201
(205) 701-3333

Northside Center for Child Development
President/Executive Director/Principal
25 Chapel Street
Brooklyn, NY 11201
(347) 505-5501

New York City Technical College
President/Executive Director/Principal
https://www.citytech.cuny.edu/
300 Jay Street
Brooklyn, NY 11201
718-260-5000

NYU Tandon School of Engineering
President/Executive Director/Principal
https://engineering.nyu.edu/contact-us
Wunsch Building
311 Bridge St
Brooklyn, NY 11201
646-997-3182

Community Roots Charter School
President/Executive Director/Principal
https://communityroots.org/
Middle School Campus
50 Navy Street, 3rd Floor
Brooklyn, NY 11201
718-522-2166

Community Roots Charter School
President/Executive Director/Principal
https://communityroots.org/
Elementary School Campus

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51 Saint Edwards Street, Third Floor
Brooklyn, NY 11205
718-858-1629

6. Community, Civic, Religious and Other Environmental Organizations:

Consolidated Edison Corporate Affairs
Johari Jenkins-Taylor – Director of Brooklyn Regional and Community Affairs
30 Flatbush Avenue
Brooklyn, NY 11217

FDNY
BROOKLYN BOROUGH COMMAND/DIVISION 11/BATTALION 31/ENGINE 207/LADDER 110
172 TILLARY STREET
Brooklyn, NY 11201

84th NYPD Police Precinct Council
President Mark Gelbs
301 Gold Street
Brooklyn, NY, 11201

Church of the Open Door
201 Gold St,
Brooklyn, NY 11201

The Brooklyn Tabernacle
17 Smith St,
Brooklyn, NY 11201

The Cathedral Basilica of St. James
250 Cathedral Pl,
Brooklyn, NY 11201

Bridge Church
345 Adams St,
Brooklyn, NY 11201

The Oratory Church of St. Boniface
190 Duffield St,
Brooklyn, NY 11201

Resurrection Brooklyn Heights
250 Cadman Plz W,
Brooklyn, NY 11201

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Willing Workers Baptist Church
365 Jay St,
Brooklyn, NY 11201

Chabad of Dumbo
205 Plymouth St 1st Floor,
Brooklyn, NY 11201

Myrtle Avenue Brooklyn Partnership
https://myrtleavenue.org/
472 Myrtle Avenue, 2nd Floor
Brooklyn, NY 11205
718-230-1689
Amanda Zenteno, Executive Director
amanda@myrtleavenue.org

MetroTech BID
https://www.downtownbrooklyn.com/about/bids/metrotech-bid/
1 Metrotech Center North, Suite 1003
Brooklyn, NY 11201
718-403-1600
info@downtownbrooklyn.com
Regina Meyer – President

Court-Livingston-Schermerhorn BID
https://www.downtownbrooklyn.com/contact/
1 Metrotech Center North, Suite 1003
Brooklyn, NY 11201
718-403-1600
info@downtownbrooklyn.com
Regina Meyer – President

Atlantic Avenue BID
https://atlanticavebid.org/
Kelly Carroll – Executive Director
306 Atlantic Avenue
Brooklyn, NY 11201
929-283-5989
info@atlanticavebid.org

Atlantic Avenue Local Development Corporation
https://www.atlanticave.org/
494 Atlantic Avenue

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Brooklyn, NY 11217
718-875-8993
atlanticave@atlanticave.org
Howard Kolins - Acting Executive Director

Ingersoll Houses (NYCHA)
chrome-extension://efaidnbmnnnibpcajpcglclefindmkaj/https://www.nyc.gov/assets/nycha/downloads/pdf/Ingersoll.pdf
DEVELOPMENT MANAGEMENT OFFICE
120 Navy Walk
Brooklyn, NY 11201

Ingersoll Houses (NYCHA)
chrome-extension://efaidnbmnnnibpcajpcglclefindmkaj/https://www.nyc.gov/assets/nycha/downloads/pdf/Ingersoll.pdf
President - Ingersoll Resident Houses Association
120 Navy Walk
Brooklyn, NY 11201

Ingersoll Houses (NYCHA)
chrome-extension://efaidnbmnnnibpcajpcglclefindmkaj/https://www.nyc.gov/assets/nycha/downloads/pdf/Ingersoll.pdf
COMMUNITY CENTER
177 MYRTLE AVENUE
Brooklyn, NY 11201

Farragut Houses (NYCHA)
chrome-extension://efaidnbmnnnibpcajpcglclefindmkaj/https://www.nyc.gov/assets/nycha/downloads/pdf/Farragut.pdf
DEVELOPMENT MANAGEMENT OFFICE
251 NASSAU STREET
Brooklyn, NY 11201

Farragut Houses (NYCHA)
chrome-extension://efaidnbmnnnibpcajpcglclefindmkaj/https://www.nyc.gov/assets/nycha/downloads/pdf/Farragut.pdf
President - Farragut Houses Resident Association
251 NASSAU STREET
Brooklyn, NY 11201

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Farragut Houses (NYCHA)
chrome-extension://efaidnbmnnnibpcajpcglclefindmkaj/https://www.nyc.gov/assets/nycha/downloads/pdf/Farragut.pdf
COMMUNITY CENTER / SENIOR CENTER
228 YORK STREET
Brooklyn, NY 11201

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Appendix C - Site Location Map

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Appendix C - Site Location Map

236-246 Gold Street Citizen Participation Plan

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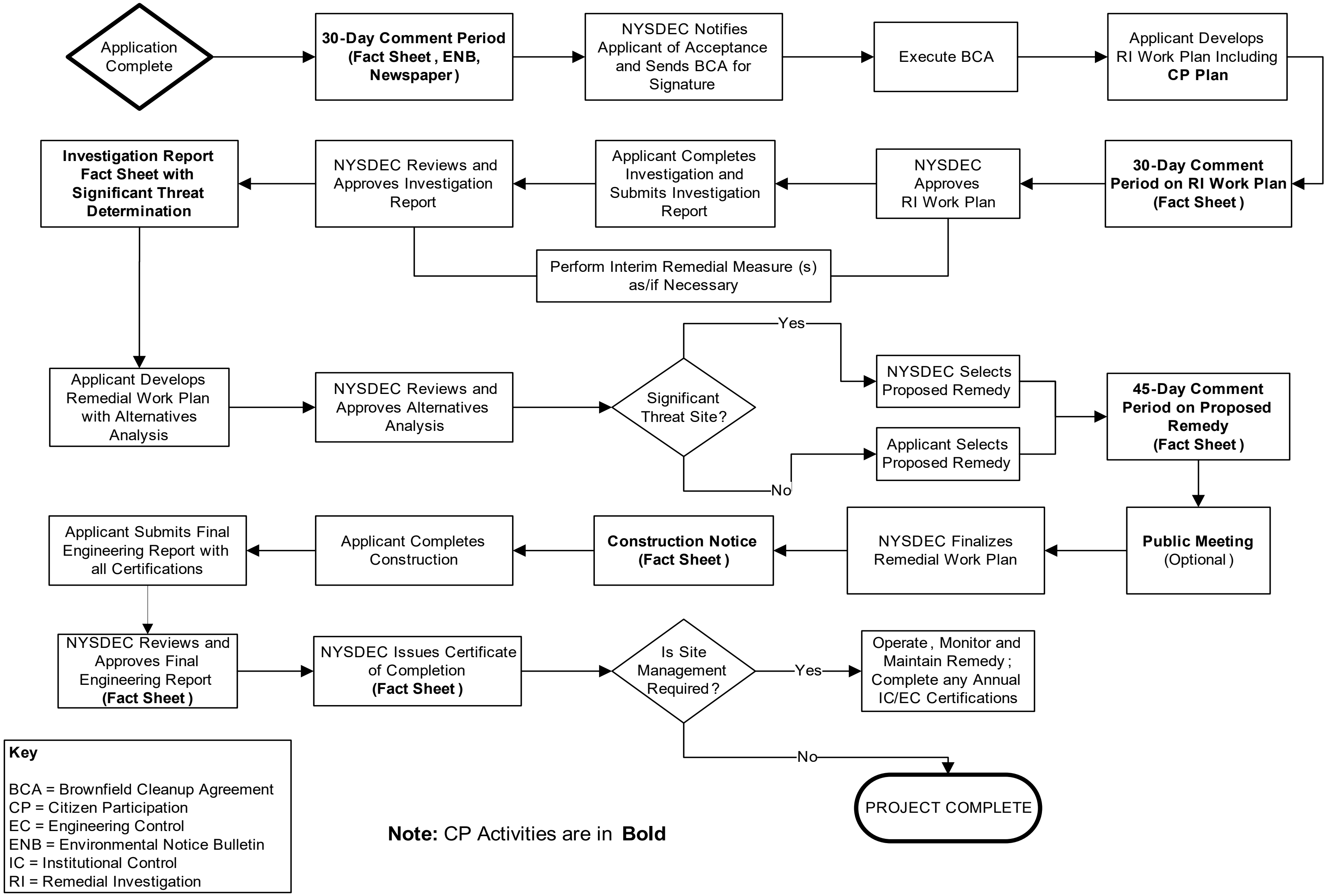
Appendix D– Brownfield Cleanup Program Process



Key

BCA = Brownfield Cleanup Agreement
CP = Citizen Participation
EC = Engineering Control
ENB = Environmental Notice Bulletin
IC = Institutional Control
RI = Remedial Investigation

Note: CP Activities are in **Bold**

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Division of Environmental Remediation

Remedial Programs
Scoping Sheet for Major Issues of Public Concern

Instructions

This Scoping Sheet assesses major issues of public concern; impacts of the site and its remedial program on the community; community interest in the site; information the public needs; and information needed from the public.

The information generated helps to plan and conduct required citizen participation (CP) activities, and to choose and conduct additional CP activities, if appropriate. The scoping sheet can be revisited and updated as appropriate during the site's remedial process to more effectively implement the site's CP program.

Note: Use the information as an aid to prepare and update the Major Issues of Public Concern section of the site CP Plan.

General Instructions

- When to prepare: During preparation of the CP Plan for the site. It can be revisited and updated anytime during the site remedial process.
- Fill in site name and other information as appropriate.
- The Scoping Sheet may be prepared by DEC or a remedial party, but must be reviewed and approved by the DER site project manager or his/her designee.

Instructions for Numbered Parts

Consider the bulleted issues and questions below and any others that may be unique or appropriate to the site and the community to help complete the five Parts of this Scoping Sheet. Identify the issue stakeholders in Parts 1 through 3 and adjust the site's contact list accordingly.

Part 1. List Major Issues of Public Concern and Information the Community Wants.

- Is our health being impacted? (e.g. Are there problems with our drinking water or air? Are you going to test our water, yards, sumps, basements? Have health studies been done?)
- There are odors in the neighborhood. Do they come from the site and are they hazardous?
- Are there restrictions on what we may do (e.g. Can our children play outside? Can we garden? Must we avoid certain areas? Can we recreate (fish, hunt, hike, etc. on/around the site?)
- How and when were the site's contamination problems created?
- What contaminants are of concern and why? How will you look for contamination and find out where it is going? What is the schedule for doing that?
- The site is affecting our property values!
- How can we get more information (e.g. who are the project contacts?)
- How will we be kept informed and involved during the site remedial process?
- Who has been contacted in the community about site remedial activities?
- What has been done to this point? What happens next and when?
- The site is going to be cleaned up for restricted use. What does that mean? We don't want redevelopment on a "dirty" site.

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Part 2. List Important Information Needed From the Community, if Applicable.

- Can the community supplement knowledge about past/current uses of the site?
- Does the community have knowledge that the site may be significantly impacting nearby people, properties, natural resources, etc.?
- Are activities currently taking place at the site or at nearby properties that may need to be restricted?
- Who may be interested or affected by the site that has not yet been identified?
- Are there unique community characteristics that could affect how information is exchanged?
- Does the community and/or individuals have any concerns they want monitored?
- Does the community have information about other sources in the area for the contamination?

Part 3. List Major Issues and Information That Need to be Communicated to the Community.

- Specific site investigation or remediation activities currently underway, or that will begin in the near future.
- The process and general schedule to investigate, remediate and, if applicable, redevelop the site.
- Current understanding about the site contamination and effects, if any, on public health and the environment.
- Site impacts on the community and any restrictions on the public's use of the site and/or nearby properties.
- Planned CP activities, their schedule, and how they relate to the site's remedial process.
- Ways for the community to obtain/provide information (document repositories, contacts, etc.).

Part 4. Community Characteristics

a. - e. Obtain information from local officials, property owners and residents, site reports, site visits, "windshield surveys," other staff, etc.

f. Has the affected community experienced other **significant** present or past environmental problems unrelated to this site? Such experiences could significantly affect public concerns and perspectives about the site; how the community will relate to project staff; the image and credibility of project staff within the community; and the ways in which project staff communicate with the community.

g. In its remedial programs, DER seeks to integrate, and be consistent with, environmental justice principles set forth in *DEC Commissioner Policy 29 on Environmental Justice* and *DER 23 – Citizen Participation Handbook for Remedial Programs*. Is the site and/or affected community wholly or partly in an Environmental Justice (EJ) Area? Use the Search feature on DEC's public web site for "environmental justice". DEC's EJ pages define an EJ area, and link to county maps to help determine if the site and/or community are in an EJ area.

h. Consider factors such as:

- Is English the primary language of the affected community? If not, provisions should be considered regarding public outreach activities such as fact sheets, meetings, door-to-door visits and other activities to ensure their effectiveness.
- The age demographics of the community. For example, is there a significant number of senior citizens in the community? It may be difficult for some to attend public meetings and use document repositories. This may suggest adopting more direct interaction with the community with activities such as door-to-door visits, additional fact sheets, visits to community and church centers, nursing homes, etc.
- How do people travel about the community? Would most people drive to a public meeting or document repository? Is there adequate public transportation?

Part 5. Affected/Interested Public.

Individuals and organizations who need or want information and input can change during the site's remedial process. This need is influenced by real, potential, or perceived impacts of the site or the remedial process. Some people may want information and input throughout the remedial process. Others may participate only during specific remedial stages, or may only be interested in particular issues.

It is important to revisit this question when reviewing this scoping sheet. Knowing who is interested in the site – and the issues that are important to them – will help to select and conduct appropriate outreach activities, and to identify their timing and the information to be exchanged.

Check all affected/interested parties that apply to the site. **Note: Adjust the site's contact list appropriately.** The following are some ways to identify affected/interested parties:

- Tax maps of adjacent property owners
- Attendees at public meetings
- Telephone discussions
- Letters and e-mails to DER, the remedial party, and other agencies
- Political jurisdictions and boundaries
- Media coverage
- Current/proposed uses of site and/or nearby properties (recreational, commercial, industrial)
- Discussions with community organizations: grass roots organizations, local environmental groups, environmental justice groups, churches, and neighborhood advisory groups

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NEW YORK STATE OF OPPORTUNITY. | Department of Environmental Conservation

Division of Environmental Remediation

Remedial Programs
Scoping Sheet for Major Issues of Public Concern (see instructions)

Site Name: 236-246 Gold Street

Site Number: C224413

Site Address and County: 236-246 Gold Street, Brooklyn, Kings County, NY 11201

Remedial Party(ies): 236 Gold LLC / 242 Gold St LLC / 244 Gold LLC / 236-242 Gold St LLC

Note: For Parts 1. – 3. the individuals, groups, organizations, businesses and units of government identified should be added to the site contact list as appropriate.

Part 1. List major issues of public concern and information the community wants. Identify individuals, groups, organizations, businesses and/or units of government related to the issue(s) and information needs. **Use this information as an aid to prepare or update the Major Issues of Public Concern section of the site Citizen Participation Plan.**
The Site is located within a Potential Environmental Justice Area. There may also be impacts with regards to noise, odor, and truck traffic.

How were these issues and/or information needs identified?
A Remedial Investigation was performed at Lot 33 in 2022, a Remedial Investigation was performed at Lot 35 in 2023, and a Limited Phase II Environmental Site Investigation was performed at Lots 36 and 37 in 2024.

Part 2. List important information needed **from** the community, if applicable. Identify individuals, groups, organizations, businesses and/or units of government related to the information needed.
N/A

How were these information needs identified?
N/A

Part 3. List major issues and information that need to be communicated **to** the community. Identify individuals, groups, organizations, businesses and/or units of government related to the issue(s) and/or information.
Possible commercial and residential tenants of surrounding properties.

How were these issues and/or information needs identified?
A Remedial Investigation was performed at Lot 33 in 2022, a Remedial Investigation was performed at Lot 35 in 2023, and a Limited Phase II Environmental Site Investigation was performed at Lots 36 and 37 in 2024.

Part 4. Identify the following characteristics of the affected/interested community. This knowledge will help to identify and understand issues and information important to the community, and ways to effectively develop and implement the site citizen participation plan (mark all that apply):

a. Land use/zoning at and around site:
☒ **Residential** ☐ **Agricultural** ☐ **Recreational** ☒ **Commercial** ☐ **Industrial**

b. Residential type around site:
☒ **Urban** ☐ **Suburban** ☐ **Rural**

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c. Population density around site:
☒ **High** ☐ **Medium** ☐ **Low**

d. Water supply of nearby residences:
☒ **Public** ☐ **Private Wells** ☐ **Mixed**

e. Is part or all of the water supply of the affected/interested community currently impacted by the site?
☐ **Yes** ☒ **No**

Provide details if appropriate:
Water is supplied to the community by NYCDEP from watersheds upstate.

f. Other environmental issues significantly impacted/impacting the affected community?
☐ **Yes** ☒ **No**

Provide details if appropriate:
N/A

g. Is the site and/or the affected/interested community wholly or partly in an Environmental Justice Area?
☒ **Yes** ☐ **No**

h. Special considerations:
☒ **Language** ☐ **Age** ☐ **Transportation** ☐ **Other**

Explain any marked categories in **h:**
All future fact sheets will be translated into Spanish and Chinese.

Part 5. The site contact list must include, at a minimum, the individuals, groups, and organizations identified in Part 2. of the Citizen Participation Plan under 'Site Contact List'. Are *other* individuals, groups, organizations, and units of government affected by, or interested in, the site, or its remedial program? (Mark and identify all that apply, then adjust the site contact list as appropriate.)

☒ **Non-Adjacent Residents/Property Owners:** See Site Contact List

☒ **Local Officials:** See Site Contact List

☒ **Media:** See Site Contact List

☒ **Business/Commercial Interests:** See Site Contact List

☐ **Labor Group(s)/Employees:** N/A

☐ **Indian Nation:** N/A

☐ **Citizens/Community Group(s):** N/A

☐ **Environmental Justice Group(s):** N/A

☐ **Environmental Group(s):** N/A

☐ **Civic Group(s):** N/A

☐ **Recreational Group(s):** N/A

☐ **Other(s):** N/A

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Prepared/Updated By: Ashley Platt **Date:** 7/25/2024

ReviewedApproved By: Thomas V. Panzone **Date:** 8-21-24

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Appendix F

Environmental Footprint Analyses

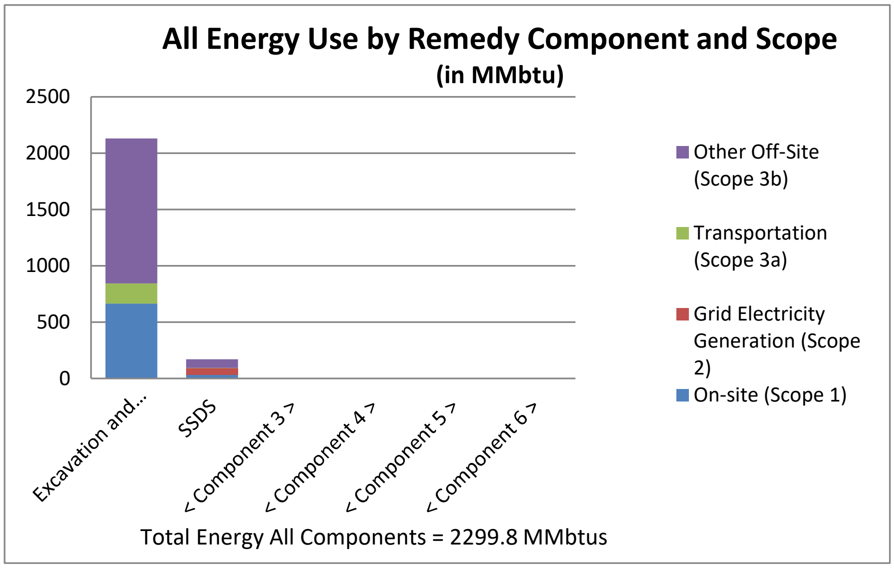
Environmental Footprint Summary

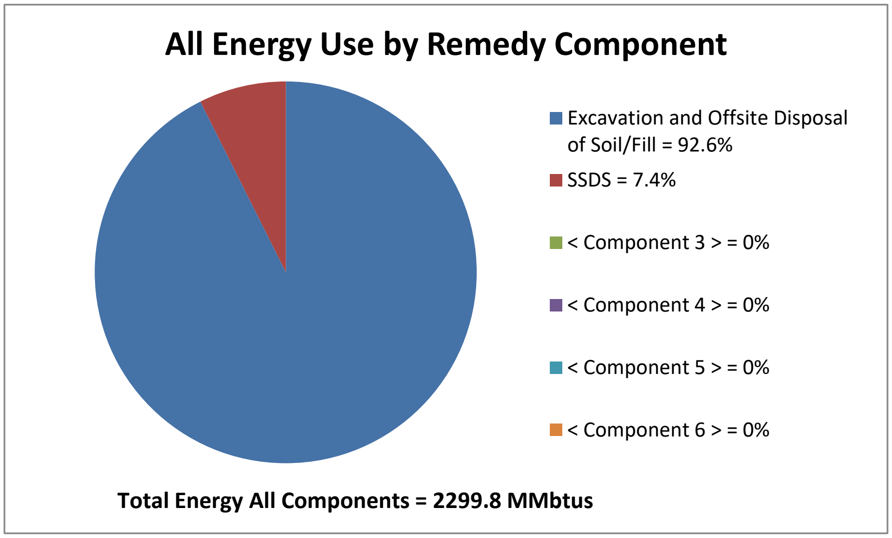
Core Element	**Metric**		**Unit of Measure**	**Footprint**						
				Excavation and Offsite Disposal of Soil/Fill	**SSDS**	**< Component 3 >**	**< Component 4 >**	**< Component 5 >**	**< Component 6 >**	**Total**
Materials & Waste	M&W-1	Refined materials used on-site	Tons	0.0	288.1	0.0	0.0	0.0	0.0	288.1
	M&W-2	% of refined materials from recycled or reused material	%		0.0%					0.0%
	M&W-3	Unrefined materials used on-site	Tons	0.000	0.000	0.000	0.000	0.000	0.000	0.0
	M&W-4	% of unrefined materials from recycled or reused material	%							
	M&W-5	On-site hazardous waste disposed of off-site	Tons	700.0	0.0	0.0	0.0	0.0	0.0	700.0
	M&W-6	On-site non-hazardous waste disposed of off-site	Tons	6,450.0	0.0	0.0	0.0	0.0	0.0	6,450.0
	M&W-7	Recycled or reused waste	Tons	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	M&W-8	% of total potential waste recycled or reused	%	0.0%						0.0%
Water (used on-site)	W-1	Public water use	MG	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	W-2	Groundwater use	MG	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	W-3	Surface water use	MG	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	W-4	Reclaimed water use	MG	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	W-5	Storm water use	MG	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	W-6	User-defined water resource #1	MG	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	W-7	User-defined water resource #2	MG	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	W-8	Wastewater generated	MG	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Energy	E-1	Total energy used (on-site and off-site)	MMBtu	2,130.2	169.6	0.0	0.0	0.0	0.0	2,299.8
	E-2	Energy voluntarily derived from renewable resources								
	E-2A	On-site renewable energy generation or use + on-site biodiesel use + biodiesel and other renewable resource use for transportation	MMBtu	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	E-2B	Voluntary purchase of renewable electricity	MWh	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	E-3	Voluntary purchase of RECs	MWh	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	E-4	On-site grid electricity use	MWh	0.000	8.764	0.000	0.000	0.000	0.000	8.8
Air	A-1	On-site NOx, SOx, and PM emissions	Pounds	854.9	0.0	0.0	0.0	0.0	0.0	854.9
	A-2	On-site HAP emissions	Pounds	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	A-3	Total NOx, SOx, and PM emissions	Pounds	5,814.9	83.5	0.0	0.0	0.0	0.0	5,898.4
	A-3A	Total NOx emissions	Pounds	2,122.8	39.4	0.0	0.0	0.0	0.0	2,162.2
	A-3B	Total SOx emissions	Pounds	751.5	39.4	0.0	0.0	0.0	0.0	790.9
	A-3C	Total PM emissions	Pounds	2,940.6	4.7	0.0	0.0	0.0	0.0	2,945.3
	A-4	Total HAP emissions	Pounds	32.3	1.4	0.0	0.0	0.0	0.0	33.8
	A-5	Total greenhouse gas emissions	Tons CO2e*	169.3	5.1	0.0	0.0	0.0	0.0	174.4
Land & Ecosystems		Qualitative Description								

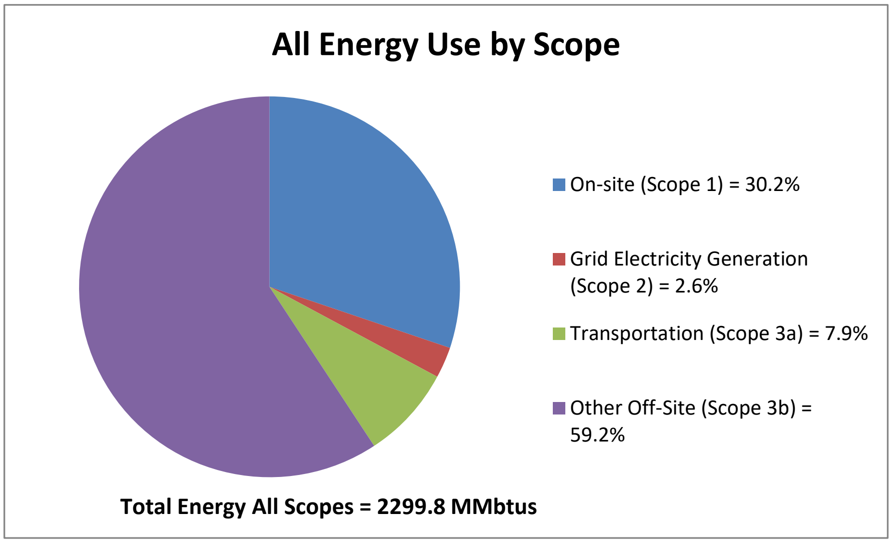
** Total greenhouse gases emissions (in CO2e) include consideration of CO2, CH4, and N2O (Nitrous oxide) emissions.*
"MMBtu" = millions of Btus
"MG" = millions of gallons
"CO2e" = carbon dioxide equivalents of global warming potential
"MWh" = megawatt hours (i.e., thousands of kilowatt-hours or millions of Watt-hours)
"Tons" = short tons (2,000 pounds)

The above metrics are consistent with EPA's Methodology for Understanding and Reducing a Project's Environmental Footprint (EPA 542-R-12-002), February 2012

Notes:


All Energy Use by Remedy Component and Scope
(in MMbtu)
2500
2000
1500
1000
500
0
Excavation and...
SSDS
< Component 3 >
< Component 4 >
< Component 5 >
< Component 6 >
Other Off-Site (Scope 3b)
Transportation (Scope 3a)
Grid Electricity Generation (Scope 2)
On-site (Scope 1)
Total Energy All Components = 2299.8 MMbtus


All Energy Use by Remedy Component
Excavation and Offsite Disposal of Soil/Fill = 92.6%
SSDS = 7.4%
< Component 3 > = 0%
< Component 4 > = 0%
< Component 5 > = 0%
< Component 6 > = 0%
Total Energy All Components = 2299.8 MMbtus


All Energy Use by Scope
On-site (Scope 1) = 30.2%
Grid Electricity Generation (Scope 2) = 2.6%
Transportation (Scope 3a) = 7.9%
Other Off-Site (Scope 3b) = 59.2%
Total Energy All Scopes = 2299.8 MMbtus

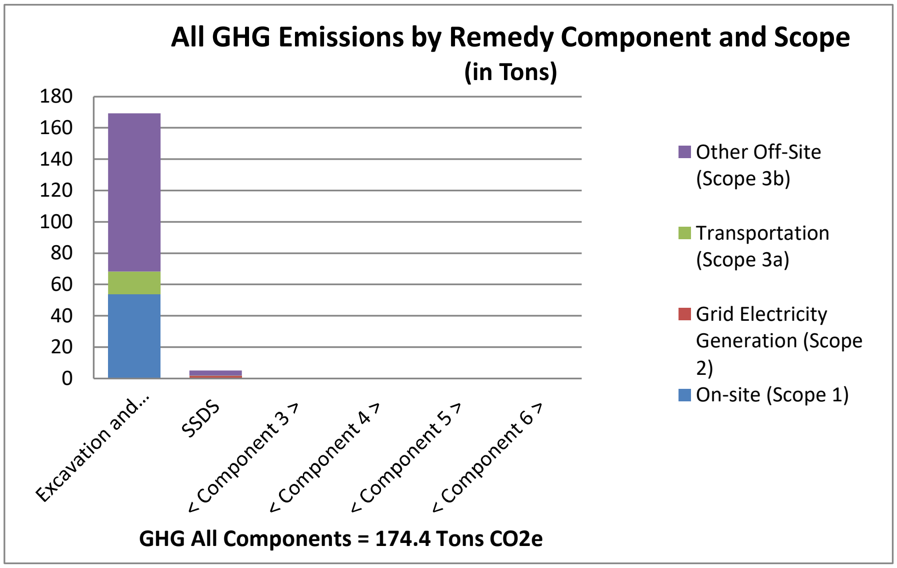
Total Energy
MMbtus

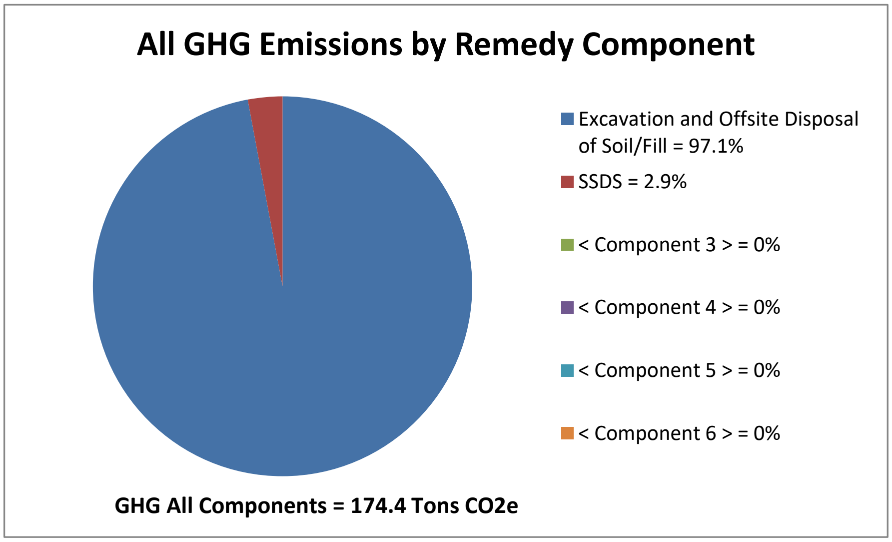
	Excavation	SSDS	< Compone	< Compone	< Compone	< Compone	Total	
On-site (Scope 1)	664.6	29.9	0.0	0.0	0.0	0.0	694.5	
' Generation (Scope 2)	0.0	60.7	0.0	0.0	0.0	0.0	60.7	d Electricity
ısportation (Scope 3a)	179.0	2.9	0.0	0.0	0.0	0.0	182.0	Trar
ıer Off-Site (Scope 3b)	1,286.6	76.0	0.0	0.0	0.0	0.0	1,362.6	Oth
Total	2,130.2	169.6	0.0	0.0	0.0	0.0	2,299.8	

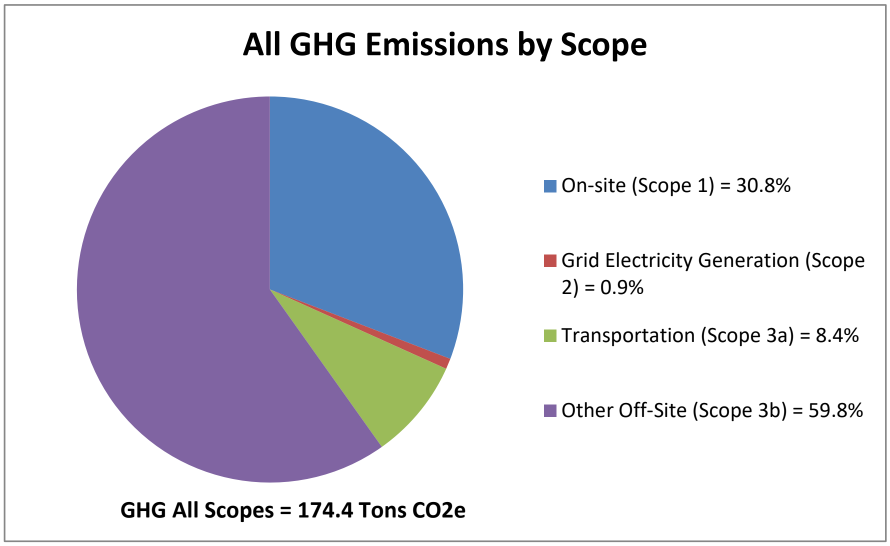
Excavation and Offsite Disposal of Soil/Fill = 9
SSDS = 7.4%
< Component 3 > = 0%
< Component 4 > = 0%
< Component 5 > = 0%
< Component 6 > = 0%

On-site (Scope 1) = 30.2%
Grid Electricity Generation (Scope 2) = 2.6%
Transportation (Scope 3a) = 7.9%
Other Off-Site (Scope 3b) = 59.2%

Total Energy All Components = 2299.8 MMbtus
Total Energy All Scopes = 2299.8 MMbtus


All GHG Emissions by Remedy Component and Scope
(in Tons)
180
160
140
120
100
80
60
40
20
0
Excavation and...
SSDS
< Component 3 >
< Component 4 >
< Component 5 >
< Component 6 >
Other Off-Site (Scope 3b)
Transportation (Scope 3a)
Grid Electricity Generation (Scope 2)
On-site (Scope 1)
GHG All Components = 174.4 Tons CO2e


All GHG Emissions by Remedy Component
Excavation and Offsite Disposal of Soil/Fill = 97.1%
SSDS = 2.9%
< Component 3 > = 0%
< Component 4 > = 0%
< Component 5 > = 0%
< Component 6 > = 0%
GHG All Components = 174.4 Tons CO2e

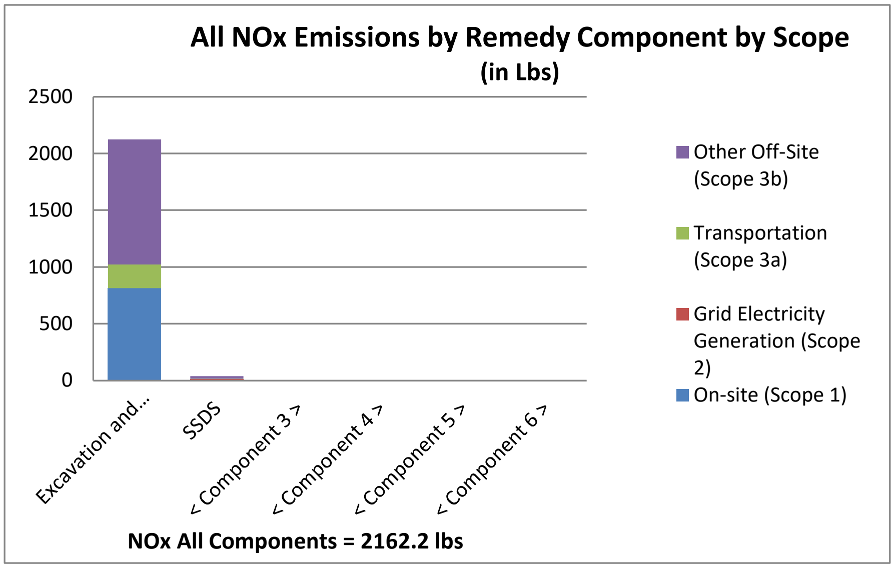

All GHG Emissions by Scope
On-site (Scope 1) = 30.8%
Grid Electricity Generation (Scope 2) = 0.9%
Transportation (Scope 3a) = 8.4%
Other Off-Site (Scope 3b) = 59.8%
GHG All Scopes = 174.4 Tons CO2e

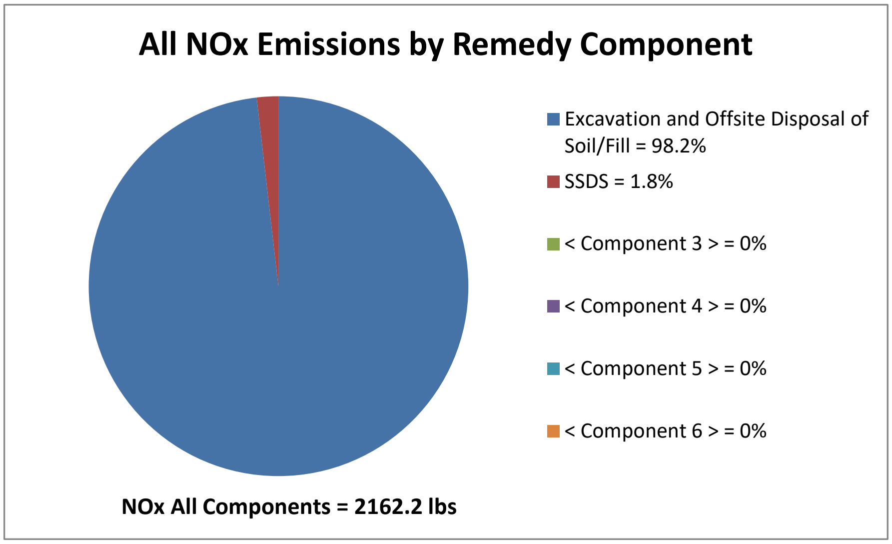
GHG Tons CO2e	Excavation	SSDS	< Compone	< Compone	< Compone	< Compone	Total	
On-site (Scope 1)	53.8	0.0	0.0	0.0	0.0	0.0	53.8	
Generation (Scope 2)	0.0	1.5	0.0	0.0	0.0	0.0	1.5	d Electricity
nsportation (Scope 3a)	14.5	0.2	0.0	0.0	0.0	0.0	14.7	Trar
her Off-Site (Scope 3b)	101.0	3.4	0.0	0.0	0.0	0.0	104.3	Oth
Total	169.3	5.1	0.0	0.0	0.0	0.0	174.4	

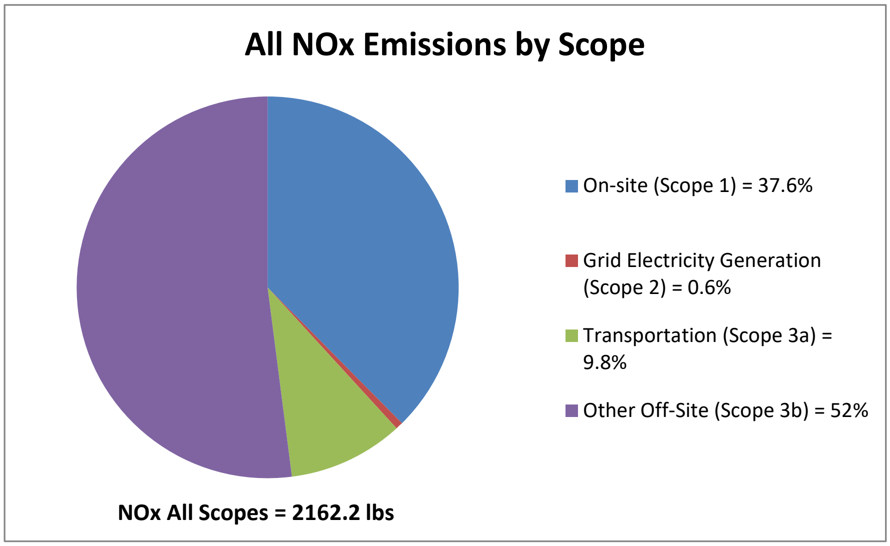
Excavation and Offsite Disposal of Soil/Fill = 9
SSDS = 2.9%
< Component 3 > = 0%
< Component 4 > = 0%
< Component 5 > = 0%
< Component 6 > = 0%

On-site (Scope 1) = 30.8%
Grid Electricity Generation (Scope 2) = 0.9%
Transportation (Scope 3a) = 8.4%
Other Off-Site (Scope 3b) = 59.8%

GHG All Components = 174.4 Tons CO2e
GHG All Scopes = 174.4 Tons CO2e


All NOx Emissions by Remedy Component by Scope
(in Lbs)
2500
2000
1500
1000
500
0
Excavation and...
SSDS
< Component 3 >
< Component 4 >
< Component 5 >
< Component 6 >
Other Off-Site (Scope 3b)
Transportation (Scope 3a)
Grid Electricity Generation (Scope 2)
On-site (Scope 1)
NOx All Components = 2162.2 lbs


All NOx Emissions by Remedy Component
Excavation and Offsite Disposal of Soil/Fill = 98.2%
SSDS = 1.8%
< Component 3 > = 0%
< Component 4 > = 0%
< Component 5 > = 0%
< Component 6 > = 0%
NOx All Components = 2162.2 lbs


All NOx Emissions by Scope
On-site (Scope 1) = 37.6%
Grid Electricity Generation (Scope 2) = 0.6%
Transportation (Scope 3a) = 9.8%
Other Off-Site (Scope 3b) = 52%
NOx All Scopes = 2162.2 lbs

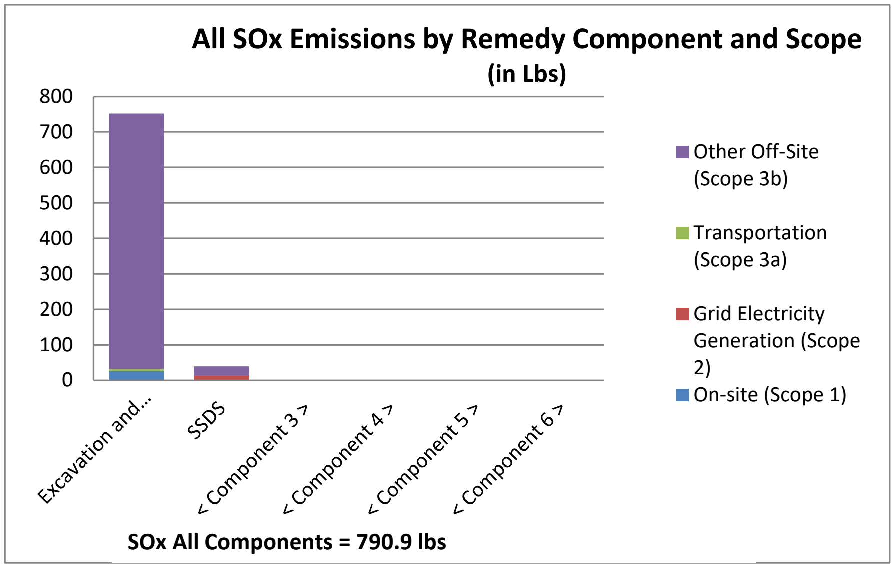
NOx
lbs

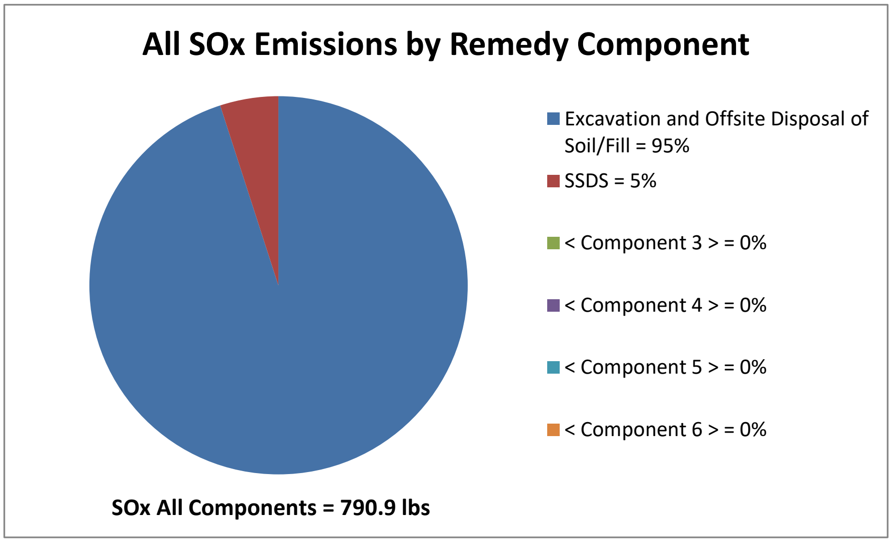
	Excavation	SSDS	< Compone	< Compone	< Compone	< Compone	Total	
On-site (Scope 1)	812.8	0.0	0.0	0.0	0.0	0.0	812.8	
Generation (Scope 2)	0.0	13.2	0.0	0.0	0.0	0.0	13.2	d Electricity
nsportation (Scope 3a)	207.7	3.5	0.0	0.0	0.0	0.0	211.2	Trar
her Off-Site (Scope 3b)	1,102.3	22.7	0.0	0.0	0.0	0.0	1,125.0	Oth
Total	2,122.8	39.4	0.0	0.0	0.0	0.0	2,162.2	

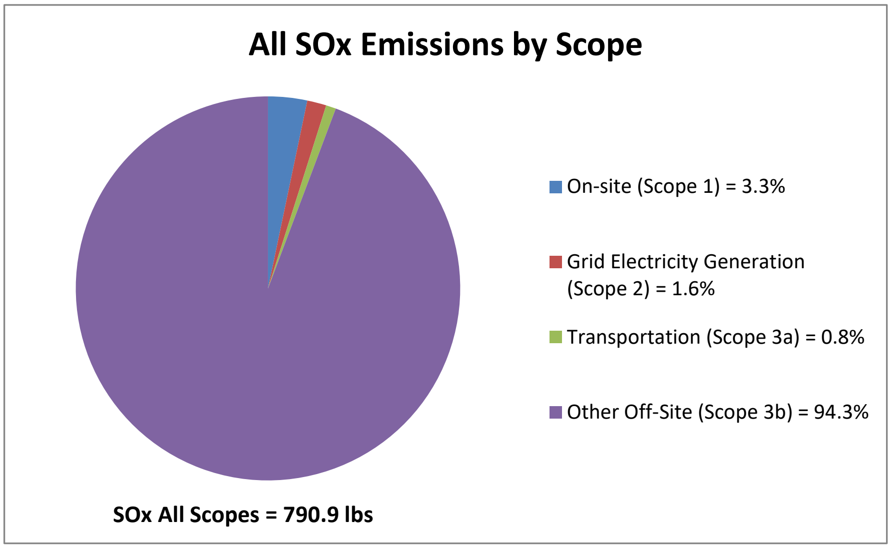
Excavation and Offsite Disposal of Soil/Fill = 9
SSDS = 1.8%
< Component 3 > = 0%
< Component 4 > = 0%
< Component 5 > = 0%
< Component 6 > = 0%

On-site (Scope 1) = 37.6%
Grid Electricity Generation (Scope 2) = 0.6%
Transportation (Scope 3a) = 9.8%
Other Off-Site (Scope 3b) = 52%

NOx All Components = 2162.2 lbs
NOx All Scopes = 2162.2 lbs


All SOx Emissions by Remedy Component and Scope
(in Lbs)
800
700
600
500
400
300
200
100
0
Excavation and...
SSDS
< Component 3 >
< Component 4 >
< Component 5 >
< Component 6 >
Other Off-Site (Scope 3b)
Transportation (Scope 3a)
Grid Electricity Generation (Scope 2)
On-site (Scope 1)
SOx All Components = 790.9 lbs


All SOx Emissions by Remedy Component
Excavation and Offsite Disposal of Soil/Fill = 95%
SSDS = 5%
< Component 3 > = 0%
< Component 4 > = 0%
< Component 5 > = 0%
< Component 6 > = 0%
SOx All Components = 790.9 lbs

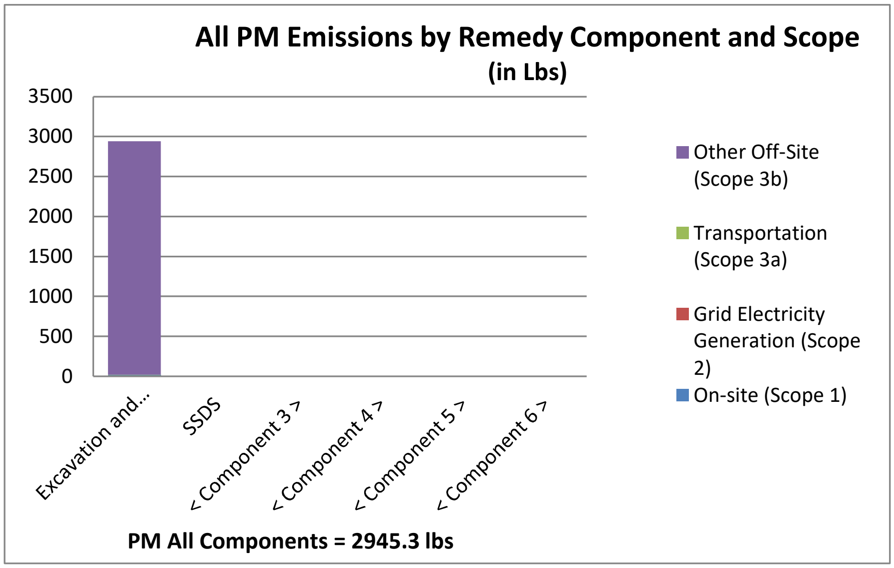

All SOx Emissions by Scope
On-site (Scope 1) = 3.3%
Grid Electricity Generation (Scope 2) = 1.6%
Transportation (Scope 3a) = 0.8%
Other Off-Site (Scope 3b) = 94.3%
SOx All Scopes = 790.9 lbs

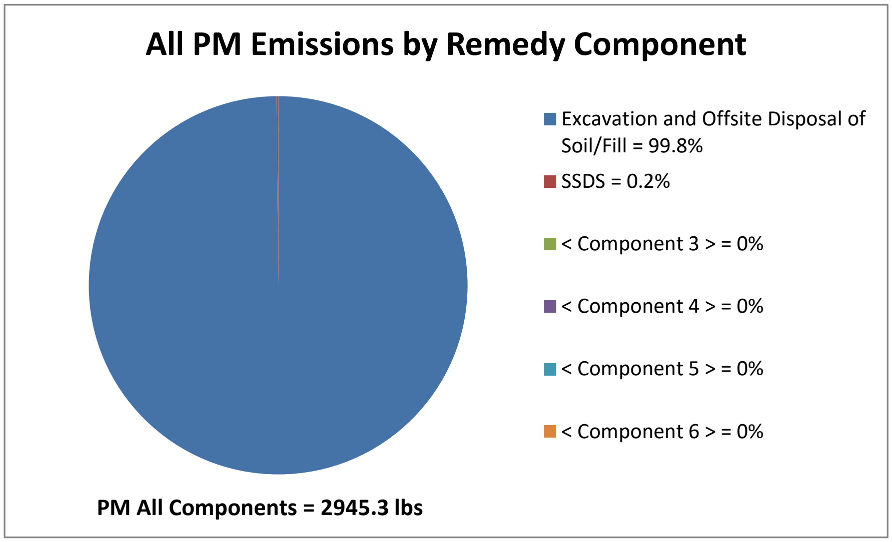
SOx lbs	Excavation	SSDS	< Compone	< Compone	< Compone	< Compone	Total	
On-site (Scope 1)	25.8	0.0	0.0	0.0	0.0	0.0	25.8	
Generation (Scope 2)	0.0	12.9	0.0	0.0	0.0	0.0	12.9	d Electricity
sportation (Scope 3a)	6.4	0.1	0.0	0.0	0.0	0.0	6.5	Trar
ner Off-Site (Scope 3b)	719.2	26.4	0.0	0.0	0.0	0.0	745.6	Oth
Total	751.5	39.4	0.0	0.0	0.0	0.0	790.9	

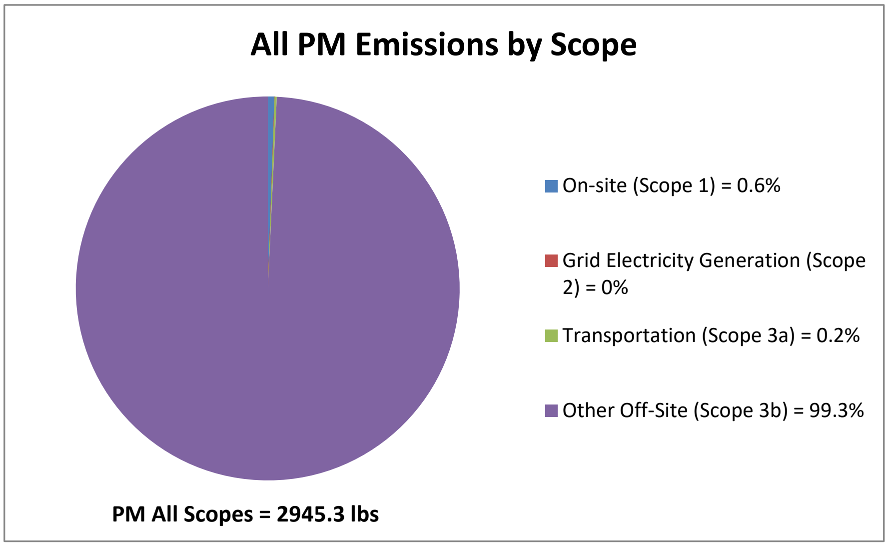
Excavation and Offsite Disposal of Soil/Fill =
SSDS = 5%
< Component 3 > = 0%
< Component 4 > = 0%
< Component 5 > = 0%
< Component 6 > = 0%

On-site (Scope 1) = 3.3%
Grid Electricity Generation (Scope 2) = 1.6%
Transportation (Scope 3a) = 0.8%
Other Off-Site (Scope 3b) = 94.3%

SOx All Components = 790.9 lbs
SOx All Scopes = 790.9 lbs


All PM Emissions by Remedy Component and Scope
(in Lbs)
3500
3000
2500
2000
1500
1000
500
0
Excavation and...
SSDS
< Component 3 >
< Component 4 >
< Component 5 >
< Component 6 >
Other Off-Site (Scope 3b)
Transportation (Scope 3a)
Grid Electricity Generation (Scope 2)
On-site (Scope 1)
PM All Components = 2945.3 lbs


All PM Emissions by Remedy Component
Excavation and Offsite Disposal of Soil/Fill = 99.8%
SSDS = 0.2%
< Component 3 > = 0%
< Component 4 > = 0%
< Component 5 > = 0%
< Component 6 > = 0%
PM All Components = 2945.3 lbs


All PM Emissions by Scope
On-site (Scope 1) = 0.6%
Grid Electricity Generation (Scope 2) = 0%
Transportation (Scope 3a) = 0.2%
Other Off-Site (Scope 3b) = 99.3%
PM All Scopes = 2945.3 lbs

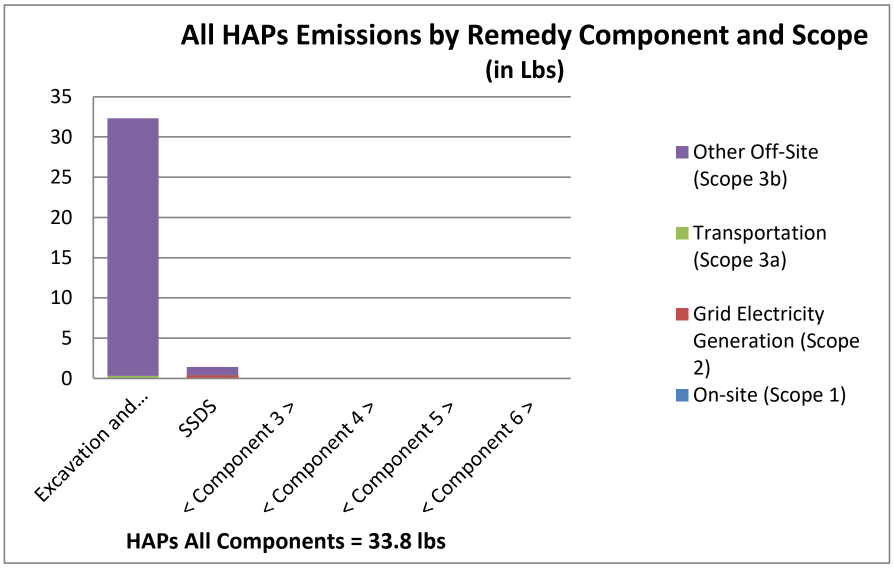
PM
lbs

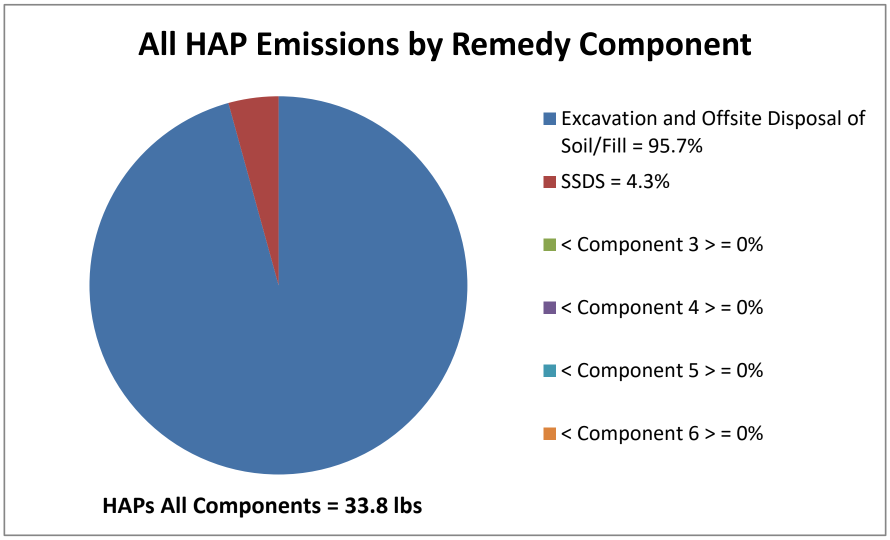
	Excavation	SSDS	< Compone	< Compone	< Compone	< Compone	Total	
On-site (Scope 1)	16.3	0.0	0.0	0.0	0.0	0.0	16.3	
' Generation (Scope 2)	0.0	0.7	0.0	0.0	0.0	0.0	0.7	d Electricity
ısportation (Scope 3a)	4.7	0.1	0.0	0.0	0.0	0.0	4.8	Trar
ıer Off-Site (Scope 3b)	2,919.6	4.0	0.0	0.0	0.0	0.0	2,923.6	Otł
Total	2,940.6	4.7	0.0	0.0	0.0	0.0	2,945.3	

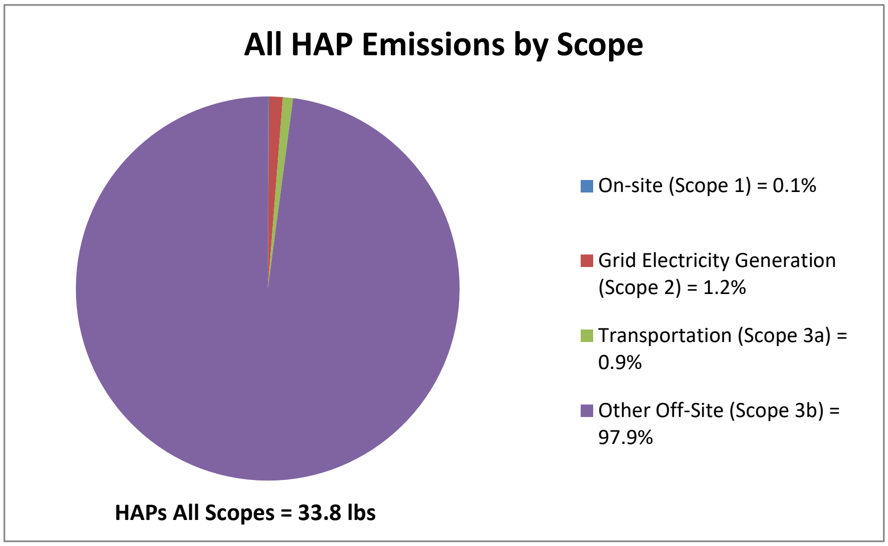
Excavation and Offsite Disposal of Soil/Fill = 9
SSDS = 0.2%
< Component 3 > = 0%
< Component 4 > = 0%
< Component 5 > = 0%
< Component 6 > = 0%

On-site (Scope 1) = 0.6%
Grid Electricity Generation (Scope 2) = 0%
Transportation (Scope 3a) = 0.2%
Other Off-Site (Scope 3b) = 99.3%

PM All Components = 2945.3 lbs
PM All Scopes = 2945.3 lbs


All HAPs Emissions by Remedy Component and Scope
(in Lbs)
35
30
25
20
15
10
5
0
Excavation and...
SSDS
< Component 3 >
< Component 4 >
< Component 5 >
< Component 6 >
Other Off-Site (Scope 3b)
Transportation (Scope 3a)
Grid Electricity Generation (Scope 2)
On-site (Scope 1)
HAPs All Components = 33.8 lbs


All HAP Emissions by Remedy Component
Excavation and Offsite Disposal of Soil/Fill = 95.7%
SSDS = 4.3%
< Component 3 > = 0%
< Component 4 > = 0%
< Component 5 > = 0%
< Component 6 > = 0%
HAPs All Components = 33.8 lbs


All HAP Emissions by Scope
On-site (Scope 1) = 0.1%
Grid Electricity Generation (Scope 2) = 1.2%
Transportation (Scope 3a) = 0.9%
Other Off-Site (Scope 3b) = 97.9%
HAPs All Scopes = 33.8 lbs

HAPs
lbs

	Excavation	SSDS	< Compone	< Compone	< Compone	< Compone	Total
On-site (Scope 1)	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Generation (Scope 2)	0.0	0.4	0.0	0.0	0.0	0.0	0.4
nsportation (Scope 3a)	0.3	0.0	0.0	0.0	0.0	0.0	0.3
ner Off-Site (Scope 3b)	32.0	1.0	0.0	0.0	0.0	0.0	33.1
Total	32.3	1.4	0.0	0.0	0.0	0.0	33.8

Excavation and Offsite Disposal of Soil/Fill =
SSDS = 4.3%
< Component 3 > = 0%
< Component 4 > = 0%
< Component 5 > = 0%
< Component 6 > = 0%

On-site (Scope 1) = 0.1%
Grid Electricity Generation (Scope 2) = 1.2%
Transportation (Scope 3a) = 0.9%
Other Off-Site (Scope 3b) = 97.9%

HAPs All Components = 33.8 lbs
HAPs All Scopes = 33.8 lbs

Spreadsheets for Environmental Footprint Analysis (SEFA) Version 3.0, November 2019
236-246 Gold Street - Track 1 Remedial Action

Input Summary

Remedy Component Number →		1	2	3	4	5	6															
		Column headings in Row 6 must match the name of "Input" tabs in this workbook for Columns C - P in this table to be populated ("0" in Row 4 means "Input" tab is turned Off and will not be grouped to a Remedy Component (Columns Q - V) or used in subsequent calculations)														Remedy Component Subtotals						
Item		Excavation	SSDS	Input Template (3)	Input Template (4)	Input Template (5)	Input Template (6)	Input Template (7)	Input Template (8)	Input Template (9)	Input Template (10)	Input Template (11)	Input Template (12)	Input Template (13)	Input Template (14)	1	2	3	4	5	6	Total
On-Site																						
On-site Renewable Energy																						
Renewable electricity generated on-site	MWh	0	0													0	0	0	0	0	0	0
Landfill gas combusted on-site for energy use	ccf CH$_4$	0	0													0	0	0	0	0	0	0
On-site biodiesel use	gal	0	0													0	0	0	0	0	0	0
On-site biodiesel use - Other	gal	0	0													0	0	0	0	0	0	0
User-defined on-site renewable energy use #1	TBD	0	0													0	0	0	0	0	0	0
User-defined on-site renewable energy use #2	TBD	0	0													0	0	0	0	0	0	0
On-Site Conventional Energy																						
Grid electricity	MWh	0	8.7635													0	8.7635	0	0	0	0	8.7635
On-site diesel use - Other	Gal	4781.25	0													4781.25	0	0	0	0	0	4781.25
On-site diesel use <75 hp	Gal	0	0													0	0	0	0	0	0	0
On-site diesel use 75<hp<750	Gal	0	0													0	0	0	0	0	0	0
On-site diesel use >750 hp	Gal	0	0													0	0	0	0	0	0	0
On-site gasoline use - Other	Gal	0	0													0	0	0	0	0	0	0
On-site gasoline use <25 hp	Gal	0	0													0	0	0	0	0	0	0
On-site gasoline use >25 hp	Gal	0	0													0	0	0	0	0	0	0
On-site natural gas use	ccf	0	0													0	0	0	0	0	0	0
On-site compressed natural gas use - Other	ccf	0	0													0	0	0	0	0	0	0
On-site compressed natural gas use	ccf	0	0													0	0	0	0	0	0	0
On-site liquified petroleum gas use - Other	gal	0	0													0	0	0	0	0	0	0
On-site liquified petroleum gas use	gal	0	0													0	0	0	0	0	0	0
Other forms of on-site conventional energy use #1	TBD	0	0													0	0	0	0	0	0	0
Other forms of on-site conventional energy use #2	TBD	0	0													0	0	0	0	0	0	0
Other On-site Emissions																						
On-site HAP process emissions	Lbs	0	0													0	0	0	0	0	0	0
On-site GHG emissions	Lbs CO2e	0	0													0	0	0	0	0	0	0
On-site carbon storage	Lbs CO2e	0	0													0	0	0	0	0	0	0
GHG avoided by flaring on-site landfill methane	ccf CH4	0	0													0	0	0	0	0	0	0
Other on-site NOx emissions or reductions	Lbs	0	0													0	0	0	0	0	0	0
Other on-site SOx emissions or reductions	Lbs	0	0													0	0	0	0	0	0	0
Other on-site PM emissions or reductions	Lbs	0	0													0	0	0	0	0	0	0
Electricity Generation																						
Grid electricity	MWh	0	8.7635													0	8.7635	0	0	0	0	8.7635
Voluntary purchase of renewable electricity	MWh	0	0													0	0	0	0	0	0	0
Voluntary purchase of RECs	MWh	0	0													0	0	0	0	0	0	0
Transportation																						
Transportation Fuel Use Breakdown																						
Biodiesel use - Personnel Transport	gal	0	0													0	0	0	0	0	0	0
Biodiesel use - Personnel Transport - User Defined	gal	0	0													0	0	0	0	0	0	0
Biodiesel use - Equipment Transport	gal	0	0													0	0	0	0	0	0	0
Biodiesel use - Equipment Transport - User Defined	gal	0	0													0	0	0	0	0	0	0
Biodiesel use - Material Transport	gal	0	0													0	0	0	0	0	0	0
Biodiesel use - Material Transport - User Defined	gal	0	0													0	0	0	0	0	0	0
Biodiesel use - Waste Transport	gal	0	0													0	0	0	0	0	0	0
Biodiesel use - Waste Transport - User Defined	gal	0	0													0	0	0	0	0	0	0
Diesel use - Personnel Transport - other vehicles	gal	0	0													0	0	0	0	0	0	0
Diesel use - Personnel Transport - car	gal	0	0													0	0	0	0	0	0	0
Diesel use - Personnel Transport - passenger truck	gal	95.4	0													95.4	0	0	0	0	0	95.4
Diesel use - Personnel Transport - User Defined	gal	0	0													0	0	0	0	0	0	0
Diesel use - Equipment Transport	gal	0.6	0													0.6	0	0	0	0	0	0.6
Diesel use - Equipment Transport - User Defined	gal	0	0													0	0	0	0	0	0	0
Diesel use - Material Transport	gal	0	20.501													0	20.501	0	0	0	0	20.501
Diesel use - Material Transport - User Defined	gal	0	0													0	0	0	0	0	0	0
Diesel use - Waste Transport	gal	1187.5	0													1187.5	0	0	0	0	0	1187.5
Diesel use - Waste Transport - User Defined	gal	0	0													0	0	0	0	0	0	0
Gasoline use - Personnel Transport - other vehicles	gal	0	0													0	0	0	0	0	0	0
Gasoline use - Personnel Transport - car	gal	4.8	0.8													4.8	0.8	0	0	0	0	5.6
Gasoline use - Personnel Transport - passenger truck	gal	0	0													0	0	0	0	0	0	0
Gasoline use - Personnel Transport - User Defined	gal	0	0													0	0	0	0	0	0	0
Gasoline use - Equipment Transport	gal	0	0													0	0	0	0	0	0	0
Gasoline use - Equipment Transport - User Defined	gal	0	0													0	0	0	0	0	0	0
Natural Gas use - Personnel Transport	ccf	0	0													0	0	0	0	0	0	0
Natural Gas use - Personnel Transport - User Defined	ccf	0	0													0	0	0	0	0	0	0
Natural Gas use - Equipment Transport	ccf	0	0													0	0	0	0	0	0	0

Spreadsheets for Environmental Footprint Analysis (SEFA) Version 3.0, November 2019
236-246 Gold Street - Track 1 Remedial Action

Input Summary

Remedy Component Number →		1	2	3	4	5	6															
		Column headings in Row 6 must match the name of "Input" tabs in this workbook for Columns C - P in this table to be populated ("0" in Row 4 means "Input" tab is turned Off and will not be grouped to a Remedy Component (Columns Q - V) or used in subsequent calculations)														Remedy Component Subtotals						
Item		Excavation	SSDS	Input Template (3)	Input Template (4)	Input Template (5)	Input Template (6)	Input Template (7)	Input Template (8)	Input Template (9)	Input Template (10)	Input Template (11)	Input Template (12)	Input Template (13)	Input Template (14)	1	2	3	4	5	6	Total
Conventional Energy																						
Transportation diesel use	gal	1283.5	20.501													1283.5	20.501	0	0	0	0	1304.001
Transportation gasoline use	gal	4.8	0.8													4.8	0.8	0	0	0	0	5.6
Transportation natural gas use	ccf	0	0													0	0	0	0	0	0	0
User-defined conventional energy transportation #1	TBD	10	10													10	10	0	0	0	0	20
User-defined conventional energy transportation #2	TBD	0	0													0	0	0	0	0	0	0
Renewable Energy																						
Transportation biodiesel use	gal	0	0													0	0	0	0	0	0	0
User-defined renewable energy transportation #1	TBD	0	0													0	0	0	0	0	0	0
User-defined renewable energy transportation #2	TBD	0	0													0	0	0	0	0	0	0
Off-Site																						
Construction Materials																						
Aluminum, Rolled Sheet	lb	0	0													0	0	0	0	0	0	0
Asphalt, mastic	lb	0	0													0	0	0	0	0	0	0
Asphalt, paving-grade	lb	0	0													0	0	0	0	0	0	0
Ethanol, Corn, 95%	lb	0	0													0	0	0	0	0	0	0
Ethanol, Corn, 99.7%	lb	0	0													0	0	0	0	0	0	0
Ethanol, Petroleum, 99.7%	lb	0	0													0	0	0	0	0	0	0
Gravel/Sand Mix, 65% Gravel	lb	0	0													0	0	0	0	0	0	0
Gravel/sand/clay	lb	0	0													0	0	0	0	0	0	0
HDPE	lb	0	0													0	0	0	0	0	0	0
Photovoltaic system (installed)	W	0	0													0	0	0	0	0	0	0
PVC	lb	0	1000													0	1000	0	0	0	0	1000
Portland cement, US average	lb	0	0																			
Ready-mixed concrete, 20 MPa	ft3	0	0													0	0	0	0	0	0	0
Round Gravel	lb	0	574000													0	574000	0	0	0	0	574000
Sand	lb	0	0													0	0	0	0	0	0	0
Stainless Steel	lb	0	0													0	0	0	0	0	0	0
Steel	lb	0	0													0	0	0	0	0	0	0
Other refined construction materials	lb	0	1130													0	1130	0	0	0	0	1130
Other unrefined construction materials	lb	0	0													0	0	0	0	0	0	0
Treatment Materials & Chemicals																						
Cheese Whey	lbs	0	0													0	0	0	0	0	0	0
Emulsified vegetable oil	lbs	0	0													0	0	0	0	0	0	0
Granular activated carbon, primary	lbs	0	0													0	0	0	0	0	0	0
Granular activated carbon, regenerated	lbs	0	0													0	0	0	0	0	0	0
Hydrogen Peroxide, 50% in H2O	lbs	0	0													0	0	0	0	0	0	0
Iron (II) Sulfate	lbs	0	0													0	0	0	0	0	0	0
Lime, Hydrated, Packed	lbs	0	0													0	0	0	0	0	0	0
Molasses	lbs	0	0													0	0	0	0	0	0	0
Phosphoric Acid, 70% in H2O	lbs	0	0													0	0	0	0	0	0	0
Potassium Permanganate	lbs	0	0													0	0	0	0	0	0	0
Sodium Hydroxide, 50% in H2O	lbs	0	0													0	0	0	0	0	0	0
Other Treatment Chemicals & Materials	lbs	0	0													0	0	0	0	0	0	0
Material Type																						
Total Virgin Refined Materials	tons	0	288.065													0	288.065	0	0	0	0	288.065
Total Recycled Refined Materials	tons	0	0													0	0	0	0	0	0	0
Total Reused Refined Materials	tons	0	0													0	0	0	0	0	0	0
Total Refined Material	tons	0	288.065													0	288.065	0	0	0	0	288.065
Total Virgin Unrefined Materials	tons	0	0													0	0	0	0	0	0	0
Total Recycled Unrefined Materials	tons	0	0													0	0	0	0	0	0	0
Total Reused Unrefined Materials	tons	0	0													0	0	0	0	0	0	0
Total Unrefined Material	tons	0	0													0	0	0	0	0	0	0
Fuel Processing																						
Biodiesel produced	gal	0	0													0	0	0	0	0	0	0
Diesel produced	gal	6064.75	20.501													6064.75	20.501	0	0	0	0	6085.251
Gasoline produced	gal	4.8	0.8													4.8	0.8	0	0	0	0	5.6
Compressed natural gas produced	ccf	0	0													0	0	0	0	0	0	0
Liquified petroleum gas produced	gal	0	0													0	0	0	0	0	0	0
Natural gas produced	ccf	0	0													0	0	0	0	0	0	0
Water Use																						
Public Water Supply	gal x 1000	20	0													20	0	0	0	0	0	20
Extracted Groundwater	gal x 1000	0	0													0	0	0	0	0	0	0
Surface Water	gal x 1000	0	0													0	0	0	0	0	0	0
Reclaimed Water	gal x 1000	0	0													0	0	0	0	0	0	0
Collected/Diverted Storm Water	gal x 1000	0	0													0	0	0	0	0	0	0
User-defined water resource #1	gal x 1000	0	0													0	0	0	0	0	0	0
User-defined water resource #2	gal x 1000	0	0													0	0	0	0	0	0	0

Input Summary

Remedy Component Number →		**1**	**2**	**3**	**4**	**5**	**6**															
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Item		**Excavation**	**SSDS**	**Input Template (3)**	**Input Template (4)**	**Input Template (5)**	**Input Template (6)**	**Input Template (7)**	**Input Template (8)**	**Input Template (9)**	**Input Template (10)**	**Input Template (11)**	**Input Template (12)**	**Input Template (13)**	**Input Template (14)**	**1**	**2**	**3**	**4**	**5**	**6**	**Total**
Waste/Recycle Handling																						
Hazardous waste incineration	lbs	0	0													0	0	0	0	0	0	0
Off-site waste water treatment (POTW)	gal x 1000	0	0													0	0	0	0	0	0	0
Off-site non-hazardous waste landfill	tons	6450	0													6450	0	0	0	0	0	6450
Off-site hazardous waste landfill	tons	700	0													700	0	0	0	0	0	700
Recycled/Reused On-Site	tons	0	0													0	0	0	0	0	0	0
Recycled/Reused Off-Site	tons	0	0													0	0	0	0	0	0	0
Solid Waste Totals																						
Total Non-Hazardous Waste	tons	6450	0													6450	0	0	0	0	0	6450
Total Hazardous Waste	tons	700	0													700	0	0	0	0	0	700
Total Recycled/Reused	tons	0	0													0	0	0	0	0	0	0
Total Waste (all types)	tons	7150	0													7150	0	0	0	0	0	7150
Lab Services																						
Off-site Laboratory Analysis - Other	sample	114	0													114	0	0	0	0	0	114
Off-site Laboratory Analysis - Metals	sample	38	0													38	0	0	0	0	0	38
Off-site Laboratory Analysis - Mercury	sample	38	0													38	0	0	0	0	0	38
Off-site Laboratory Analysis - Inorganic Anions	sample	0	0													0	0	0	0	0	0	0
Off-site Laboratory Analysis - Alkalinity	sample	0	0													0	0	0	0	0	0	0
Off-site Laboratory Analysis - Perchlorate	sample	0	0													0	0	0	0	0	0	0
Off-site Laboratory Analysis - Nitrogen/Nitrate	sample	0	0													0	0	0	0	0	0	0
Off-site Laboratory Analysis - Sulfate	sample	0	0													0	0	0	0	0	0	0
Off-site Laboratory Analysis - PCBs	sample	38	0													38	0	0	0	0	0	38
Off-site Laboratory Analysis - VOCs	sample	40	10													40	10	0	0	0	0	50
Off-site Laboratory Analysis - SVOCs	sample	38	0													38	0	0	0	0	0	38
Resource Extraction for Electricity																						
Coal extraction and processing	MWh	0	0.52581													0	0.52581	0	0	0	0	0.52581
Natural gas extraction and processing	MWh	0	0.87635													0	0.87635	0	0	0	0	0.87635
Nuclear fuel extraction and processing	MWh	0	0.17527													0	0.17527	0	0	0	0	0.17527
Oil extraction and processing	MWh	0	0.438175													0	0.438175	0	0	0	0	0.438175
Other fuel extraction and processing	MWh	0	0													0	0	0	0	0	0	0
Electricity Transmission																						
Transmission and distribution losses	MWh	0	8.7635													0	8.7635	0	0	0	0	8.7635

Input Summary

Remedy Component Number →		1	2	3	4	5	6									Remedy Component Subtotals						
		Column headings in Row 6 must match the name of "Input" tabs in this workbook for Columns C - P in this table to be populated ("0" in Row 4 means "Input" tab is turned Off and will not be grouped to a Remedy Component (Columns Q - V) or used in subsequent calculations)																				
Item		Excavation	SSDS	Input Template (3)	Input Template (4)	Input Template (5)	Input Template (6)	Input Template (7)	Input Template (8)	Input Template (9)	Input Template (10)	Input Template (11)	Input Template (12)	Input Template (13)	Input Template (14)	1	2	3	4	5	6	Total
Other																						
User-defined material #1	TBD	0	0													0	0	0	0	0	0	0
User-defined material #2	TBD	0	0													0	0	0	0	0	0	0
User-defined material #3	TBD	0	0													0	0	0	0	0	0	0
User-defined material #4	TBD	0	0													0	0	0	0	0	0	0
User-defined material #5	TBD	0	0													0	0	0	0	0	0	0
User-defined material #6	TBD	0	0													0	0	0	0	0	0	0
User-defined material #7	TBD	0	0													0	0	0	0	0	0	0
User-defined material #8	TBD	0	0													0	0	0	0	0	0	0
User-defined material #9	TBD	0	0													0	0	0	0	0	0	0
User-defined material #10	TBD	0	0													0	0	0	0	0	0	0
User-defined material #11	TBD	0	0													0	0	0	0	0	0	0
User-defined material #12	TBD	0	0													0	0	0	0	0	0	0
User-defined material #13	TBD	0	0													0	0	0	0	0	0	0
User-defined material #14	TBD	0	0													0	0	0	0	0	0	0
User-defined material #15	TBD	0	0													0	0	0	0	0	0	0
User-defined material #16	TBD	0	0													0	0	0	0	0	0	0
User-defined material #17	TBD	0	0													0	0	0	0	0	0	0
User-defined material #18	TBD	0	0													0	0	0	0	0	0	0
User-defined material #19	TBD	0	0													0	0	0	0	0	0	0
User-defined material #20	TBD	0	0													0	0	0	0	0	0	0
User-defined Waste Destinations																						
User-defined recycled/reused on-site #1	TBD	0	0													0	0	0	0	0	0	0
User-defined recycled/reused on-site #2	TBD	0	0													0	0	0	0	0	0	0
User-defined recycled/reused on-site #3	TBD	0	0													0	0	0	0	0	0	0
User-defined recycled/reused off-site #1	TBD	0	0													0	0	0	0	0	0	0
User-defined recycled/reused off-site #2	TBD	0	0													0	0	0	0	0	0	0
User-defined recycled/reused off-site #3	TBD	0	0													0	0	0	0	0	0	0
User-defined non-hazardous waste destination #1	TBD	0	0													0	0	0	0	0	0	0
User-defined non-hazardous waste destination #2	TBD	0	0													0	0	0	0	0	0	0
User-defined non-hazardous waste destination #3	TBD	0	0													0	0	0	0	0	0	0
User-defined hazardous waste destination #1	TBD	0	0													0	0	0	0	0	0	0
User-defined hazardous waste destination #2	TBD	0	0													0	0	0	0	0	0	0
User-defined hazardous waste destination #3	TBD	0	0													0	0	0	0	0	0	0

Excavation and Offsite Disposal of Soil/Fill - On-Site Footprint (Scope 1)

			Energy		**GHG**		**NOx**		**SOx**		**PM**		**HAPs**	
Contributors to Footprints	**Units**	**Usage**	**Conv. Factor**	**MMBtus**	**Conv. Factor**	**lbs CO2e**	**Conv. Factor**	**lbs**	**Conv. Factor**	**lbs**	**Conv. Factor**	**lbs**	**Conv. Factor**	**lbs**
On-Site														
On-site Renewable Energy														
Renewable electricity generated on-site	MWh	0	3.413	0										
Landfill gas combusted on-site for energy use	ccf CH4	0	0.103	0	13.1	0	0.01	0	0.0000063	0	0.00076	0	0.0000084	0
On-site biodiesel use	gal	0	0.127	0	22.3	0	0.2	0	0	0	0.00099	0	NP	
On-site biodiesel use - User Defined	gal	0	0.127	0	22.3	0	0.2	0	0	0	0.00099	0	NP	
User-defined on-site renewable energy use #1	gal	0	0	0	0	0	0	0	0	0	0	0	0	0
User-defined on-site renewable energy use #2	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0
On-site Renewable Energy Subtotals				**0**		**0**		**0**		**0**		**0**		**0**
Notes:														
On-site Conventional Energy														
On-site grid electricity	MWh	0	3.413	0										
On-site diesel use - Other	Gal	4781.25	0.139	664.59375	22.5	107578.13	0.17	812.8125	0.0054	25.81875	0.0034	16.25625	0.0000052	0.0248625
On-site diesel use <75 hp	Gal	0	0.139	0	22.21	0	0.1565	0	0.000145	0	0.0145	0	0.00004	0
On-site diesel use 75<hp<750	Gal	0	0.139	0	22.24	0	0.101	0	0.00013	0	0.009	0	0.00004	0
On-site diesel use >750 hp	Gal	0	0.139	0	22.24	0	0.149	0	0.00013	0	0.006	0	0.00004	0
On-site gasoline use - Other	Gal	0	0.124	0	19.6	0	0.11	0	0.0045	0	0.00054	0	0.000039	0
On-site gasoline use <25 hp	Gal	0	0.124	0	17.48	0	0.037	0	0.00025	0	0.165	0	0.00008	0
On-site gasoline use >25 hp	Gal	0	0.124	0	19.93	0	0.032	0	0.00029	0	0.002	0	0.00009	0
On-site natural gas use	ccf	0	0.103	0	13.1	0	0.01	0	0.0000063	0	0.00076	0	0.0000084	0
On-site compressed natural gas use - Other	ccf	0	NP		1957.835	0	16.0325	0	0.023045	0	0.2775	0	0	0
On-site compressed natural gas use	ccf	0	NP		1957.835	0	16.0325	0	0.023045	0	0.2775	0	0	0
On-site liquified petroleum gas use - Other	gal	0	NP		12.69	0	0.021	0	0.00013	0	0.001	0	0	0
On-site liquified petroleum gas use	gal	0	NP		12.69	0	0.021	0	0.00013	0	0.001	0	0	0
Other forms of on-site conventional energy use #1	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0
Other forms of on-site conventional energy use #2	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0
On-site Conventional Energy Subtotals				**665**		**107,578**		**813**		**26**		**16**		**0**
Notes:														
Other On-site Emissions														
On-site HAP process emissions	lbs	0											1	0
On-site GHG emissions	lbs CO2e	0			1	0								
On-site carbon storage	lbs CO2e	0			1	0								
GHG avoided by flaring on-site landfill methane	Lbs	0			-262	0	0.01	0	0.0000063	0	0.00076	0	0.0000084	0
Other on-site NOx emissions or reductions	lbs	0					1	0						
Other on-site SOx emissions or reductions	lbs	0							1	0				
Other on-site PM emissions or reductions	lbs	0									1	0		
User-defined recycled/reused on-site #2	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0
User-defined recycled/reused on-site #3	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0
User-defined recycled/reused off-site #1	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0
Notes:														
On-site Totals				**664.59**		**107,578**		**813**		**26**		**16**		**0**

Excavation and Offsite Disposal of Soil/Fill - Electricity Generation Footprint (Scope 2)

			Energy		GHG		NOx		SOx		PM		HAPs	
Contributors to Footprints	**Units**	**Usage**	**Conv. Factor**	**MMBtus**	**Conv. Factor**	**lbs CO2e**	**Conv. Factor**	**lbs**	**Conv. Factor**	**lbs**	**Conv. Factor**	**lbs**	**Conv. Factor**	**lbs**
Electricity Generation														
Grid electricity	MWh	0	6.929	0	1124.3	0	2.2421	0	4.6078874	0	0.057518	0	0.2102371	0
Voluntary purchase of renewable electricity	MWh	0												
Voluntary purchase of RECs	MWh	0												
Notes:														

Excavation and Offsite Disposal of Soil/Fill - Transportation Footprint (Scope 3a)

			Energy		Greenhouse Gas		NOx		SOx		PM		HAPs	
Category	**Units**	**Usage**	**Conv. Factor**	**MMBtus**	**Conv. Factor**	**lbs CO2e**	**Conv. Factor**	**lbs**	**Conv. Factor**	**lbs**	**Conv. Factor**	**lbs**	**Conv. Factor**	**lbs**
Conventional Energy														
Transportation diesel use	gal	1188.1	0.139	165.1459	22.5	26732.25	0.17	201.977	0.0054	6.41574	0.0034	4.03954	0.0000052	0.0061781
Transportation diesel use - car	gal	0	0.139	0	22.57	0	0.015	0	0.0002	0	0.003	0	0.00252	0
Transportation diesel use - passenger truck	gal	95.4	0.139	13.2606	22.545	2150.793	0.0585	5.5809	0.0002	0.01908	0.007	0.6678	0.002605	0.248517
Transportation diesel use - User Defined	gal	0	0.139	0	22.5	0	0.17	0	0.0054	0	0.0034	0	0.0000052	0
Transportation gasoline use	gal	0	0.124	0	19.6	0	0.11	0	0.0045	0	0.00054	0	0.000039	0
Transportation gasoline use - car	gal	4.8	0.124	0.5952	19.77	94.896	0.027	0.1296	0.00036	0.001728	0.003	0.0144	0.0067	0.03216
Transportation gasoline use - passenger truck	gal	0	0.124	0	19.79	0	0.035	0	0.00036	0	0.003	0	0.00661	0
Transportation gasoline use - User Defined	gal	0	0.124	0	19.6	0	0.11	0	0.0045	0	0.00054	0	0.000039	0
Transportation natural gas use	ccf	0	0.103	0	13.1	0	0.01	0	0.0000063	0	0.00076	0	0.0000084	0
Transportation natural gas use - User Defined	ccf	0	0.103	0	13.1	0	0.01	0	0.0000063	0	0.00076	0	0.0000084	0
User-defined conventional energy transportation #1	TBD	10	0	0	0	0	0	0	0	0	0	0	0	0
User-defined conventional energy transportation #2	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0
Conventional Energy Subtotals				**179**		**28,978**		**208**		**6**		**5**		**0**
Notes:														
Renewable Energy														
Transportation biodiesel use	gal	0	0.127	0	22.3	0	0.2	0	0	0	0.00099	0	NP	
Transportation biodiesel use - User Defined	gal	0	0.127	0	22.3	0	0.2	0	0	0	0.00099	0	NP	
User-defined renewable energy transportation #1	TBD	0	Biodiesel		0	0	0	0	0	0	0	0	Ref.	
User-defined renewable energy transportation #2	TBD	0	npg or pmp		0	0	0	0	0	0	0	0	0	0
Renewable Energy Subtotals				**0**		**0**		**0**		**0**		**0**		**0**
Notes:														
Transportation Totals				**179**		**28978**		**208**		**6**		**5**		**0**

Excavation and Offsite Disposal of Soil/Fill - Off-Site Footprint (Scope 3b)

			Energy		**Greenhouse Gas**		**NOx**		**SOx**		**PM**		**HAPs**	
Category	**Units**	**Usage**	**Conv. Factor**	**MMBtus**	**Conv. Factor**	**lbs CO2e**	**Conv. Factor**	**lbs**	**Conv. Factor**	**lbs**	**Conv. Factor**	**lbs**	**Conv. Factor**	**lbs**
Construction Materials														
Aluminum, Rolled Sheet	lb	0	0.0633	0	9.15	0	0.0148	0	0.0283	0	0.0088	0	0.00102	0
Asphalt, mastic	lb	0	0.0412	0	0.85	0	0.00271	0	0.00798	0	0.000766	0	0.00107	0
Asphalt, paving-grade	lb	0	0.5	0	8.58	0	0.0299	0	0.0969	0	0.0091	0	0.0133	0
Ethanol, Corn, 95%	lb	0	0.0318	0	-0.0199	0	0.00425	0	0.00303	0	0.000469	0	0.0000846	0
Ethanol, Corn, 99.7%	lb	0	0.0324	0	0.0591	0	0.00431	0	0.0031	0	0.000472	0	0.000087	0
Ethanol, Petroleum, 99.7%	lb	0	0.0205	0	1.25	0	0.00199	0	0.00214	0	0.000277	0	0.0000589	0
Gravel/Sand Mix, 65% Gravel	lb	0	0.0000248	0	0.0024	0	0.000018	0	4.52E-06	0	2.61E-06	0	3.08E-07	0
Gravel/sand/clay	lb	0	0.000028	0	0.00335	0	0.0000165	0	0.000015	0	0.000002	0	2.05E-10	0
HDPE	lb	0	0.0332	0	1.94	0	0.00325	0	0.00409	0	0.000439	0	0.0000641	0
Photovoltaic system (installed)	W	0	0.0336	0	4.47	0	0.015	0	0.032	0	0.00063	0	0.0000029	0
PVC	lb	0	0.0262	0	2.02	0	0.004	0	0.00274	0	0.000372	0	0.000375	0
Portland cement, US average	lb	0	0.0139	0	1.34	0	0.00654	0	0.0104	0	0.00378	0	0.00097	0
Ready-mixed concrete, 20 MPa	ft3	0	0.217	0	19.5	0	0.0975	0	0.154	0	0.057	0	0.0141	0
Round Gravel	lb	0	0.0000248	0	0.0024	0	0.000018	0	4.52E-06	0	2.61E-06	0	3.08E-07	0
Sand	lb	0	0.0000248	0	0.0024	0	0.000018	0	4.52E-06	0	2.61E-06	0	3.08E-07	0
Stainless Steel	lb	0	0.0116	0	3.4	0	0.0075	0	0.012	0	0.0044	0	0.000144	0
Steel	lb	0	0.0044	0	1.1	0	0.0014	0	0.0017	0	0.00056	0	0.000067	0
Other refined construction materials	lb	0	0.01885	0	2.115	0	0.0040375	0	0.0051325	0	0.0014428	0	0.0001625	0
Other unrefined construction materials	lb	0	0.000028	0	0.00335	0	0.0000165	0	0.000015	0	0.000002	0	2.05E-10	0

Notes:

Excavation and Offsite Disposal of Soil/Fill - Off-Site Footprint (Scope 3b)

			Energy		**Greenhouse Gas**		**NOx**		**SOx**		**PM**		**HAPs**	
			Conv.		**Conv.**		**Conv.**		**Conv.**		**Conv.**		**Conv.**	
Category	**Units**	**Usage**	**Factor**	**MMBtus**	**Factor**	**lbs CO2e**	**Factor**	**lbs**	**Factor**	**lbs**	**Factor**	**lbs**	**Factor**	**lbs**
Treatment Materials & Chemicals														
Cheese Whey	lbs	0	0.0025	0	0.031	0	0.000062	0	0.000033	0	0.000002	0	NP	
Emulsified vegetable oil	lbs	0	0.0077	0	3.44	0	0.0066	0	0.0019	0	0.000033	0	NP	
Granular activated carbon, primary	lbs	0	0.0356	0	4.82	0	0.0793	0	0.128	0	0.000987	0	0.000657	0
Granular activated carbon, regenerated	lbs	0	0.00873	0	1.7	0	0.00733	0	0.0129	0	0.000886	0	0.000671	0
Hydrogen Peroxide, 50% in H2O	lbs	0	0.00979	0	1.19	0	0.00142	0	0.0024	0	0.000308	0	0.0000629	0
Iron (II) Sulfate	lbs	0	0.00147	0	0.167	0	0.000316	0	0.000589	0	0.000103	0	0.000023	0
Lime, Hydrated, Packed	lbs	0	0.00206	0	0.762	0	0.000513	0	0.000358	0	0.00013	0	6.57E-06	0
Molasses	lbs	0	0.0044	0	0.48	0	0.0011	0	0.00024	0	0.0000041	0	NP	
Phosphoric Acid, 70% in H2O	lbs	0	0.0067	0	0.882	0	0.00282	0	0.0294	0	0.00171	0	0.000163	0
Potassium Permanganate	lbs	0	0.00981	0	1.16	0	0.00234	0	0.0032	0	0.000422	0	0.000122	0
Sodium Hydroxide, 50% in H2O	lbs	0	0.00977	0	1.09	0	0.00194	0	0.00352	0	0.000403	0	0.000129	0
Other Treatment Chemicals & Materials	lbs	0	0.015	0	1.67	0	0.003	0	0.0065	0	0.00061	0	0.000016	0
Notes:														
Fuel Processing														
Biodiesel produced	gal	0	0.029	0	-16.8	0	0.018	0	0.033	0	0.00082	0	NP	
Diesel produced	gal	6064.75	0.017	103.10075	3.02	18315.545	0.0051	30.930225	0.0062	37.60145	0.0017	10.310075	0.0011	6.671225
Gasoline produced	gal	4.8	0.033	0.1584	2.8	13.44	0.0046	0.02208	0.005	0.024	0.0015	0.0072	0.001	0.0048
Liquefied Petroleum Gas Produced	gal	0	0.088	0	1.47	0	0.0016	0	0.0024	0	0.0007	0	0.0003	0
Natural Gas - Compressed Produced	ccf	0	19.983	0	343.92	0	0.4732	0	2.1651	0	0.1846	0	0.2895	0
Natural Gas Produced	ccf	0	0.0052	0	2.2	0	0.0037	0	0.0046	0	0.000072	0	0.0000061	0
Fuel Processing Subtotals				**103.25915**		**18328.985**		**30.952305**		**37.62545**		**10.317275**		**6.676025**
Notes:														
Public water	gal x 1000	20	0.0092	0.184	5	100	0.0097	0.194	0.0059	0.118	0.016	0.32	0.000015	0.0003
User-defined water resource #1	gal x 1000	0	0	0	0	0	0	0	0	0	0	0	0	0
User-defined water resource #2	gal x 1000	0	0	0	0	0	0	0	0	0	0	0	0	0
Notes:														

Excavation and Offsite Disposal of Soil/Fill - Off-Site Footprint (Scope 3b)

			Energy		**Greenhouse Gas**		**NOx**		**SOx**		**PM**		**HAPs**	
Category	**Units**	**Usage**	**Conv. Factor**	**MMBtus**	**Conv. Factor**	**lbs CO2e**	**Conv. Factor**	**lbs**	**Conv. Factor**	**lbs**	**Conv. Factor**	**lbs**	**Conv. Factor**	**lbs**
Off-Site Services														
Hazardous waste incineration	lb	0	0.00609	0	2.43	0	0.0016	0	0.00167	0	0.000209	0	0.000087	0
Off-site waste water treatment (POTW)	gal x 1000	0	0.015	0	4.4	0	0.016	0	0.015	0	NP		NP	
Off-site non-hazardous waste landfill	ton	6450	0.16	1032	25	161250	0.14	903	0.075	483.75	0.4	2580	0.0014	9.03
Off-site hazardous waste landfill	ton	700	0.18	126	27.5	19250	0.154	107.8	0.0825	57.75	0.44	308	0.00154	1.078
Off-site Laboratory Analysis - Other	sample	114	0.058071	6.6200973	6.8534384	781.29198	0.131402	14.979823	0.3038758	34.641837	0.0455698	5.19496	0.0330165	3.7638843
Off-site Laboratory Analysis - Metals	sample	38	0.212	8.056	27.4693	1043.8334	0.6423	24.4074	1.5072	57.2736	0.2264	8.6032	0.1643	6.2434
Off-site Laboratory Analysis - Mercury	sample	38	0.0731715	2.780516	9.325458	354.3674	0.2127439	8.0842682	0.4982396	18.933105	0.0747359	2.8399657	0.0542332	2.0608601
Off-site Laboratory Analysis - Inorganic Anions	sample	0	0.0074025	0	0.6459478	0	0.0067681	0	0.0147929	0	0.0022024	0	0.0015542	0
Off-site Laboratory Analysis - Alkalinity	sample	0	0.0174398	0	1.3381922	0	0.0070106	0	0.0132496	0	0.00194	0	0.0012831	0
Off-site Laboratory Analysis - Perchlorate	sample	0	0.023885	0	1.8717054	0	0.0079807	0	0.0141535	0	0.0020547	0	0.0012875	0
Off-site Laboratory Analysis - Nitrogen/Nitrate	sample	0	0.0336475	0	4.29897	0	0.0954592	0	0.2226646	0	0.0335099	0	0.0242506	0
Off-site Laboratory Analysis - Sulfate	sample	0	0.0141225	0	1.4726728	0	0.0079807	0	0.0136024	0	0.0019797	0	0.0012015	0
Off-site Laboratory Analysis - PCBs	sample	38	0.0512769	1.9485222	5.224902	198.54628	0.0833339	3.1666874	0.1904774	7.2381427	0.0284393	1.0806949	0.0212083	0.8059136
Off-site Laboratory Analysis - VOCs	sample	40	0.0762045	3.0481795	9.016814	360.67256	0.104498	4.1799216	0.2270738	9.082952	0.0339508	1.3580336	0.0235892	0.9435688
Off-site Laboratory Analysis - SVOCs	sample	38	0.0715602	2.719287	7.870422	299.07604	0.1459445	5.5458918	0.3373038	12.817544	0.0504853	1.9184429	0.0372577	1.4157941
Notes:														
Resource Extraction for Electricity														
Coal extraction and processing	MWh	0	3.1	0	180.0	0	0.8	0	0.2	0	0.0	0	NP	
Natural gas extraction and processing	MWh	0	1.6	0	270.0	0	0.2	0	13.0	0	0.0	0	NP	
Nuclear fuel extraction and processing	MWh	0	0.2	0	25.0	0	0.2	0	0.5	0	0.0	0	NP	
Oil extraction and processing	MWh	0	2.3	0	270.0	0	1.7	0	0.1	0	0.0	0	NP	
Other fuel extraction and processing	MWh	0	0	0	0	0	0	0	0	0	0	0	0	0
Resource Extraction Subtotals				**0**		**0**		**0**		**0**		**0**		**0**
Notes:														
Electricity Transmission														
Transmission and distribution losses	MWh	0	1.0342	0	112.43	0	0.22421	0	0.4607887	0	0.0057518	0	0.0210237	0
Notes:														

Excavation and Offsite Disposal of Soil/Fill - Off-Site Footprint (Scope 3b)

			Energy		**Greenhouse Gas**		**NOx**		**SOx**		**PM**		**HAPs**	
Category	**Units**	**Usage**	**Conv. Factor**	**MMBtus**	**Conv. Factor**	**lbs CO2e**	**Conv. Factor**	**lbs**	**Conv. Factor**	**lbs**	**Conv. Factor**	**lbs**	**Conv. Factor**	**lbs**
User-defined Materials														
User-defined material #1	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0
User-defined material #2	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0
User-defined material #3	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0
User-defined material #4	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0
User-defined material #5	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0
User-defined material #6	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0
User-defined material #7	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0
User-defined material #8	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0
User-defined material #9	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0
User-defined material #10	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0
User-defined material #11	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0
User-defined material #12	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0
User-defined material #13	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0
User-defined material #14	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0
User-defined material #15	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0
User-defined material #16	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0
User-defined material #17	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0
User-defined material #18	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0
User-defined material #19	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0
User-defined material #20	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0
Notes:														
User-defined Waste Destinations														
User-defined recycled/reused off-site #1	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0
User-defined recycled/reused off-site #2	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0
User-defined recycled/reused off-site #3	TBD	0	y(MMBtu/		(lbs CO2e/		Ox(lbs/unit)		Ox(lbs/unit)		M(lbs/unit)		APs(lbs/unit	
User-defined non-hazardous waste destination #1	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0
User-defined non-hazardous waste destination #2	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0
User-defined non-hazardous waste destination #3	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0
User-defined hazardous waste destination #1	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0
User-defined hazardous waste destination #2	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0
User-defined hazardous waste destination #3	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0
Notes:														
Off-site Totals				**1286.6158**		**201966.77**		**1102.3103**		**719.23063**		**2919.6326**		**32.017746**

Excavation and Offsite Disposal of Soil/Fill - Intermediate Totals

Category	Units	Usage	Energy		Greenhouse Gas		NOx		SOx		PM		HAPs	
			Conv. Factor	MMBtus	Conv. Factor	lbs CO2e	Conv. Factor	lbs	Conv. Factor	lbs	Conv. Factor	lbs	Conv. Factor	lbs
Total Grid Electricity Footprint														
On-site grid electricity	MWh	0	3.413	0										
Electricity Generation														
Grid electricity	MWh	0	6.929	0	1124.3	0	2.2421	0	4.6078874	0	0.057518	0	0.2102371	0
Resource Extraction for Electricity														
Coal extraction and processing	MWh	0	3.1	0	180.0	0	0.8	0	0.2	0	0.0	0	NP	
Natural gas extraction and processing	MWh	0	1.6	0	270.0	0	0.2	0	13.0	0	0.0	0	NP	
Nuclear fuel extraction and processing	MWh	0	0.2	0	25.0	0	0.2	0	0.5	0	0.0	0	NP	
Oil extraction and processing	MWh	0	2.3	0	270.0	0	1.7	0	0.1	0	0.0	0	NP	
Other fuel extraction and processing	MWh	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0
Electricity Transmission														
Transmission and distribution losses	MWh	0	1.0342	0	112.43	0	0.22421	0	0.4607887	0	0.0057518	0	0.0210237	0
Total Grid Electricity Footprint				**0**		**0**		**0**		**0**		**0**		**0**
Total Fuel Footprints														
Total Gasoline Footprint														
On-site gasoline use - Other	gal	0	0.124	0	19.6	0	0.11	0	0.0045	0	0.00054	0	0.000039	0
On-site gasoline use <25 hp	gal	0	0.124	0	17.48	0	0.037	0	0.00025	0	0.165	0	0.00008	0
On-site gasoline use >25 hp	gal	0	0.124	0	19.93	0	0.032	0	0.00029	0	0.002	0	0.00009	0
Transportation gasoline use	gal	0	0.124	0	19.6	0	0.11	0	0.0045	0	0.00054	0	0.000039	0
Transportation gasoline use - car	gal	4.8	0.124	0.5952	19.77	94.896	0.027	0.1296	0.00036	0.001728	0.003	0.0144	0.0067	0.03216
Transportation gasoline use - passenger truck	gal	0	0.124	0	19.79	0	0.035	0	0.00036	0	0.003	0	0.00661	0
Transportation gasoline use - User Defined	gal	0	0.124	0	19.6	0	0.11	0	0.0045	0	0.00054	0	0.000039	0
Gasoline produced	gal	4.8	0.033	0.1584	2.8	13.44	0.0046	0.02208	0.005	0.024	0.0015	0.0072	0.001	0.0048
Total Gasoline Footprint		**4.8**		**0.7536**		**108.336**		**0.15168**		**0.025728**		**0.0216**		**0.03696**
Total Diesel Footprint														
On-site diesel use - Other	gal	4781.25	0.139	664.59375	22.5	107578.13	0.17	812.8125	0.0054	25.81875	0.0034	16.25625	0.0000052	0.0248625
On-site diesel use <75 hp	gal	0	0.139	0	22.21	0	0.1565	0	0.000145	0	0.0145	0	0.00004	0
On-site diesel use 75<hp<750	gal	0	0.139	0	22.24	0	0.101	0	0.00013	0	0.009	0	0.00004	0
On-site diesel use >750 hp	gal	0	0.139	0	22.24	0	0.149	0	0.00013	0	0.006	0	0.00004	0
Transportation diesel use	gal	1188.1	0.139	165.1459	22.5	26732.25	0.17	201.977	0.0054	6.41574	0.0034	4.03954	0.0000052	0.0061781
Transportation diesel use - car	gal	0	0.139	0	22.57	0	0.015	0	0.0002	0	0.003	0	0.00252	0
Transportation diesel use - passenger truck	gal	95.4	0.139	13.2606	22.545	2150.793	0.0585	5.5809	0.0002	0.01908	0.007	0.6678	0.002605	0.248517
Transportation diesel use - User Defined	gal	0	0.139	0	22.5	0	0.17	0	0.0054	0	0.0034	0	0.0000052	0
Diesel produced	gal	6064.75	0.017	103.10075	3.02	18315.545	0.0051	30.930225	0.0062	37.60145	0.0017	10.310075	0.0011	6.671225
Total Diesel Footprint		**6064.75**		**946.101**		**154776.71**		**1051.3006**		**69.85502**		**31.273665**		**6.9507826**
Total Biodiesel Footprint														
On-site biodiesel use	gal	0	0.127	0	22.3	0	0.2	0	0	0	0.00099	0	NP	
On-site biodiesel use - User Defined	gal	0	0.127	0	22.3	0	0.2	0	0	0	0.00099	0	NP	
Transportation biodiesel use	gal	0	0.127	0	22.3	0	0.2	0	0	0	0.00099	0	NP	
Transportation biodiesel use - User Defined	gal	0	0.127	0	22.3	0	0.2	0	0	0	0.00099	0	NP	
Biodiesel produced	gal	0	0.029	0	-16.8	0	0.018	0	0.033	0	0.00082	0	NP	
Total Biodiesel Footprint		**0**		**0**		**0**		**0**		**0**		**0**		**0**
Total Natural Gas Footprint														
On-site natural gas use	ccf	0	0.103	0	13.1	0	0.01	0	0.0000063	0	0.00076	0	0.0000084	0
Transportation natural gas use	ccf	0	0.103	0	13.1	0	0.01	0	0.0000063	0	0.00076	0	0.0000084	0
Transportation natural gas use - User Defined	ccf	0	0.103	0	13.1	0	0.01	0	0.0000063	0	0.00076	0	0.0000084	0
Natural gas produced	ccf	0	0.0052	0	2.2	0	0.0037	0	0.0046	0	0.000072	0	0.0000061	0
Total Natural Gas Footprint		**0**		**0**		**0**		**0**		**0**		**0**		**0**
Total Liquified Petroleum Gas Footprint														
On-site liquified petroleum gas use - Other	ccf	0	NP		12.69	0	0.021	0	0.00013	0	0.001	0	0	0
On-site liquified petroleum gas use	ccf	0	NP		12.69	0	0.021	0	0.00013	0	0.001	0	0	0
Liquified petroleum gas produced	ccf	0	0.088	0	1.47	0	0.0016	0	0.0024	0	0.0007	0	0.0003	0
Total Natural Gas Footprint		**0**		**0**		**0**		**0**		**0**		**0**		**0**
Total Compressed Gas Footprint														
On-site compressed gas use - Other	ccf	0	NP		1957.835	0	16.0325	0	0.023045	0	0.2775	0	0	0
On-site compressed gas use	ccf	0	NP		1957.835	0	16.0325	0	0.023045	0	0.2775	0	0	0
Compressed gas produced	ccf	0	19.983	0	343.92	0	0.4732	0	2.1651	0	0.1846	0	0.2895	0
Total Natural Gas Footprint		**0**		**0**		**0**		**0**		**0**		**0**		**0**
Notes:														

Note: Please refer to the "Default Conversions" tab for references for the default conversion factors used on this calculation sheet.

Space below available for notes and calculations:

SSDS - On-Site Footprint (Scope 1)

Contributors to Footprints	Units	Usage	Energy		GHG		NOx		SOx		PM		HAPs	
			Conv. Factor	MMBtus	Conv. Factor	lbs CO2e	Conv. Factor	lbs	Conv. Factor	lbs	Conv. Factor	lbs	Conv. Factor	lbs
On-Site														
On-site Renewable Energy														
Renewable electricity generated on-site	MWh	0	3.413	0										
Landfill gas combusted on-site for energy use	ccf CH4	0	0.103	0	13.1	0	0.01	0	0.0000063	0	0.00076	0	0.0000084	0
On-site biodiesel use	gal	0	0.127	0	22.3	0	0.2	0	0	0	0.00099	0	NP	
On-site biodiesel use - User Defined	gal	0	0.127	0	22.3	0	0.2	0	0	0	0.00099	0	NP	
User-defined on-site renewable energy use #1	gal	0	0	0	0	0	0	0	0	0	0	0	0	0
User-defined on-site renewable energy use #2	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0
On-site Renewable Energy Subtotals				**0**		**0**		**0**		**0**		**0**		**0**
Notes:														
On-site Conventional Energy														
On-site grid electricity	MWh	8.7635	3.413	29.909826										
On-site diesel use - Other	Gal	0	0.139	0	22.5	0	0.17	0	0.0054	0	0.0034	0	0.0000052	0
On-site diesel use <75 hp	Gal	0	0.139	0	22.21	0	0.1565	0	0.000145	0	0.0145	0	0.00004	0
On-site diesel use 75<hp<750	Gal	0	0.139	0	22.24	0	0.101	0	0.00013	0	0.009	0	0.00004	0
On-site diesel use >750 hp	Gal	0	0.139	0	22.24	0	0.149	0	0.00013	0	0.006	0	0.00004	0
On-site gasoline use - Other	Gal	0	0.124	0	19.6	0	0.11	0	0.0045	0	0.00054	0	0.000039	0
On-site gasoline use <25 hp	Gal	0	0.124	0	17.48	0	0.037	0	0.00025	0	0.165	0	0.00008	0
On-site gasoline use >25 hp	Gal	0	0.124	0	19.93	0	0.032	0	0.00029	0	0.002	0	0.00009	0
On-site natural gas use	ccf	0	0.103	0	13.1	0	0.01	0	0.0000063	0	0.00076	0	0.0000084	0
On-site compressed natural gas use - Other	ccf	0	NP		1957.835	0	16.0325	0	0.023045	0	0.2775	0	0	0
On-site compressed natural gas use	ccf	0	NP		1957.835	0	16.0325	0	0.023045	0	0.2775	0	0	0
On-site liquified petroleum gas use - Other	gal	0	NP		12.69	0	0.021	0	0.00013	0	0.001	0	0	0
On-site liquified petroleum gas use	gal	0	NP		12.69	0	0.021	0	0.00013	0	0.001	0	0	0
Other forms of on-site conventional energy use #1	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0
Other forms of on-site conventional energy use #2	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0
On-site Conventional Energy Subtotals				**30**		**0**		**0**		**0**		**0**		**0**
Notes:														
Other On-site Emissions														
On-site HAP process emissions	lbs	0											1	0
On-site GHG emissions	lbs CO2e	0			1	0								
On-site carbon storage	lbs CO2e	0			1	0								
GHG avoided by flaring on-site landfill methane	Lbs	0			-262	0	0.01	0	0.0000063	0	0.00076	0	0.0000084	0
Other on-site NOx emissions or reductions	lbs	0					1	0						
Other on-site SOx emissions or reductions	lbs	0							1	0				
Other on-site PM emissions or reductions	lbs	0									1	0		
User-defined recycled/reused on-site #2	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0
User-defined recycled/reused on-site #3	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0
User-defined recycled/reused off-site #1	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0
Notes:														
On-site Totals				**29.91**		**0**		**0**		**0**		**0**		**0**

SSDS - Electricity Generation Footprint (Scope 2)

			Energy		**GHG**		**NOx**		**SOx**		**PM**		**HAPs**	
Contributors to Footprints	**Units**	**Usage**	**Conv. Factor**	**MMBtus**	**Conv. Factor**	**lbs CO2e**	**Conv. Factor**	**lbs**	**Conv. Factor**	**lbs**	**Conv. Factor**	**lbs**	**Conv. Factor**	**lbs**
Electricity Generation														
Grid electricity	MWh	8.7635	6.929	60.722292	352	3084.752	1.504	13.180304	1.46966	12.879365	0.07546	0.6612937	0.0454035	0.3978936
Voluntary purchase of renewable electricity	MWh	0												
Voluntary purchase of RECs	MWh	0												
Notes:														

SSDS - Transportation Footprint (Scope 3a)

Category	Units	Usage	Energy		Greenhouse Gas		NOx		SOx		PM		HAPs	
			Conv. Factor	**MMBtus**	**Conv. Factor**	**lbs CO2e**	**Conv. Factor**	**lbs**	**Conv. Factor**	**lbs**	**Conv. Factor**	**lbs**	**Conv. Factor**	**lbs**
Conventional Energy														
Transportation diesel use	gal	20.501	0.139	2.849639	22.5	461.2725	0.17	3.48517	0.0054	0.1107054	0.0034	0.0697034	0.0000052	0.0001066
Transportation diesel use - car	gal	0	0.139	0	22.57	0	0.015	0	0.0002	0	0.003	0	0.00252	0
Transportation diesel use - passenger truck	gal	0	0.139	0	22.545	0	0.0585	0	0.0002	0	0.007	0	0.002605	0
Transportation diesel use - User Defined	gal	0	0.139	0	22.5	0	0.17	0	0.0054	0	0.0034	0	0.0000052	0
Transportation gasoline use	gal	0	0.124	0	19.6	0	0.11	0	0.0045	0	0.00054	0	0.000039	0
Transportation gasoline use - car	gal	0.8	0.124	0.0992	19.77	15.816	0.027	0.0216	0.00036	0.000288	0.003	0.0024	0.0067	0.00536
Transportation gasoline use - passenger truck	gal	0	0.124	0	19.79	0	0.035	0	0.00036	0	0.003	0	0.00661	0
Transportation gasoline use - User Defined	gal	0	0.124	0	19.6	0	0.11	0	0.0045	0	0.00054	0	0.000039	0
Transportation natural gas use	ccf	0	0.103	0	13.1	0	0.01	0	0.0000063	0	0.00076	0	0.0000084	0
Transportation natural gas use - User Defined	ccf	0	0.103	0	13.1	0	0.01	0	0.0000063	0	0.00076	0	0.0000084	0
User-defined conventional energy transportation #1	TBD	10	0	0	0	0	0	0	0	0	0	0	0	0
User-defined conventional energy transportation #2	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0
Conventional Energy Subtotals				**3**		**477**		**4**		**0**		**0**		**0**
Notes:														
Renewable Energy														
Transportation biodiesel use	gal	0	0.127	0	22.3	0	0.2	0	0	0	0.00099	0	NP	
Transportation biodiesel use - User Defined	gal	0	0.127	0	22.3	0	0.2	0	0	0	0.00099	0	NP	
User-defined renewable energy transportation #1	TBD	0	Biodiesel		0	0	0	0	0	0	0	0	Ref.	
User-defined renewable energy transportation #2	TBD	0	npg or pmp		0	0	0	0	0	0	0	0	0	0
Renewable Energy Subtotals				**0**		**0**		**0**		**0**		**0**		**0**
Notes:														
Transportation Totals				**3**		**477**		**4**		**0**		**0**		**0**

SSDS - Off-Site Footprint (Scope 3b)

			Energy		Greenhouse Gas		NOx		SOx		PM		HAPs	
Category	**Units**	**Usage**	**Conv. Factor**	**MMBtus**	**Conv. Factor**	**lbs CO2e**	**Conv. Factor**	**lbs**	**Conv. Factor**	**lbs**	**Conv. Factor**	**lbs**	**Conv. Factor**	**lbs**
Construction Materials														
Aluminum, Rolled Sheet	lb	0	0.0633	0	9.15	0	0.0148	0	0.0283	0	0.0088	0	0.00102	0
Asphalt, mastic	lb	0	0.0412	0	0.85	0	0.00271	0	0.00798	0	0.000766	0	0.00107	0
Asphalt, paving-grade	lb	0	0.5	0	8.58	0	0.0299	0	0.0969	0	0.0091	0	0.0133	0
Ethanol, Corn, 95%	lb	0	0.0318	0	-0.0199	0	0.00425	0	0.00303	0	0.000469	0	0.0000846	0
Ethanol, Corn, 99.7%	lb	0	0.0324	0	0.0591	0	0.00431	0	0.0031	0	0.000472	0	0.000087	0
Ethanol, Petroleum, 99.7%	lb	0	0.0205	0	1.25	0	0.00199	0	0.00214	0	0.000277	0	0.0000589	0
Gravel/Sand Mix, 65% Gravel	lb	0	0.0000248	0	0.0024	0	0.000018	0	4.52E-06	0	2.61E-06	0	3.08E-07	0
Gravel/sand/clay	lb	0	0.000028	0	0.00335	0	0.0000165	0	0.000015	0	0.000002	0	2.05E-10	0
HDPE	lb	0	0.0332	0	1.94	0	0.00325	0	0.00409	0	0.000439	0	0.0000641	0
Photovoltaic system (installed)	W	0	0.0336	0	4.47	0	0.015	0	0.032	0	0.00063	0	0.0000029	0
PVC	lb	1000	0.0262	26.2	2.02	2020	0.004	4	0.00274	2.74	0.000372	0.372	0.000375	0.375
Portland cement, US average	lb	0	0.0139	0	1.34	0	0.00654	0	0.0104	0	0.00378	0	0.00097	0
Ready-mixed concrete, 20 MPa	ft3	0	0.217	0	19.5	0	0.0975	0	0.154	0	0.057	0	0.0141	0
Round Gravel	lb	574000	0.0000248	14.2352	0.0024	1377.6	0.000018	10.332	4.52E-06	2.59448	2.61E-06	1.49814	3.08E-07	0.176792
Sand	lb	0	0.0000248	0	0.0024	0	0.000018	0	4.52E-06	0	2.61E-06	0	3.08E-07	0
Stainless Steel	lb	0	0.0116	0	3.4	0	0.0075	0	0.012	0	0.0044	0	0.000144	0
Steel	lb	0	0.0044	0	1.1	0	0.0014	0	0.0017	0	0.00056	0	0.000067	0
Other refined construction materials	lb	1130	0.01885	21.3005	2.115	2389.95	0.0040375	4.562375	0.0051325	5.799725	0.0014428	1.6303075	0.0001625	0.1836533
Other unrefined construction materials	lb	0	0.000028	0	0.00335	0	0.0000165	0	0.000015	0	0.000002	0	2.05E-10	0

Notes:

SSDS - Off-Site Footprint (Scope 3b)

			Energy		**Greenhouse Gas**		**NOx**		**SOx**		**PM**		**HAPs**	
Category	**Units**	**Usage**	**Conv. Factor**	**MMBtus**	**Conv. Factor**	**lbs CO2e**	**Conv. Factor**	**lbs**	**Conv. Factor**	**lbs**	**Conv. Factor**	**lbs**	**Conv. Factor**	**lbs**
Treatment Materials & Chemicals														
Cheese Whey	lbs	0	0.0025	0	0.031	0	0.000062	0	0.000033	0	0.000002	0	NP	
Emulsified vegetable oil	lbs	0	0.0077	0	3.44	0	0.0066	0	0.0019	0	0.000033	0	NP	
Granular activated carbon, primary	lbs	0	0.0356	0	4.82	0	0.0793	0	0.128	0	0.000987	0	0.000657	0
Granular activated carbon, regenerated	lbs	0	0.00873	0	1.7	0	0.00733	0	0.0129	0	0.000886	0	0.000671	0
Hydrogen Peroxide, 50% in H2O	lbs	0	0.00979	0	1.19	0	0.00142	0	0.0024	0	0.000308	0	0.0000629	0
Iron (II) Sulfate	lbs	0	0.00147	0	0.167	0	0.000316	0	0.000589	0	0.000103	0	0.000023	0
Lime, Hydrated, Packed	lbs	0	0.00206	0	0.762	0	0.000513	0	0.000358	0	0.00013	0	6.57E-06	0
Molasses	lbs	0	0.0044	0	0.48	0	0.0011	0	0.00024	0	0.0000041	0	NP	
Phosphoric Acid, 70% in H2O	lbs	0	0.0067	0	0.882	0	0.00282	0	0.0294	0	0.00171	0	0.000163	0
Potassium Permanganate	lbs	0	0.00981	0	1.16	0	0.00234	0	0.0032	0	0.000422	0	0.000122	0
Sodium Hydroxide, 50% in H2O	lbs	0	0.00977	0	1.09	0	0.00194	0	0.00352	0	0.000403	0	0.000129	0
Other Treatment Chemicals & Materials	lbs	0	0.015	0	1.67	0	0.003	0	0.0065	0	0.00061	0	0.000016	0
Notes:														
Fuel Processing														
Biodiesel produced	gal	0	0.029	0	-16.8	0	0.018	0	0.033	0	0.00082	0	NP	
Diesel produced	gal	20.501	0.017	0.348517	3.02	61.91302	0.0051	0.1045551	0.0062	0.1271062	0.0017	0.0348517	0.0011	0.0225511
Gasoline produced	gal	0.8	0.033	0.0264	2.8	2.24	0.0046	0.00368	0.005	0.004	0.0015	0.0012	0.001	0.0008
Liquefied Petroleum Gas Produced	gal	0	0.088	0	1.47	0	0.0016	0	0.0024	0	0.0007	0	0.0003	0
Natural Gas - Compressed Produced	ccf	0	19.983	0	343.92	0	0.4732	0	2.1651	0	0.1846	0	0.2895	0
Natural Gas Produced	ccf	0	0.0052	0	2.2	0	0.0037	0	0.0046	0	0.000072	0	0.0000061	0
Fuel Processing Subtotals				**0.374917**		**64.15302**		**0.1082351**		**0.1311062**		**0.0360517**		**0.0233511**
Notes:														
Public water	gal x 1000	0	0.0092	0	5	0	0.0097	0	0.0059	0	0.016	0	0.000015	0
User-defined water resource #1	gal x 1000	0	0	0	0	0	0	0	0	0	0	0	0	0
User-defined water resource #2	gal x 1000	0	0	0	0	0	0	0	0	0	0	0	0	0
Notes:														

SSDS - Off-Site Footprint (Scope 3b)

			Energy		**Greenhouse Gas**		**NOx**		**SOx**		**PM**		**HAPs**	
			Conv.		**Conv.**		**Conv.**		**Conv.**		**Conv.**		**Conv.**	
Category	**Units**	**Usage**	**Factor**	**MMBtus**	**Factor**	**lbs CO2e**	**Factor**	**lbs**	**Factor**	**lbs**	**Factor**	**lbs**	**Factor**	**lbs**
Off-Site Services														
Hazardous waste incineration	lb	0	0.00609	0	2.43	0	0.0016	0	0.00167	0	0.000209	0	0.000087	0
Off-site waste water treatment (POTW)	gal x 1000	0	0.015	0	4.4	0	0.016	0	0.015	0	NP		NP	
Off-site non-hazardous waste landfill	ton	0	0.16	0	25	0	0.14	0	0.075	0	0.4	0	0.0014	0
Off-site hazardous waste landfill	ton	0	0.18	0	27.5	0	0.154	0	0.0825	0	0.44	0	0.00154	0
Off-site Laboratory Analysis - Other	sample	0	0.058071	0	6.8534384	0	0.131402	0	0.3038758	0	0.0455698	0	0.0330165	0
Off-site Laboratory Analysis - Metals	sample	0	0.212	0	27.4693	0	0.6423	0	1.5072	0	0.2264	0	0.1643	0
Off-site Laboratory Analysis - Mercury	sample	0	0.0731715	0	9.325458	0	0.2127439	0	0.4982396	0	0.0747359	0	0.0542332	0
Off-site Laboratory Analysis - Inorganic Anions	sample	0	0.0074025	0	0.6459478	0	0.0067681	0	0.0147929	0	0.0022024	0	0.0015542	0
Off-site Laboratory Analysis - Alkalinity	sample	0	0.0174398	0	1.3381922	0	0.0070106	0	0.0132496	0	0.00194	0	0.0012831	0
Off-site Laboratory Analysis - Perchlorate	sample	0	0.023885	0	1.8717054	0	0.0079807	0	0.0141535	0	0.0020547	0	0.0012875	0
Off-site Laboratory Analysis - Nitrogen/Nitrate	sample	0	0.0336475	0	4.29897	0	0.0954592	0	0.2226646	0	0.0335099	0	0.0242506	0
Off-site Laboratory Analysis - Sulfate	sample	0	0.0141225	0	1.4726728	0	0.0079807	0	0.0136024	0	0.0019797	0	0.0012015	0
Off-site Laboratory Analysis - PCBs	sample	0	0.0512769	0	5.224902	0	0.0833339	0	0.1904774	0	0.0284393	0	0.0212083	0
Off-site Laboratory Analysis - VOCs	sample	10	0.0762045	0.7620449	9.016814	90.16814	0.104498	1.0449804	0.2270738	2.270738	0.0339508	0.3395084	0.0235892	0.2358922
Off-site Laboratory Analysis - SVOCs	sample	0	0.0715602	0	7.870422	0	0.1459445	0	0.3373038	0	0.0504853	0	0.0372577	0
Notes:														
Resource Extraction for Electricity														
Coal extraction and processing	MWh	0.52581	3.1	1.6057186	180.0	94.6458	0.8	0.4048737	0.2	0.0788715	0.0	0.0094646	NP	
Natural gas extraction and processing	MWh	0.87635	1.6	1.4300279	270.0	236.6145	0.2	0.157743	13.0	11.39255	0.0	0.0062221	NP	
Nuclear fuel extraction and processing	MWh	0.17527	0.2	0.0272496	25.0	4.38175	0.2	0.0262905	0.5	0.087635	0.0	0.0002629	NP	
Oil extraction and processing	MWh	0.438175	2.3	1.0057869	270.0	118.30725	1.7	0.7448975	0.1	0.0302341	0.0	0.0184034	NP	
Other fuel extraction and processing	MWh	0	0	0	0	0	0	0	0	0	0	0	0	0
Resource Extraction Subtotals				**4.068783**		**453.9493**		**1.3338047**		**11.589291**		**0.0343529**		**0**
Notes:														
Electricity Transmission														
Transmission and distribution losses	MWh	8.7635	1.0342	9.0632117	35.2	308.4752	0.1504	1.3180304	0.146966	1.2879365	0.007546	0.0661294	0.0045403	0.0397894
Notes:														

SSDS - Off-Site Footprint (Scope 3b)

			Energy		**Greenhouse Gas**		**NOx**		**SOx**		**PM**		**HAPs**	
Category	**Units**	**Usage**	**Conv. Factor**	**MMBtus**	**Conv. Factor**	**lbs CO2e**	**Conv. Factor**	**lbs**	**Conv. Factor**	**lbs**	**Conv. Factor**	**lbs**	**Conv. Factor**	**lbs**
User-defined Materials														
User-defined material #1	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0
User-defined material #2	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0
User-defined material #3	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0
User-defined material #4	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0
User-defined material #5	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0
User-defined material #6	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0
User-defined material #7	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0
User-defined material #8	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0
User-defined material #9	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0
User-defined material #10	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0
User-defined material #11	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0
User-defined material #12	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0
User-defined material #13	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0
User-defined material #14	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0
User-defined material #15	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0
User-defined material #16	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0
User-defined material #17	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0
User-defined material #18	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0
User-defined material #19	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Notes:														
User-defined Waste Destinations														
User-defined recycled/reused off-site #1	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0
User-defined recycled/reused off-site #2	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0
User-defined recycled/reused off-site #3	TBD	0	y(MMBtu/u		(lbs CO2e/u		Ox(lbs/unit		Ox(lbs/unit)		M(lbs/unit)		APs(lbs/unit	
User-defined non-hazardous waste destination #1	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0
User-defined non-hazardous waste destination #2	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0
User-defined non-hazardous waste destination #3	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0
User-defined hazardous waste destination #1	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0
User-defined hazardous waste destination #2	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0
User-defined hazardous waste destination #3	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0
Notes:														
Off-site Totals				**76.004657**		**6704.2957**		**22.699426**		**26.413276**		**3.9764899**		**1.0344779**

SSDS - Intermediate Totals

Category	Units	Usage	Energy		Greenhouse Gas		NOx		SOx		PM		HAPs	
			Conv. Factor	MMBtus	Conv. Factor	lbs CO2e	Conv. Factor	lbs	Conv. Factor	lbs	Conv. Factor	lbs	Conv. Factor	lbs
Total Grid Electricity Footprint														
On-site grid electricity	MWh	8.7635	3.413	29.909826										
Electricity Generation														
Grid electricity	MWh	8.7635	6.929	60.722292	1124.3	9852.8031	2.2421	19.648643	4.6078874	40.381221	0.057518	0.504059	0.2102371	1.8424127
Resource Extraction for Electricity														
Coal extraction and processing	MWh	0.52581	3.1	1.6057186	180.0	94.6458	0.8	0.4048737	0.2	0.0788715	0.0	0.0094646	NP	
Natural gas extraction and processing	MWh	0.87635	1.6	1.4300279	270.0	236.6145	0.2	0.157743	13.0	11.39255	0.0	0.0062221	NP	
Nuclear fuel extraction and processing	MWh	0.17527	0.2	0.0272496	25.0	4.38175	0.2	0.0262905	0.5	0.087635	0.0	0.0002629	NP	
Oil extraction and processing	MWh	0.438175	2.3	1.0057869	270.0	118.30725	1.7	0.7448975	0.1	0.0302341	0.0	0.0184034	NP	
Other fuel extraction and processing	MWh	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0
Electricity Transmission														
Transmission and distribution losses	MWh	8.7635	1.0342	9.0632117	112.43	985.28031	0.22421	1.9648643	0.4607887	4.0381221	0.0057518	0.0504059	0.0210237	0.1842413
Total Grid Electricity Footprint				**104**		**11292**		**23**		**56**		**1**		**2**
Total Fuel Footprints														
Total Gasoline Footprint														
On-site gasoline use - Other	gal	0	0.124	0	19.6	0	0.11	0	0.0045	0	0.00054	0	0.000039	0
On-site gasoline use <25 hp	gal	0	0.124	0	17.48	0	0.037	0	0.00025	0	0.165	0	0.00008	0
On-site gasoline use >25 hp	gal	0	0.124	0	19.93	0	0.032	0	0.00029	0	0.002	0	0.00009	0
Transportation gasoline use	gal	0	0.124	0	19.6	0	0.11	0	0.0045	0	0.00054	0	0.000039	0
Transportation gasoline use - car	gal	0.8	0.124	0.0992	19.77	15.816	0.027	0.0216	0.00036	0.000288	0.003	0.0024	0.0067	0.00536
Transportation gasoline use - passenger truck	gal	0	0.124	0	19.79	0	0.035	0	0.00036	0	0.003	0	0.00661	0
Transportation gasoline use - User Defined	gal	0	0.124	0	19.6	0	0.11	0	0.0045	0	0.00054	0	0.000039	0
Gasoline produced	gal	0.8	0.033	0.0264	2.8	2.24	0.0046	0.00368	0.005	0.004	0.0015	0.0012	0.001	0.0008
Total Gasoline Footprint		**0.8**		**0.1256**		**18.056**		**0.02528**		**0.004288**		**0.0036**		**0.00616**
Total Diesel Footprint														
On-site diesel use - Other	gal	0	0.139	0	22.5	0	0.17	0	0.0054	0	0.0034	0	0.0000052	0
On-site diesel use <75 hp	gal	0	0.139	0	22.21	0	0.1565	0	0.000145	0	0.0145	0	0.00004	0
On-site diesel use 75<hp<750	gal	0	0.139	0	22.24	0	0.101	0	0.00013	0	0.009	0	0.00004	0
On-site diesel use >750 hp	gal	0	0.139	0	22.24	0	0.149	0	0.00013	0	0.006	0	0.00004	0
Transportation diesel use	gal	20.501	0.139	2.849639	22.5	461.2725	0.17	3.48517	0.0054	0.1107054	0.0034	0.0697034	0.0000052	0.0001066
Transportation diesel use - car	gal	0	0.139	0	22.57	0	0.015	0	0.0002	0	0.003	0	0.00252	0
Transportation diesel use - passenger truck	gal	0	0.139	0	22.545	0	0.0585	0	0.0002	0	0.007	0	0.002605	0
Transportation diesel use - User Defined	gal	0	0.139	0	22.5	0	0.17	0	0.0054	0	0.0034	0	0.0000052	0
Diesel produced	gal	20.501	0.017	0.348517	3.02	61.91302	0.0051	0.1045551	0.0062	0.1271062	0.0017	0.0348517	0.0011	0.0225511
Total Diesel Footprint		**20.501**		**3.198156**		**523.18552**		**3.5897251**		**0.2378116**		**0.1045551**		**0.0226577**
Total Biodiesel Footprint														
On-site biodiesel use	gal	0	0.127	0	22.3	0	0.2	0	0	0	0.00099	0	NP	
On-site biodiesel use - User Defined	gal	0	0.127	0	22.3	0	0.2	0	0	0	0.00099	0	NP	
Transportation biodiesel use	gal	0	0.127	0	22.3	0	0.2	0	0	0	0.00099	0	NP	
Transportation biodiesel use - User Defined	gal	0	0.127	0	22.3	0	0.2	0	0	0	0.00099	0	NP	
Biodiesel produced	gal	0	0.029	0	-16.8	0	0.018	0	0.033	0	0.00082	0	NP	
Total Biodiesel Footprint		**0**		**0**		**0**		**0**		**0**		**0**		**0**
Total Natural Gas Footprint														
On-site natural gas use	ccf	0	0.103	0	13.1	0	0.01	0	0.0000063	0	0.00076	0	0.0000084	0
Transportation natural gas use	ccf	0	0.103	0	13.1	0	0.01	0	0.0000063	0	0.00076	0	0.0000084	0
Transportation natural gas use - User Defined	ccf	0	0.103	0	13.1	0	0.01	0	0.0000063	0	0.00076	0	0.0000084	0
Natural gas produced	ccf	0	0.0052	0	2.2	0	0.0037	0	0.0046	0	0.000072	0	0.0000061	0
Total Natural Gas Footprint		**0**		**0**		**0**		**0**		**0**		**0**		**0**
Total Liquified Petroleum Gas Footprint														
On-site liquified petroleum gas use - Other	ccf	0	NP		12.69	0	0.021	0	0.00013	0	0.001	0	0	0
On-site liquified petroleum gas use	ccf	0	NP		12.69	0	0.021	0	0.00013	0	0.001	0	0	0
Liquified petroleum gas produced	ccf	0	0.088	0	1.47	0	0.0016	0	0.0024	0	0.0007	0	0.0003	0
Total Natural Gas Footprint		**0**		**0**		**0**		**0**		**0**		**0**		**0**
Total Compressed Gas Footprint														
On-site compressed gas use - Other	ccf	0	NP		1957.835	0	16.0325	0	0.023045	0	0.2775	0	0	0
On-site compressed gas use	ccf	0	NP		1957.835	0	16.0325	0	0.023045	0	0.2775	0	0	0
Compressed gas produced	ccf	0	19.983	0	343.92	0	0.4732	0	2.1651	0	0.1846	0	0.2895	0
Total Natural Gas Footprint		**0**		**0**		**0**		**0**		**0**		**0**		**0**

Notes:

Note: Please refer to the "Default Conversions" tab for references for the default conversion factors used on this calculation sheet.

Space below available for notes and calculations:

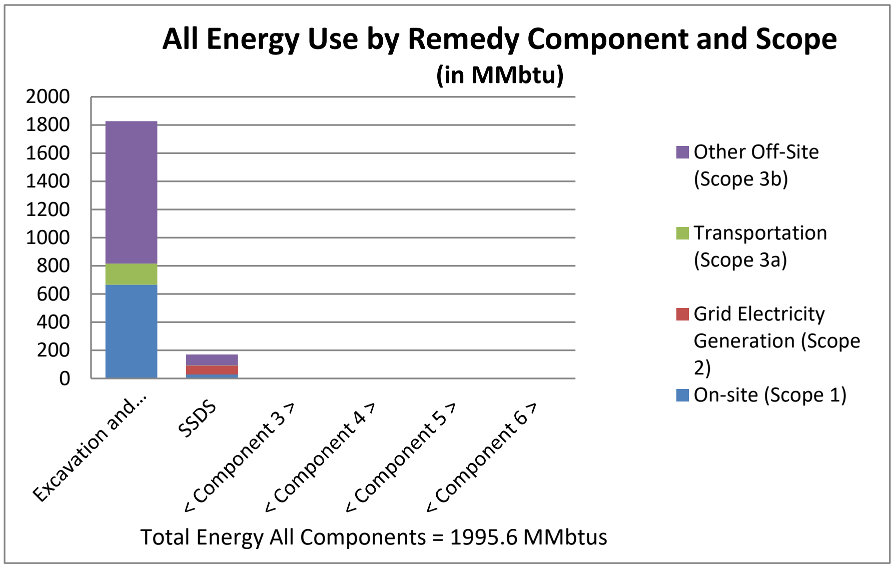
Environmental Footprint Summary

Core Element	Metric		Unit of Measure	Footprint						
				Excavation and Offsite Disposal of Soil/Fill	SSDS	< Component 3 >	< Component 4 >	< Component 5 >	< Component 6 >	Total
Materials & Waste	M&W-1	Refined materials used on-site	Tons	0.0	288.1	0.0	0.0	0.0	0.0	288.1
	M&W-2	% of refined materials from recycled or reused material	%		0.0%					0.0%
	M&W-3	Unrefined materials used on-site	Tons	0.000	0.000	0.000	0.000	0.000	0.000	0.0
	M&W-4	% of unrefined materials from recycled or reused material	%							
	M&W-5	On-site hazardous waste disposed of off-site	Tons	700.0	0.0	0.0	0.0	0.0	0.0	700.0
	M&W-6	On-site non-hazardous waste disposed of off-site	Tons	4,760.0	0.0	0.0	0.0	0.0	0.0	4,760.0
	M&W-7	Recycled or reused waste	Tons	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	M&W-8	% of total potential waste recycled or reused	%	0.0%						0.0%
Water (used on-site)	W-1	Public water use	MG	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	W-2	Groundwater use	MG	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	W-3	Surface water use	MG	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	W-4	Reclaimed water use	MG	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	W-5	Storm water use	MG	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	W-6	User-defined water resource #1	MG	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	W-7	User-defined water resource #2	MG	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	W-8	Wastewater generated	MG	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Energy	E-1	Total energy used (on-site and off-site)	MMBtu	1,826.0	169.6	0.0	0.0	0.0	0.0	1,995.6
	E-2	Energy voluntarily derived from renewable resources								
	E-2A	On-site renewable energy generation or use + on-site biodiesel use + biodiesel and other renewable resource use for transportation	MMBtu	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	E-2B	Voluntary purchase of renewable electricity	MWh	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	E-3	Voluntary purchase of RECs	MWh	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	E-4	On-site grid electricity use	MWh	0.000	8.764	0.000	0.000	0.000	0.000	8.8
Air	A-1	On-site NOx, SOx, and PM emissions	Pounds	854.9	0.0	0.0	0.0	0.0	0.0	854.9
	A-2	On-site HAP emissions	Pounds	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	A-3	Total NOx, SOx, and PM emissions	Pounds	4,714.0	83.5	0.0	0.0	0.0	0.0	4,797.5
	A-3A	Total NOx emissions	Pounds	1,844.9	39.4	0.0	0.0	0.0	0.0	1,884.2
	A-3B	Total SOx emissions	Pounds	607.7	39.4	0.0	0.0	0.0	0.0	647.1
	A-3C	Total PM emissions	Pounds	2,261.4	4.7	0.0	0.0	0.0	0.0	2,266.1
	A-4	Total HAP emissions	Pounds	28.1	1.4	0.0	0.0	0.0	0.0	29.6
	A-5	Total greenhouse gas emissions	Tons CO2e*	145.4	5.1	0.0	0.0	0.0	0.0	150.6
Land & Ecosystems		Qualitative Description								

** Total greenhouse gases emissions (in CO2e) include consideration of CO2, CH4, and N2O (Nitrous oxide) emissions.*
"MMBtu" = millions of Btus
"MG" = millions of gallons
"CO2e" = carbon dioxide equivalents of global warming potential
"MWh" = megawatt hours (i.e., thousands of kilowatt-hours or millions of Watt-hours)
"Tons" = short tons (2,000 pounds)

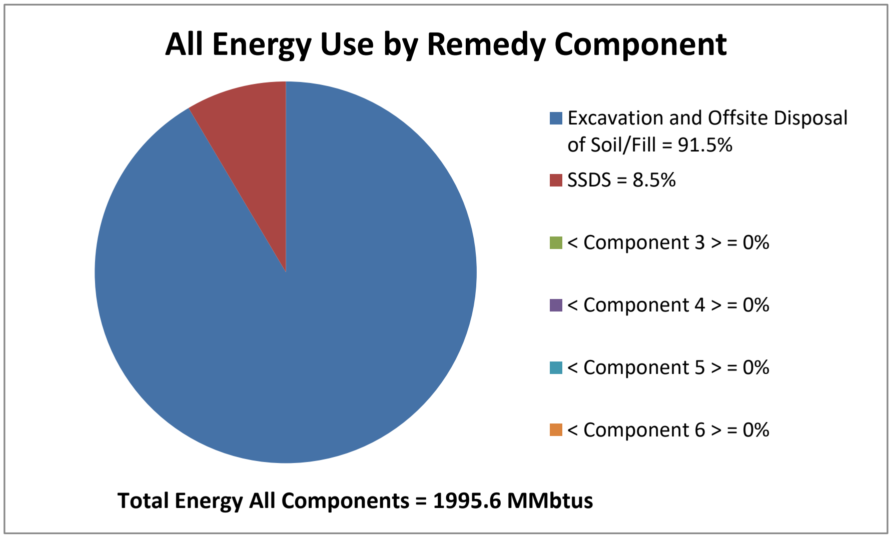
The above metrics are consistent with EPA's Methodology for Understanding and Reducing a Project's Environmental Footprint (EPA 542-R-12-002), February 2012

Notes:



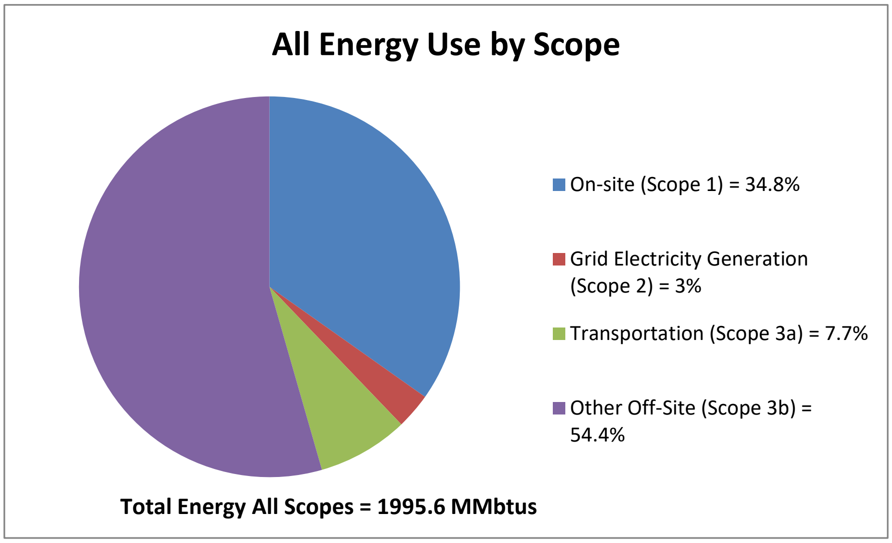
All Energy Use by Remedy Component and Scope
(in MMbtu)

Total Energy All Components = 1995.6 MMbtus



All Energy Use by Remedy Component

Total Energy All Components = 1995.6 MMbtus



All Energy Use by Scope

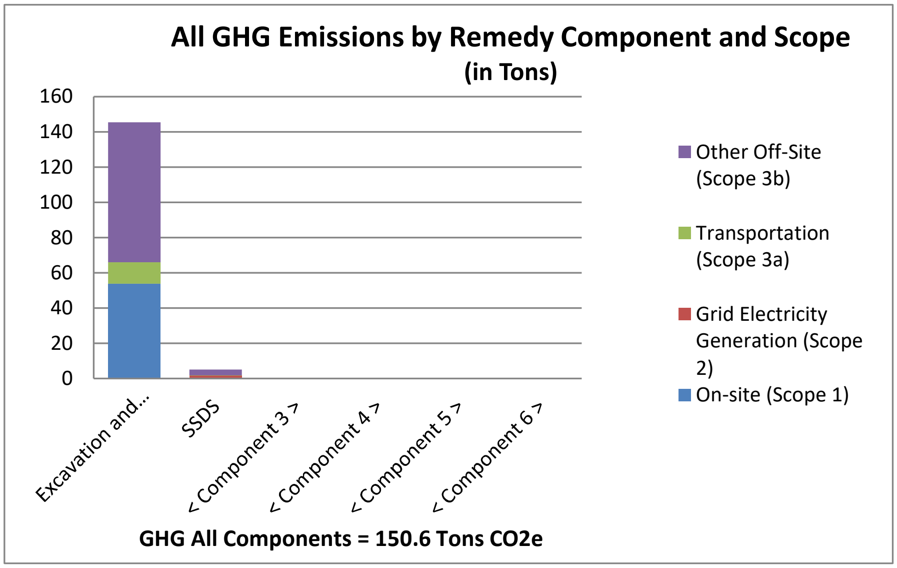
Total Energy All Scopes = 1995.6 MMbtus

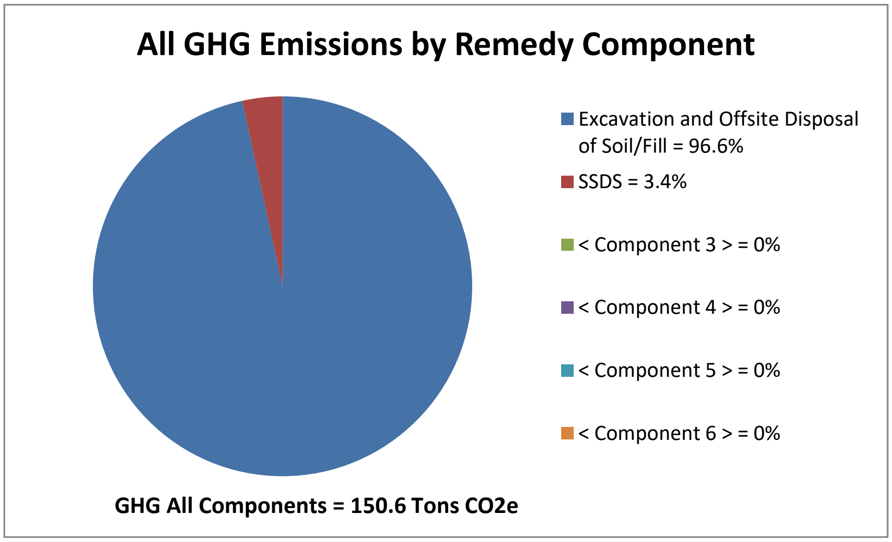
Total Energy MMbtus								
	Excavation	SSDS	< Compon	< Compon	< Compon	< Compon	Total	
On-site (Scope 1)	664.6	29.9	0.0	0.0	0.0	0.0	694.5	
Generation (Scope 2)	0.0	60.7	0.0	0.0	0.0	0.0	60.7	d Electricity
nsportation (Scope 3a)	151.2	2.9	0.0	0.0	0.0	0.0	154.2	Tra
er Off-Site (Scope 3b)	1,010.2	76.0	0.0	0.0	0.0	0.0	1,086.2	Ot
Total	1,826.0	169.6	0.0	0.0	0.0	0.0	1,995.6	

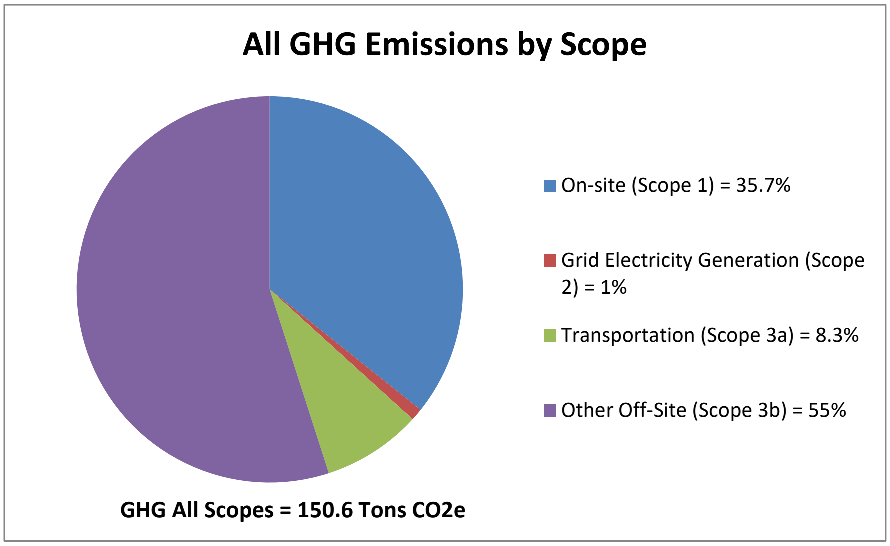
Excavation and Offsite Disposal of Soil/Fill =
SSDS = 8.5%
< Component 3 > = 0%
< Component 4 > = 0%
< Component 5 > = 0%
< Component 6 > = 0%

On-site (Scope 1) = 34.8%
Grid Electricity Generation (Scope 2) = 3%
Transportation (Scope 3a) = 7.7%
Other Off-Site (Scope 3b) = 54.4%

Total Energy All Components = 1995.6 MMbtus
Total Energy All Scopes = 1995.6 MMbtus


All GHG Emissions by Remedy Component and Scope
(in Tons)
160
140
120
100
80
60
40
20
0
Excavation and...
SSDS
< Component 3 >
< Component 4 >
< Component 5 >
< Component 6 >
Other Off-Site (Scope 3b)
Transportation (Scope 3a)
Grid Electricity Generation (Scope 2)
On-site (Scope 1)
GHG All Components = 150.6 Tons CO2e


All GHG Emissions by Remedy Component
Excavation and Offsite Disposal of Soil/Fill = 96.6%
SSDS = 3.4%
< Component 3 > = 0%
< Component 4 > = 0%
< Component 5 > = 0%
< Component 6 > = 0%
GHG All Components = 150.6 Tons CO2e


All GHG Emissions by Scope
On-site (Scope 1) = 35.7%
Grid Electricity Generation (Scope 2) = 1%
Transportation (Scope 3a) = 8.3%
Other Off-Site (Scope 3b) = 55%
GHG All Scopes = 150.6 Tons CO2e

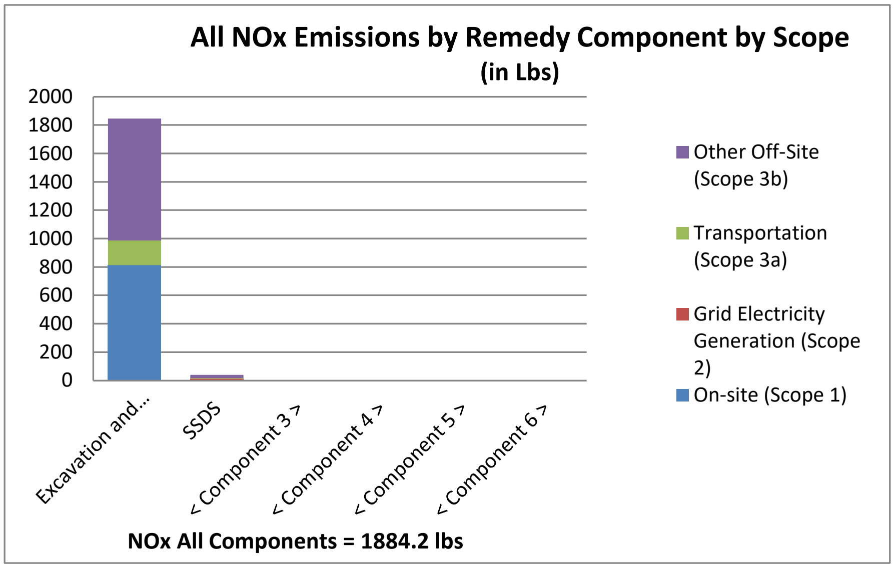
GHG
Tons CO2e

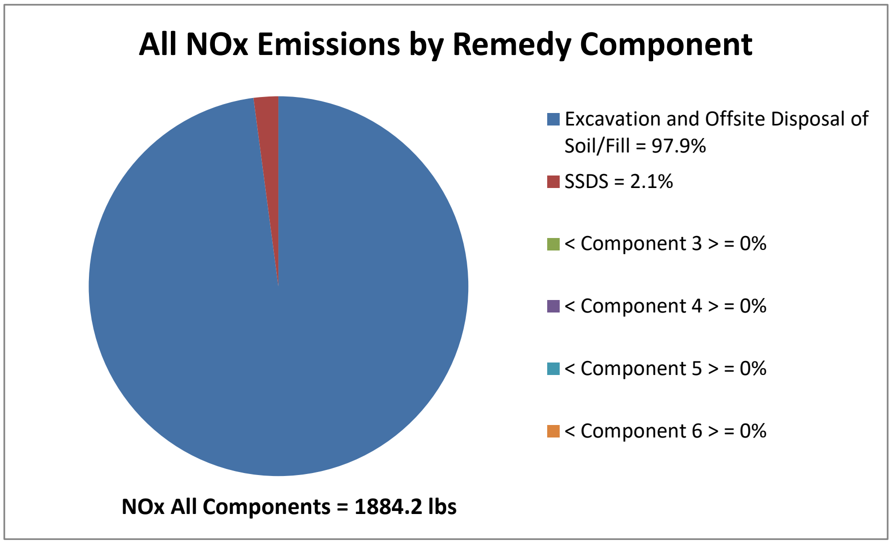
	Excavation	SSDS	< Compone	< Compone	< Compone	< Compone	Total	
On-site (Scope 1)	53.8	0.0	0.0	0.0	0.0	0.0	53.8	
Generation (Scope 2)	0.0	1.5	0.0	0.0	0.0	0.0	1.5	d Electricity
sportation (Scope 3a)	12.2	0.2	0.0	0.0	0.0	0.0	12.5	Tra
er Off-Site (Scope 3b)	79.4	3.4	0.0	0.0	0.0	0.0	82.7	Ot
Total	145.4	5.1	0.0	0.0	0.0	0.0	150.6	

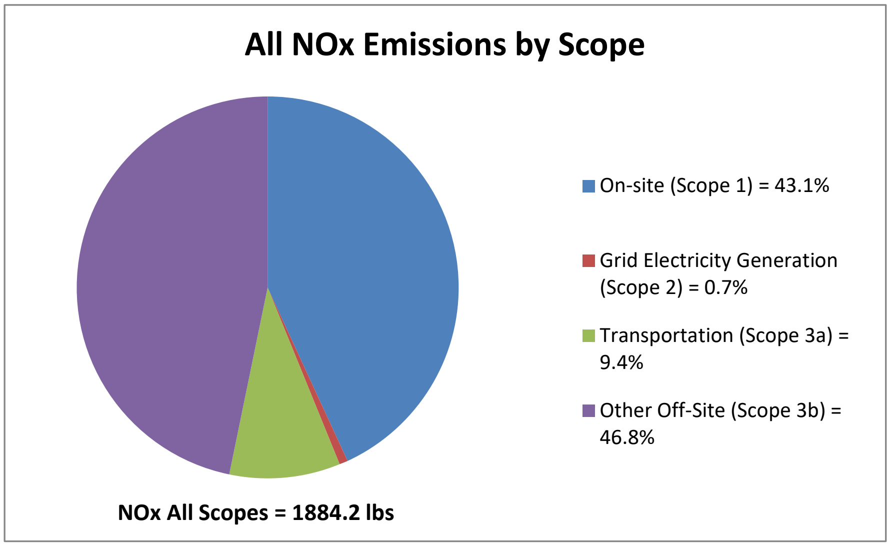
Excavation and Offsite Disposal of Soil/Fill =
SSDS = 3.4%
< Component 3 > = 0%
< Component 4 > = 0%
< Component 5 > = 0%
< Component 6 > = 0%

On-site (Scope 1) = 35.7%
Grid Electricity Generation (Scope 2) = 1%
Transportation (Scope 3a) = 8.3%
Other Off-Site (Scope 3b) = 55%

GHG All Components = 150.6 Tons CO2e
GHG All Scopes = 150.6 Tons CO2e


All NOx Emissions by Remedy Component by Scope
(in Lbs)
2000
1800
1600
1400
1200
1000
800
600
400
200
0
Excavation and...
SSDS
< Component 3 >
< Component 4 >
< Component 5 >
< Component 6 >
Other Off-Site (Scope 3b)
Transportation (Scope 3a)
Grid Electricity Generation (Scope 2)
On-site (Scope 1)
NOx All Components = 1884.2 lbs


All NOx Emissions by Remedy Component
Excavation and Offsite Disposal of Soil/Fill = 97.9%
SSDS = 2.1%
< Component 3 > = 0%
< Component 4 > = 0%
< Component 5 > = 0%
< Component 6 > = 0%
NOx All Components = 1884.2 lbs


All NOx Emissions by Scope
On-site (Scope 1) = 43.1%
Grid Electricity Generation (Scope 2) = 0.7%
Transportation (Scope 3a) = 9.4%
Other Off-Site (Scope 3b) = 46.8%
NOx All Scopes = 1884.2 lbs

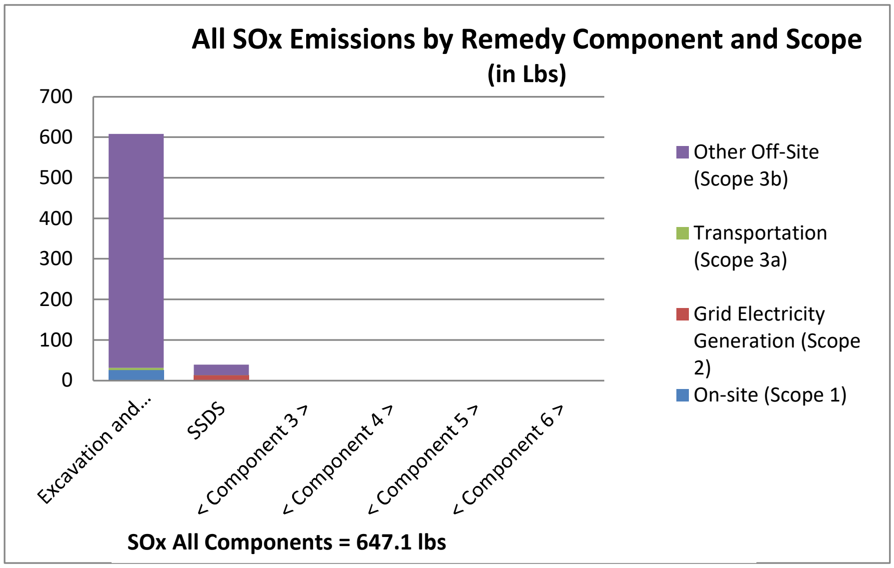
NOx
lbs

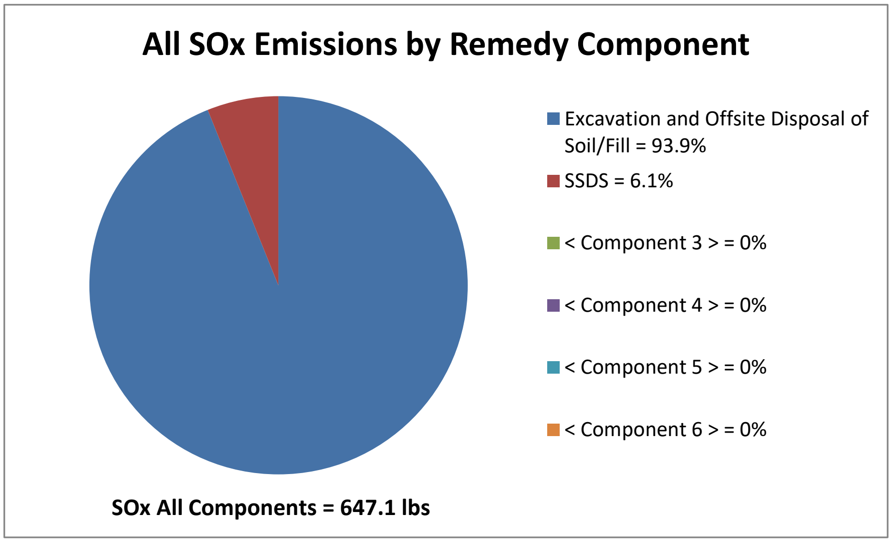
	Excavation	SSDS	< Compone	< Compone	< Compone	< Compone	Total	
On-site (Scope 1)	812.8	0.0	0.0	0.0	0.0	0.0	812.8	
Generation (Scope 2)	0.0	13.2	0.0	0.0	0.0	0.0	13.2	d Electricity
nsportation (Scope 3a)	173.7	3.5	0.0	0.0	0.0	0.0	177.2	Tran
her Off-Site (Scope 3b)	858.4	22.7	0.0	0.0	0.0	0.0	881.1	Oth
Total	1,844.9	39.4	0.0	0.0	0.0	0.0	1,884.2	

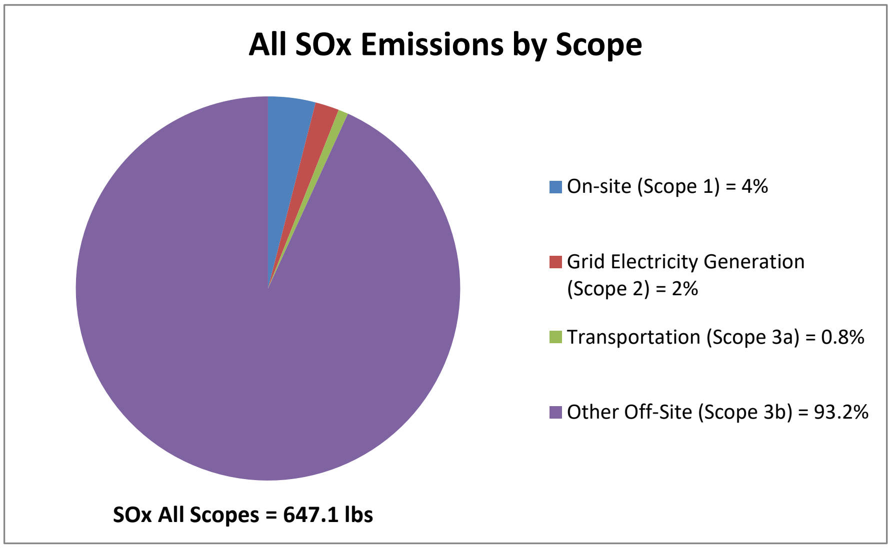
Excavation and Offsite Disposal of Soil/Fill =
SSDS = 2.1%
< Component 3 > = 0%
< Component 4 > = 0%
< Component 5 > = 0%
< Component 6 > = 0%

On-site (Scope 1) = 43.1%
Grid Electricity Generation (Scope 2) = 0.7%
Transportation (Scope 3a) = 9.4%
Other Off-Site (Scope 3b) = 46.8%

NOx All Components = 1884.2 lbs
NOx All Scopes = 1884.2 lbs


All SOx Emissions by Remedy Component and Scope
(in Lbs)
700
600
500
400
300
200
100
0
Excavation and...
SSDS
< Component 3 >
< Component 4 >
< Component 5 >
< Component 6 >
Other Off-Site (Scope 3b)
Transportation (Scope 3a)
Grid Electricity Generation (Scope 2)
On-site (Scope 1)
SOx All Components = 647.1 lbs


All SOx Emissions by Remedy Component
Excavation and Offsite Disposal of Soil/Fill = 93.9%
SSDS = 6.1%
< Component 3 > = 0%
< Component 4 > = 0%
< Component 5 > = 0%
< Component 6 > = 0%
SOx All Components = 647.1 lbs


All SOx Emissions by Scope
On-site (Scope 1) = 4%
Grid Electricity Generation (Scope 2) = 2%
Transportation (Scope 3a) = 0.8%
Other Off-Site (Scope 3b) = 93.2%
SOx All Scopes = 647.1 lbs

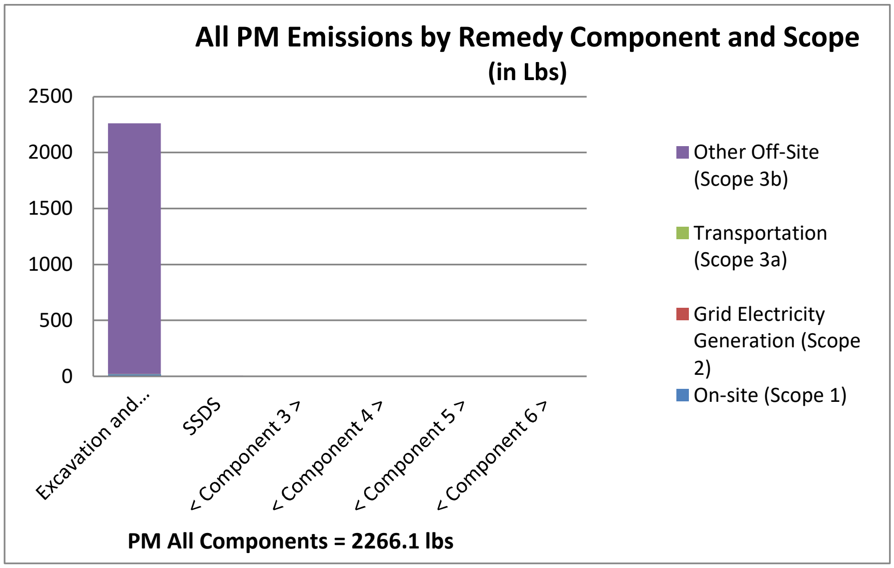
SOx
lbs

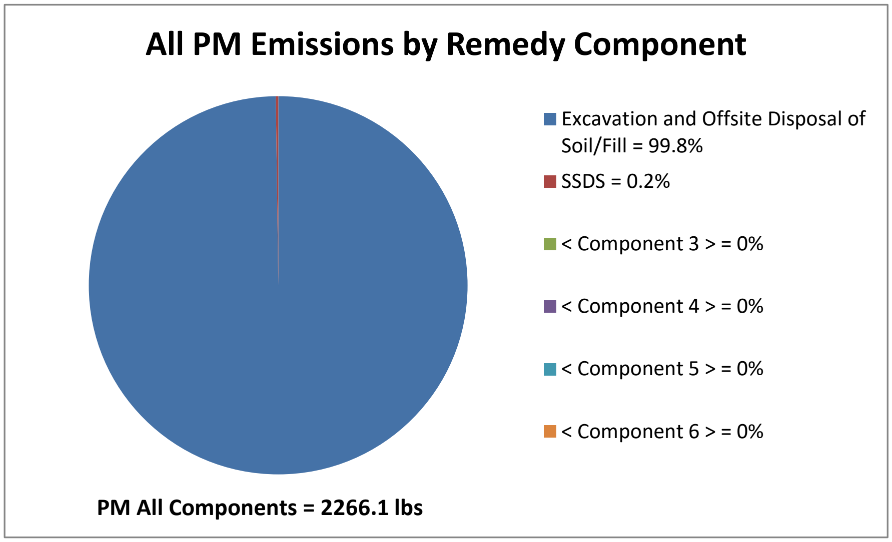
	Excavation	SSDS	< Compone	< Compone	< Compone	< Compone	Total	
On-site (Scope 1)	25.8	0.0	0.0	0.0	0.0	0.0	25.8	
Generation (Scope 2)	0.0	12.9	0.0	0.0	0.0	0.0	12.9	d Electricity
nsportation (Scope 3a)	5.4	0.1	0.0	0.0	0.0	0.0	5.5	Trar
her Off-Site (Scope 3b)	576.6	26.4	0.0	0.0	0.0	0.0	603.0	Oth
Total	607.7	39.4	0.0	0.0	0.0	0.0	647.1	

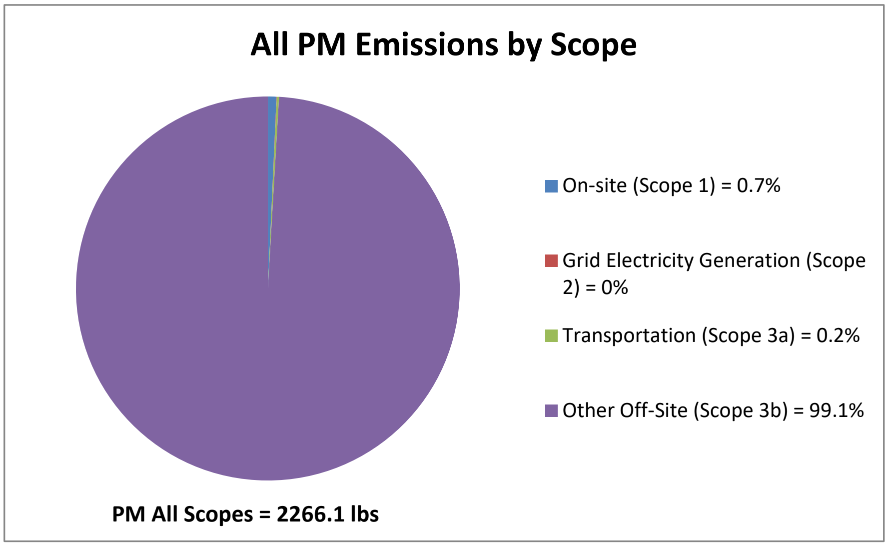
Excavation and Offsite Disposal of Soil/Fill = 9
SSDS = 6.1%
< Component 3 > = 0%
< Component 4 > = 0%
< Component 5 > = 0%
< Component 6 > = 0%

On-site (Scope 1) = 4%
Grid Electricity Generation (Scope 2) = 2%
Transportation (Scope 3a) = 0.8%
Other Off-Site (Scope 3b) = 93.2%

SOx All Components = 647.1 lbs
SOx All Scopes = 647.1 lbs


All PM Emissions by Remedy Component and Scope
(in Lbs)
2500
2000
1500
1000
500
0
Excavation and...
SSDS
< Component 3 >
< Component 4 >
< Component 5 >
< Component 6 >
Other Off-Site (Scope 3b)
Transportation (Scope 3a)
Grid Electricity Generation (Scope 2)
On-site (Scope 1)
PM All Components = 2266.1 lbs


All PM Emissions by Remedy Component
Excavation and Offsite Disposal of Soil/Fill = 99.8%
SSDS = 0.2%
< Component 3 > = 0%
< Component 4 > = 0%
< Component 5 > = 0%
< Component 6 > = 0%
PM All Components = 2266.1 lbs


All PM Emissions by Scope
On-site (Scope 1) = 0.7%
Grid Electricity Generation (Scope 2) = 0%
Transportation (Scope 3a) = 0.2%
Other Off-Site (Scope 3b) = 99.1%
PM All Scopes = 2266.1 lbs

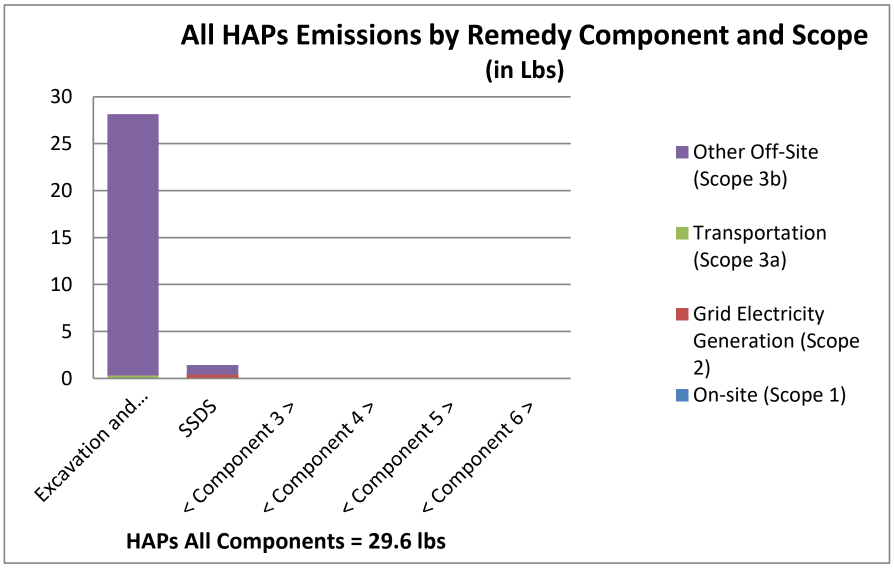
PM
lbs

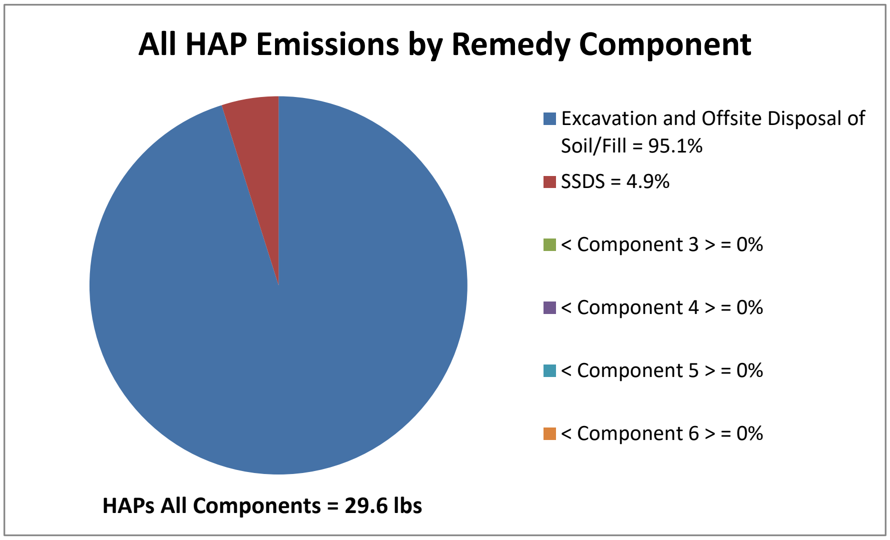
	Excavation	SSDS	< Compone	< Compone	< Compone	< Compone	Total	
On-site (Scope 1)	16.3	0.0	0.0	0.0	0.0	0.0	16.3	
Generation (Scope 2)	0.0	0.7	0.0	0.0	0.0	0.0	0.7	d Electricity
nsportation (Scope 3a)	4.0	0.1	0.0	0.0	0.0	0.0	4.1	Trar
ner Off-Site (Scope 3b)	2,241.1	4.0	0.0	0.0	0.0	0.0	2,245.1	Oth
Total	2,261.4	4.7	0.0	0.0	0.0	0.0	2,266.1	

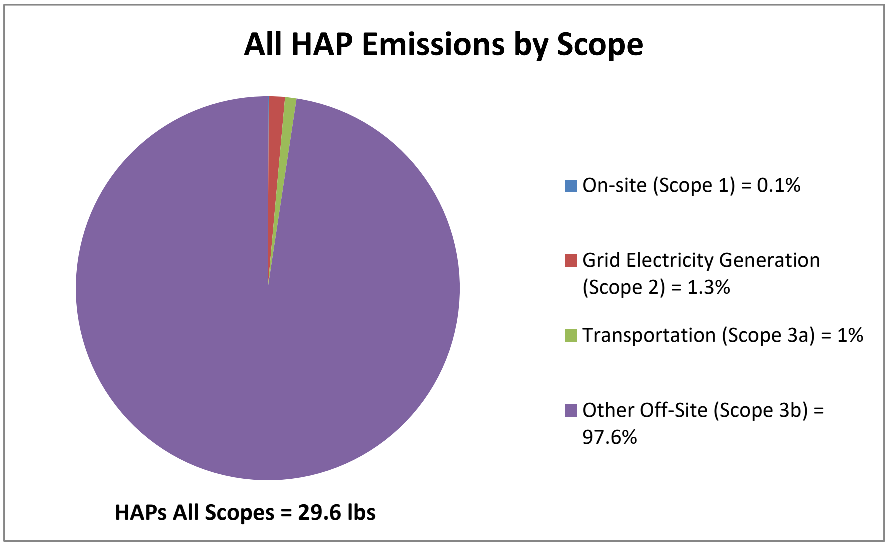
Excavation and Offsite Disposal of Soil/Fill =
SSDS = 0.2%
< Component 3 > = 0%
< Component 4 > = 0%
< Component 5 > = 0%
< Component 6 > = 0%

On-site (Scope 1) = 0.7%
Grid Electricity Generation (Scope 2) = 0%
Transportation (Scope 3a) = 0.2%
Other Off-Site (Scope 3b) = 99.1%

PM All Components = 2266.1 lbs
PM All Scopes = 2266.1 lbs


All HAPs Emissions by Remedy Component and Scope
(in Lbs)
30
25
20
15
10
5
0
Excavation and...
SSDS
< Component 3 >
< Component 4 >
< Component 5 >
< Component 6 >
Other Off-Site (Scope 3b)
Transportation (Scope 3a)
Grid Electricity Generation (Scope 2)
On-site (Scope 1)
HAPs All Components = 29.6 lbs


All HAP Emissions by Remedy Component
Excavation and Offsite Disposal of Soil/Fill = 95.1%
SSDS = 4.9%
< Component 3 > = 0%
< Component 4 > = 0%
< Component 5 > = 0%
< Component 6 > = 0%
HAPs All Components = 29.6 lbs


All HAP Emissions by Scope
On-site (Scope 1) = 0.1%
Grid Electricity Generation (Scope 2) = 1.3%
Transportation (Scope 3a) = 1%
Other Off-Site (Scope 3b) = 97.6%
HAPs All Scopes = 29.6 lbs

HAPs
lbs

	Excavation	SSDS	< Compone	< Compone	< Compone	< Compone	Total
On-site (Scope 1)	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Generation (Scope 2)	0.0	0.4	0.0	0.0	0.0	0.0	0.4
nsportation (Scope 3a)	0.3	0.0	0.0	0.0	0.0	0.0	0.3
ner Off-Site (Scope 3b)	27.8	1.0	0.0	0.0	0.0	0.0	28.9
Total	28.1	1.4	0.0	0.0	0.0	0.0	29.6

Excavation and Offsite Disposal of Soil/Fill =
SSDS = 4.9%
< Component 3 > = 0%
< Component 4 > = 0%
< Component 5 > = 0%
< Component 6 > = 0%

On-site (Scope 1) = 0.1%
Grid Electricity Generation (Scope 2) = 1.3%
Transportation (Scope 3a) = 1%
Other Off-Site (Scope 3b) = 97.6%

HAPs All Components = 29.6 lbs
HAPs All Scopes = 29.6 lbs

Input Summary

Remedy Component Number →		1	2	3	4	5	6															Total
		Column headings in Row 6 must match the name of "Input" tabs in this workbook for Columns C - P in this table to be populated ("0" in Row 4 means "Input" tab is turned Off and will not be grouped to a Remedy Component (Columns Q - V) or used in subsequent calculations)														Remedy Component Subtotals						
Item		Excavation	SSDS	Input Template (3)	Input Template (4)	Input Template (5)	Input Template (6)	Input Template (7)	Input Template (8)	Input Template (9)	Input Template (10)	Input Template (11)	Input Template (12)	Input Template (13)	Input Template (14)	1	2	3	4	5	6	
On-Site																						
On-site Renewable Energy																						
Renewable electricity generated on-site	MWh	0	0													0	0	0	0	0	0	0
Landfill gas combusted on-site for energy use	ccf CH_4	0	0													0	0	0	0	0	0	0
On-site biodiesel use	gal	0	0													0	0	0	0	0	0	0
On-site biodiesel use - Other	gal	0	0													0	0	0	0	0	0	0
User-defined on-site renewable energy use #1	TBD	0	0													0	0	0	0	0	0	0
User-defined on-site renewable energy use #2	TBD	0	0													0	0	0	0	0	0	0
On-Site Conventional Energy																						
Grid electricity	MWh	0	8.7635													0	8.7635	0	0	0	0	8.7635
On-site diesel use - Other	Gal	4781.25	0													4781.25	0	0	0	0	0	4781.25
On-site diesel use <75 hp	Gal	0	0													0	0	0	0	0	0	0
On-site diesel use 75<hp<750	Gal	0	0													0	0	0	0	0	0	0
On-site diesel use >750 hp	Gal	0	0													0	0	0	0	0	0	0
On-site gasoline use - Other	Gal	0	0													0	0	0	0	0	0	0
On-site gasoline use <25 hp	Gal	0	0													0	0	0	0	0	0	0
On-site gasoline use >25 hp	Gal	0	0													0	0	0	0	0	0	0
On-site natural gas use	ccf	0	0													0	0	0	0	0	0	0
On-site compressed natural gas use - Other	ccf	0	0													0	0	0	0	0	0	0
On-site compressed natural gas use	ccf	0	0													0	0	0	0	0	0	0
On-site liquified petroleum gas use - Other	gal	0	0													0	0	0	0	0	0	0
On-site liquified petroleum gas use	gal	0	0													0	0	0	0	0	0	0
Other forms of on-site conventional energy use #1	TBD	0	0													0	0	0	0	0	0	0
Other forms of on-site conventional energy use #2	TBD	0	0													0	0	0	0	0	0	0
Other On-site Emissions																						
On-site HAP process emissions	Lbs	0	0													0	0	0	0	0	0	0
On-site GHG emissions	Lbs CO2e	0	0													0	0	0	0	0	0	0
On-site carbon storage	Lbs CO2e	0	0													0	0	0	0	0	0	0
GHG avoided by flaring on-site landfill methane	ccf CH4	0	0													0	0	0	0	0	0	0
Other on-site NOx emissions or reductions	Lbs	0	0													0	0	0	0	0	0	0
Other on-site SOx emissions or reductions	Lbs	0	0													0	0	0	0	0	0	0
Other on-site PM emissions or reductions	Lbs	0	0													0	0	0	0	0	0	0
Electricity Generation																						
Grid electricity	MWh	0	8.7635													0	8.7635	0	0	0	0	8.7635
Voluntary purchase of renewable electricity	MWh	0	0													0	0	0	0	0	0	0
Voluntary purchase of RECs	MWh	0	0													0	0	0	0	0	0	0
Transportation																						
Transportation Fuel Use Breakdown																						
Biodiesel use - Personnel Transport	gal	0	0													0	0	0	0	0	0	0
Biodiesel use - Personnel Transport - User Defined	gal	0	0													0	0	0	0	0	0	0
Biodiesel use - Equipment Transport	gal	0	0													0	0	0	0	0	0	0
Biodiesel use - Equipment Transport - User Defined	gal	0	0													0	0	0	0	0	0	0
Biodiesel use - Material Transport	gal	0	0													0	0	0	0	0	0	0
Biodiesel use - Material Transport - User Defined	gal	0	0													0	0	0	0	0	0	0
Biodiesel use - Waste Transport	gal	0	0													0	0	0	0	0	0	0
Biodiesel use - Waste Transport - User Defined	gal	0	0													0	0	0	0	0	0	0
Diesel use - Personnel Transport - other vehicles	gal	0	0													0	0	0	0	0	0	0
Diesel use - Personnel Transport - car	gal	0	0													0	0	0	0	0	0	0
Diesel use - Personnel Transport - passenger truck	gal	95.4	0													95.4	0	0	0	0	0	95.4
Diesel use - Personnel Transport - User Defined	gal	0	0													0	0	0	0	0	0	0
Diesel use - Equipment Transport	gal	0.6	0													0.6	0	0	0	0	0	0.6
Diesel use - Equipment Transport - User Defined	gal	0	0													0	0	0	0	0	0	0
Diesel use - Material Transport	gal	0	20.501													0	20.501	0	0	0	0	20.501
Diesel use - Material Transport - User Defined	gal	0	0													0	0	0	0	0	0	0
Diesel use - Waste Transport	gal	987.5	0													987.5	0	0	0	0	0	987.5
Diesel use - Waste Transport - User Defined	gal	0	0													0	0	0	0	0	0	0
Gasoline use - Personnel Transport - other vehicles	gal	0	0													0	0	0	0	0	0	0
Gasoline use - Personnel Transport - car	gal	4.8	0.8													4.8	0.8	0	0	0	0	5.6
Gasoline use - Personnel Transport - passenger truck	gal	0	0													0	0	0	0	0	0	0
Gasoline use - Personnel Transport - User Defined	gal	0	0													0	0	0	0	0	0	0
Gasoline use - Equipment Transport	gal	0	0													0	0	0	0	0	0	0
Gasoline use - Equipment Transport - User Defined	gal	0	0													0	0	0	0	0	0	0
Natural Gas use - Personnel Transport	ccf	0	0													0	0	0	0	0	0	0
Natural Gas use - Personnel Transport - User Defined	ccf	0	0													0	0	0	0	0	0	0
Natural Gas use - Equipment Transport	ccf	0	0													0	0	0	0	0	0	0

Input Summary

Remedy Component Number →		1	2	3	4	5	6															
		Column headings in Row 6 must match the name of "Input" tabs in this workbook for Columns C - P in this table to be populated ("0" in Row 4 means "Input" tab is turned Off and will not be grouped to a Remedy Component (Columns Q - V) or used in subsequent calculations)														Remedy Component Subtotals						
Item		Excavation	SSDS	Input Template (3)	Input Template (4)	Input Template (5)	Input Template (6)	Input Template (7)	Input Template (8)	Input Template (9)	Input Template (10)	Input Template (11)	Input Template (12)	Input Template (13)	Input Template (14)	1	2	3	4	5	6	Total
Conventional Energy																						
Transportation diesel use	gal	1083.5	20.501													1083.5	20.501	0	0	0	0	1104.001
Transportation gasoline use	gal	4.8	0.8													4.8	0.8	0	0	0	0	5.6
Transportation natural gas use	ccf	0	0													0	0	0	0	0	0	0
User-defined conventional energy transportation #1	TBD	10	10													10	10	0	0	0	0	20
User-defined conventional energy transportation #2	TBD	0	0													0	0	0	0	0	0	0
Renewable Energy																						
Transportation biodiesel use	gal	0	0													0	0	0	0	0	0	0
User-defined renewable energy transportation #1	TBD	0	0													0	0	0	0	0	0	0
User-defined renewable energy transportation #2	TBD	0	0													0	0	0	0	0	0	0
Off-Site																						
Construction Materials																						
Aluminum, Rolled Sheet	lb	0	0													0	0	0	0	0	0	0
Asphalt, mastic	lb	0	0													0	0	0	0	0	0	0
Asphalt, paving-grade	lb	0	0													0	0	0	0	0	0	0
Ethanol, Corn, 95%	lb	0	0													0	0	0	0	0	0	0
Ethanol, Corn, 99.7%	lb	0	0													0	0	0	0	0	0	0
Ethanol, Petroleum, 99.7%	lb	0	0													0	0	0	0	0	0	0
Gravel/Sand Mix, 65% Gravel	lb	0	0													0	0	0	0	0	0	0
Gravel/sand/clay	lb	0	0													0	0	0	0	0	0	0
HDPE	lb	0	0													0	0	0	0	0	0	0
Photovoltaic system (installed)	W	0	0													0	0	0	0	0	0	0
PVC	lb	0	1000													0	1000	0	0	0	0	1000
Portland cement, US average	lb	0	0																			
Ready-mixed concrete, 20 MPa	ft3	0	0													0	0	0	0	0	0	0
Round Gravel	lb	0	574000													0	574000	0	0	0	0	574000
Sand	lb	0	0													0	0	0	0	0	0	0
Stainless Steel	lb	0	0													0	0	0	0	0	0	0
Steel	lb	0	0													0	0	0	0	0	0	0
Other refined construction materials	lb	0	1130													0	1130	0	0	0	0	1130
Other unrefined construction materials	lb	0	0													0	0	0	0	0	0	0
Treatment Materials & Chemicals																						
Cheese Whey	lbs	0	0													0	0	0	0	0	0	0
Emulsified vegetable oil	lbs	0	0													0	0	0	0	0	0	0
Granular activated carbon, primary	lbs	0	0													0	0	0	0	0	0	0
Granular activated carbon, regenerated	lbs	0	0													0	0	0	0	0	0	0
Hydrogen Peroxide, 50% in H2O	lbs	0	0													0	0	0	0	0	0	0
Iron (II) Sulfate	lbs	0	0													0	0	0	0	0	0	0
Lime, Hydrated, Packed	lbs	0	0													0	0	0	0	0	0	0
Molasses	lbs	0	0													0	0	0	0	0	0	0
Phosphoric Acid, 70% in H2O	lbs	0	0													0	0	0	0	0	0	0
Potassium Permanganate	lbs	0	0													0	0	0	0	0	0	0
Sodium Hydroxide, 50% in H2O	lbs	0	0													0	0	0	0	0	0	0
Other Treatment Chemicals & Materials	lbs	0	0													0	0	0	0	0	0	0
Material Type																						
Total Virgin Refined Materials	tons	0	288.065													0	288.065	0	0	0	0	288.065
Total Recycled Refined Materials	tons	0	0													0	0	0	0	0	0	0
Total Reused Refined Materials	tons	0	0													0	0	0	0	0	0	0
Total Refined Material	tons	0	288.065													0	288.065	0	0	0	0	288.065
Total Virgin Unrefined Materials	tons	0	0													0	0	0	0	0	0	0
Total Recycled Unrefined Materials	tons	0	0													0	0	0	0	0	0	0
Total Reused Unrefined Materials	tons	0	0													0	0	0	0	0	0	0
Total Unrefined Material	tons	0	0													0	0	0	0	0	0	0
Fuel Processing																						
Biodiesel produced	gal	0	0													0	0	0	0	0	0	0
Diesel produced	gal	5864.75	20.501													5864.75	20.501	0	0	0	0	5885.251
Gasoline produced	gal	4.8	0.8													4.8	0.8	0	0	0	0	5.6
Compressed natural gas produced	ccf	0	0													0	0	0	0	0	0	0
Liquified petroleum gas produced	gal	0	0													0	0	0	0	0	0	0
Natural gas produced	ccf	0	0													0	0	0	0	0	0	0
Water Use																						
Public Water Supply	gal x 1000	20	0													20	0	0	0	0	0	20
Extracted Groundwater	gal x 1000	0	0													0	0	0	0	0	0	0
Surface Water	gal x 1000	0	0													0	0	0	0	0	0	0
Reclaimed Water	gal x 1000	0	0													0	0	0	0	0	0	0
Collected/Diverted Storm Water	gal x 1000	0	0													0	0	0	0	0	0	0
User-defined water resource #1	gal x 1000	0	0													0	0	0	0	0	0	0
User-defined water resource #2	gal x 1000	0	0													0	0	0	0	0	0	0

Input Summary

Remedy Component Number →		1	2	3	4	5	6															
		Column headings in Row 6 must match the name of "Input" tabs in this workbook for Columns C - P in this table to be populated ("0" in Row 4 means "Input" tab is turned Off and will not be grouped to a Remedy Component (Columns Q - V) or used in subsequent calculations)														Remedy Component Subtotals						
Item		Excavation	SSDS	Input Template (3)	Input Template (4)	Input Template (5)	Input Template (6)	Input Template (7)	Input Template (8)	Input Template (9)	Input Template (10)	Input Template (11)	Input Template (12)	Input Template (13)	Input Template (14)	1	2	3	4	5	6	Total
Waste/Recycle Handling																						
Hazardous waste incineration	lbs	0	0													0	0	0	0	0	0	0
Off-site waste water treatment (POTW)	gal x 1000	0	0													0	0	0	0	0	0	0
Off-site non-hazardous waste landfill	tons	4760	0													4760	0	0	0	0	0	4760
Off-site hazardous waste landfill	tons	700	0													700	0	0	0	0	0	700
Recycled/Reused On-Site	tons	0	0													0	0	0	0	0	0	0
Recycled/Reused Off-Site	tons	0	0													0	0	0	0	0	0	0
Solid Waste Totals																						
Total Non-Hazardous Waste	tons	4760	0													4760	0	0	0	0	0	4760
Total Hazardous Waste	tons	700	0													700	0	0	0	0	0	700
Total Recycled/Reused	tons	0	0													0	0	0	0	0	0	0
Total Waste (all types)	tons	5460	0													5460	0	0	0	0	0	5460
Lab Services																						
Off-site Laboratory Analysis - Other	sample	102	0													102	0	0	0	0	0	102
Off-site Laboratory Analysis - Metals	sample	34	0													34	0	0	0	0	0	34
Off-site Laboratory Analysis - Mercury	sample	34	0													34	0	0	0	0	0	34
Off-site Laboratory Analysis - Inorganic Anions	sample	0	0													0	0	0	0	0	0	0
Off-site Laboratory Analysis - Alkalinity	sample	0	0													0	0	0	0	0	0	0
Off-site Laboratory Analysis - Perchlorate	sample	0	0													0	0	0	0	0	0	0
Off-site Laboratory Analysis - Nitrogen/Nitrate	sample	0	0													0	0	0	0	0	0	0
Off-site Laboratory Analysis - Sulfate	sample	0	0													0	0	0	0	0	0	0
Off-site Laboratory Analysis - PCBs	sample	34	0													34	0	0	0	0	0	34
Off-site Laboratory Analysis - VOCs	sample	36	10													36	10	0	0	0	0	46
Off-site Laboratory Analysis - SVOCs	sample	34	0													34	0	0	0	0	0	34
Resource Extraction for Electricity																						
Coal extraction and processing	MWh	0	0.52581													0	0.52581	0	0	0	0	0.52581
Natural gas extraction and processing	MWh	0	0.87635													0	0.87635	0	0	0	0	0.87635
Nuclear fuel extraction and processing	MWh	0	0.17527													0	0.17527	0	0	0	0	0.17527
Oil extraction and processing	MWh	0	0.438175													0	0.438175	0	0	0	0	0.438175
Other fuel extraction and processing	MWh	0	0													0	0	0	0	0	0	0
Electricity Transmission																						
Transmission and distribution losses	MWh	0	8.7635													0	8.7635	0	0	0	0	8.7635

Input Summary

Remedy Component Number →		**1**	**2**	**3**	**4**	**5**	**6**															
		Column headings in Row 6 must match the name of "Input" tabs in this workbook for Columns C - P in this table to be populated ("0" in Row 4 means "Input" tab is turned Off and will not be grouped to a Remedy Component (Columns Q - V) or used in subsequent calculations)														**Remedy Component Subtotals**						
Item		**Excavation**	**SSDS**	**Input Template (3)**	**Input Template (4)**	**Input Template (5)**	**Input Template (6)**	**Input Template (7)**	**Input Template (8)**	**Input Template (9)**	**Input Template (10)**	**Input Template (11)**	**Input Template (12)**	**Input Template (13)**	**Input Template (14)**	**1**	**2**	**3**	**4**	**5**	**6**	**Total**
Other																						
User-defined material #1	TBD	0	0													0	0	0	0	0	0	0
User-defined material #2	TBD	0	0													0	0	0	0	0	0	0
User-defined material #3	TBD	0	0													0	0	0	0	0	0	0
User-defined material #4	TBD	0	0													0	0	0	0	0	0	0
User-defined material #5	TBD	0	0													0	0	0	0	0	0	0
User-defined material #6	TBD	0	0													0	0	0	0	0	0	0
User-defined material #7	TBD	0	0													0	0	0	0	0	0	0
User-defined material #8	TBD	0	0													0	0	0	0	0	0	0
User-defined material #9	TBD	0	0													0	0	0	0	0	0	0
User-defined material #10	TBD	0	0													0	0	0	0	0	0	0
User-defined material #11	TBD	0	0													0	0	0	0	0	0	0
User-defined material #12	TBD	0	0													0	0	0	0	0	0	0
User-defined material #13	TBD	0	0													0	0	0	0	0	0	0
User-defined material #14	TBD	0	0													0	0	0	0	0	0	0
User-defined material #15	TBD	0	0													0	0	0	0	0	0	0
User-defined material #16	TBD	0	0													0	0	0	0	0	0	0
User-defined material #17	TBD	0	0													0	0	0	0	0	0	0
User-defined material #18	TBD	0	0													0	0	0	0	0	0	0
User-defined material #19	TBD	0	0													0	0	0	0	0	0	0
User-defined material #20	TBD	0	0													0	0	0	0	0	0	0
User-defined Waste Destinations																						
User-defined recycled/reused on-site #1	TBD	0	0													0	0	0	0	0	0	0
User-defined recycled/reused on-site #2	TBD	0	0													0	0	0	0	0	0	0
User-defined recycled/reused on-site #3	TBD	0	0													0	0	0	0	0	0	0
User-defined recycled/reused off-site #1	TBD	0	0													0	0	0	0	0	0	0
User-defined recycled/reused off-site #2	TBD	0	0													0	0	0	0	0	0	0
User-defined recycled/reused off-site #3	TBD	0	0													0	0	0	0	0	0	0
User-defined non-hazardous waste destination #1	TBD	0	0													0	0	0	0	0	0	0
User-defined non-hazardous waste destination #2	TBD	0	0													0	0	0	0	0	0	0
User-defined non-hazardous waste destination #3	TBD	0	0													0	0	0	0	0	0	0
User-defined hazardous waste destination #1	TBD	0	0													0	0	0	0	0	0	0
User-defined hazardous waste destination #2	TBD	0	0													0	0	0	0	0	0	0
User-defined hazardous waste destination #3	TBD	0	0													0	0	0	0	0	0	0

Excavation and Offsite Disposal of Soil/Fill - On-Site Footprint (Scope 1)

			Energy		**GHG**		**NOx**		**SOx**		**PM**		**HAPs**	
Contributors to Footprints	**Units**	**Usage**	**Conv. Factor**	**MMBtus**	**Conv. Factor**	**lbs CO2e**	**Conv. Factor**	**lbs**	**Conv. Factor**	**lbs**	**Conv. Factor**	**lbs**	**Conv. Factor**	**lbs**
On-Site														
On-site Renewable Energy														
Renewable electricity generated on-site	MWh	0	3.413	0										
Landfill gas combusted on-site for energy use	ccf CH4	0	0.103	0	13.1	0	0.01	0	0.0000063	0	0.00076	0	0.0000084	0
On-site biodiesel use	gal	0	0.127	0	22.3	0	0.2	0	0	0	0.00099	0	NP	
On-site biodiesel use - User Defined	gal	0	0.127	0	22.3	0	0.2	0	0	0	0.00099	0	NP	
User-defined on-site renewable energy use #1	gal	0	0	0	0	0	0	0	0	0	0	0	0	0
User-defined on-site renewable energy use #2	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0
On-site Renewable Energy Subtotals				**0**		**0**		**0**		**0**		**0**		**0**
Notes:														
On-site Conventional Energy														
On-site grid electricity	MWh	0	3.413	0										
On-site diesel use - Other	Gal	4781.25	0.139	664.59375	22.5	107578.13	0.17	812.8125	0.0054	25.81875	0.0034	16.25625	0.0000052	0.0248625
On-site diesel use <75 hp	Gal	0	0.139	0	22.21	0	0.1565	0	0.000145	0	0.0145	0	0.00004	0
On-site diesel use 75<hp<750	Gal	0	0.139	0	22.24	0	0.101	0	0.00013	0	0.009	0	0.00004	0
On-site diesel use >750 hp	Gal	0	0.139	0	22.24	0	0.149	0	0.00013	0	0.006	0	0.00004	0
On-site gasoline use - Other	Gal	0	0.124	0	19.6	0	0.11	0	0.0045	0	0.00054	0	0.000039	0
On-site gasoline use <25 hp	Gal	0	0.124	0	17.48	0	0.037	0	0.00025	0	0.165	0	0.00008	0
On-site gasoline use >25 hp	Gal	0	0.124	0	19.93	0	0.032	0	0.00029	0	0.002	0	0.00009	0
On-site natural gas use	ccf	0	0.103	0	13.1	0	0.01	0	0.0000063	0	0.00076	0	0.0000084	0
On-site compressed natural gas use - Other	ccf	0	NP		1957.835	0	16.0325	0	0.023045	0	0.2775	0	0	0
On-site compressed natural gas use	ccf	0	NP		1957.835	0	16.0325	0	0.023045	0	0.2775	0	0	0
On-site liquified petroleum gas use - Other	gal	0	NP		12.69	0	0.021	0	0.00013	0	0.001	0	0	0
On-site liquified petroleum gas use	gal	0	NP		12.69	0	0.021	0	0.00013	0	0.001	0	0	0
Other forms of on-site conventional energy use #1	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0
Other forms of on-site conventional energy use #2	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0
On-site Conventional Energy Subtotals				**665**		**107,578**		**813**		**26**		**16**		**0**
Notes:														
Other On-site Emissions														
On-site HAP process emissions	lbs	0											1	0
On-site GHG emissions	lbs CO2e	0			1	0								
On-site carbon storage	lbs CO2e	0			1	0								
GHG avoided by flaring on-site landfill methane	Lbs	0			-262	0	0.01	0	0.0000063	0	0.00076	0	0.0000084	0
Other on-site NOx emissions or reductions	lbs	0					1	0						
Other on-site SOx emissions or reductions	lbs	0							1	0				
Other on-site PM emissions or reductions	lbs	0									1	0		
User-defined recycled/reused on-site #2	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0
User-defined recycled/reused on-site #3	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0
User-defined recycled/reused off-site #1	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0
Notes:														
On-site Totals				**664.59**		**107,578**		**813**		**26**		**16**		**0**

Excavation and Offsite Disposal of Soil/Fill - Electricity Generation Footprint (Scope 2)

			Energy		**GHG**		**NOx**		**SOx**		**PM**		**HAPs**	
Contributors to Footprints	**Units**	**Usage**	**Conv. Factor**	**MMBtus**	**Conv. Factor**	**lbs CO2e**	**Conv. Factor**	**lbs**	**Conv. Factor**	**lbs**	**Conv. Factor**	**lbs**	**Conv. Factor**	**lbs**
Electricity Generation														
Grid electricity	MWh	0	6.929	0	1124.3	0	2.2421	0	4.6078874	0	0.057518	0	0.2102371	0
Voluntary purchase of renewable electricity	MWh	0												
Voluntary purchase of RECs	MWh	0												
Notes:														

Excavation and Offsite Disposal of Soil/Fill - Transportation Footprint (Scope 3a)

			Energy		**Greenhouse Gas**		**NOx**		**SOx**		**PM**		**HAPs**	
Category	**Units**	**Usage**	**Conv. Factor**	**MMBtus**	**Conv. Factor**	**lbs CO2e**	**Conv. Factor**	**lbs**	**Conv. Factor**	**lbs**	**Conv. Factor**	**lbs**	**Conv. Factor**	**lbs**
Conventional Energy														
Transportation diesel use	gal	988.1	0.139	137.3459	22.5	22232.25	0.17	167.977	0.0054	5.33574	0.0034	3.35954	0.0000052	0.0051381
Transportation diesel use - car	gal	0	0.139	0	22.57	0	0.015	0	0.0002	0	0.003	0	0.00252	0
Transportation diesel use - passenger truck	gal	95.4	0.139	13.2606	22.545	2150.793	0.0585	5.5809	0.0002	0.01908	0.007	0.6678	0.002605	0.248517
Transportation diesel use - User Defined	gal	0	0.139	0	22.5	0	0.17	0	0.0054	0	0.0034	0	0.0000052	0
Transportation gasoline use	gal	0	0.124	0	19.6	0	0.11	0	0.0045	0	0.00054	0	0.000039	0
Transportation gasoline use - car	gal	4.8	0.124	0.5952	19.77	94.896	0.027	0.1296	0.00036	0.001728	0.003	0.0144	0.0067	0.03216
Transportation gasoline use - passenger truck	gal	0	0.124	0	19.79	0	0.035	0	0.00036	0	0.003	0	0.00661	0
Transportation gasoline use - User Defined	gal	0	0.124	0	19.6	0	0.11	0	0.0045	0	0.00054	0	0.000039	0
Transportation natural gas use	ccf	0	0.103	0	13.1	0	0.01	0	0.0000063	0	0.00076	0	0.0000084	0
Transportation natural gas use - User Defined	ccf	0	0.103	0	13.1	0	0.01	0	0.0000063	0	0.00076	0	0.0000084	0
User-defined conventional energy transportation #1	TBD	10	0	0	0	0	0	0	0	0	0	0	0	0
User-defined conventional energy transportation #2	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0
Conventional Energy Subtotals				**151**		**24,478**		**174**		**5**		**4**		**0**
Notes:														
Renewable Energy														
Transportation biodiesel use	gal	0	0.127	0	22.3	0	0.2	0	0	0	0.00099	0	NP	
Transportation biodiesel use - User Defined	gal	0	0.127	0	22.3	0	0.2	0	0	0	0.00099	0	NP	
User-defined renewable energy transportation #1	TBD	0	Biodiesel		0	0	0	0	0	0	0	0	Ref.	
User-defined renewable energy transportation #2	TBD	0	npg or pmp		0	0	0	0	0	0	0	0	0	0
Renewable Energy Subtotals				**0**		**0**		**0**		**0**		**0**		**0**
Notes:														
Transportation Totals				**151**		**24478**		**174**		**5**		**4**		**0**

Excavation and Offsite Disposal of Soil/Fill - Off-Site Footprint (Scope 3b)

			Energy		**Greenhouse Gas**		**NOx**		**SOx**		**PM**		**HAPs**	
Category	**Units**	**Usage**	**Conv. Factor**	**MMBtus**	**Conv. Factor**	**lbs CO2e**	**Conv. Factor**	**lbs**	**Conv. Factor**	**lbs**	**Conv. Factor**	**lbs**	**Conv. Factor**	**lbs**
Construction Materials														
Aluminum, Rolled Sheet	lb	0	0.0633	0	9.15	0	0.0148	0	0.0283	0	0.0088	0	0.00102	0
Asphalt, mastic	lb	0	0.0412	0	0.85	0	0.00271	0	0.00798	0	0.000766	0	0.00107	0
Asphalt, paving-grade	lb	0	0.5	0	8.58	0	0.0299	0	0.0969	0	0.0091	0	0.0133	0
Ethanol, Corn, 95%	lb	0	0.0318	0	-0.0199	0	0.00425	0	0.00303	0	0.000469	0	0.0000846	0
Ethanol, Corn, 99.7%	lb	0	0.0324	0	0.0591	0	0.00431	0	0.0031	0	0.000472	0	0.000087	0
Ethanol, Petroleum, 99.7%	lb	0	0.0205	0	1.25	0	0.00199	0	0.00214	0	0.000277	0	0.0000589	0
Gravel/Sand Mix, 65% Gravel	lb	0	0.0000248	0	0.0024	0	0.000018	0	4.52E-06	0	2.61E-06	0	3.08E-07	0
Gravel/sand/clay	lb	0	0.000028	0	0.00335	0	0.0000165	0	0.000015	0	0.000002	0	2.05E-10	0
HDPE	lb	0	0.0332	0	1.94	0	0.00325	0	0.00409	0	0.000439	0	0.0000641	0
Photovoltaic system (installed)	W	0	0.0336	0	4.47	0	0.015	0	0.032	0	0.00063	0	0.0000029	0
PVC	lb	0	0.0262	0	2.02	0	0.004	0	0.00274	0	0.000372	0	0.000375	0
Portland cement, US average	lb	0	0.0139	0	1.34	0	0.00654	0	0.0104	0	0.00378	0	0.00097	0
Ready-mixed concrete, 20 MPa	ft3	0	0.217	0	19.5	0	0.0975	0	0.154	0	0.057	0	0.0141	0
Round Gravel	lb	0	0.0000248	0	0.0024	0	0.000018	0	4.52E-06	0	2.61E-06	0	3.08E-07	0
Sand	lb	0	0.0000248	0	0.0024	0	0.000018	0	4.52E-06	0	2.61E-06	0	3.08E-07	0
Stainless Steel	lb	0	0.0116	0	3.4	0	0.0075	0	0.012	0	0.0044	0	0.000144	0
Steel	lb	0	0.0044	0	1.1	0	0.0014	0	0.0017	0	0.00056	0	0.000067	0
Other refined construction materials	lb	0	0.01885	0	2.115	0	0.0040375	0	0.0051325	0	0.0014428	0	0.0001625	0
Other unrefined construction materials	lb	0	0.000028	0	0.00335	0	0.0000165	0	0.000015	0	0.000002	0	2.05E-10	0

Notes:

Excavation and Offsite Disposal of Soil/Fill - Off-Site Footprint (Scope 3b)

			Energy		**Greenhouse Gas**		**NOx**		**SOx**		**PM**		**HAPs**	
Category	**Units**	**Usage**	**Conv. Factor**	**MMBtus**	**Conv. Factor**	**lbs CO2e**	**Conv. Factor**	**lbs**	**Conv. Factor**	**lbs**	**Conv. Factor**	**lbs**	**Conv. Factor**	**lbs**
Treatment Materials & Chemicals														
Cheese Whey	lbs	0	0.0025	0	0.031	0	0.000062	0	0.000033	0	0.000002	0	NP	
Emulsified vegetable oil	lbs	0	0.0077	0	3.44	0	0.0066	0	0.0019	0	0.000033	0	NP	
Granular activated carbon, primary	lbs	0	0.0356	0	4.82	0	0.0793	0	0.128	0	0.000987	0	0.000657	0
Granular activated carbon, regenerated	lbs	0	0.00873	0	1.7	0	0.00733	0	0.0129	0	0.000886	0	0.000671	0
Hydrogen Peroxide, 50% in H2O	lbs	0	0.00979	0	1.19	0	0.00142	0	0.0024	0	0.000308	0	0.0000629	0
Iron (II) Sulfate	lbs	0	0.00147	0	0.167	0	0.000316	0	0.000589	0	0.000103	0	0.000023	0
Lime, Hydrated, Packed	lbs	0	0.00206	0	0.762	0	0.000513	0	0.000358	0	0.00013	0	6.57E-06	0
Molasses	lbs	0	0.0044	0	0.48	0	0.0011	0	0.00024	0	0.0000041	0	NP	
Phosphoric Acid, 70% in H2O	lbs	0	0.0067	0	0.882	0	0.00282	0	0.0294	0	0.00171	0	0.000163	0
Potassium Permanganate	lbs	0	0.00981	0	1.16	0	0.00234	0	0.0032	0	0.000422	0	0.000122	0
Sodium Hydroxide, 50% in H2O	lbs	0	0.00977	0	1.09	0	0.00194	0	0.00352	0	0.000403	0	0.000129	0
Other Treatment Chemicals & Materials	lbs	0	0.015	0	1.67	0	0.003	0	0.0065	0	0.00061	0	0.000016	0
Notes:														
Fuel Processing														
Biodiesel produced	gal	0	0.029	0	-16.8	0	0.018	0	0.033	0	0.00082	0	NP	
Diesel produced	gal	5864.75	0.017	99.70075	3.02	17711.545	0.0051	29.910225	0.0062	36.36145	0.0017	9.970075	0.0011	6.451225
Gasoline produced	gal	4.8	0.033	0.1584	2.8	13.44	0.0046	0.02208	0.005	0.024	0.0015	0.0072	0.001	0.0048
Liquefied Petroleum Gas Produced	gal	0	0.088	0	1.47	0	0.0016	0	0.0024	0	0.0007	0	0.0003	0
Natural Gas - Compressed Produced	ccf	0	19.983	0	343.92	0	0.4732	0	2.1651	0	0.1846	0	0.2895	0
Natural Gas Produced	ccf	0	0.0052	0	2.2	0	0.0037	0	0.0046	0	0.000072	0	0.0000061	0
Fuel Processing Subtotals				**99.85915**		**17724.985**		**29.932305**		**36.38545**		**9.977275**		**6.456025**
Notes:														
Public water	gal x 1000	20	0.0092	0.184	5	100	0.0097	0.194	0.0059	0.118	0.016	0.32	0.000015	0.0003
User-defined water resource #1	gal x 1000	0	0	0	0	0	0	0	0	0	0	0	0	0
User-defined water resource #2	gal x 1000	0	0	0	0	0	0	0	0	0	0	0	0	0
Notes:														

Excavation and Offsite Disposal of Soil/Fill - Off-Site Footprint (Scope 3b)

			Energy		**Greenhouse Gas**		**NOx**		**SOx**		**PM**		**HAPs**	
Category	**Units**	**Usage**	**Conv. Factor**	**MMBtus**	**Conv. Factor**	**lbs CO2e**	**Conv. Factor**	**lbs**	**Conv. Factor**	**lbs**	**Conv. Factor**	**lbs**	**Conv. Factor**	**lbs**
Off-Site Services														
Hazardous waste incineration	lb	0	0.00609	0	2.43	0	0.0016	0	0.00167	0	0.000209	0	0.000087	0
Off-site waste water treatment (POTW)	gal x 1000	0	0.015	0	4.4	0	0.016	0	0.015	0	NP		NP	
Off-site non-hazardous waste landfill	ton	4760	0.16	761.6	25	119000	0.14	666.4	0.075	357	0.4	1904	0.0014	6.664
Off-site hazardous waste landfill	ton	700	0.18	126	27.5	19250	0.154	107.8	0.0825	57.75	0.44	308	0.00154	1.078
Off-site Laboratory Analysis - Other	sample	102	0.058071	5.923245	6.8534384	699.05072	0.131402	13.403	0.3038758	30.995328	0.0455698	4.6481221	0.0330165	3.3676859
Off-site Laboratory Analysis - Metals	sample	34	0.212	7.208	27.4693	933.9562	0.6423	21.8382	1.5072	51.2448	0.2264	7.6976	0.1643	5.5862
Off-site Laboratory Analysis - Mercury	sample	34	0.0731715	2.4878301	9.325458	317.06557	0.2127439	7.2332926	0.4982396	16.940146	0.0747359	2.541022	0.0542332	1.8439274
Off-site Laboratory Analysis - Inorganic Anions	sample	0	0.0074025	0	0.6459478	0	0.0067681	0	0.0147929	0	0.0022024	0	0.0015542	0
Off-site Laboratory Analysis - Alkalinity	sample	0	0.0174398	0	1.3381922	0	0.0070106	0	0.0132496	0	0.00194	0	0.0012831	0
Off-site Laboratory Analysis - Perchlorate	sample	0	0.023885	0	1.8717054	0	0.0079807	0	0.0141535	0	0.0020547	0	0.0012875	0
Off-site Laboratory Analysis - Nitrogen/Nitrate	sample	0	0.0336475	0	4.29897	0	0.0954592	0	0.2226646	0	0.0335099	0	0.0242506	0
Off-site Laboratory Analysis - Sulfate	sample	0	0.0141225	0	1.4726728	0	0.0079807	0	0.0136024	0	0.0019797	0	0.0012015	0
Off-site Laboratory Analysis - PCBs	sample	34	0.0512769	1.7434146	5.224902	177.64667	0.0833339	2.8333519	0.1904774	6.476233	0.0284393	0.9669376	0.0212083	0.7210806
Off-site Laboratory Analysis - VOCs	sample	36	0.0762045	2.7433615	9.016814	324.6053	0.104498	3.7619294	0.2270738	8.1746568	0.0339508	1.2222302	0.0235892	0.8492119
Off-site Laboratory Analysis - SVOCs	sample	34	0.0715602	2.4330462	7.870422	267.59435	0.1459445	4.9621137	0.3373038	11.468329	0.0504853	1.7165016	0.0372577	1.2667632
Notes:														
Resource Extraction for Electricity														
Coal extraction and processing	MWh	0	3.1	0	180.0	0	0.8	0	0.2	0	0.0	0	NP	
Natural gas extraction and processing	MWh	0	1.6	0	270.0	0	0.2	0	13.0	0	0.0	0	NP	
Nuclear fuel extraction and processing	MWh	0	0.2	0	25.0	0	0.2	0	0.5	0	0.0	0	NP	
Oil extraction and processing	MWh	0	2.3	0	270.0	0	1.7	0	0.1	0	0.0	0	NP	
Other fuel extraction and processing	MWh	0	0	0	0	0	0	0	0	0	0	0	0	0
Resource Extraction Subtotals				**0**		**0**		**0**		**0**		**0**		**0**
Notes:														
Electricity Transmission														
Transmission and distribution losses	MWh	0	1.0342	0	112.43	0	0.22421	0	0.4607887	0	0.0057518	0	0.0210237	0
Notes:														

Excavation and Offsite Disposal of Soil/Fill - Off-Site Footprint (Scope 3b)

Category	Units	Usage	Energy		Greenhouse Gas		NOx		SOx		PM		HAPs	
			Conv. Factor	MMBtus	Conv. Factor	lbs CO2e	Conv. Factor	lbs	Conv. Factor	lbs	Conv. Factor	lbs	Conv. Factor	lbs
User-defined Materials														
User-defined material #1	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0
User-defined material #2	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0
User-defined material #3	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0
User-defined material #4	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0
User-defined material #5	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0
User-defined material #6	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0
User-defined material #7	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0
User-defined material #8	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0
User-defined material #9	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0
User-defined material #10	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0
User-defined material #11	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0
User-defined material #12	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0
User-defined material #13	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0
User-defined material #14	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0
User-defined material #15	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0
User-defined material #16	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0
User-defined material #17	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0
User-defined material #18	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0
User-defined material #19	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0
User-defined material #20	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0
Notes:														
User-defined Waste Destinations														
User-defined recycled/reused off-site #1	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0
User-defined recycled/reused off-site #2	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0
User-defined recycled/reused off-site #3	TBD	0	y(MMBtu/u		(lbs CO2e/u		Ox(lbs/unit)		Ox(lbs/unit)		M(lbs/unit)		APs(lbs/unit	
User-defined non-hazardous waste destination #1	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0
User-defined non-hazardous waste destination #2	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0
User-defined non-hazardous waste destination #3	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0
User-defined hazardous waste destination #1	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0
User-defined hazardous waste destination #2	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0
User-defined hazardous waste destination #3	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0
Notes:														
Off-site Totals				**1010.182**		**158794.9**		**858.35819**		**576.55294**		**2241.0897**		**27.833194**

Excavation and Offsite Disposal of Soil/Fill - Intermediate Totals

			Energy		**Greenhouse Gas**		**NOx**		**SOx**		**PM**		**HAPs**	
Category	**Units**	**Usage**	**Conv. Factor**	**MMBtus**	**Conv. Factor**	**lbs CO2e**	**Conv. Factor**	**lbs**	**Conv. Factor**	**lbs**	**Conv. Factor**	**lbs**	**Conv. Factor**	**lbs**
Total Grid Electricity Footprint														
On-site grid electricity	MWh	0	3.413	0										
Electricity Generation														
Grid electricity	MWh	0	6.929	0	1124.3	0	2.2421	0	4.6078874	0	0.057518	0	0.2102371	0
Resource Extraction for Electricity														
Coal extraction and processing	MWh	0	3.1	0	180.0	0	0.8	0	0.2	0	0.0	0	NP	
Natural gas extraction and processing	MWh	0	1.6	0	270.0	0	0.2	0	13.0	0	0.0	0	NP	
Nuclear fuel extraction and processing	MWh	0	0.2	0	25.0	0	0.2	0	0.5	0	0.0	0	NP	
Oil extraction and processing	MWh	0	2.3	0	270.0	0	1.7	0	0.1	0	0.0	0	NP	
Other fuel extraction and processing	MWh	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0
Electricity Transmission														
Transmission and distribution losses	MWh	0	1.0342	0	112.43	0	0.22421	0	0.4607887	0	0.0057518	0	0.0210237	0
Total Grid Electricity Footprint				**0**		**0**		**0**		**0**		**0**		**0**
Total Fuel Footprints														
Total Gasoline Footprint														
On-site gasoline use - Other	gal	0	0.124	0	19.6	0	0.11	0	0.0045	0	0.00054	0	0.000039	0
On-site gasoline use <25 hp	gal	0	0.124	0	17.48	0	0.037	0	0.00025	0	0.165	0	0.00008	0
On-site gasoline use >25 hp	gal	0	0.124	0	19.93	0	0.032	0	0.00029	0	0.002	0	0.00009	0
Transportation gasoline use	gal	0	0.124	0	19.6	0	0.11	0	0.0045	0	0.00054	0	0.000039	0
Transportation gasoline use - car	gal	4.8	0.124	0.5952	19.77	94.896	0.027	0.1296	0.00036	0.001728	0.003	0.0144	0.0067	0.03216
Transportation gasoline use - passenger truck	gal	0	0.124	0	19.79	0	0.035	0	0.00036	0	0.003	0	0.00661	0
Transportation gasoline use - User Defined	gal	0	0.124	0	19.6	0	0.11	0	0.0045	0	0.00054	0	0.000039	0
Gasoline produced	gal	4.8	0.033	0.1584	2.8	13.44	0.0046	0.02208	0.005	0.024	0.0015	0.0072	0.001	0.0048
Total Gasoline Footprint		**4.8**		**0.7536**		**108.336**		**0.15168**		**0.025728**		**0.0216**		**0.03696**
Total Diesel Footprint														
On-site diesel use - Other	gal	4781.25	0.139	664.59375	22.5	107578.13	0.17	812.8125	0.0054	25.81875	0.0034	16.25625	0.0000052	0.0248625
On-site diesel use <75 hp	gal	0	0.139	0	22.21	0	0.1565	0	0.000145	0	0.0145	0	0.00004	0
On-site diesel use 75<hp<750	gal	0	0.139	0	22.24	0	0.101	0	0.00013	0	0.009	0	0.00004	0
On-site diesel use >750 hp	gal	0	0.139	0	22.24	0	0.149	0	0.00013	0	0.006	0	0.00004	0
Transportation diesel use	gal	988.1	0.139	137.3459	22.5	22232.25	0.17	167.977	0.0054	5.33574	0.0034	3.35954	0.0000052	0.0051381
Transportation diesel use - car	gal	0	0.139	0	22.57	0	0.015	0	0.0002	0	0.003	0	0.00252	0
Transportation diesel use - passenger truck	gal	95.4	0.139	13.2606	22.545	2150.793	0.0585	5.5809	0.0002	0.01908	0.007	0.6678	0.002605	0.248517
Transportation diesel use - User Defined	gal	0	0.139	0	22.5	0	0.17	0	0.0054	0	0.0034	0	0.0000052	0
Diesel produced	gal	5864.75	0.017	99.70075	3.02	17711.545	0.0051	29.910225	0.0062	36.36145	0.0017	9.970075	0.0011	6.451225
Total Diesel Footprint		**5864.75**		**914.901**		**149672.71**		**1016.2806**		**67.53502**		**30.253665**		**6.7297426**
Total Biodiesel Footprint														
On-site biodiesel use	gal	0	0.127	0	22.3	0	0.2	0	0	0	0.00099	0	NP	
On-site biodiesel use - User Defined	gal	0	0.127	0	22.3	0	0.2	0	0	0	0.00099	0	NP	
Transportation biodiesel use	gal	0	0.127	0	22.3	0	0.2	0	0	0	0.00099	0	NP	
Transportation biodiesel use - User Defined	gal	0	0.127	0	22.3	0	0.2	0	0	0	0.00099	0	NP	
Biodiesel produced	gal	0	0.029	0	-16.8	0	0.018	0	0.033	0	0.00082	0	NP	
Total Biodiesel Footprint		**0**		**0**		**0**		**0**		**0**		**0**		**0**
Total Natural Gas Footprint														
On-site natural gas use	ccf	0	0.103	0	13.1	0	0.01	0	0.0000063	0	0.00076	0	0.0000084	0
Transportation natural gas use	ccf	0	0.103	0	13.1	0	0.01	0	0.0000063	0	0.00076	0	0.0000084	0
Transportation natural gas use - User Defined	ccf	0	0.103	0	13.1	0	0.01	0	0.0000063	0	0.00076	0	0.0000084	0
Natural gas produced	ccf	0	0.0052	0	2.2	0	0.0037	0	0.0046	0	0.000072	0	0.0000061	0
Total Natural Gas Footprint		**0**		**0**		**0**		**0**		**0**		**0**		**0**
Total Liquified Petroleum Gas Footprint														
On-site liquified petroleum gas use - Other	ccf	0	NP		12.69	0	0.021	0	0.00013	0	0.001	0	0	0
On-site liquified petroleum gas use	ccf	0	NP		12.69	0	0.021	0	0.00013	0	0.001	0	0	0
Liquified petroleum gas produced	ccf	0	0.088	0	1.47	0	0.0016	0	0.0024	0	0.0007	0	0.0003	0
Total Natural Gas Footprint		**0**		**0**		**0**		**0**		**0**		**0**		**0**
Total Compressed Gas Footprint														
On-site compressed gas use - Other	ccf	0	NP		1957.835	0	16.0325	0	0.023045	0	0.2775	0	0	0
On-site compressed gas use	ccf	0	NP		1957.835	0	16.0325	0	0.023045	0	0.2775	0	0	0
Compressed gas produced	ccf	0	19.983	0	343.92	0	0.4732	0	2.1651	0	0.1846	0	0.2895	0
Total Natural Gas Footprint		**0**		**0**		**0**		**0**		**0**		**0**		**0**

Notes:

Note: Please refer to the "Default Conversions" tab for references for the default conversion factors used on this calculation sheet.

Space below available for notes and calculations:

SSDS - On-Site Footprint (Scope 1)

Contributors to Footprints	**Units**	**Usage**	**Energy**		**GHG**		**NOx**		**SOx**		**PM**		**HAPs**	
			Conv. Factor	**MMBtus**	**Conv. Factor**	**lbs CO2e**	**Conv. Factor**	**lbs**	**Conv. Factor**	**lbs**	**Conv. Factor**	**lbs**	**Conv. Factor**	**lbs**
On-Site														
On-site Renewable Energy														
Renewable electricity generated on-site	MWh	0	3.413	0										
Landfill gas combusted on-site for energy use	ccf CH4	0	0.103	0	13.1	0	0.01	0	0.0000063	0	0.00076	0	0.0000084	0
On-site biodiesel use	gal	0	0.127	0	22.3	0	0.2	0	0	0	0.00099	0	NP	
On-site biodiesel use - User Defined	gal	0	0.127	0	22.3	0	0.2	0	0	0	0.00099	0	NP	
User-defined on-site renewable energy use #1	gal	0	0	0	0	0	0	0	0	0	0	0	0	0
User-defined on-site renewable energy use #2	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0
On-site Renewable Energy Subtotals				**0**		**0**		**0**		**0**		**0**		**0**
Notes:														
On-site Conventional Energy														
On-site grid electricity	MWh	8.7635	3.413	29.909826										
On-site diesel use - Other	Gal	0	0.139	0	22.5	0	0.17	0	0.0054	0	0.0034	0	0.0000052	0
On-site diesel use <75 hp	Gal	0	0.139	0	22.21	0	0.1565	0	0.000145	0	0.0145	0	0.00004	0
On-site diesel use 75<hp<750	Gal	0	0.139	0	22.24	0	0.101	0	0.00013	0	0.009	0	0.00004	0
On-site diesel use >750 hp	Gal	0	0.139	0	22.24	0	0.149	0	0.00013	0	0.006	0	0.00004	0
On-site gasoline use - Other	Gal	0	0.124	0	19.6	0	0.11	0	0.0045	0	0.00054	0	0.000039	0
On-site gasoline use <25 hp	Gal	0	0.124	0	17.48	0	0.037	0	0.00025	0	0.165	0	0.00008	0
On-site gasoline use >25 hp	Gal	0	0.124	0	19.93	0	0.032	0	0.00029	0	0.002	0	0.00009	0
On-site natural gas use	ccf	0	0.103	0	13.1	0	0.01	0	0.0000063	0	0.00076	0	0.0000084	0
On-site compressed natural gas use - Other	ccf	0	NP		1957.835	0	16.0325	0	0.023045	0	0.2775	0	0	0
On-site compressed natural gas use	ccf	0	NP		1957.835	0	16.0325	0	0.023045	0	0.2775	0	0	0
On-site liquified petroleum gas use - Other	gal	0	NP		12.69	0	0.021	0	0.00013	0	0.001	0	0	0
On-site liquified petroleum gas use	gal	0	NP		12.69	0	0.021	0	0.00013	0	0.001	0	0	0
Other forms of on-site conventional energy use #1	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0
Other forms of on-site conventional energy use #2	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0
On-site Conventional Energy Subtotals				**30**		**0**		**0**		**0**		**0**		**0**
Notes:														
Other On-site Emissions														
On-site HAP process emissions	lbs	0											1	0
On-site GHG emissions	lbs CO2e	0			1	0								
On-site carbon storage	lbs CO2e	0			1	0								
GHG avoided by flaring on-site landfill methane	Lbs	0			-262	0	0.01	0	0.0000063	0	0.00076	0	0.0000084	0
Other on-site NOx emissions or reductions	lbs	0					1	0						
Other on-site SOx emissions or reductions	lbs	0							1	0				
Other on-site PM emissions or reductions	lbs	0									1	0		
User-defined recycled/reused on-site #2	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0
User-defined recycled/reused on-site #3	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0
User-defined recycled/reused off-site #1	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0
Notes:														
On-site Totals				**29.91**		**0**		**0**		**0**		**0**		**0**

SSDS - Electricity Generation Footprint (Scope 2)

Contributors to Footprints	Units	Usage	Energy		GHG		NOx		SOx		PM		HAPs	
			Conv. Factor	**MMBtus**	**Conv. Factor**	**lbs CO2e**	**Conv. Factor**	**lbs**	**Conv. Factor**	**lbs**	**Conv. Factor**	**lbs**	**Conv. Factor**	**lbs**
Electricity Generation														
Grid electricity	MWh	8.7635	6.929	60.722292	352	3084.752	1.504	13.180304	1.46966	12.879365	0.07546	0.6612937	0.0454035	0.3978936
Voluntary purchase of renewable electricity	MWh	0												
Voluntary purchase of RECs	MWh	0												
Notes:														

SSDS - Transportation Footprint (Scope 3a)

Category	Units	Usage	Energy		Greenhouse Gas		NOx		SOx		PM		HAPs	
			Conv. Factor	**MMBtus**	**Conv. Factor**	**lbs CO2e**	**Conv. Factor**	**lbs**	**Conv. Factor**	**lbs**	**Conv. Factor**	**lbs**	**Conv. Factor**	**lbs**
Conventional Energy														
Transportation diesel use	gal	20.501	0.139	2.849639	22.5	461.2725	0.17	3.48517	0.0054	0.1107054	0.0034	0.0697034	0.0000052	0.0001066
Transportation diesel use - car	gal	0	0.139	0	22.57	0	0.015	0	0.0002	0	0.003	0	0.00252	0
Transportation diesel use - passenger truck	gal	0	0.139	0	22.545	0	0.0585	0	0.0002	0	0.007	0	0.002605	0
Transportation diesel use - User Defined	gal	0	0.139	0	22.5	0	0.17	0	0.0054	0	0.0034	0	0.0000052	0
Transportation gasoline use	gal	0	0.124	0	19.6	0	0.11	0	0.0045	0	0.00054	0	0.000039	0
Transportation gasoline use - car	gal	0.8	0.124	0.0992	19.77	15.816	0.027	0.0216	0.00036	0.000288	0.003	0.0024	0.0067	0.00536
Transportation gasoline use - passenger truck	gal	0	0.124	0	19.79	0	0.035	0	0.00036	0	0.003	0	0.00661	0
Transportation gasoline use - User Defined	gal	0	0.124	0	19.6	0	0.11	0	0.0045	0	0.00054	0	0.000039	0
Transportation natural gas use	ccf	0	0.103	0	13.1	0	0.01	0	0.0000063	0	0.00076	0	0.0000084	0
Transportation natural gas use - User Defined	ccf	0	0.103	0	13.1	0	0.01	0	0.0000063	0	0.00076	0	0.0000084	0
User-defined conventional energy transportation #1	TBD	10	0	0	0	0	0	0	0	0	0	0	0	0
User-defined conventional energy transportation #2	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0
Conventional Energy Subtotals				**3**		**477**		**4**		**0**		**0**		**0**
Notes:														
Renewable Energy														
Transportation biodiesel use	gal	0	0.127	0	22.3	0	0.2	0	0	0	0.00099	0	NP	
Transportation biodiesel use - User Defined	gal	0	0.127	0	22.3	0	0.2	0	0	0	0.00099	0	NP	
User-defined renewable energy transportation #1	TBD	0	Biodiesel		0	0	0	0	0	0	0	0	Ref.	
User-defined renewable energy transportation #2	TBD	0	npg or pmp		0	0	0	0	0	0	0	0	0	0
Renewable Energy Subtotals				**0**		**0**		**0**		**0**		**0**		**0**
Notes:														
Transportation Totals				**3**		**477**		**4**		**0**		**0**		**0**

SSDS - Off-Site Footprint (Scope 3b)

			Energy		**Greenhouse Gas**		**NOx**		**SOx**		**PM**		**HAPs**	
Category	**Units**	**Usage**	**Conv. Factor**	**MMBtus**	**Conv. Factor**	**lbs CO2e**	**Conv. Factor**	**lbs**	**Conv. Factor**	**lbs**	**Conv. Factor**	**lbs**	**Conv. Factor**	**lbs**
Construction Materials														
Aluminum, Rolled Sheet	lb	0	0.0633	0	9.15	0	0.0148	0	0.0283	0	0.0088	0	0.00102	0
Asphalt, mastic	lb	0	0.0412	0	0.85	0	0.00271	0	0.00798	0	0.000766	0	0.00107	0
Asphalt, paving-grade	lb	0	0.5	0	8.58	0	0.0299	0	0.0969	0	0.0091	0	0.0133	0
Ethanol, Corn, 95%	lb	0	0.0318	0	-0.0199	0	0.00425	0	0.00303	0	0.000469	0	0.0000846	0
Ethanol, Corn, 99.7%	lb	0	0.0324	0	0.0591	0	0.00431	0	0.0031	0	0.000472	0	0.000087	0
Ethanol, Petroleum, 99.7%	lb	0	0.0205	0	1.25	0	0.00199	0	0.00214	0	0.000277	0	0.0000589	0
Gravel/Sand Mix, 65% Gravel	lb	0	0.0000248	0	0.0024	0	0.000018	0	4.52E-06	0	2.61E-06	0	3.08E-07	0
Gravel/sand/clay	lb	0	0.000028	0	0.00335	0	0.0000165	0	0.000015	0	0.000002	0	2.05E-10	0
HDPE	lb	0	0.0332	0	1.94	0	0.00325	0	0.00409	0	0.000439	0	0.0000641	0
Photovoltaic system (installed)	W	0	0.0336	0	4.47	0	0.015	0	0.032	0	0.00063	0	0.0000029	0
PVC	lb	1000	0.0262	26.2	2.02	2020	0.004	4	0.00274	2.74	0.000372	0.372	0.000375	0.375
Portland cement, US average	lb	0	0.0139	0	1.34	0	0.00654	0	0.0104	0	0.00378	0	0.00097	0
Ready-mixed concrete, 20 MPa	ft3	0	0.217	0	19.5	0	0.0975	0	0.154	0	0.057	0	0.0141	0
Round Gravel	lb	574000	0.0000248	14.2352	0.0024	1377.6	0.000018	10.332	4.52E-06	2.59448	2.61E-06	1.49814	3.08E-07	0.176792
Sand	lb	0	0.0000248	0	0.0024	0	0.000018	0	4.52E-06	0	2.61E-06	0	3.08E-07	0
Stainless Steel	lb	0	0.0116	0	3.4	0	0.0075	0	0.012	0	0.0044	0	0.000144	0
Steel	lb	0	0.0044	0	1.1	0	0.0014	0	0.0017	0	0.00056	0	0.000067	0
Other refined construction materials	lb	1130	0.01885	21.3005	2.115	2389.95	0.0040375	4.562375	0.0051325	5.799725	0.0014428	1.6303075	0.0001625	0.1836533
Other unrefined construction materials	lb	0	0.000028	0	0.00335	0	0.0000165	0	0.000015	0	0.000002	0	2.05E-10	0
Notes:														

SSDS - Off-Site Footprint (Scope 3b)

			Energy		**Greenhouse Gas**		**NOx**		**SOx**		**PM**		**HAPs**	
Category	**Units**	**Usage**	**Conv. Factor**	**MMBtus**	**Conv. Factor**	**lbs CO2e**	**Conv. Factor**	**lbs**	**Conv. Factor**	**lbs**	**Conv. Factor**	**lbs**	**Conv. Factor**	**lbs**
Treatment Materials & Chemicals														
Cheese Whey	lbs	0	0.0025	0	0.031	0	0.000062	0	0.000033	0	0.000002	0	NP	
Emulsified vegetable oil	lbs	0	0.0077	0	3.44	0	0.0066	0	0.0019	0	0.000033	0	NP	
Granular activated carbon, primary	lbs	0	0.0356	0	4.82	0	0.0793	0	0.128	0	0.000987	0	0.000657	0
Granular activated carbon, regenerated	lbs	0	0.00873	0	1.7	0	0.00733	0	0.0129	0	0.000886	0	0.000671	0
Hydrogen Peroxide, 50% in H2O	lbs	0	0.00979	0	1.19	0	0.00142	0	0.0024	0	0.000308	0	0.0000629	0
Iron (II) Sulfate	lbs	0	0.00147	0	0.167	0	0.000316	0	0.000589	0	0.000103	0	0.000023	0
Lime, Hydrated, Packed	lbs	0	0.00206	0	0.762	0	0.000513	0	0.000358	0	0.00013	0	6.57E-06	0
Molasses	lbs	0	0.0044	0	0.48	0	0.0011	0	0.00024	0	0.0000041	0	NP	
Phosphoric Acid, 70% in H2O	lbs	0	0.0067	0	0.882	0	0.00282	0	0.0294	0	0.00171	0	0.000163	0
Potassium Permanganate	lbs	0	0.00981	0	1.16	0	0.00234	0	0.0032	0	0.000422	0	0.000122	0
Sodium Hydroxide, 50% in H2O	lbs	0	0.00977	0	1.09	0	0.00194	0	0.00352	0	0.000403	0	0.000129	0
Other Treatment Chemicals & Materials	lbs	0	0.015	0	1.67	0	0.003	0	0.0065	0	0.00061	0	0.000016	0
Notes:														
Fuel Processing														
Biodiesel produced	gal	0	0.029	0	-16.8	0	0.018	0	0.033	0	0.00082	0	NP	
Diesel produced	gal	20.501	0.017	0.348517	3.02	61.91302	0.0051	0.1045551	0.0062	0.1271062	0.0017	0.0348517	0.0011	0.0225511
Gasoline produced	gal	0.8	0.033	0.0264	2.8	2.24	0.0046	0.00368	0.005	0.004	0.0015	0.0012	0.001	0.0008
Liquefied Petroleum Gas Produced	gal	0	0.088	0	1.47	0	0.0016	0	0.0024	0	0.0007	0	0.0003	0
Natural Gas - Compressed Produced	ccf	0	19.983	0	343.92	0	0.4732	0	2.1651	0	0.1846	0	0.2895	0
Natural Gas Produced	ccf	0	0.0052	0	2.2	0	0.0037	0	0.0046	0	0.000072	0	0.0000061	0
Fuel Processing Subtotals				**0.374917**		**64.15302**		**0.1082351**		**0.1311062**		**0.0360517**		**0.0233511**
Notes:														
Public water	gal x 1000	0	0.0092	0	5	0	0.0097	0	0.0059	0	0.016	0	0.000015	0
User-defined water resource #1	gal x 1000	0	0	0	0	0	0	0	0	0	0	0	0	0
User-defined water resource #2	gal x 1000	0	0	0	0	0	0	0	0	0	0	0	0	0
Notes:														

SSDS - Off-Site Footprint (Scope 3b)

			Energy		**Greenhouse Gas**		**NOx**		**SOx**		**PM**		**HAPs**	
			Conv.		**Conv.**		**Conv.**		**Conv.**		**Conv.**		**Conv.**	
Category	**Units**	**Usage**	**Factor**	**MMBtus**	**Factor**	**lbs CO2e**	**Factor**	**lbs**	**Factor**	**lbs**	**Factor**	**lbs**	**Factor**	**lbs**
Off-Site Services														
Hazardous waste incineration	lb	0	0.00609	0	2.43	0	0.0016	0	0.00167	0	0.000209	0	0.000087	0
Off-site waste water treatment (POTW)	gal x 1000	0	0.015	0	4.4	0	0.016	0	0.015	0	NP		NP	
Off-site non-hazardous waste landfill	ton	0	0.16	0	25	0	0.14	0	0.075	0	0.4	0	0.0014	0
Off-site hazardous waste landfill	ton	0	0.18	0	27.5	0	0.154	0	0.0825	0	0.44	0	0.00154	0
Off-site Laboratory Analysis - Other	sample	0	0.058071	0	6.8534384	0	0.131402	0	0.3038758	0	0.0455698	0	0.0330165	0
Off-site Laboratory Analysis - Metals	sample	0	0.212	0	27.4693	0	0.6423	0	1.5072	0	0.2264	0	0.1643	0
Off-site Laboratory Analysis - Mercury	sample	0	0.0731715	0	9.325458	0	0.2127439	0	0.4982396	0	0.0747359	0	0.0542332	0
Off-site Laboratory Analysis - Inorganic Anions	sample	0	0.0074025	0	0.6459478	0	0.0067681	0	0.0147929	0	0.0022024	0	0.0015542	0
Off-site Laboratory Analysis - Alkalinity	sample	0	0.0174398	0	1.3381922	0	0.0070106	0	0.0132496	0	0.00194	0	0.0012831	0
Off-site Laboratory Analysis - Perchlorate	sample	0	0.023885	0	1.8717054	0	0.0079807	0	0.0141535	0	0.0020547	0	0.0012875	0
Off-site Laboratory Analysis - Nitrogen/Nitrate	sample	0	0.0336475	0	4.29897	0	0.0954592	0	0.2226646	0	0.0335099	0	0.0242506	0
Off-site Laboratory Analysis - Sulfate	sample	0	0.0141225	0	1.4726728	0	0.0079807	0	0.0136024	0	0.0019797	0	0.0012015	0
Off-site Laboratory Analysis - PCBs	sample	0	0.0512769	0	5.224902	0	0.0833339	0	0.1904774	0	0.0284393	0	0.0212083	0
Off-site Laboratory Analysis - VOCs	sample	10	0.0762045	0.7620449	9.016814	90.16814	0.104498	1.0449804	0.2270738	2.270738	0.0339508	0.3395084	0.0235892	0.2358922
Off-site Laboratory Analysis - SVOCs	sample	0	0.0715602	0	7.870422	0	0.1459445	0	0.3373038	0	0.0504853	0	0.0372577	0
Notes:														
Resource Extraction for Electricity														
Coal extraction and processing	MWh	0.52581	3.1	1.6057186	180.0	94.6458	0.8	0.4048737	0.2	0.0788715	0.0	0.0094646	NP	
Natural gas extraction and processing	MWh	0.87635	1.6	1.4300279	270.0	236.6145	0.2	0.157743	13.0	11.39255	0.0	0.0062221	NP	
Nuclear fuel extraction and processing	MWh	0.17527	0.2	0.0272496	25.0	4.38175	0.2	0.0262905	0.5	0.087635	0.0	0.0002629	NP	
Oil extraction and processing	MWh	0.438175	2.3	1.0057869	270.0	118.30725	1.7	0.7448975	0.1	0.0302341	0.0	0.0184034	NP	
Other fuel extraction and processing	MWh	0	0	0	0	0	0	0	0	0	0	0	0	0
Resource Extraction Subtotals				**4.068783**		**453.9493**		**1.3338047**		**11.589291**		**0.0343529**		**0**
Notes:														
Electricity Transmission														
Transmission and distribution losses	MWh	8.7635	1.0342	9.0632117	35.2	308.4752	0.1504	1.3180304	0.146966	1.2879365	0.007546	0.0661294	0.0045403	0.0397894
Notes:														

SSDS - Off-Site Footprint (Scope 3b)

			Energy		Greenhouse Gas		NOx		SOx		PM		HAPs	
Category	**Units**	**Usage**	**Conv. Factor**	**MMBtus**	**Conv. Factor**	**lbs CO2e**	**Conv. Factor**	**lbs**	**Conv. Factor**	**lbs**	**Conv. Factor**	**lbs**	**Conv. Factor**	**lbs**
User-defined Materials														
User-defined material #1	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0
User-defined material #2	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0
User-defined material #3	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0
User-defined material #4	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0
User-defined material #5	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0
User-defined material #6	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0
User-defined material #7	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0
User-defined material #8	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0
User-defined material #9	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0
User-defined material #10	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0
User-defined material #11	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0
User-defined material #12	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0
User-defined material #13	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0
User-defined material #14	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0
User-defined material #15	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0
User-defined material #16	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0
User-defined material #17	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0
User-defined material #18	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0
User-defined material #19	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Notes:														
User-defined Waste Destinations														
User-defined recycled/reused off-site #1	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0
User-defined recycled/reused off-site #2	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0
User-defined recycled/reused off-site #3	TBD	0	y(MMBtu/u		(lbs CO2e/u		Ox(lbs/unit)		Ox(lbs/unit)		M(lbs/unit)		APs(lbs/unit	
User-defined non-hazardous waste destination #1	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0
User-defined non-hazardous waste destination #2	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0
User-defined non-hazardous waste destination #3	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0
User-defined hazardous waste destination #1	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0
User-defined hazardous waste destination #2	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0
User-defined hazardous waste destination #3	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0
Notes:														
Off-site Totals				**76.004657**		**6704.2957**		**22.699426**		**26.413276**		**3.9764899**		**1.0344779**

SSDS - Intermediate Totals

			Energy		Greenhouse Gas		NOx		SOx		PM		HAPs	
			Conv.		**Conv.**		**Conv.**		**Conv.**		**Conv.**		**Conv.**	
Category	**Units**	**Usage**	**Factor**	**MMBtus**	**Factor**	**lbs CO2e**	**Factor**	**lbs**	**Factor**	**lbs**	**Factor**	**lbs**	**Factor**	**lbs**
Total Grid Electricity Footprint														
On-site grid electricity	MWh	8.7635	3.413	29.909826										
Electricity Generation														
Grid electricity	MWh	8.7635	6.929	60.722292	1124.3	9852.8031	2.2421	19.648643	4.6078874	40.381221	0.057518	0.504059	0.2102371	1.8424127
Resource Extraction for Electricity														
Coal extraction and processing	MWh	0.52581	3.1	1.6057186	180.0	94.6458	0.8	0.4048737	0.2	0.0788715	0.0	0.0094646	NP	
Natural gas extraction and processing	MWh	0.87635	1.6	1.4300279	270.0	236.6145	0.2	0.157743	13.0	11.39255	0.0	0.0062221	NP	
Nuclear fuel extraction and processing	MWh	0.17527	0.2	0.0272496	25.0	4.38175	0.2	0.0262905	0.5	0.087635	0.0	0.0002629	NP	
Oil extraction and processing	MWh	0.438175	2.3	1.0057869	270.0	118.30725	1.7	0.7448975	0.1	0.0302341	0.0	0.0184034	NP	
Other fuel extraction and processing	MWh	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0
Electricity Transmission														
Transmission and distribution losses	MWh	8.7635	1.0342	9.0632117	112.43	985.28031	0.22421	1.9648643	0.4607887	4.0381221	0.0057518	0.0504059	0.0210237	0.1842413
Total Grid Electricity Footprint				**104**		**11292**		**23**		**56**		**1**		**2**
Total Fuel Footprints														
Total Gasoline Footprint														
On-site gasoline use - Other	gal	0	0.124	0	19.6	0	0.11	0	0.0045	0	0.00054	0	0.000039	0
On-site gasoline use <25 hp	gal	0	0.124	0	17.48	0	0.037	0	0.00025	0	0.165	0	0.00008	0
On-site gasoline use >25 hp	gal	0	0.124	0	19.93	0	0.032	0	0.00029	0	0.002	0	0.00009	0
Transportation gasoline use	gal	0	0.124	0	19.6	0	0.11	0	0.0045	0	0.00054	0	0.000039	0
Transportation gasoline use - car	gal	0.8	0.124	0.0992	19.77	15.816	0.027	0.0216	0.00036	0.000288	0.003	0.0024	0.0067	0.00536
Transportation gasoline use - passenger truck	gal	0	0.124	0	19.79	0	0.035	0	0.00036	0	0.003	0	0.00661	0
Transportation gasoline use - User Defined	gal	0	0.124	0	19.6	0	0.11	0	0.0045	0	0.00054	0	0.000039	0
Gasoline produced	gal	0.8	0.033	0.0264	2.8	2.24	0.0046	0.00368	0.005	0.004	0.0015	0.0012	0.001	0.0008
Total Gasoline Footprint		**0.8**		**0.1256**		**18.056**		**0.02528**		**0.004288**		**0.0036**		**0.00616**
Total Diesel Footprint														
On-site diesel use - Other	gal	0	0.139	0	22.5	0	0.17	0	0.0054	0	0.0034	0	0.0000052	0
On-site diesel use <75 hp	gal	0	0.139	0	22.21	0	0.1565	0	0.000145	0	0.0145	0	0.00004	0
On-site diesel use 75<hp<750	gal	0	0.139	0	22.24	0	0.101	0	0.00013	0	0.009	0	0.00004	0
On-site diesel use >750 hp	gal	0	0.139	0	22.24	0	0.149	0	0.00013	0	0.006	0	0.00004	0
Transportation diesel use	gal	20.501	0.139	2.849639	22.5	461.2725	0.17	3.48517	0.0054	0.1107054	0.0034	0.0697034	0.0000052	0.0001066
Transportation diesel use - car	gal	0	0.139	0	22.57	0	0.015	0	0.0002	0	0.003	0	0.00252	0
Transportation diesel use - passenger truck	gal	0	0.139	0	22.545	0	0.0585	0	0.0002	0	0.007	0	0.002605	0
Transportation diesel use - User Defined	gal	0	0.139	0	22.5	0	0.17	0	0.0054	0	0.0034	0	0.0000052	0
Diesel produced	gal	20.501	0.017	0.348517	3.02	61.91302	0.0051	0.1045551	0.0062	0.1271062	0.0017	0.0348517	0.0011	0.0225511
Total Diesel Footprint		**20.501**		**3.198156**		**523.18552**		**3.5897251**		**0.2378116**		**0.1045551**		**0.0226577**
Total Biodiesel Footprint														
On-site biodiesel use	gal	0	0.127	0	22.3	0	0.2	0	0	0	0.00099	0	NP	
On-site biodiesel use - User Defined	gal	0	0.127	0	22.3	0	0.2	0	0	0	0.00099	0	NP	
Transportation biodiesel use	gal	0	0.127	0	22.3	0	0.2	0	0	0	0.00099	0	NP	
Transportation biodiesel use - User Defined	gal	0	0.127	0	22.3	0	0.2	0	0	0	0.00099	0	NP	
Biodiesel produced	gal	0	0.029	0	-16.8	0	0.018	0	0.033	0	0.00082	0	NP	
Total Biodiesel Footprint		**0**		**0**		**0**		**0**		**0**		**0**		**0**
Total Natural Gas Footprint														
On-site natural gas use	ccf	0	0.103	0	13.1	0	0.01	0	0.0000063	0	0.00076	0	0.0000084	0
Transportation natural gas use	ccf	0	0.103	0	13.1	0	0.01	0	0.0000063	0	0.00076	0	0.0000084	0
Transportation natural gas use - User Defined	ccf	0	0.103	0	13.1	0	0.01	0	0.0000063	0	0.00076	0	0.0000084	0
Natural gas produced	ccf	0	0.0052	0	2.2	0	0.0037	0	0.0046	0	0.000072	0	0.0000061	0
Total Natural Gas Footprint		**0**		**0**		**0**		**0**		**0**		**0**		**0**
Total Liquified Petroleum Gas Footprint														
On-site liquified petroleum gas use - Other	ccf	0	NP		12.69	0	0.021	0	0.00013	0	0.001	0	0	0
On-site liquified petroleum gas use	ccf	0	NP		12.69	0	0.021	0	0.00013	0	0.001	0	0	0
Liquified petroleum gas produced	ccf	0	0.088	0	1.47	0	0.0016	0	0.0024	0	0.0007	0	0.0003	0
Total Natural Gas Footprint		**0**		**0**		**0**		**0**		**0**		**0**		**0**
Total Compressed Gas Footprint														
On-site compressed gas use - Other	ccf	0	NP		1957.835	0	16.0325	0	0.023045	0	0.2775	0	0	0
On-site compressed gas use	ccf	0	NP		1957.835	0	16.0325	0	0.023045	0	0.2775	0	0	0
Compressed gas produced	ccf	0	19.983	0	343.92	0	0.4732	0	2.1651	0	0.1846	0	0.2895	0
Total Natural Gas Footprint		**0**		**0**		**0**		**0**		**0**		**0**		**0**
Notes:														

Note: Please refer to the "Default Conversions" tab for references for the default conversion factors used on this calculation sheet.

Space below available for notes and calculations:

Appendix G

NYSDEC Request to Import/Reuse Fill or Soil Form

NEW YORK STATE
DEPARTMENT OF ENVIRONMENTAL CONSERVATION

Request to Import/Reuse Fill or Soil

This form is based on the information required by DER-10, Section 5.4(e). Use of this form is not a substitute for reading the applicable Technical Guidance document.

SECTION 1 – SITE BACKGROUND

The allowable site use is: Choose an item

Have Ecological Resources been identified? Choose an item

Is this soil originating from the site? Choose an item

How many cubic yards of soil will be imported/reused? Choose an item

If greater than 1000 cubic yards will be imported, enter volume to be imported:

SECTION 2 – MATERIAL OTHER THAN SOIL

Is the material to be imported gravel, rock or stone? Choose an item

Does it contain less than 10%, by weight, material that would pass a size 10 sieve? Choose an item

Does it contain less than 10%, by weight, material that would pass a size 100 sieve? Choose an item

Is this virgin material from a permitted mine or quarry? Choose an item

Is this material recycled concrete or brick from a DEC registered processing facility? Choose an item

SECTION 3 - SAMPLING

Provide a brief description of the number and type of samples collected in the space below:

Example Text: 5 discrete samples were collected and analyzed for VOCs. 2 composite samples were collected and analyzed for SVOCs, Inorganics & PCBs/Pesticides.

If the material meets requirements of DER-10 section 5.4(e)5 (other material), no chemical testing needed.

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SECTION 3 CONT'D - SAMPLING

Provide a brief written summary of the sampling results or attach evaluation tables (compare to DER-10, Appendix 5):

Example Text: Arsenic was detected up to 17 ppm in 1 (of 5) samples; the allowable level is 16 ppm.

If Ecological Resources have been identified use the "If Ecological Resources are Present" column in Appendix 5.

SECTION 4 – SOURCE OF FILL

Name of person providing fill and relationship to the source:

Location where fill was obtained:

Identification of any state or local approvals as a fill source:

If no approvals are available, provide a brief history of the use of the property that is the fill source:

Provide a list of supporting documentation included with this request:

The information provided on this form is accurate and complete.

__________________________________ ________________

Signature Date

____

Print Name

____

Firm

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