M4778 BROADWAY LLC

NEW YORK, NEW YORK 10034

SITE MANAGEMENT PLAN

NYSDEC BCP NUMBER: C231131

Prepared for:

M4778 Broadway LLC,
C/O GDI Construction LLC
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Prepared by:

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Revisions to Final Approved Site Management Plan:

Revision No.	Date Submitted	Summary of Revision	NYSDEC Approval Date

JUNE 2025

CERTIFICATION STATEMENT

I PHILIP G. CLARK P.E. certify that I am currently a NYS registered professional engineer and that this Site Management 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) and Green Remediation (DER-31).

Philip G. Clark P.E.

6/3/2025 DATE

PHILIP GERALD CLARK
16 088422

I VICTORIA WHELAN P.G. certify that I am currently a Qualified Environmental Professional and that this Site Management 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) and Green Remediation (DER-31).

QEP

6/3/2025 DATE

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List of Acronyms

AS	Air Sparging
ASP	Analytical Services Protocol
BCA	Brownfield Cleanup Agreement
BCP	Brownfield Cleanup Program
CERCLA	Comprehensive Environmental Response, Compensation and Liability Act
CAMP	Community Air Monitoring Plan
C/D	Construction and Demolition
CFR	Code of Federal Regulation
CLP	Contract Laboratory Program
COC	Certificate of Completion
CO2	Carbon Dioxide
CP	Commissioner Policy
DER	Division of Environmental Remediation
DUSR	Data Usability Summary Report
EC	Engineering Control
ECL	Environmental Conservation Law
ELAP	Environmental Laboratory Approval Program
ERP	Environmental Restoration Program
EWP	Excavation Work Plan
GHG	Greenhouse Gas
GWE&T	Groundwater Extraction and Treatment
HASP	Health and Safety Plan
IC	Institutional Control
NYSDEC	New York State Department of Environmental Conservation
NYSDOH	New York State Department of Health
NYCRR	New York Codes, Rules and Regulations
O&M	Operation and Maintenance
OM&M	Operation, Maintenance and Monitoring
OSHA	Occupational Safety and Health Administration
OU	Operable Unit
P.E. or PE	Professional Engineer
PFAS	Per- and Polyfluoroalkyl Substances
PID	Photoionization Detector
PRP	Potentially Responsible Party
PRR	Periodic Review Report
QA/QC	Quality Assurance/Quality Control
QAPP	Quality Assurance Project Plan
QEP	Qualified Environmental Professional
RAO	Remedial Action Objective
RAWP	Remedial Action Work Plan
RCRA	Resource Conservation and Recovery Act
RI/FS	Remedial Investigation/Feasibility Study
ROD	Record of Decision
RP	Remedial Party

RSO	Remedial System Optimization
SAC	State Assistance Contract
SCG	Standards, Criteria and Guidelines
SCO	Soil Cleanup Objective
SMP	Site Management Plan
SOP	Standard Operating Procedures
SOW	Statement of Work
SPDES	State Pollutant Discharge Elimination System
SSD	Sub-slab Depressurization
SVE	Soil Vapor Extraction
SVI	Soil Vapor Intrusion
TAL	Target Analyte List
TCL	Target Compound List
TCLP	Toxicity Characteristic Leachate Procedure
USEPA	United States Environmental Protection Agency
UST	Underground Storage Tank
VCA	Voluntary Cleanup Agreement
VCP	Voluntary Cleanup Program

ES EXECUTIVE SUMMARY

The following provides a brief summary of the controls implemented for the Site, as well as the inspections, monitoring, maintenance and reporting activities required by this Site Management Plan:

Site Identification:	BCP#C231131, 4778 Broadway New York, NY
Institutional Controls:	1. The property may be used for restricted residential, commercial, and industrial purposes.
	2. All ECs must be operated and maintained as specified in the SMP
	3. All ECs must be inspected at a frequency and in a manner defined in the SMP.
	4. The use of groundwater underlying the property is prohibited without necessary water quality treatment determined by the NYSDOH and the use user must notify and obtain written approval to do so from the NYSDEC.
	5. Groundwater and other environmental or public health monitoring must be performed as defined in the SMP.
	6. Data and information pertinent to the Site Management of the Controlled Property must be reported at the frequency and manner defined in the SMP.
	7. All future activities on the property that will disturb remaining contaminated material must be conducted in accordance with the SMP.

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	8. Monitoring to assess the performance and effectiveness of the remedy must be performed as defined in the SMP.
	9. Operation, maintenance, monitoring, inspection, and reporting of any mechanical or physical components of the remedy shall be performed as defined in the SMP.
	10. Access to the site must be provided to agents, employees, or other representatives of the State of New York with reasonable prior notice to the property owner to assure compliance with the restrictions identified in the Environmental Easement.
	11. Recording of an Environmental Easement, including Institutional Controls, to prevent future exposure to any residual contamination remaining at the Site
Engineering Controls:	1. In-situ chemical injections/Monitoring Wells
	2. Sub Slab Depressurization System

Inspections:	Frequency
1. SSDS Inspection	Annually
Monitoring:	
1. Groundwater Monitoring Wells MW-1 through MW-6	Quarterly for two years with the frequency thereafter to be determined in consultation with the NYSDEC
2. Post Mitigation Indoor Air Sampling	Minimum one time

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Maintenance:	
1. SSDS Blower maintenance	As needed
Reporting:	
1. Groundwater Monitoring reports	Quarterly for two years; frequency thereafter to be determined with NYSDEC
2. Periodic Review Report	16 months after issuance of COC, annually thereafter

Further descriptions of the above requirements are provided in detail in the latter sections of this Site Management Plan

1.0 INTRODUCTION

1.1 General

This Site Management Plan (SMP) is a required element of the remedial program for the 4778 Broadway Site located in New York, New York (hereinafter referred to as the “Site”). See Figure 1. The Site is currently in the New York State (NYS) Brownfield Cleanup Program (BCP), Site No. C231131, which is administered by New York State Department of Environmental Conservation (NYSDEC).

M4778 Broadway LLC entered into a Brownfield Cleanup Agreement (BCA), in September 2019 with the NYSDEC to remediate the site. The site location and a site map showing the Site boundaries are provided in Figures 1 and 2. A Site Survey, which was included in the Environmental Easement Package submitted to NYSDEC on June 30, 2023, and subsequently approved and recorded in the City Register of New York as File No. CRFN2024000130778, is included in Appendix A. The survey shows the boundaries of the site and fully describes the metes and bounds site description.

After completion of the remedial work, contamination was left at this site, which is hereafter referred to as “remaining contamination.” Institutional and Engineering Controls (ICs and ECs) have been incorporated into the site remedy to control exposure to remaining contamination to ensure protection of public health and the environment. An Environmental Easement granted to the NYSDEC and recorded with the New York City Office of the City Register, requires compliance with this SMP and all ECs and ICs placed on the site.

This SMP was prepared to manage remaining contamination at the site until the Environmental Easement is extinguished in accordance with ECL Article 71, Title 36. This plan has been approved by the NYSDEC, and compliance with this plan is required by the grantor of the Environmental Easement and the grantor’s successors and assigns. This SMP may only be revised with the approval of the NYSDEC.

It is important to note that:

- This SMP details the site-specific implementation procedures that are required by the Environmental Easement. Failure to properly implement the SMP is a violation of the

Environmental Easement, which is grounds for revocation of the Certificate of Completion (COC); and

- Failure to comply with this SMP is also a violation of Environmental Conservation Law, 6 NYCRR Part 375 and the BCA (Site #C231131) for the site, and thereby subject to applicable penalties.

All reports associated with the site can be viewed by contacting the NYSDEC or its successor agency managing environmental issues in New York State. A list of contacts for persons involved with the site is provided in Appendix B of this SMP.

This SMP was prepared by HCS Civil & Environmental Engineering LLC and GZA on behalf of M4778 Broadway LLC in accordance with the requirements of the NYSDEC's DER-10 ("Technical Guidance for Site Investigation and Remediation"), dated May 2010 and the guidelines provided by the NYSDEC. This SMP addresses the means for implementing the ICs and/or ECs that are required by the Environmental Easement for the site.

1.2 Revisions and Alterations

Revisions and alterations to this plan will be proposed in writing to the NYSDEC's project manager. The NYSDEC can also make changes to the SMP or request revisions from the remedial party. Revisions will be necessary upon, but not limited to, the following occurring: a change in media monitoring requirements, upgrades to or shutdown of a remedial system, post-remedial removal of contaminated sediment or soil, or other significant change to the site conditions. All approved alterations must conform with Article 145 Section 7209 of the Education Law regarding the application of professional seals and alterations. For example, any changes to as-built drawings must be stamped by a New York State Professional Engineer. In accordance with the Environmental Easement for the site, the NYSDEC project manager will provide a notice of any approved changes to the SMP and append these notices to the SMP that is retained in its files.

1.3 Notifications

Notifications will be submitted by the property owner to the NYSDEC, as needed, in accordance with NYSDEC's DER – 10 for the following reasons:

1. 60-day advance notice of any proposed changes in site use that are required under the terms of the BCA, 6 NYCRR Part 375 and/or Environmental Conservation Law.

2. 7-day advance notice of any field activity associated with the remedial program.
3. 15-day advance notice of any proposed ground-intrusive activity pursuant to the Excavation Work Plan. If the ground-intrusive activity qualifies as a change of use as defined in 6 NYCRR Part 375, the above mentioned 60-day advance notice is also required.
4. Notice within 48 hours of any damage or defect to the foundation, structures or EC that reduces or has the potential to reduce the effectiveness of an EC, and likewise, any action to be taken to mitigate the damage or defect.
5. Notice within 48 hours of any non-routine maintenance activities.
6. Verbal notice by noon of the following day of any emergency, such as a fire; flood; or earthquake that reduces or has the potential to reduce the effectiveness of ECs in place at the site, with written confirmation within 7 days that includes a summary of actions taken, or to be taken, and the potential impact to the environment and the public.
7. Follow-up status reports on actions taken to respond to any emergency event requiring ongoing responsive action submitted to the NYSDEC within 45 days describing and documenting actions taken to restore the effectiveness of the ECs.

Any change in the ownership of the site or the responsibility for implementing this SMP will include the following notifications:

8. At least 60 days prior to the change, the NYSDEC will be notified in writing of the proposed change. This will include a certification that the prospective purchaser/Remedial Party has been provided with a copy of the BCA and all approved work plans and reports, including this SMP.
9. Within 15 days after the transfer of all or part of the site, the new owner's name, contact representative, and contact information will be confirmed in writing to the NYSDEC.

Table 1 on the following page includes contact information for the above notifications. The information on this table will be updated as necessary to provide accurate contact information. A full listing of site-related contact information is provided in Appendix B.

Table 1: Notifications*

Name	**Contact Information**	**Required Notification****
Steven Wu	718-482-6725, steven.wu@dec.ny.gov	All Notifications
Andre A. Obligado	718-482-6412, andre.obligado@dec.ny.gov	All Notifications
Alexandra M. Servis-Oettinger	518-402-9767, Alexandra.Servis@dec.ny.gov	Notifications 1 and 8
Shaun Surani	(518) 402-1338 BEEI@health.ny.gov	Notifications 4, 6, and 7

* Note: Notifications are subject to change and will be updated as necessary.

** Note: Numbers in this column reference the numbered bullets in the notification list in this section.

2.0 SUMMARY OF PREVIOUS INVESTIGATIONS AND REMEDIAL ACTIONS

2.1 Site Location and Description

The Site is located in the Borough of Manhattan, County of New York, New York, and is identified as Block 2233, Lot 10 on the New York City Tax Map. A United States Geological Survey (USGS) topographical map (Figure 1) shows the Site location. The Site is situated on an approximately 0.28-acre area. A Site map showing the site boundaries is provided in Figure 2. A boundary map is attached to the BCA as required by Environmental Conservation Law (ECL) Title 14 Section 27-1419. A Site survey fully showing the site boundaries and a metes and bounds description of the Site is included in Appendix A.

The owner(s) of the site parcel(s) at the time of issuance of this SMP is:

- M4778 Broadway LLC
  Robert Morsemen
  robertm@madddequities.com
  718-501-5972

2.2 Physical Setting

2.2.1 Land Use

The Site consists of a currently active construction Site of a 14-story mixed use structure. The Site is zoned as mixed use. The Site is bounded by Broadway, followed by a New York Presbyterian Hospital outpatient medical center to the northwest, athletic fields associated with Harold O. Levy School 52 to the southeast, a newly constructed mixed use mid-rise building to the east, and Fine Fare Supermarket to the west. A Site map showing the Site and surrounding properties is provided as Figure 2.

2.2.2 Geology

The soil recovered in the borings advanced during the February 2020 RI generally consisted of grey to brown silt and reddish-brown silty sand with weathered gravel. A total of 19 soil borings were advanced at the Site between the March/April 2017 Phase II investigation and the October 2017 RI. The borings at the Site have generally been advanced to 20 feet below ground surface (bgs), where refusal was encountered due to the presence of weathered bedrock. Based on the monitoring well survey conducted at the Site, it is evident that weathered bedrock is present at approximately 4-10 feet above mean sea level (AMSL). Site specific boring logs are provided in Appendix C. A Geologic Cross Section is provided in Figure 9A-9C.

2.2.3 Hydrogeology

The Site is relatively flat at an elevation of approximately 25 feet AMSL. The pre-construction monitoring wells onsite were screened from the terminus of the borings (approximately 20 feet bgs) to ten feet bgs. The depth to groundwater was measured between 13.14 feet and 14.30 feet below the top of casing (TOC) in the five pre-construction permanent monitoring wells at the Site. Subsequently, once excavation/construction activities commenced these wells were demolished and six new permanent monitoring wells (MW-1 through MW-6) were installed through the newly constructed concrete basement slab in March of 2023, at the same general locations as the original monitoring well locations. The new wells were screened from the terminus of each boring to a depth of one foot below the remaining overburden soils/clean stone sub-base interface. Based on a survey of monitoring wells onsite and groundwater measurements in the wells, the measured groundwater gradient onsite is to the southwest, with groundwater elevations ranging from 11.72 feet AMSL in MW-3 on the northeast portion of the Site to 10.69 feet AMSL in MW-4 on the southern portion of the Site. The shallow groundwater hydrogeologic unit encountered in the unconsolidated overburden is the only groundwater unit that has been encountered at the Site and no hydrogeologic units with different flow patterns have been identified. The closest surface water body, the Hudson River, is located approximately 0.38 mile to the west of the Site. Well construction logs for the newly installed monitoring wells are presented in Appendix D. A Groundwater contour map derived from the newly installed post construction monitoring wells is included in Figure 3.

2.3 Investigation and Remedial History

The following narrative provides a remedial history timeline and a brief summary of the available project records to document key investigative and remedial milestones for the Site. Full titles for each of the reports referenced below are provided in Section 8.0 - References.

The site was occupied by an automobile laundry/car wash from approximately 1988 to 2017. Based on a review of historical sources, the site was developed with a gasoline filling and/or service station from as early as 1921 until 1988. Three gasoline tanks were labeled on Sanborn maps from 1935 and 1951 and additional tanks were installed in 1951 during the redevelopment of the site. No documentation has been identified that indicates typical tank closure activities (including proper tank closure/removal, soil and/or groundwater sampling, or summary closure reports) were performed. It appears that the prior occupancy of the site by a gasoline service station led to onsite contamination.

A Phase II Limited Subsurface investigation (PHII) was conducted at the site in March 2017. The results of this investigation indicated that a release of gasoline had impacted soil, groundwater, and soil vapor at the site. Based on this information, the NYSDEC was notified of the release on April 24, 2017, and Spill #1700751 was issued.

An initial Remedial Investigation (RI) was conducted in July/August 2017 and included the advancement of eight soil borings at the Site, which were subsequently converted to temporary well points, for the collection and analysis of soil and groundwater samples. Based on the soil and groundwater results, three permanent groundwater wells were installed and sampled.

The soil samples showed impacts of petroleum related volatile organic compounds (VOCs) in two of the borings at concentrations exceeding the NYSDEC residential restricted use soil cleanup objectives (RUSCOs) but below the NYSDEC restricted commercial use soil cleanup objectives (RCUSCOs). No VOCs were detected above their respective NYSDEC RUSCOs at the remaining boring locations. The temporary well point groundwater samples showed impacts of petroleum related VOCs in all eight of the temporary well points at concentrations exceeding the NYSDEC ambient water quality standards (AWQS). The highest levels of contamination were detected in borings along the northwest and western portion of the Site.

The permanent monitoring well groundwater samples showed impacts of gasoline related VOCs in all three of the monitoring wells at concentrations exceeding the NYSDEC AWQS. Measurements of groundwater levels indicated that onsite groundwater flows towards the southwest.

A second RI was subsequently conducted at the Site in February 2020. The RI was conducted in accordance with a NYSDEC approved Remedial Investigation Work Plan (RIWP), and included a geophysical survey, the advancement of seven soil borings, collection and analysis of a total of 28 soil samples from the soil borings at various depths, collection and analysis of 18 soil vapor samples, [nine shallow soil vapor (collected from 3-5 feet bgs) and nine deep soil vapor (collected from 12’ bgs, or between one and two feet above the groundwater interface)], and collection and analysis of five groundwater samples from the original monitoring wells.

The geophysical survey was conducted throughout exterior portions of the Site only. According to the geophysical survey conducted during the RI, as many as nine USTs were identified to be present onsite in the area of the former gasoline filling station.

The results of the soil sampling completed during the RI indicated the highest concentrations of VOCs on-site were all detected at the northwestern corner of the site near the former underground storage tanks, at depths of 19.5 ft to 20 ft. Benzene was found at a maximum concentration of 54 parts per million (ppm), which exceeded the applicable protection of groundwater soil cleanup objective (PGSCO) of 0.06 ppm and the restricted residential soil cleanup objective (RRSCO) of 4.8 ppm; toluene was found at a maximum concentration of 810 ppm (PGSCO is 0.7 ppm, RRSCO is 100 ppm); ethylbenzene was found at a maximum concentration of 360 ppm (PGSCO is 1 ppm, RRSCO is 41 ppm); and mixed xylenes were found at a maximum concentration of 1,700 ppm (PGSCO is 1.6 ppm, RRSCO is 100 ppm). Semi-volatile organic compounds (SVOCs) were detected in highest concentrations in the southern portion of the site in shallow soil (0-2 ft). Benzo(b)fluoranthene was detected at 2.4 ppm (RRSCO is 1.0 ppm) and indeno(1,2,3-cd)pyrene was detected at 1.2 ppm (RRSCO is 0.5 ppm). No metals, pesticides or PCBs were detected exceeding their respective RRSCOs. For emerging contaminants, the highest perfluorooctanoic acid (PFOA) concentration was 2.93 parts per billion (ppb) compared to the restricted residential guidance value (RRGV) of 33 ppb and the protection of groundwater guidance value (PGGV) of 1.1 ppb. The highest perfluorooctane sulfonic acid (PFOS) concentration was 28.6 ppb (RRGV is 44 ppb and PGGV is 3.7 ppb).

The results of the soil vapor sampling completed during the RI indicated that petroleum VOCs were detected at elevated concentrations in soil vapor. At the northwestern corner of the site benzene was detected at 371,000 micrograms per cubic meter (ug/m^3), toluene at 897,000 ug/m^3, ethylbenzene at 155,000 ug/m^3, p/m-xylene at 199,000 ug/m^3, and 2,2,4-trimethylpentane at 5,000,000 ug/m^3.

The results of the groundwater sampling completed during the RI indicated petroleum VOCs were found primarily along the western edge of the site at concentrations exceeding the AWQS, including benzene at a maximum concentration of 8,200 parts per billion (ppb) (AWQS is 1 ppb), toluene at 39,000 ppb (AWQS is 5 ppb), ethylbenzene at 5,300 ppb (AWQS is 1 ppb), and mixed xylene at 16,000 ppb (AWQS is 1ppb). The following SVOCs were detected: phenol at 380 ppb

(AWQS is 1 ppb) and naphthalene at 300 ppb (AWQS is 10 ppb). For emerging contaminants, PFOA was detected at a maximum concentration of 84.1 part per trillion compared to the NYSDEC AWQS of 6.7 ppt, and PFOS was detected at a maximum concentration of 1,530 ppt (AWQS is 2.7 ppt). Only naturally occurring metals were found at concentrations exceeding the AWQS.

2.4 Remedial Action Objectives

The Remedial Action Objectives (RAOs) for the Site, as listed in the Decision Document dated August 2021, are as follows:

Groundwater

RAOs for Public Health Protection

- Prevent ingestion of groundwater with contaminant levels exceeding drinking water standards.
- Prevent contact with, or inhalation of volatiles, from contaminated groundwater.

RAOs for Environmental Protection

- Restore ground water aquifer to pre-disposal/pre-release conditions, to the extent practicable.
- Remove the source of ground or surface water contamination.

Soil

RAOs for Public Health Protection

- Prevent ingestion/direct contact with contaminated soil.
- Prevent inhalation of or exposure from contaminants volatilizing from contaminants in soil.

RAOs for Environmental Protection

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

Soil Vapor

RAOs for Public Health Protection

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

2.5 Remaining Contamination

2.5.1 Soil

In accordance with the approved Remedial Action Work Plan (RAWP), post excavation soil sampling was conducted every 900 square feet of pit bottom and every 30 linear feet of sidewall. Soil samples were collected for target compound list (TCL) VOCs and SVOCs. It should be noted that at the time of excavation, the northeastern sidewall consisted of the foundation of the adjacent building, as such no soil samples from the northeastern sidewall exist or were able to be collected. In addition, a 10 foot wide by 90 foot long by six foot deep "bench" of soil remained for structural support of the adjacent building along the southwestern portion of the Site. Pit bottom and sidewall samples were collected from the soil "bench" area in addition to the main excavation pit bottom and sidewalls. A total of 40 sidewall and pit bottom samples were collected as part of the approved RAWP post excavation sampling plan.

The results of the post excavation soil sampling revealed elevated concentrations of 1,2,4-trimethylbenzene, ethylbenzene, and total xylenes above Restricted Residential SCOs (RRUSCOs) at sidewall samples C1-SW-W and C2-SW-E and pit bottom samples C1- PB. In addition, elevated concentrations of 1,2,4-trimethylbenzene, 1,3,5-trimethylbenzene, benzene, ethylbenzene, n-propyl benzene, naphthalene, toluene, and total xylenes were detected above the Protection of Groundwater SCOs (PGSCOs). Tables 2 and 5 and Figure 4 summarize the results of all post-excavation soil samples collected that exceed the Unrestricted Use, Restricted Residential, and Protection of Groundwater SCOs at the site after completion of remedial actions. Below is a table summarizing the Unrestricted Use SCO exceedances in the soil samples.

The impacted soils are isolated to a depth of at least 14.5 to 15.0 feet bgs within the sidewall samples, and 15.0-15.5 feet bgs within the pit bottom samples. Impacted soils are further demarcated by a 12 -18 inch thick layer of ¾ inch clean stone with a vapor barrier, and a three foot thick structural mat slab above. Additional details regarding the vapor barrier are provided in section 3.3. With the exception of the soil samples collected from shallower depths within the soil "bench" area, all post excavation and sidewall samples were collected from a depth below the encountered groundwater table. As such, these samples were saturated soil samples. Soil excavation was conducted to a depth below the soil/groundwater interface in part to remove any and all potentially impacted unsaturated soils across the Site, and to facilitate the installation and construction of the building foundation.

Table 2 – End-Point Soil Sample Exceedances

Sample ID	1,2,4-Trimethylbenzene (mg/kg)	1,3,5-Trimethylbenzene (mg/kg)	Acetone (mg/kg)	Benzene (mg/kg)	Ethylbenzene (mg/kg)	n-Propylbenzene (mg/kg)	Naphthalene (mg/kg)	Toluene (mg/kg)	Xylenes, Total (mg/kg)
NYPGW SCO	3.6	8.4	0.005	0.06	1	3.9	12	0.7	1.6
NYRRUSCO	**52**	**52**	**100**	**4.8**	**41**	**100**	**100**	**100**	**100**
C1-SW-S	13	4.9	ND	0.034	3.5	2.1	1.9	0.075	14
C2-SW-E	**63**	17	ND	ND	13	11	2.6	0.24	42
A5-PB	ND	0.00023	0.0084	ND	0.00016	ND	ND	ND	ND
B5-PB	ND	0.00047	0.014	ND	0.00026	ND	0.0031	ND	0.0033
B6-PB	ND	ND	0.007	ND	ND	ND	ND	0.0013	ND
C6-SW-S	ND	ND	0.012	ND	ND	ND	ND	0.00072	ND
C4-SW-S	4.7	1.5	ND	ND	0.98	0.07	0.46	0.24	7
C4-PB	3.6	1.2	ND	ND	1	0.056	0.36	0.33	7.2
A3-PB	3.9	1.4	ND	ND	1.5	0.082	0.52	2.1	10
B3-PB	ND	ND	0.026	ND	ND	ND	ND	ND	ND
C3-PB	ND	ND	0.0074	ND	ND	ND	ND	ND	ND
A1-PB	0.0021	0.0024	0.0061	ND	0.0011	0.00011	ND	0.0025	0.0068
A1-SW-W	0.33	0.068	0.0076	ND	0.31	0.0026	0.079	0.019	0.32
A2-PB	0.044	0.0064	0.051	ND	0.15	0.0017	0.0011	0.0028	0.12
B1-PB	2.4	0.88	ND	ND	0.89	0.84	0.72	0.036	1.6
B1-SW-W	2.1	0.66	ND	0.011	0.72	0.39	0.27	ND	3.1
B2-PB	ND	0.0021	0.046	ND	0.00027	ND	ND	ND	0.0013
C2-PB	15	6.1	ND	0.27	6	3.8	2.8	2.7	24
C1-PB	**67**	21	ND	1.6	**48**	11	9.3	61	**260**
C1-SW-W	**120**	32	ND	2.4	**68**	14	18	95	**420**

Notes:

ND = Analyte note detected above laboratory reporting limits
3.6 = Analyte was detected above the NYPGW SCOs
52 = Analyte was detected above the NY RRUSCOs

2.5.2 Groundwater

In accordance with the approved RAWP, and the subsequently NYSDEC approved In-Situ Remediation Design and Monitoring plan dated August 29, 2022, In Situ Chemical Oxidant (ISCO) injections were proposed to address onsite groundwater impacts. At the request of NYSDEC, after review of the post excavation soil sampling data described above, revisions were made to the approved injection plan to ensure saturated soils where post-excavation sampling indicated exceedances of their respective restricted residential and/or protection of groundwater SCOs would be treated via the ISCO injections. The revised injection plan was subsequently submitted to NYSDEC and approved via email correspondence on August 16, 2023. The initial ISCO injections were implemented in early October 2023. A Supplemental Remedial Action Plan was submitted to NYSDEC in October 2024 and approved for a supplemental round of ISCO injections. The supplemental injections were completed between October 28 and November 4, 2024. Current groundwater conditions at the Site are summarized below, along with the table.

Table 3 - Groundwater Sample Exceedances

Analyte	NYSDEC TOGS 1.1.1 AWQS	MW-1	MW-2	MW-3	MW-4	MW-5	MW-6
	(ug/L)	(ug/L)	(ug/L)	(ug/L)	(ug/L)	(ug/L)	(ug/L)
VOCs							
1,2,4,5-Tetramethylbenzene	5	33	ND	ND	ND	15	ND
1,2,4-Trimethylbenzene	5	1,000	200	ND	ND	360	8.3
1,2-Dichloroethane	0.6	ND	ND	ND	ND	ND	1.3
1,3,5-Trimethylbenzene	5	200	20	ND	ND	42	ND
2-Butanone	50	780	320	16	10	270	1,300
Acetone	50	2,000	800	530	190	980	4,400
Benzene	1	120	1,100	ND	0.63	14	15
Chloroethane	5	ND	20	ND	ND	30	36
Chloroform	7	ND	ND	ND	ND	ND	21
Ethylbenzene	5	1,800	1,100	ND	ND	750	280
Isopropylbenzene	5	78	25	ND	ND	35	17
n-Propylbenzene	5	190	68	ND	ND	98	48
Naphthalene	10	200	70	ND	ND	110	11
o-Xylene	5	890	960	ND	ND	750	120
p/m-Xylene	5	5,600	2,100	ND	ND	1,900	170

Analyte	**NYSDEC TOGS 1.1.1 AWQS**	**MW-1**	**MW-2**	**MW-3**	**MW-4**	**MW-5**	**MW-6**
	(ug/L)	(ug/L)	(ug/L)	(ug/L)	(ug/L)	(ug/L)	(ug/L)
Toluene	5	1,000	4,600	ND	ND	1,300	73
SVOCs							
2,4-Dimethylphenol	50	56	ND	ND	ND	ND	ND
Bis(2-ethylhexyl)phthalate	5	2.6	22	ND	ND	ND	30
Phenol	1	14	15	ND	ND	ND	ND
Hexachlorobenzene	0.04	ND	ND	0.07	ND	ND	ND
Naphthalene	10	180	98	0.05	0.1	130	61
General Chemistry							
Sulfate	250,000	7,550,000	15,400,000	36,500,000	6,940,000	6,100,000	29,000,000

Notes:
ND = Analyte note detected above laboratory reporting limits
3.6 = Analyte was detected above the NYSDEC TOGS

The results of the groundwater sampling completed during the RI indicated that benzene, toluene, ethylbenzene, and xylenes (BTEX) and other petroleum-related VOCs including sec-butylbenzene, isopropylbenzene, naphthalene, n-propylbenzene, 1,3,5-trimethylbenzene, 1,2,4-trimethylbenzene, and 1,2,4,5-trimethylbenzene, are present at concentrations in exceedance of the applicable NYSDEC AWQS in the original onsite monitoring wells MW-1, MW-2, MW-3, and MW-5. The highest concentrations of petroleum-related VOCs were detected in monitoring wells MW-2 and MW-5, located on the north and northwestern portion of the Site in the area of the former gasoline filling station. No VOCs were detected in MW-4, located on the southern portion of the Site. SVOCs 2,4-dimethylphenol, phenol, and naphthalene, and dissolved and total metals arsenic, barium, iron, magnesium, manganese, sodium, and thallium were also detected in groundwater samples at the Site at concentrations exceeding their applicable NYSDEC AWQS.

Additionally, individual PFOA and PFOS concentrations, other individual PFAS concentrations, and combined PFAS concentrations exceeded the screening levels outlined in the Guidelines for Sampling and Analysis of PFAS Under the NYSDEC's Ambient Water Quality Guidance Values. The highest concentrations of PFAS compounds were detected in groundwater samples from monitoring wells MW-2, MW-3, and MW-5, located on the north and northwestern portions of the Site. No other significant VOCs, SVOCs, PCBs, Metals, Pesticides, Herbicides, 1,4-Dioxane, or

PFAS were detected in any of the groundwater samples at concentrations exceeding the applicable NYSDEC AWQS or guidance levels.

On May 10, 2023, a pre-injection groundwater sampling event was conducted. Groundwater samples were collected from the six newly installed monitoring wells, MW-1, MW-2, MW-3, MW-4, MW-5 and MW-6 (as described in section 2.2.3). The purpose of this groundwater sampling event was to serve as a baseline for pre-injection conditions after the soil source material was removed. The results of the May 10, 2023 groundwater sampling event indicated BTEX and other petroleum-related VOCs including benzene, ethylbenzene, isopropylbenzene, sec-butylbenzene, naphthalene, o-xylenes, p/m-xylenes n-propylbenzene, toluene, 1,3,5-trimethylbenzene, 1,2,4-trimethylbenzene, and 1,2,4,5-trimethylbenzene, were detected in groundwater samples at concentrations in exceedance of the applicable NYSDEC AWQS. SVOCs 2,4-dimethylphenol, phenol, benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, chrysene, indeno(1,2,3-cd)pyrene, and naphthalene, were also detected in the groundwater samples at concentrations exceeding their applicable NYSDEC AWQS. In general, the May 10, 2023 groundwater sampling results indicated similar concentrations of VOCs over a larger area compared to pre-construction concentrations identified in the RI. Tables 6, 7, and 8 summarize the groundwater analytical results from the remedial investigation, monitoring prior to the ISCO injections, and post-injection monitoring. Appendix N Figures 3 and 4 summarize the groundwater contaminant concentrations from the RI and the pre-injection monitoring.

The first round of ISCO injections were conducted from October 16 to 20, 2023. Additional details about the ISCO injection process are further discussed in section 3.3.3.3. After the initial ISCO injections were completed, three rounds of post injection groundwater sampling were conducted to assess the effectiveness of the first round of injections and assist in the design specifications needed for any subsequent rounds of ISCO injections. On December 21, 2023, all six monitoring wells were sampled. On March 8, 2024, select monitoring wells, MW-1, MW-2, MW-3, and MW-5 were sampled, and on June 7, 2024, all six monitoring wells were sampled.

Due to failure of one of the injection wells (IW-6) in the vicinity of MW-6, and three other injection wells (IW-3, IW-4, IW-7) not accepting the treatment injections at acceptable rates during the first treatment injections, it did not appear that the area in the vicinity of MW-6 received adequate treatment. An increase in sulfate in MW-6 from 35,000 ug/L in May 2023 to 5,660,000 ug/L in June 2024 is likely a result of this monitoring well located immediately down-gradient of a treated area; however, direct treatment of this area was still necessary to address likely separate-phase hydrocarbons in the vicinity.

The supplemental round of ISCO injections were conducted from October 28 to November 5, 2024. Additional details about the ISCO injection process are further discussed in section 3.3.3.3. After the supplemental ISCO injections were completed, two rounds of post injection groundwater sampling were conducted at 8-week and 12-week intervals to assess the effectiveness of the injections. On January 2 and 3, 2025 and January 28 and 29, 2025 all six monitoring wells were sampled.

The results of the sampling from these five events indicate that elevated concentrations of BTEX and other petroleum-related VOCs and SVOCs remained in groundwater above NYSDEC AWQS; however, notable reductions have been observed in wells where adequate ISCO reagent has been achieved. Concentrations of several key indicator chemicals (BTEX and naphthalene) decreased in wells MW-1, MW-3, and MW-4 between May 2023 and January 2025, as summarized below, and on Table 8:

MW-1

- Benzene: 150 ug/L to 120 ug/L
- Toluene: 9,200 ug/L to 1,000 ug/L
- Ethylbenzene: 5,000 ug/L to 1,800 ug/L
- Total xylenes: 27,400 ug/L to 6,500 ug/L
- Naphthalene: 6,900 ug/L to 180 ug/L

MW-3

- Benzene: 23 ug/L to not detected above the laboratory reporting limit of 0.4 ug/L
- Toluene: estimated 10 ug/L to not detected above the laboratory reporting limit of 1.8 ug/L
- Ethylbenzene: 100 ug/L to not detected above the laboratory reporting limit of 1.8 ug/L
- Total xylenes: 360 ug/L to not detected above the laboratory reporting limit of 1.8 ug/L

- Naphthalene: 8.4 ug/L to estimated 0.05 ug/L

MW-4

- Benzene: not detected above the laboratory reporting limits of 0.16 ug/L to estimated 0.63 ug/L
- Toluene: 10 ug/L to not detected above the laboratory reporting limit of 1.8 ug/L
- Ethylbenzene: 29 ug/L to not detected above the laboratory reporting limit of 1.8 ug/L
- Total xylenes: 190 ug/L to not detected above the laboratory reporting limit of 1.8 ug/L
- Naphthalene: 3.9 ug/L to estimated 0.1 ug/L

The concentration reductions at wells MW-1, MW-3, and MW-4 indicated that meaningful contaminant degradation had occurred in direct response to the ISCO injections. Although MW-4 is located outside the areas that received reagent during the initial injections and contaminant concentrations were relatively low at this location to begin with, some increases in sulfate (a reagent by-product which is used as an indicator compound when evaluating the effectiveness of the in-situ treatment) may be helping biodegradation in the area of MW-4, such that the modest contaminant concentrations pre-injection have been reduced below laboratory reporting limits.

At MW-2, the indicator chemicals increased in concentration following the October 2023 injection, but generally reduced in March 2024 before another increase in June 2024 and an overall reduction January 2025, as summarized below:

MW-2

- Benzene: 49 ug/L in May 2023, to 1,800 ug/L in December 2023, to 1,800 ug/L in March 2024, to 5,600 ug/L in June 2024, to 1,100 ug/L in January 2025.
- Toluene: 710 ug/L in May 2023, to 20,000 ug/L in December 2023, to below the laboratory reporting limit of 70 ug/L in March 2024, to 25,300 ug/L in June 2024, to 4,600 ug/L in January 2025.
- Ethylbenzene: 180 ug/L in May 2023, to 5,500 ug/L in December 2023, to 1,900 ug/L in March 2024, to 4,150 ug/L in June 2024, to 1,100 ug/L in January 2025.
- Total xylenes: 890 ug/L in May 2023, to 26,000 ug/L in December 2023, to below the laboratory reporting limit of 70 ug/L in March 2024, to 17,800 ug/L in June 2024, to 3,100 ug/L in January 2025.
- Naphthalene: 3.3 ug/L in May 2023, to 660 ug/L in December 2023, to 316 ug/L in

June 2024, to 98 ug/L in January 2025.

Based on historic observation of free phase product in the vicinity of the approximate location of MW-2 prior to construction of the current building, petroleum hydrocarbon mass likely remained sorbed to the soil in the vicinity of well MW-2. It appears as though the injections in the vicinity induced limited lateral displacement or dissolution of separate phase petroleum hydrocarbons to this well. Hydrocarbon degradation can lead to temporary increases in chemical dissolution rates due to changes in the surface area of separate phase hydrocarbons as the contaminant degradation proceeds. In addition, microbial growth can generate natural surfactants that temporarily increase hydrocarbon solubility.

After the supplemental round of injections were completed, observed concentrations of BTEX and naphthalene in MW-2 had a substantial reduction at the 8-week post-injection monitoring event at the beginning of January. However, there was a moderate increase of these contaminants by the 12-week monitoring period. Concentrations after the increase still remained significantly below the pre-supplemental injection concentrations from June 2024.

Sulfate (a reagent by-product) may be used as an indicator compound when evaluating the effectiveness of the in-situ treatment, and if additional treatment injection may be needed. Sulfate concentrations in MW-2 were 1,500,000 ug/L in the first groundwater sampling event (December 2023) following the October 2023 injection but decreased to 164,000 ug/L in the sampling event in June 2024. The relatively rapid “wash-out” of sulfate suggests that only partial treatment may have been achieved at this location during the initial injections. After the supplemental injections, sulfate concentrations increased dramatically to 1,200,000 ug/L at 8-weeks and to 15,400,00 ug/L at 12-weeks. Additionally, monitoring well MW-2 is located closest to the former USTs on the property, and post-excavation soil data indicates petroleum related compounds remain present in the saturated soils in this area at concentrations above NYSDEC Protection of Groundwater SCOs. The data suggests the in-situ treatment is working; however, remaining petroleum related compounds sorbed to the soil that were not flushed during the initial injections were partitioning from the soil back into the groundwater.

Concentrations of indicator compounds at MW-5 had fluctuating concentrations with some lowering after initial injections and increasing after supplemental injection or had a general increase throughout the monitoring period. BTEX and naphthalene concentrations were observed as follows:

<u>MW-5</u>

- Benzene: not detected above the laboratory reporting limits between May 2023 and March 2024, to 0.67 ug/L in June 2024, to 14 ug/L in January 2025.
- Toluene: 930 ug/L in May 2023, to 150 ug/L in December 2023, to estimated 2 ug/L in March 2024, to 162 ug/L in June 2024, to 1,300 ug/L in January 2025.
- Ethylbenzene: 730 ug/L in May 2023, to 420 ug/L in December 2023, to 3.6 ug/L in March 2024, to 116 ug/L in June 2024, to 750 ug/L in January 2025.
- Total xylenes: 4,200 ug/L in May 2023, to 2,500 ug/L in December 2023, to 21 ug/L in March 2024, to 677 ug/L in June 2024, to 2,700 ug/L in January 2025.
- Naphthalene: 140 ug/L in May 2023, to 110 ug/L in December 2023, to 3.6 ug/L in June 2024, to 130 ug/L in January 2025.

MW-5 was outside of the estimated radius of influence during the initial round of injections that occurred in October 2023 due to the limited amount of persulfate delivered to the area. This area was not directly treated due to the failure of injections at IW-3. The increase dosage to MW-5 during the supplemental injections in 2024 resulted in a post-injection increase in concentrations due to the additional desorption of contaminants in the area that had not been sufficiently targeted during the initial injections. MW-5 is upgradient of MW-6 and MW-3 and therefore increased mobilization from treating the area around MW-5 may result in temporary increases in MW-6 and MW-3 as the degradation of contaminants proceeds.

At MW-6, concentrations of the indicator compounds have fluctuated, as follows:

<u>MW-6</u>

- Benzene: 41 ug/L in May 2023, 37 ug/L in December 2023, and 5,580 ug/L in June 2024, to 15 ug/L in January 2025.
- Toluene: 9,400 ug/L in May 2023, 3,800 ug/L in December 2023, and 21,500 ug/L in June 2024, to 73 ug/L in January 2025.
- Ethylbenzene: 5,300 ug/L in May 2023, 3,400 ug/L in December 2023, and 4,300 ug/L in June 2024, to 280 ug/L in January 2025.
- Total xylenes: 24,000 ug/L in May 2023, 13,000 ug/L in December 2023, and 20,000 ug/L in June 2024, to 290 in January 2025.

- Naphthalene: 460 ug/L in May 2023, 4,000 ug/L in December 2023, and 341 ug/L in June 2024, to 61 ug/L in January 2025.

Due to failure of one of the injection wells (IW-6) in the vicinity of MW-6, and three other injection wells (IW-3, IW-4, IW-7) not accepting the treatment injections at acceptable rates during the first treatment injections, it does not appear that the area in the vicinity of MW-6 received adequate treatment. An increase in sulfate in MW-6 from 35,000 ug/L in May 2023 to 5,660,000 ug/L in June 2024 is likely a result of this monitoring well located immediately down-gradient of a treated area; however, direct treatment of this area was still necessary to address likely separate-phase hydrocarbons in the vicinity. With direct application to MW-6 during the supplemental injections, significant decreases in concentrations of indicator contaminants were observed by the 8-week post injection monitoring event. However, the increase observed during the 12-week monitoring event may be the result of mobilized contaminants for sorbed soil in upgradient well MW-5. The observed oxidation reduction potential and elevated sulfate concentrations in these wells indicates that the conditions for continued contaminant breakdown are present.

Due to the nature of petroleum hydrocarbons and the potential for separate-phase contamination to remain sorbed to the aquifer matrix, the multiple ISCO injections resulted in targeted treatments across the Site that led to increases in mobilization of contaminants during their degradation. Observed oxidation reduction potential and elevated sulfate concentrations observed in all six monitoring wells indicate that additional degradation is ongoing. Therefore, in order to monitor the continued effectiveness of the ISCO injections and contaminant breakdown progress, a minimum of eight quarters (or two years) of continued groundwater monitoring will be conducted as part of the Site Management Plan (SMP) in order to confirm a downward or overall stabilizing trend within the groundwater impacts that remain at the Site, or if additional injections, beyond the second round will be necessary. After each groundwater sampling event, GZA will assess the continued effectiveness of the ISCO injections. If data trends indicate COC concentrations are not reducing, additional ISCO injections may be conducted to adequately reduce the concentrations of VOCs within on site groundwater, as needed.

Further details of the ISCO injections are discussed in section 3.3.3.3.

2.5.3 Soil Vapor

During the RI, a total of nine borings, SGS-1 through SGS-9, were converted to soil vapor probes for the collection of soil vapor samples in accordance with Section 2.7.1 of the New York

State SVI Guidance and DER-10 Section 3.6. Nine shallow soil vapor (3-5 feet bgs) and nine deep soil vapor (collected from 12 feet bgs, or between one and two feet above the groundwater interface) samples were collected at the locations illustrated on Figure 7 and the results summarized on Table 9.

The results of the soil vapor sampling completed during the RI indicated that elevated concentrations of methylene chloride and gasoline related compounds, including BTEX, were detected at the Site. The depth ranges where the soil vapor samples were collected have since been excavated and removed from Site. In addition, as further discussed in section 3.3, a vapor barrier and sub-slab depressurization system has been installed as part of the ECs required by the RAWP. Performance monitoring of the vapor barrier and SSDS (i.e. indoor air sampling) is discussed in the following section and further discussed in section 3.3.2.

2.5.4 Indoor Air

The SSDS, which is further discussed in section 3.3.2, was started on May 2, 2024, and ran for a minimum of 30 days prior to conducting the first round of indoor air sampling. The first round of indoor air sampling was conducted on June 6 and 7, 2024, at the sample locations and in accordance with the sampling procedures outlined in correspondence between AEI and NYSDEC on May 30, 2024, which was subsequently approved by NYSDEC in a June 7, 2024 via email. At the time of the sampling, the SSDS appeared to be operating properly. Six-liter Summa canisters were placed at each sample location. The canisters were certified by the laboratory and fitted with a regulator that allowed ambient air to be collected over a 24-hour period given the Restricted Residential nature of the Site. The Summa canisters were placed on the morning of June 6, and retrieved on the morning of June 7, 2024. The air samples were submitted to SGS North America, Inc., Dayton, New Jersey, a NY certified laboratory (Cert #10983) for analysis of select VOCs by U.S. EPA Method TO-15. At the time of the sampling, some construction activities were still being conducted and many associated full, partially full, and empty containers, including sheetrock joint compound, sealers, paints (mostly latex), adhesives, paint sprayer cleaner, pipe joint compound, and other similar materials, were present in the basement at the time of sampling.

The primary vapor migration concern is petroleum related compounds in groundwater/soil gas migrating into the building. The results were compared to the NYS DOH Soil Vapor/Indoor Air Decision Matrices, May 2017, and updated with petroleum compounds in February 2024. As shown on the attached Table 9, ethylbenzene (34 – 103 ug/m^3), 1,2,4-trimethylbenzene (13 – 37 ug/m^3), m,p-xylene (142 – 521 ug/m^3), and o-xylene (56.5 – 176 ug/m^3) were detected in all four of the indoor air samples above the indoor air concentrations where the NYS DOH Matrices recommendation is ‘Identify Source(s) or Resample or Mitigate’; and above the corresponding ambient air results.

AEI attributed the elevated concentrations of compounds detected to ongoing construction activities within the building and associated construction materials/containers stored in the basement. Therefore, a second round of indoor air sampling was conducted on July 2/3, 2024. At the time of the sampling the SSDS system had been continuously operating since start-up on May 2. Although, not completely removed, many of the materials present in the basement during the first round of sampling had been removed. Prior to sampling, AEI also checked and confirmed that well covers/seals were in-place and properly sealed on the injection and monitoring wells present in the basement. Samples were collected from the same locations as those in the first round of sampling, as shown on the attached figure. Six-liter Summa canisters were placed at each sample location. The canisters were certified by the laboratory and fitted with a regulator that allowed ambient air to be collected over a 24-hour period. The Summa canisters were placed on the morning of July 2, 2024 and retrieved on the morning of July 3, 2024. The air samples were submitted to Integrated Analytical Laboratories, LLC (IAL), Inc., a NY certified laboratory (Cert #11402) for analysis of select VOCs by U.S. EPA Method TO-15.

As with the first round of sampling results, the results of the second round were compared to the NYS DOH Soil Vapor/Indoor Air Decision Matrices, May 2017, and updated with petroleum compounds in February 2024. The only compounds detected above their respective NYS DOH Matrices guidance values were methylene chloride and m,p-xylene. Methylene chloride was detected in three of the four indoor air samples ranging from 18 – 37 ug/m^3,but was also detected in the ambient air sample collected outside of the building at a concentration of 26 ug/m^3, indicating methylene chloride concentrations detected in the indoor samples are attributable to background concentrations. m,p-Xylene was detected in all four indoor air samples; however, only two were above the 20 ug/m^3 NYS DOH Matrices guidance value; samples IA-2 (25 ug/m^3) and IA-4 (26 ug/m^3). The m,p-xylene concentration in samples IA-1 and IA-3 were 12 ug/m^3 and 16 ug/m^3, respectively.

Although ethylbenzene (2.9 – 6.6 ug/m^3), 1,2,4-trimethylbenzene (1.2 – 2.6 ug/m^3), and o-xylene (4 – 8.1 ug/m^3) were detected in all four of the indoor air samples, they were all below their respective 10 ug/m^3 NYSDOH guidance values, and considerably below the concentrations detected in the first indoor air sampling event.

AEI conducted additional rounds of indoor air sampling to assess the operational performance of the Sub-Slab Depressurization System (SSDS) on August 19-20, August 22-23, and September 3-4, 2024. The results indicated multiple exceedances for ethylbenzene, p/m-xylene, and o-xylene. These exceedances in the August 2024 samples were attributed to the improper application of a floor sealant containing xylenes and ethylbenzene. To prevent further emissions from the sealant, a ½-inch layer of concrete resurfacer was applied over the affected basement areas.

After the resurfacer application, additional samples were collected in September 2024. The results no longer showed exceedances for ethylbenzene, although xylenes remained above the NYSDOH guidance values. To inspect and maintain the SSDS, GZA subcontracted AARCO Environmental Services Corp (AARCO) and Tyll Engineering and Consulting (TEC). They conducted a visual inspection and flushed the system on September 16, 2024.

On October 21, 2024, GZA personnel collected ambient air (AA-1 and AA-Roof) and indoor air (IA-1 through IA-7) samples using 6-liter stainless steel Summa canisters with 24-hour flow regulators. The ambient air results for AA-1 and AA-Roof, and indoor air results for IA-1, 2, 3, 5, 6, and 7 did not show VOC concentrations exceeding NYSDOH Air Guidance Values (for chlorinated solvents). However, IA-4 showed elevated methylene chloride levels (11.7 µg/m^3) above NYSDOH Air Guidance Values. Methylene chloride was not detected in nearby IA-3 from the same room and is considered a common laboratory contaminant. Previous sampling indicated that methylene chloride was not a concern related to soil vapor or construction materials at the site. Therefore, GZA does not consider this exceedance to be related to vapor infiltration or VOC contamination within the indoor air space.

On November 19, 2024, GZA personnel collected another round of ambient air and indoor air samples from the same sample locations for evaluation during the heating season. The ambient air and indoor air results showed no exceedances above NYSDOH Air Guidance Values or the Decision Matrices “No Further Action” thresholds. Based on the data, there does not appear to be a pathway for human exposure to contaminants in the breathing zone. The analytical results from the October and November 2024 confirmatory sampling events are provided in Table 10.

3.0 INSTITUTIONAL AND ENGINEERING CONTROL PLAN

3.1 General

Since remaining contamination exists at the site, Institutional Controls (ICs) and Engineering Controls (ECs) are required to protect human health and the environment. This IC/EC Plan describes the procedures for the implementation and management of all IC/ECs at the site. The IC/EC Plan is one component of the SMP and is subject to revision by the NYSDEC project manager.

This plan provides:

- A description of all IC/ECs on the site;
- The basic implementation and intended role of each IC/EC;
- A description of the key components of the ICs set forth in the Environmental Easement;
- A description of the controls to be evaluated during each required inspection and periodic review;
- A description of plans and procedures to be followed for implementation of IC/ECs, such as the implementation of the Excavation Work Plan (EWP) (as provided in Appendix F) for the proper handling of remaining contamination that may be disturbed during maintenance or redevelopment work on the site; and
- Any other provisions necessary to identify or establish methods for implementing the IC/ECs required by the site remedy, as determined by the NYSDEC project manager.

3.2 Institutional Controls

A series of ICs is required by the RAWP and Decision Document to: (1) implement, maintain and monitor Engineering Control systems; (2) prevent future exposure to remaining contamination; and (3) limit the use and development of the site to restricted residential uses only.

Adherence to these ICs on the site is required by the Environmental Easement and will be implemented under this SMP. ICs identified in the Environmental Easement may not be discontinued without an amendment to or extinguishment of the Environmental Easement. The IC boundaries are shown on Figure 8. These ICs are:

- The property may be used for: restricted residential, commercial, or industrial use;
- All ECs must be operated and maintained as specified in this SMP;
- All ECs must be inspected at a frequency and in a manner defined in the SMP;
- The use of groundwater underlying the property is prohibited without necessary water quality treatment as determined by the NYSDOH or the New York City Department of Health to render it safe for use as drinking water or for industrial purposes, and the user must first notify and obtain written approval to do so from the Department;
- Groundwater and other environmental or public health monitoring must be performed as defined in this SMP;
- Data and information pertinent to site management must be reported at the frequency and in a manner as defined in this SMP;
- All future activities that will disturb remaining contaminated material must be conducted in accordance with this SMP;
- Monitoring to assess the performance and effectiveness of the remedy must be performed as defined in this SMP;
- Operation, maintenance, monitoring, inspection, and reporting of any mechanical or physical component of the remedy shall be performed as defined in this SMP;
- Access to the site must be provided to agents, employees or other representatives of the State of New York with reasonable prior notice to the property owner to assure compliance with the restrictions identified by the Environmental Easement;
- The potential for vapor intrusion must be evaluated for any buildings developed in the area within the IC boundaries noted on Figure 8, and any potential impacts that are identified must be monitored or mitigated;

- Vegetable gardens and farming on the site are prohibited; and
- An evaluation shall be performed to determine the need for further investigation and remediation should large scale redevelopment occur, if any of the existing structures are demolished, or if the subsurface is otherwise made accessible.

3.3 Engineering Controls

3.3.1 In-Situ Chemical Injection and Monitoring Wells

In accordance with the NYSDEC approved RAWP, the subsequently approved In-Situ Remediation Design and Monitoring plan dated August 29, 2022, the revised injection plan approved on August 16, 2023, and the Supplemental Remedial Action Plan dated October 22, 2024, ISCO injections have been conducted to address the onsite groundwater impacts. The initial ISCO injections were completed in October 2023 and the supplemental injections were completed in November 2024.

In accordance with the approved plan, 11 temporary injection wells (IWs) constructed of 4-inch PVC screen and riser pipe were installed in March 2023. Each screened interval extends to the encountered bedrock surface or 15 feet below the existing basement slab grade, whichever comes first, well within the zone of saturated soils and impacted groundwater. Figure 10 presents the locations and expected Radius of Influence of each ISCO injection well point. As summarized in section 2.5.2, three rounds of post injection groundwater sampling (December 2023, March 2024, June 2024) were conducted after the initial injections in October 2023. The data from the three post injection sampling events indicate that reduction in contaminants of concern was started with the initial injection dosage. However, due to the rebound observed in some wells during the June 2024 monitoring event, insufficient persulfate was delivered to account for the degradation of the full contaminant mass. Based on AEI’s evaluation of the results of the first three rounds of post injection monitoring, a second round of injections was needed to further reduce contaminant concentrations and to firmly establish a more stable downward trend of the contaminants of concern.

The supplemental round of injections dosage of PersulfOx increased from 12% to 20% and more volume to help ensure adequate distribution of reagent across the entire targeted treatment area. Two rounds of post-injection groundwater monitoring were conducted at 8-weeks and 12-weeks post injections. Based on the GZA’s evaluation of these two monitoring events, an initial increase in hydrocarbon mobilization and displacement was observed from the additional treatment in newly targeted areas. Although adequate reduction to establish a more stable downward trend has yet to be fully demonstrated, indicators of the oxidation condition in the groundwater show there currently are optimal conditions for continued degradation of the contaminants of concern.

3.3.2 Sub-Slab Depressurization System (SSDS)

Immediately following the completion of the soil excavation activities, installation of the SSDS and requisite components began. The SSDS consists of five individual loops of piping installed within porous granular material consisting of 3/4-inch clean stone beneath the composite cover system described above. Prior to the placement of the stone and piping, a nonwoven geotextile fabric was placed on the base of the excavation. Each loop consists of a network of horizontal pipe set in the middle of a gas permeable layer immediately beneath the building slab. The horizontal piping in each loop consists of perforated schedule 40 4-inch PVC pipe connected to a 4-inch steel pipe that penetrates the foundation and vented to the roof. The gas permeable layer consists of a 12-inch thick layer of 3/4-inch trap rock stone. A second layer of geotextile fabric was installed above the stone layer and below the composite cover system described above. The five individual loop riser pipes are connected to a single common trunk line that is run through the first floor and exits on the roofline of the first floor. The SSDS piping is finished at the roof line with a 6-inch goose neck pipe to prevent rain infiltration. The SSDS is hardwired and includes a blower installed on the roof line inside a protective metal casing. Pressure gauges, ball valves, and sampling ports fitted with a capped barb nipple are placed on each vertical riser pipe to allow for balancing and sampling of the system as needed. An alarm is located in an accessible area in the basement. Measurements of the installed system were completed on August 7, 2024 and the summary of measured results is provided in Table 4 below.

Procedures for operating and maintaining the SSDS are documented in the Operation and Maintenance Plan (Section 5.0 of this SMP). As-built drawings, signed and sealed by a PE who is licensed and registered in New York State, are provided in Figures 9A-9D. The SSDS Operations and Maintenance Manual is provided in Appendix H.

Table 4 – SSDS Measurements

SSDS Loop	Measured Flow Rate (CFM)	Measured Vacuum (in, H20)
1	15.2	0.27
2	15.9	0.54
3	17.0	0.27
4	19.1	0.54
5	19.8	0.54

3.3.3 Criteria for Completion of Remediation/Termination of Remedial Systems

Generally, remedial processes are considered completed when monitoring indicates that the remedy has achieved the remedial action objectives identified by the decision document. The framework for determining when remedial processes are complete is provided in Section 6.4 of NYSDEC DER-10. Unless waived by the NYSDEC, confirmation samples of applicable environmental media are required before terminating any remedial actions at the site. Confirmation samples require Category B deliverables and a Data Usability Summary Report (DUSR).

As discussed below, the NYSDEC may approve termination of a groundwater monitoring program. When a remedial party receives this approval, the remedial party will decommission all site-related monitoring, injection and recovery wells as per the NYSDEC CP-43 policy.

The remedial party will also conduct any needed site restoration activities, such as asphalt patching and decommissioning treatment system equipment. In addition, the remedial party will conduct any necessary restoration of vegetation coverage, trees and wetlands, and will comply with NYSDEC and United States Army Corps of Engineers regulations and guidance. Also, the remedial party will ensure that no ongoing erosion is occurring on the site.

3.3.3.1 - Sub-Slab Depressurization (SSD) System

The SSDS will not be discontinued unless prior written approval is granted by the NYSDEC and the NYSDOH project managers. If monitoring data indicates that the SSDS may no longer be required, a proposal to discontinue the SSDS will be submitted by the remedial party to the NYSDEC and NYSDOH project managers.

3.3.3.2 Monitoring Wells associated with In-Situ Chemical Oxidation

The monitoring and injection wells installed as a part of the remedial action are still in place and are shown on Figure ??. Groundwater monitoring activities to assess in-situ chemical oxidation will continue as determined by the NYSDEC project manager in consultation with NYSDOH project manager, until residual groundwater concentrations are found to be consistently below ambient water quality standards or the site SCGs or have become asymptotic at an acceptable level over an extended period. If monitoring data indicates that monitoring may no longer be required, a proposal to discontinue the remedy will be submitted by the remedial party. Monitoring will continue until permission to discontinue is granted in writing by the NYSDEC project manager. If groundwater contaminant levels become asymptotic at a level that is not acceptable to the NYSDEC, additional injections, source removal, treatment and/or control measures will be evaluated.

4.0 MONITORING AND SAMPLING PLAN

4.1 General

This Monitoring and Sampling Plan describes the measures for evaluating the overall performance and effectiveness of the remedy. This Monitoring and Sampling Plan may only be revised with the approval of the NYSDEC project manager. Details regarding the sampling procedures, data quality usability objectives, analytical methods, etc. for all samples collected as part of site management for the site are included in the Quality Assurance Project Plan provided in Appendix i.

This Monitoring and Sampling Plan describes the methods to be used for:

- Sampling and analysis of all appropriate media (e.g., groundwater, indoor air, soil vapor, soils);
- Assessing compliance with applicable NYSDEC standards, criteria and guidance (SCGs), particularly groundwater standards and Part 375 SCOs for soil; and
- Evaluating site information periodically to confirm that the remedy continues to be effective in protecting public health and the environment;

To adequately address these issues, this Monitoring and Sampling Plan provides information on:

- Sampling locations, protocol and frequency;
- Information on all designed monitoring systems;
- Analytical sampling program requirements;
- Inspection and maintenance requirements for monitoring wells;
- Monitoring well decommissioning procedures; and
- Annual inspection and periodic certification.

Reporting requirements are provided in Section 7.0 of this SMP.

4.2 Site – wide Inspection

Site-wide inspections will be performed at a minimum of once per year. These periodic inspections must be conducted when the ground surface is visible (i.e. no snow cover). Site-wide inspections will be performed by a qualified environmental professional as defined in 6 NYCRR Part 375, a Professional Engineer (PE) who is licensed and registered in New York State, or a qualified person who directly reports to a PE who is licensed and registered in New York State. Modification to the frequency or duration of the inspections will require approval from the NYSDEC project manager. Site-wide inspections will also be performed after all severe weather conditions that may affect ECs or monitoring devices. During these inspections, an inspection form will be completed as provided in Appendix J – Site Management Forms. The form will compile sufficient information to assess the following:

- Compliance with all ICs, including site usage;
- An evaluation of the condition and continued effectiveness of ECs;
- General site conditions at the time of the inspection;
- Whether stormwater management systems, such as basins and outfalls, are working as designed;
- The site management activities being conducted including, where appropriate, confirmation sampling and a health and safety inspection; and
- Confirm that site records are up to date.

Inspections of all remedial components installed at the site will be conducted. A comprehensive site-wide inspection will be conducted and documented according to the SMP schedule, regardless of the frequency of the Periodic Review Report. The inspections will determine and document the following:

- Whether ECs continue to perform as designed;
- If these controls continue to be protective of human health and the environment;
- Compliance with requirements of this SMP and the Environmental Easement;
- Achievement of remedial performance criteria; and
- If site records are complete and up to date.

Reporting requirements are outlined in Section 7.0 of this plan.

Inspections will also be performed in the event of an emergency. If an emergency, such as a natural disaster or an unforeseen failure of any of the ECs occurs that reduces or has the potential to reduce the effectiveness of ECs in place at the site, verbal notice to the NYSDEC project manager must be given by noon of the following day. In addition, an inspection of the site will be conducted within 5 days of the event to verify the effectiveness of the IC/ECs implemented at the site by a qualified environmental professional, as defined in 6 NYCCR Part 375. Written confirmation must be provided to the NYSDEC project manager within 7 days of the event that includes a summary of actions taken, or to be taken, and the potential impact to the environment and the public. The remedial party will submit follow-up status reports to the NYSDEC within 45 days of the event on actions taken to respond to any emergency event requiring ongoing responsive action, describing and documenting actions taken to restore the effectiveness of the ECs.

4.3 Engineering Control Monitoring and Sampling

4.3.1 Engineering Control Monitoring (SSDS)

The only active engineering control at the Site is the sub-slab depressurization system (SSDS). Monitoring of the SSDS will be performed on a routine basis, as identified in Table 11 Remedial System Monitoring Requirements and Schedule (see below). The monitoring of the remedial system must be conducted by a qualified environmental professional as defined in 6 NYCRR Part 375, a Professional Engineer (PE) who is licensed and registered in New York State, or a qualified person who directly reports to a PE who is licensed and registered in New York State Modification to the frequency or sampling requirements will require approval from the NYSDEC project manager. A visual inspection of the complete system and verification sampling will be conducted during each monitoring event. Verification sampling will include collecting indoor air samples from the cellar and an SSDS effluent sample from the system piping on the roof. Unscheduled inspections and/or sampling may take place when a suspected failure of the SSDS has been reported or an emergency occurs that is deemed likely to affect the operation of the system. SSDS components to be monitored include, but are not limited to, the components included in Table 6 below.

Table 11 – Engineering Control Monitoring Requirements and Schedule

Engineering Control Component	Monitoring Parameter	Operating Range	Monitoring Schedule
Vacuum Blower	Pressure (in/H_20) and Cubic Feet per minute (CFM)	75-85 in/H_20 or 105-125 CFM	Annual
Building Slab	Cracking, breaking, general condition	No visual cracking, breaking or deterioration	Annual
System Piping	Pressure (in/H20)	0.3-1.0 in/H_20	Annual
System Piping	Damage Inspection	No cracking, Breaking	Annual
System Operation	Indoor Air VOC Concentrations	NYSDOH Soil Vapor/Indoor Air Decision Matrices	Annual (during heating season)

A complete list of components to be inspected is provided in the Inspection Checklist, provided in Appendix J - Site Management Forms. If any equipment readings are not within their specified operation range, any equipment is observed to be malfunctioning, or the system is not performing within specifications; maintenance and repair, as per the Operation and Maintenance Plan, is required immediately.

4.4 Post-Remediation Media Monitoring and Sampling

Samples shall be collected from the groundwater on a routine basis. Sampling locations, required analytical parameters, and schedule are provided in Table 12 – Post Remediation System Sampling Requirements and Schedule below. Modification to the frequency or sampling requirements will require approval from the NYSDEC project manager.

Table 12 – Post Remediation Sampling Requirements and Schedule

Sampling Location	Analytical Parameters	Schedule
Monitoring Wells 1 through 6	VOCs (EPA Method 8260) and SVOCs (EPA Method 8270), PFOA, PFOS (EPA Method 1633)	Quarterly for two years

Detailed sample collection and analytical procedures and protocols are provided in Appendix K – Field Activities Plan and Appendix I – Quality Assurance Project Plan.

4.4.1 Groundwater Sampling

Groundwater monitoring will be performed quarterly for two years (eight monitoring events) to assess the performance of the remedy. Modification to the frequency or sampling requirements will require approval from the NYSDEC project manager.

The network of monitoring wells has been installed to monitor groundwater conditions at the site. The network of on-site wells has been designed based on the following criteria:

In accordance with the approved RAWP, the monitoring well network includes on-site monitoring wells only and no downgradient off-site sentinel wells have been installed. However, several onsite wells are located downgradient of the current groundwater contaminant plume. The terminal depth of each monitoring well and subsequent screened interval varies due to shallow and undulating bedrock refusal. Each monitoring well was installed to the deepest achievable depth or 15 feet below the surface of the finished concrete slab, whichever came first. Each well is constructed as a stick up well with a steel casing and locking lid protecting each PVC riser pipe. Stick up wells were chosen to provide adequate vertical head space due to the anticipated depth to groundwater located directly below, in close proximity, or even above to the bottom of the poured concrete slab, depending on seasonal hydrogeologic conditions.

Table 13 summarizes the well identification numbers, as well as the purpose, location, depths, diameter and screened intervals of the wells. As part of the groundwater monitoring, all on site wells are sampled to evaluate the effectiveness of the remedial system. The remedial party will measure depth to the water table for each monitoring well in the network before sampling. Each sampling event will consist of the collection of one groundwater sample from each monitoring well, and the collection of appropriate field and trip blanks. Samples will be submitted to an ELAP and New York Certified laboratory for analysis of TCL-VOCs.

Table 13 – Monitoring Well Construction Details

Monitoring Well ID	Well Location	Coordinates (longitude/ latitude)	Well Diameter (inches)	Elevation (above mean sea level)			
				Casing	Surface	Screen Top	Screen Bottom
MW-1	On Site	40*51’55.90 N 73*55’33.75 W	2	16.85	17.07	12.35	5.85
MW-2	On Site	40*51’55.66 N 73*55’34.38 W	2	16.98	17.19	12.98	9.98
MW-3	On Site	40*51’56.84 N 73*55’33.85W	2	17.44	17.62	12.44	2.44
MW-4	On Site	40*51’55.60 N 73*55’33.38W	2	17.06	17.34	12.84	11.34
MW-5	On Site	40*51’56.28 N 73*55’34.26 W	2	16.84	17.32	11.84	1.84
MW-6	On Site	40*51’56.43 N 73*55’33.92 W	2	16.99	17.20	12.20	6.20

Monitoring well construction logs are included in Appendix D of this document.

If biofouling or silt accumulation occurs in the on-site wells, the wells will be physically agitated/surged and redeveloped. Additionally, monitoring wells will be properly decommissioned and replaced if an event renders the wells unusable.

Repairs and/or replacement of wells in the monitoring well network will be performed based on assessments of structural integrity and overall performance.

The NYSDEC project manager will be notified prior to any repair or decommissioning of any monitoring well for the purpose of replacement, and the repair or decommissioning and replacement process will be documented in the subsequent Periodic Review Report. Well decommissioning without replacement will be done only with the prior approval of the NYSDEC project manager. Well abandonment will be performed in accordance with NYSDEC’s guidance entitled “CP-43: Groundwater Monitoring Well Decommissioning Procedures.” Monitoring wells that are decommissioned because they have been rendered unusable will be replaced in kind in the nearest available location, unless otherwise approved by the NYSDEC project manager.

The sampling frequency may only be modified with the approval of the NYSDEC project manager. This SMP will be modified to reflect changes in sampling plans approved by the NYSDEC project manager.

Deliverables for the groundwater monitoring program are specified in Section 7.0 – Reporting Requirements.

4.4.2 Monitoring and Sampling Protocol

All sampling activities will be recorded in a field book and associated sampling log as provided in Appendix J - Site Management Forms. Other observations (e.g., groundwater monitoring well integrity) will be noted on the sampling log. The sampling log will serve as the inspection form for the monitoring network. Additional detail regarding monitoring and sampling protocols are provided in the site-specific Field Activities Plan provided as Appendix K of this document.

5.0 OPERATION AND MAINTENANCE PLAN

5.1 General

This Operation and Maintenance Plan provides a brief description of the measures necessary to operate, monitor and maintain the mechanical components of the remedy selected for the site. This Operation and Maintenance Plan:

- Includes the procedures necessary to allow individuals unfamiliar with the site to operate and maintain the SSDS;
- Will be updated periodically to reflect changes in site conditions or the manner in which the SSDS is operated and maintained.

Further detail regarding the Operation and Maintenance of the SSDS is provided in Appendix H - Operation and Maintenance Manual. A copy of this Operation and Maintenance Manual, along with the complete SMP, is to be maintained at the site. This Operation and Maintenance Plan is not to be used as a stand-alone document, but as a component document of this SMP.

5.2 SSDS Performance Criteria

The SSDS provides a continuous vacuum across the entire underside of the concrete slab. The SSDS prevents sub-slab vapors from entering the building. A working range of 0.3 to 1.0 inches of water (in/H_2O) should be achieved and maintained within each vertical piping slab penetration riser. Magnahelic^{TM} vacuum pressure gauges and flow control valves installed at the basement level will allow the operator of the SSDS to monitor and adjust vacuum and flow to each portion of the system. The operational range of the vacuum blower should be maintained between 75 and 85 in/H_2O and 105 to 125 CFM; however, it should be noted this operational range may need to be altered depending on the vacuum readings of the individual vertical riser pipes after start-up.

5.3 Operation and Maintenance of SSDS

The following sections provide a description of the operations and maintenance of the SSDS. Cut-sheets and as-built drawings for the SSDS and vacuum blower are provided in Appendix H - Operations and Maintenance Manual.

5.3.1 System Start-Up and Testing

Prior to initial start-up, all SSDS piping joints and seals should be checked, flow control valves should be in the fully open position, and vacuum gauges should read zero. The blower should then be started. Flow/pressure readings should be collected from the blower itself and the individual vertical riser pipes. Adjustments to the individual flow control valves should be made to ensure a relatively similar level of vacuum is achieved in all of the individual riser pipes. This will ensure a similar level of vacuum is achieved across the entire basement slab. Once initial adjustments have been made and the system stabilized, those pressure/vacuum readings should be maintained throughout the useful lifetime of the SSDS as the baseline for future adjustments as needed.

The system testing described above will be conducted if, in the course of the SSDS lifetime, the system goes down or significant changes are made to the system and the system must be restarted.

5.3.2 Routine System Operation and Maintenance

Under normal operating conditions, regular maintenance of the system is not required unless monitoring results indicate a significant change from normal operating conditions.

5.3.3 Non-Routine Operation and Maintenance

Non-routine maintenance may be required to address issues such as unresolvable alarms, repeatedly malfunctioning components, or accidental or weather-related damage to system components. If non-routine maintenance is required, the Engineer of record must be notified. If the routine operation of the SSDS cannot be restored within two weeks from when a non-routine maintenance issue was identified, the owner must notify NYSDEC/NYSDOH and provide a schedule for resolving the issue. A field log or simple report documenting any non-routine maintenance activities performed must be prepared and maintained in the file with the yearly monitoring described above in Section 4.2. The documentation should include a description of the issue addressed, the location of the components involved, a description of the maintenance actions completed, a description of the actions taken to confirm that routine system operation was restored, the date or dates when the activities were performed, and the names and affiliations of the personnel involved.

5.3.4 System Monitoring Devices and Alarms

The SSDS has a warning device in the form of an audible alarm to indicate that the blower has shut down or no/low airflow is detected. In the event that the warning device is activated, applicable maintenance and repairs will be conducted, as specified in the Operation and Maintenance Plan, and the SSDS will be restarted. Operational problems will be noted in the yearly inspection report outlined in section 4.2.

5.3.5 Fire Safety

The remedial party will conduct an annual facility walk with the local fire chief and/or fire suppression team. The site walk will allow for the addition of the facility to any local preplanning efforts. The NYSDEC project manager will be provided with the local fire chief’s/fire suppression team’s recommendations as soon as they become available. Following review, the NYSDEC project manager may direct the remedial party to implement the recommendations and/or revise the SMP.

6.0 PERIODIC ASSESSMENTS/EVALUATIONS

6.1 Climate Change Vulnerability Assessment

Increases in both the severity and frequency of storms/weather events, an increase in sea level elevations along with accompanying flooding impacts, shifting precipitation patterns and wide temperature fluctuation, resulting from global climactic change and instability, have the potential to significantly impact the performance, effectiveness and protectiveness of a given site and associated remedial systems. Vulnerability assessments provide information so that the site and associated remedial systems are prepared for the impacts of the increasing frequency and intensity of severe storms/weather events and associated flooding.

This section provides a summary of vulnerability assessments that will be conducted for the site during periodic assessments and briefly summarizes the vulnerability of the site and/or engineering controls to severe storms/weather events and associated flooding.

Both the remedial systems (SSDS, composite cover system, ISCO injection) and the remaining areas of the Site itself are not considered vulnerable to climate change. The Site is not within a FEMA mapped flood plain or considered low lying. Stormwater, site drainage, and resistance to high winds have been designed in conformance with New York City Department of Buildings guidelines. The entire Site is covered by the newly constructed onsite building, with the lowest level comprised of a concrete cover system preventing any possible erosion or remaining contamination releases. The building is equipped with backup generators that have the ability to temporarily power all life support and basic safety systems within the building during a loss of power. This backup power is connected to the SSDS; therefore, the SSDS will continue to operate should the building experience a temporary loss of power. Furthermore, the Site is located at approximately 25 feet above mean sea level with the nearest water body 0.36 miles away, both of which indicate a low risk of the site being affected by sea level rise or flooding. According to the National Oceanic and Atmospheric Administration (NOAA) Sea Level Riser Viewer, the Site will not be affected by up to 10 feet of sea level rise. The location of the Site within a highly urbanized city environment there is a very low risk of being affected by wildfires. Due to the connection of the onsite building to city water and the chosen remedies not reliant on a water supply, both the site and the chosen remedies are unaffected by drought conditions. Conversely, the highly urbanized location of the Site dictate that very little exposed soil remains both on site and on the surrounding properties, thus the risk of erosion and degradation of the site or surrounding area would very low. The affected area where ongoing remedies will remain in place is located beneath the building slab itself; therefore, new spills and releases of impacted materials to the environment would be low. All sampling and any further ISCO injection operations, if necessary, will be conducted in accordance with all manufacturers, local, state, and federal safety regulations to reduce the likelihood of any new spills or releases occurring.

6.2 Green Remediation Evaluation

According to NYSDEC DER-31 Green Remediation guidance document, green Remediation approaches should be considered during site remediation. GZA, the volunteer and its subcontractors will incorporate sustainable practices with the goal to reduce the environmental footprint of the remediation and site management efforts. In accordance with ASTM E2893-16e1 the project GSR goals include the following:

- To minimize total energy use and maximize use of renewable energy,
- To minimize air pollutants and greenhouse gas emissions,
- To minimize water, use and impact to water resources,
- To reduce, reuse and recycle materials and waste; and
- To protect land and ecosystems

GZA will incorporate best management practices to lower the environmental footprint during the Site Management phase of the project. GZA, the volunteer, and the subcontractors will incorporate the following practicable measures during the implementation of the elements of the SMP:

1. Limit the use and idling of generators and vehicles to reduce emissions.
2. Minimize truck travel for disposal of O&M waste disposal during groundwater sampling by selecting local disposal facilities.
3. Manage onsite resources and materials efficiently.
4. Use local subcontractors to minimize vehicle emissions during commute.
5. Request that subcontractors use clean diesel equipment to reduce emissions.

6. Reduce the use of water used for decontamination of equipment.
7. Request project staff and subcontractors to use public transportation to the extent practicable.
8. Reduce waste, increasing recycling and increasing reuse of materials that would otherwise be considered waste.

As required a Climate screen checklist and an environmental footprint analysis has been completed for the project and are included in Appendix L.

6.2.1 Timing of Green Remediation Evaluations

For major remedial system components, green remediation evaluations and corresponding modifications will be undertaken as part of a formal Remedial System Optimization (RSO), or at any time that the NYSDEC project manager feels appropriate, e.g. during significant maintenance events or in conjunction with storm recovery activities.

Modifications resulting from green remediation evaluations will be routinely implemented and scheduled to occur during planned/routine operation and maintenance activities. Reporting of these modifications will be presented in the PRR.

6.2.2 Frequency of System Checks, Sampling and Other Periodic Activities

Transportation to and from the Site, use of consumables in relation to Site visits to conduct system checks and/or collect samples, and shipping samples to a laboratory for analyses have direct and/or inherent energy costs. The schedule and/or means of these periodic activities have been prepared so that these tasks can be accomplished in a manner that does not impact remedy protectiveness but reduces expenditure of energy or resources.

With respect to the ISCO injections, the minimum practicable mobilizations of injection equipment and consumable materials will be used. In addition, each quarterly groundwater monitoring event will only require a single mobilization to the Site. Coordination and consolidation of Site visits will be conducted to the extent feasible if multiple tasks are to be performed at the Site at any given time.

6.2.3 Metrics and Reporting

As discussed in Section 7.0 and as shown in Appendix K – Site Management Forms, information on energy usage, solid waste generation, transportation and shipping, water usage and land use and ecosystems will be recorded to facilitate and document consistent implementation of green remediation during site management and to identify corresponding benefits. A set of metrics has been developed.

6.3 Remedial System Optimization

A Remedial System Optimization (RSO) study will be conducted any time that the NYSDEC project manager or the remedial party requests in writing that an in-depth evaluation of the remedy is needed. An RSO may be appropriate if any of the following occur:

- The remedial actions have not met or are not expected to meet RAOs in the time frame estimated in the Decision Document;
- The management and operation of the remedial system is exceeding the estimated costs;
- The remedial system is not performing as expected or as designed;
- Previously unidentified source material may be suspected;
- Plume shift has potentially occurred;
- Site conditions change due to development, change of use, change in groundwater use, etc.;
- There is an anticipated transfer of the site management to another remedial party or agency; and
- A new and applicable remedial technology becomes available.

An RSO will provide a critique of a site’s conceptual model, give a summary of past performance, document current cleanup practices, summarize progress made toward the site’s cleanup goals, gather additional performance or media specific data and information and provide recommendations for improvements to enhance the ability of the present system to reach RAOs or to provide a basis for changing the remedial strategy.

The RSO study will focus on overall site cleanup strategy, process optimization and management with the intent of identifying impediments to cleanup and improvements to site operations to increase efficiency, cost effectiveness and remedial time frames. Green remediation technology and principals are to be considered when performing the RSO.

7.0. REPORTING REQUIREMENTS

7.1 Site Management Reports

All site management inspection, maintenance and monitoring events will be recorded on the appropriate site management forms provided in Appendix K. These forms are subject to NYSDEC revision. All site management inspection, maintenance, and monitoring events will be conducted by a qualified environmental professional as defined in 6 NYCRR Part 375, a Professional Engineer (PE) who is licensed and registered in New York State, or a qualified person who directly reports to a PE who is licensed and registered in New York State.

All applicable inspection forms and other records, including media sampling data and system maintenance reports, generated for the site during the reporting period will be provided in electronic format to the NYSDEC in accordance with the requirements of Table 14 and summarized in the Periodic Review Report.

Table 14: Schedule of Interim Monitoring/Inspection Reports

Task/Report	**Reporting Frequency***
Quarterly Groundwater Monitoring Report	Quarterly (for a minimum of 2 years)
Periodic Review Report	Annually, or as otherwise determined by the NYSDEC

* The frequency of events will be conducted as specified until otherwise approved by the NYSDEC project manager.

All interim monitoring/inspections reports will include, at a minimum:

- Date of event or reporting period;
- Name, company, and position of person(s) conducting monitoring/inspection activities;
- Description of the activities performed;
- Where appropriate, color photographs or sketches showing the approximate location of any problems or incidents noted (included either on the checklist/form or on an attached sheet);
- Type of samples collected (e.g., sub-slab vapor, indoor air, outdoor air);

- Copies of all field forms completed (e.g., well sampling logs, chain-of-custody documentation);
- Sampling results in comparison to appropriate standards/criteria;
- A figure illustrating sample type and sampling locations;
- Copies of all laboratory data sheets and the required laboratory data deliverables required for all points sampled (to be submitted electronically in the NYSDEC-identified format);
- Any observations, conclusions, or recommendations; and
- A determination as to whether contaminant conditions have changed since the last reporting event.

Routine maintenance event reporting forms will include, at a minimum:

- Date of event;
- Name, company, and position of person(s) conducting maintenance activities;
- Description of maintenance activities performed;
- Any modifications to the system;
- Where appropriate, color photographs or sketches showing the approximate location of any problems or incidents noted (included either on the checklist/form or on an attached sheet); and
- Other documentation such as copies of invoices for maintenance work, receipts for replacement equipment, etc., (attached to the checklist/form).

Non-routine maintenance event reporting forms will include, at a minimum:

- Date of event;
- Name, company, and position of person(s) conducting non-routine maintenance/repair activities;
- Description of non-routine activities performed;

- Where appropriate, color photographs or sketches showing the approximate location of any problems or incidents (included either on the form or on an attached sheet); and
- Other documentation such as copies of invoices for repair work, receipts for replacement equipment, etc. (attached to the checklist/form).

Data will be reported in digital format as determined by the NYSDEC. Currently, data is to be supplied electronically and submitted to the NYSDEC EQuIS™ database in accordance with the requirements found at the link below.

http://www.dec.ny.gov/chemical/62440.html.

7.2 Periodic Review Report

A Periodic Review Report (PRR) will be submitted to the NYSDEC project manager beginning 16 months after the Certificate of Completion is issued. After submittal of the initial Periodic Review Report, the next PRR shall be submitted anually to the NYSDEC project manager or at another frequency as may be required by the NYSDEC project manager. In the event that the site is subdivided into separate parcels with different ownership, a single Periodic Review Report will be prepared that addresses the site described in the Environmental Easement. The PRR will be prepared in accordance with NYSDEC's DER-10 and submitted within 30 days of the end of each certification period. Media sampling results will also be incorporated into the PRR. The report will include:

- Identification, assessment and certification of all ECs/ICs required by the remedy for the site.
- Results of the required annual site inspections, fire inspections and severe condition inspections, if applicable.
- Description of any change of use, import of materials, or excavation that occurred during the certifying period.
- All applicable site management forms and other records generated for the site during the reporting period in the NYSDEC-approved electronic format, if not previously submitted.

- Identification of any wastes generated during the reporting period, along with waste characterization data, manifests, and disposal documentation.

- A summary of any discharge monitoring data and/or information generated during the reporting period, with comments and conclusions.

- Data summary tables and graphical representations of contaminants of concern by media (groundwater, soil vapor, etc.), which include a listing of all compounds analyzed, along with the applicable standards, with all exceedances highlighted. These tables and figures will include a presentation of past data as part of an evaluation of contaminant concentration trends, including but not limited to:
  - Trend monitoring graphs that present groundwater contaminant levels from before the start of the remedy implementation to the most current sampling data;
  - Trend monitoring graphs depicting system influent analytical data on a per event and cumulative basis;
  - O&M data summary tables;
  - A current plume map for sites with remaining groundwater contamination; and
  - A groundwater elevation contour map for each gauging event.

- Results of all analyses, copies of all laboratory data sheets, and the required laboratory data deliverables for all samples collected during the reporting period will be submitted in digital format as determined by the NYSDEC. Currently, data is supplied electronically and submitted to the NYSDEC EQuIS^{TM} database in accordance with the requirements found at the link below.

  http://www.dec.ny.gov/chemical/62440.html.

- A site evaluation, which includes the following:
  - The compliance of the remedy with the requirements of the site-specific Remedial Action Work Plan (RAWP), ROD or Decision Document;
  - The operation and the effectiveness of all treatment units, etc., including identification of any needed repairs or modifications;

- Any new conclusions or observations regarding site contamination based on inspections or data generated by the Monitoring and Sampling Plan for the media being monitored;
- Recommendations regarding any necessary changes to the remedy and/or Monitoring and Sampling Plan;
- An evaluation of trends in contaminant levels in the affected media to determine if the remedy continues to be effective in achieving remedial goals as specified by the RAWP, ROD or Decision Document; and
- The overall performance and effectiveness of the remedy.

7.2.1 Certification of Institutional and Engineering Controls

Following the last inspection of the reporting period, a Professional Engineer licensed to practice and registered in New York State will prepare, and include in the Periodic Review Report, the following certification as per the requirements of NYSDEC DER-10:

"For each institutional or engineering control identified for the site, I certify that all of the following statements are true:

- *The inspection of the site to confirm the effectiveness of the institutional and engineering controls required by the remedial program was performed under my direction;*
- *The institutional control and/or engineering control employed at this site is unchanged from the date the control was put in place, or last approved by the Department;*
- *Nothing has occurred that would impair the ability of the control to protect the public health and environment;*
- *Nothing has occurred that would constitute a violation or failure to comply with any site management plan for this control;*
- *Access to the site will continue to be provided to the Department to evaluate the remedy, including access to evaluate the continued maintenance of this control;*

- *If a financial assurance mechanism is required under the oversight document for the site, the mechanism remains valid and sufficient for the intended purpose under the document;*
- *Use of the site is compliant with the environmental easement;*
- *The engineering control systems are performing as designed and are effective;*
- *To the best of my knowledge and belief, the work and conclusions described in this certification are in accordance with the requirements of the site remedial program and generally accepted engineering practices; and*
- *The information presented in this report is accurate and complete.*

I certify that all information and statements in this certification form are true. I understand that a false statement made herein is punishable as a Class "A" misdemeanor, pursuant to Section 210.45 of the Penal Law. I, PHILLIP G. CLARK P.E. , of HCS Civil & Environmental Engineering, LLC, am certifying as Owner's/Remedial Party's Designated Site Representative for the site."

"I certify that the New York State Education Department has granted a Certificate of Authorization to provide Professional Engineering services to the firm that prepared this Periodic Review Report."

- *No new information has come to my attention, including groundwater monitoring data from wells located at the site boundary, if any, to indicate that the assumptions made in the qualitative exposure assessment of off-site contamination are no longer valid; and*
- *The assumptions made in the qualitative exposure assessment remain valid.*

The signed certification will be included in the Periodic Review Report.

The Periodic Review Report will be submitted, in electronic format, to the NYSDEC project manager and the NYSDOH project manager. The Periodic Review Report may also need to be submitted in hard-copy format if requested by the NYSDEC project manager.

7.3 Corrective Measures Work Plan

If any component of the remedy is found to have failed, or if the periodic certification cannot be provided due to the failure of an institutional or engineering control or failure to conduct site management activities, a Corrective Measures Work Plan will be submitted to the NYSDEC project manager for approval. This plan will explain the failure and provide the details and schedule for performing work necessary to correct the failure. Unless an emergency condition exists, no work will be performed pursuant to the Corrective Measures Work Plan until it has been approved by the NYSDEC project manager.

7.4 Remedial System Optimization Report

If an RSO is to be performed (see Section 6.3), upon completion of an RSO, an RSO report must be submitted to the NYSDEC project manager for approval. A general outline for the RSO report is provided in Appendix M. The RSO report will document the research/ investigation and data gathering that was conducted, evaluate the results and facts obtained, present a revised conceptual site model and present recommendations. RSO recommendations are to be implemented upon approval from the NYSDEC. Additional work plans, design documents, HASPs etc., may still be required to implement the recommendations, based upon the actions that need to be taken. A final engineering report and update to the SMP may also be required.

The RSO report will be submitted, in electronic format, to the NYSDEC project manager and the NYSDOH project manager.

8.0 REFERENCES

6 NYCRR Part 375, Environmental Remediation Programs. December 14, 2006.

NYSDEC DER-10 – "Technical Guidance for Site Investigation and Remediation".

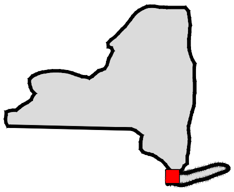
NYSDEC, 1998. Ambient Water Quality Standards and Guidance Values and Groundwater Effluent Limitations Division of Water Technical and Operational Guidance Series (TOGS) 1.1.1. June 1998 (April 2000 addendum).

Remedial Action Work Plan, M4778 Broadway LLC, NYSDEC BCP Number C231131, 4778 Broadway, New York, New York, prepared by AEI Consultants and HCS Civil & Environmental Engineering, LLC, dated April 2021.

Remedial Investigation Report, M4778 Broadway LLC, NYSDEC BCP Number C231131, NYSDEC Spill #1700751, 4778 Broadway, New York, New York, prepared by AEI Consultants, dated December 2020.

FIGURES

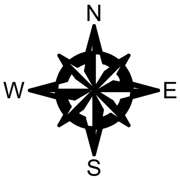
NEW YORK



QUADRANGLE LOCATION

SOURCE:

USGS TOPOGRAPHIC MAPS: CENTRAL PARK, NY, NJ (2023). CONTOUR INTERVAL 10FT., NAVD-1988, ORIGINAL SCALE 1:24,000 (1IN.=2,000FT.).



4778 BROADWAY
NEW YORK, NY 10034

PREPARED BY:

GZAGeoEnvironmental of NY
Engineers and Scientists
www.gza.com

PREPARED FOR:

M4778 BROADWAY, LLC

SITE LOCATION MAP

PROJ MGR: ZL	REVIEWED BY: ZL	CHECKED BY: VW	FIGURE
DESIGNED BY: SG	DRAWN BY: SG	SCALE: 1"=2000'	1
DATE: FEBRUARY 2025	PROJECT NO. 41.0163310.10	REVISION NO. -	SHEET NO.

GZA-J:\Active 163300 to 163399\163310.10 – M44778 Broadway Remedial Closure Consulting\Drawings\GZA CAD\41.0163310.10 SMP.dwg [FIG 1 8.5x11] March 17, 2025 – 12:21pm Seila.Gupta

LEGEND

🟥 APPROXIMATE SITE BOUNDARY

GENERAL NOTES

1. AERIAL IMAGERY DEVELOPED FROM © 2025 MICROSOFT CORPORATION © 2025 MAXAR © CNES (2025) DISTRIBUTION AIRBUS

NO.	ISSUE/DESCRIPTION	BY	DATE

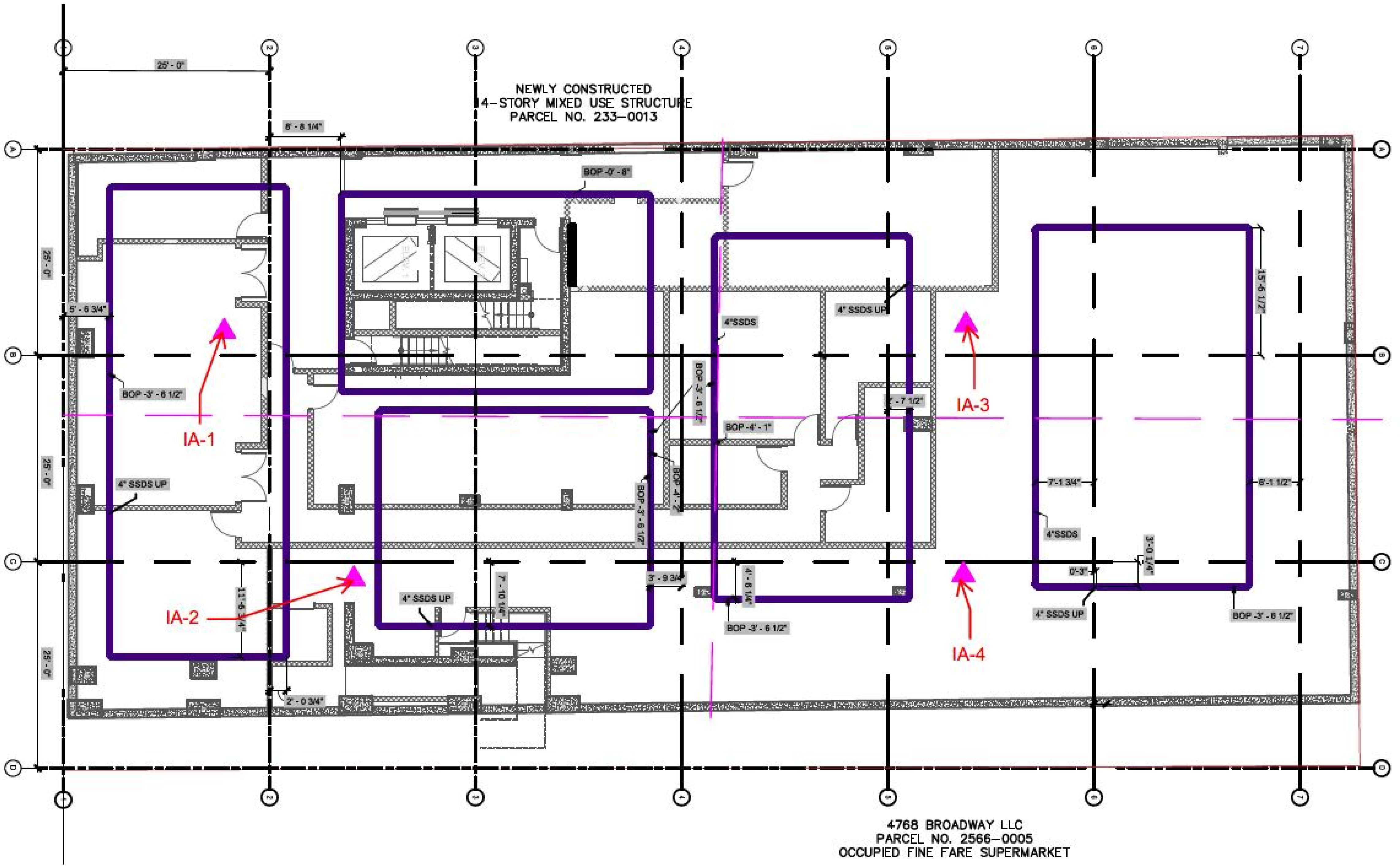
4778 BROADWAY
NEW YORK, NY 10034

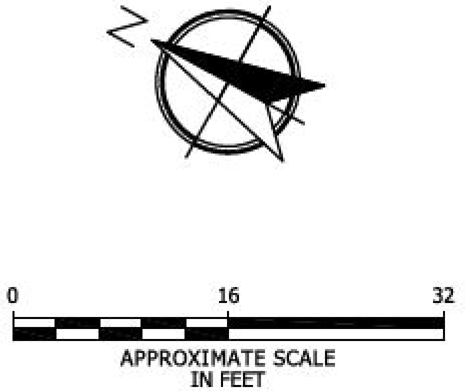
PREPARED BY:
GZAGeoEnvironmental of NY
Engineers and Scientists
www.gza.com

PREPARED FOR:
M4778 BROADWAY, LLC

SITE AERIAL MAP

PROJ MGR: ZL	REVIEWED BY: ZL	CHECKED BY: VW	FIGURE
DESIGNED BY: LWC	DRAWN BY: LWC	SCALE: 1"=30'	2
DATE: FEBRUARY 2025	PROJECT NO. 41.0163310.10	REVISION NO. -	SHEET NO.





LEGEND:

🟥	Boundary Line
🟪	SSDS Piping/Fixtures
🟪	Air Sampling Quadrant Lines
▲	Proposed Confirmatory Indoor/Ambient Air Sampling Locations

NOTES:

1. Map is based on Plumbing Underground figure prepared by Aufgang Architects, AvCon Engineering PC, and GDI Construction (P099) dated February 7, 2023. See full figure for details.
2. All measurements are in feet.
3. SSDS - Sub-Slab Depressurization System
   BOP - Bottom of Pipe

NO.	ISSUE/DESCRIPTION	BY	DATE

4778 Broadway
Manhattan, New York

Indoor Air Sampling Locations

PREPARED BY:
GZAGeoEnvironmental of NY
Engineers and Scientists
www.gza.com

PREPARED FOR:
M4778 Broadway LLC

PROJ MGR: ZL	REVIEWED BY: VW	CHECKED BY: VW	FIGURE 3
DESIGNED BY: JB	DRAWN BY: ZL	SCALE: 1"=15'	
DATE: June 2025	PROJECT NO. 41.0163310.10	REVISION NO. -	SHEET NO. 1 OF 1

TABLES

Table 5: Post Excavation Soil Sample Results Summary
4778 Broadway, NY, NY
BCP Number: C231131

SAMPLE LOCATION					C1-SW-S	C2-SW-E	C2-SW-S	A5-PB	A6-PB	A6-SW-E	A6-SW-N	B5-PB	B6-PB	B6-SW-E	C5-PB	C5-SW-S	C6-PB	C6-SW-E	C6-SW-S	A4-PB	B4-PB	C4-SW-S
SAMPLING DATE					1/5/2023	1/5/2023	1/5/2023	1/16/2023	1/16/2023	1/16/2023	1/16/2023	1/16/2023	1/16/2023	1/16/2023	1/18/2023	1/18/2023	1/18/2023	1/18/2023	1/18/2023	2/2/2023	2/2/2023	2/2/2023
SAMPLE DEPTH (ft.)					14.5.15.0	14.5.15.0	14.5.15.0	15.0-15.5	15.0-15.5	14.5.15.0	14.5.15.0	15.0-15.5	15.0-15.5	14.5.15.0	15.0-15.5	14.5.15.0	15.0-15.5	14.5.15.0	14.5.15.0	15.0-15.5	15.0-15.5	14.5.15.0
	NYUUSCO	NYPGWSCO	NYRRSCO	Units	Results	Results	Results	Results	Results	Results	Results	Results	Results	Results	Results	Results	Results	Results	Results	Results	Results	Results
Semivolatile Organics by GC/MS																						
1,2,4,5-Tetrachlorobenzene				mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,2,4-Trichlorobenzene				mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,2-Dichlorobenzene	1.1	1.1	100	mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,3-Dichlorobenzene	2.4	2.4	49	mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,4-Dichlorobenzene	1.8	1.8	13	mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,4-Dioxane	0.1	0.1	13	mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
2,4,5-Trichlorophenol				mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
2,4,6-Trichlorophenol				mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
2,4-Dichlorophenol				mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
2,4-Dimethylphenol				mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
2,4-Dinitrophenol				mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
2,4-Dinitrotoluene				mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
2,6-Dinitrotoluene				mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
2-Chloronaphthalene				mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
2-Chlorophenol				mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
2-Methylnaphthalene				mg/kg	1.9	2.1	0.75	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.14 (J)
2-Methylphenol	0.33	0.33	100	mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
2-Nitroaniline				mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
2-Nitrophenol				mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
3,3'-Dichlorobenzidine				mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
3-Methylphenol/4-Methylphenol	0.33	0.33	100	mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
3-Nitroaniline				mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
4,6-Dinitro-o-cresol				mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
4-Bromophenyl phenyl ether				mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
4-Chloroaniline				mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
4-Chlorophenyl phenyl ether				mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
4-Nitroaniline				mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
4-Nitrophenol				mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Acenaphthene	20	98	100	mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Acenaphthylene	100	107	100	mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Acetophenone				mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Anthracene	100	1000	100	mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Benzo(a)anthracene	1	1	1	mg/kg	ND	ND	ND	0.038 (J)	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Benzo(a)pyrene	1	22	1	mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Benzo(b)fluoranthene	1	1.7	1	mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Benzo(ghi)perylene	100	1000	100	mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Benzo(k)fluoranthene	0.8	1.7	3.9	mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Benzoic Acid				mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Benzyl Alcohol				mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Biphenyl				mg/kg	ND	0.06 (J)	0.024 (J)	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Bis(2-chloroethoxy)methane				mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Bis(2-chloroethyl)ether				mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Bis(2-chloroisopropyl)ether				mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Bis(2-ethylhexyl)phthalate				mg/kg	ND	ND	ND	ND	ND	0.1 (J)	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Butyl benzyl phthalate				mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Carbazole				mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Chrysene	1	1	3.9	mg/kg	ND	ND	ND	0.083 (J)	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Di-n-butylphthalate				mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Di-n-octylphthalate				mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Dibenzo(a,h)anthracene	0.33	1000	0.33	mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Dibenzofuran		210	59	mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Diethyl phthalate				mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Dimethyl phthalate				mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Fluoranthene	100	1000	100	mg/kg	ND	ND	ND	0.028 (J)	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Fluorene	30	386	100	mg/kg	ND	0.032 (J)	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Hexachlorobenzene		3.2	1.2	mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Hexachlorobutadiene				mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Hexachlorocyclopentadiene				mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Hexachloroethane				mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Indeno(1,2,3-cd)pyrene	0.5	8.2	0.5	mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Isophorone				mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
n-Nitrosodi-n-propylamine				mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Naphthalene	12	12	100	mg/kg	1.4	0.57	0.1 (J)	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
NDPA/DPA				mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Nitrobenzene				mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
p-Chloro-m-cresol				mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Pentachlorophenol	0.8	0.8	6.7	mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Phenanthrene	100	1000	100	mg/kg	ND	0.05 (J)	ND	0.059 (J)	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Phenol	0.33	0.33	100	mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Pyrene	100	1000	100	mg/kg	ND	ND	ND	0.07 (J)	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND

Table 5: Post Excavation Soil Sample Results Summary
4778 Broadway, NY, NY
BCP Number: C231131

SAMPLE LOCATION					C1-SW-S	C2-SW-E	C2-SW-S	A5-PB	A6-PB	A6-SW-E	A6-SW-N	B5-PB	B6-PB	B6-SW-E	C5-PB	C5-SW-S	C6-PB	C6-SW-E	C6-SW-S	A4-PB	B4-PB	C4-SW-S
SAMPLING DATE					1/5/2023	1/5/2023	1/5/2023	1/16/2023	1/16/2023	1/16/2023	1/16/2023	1/16/2023	1/16/2023	1/16/2023	1/18/2023	1/18/2023	1/18/2023	1/18/2023	1/18/2023	2/2/2023	2/2/2023	2/2/2023
SAMPLE DEPTH (ft.)					14.5.15.0	14.5.15.0	14.5.15.0	15.0-15.5	15.0-15.5	14.5.15.0	14.5.15.0	15.0-15.5	15.0-15.5	14.5.15.0	15.0-15.5	14.5.15.0	15.0-15.5	14.5.15.0	14.5.15.0	15.0-15.5	15.0-15.5	14.5.15.0
	NYUUSCO	NYPGWSCO	NYRRSCO	Units	Results	Results	Results	Results	Results	Results	Results	Results	Results	Results	Results	Results	Results	Results	Results	Results	Results	Results
Volatile Organics by EPA 5035																						
1,1,1,2-Tetrachloroethane				mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,1,1-Trichloroethane	0.68	0.68	100	mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,1,2,2-Tetrachloroethane				mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,1,2-Trichloroethane				mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,1-Dichloroethane	0.27	0.27	26	mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,1-Dichloroethene	0.33	0.33	100	mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,1-Dichloropropene				mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,2,3-Trichlorobenzene				mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,2,3-Trichloropropane				mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,2,4,5-Tetramethylbenzene				mg/kg	2.1	5.8	0.72	0.00048 (J)	ND	ND	ND	0.00094 (J)	ND	ND	0.026	0.00028 (J)	ND	0.00057 (J)	ND	ND	0.00034 (J)	0.63
1,2,4-Trichlorobenzene				mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,2,4-Trimethylbenzene	3.6	3.6	52	mg/kg	13	63	3.5	ND	ND	ND	ND	ND	ND	ND	0.0019	0.0018 (J)	ND	0.00087 (J)	ND	ND	ND	4.7
1,2-Dibromo-3-chloropropane				mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,2-Dibromoethane				mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,2-Dichlorobenzene	1.1	1.1	100	mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,2-Dichloroethane	0.02	0.02	3.1	mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,2-Dichloroethene, Total				mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,2-Dichloropropane				mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,3,5-Trimethylbenzene	8.4	8.4	52	mg/kg	4.9	17	0.97	0.00023 (J)	ND	ND	ND	0.00047 (J)	ND	ND	0.031	0.00058 (J)	ND	0.00095 (J)	ND	ND	0.00041 (J)	1.5
1,3-Dichlorobenzene	2.4	2.4	49	mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,3-Dichloropropane				mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,3-Dichloropropene, Total				mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,4-Dichlorobenzene	1.8	1.8	13	mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,4-Dioxane	0.1	0.1	13	mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
2,2-Dichloropropane				mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
2-Butanone	0.12	0.12	100	mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
2-Hexanone				mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
4-Methyl-2-pentanone				mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Acetone	0.05	0.05	100	mg/kg	ND	ND	ND	0.0084 (J)	ND	0.012	ND	0.014	0.007 (J)	ND	ND	ND	ND	ND	0.012	ND	ND	ND
Acrylonitrile				mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Benzene	0.06	0.06	4.8	mg/kg	0.034 (J)	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Bromobenzene				mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Bromochloromethane				mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Bromodichloromethane				mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Bromoform				mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Bromomethane				mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Carbon disulfide				mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Carbon tetrachloride	0.76	0.76	2.4	mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Chlorobenzene	1.1	1.1	100	mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Chloroethane				mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Chloroform	0.37	0.37	49	mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Chloromethane				mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
cis-1,2-Dichloroethene	0.25	0.25	100	mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
cis-1,3-Dichloropropene				mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Dibromochloromethane				mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Dibromomethane				mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Dichlorodifluoromethane				mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Ethyl ether				mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Ethylbenzene	1	1	41	mg/kg	3.5	13	0.2	0.00016 (J)	ND	0.00034 (J)	ND	0.00026 (J)	ND	0.0003 (J)	0.00016 (J)	0.00034 (J)	ND	ND	ND	ND	ND	0.98
Hexachlorobutadiene				mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Isopropylbenzene				mg/kg	0.56	2.7	0.14	ND	ND	ND	ND	ND	ND	ND	0.00021 (J)	ND	ND	ND	ND	ND	ND	0.13
Methyl tert butyl ether	0.93	0.93	100	mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Methylene chloride	0.05	0.05	100	mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
n-Butylbenzene	12	12	100	mg/kg	0.88	3.5	0.33	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.18
n-Propylbenzene	3.9	3.9	100	mg/kg	2.1	11	0.56	ND	ND	ND	ND	ND	ND	ND	0.00022 (J)	0.0002 (J)	ND	0.00018 (J)	ND	ND	ND	0.4
Naphthalene	12	12	100	mg/kg	1.9	2.6	0.18 (J)	ND	ND	ND	ND	0.0031 (J)	ND	ND	0.0018 (J)	0.00076 (J)	ND	ND	ND	ND	ND	0.46
o-Chlorotoluene				mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
o-Xylene				mg/kg	1.9	0.54	0.03 (J)	ND	ND	0.00044 (J)	ND	0.0022	ND	0.00044 (J)	0.012	0.00055 (J)	ND	ND	ND	ND	ND	1.7
p-Chlorotoluene				mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
p-Diethylbenzene				mg/kg	0.64	2.4	0.21	ND	ND	ND	ND	ND	ND	ND	0.0047	ND	ND	ND	ND	0.0002 (J)	0.00075 (J)	1.9
p-Ethyltoluene				mg/kg	11	56	2.1	ND	ND	ND	ND	0.00044 (J)	ND	ND	0.013	0.001 (J)	ND	0.0005 (J)	ND	ND	0.0004 (J)	3.2
p-Isopropyltoluene				mg/kg	0.28	0.74	0.099	ND	ND	ND	ND	ND	ND	ND	0.0024	ND	ND	0.0001 (J)	ND	ND	ND	0.07
p/m-Xylene				mg/kg	12	41	0.77	ND	ND	0.0014 (J)	ND	0.0011 (J)	ND	0.0013 (J)	0.0032	0.0016 (J)	ND	ND	ND	ND	ND	5.3
sec-Butylbenzene	11	11	100	mg/kg	0.34	1.5	0.16	ND	ND	ND	ND	ND	ND	ND	0.00058 (J)	ND	ND	0.00012 (J)	ND	ND	ND	0.083
Styrene				mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.0097 (J)
tert-Butylbenzene	5.9	5.9	100	mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.0002 (J)	ND	ND	ND	ND	ND	ND	ND
Tetrachloroethene	1.3	1.3	19	mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Toluene	0.7	0.7	100	mg/kg	0.075 (J)	0.24	ND	ND	0.0059	0.021	ND	ND	0.0013	0.036	ND	ND	ND	0.00048 (J)	0.00072 (J)	ND	ND	0.24
trans-1,2-Dichloroethene	0.19	0.19	100	mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
trans-1,3-Dichloropropene				mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
trans-1,4-Dichloro-2-butene				mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Trichloroethene	0.47	0.47	21	mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Trichlorofluoromethane				mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Vinyl acetate				mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Vinyl chloride	0.02	0.02	0.9	mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Xylenes, Total	0.26	1.6	100	mg/kg	14	42	0.8 (J)	ND	ND	0.0018 (J)	ND	0.0033 (J)	ND	0.0017 (J)	0.015	0.0022 (J)	ND	ND	ND	ND	ND	7

Notes and Acronyms:

mg/kg: Milligrams per kilogram

Table 5: Post Excavation Soil Sample Results Summary

4778 Broadway, NY, NY

BCP Number: C231131

SAMPLE LOCATION					C1-SW-S	C2-SW-E	C2-SW-S	A5-PB	A6-PB	A6-SW-E	A6-SW-N	B5-PB	B6-PB	B6-SW-E	C5-PB	C5-SW-S	C6-PB	C6-SW-E	C6-SW-S	A4-PB	B4-PB	C4-SW-S
SAMPLING DATE					1/5/2023	1/5/2023	1/5/2023	1/16/2023	1/16/2023	1/16/2023	1/16/2023	1/16/2023	1/16/2023	1/16/2023	1/18/2023	1/18/2023	1/18/2023	1/18/2023	1/18/2023	2/2/2023	2/2/2023	2/2/2023
SAMPLE DEPTH (ft.)					14.5.15.0	14.5.15.0	14.5.15.0	15.0-15.5	15.0-15.5	14.5.15.0	14.5.15.0	15.0-15.5	15.0-15.5	14.5.15.0	15.0-15.5	14.5.15.0	15.0-15.5	14.5.15.0	14.5.15.0	15.0-15.5	15.0-15.5	14.5.15.0
	NYUUSCO	NYPGWSCO	NYRRSCO	Units	Results	Results	Results	Results	Results	Results	Results	Results	Results	Results	Results	Results	Results	Results	Results	Results	Results	Results

ND: Non-Detect

J: Estimated value

NYUUSCO: New York Restricted Unrestricted Use Soil Cleanup Objectives

NYPGWSCO: New York NYCRR Part 375 Protection of Groundater Soil Cleanup Objectives

NYRRSCO: New York Restricted Residential Use Soil Cleanup Objectives

Highlight: exceeds one or more respective criteria

Table 5: Post Excavation Soil Sample Results Summary
4778 Broadway, NY, NY
BCP Number: C231131

SAMPLE LOCATION					C4-PB	A3-PB	B3-PB	C3-PB	C3-SW-S	A1-PB	A1-SW-W	A2-PB	B1-PB	B1-SW-W	B2-PB	C2-PB	C1-PB	C1-SW-W	C3-PB-S	C3-SW-S	C4-PB-S
SAMPLING DATE					**2/2/2023**	**2/27/2023**	**2/27/2023**	**2/27/2023**	**2/27/2023**	**3/2/2023**	**3/2/2023**	**3/2/2023**	**3/2/2023**	**3/2/2023**	**3/2/2023**	**3/2/2023**	**3/6/2023**	**3/6/2023**	**4/3/2023**	**4/3/2023**	**4/3/2023**
SAMPLE DEPTH (ft.)					**15.0-15.5**	**15.0-15.5**	**15.0-15.5**	**15.0-15.5**	**14.5.15.0**	**15.0-15.5**	**14.5.15.0**	**15.0-15.5**	**15.0-15.5**	**14.5.15.0**	**15.0-15.5**	**15.0-15.5**	**15.0-15.5**	**14.5.15.0**	**6.0-6.5**	**10.0-10.5**	**6.0-6.5**
	NYUUSCO	**NYPGWSCO**	**NYRRSCO**	**Units**	**Results**	**Results**	**Results**	**Results**	**Results**	**Results**	**Results**	**Results**	**Results**	**Results**	**Results**	**Results**	**Results**	**Results**	**Results**	**Results**	**Results**
Semivolatile Organics by GC/MS																					
1,2,4,5-Tetrachlorobenzene				mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,2,4-Trichlorobenzene				mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,2-Dichlorobenzene	1.1	1.1	100	mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,3-Dichlorobenzene	2.4	2.4	49	mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,4-Dichlorobenzene	1.8	1.8	13	mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,4-Dioxane	0.1	0.1	13	mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
2,4,5-Trichlorophenol				mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
2,4,6-Trichlorophenol				mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
2,4-Dichlorophenol				mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
2,4-Dimethylphenol				mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
2,4-Dinitrophenol				mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
2,4-Dinitrotoluene				mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
2,6-Dinitrotoluene				mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
2-Chloronaphthalene				mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
2-Chlorophenol				mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
2-Methylnaphthalene				mg/kg	ND	0.17 (J)	ND	ND	ND	ND	ND	ND	0.84	ND	ND	0.82	3.8	3.6	ND	ND	0.04 (J)
2-Methylphenol	0.33	0.33	100	mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
2-Nitroaniline				mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
2-Nitrophenol				mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
3,3'-Dichlorobenzidine				mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
3-Methylphenol/4-Methylphenol	0.33	0.33	100	mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
3-Nitroaniline				mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
4,6-Dinitro-o-cresol				mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
4-Bromophenyl phenyl ether				mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
4-Chloroaniline				mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
4-Chlorophenyl phenyl ether				mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
4-Nitroaniline				mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
4-Nitrophenol				mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Acenaphthene	20	98	100	mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.03 (J)	ND	0.16
Acenaphthylene	100	107	100	mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Acetophenone				mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Anthracene	100	1000	100	mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.074 (J)	ND	0.33
Benzo(a)anthracene	1	1	1	mg/kg	ND	ND	0.027 (J)	0.026 (J)	ND	ND	ND	0.035 J	ND	ND	ND	ND	ND	ND	0.17	0.055 (J)	0.62
Benzo(a)pyrene	1	22	1	mg/kg	ND	0.038 (J)	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.15 (J)	0.047 (J)	0.48
Benzo(b)fluoranthene	1	1.7	1	mg/kg	ND	ND	ND	ND	ND	ND	ND	0.041 J	ND	ND	ND	ND	ND	ND	0.18	0.058 (J)	0.58
Benzo(ghi)perylene	100	1000	100	mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.098 (J)	0.037 (J)	0.29
Benzo(k)fluoranthene	0.8	1.7	3.9	mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.069 (J)	ND	0.21
Benzoic Acid				mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.26 (J)	0.24 (J)	0.24 (J)
Benzyl Alcohol				mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Biphenyl				mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.074 J	0.072 J	ND	ND	ND
Bis(2-chloroethoxy)methane				mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Bis(2-chloroethyl)ether				mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Bis(2-chloroisopropyl)ether				mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Bis(2-ethylhexyl)phthalate				mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Butyl benzyl phthalate				mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.25	ND
Carbazole				mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.031 (J)	ND	0.12 (J)
Chrysene	1	1	3.9	mg/kg	ND	0.039 (J)	0.028 (J)	0.024 (J)	ND	ND	ND	0.033 J	ND	ND	ND	ND	ND	ND	0.17	0.051 (J)	0.57
Di-n-butylphthalate				mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Di-n-octylphthalate				mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Dibenzo(a,h)anthracene	0.33	1000	0.33	mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.023 (J)	ND	0.071 (J)
Dibenzofuran		210	59	mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.085 (J)
Diethyl phthalate				mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Dimethyl phthalate				mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Fluoranthene	100	1000	100	mg/kg	ND	0.048 (J)	ND	ND	ND	ND	ND	0.081 J	ND	ND	ND	ND	ND	ND	0.36	0.096 (J)	1.3
Fluorene	30	386	100	mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.033 J	0.033 J	0.031 (J)	ND	0.15 (J)
Hexachlorobenzene		3.2	1.2	mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Hexachlorobutadiene				mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Hexachlorocyclopentadiene				mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Hexachloroethane				mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Indeno(1,2,3-cd)pyrene	0.5	8.2	0.5	mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.1 (J)	0.035 (J)	0.33
Isophorone				mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
n-Nitrosodi-n-propylamine				mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Naphthalene	12	12	100	mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	0.8	ND	ND	0.58	4.3	4	ND	ND	0.049 (J)
NDPA/DPA				mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Nitrobenzene				mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
p-Chloro-m-cresol				mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Pentachlorophenol	0.8	0.8	6.7	mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Phenanthrene	100	1000	100	mg/kg	ND	ND	ND	ND	ND	ND	ND	0.048 J	ND	ND	ND	ND	0.035 J	0.035 J	0.29	0.071 (J)	1.3
Phenol	0.33	0.33	100	mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Pyrene	100	1000	100	mg/kg	ND	0.059 J	0.028 J	0.026 J	ND	ND	ND	0.066 J	ND	ND	ND	ND	ND	ND	0.31	0.084 (J)	1.1

Table 5: Post Excavation Soil Sample Results Summary

4778 Broadway, NY, NY

BCP Number: C231131

SAMPLE LOCATION					C4-PB	A3-PB	B3-PB	C3-PB	C3-SW-S	A1-PB	A1-SW-W	A2-PB	B1-PB	B1-SW-W	B2-PB	C2-PB	C1-PB	C1-SW-W	C3-PB-S	C3-SW-S	C4-PB-S
SAMPLING DATE					2/2/2023	2/27/2023	2/27/2023	2/27/2023	2/27/2023	3/2/2023	3/2/2023	3/2/2023	3/2/2023	3/2/2023	3/2/2023	3/2/2023	3/6/2023	3/6/2023	4/3/2023	4/3/2023	4/3/2023
SAMPLE DEPTH (ft.)					15.0-15.5	15.0-15.5	15.0-15.5	15.0-15.5	14.5.15.0	15.0-15.5	14.5.15.0	15.0-15.5	15.0-15.5	14.5.15.0	15.0-15.5	15.0-15.5	15.0-15.5	14.5.15.0	6.0-6.5	10.0-10.5	6.0-6.5
	NYUUSCO	NYPGWSCO	NYRRSCO	Units	Results	Results	Results	Results	Results	Results	Results	Results	Results	Results	Results	Results	Results	Results	Results	Results	Results
Volatile Organics by EPA 5035																					
1,1,1,2-Tetrachloroethane				mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,1,1-Trichloroethane	0.68	0.68	100	mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,1,2,2-Tetrachloroethane				mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,1,2-Trichloroethane				mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,1-Dichloroethane	0.27	0.27	26	mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,1-Dichloroethene	0.33	0.33	100	mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,1-Dichloropropene				mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,2,3-Trichlorobenzene				mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,2,3-Trichloropropane				mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,2,4,5-Tetramethylbenzene				mg/kg	0.44	0.78	ND	ND	ND	0.00091 J	0.011	0.0085	0.65	0.19	0.003	2.3	5.7	11	ND	ND	ND
1,2,4-Trichlorobenzene				mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,2,4-Trimethylbenzene	3.6	3.6	52	mg/kg	3.6	3.9	ND	ND	ND	0.0021	0.33	0.044	2.4	2.1	ND	15	67	120	ND	ND	ND
1,2-Dibromo-3-chloropropane				mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,2-Dibromoethane				mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,2-Dichlorobenzene	1.1	1.1	100	mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,2-Dichloroethane	0.02	0.02	3.1	mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,2-Dichloroethene, Total				mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,2-Dichloropropane				mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,3,5-Trimethylbenzene	8.4	8.4	52	mg/kg	1.2	1.4	ND	ND	ND	0.0024	0.068	0.0064	0.88	0.66	0.0021	6.1	21	32	ND	ND	ND
1,3-Dichlorobenzene	2.4	2.4	49	mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,3-Dichloropropane				mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,3-Dichloropropene, Total				mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,4-Dichlorobenzene	1.8	1.8	13	mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,4-Dioxane	0.1	0.1	13	mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
2,2-Dichloropropane				mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
2-Butanone	0.12	0.12	100	mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.014	ND	ND	ND	ND	ND	0.015
2-Hexanone				mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
4-Methyl-2-pentanone				mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Acetone	0.05	0.05	100	mg/kg	ND	ND	0.026	0.0074 J	ND	0.0061 J	0.0076 J	0.051	ND	ND	0.046	ND	ND	ND	ND	ND	0.041
Acrylonitrile				mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Benzene	0.06	0.06	4.8	mg/kg	ND	0.039	ND	ND	ND	0.00026 J	0.0023	0.0062	ND	0.011 J	ND	0.27	1.6	2.4	ND	ND	ND
Bromobenzene				mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Bromochloromethane				mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Bromodichloromethane				mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Bromoform				mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Bromomethane				mg/kg	ND	0.055 J	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Carbon disulfide				mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Carbon tetrachloride	0.76	0.76	2.4	mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Chlorobenzene	1.1	1.1	100	mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Chloroethane				mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Chloroform	0.37	0.37	49	mg/kg	ND	ND	ND	ND	ND	0.00028 J	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Chloromethane				mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
cis-1,2-Dichloroethene	0.25	0.25	100	mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
cis-1,3-Dichloropropene				mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Dibromochloromethane				mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Dibromomethane				mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Dichlorodifluoromethane				mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Ethyl ether				mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Ethylbenzene	1	1	41	mg/kg	1	1.5	ND	ND	ND	0.0011	0.31	0.15	0.89	0.72	0.00027	6	48	68	ND	ND	ND
Hexachlorobutadiene				mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Isopropylbenzene				mg/kg	0.13	0.14	ND	ND	ND	0.00012 J	0.029	0.025	0.24	0.099	ND	1.3	3.2	4.2	ND	ND	ND
Methyl tert butyl ether	0.93	0.93	100	mg/kg	ND	ND	ND	ND	ND	ND	ND	0.00042 J	ND	ND	ND	ND	ND	ND	ND	ND	ND
Methylene chloride	0.05	0.05	100	mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
n-Butylbenzene	12	12	100	mg/kg	0.2	0.17	ND	ND	ND	ND	0.0031	0.0021	0.37	0.11	ND	1.6	3.3	4.3	ND	ND	ND
n-Propylbenzene	3.9	3.9	100	mg/kg	0.43	0.41	ND	ND	ND	0.00032 J	0.056	0.035	0.84	0.39	ND	3.8	11	14	ND	ND	ND
Naphthalene	12	12	100	mg/kg	0.36	0.52	ND	ND	ND	ND	0.079	0.0011 J	0.72	0.27	ND	2.8	9.3	18	ND	ND	ND
o-Chlorotoluene				mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
o-Xylene				mg/kg	1.8	2.8	ND	ND	ND	0.0028	0.0081	0.016	0.2	0.56	0.00077 J	4.1	61	96	ND	ND	ND
p-Chlorotoluene				mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
p-Diethylbenzene				mg/kg	1.4	2.2	ND	ND	0.00036 J	ND	0.0028	0.0043	0.3	0.062 J	0.0059	0.65	1.8		ND	ND	0.00026 (J)
p-Ethyltoluene				mg/kg	2.6	3.4	ND	ND	ND	0.0036	0.088	0.066	1.7	1.8	0.001 J	15	56	90	ND	ND	ND
p-Isopropyltoluene				mg/kg	0.056 (J)	0.082	ND	ND	ND	0.00011 J	0.0026	0.0017	0.26	0.026 J	0.00019 J	0.63	0.7	1.1	ND	ND	ND
p/m-Xylene				mg/kg	5.4	7.2	ND	ND	ND	0.004	0.31	0.1	1.4	2.5	0.0005 J	20	200	320	ND	ND	ND
sec-Butylbenzene	11	11	100	mg/kg	0.074	0.08	ND	ND	ND	ND	0.0031	0.0029	0.17	0.046 J	ND	0.71	1.2	1.7	ND	ND	ND
Styrene				mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.13 J	0.19 J	ND	ND	ND
tert-Butylbenzene	5.9	5.9	100	mg/kg	ND	ND	ND	ND	ND	ND	0.00039 J	0.00034 J	0.014 J	ND	ND	0.043 J	0.041 J	ND	ND	ND	ND
Tetrachloroethene	1.3	1.3	19	mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Toluene	0.7	0.7	100	mg/kg	0.33	2.1	ND	ND	ND	0.0025	0.019	0.0028	0.036 J	ND	ND	2.7	61	95	ND	ND	ND
trans-1,2-Dichloroethene	0.19	0.19	100	mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
trans-1,3-Dichloropropene				mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
trans-1,4-Dichloro-2-butene				mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Trichloroethene	0.47	0.47	21	mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Trichlorofluoromethane				mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Vinyl acetate				mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Vinyl chloride	0.02	0.02	0.9	mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Xylenes, Total	0.26	1.6	100	mg/kg	7.2	10	ND	ND	ND	0.0068	0.32	0.12	1.6	3.1	0.0013 J	24	260	420	ND	ND	ND

Notes and Acronyms:

mg/kg: Milligrams per kilogram

Table 5: Post Excavation Soil Sample Results Summary
4778 Broadway, NY, NY
BCP Number: C231131

SAMPLE LOCATION					C4-PB	A3-PB	B3-PB	C3-PB	C3-SW-S	A1-PB	A1-SW-W	A2-PB	B1-PB	B1-SW-W	B2-PB	C2-PB	C1-PB	C1-SW-W	C3-PB-S	C3-SW-S	C4-PB-S
SAMPLING DATE					2/2/2023	2/27/2023	2/27/2023	2/27/2023	2/27/2023	3/2/2023	3/2/2023	3/2/2023	3/2/2023	3/2/2023	3/2/2023	3/2/2023	3/6/2023	3/6/2023	4/3/2023	4/3/2023	4/3/2023
SAMPLE DEPTH (ft.)					15.0-15.5	15.0-15.5	15.0-15.5	15.0-15.5	14.5.15.0	15.0-15.5	14.5.15.0	15.0-15.5	15.0-15.5	14.5.15.0	15.0-15.5	15.0-15.5	15.0-15.5	14.5.15.0	6.0-6.5	10.0-10.5	6.0-6.5
	NYUUSCO	NYPGWSCO	NYRRSCO	Units	Results	Results	Results	Results	Results	Results	Results	Results	Results	Results	Results	Results	Results	Results	Results	Results	Results

ND: Non-Detect

J: Estimated value

NYUUSCO: New York Restricted Unrestricted Use Soil Cleanup Objectives

NYPGWSCO: New York NYCRR Part 375 Protection of Groundater Soil Cleanup Objectives

NYRRSCO: New York Restricted Residential Use Soil Cleanup Objectives

Highlight: exceeds one or more respective criteria

Table 5: Post Excavation Soil Sample Results Summary
4778 Broadway, NY, NY
BCP Number: C231131

SAMPLE LOCATION					C4-SW-S	C5-PB-S	C5-SW-S	C6-PB-S	C6-SW-S
SAMPLING DATE					4/3/2023	4/3/2023	4/3/2023	4/3/2023	4/3/2023
SAMPLE DEPTH (ft.)					10.0-10.5	6.0-6.5	10.0-10.5	6.0-6.5	10.0-10.5
	NYUUSCO	NYPGWSCO	NYRRSCO	Units	Results	Results	Results	Results	Results
Semivolatile Organics by GC/MS									
1,2,4,5-Tetrachlorobenzene				mg/kg	ND	ND	ND	ND	ND
1,2,4-Trichlorobenzene				mg/kg	ND	ND	ND	ND	ND
1,2-Dichlorobenzene	1.1	1.1	100	mg/kg	ND	ND	ND	ND	ND
1,3-Dichlorobenzene	2.4	2.4	49	mg/kg	ND	ND	ND	ND	ND
1,4-Dichlorobenzene	1.8	1.8	13	mg/kg	ND	ND	ND	ND	ND
1,4-Dioxane	0.1	0.1	13	mg/kg	ND	ND	ND	ND	ND
2,4,5-Trichlorophenol				mg/kg	ND	ND	ND	ND	ND
2,4,6-Trichlorophenol				mg/kg	ND	ND	ND	ND	ND
2,4-Dichlorophenol				mg/kg	ND	ND	ND	ND	ND
2,4-Dimethylphenol				mg/kg	ND	ND	ND	ND	ND
2,4-Dinitrophenol				mg/kg	ND	ND	ND	ND	ND
2,4-Dinitrotoluene				mg/kg	ND	ND	ND	ND	ND
2,6-Dinitrotoluene				mg/kg	ND	ND	ND	ND	ND
2-Chloronaphthalene				mg/kg	ND	ND	ND	ND	ND
2-Chlorophenol				mg/kg	ND	ND	ND	ND	ND
2-Methylnaphthalene				mg/kg	ND	ND	ND	ND	0.033 (J)
2-Methylphenol	0.33	0.33	100	mg/kg	ND	ND	ND	ND	ND
2-Nitroaniline				mg/kg	ND	ND	ND	ND	ND
2-Nitrophenol				mg/kg	ND	ND	ND	ND	ND
3,3'-Dichlorobenzidine				mg/kg	ND	ND	ND	ND	ND
3-Methylphenol/4-Methylphenol	0.33	0.33	100	mg/kg	ND	ND	ND	ND	ND
3-Nitroaniline				mg/kg	ND	ND	ND	ND	ND
4,6-Dinitro-o-cresol				mg/kg	ND	ND	ND	ND	ND
4-Bromophenyl phenyl ether				mg/kg	ND	ND	ND	ND	ND
4-Chloroaniline				mg/kg	ND	ND	ND	ND	ND
4-Chlorophenyl phenyl ether				mg/kg	ND	ND	ND	ND	ND
4-Nitroaniline				mg/kg	ND	ND	ND	ND	ND
4-Nitrophenol				mg/kg	ND	ND	ND	ND	ND
Acenaphthene	20	98	100	mg/kg	ND	0.045 (J)	ND	ND	0.052 (J)
Acenaphthylene	100	107	100	mg/kg	ND	ND	ND	ND	ND
Acetophenone				mg/kg	ND	ND	ND	ND	ND
Anthracene	100	1000	100	mg/kg	ND	0.12	ND	ND	0.096 (J)
Benzo(a)anthracene	1	1	1	mg/kg	0.056 (J)	0.31	0.093 (J)	0.094 (J)	0.22
Benzo(a)pyrene	1	22	1	mg/kg	0.055 (J)	0.24	0.085 (J)	0.078 (J)	0.2
Benzo(b)fluoranthene	1	1.7	1	mg/kg	0.063 (J)	0.3	0.1 (J)	0.1 (J)	0.23
Benzo(ghi)perylene	100	1000	100	mg/kg	0.036 (J)	0.16	0.06 (J)	0.054 (J)	0.13 (J)
Benzo(k)fluoranthene	0.8	1.7	3.9	mg/kg	ND	0.11 (J)	0.038 (J)	ND	0.089 (J)
Benzoic Acid				mg/kg	ND	0.24 (J)	0.23 (J)	0.24 (J)	ND
Benzyl Alcohol				mg/kg	ND	ND	ND	ND	ND
Biphenyl				mg/kg	ND	ND	ND	ND	ND
Bis(2-chloroethoxy)methane				mg/kg	ND	ND	ND	ND	ND
Bis(2-chloroethyl)ether				mg/kg	ND	ND	ND	ND	ND
Bis(2-chloroisopropyl)ether				mg/kg	ND	ND	ND	ND	ND
Bis(2-ethylhexyl)phthalate				mg/kg	ND	ND	0.1 (J)	ND	ND
Butyl benzyl phthalate				mg/kg	ND	ND	ND	ND	ND
Carbazole				mg/kg	ND	0.036 (J)	ND	ND	0.046 (J)
Chrysene	1	1	3.9	mg/kg	0.052 (J)	0.29	0.095 (J)	0.088 (J)	0.23
Di-n-butylphthalate				mg/kg	ND	ND	ND	ND	ND
Di-n-octylphthalate				mg/kg	ND	ND	ND	ND	ND
Dibenzo(a,h)anthracene	0.33	1000	0.33	mg/kg	ND	0.04 (J)	ND	ND	0.03 (J)
Dibenzofuran		210	59	mg/kg	ND	0.021 (J)	ND	ND	0.021 (J)
Diethyl phthalate				mg/kg	ND	ND	ND	ND	ND
Dimethyl phthalate				mg/kg	ND	ND	ND	ND	ND
Fluoranthene	100	1000	100	mg/kg	0.085 (J)	0.61	0.16	0.18	0.43
Fluorene	30	386	100	mg/kg	ND	0.046 (J)	ND	ND	0.039 (J)
Hexachlorobenzene		3.2	1.2	mg/kg	ND	ND	ND	ND	ND
Hexachlorobutadiene				mg/kg	ND	ND	ND	ND	ND
Hexachlorocyclopentadiene				mg/kg	ND	ND	ND	ND	ND
Hexachloroethane				mg/kg	ND	ND	ND	ND	ND
Indeno(1,2,3-cd)pyrene	0.5	8.2	0.5	mg/kg	0.036 (J)	0.17	0.061 (J)	0.056 (J)	0.13 (J)
Isophorone				mg/kg	ND	ND	ND	ND	ND
n-Nitrosodi-n-propylamine				mg/kg	ND	ND	ND	ND	ND
Naphthalene	12	12	100	mg/kg	ND	ND	ND	ND	0.047 (J)
NDPA/DPA				mg/kg	ND	ND	ND	ND	ND
Nitrobenzene				mg/kg	ND	ND	ND	ND	ND
p-Chloro-m-cresol				mg/kg	ND	ND	ND	ND	ND
Pentachlorophenol	0.8	0.8	6.7	mg/kg	ND	ND	ND	ND	ND
Phenanthrene	100	1000	100	mg/kg	0.039 (J)	0.49	0.1 (J)	0.11 (J)	0.44
Phenol	0.33	0.33	100	mg/kg	ND	ND	ND	ND	ND
Pyrene	100	1000	100	mg/kg	0.093 (J)	0.52	0.15	0.15	0.42

Table 5: Post Excavation Soil Sample Results Summary
4778 Broadway, NY, NY
BCP Number: C231131

SAMPLE LOCATION					**C4-SW-S**	**C5-PB-S**	**C5-SW-S**	**C6-PB-S**	**C6-SW-S**
SAMPLING DATE					**4/3/2023**	**4/3/2023**	**4/3/2023**	**4/3/2023**	**4/3/2023**
SAMPLE DEPTH (ft.)					**10.0-10.5**	**6.0-6.5**	**10.0-10.5**	**6.0-6.5**	**10.0-10.5**
	NYUUSCO	**NYPGWSCO**	**NYRRSCO**	**Units**	**Results**	**Results**	**Results**	**Results**	**Results**
Volatile Organics by EPA 5035									
1,1,1,2-Tetrachloroethane				mg/kg	ND	ND	ND	ND	ND
1,1,1-Trichloroethane	0.68	0.68	100	mg/kg	ND	ND	ND	ND	ND
1,1,2,2-Tetrachloroethane				mg/kg	ND	ND	ND	ND	ND
1,1,2-Trichloroethane				mg/kg	ND	ND	ND	ND	ND
1,1-Dichloroethane	0.27	0.27	26	mg/kg	ND	ND	ND	ND	ND
1,1-Dichloroethene	0.33	0.33	100	mg/kg	ND	ND	ND	ND	ND
1,1-Dichloropropene				mg/kg	ND	ND	ND	ND	ND
1,2,3-Trichlorobenzene				mg/kg	ND	ND	ND	ND	ND
1,2,3-Trichloropropane				mg/kg	ND	ND	ND	ND	ND
1,2,4,5-Tetramethylbenzene				mg/kg	ND	ND	ND	ND	ND
1,2,4-Trichlorobenzene				mg/kg	ND	ND	ND	ND	ND
1,2,4-Trimethylbenzene	3.6	3.6	52	mg/kg	ND	ND	ND	ND	ND
1,2-Dibromo-3-chloropropane				mg/kg	ND	ND	ND	ND	ND
1,2-Dibromoethane				mg/kg	ND	ND	ND	ND	ND
1,2-Dichlorobenzene	1.1	1.1	100	mg/kg	ND	ND	ND	ND	ND
1,2-Dichloroethane	0.02	0.02	3.1	mg/kg	ND	ND	ND	ND	ND
1,2-Dichloroethene, Total				mg/kg	ND	ND	ND	ND	ND
1,2-Dichloropropane				mg/kg	ND	ND	ND	ND	ND
1,3,5-Trimethylbenzene	8.4	8.4	52	mg/kg	ND	ND	ND	ND	ND
1,3-Dichlorobenzene	2.4	2.4	49	mg/kg	ND	ND	ND	ND	ND
1,3-Dichloropropane				mg/kg	ND	ND	ND	ND	ND
1,3-Dichloropropene, Total				mg/kg	ND	ND	ND	ND	ND
1,4-Dichlorobenzene	1.8	1.8	13	mg/kg	ND	ND	ND	ND	ND
1,4-Dioxane	0.1	0.1	13	mg/kg	ND	ND	ND	ND	ND
2,2-Dichloropropane				mg/kg	ND	ND	ND	ND	ND
2-Butanone	0.12	0.12	100	mg/kg	ND	ND	ND	ND	ND
2-Hexanone				mg/kg	ND	ND	ND	ND	ND
4-Methyl-2-pentanone				mg/kg	ND	ND	ND	ND	ND
Acetone	0.05	0.05	100	mg/kg	ND	ND	ND	ND	ND
Acrylonitrile				mg/kg	ND	ND	ND	ND	ND
Benzene	0.06	0.06	4.8	mg/kg	ND	ND	ND	ND	ND
Bromobenzene				mg/kg	ND	ND	ND	ND	ND
Bromochloromethane				mg/kg	ND	ND	ND	ND	ND
Bromodichloromethane				mg/kg	ND	ND	ND	ND	ND
Bromoform				mg/kg	ND	ND	ND	ND	ND
Bromomethane				mg/kg	ND	ND	ND	ND	ND
Carbon disulfide				mg/kg	ND	ND	ND	ND	ND
Carbon tetrachloride	0.76	0.76	2.4	mg/kg	ND	ND	ND	ND	ND
Chlorobenzene	1.1	1.1	100	mg/kg	ND	ND	ND	ND	ND
Chloroethane				mg/kg	ND	ND	ND	ND	ND
Chloroform	0.37	0.37	49	mg/kg	ND	ND	ND	ND	ND
Chloromethane				mg/kg	ND	ND	ND	ND	ND
cis-1,2-Dichloroethene	0.25	0.25	100	mg/kg	ND	ND	ND	ND	ND
cis-1,3-Dichloropropene				mg/kg	ND	ND	ND	ND	ND
Dibromochloromethane				mg/kg	ND	ND	ND	ND	ND
Dibromomethane				mg/kg	ND	ND	ND	ND	ND
Dichlorodifluoromethane				mg/kg	ND	ND	ND	ND	ND
Ethyl ether				mg/kg	ND	ND	ND	ND	ND
Ethylbenzene	1	1	41	mg/kg	ND	ND	ND	ND	ND
Hexachlorobutadiene				mg/kg	ND	ND	ND	ND	ND
Isopropylbenzene				mg/kg	ND	ND	ND	ND	ND
Methyl tert butyl ether	0.93	0.93	100	mg/kg	ND	ND	ND	ND	ND
Methylene chloride	0.05	0.05	100	mg/kg	ND	ND	ND	ND	ND
n-Butylbenzene	12	12	100	mg/kg	ND	ND	ND	ND	ND
n-Propylbenzene	3.9	3.9	100	mg/kg	ND	ND	ND	ND	ND
Naphthalene	12	12	100	mg/kg	ND	ND	ND	ND	ND
o-Chlorotoluene				mg/kg	ND	ND	ND	ND	ND
o-Xylene				mg/kg	ND	ND	ND	ND	ND
p-Chlorotoluene				mg/kg	ND	ND	ND	ND	ND
p-Diethylbenzene				mg/kg	ND	ND	ND	ND	ND
p-Ethyltoluene				mg/kg	ND	ND	ND	ND	ND
p-Isopropyltoluene				mg/kg	ND	ND	ND	ND	ND
p/m-Xylene				mg/kg	ND	ND	ND	ND	ND
sec-Butylbenzene	11	11	100	mg/kg	ND	ND	ND	ND	ND
Styrene				mg/kg	ND	ND	ND	ND	ND
tert-Butylbenzene	5.9	5.9	100	mg/kg	ND	ND	ND	ND	ND
Tetrachloroethene	1.3	1.3	19	mg/kg	ND	ND	ND	ND	ND
Toluene	0.7	0.7	100	mg/kg	ND	ND	ND	ND	ND
trans-1,2-Dichloroethene	0.19	0.19	100	mg/kg	ND	ND	ND	ND	ND
trans-1,3-Dichloropropene				mg/kg	ND	ND	ND	ND	ND
trans-1,4-Dichloro-2-butene				mg/kg	ND	ND	ND	ND	ND
Trichloroethene	0.47	0.47	21	mg/kg	ND	ND	ND	ND	ND
Trichlorofluoromethane				mg/kg	ND	ND	ND	ND	ND
Vinyl acetate				mg/kg	ND	ND	ND	ND	ND
Vinyl chloride	0.02	0.02	0.9	mg/kg	ND	ND	ND	ND	ND
Xylenes, Total	0.26	1.6	100	mg/kg	ND	ND	ND	ND	ND

Notes and Acronyms:

mg/kg: Milligrams per kilogram

Table 5: Post Excavation Soil Sample Results Summary
4778 Broadway, NY, NY
BCP Number: C231131

SAMPLE LOCATION					C4-SW-S	C5-PB-S	C5-SW-S	C6-PB-S	C6-SW-S
SAMPLING DATE					4/3/2023	4/3/2023	4/3/2023	4/3/2023	4/3/2023
SAMPLE DEPTH (ft.)					10.0-10.5	6.0-6.5	10.0-10.5	6.0-6.5	10.0-10.5
	NYUUSCO	NYPGWSCO	NYRRSCO	Units	Results	Results	Results	Results	Results

ND: Non-Detect

J: Estimated value

NYUUSCO: New York Restricted Unrestricted Use Soil Cleanup Objectives

NYPGWSCO: New York NYCRR Part 375 Protection of Groundater Soil Cleanup Objectives

NYRRSCO: New York Restricted Residential Use Soil Cleanup Objectives

Highlight: exceeds one or more respective criteria

Table 6 Groundwater Sample Results Summary -RI
4778 Broadway,New York, NY
AEI Project #384736
BCP#C231131

LOCATION			**MW-1**		**MW-2**		**MW-3**		**MW-4**		**MW-5**		**MW-6**		**FIELD BLANK**		**TB**		**FB-02**		**TB**
SAMPLING DATE			**2/25/2020**		**2/25/2020**		**2/25/2020**		**2/25/2020**		**2/25/2020**		**2/25/2020**		**2/10/2020**		**2/10/2020**		**2/12/2020**		**2/12/2020**
SAMPLE TYPE			**WATER**		**WATER**		**WATER**		**WATER**		**WATER**		**WATER**		**WATER**		**WATER**		**WATER**		**WATER**
	NY-AWQS	**Units**	**Results**	**Qual**	**Results**	**Qual**	**Results**	**Qual**	**Results**	**Qual**	**Results**	**Qual**	**Results**	**Qual**	**Results**	**Qual**	**Results**	**Qual**	**Results**	**Qual**	**Results**
1,4 Dioxane by 8270D-SIM																					
1,4-Dioxane		ug/l	1.68		0.268	U	0.129	U	0.139	U	0.646	U	0.134	U	0.139	U	-	-	0.15	U	-
Chlorinated Herbicides by GC																					
2,4-D	50	ug/l	10	U	10	U	10	U	10	U	10	U	10	U	10	U	-	-	10	U	-
2,4,5-T	35	ug/l	2	U	2	U	2	U	2	U	2	U	2	U	2	U	-	-	2	U	-
2,4,5-TP (Silvex)		ug/l	2	U	2	U	2	U	2	U	2	U	2	U	2	U	-	-	2	U	-
Dissolved Metals																					
Aluminum, Dissolved		ug/l	10	U	10		4.7	J	4.5	J	10	U	4.29	J	-	-	-	-	-	-	-
Antimony, Dissolved	3	ug/l	1.5	J	0.78	J	0.57	J	4	U	4	U	4	U	-	-	-	-	-	-	-
Arsenic, Dissolved	25	ug/l	9.72		21.3		27.65		0.41	J	8.97		0.33	J	-	-	-	-	-	-	-
Barium, Dissolved	1000	ug/l	687.3		196.1		203.3		110		2194		105.2		-	-	-	-	-	-	-
Beryllium, Dissolved	3	ug/l	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U	-	-	-	-	-	-	-
Cadmium, Dissolved	5	ug/l	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	-	-	-	-	-	-	-
Calcium, Dissolved		ug/l	342000		52600		34600		114000		194000		112000		-	-	-	-	-	-	-
Chromium, Dissolved	50	ug/l	0.18	J	0.33	J	1	U	0.37	J	0.2	J	0.47	J	-	-	-	-	-	-	-
Cobalt, Dissolved		ug/l	8.27		4.72		2.99		0.99		3.09		1		-	-	-	-	-	-	-
Copper, Dissolved	200	ug/l	0.65	J	0.44	J	1	U	0.8	J	1.54		0.84	J	-	-	-	-	-	-	-
Iron, Dissolved	300	ug/l	33600		1680		687		40.3	J	20400		46.3	J	-	-	-	-	-	-	-
Lead, Dissolved	25	ug/l	5.88		6.73		1	U	1	U	8.14		1	U	-	-	-	-	-	-	-
Magnesium, Dissolved	35000	ug/l	123000		5300		3800		41000		68600		41700		-	-	-	-	-	-	-
Manganese, Dissolved	300	ug/l	12280		727.1		323.6		116.9		4363		77.1		-	-	-	-	-	-	-
Mercury, Dissolved	0.7	ug/l	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	-	-	-	-	-	-	-
Nickel, Dissolved	100	ug/l	33.63		20.32		11.49		14.92		70.06		15.66		-	-	-	-	-	-	-
Potassium, Dissolved		ug/l	7930		4660		9680		11700		6920		10600		-	-	-	-	-	-	-
Selenium, Dissolved	10	ug/l	5	U	5	U	5	U	3.71	J	5	U	3.28	J	-	-	-	-	-	-	-
Silver, Dissolved	50	ug/l	0.4	U	0.4	U	0.4	U	0.4	U	0.4	U	0.4	U	-	-	-	-	-	-	-
Sodium, Dissolved	20000	ug/l	374000		566000		441000		95300		1100000		94600		-	-	-	-	-	-	-
Thallium, Dissolved	0.5	ug/l	0.2	J	1	U	1	U	0.5	J	1	U	0.47	J	-	-	-	-	-	-	-
Vanadium, Dissolved		ug/l	5	U	5	U	5	U	5	U	1.71	J	5	U	-	-	-	-	-	-	-
Zinc, Dissolved	2000	ug/l	4	J	10	U	10	U	10	U	4.53	J	10	U	-	-	-	-	-	-	-
Organochlorine Pesticides by GC																					
Delta-BHC	0.04	ug/l	0.014	U	0.014	U	0.014	U	0.014	U	0.014	U	0.014	U	0.014	U	-	-	0.014	U	-
Lindane	0.05	ug/l	0.014	U	0.014	U	0.014	U	0.014	U	0.014	U	0.014	U	0.014	U	-	-	0.014	U	-
Alpha-BHC	0.01	ug/l	0.014	U	0.014	U	0.014	U	0.014	U	0.014	U	0.014	U	0.014	U	-	-	0.014	U	-
Beta-BHC	0.04	ug/l	0.014	U	0.014	U	0.014	U	0.014	U	0.014	U	0.014	U	0.014	U	-	-	0.014	U	-
Heptachlor	0.04	ug/l	0.014	U	0.014	U	0.014	U	0.014	U	0.014	U	0.014	U	0.014	U	-	-	0.014	U	-
Aldrin	0	ug/l	0.014	U	0.014	U	0.014	U	0.014	U	0.014	U	0.014	U	0.014	U	-	-	0.014	U	-
Heptachlor epoxide	0.03	ug/l	0.014	U	0.014	U	0.014	U	0.014	U	0.014	U	0.014	U	0.014	U	-	-	0.014	U	-
Endrin	0	ug/l	0.029	U	0.029	U	0.029	U	0.029	U	0.029	U	0.029	U	0.029	U	-	-	0.029	U	-
Endrin aldehyde	5	ug/l	0.029	U	0.029	U	0.029	U	0.029	U	0.029	U	0.029	U	0.029	U	-	-	0.029	U	-
Endrin ketone	5	ug/l	0.029	U	0.029	U	0.029	U	0.029	U	0.029	U	0.029	U	0.029	U	-	-	0.029	U	-
Dieldrin	0.004	ug/l	0.029	U	0.029	U	0.029	U	0.029	U	0.029	U	0.029	U	0.029	U	-	-	0.029	U	-
4,4'-DDE	0.2	ug/l	0.029	U	0.029	U	0.029	U	0.029	U	0.029	U	0.029	U	0.029	U	-	-	0.029	U	-
4,4'-DDD	0.3	ug/l	0.029	U	0.029	U	0.029	U	0.029	U	0.029	U	0.029	U	0.029	U	-	-	0.029	U	-
4,4'-DDT	0.2	ug/l	0.029	U	0.029	U	0.029	U	0.029	U	0.029	U	0.029	U	0.029	U	-	-	0.029	U	-
Endosulfan I		ug/l	0.014	U	0.014	U	0.014	U	0.014	U	0.014	U	0.014	U	0.014	U	-	-	0.014	U	-
Endosulfan II		ug/l	0.029	U	0.029	U	0.029	U	0.029	U	0.029	U	0.029	U	0.029	U	-	-	0.029	U	-
Endosulfan sulfate		ug/l	0.029	U	0.029	U	0.029	U	0.029	U	0.029	U	0.029	U	0.029	U	-	-	0.029	U	-
Methoxychlor	35	ug/l	0.143	U	0.143	U	0.143	U	0.143	U	0.143	U	0.143	U	0.143	U	-	-	0.143	U	-
Toxaphene	0.06	ug/l	0.143	U	0.143	U	0.143	U	0.143	U	0.143	U	0.143	U	0.143	U	-	-	0.143	U	-
cis-Chlordane		ug/l	0.014	U	0.014	U	0.014	U	0.014	U	0.014	U	0.014	U	0.014	U	-	-	0.014	U	-
trans-Chlordane		ug/l	0.014	U	0.014	U	0.014	U	0.014	U	0.014	U	0.014	U	0.008	JIP	-	-	0.014	U	-
Chlordane	0.05	ug/l	0.143	U	0.143	U	0.143	U	0.143	U	0.143	U	0.143	U	0.143	U	-	-	0.143	U	-
Perfluorinated Alkyl Acids by Isotope Dilution																					
Perfluorobutanoic Acid (PFBA)		ug/l	0.204		0.274		0.192		0.0271		0.392		0.0296		0.00192	U	-	-	0.00186	U	-
Perfluoropentanoic Acid (PFPeA)		ug/l	0.255		1.31		0.994		0.0532		1.98		0.0588		0.00192	U	-	-	0.00186	U	-
Perfluorobutanesulfonic Acid (PFBS)		ug/l	0.0442		0.00725		0.0167		0.0178		0.0215		0.0194		0.00192	U	-	-	0.00186	U	-
Perfluorohexanoic Acid (PFHxA)		ug/l	0.209		1.23		1.09		0.0573		1.36		0.0616		0.000421	J	-	-	0.000431	J	-
Perfluoroheptanoic Acid (PFHpA)		ug/l	0.162		0.362		0.45		0.0353		0.551		0.0386		0.00192	U	-	-	0.00186	U	-
Perfluorohexanesulfonic Acid (PFHxS)		ug/l	0.232		0.0167		0.0343		0.0258		0.0703		0.0284		0.00192	U	-	-	0.00186	U	-
Perfluorooctanoic Acid (PFOA)		ug/l	0.0841		0.105		0.172		0.0676		0.2		0.0685		0.00192	U	-	-	0.000297	J	-
1H,1H,2H,2H-Perfluorooctanesulfonic Acid (6:2FTS)		ug/l	0.0292		0.00817		0.005	U	0.00174	U	0.00346		0.00189	U	0.00192	U	-	-	0.00186	U	-
Perfluoroheptanesulfonic Acid (PFHpS)		ug/l	0.00201	U	0.00809	J	0.0056		0.00174	U	0.0391		0.00189	U	0.00192	U	-	-	0.00186	U	-
Perfluorononanoic Acid (PFNA)		ug/l	0.00191	J	0.0258		0.0182		0.0029		0.0458		0.00291		0.00192	U	-	-	0.00186	U	-
Perfluorooctanesulfonic Acid (PFOS)		ug/l	0.0173	J	0.745		1.37		0.0452		1.53		0.0455		0.00192	U	-	-	0.00186	U	-
Perfluorodecanoic Acid (PFDA)		ug/l	0.00201	U	0.00954		0.00918		0.00101	J	0.005		0.000989	J	0.00192	U	-	-	0.00186	U	-
1H,1H,2H,2H-Perfluorodecanesulfonic Acid (8:2FTS)		ug/l	0.00201	U	0.00435		0.005	U	0.00174	U	0.00214	U	0.00189	U	0.00192	U	-	-	0.00186	U	-
N-Methyl Perfluorooctanesulfonamidoacetic Acid (NMeFO		ug/l	0.000843	J	0.00141	J	0.00208	J	0.00174	U	0.00214	U	0.00189	U	0.00192	U	-	-	0.00186	U	-

Table 6 Groundwater Sample Results Summary -RI
4778 Broadway,New York, NY
AEI Project #384736
BCP#C231131

LOCATION			MW-1		MW-2		MW-3		MW-4		MW-5		MW-6		FIELD BLANK		TB		FB-02		TB
SAMPLING DATE			2/25/2020		2/25/2020		2/25/2020		2/25/2020		2/25/2020		2/25/2020		2/10/2020		2/10/2020		2/12/2020		2/12/2020
SAMPLE TYPE			WATER		WATER		WATER		WATER		WATER		WATER		WATER		WATER		WATER		WATER
	NY-AWQS	Units	Results	Qual	Results	Qual	Results	Qual	Results	Qual	Results	Qual	Results	Qual	Results	Qual	Results	Qual	Results	Qual	Results
Perfluoroundecanoic Acid (PFUnA)		ug/l	0.00201	U	0.00191	U	0.00105	J	0.00174	U	0.000504	J	0.00189	U	0.00192	U	-	-	0.00186	U	-
Perfluorodecanesulfonic Acid (PFDS)		ug/l	0.00201	U	0.00133	J	0.005	U	0.00174	U	0.00214	U	0.00189	U	0.00192	U	-	-	0.00186	U	-
Perfluorooctanesulfonamide (FOSA)		ug/l	0.00201	U	0.00191	U	0.017		0.00174	U	0.00214	U	0.00189	U	0.00192	U	-	-	0.00186	U	-
N-Ethyl Perfluorooctanesulfonamidoacetic Acid (NEtFOSA		ug/l	0.00201	U	0.167		0.104		0.000996	J	0.00113	J	0.00189	U	0.00192	U	-	-	0.00186	U	-
Perfluorododecanoic Acid (PFDoA)		ug/l	0.00201	U	0.00191	U	0.005	U	0.00174	U	0.00214	U	0.00189	U	0.00192	U	-	-	0.00186	U	-
Perfluorotridecanoic Acid (PFTrDA)		ug/l	0.00201	U	0.00191	U	0.005	U	0.00174	U	0.00214	U	0.00189	U	0.00192	U	-	-	0.00186	U	-
Perfluorotetradecanoic Acid (PFTA)		ug/l	0.00201	U	0.00191	U	0.005	U	0.00174	U	0.00214	U	0.00189	U	0.00192	U	-	-	0.00186	U	-
PFOA/PFOS, Total		ug/l	0.101	J	0.85		1.54		0.113		1.73		0.114		0.00192	U	-	-	0.000297	J	-
Polychlorinated Biphenyls by GC																					
Aroclor 1016	0.09	ug/l	0.083	U	0.083	U	0.083	U	0.083	U	0.083	U	0.083	U	0.083	U	-	-	0.083	U	-
Aroclor 1221	0.09	ug/l	0.083	U	0.083	U	0.083	U	0.083	U	0.083	U	0.083	U	0.083	U	-	-	0.083	U	-
Aroclor 1232	0.09	ug/l	0.083	U	0.083	U	0.083	U	0.083	U	0.083	U	0.083	U	0.083	U	-	-	0.083	U	-
Aroclor 1242	0.09	ug/l	0.083	U	0.083	U	0.083	U	0.083	U	0.083	U	0.083	U	0.083	U	-	-	0.083	U	-
Aroclor 1248	0.09	ug/l	0.083	U	0.083	U	0.083	U	0.083	U	0.083	U	0.083	U	0.083	U	-	-	0.083	U	-
Aroclor 1254	0.09	ug/l	0.083	U	0.083	U	0.083	U	0.083	U	0.083	U	0.083	U	0.083	U	-	-	0.083	U	-
Aroclor 1260	0.09	ug/l	0.083	U	0.083	U	0.083	U	0.083	U	0.083	U	0.083	U	0.083	U	-	-	0.083	U	-
Aroclor 1262	0.09	ug/l	0.083	U	0.083	U	0.083	U	0.083	U	0.083	U	0.083	U	0.083	U	-	-	0.083	U	-
Aroclor 1268	0.09	ug/l	0.083	U	0.083	U	0.083	U	0.083	U	0.083	U	0.083	U	0.083	U	-	-	0.083	U	-
PCBs, Total		ug/l	0.083	U	0.083	U	0.083	U	0.083	U	0.083	U	0.083	U	0.083	U	-	-	0.083	U	-
Semivolatile Organics by GC/MS																					
1,2,4-Trichlorobenzene	5	ug/l	5	U	5	U	5	U	5	U	5	U	5	U	5	U	-	-	5	U	-
Bis(2-chloroethyl)ether	1	ug/l	2	U	2	U	2	U	2	U	2	U	2	U	2	U	-	-	2	U	-
1,2-Dichlorobenzene	3	ug/l	2	U	2	U	2	U	2	U	2	U	2	U	2	U	-	-	2	U	-
1,3-Dichlorobenzene	3	ug/l	2	U	2	U	2	U	2	U	2	U	2	U	2	U	-	-	2	U	-
1,4-Dichlorobenzene	3	ug/l	2	U	2	U	2	U	2	U	2	U	2	U	2	U	-	-	2	U	-
3,3'-Dichlorobenzidine	5	ug/l	5	U	5	U	5	U	5	U	5	U	5	U	5	U	-	-	5	U	-
2,4-Dinitrotoluene	5	ug/l	5	U	5	U	5	U	5	U	5	U	5	U	5	U	-	-	5	U	-
2,6-Dinitrotoluene	5	ug/l	5	U	5	U	5	U	5	U	5	U	5	U	5	U	-	-	5	U	-
4-Chlorophenyl phenyl ether		ug/l	2	U	2	U	2	U	2	U	2	U	2	U	2	U	-	-	2	U	-
4-Bromophenyl phenyl ether		ug/l	2	U	2	U	2	U	2	U	2	U	2	U	2	U	-	-	2	U	-
Bis(2-chloroisopropyl)ether	5	ug/l	2	U	2	U	2	U	2	U	2	U	2	U	2	U	-	-	2	U	-
Bis(2-chloroethoxy)methane	5	ug/l	5	U	5	U	5	U	5	U	5	U	5	U	5	U	-	-	5	U	-
Hexachlorocyclopentadiene	5	ug/l	20	U	20	U	20	U	20	U	20	U	20	U	20	U	-	-	20	U	-
Isophorone	50	ug/l	5	U	5	U	5	U	5	U	5	U	5	U	5	U	-	-	5	U	-
Nitrobenzene	0.4	ug/l	2	U	2	U	2	U	2	U	2	U	2	U	2	U	-	-	2	U	-
NDPA/DPA	50	ug/l	2	U	2	U	2	U	2	U	2	U	2	U	2	U	-	-	2	U	-
n-Nitrosodi-n-propylamine		ug/l	5	U	5	U	5	U	5	U	5	U	5	U	5	U	-	-	5	U	-
Bis(2-ethylhexyl)phthalate	5	ug/l	3	U	3	U	3	U	2	J	3	U	3	U	3	U	-	-	3	U	-
Butyl benzyl phthalate	50	ug/l	5	U	5	U	5	U	5	U	5	U	5	U	5	U	-	-	5	U	-
Di-n-butylphthalate	50	ug/l	5	U	5	U	5	U	5	U	5	U	5	U	5	U	-	-	5	U	-
Di-n-octylphthalate	50	ug/l	5	U	5	U	5	U	5	U	5	U	5	U	5	U	-	-	5	U	-
Diethyl phthalate	50	ug/l	5	U	5	U	5	U	5	U	5	U	5	U	5	U	-	-	5	U	-
Dimethyl phthalate	50	ug/l	5	U	5	U	5	U	5	U	5	U	5	U	5	U	-	-	5	U	-
Biphenyl		ug/l	2	U	2	U	2	U	2	U	2	U	2	U	2	U	-	-	2	U	-
4-Chloroaniline	5	ug/l	5	U	5	U	5	U	5	U	5	U	5	U	5	U	-	-	5	U	-
2-Nitroaniline	5	ug/l	5	U	5	U	5	U	5	U	5	U	5	U	5	U	-	-	5	U	-
3-Nitroaniline	5	ug/l	5	U	5	U	5	U	5	U	5	U	5	U	5	U	-	-	5	U	-
4-Nitroaniline	5	ug/l	5	U	5	U	5	U	5	U	5	U	5	U	5	U	-	-	5	U	-
Dibenzofuran		ug/l	2	U	2	U	2	U	2	U	2	U	2	U	2	U	-	-	2	U	-
1,2,4,5-Tetrachlorobenzene	5	ug/l	10	U	10	U	10	U	10	U	10	U	10	U	10	U	-	-	10	U	-
Acetophenone		ug/l	5	U	5	U	5	U	5	U	5	U	5	U	5	U	-	-	5	U	-
2,4,6-Trichlorophenol		ug/l	5	U	5	U	5	U	5	U	5	U	5	U	5	U	-	-	5	U	-
p-Chloro-m-cresol		ug/l	2	U	2	U	2	U	2	U	2	U	2	U	2	U	-	-	2	U	-
2-Chlorophenol		ug/l	2	U	2	U	2	U	2	U	2	U	2	U	2	U	-	-	2	U	-
2,4-Dichlorophenol	1	ug/l	5	U	5	U	5	U	5	U	5	U	5	U	5	U	-	-	5	U	-
2,4-Dimethylphenol	50	ug/l	10		72		5	U	5	U	87		5	U	5	U	-	-	5	U	-
2-Nitrophenol		ug/l	10	U	10	U	10	U	10	U	10	U	10	U	10	U	-	-	10	U	-
4-Nitrophenol		ug/l	10	U	10	U	10	U	10	U	10	U	10	U	10	U	-	-	10	U	-
2,4-Dinitrophenol	10	ug/l	20	U	20	U	20	U	20	U	20	U	20	U	20	U	-	-	20	U	-
4,6-Dinitro-o-cresol		ug/l	10	U	10	U	10	U	10	U	10	U	10	U	10	U	-	-	10	U	-
Phenol	1	ug/l	6.7		6.7		5	U	5	U	49		5	U	5	U	-	-	5	U	-
2-Methylphenol		ug/l	4.8	J	17		5	U	5	U	92		5	U	5	U	-	-	5	U	-
3-Methylphenol/4-Methylphenol		ug/l	11		31		0.52	J	5	U	120		5	U	5	U	-	-	5	U	-
2,4,5-Trichlorophenol		ug/l	5	U	5	U	5	U	5	U	5	U	5	U	5	U	-	-	5	U	-
Benzoic Acid		ug/l	66		59		50	U	50	U	84		50	U	50	U	-	-	50	U	-
Benzyl Alcohol		ug/l	2	U	2	U	2	U	2	U	2	U	2	U	0.92	J	-	-	2	U	-
Carbazole		ug/l	2	U	2	U	2	U	2	U	2	U	2	U	2	U	-	-	2	U	-
Semivolatile Organics by GC/MS-SIM																					

Table 6 Groundwater Sample Results Summary -RI
4778 Broadway,New York, NY
AEI Project #384736
BCP#C231131

LOCATION			MW-1		MW-2		MW-3		MW-4		MW-5		MW-6		FIELD BLANK		TB		FB-02		TB
SAMPLING DATE			2/25/2020		2/25/2020		2/25/2020		2/25/2020		2/25/2020		2/25/2020		2/10/2020		2/10/2020		2/12/2020		2/12/2020
SAMPLE TYPE			WATER		WATER		WATER		WATER		WATER		WATER		WATER		WATER		WATER		WATER
	NY-AWQS	**Units**	**Results**	**Qual**	**Results**	**Qual**	**Results**	**Qual**	**Results**	**Qual**	**Results**	**Qual**	**Results**	**Qual**	**Results**	**Qual**	**Results**	**Qual**	**Results**	**Qual**	**Results**
Acenaphthene	20	ug/l	1	U	1	U	0.1	U	0.1	U	1	U	0.1	U	0.1	U	-	-	0.1	U	-
2-Chloronaphthalene	10	ug/l	2	U	2	U	0.2	U	0.2	U	2	U	0.2	U	0.2	U	-	-	0.2	U	-
Fluoranthene	50	ug/l	1	U	1	U	0.1	U	0.1	U	1	U	0.1	U	0.1	U	-	-	0.1	U	-
Hexachlorobutadiene	0.5	ug/l	5	U	5	U	0.5	U	0.5	U	5	U	0.5	U	0.5	U	-	-	0.5	U	-
Naphthalene	10	ug/l	300		380		0.72		0.08	J	260		0.1	U	0.1	U	-	-	0.1	U	-
Benzo(a)anthracene	0.002	ug/l	1	U	1	U	0.1	U	0.1	U	1	U	0.1	U	0.1	U	-	-	0.1	U	-
Benzo(a)pyrene	0	ug/l	1	U	1	U	0.1	U	0.1	U	1	U	0.1	U	0.1	U	-	-	0.1	U	-
Benzo(b)fluoranthene	0.002	ug/l	1	U	1	U	0.1	U	0.1	U	1	U	0.1	U	0.1	U	-	-	0.1	U	-
Benzo(k)fluoranthene	0.002	ug/l	1	U	1	U	0.1	U	0.1	U	1	U	0.1	U	0.1	U	-	-	0.1	U	-
Chrysene	0.002	ug/l	1	U	1	U	0.1	U	0.1	U	1	U	0.1	U	0.1	U	-	-	0.1	U	-
Acenaphthylene		ug/l	1	U	1	U	0.1	U	0.1	U	1	U	0.1	U	0.1	U	-	-	0.1	U	-
Anthracene	50	ug/l	1	U	1	U	0.1	U	0.1	U	1	U	0.1	U	0.1	U	-	-	0.1	U	-
Benzo(ghi)perylene		ug/l	1	U	1	U	0.1	U	0.1	U	1	U	0.1	U	0.1	U	-	-	0.1	U	-
Fluorene	50	ug/l	1	U	1	U	0.1	U	0.1	U	1	U	0.1	U	0.1	U	-	-	0.1	U	-
Phenanthrene	50	ug/l	1	U	1	U	0.1	U	0.1	U	1	U	0.1	U	0.03	J	-	-	0.1	U	-
Dibenzo(a,h)anthracene		ug/l	1	U	1	U	0.1	U	0.1	U	1	U	0.1	U	0.1	U	-	-	0.1	U	-
Indeno(1,2,3-cd)pyrene	0.002	ug/l	1	U	1	U	0.1	U	0.1	U	1	U	0.1	U	0.1	U	-	-	0.1	U	-
Pyrene	50	ug/l	1	U	1	U	0.1	U	0.1	U	1	U	0.1	U	0.1	U	-	-	0.1	U	-
2-Methylnaphthalene		ug/l	69		23		0.1	U	0.1	U	15		0.1	U	0.1	U	-	-	0.1	U	-
Pentachlorophenol	1	ug/l	8	U	8	U	0.8	U	0.8	U	8	U	0.8	U	0.8	U	-	-	0.8	U	-
Hexachlorobenzene	0.04	ug/l	8	U	8	U	0.8	U	0.8	U	8	U	0.8	U	0.8	U	-	-	0.8	U	-
Hexachloroethane	5	ug/l	8	U	8	U	0.8	U	0.8	U	8	U	0.8	U	0.8	U	-	-	0.8	U	-
Total Metals																					
Aluminum, Total		ug/l	210		2060		784		3830		22		12.4		100	U	-	-	100	U	-
Antimony, Total	3	ug/l	4	U	0.92	J	4	U	4	U	4	U	4	U	50	U	-	-	8	J	-
Arsenic, Total	25	ug/l	9.96		19.39		11.49		1.21		9.35		0.3	J	5	U	-	-	5	U	-
Barium, Total	1000	ug/l	673		231.7		182.3		138		2251		115.4		10	U	-	-	10	U	-
Beryllium, Total	3	ug/l	0.5	U	0.11	J	0.5	U	0.19	J	0.5	U	0.5	U	5	U	-	-	5	U	-
Cadmium, Total	5	ug/l	0.2	U	0.2	U	0.2	U	0.1	J	0.2	U	0.2	U	5	U	-	-	5	U	-
Calcium, Total		ug/l	343000		59000		31100		130000		194000		114000		100	U	-	-	100	U	-
Chromium, Total	50	ug/l	0.54	J	3.5		1.18		5.98		0.2	J	0.46	J	10	U	-	-	10	U	-
Cobalt, Total		ug/l	8.31		6.44		3.94		3.24		2.32		0.94		20	U	-	-	20	U	-
Copper, Total	200	ug/l	1.34		10.13		3.64		11.28		2.02		1.26		10	U	-	-	10	U	-
Iron, Total	300	ug/l	29900		4450		1800		4530		22700		127		13	J	-	-	50	U	-
Lead, Total	25	ug/l	6.5		9.54		1.27		4.39		7.72		1	U	10	U	-	-	10	U	-
Magnesium, Total	35000	ug/l	121000		6920		3660		45800		72700		41500		100	U	-	-	100	U	-
Manganese, Total	300	ug/l	11790		878.8		314.4		158.2		3925		76.73		10	U	-	-	10	U	-
Mercury, Total	0.7	ug/l	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	-	-	0.2	U	-
Nickel, Total	100	ug/l	34.11		24.66		12.47		22.16		65.77		15.61		25	U	-	-	25	U	-
Potassium, Total		ug/l	7830		5540		9450		11900		7120		10800		2500	U	-	-	2500	U	-
Selenium, Total	10	ug/l	5	U	2.45	J	5	U	4.34	J	5	U	3.86	J	10	U	-	-	10	U	-
Silver, Total	50	ug/l	0.4	U	0.4	U	0.4	U	0.4	U	0.4	U	0.4	U	7	U	-	-	7	U	-
Sodium, Total	20000	ug/l	371000		642000		473000		95400		1130000		94000		2000	U	-	-	2000	U	-
Thallium, Total	0.5	ug/l	1	U	1	U	1	U	0.74	J	1	U	0.45	J	20	U	-	-	20	U	-
Vanadium, Total		ug/l	1.71	J	5.54		2.14	J	7.6		1.58	J	5	U	10	U	-	-	10	U	-
Zinc, Total	2000	ug/l	10	U	8.39	J	10	U	29.43		4.61	J	10	U	50	U	-	-	50	U	-
Volatile Organics by GC/MS																					
Methylene chloride	5	ug/l	62	U	1000	U	6.2	U	2.5	U	1000	U	2.5	U	2.5	U	2.5	U	2.5	U	2.5
1,1-Dichloroethane	5	ug/l	62	U	1000	U	6.2	U	2.5	U	1000	U	2.5	U	2.5	U	2.5	U	2.5	U	2.5
Chloroform	7	ug/l	62	U	1000	U	6.2	U	2.5	U	1000	U	2.5	U	2.5	U	2.5	U	2.5	U	2.5
Carbon tetrachloride	5	ug/l	12	U	200	U	1.2	U	0.5	U	200	U	0.5	U	0.5	U	0.5	U	0.5	U	0.5
1,2-Dichloropropane	1	ug/l	25	U	400	U	2.5	U	1	U	400	U	1	U	1	U	1	U	1	U	1
Dibromochloromethane	50	ug/l	12	U	200	U	1.2	U	0.5	U	200	U	0.5	U	0.5	U	0.5	U	0.5	U	0.5
1,1,2-Trichloroethane	1	ug/l	38	U	600	U	3.8	U	1.5	U	600	U	1.5	U	1.5	U	1.5	U	1.5	U	1.5
Tetrachloroethene	5	ug/l	12	U	200	U	1.2	U	0.5	U	200	U	0.5	U	0.5	U	0.5	U	0.5	U	0.5
Chlorobenzene	5	ug/l	62	U	1000	U	6.2	U	2.5	U	1000	U	2.5	U	2.5	U	2.5	U	2.5	U	2.5
Trichlorofluoromethane	5	ug/l	62	U	1000	U	6.2	U	2.5	U	1000	U	2.5	U	2.5	U	2.5	U	2.5	U	2.5
1,2-Dichloroethane	0.6	ug/l	12	U	200	U	1.2	U	0.5	U	200	U	0.5	U	0.5	U	0.5	U	0.5	U	0.5
1,1,1-Trichloroethane	5	ug/l	62	U	1000	U	6.2	U	2.5	U	1000	U	2.5	U	2.5	U	2.5	U	2.5	U	2.5
Bromodichloromethane	50	ug/l	12	U	200	U	1.2	U	0.5	U	200	U	0.5	U	0.5	U	0.5	U	0.5	U	0.5
trans-1,3-Dichloropropene	0.4	ug/l	12	U	200	U	1.2	U	0.5	U	200	U	0.5	U	0.5	U	0.5	U	0.5	U	0.5
cis-1,3-Dichloropropene	0.4	ug/l	12	U	200	U	1.2	U	0.5	U	200	U	0.5	U	0.5	U	0.5	U	0.5	U	0.5
1,3-Dichloropropene, Total		ug/l	12	U	200	U	1.2	U	0.5	U	200	U	0.5	U	0.5	U	0.5	U	0.5	U	0.5
1,1-Dichloropropene	5	ug/l	62	U	1000	U	6.2	U	2.5	U	1000	U	2.5	U	2.5	U	2.5	U	2.5	U	2.5
Bromoform	50	ug/l	50	U	800	U	5	U	2	U	800	U	2	U	2	U	2	U	2	U	2
1,1,2,2-Tetrachloroethane	5	ug/l	12	U	200	U	1.2	U	0.5	U	200	U	0.5	U	0.5	U	0.5	U	0.5	U	0.5
Benzene	1	ug/l	920		8000		120		0.5	U	8200		0.5	U	0.5	U	0.5	U	0.5	U	0.5
Toluene	5	ug/l	1500		39000		490		2.5	U	34000		2.5	U	2.5	U	2.5	U	2.5	U	2.5

Table 6 Groundwater Sample Results Summary -RI
4778 Broadway,New York, NY
AEI Project #384736
BCP#C231131

LOCATION			MW-1		MW-2		MW-3		MW-4		MW-5		MW-6		FIELD BLANK		TB		FB-02		TB
SAMPLING DATE			2/25/2020		2/25/2020		2/25/2020		2/25/2020		2/25/2020		2/25/2020		2/10/2020		2/10/2020		2/12/2020		2/12/2020
SAMPLE TYPE			WATER		WATER		WATER		WATER		WATER		WATER		WATER		WATER		WATER		WATER
	NY-AWQS	Units	Results	Qual	Results	Qual	Results	Qual	Results	Qual	Results	Qual	Results	Qual	Results	Qual	Results	Qual	Results	Qual	Results
Ethylbenzene	5	ug/l	2000		5300		410		2.5	U	3600		2.5	U	2.5	U	2.5	U	2.5	U	2.5
Chloromethane		ug/l	62	U	1000	U	6.2	U	2.5	U	1000	U	2.5	U	2.5	U	2.5	U	2.5	U	2.5
Bromomethane	5	ug/l	62	U	1000	U	6.2	U	2.5	U	1000	U	2.5	U	2.5	U	2.5	U	2.5	U	2.5
Vinyl chloride	2	ug/l	25	U	400	U	2.5	U	1	U	400	U	1	U	1	U	1	U	1	U	1
Chloroethane	5	ug/l	62	U	1000	U	6.2	U	2.5	U	1000	U	2.5	U	2.5	U	2.5	U	2.5	U	2.5
1,1-Dichloroethene	5	ug/l	12	U	200	U	1.2	U	0.5	U	200	U	0.5	U	0.5	U	0.5	U	0.5	U	0.5
trans-1,2-Dichloroethene	5	ug/l	62	U	1000	U	6.2	U	2.5	U	1000	U	2.5	U	2.5	U	2.5	U	2.5	U	2.5
Trichloroethene	5	ug/l	12	U	200	U	1.2	U	0.5	U	200	U	0.5	U	0.5	U	0.5	U	0.5	U	0.5
1,2-Dichlorobenzene	3	ug/l	62	U	1000	U	6.2	U	2.5	U	1000	U	2.5	U	2.5	U	2.5	U	2.5	U	2.5
1,3-Dichlorobenzene	3	ug/l	62	U	1000	U	6.2	U	2.5	U	1000	U	2.5	U	2.5	U	2.5	U	2.5	U	2.5
1,4-Dichlorobenzene	3	ug/l	62	U	1000	U	6.2	U	2.5	U	1000	U	2.5	U	2.5	U	2.5	U	2.5	U	2.5
Methyl tert butyl ether	10	ug/l	62	U	1000	U	6.2	U	2.5	U	1000	U	2.5	U	2.5	U	2.5	U	2.5	U	2.5
p/m-Xylene	5	ug/l	5700		16000		500		2.5	U	11000		2.5	U	2.5	U	2.5	U	2.5	U	2.5
o-Xylene	5	ug/l	1800		6600		160		2.5	U	5100		2.5	U	2.5	U	2.5	U	2.5	U	2.5
Xylenes, Total		ug/l	7500		23000		660		2.5	U	16000		2.5	U	2.5	U	2.5	U	2.5	U	2.5
cis-1,2-Dichloroethene	5	ug/l	62	U	1000	U	6.2	U	2.5	U	1000	U	2.5	U	2.5	U	2.5	U	2.5	U	2.5
1,2-Dichloroethene, Total		ug/l	62	U	1000	U	6.2	U	2.5	U	1000	U	2.5	U	2.5	U	2.5	U	2.5	U	2.5
Dibromomethane	5	ug/l	120	U	2000	U	12	U	5	U	2000	U	5	U	5	U	5	U	5	U	5
1,2,3-Trichloropropane	0.04	ug/l	62	U	1000	U	6.2	U	2.5	U	1000	U	2.5	U	2.5	U	2.5	U	2.5	U	2.5
Acrylonitrile	5	ug/l	120	U	2000	U	12	U	5	U	2000	U	5	U	5	U	5	U	5	U	5
Styrene	5	ug/l	62	U	1000	U	6.2	U	2.5	U	1000	U	2.5	U	2.5	U	2.5	U	2.5	U	2.5
Dichlorodifluoromethane	5	ug/l	120	U	2000	U	12	U	5	U	2000	U	5	U	5	U	5	U	5	U	5
Acetone	50	ug/l	120	U	2000	U	12	U	5	U	2000	U	5	U	5	U	5	U	5	U	5
Carbon disulfide	60	ug/l	120	U	2000	U	12	U	5	U	2000	U	5	U	5	U	5	U	5	U	5
2-Butanone	50	ug/l	120	U	2000	U	12	U	5	U	2000	U	5	U	5	U	5	U	5	U	5
Vinyl acetate		ug/l	120	U	2000	U	12	U	5	U	2000	U	5	U	5	U	5	U	5	U	5
4-Methyl-2-pentanone		ug/l	120	U	2000	U	12	U	5	U	2000	U	5	U	5	U	5	U	5	U	5
2-Hexanone	50	ug/l	120	U	2000	U	12	U	5	U	2000	U	5	U	5	U	5	U	5	U	5
Bromochloromethane	5	ug/l	62	U	1000	U	6.2	U	2.5	U	1000	U	2.5	U	2.5	U	2.5	U	2.5	U	2.5
2,2-Dichloropropane	5	ug/l	62	U	1000	U	6.2	U	2.5	U	1000	U	2.5	U	2.5	U	2.5	U	2.5	U	2.5
1,2-Dibromoethane	0.0006	ug/l	50	U	800	U	5	U	2	U	800	U	2	U	2	U	2	U	2	U	2
1,3-Dichloropropane	5	ug/l	62	U	1000	U	6.2	U	2.5	U	1000	U	2.5	U	2.5	U	2.5	U	2.5	U	2.5
1,1,1,2-Tetrachloroethane	5	ug/l	62	U	1000	U	6.2	U	2.5	U	1000	U	2.5	U	2.5	U	2.5	U	2.5	U	2.5
Bromobenzene	5	ug/l	62	U	1000	U	6.2	U	2.5	U	1000	U	2.5	U	2.5	U	2.5	U	2.5	U	2.5
n-Butylbenzene	5	ug/l	62	U	1000	U	6.2	U	2.5	U	1000	U	2.5	U	2.5	U	2.5	U	2.5	U	2.5
sec-Butylbenzene	5	ug/l	62	U	1000	U	6.5		2.5	U	1000	U	2.5	U	2.5	U	2.5	U	2.5	U	2.5
tert-Butylbenzene	5	ug/l	62	U	1000	U	6.2	U	2.5	U	1000	U	2.5	U	2.5	U	2.5	U	2.5	U	2.5
o-Chlorotoluene	5	ug/l	62	U	1000	U	6.2	U	2.5	U	1000	U	2.5	U	2.5	U	2.5	U	2.5	U	2.5
p-Chlorotoluene	5	ug/l	62	U	1000	U	6.2	U	2.5	U	1000	U	2.5	U	2.5	U	2.5	U	2.5	U	2.5
1,2-Dibromo-3-chloropropane	0.04	ug/l	62	U	1000	U	6.2	U	2.5	U	1000	U	2.5	U	2.5	U	2.5	U	2.5	U	2.5
Hexachlorobutadiene	0.5	ug/l	62	U	1000	U	6.2	U	2.5	U	1000	U	2.5	U	2.5	U	2.5	U	2.5	U	2.5
Isopropylbenzene	5	ug/l	77		1000	U	32		2.5	U	1000	U	2.5	U	2.5	U	2.5	U	2.5	U	2.5
p-Isopropyltoluene	5	ug/l	62	U	1000	U	6.2	U	2.5	U	1000	U	2.5	U	2.5	U	2.5	U	2.5	U	2.5
Naphthalene	10	ug/l	280		360	J	13		2.5	U	1000	U	2.5	U	2.5	U	2.5	U	2.5	U	2.5
n-Propylbenzene	5	ug/l	190		1000	U	71		2.5	U	1000	U	2.5	U	2.5	U	2.5	U	2.5	U	2.5
1,2,3-Trichlorobenzene	5	ug/l	62	U	1000	U	6.2	U	2.5	U	1000	U	2.5	U	2.5	U	2.5	U	2.5	U	2.5
1,2,4-Trichlorobenzene	5	ug/l	62	U	1000	U	6.2	U	2.5	U	1000	U	2.5	U	2.5	U	2.5	U	2.5	U	2.5
1,3,5-Trimethylbenzene	5	ug/l	380		450	J	23		2.5	U	310	J	2.5	U	2.5	U	2.5	U	2.5	U	2.5
1,2,4-Trimethylbenzene	5	ug/l	1400		1800		140		2.5	U	1300		2.5	U	2.5	U	2.5	U	2.5	U	2.5
1,4-Dioxane		ug/l	6200	U	100000	U	620	U	250	U	100000	U	250	U	250	U	250	U	250	U	250
p-Diethylbenzene		ug/l	160		800	U	18		2	U	800	U	2	U	2	U	2	U	2	U	2
p-Ethyltoluene		ug/l	920		1400		77		2	U	1100		2	U	2	U	2	U	2	U	2
1,2,4,5-Tetramethylbenzene	5	ug/l	64		800	U	40		2	U	800	U	2	U	2	U	2	U	2	U	2
Ethyl ether		ug/l	62	U	1000	U	6.2	U	2.5	U	1000	U	2.5	U	2.5	U	2.5	U	2.5	U	2.5
trans-1,4-Dichloro-2-butene	5	ug/l	62	U	1000	U	6.2	U	2.5	U	1000	U	2.5	U	2.5	U	2.5	U	2.5	U	2.5

Notes:
ug/l:Micrograms per liter
U: Value below the Method Detection Limit (MDL)
J: Estimated Value
Highlighted: Exceeds respective criteria
NY-AWQS: New York TOGS 111 Ambient Water Quality Standards criteria reflects all addendum to criteria through June 2004.

Table 6 Groundwater Sample Results Summary -RI
4778 Broadway,New York, NY
AEI Project #384736
BCP#C231131

LOCATION				**FIELD BLANK**		**TRIP BLANK**	
SAMPLING DATE				**2/25/2020**		**2/25/2020**	
SAMPLE TYPE				**WATER**		**WATER**	
	NY-AWQS	**Units**	**Qual**	**Results**	**Qual**	**Results**	**Qual**
1,4 Dioxane by 8270D-SIM							
1,4-Dioxane		ug/l	-	0.129	U	-	-
Chlorinated Herbicides by GC							
2,4-D	50	ug/l	-	10	U	-	-
2,4,5-T	35	ug/l	-	2	U	-	-
2,4,5-TP (Silvex)		ug/l	-	2	U	-	-
Dissolved Metals							
Aluminum, Dissolved		ug/l	-	11.5		-	-
Antimony, Dissolved	3	ug/l	-	4	U	-	-
Arsenic, Dissolved	25	ug/l	-	0.5	U	-	-
Barium, Dissolved	1000	ug/l	-	0.55		-	-
Beryllium, Dissolved	3	ug/l	-	0.5	U	-	-
Cadmium, Dissolved	5	ug/l	-	0.2	U	-	-
Calcium, Dissolved		ug/l	-	100	U	-	-
Chromium, Dissolved	50	ug/l	-	1	U	-	-
Cobalt, Dissolved		ug/l	-	0.5	U	-	-
Copper, Dissolved	200	ug/l	-	1	U	-	-
Iron, Dissolved	300	ug/l	-	50	U	-	-
Lead, Dissolved	25	ug/l	-	1	U	-	-
Magnesium, Dissolved	35000	ug/l	-	70	U	-	-
Manganese, Dissolved	300	ug/l	-	1	U	-	-
Mercury, Dissolved	0.7	ug/l	-	0.2	U	-	-
Nickel, Dissolved	100	ug/l	-	2	U	-	-
Potassium, Dissolved		ug/l	-	100	U	-	-
Selenium, Dissolved	10	ug/l	-	5	U	-	-
Silver, Dissolved	50	ug/l	-	0.4	U	-	-
Sodium, Dissolved	20000	ug/l	-	100	U	-	-
Thallium, Dissolved	0.5	ug/l	-	1	U	-	-
Vanadium, Dissolved		ug/l	-	5	U	-	-
Zinc, Dissolved	2000	ug/l	-	10	U	-	-
Organochlorine Pesticides by GC							
Delta-BHC	0.04	ug/l	-	0.014	U	-	-
Lindane	0.05	ug/l	-	0.014	U	-	-
Alpha-BHC	0.01	ug/l	-	0.014	U	-	-
Beta-BHC	0.04	ug/l	-	0.014	U	-	-
Heptachlor	0.04	ug/l	-	0.014	U	-	-
Aldrin	0	ug/l	-	0.014	U	-	-
Heptachlor epoxide	0.03	ug/l	-	0.014	U	-	-
Endrin	0	ug/l	-	0.029	U	-	-
Endrin aldehyde	5	ug/l	-	0.029	U	-	-
Endrin ketone	5	ug/l	-	0.029	U	-	-
Dieldrin	0.004	ug/l	-	0.029	U	-	-
4,4'-DDE	0.2	ug/l	-	0.029	U	-	-
4,4'-DDD	0.3	ug/l	-	0.029	U	-	-
4,4'-DDT	0.2	ug/l	-	0.029	U	-	-
Endosulfan I		ug/l	-	0.014	U	-	-
Endosulfan II		ug/l	-	0.029	U	-	-
Endosulfan sulfate		ug/l	-	0.029	U	-	-
Methoxychlor	35	ug/l	-	0.143	U	-	-
Toxaphene	0.06	ug/l	-	0.143	U	-	-
cis-Chlordane		ug/l	-	0.014	U	-	-
trans-Chlordane		ug/l	-	0.014	U	-	-
Chlordane	0.05	ug/l	-	0.143	U	-	-
Perfluorinated Alkyl Acids by Isotope Dilution							
Perfluorobutanoic Acid (PFBA)		ug/l	-	0.00206	U	-	-
Perfluoropentanoic Acid (PFPeA)		ug/l	-	0.000609	J	-	-
Perfluorobutanesulfonic Acid (PFBS)		ug/l	-	0.00206	U	-	-
Perfluorohexanoic Acid (PFHxA)		ug/l	-	0.000366	J	-	-
Perfluoroheptanoic Acid (PFHpA)		ug/l	-	0.00206	U	-	-
Perfluorohexanesulfonic Acid (PFHxS)		ug/l	-	0.00206	U	-	-
Perfluorooctanoic Acid (PFOA)		ug/l	-	0.00206	U	-	-
1H,1H,2H,2H-Perfluorooctanesulfonic Acid (6:2FTS)		ug/l	-	0.00206	U	-	-
Perfluoroheptanesulfonic Acid (PFHpS)		ug/l	-	0.00206	U	-	-
Perfluorononanoic Acid (PFNA)		ug/l	-	0.00206	U	-	-
Perfluorooctanesulfonic Acid (PFOS)		ug/l	-	0.00206	U	-	-
Perfluorodecanoic Acid (PFDA)		ug/l	-	0.00206	U	-	-
1H,1H,2H,2H-Perfluorodecanesulfonic Acid (8:2FTS)		ug/l	-	0.00206	U	-	-
N-Methyl Perfluorooctanesulfonamidoacetic Acid (NMeFO		ug/l	-	0.00206	U	-	-

Table 6 Groundwater Sample Results Summary -RI
4778 Broadway,New York, NY
AEI Project #384736
BCP#C231131

LOCATION				**FIELD BLANK**		**TRIP BLANK**	
SAMPLING DATE				**2/25/2020**		**2/25/2020**	
SAMPLE TYPE				**WATER**		**WATER**	
	NY-AWQS	**Units**	**Qual**	**Results**	**Qual**	**Results**	**Qual**
Perfluoroundecanoic Acid (PFUnA)		ug/l	-	0.00206	U	-	-
Perfluorodecanesulfonic Acid (PFDS)		ug/l	-	0.00206	U	-	-
Perfluorooctanesulfonamide (FOSA)		ug/l	-	0.00206	U	-	-
N-Ethyl Perfluorooctanesulfonamidoacetic Acid (NEtFOSA		ug/l	-	0.00206	U	-	-
Perfluorododecanoic Acid (PFDoA)		ug/l	-	0.00206	U	-	-
Perfluorotridecanoic Acid (PFTrDA)		ug/l	-	0.00206	U	-	-
Perfluorotetradecanoic Acid (PFTA)		ug/l	-	0.00206	U	-	-
PFOA/PFOS, Total		ug/l	-	0.00206	U	-	-
Polychlorinated Biphenyls by GC							
Aroclor 1016	0.09	ug/l	-	0.083	U	-	-
Aroclor 1221	0.09	ug/l	-	0.083	U	-	-
Aroclor 1232	0.09	ug/l	-	0.083	U	-	-
Aroclor 1242	0.09	ug/l	-	0.083	U	-	-
Aroclor 1248	0.09	ug/l	-	0.083	U	-	-
Aroclor 1254	0.09	ug/l	-	0.083	U	-	-
Aroclor 1260	0.09	ug/l	-	0.083	U	-	-
Aroclor 1262	0.09	ug/l	-	0.083	U	-	-
Aroclor 1268	0.09	ug/l	-	0.083	U	-	-
PCBs, Total		ug/l	-	0.083	U	-	-
Semivolatile Organics by GC/MS							
1,2,4-Trichlorobenzene	5	ug/l	-	5	U	-	-
Bis(2-chloroethyl)ether	1	ug/l	-	2	U	-	-
1,2-Dichlorobenzene	3	ug/l	-	2	U	-	-
1,3-Dichlorobenzene	3	ug/l	-	2	U	-	-
1,4-Dichlorobenzene	3	ug/l	-	2	U	-	-
3,3'-Dichlorobenzidine	5	ug/l	-	5	U	-	-
2,4-Dinitrotoluene	5	ug/l	-	5	U	-	-
2,6-Dinitrotoluene	5	ug/l	-	5	U	-	-
4-Chlorophenyl phenyl ether		ug/l	-	2	U	-	-
4-Bromophenyl phenyl ether		ug/l	-	2	U	-	-
Bis(2-chloroisopropyl)ether	5	ug/l	-	2	U	-	-
Bis(2-chloroethoxy)methane	5	ug/l	-	5	U	-	-
Hexachlorocyclopentadiene	5	ug/l	-	20	U	-	-
Isophorone	50	ug/l	-	5	U	-	-
Nitrobenzene	0.4	ug/l	-	2	U	-	-
NDPA/DPA	50	ug/l	-	2	U	-	-
n-Nitrosodi-n-propylamine		ug/l	-	5	U	-	-
Bis(2-ethylhexyl)phthalate	5	ug/l	-	3	U	-	-
Butyl benzyl phthalate	50	ug/l	-	5	U	-	-
Di-n-butylphthalate	50	ug/l	-	5	U	-	-
Di-n-octylphthalate	50	ug/l	-	5	U	-	-
Diethyl phthalate	50	ug/l	-	5	U	-	-
Dimethyl phthalate	50	ug/l	-	5	U	-	-
Biphenyl		ug/l	-	2	U	-	-
4-Chloroaniline	5	ug/l	-	5	U	-	-
2-Nitroaniline	5	ug/l	-	5	U	-	-
3-Nitroaniline	5	ug/l	-	5	U	-	-
4-Nitroaniline	5	ug/l	-	5	U	-	-
Dibenzofuran		ug/l	-	2	U	-	-
1,2,4,5-Tetrachlorobenzene	5	ug/l	-	10	U	-	-
Acetophenone		ug/l	-	5	U	-	-
2,4,6-Trichlorophenol		ug/l	-	5	U	-	-
p-Chloro-m-cresol		ug/l	-	2	U	-	-
2-Chlorophenol		ug/l	-	2	U	-	-
2,4-Dichlorophenol	1	ug/l	-	5	U	-	-
2,4-Dimethylphenol	50	ug/l	-	5	U	-	-
2-Nitrophenol		ug/l	-	10	U	-	-
4-Nitrophenol		ug/l	-	10	U	-	-
2,4-Dinitrophenol	10	ug/l	-	20	U	-	-
4,6-Dinitro-o-cresol		ug/l	-	10	U	-	-
Phenol	1	ug/l	-	5	U	-	-
2-Methylphenol		ug/l	-	5	U	-	-
3-Methylphenol/4-Methylphenol		ug/l	-	5	U	-	-
2,4,5-Trichlorophenol		ug/l	-	5	U	-	-
Benzoic Acid		ug/l	-	50	U	-	-
Benzyl Alcohol		ug/l	-	0.9	J	-	-
Carbazole		ug/l	-	2	U	-	-
Semivolatile Organics by GC/MS-SIM							

Table 6 Groundwater Sample Results Summary -RI
4778 Broadway,New York, NY
AEI Project #384736
BCP#C231131

LOCATION				**FIELD BLANK**		**TRIP BLANK**	
SAMPLING DATE				**2/25/2020**		**2/25/2020**	
SAMPLE TYPE				**WATER**		**WATER**	
	NY-AWQS	**Units**	**Qual**	**Results**	**Qual**	**Results**	**Qual**
Acenaphthene	20	ug/l	-	0.1	U	-	-
2-Chloronaphthalene	10	ug/l	-	0.2	U	-	-
Fluoranthene	50	ug/l	-	0.1	U	-	-
Hexachlorobutadiene	0.5	ug/l	-	0.5	U	-	-
Naphthalene	10	ug/l	-	0.1	U	-	-
Benzo(a)anthracene	0.002	ug/l	-	0.1	U	-	-
Benzo(a)pyrene	0	ug/l	-	0.1	U	-	-
Benzo(b)fluoranthene	0.002	ug/l	-	0.1	U	-	-
Benzo(k)fluoranthene	0.002	ug/l	-	0.1	U	-	-
Chrysene	0.002	ug/l	-	0.1	U	-	-
Acenaphthylene		ug/l	-	0.1	U	-	-
Anthracene	50	ug/l	-	0.1	U	-	-
Benzo(ghi)perylene		ug/l	-	0.1	U	-	-
Fluorene	50	ug/l	-	0.1	U	-	-
Phenanthrene	50	ug/l	-	0.1	U	-	-
Dibenzo(a,h)anthracene		ug/l	-	0.1	U	-	-
Indeno(1,2,3-cd)pyrene	0.002	ug/l	-	0.1	U	-	-
Pyrene	50	ug/l	-	0.1	U	-	-
2-Methylnaphthalene		ug/l	-	0.1	U	-	-
Pentachlorophenol	1	ug/l	-	0.8	U	-	-
Hexachlorobenzene	0.04	ug/l	-	0.8	U	-	-
Hexachloroethane	5	ug/l	-	0.8	U	-	-
Total Metals							
Aluminum, Total		ug/l	-	4.14	J	-	-
Antimony, Total	3	ug/l	-	4	U	-	-
Arsenic, Total	25	ug/l	-	0.5	U	-	-
Barium, Total	1000	ug/l	-	0.56		-	-
Beryllium, Total	3	ug/l	-	0.5	U	-	-
Cadmium, Total	5	ug/l	-	0.2	U	-	-
Calcium, Total		ug/l	-	100	U	-	-
Chromium, Total	50	ug/l	-	1	U	-	-
Cobalt, Total		ug/l	-	0.5	U	-	-
Copper, Total	200	ug/l	-	1	U	-	-
Iron, Total	300	ug/l	-	23.6	J	-	-
Lead, Total	25	ug/l	-	1	U	-	-
Magnesium, Total	35000	ug/l	-	70	U	-	-
Manganese, Total	300	ug/l	-	1	U	-	-
Mercury, Total	0.7	ug/l	-	0.2	U	-	-
Nickel, Total	100	ug/l	-	2	U	-	-
Potassium, Total		ug/l	-	100	U	-	-
Selenium, Total	10	ug/l	-	5	U	-	-
Silver, Total	50	ug/l	-	0.4	U	-	-
Sodium, Total	20000	ug/l	-	100	U	-	-
Thallium, Total	0.5	ug/l	-	1	U	-	-
Vanadium, Total		ug/l	-	5	U	-	-
Zinc, Total	2000	ug/l	-	10	U	-	-
Volatile Organics by GC/MS							
Methylene chloride	5	ug/l	U	2.5	U	2.5	U
1,1-Dichloroethane	5	ug/l	U	2.5	U	2.5	U
Chloroform	7	ug/l	U	2.5	U	2.5	U
Carbon tetrachloride	5	ug/l	U	0.5	U	0.5	U
1,2-Dichloropropane	1	ug/l	U	1	U	1	U
Dibromochloromethane	50	ug/l	U	0.5	U	0.5	U
1,1,2-Trichloroethane	1	ug/l	U	1.5	U	1.5	U
Tetrachloroethene	5	ug/l	U	0.5	U	0.5	U
Chlorobenzene	5	ug/l	U	2.5	U	2.5	U
Trichlorofluoromethane	5	ug/l	U	2.5	U	2.5	U
1,2-Dichloroethane	0.6	ug/l	U	0.5	U	0.5	U
1,1,1-Trichloroethane	5	ug/l	U	2.5	U	2.5	U
Bromodichloromethane	50	ug/l	U	0.5	U	0.5	U
trans-1,3-Dichloropropene	0.4	ug/l	U	0.5	U	0.5	U
cis-1,3-Dichloropropene	0.4	ug/l	U	0.5	U	0.5	U
1,3-Dichloropropene, Total		ug/l	U	0.5	U	0.5	U
1,1-Dichloropropene	5	ug/l	U	2.5	U	2.5	U
Bromoform	50	ug/l	U	2	U	2	U
1,1,2,2-Tetrachloroethane	5	ug/l	U	0.5	U	0.5	U
Benzene	1	ug/l	U	0.5	U	0.5	U
Toluene	5	ug/l	U	2.5	U	2.5	U

Table 6 Groundwater Sample Results Summary -RI
4778 Broadway,New York, NY
AEI Project #384736
BCP#C231131

LOCATION				**FIELD BLANK**		**TRIP BLANK**	
SAMPLING DATE				**2/25/2020**		**2/25/2020**	
SAMPLE TYPE				**WATER**		**WATER**	
	NY-AWQS	**Units**	**Qual**	**Results**	**Qual**	**Results**	**Qual**
Ethylbenzene	5	ug/l	U	2.5	U	2.5	U
Chloromethane		ug/l	U	2.5	U	2.5	U
Bromomethane	5	ug/l	U	2.5	U	2.5	U
Vinyl chloride	2	ug/l	U	1	U	1	U
Chloroethane	5	ug/l	U	2.5	U	2.5	U
1,1-Dichloroethene	5	ug/l	U	0.5	U	0.5	U
trans-1,2-Dichloroethene	5	ug/l	U	2.5	U	2.5	U
Trichloroethene	5	ug/l	U	0.5	U	0.5	U
1,2-Dichlorobenzene	3	ug/l	U	2.5	U	2.5	U
1,3-Dichlorobenzene	3	ug/l	U	2.5	U	2.5	U
1,4-Dichlorobenzene	3	ug/l	U	2.5	U	2.5	U
Methyl tert butyl ether	10	ug/l	U	2.5	U	2.5	U
p/m-Xylene	5	ug/l	U	2.5	U	2.5	U
o-Xylene	5	ug/l	U	2.5	U	2.5	U
Xylenes, Total		ug/l	U	2.5	U	2.5	U
cis-1,2-Dichloroethene	5	ug/l	U	2.5	U	2.5	U
1,2-Dichloroethene, Total		ug/l	U	2.5	U	2.5	U
Dibromomethane	5	ug/l	U	5	U	5	U
1,2,3-Trichloropropane	0.04	ug/l	U	2.5	U	2.5	U
Acrylonitrile	5	ug/l	U	5	U	5	U
Styrene	5	ug/l	U	2.5	U	2.5	U
Dichlorodifluoromethane	5	ug/l	U	5	U	5	U
Acetone	50	ug/l	U	5	U	5	U
Carbon disulfide	60	ug/l	U	5	U	5	U
2-Butanone	50	ug/l	U	5	U	5	U
Vinyl acetate		ug/l	U	5	U	5	U
4-Methyl-2-pentanone		ug/l	U	5	U	5	U
2-Hexanone	50	ug/l	U	5	U	5	U
Bromochloromethane	5	ug/l	U	2.5	U	2.5	U
2,2-Dichloropropane	5	ug/l	U	2.5	U	2.5	U
1,2-Dibromoethane	0.0006	ug/l	U	2	U	2	U
1,3-Dichloropropane	5	ug/l	U	2.5	U	2.5	U
1,1,1,2-Tetrachloroethane	5	ug/l	U	2.5	U	2.5	U
Bromobenzene	5	ug/l	U	2.5	U	2.5	U
n-Butylbenzene	5	ug/l	U	2.5	U	2.5	U
sec-Butylbenzene	5	ug/l	U	2.5	U	2.5	U
tert-Butylbenzene	5	ug/l	U	2.5	U	2.5	U
o-Chlorotoluene	5	ug/l	U	2.5	U	2.5	U
p-Chlorotoluene	5	ug/l	U	2.5	U	2.5	U
1,2-Dibromo-3-chloropropane	0.04	ug/l	U	2.5	U	2.5	U
Hexachlorobutadiene	0.5	ug/l	U	2.5	U	2.5	U
Isopropylbenzene	5	ug/l	U	2.5	U	2.5	U
p-Isopropyltoluene	5	ug/l	U	2.5	U	2.5	U
Naphthalene	10	ug/l	U	2.5	U	2.5	U
n-Propylbenzene	5	ug/l	U	2.5	U	2.5	U
1,2,3-Trichlorobenzene	5	ug/l	U	2.5	U	2.5	U
1,2,4-Trichlorobenzene	5	ug/l	U	2.5	U	2.5	U
1,3,5-Trimethylbenzene	5	ug/l	U	2.5	U	2.5	U
1,2,4-Trimethylbenzene	5	ug/l	U	2.5	U	2.5	U
1,4-Dioxane		ug/l	U	250	U	250	U
p-Diethylbenzene		ug/l	U	2	U	2	U
p-Ethyltoluene		ug/l	U	2	U	2	U
1,2,4,5-Tetramethylbenzene	5	ug/l	U	2	U	2	U
Ethyl ether		ug/l	U	2.5	U	2.5	U
trans-1,4-Dichloro-2-butene	5	ug/l	U	2.5	U	2.5	U

Notes:
ug/l:Micrograms per liter
U: Value below the Method Detection Limit (MDL)
J: Estimated Value
Highlighted: Exceeds respective criteria
NY-AWQS: New York TOGS 111 Ambient Water Quality Standards criteria reflects all

Table 7: Groundwater Sample Results Summary- Pre Injection
4778 Broadway New York, New York10034
AEI Project Number 387436
BCP#C231131

SAMPLE LOCATION			**FIELD BLANK**	**FIELD BLANK**	**MW-1**	**MW-1**	**MW-2**	**MW-3**	**MW-4**	**MW-5**	**MW-5**	**MW-6**	**MW-6**	**TRIP BLANK**
SAMPLING DATE			**5/10/2023**	**5/10/2023**	**5/10/2023**	**5/10/2023**	**5/10/2023**	**5/10/2023**	**5/10/2023**	**5/10/2023**	**5/10/2023**	**5/10/2023**	**5/10/2023**	**5/10/2023**
	NY-AWQS	**Units**	**Results**	**Results**	**Results**	**Results**	**Results**	**Results**	**Results**	**Results**	**Results**	**Results**	**Results**	**Results**
Semivolatile Organics by GC/MS														
1,2,4,5-Tetrachlorobenzene	5	µg/L	ND	-	ND	-	ND	ND	ND	ND	-	ND	-	-
1,2,4-Trichlorobenzene	5	µg/L	ND	-	ND	-	ND	ND	ND	ND	-	ND	-	-
1,2-Dichlorobenzene	3	µg/L	ND	-	ND	-	ND	ND	ND	ND	-	ND	-	-
1,3-Dichlorobenzene	3	µg/L	ND	-	ND	-	ND	ND	ND	ND	-	ND	-	-
1,4-Dichlorobenzene	3	µg/L	ND	-	ND	-	ND	ND	ND	ND	-	ND	-	-
2,4,5-Trichlorophenol		µg/L	ND	-	ND	-	ND	ND	ND	ND	-	ND	-	-
2,4,6-Trichlorophenol		µg/L	ND	-	ND	-	ND	ND	ND	ND	-	ND	-	-
2,4-Dichlorophenol	1	µg/L	ND	-	ND	-	ND	ND	ND	ND	-	ND	-	-
2,4-Dimethylphenol	50	µg/L	ND	-	ND	-	ND	2.5 (J)	ND	ND	-	67	-	-
2,4-Dinitrophenol	10	µg/L	ND	-	ND	-	ND	ND	ND	ND	-	ND	-	-
2,4-Dinitrotoluene	5	µg/L	ND	-	ND	-	ND	ND	ND	ND	-	ND	-	-
2,6-Dinitrotoluene	5	µg/L	ND	-	ND	-	ND	ND	ND	ND	-	ND	-	-
2-Chlorophenol		µg/L	ND	-	ND	-	ND	ND	ND	ND	-	ND	-	-
2-Methylphenol		µg/L	ND	-	ND	-	13	ND	ND	ND	-	36	-	-
2-Nitroaniline	5	µg/L	ND	-	ND	-	ND	ND	ND	ND	-	ND	-	-
2-Nitrophenol		µg/L	ND	-	ND	-	ND	ND	ND	ND	-	ND	-	-
3,3'-Dichlorobenzidine	5	µg/L	ND	-	ND	-	ND	ND	ND	ND	-	ND	-	-
3-Methylphenol/4-Methylphenol		µg/L	ND	-	ND	-	6.2	2.7 (J)	ND	ND	-	53	-	-
3-Nitroaniline	5	µg/L	ND	-	ND	-	ND	ND	ND	ND	-	ND	-	-
4,6-Dinitro-o-cresol		µg/L	ND	-	ND	-	ND	ND	ND	ND	-	ND	-	-
4-Bromophenyl phenyl ether		µg/L	ND	-	ND	-	ND	ND	ND	ND	-	ND	-	-
4-Chloroaniline	5	µg/L	ND	-	ND	-	ND	ND	ND	ND	-	ND	-	-
4-Chlorophenyl phenyl ether		µg/L	ND	-	ND	-	ND	ND	ND	ND	-	ND	-	-
4-Nitroaniline	5	µg/L	ND	-	ND	-	ND	ND	ND	ND	-	ND	-	-
4-Nitrophenol		µg/L	ND	-	ND	-	ND	ND	ND	ND	-	ND	-	-
Acetophenone		µg/L	ND	-	ND	-	ND	2.2 (J)	ND	ND	-	53	-	-
Benzoic Acid		µg/L	ND	-	ND	-	ND	ND	ND	ND	-	ND	-	-
Benzyl Alcohol		µg/L	ND	-	ND	-	ND	ND	ND	ND	-	ND	-	-
Biphenyl		µg/L	ND	-	50	-	ND	ND	ND	6.6	-	1.6 (J)	-	-
Bis(2-chloroethoxy)methane	5	µg/L	ND	-	ND	-	ND	ND	ND	ND	-	ND	-	-
Bis(2-chloroethyl)ether	1	µg/L	ND	-	ND	-	ND	ND	ND	ND	-	ND	-	-
Bis(2-chloroisopropyl)ether	5	µg/L	ND	-	ND	-	ND	ND	ND	ND	-	ND	-	-
Bis(2-ethylhexyl)phthalate	5	µg/L	ND	-	ND	-	ND	ND	ND	ND	-	ND	-	-
Butyl benzyl phthalate	50	µg/L	ND	-	ND	-	ND	ND	ND	ND	-	ND	-	-
Carbazole		µg/L	ND	-	ND	-	ND	ND	ND	ND	-	ND	-	-
Di-n-butylphthalate	50	µg/L	ND	-	ND	-	ND	ND	ND	ND	-	ND	-	-
Di-n-octylphthalate	50	µg/L	ND	-	ND	-	ND	ND	ND	ND	-	ND	-	-
Dibenzofuran		µg/L	ND	-	ND	-	ND	ND	ND	ND	-	ND	-	-
Diethyl phthalate	50	µg/L	ND	-	ND	-	ND	ND	ND	ND	-	ND	-	-
Dimethyl phthalate	50	µg/L	ND	-	ND	-	ND	ND	ND	ND	-	ND	-	-
Hexachlorocyclopentadiene	5	µg/L	ND	-	ND	-	ND	ND	ND	ND	-	ND	-	-
Isophorone	50	µg/L	ND	-	ND	-	ND	ND	ND	ND	-	ND	-	-
n-Nitrosodi-n-propylamine		µg/L	ND	-	ND	-	ND	ND	ND	ND	-	ND	-	-
NDPA/DPA	50	µg/L	ND	-	ND	-	ND	ND	ND	ND	-	ND	-	-
Nitrobenzene	0.4	µg/L	ND	-	ND	-	ND	ND	ND	ND	-	ND	-	-
p-Chloro-m-cresol		µg/L	ND	-	ND	-	ND	ND	ND	ND	-	ND	-	-
Phenol	1	µg/L	ND	-	ND	-	2 (J)	2.3 (J)	ND	ND	-	ND	-	-
Semivolatile Organics by GC/MS-SIM														
2-Chloronaphthalene	10	µg/L	ND	ND	ND	-	ND	ND	ND	ND	-	ND	-	-
2-Methylnaphthalene		µg/L	0.07 (J)	0.03 (J)	4400	6300	1.4	0.82	3.8	240	200	69	-	-
Acenaphthene	20	µg/L	ND	ND	21	-	0.03 (J)	0.25	0.08 (J)	ND	-	0.26	-	-
Acenaphthylene		µg/L	ND	ND	12	-	ND	ND	0.02 (J)	0.67	-	ND	-	-
Anthracene	50	µg/L	ND	ND	14	-	ND	0.24	0.01 (J)	0.86	-	0.09 (J)	-	-
Benzo(a)anthracene	0.002	µg/L	ND	ND	4.3	-	ND	ND	0.02 (J)	0.3	-	ND	-	-
Benzo(a)pyrene	0	µg/L	ND	ND	2.6	-	ND	ND	ND	0.18	-	ND	-	-
Benzo(b)fluoranthene	0.002	µg/L	ND	ND	3.1	-	0.01 (J)	ND	ND	0.18	-	0.01 (J)	-	-
Benzo(ghi)perylene		µg/L	ND	ND	3.1	-	ND	ND	ND	0.2	-	ND	-	-
Benzo(k)fluoranthene	0.002	µg/L	ND	ND	0.72 (J)	-	ND	ND	ND	0.06 (J)	-	ND	-	-

Table 7: Groundwater Sample Results Summary- Pre Injection
4778 Broadway New York, New York10034
AEI Project Number 387436
BCP#C231131

SAMPLE LOCATION			**FIELD BLANK**	**FIELD BLANK**	**MW-1**	**MW-1**	**MW-2**	**MW-3**	**MW-4**	**MW-5**	**MW-5**	**MW-6**	**MW-6**	**TRIP BLANK**
SAMPLING DATE			**5/10/2023**	**5/10/2023**	**5/10/2023**	**5/10/2023**	**5/10/2023**	**5/10/2023**	**5/10/2023**	**5/10/2023**	**5/10/2023**	**5/10/2023**	**5/10/2023**	**5/10/2023**
	NY-AWQS	**Units**	**Results**	**Results**	**Results**	**Results**	**Results**	**Results**	**Results**	**Results**	**Results**	**Results**	**Results**	**Results**
Chrysene	0.002	µg/L	ND	ND	4	-	ND	ND	ND	0.28	-	0.02 (J)	-	-
Dibenzo(a,h)anthracene		µg/L	ND	ND	0.28 (J)	-	ND	ND	ND	0.02 (J)	-	ND	-	-
Fluoranthene	50	µg/L	ND	ND	9.8	-	ND	0.02 (J)	0.02 (J)	0.72	-	0.04 (J)	-	-
Fluorene	50	µg/L	ND	ND	72	-	0.05 (J)	0.06 (J)	0.12	2.6	-	0.6	-	-
Hexachlorobenzene	0.04	µg/L	ND	0.01 (J)	ND	-	ND	ND	ND	ND	-	ND	-	-
Hexachlorobutadiene	0.5	µg/L	ND	ND	ND	-	ND	ND	ND	ND	-	ND	-	-
Hexachloroethane	5	µg/L	ND	ND	ND	-	ND	ND	ND	ND	-	ND	-	-
Indeno(1,2,3-cd)pyrene	0.002	µg/L	ND	ND	1.1 (J)	-	ND	ND	ND	0.08 (J)	-	ND	-	-
Naphthalene	10	µg/L	0.13	ND	4600	6900	3.3	8.4	3.9	160	140	140	220	-
Pentachlorophenol	1	µg/L	ND	ND	ND	-	0.07 (J)	ND	ND	ND	-	0.07 (J)	-	-
Phenanthrene	50	µg/L	ND	0.03 (J)	60	-	ND	0.11	0.13	3.6	-	0.35	-	-
Pyrene	50	µg/L	ND	ND	19	-	ND	0.04 (J)	0.02 (J)	1	-	0.07 (J)	-	-
Volatile Organics by GC/MS														
1,1,1,2-Tetrachloroethane	5	µg/L	ND	-	ND	-	ND	ND	ND	ND	-	ND	-	ND
1,1,1-Trichloroethane	5	µg/L	ND	-	ND	-	ND	ND	ND	ND	-	ND	-	ND
1,1,2,2-Tetrachloroethane	5	µg/L	ND	-	ND	-	ND	ND	ND	ND	-	ND	-	ND
1,1,2-Trichloroethane	1	µg/L	ND	-	ND	-	ND	ND	ND	ND	-	ND	-	ND
1,1-Dichloroethane	5	µg/L	ND	-	ND	-	ND	ND	ND	ND	-	ND	-	ND
1,1-Dichloroethene	5	µg/L	ND	-	ND	-	ND	ND	ND	ND	-	ND	-	ND
1,1-Dichloropropene	5	µg/L	ND	-	ND	-	ND	ND	ND	ND	-	ND	-	ND
1,2,3-Trichlorobenzene	5	µg/L	ND	-	ND	-	ND	ND	ND	ND	-	ND	-	ND
1,2,3-Trichloropropane	0.04	µg/L	ND	-	ND	-	ND	ND	ND	ND	-	ND	-	ND
1,2,4,5-Tetramethylbenzene	5	µg/L	ND	-	140 (J)	-	8.8 (J)	ND	6.5	110	-	100	-	ND
1,2,4-Trichlorobenzene	5	µg/L	ND	-	ND	-	ND	ND	ND	ND	-	ND	-	ND
1,2,4-Trimethylbenzene	5	µg/L	ND	-	3400	-	140	61	71	1700	-	3400	-	ND
1,2-Dibromo-3-chloropropane	0.04	µg/L	ND	-	ND	-	ND	ND	ND	ND	-	ND	-	ND
1,2-Dibromoethane	0.0006	µg/L	ND	-	ND	-	ND	ND	ND	ND	-	ND	-	ND
1,2-Dichlorobenzene	3	µg/L	ND	-	ND	-	ND	ND	ND	ND	-	ND	-	ND
1,2-Dichloroethane	0.6	µg/L	ND	-	ND	-	ND	ND	ND	ND	-	ND	-	ND
1,2-Dichloroethene, Total		µg/L	ND	-	ND	-	ND	ND	ND	ND	-	ND	-	ND
1,2-Dichloropropane	1	µg/L	ND	-	ND	-	ND	ND	ND	ND	-	ND	-	ND
1,3,5-Trimethylbenzene	5	µg/L	ND	-	900	-	49	22	20	580	-	950	-	ND
1,3-Dichlorobenzene	3	µg/L	ND	-	ND	-	ND	ND	ND	ND	-	ND	-	ND
1,3-Dichloropropane	5	µg/L	ND	-	ND	-	ND	ND	ND	ND	-	ND	-	ND
1,3-Dichloropropene, Total		µg/L	ND	-	ND	-	ND	ND	ND	ND	-	ND	-	ND
1,4-Dichlorobenzene	3	µg/L	ND	-	ND	-	ND	ND	ND	ND	-	ND	-	ND
1,4-Dioxane		µg/L	ND	-	ND	-	ND	ND	ND	ND	-	ND	-	ND
2,2-Dichloropropane	5	µg/L	ND	-	ND	-	ND	ND	ND	ND	-	ND	-	ND
2-Butanone	50	µg/L	ND	-	ND	-	ND	15 (J)	15	ND	-	ND	-	ND
2-Hexanone	50	µg/L	ND	-	ND	-	ND	ND	ND	ND	-	ND	-	ND
4-Methyl-2-pentanone		µg/L	ND	-	ND	-	ND	ND	ND	ND	-	ND	-	ND
Acetone	50	µg/L	ND	-	ND	-	ND	14 (J)	29	ND	-	100 (J)	-	ND
Acrylonitrile	5	µg/L	ND	-	ND	-	ND	ND	ND	ND	-	ND	-	ND
Benzene	1	µg/L	ND	-	150	-	49	23	ND	ND	-	41	-	ND
Bromobenzene	5	µg/L	ND	-	ND	-	ND	ND	ND	ND	-	ND	-	ND
Bromochloromethane	5	µg/L	ND	-	ND	-	ND	ND	ND	ND	-	ND	-	ND
Bromodichloromethane	50	µg/L	ND	-	ND	-	ND	ND	ND	ND	-	ND	-	ND
Bromoform	50	µg/L	ND	-	ND	-	ND	ND	ND	ND	-	ND	-	ND
Bromomethane	5	µg/L	ND	-	ND	-	ND	ND	ND	ND	-	ND	-	ND
Carbon disulfide	60	µg/L	ND	-	ND	-	ND	ND	ND	ND	-	ND	-	ND
Carbon tetrachloride	5	µg/L	ND	-	ND	-	ND	ND	ND	ND	-	ND	-	ND
Chlorobenzene	5	µg/L	ND	-	ND	-	ND	ND	ND	ND	-	ND	-	ND
Chloroethane	5	µg/L	ND	-	ND	-	ND	ND	ND	ND	-	ND	-	ND
Chloroform	7	µg/L	ND	-	ND	-	ND	ND	ND	ND	-	ND	-	ND
Chloromethane		µg/L	ND	-	ND	-	ND	ND	ND	ND	-	ND	-	ND
cis-1,2-Dichloroethene	5	µg/L	ND	-	ND	-	ND	ND	ND	ND	-	ND	-	ND
cis-1,3-Dichloropropene	0.4	µg/L	ND	-	ND	-	ND	ND	ND	ND	-	ND	-	ND
Dibromochloromethane	50	µg/L	ND	-	ND	-	ND	ND	ND	ND	-	ND	-	ND
Dibromomethane	5	µg/L	ND	-	ND	-	ND	ND	ND	ND	-	ND	-	ND

Table 7: Groundwater Sample Results Summary- Pre Injection
4778 Broadway New York, New York10034
AEI Project Number 387436
BCP#C231131

SAMPLE LOCATION			**FIELD BLANK**	**FIELD BLANK**	**MW-1**	**MW-1**	**MW-2**	**MW-3**	**MW-4**	**MW-5**	**MW-5**	**MW-6**	**MW-6**	**TRIP BLANK**
SAMPLING DATE			**5/10/2023**	**5/10/2023**	**5/10/2023**	**5/10/2023**	**5/10/2023**	**5/10/2023**	**5/10/2023**	**5/10/2023**	**5/10/2023**	**5/10/2023**	**5/10/2023**	**5/10/2023**
	NY-AWQS	**Units**	**Results**	**Results**	**Results**	**Results**	**Results**	**Results**	**Results**	**Results**	**Results**	**Results**	**Results**	**Results**
Dichlorodifluoromethane	5	µg/L	ND	-	ND	-	ND	ND	ND	ND	-	ND	-	ND
Ethyl ether		µg/L	ND	-	ND	-	ND	ND	ND	ND	-	ND	-	ND
Ethylbenzene	5	µg/L	ND	-	5000	-	180	100	29	730	-	5300	-	ND
Hexachlorobutadiene	0.5	µg/L	ND	-	ND	-	ND	ND	ND	ND	-	ND	-	ND
Isopropylbenzene	5	µg/L	ND	-	160 (J)	-	7.2 (J)	4.4 (J)	2.4 (J)	73	-	170	-	ND
Methyl tert butyl ether	10	µg/L	ND	-	ND	-	ND	ND	ND	ND	-	ND	-	ND
Methylene chloride	5	µg/L	ND	-	ND	-	ND	ND	ND	ND	-	ND	-	ND
n-Butylbenzene	5	µg/L	ND	-	ND	-	ND	ND	1.8 (J)	42 (J)	-	ND	-	ND
n-Propylbenzene	5	µg/L	ND	-	410 (J)	-	20	6.6 (J)	7.9	260	-	480	-	ND
Naphthalene	10	µg/L	ND	-	860	-	16	12	11	130	-	460	-	ND
o-Chlorotoluene	5	µg/L	ND	-	ND	-	ND	ND	ND	ND	-	ND	-	ND
o-Xylene	5	µg/L	ND	-	7400	-	270	81	49	1100	-	7000	-	ND
p-Chlorotoluene	5	µg/L	ND	-	ND	-	ND	ND	ND	ND	-	ND	-	ND
p-Diethylbenzene		µg/L	ND	-	ND	-	31	4.9 (J)	19	430	-	330	-	ND
p-Ethyltoluene		µg/L	ND	-	2500	-	130	45	50	1600	-	2200	-	ND
p-Isopropyltoluene	5	µg/L	ND	-	ND	-	ND	ND	11	15 (J)	-	ND	-	ND
p/m-Xylene	5	µg/L	ND	-	20000	-	620	280	140	3100	-	17000	-	ND
sec-Butylbenzene	5	µg/L	ND	-	ND	-	ND	ND	0.94 (J)	25 (J)	-	ND	-	ND
Styrene	5	µg/L	ND	-	ND	-	ND	ND	ND	ND	-	ND	-	ND
tert-Butylbenzene	5	µg/L	ND	-	ND	-	ND	ND	ND	ND	-	ND	-	ND
Tetrachloroethene	5	µg/L	ND	-	ND	-	2.3 (J)	ND	ND	ND	-	ND	-	ND
Toluene	5	µg/L	ND	-	9200	-	710	10 (J)	10	930	-	9400	-	ND
trans-1,2-Dichloroethene	5	µg/L	ND	-	ND	-	ND	ND	ND	ND	-	ND	-	ND
trans-1,3-Dichloropropene	0.4	µg/L	ND	-	ND	-	ND	ND	ND	ND	-	ND	-	ND
trans-1,4-Dichloro-2-butene	5	µg/L	ND	-	ND	-	ND	ND	ND	ND	-	ND	-	ND
Trichloroethene	5	µg/L	ND	-	ND	-	ND	ND	ND	ND	-	ND	-	ND
Trichlorofluoromethane	5	µg/L	ND	-	ND	-	ND	ND	ND	ND	-	ND	-	ND
Vinyl acetate		µg/L	ND	-	ND	-	ND	ND	ND	ND	-	ND	-	ND
Vinyl chloride	2	µg/L	ND	-	ND	-	ND	ND	ND	ND	-	ND	-	ND
Xylenes, Total		µg/L	ND	-	27000	-	890	360	190	4200	-	24000	-	ND

Notes:
µg/L: Micrograms per liter
ND: Non-Detect
J: Estimated value
NY-AWQS: New York TOGS 111 Ambient Water Quality Standards criteria reflects all addendum to criteria through June 2004.
Highlight: Exceeds Respective Standard

Table 8 - Groundwater Monitoring Results Summary Pre and Post Injection

4778 Broadway New York, New York 10034

BCP# C231131

LOCATION	NYSDEC TOGS 1.1.1 AWQS GV	MW-1		MW-1		MW-1		MW-1		MW-1		MW-1		MW-2		MW-2		MW-2		MW-2		MW-2		MW-2		MW-3		MW-3		MW-3		MW-3		MW-3		MW-3		MW
SAMPLING DATE		5/10/2023		12/21/2023		3/8/2024		6/7/2024		1/3/2025		1/28/2025		5/10/2023		12/21/2023		3/8/2024		6/7/2024		1/2/2025		1/28/2025		5/10/2023		12/21/2023		3/8/2024		6/7/2024		1/3/2025		1/28/2025		5/10/2
SAMPLE TYPE		Water		Water		Water		Water		Water		Water		Water		Water		Water		Water		Water		Water		Water		Water		Water		Water		Water		Water		Wat
		Results	Qual	Results	Qual	Results	Qual	Results	Qual	Results	Qual	Results	Qual	Results	Qual	Results	Qual	Results	Qual	Results	Qual	Results	Qual	Results	Qual	Results	Qual	Results	Qual	Results	Qual	Results	Qual	Results	Qual	Results	Qual	Results
Volatile Organics by GC/MS (ug/L)																																						
1,1,1,2-Tetrachloroethane	5	<140	U	<70	U	<7	U	NA		0.7	U	28	U	<3.5		<35	U	<70	U	NA		7	U	14	U	<3.5	U	<0.7	U	<1.4		NA		1.8	U	1.8	U	<0.7
1,1,1-Trichloroethane	5	<140	U	<70	U	<7	U	<5.4	U	0.7	U	28	U	<3.5		<35	U	<70	U	<27	U	7	U	14	U	<3.5	U	<0.7	U	<1.4		<0.54	U	1.8	U	1.8	U	<0.7
1,1,2,2-Tetrachloroethane	5	<33	U	<17	U	<1.7	U	<6.5	U	0.17	U	6.7	U	<0.84		<8.4	U	<17	U	<33	U	1.7	U	3.3	U	<0.84	U	<0.17	U	<0.33		<0.65	U	0.42	U	0.42	U	<0.17
1,1,2-Trichloroethane	1	<100	U	<50	U	<5	U	<5.3	U	0.5	U	20	U	<2.5	U	<25	U		U	<27	U	5	U	10	U	<2.5	U	<0.5	U	<1	U	<0.53	U	1.2	U	1.2	U	<0.5
1,1-Dichloroethane	5	<140	U	<70	U	<7	U	<5.7	U	0.7	U	28	U	<3.5		<35	U	<70	U	<28	U	7	U	14	U	<3.5	U	<0.7	U	<1.4		<0.57	U	1.8	U	1.8	U	<0.7
1,1-Dichloroethene	5	<34	U	<17	U	<1.7	U	<5.9	U	0.17	U	6.8	U	<0.84		<8.4	U	<17	U	<30	U	1.7	U	3.4	U	<0.84	U	<0.17	U	<0.34		<0.59	U	0.42	U	0.42	U	<0.17
1,1-Dichloropropene	5	<140	U	<70	U	<7	U	NA		0.7	U	28	U	<3.5		<35	U	<70	U	NA		7	U	14	U	<3.5	U	<0.7	U	<1.4		NA		1.8	U	1.8	U	<0.7
1,2,3-Trichlorobenzene	5	<140	U	<70	U	<7	U	<5.0	U	0.7	U	28	U	<3.5		<35	U	<70	U	<25	U	7	U	14	U	<3.5	U	<0.7	U	<1.4		<0.50	U	1.8	U	1.8	U	<0.7
1,2,3-Trichloropropane	0.04	<140	U	<70	U	<7	U	NA		0.7	U	28	U	<3.5		<35	U	<70	U	NA		7	U	14	U	<3.5	U	<0.7	U	<1.4	U	NA		1.8	U	1.8	U	<0.7
1,2,4,5-Tetramethylbenzene	5	140	J	400		56		NA		68		33	J	8.8	J	140		<54	U	NA		5.4	U	11	U	<2.7	U	<0.54	U	<1.1		NA		1.4	U	1.4	U	6.5
1,2,4-Trichlorobenzene	5	<140	U	<70	U	<7	U	<5.0	U	0.7	U	28	U	<3.5	U	<35	U	<70	U	<25	U	7	U	14	U	<3.5	U	<0.7	U	<1.4		<0.50	U	1.8	U	1.8	U	<0.7
1,2,4-Trimethylbenzene	5	3,400		7,200		1,100		1,150		440	E	1000		140		4,200		930		1540		7	U	200		61		<0.7	U	<1.4		<1	U	1.8	U	1.8	U	71
1,2-Dibromo-3-chloropropane	0.04	<140	U	<70	U	<7	U	<5.3	U	0.7	U	28	U	<3.5	U	<35	U	<70	U	<26	U	7	U	14	U	<3.5	U	<0.7	U	<1.4	U	<0.53	U	1.8	U	1.8	U	<0.7
1,2-Dibromoethane	0.0006	<130	U	<65	U	<6.5	U	<4.8	U	0.65	U	26	U	<3.2	U	<32	U	<65	U	<24	U	6.5	U	13	U	<3.2	U	<0.65	U	<1.3	U	<0.48	U	1.6	U	1.6	U	<0.65
1,2-Dichlorobenzene	3	<140	U	<70	U	<7	U	<5.3	U	0.7	U	28	U	<3.5	U	<35	U	<70	U	<27	U	7	U	14	U	<3.5	U	<0.7	U	<1.4		<0.53	U	1.8	U	1.8	U	<0.7
1,2-Dichloroethane	0.6	<26	U	<13	U	<1.3	U	<6.0	U	0.13	U	5.3	U	<0.66	U	<6.6	U	<13	U	<30	U	1.3	U	2.6	U	<0.66	U	0.42		<0.26		<0.60	U	0.33	U	0.33	U	<0.13
1,2-Dichloroethene, Total	--	<140	U	<70	U	<7	U	NA		0.7	U	14	U	<3.5	U	<35	U	<70	U	NA		7	U	14	U	<3.5	U	<0.7	U	<1.4		NA		1.8	U	1.8	U	<0.7
1,2-Dichloropropane	1	<27	U	<14	U	<1.4	U	<5.1	U	0.14	U	5.5	U	<0.68	U	<6.8	U	<14	U	<25	U	1.4	U	2.7	U	<0.68	U	<0.14	U	<0.27		<0.51	U	0.34	U	0.34	U	<0.14
1,3,5-Trimethylbenzene	5	900		1,900		350		335		250	E	200		49		1,100		240		372		7	U	20	J	22		<0.7	U	<1.4		<1	U	1.8	U	1.8	U	20
1,3-Dichlorobenzene	3	<140	U	<70	U	<7	U	<5.4	U	0.7	U	28	U	<3.5	U	<35	U	<70	U	<27	U	7	U	14	U	<3.5	U	<0.7	U	<1.4		<0.54	U	1.8	U	1.8	U	<0.7
1,3-Dichloropropane	5	<140	U	<70	U	<7	U	NA		0.7	U	28	U	<3.5	U	<35	U	<70	U	NA		7	U	14	U	<3.5	U	<0.7	U	<1.4	U	NA		1.8	U	1.8	U	<0.7
1,3-Dichloropropene, Total	--	<29	U	<14	U	<1.4	U	NA		0.14	U	2.9	U	<0.72	U	<7.2	U	<14	U	NA		1.4	U	2.9	U	<0.72	U	<0.14	U	<0.29	U	NA		0.36	U	0.36	U	<0.14
1,4-Dichlorobenzene	3	<140	U	<70	U	<7	U	<5.1	U	0.7	U	28	U	<3.5	U	<35	U	<70	U	<25	U	7	U	14	U	<3.5	U	<0.7	U	<1.4	U	<0.51	U	1.8	U	1.8	U	<0.7
1,4-Dioxane	--	<1,2000	U	<6,100	U	<610	U	<0.66	U	61	U	2400	U	<300	U	<3000	U	<6,100	U	<0.66	U	610	U	1200	U	<300	U	<61	U	<120	U	NA		150	U	150	U	<61
2,2-Dichloropropane	5	<140	U	<70	U	<7	U	NA		0.7	U	28	U	<3.5	U	<35	U	<70	U	NA		7	U	14	U	<3.5	U	<0.7	U	<1.4	U	NA		1.8	U	1.8	U	<0.7
2-Butanone	50	<390	U	<190	U	<19	U	<27	U	350	E	780		<9.7	U	<97	U	<190	U	<140	U	390		320		15	J	39		24		<2.7	U	21		16		15
2-Hexanone	50	<200	U	<100	U	<10	U	<48	U	48		48	J	<5	U	<50	U	<100	U	<240	U	40	J	20	U	<5	U	<1	U	<2	U	<4.8	U	2.5	U	2.5	U	<1
4-Methyl-2-pentanone	--	<200	U	<100	U	<10	U	<49	U	23		40	U	<5	U	<50	U	<100	U	<240	U	28	J	20	J	<5	U	<1	U	<2	U	<4.9	U	2.5	U	2.5	U	<1
Acetone	50	<290	U	<150	U	<15	U	<31	U	710	E	2000		<7.3	U	130	J	<150	U	214	J	940		800		14	J	240	D	200		32.4		230		530	E	29
Acrylonitrile	5	<300	U	<150	U	<15	U	NA		1.5	U	60	U	<7.5	U	<75	U	<150	U	NA		15	U	30	U	<7.5	U	<1.5	U	<3	U	NA		3.8	U	3.8	U	<1.5
Benzene	1	150		140		8.8		14		64		120		49		3,800		1,800		5,600		670		1100		23		0.27	J	10		<0.43	U	0.4	U	0.4	U	<0.16
Bromobenzene	5	<140	U	<70	U	<7	U	NA		0.7	U	28	U	<3.5	U	<35	U	<70	U			7	U	14	U	<3.5	U	<0.7	U	<1.4	U	NA		1.8	U	1.8	U	<0.7
Bromochloromethane	5	<140	U	<70	U	<7	U	<4.8	U	0.7	U	28	U	<3.5	U	<35	U	<70	U	<24	U	7	U	14	U	<3.5	U	<0.7	U	<1.4	U	<0.48	U	1.8	U	1.8	U	<0.7
Bromodichloromethane	50	<38	U	<19	U	<1.9	U	<4.5	U	0.19	U	7.7	U	<0.96	U	<9.6	U	<19	U	<23	U	1.9	U	3.8	U	<0.96	U	<0.19	U	<0.38	U	<0.45	U	0.62	J	0.68	J	<0.19
Bromoform	50	<130	U	<65	U	<6.5	U	<6.3	U	0.65	U	26	U	<3.2	U	<32	U	<65	U	<32	U	6.5	U	13	U	<3.2	U	<0.65	U	<1.3	U	<0.63	U	2.1	J	2.8	J	<0.65
Bromomethane	5	<140	U	<70	U	<7	U	<16	U	1.2	J	28	U	<3.5	U	<35	U	<70	U	<82	U	7	U	14	U	<3.5	U	<0.7	U	<1.4	U	<1.6	U	3.9	J	1.8	U	<0.7
Carbon disulfide	60	<200	U	<100	U	<10	U	<18	U	2.7	J	40	U	<5	U	<50	U	<100	U	<90	U	10	U	20	U	<5	U	<1	U	<2	U	<1.8	U	2.5	U	2.5	U	<1
Carbon tetrachloride	5	<27	U	<13	U	<1.3	U	<5.5	U	0.13	U	5.4	U	<0.67	U	<6.7	U	<13	U	<28	U	1.3	U	2.7	U	<0.67	U	<0.13	U	<0.27	U	<0.55	U	0.34	U	0.34	U	<0.13
Chlorobenzene	5	<140	U	<70	U	<7	U	<5.6	U	0.7	U	28	U	<3.5	U	<35	U	<70	U	<28	U	7	U	14	U	<3.5	U	<0.7	U	<1.4	U	<0.56	U	1.8	U	1.8	U	<0.7
Chloroethane	5	<140	U	<70	U	<7	U	<7.3	U	3.4		28	U	<3.5	U	<35	U	<70	U	<36	U	10	J	20	J	<3.5	U	0.79	J	<1.4	U	<0.73	U	1.8	U	1.8	U	<0.7
Chloroform	7	<140	U	<70	U	<7	U	<5.0	U	0.7	U	28	U	<3.5	U	<35	U	<70	U	<25	U	7	U	14	U	<3.5	U	0.7	J	<1.4	U	<0.50	U	1.8	U	1.8	U	<0.7
Chloromethane	--	<140	U	<70	U	<7	U	<7.6	U	20		46	J	<3.5	U	<35	U	<70	U	<38	U	29		45	J	<3.5	U	23		13		2.2		20		34		<0.7
cis-1,2-Dichloroethene	5	<140	U	<70	U	<7	U	<5.1	U	0.7	U	28	U	<3.5	U	<35	U	<70	U	<25	U	7	U	14	U	<3.5	U	<0.7	U	<1.4	U	<0.51	U	1.8	U	1.8	U	<0.7
cis-1,3-Dichloropropene	0.4	<29	U	<14	U	<1.4	U	<4.7	U	0.14	U	5.8	U	<0.72	U	<7.2	U	<14	U	<24	U	1.4	U	2.9	U	<0.72	U	<0.14	U	<0.29	U	<0.47	U	0.36	U	0.36	U	<0.14
Dibromochloromethane	50	<30	U	<15	U	<1.5	U	<5.6	U	0.15	U	6	U	<0.74	U	<7.4	U	<15	U	<28	U	1.5	U	3	U	<0.74	U	<0.15	U	<0.3	U	<0.56	U	2.4		3		<0.15
Dibromomethane	5	<200	U	<100	U	<10	U	NA		1	U	40	U	<5	U	<50	U	<100	U	NA		10	U	20	U	<5	U	<1	U	<2	U	NA		2.5	U	2.5	U	<1
Dichlorodifluoromethane	5	<200	U	<100	U	<10	U	<5.6	U	1	U	40	U	<5	U	<50	U	<100	U	<28	U	10	U	20	U	<5	U	<1	U	<2	U	<0.56	U	2.5	U	2.5	U	<1
Ethyl ether	--	<140	U	<70	U	<7	U	NA		0.7	U	28	U	<3.5	U	<35	U	<70	U	NA		7	U	14	U	<3.5	U	<0.7	U	<1.4	U	NA		1.8	U	1.8	U	<0.7
Ethylbenzene	5	5,000		7,300		800		1,070		570	E	1800		180		5,500		1,900		4,150		120		1100		100		<0.7	U	5.2		<0.60	U	1.8	U	1.8	U	29
Hexachlorobutadiene	0.5	<140	U	<70	U	<7	U	NA		0.7	U	28	U	<3.5	U	<35	U	<70	U			7	U	14	U	<3.5	U	<0.7	U	<1.4	U	<0.6	U	1.8	U	1.8	U	<0.7
Isopropylbenzene	5	160	J	290		52		69.4		63		78	J	7.2	J	180		<70	U	83.9		7	U	25	J	4.4	J	<0.7	U	<1.4	U	<0.65	U	1.8	U	1.8	U	2.4
Methyl tert butyl ether	10	<140	U	<70	U	<7	U	<5.1	U	0.17	U	6.6	U	<3.5	U	<35	U	<70	U	44.9	J	8.5	J	7	J	<3.5	U	<0.7	U	<1.4	U	<0.51	U	0.42	U	0.42	U	<0.7
Methylene chloride	5	<140	U	<70	U	<7	U	<10	U	0.7	U	28	U	<3.5	U	<35	U	<70	U	<50	U	7	U	14	U	<3.5	U	0.87	J	<1.4	U	<1.0	U	1.8	U	1.8	U	<0.7
n-Butylbenzene	5	<140	U	140	J	14	J	19.1	J	24		28	U	<3.5	U	52	J	<70	U	<26	U	7	U	14	U	<3.5	U	<0.7	U	<1.4	U	<0.52	U	1.8	U	1.8	U	1.8
n-Propylbenzene	5	410	J	890		130		155		160		190		20		520		110	J	189		8.6	J	68		6.6	J	<0.7	U	<1.4	U	<0.6	U	1.8	U	1.8	U	7.9
Naphthalene	10	860		1,500		130		189		240	E	200		16		710		130	J	338		7	U	70		12		<0.7	U	<1.4	U	<1.4	U	1.8	U	1.8	U	11
o-Chlorotoluene	5	<140	U	<70	U	<7	U	NA		0.7	U	28	U	<3.5	U	<35	U	<70	U	NA		8.7	J	14	U	<3.5	U	<0.7	U	<1.4	U	NA		1.8	U	1.8	U	<0.7
o-Xylene	5	7,400		9,900		1,200		1,500		650	E	890		270		8,000		2,900		5,520		7.2	J	960		81		<0.7	U	7.7		<0.59	U	1.8	U	1.8	U	49
p-Chlorotoluene	5	<140	U	<70	U	<7	U	NA		0.7	U	28	U	<3.5	U	<35	U	<70	U	NA		7	U	14	U	<3.5	U	<0.7	U	<1.4	U	NA		1.8	U	1.8	U	<0.7
p-Diethylbenzene	--	<140	U	74	J	30		NA		160		99		31		460		<70	U	NA		7	U	14	U	4.9	J	<0.7	U	<1.4	U	NA		1.8	U	1.8	U	19
p-Ethyltoluene	--	2,500		5,300		990		NA		490	E	990		130		3,200		750		NA		7	U	250		45		<0.7	U	1.6		NA		1.8	U	1.8	U	50
p-Isopropyltoluene	5	<140	U	<70	U	<7	U	NA		8.1		28	U	<3.5	U	<35	U	<70	U	NA		7	U	14	U	<3.5	U	<0.7	U	<1.4	U	NA		1.8	U	1.8	U	11
p/m-Xylene	5	20,000		28,000		3,900		3,960		1800	E	5600		620		18,000	D	7,200		12,300		7	U	2100		280		<0.7	U	12		<0.78	U	1.8	U	1.8	U	140
sec-Butylbenzene	5	<140	U	<70	U	14	J	NA		13		28	U	<3.5	U	<35	U	<70	U	NA		7	U	14	U	<3.5	U	<0.7	U	<1.4	U	NA		1.8	U	1.8	U	0.94
Styrene	5	<140	U	<70	U	<7	U	<4.9	U	0.7	U	28	U	<3.5	U	<35	U	<70	U	<24	U	7	U	14	U	<3.5	U	<0.7	U	<1.4	U	<0.49	U	1.8	U	1.8	U	<0.7
tert-Butylbenzene	5	<140	U	<70	U	<7	U	NA		0.7	U	28	U	<3.5	U	<35	U	<70	U	NA		7	U	14	U	<3.5	U	<0.7	U	<1.4	U	NA		1.8	U	1.8	U	<0.7
Tetrachloroethene	5	<36	U	<18	U	<1.8	U	<5.6	U	0.18	U	7.2	U	2.3	J	<9	U	<18	U	<28	U	1.8	U	3.6	U	<0.9	U	<0.18	U	<0.36	U	<0.56	U	0.45	U	0.45	U	<0.18
Toluene	5	9,200		12,000		940		1,190		700	E	1000		710		20,000	D	10,000		25,300		410		4600	E	10	J	<0.7	U	43		<0.49	U	1.8	U	1.8	U	10
trans-1,2-Dichloroethene	5	<140	U	<70	U	<7	U	<5.4	U	0.7	U	28	U	<3.5	U	<35	U	<70	U	<27	U	7	U	14	U	<3.5	U	<0.7	U	<1.4	U	<0.54	U	1.8	U	1.8	U	<0.7
trans-1,3-Dichloropropene	0.4	<33	U	<16	U	<1.6	U	<4.3	U	0.16	U	6.6	U	<0.82	U	<8.2	U	<16	U	<22	U	1.6	U	3.3	U	<0.82	U	<0.16	U	<0.33	U	<0.43	U	0.41	U	0.41	U	<0.16
trans-1,4-Dichloro-2-butene	5	<140	U	<70	U	<7	U	NA		0.7	U	28	U	<3.5	U	<35	U	<70	U	NA		7	U	14	U	<3.5	U	<0.7	U	<1.4	U	NA		1.8	U	1.8	U	<0.7
Trichloroethene	5	<35	U	<18	U	<1.8	U	<5.3	U	0.18	U	7	U	<0.88	U	<8.8	U	<18	U	<26	U	1.8	U	3.5	U	<0.88	U	<0.18	U	<0.35	U	<0.53	U	0.44	U	0.44	U	<0.18
Trichlorofluoromethane	5	<140	U	<70	U	<7	U	<4.0	U	0.7	U	28	U	<3.5	U	<35	U	<70	U	<20	U	7	U	14	U	<3.5	U	<0.7	U	<1.4	U	<0.40	U	1.8	U	1.8	U	<0.7
Vinyl acetate	--	<200	U	<100	U	<10	U	NA		1	U	40	U	<5	U	<50	U	<100	U	NA		10	U	20	U	<5	U	<1	U	<2	U	NA		2.5	U	2.5	U	<1
Vinyl chloride	2	<14	U	<7.1	U	<0.71	U	<5.2	U	0.07	U	2.8	U	<0.36	U	<3.6	U	<7.1	U	<26	U	0.71	U	1.4	U	<0.36	U	<0.07	U	<0.14	U	<0.52	U	0.18	U	0.18	U	<0.07
Xylenes, Total	--	27,000		38,000		5,100		5,460		5500		6500		890		26,000		10,000		17,800		7.2	J	3100		360		<0.7	U	20		<0.59	U	1.8	U	1.8	U	190

MW	Permanent Monitoring Well
J	Estimate Value. The analyte co--entration is below the quantitative limit (RL), but above the method detection limit (MDL) or estimated detection limit (EDL)
U	Not detected at the reported detection limit for the sample
E	Concentration of analyte exceeds the range of the calibration curve and/or linear range of the instrument.
D	Co--entration of analyte was quantified from diluted analysis.
NA	Not analyzed
--	No Guida--e Value
ug/L	Results are reported in microgram per liter

Table 8 - Groundwater Monitoring Results Summary Pre and Post Injection
4778 Broadway New York, New York 10034
BCP# C231131

LOCATION	NYSDEC TOGS 1.1.1 AWQS GV	-4	MW-4		MW-4		MW-4		MW-4		MW-5		MW-5		MW-5		MW-5		MW-5		MW-5		MW-6		MW-6		MW-6		MW-6		MW-6	
SAMPLING DATE		2023	12/21/2023		6/7/2024		1/3/2025		1/29/2025		5/10/2023		12/21/2023		3/8/2024		6/7/2024		1/2/2025		1/28/2025		5/10/2023		12/21/2023		6/7/2024		1/2/2025		1/28/2025	
SAMPLE TYPE		er	Water		Water		Water		Water		Water		Water		Water		Water		Water		Water		Water		Water		Water		Water		Water	
		Qual	Results	Qual	Results	Qual	Results	Qual	Results	Qual	Results	Qual	Results	Qual	Results	Qual	Results	Qual	Results	Qual	Results	Qual	Results	Qual	Results	Qual	Results	Qual	Results	Qual	Results	Qual
Volatile Organics by GC/MS (ug/L)																																
1,1,1,2-Tetrachloroethane	5		<0.7	U	NA		0.7	U	1.8	U	<14	U	<7	U	<0.7		NA		7	U	14	U	<35	U	<28	U	NA		7	U	7	U
1,1,1-Trichloroethane	5		<0.7	U	<0.54	U	0.7	U	1.8	U	<14	U	<7	U	<0.7		<0.54	U	7	U	14	U	<35	U	<28	U	<27	U	7	U	7	U
1,1,2,2-Tetrachloroethane	5		<0.17	U	<0.65	U	0.17	U	0.42	U	<3.3		<1.7		<0.17		<0.65	U	1.7	U	3.3	U	<8.4	U	<6.7	U	<33	U	1.7	U	1.7	U
1,1,2-Trichloroethane	1		<0.5	U	<0.53	U	0.5	U	1.2	U	<10	U	<5	U	<0.5		<0.53	U	5	U	10	U	<25	U	<20	U	<27	U	5	U	5	U
1,1-Dichloroethane	5		<0.7	U	<0.57	U	0.7	U	1.8	U	<14	U	<7	U	<0.7		<0.57	U	7	U	14	U	<35	U	<28	U	<28	U	7	U	7	U
1,1-Dichloroethene	5		<0.17	U	<0.59	U	0.17	U	0.42	U	<3.4		<1.7		<0.17		<0.59	U	1.7	U	3.4	U	<8.4	U	<6.8	U	<30	U	1.7	U	1.7	U
1,1-Dichloropropene	5		<0.7	U	NA		0.7	U	1.8	U	<14	U	<7	U	<0.7		NA		7	U	14	U	<35	U	<28	U	NA		7	U	7	U
1,2,3-Trichlorobenzene	5		<0.7	U	<0.50	U	0.7	U	1.8	U	<14	U	<7	U	<0.7		<0.50	U	7	U	14	U	<35	U	<28	U	<25	U	7	U	7	U
1,2,3-Trichloropropane	0.04	U	<0.7	U	NA		0.7	U	1.8	U	<14	U	<7	U	<0.7	U	NA		7	U	14	U	<35	U	<28	U	NA		7	U	7	U
1,2,4,5-Tetramethylbenzene	5		<0.54	U	NA		0.54	U	1.4	U	110		100		<0.54		NA		10	J	15	J	100		82		NA		5.4	U	5.4	U
1,2,4-Trichlorobenzene	5		<0.7	U	<0.50	U	0.7	U	1.8	U	<14	U	<7		<0.7		<0.50	U	7	U	14	U	<35	U	<28	U	<25	U	7	U	7	U
1,2,4-Trimethylbenzene	5		<0.7	U	<1	U	0.7	U	1.8	U	1,700		1,200		5.6		126		230		360		3,400		2,200		1,790		7	U	8.3	J
1,2-Dibromo-3-chloropropane	0.04	U	<0.7	U	<0.53	U	0.7	U	1.8	U	<14	U	<7	U	<0.7	U	<0.53	U	7	U	14	U	<35	U	<28	U	<26	U	7	U	7	U
1,2-Dibromoethane	0.0006	U	<0.65	U	<0.48	U	0.65	U	1.6	U	<13	U	<6.5	U	<0.65	U	<0.48	U	6.5	U	13	U	<32	U	<26	U	<24	U	6.5	U	6.5	U
1,2-Dichlorobenzene	3		<0.7	U	<0.53	U	0.7	U	1.8	U	<14	U	<7	U	<0.7		<0.53	U	7	U	14	U	<35	U	<28	U	<27	U	7	U	7	U
1,2-Dichloroethane	0.6		<0.13	U	<0.60	U	0.13	U	0.33	U	<2.6	U	<1.3	U	<0.13		<0.60	U	1.3	U	2.6	U	<6.6	U	<5.3	U	<30	U	1.3	U	1.3	J
1,2-Dichloroethene, Total	--		<0.7	U	NA		0.7	U	1.8	U	<14	U	<7		<0.7		NA		7	U	14	U	<35		<28		NA		7	U	7	U
1,2-Dichloropropane	1		<0.14	U	<0.51	U	0.14	U	0.34	U	<2.7	U	<1.4	U	<0.14		<0.51	U	1.4	U	2.7	U	<6.8	U	<5.5	U	<25	U	1.4	U	1.4	U
1,3,5-Trimethylbenzene	5		<0.7	U	<1	U	0.7	U	1.8	U	580		350		2 J		50.2		7	U	42	J	950		520		466		7	U	7	U
1,3-Dichlorobenzene	3		<0.7	U	<0.54	U	0.7	U	1.8	U	<14	U	<7	U	<0.7		<0.54	U	7	U	14	U	<35	U	<28	U	<27	U	7	U	7	U
1,3-Dichloropropane	5	U	<0.7	U	NA		0.7	U	1.8	U	<14	U	<7	U	<0.7	U	NA		7	U	14	U	<35	U	<28	U	NA		7	U	7	U
1,3-Dichloropropene, Total	--	U	<0.14	U	NA		0.14	U	0.36	U	<2.9	U	<1.4	U	<0.14	U	NA		1.4	U	2.9	U	<7.2	U	<5.8	U	NA		1.4	U	1.4	U
1,4-Dichlorobenzene	3	U	<0.7	U	<0.51	U	0.7	U	1.8	U	<14	U	<7	U	<0.7	U	<0.51	U	7	U	14	U	<35	U	<28	U	<25	U	7	U	7	U
1,4-Dioxane	--	U	<61	U	NA		61	U	150	U	<1,200	U	<610	U	<61	U	NA		610	U	1200	U	<3,000	U	<2400	U	NA		610	U	610	U
2,2-Dichloropropane	5	U	<0.7	U	NA		0.7	U	1.8	U	<14	U	<7	U	<0.7	U	NA		7	U	14	U	<35	U	<28	U	NA		7	U	7	U
2-Butanone	50		<1.9	U	<2.7	U	3.3	J	10	J	<39	U	<19	U	<1.9	U	30.9		240		270		<97	U	180	J	<140	U	550		1300	
2-Hexanone	50	U	<1	U	<4.8	U	1	U	2.5	U	<20	U	<10	U	<1	U	<4.8	U	21	J	26	J	<50	U	<40	U	<240	U	24	J	10	U
4-Methyl-2-pentanone	--	U	<1	U	<4.9	U	1	U	2.5	U	<20	U	<10	U	<1	U	<4.9	U	10	U	20	U	<50	U	<40	U	<240	U	20	J	10	U
Acetone	50		2.3 J		<3.1	U	45		190		<29	U	21	J	<1.5	U	77.4		630		980		100	J	960		412 J		1800		4400	E
Acrylonitrile	5	U	<1.5	U	NA		1.5	U	3.8	U	<30	U	<15	U	<1.5	U	NA		15	U	30	U	<75	U	<60	U	NA		15	U	15	U
Benzene	1	U	<0.16	U	<0.43	U	0.16	U	0.63	J	<3.2	U	<1.6	U	<0.16	U	0.67		12		14		41		37		5,580		3.2	J	15	
Bromobenzene	5	U	<0.7	U	NA		0.7	U	1.8	U	<14	U	<7	U	<0.7	U	NA		7	U	14	U	<35	U	<28	U	NA		7	U	7	U
Bromochloromethane	5	U	<0.7	U	<0.48	U	0.7	U	1.8	U	<14	U	<7	U	<0.7	U	<0.48	U	7	U	14	U	<35	U	<28	U	<24	U	7	U	7	U
Bromodichloromethane	50	U	<0.19	U	<0.45	U	0.19	U	0.48	U	<3.8	U	<1.9	U	<0.19	U	<0.45	U	1.9	U	3.8	U	<9.6	U	<7.7	U	<23	U	1.9	U	1.9	U
Bromoform	50	U	<0.65	U	<0.63	U	0.65	U	1.6	U	<13	U	<6.5	U	<0.65	U	<0.63	U	6.5	U	13	U	<32	U	<26	U	<32	U	6.5	U	6.5	U
Bromomethane	5	U	<0.7	U	<1.6	U	0.73	J	1.8	U	<14	U	<7	U	<0.7	U	<1.6	U	7	U	14	U	<35	U	<28	U	<82	U	7	U	7	U
Carbon disulfide	60	U	<1	U	<1.8	U	1	U	2.5	U	<20	U	<10	U	<1	U	<1.8	U	10	U	20	U	<50	U	<40	U	<90	U	10	U	10	U
Carbon tetrachloride	5	U	<0.13	U	<0.55	U	0.13	U	0.34	U	<2.7	U	<1.3	U	<0.13	U	<0.55	U	1.3	U	2.7	U	<6.7	U	<5.4	U	<28	U	1.3	U	1.3	U
Chlorobenzene	5	U	<0.7	U	<0.56	U	0.7	U	1.8	U	<14	U	<7	U	<0.7	U	<0.56	U	7	U	14	U	<35	U	<28	U	<28	U	7	U	7	U
Chloroethane	5	U	<0.7	U	<0.73	U	0.7	U	1.8	U	<14	U	<7	U	<0.7	U	<0.73	U	23	J	30	J	<35	U	34	J	<36	U	15	J	36	
Chloroform	7	U	<0.7	U	<0.50	U	0.7	U	1.8	U	<14	U	<7	U	<0.7	U	<0.50	U	7	U	14	U	<35	U	<28	U	<25	U	7	U	21	J
Chloromethane	--	U	<0.7	U	<0.76	U	3		8.9		<14	U	<7	U	<0.7	U	<0.76	U	54		20	J	<35	U	220		<38	U	85		310	
cis-1,2-Dichloroethene	5	U	<0.7	U	<0.51	U	0.7	U	1.8	U	<14	U	<7	U	<0.7	U	<0.51	U	7	U	14	U	<35	U	<28	U	<25	U	7	U	7	U
cis-1,3-Dichloropropene	0.4	U	<0.14	U	<0.47	U	0.14	U	0.36	U	<2.9	U	<1.4	U	<0.14	U	<0.47	U	1.4	U	2.9	U	<7.2	U	<5.8	U	<24	U	1.4	U	1.4	U
Dibromochloromethane	50	U	<0.15	U	<0.56	U	0.15	U	0.37	U	<3	U	<1.5	U	<0.15	U	<0.56	U	1.5	U	3	U	<7.4	U	<6	U	<28	U	1.5	U	1.5	U
Dibromomethane	5	U	<1	U	NA		1	U	2.5	U	<20	U	<10	U	<1	U	NA		10	U	20	U	<50	U	<40	U	NA		10	U	10	U
Dichlorodifluoromethane	5	U	<1	U	<0.56	U	1	U	2.5	U	<20	U	<10	U	<1	U	<0.56	U	10	U	20	U	<50	U	<40	U	<28	U	10	U	10	U
Ethyl ether	--	U	<0.7	U	NA		0.7	U	1.8	U	<14	U	<7	U	<0.7	U	NA		7	U	14	U	<35	U	<28	U	NA		7	U	7	U
Ethylbenzene	5		<0.7	U	<0.60	U	0.7	U	1.8	U	730		420		3.6		116		760		750		5,300		3,400		4,300		7	U	280	
Hexachlorobutadiene	0.5	U	<0.7	U	NA		0.7	U	1.8	U	<14	U	<7	U	<0.7	U	NA		7	U	14	U	<35	U	<28	U	NA		7	U	7	U
Isopropylbenzene	5	J	<0.7	U	<0.65	U	0.7	U	1.8	U	73		48		<0.7	U	6		30		35	J	170		110		94.8		7	U	17	J
Methyl tert butyl ether	10	U	<0.7	U	<0.51	U	0.17	U	0.42	U	<14	U	<7	U	<0.7	U	<0.51	U	1.7	U	3.3	U	<35	U	<28	U	41.7 J		1.7	U	1.7	U
Methylene chloride	5	U	<0.7	U	<1.0	U	0.7	U	1.8	U	<14	U	<7	U	<0.7	U	<1.0		7	U	14	U	<35	U	<28	U	<50	U	7	U	7	U
n-Butylbenzene	5	J	<0.7	U	<0.52	U	0.7	U	1.8	U	42	J	40		<0.7	U	1.3	J	9.2	J	14	U	<35	U	28	J	<26	U	7	U	7	U
n-Propylbenzene	5		<0.7	U	<0.6	U	0.7	U	1.8	U	260		180		1.1	J	14.8		84		98		480		320		238		7	U	48	
Naphthalene	10		<0.7	U	<4.4	U	0.7	U	1.8	U	130		170		<0.7	U	15.1		120		110		460		400		341		8.9	J	11	J
o-Chlorotoluene	5	U	<0.7	U	NA		0.7	U	1.8	U	<14	U	<7	U	<0.7	U	NA		7	U	14	U	<35	U	<28	U	NA		7	U	7	U
o-Xylene	5		<0.7	U	<0.59	U	0.7	U	1.8	U	1,100		650		6.1		198		720		750		7,000		3,300		5,760		7	U	120	
p-Chlorotoluene	5	U	<0.7	U	NA		0.7	U	1.8	U	<14	U	<7	U	<0.7	U	NA		7	U	14	U	<35	U	<28	U	NA		7	U	7	U
p-Diethylbenzene	--		<0.7	U	NA		0.7	U	1.8	U	430		320		<0.7	U	NA		8.8	J	29	J	330		250		NA		7	U	7	U
p-Ethyltoluene	--		<0.7	U	NA		0.7	U	1.8	U	1,600		940		6.2		NA		290		390		2,200		1,700		NA		7	U	53	
p-Isopropyltoluene	5		<0.7	U	NA		0.7	U	1.8	U	15	J	13	J	<0.7	U	NA		7	U	14	U	<35	U	<28	U	NA		7	U	7	U
p/m-Xylene	5		<0.7	U	<0.78	U	0.7	U	1.8	U	3,100		1,800		15		479		1500		1900		17,000		10,000		14,200		8.8	J	170	
sec-Butylbenzene	5	J	<0.7	U	NA		0.7	U	1.8	U	25	J	19	J	<0.7	U	NA		7	U	14	U	<35	U	<28	U	NA		7	U	7	U
Styrene	5	U	<0.7	U	<0.49	U	0.7	U	1.8	U	<14	U	<7	U	<0.7	U	<0.49	U	7	U	14	U	<35	U	<28	U	<24	U	7	U	7	U
tert-Butylbenzene	5	U	<0.7	U	NA		0.7	U	1.8	U	<14	U	<7	U	<0.7	U	NA		7	U	14	U	<35	U	<28	U	NA		7	U	7	U
Tetrachloroethene	5	U	<0.18	U	<0.56	U	0.18	U	0.45	U	<3.6	U	<1.8	U	<0.18	U	<0.56	U	1.8	U	3.6	U	<9	U	<7.2	U	<28	U	1.8	U	1.8	U
Toluene	5		<0.7	U	<0.49	U	0.7	U	1.8	U	930		150		2	J	162		1200		1300		9,400		3,800		21,500		7	U	73	
trans-1,2-Dichloroethene	5	U	<0.7	U	<0.54	U	0.7	U	1.8	U	<14	U	<7	U	<0.7	U	<0.54	U	7	U	14	U	<35	U	<28	U	<27	U	7	U	7	U
trans-1,3-Dichloropropene	0.4	U	<0.16	U	<0.43	U	0.16	U	0.41	U	<3.3	U	<1.6	U	<0.16	U	<0.43	U	1.6	U	3.3	U	<8.2	U	<6.6	U	<22	U	1.6	U	1.6	U
trans-1,4-Dichloro-2-butene	5	U	<0.7	U	NA		0.7	U	1.8	U	<14	U	<7	U	<0.7	U	NA		7	U	14	U	<35	U	<28	U	NA		7	U	7	U
Trichloroethene	5	U	<0.18	U	<0.53	U	0.18	U	0.44	U	<3.5	U	<1.8	U	<0.18	U	<0.53	U	1.8	U	3.5	U	<8.8	U	<7	U	<26	U	1.8	U	1.8	U
Trichlorofluoromethane	5	U	<0.7	U	<0.40	U	0.7	U	1.8	U	<14	U	<7	U	<0.7	U	<0.40	U	7	U	14	U	<35	U	<28	U	<20	U	7	U	7	U
Vinyl acetate	--	U	<1	U	NA		1	U	2.5	U	<20	U	<10	U	<1	U	NA		10	U	20	U	<50	U	<40	U	NA		10	U	10	U
Vinyl chloride	2	U	<0.07	U	<0.52	U	0.07	U	0.18	U	<1.4	U	<0.71	U	<0.07	U	<0.52	U	0.71	U	1.4	U	<3.6	U	<2.8	U	<26	U	0.71	U	0.71	U
Xylenes, Total	--		<0.7	U	<0.59	U	0.7	U	1.8	U	4,200		2,500		21		677		2200		2700		24,000		13,000		20,000		8.8	J	290	

Table 8 - Groundwater Monitoring Results Summary Pre and Post Injection
4778 Broadway New York, New York 10034
BCP# C231131

LOCATION	NYSDEC TOGS 1.1.1 AWQS GV	MW-1		MW-1		MW-1		MW-1		MW-1		MW-1		MW-2		MW-2		MW-2		MW-2		MW-2		MW-2	
SAMPLING DATE		5/10/2023		12/21/2023		3/8/2024		6/7/2024		1/3/2025		1/28/2025		5/10/2023		12/21/2023		3/8/2024		6/7/2024		1/2/2025		1/28/2025	
SAMPLE TYPE		Water		Water		Water		Water		Water		Water		Water		Water		Water		Water		Water		Water	
		Results	Qual	Results	Qual	Results	Qual	Results	Qual	Results	Qual	Results	Qual	Results	Qual	Results	Qual	Results	Qual	Results	Qual	Results	Qual	Results	Qual
Semivolatile Organics by GC/MS (ug/L)																									
1,2,4,5-Tetrachlorobenzene	5	<8.8	U	<8.8	U	NA		<0.37	U	0.24	U	0.24	U	<0.44	U	<4.4	U	NA		<0.37	U	0.24	U	2.4	U
1,2,4-Trichlorobenzene	5	<10	U	<10	U	NA		NA		0.98	U	0.98	U	<0.5	U	<5	U	NA		NA		0.98	U	9.8	U
1,2-Dichlorobenzene	3	<9.1	U	<9.1	U	NA		NA		0.33	U	0.33	U	<0.45	U	<4.5	U	NA		NA		0.33	U	3.3	U
1,3-Dichlorobenzene	3	<8.1	U	<8.1	U	NA		NA		0.32	U	0.32	U	<0.4	U	<4	U	NA		NA		0.32	U	3.2	U
1,4-Dichlorobenzene	3	<8.6	U	<8.6	U	NA		NA		0.39	U	0.39	U	<0.43	U	<4.3	U	NA		NA		0.39	U	3.9	U
2,4,5-Trichlorophenol	--	<15	U	<15	U	NA		<1.3	U	2.1	U	2.1	U	<0.77	U	<7.7	U	NA		<1.3	U	2.1	U	21	U
2,4,6-Trichlorophenol	--	<12	U	<12	U	NA		<0.92	U	2.1	U	2.1	U	<0.61	U	<6.1	U	NA		<0.92	U	2.1	U	21	U
2,4-Dichlorophenol	1	<8.2	U	<8.2	U	NA		<1.3	U	1.7	U	1.7	U	<0.41	U	<4.1	U	NA		<1.3	U	1.7	U	17	U
2,4-Dimethylphenol	50	<36	U	60	J	NA		82.7		220		56		<1.8	U	300		NA		133		11		20	U
2,4-Dinitrophenol	10	<130	U	<130	U	NA		<1.6	U	5.4	U	5.4	U	<6.6	U	<66	U	NA		<1.6	U	5.4	U	54	U
2,4-Dinitrotoluene	5	<23	U	<23	U	NA		<0.55	U	0.54	U	0.54	U	<1.2	U	<12	U	NA		<0.55	U	0.54	U	5.4	U
2,6-Dinitrotoluene	5	<19	U	<19	U	NA		<0.48	U	0.84	U	0.84	U	<0.93	U	<9.3	U	NA		<0.48	U	0.84	U	8.4	U
2-Chlorophenol	--	<9.6	U	<9.6		NA		<0.82	U	0.65	U	0.65	U	<0.48	U	<4.8	U	NA		<0.82	U	0.65	U	6.5	U
2-Methylphenol	--	<9.8	U	200		NA		33.3		130		80		13		850		NA		205		2.8	J	23	U
2-Nitroaniline	5	<10	U	<10	U	NA		<0.28	U	1	U	1	U	<0.5	U	<5	U	NA		<0.28	U	1	U	10	U
2-Nitrophenol	--	<17	U	<17	U	NA		<0.96	U	2	U	2	U	<0.85	U	<8.5	U	NA		<0.96	U	2	U	20	U
3,3'-Dichlorobenzidine	5	<32	U	<32	U	NA		30.2		1.8	U	1.8	U	<1.6	U	<16	U	NA		114		1.8	U	18	U
3-Methylphenol/4-Methylphenol	--	<9.6	U	220		NA		<0.51	U	110		84		6.2		880		NA		<0.51	U	14		14	U
3-Nitroaniline	5	<16	U	<16		NA		<0.39	U	1.2	U	1.2	U	<0.81	U	<8.1	U	NA		<0.39	U	1.2	U	12	U
4,6-Dinitro-o-cresol	--	<36	U	<36	U	NA		<1.3	U	2.3	U	2.3	U	<1.8	U	<18	U	NA		<1.3	U	2.3	U	23	U
4-Bromophenyl phenyl ether	--	<7.6	U	<7.6	U	NA		<0.40	U	0.24	U	0.24	U	<0.38	U	<3.8	U	NA		<0.40	U	0.24	U	2.4	U
4-Chloroaniline	5	<21	U	<21	U	NA		<0.34	U	0.47	U	0.47	U	<1.1	U	<11	U	NA		<0.34	U	0.47	U	4.7	U
4-Chlorophenyl phenyl ether	--	<9.7	U	<9.7	U	NA		<0.37	U	0.39	U	0.39	U	<0.49	U	<4.9	U	NA		<0.37	U	0.39	U	3.9	U
4-Nitroaniline	5	<16	U	<16	U	NA		<0.44	U	1.4	U	1.4	U	<0.8	U	<8	U	NA		<0.44	U	1.4	U	14	U
4-Nitrophenol	--	<13	U	<13	U	NA		<1.2	U	1.4	U	1.4	U	<0.67	U	<6.7	U	NA		<1.2	U	1.4	U	14	U
Acetophenone	--	<10	U	<10	U	NA		37.5		1100	E	1300		<0.53	U	530		NA		21.7		2200	E	2300	
Benzoic Acid	--	<53	U	<53	U	NA		NA		2.6	U	2.6	U	<2.6	U	<26	U	NA		NA		2.6	U	320	J
Benzyl Alcohol	--	<12	U	<12	U	NA		NA		66		150		<0.59	U	41		NA		NA		65		230	
Biphenyl	--	50		47		NA		1.3		2		2		<0.46	U	10	J	NA		1.4		0.89	J	2	U
Bis(2-chloroethoxy)methane	5	<10	U	<10	U	NA		<0.28	U	0.84	U	0.84	U	<0.5	U	<5	U	NA		<0.28	U	0.84	U	8.4	U
Bis(2-chloroethyl)ether	1	<10	U	<10	U	NA		<0.25	U	0.39	U	0.39	U	<0.5	U	<5	U	NA		<0.25	U	0.39	U	3.9	U
Bis(2-chloroisopropyl)ether	5	<10	U	<10	U	NA		NA		0.4	U	0.4	U	<0.53	U	<5.3	U	NA		NA		0.4	U	4	U
Bis(2-ethylhexyl)phthalate	5	<31	U	<31	U	NA		<1.7	U	1.4	J	2.6	J	<1.5	U	<15	U	NA		<1.7	U	1.4	U	22	J
Butyl benzyl phthalate	50	<23	U	<23	U	NA		<0.46	U	2.6	U	2.6	U	<1.2	U	<12	U	NA		<0.46	U	2.6	U	26	U
Carbazole	--	<9.8	U	<9.8	U	NA		<0.65	U	0.31	U	0.31	U	<0.49	U	<4.9	U	NA		<0.65	U	0.31	U	3.1	U
Di-n-butylphthalate	50	<7.8	U	<7.8	U	NA		<0.23	U	3.3	J	0.96	U	<0.39	U	<3.9	U	NA		<0.23	U	0.96	U	9.6	U
Di-n-octylphthalate	50	<25	U	<25	U	NA		<0.22	U	2.3	U	2.3	U	<1.3	U	<13	U	NA		<0.22	U	2.3	U	23	U
Dibenzofuran	--	<10	U	<10	U	NA		<0.26	U	0.4	U	0.4	U	<0.5	U	<5	U	NA		<0.26	U	0.4	U	4	U
Diethyl phthalate	50	<7.6	U	<7.6	U	NA		<0.22	U	0.76	U	0.76	U	<0.38	U	<3.8	U	NA		<0.22	U	0.76	U	7.6	U
Dimethyl phthalate	50	<36	U	<36	U	NA		<0.50	U	0.92	U	0.92	U	<1.8	U	<18	U	NA		<0.50	U	0.92	U	9.2	U
Hexachlorocyclopentadiene	5	<14	U	<14	U	NA		<0.23	U	1.2	U	1.2	U	<0.69	U	<6.9	U	NA		<0.23	U	1.2	U	12	U
Isophorone	50	<24	U	<24	U	NA		<2.8	U	0.86	U	0.86	U	<1.2	U	<12	U	NA		<2.8	U	0.86	U	8.6	U
n-Nitrosodi-n-propylamine	--	<13	U	<13	U	NA		<0.28	U	0.91	U	0.91	U	<0.64	U	<6.4	U	NA		<0.28	U	0.91	U	9.1	U
NDPA/DPA	50	<8.4	U	<8.4	U	NA		NA		0.92	U	0.92	U	<0.42	U	<4.2	U	NA		NA		0.92	U	9.2	U
Nitrobenzene	0.4	<15	U	<15	U	NA		<0.64	U	0.2	U	0.2	U	<0.77	U	<7.7	U	NA		<0.64	U	0.2	U	2	U
p-Chloro-m-cresol	--	<7	U	<7	U	NA		NA		0.61	U	0.61	U	<0.35	U	<3.5	U	NA		NA		0.61	U	6.1	U
Phenol	1	<11	U	38	J	NA		<0.39	U	21		14		2 J		180		NA		<0.39	U	7.3		15	J
Semivolatile Organics by GC/MS-SIM (ug/L)																									
2-Chloronaphthalene	10	<0.36	U	<0.18	U	NA		<0.24	U	0.02	U	0.23	U	<0.02	U	<0.02		NA		<0.24	U	0.02	U	0.11	U
2-Methylnaphthalene	--	6,300	D	2,000	D	NA		47.4		88	E	86		1.4		470	D	NA		56.6		14		19	
Acenaphthene	20	21		8.1		NA		0.30	J	0.02	U	0.24	U	0.03	J	2.3		NA		0.48	J	0.02	U	0.12	U
Acenaphthylene	--	12		4.4		NA		<0.14	U	0.02	U	0.2	U	<0.01	U	1		NA		<0.14	U	0.02	U	0.1	U
Anthracene	50	14		4.9		NA		<0.21	U	0.08	J	0.24	U	<0.01	U	1.3		NA		<0.21	U	0.11		0.12	U
Benzo(a)anthracene	0.002	4.3		2.2		NA		<0.20	U	0.03	U	0.3	U	<0.02	U	0.49		NA		<0.20	U	0.03	U	0.15	U
Benzo(a)pyrene	--	2.6		1.2		NA		<0.21	U	0.02	U	0.24	U	<0.02	U	0.26		NA		<0.21	U	0.02	U	0.12	U
Benzo(b)fluoranthene	0.002	3.1		1.6		NA		<0.21	U	0.03	U	0.27	U	0.01	J	0.32		NA		<0.21	U	0.04	J	0.14	U
Benzo(ghi)perylene	--	3.1		1.4		NA		<0.34	U	0.02	U	0.24	U	<0.01	U	0.37		NA		<0.34	U	0.02	U	0.12	U
Benzo(k)fluoranthene	0.002	0.72	J	0.44	J	NA		<0.21	U	0.03	U	0.34	U	<0.01	U	0.08	J	NA		<0.21	U	0.03	U	0.17	U
Chrysene	0.002	4		1.9		NA		<0.18	U	0.03	U	0.31	U	<0.01	U	0.43		NA		<0.18	U	0.03	U	0.16	U
Dibenzo(a,h)anthracene	--	0.28	J	0.14	J	NA		<0.33	U	0.02	U	0.24	U	<0.01	U	0.04	J	NA		<0.33	U	0.02	U	0.12	U
Fluoranthene	50	9.8		4.9		NA		<0.17	U	0.03	U	0.27	U	<0.02	U	1.2		NA		<0.17	U	0.04	J	0.14	U
Fluorene	50	72		17		NA		0.52	J	0.03	U	0.58	J	0.05	J	6.2		NA		<0.17	U	0.03	U	0.13	U
Hexachlorobenzene	0.04	<0.19	U	<0.09	U	NA		<0.33	U	0.01	U	0.13	U	<0.01	U	<0.01		NA		<0.33	U	0.01	U	0.07	U
Hexachlorobutadiene	0.5	<0.93	U	<0.47	U	NA		<0.49	U	0.02	U	0.2	U	<0.05	U	<0.05		NA		<0.49	U	0.02	U	0.1	U
Hexachloroethane	5	<1.3	U	<0.63	U	NA		<0.39	U	0.02	U	0.22	U	<0.06	U	<0.06		NA		<0.39	U	0.02	U	0.11	U
Indeno(1,2,3-cd)pyrene	0.002	1.1	J	0.67	J	NA		<0.33	U	0.02	U	0.22	U	<0.01	U	0.13		NA		<0.33	U	0.02	U	0.11	U
Naphthalene	10	6,900	D	2,000	D	NA		119		150	E	180		3.3		660	D	NA		316		65	E	98	
Pentachlorophenol	1	<0.29	U	<0.14	U	NA		<1.4	U	0.06	U	0.56	U	0.07	J	0.07	J	NA		<1.4	U	0.06	J	0.28	U
Phenanthrene	50	60		25		NA		0.22 J		0.65		0.42	J	<0.02	U	6.1		NA		<0.18	U	0.15		0.2	U
Pyrene	50	19		8.2		NA		<0.22	U	0.04	U	0.42	U	<0.02	U	1.8		NA		<0.22	U	0.04	U	0.21	U

LOCATION	NYSDEC TOGS 1.1.1 AWQS GV	MW-3		MW-3		MW-3		MW-3		MW-3		MW-3		MW-4		MW-4		MW-4		MW-4		MW-4	
SAMPLING DATE		5/10/2023		12/21/2023		3/8/2024		6/7/2024		1/3/2025		1/28/2025		5/10/2023		12/21/2023		6/7/2024		1/3/2025		1/29/2025	
SAMPLE TYPE		Water		Water		Water		Water		Water		Water		Water		Water		Water		Water		Water	
		Results	Qual	Results	Qual	Results	Qual	Results	Qual	Results	Qual	Results	Qual	Results	Qual	Results	Qual	Results	Qual	Results	Qual	Results	Qual
Semivolatile Organics by GC/MS (ug/L)																							
1,2,4,5-Tetrachlorobenzene	5	<0.44	U	<0.44	U	NA		<0.37	U	0.24	U	0.24	U	<0.44	U	<0.44	U	<0.37	U	0.24	U	0.24	U
1,2,4-Trichlorobenzene	5	<0.5	U	<0.5	U	NA		NA		0.98	U	0.98	U	<0.5	U	<0.5	U	NA		0.98	U	0.98	U
1,2-Dichlorobenzene	3	<0.45	U	<0.45	U	NA		NA		0.33	U	0.33	U	<0.45	U	<0.45	U	NA		0.33	U	0.33	U
1,3-Dichlorobenzene	3	<0.4	U	<0.4	U	NA		NA		0.32	U	0.32	U	<0.4	U	<0.4	U	NA		0.32	U	0.32	U
1,4-Dichlorobenzene	3	<0.43	U	<0.43	U	NA		NA		0.39	U	0.39	U	<0.43	U	<0.43	U	NA		0.39	U	0.39	U
2,4,5-Trichlorophenol	--	<0.77	U	<0.77	U	NA		<1.3	U	2.1	U	2.1	U	<0.77	U	<0.77	U	<1.3	U	2.1	U	2.1	U
2,4,6-Trichlorophenol	--	<0.61	U	<0.61	U	NA		<0.92	U	2.1	U	2.1	U	<0.61	U	<0.61	U	<0.92	U	2.1	U	2.1	U
2,4-Dichlorophenol	1	<0.41	U	<0.41	U	NA		<1.3	U	1.7	U	1.7	U	<0.41	U	<0.41	U	<1.3	U	1.7	U	1.7	U
2,4-Dimethylphenol	50	2.5	J	<1.8	U	NA		<2.4	U	2	U	2	U	<1.8	U	<1.8	U	<2.4	U	2	U	2	U
2,4-Dinitrophenol	10	<6.6	U	<6.6	U	NA		<1.6	U	5.4	U	5.4	U	<6.6	U	<6.6	U	<1.6	U	5.4	U	5.4	U
2,4-Dinitrotoluene	5	<1.2	U	<1.2	U	NA		<0.55	U	0.54	U	0.54	U	<1.2	U	<1.2	U	<0.55	U	0.54	U	0.54	U
2,6-Dinitrotoluene	5	<0.93	U	<0.93	U	NA		<0.48	U	0.84	U	0.84	U	<0.93	U	<0.93	U	<0.48	U	0.84	U	0.84	U
2-Chlorophenol	--	<0.48	U	<0.48	U	NA		<0.82	U	0.65	U	0.65	U	<0.48	U	<0.48	U	<0.82	U	0.65	U	0.65	U
2-Methylphenol	--	<0.49	U	<0.49	U	NA		<0.89	U	2.3	U	2.3	U	<0.49	U	<0.49	U	<0.89	U	2.3	U	2.3	U
2-Nitroaniline	5	<0.5	U	<0.5	U	NA		<0.28	U	1	U	1	U	<0.5	U	<0.5	U	<0.28	U	1	U	1	U
2-Nitrophenol	--	<0.85	U	<0.85	U	NA		<0.96	U	2	U	2	U	<0.85	U	<0.85	U	<0.96	U	2	U	2	U
3,3'-Dichlorobenzidine	5	<1.6	U	<1.6	U	NA		<0.88	U	1.8	U	1.8	U	<1.6	U	<1.6	U	<0.88	U	1.8	U	1.8	U
3-Methylphenol/4-Methylphenol	--	2.7	J	<0.48	U	NA		<0.51	U	1.4	U	1.4	U	<0.48	U	<0.48	U	<0.51	U	1.4	U	1.4	U
3-Nitroaniline	5	<0.81	U	<0.81	U	NA		<0.39	U	1.2	U	1.2	U	<0.81	U	<0.81	U	<0.39	U	1.2	U	1.2	U
4,6-Dinitro-o-cresol	--	<1.8	U	<1.8	U	NA		<1.3	U	2.3	U	2.3	U	<1.8	U	<1.8	U	<1.3	U	2.3	U	2.3	U
4-Bromophenyl phenyl ether	--	<0.38	U	<0.38	U	NA		<0.40	U	0.24	U	0.24	U	<0.38	U	<0.38	U	<0.40	U	0.24	U	0.24	U
4-Chloroaniline	5	<1.1	U	<1.1	U	NA		<0.34	U	0.47	U	0.47	U	<1.1	U	<1.1	U	<0.34	U	0.47	U	0.47	U
4-Chlorophenyl phenyl ether	--	<0.49	U	<0.49	U	NA		<0.37	U	0.39	U	0.39	U	<0.49	U	<0.49	U	<0.37	U	0.39	U	0.39	U
4-Nitroaniline	5	<0.8	U	<0.8	U	NA		<0.44	U	1.4	U	1.4	U	<0.8	U	<0.8	U	<0.44	U	1.4	U	1.4	U
4-Nitrophenol	--	<0.67	U	<0.67	U	NA		<1.2	U	1.4	U	1.4	U	<0.67	U	<0.67	U	<1.2	U	1.4	U	1.4	U
Acetophenone	--	2.2	J	<0.53	U	NA		<0.21	U	2.5	J	11		<0.53	U	<0.53	U	<0.21	U	0.92	U	2.4	J
Benzoic Acid	--	<2.6	U	16	J	NA		NA		16	J	2.6	U	<2.6	U	<2.6	U	NA		14	J	2.6	U
Benzyl Alcohol	--	<0.59	U	<0.59	U	NA		NA		0.38	U	0.38	U	<0.59	U	<0.59	U	NA		0.38	U	0.38	U
Biphenyl	--	<0.46	U	<0.46	U	NA		<0.21	U	0.2	U	0.2	U	<0.46	U	<0.46	U	<0.21	U	0.2	U	0.2	U
Bis(2-chloroethoxy)methane	5	<0.5	U	<0.5	U	NA		<0.28	U	0.84	U	0.84	U	<0.5	U	<0.5	U	<0.28	U	0.84	U	0.84	U
Bis(2-chloroethyl)ether	1	<0.5	U	<0.5	U	NA		<0.25	U	0.39	U	0.39	U	<0.5	U	<0.5	U	<0.25	U	0.39	U	0.39	U
Bis(2-chloroisopropyl)ether	5	<0.53	U	<0.53	U	NA		NA		0.4	U	0.4	U	<0.53	U	<0.53	U	NA		0.4	U	0.4	U
Bis(2-ethylhexyl)phthalate	5	<1.5	U	<1.5	U	NA		<1.7	U	1.4	U	1.4	U	<1.5	U	<1.5	U	<1.7	U	1.4	U	1.4	U
Butyl benzyl phthalate	50	<1.2	U	<1.2	U	NA		<0.46	U	2.6	U	2.6	U	<1.2	U	<1.2	U	<0.46	U	2.6	U	2.6	U
Carbazole	--	<0.49	U	<0.49	U	NA		<0.65	U	0.31	U	0.31	U	<0.49	U	<0.49	U	<0.65	U	0.31	U	0.31	U
Di-n-butylphthalate	50	<0.39	U	<0.39	U	NA		<0.23	U	0.96	U	0.96	U	<0.39	U	<0.39	U	<0.23	U	1.6	J	0.96	U
Di-n-octylphthalate	50	<1.3	U	<1.3	U	NA		<0.22	U	2.3	U	2.3	U	<1.3	U	<1.3	U	<0.22	U	2.3	U	2.3	U
Dibenzofuran	--	<0.5	U	<0.5	U	NA		<0.26	U	0.4	U	0.4	U	<0.5	U	<0.5	U	<0.26	U	0.4	U	0.4	U
Diethyl phthalate	50	<0.38	U	<0.38	U	NA		<0.22	U	0.76	U	0.76	U	<0.38	U	<0.38	U	<0.22	U	0.76	U	0.76	U
Dimethyl phthalate	50	<1.8	U	<1.8	U	NA		<0.50	U	0.92	U	0.92	U	<1.8	U	<1.8	U	<0.50	U	0.92	U	0.92	U
Hexachlorocyclopentadiene	5	<0.69	U	<0.69	U	NA		<0.23	U	1.2	U	1.2	U	<0.69	U	<0.69	U	<0.23	U	1.2	U	1.2	U
Isophorone	50	<1.2	U	<1.2	U	NA		<2.8	U	0.86	U	0.86	U	<1.2	U	<1.2	U	<2.8	U	0.86	U	0.86	U
n-Nitrosodi-n-propylamine	--	<0.64	U	<0.64	U	NA		<0.28	U	0.91	U	0.91	U	<0.64	U	<0.64	U	<0.28	U	0.91	U	0.91	U
NDPA/DPA	50	<0.42	U	<0.42	U	NA		NA		0.92	U	0.92	U	<0.42	U	<0.42	U	NA		0.92	U	0.92	U
Nitrobenzene	0.4	<0.77	U	<0.77	U	NA		<0.64	U	0.2	U	0.2	U	<0.77	U	<0.77	U	<0.64	U	0.2	U	0.2	U
p-Chloro-m-cresol	--	<0.35	U	<0.35	U	NA		NA		0.61	U	0.61	U	<0.35	U	<0.35	U	NA		0.61	U	0.61	U
Phenol	1	2.3	J	<0.57	U	NA		<0.39	U	0.35	U	0.35	U	<0.57	U	<0.57	U	<0.39	U	0.35	U	0.35	U
Semivolatile Organics by GC/MS-SIM (ug/L)																							
2-Chloronaphthalene	10	<0.03	U	<0.02	U	NA		<0.24	U	0.02	U	0.02	U	<0.02	U	<0.02	U	<0.24	U	0.02	U	0.02	U
2-Methylnaphthalene	--	0.82		0.15		NA		<0.21	U	0.04	J	0.04	J	3.8		0.03	J	<0.21	U	0.03	U	0.03	U
Acenaphthene	20	0.25		<0.01	U	NA		<0.19	U	0.02	U	0.02	U	0.08	J	<0.01	U	<0.19	U	0.02	U	0.02	U
Acenaphthylene	--	<0.01	U	<0.01	U	NA		<0.14	U	0.02	U	0.02	U	0.02	J	<0.01	U	<0.14	U	0.02	U	0.02	U
Anthracene	50	0.24		<0.01	U	NA		<0.21	U	0.02	U	0.02	U	0.01	J	<0.01	U	<0.21	U	0.02	U	0.02	U
Benzo(a)anthracene	0.002	<0.02	U	<0.02	U	NA		<0.20	U	0.03	U	0.03	U	0.02	J	0.02	J	<0.20	U	0.03	U	0.03	U
Benzo(a)pyrene	--	<0.02	U	<0.02	U	NA		<0.21	U	0.02	U	0.02	U	<0.02	U	<0.02	U	<0.21	U	0.04	J	0.02	U
Benzo(b)fluoranthene	0.002	<0.01	U	0.02	J	NA		<0.21	U	0.03	U	0.03	U	<0.01	U	<0.01	U	<0.21	U	0.04	J	0.03	U
Benzo(ghi)perylene	--	<0.01	U	<0.01	U	NA		<0.34	U	0.02	U	0.02	U	<0.01	U	<0.01	U	<0.34	U	0.09	J	0.02	U
Benzo(k)fluoranthene	0.002	<0.01	U	<0.01	U	NA		<0.21	U	0.03	U	0.03	U	<0.01	U	<0.01	U	<0.21	U	0.04	J	0.03	U
Chrysene	0.002	<0.01	U	<0.01	U	NA		<0.18	U	0.03	U	0.03	U	<0.01	U	<0.01	U	<0.18	U	0.03	U	0.03	U
Dibenzo(a,h)anthracene	--	<0.01	U	<0.01	U	NA		<0.33	U	0.02	U	0.02	U	<0.01	U	<0.01	U	<0.33	U	0.08	J	0.02	U
Fluoranthene	50	0.02	J	0.02	J	NA		<0.17	U	0.03	U	0.05	J	0.02	J	<0.02	U	<0.17	U	0.03	U	0.03	U
Fluorene	50	0.06	J	0.2		NA		<0.17	U	0.03	U	0.03	U	0.12		<0.01	U	<0.17	U	0.03	U	0.03	U
Hexachlorobenzene	0.04	<0.01	U	<0.01	U	NA		<0.33	U	0.01	U	0.07	J	<0.01	U	<0.01	U	<0.33	U	0.01	U	0.01	U
Hexachlorobutadiene	0.5	<0.05	U	<0.05	U	NA		<0.49	U	0.02	U	0.02	U	<0.05	U	<0.05	U	<0.49	U	0.02	U	0.02	U
Hexachloroethane	5	<0.06	U	<0.06	U	NA		<0.39	U	0.02	U	0.02	U	<0.06	U	<0.06	U	<0.39	U	0.02	U	0.02	U
Indeno(1,2,3-cd)pyrene	0.002	<0.01	U	<0.01	U	NA		<0.33	U	0.02	U	0.02	U	<0.01	U	<0.01	U	<0.33	U	0.08	J	0.02	U
Naphthalene	10	8.4		3.6		NA		<0.23	U	0.04	J	0.05	J	3.9		0.11		<0.23	U	0.02	U	0.1	J
Pentachlorophenol	1	<0.01	U	<0.01	U	NA		<1.4	U	0.06	U	0.06	U	<0.01	U	<0.01	U	<1.4	U	0.06	U	0.06	U
Phenanthrene	50	0.11		0.04	J	NA		<0.18	U	0.04	U	0.04	J	0.13		<0.02	U	<0.18	U	0.04	U	0.04	U
Pyrene	50	0.04	J	<0.02	U	NA		<0.22	U	0.04	U	0.04	U	0.02	J	<0.02	U	<0.22	U	0.04	U	0.04	U

LOCATION	NYSDEC TOGS 1.1.1 AWQS GV	MW-5		MW-5		MW-5		MW-5		MW-5		MW-5		MW-6		MW-6	
SAMPLING DATE		5/10/2023		12/21/2023		3/8/2024		6/7/2024		1/2/2025		1/28/2025		5/10/2023		12/21/2023	
SAMPLE TYPE		Water		Water		Water		Water		Water		Water		Water		Water	
		Results	Qual	Results	Qual	Results	Qual	Results	Qual	Results	Qual	Results	Qual	Results	Qual	Results	Qual
Semivolatile Organics by GC/MS (ug/L)																	
1,2,4,5-Tetrachlorobenzene	5	<0.44	U	<0.44	U	NA		<0.37	U	0.24	U	1.2	U	<0.44	U	<4.4	U
1,2,4-Trichlorobenzene	5	<0.5	U	<0.5	U	NA		NA		0.98	U	4.9	U	<0.5	U	<5	U
1,2-Dichlorobenzene	3	<0.45	U	<0.45	U	NA		NA		0.33	U	1.6	U	<0.45	U	<4.5	U
1,3-Dichlorobenzene	3	<0.4	U	<0.4	U	NA		NA		0.32	U	1.6	U	<0.4	U	<4	U
1,4-Dichlorobenzene	3	<0.43	U	<0.43	U	NA		NA		0.39	U	2	U	<0.43	U	<4.3	U
2,4,5-Trichlorophenol	--	<0.77	U	<0.77	U	NA		<1.3	U	2.1	U	10	U	<0.77	U	<7.7	U
2,4,6-Trichlorophenol	--	<0.61	U	<0.61	U	NA		<0.92	U	2.1	U	10	U	<0.61	U	<6.1	U
2,4-Dichlorophenol	1	<0.41	U	<0.41	U	NA		<1.3	U	1.7	U	8.5	U	<0.41	U	<4.1	U
2,4-Dimethylphenol	50	<1.8	U	<1.8	U	NA		4.1	J	2	U	10	U	67		<18	U
2,4-Dinitrophenol	10	<6.6	U	<6.6	U	NA		<1.6	U	5.4	U	27	U	<6.6	U	<66	U
2,4-Dinitrotoluene	5	<1.2	U	<1.2	U	NA		<0.55	U	0.54	U	2.7	U	<1.2	U	<12	U
2,6-Dinitrotoluene	5	<0.93	U	<0.93	U	NA		<0.48	U	0.84	U	4.2	U	<0.93	U	<9.3	U
2-Chlorophenol	--	<0.48	U	<0.48	U	NA		<0.82	U	0.65	U	3.3	U	<0.48	U	<4.8	U
2-Methylphenol	--	<0.49	U	<0.49	U	NA		1.4	J	6.3		12	U	36		9.6	J
2-Nitroaniline	5	<0.5	U	<0.5	U	NA		<0.28	U	1	U	5.2	U	<0.5	U	<5	U
2-Nitrophenol	--	<0.85	U	<0.85	U	NA		<0.96	U	2	U	9.8	U	<0.85	U	<8.5	U
3,3'-Dichlorobenzidine	5	<1.6	U	<1.6	U	NA		<0.88	U	1.8	U	9.2	U	<1.6	U	<16	U
3-Methylphenol/4-Methylphenol	--	<0.48	U	<0.48	U	NA		<0.51	U	22		28		53		17	J
3-Nitroaniline	5	<0.81	U	<0.81	U	NA		<0.39	U	1.2	U	5.8	U	<0.81	U	<8.1	U
4,6-Dinitro-o-cresol	--	<1.8	U	<1.8	U	NA		<1.3	U	2.3	U	12	U	<1.8	U	<18	U
4-Bromophenyl phenyl ether	--	<0.38	U	<0.38	U	NA		<0.40	U	0.24	U	1.2	U	<0.38	U	<3.8	U
4-Chloroaniline	5	<1.1	U	<1.1	U	NA		<0.34	U	0.47	U	2.3	U	<1.1	U	<11	U
4-Chlorophenyl phenyl ether	--	<0.49	U	<0.49	U	NA		<0.37	U	0.39	U	1.9	U	<0.49	U	<4.9	U
4-Nitroaniline	5	<0.8	U	<0.8	U	NA		<0.44	U	1.4	U	7.2	U	<0.8	U	<8	U
4-Nitrophenol	--	<0.67	U	<0.67	U	NA		<1.2	U	1.4	U	7.1	U	<0.67	U	<6.7	U
Acetophenone	--	<0.53	U	<0.53	U	NA		63.3		2300	E	2200		53		2,500	D
Benzoic Acid	--	<2.6	U	<2.6	U	NA		NA		2.6	U	310		<2.6	U	<26	U
Benzyl Alcohol	--	<0.59	U	<0.59	U	NA		NA		330		360		<0.59	U	43	
Biphenyl	--	6.6		2.2		NA		<0.21	U	1.4	J	0.98	U	1.6	J	<4.6	U
Bis(2-chloroethoxy)methane	5	<0.5	U	<0.5	U	NA		<0.28	U	0.84	U	4.2	U	<0.5	U	<5	U
Bis(2-chloroethyl)ether	1	<0.5	U	<0.5	U	NA		<0.25	U	0.39	U	2	U	<0.5	U	<5	U
Bis(2-chloroisopropyl)ether	5	<0.53	U	<0.53	U	NA		NA		0.4	U	2	U	<0.53	U	<5.3	U
Bis(2-ethylhexyl)phthalate	5	<1.5	U	<1.5	U	NA		<1.7	U	1.4	U	7.1	U	<1.5	U	<15	U
Butyl benzyl phthalate	50	<1.2	U	<1.2	U	NA		<0.46	U	2.6	U	13	U	<1.2	U	<12	U
Carbazole	--	<0.49	U	<0.49	U	NA		<0.65	U	0.31	U	1.5	U	<0.49	U	<4.9	U
Di-n-butylphthalate	50	<0.39	U	<0.39	U	NA		<0.23	U	1.9	J	4.8	U	<0.39	U	<3.9	U
Di-n-octylphthalate	50	<1.3	U	<1.3	U	NA		<0.22	U	2.3	U	11	U	<1.3	U	<13	U
Dibenzofuran	--	<0.5	U	<0.5	U	NA		<0.26	U	0.4	U	2	U	<0.5	U	<5	U
Diethyl phthalate	50	<0.38	U	<0.38	U	NA		<0.22	U	0.76	U	3.8	U	<0.38	U	<3.8	U
Dimethyl phthalate	50	<1.8	U	<1.8	U	NA		<0.50	U	0.92	U	4.6	U	<1.8	U	<18	U
Hexachlorocyclopentadiene	5	<0.69	U	<0.69	U	NA		<0.23	U	1.2	U	6.2	U	<0.69	U	<6.9	U
Isophorone	50	<1.2	U	<1.2	U	NA		<2.8	U	0.86	U	4.3	U	<1.2	U	<12	U
n-Nitrosodi-n-propylamine	--	<0.64	U	<0.64	U	NA		<0.28	U	0.91	U	4.5	U	<0.64	U	<6.4	U
NDPA/DPA	50	<0.42	U	<0.42	U	NA		NA		0.92	U	4.6	U	<0.42	U	<4.2	U
Nitrobenzene	0.4	<0.77	U	<0.77	U	NA		<0.64	U	0.2	U	1	U	<0.77	U	<7.7	U
p-Chloro-m-cresol	--	<0.35	U	<0.35	U	NA		NA		0.61	U	3	U	<0.35	U	<3.5	U
Phenol	1	<0.57	U	<0.57	U	NA		<0.39	U	6.2		1.8	U	<0.57	U	7.1	J
Semivolatile Organics by GC/MS-SIM (ug/L)																	
2-Chloronaphthalene	10	<0.02	U	<0.02	U	NA		<0.24	U	0.02	U	0.23	U	<0.02	U	<0.18	U
2-Methylnaphthalene	--	200	D	95	D	NA		1.1		46		50		69		170	
Acenaphthene	20	<0.01	U	0.39		NA		<0.19	U	0.02	U	0.24	U	0.26		0.28	J
Acenaphthylene	--	0.67		0.17		NA		<0.14	U	0.02	U	0.2	U	<0.01	U	<0.12	U
Anthracene	50	0.86		0.14		NA		<0.21	U	0.02	U	0.24	U	0.09	J	<0.14	U
Benzo(a)anthracene	0.002	0.3		0.14		NA		<0.20	U	0.03	U	0.3	U	<0.02		<0.2	U
Benzo(a)pyrene	--	0.18		0.05	J	NA		<0.21	U	0.02	U	0.24	U	<0.02	U	<0.15	U
Benzo(b)fluoranthene	0.002	0.18		0.09	J	NA		<0.21	U	0.03	U	0.27	U	0.01	J	<0.12	U
Benzo(ghi)perylene	--	0.2		0.1		NA		<0.34	U	0.02	U	0.24	U	<0.01	U	<0.14	U
Benzo(k)fluoranthene	0.002	0.06	J	0.02	J	NA		<0.21	U	0.03	U	0.34	U	<0.01		<0.09	U
Chrysene	0.002	0.28		0.13		NA		<0.18	U	0.03	U	0.31	U	0.02	J	<0.12	U
Dibenzo(a,h)anthracene	--	0.02	J	<0.01	U	NA		<0.33	U	0.02	U	0.24	U	<0.01	U	<0.13	U
Fluoranthene	50	0.72		0.33		NA		<0.17	U	0.03	U	0.27	U	0.04 J	J	<0.2	U
Fluorene	50	2.6		1		NA		<0.17	U	0.1		0.26	U	0.6		0.62	J
Hexachlorobenzene	0.04	<0.01	U	<0.01	U	NA		<0.33	U	0.01	U	0.13	U	<0.01	U	<0.09	U
Hexachlorobutadiene	0.5	<0.05	U	<0.05	U	NA		<0.49	U	0.02	U	0.2	U	<0.05	U	<0.47	U
Hexachloroethane	5	<0.06	U	<0.06	U	NA		<0.39	U	0.02	U	0.22	U	<0.06	U	<0.63	U
Indeno(1,2,3-cd)pyrene	0.002	0.08	J	0.03	J	NA		<0.33	U	0.02	U	0.22	U	<0.01	U	<0.12	U
Naphthalene	10	140	D	110	D	NA		3.6		110	E	130		220	D	430	
Pentachlorophenol	1	<0.01	U	<0.01	U	NA		<1.4	U	0.06	U	0.56	U	0.07	J	<0.14	U
Phenanthrene	50	3.6		1.2		NA		<0.18	U	0.22		0.39	U	0.35		0.75	J
Pyrene	50	1		0.52		NA		<0.22	U	0.04	U	0.42	U	0.07	J	0.19	J

Table Notes:

NYSDEC	New York State Department of Conservation Technical Operational Guida--e Series 1.1.1 Ambient Water Quality Standard and Guida--e Values
🟨	The recording limit exceeds the NYSDEC TOGS 1.1.1 AWQS GV
▨	Laboratory method detection limit (MDL) above established standard
MW	Permanent Monitoring Well
J	Estimate Value. The analyte concentration is below the quantitative limit (RL), but above the method detection limit (MDL) or estimated detection limit (EDL)
U	Not detected at the reported detection limit for the sample
D	Concentration of analyte was quantified from diluted analysis.
E	Concentration of analyte exceeds the range of the calibration curve and/or linear range of the instrument.
NA	Not analyzed
--	No Guidance Value
ug/L	Results are reported in microgram per liter

Table 8 - Groundwater Monitoring Results Summary Pre and Post Injection
4778 Broadway New York, New York 10034
BCP# C231131

LOCATION	NYSDEC TOGS 1.1.1 AWQS GV	MW-6		MW-6		MW-6	
SAMPLING DATE		12/21/2023		1/2/2025		1/28/2025	
SAMPLE TYPE		Water		Water		Water	
		Results	Qual	Results	Qual	Results	Qual
Semivolatile Organics by GC/MS (ug/L)							
1,2,4,5-Tetrachlorobenzene	5	<0.37	U	0.24	U	1.2	U
1,2,4-Trichlorobenzene	5	NA		0.98	U	4.9	U
1,2-Dichlorobenzene	3	NA		0.33	U	1.6	U
1,3-Dichlorobenzene	3	NA		0.32	U	1.6	U
1,4-Dichlorobenzene	3	NA		0.39	U	2	U
2,4,5-Trichlorophenol	--	<1.3	U	2.1	U	10	U
2,4,6-Trichlorophenol	--	<0.92	U	2.1	U	10	U
2,4-Dichlorophenol	1	<1.3	U	1.7	U	8.5	U
2,4-Dimethylphenol	50	337		11		10	U
2,4-Dinitrophenol	10	<1.6	U	5.4	U	27	U
2,4-Dinitrotoluene	5	<0.55	U	0.54	U	2.7	U
2,6-Dinitrotoluene	5	<0.48	U	0.84	U	4.2	U
2-Chlorophenol	--	<0.82	U	0.65	U	3.3	U
2-Methylphenol	--	30.5		2.3	U	12	U
2-Nitroaniline	5	<0.28	U	1	U	5.2	U
2-Nitrophenol	--	<0.96	a	2	U	9.8	U
3,3'-Dichlorobenzidine	5	6.4		1.8	U	9.2	U
3-Methylphenol/4-Methylphenol	--	<0.51	a	5.4		7	U
3-Nitroaniline	5	<0.39	U	1.2	U	5.8	U
4,6-Dinitro-o-cresol	--	<1.3	U	2.3	U	12	U
4-Bromophenyl phenyl ether	--	<0.40	U	0.24	U	1.2	U
4-Chloroaniline	5	<0.34	U	0.47	U	2.3	U
4-Chlorophenyl phenyl ether	--	<0.37	U	0.39	U	1.9	U
4-Nitroaniline	5	<0.44	U	1.4	U	7.2	U
4-Nitrophenol	--	<1.2	b	1.4	U	7.1	U
Acetophenone	--	5,720		1100	E	3800	E
Benzoic Acid	--	NA		2.6	U	250	
Benzyl Alcohol	--	NA		7.4		20	
Biphenyl	--	1.5		0.76	J	0.98	U
Bis(2-chloroethoxy)methane	5	<0.28	U	0.84	U	4.2	U
Bis(2-chloroethyl)ether	1	<0.25	U	0.39	U	2	U
Bis(2-chloroisopropyl)ether	5	NA		0.4	U	2	U
Bis(2-ethylhexyl)phthalate	5	<1.7	U	1.4	U	30	
Butyl benzyl phthalate	50	<0.46	U	2.6	U	13	U
Carbazole	--	<0.65	U	0.31	U	1.5	U
Di-n-butylphthalate	50	<0.23	U	0.96	U	4.8	U
Di-n-octylphthalate	50	<0.22	U	2.3	U	11	U
Dibenzofuran	--	<0.26	U	0.4	U	2	U
Diethyl phthalate	50	<0.22	U	0.76	U	3.8	U
Dimethyl phthalate	50	<0.50	U	0.92	U	4.6	U
Hexachlorocyclopentadiene	5	<0.23	U	1.2	U	6.2	U
Isophorone	50	<2.8	U	0.86	U	4.3	U
n-Nitrosodi-n-propylamine	--	<0.28	U	0.91	U	4.5	U
NDPA/DPA	50	NA		0.92	U	4.6	U
Nitrobenzene	0.4	<0.64	U	0.2	U	1	U
p-Chloro-m-cresol	--	NA		0.61	U	3	U
Phenol	1	<0.39	U	0.35	U	1.8	U
Semivolatile Organics by GC/MS-SIM (ug/L)							
2-Chloronaphthalene	10	<0.24	U	0.02	U	0.11	U
2-Methylnaphthalene	--	78		0.17		16	
Acenaphthene	20	<0.19	U	0.02	U	0.12	U
Acenaphthylene	--	<0.14	U	0.02	U	0.1	U
Anthracene	50	<0.21	U	0.02	U	0.12	U
Benzo(a)anthracene	0.002	<0.20	U	0.03	U	0.15	U
Benzo(a)pyrene	--	<0.21	U	0.02	U	0.12	U
Benzo(b)fluoranthene	0.002	<0.21	U	0.03	U	0.14	U
Benzo(ghi)perylene	--	<0.34	U	0.02	U	0.12	U
Benzo(k)fluoranthene	0.002	<0.21	U	0.03	U	0.17	U
Chrysene	0.002	<0.18	U	0.03	U	0.16	U
Dibenzo(a,h)anthracene	--	<0.33	U	0.02	U	0.12	U
Fluoranthene	50	<0.17	U	0.03	U	0.14	U
Fluorene	50	<0.17	U	0.03	U	0.13	U
Hexachlorobenzene	0.04	<0.33	U	0.01	U	0.07	U
Hexachlorobutadiene	0.5	<0.49	U	0.02	U	0.1	U
Hexachloroethane	5	<0.39	U	0.02	U	0.11	U
Indeno(1,2,3-cd)pyrene	0.002	<0.33	U	0.02	U	0.11	U
Naphthalene	10	265		7.1		61	
Pentachlorophenol	1	<1.4	U	0.06	U	0.28	U
Phenanthrene	50	0.21	J	0.04	U	0.2	U
Pyrene	50	<0.22	U	0.04	U	0.21	U

Table 8 - Groundwater Monitoring Results Summary Pre and Post Injection
4778 Broadway New York, New York 10034
BCP# C231131

LOCATION	NYSDEC TOGS 1.1.1 AWQS GV	MW-1		MW-1		MW-1		MW-4		MW-1		MW-1	
SAMPLING DATE		5/10/2023		12/21/2023		3/8/2024		6/7/2024		1/3/2025		1/28/2025	
SAMPLE TYPE		Water		Water		Water		Water		Water		Water	
		Results	Qual	Results	Qual	Results	Qual	Results	Qual	Results	Qual	Results	Qual
General Chemistry (ug/L)													
Sulfate	250,000	110,000		300,000		NA		1,230,00		2,600,000		NA	
TPH, SGT-HEM	--	NA		NA		NA		NA		NA		1240	U
Anions by Ion Chromatography (ug/L)													
Sulfate	250,000	NA		NA		NA		NA		NA		7,550,000	

LOCATION	NYSDEC TOGS 1.1.1 AWQS GV	MW-2		MW-2		MW-2		MW-2		MW-2		MW-2	
SAMPLING DATE		5/10/2023		12/21/2023		3/8/2024		6/7/2024		1/2/2025		1/28/2025	
SAMPLE TYPE		Water		Water		Water		Water		Water		Water	
		Results	Qual	Results	Qual	Results	Qual	Results	Qual	Results	Qual	Results	Qual
General Chemistry (ug/L)													
Sulfate	250,000	85,000		1,500,000		NA		164,000		1,200,000		NA	
TPH, SGT-HEM	--	NA		NA		NA		NA		NA		1240	U
Anions by Ion Chromatography (ug/L)													
Sulfate	250,000	NA		NA		NA		NA		NA		15,400,000	

LOCATION	NYSDEC TOGS 1.1.1 AWQS GV	MW-3		MW-3		MW-3		MW-3		MW-3		MW-3		MW
SAMPLING DATE		5/10/2023		12/21/2023		3/8/2024		6/7/2024		1/3/2025		1/28/2025		5/10/
SAMPLE TYPE		Water		Water		Water		Water		Water		Water		Wa
		Results	Qual	Results	Qual	Results	Qual	Results	Qual	Results	Qual	Results	Qual	Results
General Chemistry (ug/L)														
Sulfate	250,000	150,000		3,000,000		NA		1,220,000		4,100,000		NA		64,000
TPH, SGT-HEM	--	NA		NA		NA		NA		NA		1360	U	NA
Anions by Ion Chromatography (ug/L)														
Sulfate	250,000	NA		NA		NA		NA		NA		36,500,000		NA

Table Notes:

NYSDEC TOGS 1.1.1	New York State Department of Conservation Technical Operational Guida--e Series 1.1.1 Ambient Water Quality Standard and Guida--e Values
🟨	The recording limit exceeds the NYSDEC TOGS 1.1.1 AWQS GV
MW	Permanent Monitoring Well
ug/L	Results are reported in microgram per liter
NA	Not analyzed

Table 8 - Groundwater Monitoring Results Summary Pre and Post Injection
4778 Broadway New York, New York 10034
BCP# C231131

LOCATION	**NYSDEC TOGS 1.1.1 AWQS GV**	**V-4**	**MW-4**		**MW-4**		**MW-4**		**MW-4**		**MW-5**		**MW-5**		**MW-5**		**MW-5**		**MW-5**		**MW-5**		**MW-6**		**MW-6**		**MW-6**		**MW-6**		**MW-6**	
SAMPLING DATE		**/2023**	**12/21/2023**		**6/7/2024**		**1/3/2025**		**1/29/2025**		**5/10/2023**		**12/21/2023**		**3/8/2024**		**6/7/2024**		**1/2/2025**		**1/28/2025**		**5/10/2023**		**12/21/2023**		**6/7/2024**		**1/2/2025**		**1/28/2025**	
SAMPLE TYPE		**ter**	**Water**		**Water**		**Water**		**Water**		**Water**		**Water**		**Water**		**Water**		**Water**		**Water**		**Water**		**Water**		**Water**		**Water**		**Water**	
		Qual	**Results**	**Qual**	**Results**	**Qual**	**Results**	**Qual**	**Results**	**Qual**	**Results**	**Qual**	**Results**	**Qual**	**Results**	**Qual**	**Results**	**Qual**	**Results**	**Qual**	**Results**	**Qual**	**Results**	**Qual**	**Results**	**Qual**	**Results**	**Qual**	**Results**	**Qual**	**Results**	**Qual**
General Chemistry (ug/L)																																
Sulfate	250,000		180,000		173,000		570,000		NA		69,000		220,000		NA		619,000		560,000		NA		35,000		4,000,000		5,660,000		1,700,000		NA	
TPH, SGT-HEM	--		NA		NA		NA		1240	U	NA		NA		NA		NA		NA		1240	U	NA		NA		NA		NA		1240	U
Anions by Ion Chromatography (ug/L)																																
Sulfate	250,000		NA		NA		NA		6,940,000		NA		NA		NA		NA		NA		6,100,000		NA		NA		NA		NA		29,000,000	

Table 9 - Soil Vapor Results Summary
4778 Broadway New York, New York
BCP# C231131

LOCATION			**SGS-1S**		**SGS-1D**		**SGS-2S**		**SGS-2D**		**SGS-3S**		**SGS-3D**		**SGS-4S**		**SGS-4D**		**SGS-5S**		**SGS-5D**	
SAMPLING DATE			**2/11/2020**		**2/11/2020**		**2/11/2020**		**2/11/2020**		**2/11/2020**		**2/11/2020**		**2/11/2020**		**2/11/2020**		**2/11/2020**		**2/11/2020**	
SAMPLE DEPTH (ft.)			**3.0-5.0**		**11.0-13.0**		**3.0-5.0**		**11.0-13.0**		**3.0-5.0**		**11.0-13.0**		**3.0-5.0**		**11.0-13.0**		**3.0-5.0**		**11.0-13.0**	
	NY-SSC-A, B,C	**Units**	**Results**	**Qual**	**Results**	**Qual**	**Results**	**Qual**	**Results**	**Qual**	**Results**	**Qual**	**Results**	**Qual**	**Results**	**Qual**	**Results**	**Qual**	**Results**	**Qual**	**Results**	**Qual**
Volatile Organics in Air																						
Dichlorodifluoromethane		ug/m3	6.92		6.82		8.95		9.54		2.84		2.9		1.82		1.71		33.4		47	
Chloromethane		ug/m3	0.413	U	0.413	U	4.32		0.413	U	0.413	U	0.413	U	0.413	U	0.413	U	0.855		0.549	
Freon-114		ug/m3	1.4	U	1.4	U	8.74	U	1.4	U	1.4	U	1.4	U	1.4	U	1.4	U	1.4	U	1.4	U
Vinyl chloride	6	ug/m3	0.511	U	0.511	U	3.2	U	0.511	U	0.511	U	0.511	U	0.511	U	0.511	U	0.511	U	0.511	U
1,3-Butadiene		ug/m3	0.591		0.442	U	9.49		5.02		0.442	U	0.757		0.442	U	0.442	U	6.44		14.8	
Bromomethane		ug/m3	0.777	U	0.777	U	4.85	U	0.777	U	0.777	U	0.777	U	0.777	U	0.777	U	0.777	U	0.777	U
Chloroethane		ug/m3	0.528	U	0.528	U	3.3	U	0.528	U	0.528	U	0.528	U	0.528	U	0.528	U	0.528	U	0.528	U
Ethanol		ug/m3	9.42	U	9.42	U	58.8	U	11.3		9.42	U	11.9		9.42	U	9.42	U	9.42	U	15.8	
Vinyl bromide		ug/m3	0.874	U	0.874	U	5.47	U	0.874	U	0.874	U	0.874	U	0.874	U	0.874	U	0.874	U	0.874	U
Acetone		ug/m3	8.72		6.41		14.8	U	38.7		3.97		302		2.38	U	96.4		74.4		53.4	
Trichlorofluoromethane		ug/m3	1.12	U	1.12	U	7.02	U	1.12	U	1.12	U	1.12	U	1.12	U	1.12	U	1.65		1.97	
Isopropanol		ug/m3	1.23	U	1.23	U	7.67	U	1.59		1.23	U	14.2		1.23	U	1.23	U	8.19		2.75	
1,1-Dichloroethene	6	ug/m3	0.793	U	0.793	U	4.96	U	0.793	U	0.793	U	0.793	U	0.793	U	0.793	U	0.793	U	0.793	U
Methylene chloride	100	ug/m3	1.74	U	1.74	U	10.8	U	1.74	U	1.74	U	1.74	U	1.74	U	1.74	U	1.74	U	1.74	U
3-Chloropropene		ug/m3	0.626	U	0.626	U	3.91	U	0.626	U	0.626	U	0.626	U	0.626	U	0.626	U	0.626	U	0.626	U
Carbon disulfide		ug/m3	1.6		1.1		10.1		7.07		1.65		7.97		1.38		1.82		3.64		9.31	
Freon-113		ug/m3	1.53	U	1.53	U	9.58	U	1.53	U	1.53	U	1.53	U	1.53	U	1.53	U	1.53	U	1.53	U
trans-1,2-Dichloroethene		ug/m3	0.793	U	0.793	U	4.96	U	0.793	U	0.793	U	1.27		0.793	U	0.793	U	0.793	U	0.793	U
1,1-Dichloroethane		ug/m3	0.809	U	0.809	U	5.06	U	0.809	U	0.809	U	0.809	U	0.809	U	0.809	U	0.809	U	0.809	U
Methyl tert butyl ether		ug/m3	0.721	U	0.721	U	4.51	U	0.721	U	0.721	U	0.721	U	0.721	U	0.721	U	0.721	U	0.721	U
2-Butanone		ug/m3	1.86		1.98		9.2	U	9.14		1.47	U	11.4		1.47	U	7.05		22.7		24.6	
cis-1,2-Dichloroethene	6	ug/m3	0.793	U	0.793	U	4.96	U	0.793	U	0.793	U	0.793	U	0.793	U	0.793	U	0.793	U	0.793	U
Ethyl Acetate		ug/m3	1.8	U	1.8	U	11.2	U	1.8	U	1.8	U	1.8	U	1.8	U	1.8	U	1.8	U	1.8	U
Chloroform		ug/m3	6.2		6.79		6.1	U	2.54		1.43		0.977	U	1.05		1		2.66		3.85	
Tetrahydrofuran		ug/m3	1.47	U	1.47	U	9.2	U	1.47	U	1.47	U	4.75		1.47	U	1.47	U	1.47	U	1.47	U
1,2-Dichloroethane		ug/m3	0.809	U	0.809	U	5.06	U	0.809	U	0.809	U	0.809	U	0.809	U	0.809	U	0.809	U	0.809	U
n-Hexane		ug/m3	4.83		0.705	U	59.2		5.5		4.9		6.8		0.8		7.01		9.94		31.2	
1,1,1-Trichloroethane	100	ug/m3	1.09	U	1.09	U	6.82	U	1.09	U	1.09	U	1.09	U	1.09	U	1.09	U	1.09	U	1.09	U
Benzene		ug/m3	1.09		1.11		58.8		3.87		1.56		7.25		0.639	U	1.45		2.19		5.97	
Carbon tetrachloride	6	ug/m3	1.26	U	1.26	U	7.86	U	1.26	U	1.26	U	1.26	U	1.26	U	1.26	U	1.26	U	1.26	U
Cyclohexane		ug/m3	1.15		0.688	U	16.3		1.21		2		4.54		0.688	U	0.688	U	5.68		9.33	
1,2-Dichloropropane		ug/m3	0.924	U	0.924	U	5.78	U	0.924	U	0.924	U	0.924	U	0.924	U	0.924	U	0.924	U	0.924	U
Bromodichloromethane		ug/m3	1.34	U	1.34	U	8.37	U	1.34	U	1.34	U	1.34	U	1.34	U	1.34	U	1.34	U	1.34	U
1,4-Dioxane		ug/m3	0.721	U	0.721	U	4.5	U	2.09		0.721	U	0.721	U	0.721	U	0.721	U	0.721	U	0.721	U
Trichloroethene	6	ug/m3	1.07	U	1.07	U	6.72	U	1.07	U	1.34		1.07	U	1.07	U	1.07	U	1.07	U	1.07	U
2,2,4-Trimethylpentane		2,2,	1.49		0.934	U	1440		10.1		1.52		0.934	U	0.934	U	1.2		2.07		4.23	
Heptane		ug/m3	4.22		1.2		100		4.3		3.67		17.7		0.82	U	6.93		8.32		22.7	
cis-1,3-Dichloropropene		ug/m3	0.908	U	0.908	U	5.67	U	0.908	U	0.908	U	0.908	U	0.908	U	0.908	U	0.908	U	0.908	U
4-Methyl-2-pentanone		ug/m3	2.05	U	2.05	U	12.8	U	7.83		2.05	U	2.05	U	2.05	U	2.05	U	7.09		10.4	
trans-1,3-Dichloropropene		ug/m3	0.908	U	0.908	U	5.67	U	0.908	U	0.908	U	0.908	U	0.908	U	0.908	U	0.908	U	0.908	U
1,1,2-Trichloroethane		ug/m3	1.09	U	1.09	U	6.82	U	1.09	U	1.09	U	1.09	U	1.09	U	1.09	U	1.09	U	1.09	U
Toluene		ug/m3	4.45		5.43		445		9.42		12.7		38.4		3.09		11.3		9.27		16.4	
2-Hexanone		ug/m3	0.82	U	0.82	U	5.12	U	-	-	0.82	U	0.82	U	0.82	U	0.82	U	-	-	-	-
Dibromochloromethane		ug/m3	1.7	U	1.7	U	10.6	U	1.7	U	1.7	U	1.7	U	1.7	U	1.7	U	1.7	U	1.7	U
1,2-Dibromoethane		ug/m3	1.54	U	1.54	U	9.61	U	1.54	U	1.54	U	1.54	U	1.54	U	1.54	U	1.54	U	1.54	U
Tetrachloroethene	100	ug/m3	1.36	U	1.51		8.48	U	7.8		10.6		5.05		3.84		12.1		1.44		2.22	
Chlorobenzene		ug/m3	0.921	U	0.921	U	5.76	U	0.921	U	0.921	U	0.921	U	0.921	U	0.921	U	0.921	U	0.921	U
Ethylbenzene		ug/m3	3.43		10.9		60.8		6.34		13.1		11.1		2.47		5.08		4.33		6.6	
p/m-Xylene		ug/m3	14.6		44.7		160		24.2		55.6		32.5		11.2		18.1		16.9		24.1	
Bromoform		ug/m3	2.07	U	2.07	U	12.9	U	2.07	U	2.07	U	2.07	U	2.07	U	2.07	U	2.07	U	2.07	U
Styrene		ug/m3	0.852	U	0.852	U	5.32	U	0.852	U	0.852	U	0.852	U	0.852	U	0.852	U	0.852	U	0.852	U
1,1,2,2-Tetrachloroethane		ug/m3	1.37	U	1.37	U	8.58	U	1.37	U	1.37	U	1.37	U	1.37	U	1.37	U	1.37	U	1.37	U
o-Xylene		ug/m3	6.56		16.2		50.4		11.9		23.8		12.9		5.08		7.51		7.47		11.8	
4-Ethyltoluene		ug/m3	3.75		4.1		6.15	U	4.75		8.55		0.983	U	2.95		4.41		4.1		5.16	
1,3,5-Trimethylbenzene		ug/m3	4.4		4.6		6.39		6.83		11.6		4.77		4.56		4.33		4.83		6.34	
1,2,4-Trimethylbenzene		ug/m3	16.1		17.3		17.8		18.8		45		18.9		16.3		15.5		17.4		22	
Benzyl chloride		ug/m3	1.04	U	1.04	U	6.47	U	1.04	U	1.04	U	1.04	U	1.04	U	1.04	U	1.04	U	1.04	U
1,3-Dichlorobenzene		ug/m3	1.2	U	1.2	U	7.52	U	1.2	U	1.2	U	1.2	U	1.2	U	1.2	U	1.2	U	1.2	U
1,4-Dichlorobenzene		ug/m3	1.2	U	1.2	U	7.52	U	1.2	U	1.2	U	1.2	U	1.2	U	1.2	U	1.2	U	1.2	U
1,2-Dichlorobenzene		ug/m3	1.2	U	1.2	U	7.52	U	1.2	U	1.2	U	1.2	U	1.2	U	1.2	U	1.2	U	1.2	U
1,2,4-Trichlorobenzene		ug/m3	1.48	U	1.48	U	9.28	U	1.48	U	1.48	U	1.48	U	1.48	U	1.48	U	1.48	U	1.48	U
Hexachlorobutadiene		ug/m3	2.13	U	2.13	U	13.3	U	2.13	U	2.13	U	2.13	U	2.13	U	2.13	U	2.13	U	2.13	U
Volatile Organics in Air by SIM																						
tert-Butyl Alcohol		ug/m3	3.27		3.67		9.46	U	4.61		1.52	U	1.52	U	1.52	U	1.71		8.82		14.9	
2-Hexanone		ug/m3	-	-	-	-	-	-	3.36		-	-	-	-	-	-	-	-	6.8		6.11	

Notes:

U: Value below Method Detection Limit (MDL)

Highlighted: Exceeds respective concentration

NY-SSC-A: New York DOH Matrix A Sub-slab Vapor Concentrations Criteria per Guidance for Evaluating Soil Vapor Intrusion, October 2006, and updated May 2017.

NY-SSC-B: New York DOH Matrix B Sub-slab Vapor Concentrations Criteria per Guidance for Evaluating Soil Vapor Intrusion, October 2006, and updated May 2017.

NY-SSC-C: New York DOH Matrix C Sub-slab Vapor Concentrations Criteria per Guidance for Evaluating Soil Vapor Intrusion, October 2006, and updated May 2017.

Table 9 - Soil Vapor Results Summary
4778 Broadway New York, New York
BCP# C231131

LOCATION			SGS-6S		SGS-6D		SGS-7S		SGS-7D		SGS-8S		SGS-8D		SGS-9S		SGS-9D	
SAMPLING DATE			2/11/2020		2/11/2020		2/11/2020		2/11/2020		2/11/2020		2/11/2020		2/11/2020		2/11/2020	
SAMPLE DEPTH (ft.)			3.0-5.0		11.0-13.0		3.0-5.0		11.0-13.0		3.0-5.0		11.0-13.0		3.0-5.0		11.0-13.0	
	NY-SSC-A, B,C	**Units**	**Results**	**Qual**	**Results**	**Qual**	**Results**	**Qual**	**Results**	**Qual**	**Results**	**Qual**	**Results**	**Qual**	**Results**	**Qual**	**Results**	**Qual**
Volatile Organics in Air																		
Dichlorodifluoromethane		ug/m3	46.6		36.6		34.7		48.9		2.91	U	603	U	19.8	U	21900	U
Chloromethane		ug/m3	0.617		0.413	U	1.59	U	16.6	U	1.21	U	252	U	8.28	U	9130	U
Freon-114		ug/m3	1.4	U	1.4	U	5.38	U	56.3	U	4.11	U	853	U	28	U	30900	U
Vinyl chloride	6	ug/m3	0.511	U	0.511	U	1.97	U	20.6	U	1.5	U	312	U	10.3	U	11300	U
1,3-Butadiene		ug/m3	29.4		10.2		22.6		17.8	U	19.8		270	U	8.87	U	9780	U
Bromomethane		ug/m3	0.777	U	0.777	U	2.99	U	31.3	U	2.28	U	474	U	15.6	U	17200	U
Chloroethane		ug/m3	0.528	U	0.528	U	2.03	U	21.3	U	1.55	U	322	U	10.6	U	11700	U
Ethanol		ug/m3	9.42	U	15.5		36.2	U	381	U	27.7	U	5750	U	188	U	209000	U
Vinyl bromide		ug/m3	0.874	U	0.874	U	3.36	U	35.2	U	2.57	U	533	U	17.5	U	19300	U
Acetone		ug/m3	14.2		76.5		9.15	U	95.7	U	46.3		1450	U	47.7	U	52500	U
Trichlorofluoromethane		ug/m3	1.12	U	1.12	U	4.32	U	45.3	U	3.3	U	686	U	22.5	U	24800	U
Isopropanol		ug/m3	1.23	U	1.74		4.72	U	56.3		3.61	U	750	U	24.6	U	27300	U
1,1-Dichloroethene	6	ug/m3	0.793	U	0.793	U	3.05	U	32	U	2.33	U	484	U	15.9	U	17500	U
Methylene chloride	100	ug/m3	1.74	U	1.74	U	6.67	U	167		5.11	U	1060	U	34.7	U	38600	U
3-Chloropropene		ug/m3	0.626	U	0.626	U	2.41	U	25.2	U	1.84	U	382	U	12.6	U	13800	U
Carbon disulfide		ug/m3	3.49		4.08		94.4		25.1	U	15.8		380	U	44.2		13800	U
Freon-113		ug/m3	1.53	U	1.53	U	5.89	U	61.8	U	4.51	U	935	U	30.7	U	33900	U
trans-1,2-Dichloroethene		ug/m3	0.793	U	0.793	U	3.05	U	32	U	2.33	U	484	U	15.9	U	17500	U
1,1-Dichloroethane		ug/m3	0.809	U	0.809	U	3.11	U	32.6	U	2.38	U	494	U	16.2	U	17900	U
Methyl tert butyl ether		ug/m3	0.721	U	0.721	U	2.77	U	29.1	U	2.12	U	440	U	14.5	U	15900	U
2-Butanone		ug/m3	3.16		27.1		5.66	U	59.6	U	17.2		900	U	29.5	U	32700	U
cis-1,2-Dichloroethene	6	ug/m3	0.793	U	0.793	U	3.05	U	32	U	2.33	U	484	U	15.9	U	17500	U
Ethyl Acetate		ug/m3	1.8	U	1.8	U	6.92	U	72.8	U	5.3	U	1100	U	36	U	40000	U
Chloroform		ug/m3	0.977	U	0.977	U	3.76	U	39.4	U	5.76		596	U	19.6	U	21600	U
Tetrahydrofuran		ug/m3	1.47	U	1.47	U	5.66	U	59.6	U	4.34	U	900	U	29.5	U	32700	U
1,2-Dichloroethane		ug/m3	0.809	U	0.809	U	3.11	U	32.6	U	2.38	U	494	U	16.2	U	17900	U
n-Hexane		ug/m3	31.8		13.7		145		195		181		430	U	1150		1800000	
1,1,1-Trichloroethane	100	ug/m3	1.09	U	1.09	U	4.2	U	44	U	3.21	U	666	U	21.9	U	24100	U
Benzene		ug/m3	6.68		4.7		7.19		25.7	U	36.4		390	U	990		371000	
Carbon tetrachloride	6	ug/m3	1.26	U	1.26	U	4.84	U	50.7	U	3.7	U	767	U	25.2	U	27800	U
Cyclohexane		ug/m3	7.54		2.77		141		344		89.5		420	U	379		282000	
1,2-Dichloropropane		ug/m3	0.924	U	0.924	U	3.55	U	37.3	U	2.72	U	564	U	18.5	U	20400	U
Bromodichloromethane		ug/m3	1.34	U	1.34	U	5.15	U	54	U	3.94	U	817	U	26.9	U	29600	U
1,4-Dioxane		ug/m3	0.721	U	0.721	U	2.77	U	29	U	2.12	U	440	U	14.5	U	15900	U
Trichloroethene	6	ug/m3	1.07	U	1.07	U	4.13	U	43.3	U	3.16	U	656	U	21.6	U	23800	U
2,2,4-Trimethylpentane		2,2,	21		13.1		715		9060		551		179000		7190		5000000	
Heptane		ug/m3	10.5		11.9		33.7		59		143		500	U	338		979000	
cis-1,3-Dichloropropene		ug/m3	0.908	U	0.908	U	3.49	U	36.6	U	2.67	U	554	U	18.2	U	20100	U
4-Methyl-2-pentanone		ug/m3	2.05	U	7.09		7.87	U	82.8	U	6.02	U	1250	U	41	U	45500	U
trans-1,3-Dichloropropene		ug/m3	0.908	U	0.908	U	3.49	U	36.6	U	2.67	U	554	U	18.2	U	20100	U
1,1,2-Trichloroethane		ug/m3	1.09	U	1.09	U	4.2	U	44	U	3.21	U	666	U	21.9	U	24100	U
Toluene		ug/m3	7.2		18.2		10.3		30.4	U	66.7		460	U	132		897000	
2-Hexanone		ug/m3	0.82	U	-	-	3.15	U	33	U	2.41	U	500	U	16.4	U	18100	U
Dibromochloromethane		ug/m3	1.7	U	1.7	U	6.55	U	68.7	U	5.01	U	1040	U	34.2	U	37700	U
1,2-Dibromoethane		ug/m3	1.54	U	1.54	U	5.91	U	61.9	U	4.52	U	938	U	30.8	U	34000	U
Tetrachloroethene	100	ug/m3	1.36	U	2.62		5.21	U	54.7	U	3.99	U	827	U	27.2	U	30000	U
Chlorobenzene		ug/m3	0.921	U	0.921	U	3.54	U	37.1	U	2.71	U	562	U	18.5	U	20400	U
Ethylbenzene		ug/m3	3.4		7.77		3.83		35	U	17.8		530	U	77.3		155000	
p/m-Xylene		ug/m3	13.2		26.6		13.7		69.9	U	91.2		1060	U	216		199000	
Bromoform		ug/m3	2.07	U	2.07	U	7.95	U	83.3	U	6.08	U	1260	U	41.5	U	45700	U
Styrene		ug/m3	0.852	U	0.852	U	3.27	U	34.3	U	2.5	U	519	U	17.1	U	18800	U
1,1,2,2-Tetrachloroethane		ug/m3	1.37	U	1.37	U	5.28	U	55.3	U	4.04	U	838	U	27.5	U	30400	U
o-Xylene		ug/m3	6.12		12.2		6.47		35	U	40.2		530	U	61.2		38100	
4-Ethyltoluene		ug/m3	4.01		4.7		3.78	U	39.6	U	7.87		600	U	19.7	U	21700	U
1,3,5-Trimethylbenzene		ug/m3	5.51		5.85		4.37		39.6	U	7.33		600	U	19.7	U	21700	U
1,2,4-Trimethylbenzene		ug/m3	20.5		20.5		15.6		39.6	U	27.3		600	U	29.2		21700	U
Benzyl chloride		ug/m3	1.04	U	1.04	U	3.98	U	41.7	U	3.04	U	632	U	20.8	U	22900	U
1,3-Dichlorobenzene		ug/m3	1.2	U	1.2	U	4.62	U	48.5	U	3.54	U	733	U	24.1	U	26600	U
1,4-Dichlorobenzene		ug/m3	1.2	U	1.2	U	4.62	U	48.5	U	3.54	U	733	U	24.1	U	26600	U
1,2-Dichlorobenzene		ug/m3	1.2	U	1.2	U	4.62	U	48.5	U	3.54	U	733	U	24.1	U	26600	U
1,2,4-Trichlorobenzene		ug/m3	1.48	U	1.48	U	5.71	U	59.8	U	4.36	U	906	U	29.8	U	32800	U
Hexachlorobutadiene		ug/m3	2.13	U	2.13	U	8.2	U	86	U	6.27	U	1300	U	42.8	U	47100	U
Volatile Organics in Air by SIM																		
tert-Butyl Alcohol		ug/m3	7.49		10		7.91		70		12.2		925	U	30.3	U	33600	U
2-Hexanone		ug/m3	-	-	2.99		-	-	-	-	-	-	-	-	-	-	-	-

Notes:
U: Value below Method Detection Limit (MDL)
Highlighted: Exceeds respective concentration
NY-SSC-A: New York DOH Matrix A Sub-slab Vapor Concentrations Criteria p
NY-SSC-B: New York DOH Matrix B Sub-slab Vapor Concentrations Criteria p
NY-SSC-C: New York DOH Matrix C Sub-slab Vapor Concentrations Criteria p

Table 10 - Indoor and Ambient Air Sample Results Summary - October and November 2024
44778 Broadway New York, New York 10034
BCP# C231131

SAMPLE LOCATION	NYSDOH-Indoor Air Vapor Concentrations: Matrix A, B, and C, - No Further Action	NYSDOH-Indoor Air Vapor Concentrations: Matrix D,E, and F, - No Further Action	IA-1_10.22.24		IA-1_11.19.24		IA-2_10.22.24		IA-2_11.19.24		IA-3_10.22.24		IA-3_11.19.24		IA-4_10.22.24		IA-4_11.19.24		IA-5_10.22.24		IA-5_11.19.24		IA-6_10.22.24		IA-6_11.19.24		IA-7_10.22.24		IA-7_11.19.24		AA-1_10.22.24		AA-1_11.19.24		AA-ROOF_10.22.24		AA-ROOF_11.19.24		11.19.24_DUP	
SAMPLING DATE			L2461476-01 R1		L2467893-01		L2461476-02 R1		L2467893-02		L2461476-03 R1		L2467893-03		L2461476-04 R1		L2467893-04		L2461476-05 R1		L2467893-05		L2461476-06		L2467893-06		L2461476-07		L2467893-07		L2461476-08		L2467893-08		L2461476-09		L2467893-09		L2467893-10	
LABORATORY SAMPLE ID			10/22/2024		11/19/2024		10/22/2024		11/19/2024		10/22/2024		11/19/2024		10/22/2024		11/19/2024		10/22/2024		11/19/2024		10/22/2024		11/19/2024		10/22/2024		11/19/2024		10/22/2024		11/19/2024		10/22/2024		11/19/2024		11/19/2024	
SAMPLE TYPE			Soil Vapor		Soil Vapor		Soil Vapor		Soil Vapor		Soil Vapor		Soil Vapor		Soil Vapor		Soil Vapor		Soil Vapor		Soil Vapor		Soil Vapor		Soil Vapor		Soil Vapor		Soil Vapor		Soil Vapor		Soil Vapor		Soil Vapor		Soil Vapor		Soil Vapor	
			Results	Qual	Results	Qual	Results	Qual	Results	Qual	Results	Qual	Results	Qual	Results	Qual	Results	Qual	Results	Qual	Results	Qual	Results	Qual	Results	Qual	Results	Qual	Results	Qual	Results	Qual	Results	Qual	Results	Qual	Results	Qual	Results	Qual
Volatile Organics in Air by TO-15 (µg/m3)																																								
1,1,1-Trichloroethane	10	--	ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND	
1,1,2,2-Tetrachloroethane	--	--	ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND	
1,1,2-Trichloroethane	--	--	ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND	
1,1-Dichloroethane	--	--	ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND	
1,1-Dichloroethene	1	--	ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND	
1,2,4-Trichlorobenzene	--	--	ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND	
1,2,4-Trimethylbenzene	--	10	1.5		ND		ND		ND		ND		ND		ND		ND		1.02		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND	
1,2-Dibromoethane	--	--	ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND	
1,2-Dichlorobenzene	--	--	ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND	
1,2-Dichloroethane	--	--	ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND	
1,2-Dichloropropane	--	--	ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND	
1,3,5-Trimethylbenzene	--	10	ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND	
1,3-Butadiene	--	--	ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND	
1,3-Dichlorobenzene	--	--	ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND	
1,4-Dichlorobenzene	--	--	ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND	
1,4-Dioxane	--	--	ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND	
2,2,4-Trimethylpentane	--	10	1.62		ND		1.95		ND		2.02		ND		1.66		ND		1.93		ND		1.16		ND		1.35		ND		1.53		ND		0.986		ND		ND	
2-Butanone	--	--	1.73		2.05		1.97		2.08		2.19		16.1		1.79		ND		1.9		ND		2		ND		1.64		ND		1.87		3.69		1.57		ND		2.2	
2-Hexanone	--	--	ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND	
3-Chloropropene	--	--	ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND	
4-Ethyltoluene	--	--	ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND	
4-Methyl-2-pentanone	--	--	2.59		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND	
Acetone	--	--	18		15.6		15.3		10.4		14.6		12		11.9		8.91		14.1		13.4		25.4		8.36		14.9		8.34		15		6.87		13.4		5.91		11.1	
Benzene	--	10	1.08		ND		1.19		ND		1.2		ND		1.03		ND		1.19		ND		0.994		ND		1.11		ND		1.19		ND		0.93		ND		1.49	
Benzyl chloride	--	--	ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND	
Bromodichloromethane	--	--	ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND	
Bromoform	--	--	ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND	
Bromomethane	--	--	ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND	
Carbon disulfide	--	--	ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND	
Carbon tetrachloride	1	--	0.642		0.428		0.648		0.44		0.629		0.44		0.642		0.447		0.648		0.453		0.503		0.44		0.535		0.44		0.478		0.434		0.528		0.44		0.447	
Chlorobenzene	--	--	ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND	
Chloroethane	--	--	ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND	
Chloroform	--	--	ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND	
Chloromethane	--	--	1.06		0.96		1.04		0.89		1.04		0.981		1.04		0.973		1.07		0.962		1.13		0.923		1.19		1.02		1.12		0.946		1.15		0.983		0.983	
cis-1,2-Dichloroethene	1	--	ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND	
cis-1,3-Dichloropropene	--	--	ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND	
Cyclohexane	--	10	ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		2.32		ND	
Dibromochloromethane	--	--	ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND	
Dichlorodifluoromethane	--	--	2.25		2.11		2.27		2.21		2.27		2.15		2.24		2.11		2.27		2.12		2.35		2.15		2.55		2.09		2.43		2.07		2.43		2.08		2.13	
Ethanol	--	--	42.8		45.2		47.7		14.4		47.3		11.9		39.6		12.2		49.9		14.5		29.8		ND		35		ND		45.6		ND		29.4		ND		11.6	
Ethyl Acetate	--	--	ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND	
Ethylbenzene	--	10	2.36		ND		1.39		ND		1.25		ND		1.05		ND		1.77		ND		ND		ND		0.986		ND		ND		ND		ND		ND		1.19	
Freon-113	--	--	ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND	
Freon-114	--	--	ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND	
Heptane	--	20	ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND	
Hexachlorobutadiene	--	--	ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND	
Isopropanol	--	--	7.84		177		9.59		20.4		9.05		8.8		8.78		6.78		9.96		21.2		5.33		1.91		5.26		11.7		6.93		16.5		4.45		1.42		36.4	
Methyl tert butyl ether	--	--	ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND	
Methylene chloride	10	--	4.38		ND		ND		ND		ND		ND		**11.2**		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND	
Naphthalene	10	-	ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND	
n-Hexane	--	20	1.35		ND		1.54		ND		1.58		0.747		1.47		0.751		1.52		ND		1.39		ND		1.23		ND		3.56		ND		0.934		ND		ND	
o-Xylene	--	10	4.56		1.3		2.54		ND		2.21		ND		1.86		ND		3.41		ND		1.38		ND		1.77		ND		ND		ND		ND		ND		2.36	
p/m-Xylene	--	20	10.7		2.25		6.04		ND		5.34		ND		4.39		ND		8.04		ND		3.28		ND		4.23		ND		ND		ND		ND		ND		5.39	
Styrene	--	--	ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND	
Tertiary butyl Alcohol	--	--	ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND	
Tetrachloroethene	10	--	0.251		ND		0.197		ND		0.183		ND		ND		ND		0.142		ND		0.197		ND		0.224		ND		0.203		ND		0.197		ND		ND	
Tetrahydrofuran	--	--	ND		ND		ND		ND		ND		1.65		ND		ND		ND		ND		ND		ND		ND		ND		2.23		ND		ND		ND		ND	
Toluene	--	50	1.94		1.42		2.16		ND		2.21		ND		1.82		ND		2.13		ND		1.87		ND		2.08		ND		2.4		ND		1.57		ND		0.855	
trans-1,2-Dichloroethene	--	--	ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND	
trans-1,3-Dichloropropene	--	--	ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND	
Trichloroethene	1	--	ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND	
Trichlorofluoromethane	--	--	ND		ND		ND		1.2		ND		ND		ND		ND		ND		ND		1.28		ND		1.37		ND		1.35		ND		1.33		ND		ND	
Vinyl bromide	--	--	ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND	
Vinyl chloride	0.2	--	ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND	

TABLE NOTES:

NYSDOH Indoor Air Vapor Concentration values are from NYSDOH's October 2006 Guidance for Evaluating Soil Vapor Intrusion in the State of New York Matrices A through F from the May 2017 and February 2024 updates.

ug/m^3 : micrograms per cubic meter

ND: Not detected above reporting limit

-- : No NYSDOH guidance value established

APENDICES

APPENDIX A

ENVIRONMENTAL EASEMENT PACKAGE

NYC DEPARTMENT OF FINANCE
OFFICE OF THE CITY REGISTER

This page is part of the instrument. The City Register will rely on the information provided by you on this page for purposes of indexing this instrument.The information on this page will control for indexing purposes in the event of any conflict with the rest of the document.

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RECORDING AND ENDORSEMENT COVER PAGE

PAGE 1 OF 10

Document ID: 2024052100856001
Document Date: 05-13-2024
Preparation Date: 05-21-2024
Document Type: EASEMENT
Document Page Count: 9

PRESENTER:

ULTIMATE ABSTRACT OF NEW YORK
1383 VETERANS MEMORIAL HIGHWAY * SUITE 30
UNY54339NY
HAUPPAUGE, NY 11788
631-501-9100
SARA.ROTH@ULTIMATEABSTRACT.COM

RETURN TO:

ULTIMATE ABSTRACT OF NEW YORK
1383 VETERANS MEMORIAL HIGHWAY * SUITE 30
UNY54339NY
HAUPPAUGE, NY 11788
631-501-9100
SARA.ROTH@ULTIMATEABSTRACT.COM

PROPERTY DATA

Borough	Block	Lot		Unit	Address
MANHATTAN	2233	10	Entire Lot		4778 BROADWAY

Property Type: OTHER Easement

CROSS REFERENCE DATA

CRFN_______ *or* DocumentID________ *or* _______ Year_____ Reel____ Page_____ *or* File Number__________

PARTIES

GRANTOR/SELLER:
M4778 BROADWAY LLC
15 VERBENA AVENUE, SUITE 200
FLORAL PARK, NY 11001

GRANTEE/BUYER:
N.Y.S. DEPARTMENT OF ENVIRONMENTAL CONSERVATION
625 BROADWAY
ALBANY, NY 12233

FEES AND TAXES

Mortgage :

Mortgage Amount:	$	0.00
Taxable Mortgage Amount:	$	0.00
Exemption:		
TAXES: County (Basic):	$	0.00
City (Additional):	$	0.00
Spec (Additional):	$	0.00
TASF:	$	0.00
MTA:	$	0.00
NYCTA:	$	0.00
Additional MRT:	$	0.00
TOTAL:	$	0.00
Recording Fee:	$	82.00
Affidavit Fee:	$	0.00

Filing Fee:	$	100.00
NYC Real Property Transfer Tax:	$	0.00
NYS Real Estate Transfer Tax:	$	0.00

RECORDED OR FILED IN THE OFFICE OF THE CITY REGISTER OF THE CITY OF NEW YORK

Recorded/Filed 05-22-2024 11:37
City Register File No.(CRFN):
2024000130778

1625

Colette McClain-Jacques

City Register Official Signature

ENVIRONMENTAL EASEMENT GRANTED PURSUANT TO ARTICLE 71, TITLE 36 OF THE NEW YORK STATE ENVIRONMENTAL CONSERVATION LAW

THIS INDENTURE made as of this 13th day of May, 2024, between Owner, M4778 Broadway LLC, having an office at 15 Verbena Avenue, Suite 200, Floral Park, New York 11001, County of Nassau, State of New York (the "Grantor"), and The People of the State of New York (the "Grantee."), acting through their Commissioner of the Department of Environmental Conservation (the "Commissioner", or "NYSDEC" or "Department" as the context requires) with its headquarters located at 625 Broadway, Albany, New York 12233,

WHEREAS, the Legislature of the State of New York has declared that it is in the public interest to encourage the remediation of abandoned and likely contaminated properties ("sites") that threaten the health and vitality of the communities they burden while at the same time ensuring the protection of public health and the environment; and

WHEREAS, the Legislature of the State of New York has declared that it is in the public interest to establish within the Department a statutory environmental remediation program that includes the use of Environmental Easements as an enforceable means of ensuring the performance of operation, maintenance, and/or monitoring requirements and the restriction of future uses of the land, when an environmental remediation project leaves residual contamination at levels that have been determined to be safe for a specific use, but not all uses, or which includes engineered structures that must be maintained or protected against damage to perform properly and be effective, or which requires groundwater use or soil management restrictions; and

WHEREAS, the Legislature of the State of New York has declared that Environmental Easement shall mean an interest in real property, created under and subject to the provisions of Article 71, Title 36 of the New York State Environmental Conservation Law ("ECL") which contains a use restriction and/or a prohibition on the use of land in a manner inconsistent with engineering controls which are intended to ensure the long term effectiveness of a site remedial program or eliminate potential exposure pathways to hazardous waste or petroleum; and

WHEREAS, Grantor, is the owner of real property located at the address of 4778 Broadway in the City of New York, County of New York and State of New York, known and designated on the tax map of the New York City Department of Finance as tax map parcel number: Block 2233 Lot 10, being the same as that property conveyed to Grantor by deed dated February 17, 2023 and recorded in the City Register of the City of New York as CRFN # 2023000058896. The property subject to this Environmental Easement (the "Controlled Property") comprises approximately 0.27107 +/- acres, and is hereinafter more fully described in the Land Title Survey dated May 14, 2023 prepared by Arkadiusz Jusiega, P.L.S. of Arek Surveying P.C., which will be attached to the Site Management Plan. The Controlled Property description is set forth in and attached hereto as Schedule A; and

WHEREAS, the Department accepts this Environmental Easement in order to ensure the protection of public health and the environment and to achieve the requirements for remediation established for the Controlled Property until such time as this Environmental Easement is extinguished pursuant to ECL Article 71, Title 36; and

NOW THEREFORE, in consideration of the mutual covenants contained herein and the terms and conditions of Brownfield Cleanup Agreement IndexNumber: C231131-07-19, Grantor conveys to Grantee a permanent Environmental Easement pursuant to ECL Article 71, Title 36 in, on, over, under, and upon the Controlled Property as more fully described herein ("Environmental Easement").

1. Purposes. Grantor and Grantee acknowledge that the Purposes of this Environmental Easement are: to convey to Grantee real property rights and interests that will run with the land in perpetuity in order to provide an effective and enforceable means of encouraging the reuse and redevelopment of this Controlled Property at a level that has been determined to be safe for a specific use while ensuring the performance of operation, maintenance, and/or monitoring requirements; and to ensure the restriction of future uses of the land that are inconsistent with the above-stated purpose.

2. Institutional and Engineering Controls. The controls and requirements listed in the Department approved Site Management Plan ("SMP") including any and all Department approved amendments to the SMP are incorporated into and made part of this Environmental Easement. These controls and requirements apply to the use of the Controlled Property, run with the land, are binding on the Grantor and the Grantor's successors and assigns, and are enforceable in law or equity against any owner of the Controlled Property, any lessees and any person using the Controlled Property.

A. (1) The Controlled Property may be used for:

Restricted Residential as described in 6 NYCRR Part 375-1.8(g)(2)(ii), Commercial as described in 6 NYCRR Part 375-1.8(g)(2)(iii) and Industrial as described in 6 NYCRR Part 375-1.8(g)(2)(iv)

(2) All Engineering Controls must be operated and maintained as specified in the Site Management Plan (SMP);

(3) All Engineering Controls must be inspected at a frequency and in a manner defined in the SMP;

(4) The use of groundwater underlying the property is prohibited without necessary water quality treatment as determined by the NYSDOH or the New York City Department of Health and Mental Hygiene to render it safe for use as drinking water or for industrial purposes, and the user must first notify and obtain written approval to do so from the Department;

(5) Groundwater and other environmental or public health monitoring must be performed as defined in the SMP;

(6) Data and information pertinent to Site Management of the Controlled Property must be reported at the frequency and in a manner defined in the SMP;

(7) All future activities on the property that will disturb remaining

contaminated material must be conducted in accordance with the SMP;

(8) Monitoring to assess the performance and effectiveness of the remedy must be performed as defined in the SMP;

(9) Operation, maintenance, monitoring, inspection, and reporting of any mechanical or physical components of the remedy shall be performed as defined in the SMP;

(10) Access to the site must be provided to agents, employees or other representatives of the State of New York with reasonable prior notice to the property owner to assure compliance with the restrictions identified by this Environmental Easement.

B. The Controlled Property shall not be used for Residential purposes as defined in 6NYCRR 375-1.8(g)(2)(i), and the above-stated engineering controls may not be discontinued without an amendment or extinguishment of this Environmental Easement.

C. The SMP describes obligations that the Grantor assumes on behalf of Grantor, its successors and assigns. The Grantor's assumption of the obligations contained in the SMP which may include sampling, monitoring, and/or operating a treatment system, and providing certified reports to the NYSDEC, is and remains a fundamental element of the Department's determination that the Controlled Property is safe for a specific use, but not all uses. The SMP may be modified in accordance with the Department's statutory and regulatory authority. The Grantor and all successors and assigns, assume the burden of complying with the SMP and obtaining an up-to-date version of the SMP from:

Site Control Section
Division of Environmental Remediation
NYSDEC
625 Broadway
Albany, New York 12233
Phone: (518) 402-9553

D. Grantor must provide all persons who acquire any interest in the Controlled Property a true and complete copy of the SMP that the Department approves for the Controlled Property and all Department-approved amendments to that SMP.

E. Grantor covenants and agrees that until such time as the Environmental Easement is extinguished in accordance with the requirements of ECL Article 71, Title 36 of the ECL, the property deed and all subsequent instruments of conveyance relating to the Controlled Property shall state in at least fifteen-point bold-faced type:

This property is subject to an Environmental Easement held by the New York State Department of Environmental Conservation pursuant to Title 36 of Article 71 of the Environmental Conservation

Law.

F. Grantor covenants and agrees that this Environmental Easement shall be incorporated in full or by reference in any leases, licenses, or other instruments granting a right to use the Controlled Property.

G. Grantor covenants and agrees that it shall, at such time as NYSDEC may require, submit to NYSDEC a written statement by an expert the NYSDEC may find acceptable certifying under penalty of perjury, in such form and manner as the Department may require, that:

(1) the inspection of the site to confirm the effectiveness of the institutional and engineering controls required by the remedial program was performed under the direction of the individual set forth at 6 NYCRR Part 375-1.8(h)(3).

(2) the institutional controls and/or engineering controls employed at such site:

(i) are in-place;

(ii) are unchanged from the previous certification, or that any identified changes to the controls employed were approved by the NYSDEC and that all controls are in the Department-approved format; and

(iii) that nothing has occurred that would impair the ability of such control to protect the public health and environment;

(3) the owner will continue to allow access to such real property to evaluate the continued maintenance of such controls;

(4) nothing has occurred that would constitute a violation or failure to comply with any site management plan for such controls;

(5) the report and all attachments were prepared under the direction of, and reviewed by, the party making the certification;

(6) to the best of his/her knowledge and belief, the work and conclusions described in this certification are in accordance with the requirements of the site remedial program, and generally accepted engineering practices; and

(7) the information presented is accurate and complete.

3. Right to Enter and Inspect. Grantee, its agents, employees, or other representatives of the State may enter and inspect the Controlled Property in a reasonable manner and at reasonable times to assure compliance with the above-stated restrictions.

4. Reserved Grantor's Rights. Grantor reserves for itself, its assigns, representatives, and successors in interest with respect to the Property, all rights as fee owner of the Property, including:

A. Use of the Controlled Property for all purposes not inconsistent with, or limited by the terms of this Environmental Easement;

B. The right to give, sell, assign, or otherwise transfer part or all of the underlying fee interest to the Controlled Property, subject and subordinate to this Environmental Easement;

5. Enforcement

A. This Environmental Easement is enforceable in law or equity in perpetuity by

Grantor, Grantee, or any affected local government, as defined in ECL Section 71-3603, against the owner of the Property, any lessees, and any person using the land. Enforcement shall not be defeated because of any subsequent adverse possession, laches, estoppel, or waiver. It is not a defense in any action to enforce this Environmental Easement that: it is not appurtenant to an interest in real property; it is not of a character that has been recognized traditionally at common law; it imposes a negative burden; it imposes affirmative obligations upon the owner of any interest in the burdened property; the benefit does not touch or concern real property; there is no privity of estate or of contract; or it imposes an unreasonable restraint on alienation.

B. If any person violates this Environmental Easement, the Grantee may revoke the Certificate of Completion with respect to the Controlled Property.

C. Grantee shall notify Grantor of a breach or suspected breach of any of the terms of this Environmental Easement. Such notice shall set forth how Grantor can cure such breach or suspected breach and give Grantor a reasonable amount of time from the date of receipt of notice in which to cure. At the expiration of such period of time to cure, or any extensions granted by Grantee, the Grantee shall notify Grantor of any failure to adequately cure the breach or suspected breach, and Grantee may take any other appropriate action reasonably necessary to remedy any breach of this Environmental Easement, including the commencement of any proceedings in accordance with applicable law.

D. The failure of Grantee to enforce any of the terms contained herein shall not be deemed a waiver of any such term nor bar any enforcement rights.

6. Notice. Whenever notice to the Grantee (other than the annual certification) or approval from the Grantee is required, the Party providing such notice or seeking such approval shall identify the Controlled Property by referencing the following information:

County, NYSDEC Site Number, NYSDEC Brownfield Cleanup Agreement, State Assistance Contract or Order Number, and the County tax map number or the Liber and Page or computerized system identification number.

Parties shall address correspondence to:

Site Number: C231131
Office of General Counsel
NYSDEC
625 Broadway
Albany New York 12233-5500

With a copy to:

Site Control Section
Division of Environmental Remediation
NYSDEC
625 Broadway
Albany, NY 12233

All notices and correspondence shall be delivered by hand, by registered mail or by Certified mail and return receipt requested. The Parties may provide for other means of receiving and communicating notices and responses to requests for approval.

7. Recordation. Grantor shall record this instrument, within thirty (30) days of execution of

this instrument by the Commissioner or her/his authorized representative in the office of the recording officer for the county or counties where the Property is situated in the manner prescribed by Article 9 of the Real Property Law.

8. Amendment. Any amendment to this Environmental Easement may only be executed by the Commissioner of the New York State Department of Environmental Conservation or the Commissioner's Designee, and filed with the office of the recording officer for the county or counties where the Property is situated in the manner prescribed by Article 9 of the Real Property Law.

9. Extinguishment. This Environmental Easement may be extinguished only by a release by the Commissioner of the New York State Department of Environmental Conservation, or the Commissioner's Designee, and filed with the office of the recording officer for the county or counties where the Property is situated in the manner prescribed by Article 9 of the Real Property Law.

10. Joint Obligation. If there are two or more parties identified as Grantor herein, the obligations imposed by this instrument upon them shall be joint and several.

11. Consistency with the SMP. To the extent there is any conflict or inconsistency between the terms of this Environmental Easement and the SMP, regarding matters specifically addressed by the SMP, the terms of the SMP will control.

Remainder of Page Intentionally Left Blank

IN WITNESS WHEREOF, Grantor has caused this instrument to be signed in its name.

M4778 Broadway LLC:

By: ______________________

Print Name: Eli Weiss

Title: Authorized Signatory Date: 5/3/24

Grantor's Acknowledgment

STATE OF NEW YORK)
) ss:
COUNTY OF NY)

On the 3rd day of May, in the year 2024 before me, the undersigned, personally appeared Eli Weiss, personally known to me or proved to me on the basis of satisfactory evidence to be the individual(s) whose name is (are) subscribed to the within instrument and acknowledged to me that he/she/they executed the same in his/her/their capacity(ies), and that by his/her/their signature(s) on the instrument, the individual(s), or the person upon behalf of which the individual(s) acted, executed the instrument.

____
Notary Public - State of New York

Karen Rivera
NOTARY PUBLIC, STATE OF NEW YORK
Registration No. 01RI6400026
Qualified in Queens County
Commission Expires November 4, 2027

THIS ENVIRONMENTAL EASEMENT IS HEREBY ACCEPTED BY THE PEOPLE OF THE STATE OF NEW YORK, Acting By and Through the Department of Environmental Conservation as Designee of the Commissioner,

By: Andrew Guglielmi
Andrew O. Guglielmi, Director
Division of Environmental Remediation

Grantee's Acknowledgment

STATE OF NEW YORK)
) ss:
COUNTY OF ALBANY)

On the 13 day of May, in the year 2024, before me, the undersigned, personally appeared ~~Michael J. Ryan,~~ Andrew O. Guglielmi personally known to me or proved to me on the basis of satisfactory evidence to be the individual(s) whose name is (are) subscribed to the within instrument and acknowledged to me that he/she/ executed the same in his/her/ capacity as Designee of the Commissioner of the State of New York Department of Environmental Conservation, and that by his/her/ signature on the instrument, the individual, or the person upon behalf of which the individual acted, executed the instrument.

Cheryl A Salem
Notary Public - State of New York

Cheryl A. Salem
Notary Public State of New York
Registration No. 01SA0002177
Qualified in Albany County
My Commission Expires March 3, 2027

SCHEDULE "A" PROPERTY DESCRIPTION

ENVIRONMENTAL EASEMENT DESCRIPTION

ALL that certain plot, piece or parcel of land, situate, lying and being in New York City and State of New York, bounded and described as follows:

BEGINNING at the point on the southerly side of Broadway, distant 225 Feet ¼ of an inch easterly from the corner formed by the intersection of the southerly side of Broadway with the easterly side of Dyckman Street; which said point of beginning is at the point formed by the intersection of the said southerly side of Broadway with the division line between Lot Nos. 11 and 12 on said map;

RUNNING THENCE easterly along the southerly side of Broadway, a distance of 75 Feet to the point formed by the intersection of the said southerly side of Broadway with the division line between Lot Nos. 14 and 15 on said map;

THENCE southerly at an interior angle of 90 Degrees 41 minutes 08 seconds with the southerly side of Broadway and along said division line between Lot Nos. 14 and 15, a distance of 157 Feet to the northerly line of Lot No. 31 on said map;

THENCE westerly at a right angle with the last mentioned course and along the northerly line of Lot Nos. 31, 32 and 33 on said map, a distance of 75 Feet to the division line between Lot Nos. 11 and 12 on said map; and

THENCE northerly at right angle with the last mentioned course and at an interior angle of 89 Degrees 18 minutes 52 seconds with the southerly side of Broadway and along said division line between Lot Nos. 11 and 12 on said map, a distance of 157 Feet 11 Inches to the point or place of BEGINNING.

CONTAINING WITHIN SAID BOUNDS 0.27107 ACRES OR 11,807.9 SQUARE FEET

NYC DEPARTMENT OF FINANCE
OFFICE OF THE CITY REGISTER

2024052100856001001S44DE

SUPPORTING DOCUMENT COVER PAGE

PAGE 1 OF 1

Document ID: 2024052100856001 Document Date: 05-13-2024 Preparation Date: 05-21-2024
Document Type: EASEMENT

SUPPORTING DOCUMENTS SUBMITTED:

	Page Count
DEP CUSTOMER REGISTRATION FORM FOR WATER AND SEWER BILLING	1
SMOKE DETECTOR AFFIDAVIT	1

The City of New York
Department of Environmental Protection
Bureau of Customer Services
59-17 Junction Boulevard
Flushing, NY 11373-5108

Customer Registration Form for Water and Sewer Billing

Property and Owner Information:

(1) **Property receiving service:** BOROUGH: MANHATTAN BLOCK: 2233 LOT: 10

(2) **Property Address:** 4778 BROADWAY, NEW YORK, NY 10034

(3) **Owner's Name:** N.Y.S. DEPARTMENT OF ENVIRONMENTAL CONSERVATION

Additional Name:

Affirmation:

☑ Your water & sewer bills will be sent to the property address shown above.

Customer Billing Information:

Please Note:

A. Water and sewer charges are the legal responsibility of the owner of a property receiving water and/or sewer service. The owner's responsibility to pay such charges is not affected by any lease, license or other arrangement, or any assignment of responsibility for payment of such charges. Water and sewer charges constitute a lien on the property until paid. In addition to legal action against the owner, a failure to pay such charges when due may result in foreclosure of the lien by the City of New York, the property being placed in a lien sale by the City or Service Termination.

B. Original bills for water and/or sewer service will be mailed to the owner, **at the property address or to an alternate mailing address**. DEP will provide a duplicate copy of bills to one other party (such as a managing agent), however, any failure or delay by DEP in providing duplicate copies of bills shall in no way relieve the owner from his/her liability to pay all outstanding water and sewer charges. Contact DEP at (718) 595-7000 during business hours or visit www.nyc.gov/dep to provide us with the other party's information.

Owner's Approval:

The undersigned certifies that he/she/it is the owner of the property receiving service referenced above; that he/she/it has read and understands Paragraphs A & B under the section captioned "Customer Billing Information"; and that the information supplied by the undersigned on this form is true and complete to the best of his/her/its knowledge.

Print Name of Owner:

Signature: ______________________ Date (mm/dd/yyyy)

Name and Title of Person Signing for Owner, if applicable: Eli Weiss – Authorized Signatory

BCS-7CRF-ACRIS REV. 8/08

AFFIDAVIT OF COMPLIANCE
WITH SMOKE DETECTOR REQUIREMENT FOR ONE- AND TWO-FAMILY DWELLINGS

State of New York } SS.:
County of Albany }

The undersigned, being duly sworn, depose and say under penalty of perjury that they are the grantor and grantee of the real property or of the cooperative shares in a cooperative corporation owning real property located at

4778 BROADWAY , ______ ,
Street Address Unit/Apt.

MANHATTAN (Borough) New York, 2233 (Block) 10 (Lot) (the "Premises");

That the Premises is a one or two family dwelling, or a cooperative apartment or condominium unit in a one- or two-family dwelling, and that installed in the Premises is an approved and operational smoke detecting device in compliance with the provisions of Article 6 of Subchapter 17 of Chapter 1 of Title 27 of the Administrative Code of the City of New York concerning smoke detecting devices;

That they make affidavit in compliance with New York City Administrative Code Section 11-2105 (g). (The signatures of at least one grantor and one grantee are required, and must be notarized).

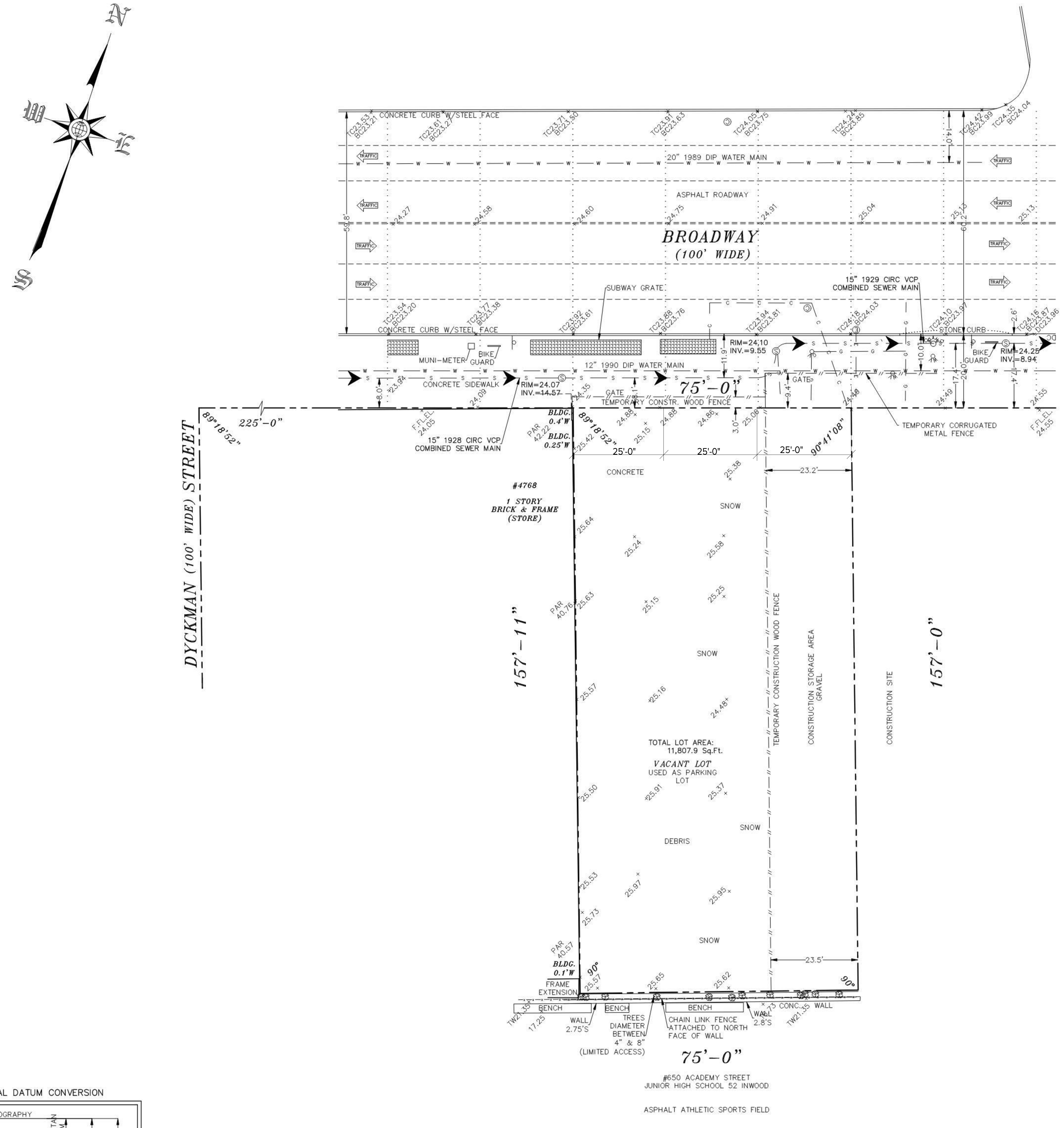
Eli Weiss Name of Grantor (Type or Print)	Andrew Guglielmi Name of Grantee (Type or Print)
Signature of Grantor	Andrew Guglielmi Signature of Grantee
Sworn to before me this 3rd day of May 20 24	Sworn to before me this 13 day of May 20 24
Karen Rivera NOTARY PUBLIC, STATE OF NEW YORK Registration No. 01RI6400026 Qualified in Queens County Commission Expires November 4, 2027	Cheryl A Salem Cheryl A. Salem Notary Public State of New York Registration No. 01SA0002177 Qualified in Albany County My Commission Expires March 3, 2027

These statements are made with the knowledge that a willfully false representation is unlawful and is punishable as a crime of perjury under Article 210 of the Penal Law.

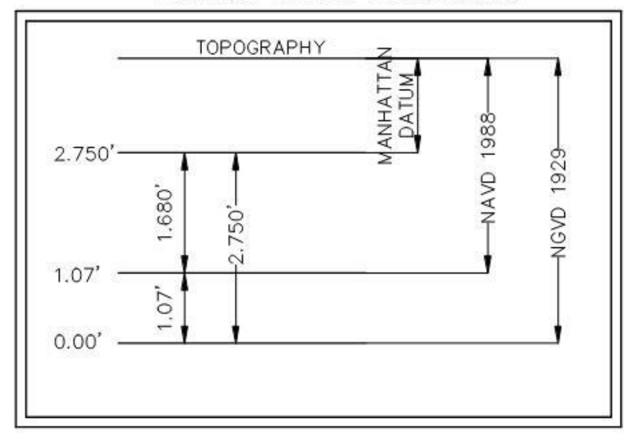
NEW YORK CITY REAL PROPERTY TRANSFER TAX RETURNS FILED ON OR AFTER FEBRUARY 6th, 1990, WITH RESPECT TO THE CONVEYANCE OF A ONE- OR TWO-FAMILY DWELLING, OR A COOPERATIVE APARTMENT OR A CONDOMINIUM UNIT IN A ONE- OR TWO-FAMILY DWELLING, WILL NOT BE ACCEPTED FOR FILING UNLESS ACCOMPANIED BY THIS AFFIDAVIT.

DEPT OF BLDGS 121209138 Job Number

ES688444149 Scan Code



VERTICAL DATUM CONVERSION



Only copies from the original of this survey marked with an original of the land surveyor's embossed seal shall be considered to be valid true copies.

Unauthorized alteration or addition to a survey map bearing a licensed land surveyor's seal is a violation of section 7209, sub-division 2, of the New York State Education Law.

Certification indicated hereon signify that this survey was prepared in accordance with the existing Code of Practice for Land Surveys adopted by the New York State Association of Professional Land Surveyors. Said certifications shall run only to the person for whom the survey is prepared, and on his behalf to the title company, governmental agency and lending institution listed hereon, and to the assignees of the lending institution. Certifications are not transferable to additional institutions or subsequent owner.

NOTES:

1. THE OFFSETS OR DIMENSIONS SHOWN HEREON, FROM THE PROPERTY LINES TO THE STRUCTURES ARE FOR A SPECIFIC PURPOSE AND USE. THEREFORE THEY ARE NOT INTENDED TO MONUMENT PROPERTY LINES OR TO GUIDE THE ERECTION OF FENCES, ADDITIONAL STRUCTURES OR ANY OTHER IMPROVEMENTS.
2. CONSULT WITH THE HIGHWAY DEPARTMENT BEFORE DESIGNING, INSTALLING OR MODIFYING ANY NEW OR EXISTING CURBS, WALKS OR ROADWAYS IN THE STREET SHOWN HEREON.
3. SUBSURFACE INFORMATION SHOWN HEREON WAS BASED ON VISUAL OBSERVATIONS, VARIOUS CITY DEPARTMENTS, AND/OR PRIVATE UTILITY COMPANIES RECORDS, AND/OR UTILITY MARKOUT. THIS SURVEYOR ACCEPTS NO RESPONSIBILITY FOR ANY OF THIS DATA. SUBSURFACE UTILITIES ARE NOT CERTIFIED AS TO THE ACCURACY AND/OR COMPLETENESS.
4. ALL SUBSURFACE UTILITY LOCATION AND DEPTH SHOULD BE RECHECKED AND LEGAL GRADES SHOULD BE VERIFIED WITH THE TOPOGRAPHICAL BUREAU, PREFERABLY IN WRITING BEFORE COMMENCING FINAL DESIGN OR CONSTRUCTION.
5. THIS IS TO CERTIFY THAT THERE ARE NO VISIBLE STREAMS OR NATURAL WATER COURSES IN THE PROPERTY AS SHOWN ON THIS SURVEY.
6. **ELEVATIONS REFER TO THE NORTH AMERICAN VERTICAL DATUM OF 1988.**
7. REFER TO ARTICLE 36 OF THE GENERAL BUSINESS LAW AND THE PROVISIONS OF INDUSTRIAL CODE PART (RULE NO. 53) BEFORE ANY EXCAVATION OR DEMOLITION IS COMMENCED. THESE LAWS REQUIRE EACH EXCAVATOR TO GIVE ADVANCE NOTICE TO ALL OPERATORS OF UNDERGROUND FACILITIES OF HIS INTENT TO PERFORM EXCAVATION OR DEMOLITION IN THE SPECIFIED AREAS.
8. ALL DIMENSIONS ARE IN U.S. STANDARD MEASUREMENTS.
9. LEGAL GRADES REFER TO TOP OF CURB.
10. EASEMENTS NOT SHOWN ARE NOT GUARANTEED.
11. UTILITIES MARK–OUT SHOWN PER 3–1–2020 FIELD MEASUREMENTS.
12. PARCEL COVERED BY SNOW AT THE TIME OF SURVEY.

LEGEND & ABBREVATIONS:

HR	HANDICAP RAMP	-☼-	UTILITY & LIGHT POLE
TB	TRAFFIC BOX	⊗	UTILITY POLE
SF	STEEL FACE CURB	○	VENT
RD	ROOF DRAIN	☼	LIGHT POLE
DC	DEPRESSED CURB	♂	FLAG POLE
CB	CATCH BASIN	⊥	TRAFFIC SIGN
E.O.P	EDGE OF PAVEMENT	Ⓢ	SANITARY MANHOLE
PLNT.	PLANTER	Ⓦ	WATER MANHOLE
TP	TREE PIT	Ⓔ	ELECTRIC MANHOLE
CHIM.	CHIMNEY	Ⓣ	TELEPHONE MANHOLE
T.O.P.	TOP OF PIPE	Ⓓ	DRAINAGE MANHOLE
B.O.P.	BOTTOM OF PIPE	Ⓖ	GAS MANHOLE
L.	LANDING	Ⓟ	DEPARTMENT OF PUBLIC WORKS MANHOLE
TW	TOP OF WALL	Ⓜ	EMPIRE CITY SUBWAY MANHOLE
T.P.	TOP OF PARAPET	Ⓤ	UNKNOWN MANHOLE
TR.	THRESHOLD	●	DRAIN
T.CH.	TOP OF CHIMNEY	▥	INLET
T.B.	TOP OF BULKHEAD	☒	MAIL BOX
T.C.	TOP OF CURB	♁	PARKING METER
B.C.	BOTTOM OF CURB	❀	TREE
F.S.M.	FINAL SECTION MAP	✿	SHRUB
☼	FIRE HYDRANT	—GAS—	GAS LINE
☼	SPRINKLER	— W —	WATER LINE
♉	WATER VALVE	— E —	ELECTRIC LINE
♉	GAS VALVE	— C —	COMMUNICATION LINE
♉	OIL VALVE	— S —	SEWER LINE
♉	UNKNOWN VALVE		
♉	MONITORING WELL		

SURVEY OF PROPERTY LOCATED AT:
#4778 BROADWAY, MANHATTAN
COUNTY OF NEW YORK
CITY & STATE OF NEW YORK
BLOCK .... 2233, LOT(S) 10

REVISIONS DESCRIPTION	PREPARED BY	DATE	FILE
1. TOPOGRAPHICAL SURVEY	K.S.	03–01–20	ASC20115
2. TOPOGRAPHICAL SURVEY UPDATE	K.S.	02–02–22	ASC22046

CERTIFY TO:

SURVEYED BY
ARKADIUSZ JUSIEGA, P.L.S.
A Jusiega
N.Y.S. LIC. NO. 050569

050569

LICENSED IN N.Y. & N.J.

AREK SURVEYING P.C.
10 TAFT PLACE
ALBERTSON, NY 11507
WWW.ASCNY.NET
TEL: (516) 792–6676

Scale: 1" = 16'
Job No: ASC–22046

ORDERED BY:
MADD EQUITIES

PROPOSED NEW DEVELOPMENT

4778

4778 BROADWAY
MANHATTAN, NY 10034

BLOCK: 2233 LOT: 10

Architect:
AUFGANG.
74 Lafayette Avenue
Suite 301
Suffern, NY 10901
845.368.0004
info@aufgang.com

Owner/Developer
OWNER/DEVELOPER:

M4778 BROADWAY LLC
15 VERNENA AVENUE
ANA@MADDEQUITIES.COM
516-821-2004

Structural Engineer
STRUCTURAL COMPANY:

ENGINEERING GROUP
ASSOCIATES
19 W 21ST STREET, SUITE 1103
NEW YORK, NY 10018
212-982-0488

MEP Engineer
MEP COMPANY:

AVCON ENGINEER
580 8TH AVENUE, 14TH FLOOR
NEW YORK, NY 10018
646-572-0488

Civil Engineer
CIVIL COMPANY:

BROOKER ENGINEERING
74 LAFAYETTE, SUITE 501
NEW YORK, NY 10901
845-357-4411

APPROVED
Under Directive 2 of 1975
AMENDED APPLICATION
Date: 02/06/2024
NYC Development Hub

DATE	SUBMISSIONS / REVISIONS
02-24-2023	ISSUED FOR CONSTRUCTION
12-15-2022	ISSUED FOR 80% CD
06-24-2022	REVISIONS PER DOB COMMENTS
06-17-2022	ISSUED H.P.D
01-26-2022	P.A.A
11-02-2021	REVISIONS PER DOB COMMENTS
09-02-2021	REVISIONS PER DOB COMMENTS
05-07-2021	REVISIONS PER DOB COMMENTS
03-26-2021	DOB REVISIONS
02-01-2021	DOB SUBMISSION

SHEET TITLE:

SURVEY

SEAL & SIGNATURE
ARIEL AUFGANG
032789

ISSUE DATE: 06/24/2022
PROJECT NO: 20010R
DRAWN BY: HT
CHECKED BY: AFM
SCALE:
SHEET NO: 2 OF
DRAWING NO: C-001.01
NYC DOB NUMBER: 1091659

FILL & LANDSCAPING NOTES

1. ALL FILL USED BELOW SLABS UNDER BUILDINGS AND IN PAVED AREAS SHALL BE QUALITY SANDY MATERIAL AND SHALL BE COMPACTED IN 12" LAYERS TO 95% DENSITY TO PREVENT SETTLEMENT AS PER ASTM D1557, METHOD C.
2. CONTRACTOR MUST ALSO FOLLOW ALL REQUIREMENTS FOR PREPARATION, CLEARING, PROOF ROLLING, AND FILL REPLACEMENT RECOMMENDED BY A REPORT ON SOIL AND FOUNDATION INVESTIGATION.
3. ALL FILL SHALL BE COMPACTED WITH SOIL COMPACTION EQUIPMENT RATHER THAN BY HAND TAMPING (EXCEPT AROUND PIPES, ETC.)
4. THE THICKNESS OF FILL LAYERS PLACED SHALL BE COMPATIBLE WITH THE TYPE OF COMPACTION EQUIPMENT USED.
5. THE ATTAINMENT OF SPECIFIED DENSITIES SHALL BE VERIFIED BY FIELD DENSITY TESTS MADE BY AN INDEPENDENT TESTING LABORATORY ON EACH LAYER OF MATERIAL COMPACTED. ONE TEST PER 5,000 SQ. FT. OF SURFACE AREA SHALL BE MADE ON EACH LAYER WITHIN THE BUILDING.
6. TREES BEING PLANTED IN LANDSCAPE PLANS (OR OTHER SITE PLANS) ARE NATIVE OR ADAPTIVE SPECIES.
7. THE SITE'S HARDSCAPE AREA WILL HAVE A MIN. REFLECTANCE OF 0.3 FOR AT LEAST 50% OF THE AREA.

EROSION & SEDIMENT CONTROL PLAN - CONSTRUCTION SEQUENCE

1. ALL EROSION AND SEDIMENT CONTROL MEASURES, EXCLUDING CATCH-BASIN MEASURES, SHALL BE IN PLACE PRIOR TO ANY GRADING OPERATIONS AND INSTALLATION OF PROPOSED STRUCTURES AND OR UTILITIES.
2. ALL EROSION AND SEDIMENT CONTROL MEASURES SHALL REMAIN IN PLACE AND BE MAINTAINED UNTIL CONSTRUCTION IS COMPLETED AND/OR STABILIZED
3. INSTALL STABILIZED CONSTRUCTION ENTRANCE AS INDICATED ON PLAN.
4. INSTALL SILT FENCE AND/OR HAY BALE BARRIERS DOWN SLOPE OF ALL AREAS TO BE DISTURBED AND DOWN SLOPE OF ALL AREAS DESIGNATED FOR TOPSOIL STOCKPILING.
5. CONSTRUCT BERMS, TEMPORARY SWALES AND PIPES AS NECESSARY TO DIRECT RUNOFF TO TEMPORARY SEDIMENTATION ENTRAPMENT AREAS.
6. CLEAR EXISTING TREES, VEGETATION AND EXISTING STRUCTURES FROM AREAS TO BE FILLED OR EXCAVATED. STRIP AND STOCKPILE TOPSOIL FROM ALL AREAS TO BE DISTURBED. SEED STOCKPILED TOPSOIL WITH TEMPORARY RYE GRASS COVER.
7. PERFORM EXCAVATION AND FILL TO BRING LAND TO DESIRED GRADE. ANY DISTURBED AREAS TO REMAIN BARE SHOULD BE SEEDED WITH TEMPORARY RYE GRASS.
8. INSTALL UNDERGROUND UTILITIES, MANHOLES AND CATCH BASINS. GRATES OF CURB AND FIELD INLETS SHOULD BE LEFT AT ELEVATIONS WHICH PERMIT PROPER COLLECTION OF SURFACE RUNOFF.
9. INSTALL HAY BALE RINGS AROUND ALL CURB AND FIELD INLETS EXCEPT FOR THE BASINS LOCATED AT THE ANTI TRACKING PAD. BASINS AT THE PAD SHALL BE TREATED WITH THE CATCH BASIN-FILTER FABRIC DETAIL.
10. CONSTRUCT CURBS AND INSTALL BASE AND BINDER COURSES OF PAVED AREAS. RAISE GRATES OF CURB AND FIELD INLETS ACCORDINGLY.
11. COMPLETE FINE GRADING.
12. RAISE GRATES OF CURB AND FIELD INLETS TO FINAL ELEVATIONS. INSTALL SURFACE COURSE OF PAVEMENT.
13. UPON COMPLETION OF CONSTRUCTION, ALL DISTURBED AREAS ARE TO BE SEEDED. ALL TEMPORARY DEVICES SHALL BE REMOVED AND THE AFFECTED AREAS RE-GRADED, PLANTED OR TREATED IN ACCORDANCE WITH THE APPROVED SITE PLANS.

STANDARD EROSION CONTROL NOTES

1. ALL CONTROL MEASURES FOR EROSION AND SEDIMENTATION SHALL COMPLY WITH THE STORMWATER POLLUTION PREVENTION PLAN (SWPPP)
   A. INSPECTIONS OF ALL CONTROL MEASURES PER THE SWPPP.
   B. WEEKLY INSPECTIONS AND DOCUMENTATION OF EROSION CONTROL PRACTICES.
   C. INSPECTIONS OF ALL CONTROL MEASURES BEFORE FORECASTED AND AFTER PERIODS OF HEAVY OR PROLONGED RAIN RESULTING IN MORE THAN 0.5-INCHES
   D. WEEKLY INSPECTIONS OF ON AND OFF-SITE AREAS DOWNSTREAM FROM CONSTRUCTION ACTIVITIES.
2. THE INSPECTIONS SHALL BE CONDUCTED BY THE APPLICANT AND/OR HIS REPRESENTATIVE, I.E. THE SITE ENGINEER, OR THE CONTRACTOR, TO DETERMINE THE FOLLOWING:
   A. THE CONDITIONS OF THE CONTROL MEASURES AND THE NEED FOR REPAIR OR REPLACEMENT
   B. THE NEED FOR MAINTENANCE, E.G. REMOVAL OF SEDIMENT FROM BARRIERS, TRAPS, AND BASINS.
   C. THE NEED FOR ADDITIONAL CONTROL MEASURES.
   D. THE NEED FOR REAPPLICATION OF SEEDING, NETTING AND/OR MULCHING.
   E. THE OVERALL EFFECTIVENESS OF THE CONTROL PLAN.
3. ALL TEMPORARY AND PERMANENT CONTROL DEVICES MUST BE MAINTAINED AND REPAIRED AS NEEDED TO ASSURE CONTINUED PERFORMANCE OF THEIR INTENDED FUNCTION. ALL NECESSARY REPAIRS SHALL BE PERFORMED IMMEDIATELY.
4. THESE PLANS INDICATE THE CONTROL MEASURES TO BE PUT IN PLACE. ADDITIONAL CONTROL MEASURES SHALL BE IMPLEMENTED AS SITE CONDITIONS CHANGE AND UNFORSEEN PROBLEMS OCCUR. IMPLEMENTATION OF THE ADDITIONAL CONTROL MEASURES SHALL BE AT THE DISCRETION OF THE SITE INSPECTOR.
5. AN EROSION CONTROL SYSTEM WILL BE UTILIZED BY THE DEVELOPER TO MINIMIZE THE PRODUCTION OF SEDIMENT FROM THE SITE. METHODS TO BE UTILIZED WILL BE THOSE FOUND MOST EFFECTIVE FOR THE SITE AND SHALL INCLUDE ONE OR MORE OF THE FOLLOWING, AS APPLICABLE:
   A. TEMPORARY SEDIMENTATION ENTRAPMENT AREAS SHALL BE PROVIDED AT KEY LOCATIONS TO INTERCEPT AND CLARIFY SILT LADEN RUNOFF FROM THE SITE. THESE MAY BE EXCAVATED OR MAY BE CREATED UTILIZING EARTHEN BERMS, RIP-RAP OR CRUSHED STONE DAMS, HAY BALES, OR OTHER SUITABLE MATERIALS. DIVERSION SWALES, BERMS, OR OTHER CANALIZATION SHALL BE CONSTRUCTED TO INSURE THAT ALL SILT LADEN WATERS ARE DIRECTED INTO THE ENTRAPMENT AREAS, WHICH SHALL NOT BE PERMITTED TO FILL IN, BUT SHALL BE CLEANED PERIODICALLY DURING THE COURSE CONSTRUCTION. THE COLLECTED SILT SHALL BE DEPOSITED IN AREAS SAFE FROM FURTHER EROSION.
   B. ALL DISTURBED AREAS, EXCEPT ROADWAYS, WHICH WILL REMAIN UNFINISHED FOR MORE THAN 30 DAYS SHALL BE TEMPORARILY SEEDED WITH 1/2 LB. OF RYE GRASS OR MULCHED WITH 100 LBS. OF STRAW OR HAY PER 1,000 SQUARE FEET. ROADWAYS SHALL BE STABILIZED AS RAPIDLY AS PRACTICABLE BY THE INSTALLATION OF THE BASE COURSE.
   C. SILT THAT LEAVES THE SITE IN SPITE OF THE REQUIRED PRECAUTIONS SHALL BE COLLECTED AND REMOVED AS DIRECTED BY APPROPRIATE MUNICIPAL AUTHORITIES.

ENTERPRISE GREEN COMMUNITIES

GREEN BUILDINGS & ENERGY EFFICIENCY PRACTICES

1. COMPLY WITH LATEST HUD EDITION GUIDELINES FOR THE EVALUATION AND THE CONTROL OF LEED BASED PAINT IN HOUSING AND THE EPA RENOVATION, REPAIR AND PAINTING RULE.
2. DOMESTIC WATER SUPPLY/ DISTRIBUTION TO BE LEAD FREE PLUMBING.
3. INSTALL PASSIVE RADON-RESISTANT FEATURES BELOW THE SLAB AND VENTED UP THROUGH THE ROOF BY UTILIZING VENT PIPING RUNNING THROUGH THE INTERIOR OF THE BUILDING. RADON TESTING SHALL BE CONDUCTED PRIOR TO OCCUPANCY. IF THE RESULTS OF THIS TESTING EXCEED THE RECOMMENCED EPA ACTION LEVEL, THE PASSIVE RADON SYSTEM SHALL BE ACTIVATED.
4. ENERGY STAR APPLIANCES
5. ENERGY STAR EQUIPMENT
6. ENERGY STAR LIGHTING
7. LOW VOC PAINTS
8. PEST MANAGEMENT
9. FULLY ACCESSIBLE / HVI

STREET TREE CHECKLIST

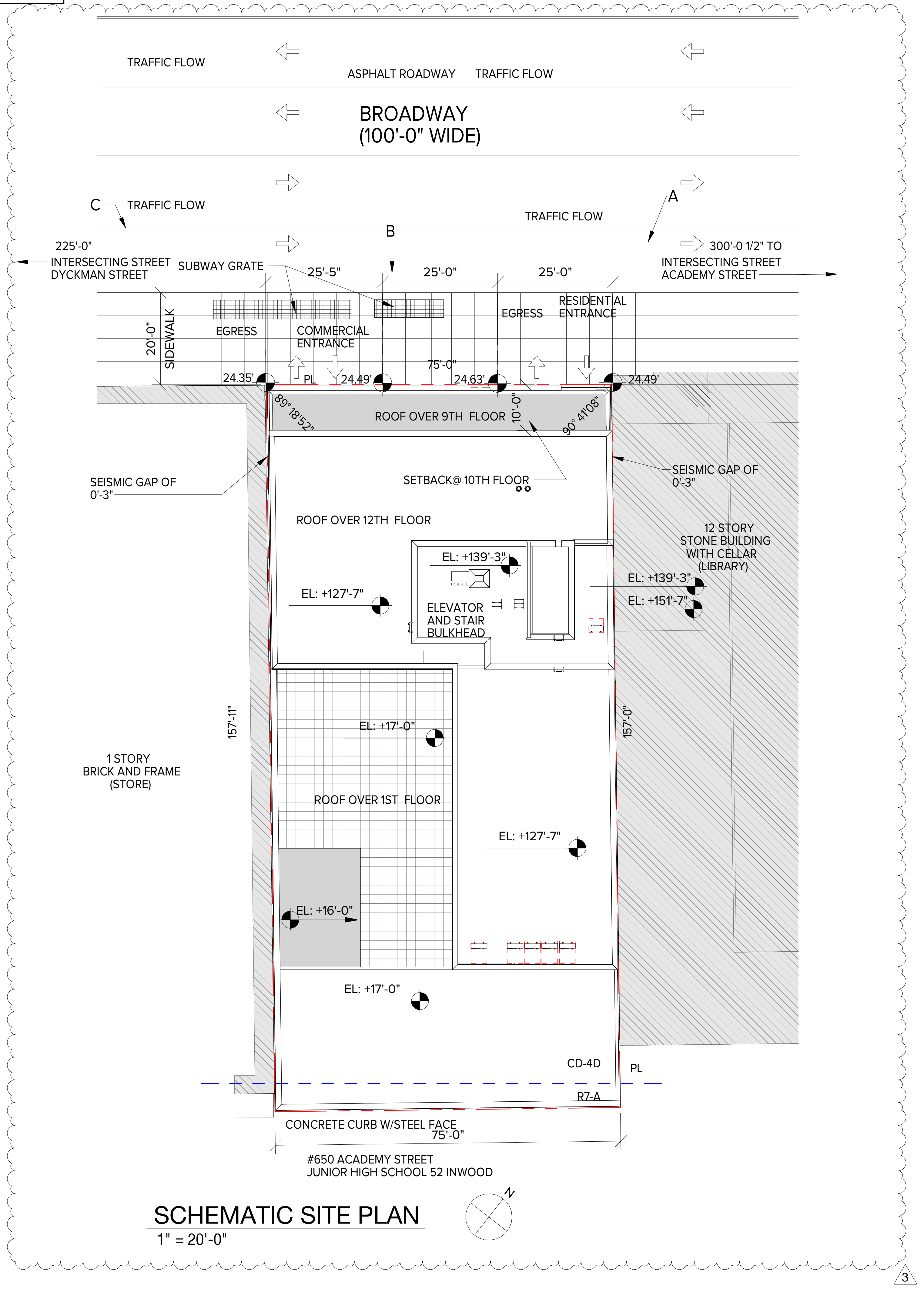
STREET FRONTAGE	STREET TREES REQUIRED	PROPOSED TREE		TOTAL PROVIDED
		ON SITE	PAY TO FUND	
BROADWAY: 75'	EVERY25'	0	3	3
TOTAL				3

STREET TREE PLANTING

TOTAL NUMBER OF TREES REQUIRED BY NYC DOB	3
EXISTING TREES TO PROTECT	0
PROPOSED TREES TO REMOVE	0
PROPOSED TREES TO PLANT ON SITE	0
TREES TO PLANT OFF SITE	0
TREES TO PAY INTO TREE FUND	3

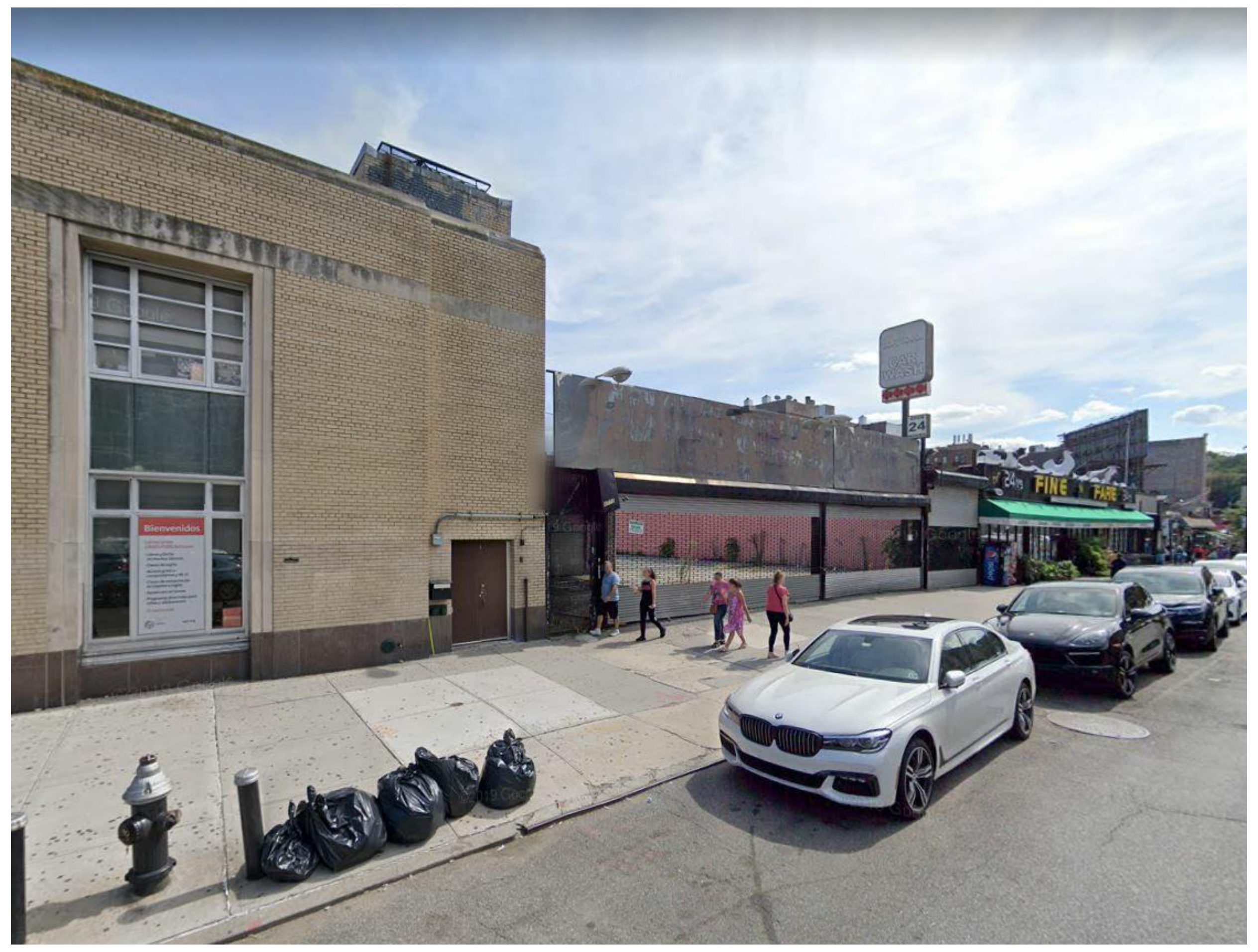
LEGEND:

▲	RESIDENTIAL ENTRY
▽	RESIDENTIAL EGRESS
△	COMMERCIAL ENTRY
△	COMMUNITY FACILITY ENTRY
△	MARKETING OFFICE ENTRY
⊕	EXISTING TREE
✿	PROPOSED TREE
○	HYDRANT
□	TRAFFIC SIGNAL
○	WOOD POLE
□—	LIGHT POLE
▭	CURB CUT
⇦	TRAFFIC DIRECTION
⊞	5FT X5FT CONCRETE SIDEWALK SCOORING
Ⓜ	MANHOLES
▥	GRATES
— — —	PROPERTY LINE

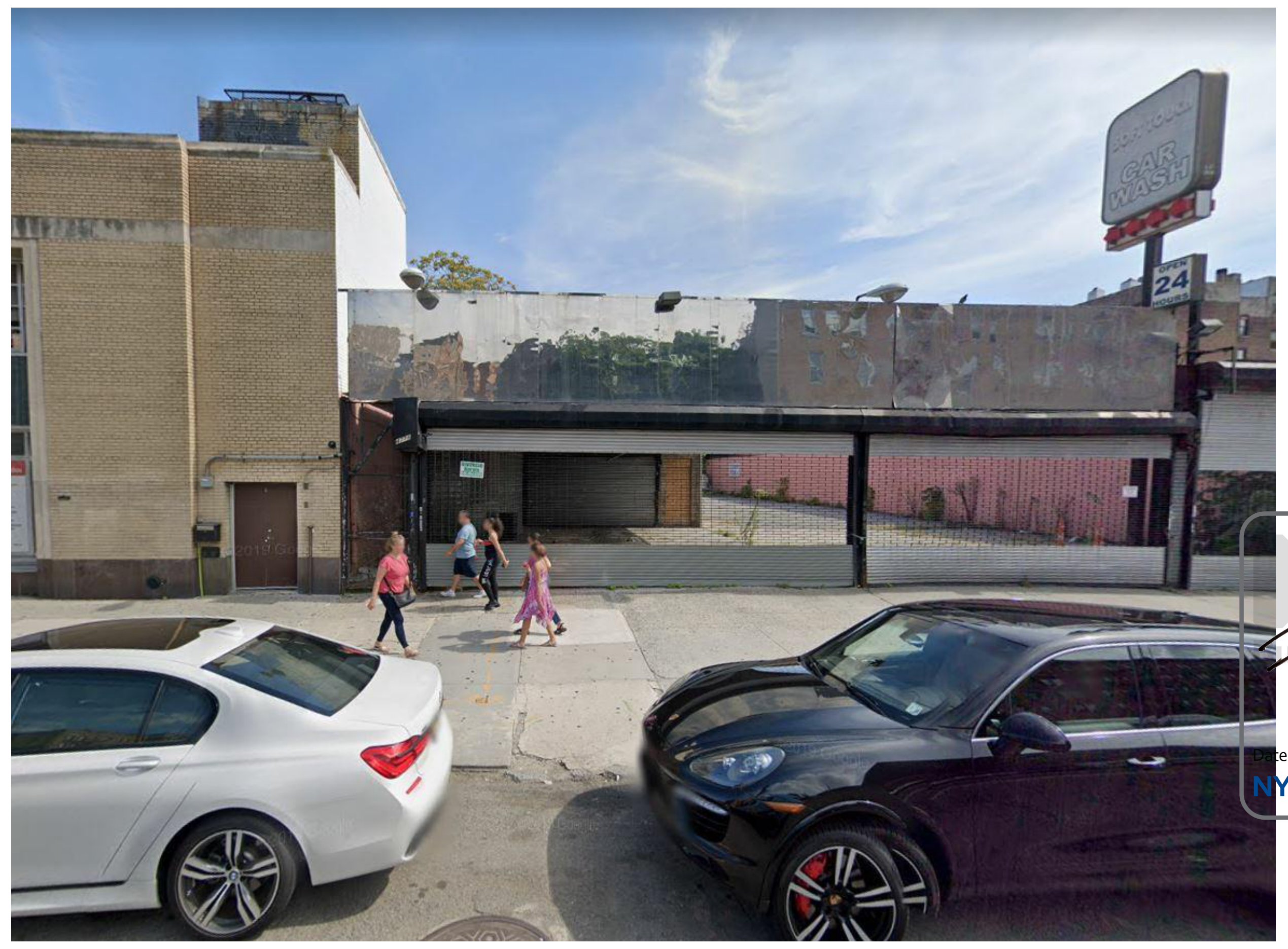


SCHEMATIC SITE PLAN

1" = 20'-0"



VIEW A
N.T.S.



VIEW B
N.T.S.

VIEW C
N.T.S.

DEPT OF BLDGS 121209138 Job Number

ES082522785 Scan Code

PROPOSED NEW DEVELOPMENT

4778

4778 BROADWAY
MANHATTAN, NY 10034

BLOCK: 2233 LOT: 10

Architect:
AUFGANG.
74 Lafayette Avenue
Suite 301
Suffern, NY 10901
845.368.0004
info@aufgang.com

Owner/Developer
OWNER/DEVELOPER:
M4778 BROADWAY LLC
15 VERNENA AVENUE
ANA@MADDEQUITIES.COM
516-821-2004

Structural Engineer
STRUCTURAL COMPANY:
ENGINEERING GROUP ASSOCIATES
19 W 21ST STREET, SUITE 1103
NEW YORK, NY 10018
212-982-0488

MEP Engineer
MEP COMPANY:
AVCON ENGINEER
580 8TH AVENUE, 14TH FLOOR
NEW YORK, NY 10018
646-572-0488

Civil Engineer
CIVIL COMPANY:
BROOKER ENGINEERING
74 LAFAYETTE, SUITE 501
NEW YORK, NY 10901
845-357-4411

APPROVED
Under Directive 2 of 1975
AMENDED APPLICATION
Date: 02/06/2024
NYC Development Hub

DATE	SUBMISSIONS / REVISIONS
3 03-14-2023	P.A.A TO DOB #2
02-24-2023	ISSUED FOR CONSTRUCTION
12-15-2022	ISSUED FOR 80% CD
06-24-2022	REVISIONS PER DOB COMMENTS
06-17-2022	ISSUED H.P.D
01-26-2022	P.A.A
11-02-2021	REVISIONS PER DOB COMMENTS
09-02-2021	REVISIONS PER DOB COMMENTS
05-07-2021	REVISIONS PER DOB COMMENTS
03-26-2021	DOB REVISIONS
02-01-2021	DOB SUBMISSION

SHEET TITLE:

SCHEMATIC SITE PLAN

SEAL & SIGNATURE
ARIEL AUFGANG 032789

ISSUE DATE: 06/24/2022
PROJECT NO: 20010R
DRAWN BY: HT
CHECKED BY: AFM
SCALE: As indicated
SHEET NO: 3 OF
DRAWING NO: C-002.02
NYC DOB NUMBER: 1091659

APPENDIX B

LIST OF CONTACT PERSONS

Name	Phone/Email Address
Site owner and Remedial Party: M4778 Broadway LLC (contact person, Robert Morsemen)	718-501-5972, robertm@maddequities.com
QEP and Remedial Engineer: Philip G. Clark P.E.	413-281-2797, philip.clark@hcscepc.com
NYSDEC DER Project Manager: Steven Wu	718-482-6725, steven.Wu@dec.ny.gov
NYSDEC DER Project Manager’s Supervisor: Andre A. Obligado	718-482-6412, andre.olbigado@dec.ny.gov
NYSDEC Site Control: Alexandra M. Servis-Oettinger	518-402-9767, Alexandra.Servis@dec.ny.gov
Owner Environmental Attorney: George C.D. Duke	212-307-3700, GDuke@connellfoley.com
Owner Environmental Consultant: GZA GeoEnvironmental of New York (contact person, Victoria Whelan, P.G.)	631-793-8821, Victoria.Whelan@gza.com

APPENDIX C

SITE SPECIFIC BORING LOGS

AEI Consultants
Environmental & Engineering Services

AEI CONSULTANTS
2500 CAMINO DIABLE
WALNUT CREEK CA 94597
Telephone: 925 746-6000
Fax: 925 746-6099

BORING NUMBER SB-13

PAGE 1 OF 1

CLIENT M4778 Broadway, LLC, C231131
PROJECT NAME
PROJECT NUMBER 384736
PROJECT LOCATION 4478 Broadway, NY, NY
DATE STARTED 2/10/20 **COMPLETED** 2/10/20
GROUND ELEVATION **HOLE SIZE** 2.25 inches
DRILLING CONTRACTOR Core Down Drilling
GROUND WATER LEVELS:
DRILLING METHOD Direct Push
AT TIME OF DRILLING ---
LOGGED BY JM **CHECKED BY**
AT END OF DRILLING ---
NOTES Bedrock refusal at 15'
AFTER DRILLING ---

DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS	PID DATA (ppm)	GRAPHIC LOG	MATERIAL DESCRIPTION	COMPLETION
0.0 2.5	SB-13-0-2" SB-13-1.5-2.0		0.0 0.0 0.0	▨	FILL, Medium Sand	
5.0			0.0 0.0	▨	4.0 Fill, Medium Sand	
7.5			0.0 0.0	⋯	6.0 Brown, Fine SAND trace silt, moist	
10.0			0.0 0.0 0.0 0.0	⋯	8.0 Brown, Fine SAND trace silt, moist	
12.5 15.0	SB-13-12.5-13.0 SB-13-14.5-15.0		0.0 0.0 0.0	⋯	12.0 Brown, Fine SAND trace silt, moist 15.0	

Refusal at 15.0 feet.
Bottom of borehole at 15.0 feet.

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BORING NUMBER SB-14

PAGE 1 OF 1

CLIENT M4778 Broadway, LLC, C231131
PROJECT NAME
PROJECT NUMBER 384736
PROJECT LOCATION 4478 Broadway, NY, NY
DATE STARTED 2/10/20 **COMPLETED** 2/10/20
GROUND ELEVATION **HOLE SIZE** 2.25 inches
DRILLING CONTRACTOR Core Down Drilling
GROUND WATER LEVELS:
DRILLING METHOD Direct Push
AT TIME OF DRILLING ---
LOGGED BY JM **CHECKED BY**
AT END OF DRILLING ---
NOTES
AFTER DRILLING ---

DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS	PID DATA (ppm)	GRAPHIC LOG	MATERIAL DESCRIPTION	COMPLETION
0	SB-14-0-2"				FILL, Medium Sand	
			0.0			
	SB-14-1.5-2.0					
			0.0			
			0.0			
			0.0		4.0 Fill, Medium Sand	
5			0.0			
			0.0			
			0.0		7.0 Brown, Fine SAND trace silt, moist	
			0.0		8.0 Brown, Fine SAND trace silt, moist	
			0.0			
10			0.0			
			0.0			
			0.0		12.0 Brown, Fine SAND trace silt, wet- saturated at 13'	
	SB-14-12.5-13.0					
			0.0			
			0.0			
15			0.0			
			0.0		16.0 Brown, Fine SAND trace silt, saturated	
			0.0			
			0.0			
			0.0			
	SB-14-19.5-20.0					
20					20.0	

Bottom of borehole at 20.0 feet.

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BORING NUMBER SB-15

PAGE 1 OF 1

CLIENT M4778 Broadway, LLC, C231131

PROJECT NAME

PROJECT NUMBER 384736

PROJECT LOCATION 4478 Broadway, NY, NY

DATE STARTED 2/12/20 **COMPLETED** 2/12/20

GROUND ELEVATION **HOLE SIZE** 2.25 inches

DRILLING CONTRACTOR Core Down Drilling

GROUND WATER LEVELS:

DRILLING METHOD Direct Push

AT TIME OF DRILLING ---

LOGGED BY JM **CHECKED BY**

AT END OF DRILLING ---

NOTES Bedrock refusal at 19'

AFTER DRILLING ---

DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS	PID DATA (ppm)	GRAPHIC LOG	MATERIAL DESCRIPTION	COMPLETION
0	SB-15-0-2"				FILL, Medium Sand	
			0.0			
	SB-15-1.5-2.0		0.0			
			0.0			
			0.0		4.0 Fill, Medium Sand	
5			0.0			
			0.0			
			0.0		7.0 Brown, Fine SAND trace silt, moist	
			0.0		8.0 Brown, Fine SAND trace silt, moist	
			0.0			
10			0.0			
			0.0			
			0.0		12.0 Brown, Fine SAND trace silt, wet- saturated at 13'	
	SB-15-12.5-13.0		0.0			
			0.0			
15			0.0			
			0.0		16.0 Brown, Fine SAND trace silt, saturated	
			0.0			
			0.0			
	SB-15-18.5-19.0				19.0	

Refusal at 19.0 feet.
Bottom of borehole at 19.0 feet.

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Environmental & Engineering Services

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BORING NUMBER SB-16

PAGE 1 OF 1

CLIENT M4778 Broadway, LLC, C231131
PROJECT NAME
PROJECT NUMBER 384736
PROJECT LOCATION 4478 Broadway, NY, NY
DATE STARTED 2/12/20 **COMPLETED** 2/12/20
GROUND ELEVATION **HOLE SIZE** 2.25 inches
DRILLING CONTRACTOR Core Down Drilling
GROUND WATER LEVELS:
DRILLING METHOD Direct Push
AT TIME OF DRILLING ---
LOGGED BY JM **CHECKED BY**
AT END OF DRILLING ---
NOTES Bedreock refusal at 19'
AFTER DRILLING ---

DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS	PID DATA (ppm)	GRAPHIC LOG	MATERIAL DESCRIPTION	COMPLETION
0	SB-16-0-2"				FILL, Medium Sand	
1			0.0			
1.5	SB-16-1.5-2.0					
2			0.0			
3			0.0			
4			0.0		4.0 Fill, Medium Sand	
5			0.0			
6			0.0			
7			0.0		7.0 Brown, Fine SAND trace silt, moist	
8			0.0		8.0 Brown, Fine SAND trace silt, moist	
9			0.0			
10			0.0			
11			0.0			
12			0.0		12.0 Brown, Fine SAND trace silt, wet- saturated at 13'	
12.5	SB-16-12.5-13.0					
13			0.0			
14			0.0			
15			0.0			
16			0.0		16.0 Brown, Fine SAND trace silt, saturated	
17			0.0			
17.5	SB-16-17.5-18.0					
18					18.0	

Refusal at 18.0 feet.
Bottom of borehole at 18.0 feet.

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BORING NUMBER SB-17

PAGE 1 OF 1

CLIENT M4778 Broadway, LLC, C231131
PROJECT NAME
PROJECT NUMBER 384736
PROJECT LOCATION 4478 Broadway, NY, NY
DATE STARTED 2/12/20 **COMPLETED** 2/12/20
GROUND ELEVATION **HOLE SIZE** 2.25 inches
DRILLING CONTRACTOR Core Down Drilling
GROUND WATER LEVELS:
DRILLING METHOD Direct Push
AT TIME OF DRILLING ---
LOGGED BY JM **CHECKED BY**
AT END OF DRILLING ---
NOTES
AFTER DRILLING ---

DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS	PID DATA (ppm)	GRAPHIC LOG	MATERIAL DESCRIPTION	COMPLETION
0	SB-17-0-2"				FILL, Medium Sand	
			0.0			
	SB-17-1.5-2.0					
			0.0			
			0.0			
			0.0		4.0 Fill, Medium Sand	
5						
			0.0			
			0.0			
			0.0		7.0 Brown, Fine SAND trace silt, moist	
			0.0		8.0 Brown, Fine SAND trace silt, moist	
			0.0			
10			1.7			
			27.9			
			180		12.0 Brown, Fine SAND trace silt, wet- saturated at 13'	
	SB-17-12.5-13.0					
			272			
			689			
15			890			
			924		16.0 Brown, Fine SAND trace silt, saturated	
			877			
			971			
			982			
20	SB-17-19.5-20.0				20.0	

Bottom of borehole at 20.0 feet.

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BORING NUMBER SB-18

PAGE 1 OF 1

CLIENT M4778 Broadway, LLC, C231131
PROJECT NAME
PROJECT NUMBER 384736
PROJECT LOCATION 4478 Broadway, NY, NY
DATE STARTED 2/12/20 **COMPLETED** 2/12/20
GROUND ELEVATION **HOLE SIZE** 2.25 inches
DRILLING CONTRACTOR Core Down Drilling
GROUND WATER LEVELS:
DRILLING METHOD Direct Push
AT TIME OF DRILLING ---
LOGGED BY JM **CHECKED BY**
AT END OF DRILLING ---
NOTES
AFTER DRILLING ---

DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS	PID DATA (ppm)	GRAPHIC LOG	MATERIAL DESCRIPTION	COMPLETION
0	SB-18-0-2"			▨	FILL, Medium Sand	
			0	▨		
	SB-18-1.5-2.0			▨		
			1.7	▨		
			2.9	▨		
			4.9	▨	4.0 Fill, Medium Sand	
5			22.1	▨		
			4.4	▨		
			7.1	░	7.0 Brown, Fine SAND trace silt, moist	
			10.6	░	8.0 Brown, Fine SAND trace silt, moist	
			11	░		
10			206	░		
			221	░		
			196	░	12.0 Brown, Fine SAND trace silt, wet- saturated at 13'	
	SB-18-12.5-13.0			░		
			290	░		
			309	░		
15			421	░		
			886	░	16.0 Brown, Fine SAND trace silt, saturated	
			1262	░		
			2191	░		
			2604	░		
20	SB-18-19.5-20.0			░	20.0	

Bottom of borehole at 20.0 feet.

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BORING NUMBER SB-19

PAGE 1 OF 1

CLIENT M4778 Broadway, LLC, C231131
PROJECT NAME
PROJECT NUMBER 384736
PROJECT LOCATION 4478 Broadway, NY, NY
DATE STARTED 2/12/20 **COMPLETED** 2/12/20
GROUND ELEVATION **HOLE SIZE** 2.25 inches
DRILLING CONTRACTOR Core Down Drilling
GROUND WATER LEVELS:
DRILLING METHOD Direct Push
AT TIME OF DRILLING ---
LOGGED BY JM **CHECKED BY**
AT END OF DRILLING ---
NOTES
AFTER DRILLING ---

DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS	PID DATA (ppm)	GRAPHIC LOG	MATERIAL DESCRIPTION	COMPLETION
0	SB-19-0-2"			▨	FILL, Medium Sand	
			529	▨		
	SB-19-1.5-2.0		610	▨		
			1122	▨		
			1260	▨	4.0 Fill, Medium Sand	
5			1529	▨		
			60	▨		
			129	⋯	7.0 Brown, Fine SAND trace silt, moist	
			137	⋯	8.0 Brown, Fine SAND trace silt, moist	
			142	⋯		
10			1137	⋯		
			1579	⋯		
			1661	⋯	12.0 Brown, Fine SAND trace silt, wet- saturated at 13'	
	SB-19-12.5-13.0		1629	⋯		
			1201	⋯		
15			988	⋯		
			57	⋯	16.0 Brown, Fine SAND trace silt, saturated	
			76	⋯		
			42	⋯		
			50	⋯		
20	SB-19-19.5-20.0			⋯	20.0	

Bottom of borehole at 20.0 feet.

APPENDIX D

WELL CONSTRUCTION LOGS

AEI

AEI Consultants
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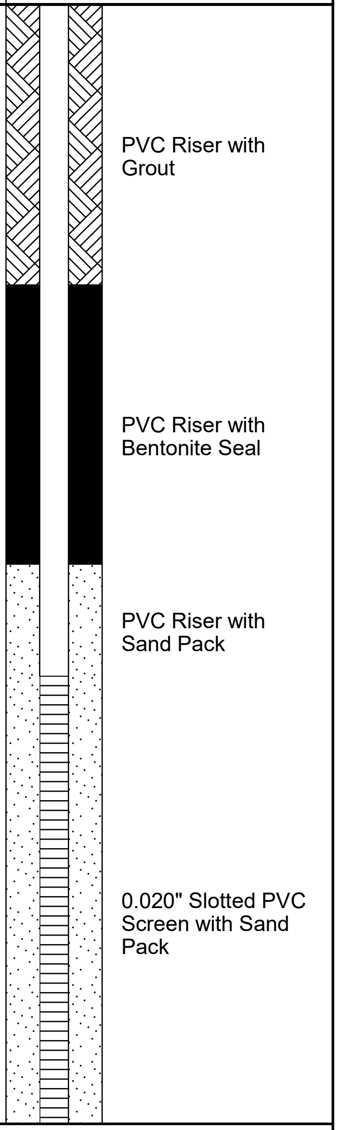
Walnut Creek, CA 94596
Telephone: 925-746-6000
Fax: 925-746-6099

BORING NUMBER IW-1

PAGE 1 OF 1

CLIENT M4778 Broadway LLC
PROJECT NAME New York, New York
PROJECT NUMBER 384736
PROJECT LOCATION 4778 Broadway
DATE STARTED 3/13/23 **COMPLETED** 3/13/23
GROUND ELEVATION **HOLE SIZE** 8.25 inches
DRILLING CONTRACTOR Core Down
GROUND WATER LEVELS:
DRILLING METHOD Hollow Stem Auger
AT TIME OF DRILLING ---
LOGGED BY Joseph Maggiulli **CHECKED BY**
AT END OF DRILLING ---
NOTES 4" Diameter Injection Well
AFTER DRILLING ---

DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS	PID DATA (ppm)	GRAPHIC LOG	MATERIAL DESCRIPTION	COMPLETION
0.0						
2.5						
5.0						
7.5						
10.0						



AEI Consultants
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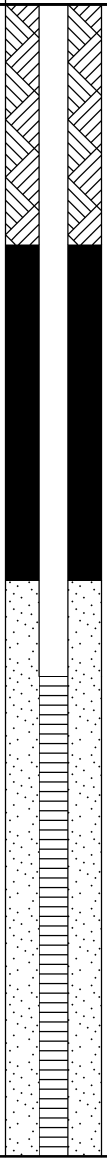
Fax: 925-746-6099

BORING NUMBER IW-2

PAGE 1 OF 1

CLIENT M4778 Broadway LLC	**PROJECT NAME** New York, New York
PROJECT NUMBER 384736	**PROJECT LOCATION** 4778 Broadway
DATE STARTED 3/15/23 **COMPLETED** 3/15/23	**GROUND ELEVATION** **HOLE SIZE** 8.25 inches
DRILLING CONTRACTOR Core Down	**GROUND WATER LEVELS:**
DRILLING METHOD Hollow Stem Auger	**AT TIME OF DRILLING** ---
LOGGED BY Joseph Maggiulli **CHECKED BY**	**AT END OF DRILLING** ---
NOTES 4" Diameter Injection Well	**AFTER DRILLING** ---

DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS	PID DATA (ppm)	GRAPHIC LOG	MATERIAL DESCRIPTION	COMPLETION
0.0						PVC Riser with Grout
2.5						PVC Riser with Bentonite Seal
5.0						PVC Riser with Sand Pack
7.5						
10.0						0.020" Slotted PVC Screen with Sand Pack



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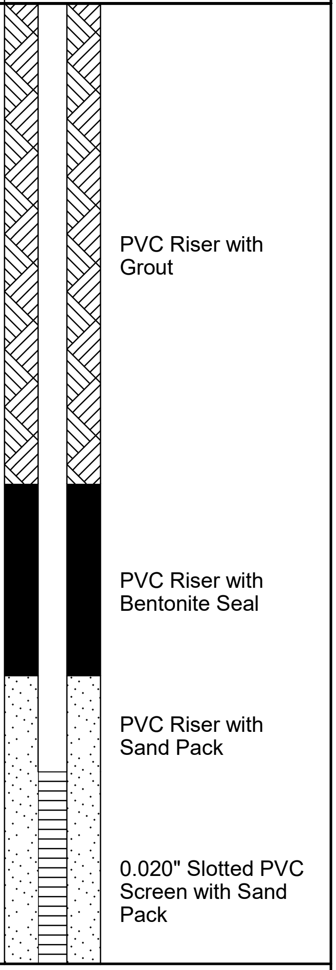
Fax: 925-746-6099

BORING NUMBER IW-3

PAGE 1 OF 1

CLIENT M4778 Broadway LLC
PROJECT NAME New York, New York
PROJECT NUMBER 384736
PROJECT LOCATION 4778 Broadway
DATE STARTED 3/15/23 **COMPLETED** 3/15/23
GROUND ELEVATION ______ **HOLE SIZE** 8.25 inches
DRILLING CONTRACTOR Core Down
GROUND WATER LEVELS:
DRILLING METHOD Hollow Stem Auger
AT TIME OF DRILLING ---
LOGGED BY Joseph Maggiulli **CHECKED BY** ______
AT END OF DRILLING ---
NOTES 4" Diameter Injection Well
AFTER DRILLING ---

DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS	PID DATA (ppm)	GRAPHIC LOG	MATERIAL DESCRIPTION	COMPLETION
0.0						
2.5						
5.0						



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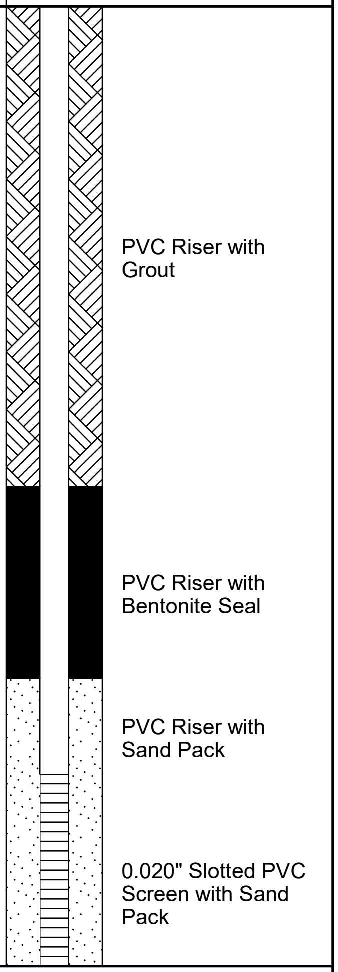
Fax: 925-746-6099

BORING NUMBER IW-4

PAGE 1 OF 1

CLIENT M4778 Broadway LLC
PROJECT NAME New York, New York
PROJECT NUMBER 384736
PROJECT LOCATION 4778 Broadway
DATE STARTED 3/15/23 **COMPLETED** 3/15/23
GROUND ELEVATION **HOLE SIZE** 8.25 inches
DRILLING CONTRACTOR Core Down
GROUND WATER LEVELS:
DRILLING METHOD Hollow Stem Auger
AT TIME OF DRILLING ---
LOGGED BY Joseph Maggiulli **CHECKED BY**
AT END OF DRILLING ---
NOTES 4" Diameter Injection Well
AFTER DRILLING ---

DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS	PID DATA (ppm)	GRAPHIC LOG	MATERIAL DESCRIPTION	COMPLETION
0.0						
2.5						
5.0						

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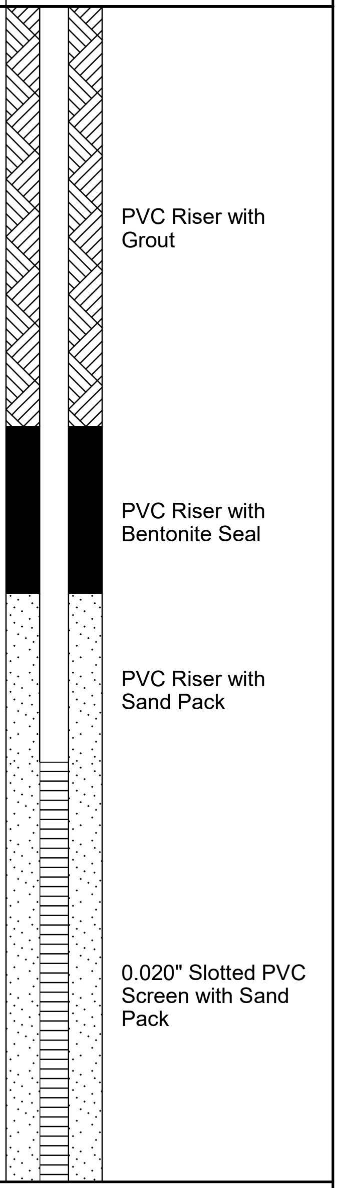
Walnut Creek, CA 94596
Telephone: 925-746-6000
Fax: 925-746-6099

BORING NUMBER IW-5

PAGE 1 OF 1

CLIENT M4778 Broadway LLC
PROJECT NAME New York, New York
PROJECT NUMBER 384736
PROJECT LOCATION 4778 Broadway
DATE STARTED 3/15/23 **COMPLETED** 3/15/23
GROUND ELEVATION **HOLE SIZE** 8.25 inches
DRILLING CONTRACTOR Core Down
GROUND WATER LEVELS:
DRILLING METHOD Hollow Stem Auger
AT TIME OF DRILLING ---
LOGGED BY Joseph Maggiulli **CHECKED BY**
AT END OF DRILLING ---
NOTES 4" Diameter Injection Well
AFTER DRILLING ---

DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS	PID DATA (ppm)	GRAPHIC LOG	MATERIAL DESCRIPTION	COMPLETION
0.0						
2.5						
5.0						



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Fax: 925-746-6099

BORING NUMBER IW-6

PAGE 1 OF 1

CLIENT M4778 Broadway LLC

PROJECT NAME New York, New York

PROJECT NUMBER 384736

PROJECT LOCATION 4778 Broadway

DATE STARTED 3/16/23 **COMPLETED** 3/16/23

GROUND ELEVATION **HOLE SIZE** 8.25 inches

DRILLING CONTRACTOR Core Down

GROUND WATER LEVELS:

DRILLING METHOD Hollow Stem Auger

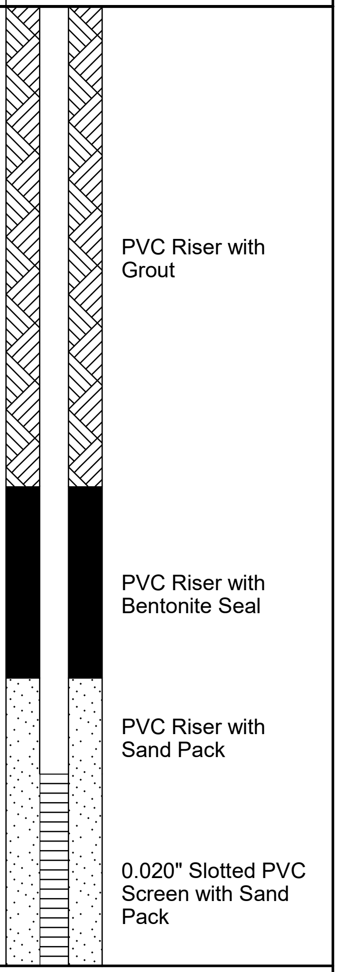
AT TIME OF DRILLING ---

LOGGED BY Joseph Maggiulli **CHECKED BY**

AT END OF DRILLING ---

NOTES 4" Diameter Injection Well

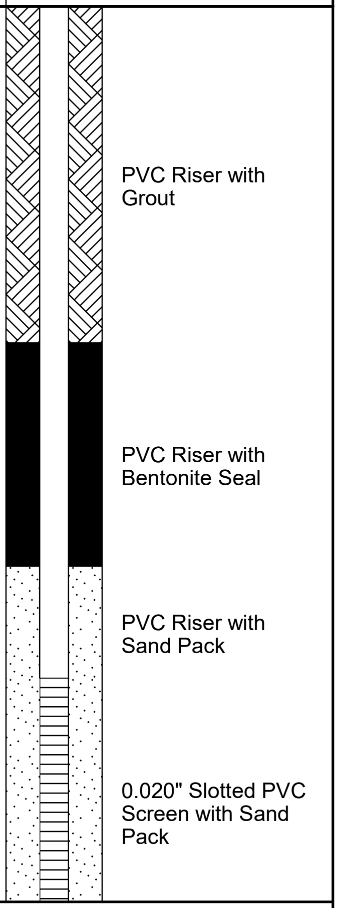
AFTER DRILLING ---

DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS	PID DATA (ppm)	GRAPHIC LOG	MATERIAL DESCRIPTION	COMPLETION
0.0						
2.5						
5.0						

AEI Consultants
2500 Camino Diablo
Walnut Creek, CA 94596
Telephone: 925-746-6000
Fax: 925-746-6099

BORING NUMBER IW-7

CLIENT M4778 Broadway LLC
PROJECT NAME New York, New York
PROJECT NUMBER 384736
PROJECT LOCATION 4778 Broadway
DATE STARTED 3/16/23 **COMPLETED** 3/16/23
GROUND ELEVATION **HOLE SIZE** 8.25 inches
DRILLING CONTRACTOR Core Down
GROUND WATER LEVELS:
DRILLING METHOD Hollow Stem Auger
AT TIME OF DRILLING ---
LOGGED BY Joseph Maggiulli **CHECKED BY**
AT END OF DRILLING ---
NOTES 4" Diameter Injection Well
AFTER DRILLING ---

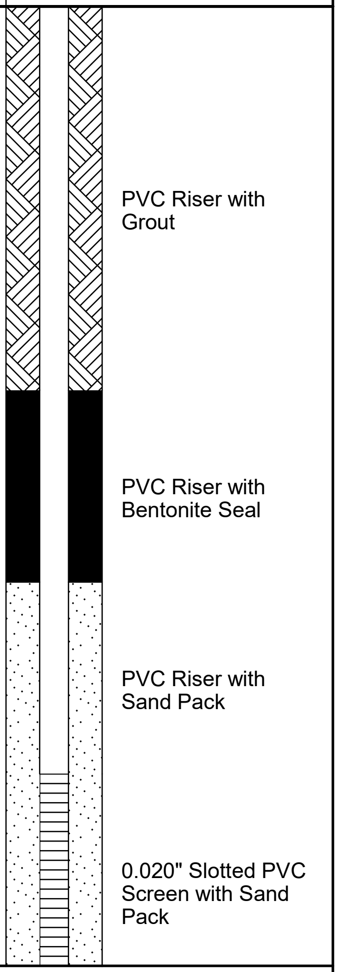
DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS	PID DATA (ppm)	GRAPHIC LOG	MATERIAL DESCRIPTION	COMPLETION
0						
1						
2						
3						
4						

AEI Consultants
2500 Camino Diablo
Walnut Creek, CA 94596
Telephone: 925-746-6000
Fax: 925-746-6099

BORING NUMBER IW-8

CLIENT M4778 Broadway LLC
PROJECT NAME New York, New York
PROJECT NUMBER 384736
PROJECT LOCATION 4778 Broadway
DATE STARTED 3/17/23 **COMPLETED** 3/17/23
GROUND ELEVATION **HOLE SIZE** 8.25 inches
DRILLING CONTRACTOR Core Down
GROUND WATER LEVELS:
DRILLING METHOD Hollow Stem Auger
AT TIME OF DRILLING ---
LOGGED BY Joseph Maggiulli **CHECKED BY**
AT END OF DRILLING ---
NOTES 4" Diameter Injection Well
AFTER DRILLING ---

DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS	PID DATA (ppm)	GRAPHIC LOG	MATERIAL DESCRIPTION	COMPLETION
0.0						
2.5						
5.0						



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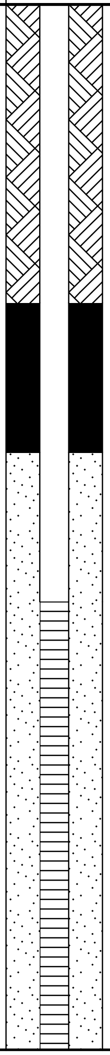
Walnut Creek, CA 94596
Telephone: 925-746-6000
Fax: 925-746-6099

BORING NUMBER IW-9

PAGE 1 OF 1

CLIENT	M4778 Broadway LLC	**PROJECT NAME**	New York, New York
PROJECT NUMBER	384736	**PROJECT LOCATION**	4778 Broadway
DATE STARTED	3/17/23 **COMPLETED** 3/17/23	**GROUND ELEVATION**	**HOLE SIZE** 8.25 inches
DRILLING CONTRACTOR	Core Down	**GROUND WATER LEVELS:**	
DRILLING METHOD	Hollow Stem Auger	**AT TIME OF DRILLING**	---
LOGGED BY	Joseph Maggiulli **CHECKED BY**	**AT END OF DRILLING**	---
NOTES	4" Diameter Injection Well	**AFTER DRILLING**	---

DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS	PID DATA (ppm)	GRAPHIC LOG	MATERIAL DESCRIPTION	COMPLETION
0.0						
2.5						
5.0						



PVC Riser with Grout

PVC Riser with Bentonite Seal

PVC Riser with Sand Pack

0.020" Slotted PVC Screen with Sand Pack

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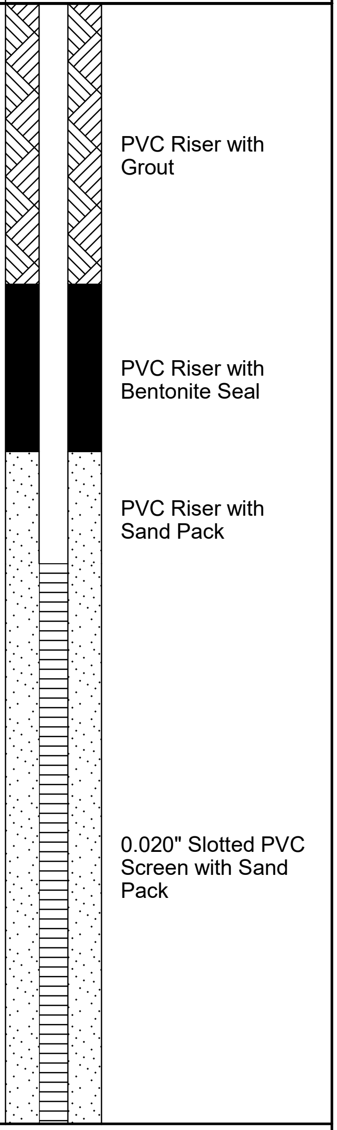
Fax: 925-746-6099

BORING NUMBER IW-10

PAGE 1 OF 1

CLIENT M4778 Broadway LLC		**PROJECT NAME** New York, New York	
PROJECT NUMBER 384736		**PROJECT LOCATION** 4778 Broadway	
DATE STARTED 3/17/23	**COMPLETED** 3/17/23	**GROUND ELEVATION**	**HOLE SIZE** 8.25 inches
DRILLING CONTRACTOR Core Down		**GROUND WATER LEVELS:**	
DRILLING METHOD Hollow Stem Auger		**AT TIME OF DRILLING** ---	
LOGGED BY Joseph Maggiulli	**CHECKED BY**	**AT END OF DRILLING** ---	
NOTES 4" Diameter Injection Well		**AFTER DRILLING** ---	

DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS	PID DATA (ppm)	GRAPHIC LOG	MATERIAL DESCRIPTION	COMPLETION
0.0						
2.5						
5.0						
7.5						
10.0						



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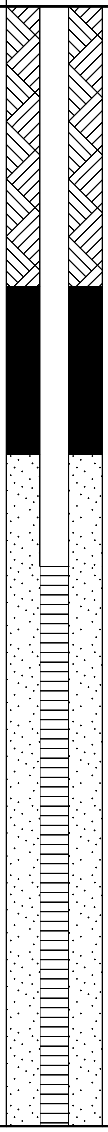
Walnut Creek, CA 94596
Telephone: 925-746-6000
Fax: 925-746-6099

BORING NUMBER IW-11

PAGE 1 OF 1

CLIENT M4778 Broadway LLC
PROJECT NAME New York, New York
PROJECT NUMBER 384736
PROJECT LOCATION 4778 Broadway
DATE STARTED 3/17/23 **COMPLETED** 3/17/23
GROUND ELEVATION **HOLE SIZE** 8.25 inches
DRILLING CONTRACTOR Core Down
GROUND WATER LEVELS:
DRILLING METHOD Hollow Stem Auger
AT TIME OF DRILLING ---
LOGGED BY Joseph Maggiulli **CHECKED BY**
AT END OF DRILLING ---
NOTES 4" Diameter Injection Well
AFTER DRILLING ---

DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS	PID DATA (ppm)	GRAPHIC LOG	MATERIAL DESCRIPTION	COMPLETION
0.0						
2.5						
5.0						
7.5						
10.0						



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Walnut Creek, CA 94596
Telephone: 925-746-6000
Fax: 925-746-6099

BORING NUMBER MW-1

PAGE 1 OF 1

CLIENT M4778 Broadway LLC

PROJECT NAME New York, New York

PROJECT NUMBER 384736

PROJECT LOCATION 4778 Broadway

DATE STARTED 3/15/23 **COMPLETED** 3/15/23

GROUND ELEVATION **HOLE SIZE** 6.25 inches

DRILLING CONTRACTOR Core Down

GROUND WATER LEVELS:

DRILLING METHOD Hollow Stem Auger

AT TIME OF DRILLING ---

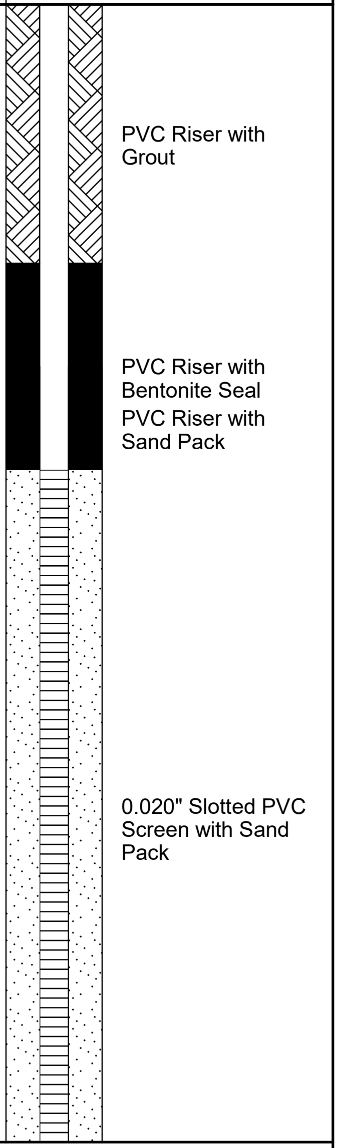
LOGGED BY Joseph Maggiulli **CHECKED BY**

AT END OF DRILLING ---

NOTES 2" Diameter Monitoring Well

AFTER DRILLING ---

DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS	PID DATA (ppm)	GRAPHIC LOG	MATERIAL DESCRIPTION	COMPLETION
0.0						
2.5						
5.0						
7.5						
10.0						



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AEI Consultants
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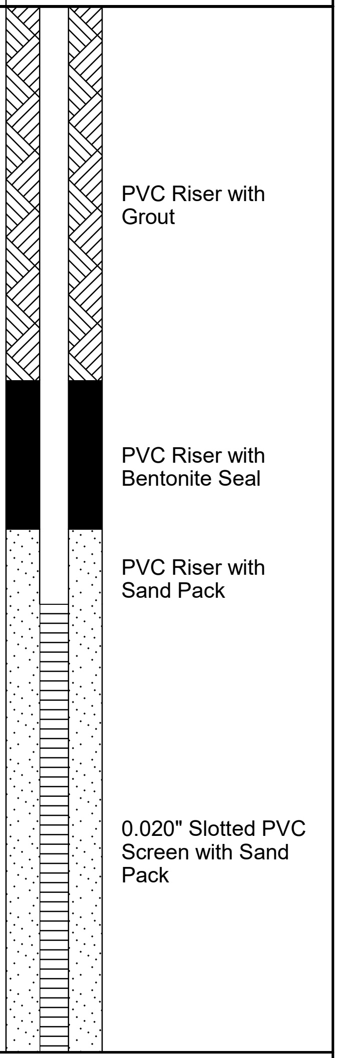
Fax: 925-746-6099

BORING NUMBER MW-2

PAGE 1 OF 1

CLIENT M4778 Broadway LLC	**PROJECT NAME** New York, New York
PROJECT NUMBER 384736	**PROJECT LOCATION** 4778 Broadway
DATE STARTED 3/16/23 **COMPLETED** 3/16/23	**GROUND ELEVATION** **HOLE SIZE** 6.25 inches
DRILLING CONTRACTOR Core Down	**GROUND WATER LEVELS:**
DRILLING METHOD Hollow Stem Auger	**AT TIME OF DRILLING** ---
LOGGED BY Joseph Maggiulli **CHECKED BY**	**AT END OF DRILLING** ---
NOTES 2" Diameter Monitoring Well	**AFTER DRILLING** ---

DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS	PID DATA (ppm)	GRAPHIC LOG	MATERIAL DESCRIPTION	COMPLETION
0.0						
2.5						
5.0						



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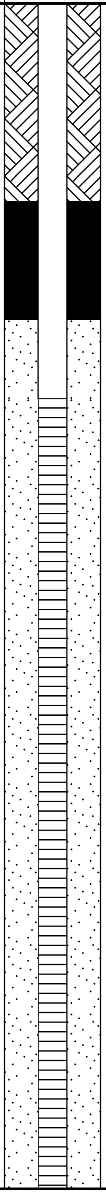
Walnut Creek, CA 94596
Telephone: 925-746-6000
Fax: 925-746-6099

BORING NUMBER MW-3

CLIENT	M4778 Broadway LLC	**PROJECT NAME**	New York, New York
PROJECT NUMBER	384736	**PROJECT LOCATION**	4778 Broadway
DATE STARTED	3/17/23 **COMPLETED** 3/17/23	**GROUND ELEVATION**	**HOLE SIZE** 6.25 inches
DRILLING CONTRACTOR	Core Down	**GROUND WATER LEVELS:**	
DRILLING METHOD	Hollow Stem Auger	**AT TIME OF DRILLING**	---
LOGGED BY	Joseph Maggiulli **CHECKED BY**	**AT END OF DRILLING**	---
NOTES	2" Diameter Monitoring Well	**AFTER DRILLING**	---

DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS	PID DATA (ppm)	GRAPHIC LOG	MATERIAL DESCRIPTION	COMPLETION
0.0						PVC Riser with Grout
2.5						PVC Riser with Bentonite Seal PVC Riser with Sand Pack
5.0						
7.5						
10.0						0.020" Slotted PVC Screen with Sand Pack
12.5						
15.0						



AEI Consultants
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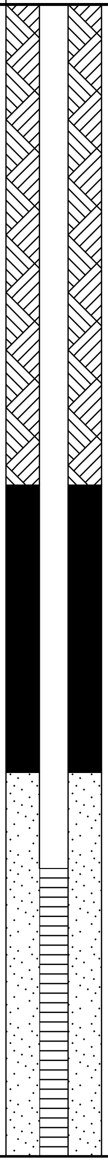
Walnut Creek, CA 94596
Telephone: 925-746-6000
Fax: 925-746-6099

BORING NUMBER MW-4

PAGE 1 OF 1

CLIENT M4778 Broadway LLC
PROJECT NAME New York, New York
PROJECT NUMBER 384736
PROJECT LOCATION 4778 Broadway
DATE STARTED 3/13/23 **COMPLETED** 3/13/23
GROUND ELEVATION **HOLE SIZE** 6.25 inches
DRILLING CONTRACTOR Core Down
GROUND WATER LEVELS:
DRILLING METHOD Hollow Stem Auger
AT TIME OF DRILLING ---
LOGGED BY Joseph Maggiulli **CHECKED BY**
AT END OF DRILLING ---
NOTES 2" Diameter Monitoring Well
AFTER DRILLING ---

DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS	PID DATA (ppm)	GRAPHIC LOG	MATERIAL DESCRIPTION	COMPLETION
0.0						PVC Riser with Grout
2.5						PVC Riser with Bentonite Seal PVC Riser with Sand Pack
5.0						0.020" Slotted PVC Screen with Sand Pack



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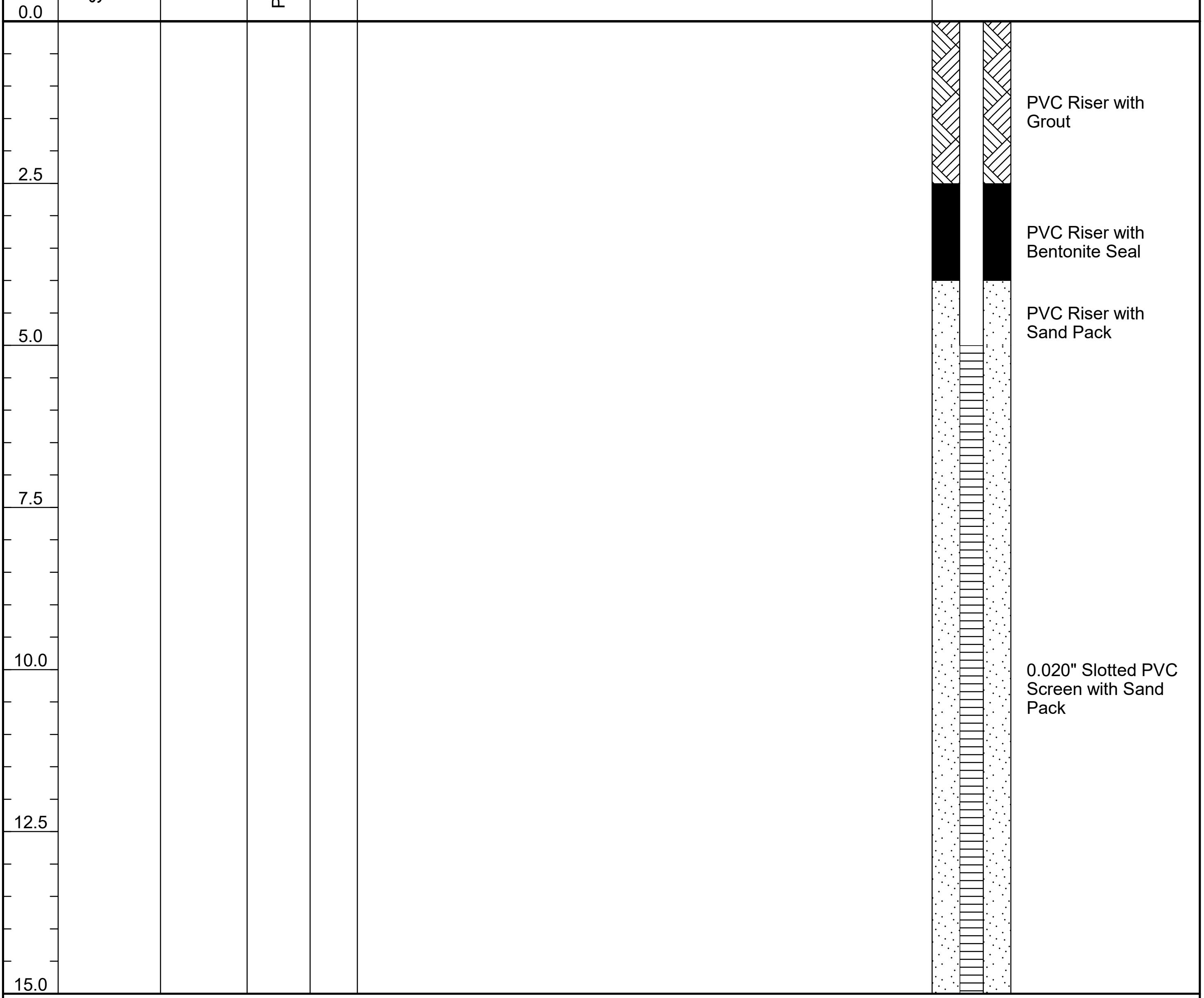
Telephone: 925-746-6000
Fax: 925-746-6099

BORING NUMBER MW-5

CLIENT M4778 Broadway LLC
PROJECT NAME New York, New York
PROJECT NUMBER 384736
PROJECT LOCATION 4778 Broadway
DATE STARTED 3/16/23 **COMPLETED** 3/16/23
GROUND ELEVATION **HOLE SIZE** 6.25 inches
DRILLING CONTRACTOR Core Down
GROUND WATER LEVELS:
DRILLING METHOD Hollow Stem Auger
AT TIME OF DRILLING ---
LOGGED BY Joseph Maggiulli **CHECKED BY**
AT END OF DRILLING ---
NOTES 2" Diameter Monitoring Well
AFTER DRILLING ---

DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS	PID DATA (ppm)	GRAPHIC LOG	MATERIAL DESCRIPTION	COMPLETION



AEI Consultants
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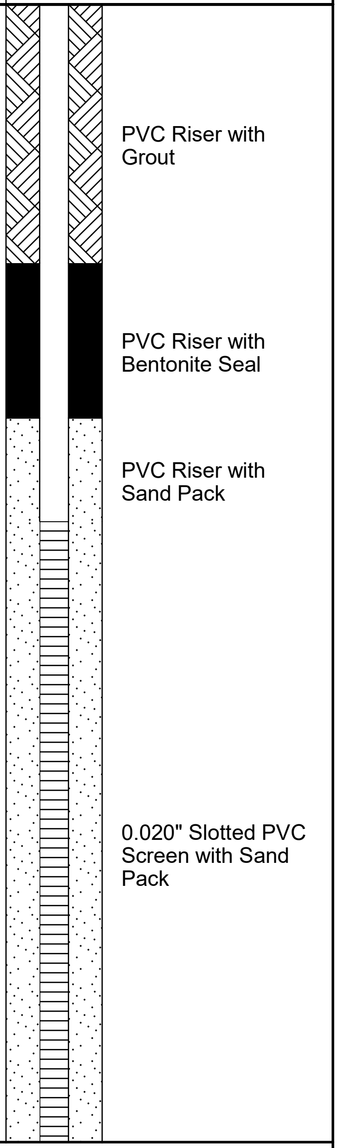
Walnut Creek, CA 94596
Telephone: 925-746-6000
Fax: 925-746-6099

BORING NUMBER MW-6

CLIENT M4778 Broadway LLC
PROJECT NAME New York, New York
PROJECT NUMBER 384736
PROJECT LOCATION 4778 Broadway
DATE STARTED 3/16/23 **COMPLETED** 3/16/23
GROUND ELEVATION ______ **HOLE SIZE** 6.25 inches
DRILLING CONTRACTOR Core Down
GROUND WATER LEVELS:
DRILLING METHOD Hollow Stem Auger
AT TIME OF DRILLING ---
LOGGED BY Joseph Maggiulli **CHECKED BY** ______
AT END OF DRILLING ---
NOTES 2" Diameter Monitoring Well
AFTER DRILLING ---

DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS	PID DATA (ppm)	GRAPHIC LOG	MATERIAL DESCRIPTION	COMPLETION
0.0						
2.5						
5.0						
7.5						
10.0						



APPENDIX E

COMPOSITE COVER SYSTEM SPECIFICATIONS

HCS Civil & Environmental Engineering, LLC
Professional Engineering Consultants
Licensed MA, VT, CT, NY

January 27, 2023

GDI Construction, LLC
15 Verbena Avenue, Suite 200
Floral Park, NY 11001

Attn: Mr. Austin Johnson
Project Manager

Subject: M4778 Broadway LLC
NYSDEC BCP Number: C231131
4778 Broadway, New York, New York
Vapor Protection System

HCS File: 20-0799

Dear Mr. Austin:

We are writing to provide information regarding our review of the shop drawings submitted on December 7, 2022, as attached. This letter supersedes the November 14, 2022, submittal cover letter issued by W.R. Meadows. Note that the attached cover letter indicates a warranty of ten (10) years and specifies installation review by a WR Meadows representative prior to pouring the slab. Provided the WR Meadows installation review report is provided to me for review prior to pouring the slab, the attached submittals are accetable as noted herein.

Our review represents acceptance in substantial conformance the approved RAWP based on information provided by your environmental consultant AEI Consultants, Inc. We are providing this review in accordance with NYSDEC requirements as the designated remediation engineer for the project.

Should there be any questions or concerns, please contact the undersigned or David Bausmith.

Sincerely,
HCS CIVIL & ENVIRONMENTAL ENGINEERING, LLC

Philip G. Clark

Philip G. Clark, P.E., LSP
President

Cc: D. Bausmith, AEI Consultants, Inc.

Submittal Package

QUALITY | SERVICE | INTEGRITY

W. R. MEADOWS®

A Family Company Since 1926

800-342-5976
www.wrmeadows.com

W. R. MEADOWS OF PA

W. R. MEADOWS
SEALTIGHT
A Family Company Since 1926
QUALITY...SERVICE...INTEGRITY

TELEPHONE: 717-792-2627
FAX: 717-792-0151

2150 Monroe St. • York, PA 17404
www.wrmeadows.com • wrmpa@wrmeadows.com

Centrifugal Concrete
7 West 36th Street
7th Floor
New York, NY 10018

December 7, 2022

C/o Eileen Reynolds

Project: 4778 Broadway Manhattan NYC

Dear Ms. Reynolds,

I have reviewed the application procedures for the above-mentioned project.

Note: Water Table is approximately 14'8"

You plan to install 12" clean stone over the soil with a SSDS system at 4"

Then install our EVOH Perminator on top of the crushed stone base.

PERMINATOR EVOH is a seven-layer co-extruded barrier manufactured from state-of-the-art polyethylene and EVOH resins. Designed to provide superior resistance to gas and moisture transmission, PERMINATOR EVOH is a highly resilient under slab gas/vapor barrier (20 Mil) designed to restrict naturally occurring gases, such as radon, methane, gasoline, solvents, oils, and hydrocarbons, from migrating through the ground and into the concrete slab.

Then installing our Pre Con System over the application of the EVOH Perminator.

PRECON is a composite sheet membrane comprised of a non-woven fabric, elastomeric membrane, and W. R. MEADOWS' exclusive, patented PLASMATIC CORE (U.S. Patent No. 7,179,761). The PLASMATIC CORE is a seven-layer matrix designed for toughness and provides the lowest water vapor transmission (WVT) rating on the market. Once concrete is poured against PRECON and the concrete cures, a mechanical bond forms that secures the concrete to the membrane.

Since the Pre Con System will not be coming in contact with the existing soil conditions, WRM of PA is willing to issue a 10 year material warranty for this project. As long as the material is installed correctly by the waterproofing contractor and the application is reviewed by a WR Meadows representative prior to pouring the mud slab. Visits can be arranged by calling Joseph Talecki WRM of PA at (267) 893-8049.

If you have any questions or concerns, do not hesitate to contact this writer at your earliest convenience.

Thank you for considering WR Meadows of PA for your project.

Sincerely,

Joseph Talecki

Joseph Talecki
Senior Technical Sales Representative
WRM of PA

W. R. MEADOWS OF PA

2150 Monroe St. • York, PA 17404
www.wrmeadows.com • wrmpa@wrmeadows.com

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TELEPHONE: 717-792-2627
FAX: 717-792-0151

To whom it may concern:

Centrifugal Concrete is an acceptable applicator of the Mel Rol Products.

Included products are:

Mel Rol, Mel Prime WB, Detail Strip, Pre-Con, Perminator EVOH & HP, Hydralastic 836 & SL, Detail Fabric, BEM, Cem-Kote Flex CR, Cem-Kote Flex St, Reinforcing Fabric HD, Reinforcing Fabric NW, Mel-Rol LM(all season), Mel-Drain & Mel-Drain Total-Drain, Water-Stop EC.

Please let me know if you need anything else,

Thanks,

Joseph Talecki

NYC Metro Sales

WARRANTY

PRECON™

Sample

Blindside/Underslab Membrane

==

NAME OF BUILDING**:** ____

LOCATION OF BUILDING**:** ____

NAME OF OWNER:____

WATERPROOFING CONTRACTOR: ______________________________

DATE OF INSTALLATION COMPLETION:__________________________

W. R. MEADOWS, INC. hereby warranties that for a period of **(10)** year(s) from the date of completion of installation of PRECON at the subject building, PRECON will be of good quality and will conform with our published specifications in force at the time of installation.

If at any time during such **(10)** year period the PRECON does not perform as warranted above, W. R. MEADOWS, INC. will supply replacement PRECON to the owner in exchange for and to the extent that the PRECON is found by W. R. MEADOWS, INC. not to comply with this warranty.

This warranty does not apply to any PRECON sheet unless installed and maintained in conformance with the printed instruction of W. R. MEADOWS, INC. from time to time in effect. Further, this warranty does not cover damage caused by abuse or abnormal use of the PRECON, acts of God, inadequate or faulty design of the subject building, and disclaims all liability where any failure results from structural cracks or defects or repairs, installations, designs, materials or products made by other persons. In addition, this warranty does not cover any costs or expenses associated with the removal, excavation or replacement of concrete or other substrates in connection with the testing, repair, removal or replacement of PRECON.

The foregoing warranty is exclusive and is in lieu of any and all other guarantees or warranties, express or implied, including without limitation the implied warranties of merchantability and fitness for a particular purpose. The remedies of the buyer for any breach of the warranty shall be limited to those herein provided to the exclusion of any and all other remedies, including without limitation incidental or consequential damages. W. R. MEADOWS, INC. shall not be liable in any case for any damage to the building or the contents thereof. Any lawsuit based on this warranty must be filed within one year (or within the shortest time period permitted to be established by agreement, if this period is longer than one year) from the date during the (10) year period described above on which the buyer discovers or should have discovered a breach of this warranty. No agreement varying or extending the foregoing warranty remedies will be binding upon W. R. MEADOWS, INC. unless it is in writing, and is signed by a duly authorized officer of W. R. MEADOWS, INC.

W. R. MEADOWS, INC.

BY: ______Sample______________

DATE: __________________________

W. R. MEADOWS, INC.
P. O. BOX 338 • HAMPSHIRE, IL 60140 • 847/683-4500

WARRANTY

PERMINATOR® EVOH

Underslab Gas Vapor Barrier

==

NAME OF BUILDING: ____

LOCATION OF BUILDING: ____

NAME OF OWNER: ____

WATERPROOFING CONTRACTOR: ______________________________________

DATE OF SUBSTANTIAL COMPLETION: _________________________________

W. R. MEADOWS, INC. hereby warranties that for a period of (**10**) year(s) from the date of substantial completion of PERMINATOR EVOH Underslab Gas Vapor Barrier at the subject building, PERMINATOR EVOH Underslab Gas Vapor Barrier will be of good quality and will conform with our published specifications in force at the time of installation.

If at any time during such (**10**) year period the PERMINATOR EVOH Underslab Gas Vapor Barrier does not perform as warranted above, W. R. MEADOWS, INC. will supply replacement PERMINATOR EVOH Underslab Gas Vapor Barrier to the owner in exchange for and to the extent that the PERMINATOR EVOH Underslab Gas Vapor Barrier is found by W. R. MEADOWS, INC. not to comply with this warranty.

This warranty does not apply to any PERMINATOR EVOH Underslab Gas Vapor Barrier sheet unless installed and maintained in conformance with the printed instruction of W. R. MEADOWS, INC. from time to time in effect. Further, this warranty does not cover damage caused by abuse or abnormal use of the PERMINATOR EVOH Underslab Gas Vapor Barrier, acts of God, inadequate or faulty design of the subject building, and disclaims all liability where any failure results from structural cracks or defects or repairs, installations, designs, materials or products made by other persons. In addition, this warranty does not cover any costs or expenses associated with the removal, excavation or replacement of concrete or other substrates in connection with the testing, repair, removal or replacement of PERMINATOR EVOH Underslab Gas Vapor Barrier.

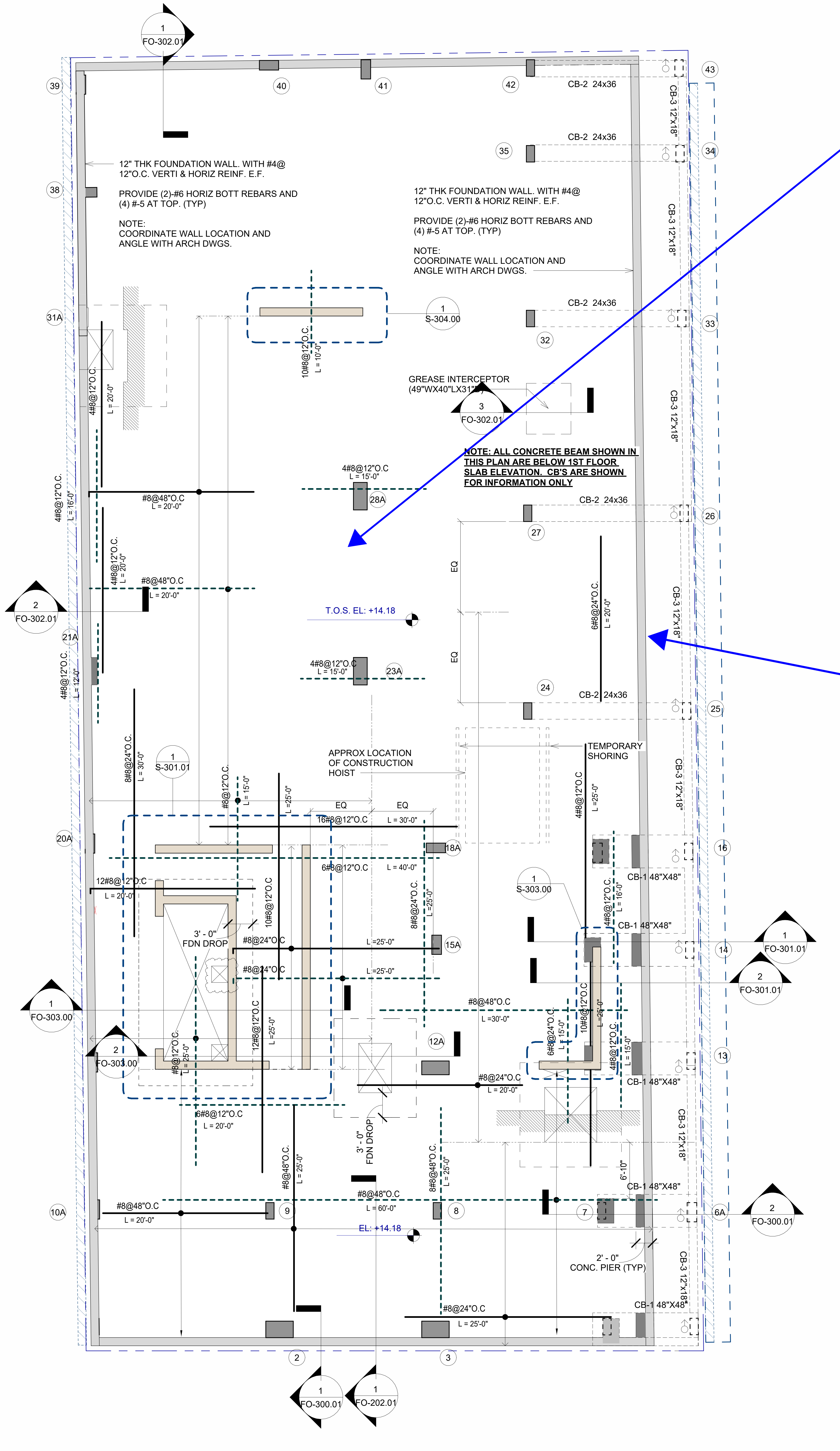
> **The foregoing warranty is exclusive and is in lieu of any and all other guarantees or warranties, express or implied, including without limitation the implied warranties of merchantability and fitness for a particular purpose. The remedies of the buyer for any breach of the warranty shall be limited to those herein provided to the exclusion of any and all other remedies, including without limitation incidental or consequential damages. W. R. MEADOWS, INC. shall not be liable in any case for any damage to the building or the contents thereof. Any lawsuit based on this warranty must be filed within one year (or within the shortest time period permitted to be established by agreement, if this period is longer than one year) from the date during the (10) year period described above on which the buyer discovers or should have discovered a breach of this warranty. No agreement varying or extending the foregoing warranty remedies will be binding upon W. R. MEADOWS, INC. unless it is in writing, and is signed by a duly authorized officer of W. R. MEADOWS, INC.**

W. R. MEADOWS, INC.

BY: ______________________________

DATE: ______________________________

W. R. MEADOWS, INC.
P. O. BOX 338 • HAMPSHIRE, IL 60140 • 847/683-4500



1 Foundation/Cellar
FO-100.01 1/8" = 1'-0"

Steps 1-6 on Waterproofing Procedure

7. Pre-Con will come up 12" on the FDN wall

Waterproofing Procedure

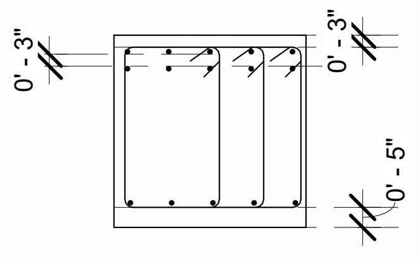
1. Lay Geo-tech fabric on soil
2. Lay 4" of clean stone
3. Place SSDS system (pipe)
4. Lay 8" of crushed stone
5. Lay EVO-H Perminator
6. Lay Pre-Con
7. Pre-Con will come up 12" on the FDN wall

FOUNDATION NOTES:

1. 36" MAT REINFORCED WITH #10@12" TOP AND BOTTOM E.W., UNLESS OTHERWISE NOTED.
2. ADDITIONAL TOP BARS ARE SHOWN THUS ON PLAN.
3. ADDITIONAL BOTTOM BARS ARE SHOWN THUS ON PLAN.
4. TOP CLEAR COVER TO BE 0.75".
5. BOTTOM CLEAR COVER TO BE 3". UNLESS OTHERWISE NOTED ON PLAN AND DETAILS.
6. SEE ARCH. AND MECH. DRAWINGS FOR SIZE AND LOCATION OF WATER DETENTION TANK.
7. REINFORCEMENT SHOWN IN PLAN, CROSSING ELEVATOR PIT, MAT DROP, WALL FDN DOES NOT INCLUDE VERTICAL REBAR LENGTH.
8. FOR TOP OF NEW SLAB ELEVATION SEE PLAN.
9. BOTTOM OF NEW FOOTING SHOWN THUS [-...] ON THE PLAN.
10. ALL SLAB OPENINGS ARE TO BE COORDINATED WITH ARCH. AND MECH. DWG'S. SEE ARCH. DWG'S FOR LOCATION AND DIMENSIONS.
11. FOR DIMENSIONS NOT SHOWN ON THIS PLAN SEE ARCH. DWG'S.
12. SLAB ON GRADE PITCH TO DRAINS AS SHOWN ON ARCH. DWG'S. FOR DRAIN LOCATIONS REFER TO ARCH. AND MECH. DWG'S.
13. ALL REINFORCEMENT AT EXPOSED CONCRETE SLABS SHALL BE EPOXY COATED.
14. FOR COLUMN COORDINATES, SEE ARCH DWGS.
15. SEE ARCH. AND MECH DWGS. FOR LOCATION AND SIZE OF PIPE PENETRATIONS AT MAT FOUNDATION.

BEAM SCHEDULE

MARK	SIZE		REINFORCEMENT		STIRRUPS	REMARKS
	WIDTH	WIDTH	TOP	BOT		
CB-1	48"	48"	10 - #10	6 - #10	3 -#5 @ 9"O.C.	TOP REIN. IN 2 LAYERS
CB-2	24"	36"	6 - #10	3 - #10	2 -#5 @ 9"O.C.	TOP REIN. IN 2 LAYERS
CB-3	12"	18"	2 - #6	2 - #6	#4 @ 12"O.C.	



CB-1 CROSS SECTION
1/4" = 1'-0"

LEGEND:

■	INDICATES CONCRETE COLUMN
▢	INDICATES COLUMN ABOVE 1ST FLOOR LEVEL
▯	INDICATES CONCRETE PIER
▨	INDICATES 12" THK SHEAR WALL. SEE SHEAR WALL REINF DETAILS ON S-300 SERIES
-·-·-	INDICATES PROPERTY LINE
- - -	INDICATES STRESS LINE
·····	INDICATES BUILDING LINE ABOVE SLAB
CB-X	INDICATES CONCRETE BEAM AT AT 1ST FLOOR LEVEL

PROPOSED NEW DEVELOPMENT

4778

BROADWAY
NEW YORK,NY 10034

BLOCK 2233 LOT: 10

Architect:
AUFGANG.
74 Lafayette Avenue
Suite 301
Suffern, NY 10901
845.368.0004
info@aufgang.com

Owner/Developer
OWNER/DEVELOPER:

M4778 BROADWAY LLC
15 VERNENA AVENUE
ANA@MADDEQUITIES.COM
516-821-2004

Structural Engineer
STRUCTURAL COMPANY:

ENGINEERING GROUP ASSOCIATES
19 W 21ST STREET, SUITE 1103
NEW YORK, NY 10018
212-982-0488

MEP Engineer
MEP COMPANY:

AVCON ENGINEER
580 8TH AVENUE, 14TH FLOOR
NEW YORK, NY 10018
646-572-0488

Civil Engineer
CIVIL COMPANY:

BROOKER ENGINEERING
74 LAFAYETTE, SUITE 501
NEW YORK, NY 10901
845-357-4411

Rev #	Date	Description
	12-21-2022	Structural Fabrication
	11-18-2022	Foundation - For fabrication
	11-09-2022	Foundation - Pricing
	07-21-2022	Progress Set
1	02-04-2022	DOB PAA
	01-27-2021	DOB FILING

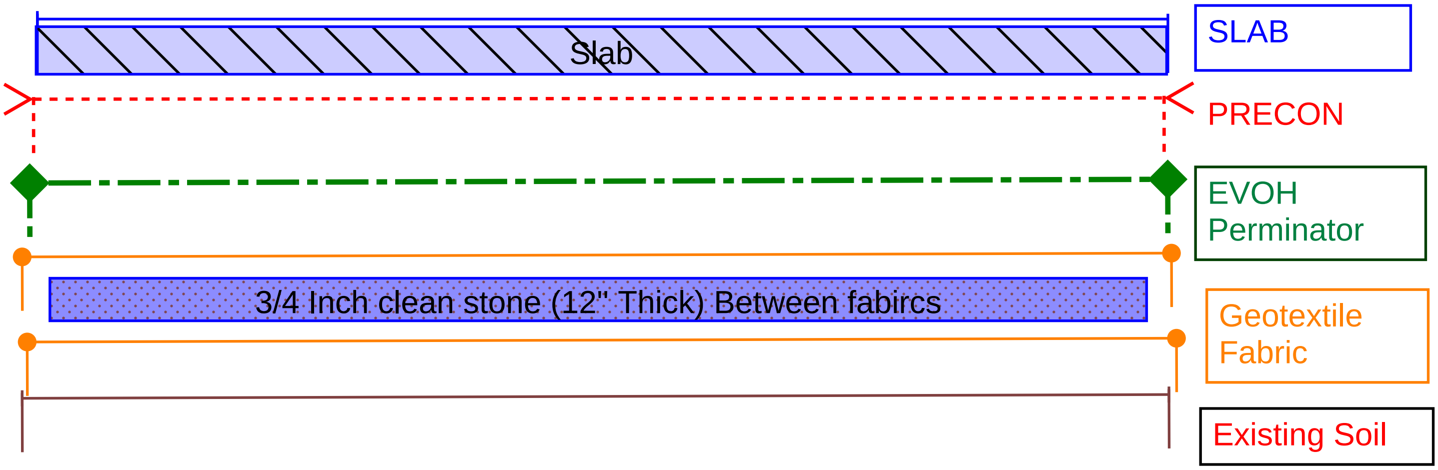
SHEET TITLE:

FOUNDATION/CELLAR REINFORCEMENT PLAN

80% CONSTRUCTION DOCUMENTS

SEAL & SIGNATURE
GENNADY SARATOVSKY
075323

ISSUE DATE: 11/17/21
PROJECT NO: 2020.1292
DRAWN BY: Author
CHECKED BY: Checker
SCALE: As indicated
SHEET NO: 4 OF
DRAWING NO: FO-100.01
NYC DOB NUMBER: M00464453-P1


Slab
SLAB
PRECON
EVOH Permінator
3/4 Inch clean stone (12" Thick) Between fabircs
Geotextile Fabric
Existing Soil

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PRECON

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PRECON

End Lap Taping Method Tech Bulletin

PRECON

LEED v4 Letter

MasterFormat:
03 33 00
07 26 23
07 26 16

MAY 2018
(Supersedes July 2017)

PERMINATOR® EVOH

Underslab Gas Vapor Barrier

DESCRIPTION

PERMINATOR EVOH is a seven-layer co-extruded barrier manufactured from state-of-the-art polyethylene and EVOH resins. Designed to provide superior resistance to gas and moisture transmission, PERMINATOR EVOH is a highly resilient underslab gas/vapor barrier designed to restrict naturally occurring gases, such as radon, methane, gasoline, solvents, oils, and hydrocarbons, from migrating through the ground and into the concrete slab.

USES

When properly installed, PERMINATOR EVOH resists gas and moisture migration into the building envelope to provide protection from toxic/harmful chemicals. It can be installed as part of a passive or active control system extending across the entire building, including floors, walls, and crawl spaces. PERMINATOR EVOH protects flooring and other moisture-sensitive furnishings in the building's interior from moisture and water vapor migration, greatly reducing condensation, mold, and degradation.

FEATURES/BENEFITS

- Resistant to gasoline, oils, solvents, hydrocarbons, radon, and methane.
- Available in 150' (45.7 m) long rolls.
- Helps reduce the penetration of moisture and water vapor through the slab into the structure.
- Helps reduce fungus, mildew, and mold.
- Tough enough to withstand normal construction jobsite conditions and traffic … will not crack, puncture, snag, split, or tear easily.
- Seven-layer construction with EVOH gas barrier core.

PACKAGING

10' (3 m) x 150' (45.7 m) Rolls

SPECIFICATIONS

- Meets or exceeds all requirements of ASTM E 1745-11 Class A, B & C.

APPLICATION

Surface Preparation … Level, tamp, or roll earth or granular material beneath the slab base as specified by supplied architectural drawings. Follow ASTM E-1643-10 (standard practice and procedure for installation of vapor retarder used in contact with earth or fill under concrete slabs). Reference American Concrete Institute (ACI) 302.1R-15 Section 6.1.4 – Base Material for sub-grade preparation prior to placement of PERMINATOR.

Horizontal Application … Unroll 150' (45.7 m) PERMINATOR EVOH over the area where the slab is to be poured. Cut to size if necessary. PERMINATOR should completely cover the pour area. All joints/seams, both side and end, should be overlapped 12" (304.8 mm) and taped using 4" (101.6 mm) wide PERMINATOR EVOH TAPE. (Note: The PERMINATOR EVOH TAPE area of adhesion should be free from dust, dirt, and moisture to allow maximum adhesion of the pressure-sensitive tape.) To ensure placement of laps, PERMINATOR BUTYL TAPE should be used underneath the overlap area to hold membrane in place as PERMINATOR EVOH TAPE is applied.
The most efficient installation method includes placing PERMINATOR EVOH on top of the footing and against the vertical wall. This will sandwich PERMINATOR EVOH between the footing, vertical wall, and poured concrete floor. This will help protect the concrete slab from external moisture sources once the slab has been placed.
Before placing concrete slab, make sure all penetrations, block outs, and damaged areas are repaired/addressed. For detailed information on detailing penetrations, such as pipe clusters, please refer to INSTALLATION GUIDELINES: PERMINATOR EVOH PENETRATIONS available at www.wrmeadows.com.

Numerous municipal building codes do not allow the placement of vapor barriers over the footing, due to breaking of the bond between the wall and footing. Although this is not an optimal application method, W. R. MEADOWS approves this alternate method when required by building code.

CONTINUED ON THE REVERSE SIDE…

TECHNICAL DATA

Properties	Test Method	Result
Appearance		White/Green
Thickness, Nominal		20 Mil (0.51 mm)
Weight		102 lb./MSF (498 g/m^2)
Classification	ASTM E 1745	Class A, B, and C
Tensile Strength	ASTM E 154, Section 9, (D-882)	58 lbf (10.2 Kn/m)
Impact Resistance	ASTM D 1709	2600 g
Permeance (New Material)	ASTM E 154, Section 7 ASTM E 96, Procedure B	0.0098 Perms grains/(ft^2·hr·in·Hg) [0.0064 Perms g/(24hr·m^2·mm Hg)]
Permeance (After Conditioning) (Same Measurement as Above Performance)	ASTM E 154 Section 8, E96 Section 11, E96 Section 12, E96 Section 13, E96	 0.0079 (0.0052) 0.0079 (0.0052) 0.0097 (0.0064) 0.0113 (0.0074)
WVTR	ASTM E 96 Procedure B	0.0040 grains/hr-ft^2 (0.0028 gm/hr-m^2)
Benzene Permeance	Aqueous Phase Film Permeance	1.57E-10 m/s
Toluene Permeance	Aqueous Phase Film Permeance	2.18E-10 m/s
Ethylbenzene Permeance	Aqueous Phase Film Permeance	1.71E-10 m/s
M & P Xylenes Permeance	Aqueous Phase Film Permeance	1.62E-10 m/s
O Xylene Permeance	Aqueous Phase Film Permeance	1.53E-10 m/s
Perchloroethylene (PCE)	Aqueous Phase Film Permeance	1.5 x 10-^{9} m/s
Trichloroethylene (TCE)	Aqueous Phase Film Permeance	2.4 x 10-^{9} m/s
Radon Diffusion Coefficient	K124/02/95	< 1.1 x 10^{-13} m^2/s
Methane Permeance	ASTM D 1434	3.68E-^{12} m/s Gas Transmission Rate (GTR): 0.32 mL/m^2•day•atm
Maximum Static Use Temperature		180° F (82° C)
Minimum Static Use Temperature		-70° F (-57° C)

LEED INFORMATION

May help contribute to LEED credits:

- EAp2: Minimum Energy Performance
- EAc2: Optimize Energy Performance
- MRc9: Construction and Demolition Waste Management

For CAD details, most current data sheet, further LEED information, and SDS, visit www.wrmeadows.com.

LIMITED WARRANTY

W. R. MEADOWS, INC. warrants at the time and place we make shipment, our material will be of good quality and will conform with our published specifications in force on the date of acceptance of the order. Read complete warranty. Copy furnished upon request.

Disclaimer

The information contained herein is included for illustrative purposes only, and to the best of our knowledge, is accurate and reliable. W. R. MEADOWS, INC. cannot however under any circumstances make any guarantee of results or assume any obligation or liability in connection with the use of this information. As W. R. MEADOWS, INC. has no control over the use to which others may put its product, it is recommended that the products be tested to determine if suitable for specific application and/or our information is valid in a particular circumstance. Responsibility remains with the architect or engineer, contractor and owner for the design, application and proper installation of each product. Specifier and user shall determine the suitability of products for specific application and assume all responsibilities in connection therewith.

W. R. MEADOWS® SEALTIGHT®

SAFETY DATA SHEET

SECTION 1: PRODUCT AND COMPANY IDENTIFICATION

Product: **PERMINATOR® EVOH**
Part Number: 5244100
Manufacturer: **W. R. MEADOWS, INC.**
Address: 300 Industrial Drive
Hampshire, Illinois 60140
Telephone: (847) 214-2100
In case of emergency, dial (800) 424-9300 (CHEMTREC)
Revision Date: 10/10/2019
Product Use: Underslab Gas Vapor Barrier

SECTION 2: HAZARDS IDENTIFICATION/EXPOSURE LIMITS

HMIS	
|Health|	|0|
|Flammability|	|0|
|Reactivity|	|0|
|Personal Protection|	| |

Product is classified as non-hazardous per OSHA 1910.1200. Perminator is defined by OSHA as an "article." A manufactured item that is formed to a specific shape or design during manufacture that does not release or result in exposure to a hazardous chemical under normal use conditions.

SECTION 3: HAZARDS COMPONENTS

Chemical Name:	**CAS Number**	**% by Weight**	**SARA 313**	**Vapor Pressure (mm Hg@20°C)**	**LEL (@24°C)**
None					

N/A: Not Applicable

Under the reporting requirements of Section 313 of Title III of the Superfund Amendments and Reauthorization Act of 1966 (SARA) and 40 CFR Part 372, chemicals listed on the 313 List (40 CFR Part 373.65) are identified under the heading "SARA" 313."

SECTION 4: EMERGENCY AND FIRST AID PROCEDURES

EYE CONTACT: Not expected to be an exposure route.
SKIN CONTACT: Not Expected to be an exposure route.
INHALATION: Not expected to be an exposure route.
INGESTION: Not expected to be an exposure source.
MOST IMPORTANT SYMPTOMS/EFFECTS, ACUTE AND CHRONIC: See Section Eleven for Symptoms/Effects.

SECTION 5: FIRE AND EXPLOSIVES HAZARDS

FLASHPOINT: Not applicable; product is a solid.
EXTINGUISHING MEDIA: Water fog, foam, dry chemical.
CHEMICAL/COMBUSTION HAZARDS: Carbon monoxide, carbon dioxide, and incomplete combustion products.
PRECAUTIONS/PERSONAL PROTECTIVE EQUIPMENT: Avoid smoke inhalation. Use appropriate respiratory protection.

SECTION 6: ACCIDENTAL RELEASE MEASURES

SPILL OR LEAK PROCEDURES: Not applicable. Product is a solid.

SECTION 7: HANDLING AND STORAGE

SAFE HANDLING PROCEDURES: None.
SAFE STORAGE: Prevent job-site damage.

SECTION 8: EXPOSURE CONTROLS/PERSONAL PROTECTION

	OSHA				**ACGIH**			
Chemical Name:	**PEL**	**PEL/CEILING**	**PEL/STEL**	**SKIN**	**TLV**	**TLV/CEILING**	**TLV/STEL**	**SKIN**
1. Blown Polyethylene	N/E	N/E	N/E	No	N/E	N/E	N/E	N/E

N/E = Not Established

ENGINEERING CONTROLS: None required under normal use conditions.
PERSONAL PROTECTIVE EQUIPMENT: None required under normal use conditions.

SAFETY DATA SHEET

SECTION 9: PHYSICAL AND CHEMICAL PROPERTIES

BOILING POINT: N/A
EVAPORATION RATE: N/A
WEIGHT PER GALLON: N/A
ODOR: None
FLASH POINT: See Section 5
VAPOR PRESSURE: N/D
PARTITION COEFFICENT: N/D
VISCOSITY: N/D

VAPOR DENSITY: N/A
pH LEVEL: N/A
PRODUCT APPEARANCE: White/Gold Film
ODOR THRESHOLD: N/D
FLAMMABILITY: See Section 5
RELATIVE DENSITY: N/D
AUTOIGNITION TEMPERATURE: N/D

% VOLATILE BY VOLUME: N/A
% VOLATILE BY WEIGHT: N/A
VOC CONTENT: N/A
MELTING/FREEZING POINT: N/D
UEL/LEL: N/D
SOLUBILITY: N/D
DECOMPOSITION TEMPERATURE: N/D

N/A : Not Applicable *N/D: Not Determined*

SECTION 10: STABILITY/REACTIVITY

STABILITY: Stable. **HAZARDOUS POLYMERIZATION:** Will not occur.
CONDITIONS AND MATERIALS TO AVOID: None recognized.
HAZARDOUS DECOMPOSITION PRODUCTS: None recognized.

SECTION 11: TOXICOLOGICAL INFORMATION

EYE CONTACT: Not anticipated to be an exposure route.
SKIN CONTACT: Direct contact may cause slight skin irritation.
INHALATION: Not anticipated to be an exposure route.
INGESTION: Not anticipated to be an exposure route.
SIGNS AND SYMPTOMS: None recognized.
AGGRAVATED MEDICAL CONDITIONS: None recognized.
OTHER HEALTH EFFECTS: None recognized

SECTION 12: ECOLOGICAL INFORMATION

ECOTOXICITY: N/E **DEGRADABILITY:** N/E **BIOACCUMULATIVE POTENTIAL:** N/E
SOIL MOBILITY: N/E **OTHER ADVERSE EFFECTS:** None Recognized

SECTION 13: WASTE DISPOSAL INFORMATION

WASTE DISPOSAL INFORMATION: Product is classified as a non-hazardous waste.

SECTION 14: TRANSPORTATION INFORMATION

HAZARDOUS/NON-HAZARDOUS MATERIAL: Not regulated by DOT.
UN NUMBER: None **HAZARD CLASS:** N/A **PACKING GROUP:** N/A
UN PROPER SHIPPING NAME: N/A
ENVIRONMENTAL HAZARDS: None recognized.
BULK TRANSPORTATION INFORMATION: None.
SPECIAL PRECAUTIONS: None.

SECTION 15: REGULATORY INFORMATION

OTHER REGULATORY CONSIDERATIONS: None recognized.

SECTION 16: OTHER INFORMATION

PREPARATION DATE: 10/10/2019
PREPARED BY: Dave Carey

GUIDE SPECIFICATION FOR PERMINATOR® EVOH UNDERSLAB GAS AND VAPOR BARRIER

SECTION 07 26 16

Below Grade Vapor Retarders

Revision Date: July 3, 2019

Specifier Notes: This guide specification is written according to the Construction Specifications Institute (CSI) MasterFormat. The section must be carefully reviewed and edited by the architect or engineer to meet the requirements of the project. Coordinate this section with other specification sections and the drawings.

Specifier Notes: PERMINATOR EVOH is a seven-layer co-extruded barrier manufactured from state-of-the-art polyethylene and EVOH resins. Designed to provide superior resistance to gas and moisture transmission, as well as water vapor, PERMINATOR EVOH is a highly resilient underslab gas/vapor barrier designed to restrict naturally occurring gases, such as radon, methane, gasoline, solvents, oils, and hydrocarbons, from migrating through the ground and into the concrete slab.

When properly installed, PERMINATOR EVOH resists gas and moisture migration into the building envelope to provide protection from toxic/harmful chemicals. It can be installed as part of a passive or active control system extending across the entire building, including floors, walls, and crawl spaces. PERMINATOR EVOH protects flooring and other moisture-sensitive furnishings in the building's interior from moisture and water vapor migration, greatly reducing condensation, mold, and degradation.

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Surface preparation.

B. Application of an underslab soil gas barrier.

1.02 RELATED SECTIONS

Specifier Notes: Edit the list of related sections as required for the project. List other sections dealing with work directly related to this section.

A. Section 03 30 00 - Concrete.

B. Section 07 10 00 – Dampproofing and Waterproofing.

C. Section 09 64 00 - Wood Flooring.

D. Section 09 65 00 - Resilient Flooring.

1.03 REFERENCES

A. ASTM D1434: Standard Test Method for Determining Gas Permeability Characteristics of Plastic Film and Sheeting.

B. ASTM D1709: Standard Test Methods for Impact Resistance of Plastic Film by the Free-Falling Dart Method.

C. ASTM E96: Standard Test Methods for Water Vapor Transmission of Materials.

D. ASTM E154: Standard Test Methods for Water Vapor Retarders Used in Contact with Earth Under Concrete Slabs.

E. ASTM E1643: Standard Practice for Installation of Water Vapor Retarders Used in Contact with Earth or Granular Fill Under Concrete Slabs.

F. ASTM E1745: Standard Specification for Plastic Water Vapor Retarders Used in Contact with Soil or Granular Fill Under Concrete Slabs.

G. ASTM F1249: Standard Test Method for Water Vapor Transmission Rate Through Plastic Film and Sheeting Using a Modulated Infrared Sensor.

H. K124/02/95: Determination of Radon Transmittance.

1.04 SUBMITTALS

A. Comply with Section 01 33 00 - Submittal Procedures.

B. Submit manufacturer's product data and application instructions.

1.05 QUALITY ASSURANCE

A. Use an experienced installer and adequate number of skilled personnel who are thoroughly trained and experienced in the application of the soil gas barrier.

B. Obtain gas barrier materials from a single manufacturer regularly engaged in manufacturing the product.

C. Provide products which comply with all state and local regulations controlling use of volatile organic compounds (VOCs).

1.06 PRECONSTRUCTION MEETING

A. Pre-Construction Meeting: Convene one week prior to installation of underslab soil gas barrier. Attendees to be as follows: - Architect, Engineer, General Contractor, Gas Barrier Installer, and Gas Barrier Manufacturer to discuss the installation in detail.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to site in manufacturer's original, unopened containers and packaging, with labels clearly identifying product name and manufacturer.

B. Store materials in a clean, dry area in accordance with manufacturer's instructions.

C. Protect materials during handling and application to prevent damage or contamination.

D. Ensure membrane is stamped with manufacturer’s name, product name, and membrane thickness at intervals of no more than 85” (220 cm).

1.08 ENVIRONMENTAL REQUIREMENTS

A. Product not intended for uses subject to abuse or permanent exposure to the elements.

B. Do not apply on frozen ground.

PART 2 PRODUCTS

2.01 MANUFACTURER

A. W. R. MEADOWS®, INC., PO Box 338, Hampshire, Illinois 60140-0338. (800) 342-5976. (847) 683-4500. Fax (847) 683-4544. Web Site www.wrmeadows.com.

2.02 MATERIALS

A. Soil Gas Barrier
  1. Performance-Based Specification: Gas barrier membrane shall be a seven layer co-extruded barrier manufactured from polyethylene and ethylene vinyl alcohol (EVOH) resins, meeting the shall meet the following minimum performance requirements:
    a. Maximum Water Vapor Permeance (ASTM E154 Sections 7, 8, 11, 12, 13, by ASTM E96, Method B or ASTM F1249)
      i. As received: 0.0098 perms.
      ii. After Wetting and Drying: 0.0079 perms.
      iii. Resistance to Plastic Flow and Temperature: 0.0079 perms.
      iv. Effect Low Temperature and Flexibility: 0.0097 perms.
      v. Resistance to Deterioration from Organisms and Substances in Contacting Soil: 0.0113 perms.
    b. Puncture Resistance, ASTM D1709: 2,600 grams.
    c. Tensile Strength, ASTM E154, Section 9: 58 Lb. Force/Inch.
    d. Radon Diffusion Coefficient, k124/02/95: $<1.1 \times 10^{-13}$ m^2/s.
    e. Methane Permeance, ASTM D1434: 3.68×10^{-12} GTR.
    f. Aqueous Phase Film Permeance
      i. Benzene Permeance: 1.57×10^{-10} m/s.
      ii. Toluene Permeance: 2.18×10^{-10} m/s.
      iii. Ethylbenzene Permeance: 1.71×10^{-10} m/s.
      iv. M & P Xylenes Permeance: 1.62×10^{-10} m/s.
      v. O Xylene Permeance: 1.53×10^{-10} m/s.

  2. Proprietary-Based Specification:
    a. PERMINATOR EVOH by W. R. MEADOWS.

2.03 ACCESSORIES

Specifier Notes: When PERMINATOR EVOH is to be used strictly as a water vapor barrier, only the PERMINATOR EVOH Tape is required to be used. In situations where the PERMINATOR EVOH is to be used as a soil gas barrier, PERMINATOR EVOH BUTYL TAPE is installed within a 12” (304.8 mm) overlap and then the seam is then taped with PERMINATOR EVOH Tape. Select accessories based on project requirements.

A. Seam Tape
  1. High Density Polyethylene Tape with pressure sensitive adhesive. Minimum width 4” (100 mm).
    a. PERMINATOR EVOH TAPE by W. R. MEADOWS.

B. Double Sided Seam Tape
  1. Double sided butyl tape for overlap sealing in gas barrier installations. Minimum width 2” (50 mm).
    a. PERMINATOR EVOH BUTYL TAPE by W. R. MEADOWS.

C. Pipe Collars
  1. Construct pipe collars from gas barrier material and pressure sensitive tape per manufacturer’s instructions.

PART 3 EXECUTION

3.01 SURFACE PREPARATION

Specifier Notes: A base for a gas-reduction system may require a 4” - 6” (101. 6 – 152.4 mm) gas permeable layer of clean coarse aggregate as specified by architectural or structural consultant after installation of the recommended gas collection system. In this situation, a cushion layer consisting of a non-woven geotextile fabric placed directly under PERMINATOR EVOH will help protect the barrier from damage due to possible sharp coarse aggregate. Surface preparation needs to be reviewed based on the specific project requirements.

A. Prepare surfaces in accordance with project requirements.

Specifier Notes: It may also be advisable to reference American Concrete Institute (ACI) 302.1R-15: Chapter 6, Section 6.1.4 – Base Material, for sub-grade preparation prior to placement of PERMINATOR EVOH. As this is a guide, reference to this document shall not be made in contract documents and any items in this document that the Architect/Engineer wants to be part of the contract documents, the items need to be reinstated in mandatory language for incorporation by the Architect/Engineer.

B. Level, tamp, or roll earth or granular material beneath the slab base.

3.02 EXAMINATION

A. Examine surfaces to receive membrane. Notify architect if surfaces are not acceptable. Do not begin surface preparation or application until unacceptable conditions have been corrected.

3.03 INSTALLATION

Specifier Notes: If PERMINATOR EVOH is being used as strictly a vapor barrier, then delete Section B below. If the requirement is for PERMINATOR EVOH to be used as a soil gas barrier for contaminated site installation, then delete Section A. It is also advisable to review the PERMINATOR EVOH Installation Guidelines for additional installation information that may be specific for the project requirements.

A. Vapor Barrier

1. Install the vapor barrier membrane in accordance with manufacturer’s instructions and ASTM E1643.

2. Unroll vapor retarder with the longest dimension parallel with the direction of the pour.

3. Lap vapor barrier over footings and seal to foundation walls with 4” (100 mm) seam tape.

4. Overlap joints 6” (152 mm) and seal with 4” (100 mm) seam tape and roll press into place.

5. Seal all penetrations (including pipes) with manufacturer’s written installation procedures.

6. No penetration of the vapor retarder is allowed except for reinforcing steel and permanent utilities.

7. Repair damaged areas by cutting patches of vapor barrier, overlapping damaged area 6” (150 mm) and taping all four sides with tape.

B. Soil Gas Barrier

1. Install the gas barrier membrane in accordance with manufacturer’s instructions and ASTM E1643.

2. Unroll gas barrier membrane with the longest dimension parallel with the direction of the pour.

3. Lap gas barrier over the footing and seal to foundation walls with 2” (50 mm) double sided butyl tape and roll press into place with rubber roller.

4. Apply gas barrier seam tape to the terminated edge of the gas barrier membrane and onto the concrete foundation.

5. Roll press into place.

4. Joint Overlap
    a. Apply double sided butyl tape 6” (150 mm) from the termination of the gas barrier membrane and press into place.
    b. Overlap the next layer of gas barrier membrane 12” (300 mm) and roll press into place.
    c. Apply gas barrier seam tape centered over the joint and roll press into place.

5. Repair of Damaged Areas
    a. Cut out damaged area of gas barrier membrane allowing for an overlap of 12” (300 mm) in all directions.
    b. Apply double sided butyl tape 6” (150 mm) from the cut edges of the gas barrier membrane in all directions and press into place.
    c. Place the new piece of gas barrier membrane overlapping the existing areas a minimum of 12” (300 mm) and roll press into place.
    d. Apply 4” (100 mm) gas barrier seam tape centered over the joint in all directions and roll press into place.

END OF SECTION

W. R. MEADOWS®
SEALTIGHT®
A Family Company Since 1926
QUALITY...SERVICE...INTEGRITY

INSTALLATION GUIDELINES
PERMINATOR® EVOH

PERMINATOR EVOH is a seven-layer co-extruded barrier manufactured from state-of-the-art polyethylene and EVOH resins. Designed to provide superior resistance to gas and moisture transmission, PERMINATOR EVOH is a highly resilient underslab gas/vapor barrier designed to restrict naturally occurring gases, such as radon, methane, gasoline, solvents, oils, and hydrocarbons, from migrating through the ground and into the concrete slab. PERMINATOR EVOH is furnished in rolls which are 10′ (3 m) wide and 150′ (45.7 m) long.

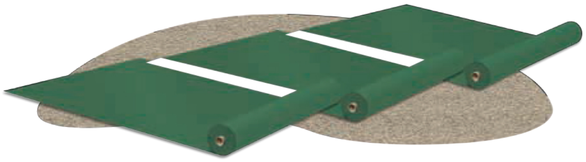
This document has been created as an addendum to the PERMINATOR EVOH technical data sheet to provide the recommended procedure to use when installing PERMINATOR EVOH in applications featuring penetrations.

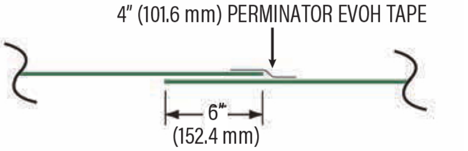
PLACEMENT

Level and tamp or roll granular base as specified. A base for a gas-reduction system may require a 4″ - 6″ (101. 6 – 152.4 mm) gas permeable layer of clean coarse aggregate as specified by architectural or structural drawings after installation of the recommended gas collection system. In this situation, a cushion layer consisting of a non-woven geotextile fabric placed directly under PERMINATOR EVOH will help protect the barrier from damage due to possible sharp coarse aggregate.

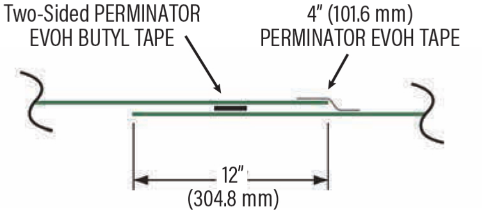
Unroll PERMINATOR EVOH running the longest dimension parallel with the direction of the pour and pull open all folds to full width.

Extend PERMINATOR EVOH across the top of the footing and turn up against the vertical wall. This will sandwich PERMINATOR EVOH between the footing, wall, and poured concrete floor. Terminate PERMINATOR EVOH at full slab thickness and seal to wall with PERMINATOR EVOH BUTYL TAPE. Prime concrete surfaces, when necessary, and assure they are dry and clean prior to applying two-sided PERMINATOR EVOH BUTYL TAPE. Apply even and firm pressure with a rubber roller. Overlap joints a minimum of 6″ (101.6 mm) and seal overlap with 4″ (101.6 mm) PERMINATOR EVOH TAPE. When used as a gas barrier, overlap joints a minimum of 12″ (304.8 mm) and seal in between overlap with two-sided PERMINATOR EVOH BUTYL TAPE. Then seal with 4″ (101.6 mm) PERMINATOR EVOH TAPE centered on the overlap seam.


PERMINATOR EVOH Overlapping Roll-out Method



PERMINATOR EVOH Overlap Joint Sealing Method
Vapor Retarder Applications



PERMINATOR EVOH Overlap Joint Sealing Method
Gas Barrier Applications

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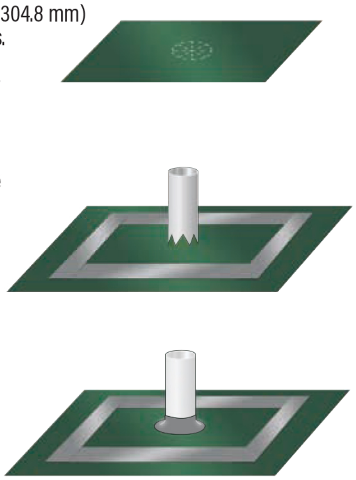
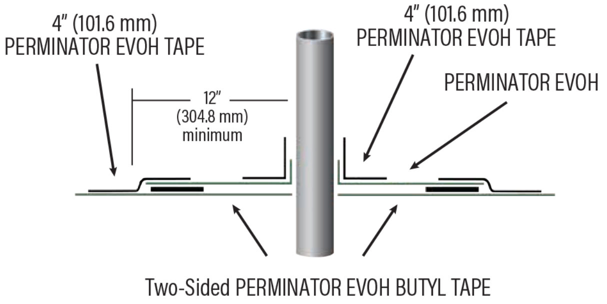
INSTALLATION GUIDELINES
PERMINATOR® EVOH

SINGLE PENETRATION PIPE BOOT INSTALLATION

Seal around all plumbing, conduit, support columns, or other penetrations that protrude through the PERMINATOR EVOH membrane. Fabricate pipe boots from PERMINATOR EVOH excess material. Cut a square large enough to overlap 12" (304.8 mm) in all directions. Mark where to cut opening on the center of the square and cut four to eight slices about 3/8" (9.5 mm) less than the diameter of the pipe. Force the square over the pipe leaving the tightly stretched cut area around the bottom of the pipe with approximately a 1/2" (12.7 mm) of the boot material running vertically up the pipe. No more than a 1/2" (12.7 mm) of stretched boot material is recommended. Once boot is positioned, seal the perimeter to the membrane by applying two-sided PERMINATOR EVOH BUTYL TAPE in between the two layers. Secure boot down firmly over the membrane taking care not to have any large folds or creases. Use PERMINATOR EVOH TAPE to secure the boot to the pipe. Tape completely around pipe, overlapping the PERMINATOR EVOH square, to create a tight seal against the pipe. Complete the process by taping over the boot perimeter edge with PERMINATOR EVOH TAPE to create a monolithic membrane between the surface of the slab and gas/moisture sources below and at the slab perimeter.



1. Cut a square of PERMINATOR EVOH barrier to extend at least 12" (304.8 mm) from the pipe in all directions.
2. Cut four to eight slices about 3/8" (9.5 mm) less than the diameter of the pipe.
3. Force over pipe and tape the underside boot perimeter to existing barrier with two-sided PERMINATOR EVOH BUTYL TAPE.
4. Tape over the boot perimeter edge with PERMINATOR EVOH TAPE.
5. Use PERMINATOR EVOH TAPE and overlap 1" (25.4 mm) at the seam.

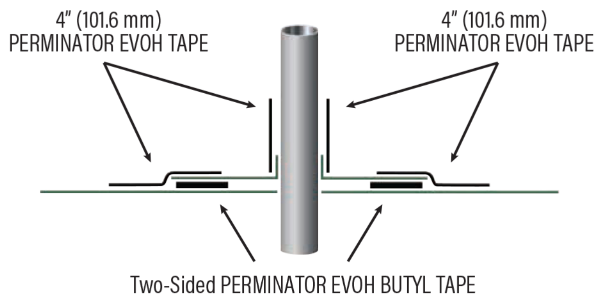


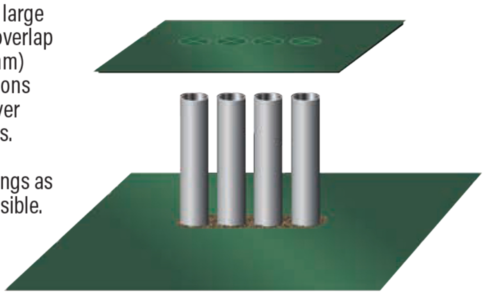
Square Material Pipe Boot

MULTIPLE PENETRATION PIPE BOOT INSTALLATION - OPTION 1

Cut a patch large enough to overlap 12" (304.8 mm) in all directions of penetrations. Mark where to cut openings and cut four to eight slices about 3/8" (9.5 mm) less than the diameter of the penetration for each. Force patch material over penetration to achieve a tight fit and form a lip. Once patch is positioned, seal the perimeter to the membrane by

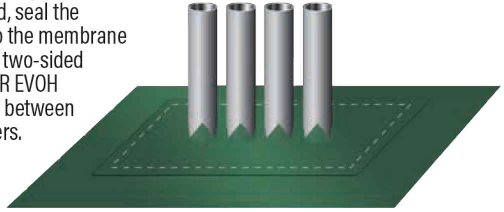
applying two-sided PERMINATOR EVOH BUTYL TAPE in between the two layers. After applying two-sided PERMINATOR EVOH BUTYL TAPE between the patch and membrane, tape around each of the penetrations and the patch with 4″ (101.6 mm) PERMINATOR EVOH TAPE. For additional protection apply, REZI-WELD™ 1000 from W. R. MEADOWS around the penetrations.



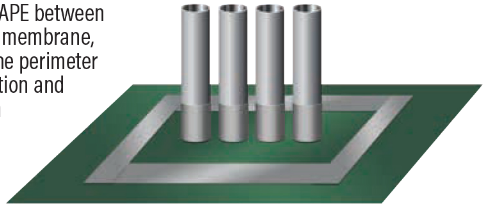


Cut a patch large enough to overlap 12″ (305.8 mm) in all directions and slide over penetrations.

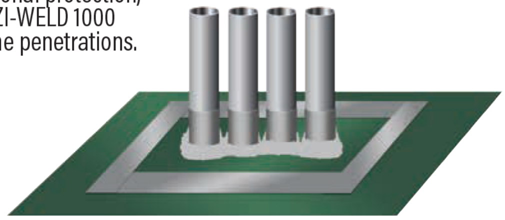
Make openings as tight as possible.



Once the overlay patch is positioned, seal the perimeter to the membrane by applying two-sided PERMINATOR EVOH BUTYL TAPE between the two layers.



After applying PERMINATOR EVOH BUTYL TAPE between the patch and membrane, tape around the perimeter of the penetration and the patch with 4″ (101.6 mm) PERMINATOR EVOH TAPE.



For additional protection, apply REZI-WELD 1000 around the penetrations.

MULTIPLE PENETRATION PIPE BOOT INSTALLATION - OPTION 2

Install PERMINATOR EVOH as closely as possible to pipe penetrations to minimize the amount of REZI-WELD 1000 necessary to seal around all penetrations. Once PERMINATOR EVOH is in place, remove soil or other particles with a dry cloth or a fine broom to allow for improved adhesion to the REZI-WELD 1000 material. Create a dam around the penetration area approximately 2″ (50.8 mm) away from the pipe or other vertical penetrations by removing the release liner from the back of a 1″ (25.4 mm) weather stripping foam and adhere to PERMINATOR EVOH. Form a complete circle to contain the REZI-WELD 1000 material. Once mixed, pour REZI-WELD 1000 around the pipe penetrations. If needed, a brush or a flat wooden stick can be used to direct REZI-WELD 1000 completely around penetrations creating a complete seal.

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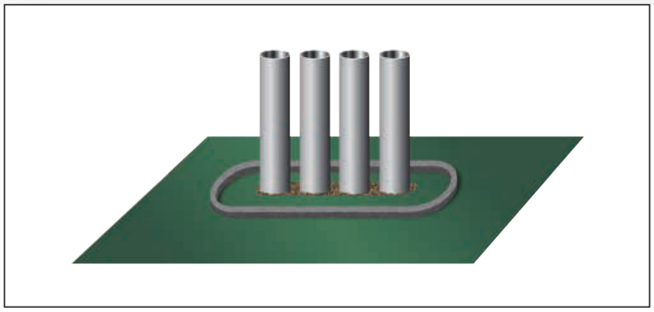
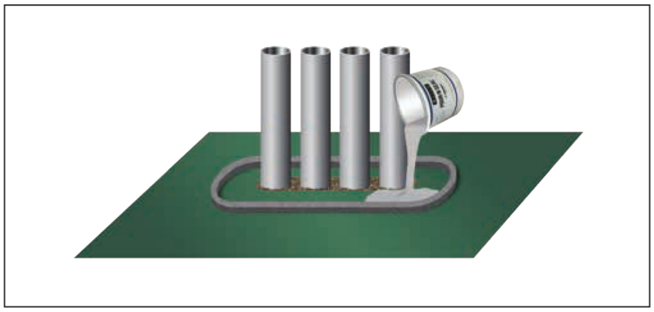
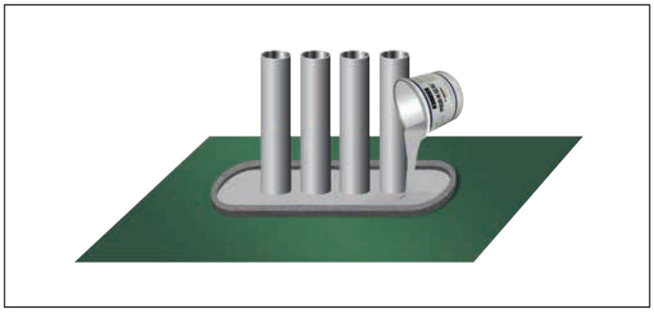
INSTALLATION GUIDELINES
PERMINATOR® EVOH



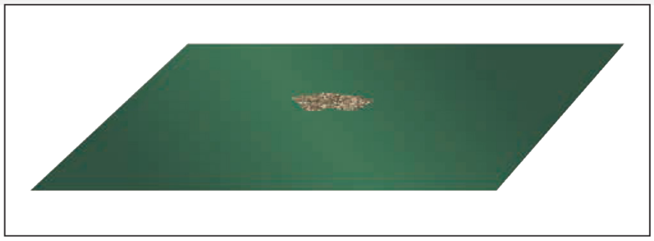


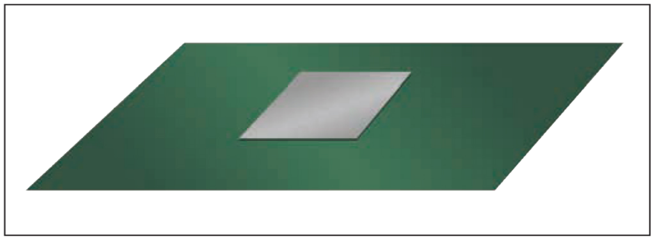


PERMINATOR EVOH REPAIR INSTRUCTIONS

LARGE PATCHES

Proper installation requires all holes and openings are repaired prior to placing concrete. When patching small holes, simply use PERMINATOR EVOH TAPE.





PERMINATOR EVOH REPAIR INSTRUCTIONS

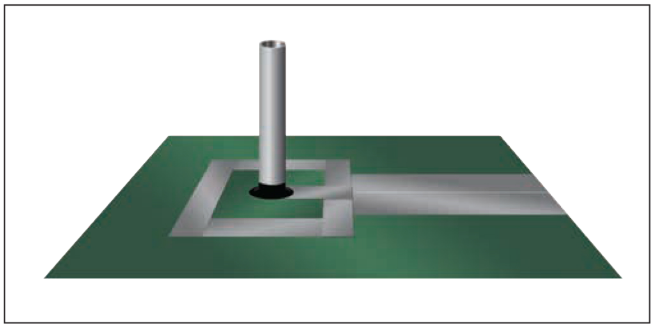
PIPE PENETRATIONS

When installing PERMINATOR EVOH around pipe penetrations, vertical columns, electrical ducts, and other obstructions, cut the material to the nearest outside edge. This cut can be sealed with PERMINATOR EVOH TAPE by simply centering it over the cut. Once the tape is placed correctly, apply pressure to assure a complete seal. All holes or penetrations through the membrane will need to be patched with PERMINATOR EVOH TAPE.

PERMINATOR EVOH PROTECTION

When installing reinforcing steel and utilities, in addition to the placement of concrete, take precaution to protect PERMINATOR EVOH. Carelessness during installation can damage the most puncture-resistant membrane. Sheets of plywood cushioned with geotextile fabric temporarily

placed on PERMINATOR EVOH provide for additional protection in high traffic areas including concrete buggies. Use only brick-type or chair-type reinforcing bar supports to protect PERMINATOR EVOH from puncture. Avoid driving stakes through PERMINATOR EVOH. If this cannot be avoided, each individual hole must be repaired. To avoid penetrating PERMINATOR EVOH when installing screed supports, utilize non-penetrating support. If a cushion or blotter layer is required in the design between PERMINATOR EVOH and the slab, additional care should be given if sharp crushed rock is used. Washed rock will provide less chance of damage during placement. Care must be taken to protect blotter layer from precipitation before concrete is placed.



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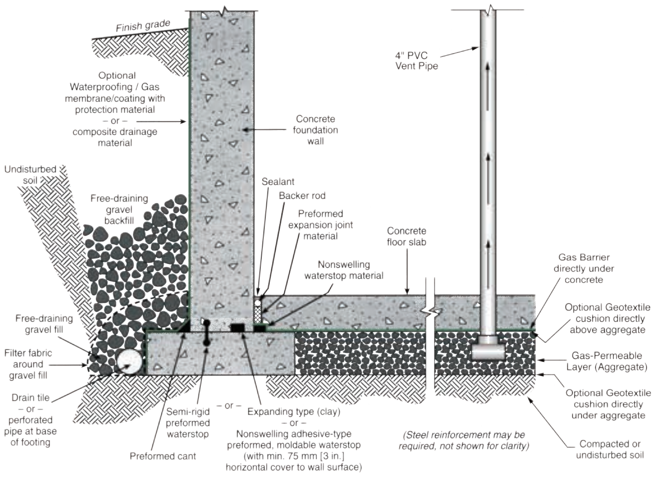
INSTALLATION GUIDELINES
PERMINATOR® EVOH PENETRATIONS

PERMINATOR EVOH is a seven-layer co-extruded barrier manufactured from state-of-the-art polyethylene and EVOH resins. Designed to provide superior resistance to gas and moisture transmission, PERMINATOR EVOH is a highly resilient underslab gas/vapor barrier designed to restrict naturally occurring gases, such as radon, methane, gasoline, solvents, oils, and hydrocarbons, from migrating through the ground and into the concrete slab. PERMINATOR EVOH is furnished in rolls which are 10′ (3 m) wide and 150′ (45.7 m) long.

This document has been created as an addendum to the PERMINATOR EVOH technical data sheet to provide the recommended procedure to use when installing PERMINATOR EVOH in applications featuring penetrations.



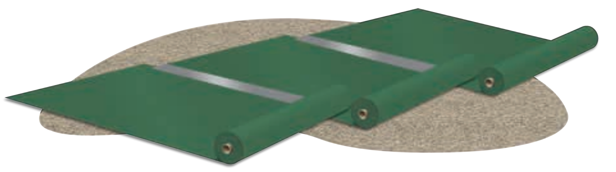
Elements of a moisture/gas-resistant floor system. General illustrations only.
(Note: this example shows multiple options for waterstop placement.)
(Note: the example show multiple options for waterstop placement.)

PLACEMENT

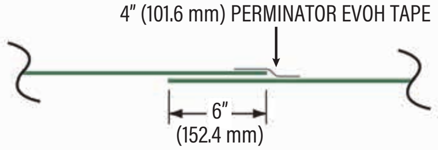
Level and tamp or roll granular base as specified. A base for a gas-reduction system may require a 4″ - 6″ (101. 6 – 152.4 mm) gas permeable layer of clean coarse aggregate as specified by architectural or structural drawings after installation of the recommended gas collection system. In this situation, a cushion layer consisting of a non-woven geotextile fabric placed directly under PERMINATOR EVOH will help protect the barrier from damage due to possible sharp coarse aggregate.

Unroll PERMINATOR EVOH running the longest dimension parallel with the direction of the pour and pull open all folds to full width.

Lap PERMINATOR EVOH over the footings and seal with PERMINATOR EVOH BUTYL TAPE at the footing-wall connection. Prime concrete surfaces, when necessary, and assure they are dry and clean prior to applying two-sided PERMINATOR EVOH BUTYL TAPE. Apply even and firm pressure with a rubber roller. Overlap joints a minimum of 6″ (101.6 mm) and seal overlap with 4″ (101.6 mm) PERMINATOR EVOH TAPE. When used as a gas barrier, overlap joints a minimum of 12″ (304.8 mm) and seal in between overlap with two-sided PERMINATOR EVOH BUTYL TAPE. Then seal with 4″ (101.6 mm) PERMINATOR EVOH TAPE centered on the overlap seam.



PERMINATOR EVOH Overlapping Roll-out Method



**PERMINATOR EVOH Overlap Joint Sealing Method
Vapor Retarder Applications**

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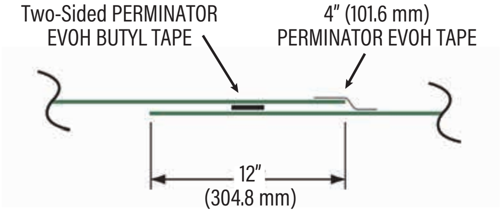
INSTALLATION GUIDELINES
PERMINATOR® EVOH PENETRATIONS



PERMINATOR EVOH Overlap Joint Sealing Method Gas Barrier Applications

SINGLE PENETRATION PIPE BOOT INSTALLATION

Seal around all plumbing, conduit, support columns, or other penetrations that protrude through the PERMINATOR EVOH membrane. Fabricate pipe boots from PERMINATOR EVOH excess material. Cut a square large enough to overlap 12" (304.8 mm) in all directions. Mark where to cut opening on the center of the square and cut four to eight slices about 3/8" (9.5 mm) less than the diameter of the pipe. Force the square over the pipe leaving the tightly stretched cut area around the bottom of the pipe with approximately a 1/2" (12.7 mm) of the boot material running vertically up the pipe. No more than a 1/2" (12.7 mm) of stretched boot material is recommended. Once boot is positioned, seal the perimeter to the membrane by applying two-sided PERMINATOR EVOH BUTYL TAPE in between the two layers. Secure boot down firmly over the membrane taking care not to have any large folds or creases. Use PERMINATOR EVOH TAPE to secure the boot to the pipe. Tape completely around pipe, overlapping the PERMINATOR EVOH square, to create a tight seal against the pipe. Complete the process by taping over the boot perimeter edge with PERMINATOR EVOH TAPE to create a monolithic membrane between the surface of the slab and gas/moisture sources below and at the slab perimeter.

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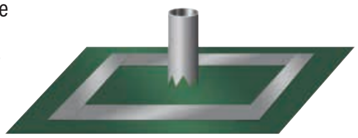
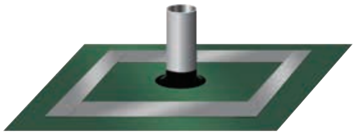
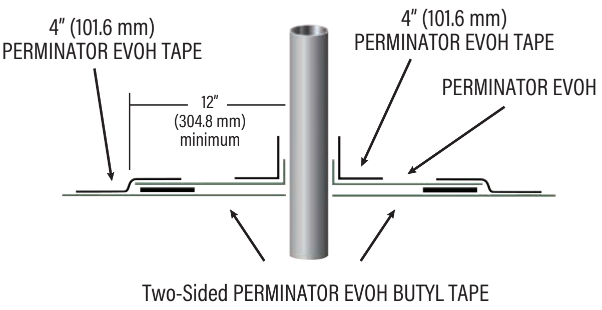
3. Force over pipe and tape the underside boot perimeter to existing barrier with two-sided PERMINATOR EVOH BUTYL TAPE.



4. Tape over the boot perimeter edge with PERMINATOR EVOH TAPE.
5. Use PERMINATOR EVOH TAPE and overlap 1" (25.4 mm) at the seam.



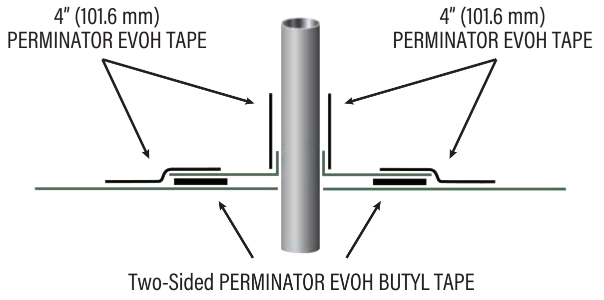


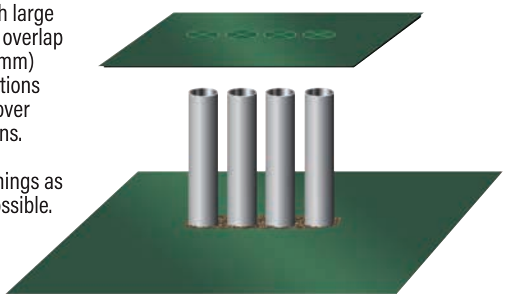
Square Material Pipe Boot

MULTIPLE PENETRATION PIPE BOOT INSTALLATION - OPTION 1

Cut a patch large enough to overlap 12" (304.8 mm) in all directions of penetrations. Mark where to cut openings and cut four to eight slices about 3/8" (9.5 mm) less than the diameter of the penetration for each. Force patch material over penetration to achieve a tight fit and form a lip. Once patch is positioned, seal the perimeter to the membrane by

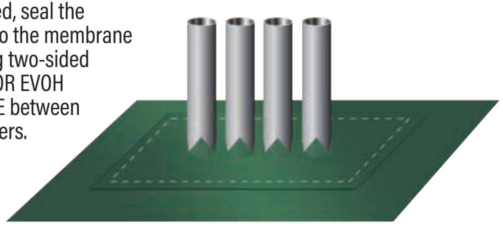
applying two-sided PERMINATOR EVOH BUTYL TAPE in between the two layers. After applying two-sided PERMINATOR EVOH BUTYL TAPE between the patch and membrane, tape around each of the penetrations and the patch with 4″ (101.6 mm) PERMINATOR EVOH TAPE. For additional protection apply, REZI-WELD™ 1000 from W. R. MEADOWS around the penetrations.



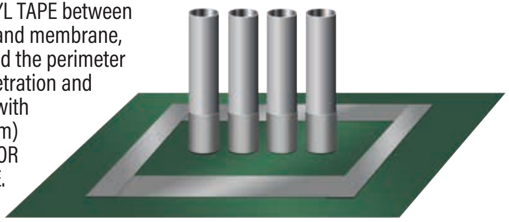


Cut a patch large enough to overlap 12″ (305.8 mm) in all directions and slide over penetrations.

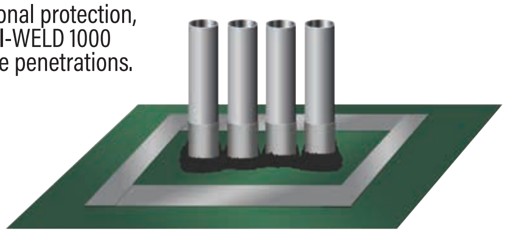
Make openings as tight as possible.



Once the overlay patch is positioned, seal the perimeter to the membrane by applying two-sided PERMINATOR EVOH BUTYL TAPE between the two layers.



After applying PERMINATOR EVOH BUTYL TAPE between the patch and membrane, tape around the perimeter of the penetration and the patch with 4″ (101.6 mm) PERMINATOR EVOH TAPE.



For additional protection, apply REZI-WELD 1000 around the penetrations.

MULTIPLE PENETRATION PIPE BOOT INSTALLATION - OPTION 2

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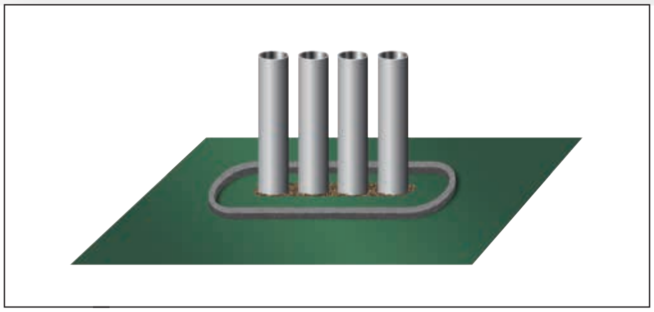
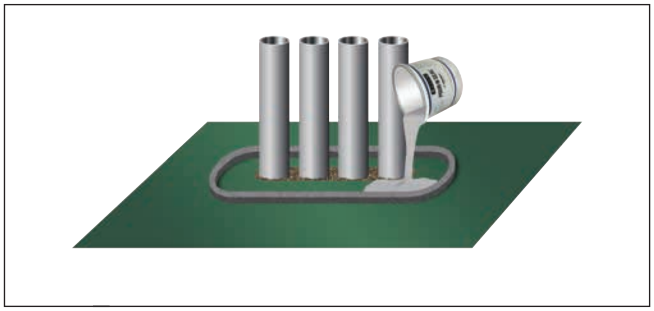
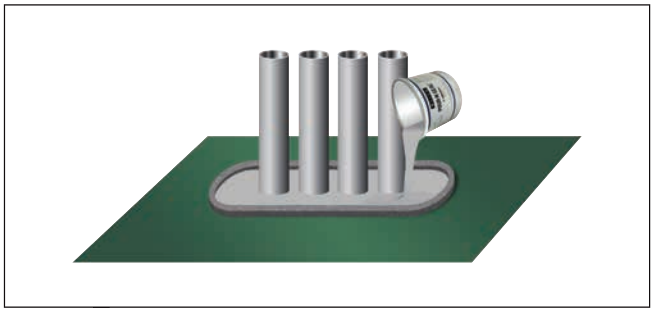
INSTALLATION GUIDELINES
PERMINATOR® EVOH PENETRATIONS







PERMINATOR EVOH REPAIR INSTRUCTIONS

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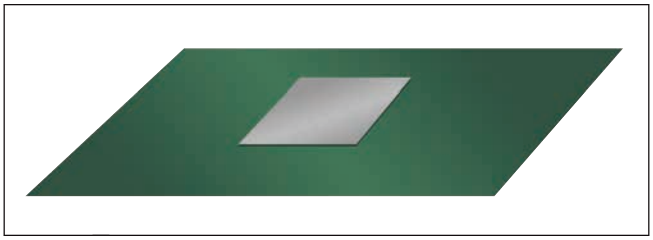

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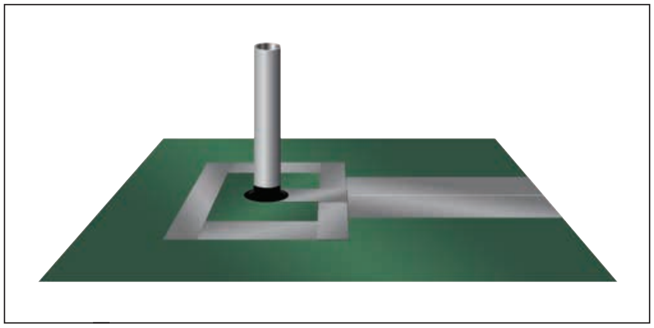

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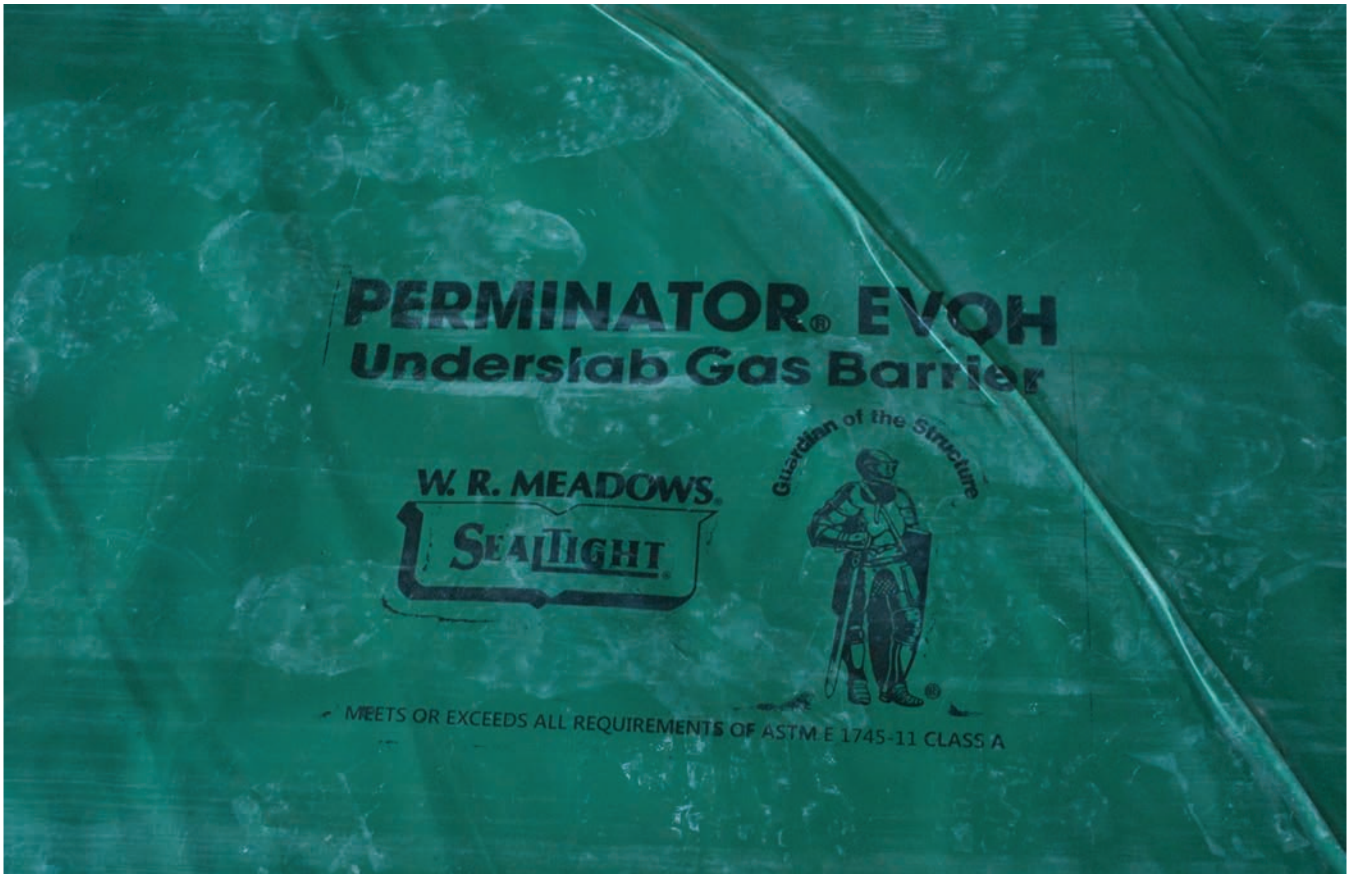
TECHNICAL BULLETIN
SEAM HEAT WELD FOR PERMINATOR® EVOH

Overlap edges 6” (152.4 mm) in preparation for thermal seaming. This overlap area must be cleaned of all dust, dirt, water and foreign debris no more than 30 minutes prior to the heat-seaming operation. Acceptable field-welding methods are thermal fusion and extrusion. The thermal energy for fusion welding can be provided by a single or dual hot wedge welder, hot air or a combination. Extrusion welding rod should be made from the same resin class as the bonding surface of the gas barrier being extruded to. Trial welds, at least 4’ (1.2 m) long, shall be made on scraps of the same material being installed.

Three non-destructive test methods are available to verify field welds, including: center air channel pressure testing for double-track fusion seams, vacuum box testing for single-track fusion seams and extrusion seams or patches, and air lance testing for single-track fusion seams.



07/28/20

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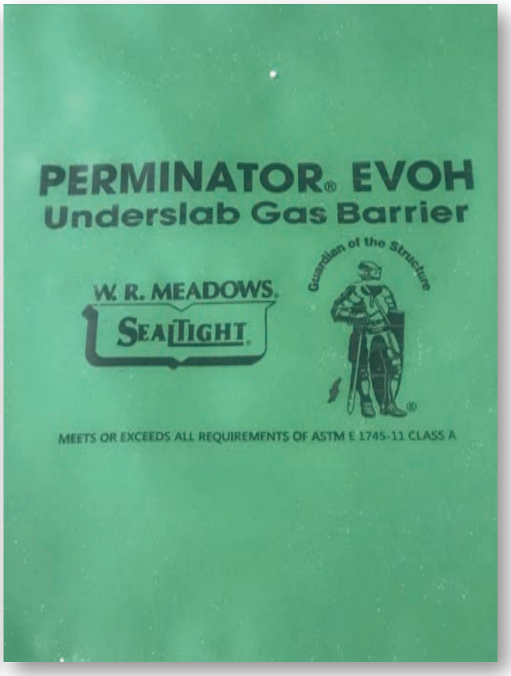

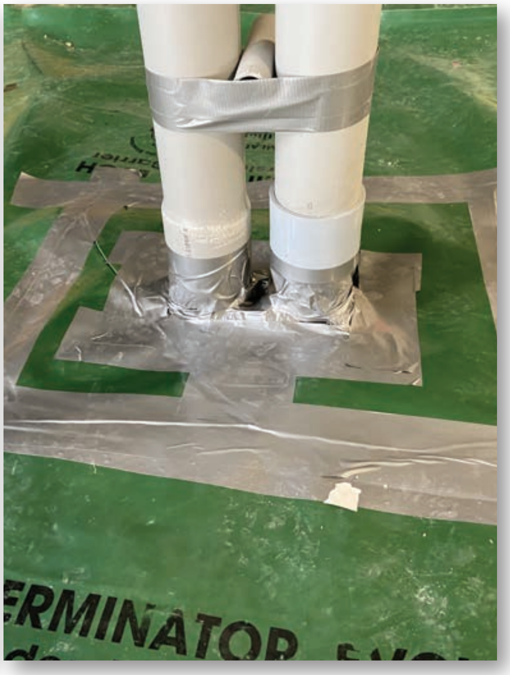

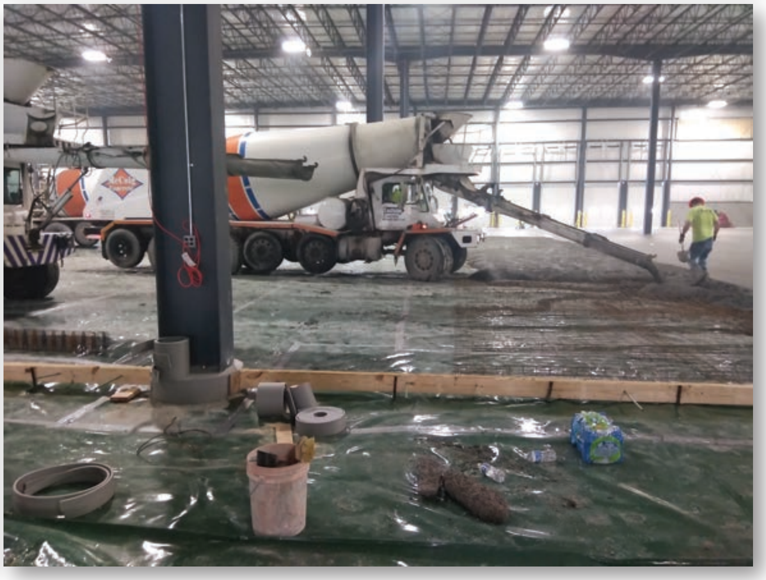

Project:	FCA Hoover
Location:	Warren, Michigan, USA
Engineer:	IBI Group
General Contractor:	Roncelli
Subcontractor:	Arisco Contracting Group, Inc.
Salesperson:	Jason Everhart

Products:	PERMINATOR® EVOH PERMINATOR EVOH TAPE PERMINATOR BUTYL TAPE SEALMASTIC™ TYPE II
Scope:	500,000 square feet

NO. 714-A **DATA SHEET**

MasterFormat: 07 14 16

OCTOBER 2017
(Supersedes November 2013)

MEL-ROL® LM

Single-Component, Water-Based, Polymer-Modified, Cold-Applied, Waterproofing Membrane

DESCRIPTION

MEL-ROL LM is a single-component, polymer-modified, cold-applied, water-based, liquid waterproofing membrane ideal for below-grade vertical seamless waterproofing applications. We have taken the same high quality rubber polymers found in W. R. MEADOWS' successful MEL-ROL "peel and stick" membrane and converted them into a heavy-bodied, high solids, quick drying liquid membrane.

With MEL-ROL LM, installation time is reduced, utilizing either a spray or roller application. A variety of different protection courses, insulation boards, or drainage boards can be embedded into the membrane to create a superior waterproofing system. With the application of PERMINATOR® vapor barrier over the membrane, a composite system can be created that has the combined advantages of both "peel and stick" and liquid-applied membranes.

USES

MEL-ROL LM can be used on new and remedial waterproofing applications on concrete or masonry block substrates. Since the formula is water-based, MEL-ROL LM can also be used on both ICFs and "green concrete" applications.

FEATURES/BENEFITS

- Waterproof – very low vapor permeability (perm rating).
- Superior elongation – bridges minor cracks; will not become brittle with age.
- Fully bonded – water will not run beneath the membrane.
- High solids, single-component, fast drying formulation – easy to apply; low cost application equipment; eliminates two-component mixing problems.
- Cold-applied/water-based – will not adversely affect insulated forms (ICFs) or various protection board options. Allows for application to damp or "green concrete."
- VOC content is 0.0 g/L. Produces no harmful odors.
- Easy application – no heating necessary. Eliminates fire hazards associated with heating kettles. Apply with roller or airless sprayer.

PACKAGING

5 Gallon (18.93 Liter) Pails
55 Gallon (208.20 Liter) Drums*
*Special order only

COVERAGE

20 - 25 ft.^{2}/gal. (0.49 – 0.61 m^2/L) @ 60 mils. Coverage dependent on substrate type, weather, and application conditions.

SPECIFICATIONS

- Complies with all current federal, state, and local maximum allowable VOC requirements, including National EPA VOC Emission Standard for Architectural Coatings, CARB, LADCO, OTC Phase I and II, and SCAQMD.

SHELF LIFE

When stored indoors in original, unopened containers at temperatures between 40° - 90° F (4° - 32° C), optimum performance and best use is obtained within six months of date of manufacture.

APPLICATION

Surface Preparation … All surfaces must be clean (free of all coatings and curing compounds), free of frost, relatively smooth, and structurally sound. Patch any bug holes, tie holes, large gaps, or cracks with MEADOW-PATCH® 5 or MEADOW-PATCH 20 from W. R. MEADOWS. All loose laitance on the substrates, such as dirt, dust, loose stones, and debris, should be either swept or blown clean. All inside corners should be addressed with a cove of BEM from W. R. MEADOWS prior to application of MEL-ROL LM.

CONTINUED ON THE REVERSE SIDE…

All shrinkage cracks less than 1/16" (1.6 mm) should be pretreated with a 60-mil coat of MEL-ROL LM 6" (152.4 mm) wide. All cracks greater than 1/16" (1.6 mm) should be taped with DETAIL STRIP from W. R. MEADOWS prior to application of the membrane. For specific project recommendations, please contact W. R. MEADOWS technical services.

Mixing ... MEL-ROL LM is designed to be used from the pail or drum with little or no mixing. However, if water appears on the surface, mix thoroughly with a low-speed mechanical mixer prior to application.

Priming ... To reduce blistering on concrete surfaces, a thin coat of MEL-ROL LM diluted with water may be required. (Approximate dilution ratio of MEL-ROL LM to water is between 4:1 and 5:1.)

Thoroughly mix primer with a mechanical mixer. Prime the entire concrete surface to be waterproofed by spraying or rolling on a single coat at a coverage rate of 100 - 150 ft.^{2}/gal. (2.45 - 3.68 m^2/L). Allow primer to dry (approximately one hour, depending on temperature and conditions).

TECHNICAL DATA

Membrane		
Property	Typical Value	Test Method
Color	Black	
Solids	70%	
VOC Content	0 g/L	
Total Cure Time	16 - 24 hours	
Service Temperature	-20° - 140° F (-29° - 60° C)	
Application Temperature	40˚ F (4.4° C) minimum	
Shore “00” Hardness	Passes	ASTM C836
Stability	Exceeds	ASTM C836
Elongation	1500%	ASTM D412
Water Absorption	0.7%	ASTM D1970
WVT	0.03 Perms	ASTM E96, B
Composite (55 Mil Membrane/10 Mil PERMINATOR)		
Peel Adhesion	7 lb./in. (125 g/mm)	ASTM C794
Tensile Strength (Film)	5000 psi (36 MPa)	ASTM D412 (Die C)
Elongation	900%	ASTM D412 (Die C)
Water Vapor Permeability	0.02 Perms (0.013 g/m^2/24 h)	ASTM E96, B
Water Absorption	0.1%	ASTM D1970
Resistance to Hydrostatic Head	48 psi (0.3 MPa)	ASTM D751
Puncture Resistance	22 lbf. (98 N)	ASTM D4833

Detailing ... After surface preparations are complete, detailing should be addressed. The desired thickness of membrane coverage is 120 mils for inside/outside corners and non-moving and hairline cracks, as well as around drains and penetrations. Request and view the W. R. MEADOWS WATERPROOFING CONTRACTORS' HANDBOOK for additional information.

Footing Details ... Use DETAIL STRIP from W. R. MEADOWS for impaction sheet coverage. First, fold strips lengthwise and then cut at the fold. Material is then ready to install as 4 ½" (114.3 mm) strips on either side of the rebar. Any excess can be turned down on the face of the footing. Next, fill the voids around rebars in the keyway with BEM. Pour the walls. Install DETAIL STRIP horizontally along the wall where it meets the footing, placing half the material up the wall and the other half onto the footing. Extend the material 4 ½" (114.3 mm) beyond outside corners. Slit extended portion of DETAIL STRIP lengthwise. Place the horizontal flap out onto the footing and bend the vertical flap around the wall. Repeat this procedure in the opposite direction. In high water table applications, install WATERSTOP EC from W. R. MEADOWS directly to the cold joint before application of DETAIL STRIP.

Roller Application ... MEL-ROL LM can be applied directly from the container using a ¾" (19.1 mm) nap roller. Apply in two coats, each 30 mils thick, allowing first coat to reach initial set prior to application of second coat.

Spray Application ... MEL-ROL LM may be sprayed on at a minimum coverage thickness of 60 mils wet (45 mils dry). To obtain 60 mils wet thickness, and to prevent slumping, apply MEL-ROL LM in two coats of 30 wet mils. Apply the second coat after the first coat has dried (approximately one to two hours).

Spraying Equipment ... MEL-ROL LM is most effectively applied by using the Graco HydraMax 350 or the Graco GH833 Big Rig. The Graco heavy-duty texture gun is recommended for use with the following tips: For best results, use the 0.051″ (Graco GHD551) heavy-duty switch tip. For spraying of primer coat, a smaller orifice tip such as the 0.035″ (Graco GHD635) can be used. Tips should be reversible types for easy clean out. For more complete spraying equipment information, please view INSTALLATION INSTRUCTIONS: SPRAYER EQUIPMENT GUIDELINES FOR W. R. MEADOWS FLUID-APPLIED MEMBRANES available at www.wrmeadows.com.

Horizontal Application ... For horizontal applications, use HYDRALASTIC 836 from W. R. MEADOWS.

Thickness Control ... Frequently inspect surface area with a wet mil gauge to ensure desired consistent thickness is achieved. Porous substrates or masonry block walls may require additional coats to obtain desired thickness.

Cleanup ... Material should not be left in the pump, lines, or gun when finished spraying. CAUTION: Solvents must not come in contact with MEL-ROL LM in the sprayer, as they will break the emulsion and plug up the entire sprayer system. After spraying, promptly flush water only (no soap) through the system until pump and hose are clear [approx. five gallons (18.9 L)]. Aromatic solvents, such as xylene or toluene [approx. two gallons (7.6 L)], should be used for final flushing after water is flushed through the pump and lines.

Mineral spirits, paint thinner, gasoline, etc., must not be used to flush system. NOTE: Water must be flushed through the machine to remove any solvents prior to spraying of MEL-ROL LM.

Protection ... Cover vertical applications with PROTECTION COURSE, MEL-DRAIN™, or PERMINATOR (10 mil) from W. R. MEADOWS. Surfaces must be covered within 45 days.

Backfilling ... Allow 24 hours for complete cure of membrane prior to backfilling.

PRECAUTIONS

Do not freeze. Do not apply MEL-ROL LM if rainfall is forecast or imminent within 12 hours. For horizontal applications, HYDRALASTIC 836 is recommended. Do not apply MEL-ROL LM or primer when air, material, and surface temperatures are expected to fall below 40˚ F (4.4° C) within four hours of completed application. Sprayed urethane foams applied over MEL-ROL LM can melt the membrane and cause delamination and failure due to the exothermic reaction that takes place after spraying the foam. These foams should not be sprayed over MEL-ROL LM. The use of MEL-ROL LM does not negate the need for relief of hydrostatic heads. A complete drain tile system should be placed around the exterior of footing and under slabs, as required.

LEED INFORMATION

May help contribute to LEED credits:

- EAp2: Minimum Energy Performance
- EAc2: Optimize Energy Performance
- MRc9: Construction and Demolition Waste Management
- EQc2: Low-Emitting Materials [For Healthcare and Schools (exterior-applied products) ONLY]

For BIM assemblies, CAD details, most recent data sheet, further LEED information, and SDS, visit www.wrmeadows.com.

GreenLine® By W. R. MEADOWS
Environmentally Responsible Products
for Concrete Performance

SAFETY DATA SHEET

SECTION 1: PRODUCT AND COMPANY IDENTIFICATION

Product: MEL-ROL® LM
Part Number: 6511000
Manufacturer: W. R. MEADOWS, INC.
Address: 300 Industrial Drive
Hampshire, Illinois 60140
Telephone: (847) 214-2100
In case of emergency, dial (800) 424-9300 (CHEMTREC)
Revision Date: 3/14/2022
Product Use: Cold-Applied Waterproofing Membrane

SECTION 2: HAZARDS IDENTIFICATION/EXPOSURE LIMITS

HMIS	
|Health|	|1|
|Flammability|	|1|
|Reactivity|	|0|
|Personal Protection|	| |

Product is classified as non-hazardous per OSHA 1910.1200.

SECTION 3: HAZARDS COMPONENTS

Chemical Name:	CAS Number	% by Weight	SARA 313	Vapor Pressure (mm Hg@20°C)	LEL (@25°C)
1. Petroleum Asphalt	8052-42-4	50-55	No	N/A	N/A
2. Petroleum Oil Base Stock	64742-65-0	50-55	No	N/A	0.9

N/A: Not Applicable

Under the reporting requirements of Section 313 of Title III of the Superfund Amendments and Reauthorization Act of 1966 (SARA) and 40 CFR Part 372, chemicals listed on the 313 List (40 CFR Part 373.65) are identified under the heading "SARA 313."

SECTION 4: EMERGENCY AND FIRST AID PROCEDURES

EYE CONTACT: Flush eyes with water for fifteen (15) minutes. If symptoms persist, seek medical attention.

SKIN CONTACT: Wash affected areas with mild soap and water.

INHALATION: Not expected to be an exposure route as supplied. If respiratory symptoms develop, seek medical attention.

INGESTION: Dilute with liquid unless the victim is unconscious or very drowsy. Do not induce vomiting. If vomiting spontaneously occurs, prevent lung aspiration. Seek immediate medical attention.

MOST IMPORTANT SYMPTOMS/EFFECTS, ACUTE AND CHRONIC: See Section Eleven for Symptoms/Effects.

SECTION 5: FIRE AND EXPLOSIVES HAZARDS

FLASHPOINT: Product will not flash due to water content.

EXTINGUISHING MEDIA: Water fog, foam, dry chemical.

CHEMICAL/COMBUSTION HAZARDS: Oxides and compounds of nitrogen/sulfur, carbon monoxide/dioxide, and incomplete combustion products.

PRECAUTIONS/PERSONAL PROTECTIVE EQUIPMENT: Avoid smoke inhalation. Use appropriate personal protective equipment.

SECTION 6: ACCIDENTAL RELEASE MEASURES

SPILL OR LEAK PROCEDURES: Avoid direct contact. Dike and contain spilled material. Remove source of spill if safe to do so. Apply absorbent and place clean-up material in sealed/marked containers for proper disposal. Clean-up materials will be classified as non-hazardous waste.

SECTION 7: HANDLING AND STORAGE

SAFE HANDLING PROCEDURES: Avoid direct contact.

SAFE STORAGE: Prevent product from freezing.

SECTION 8: EXPOSURE CONTROLS/PERSONAL PROTECTION

	OSHA				ACGIH			
Chemical Name:	PEL	PEL/CEILING	PEL/STEL	SKIN	TLV	TLV/CEILING	TLV/STEL	SKIN
1. Petroleum Asphalt	5 mg/m^3*	N/E	N/E	No	0.5 mg/m^3*	N/E	N/E	N/E
2. Petroleum Oil Base Stock	N/E	N/E	N/E	No	5 mg/m^3+	N/E	N/E	N/E

*: Asphalt Fumes
+: Mineral Oil Mist in Air
N/E: Not Established

ENGINEERING CONTROLS: None required under normal use conditions.

PERSONAL PROTECTIVE EQUIPMENT: Safety glasses, chemical-resistant gloves.

SAFETY DATA SHEET

SECTION 9: PHYSICAL AND CHEMICAL PROPERTIES

BOILING POINT: 212 °F
EVAPORATION RATE: <1 (Ether=1)
WEIGHT PER GALLON: 8.3
ODOR: None
FLASH POINT: See Section 5
VAPOR PRESSURE: N/D
PARTITION COEFFICENT: N/D
VISCOSITY: N/D

VAPOR DENSITY: N/A
pH LEVEL: N/A
PRODUCT APPEARANCE: Black Liquid
ODOR THRESHOLD: N/D
FLAMMABILITY: N/D
RELATIVE DENSITY: N/D
AUTOIGNITION TEMPERATURE: N/D

% VOLATILE BY VOLUME: N/A
% VOLATILE BY WEIGHT: 30
VOC CONTENT: 0 g/L
MELTING/FREEZING POINT: N/D
UEL/LEL: N/D
SOLUBILITY: N/D
DECOMPOSITION TEMPERATURE: N/D

N/A: Not Applicable *N/D: Not Determined*

SECTION 10: STABILITY/REACTIVITY

STABILITY: Stable.
HAZARDOUS POLYMERIZATION: Will not occur.
CONDITIONS AND MATERIALS TO AVOID: None recognized.
HAZARDOUS DECOMPOSITION PRODUCTS: None recognized.

SECTION 11: TOXICOLOGICAL INFORMATION

EYE CONTACT: Direct contact may cause mild irritation.
SKIN CONTACT: Direct contact may cause slight skin irritation. Prolonged/repeated contact may result in irritation.
INHALATION: Not anticipated to be an exposure route.
INGESTION: Not anticipated to be an exposure route.
SIGNS AND SYMPTOMS: Symptoms of eye irritation include tearing, reddening, and swelling. Symptoms of skin irritation include redness and swelling. Gastrointestinal irritation symptoms include nausea, vomiting, and abdominal discomfort. Symptoms of respiratory irritation include runny nose, sore throat, coughing, chest discomfort, shortness of breath, and reduced lung function.
AGGRAVATED MEDICAL CONDITIONS: Pre-existing skin, eye, and respiratory disorders may be aggravated by exposure to this product.
OTHER HEALTH EFFECTS: ACGIH classifies asphalt as *Not Classifiable as a Human Carcinogen; A4.*

SECTION 12: ECOLOGICAL INFORMATION

ECOTOXICITY: N/E
SOIL MOBILITY: N/E

DEGRADABILITY: N/E
OTHER ADVERSE EFFECTS: None Recognized

BIOACCUMULATIVE POTENTIAL: N/E
N/E: Not Established

SECTION 13: WASTE DISPOSAL INFORMATION

WASTE DISPOSAL INFORMATION: Solidified product can be landfill disposed. No free liquids.

SECTION 14: TRANSPORTATION INFORMATION

HAZARDOUS/NON-HAZARDOUS MATERIAL: Not regulated by DOT.
UN NUMBER: None.
HAZARD CLASS: N/A
PACKING GROUP: N/A
UN PROPER SHIPPING NAME: N/A
ENVIRONMENTAL HAZARDS: None recognized.
BULK TRANSPORTATION INFORMATION: None.
SPECIAL PRECAUTIONS: Prevent product from freezing.
N/A: Not Applicable

SECTION 15: REGULATORY INFORMATION

OTHER REGULATORY CONSIDERATIONS: None recognized.

SECTION 16: OTHER INFORMATION

PREPARATION DATE: 3/14/2022
PREPARED BY: Dave Carey

W. R. MEADOWS®
SEALTIGHT®
A Family Company Since 1926
QUALITY...SERVICE...INTEGRITY

W. R. MEADOWS, INC.
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HAMPSHIRE, IL / CARTERSVILLE, GA / YORK, PA
FORT WORTH, TX / BENICIA, CA / POMONA, CA
GOODYEAR, AZ / MILTON, ON / SHERWOOD PARK, AB

Project:	Saint Paraskevi Greek Orthodox Monastery
Location:	Washington, Texas, USA
Engineer:	MLAW Forensics, Inc.
Contractor:	Shepperd Construction
Salesperson:	Nick Tam
Products:	MEADOW-PATCH® 20
	MEL-ROL® LM
	MEL-ROL
	MEL-PRIME™
	POINTING MASTIC
	MEL-DRAIN™ 5035-B
	PERMINATOR® 15 mil
Scope:	3,400 square feet

The Saint Paraskevi Monastery was experiencing excessive leaks and puddles of water in the basement which prevented use of the interior space. After excavation of the below-grade walls and foundation, it was revealed that the makeup of the wall system was EFIS, with a waterproofing membrane applied directly to the insulated concrete forms. Unfortunately, due to the incompatibility of the waterproofing membrane, the insulation of the concrete forms began to deteriorate and create air/moisture leaks from the ambient conditions.

To repair the envelope system and provide a watertight seal, removal of the insulation from the concrete forms was needed. After the insulation was removed it was apparent that the rough and rigid substrate would not be an adequate surface for any waterproofing membrane, especially when you take into account that aggregate and plastics were exposed in most areas. It was determined that MEADOW-PATCH 20 repair mortar was to be used to repair the concrete substrate and provide a smooth surface for waterproofing application.

Once the walls were ready for waterproofing, MEL-ROL sheet applied waterproofing was used for the base of wall transition, as well as any sharp corners that presented themselves. This was followed by an initial 30mil coat of MEL-ROL LM, finishing off with a second 30mil coat of MEL-ROL LM.

After the waterproofing portion of work was completed, it was time to protect the membrane and provide a drainage layer utilizing MEL-DRAIN 5035-B. To anchor this system, a termination bar was used to mechanically fasten the drainage board at the top of the wall, using POINTING MASTIC to seal or gasket our anchor system. Spray-adhesive was used to adhere all side-laps of the drainage board as extra security in creating a monolithic protection layer.

GUIDE SPECIFICATION FOR MEL- ROL® LM: LIQUID-APPLIED WATERPROOFING MEMBRANE

SECTION 07 14 16

COLD-FLUID APPLIED WATERPROOFING

> Specifier Notes: This guide specification is written according to the Construction Specifications Institute (CSI) format. The section must be carefully reviewed and edited by the architect or engineer to meet the requirements of the project. Coordinate this section with other specification sections and the drawings.

> Specifier Notes: MEL-ROL LM waterproofing system is a single-component, polymer-modified, cold-applied, liquid waterproofing membrane ideal for vertical waterproofing applications. This heavy bodied, liquid membrane is ideal for immediate application to newly stripped, below-grade concrete walls and for use with insulated concrete forms. It is also suitable for below-grade masonry block walls.

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Surface preparation.

B. Application of single-component, cold-applied, liquid waterproofing membrane.

1.02 RELATED SECTIONS

> Specifier Notes: Edit the list of related sections as required for the project. List other sections dealing with work directly related to this section.

A. Section 03 30 00 – Cast-in-Place Concrete.

B. Section 04 20 00 – Unit Masonry.

C. Section 07 13 26 – Self-Adhering Sheet Waterproofing.

D. Section 07 21 00 – Thermal Insulation.

E. Section 07 60 00 – Flashing and Sheet Metal.

F. Section 07 92 00 – Joint Sealants.

G. Section 33 46 13 - Foundation Drainage.

1.03 REFERENCES

A. ASTM D146-97 - Standard Test Methods for Sampling and Testing Bitumen-Saturated Felts and Fabrics Used in Roofing and Waterproofing.

B. ASTM D412-98a(2002)e1 - Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers -Tension.

C. ASTM E96-00e1 (Method B) - Standard Test Methods for Water Vapor Transmission of Materials.

D. ASTM D1228 - Methods of Testing Asphalt Insulating Siding Surfaced with Mineral Granules.

E. ASTM C836 - Standard Specification for High Solids Content, Cold Liquid-Applied Elastomeric Waterproofing Membrane for Use with Separate Wearing Course.

F. ASTM D1970-01 - Standard Specification for Self-Adhering Polymer Modified Bituminous Sheet Materials Used as Steep Roofing Underlayment for Ice Dam Protection.

1.04 SUBMITTALS

A. Comply with Section 01 33 00 - Submittal Procedures.

B. Submit manufacturer's product data and application instructions.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to site in manufacturer's original, unopened containers and packaging, with labels clearly identifying product name and manufacturer.

B. Store materials in a clean, dry area in accordance with manufacturer's instructions.

C. Store adhesives and primers at temperatures of 40^{o} F (5^{o} C) and above to facilitate handling.

D. Do not store at temperatures above 90^{o} F (32^{o} C) for extended periods.

E. Protect materials during handling and application to prevent damage or contamination.

1.06 ENVIRONMENTAL REQUIREMENTS

A. Product not intended for uses subject to abuse or permanent exposure to the elements.

B. Do not apply membrane when air, material, or surface temperatures are expected to fall below 30^{o} F (-1^{o} C) within four hours of completed application.

C. Do not apply membrane if rainfall is forecast or imminent within 12 hours.

D. Do not apply to frozen concrete.

E. Membrane can be applied to green concrete.

PART 2 PRODUCTS

2.01 MANUFACTURER

A. W. R. MEADOWS®, INC., PO Box 338, Hampshire, Illinois 60140-0338. (800) 342-5976. (847) 683-4500. Fax (847) 683-4544. Web Site www.wrmeadows.com.

2.02 MATERIALS

A. Waterproofing Membrane: single-component, polymer-modified, cold-applied, liquid waterproofing membrane.
  1. Performance Based Spec: Waterproofing membrane shall have the following properties as determined by laboratory testing:
    a. Color: Black
    b. Solids: 70%
    c. Total Cure Time: 16-24 hours
    d. Shore “00” Hardness, ASTM C836: Passes
    e. Adhesion to Concrete, ASTM C836: Exceeds
    f. Low Temperature Flex and Crack Bridging, ASTM C836: Passes
    g. Stability, ASTM C836: Exceeds
    h. Elongation, ASTM D412: 1500%

i. Water Absorption, ASTM D1970: 0.7%
j. Water Vapor Transmission, ASTM E96 (Method B): 0.03 perms

2. Proprietary Based Spec:
   a. MEL-ROL LM Waterproofing System by W. R. MEADOWS.

2.03 ACCESSORIES

A. Concrete Repair Materials: MEADOW-PATCH™ 5 and 20 Concrete Repair Mortars.

B. Waterproofing Protection Course: PERMINATOR™ 10 mil.

C. Rolled Matrix Drainage System: MEL-DRAIN™.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine surfaces to receive membrane. Notify architect if surfaces are not acceptable. Do not begin surface preparation or application until unacceptable conditions have been corrected.

3.02 SURFACE PREPARATION

A. Protect adjacent surfaces not designated to receive waterproofing.

B. Clean and prepare surfaces to receive waterproofing in accordance with manufacturer's instructions.

C. Do not apply waterproofing to surfaces unacceptable to manufacturer.

D. Concrete surfaces must be clean, relatively smooth, and free of standing water.

E. Patch all holes and voids and smooth out any surface misalignments.

F. Remove and patch all concrete form ties.

G. Apply primer coat of membrane diluted 4:1 with water if necessary to reduce blistering on concrete surfaces at a coverage rate of 100-150 ft.^{2}/U.S. gal (13.9 m^2/3.78 L) by spraying or rolling.

H. Allow primer coat to dry before proceeding to membrane application.

3.03 APPLICATION

A. Apply waterproofing membrane system in accordance with manufacturer's instructions.

B. Thoroughly mechanically mix membrane prior to application.

C. Apply membrane by spray, roller, or brush at a minimum coverage rate of 20-25 ft.^{2}/U.S. gal (1.9-2.3 m^2/3.78L) providing a thickness of 60 wet mils.

D. Frequently inspect surface area with a wet mil gauge to ensure consistent thickness.

E. Work material into any fluted rib forming indentations.

F. Cured thickness of membrane should be 45 mils dry.

G. Avoid use of products that contain tars, solvents, pitches, polysulfide polymers, or PVC materials that may come into contact with waterproofing membrane system.

3.04 PROTECTION

A. Protect membrane with application of waterproofing protection course, drainage board, or other approved material.

B. Backfill immediately using care to avoid damaging waterproofing membrane system.

END OF SECTION

INSTALLATION GUIDELINES
MEL-ROL® LM

This document has been created as an addendum to the MEL-ROL LM technical data sheet to provide the recommended procedure to use when installing MEL-ROL LM single-component, polymer-modified, cold-applied, water-based, liquid waterproofing membrane from W. R. MEADOWS.

APPLICATION

SURFACE PREPARATION

All surfaces must be clean (free of all coatings and curing compounds), free of frost, relatively smooth, and structurally sound. Patch any bug holes, tie holes, large gaps, or cracks with MEADOW-PATCH® 5 or MEADOW-PATCH 20 from W. R. MEADOWS. All loose laitance on the substrates, such as dirt, dust, loose stones, and debris, should be either swept or blown clean. All inside corners should be addressed with a cove of BEM from W. R. MEADOWS prior to application of MEL-ROL LM.

All shrinkage cracks less than 1/16" (1.6 mm) should be pretreated with a 60-mil coat of MEL-ROL LM 6" (152.4 mm) wide. All cracks greater than 1/16" (1.6 mm) should be taped with DETAIL STRIP from W. R. MEADOWS prior to application of the membrane. For specific project recommendations, please contact W. R. MEADOWS technical services.

MIXING

MEL-ROL LM is designed to be used from the pail or drum with little or no mixing. However, if water appears on the surface, mix thoroughly with a low speed mechanical mixer prior to application.

PRIMING

To reduce blistering on concrete surfaces, a thin coat of MEL-ROL LM diluted with water may be required. (Approximate dilution ratio of MEL-ROL LM to water is between 4:1 and 5:1.)

Thoroughly mix primer with a mechanical mixer. Prime the entire concrete surface to be waterproofed by spraying or rolling on a single coat at a coverage rate of 100 - 150 ft.2/gal. (2.45 - 3.68 m2/L). Allow primer to dry (approximately one hour, depending on temperature and conditions).

DETAILING

After surface preparations are complete, detailing should be addressed. The desired thickness of membrane coverage is 120 mils for inside/outside corners and non-moving and hairline cracks, as well as around drains and penetrations. Request and view the W. R. MEADOWS WATERPROOFING CONTRACTORS HANDBOOK for additional information.

FOOTING DETAILS

Use DETAIL STRIP from W. R. MEADOWS for impaction sheet coverage. First, fold strips lengthwise and then cut at the fold. Material is then ready to install as 4 ½” (114.3 mm) strips on either side

06/18/20

of the rebar. Any excess can be turned down on the face of the footing. Next, fill the voids around rebars in the keyway with BEM. Pour the walls.

Install DETAIL STRIP horizontally along the wall where it meets the footing, placing half the material up the wall and the other half onto the footing. Extend the material 4 ½" (114.3 mm) beyond outside corners. Slit extended portion of DETAIL STRIP lengthwise. Place the horizontal flap out onto the footing and bend the vertical flap around the wall. Repeat this procedure in the opposite direction.

In applications subject to a high water table, WATERSTOP EC PLUS from W. R. MEADOWS (or approved alternative), must be incorporated in the wall design.

ROLLER APPLICATION

MEL-ROL LM can be applied directly from the container using a ¾" (19.1 mm) nap roller. Apply in two coats, each 30 mils thick, allowing first coat to reach initial set prior to application of second coat.

SPRAYER APPLICATION

MEL-ROL LM may be sprayed on at a minimum coverage thickness of 60 mils wet (45 mils dry). To obtain 60 mils wet thickness, and to prevent slumping, apply MEL-ROL LM in two coats of 30 wet mils. Apply the second coat after the first coat has dried (approximately one to two hours).

W. R. MEADOWS®
SEALTIGHT®
A Family Company Since 1926
QUALITY...SERVICE...INTEGRITY

INSTALLATION GUIDELINES
MEL-ROL® LM

SPRAYING EQUIPMENT

MEL-ROL LM is most effectively applied by using the Graco HydraMax 350 or the Graco GH833 Big Rig.

The Graco heavy-duty texture gun is recommended for use with the following tips: For best results, use the 0.051″ (Graco GHD551) heavy-duty switch tip. For spraying of primer coat, a smaller orifice tip such as the 0.035″ (Graco GHD635) can be used. Tips should be reversible types for easy clean out. For more complete spraying equipment information, please view INSTALLATION INSTRUCTIONS: SPRAYER EQUIPMENT GUIDELINES FOR W. R. MEADOWS FLUID-APPLIED MEMBRANES available at www.wrmeadows.com.

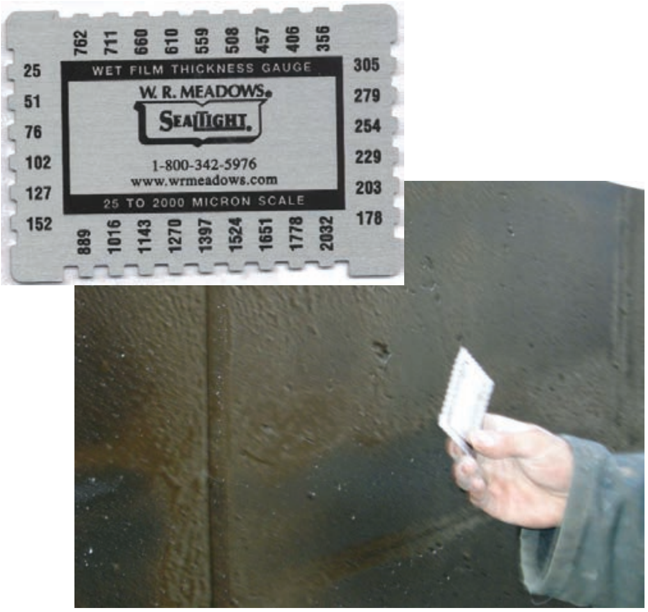
HORIZONTAL APPLICATION

For horizontal applications, use HYDRALASTIC 836 from W. R. MEADOWS.

HYDRALASTIC 836

THICKNESS CONTROL

Frequently inspect surface area with a wet mil gauge to ensure desired consistent thickness is achieved. Porous substrates or masonry block walls may require additional coats to obtain desired thickness.



CLEANUP

Material should not be left in the pump, lines, or gun when finished spraying. CAUTION: Solvents must not come in contact with MEL-ROL LM in the sprayer, as they will break the emulsion and plug up the entire sprayer system. After spraying, promptly flush water only (no soap) through the system until pump and hose are clear [approx. five gallons (18.9 L)]. Aromatic solvents, such as xylene or toluene [approx. two gallons (7.6 L)], should be used for final flushing after water is flushed through the pump and lines.

Mineral spirits, paint thinner, gasoline, etc., must not be used to flush system. NOTE: Water must be flushed through the machine to remove any solvents prior to spraying of MEL-ROL LM.

PROTECTION

Cover vertical applications with PROTECTION COURSE, MEL-DRAIN™, or PERMINATOR (10 mil) from W. R. MEADOWS. Surfaces must be covered within 45 days.

BACKFILLING

Allow 24 hours for complete cure of membrane prior to backfilling.

INSTALLATION GUIDELINES
MEL-ROL® AND MEL-ROL LM FOR WATERPROOFING INSULATED CONCRETE FORMS (ICF)

At W. R. MEADOWS, we get many questions about the proper way to waterproof ICFs. The use of our MEL-ROL and MEL-ROL LM as the overall waterproofing membrane will work for this type of application.

The following products will be used in waterproofing ICFs:

MEL-PRIME™ W/B
BEM
MEL-ROL LIQUID MEMBRANE
MEL-ROL
MEL-ROL LM
TERMINATION BAR

RECOMMENDED TOOLS
Broom
Caulking Gun
Chalk Line
Impact Hammer
Paint Brushes and Roller

Surface Preparation … Remove any oxidized foam (rasp) from the surface.

Joint Treatment … All joints in the ICF need to be addressed. For applications of MEL-ROL, if joints in the ICF are wider than ¼" (6.35 mm), they should be filled with either MEL-ROL LIQUID MEMBRANE or BEM prior to priming and installation of the waterproofing membrane. Also pay close attention to where the wall meets the footing. This area should be treated with BEM or MEL-ROL LIQUID MEMBRANE. This treatment creates a cant where the wall meets the footing. In applications of MEL-ROL LM, all joints need to be filled with BEM.

Application Method .... Follow same application procedure as indicated on MEL-ROL and MEL-ROL LM technical data sheet. For more detailed application information, see MEL-ROL INSTALLATION GUIDELINES and MEL-ROL LM INSTALLATION GUIDELINES documents.

Priming … When using MEL-ROL to waterproof the ICF, priming must be done. MEL-PRIME W/B should be used as the primer. The prime-coat should be in the range of 5-10 mils. After proper priming (not required for MEL-ROL LM) and joint detail, the ICF surface is ready for the application of MEL-ROL or MEL-ROL LM. Apply the product as outlined in the applications directions listed previously. When using MEL-ROL, TERMINATION BAR is required to seal the top edge.

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INSTALLATION INSTRUCTIONS

SPRAYER EQUIPMENT GUIDELINES FOR W. R. MEADOWS FLUID-APPLIED MEMBRANES

Extensive field testing has shown that the **Graco GH 833 Big Rig** or **Hydra Max 350** (now obsolete) sprayers work best for spraying of the water-based **AIR-SHIELD™ LM**, **AIR-SHIELD LMP**, **AIR-SHIELD LSR**, **AIR-SHIELD TMP**, and **MEL-ROL® LM** products. (These sprayers also work well for the spraying of the solvent-based, ALL SEASON versions of these products.) We are not aware of any other types of sprayers being used successfully with our products. Initially, we had used the **Gmax 7900 Roof Rig**, but we have found that the pressures (4000 psi) attained by the **Graco GH 833 Big Rig** and **Hydra Max 350** units yield more consistent, trouble-free results. The **Graco GH 833 Big Rig** and **Hydra Max 350 units** are capable of a 3.5 – 4.0 gal./min. output, compared to a 2.1 gal./min. for the **Gmax 7900 Roof Rig.** The water-based emulsion products are extremely shear sensitive and should **NOT** be applied through gear-type pumps or pressurized follower plate systems. These systems will cause the emulsions to break, which will then clog the equipment. The ALL SEASON versions of the products are not shear sensitive and will remain stable when applied by most standard spray equipment.

The **Graco GH 833 Big Rig** unit comes equipped with 100' of hose, a texture spray gun, and several tips. NOTE: The standpipe on the sprayer **MUST** be opened and checked for the presence of a filter element and plastic sleeve. For **AIR-SHIELD LM** and **MEL-ROL LM**, these MUST BOTH be removed prior to use, as they will cause clogging.

Both the **Graco GH 833 Big Rig** and **Hydra Max 350** can be used for five-gal. pails or 55-gal. drums. Extensions on the pumps are able to create enough suction to allow material to be pulled from the top of a standing drum (or tote) of product. (An option available for the **Graco GH 833 Big Rig** allows the pump to be placed directly over a drum for improved pumping of thicker materials in cooler weather.)

GRACO HYDRA MAX 350

GRACO GH 833 BIG RIG

INSTALLATION INSTRUCTIONS

SPRAYER EQUIPMENT GUIDELINES FOR W. R. MEADOWS FLUID-APPLIED MEMBRANES

EQUIPMENT

HOSE: We have used up to 100' of hose with these products. (Longer lengths may work; possibly up to 150'.) The hose must be rated for use up to 4000 psi for these units. W. R. MEADOWS recommends using separate hoses specific to each material.

SPRAY GUN: The Graco heavy duty texture gun is required (part #241705). It does not contain a paint filter and works well for these products. Other Graco guns have not worked, as they contain a diverter pin in the spray nozzle that will constantly clog the gun.

SPRAY TIPS: We have used the 0.051" (Graco 551,651) tip successfully for spraying and this is our preferred tip size for MEL-ROL LM/AIR-SHIELD LM products. For spraying of AIR-SHIELD LMP, AIR-SHIELD TMP, and AIR-SHIELD LSR, the 0.051" tip will work, but using the 0.035" or 0.037" tip will yield a smoother finish on the wall. For spraying of a solvent-based ALL SEASON products, we recommend using the 0.035" (Graco 535, 635) tip. NOTE: Tips should be the "reversible" type for easy clean out.

APPLICATION - PRIMER

PRIMING: Priming of poured concrete substrates may be required to minimize the potential for blistering of the membrane after it is applied and when exposed to direct sunlight. Once applied, the primer coat should be allowed to dry and be allowed to "warm up" while exposed to direct sunlight. Allowing the primer to be exposed to direct sunlight prior to the membrane application will allow the surface to "warm up" (due to the black color) and help "de-gas" the surface. This "de-gassing" releases the air/moisture vapors in the pores of the substrate, allowing them to expand and dissipate prior to the membrane application. If the primer is not exposed to direct sunlight for a sufficient time interval prior to membrane application, then blistering of the membrane may occur.

PRIMER DILUTION / APPLICATION

RATE: Dilute the water-based LM products 4-5 parts product to one part water. Apply at 100-150 ft.^{2}/gal. and allow to dry approximately one hour. The solvent-based ALL SEASON products do not need to be diluted and should also be applied at 100-150 ft.^{2}/gal. AIR-SHIELD LMP, AIR-SHIELD LSR, and AIR-SHIELD TMP typically do not require a prime coat.

APPLICATION - MEMBRANE

SPRAY: Several coats may be required to obtain the recommended thickness without excessive running or slumping of the wet membrane in hot weather. Allow the first coat to dry approximately one hour before application of the second coat.

NOTE: MEL-ROL LM and AIR-SHIELD LM can be sprayed easily when the material temperature is 40° F or above.

The material temperature of AIR-SHIELD LMP, AIR-SHIELD LSR, and AIR-SHIELD TMP should be 40° F or above to be successfully sprayed; AIR-SHIELD LM (ALL SEASON) and MEL-ROL LM (ALL SEASON) can be applied below 40° F.

Filter is recommended for use in applications of AIR-SHIELD LMP, AIR-SHIELD LSR, and AIR-SHIELD TMP. The filter is not needed for applications of AIR-SHIELD LM, AIR-SHIELD LM (ALL SEASON), MEL-ROL LM, and MEL-ROL LM (ALL SEASON).

ROLLER: Material can be roller applied if a ¾" minimum nap roller is used. Several coats will typically be required to obtain the desired thickness. Allow the first coat to dry thoroughly before second coat is applied. Foam-type rollers or shorter naps should not be used, as they will simply slide on the substrate. Rinse and store all rollers used for water-based products in a container of water when not in use. This is necessary, as the material will cure very quickly on the rollers if allowed to "dry out." If this does occur, the rollers will need to be discarded or cleaned with solvent and allowed to dry thoroughly prior to reuse.

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INSTALLATION INSTRUCTIONS

SPRAYER EQUIPMENT GUIDELINES FOR W. R. MEADOWS FLUID-APPLIED MEMBRANES

EQUIPMENT SUMMARY CHART

WRM PRODUCT	Water-Based (W/B) Or Solvent-Based (S/B)	Sprayer Type	Hose	Gun	Spray Tip***
AIR-SHIELD LM	W/B	Graco GH 833 or Hydra Max 350	Rated for 4000 psi	Graco Heavy Duty Texture	Graco GHD 551 (0.051”)
MEL-ROL LM	W/B	Graco GH 833 or Hydra Max 350	Rated for 4000 psi	Graco Heavy Duty Texture	Graco GHD 551 (0.051”)
AIR-SHIELD LMP	W/B	Graco GH 833 or Hydra Max 350	Rated for 4000 psi	Graco Heavy Duty Texture	Graco GHD 551 or 637 (0.051” or 0.037”)
AIR-SHIELD LSR	W/B	Graco GH 833 or Hydra Max 350	Rated for 4000 psi	Graco Heavy Duty Texture	Graco GHD 551 or 637 (0.051” or 0.037”)
AIR-SHIELD LM (ALL SEASON)	S/B	Graco GH 833 or Hydra Max 350**	Rated for 4000 psi	Graco Heavy Duty Texture	Graco GHD 635 (0.035”)
AIR-SHIELD TMP	W/B	Graco GH 833 or Hydra Max 350	Rated for 4000 psi	Graco Heavy Duty Texture	Graco GHD 551 or 637 (0.051” or 0.037”)
MEL-ROL LM (ALL SEASON)	S/B	Graco GH 833 or Hydra Max 350**	Rated for 4000 psi	Graco Heavy Duty Texture	Graco GHD 635 (0.035”)

**OTHER TYPES OF STANDARD SPRAYERS ALSO ACCEPTABLE. ***TIPS SHOULD BE “REVERSIBLE” FOR EASY CLEANOUT.

APPLICATION/CLEANUP

WRM PRODUCT	Primer Coat Dilution Ratio (Product : H2O)	Primer Coat Application Rate	Minimum Product Temperature (When Sprayed)	Membrane Application Method	Sprayer Cleanup
AIR-SHIELD LM	4-5 : 1	100-150 ft.^{2}/gal.	40° F	Sprayer or ¾” (min.) Nap Roller**	Water Flush First
MEL-ROL LM	4-5 : 1	100-150 ft.^{2}/gal.	40° F	Sprayer or ¾” (min.) Nap Roller**	Water Flush First
AIR-SHIELD LMP	N/A	N/A	60° F	Sprayer or ¾” (min.) Nap Roller**	Water Flush First
AIR-SHIELD LSR	N/A	N/A	60° F	Sprayer or ¾” (min.) Nap Roller**	Water Flush First
AIR-SHIELD LM (ALL SEASON)	No Dilution Needed	100-150 ft.^{2}/gal.	60° F	Sprayer or ¾” (min.) Nap Roller**	Solvent Flush First
AIR-SHIELD TMP	N/A	N/A	60° F	Sprayer or ¾” (min.) Nap Roller**	Water Flush First
MEL-ROL LM (ALL SEASON)	No Dilution Needed	100-150 ft.^{2}/gal.	60° F	Sprayer or ¾” (min.) Nap Roller**	Solvent Flush First

**DO NOT USE FOAM OR SHORTER NAP ROLLERS.

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INSTALLATION INSTRUCTIONS

SPRAYER EQUIPMENT GUIDELINES FOR W. R. MEADOWS FLUID-APPLIED MEMBRANES

EQUIPMENT CLEANUP

WATER-BASED PRODUCTS:

- Solvents must NOT come in contact with the liquid emulsion AIR-SHIELD LM and MEL-ROL LM products while in the sprayer, as they will immediately break the emulsion and plug up the entire sprayer system.

- Before starting to spray, the sprayer MUST be flushed with clean water.

- When spraying is complete, material must NOT be left in the pump, lines or gun as the MEL-ROL/AIR-SHIELD emulsions will quickly begin to break and cure in the equipment. When finished spraying, WATER ONLY should be PROMPTLY flushed through the system until pump and hose run clear. Do NOT add soap to the flush water, as it too will break the emulsion. “Simple Green” cleaner is the only cleaner found that can be used successfully.

- When spraying is complete, solvents, including xylene, toluene, mineral spirits, paint thinner, gasoline, etc., must NOT be used for the INITIAL flushing of the system. These solvents will break the emulsion and clog the system

- Aromatic solvents (xylene or toluene) are recommended for the FINAL flushing AFTER water has been flushed through the pump and lines. If solvent is pumped through the system after being flushed with water, all equipment MUST be flushed with water before spraying emulsion. All traces of solvent MUST be completely removed. Note: Aromatic solvent may be used to soak and clean the pump housing, gun, and tips. Solvents can be left in the sprayer for short durations (days) to aid in cleaning of the system. Solvents left in the sprayer for extended periods may begin to degrade the seals and hose. Again, all traces of solvent MUST be removed prior to using the equipment with the water-based emulsion products.

SOLVENT-BASED, ALL SEASON PRODUCTS:

- While the ALL SEASON products are stable in the sprayer, once spraying is complete, solvents should be flushed through the system until pump and hose run clear. Aromatic solvents (xylene or toluene) work best, but mineral spirits, paint thinner, etc., can also be used. Solvents can be left in the sprayer for short periods of time, but should NOT be allowed to remain in the sprayer for extended periods of time, as they may begin to degrade the seals and hose.

- When switching from a solvent-based to a water-based product: After flushing with solvent, water MUST be flushed through the ENTIRE system until all traces of solvent have been removed. When beginning to spray a water-based emulsion product, if ANY solvent remains in the sprayer, the pump, hose, gun, and spray tips WILL CLOG and will need to be cleaned out.

NO. 714-B **DATA SHEET**

MasterFormat: 07 14 16

AUGUST 2009
(Supersedes November 2005)

MEL-ROL® LM (ALL SEASON)

Single-Component, Liquid-Applied, Polymer-Modified Waterproofing Membrane

DESCRIPTION

MEL-ROL LM (ALL SEASON) is a single-component, polymer-modified, cold-applied, liquid waterproofing membrane ideal for below-grade vertical seamless waterproofing applications. MEL-ROL LM (ALL SEASON) is formulated with the same high quality rubber polymers found in MEADOWS' successful MEL-ROL "peel and stick" membrane, converting them into a heavy-bodied, high solids, quick drying liquid membrane. The liquid-membrane technology allows faster installation times using either a spray or roller application.

USES

MEL-ROL LM (ALL SEASON) can be used on new and remedial waterproofing applications on both concrete and masonry block substrates.

FEATURES/BENEFITS

- Waterproof/Very low vapor permeability (perm rating).
- All weather application/Can be applied down to 10° F (-12° C).
- Superior elongation/Bridges minor cracks and will not become brittle with age.
- Excellent adhesion and bond/Water will not run beneath the membrane.
- Single component/Eliminates two-component mixing problems.
- Easy to apply/Apply with roller or airless sprayer.
- Low-cost application equipment. (See recommended spraying equipment section.)
- No heating/Eliminates fire hazards associated with heating kettles.
- Low VOC/Content is <400 g/L.

PACKAGING

5 Gallon (18.93 Liter) Pails
55 Gallon (208.20 Liter) Drums*
*Special order only

LEED INFORMATION

May help contribute to LEED credits:

- EA Credit 1: Optimize Energy Performance
- EQ Credit 3.1: Construction IAQ Management Plan: During Construction
- MR Credit 5.1: Regional Materials: 10% Extracted, Processed & Manufactured Regionally
- MR Credit 5.2: Regional Materials: 20% Extracted, Processed & Manufactured Regionally

APPLICATION

Surface Preparation ... All surfaces must be clean (free of all coatings and curing compounds), free of frost, relatively smooth, and structurally sound. Patch any bug holes, tie holes, large gaps, or cracks with MEADOW-PATCH® 5 or MEADOW-PATCH 20 from W. R. MEADOWS. All loose laitance, such as dirt, dust, loose stones, debris, etc., must be swept or blown clean from the substrate.

NOTE: Do not apply to "green" (fresh) concrete. Concrete must be cured a minimum of 14 days prior to application. Do not use with insulated concrete forms (ICFs). Polystyrene insulation boards may be used only after membrane has thoroughly cured a minimum of 72 hours, and there is no danger of residual solvent degrading the boards.

All shrinkage cracks less than 1/16" (0.16 cm) should be pretreated with a 60 mil (1.52 mm) wet coat of MEL-ROL LM (ALL SEASON) at 6" (15.24 cm) wide. All cracks greater than 1/16" (0.16 cm) should be pretreated with DETAIL STRIP from W. R. MEADOWS prior to application of the membrane.

PRIMING

To reduce blistering on concrete surfaces, a thin coat of MEL-ROL LM (ALL SEASON) may be required. Using a roller or sprayer, prime the entire concrete surface to be waterproofed, with a single coat, at a coverage rate of 100-150 ft.²/gal. Allow the primer to dry, which is approximately 1 - 2 hours, depending on jobsite conditions (temperature, humidity, air flow, etc.). As the primer is allowed to warm by exposure to sunlight, the surface of the concrete will de-gas, helping to eliminate problems with blistering of the membrane.

CONTINUED ON THE REVERSE SIDE...

DETAILING

After surface preparations are finished, detailing should be completed. The recommended membrane thickness is 120 mils (3.04 mm) wet for inside and outside corners, non-moving cracks, and hairline cracks, as well as around drains and penetrations.

Roller Application ... MEL-ROL LM (ALL SEASON) can be applied directly from the container using a ¾" nap roller. Apply in multiple coats, each at a 40 mils (1.02 mm) wet thickness. Allow the previous coat to reach initial set prior to application of the next coat, which is approximately one (1) hour, depending on jobsite conditions (temperature, humidity, airflow, etc.).

Sprayer Application ... NOTE: MEL-ROL LM (ALL SEASON) MUST BE A MINIMUM OF 60° F (15° C) WHEN SPRAYING. Material will become very thick and difficult to spray at lower temperatures. MEL-ROL LM (ALL SEASON) must be stored in a heated trailer and/or passed through a heat exchanger for successful spraying.

Equipment ... MEL-ROL LM (ALL SEASON) is most effectively and efficiently applied by using either the Graco HydraMax 350 or the Graco GH833 Big Rig sprayer.

The Graco heavy-duty texture gun, with the 0.035" (Graco GHD535) heavy-duty switch tip, is recommended for the best results.

For detailed information on the recommended spray equipment, use, and cleanup, please refer to the W. R. MEADOWS sprayer equipment guide available on the building envelope page of www.wrmeadows.com and the softbound catalog.

MEL-ROL LM (ALL SEASON) can be sprayed on vertical surfaces at a minimum coverage thickness of 80 mils (2.03 mm) wet [45 mils (1.14 mm) dry]. The recommended coating thickness can be achieved in a single coat; however, if product slumps due to temperature or substrate conditions, two coats [each at 40 mils (1.02 mm) wet] may be necessary. Apply the second coat after the first coat has dried, which is approximately one (1) hour, depending on jobsite conditions (temperature, humidity, airflow, etc.).

Thickness Control ... Frequently inspect surface with a wet mil gauge to ensure the recommended thickness is achieved, and that the thickness is consistent. Porous substrates or masonry block walls may require additional coats to obtain the recommended thickness.

COVERAGE

Approximately 17-20 ft.²/gal. at 80 mils (2.03 mm) wet [45 mils (1.14 mm) dry]. Coverage depends on substrate type, weather, and application conditions.

CLEANUP

Material should not be left in the pump, lines, or gun when finished spraying. Aromatic solvents such as xylene and toluene should be flushed through the sprayer until the pump and hose run clear.

CAUTION: A final flush of the spraying equipment, with water, must be completed to remove any traces of solvent prior to spraying a water-based product. The presence of any residual solvent will cause the water-based product to solidify and clog the pump and hose.

PROTECTION

Allow membrane to cure a minimum of 48 hours prior to application of a protection course. Membrane should be covered within 30 days after application. Cover with PROTECTION COURSE, MEL-DRAIN™ or 10 mil PERMINATOR® from W. R. MEADOWS. A primer coat of POINTING MASTIC from W. R. MEADOWS can be used to secure the protection to the wall.

NOTE: Polystyrene insulation boards can be applied only if the membrane has thoroughly cured a minimum of 72 hours and all traces of residual solvent have evaporated. Failure to allow the 72-hour cure time, and complete solvent evaporation, may degrade the boards.

BACKFILLING

Allow membrane to cure 48 hours prior to backfilling.

SHELF LIFE (TYPICAL)

Twelve (12) months in original, unopened container. Store at 40-90° F (4-32° C).

PRECAUTIONS

For exterior use only. Use with adequate ventilation. Do not apply MEL-ROL LM (ALL SEASON) if rainfall is forecast or imminent within two hours of application. Do not apply to ICFs. Sprayed urethane foams should not be applied over MEL-ROL LM (ALL SEASON). These foams can melt the membrane and cause delamination and failure due to the exothermic reaction that takes place after application. A complete drain tile system should be placed around the exterior of footing and under slabs, as required. The use of MEL-ROL LM (ALL SEASON) does not negate the need for relief of hydrostatic heads.

HEALTH AND SAFETY

FOR EXTERIOR USE ONLY. AVOID IGNITION SOURCES. AVOID PROLONGED BREATHING OF VAPORS. Use proper personal protective equipment, including chemical resistant gloves and eye and respiratory protection. Keep out of reach of children. Do not swallow. Should adverse effects occur, remove subject from area immediately. Refer to Material Safety Data Sheet for complete health and safety information. Flash point is 103° F (39° C).

For CAD details, most recent data sheet, further LEED information, and MSDS, visit www.wrmeadows.com.

PHYSICAL PROPERTIES MEMBRANE

Color:	Black	
Solids, wt. %:	65	
Total Cure Time, hours:	48	
Application Temperature, °F, (°C) minimum:	10 (-12)	
Coverage, ft.^{2}/gal.	17-20	
Shore “00” Hardness:	Pass	ASTM C 836
Adhesion to Concrete:	Exceeds Requirements	ASTM C 836
Low Temp Flex & Crack Bridging:	Pass	ASTM C 836
Stability:	Exceeds Requirements	ASTM C 836
Tensile Strength, psi:	30	ASTM D 412
Elongation, %:	1000	ASTM D 412
Water Absorption @ 72 hours, %:	<0.5	ASTM D 1970
WVT, perms:	0.06	ASTM E 96, B

SAFETY DATA SHEET

SECTION 1: PRODUCT AND COMPANY IDENTIFICATION

Product:	**MEL-ROL® LM (ALL SEASON)**	**Part Number: 6516000**	
Manufacturer:	**W. R. MEADOWS, INC.**	**Address:**	300 Industrial Drive Hampshire, Illinois 60140
Telephone:	(847) 214-2100	In case of emergency, dial (800) 424-9300 (CHEMTREC	
Revision Date:	4/20/2020		
Product Use:	Liquid Applied Water-Proofing Membrane		

SECTION 2: HAZARDS IDENTIFICATION/EXPOSURE LIMITS

HMIS	
|Health|	| 1 |
|Flammability|	| 2 |
|Reactivity|	| 0 |
|Personal Protection|	| |

HAZARD STATEMENTS

WARNING!

Flammable Liquid and vapor.
Causes skin, eye, respiratory irritation.
Suspected of causing genetic defects.
Causes damage to liver, kidneys, lungs, and blood.
Harmful if inhaled.
May be fatal if ingested and enters airway.

PRECAUTIONARY STATEMENTS

Use only in well-ventilated areas.
Avoid breathing vapors and direct contact.
Store in well-ventilated location.
Wear appropriate personal protective equipment.
Keep away from ignition sources.
Control vapors in confined spaces utilizing mechanical ventilation.

SECTION 3: HAZARDS COMPONENTS

Chemical Name:	CAS Number	% by Weight	SARA 313	Vapor Pressure (mm Hg@20°C)	LEL (@25°C)
1. Xylene	1330-20-7	1-5	Yes	6.6	1.1
2. Light Aromatic Naphtha	64742-95-6	20-25	No	<10 @ 25°C	0.9
3. Petroleum Asphalt	8052-42-4	30-35	No	N/A	N/A
4. Petroleum Oil	64742-52-5	5-10	No	N/A	N/A
5. 1,2,4-Trimethylbenzene	95-63-6	5-10	Yes	N/A	0.9

N/A = Not Applicable

Under the reporting requirements of Section 313 of Title III of the Superfund Amendments and Reauthorization Act of 1966 (SARA) and 40 CFR Part 372, chemicals listed on the 313 List (40 CFR Part 373.65) are identified under the heading "SARA 313."

SECTION 4: EMERGENCY AND FIRST AID PROCEDURES

EYE CONTACT: Move victim from exposure source and into fresh air. Flush eyes with water for Fifteen (15) minutes. If symptoms persist, seek medical attention.

SKIN CONTACT: Wash affected areas with mild soap and water. Product may be difficult to remove. Do not use petroleum solvents.

INHALATION: If respiratory symptoms develop, move victim from exposure source and into fresh air. If symptoms persist, seek medical attention.

INGESTION: Not anticipated to be an exposure route. If ingested, do not induce vomiting. Dilute by giving victim water or milk. Seek immediate medical attention.

MOST IMPORTANT SYMPTOMS/EFFECTS, ACUTE AND CHRONIC: See Section Eleven for Symptoms/Effects.

SECTION 5: FIRE AND EXPLOSIVES HAZARDS

FLASHPOINT: 150 °F (Method 1010 A-M)

EXTINGUISHING MEDIA: Water fog, foam, dry chemical, or carbon dioxide.

CHEMICAL/COMBUSTION HAZARDS: Oxides/compounds of nitrogen/sulfur, carbon dioxide, carbon monoxide, and incomplete combustion products.

PRECAUTIONS/PERSONAL PROTECTIVE EQUIPMENT: Avoid direct contact. Use of eye protection and chemical-resistant gloves is recommended. Respiratory protection may be required if excessive vapor concentrations are present.

SECTION 6: ACCIDENTAL RELEASE MEASURES

SPILL OR LEAK PROCEDURES: Evacuate the hazard area of unprotected personnel. Remove/extinguish ignition sources. Dike and contain. Wear appropriate personal protective equipment. Place spilled material in sealed/marked containers for disposal.

SECTION 7: HANDLING AND STORAGE

SAFE HANDLING PROCEDURES: Avoid direct contact. For exterior use only. Avoid ignition sources.

SAFE STORAGE: Keep containers closed when not in use. Store away from ignition sources.

SECTION 8: EXPOSURE CONTROLS/PERSONAL PROTECTION

	OSHA				ACGIH			
Chemical Name:	**PEL**	**PEL/CEILING**	**PEL/STEL**	**SKIN**	**TWA**	**TLV/CEILING**	**TLV/STEL**	**SKIN**
1. Xylene	100 ppm	N/E	N/E	N/E	100 ppm	N/E	150 ppm	N/E
2. Light Aromatic Naphtha	N/E	N/E	N/E	N/E	N/E	N/E	N/E	N/E
3. Petroleum Asphalt	5 mg/m^{3}*	N/E	N/E	N/E	5 mg/m^{3}*	N/E	N/E	N/E
4. Petroleum Oil	5 mg/m^{3}+	N/E	N/E	N/E	5 mg/m^{3}+	N/E	10 mg/m^{3}+	N/E
5. 1,2,4-Trimethylbenzene	25 ppm	N/E	N/E	No	25 ppm	N/E	N/E	No

**: Asphalt Fumes* *+: Petroleum Oil mist in air* *N/E: Not Established*

ENGINEERING CONTROLS: Use with adequate ventilation. Use explosion-proof equipment.

PERSONAL PROTECTIVE EQUIPMENT: Safety glasses, chemical-resistant gloves.

SECTION 9: PHYSICAL AND CHEMICAL PROPERTIES

BOILING POINT: 284°F
EVAPORATION RATE: <1 (ether=1)
WEIGHT PER GALLON: 8.62
ODOR: Mild Organic
FLASH POINT: See Section 5
VAPOR PRESSURE: N/D
PARTITION COEFFICENT: N/D
VISCOSITY: N/D

VAPOR DENSITY: >1 (air=1)
pH LEVEL: N/A
PRODUCT APPEARANCE: Black, Heavy Liquid
ODOR THRESHOLD: N/D
FLAMMABILITY: N/D
RELATIVE DENSITY: N/D
AUTOIGNITION TEMPERATURE: N/D

% VOLATILE BY VOLUME: N/E
% VOLATILE BY WEIGHT: 36 (approximate)
VOC CONTENT: 371 g/L
MELTING/FREEZING POINT: N/D
UEL/LEL: N/D
SOLUBILITY: N/D
DECOMPOSITION TEMPERATURE: N/D

N/D: Not Determined

SECTION 10: STABILITY/REACTIVITY

STABILITY: Stable. **HAZARDOUS POLYMERIZATION:** Will not occur.

CONDITIONS AND MATERIALS TO AVOID: Oxidizing agents, strong acids, strong alkalies.

HAZARDOUS DECOMPOSITION PRODUCTS: Carbon dioxide, carbon monoxide, oxides/compounds of nitrogen/sulfur, and incomplete combustion products.

SECTION 11: TOXICOLOGICAL INFORMATION

EYE CONTACT: Direct contact may result in moderate irritation. Product vapors/mists may also cause irritation.

SKIN CONTACT: Direct contact may cause mild skin irritation. Prolonged/repeated contact may result in skin irritation/dermatitis.

INHALATION: Exposure to excessive vapor concentrations may result in transient central nervous system depression (headache, fatigue, drowsiness, loss of coordination). Intentional misuse by deliberately concentrating/inhaling vapors may be harmful or fatal. Repeated/prolonged occupational exposures to solvents may cause permanent brain and nervous system damage.

INGESTION: Not anticipated to be an exposure route. Ingestion will cause irritation of the digestive tract.

SIGNS AND SYMPTOMS: Symptoms of eye irritation include tearing, reddening, and swelling. Symptoms of skin irritation include redness and swelling. Gastrointestinal irritation symptoms include nausea, vomiting, and abdominal discomfort. Symptoms of respiratory irritation include runny nose, sore throat, coughing, chest discomfort, shortness of breath, and reduced lung function. Symptoms of transient central nervous system depression include: headache, fatigue, drowsiness, dizziness, and loss of coordination.

AGGRAVATED MEDICAL CONDITIONS: Pre-existing skin, eye, and respiratory disorders may be aggravated by exposure to this product.

OTHER HEALTH EFFECTS: Xylene may cause damage to the following organs: blood, kidneys, lungs, liver, mucous membranes, heart, upper respiratory tract, auditory system, central nervous system, and eyes. Some asphalts may possess weak carcinogenic activity. Repeated direct skin contact should be avoided. Occasional contact with asphalt is not expected to have serious health effects as long as good personal hygiene measures are followed.

SECTION 12: ECOLOGICAL INFORMATION

ECOTOXICITY: N/E **DEGRADABILITY:** N/E **BIOACCUMULATIVE POTENTIAL:** N/E
SOIL MOBILITY: N/E **OTHER ADVERSE EFFECTS:** N/E

SAFETY DATA SHEET

Date of Preparation: 4/20/20 **Page 3 of 3** **6516000**

SECTION 13: WASTE DISPOSAL INFORMATION

WASTE DISPOSAL INFORMATION: Product will be classified as a hazardous waste (D001). Suitable for fuel blending.

SECTION 14: TRANSPORTATION INFORMATION

HAZARDOUS/NON-HAZARDOUS MATERIAL: Not regulated by domestic ground shipment.

UN NUMBER: None **HAZARD CLASS:** None **PACKING GROUP:** None

UN PROPER SHIPPING NAME: None.

ENVIRONMENTAL HAZARDS: None recognized.

BULK TRANSPORTATION INFORMATION: Not applicable. Product not supplied in bulk configuration.

SPECIAL PRECAUTIONS: None.

SECTION 15: REGULATORY INFORMATION

OTHER REGULATORY CONSIDERATIONS: None recognized.

SECTION 16: OTHER INFORMATION

PREPARATION DATE: 4/20/2020

PREPARED BY: Dave Carey

GUIDE SPECIFICATION FOR MEL-ROL® LM (ALL SEASON): LIQUID APPLIED WATERPROOFING MEMBRANE

SECTION 07140

FLUID APPLIED WATERPROOFING MEMBRANE SYSTEM

Specifier Notes: This guide specification is written according to the Construction Specifications Institute (CSI) format. The section must be carefully reviewed and edited by the architect or engineer to meet the requirements of the project. Coordinate this section with other specification sections and the drawings.

Specifier Notes: W. R. MEADOWS® MEL-ROL® LM (ALL SEASON) waterproofing system is a single-component, polymer-modified, cold-applied, liquid waterproofing membrane ideal for vertical waterproofing applications. MEL-ROL LM (ALL SEASON) can be used on new and remedial waterproofing applications on concrete or masonry block substrates. Application can be performed in colder weather when water-based products cannot be used.

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Surface preparation.

B. Application of single-component, cold-applied, liquid waterproofing membrane.

1.02 RELATED SECTIONS

Specifier Notes: Edit the list of related sections as required for the project. List other sections dealing with work directly related to this section.

A. Section 03 30 00 – Cast-in-Place Concrete.

B. Section 04 20 00 – Unit Masonry.

C. Section 07 13 26 – Self-Adhering Sheet Waterproofing.

D. Section 07 21 00 – Thermal Insulation.

E. Section 07 60 00 – Flashing and Sheet Metal.

F. Section 07 92 00 – Joint Sealants.

G. Section 33 46 13 - Foundation Drainage.

1.03 REFERENCES

A. ASTM D146-97 - Standard Test Methods for Sampling and Testing Bitumen-Saturated Felts and Fabrics Used in Roofing and Waterproofing.

B. ASTM D412-98a(2002)e1 - Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers-Tension.

C. ASTM E96-00e1 (Method B) - Standard Test Methods for Water Vapor Transmission of Materials.

D. ASTM D1228 - Methods of Testing Asphalt Insulating Siding Surfaced with Mineral Granules.

E. ASTM C836 - Standard Specification for High Solids Content, Cold Liquid-Applied Elastomeric Waterproofing Membrane for Use with Separate Wearing Course.

F. ASTM D1970-01 - Standard Specification for Self-Adhering Polymer Modified Bituminous Sheet Materials Used as Steep Roofing Underlayment for Ice Dam Protection.

1.04 SUBMITTALS

A. Comply with Section 01330 - Submittal Procedures.

B. Submit manufacturer's product data and application instructions.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to site in manufacturer's original, unopened containers and packaging, with labels clearly identifying product name and manufacturer.

B. Store materials in a clean, dry area in accordance with manufacturer's instructions.

C. Store the material at room temperature or heat material to a minimum of 50°F (10 ^{o} C) prior to application.

D. Ensure concrete has been cured for a minimum of 14 days prior to application.

E. Do not store at temperatures above 90^{o} F (32^{o} C) for extended periods.

F. Protect materials during handling and application to prevent damage or contamination.

1.06 ENVIRONMENTAL REQUIREMENTS

A. Product not intended for uses subject to abuse or permanent exposure to the elements.

B. Do not apply membrane when air, material, or surface temperatures are expected to fall below 10^{o} F (-12^{o} C) within four hours of completed application.

C. Do not apply membrane if rainfall is forecast or imminent within two hours.

D. Do not apply to frozen concrete.

E. For spray applications, ensure material has been stored at room temperature or heated to a minimum of 50^{o} F (10^{o} C) prior to application.

PART 2 PRODUCTS

2.01 MANUFACTURER

A. W. R. MEADOWS, INC., PO Box 338, Hampshire, Illinois 60140-0338. (800) 342-5976. (847) 683-4500. Fax (847) 683-4544. Web Site www.wrmeadows.com.

2.02 MATERIALS

A. Waterproofing Membrane: A single-component, polymer-modified, cold-applied, liquid waterproofing membrane.
  1. Performance Based Spec: Waterproofing membrane shall have the following properties as determined by laboratory testing:
    a. Color: Black
    b. Solids: 65 %

    - c. Total Cure Time: 48 hours
    - d. Shore “00” Hardness, ASTM C836: Passes
    - e. Adhesion to Concrete, ASTM C836: Exceeds
    - f. Low Temperature Flex and Crack Bridging, ASTM C836: Passes
    - g. Stability, ASTM C836: Exceeds
    - h. Tensile Strength, ASTM D412: 30 psi
    - i. Elongation, ASTM D412: 1000%
    - j. Water Absorption, ASTM D1970: <0.5%
    - k. Water Vapor Transmission, ASTM E96 (Method B): 0.06 perms

2. Proprietary Based Spec:
    - a. MEL-ROL LM (ALL SEASON) Waterproofing System by W. R. MEADOWS.

2.03 ACCESSORIES

A. Concrete Repair Materials: MEADOW-PATCH™ 5 AND 20 CONCRETE REPAIR MORTARS.

B. Waterproofing Protection Course: PERMINATOR® 10 mil or PC-1 PROTECTION COURSE.

C. Rolled Matrix Drainage System: MEL-DRAIN™.

D. Reinforced Self-Adhesive Joint Tape: DETAIL STRIP

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine surfaces to receive membrane. Notify architect if surfaces are not acceptable. Do not begin surface preparation or application until unacceptable conditions have been corrected.

3.02 SURFACE PREPARATION

A. Protect adjacent surfaces not designated to receive waterproofing.

B. Clean and prepare surfaces to receive waterproofing in accordance with manufacturer's instructions.

C. Do not apply waterproofing to surfaces unacceptable to manufacturer.

D. Concrete surfaces must be clean, relatively smooth, and free of standing water.

E. Patch all holes and voids and smooth out any surface misalignments.

F. Remove and patch all concrete form ties.

G. Pre-treat all shrinkage cracks less than 1/16" with a 60-mil coat of material 6" (1.5 mm) wide.

H. Pre-treat all cracks greater then 1/16" with reinforced self-adhesive tape, as approved by manufacturer, prior to application of the membrane.

I. Apply primer coat of membrane diluted 4:1 with water if necessary to reduce blistering on concrete surfaces at a coverage rate of 100-150 ft.^{2}/U.S. gal (13.9 m^2/3.78 L) by spraying or rolling.

J. Allow primer coat to dry before proceeding to membrane application.

3.03 APPLICATION

A. Apply waterproofing membrane system in accordance with manufacturer's instructions.

B. Thoroughly mechanically mix membrane prior to application.

C. Apply membrane by spray or roller at a minimum coverage rate of 20-25 $ft.^2$/U.S. gal (1.9-2.3 m^2/3.78 L) providing a thickness of 80 wet mils.

D. Frequently inspect surface area with a wet mil gauge to ensure consistent thickness.

E. Ensure membrane coverage is 120 mils for inside/outside corners and non-moving and hairline cracks, as well as around drains and penetrations.

F. Work material into any fluted rib forming indentations.

G. Cured thickness of membrane should be 45 mils dry.

H. Avoid use of products which contain tars, solvents, pitches, polysulfide polymers, or PVC materials that may come into contact with waterproofing membrane system.

3.04 PROTECTION

A. Protect membrane with application of waterproofing protection course, drainage board, or other approved material after a minimum of 48 hours.

B. Backfill immediately using care to avoid damaging waterproofing membrane system.

END OF SECTION

Master Format: 07 13 26

FEBRUARY 2022
(Supersedes October 2013)

MEL-ROL®

Rolled, Self-Adhering Waterproofing Membrane

DESCRIPTION

MEL-ROL waterproofing system is a flexible, versatile, dependable, bituminous, roll-type waterproofing membrane. It is a 60 mil-membrane composed of a nominally 56 mil thick layer of polymeric waterproofing membrane on a heavy duty, four-mil thick, cross-laminated polyethylene carrier film. The two components are laminated together under strict quality-controlled production procedures.

A handy overlap guideline is printed 2 ½" (63.5 mm) in from the material edge on each side to assure proper overlap coverage and to assist in maintaining a straight application. Special exposed polymeric membrane strips are provided on both sides for positive membrane-to-membrane adhesion in the overlap area. The membrane strips are protected by a pull-off release strip. All components of the MEL-ROL waterproofing system work together to provide a cost-effective, positive waterproofing system that's quick and easy to apply.

W. R. MEADOWS accessory products included in the MEL-ROL waterproofing system are: BEM, MEL-ROL LIQUID MEMBRANE, MEL-PRIME™ adhesive (solvent-based and water-based), POINTING MASTIC, DETAIL STRIP, CATALYTIC BONDING ASPHALT, TERMINATION BAR, PROTECTION COURSE and MEL-DRAIN™ drainage board.

USES

MEL-ROL waterproofing system provides a cost-effective answer to properly waterproof foundations, vertical walls, and below-grade floors in residential and commercial construction. It is equally effective for use as between-the-slab waterproofing on plaza decks, parking decks, and structural slabs. Use it as a waterproofing membrane to isolate mechanical and electronic rooms, laboratories, kitchens, and bathrooms. MEL-ROL offers positive protection when "wrapped around" major rapid transit, vehicular, utility, and pedestrian tunnel projects. MEL-ROL can also be used on insulated concrete forms (ICF). MEL-ROL can be applied to concrete, masonry surfaces, wood, insulated wall systems, and metal.

Installation of PROTECTION COURSE from W. R. MEADOWS is recommended before backfilling. MEL-ROL can also be used with drainage boards when specified.

FEATURES/BENEFITS

- Provides cost-effective, flexible, versatile, dependable, positive waterproofing protection against damaging moisture migration and the infiltration of free water.
- Offers a quick and easy-to-apply system for maximum productivity.
- Special membrane-to-membrane adhesion provides additional overlap security.
- Meets or exceeds the test requirements of all currently applicable specifications.
- Components work together for positive waterproofing protection.
- Handles with ease on the jobsite.
- Available in a low temperature version for use when air and surface temperatures are between 20° F (-7° C) and 60° F (16° C). An extra-low temp version is also available, ideal for application in extra-low temperatures down to 0º F (-18º C).

PACKAGING

38.5" (977.9 mm) wide x 62.5' (19.1 m) long, one roll per carton.

COVERAGE

Provides 200 ft.^{2} (18.6 m^2) per roll. Gross coverage is 200 ft.^{2} (18.6 m^2). [Net coverage is 187.5 ft.^{2} (17.4 m^2) with overlap of 2 ½" (63.5 mm).]

SPECIFICATIONS

- A.R.E.M.A.® Specifications Chapter 29, Waterproofing
- LARR Report 26022

APPLICATION

Surface Preparation … Concrete should be cured at least 72 hours, be clean, dry, smooth, and free of voids. Repair spalled areas; fill all voids and remove all sharp protrusions.

CONTINUED ON THE REVERSE SIDE…

MEL-ROL COMBINES POSITIVE WATERPROOFING PROTECTION WITH EASE OF HANDLING

EXCLUSIVE FEATURES

A handy overlap guideline is printed 2 ½” (63.5 mm) in from the material edge on each side, assuring proper overlap coverage and assisting in maintaining a straight application. The polymeric waterproofing membrane is protected by a special, easy-to-remove release paper. The exposed membrane strips on the material edges are protected by a pull-off release strip. Exposed polymeric membrane strips are provided on both sides of MEL-ROL for positive membrane-to-membrane adhesion in the overlap area ... Note the detail, as shown in inset photo.

TECHNICAL DATA

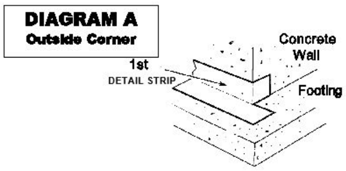
PROPERTY	TYPICAL VALUE	TEST METHOD
COLOR … Carrier Film Polymeric Membrane	White Black	
THICKNESS … Carrier Film Polymeric Membrane	4 mils 56 mils	
TENSILE STRENGTH ... Carrier Film Membrane	5900 psi min. (40.71 MPa) 460 psi (3230 KPa)	ASTM D 412 (Die C)
ELONGATION	971.3%	ASTM D 412
LOW TEMP CRACK BRIDGING 100 Cycle -25° F (-32° C)	Pass	ASTM C 836
PEEL ADHESION	11.8 lb./in. (2068 N/m)	ASTM D 903
LAP ADHESION	8.62 lbf/in. (1508.5 N/m)	ASTM D 1876
WATER VAPOR PERMEABILITY ASTM E-96, B	0.036 Perms	
WATER ABSORPTION	0.1%, 72 hrs. max.	ASTM D570
HYDROSTATIC RESISTANCE	Equiv. to 230.9’ (70.38 m) of water	ASTM D 5385
PUNCTURE RESISTANCE	50 lbf (222 N)	ASTM E154
EXPOSURE TO FUNGI	Pass, 16 weeks	Soil Test
FLEXIBILITY @ -20° F (-29° C)	Pass	ASTM D 1970

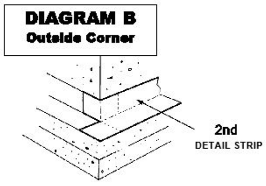
MEL-ROL IS QUICK AND EASY TO APPLY

Temperature ... Apply in dry, fair weather when the air and surface temperatures are above 40° F (4° C). Do not apply to frozen concrete.

MEL-ROL LOW TEMP can be used when air and surface temperatures are between 20° F (-7° C) and 60° F (16° C).

Surface Conditioning … Apply MEL-PRIME adhesive to surfaces that will be covered within one working day. If left exposed overnight, additional adhesive must be applied. Follow all instructions and precautions on containers. All substrates must be clean, dry, and free of all surface irregularities.





Footing Details … Use DETAIL STRIP for impaction sheet coverage. First, fold strips lengthwise and then cut at the fold. Material is then ready to install as 4 ½” (114.3 mm) strips on either side of the rebar. Any excess can be turned down on the face of the footing. Next, fill the voids around rebars in the keyway with CATALYTIC BONDING ASPHALT. Pour the walls. Install DETAIL STRIP horizontally along the wall where it meets the footing, placing half the material up the wall and the other half onto the footing. Extend the material 4 ½” (114.3 mm) beyond outside corners. Slit extended portion of DETAIL STRIP lengthwise. Place the horizontal flap out onto the footing and bend the vertical flap around the wall. (See Diagram A.) Repeat this procedure in the opposite direction as shown in Diagram B.

Horizontal Application … REMOVE release paper from MEL-ROL from the top edge of the roll and firmly press exposed area to the wall. Remove the release paper from the rolls in a downward direction, pressing MEL-ROL into place on the wall. Remove release paper on edge, then position the MEL-ROL membrane. Pull balance of release paper off, running the roll from low to high points, so all laps will shed water. Stagger end laps and overlap all seams at least 2 ½” (63.5 mm). Apply a double-thickness of the MEL-ROL membrane over construction, control, all expansion joints and over cracks greater than 1/16” (1.59 mm) wide.

Vertical Wall Application … Masonry walls may require the application of a cementitious parge-coat. Allow the parge-coat to dry before priming and applying MEL-ROL. When applied, the parge-coat will produce a smooth, uniform, and well-bonded surface. Remove release paper, then apply vertically in lengths approximately 8’ (2.44 m) long over the top of the horizontal DETAIL STRIP at the footing. Overlap seams at least 2 ½” (63.5 mm). Tightly butt edges of membrane and apply POINTING MASTIC in corner applications. (See Diagram C.)

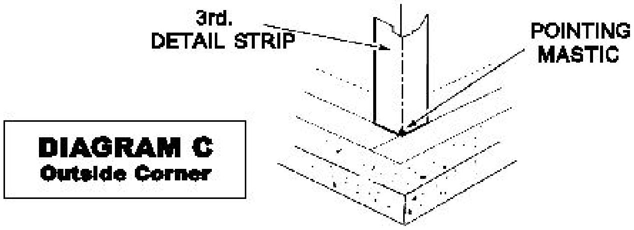


DIAGRAM C
Outside Corner

To the top terminations, apply POINTING MASTIC at least 1/8” (3.18 mm) thick and 1” (25.4 mm) wide. As an option, TERMINATION BAR may be used to mechanically fasten the membrane.

Hand-Rub and Roll Press … Once positioned, immediately hand-rub the MEL-ROL membrane firmly to the surface, removing any bubbles or wrinkles, then pressure roll the complete surface to assure positive adhesion.

Inside Corners ... Before MEL-ROL is applied, place a vertical DETAIL STRIP on inside corners extending the material 4 ½” (114.3 mm) beyond each side of the corner. (See Diagram D.) Terminate at the footing and finish the corner with POINTING MASTIC.

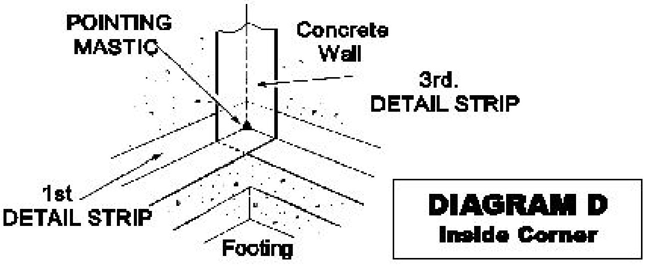
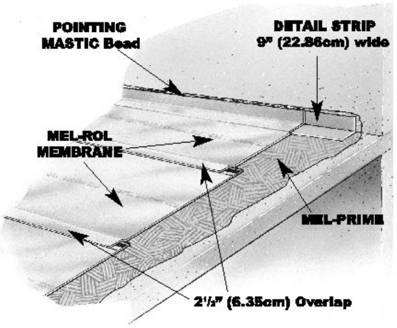


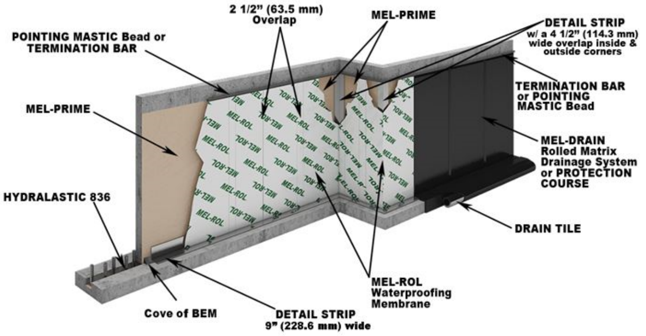
DIAGRAM D
Inside Corner

Outside Corners … Bend DETAIL STRIP vertically over the outside corner and extend 4 ½” (114.3 mm) beyond each side of the corner. Terminate the material at the footing. Finish the corner with POINTING MASTIC. (See Diagram C.)

If MEL-ROL is proposed to be used in place of DETAIL STRIP, contact W. R. MEADOWS Technical Services to determine the suitability of the installation.

Drains and Protrusions … All protrusions should be sealed with two layers of membrane applied at least 6” (152.4 mm) in all directions. Seal all terminations with POINTING MASTIC. Around drains, apply two layers of MEL-ROL and put a bead of POINTING MASTIC between the membrane and clamping rings and at all terminations, drains, and protrusions. See ASTM D 5898.





Inspect and Repair … A thorough inspection should be made before covering and all necessary repairs made immediately. Tears and inadequate overlaps should be covered with MEL-ROL ... slit fish mouths and patch. Seal edges of all patches with POINTING MASTIC. Where applicable, horizontal applications can be flood-tested for 24 hours. All leaks should be marked and repaired when membrane dries.

Protect the Membrane … on all vertical and horizontal installations with the immediate application of PROTECTION COURSE if no drainage system is used, or MEL-DRAIN. To secure PROTECTION COURSE, use POINTING MASTIC as an adhesive, and/or physically attach at the top edge using TERMINATION BAR. Backfilling should be done immediately, using care and caution to avoid damaging the waterproofing application.

PRECAUTIONS

Avoid the use of products that contain tars, solvents, pitches, polysulfide polymers, or flexible PVC and vinyl materials that may come into contact with MEL-ROL. As part of a complete waterproofing solution, W. R. MEADOWS recommends proper site drainage, but due to certain site conditions this sometimes cannot be done effectively. Proper design and suitability of the use of MEL-ROL should be at the discretion of the design consultant.

ACCESSORIES

MEL-PRIME W/B … This water-based adhesive prepares surfaces for MEL-ROL application. Applies easily with manual sprayer or roller; VOC-compliant. MEL-PRIME W/B is for use at temperatures of 40° F (4° C) and up.

COVERAGE: 150 - 200 ft.^{2}/gal. (3.7 - 4.9 m^2/L)

PACKAGING: 1 Gallon (3.79 Liter) Units (4 units per carton), 5 Gallon (18.93 Liter) Pails

MEL-PRIME … This solvent-based adhesive is for use at temperatures of 25° F (-4° C) and above. Apply by roller.

COVERAGE: 250-350 ft.^{2}/gal. (6.14 to 8.59 m^2/L) PACKAGING: 5 Gallon (18.93 Liter) Pails

MEL-PRIME N.E. … MEL-PRIME N.E. solvent-based VOC adhesive is a ready-to-use adhesive specifically formulated to meet the maximum VOC content limits of 200 g/L for quick dry primers as required by VOC regulations in the northeastern U.S.

COVERAGE: 150 - 250 ft.^{2}/gal.

PACKAGING: 1 Gallon Can, 5 Gallon Pail

MEL-ROL LIQUID MEMBRANE … A two-component material used as a flashing to form fillets at corners and at protrusions. May be used as a substitute for POINTING MASTIC. Product can also be used in between walls and footings in lieu of DETAIL STRIP.

COVERAGE: As a fillet, approximately 135 lineal feet per gallon (10.87 m per liter) PACKAGING: 1 Gallon (3.79 Liter) Units, 4 Units per carton.

BEM … BEM can be used as a fillet to round out 90° angles, such as the wall-footing connection, and can be used as a substitute for MEL-ROL LIQUID MEMBRANE.

COVERAGE: As a fillet, approximately 135 lineal ft./gal. (10.9 m/L). PACKAGING: 28 Oz. (828 mL) Cartridges (12 per Carton)

POINTING MASTIC … Used as an adhesive and for sealing top edge terminations on DETAIL STRIP and membrane, and to adhere PROTECTION COURSE.

COVERAGE: 1/8” x 1” x 200’/gal. (3.18 mm x 25.4 mm x 16.10 ml). PACKAGING: 5 Gallon (18.93 Liter) Pails, 29 Oz. (857.65

CATALYTIC BONDING ASPHALT … Easy-to-apply, one-component material for sealing around rebar.

COVERAGE: 5 gal./1000 ft.^{2}/gal. (4.9 m^2/L) PACKAGING: 5 Gallon (18.93 Liter) Pails.

DETAIL STRIP … Convenient, easy-to-use DETAIL STRIP provides an economical and effective method for sealing vertical and horizontal butt joints, i.e. inside or outside corners and where walls and footings meet.

PACKAGING: 9” x 50’ (.23 x 15.24 m) roll, 4 rolls per carton.

PROTECTION COURSE … Use for vertical and horizontal applications. Adhere with POINTING MASTIC or use mechanical fasteners.

PACKAGING: 4’ x 8’ (1.22 x 2.44 m) panels.

MEL-DRAIN … is a dimple-raised molded polystyrene fabric designed to provide high flow capacity to reduce hydrostatic pressure buildup around waterproofing and vaporproofing membranes. Choice of drain types are available for vertical, horizontal, and site applications. Use MEL-PRIME to condition surface prior to application of MEL-DRAIN.

TERMINATION BAR ... is a high strength, pre-formed, multi-purpose, plastic strip designed to support vertical membrane systems and PROTECTION COURSE at their termination point.

PACKAGING: 10' (Holes every 6" o/c, 2" from either end), 25 pieces per carton.

MAINTAIN ENERGY EFFICIENCY

Wet insulating materials lose much of their “R” factor performance characteristics, reducing the energy efficiency of the structure. W. R. MEADOWS thermal and moisture protection products play a key role in *maintaining* the structure’s energy efficiency and aiding in the integrity of other structural systems, such as insulation.

For CAD details, most recent data sheet, further LEED information, and SDS, visit www.wrmeadows.com.

W. R. MEADOWS
SEALTIGHT

SAFETY DATA SHEET

SECTION 1: PRODUCT AND COMPANY IDENTIFICATION

Product: **MEL-ROL®**
Part Number: 5110060
Manufacturer: **W. R. MEADOWS, INC.**
Address: 300 Industrial Drive
Hampshire, Illinois 60140
Telephone: (847) 214-2100
In case of emergency, dial (800) 424-9300 (CHEMTREC)
Revision Date: 8/15/2019
Product Use: Waterproofing Membrane

SECTION 2: HAZARDS IDENTIFICATION/EXPOSURE LIMITS

HMIS	
|Health|	|0|
|Flammability|	|1|
|Reactivity|	|0|
|Personal Protection|	| |

Product is classified as non-hazardous per OSHA 1910.1200. Mel-Rol is defined by OSHA as an "article." A manufactured item that is formed to a specific shape or design during manufacture that does not release or result in exposure to a hazardous chemical under normal use conditions.

SECTION 3: HAZARDS COMPONENTS

Chemical Name:	CAS Number	% by Weight	SARA 313	Vapor Pressure (mm Hg@20°C)	LEL (@24°C)
1. Petroleum Asphalt	8052-42-4	55-60	No	N/A	N/A

N/A = Not Applicable

Under the reporting requirements of Section 313 of Title III of the Superfund Amendments and Reauthorization Act of 1966 (SARA) and 40 CFR Part 372, chemicals listed on the 313 List (40 CFR Part 373.65) are identified under the heading "SARA 313."

SECTION 4: EMERGENCY AND FIRST AID PROCEDURES

EYE CONTACT: Not expected to be an exposure route.
SKIN CONTACT: Wash affected areas with soap and water if available.
INHALATION: Not expected to be an exposure route.
INGESTION: Not expected to be an exposure source.
MOST IMPORTANT SYMPTOMS/EFFECTS, ACUTE AND CHRONIC: See Section Eleven for Symptoms/Effects.

SECTION 5: FIRE AND EXPLOSIVES HAZARDS

FLASHPOINT: Not applicable; product is a solid.
EXTINGUISHING MEDIA: Water fog, foam, dry chemical.
CHEMICAL/COMBUSTION HAZARDS: Oxides and compounds of nitrogen/sulfur.
PRECAUTIONS/PERSONAL PROTECTIVE EQUIPMENT: Avoid smoke inhalation. Use appropriate respiratory protection.

SECTION 6: ACCIDENTAL RELEASE MEASURES

SPILL OR LEAK PROCEDURES: Not applicable. Product is a solid.

SECTION 7: HANDLING AND STORAGE

SAFE HANDLING PROCEDURES: Avoid direct contact.
SAFE STORAGE: Prevent job-site damage.

SECTION 8: EXPOSURE CONTROLS/PERSONAL PROTECTION

	OSHA				ACGIH			
Chemical Name:	PEL	PEL/CEILING	PEL/STEL	SKIN	TLV	TLV/CEILING	TLV/STEL	SKIN
1. Petroleum Asphalt	5 mg/m^3*	N/E	N/E	No	0.5 mg/m^3*	N/E	N/E	N/E

ENGINEERING CONTROLS: None required under normal use conditions.
PERSONAL PROTECTIVE EQUIPMENT: Safety glasses, chemical-resistant gloves.

N/E = Not Established

*: Asphalt Fumes

SECTION 9: PHYSICAL AND CHEMICAL PROPERTIES

BOILING POINT: N/A
EVAPORATION RATE: N/A
WEIGHT PER GALLON: N/A
ODOR: Mild Asphaltic
FLASH POINT: See Section 5
VAPOR PRESSURE: N/D
PARTITION COEFFICENT: N/D
VISCOSITY: N/D
VAPOR DENSITY: N/A
pH LEVEL: N/A
PRODUCT APPEARANCE: Black Solid
ODOR THRESHOLD: N/D
FLAMMABILITY: N/D
RELATIVE DENSITY: N/D
AUTOIGNITION TEMPERATURE: N/D
% VOLATILE BY VOLUME: N/A
% VOLATILE BY WEIGHT: N/A
VOC CONTENT: N/A
MELTING/FREEZING POINT: N/D
UEL/LEL: N/D
SOLUBILITY: N/D
DECOMPOSITION TEMPERATURE: N/D

N/D: Not Determined

SAFETY DATA SHEET

SECTION 10: STABILITY/REACTIVITY

STABILITY: Stable. **HAZARDOUS POLYMERIZATION:** Will not occur.

CONDITIONS AND MATERIALS TO AVOID: None recognized.

HAZARDOUS DECOMPOSITION PRODUCTS: None recognized.

SECTION 11: TOXICOLOGICAL INFORMATION

EYE CONTACT: Direct contact may cause mild irritation.

SKIN CONTACT: Direct contact may cause slight skin irritation.

INHALATION: Not anticipated to be an exposure route.

INGESTION: Not anticipated to be an exposure route.

SIGNS AND SYMPTOMS: Symptoms of eye irritation include tearing, reddening, and swelling. Symptoms of skin irritation include redness and swelling. Gastrointestinal irritation symptoms include nausea, vomiting, and abdominal discomfort.

AGGRAVATED MEDICAL CONDITIONS: None recognized.

OTHER HEALTH EFFECTS: None recognized.

SECTION 12: ECOLOGICAL INFORMATION

ECOTOXICITY: N/E **DEGRADABILITY:** N/E **BIOACCUMULATIVE POTENTIAL:** N/E

SOIL MOBILITY: N/E **OTHER ADVERSE EFFECTS:** None Recognized

SECTION 13: WASTE DISPOSAL INFORMATION

WASTE DISPOSAL INFORMATION: Product is classified as a non-hazardous waste.

SECTION 14: TRANSPORTATION INFORMATION

HAZARDOUS/NON-HAZARDOUS MATERIAL: Not regulated by DOT.

UN NUMBER: None **HAZARD CLASS:** N/A **PACKING GROUP:** N/A

UN PROPER SHIPPING NAME: N/A

ENVIRONMENTAL HAZARDS: None recognized.

BULK TRANSPORTATION INFORMATION: None.

SPECIAL PRECAUTIONS: None.

SECTION 15: REGULATORY INFORMATION

OTHER REGULATORY CONSIDERATIONS: None recognized.

SECTION 16: OTHER INFORMATION

PREPARATION DATE: 8/15/2019

PREPARED BY: Dave Carey

GUIDE SPECIFICATION FOR MEL-ROL: ROLLED, SELF ADHERING WATERPROOFING MEMBRANE

SECTION 07 13 26

SELF-ADHERING SHEET WATERPROOFING

Specifier Notes: This guide specification is written according to the Construction Specifications Institute (CSI) MasterFormat 2010. The section must be carefully reviewed and edited by the Architect or Engineer to meet the requirements of the project. Coordinate this section with other specification sections and the drawings.

Specifier Notes: W.R. Meadows SEALTIGHT® MEL-ROL® waterproofing system is a flexible, versatile, dependable, roll-type waterproofing membrane. It is composed of a nominally 56 mil thick layer of polymeric waterproofing membrane on a heavy duty, 4 mil thick, cross-laminated polyethylene carrier film. The two components are laminated together under strict quality-controlled production procedures. A handy overlap guideline is printed 2 ½" (63.5 mm) in from the material edge on each side to assure proper overlap coverage and to assist in maintaining a straight application. Special exposed polymeric membrane strips are provided on both sides for positive membrane-to-membrane adhesion in the overlap area. The membrane strips are protected by a pull-off release strip.

MEL-ROL waterproofing system provides a cost-effective answer to properly waterproof foundations, vertical walls and below-grade floors in residential and commercial construction. It is equally effective for use as between-the-slab waterproofing on plaza decks, parking decks and structural slabs. Use it as a waterproofing membrane to isolate mechanical and electronic rooms, laboratories, kitchens and bathrooms. MEL-ROL offers positive protection when "wrapped around" major rapid transit, vehicular, utility and pedestrian tunnel projects. MEL-ROL can also be used on insulated concrete forms (ICF).

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Surface preparation.

B. Application of rolled, self-adhering waterproofing membrane system.

1.02 RELATED SECTIONS

Specifier Notes: Edit the list of related sections as required for the project. List other sections dealing with work directly related to this section.

A. Section 03 30 00 - Cast-in-Place Concrete.

B. Section 07 21 00 – Thermal Insulation.

C. Section 07 60 00 – Flashing and Sheet Metal.

D. Section 07 92 00 – Joint Sealants.

E. Section 33 46 00 - Subdrainage.

1.03 REFERENCES

A. American Railway Engineering & Maintenance of Way Association (AREMA) Specification Chapter 29 - Waterproofing.

B. ASTM D146 - Standard Test Methods for Sampling and Testing Bitumen-Saturated Felts and Fabrics Used in Roofing and Waterproofing.

C. ASTM D412 - Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers-Tension.

D. ASTM D570 - Standard Test Method for Water Absorption of Plastics.

E. ASTM D903 - Standard Test Method for Peel or Stripping Strength of Adhesive Bonds.

F. ASTM D1876 – Standard Test Method for Peel Resistance of Adhesives. (T-Peel Test).

G. ASTM D1970 - Standard Specification for Self-Adhering Polymer Modified Bituminous Sheet Materials Used as Steep Roofing Underlayment for Ice Dam Protection.

H. ASTM E96 (Method B) - Standard Test Methods for Water Vapor Transmission of Materials.

I. ASTM E154 - Standard Test Methods for Water Vapor Retarders Used in Contact with Earth Under Concrete Slabs, on Walls, or as Ground Cover.

1.04 SUBMITTALS

A. Comply with Section 01 33 00 - Submittal Procedures.

B. Submit manufacturer's product data and application instructions.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to site in manufacturer's original, unopened containers and packaging, with labels clearly identifying product name and manufacturer.

B. Store materials in a clean dry area in accordance with manufacturer's instructions.

C. Store adhesives and primers at temperatures of 40ºF (5ºC) and above to facilitate handling.

D. Store membrane cartons on pallets.

E. Do not store at temperatures above 90ºF (32ºC) for extended periods.

F. Keep away from sparks and flames.

G. Completely cover when stored outside. Protect from rain.

H. Protect materials during handling and application to prevent damage or contamination.

I. Avoid use of products which contain tars, solvents, pitches, polysulfide polymers, or PVC materials that may come into contact with waterproofing membrane system.

1.06 ENVIRONMENTAL REQUIREMENTS

A. Product not intended for uses subject to abuse or permanent exposure to the elements.

B. Protect rolls from direct sunlight until ready for use

C. Do not apply membrane when air or surface temperatures are below 40ºF (4ºC).

D. Do not apply to frozen concrete.

PART 2 PRODUCTS

2.01 MANUFACTURER

A. W.R. MEADOWS, Inc., PO Box 338, Hampshire, Illinois 60140-0338. (800) 342-5976. (847) 683-4500. Fax (847) 683-4544. Web Site www.wrmeadows.com.

2.02 MATERIALS

A. Rolled, Self-Adhering Waterproofing Membrane: Polymeric waterproofing membrane protected by release paper on cross-laminated polyethylene carrier film with exposed polymeric membrane strips on both sides protected by pull-off release strips.
  1. Performance Based Specification: Waterproofing membrane shall have the following characteristics:
    a. Compliance: AREMA Specification Chapter 29 - Waterproofing.
    b. Thickness:
      1) Carrier Film: 4 mils.
      2) Polymeric Membrane: 56 mils.
    c. Tensile Strength, ASTM D412, Die C:
      1) Carrier Film: 5,900 psi (40.71 MPa) minimum.
      2) Polymeric Membrane: 460 psi (3.23 MPa) minimum.
    d. Elongation, ASTM D412, Die C: Polymeric Membrane: 971 % minimum.
    e. Peel Adhesion, ASTM D903: 11.8 lbf/in. (2068 N/m).
    f. Lap Adhesion, ASTM D1876: 8.62 lbf/in. (1508 N/m)
    g. Water Vapor Permeability, ASTM E96, Method B: 0.036 perms.
    h. Water Absorption, ASTM D570: 0.1 percent, 72 hours maximum.
    i. Resistance to Hydrostatic Head: Equivalent to 230.9 feet (70.3 m) of water.
    j. Puncture Resistance, ASTM E154: 48.2 lbf (214.6 N).
    k. Exposure to Fungi, Soil Test: Pass, 16 weeks.
    l. Color:
      1) Carrier Film: White.
      2) Polymeric Membrane: Black.

  2. Proprietary Based Specification: MEL-ROL Waterproofing System by W.R. MEADOWS.

Specifier Notes: Select one of the following MEL-ROL products based on air and surface temperatures during time of application.

    a. MEL-ROL: For use at temperatures of 40ºF (4ºC) and above.
    b. MEL-ROL LT (Low Temperature): For use at temperatures of 20ºF (-7ºC) to 60ºF (16ºC).
    c. MEL-ROL XLT (Extra Low Temperature): For use at temperatures of 0ºF (-18ºC) to 60ºF (16ºC).

2.03 ACCESSORIES

A. Surface Conditioner:
  1. Temperatures Above 40ºF (4ºC): Mel-Prime Water Base Primer.
  2. Temperatures Above 0ºF (-18ºC): Mel-Prime VOC Compliant Solvent Base Primer or Standard Solvent Base Primer.

B. Flashing and Fillets: MEL-ROL LIQUID MEMBRANE.

C. Pointing Mastic: POINTING MASTIC.

D. Termination Bar: TERMINATION BAR.

E. Corner Tape: DETAIL STRIP.

F. Waterproofing Protection Course: PROTECTION COURSE

G. Rolled Matrix Drainage System: MEL-DRAIN Rolled Matrix Drainage System.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine surfaces to receive self-adhering membrane. Notify Architect if surfaces are not acceptable. Do not begin surface preparation or application until unacceptable conditions have been corrected.

3.02 SURFACE PREPARATION

A. Protect adjacent surfaces not designated to receive waterproofing.

B. Clean and prepare surfaces to receive waterproofing in accordance with manufacturer's instructions.

C. Do not apply waterproofing to surfaces unacceptable to manufacturer.

D. Concrete surfaces must be clean, smooth and free of standing water.

E. Patch all holes and voids and smooth out any surface misalignments.

F. Apply surface conditioner to surfaces that will be covered within one working day according to manufacturer’s recommended coverage rates.

G. Install corner tape on all inside and outside corners, including the footing.

H. Apply a 9” (229 mm) strip of self-adhering membrane over construction, control and expansion joints and over cracks greater than 1/16” (1.59 mm) wide.

I. Seal all terminations with pointing mastic.

3.03 APPLICATION

Specifier Notes: Select A (Horizontal Application), or B (Vertical Application) based on project requirements

A. Horizontal Application
  1. Apply waterproofing membrane system in accordance with manufacturer's instructions.
  2. Ensure accessory materials are compatible with membrane and approved by membrane manufacturer.
  3. Remove release paper on edge, then position the membrane.
  4. Pull balance of release paper off, running the roll from low to high points, so all laps will shed water.
  5. Immediately hand-rub the membrane firmly to the surface, removing any bubbles or wrinkles, then pressure roll the complete surface to assure positive adhesion.
  6. Stagger end laps and overlap all seams at least 2 ½” (63.5 mm).
  7. Seal all terminations with pointing mastic.
  8. Inspect membrane before covering and repair as necessary. Cover tears and inadequate overlaps with membrane. Seal edges of patches with pointing mastic.
  9. Perform flood testing of horizontal applications, as required. Mark leaks and repair when membrane dries.

B. Vertical Application
  1. Apply waterproofing membrane system in accordance with manufacturer's instructions.

2. Ensure accessory materials are compatible with membrane and approved by membrane manufacturer.
3. Remove release paper on edge and position the membrane.
4. Pull balance of release paper off, running the roll vertically over the top of the corner tape at the footing.
5. Immediately hand-rub the membrane firmly to the surface, removing any bubbles or wrinkles, then pressure roll the complete surface to assure positive adhesion.
6. Overlap all seams and stagger end laps at least 2 ½” (63.5 mm).
7. Seal all terminations with pointing mastic.
8. Inspect membrane before covering and repair as necessary. Cover tears and inadequate overlaps with membrane. Seal edges of patches with pointing mastic.

3.04 PROTECTION

A. Protect membrane on vertical and horizontal applications with immediate application of waterproofing protection course, rolled matrix drainage board.

B. Backfill immediately using care to avoid damaging waterproofing membrane system.

END OF SECTION

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INSTALLATION GUIDELINES
MEL-ROL®

This document has been created as an addendum to the MEL-ROL technical data sheet to provide the recommended procedure to use when installing MEL-ROL self-adhesive waterproofing membrane from W. R. MEADOWS. The guide will cover recommended tools to use, surface preparation prior to membrane installation, and the membrane installation on both vertical and horizontal surfaces.

TOOLS RECOMMENDED

- Utility knife
- Chalk line
- Stiff bristle broom
- 6' (1.8 m) broom handle or equivalent
- 1.5" (38.1 mm) or 2" (50.8 mm) margin trowel
- Medium nap (3/8" - 1/2") lambswool paint roller
- Tape measurer
- Gloves (solvent-resistant)
- Screwdriver
- Small diamond point trowel
- 35 lb. or heavier linoleum roller
- Hammer
- Rags
- Cleanup solvent similar to xylene or toluene or SEALTIGHT CLEANER or SEALTIGHT SOLVENT from W. R. MEADOWS

The above tools are enough to perform a proper installation; however, more tools may be used.

W. R. MEADOWS MATERIALS NEEDED

- MEL-ROL self-adhesive waterproofing membrane
- MEL-PRIME, MEL-PRIME N.E., or MEL-PRIME W/B adhesive
- DETAIL STRIP
- POINTING MASTIC
- BEM
- PC protection board and/or MEL-DRAIN drainage board
- MEADOW-CRETE GPS
- MEADOW-PATCH 20

SURFACE PREPARATION

Concrete should be cured at least 72 hours, be clean, dry, smooth, and free of voids. Repair spalled areas; fill all voids and remove all sharp protrusions. Apply in dry, fair weather when the air and surface temperature are above 40° F (4° C). Do not apply to frozen concrete. MEL-ROL LOW TEMP can be used when air and surface temperatures are between 20° F (-7° C) and 60° F (16° C),

Apply MEL-PRIME adhesive to surfaces that will be covered within one working day. If left exposed overnight, additional adhesive must be applied. Follow all instructions and precautions on containers.

MEL-ROL can be applied to concrete, masonry surfaces, wood, insulated wall systems, and metal. All substrates must be clean, dry, and free of all surface irregularities.

Masonry walls may require the application of a cementitious parge-coat. Allow the parge-coat to dry before priming and applying MEL-ROL. When applied, the parge-coat will produce a smooth, uniform, and well-bonded surface. Apply MEL-PRIME to all areas to receive MEL-ROL.

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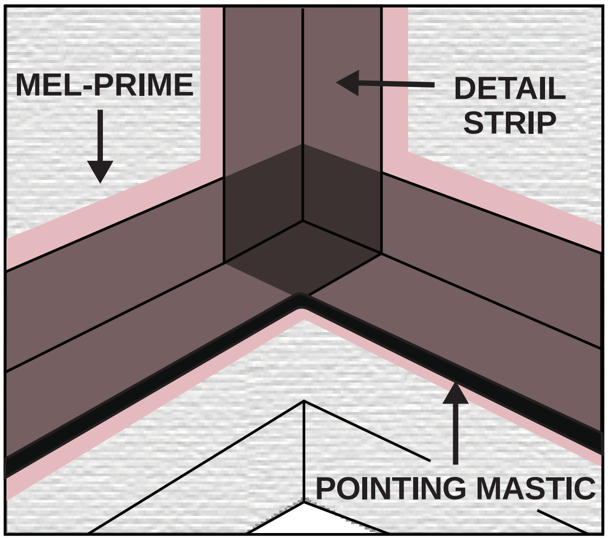
INSTALLATION GUIDELINES
MEL-ROL®

DETAILING

INSIDE CORNERS

Before MEL-ROL is applied, place a vertical DETAIL STRIP on inside corners extending the material 4 ½” (114.3 mm) beyond each side of the corner. Terminate at the footing and finish the corner with POINTING MASTIC.



OUTSIDE CORNERS

Bend DETAIL STRIP vertically over the outside corner and extend 4 ½” (114.3 mm) beyond each side of the corner. Terminate the material at the footing. Finish the corner with POINTING MASTIC.

DRAINS AND PROTRUSIONS

All protrusions should be sealed by forming a collar of MEL-ROL or DETAIL STRIP applied at least 3” (76.2 mm) in all directions. Seal all terminations with POINTING MASTIC. Around drains, apply in the same method and put a bead of POINTING MASTIC between the membrane and clamping rings at all terminations, drains, and protrusions.

FOOTING DETAILS

Fill 90° interior angles with a cove of BEM. Apply MEL-PRIME in all the inside and outside corners prior to installing DETAIL STRIP. Install DETAIL STRIP 4 ½” (114.3 mm) up the wall and 4 ½” (114.3 mm) on the footing. Extend the material 4 ½” (114.3 mm) beyond outside corners. Slit extended portion of DETAIL STRIP lengthwise. Place the horizontal flap out onto the footing and bend the vertical flap around the wall. Repeat this procedure in the opposite direction. Apply a bead of POINTING MASTIC on the exposed edge of installed DETAIL STRIP at footing. Please note: use POINTING MASTIC in place of BEM when using MEL-ROL XLT.

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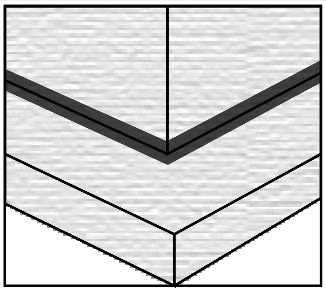
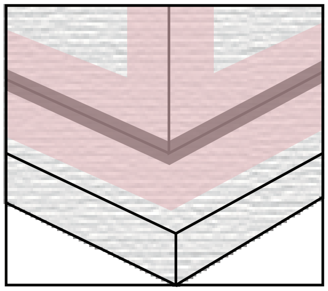
INSTALLATION GUIDELINES
MEL-ROL®

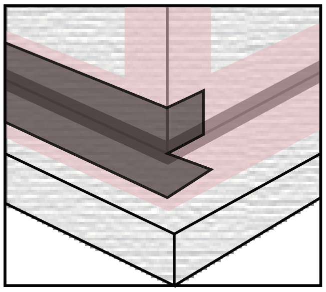
1. Cove of BEM



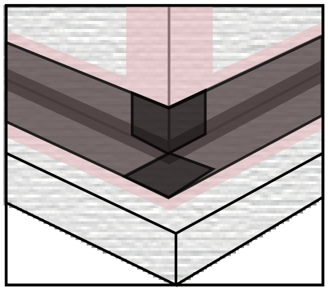
2. MEL-PRIME



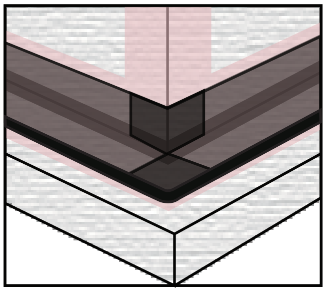
3. 1st DETAIL STRIP



4. 2nd DETAIL STRIP



5. POINTING MASTIC



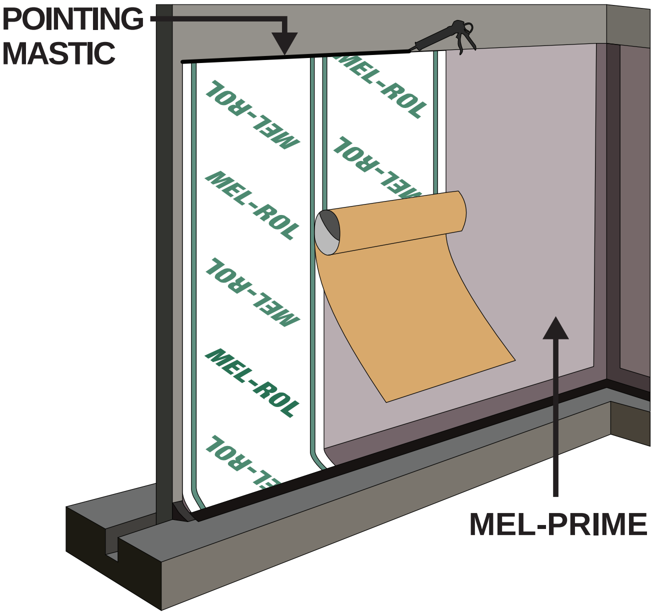
VERTICAL WALL APPLICATION

Remove the release paper, then apply vertically in lengths approximately 8' (2.44 m) long over the top of the horizontal DETAIL STRIP at the footing. Overlap the seams at least 2 ½" (63.5 mm). Tightly butt edges of membrane and apply POINTING MASTIC in corner applications.

To aid in a proper overlap, position the membrane so that it covers the "W. R. MEADOWS" wording running along the edge.

Apply POINTING MASTIC to the top terminations at least 1/8" (3.18 mm) thick and 1" (25.4 mm) wide. As an option, TERMINATION BAR may be used to fasten and membrane mechanically.

Once positioned, immediately hand-rub the MEL-ROL membrane firmly to the surface removing any bubbles or wrinkles, then pressure roll the complete surface to assure positive adhesion. Apply POINTING MASTIC to the leading edge of the membrane at the end of each working day.



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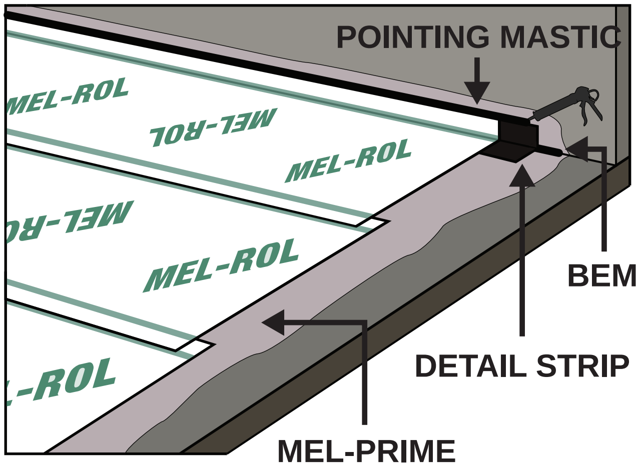
INSTALLATION GUIDELINES
MEL-ROL®

HORIZONTAL APPLICATION

Remove the release paper on the edge, then position the MEL-ROL membrane. Pull the balance of the release paper off, running the roll from low to high points so that all the laps will shed water. Stagger end laps and overlap all seams at least 2 ½" (63.5 mm). All terminations of MEL-ROL must be detailed with a bead of POINTING MASTIC. Apply a double-thickness of the MEL-ROL membrane over construction, control, and all expansion joints and cracks greater than 1/16" (1.59 mm) wide.

Once positioned, immediately hand-rub the MEL-ROL membrane firmly to the surface removing any bubbles or wrinkles. Pressure roll the complete surface to assure positive adhesion.

A thorough inspection should be made before covering and all necessary repairs made immediately. Tears and inadequate overlaps should be covered with MEL-ROL. Slit fish mouths and patch. If flooding test is required, allow a minimum of 24 hours following the membrane installation. Flood testing should be performed accordingly to ASTM D5957.



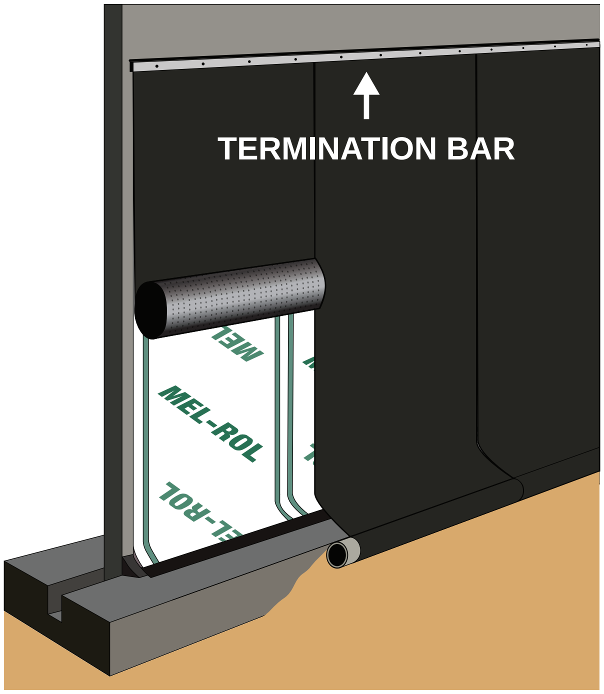
INSPECT AND REPAIR

A thorough inspection should be made before covering and all necessary repairs made immediately. Tears and inadequate overlaps should be covered with MEL-ROL. Slit fish mouths and patch. Seal edges of all patches with POINTING MASTIC. Where applicable, horizontal applications can be flood-tested for 24 hours. All leaks should be marked and repaired when membrane dries.

PROTECT THE MEMBRANE

Immediately apply PROTECTION COURSE on all vertical and horizontal installations if no drainage system is used, or apply MEL-DRAIN. To secure PROTECTION COURSE, use POINTING MASTIC as an adhesive, and/or physically attach at the top edge using TERMINATION BAR.

When using MEL-DRAIN on a vertical wall application, align the first roll and mechanically fasten in place. Roll MEL-DRAIN down the wall, overlapping the footing. Continue MEL-DRAIN installation to cover installed MEL-ROL. Pull away the fabric layer of MEL-DRAIN to expose dimples. Install drainage tile and wrap excess fabric over the drainage tile. Install TERMINATION BAR and fasted at 12" on center to hold MEL-DRAIN in place and apply a bead of POINTING MASTIC on the top edge of the TERMINATION BAR.



Backfilling should be done immediately, using care and caution to avoid damaging the waterproofing application.

PRECAUTIONS

Avoid the use of products that contain tars, solvents, pitches, polysulfide polymers, or PVC materials that may come into contact with MEL-ROL. The use of MEL-ROL does not negate the need for relief of hydrostatic heads. A complete drain tile system should be placed around the exterior of footings and under slabs, as required.

W. R. MEADOWS, INC.

P.O. Box 338 ▪ Hampshire, IL 60140-338
www.wrmeadows.com ▪ wrmil@wrmeadows.com

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W. R. MEADOWS®
A Family Company Since 1926

TELEPHONE: 847-214-2100
800-825-5976
FAX: 847-683-4544

January 9, 2023

W. R. MEADOWS certifies the following information for MEL-ROL® Self-Adhering Waterproofing Membrane:

LEED v4.0 - Building Product Disclosure and Optimization (MRc3 and MRc4):

Manufacturing Location(s):	Hampshire, IL 60140
Raw Material Extraction Point:	Not Available
Recycled Content:	0%

LEED v4.0 Low-Emitting Materials (EQc2):

VOC Emissions:	N/A - Classified as an exterior product. Not required per LEEDv4 EQc2.
VOC Content:	N/A - Not a wet-applied product. Not required per LEEDv4 EQc2.

If field sampling and/or field or laboratory testing be required, W. R. MEADOWS cannot be held responsible for any cost incurred if this product is used prior to receipt of that approval.

Should you have any questions or require additional information, please feel free to contact Technical Services or your local W. R. MEADOWS Representative.

Sincerely,

Kimberly Ann Lombardozzi

Kimberly Ann Lombardozzi, LEED AP ID+C, WELL AP, fitwel Ambassador
Sustainability Manager
W. R. MEADOWS, INC.

PROVIDING A FULL BUILDING
ENVELOPE
SYSTEM

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A NEW HOME FOR BIOSCIENCE RESEARCH:

W. R. MEADOWS on Campus at the University of Arizona

Pursuing the cutting edge in research and education has always been a focus at the University of Arizona—located in Tucson. And this intent was evident when the University first set out to build a new hub, on campus, to house bioscience research themes that included work on biosensors, bioimaging, bioinformatics, healthy aging, genomics technology, and precision medicine. The building itself is a joint collaboration between the University of Arizona Office for Research, Discovery, and Innovation and the University's Department of Health Sciences. It was designed by ZGF Architects and BWS Architects, and the general contractor was DPR Construction.

The goal of the building was to house 50 faculty members and over 300 graduate students, post-docs, and technical support staff. Some of these individuals would be moving from other places on campus to pursue interdisciplinary research, and many would be new to the University—especially recruited because of the promise associated with this new space. The building was also set to be home to a clinical-certified genetics facility focused on testing tumor biopsies in order to set the best course of treatment for individual patients.

Ultimately, the demand for innovation was primary in this construction project. And the teams associated with the groundbreaking and realization of this building had to be able to rise to the challenge.

A Trifecta of Beauty, Functionality, and Sustainability

With a price tag of $107M and comprised of square footage equaling just over 140K, the new construction of this state-of-the-art facility began in 2015. It was significant in nature and involved many moving parts—and project teams. There was a need for collaboration, communication, and synergy alongside the requirement of hitting quality assurance targets. And it just so happened that W. R. MEADOWS happened to be listed in the construction specifications as a potential manufacturer who could get the job done.

> ***"An air barrier and numerous waterproofing products were needed for this project," states Greg Neundorfer, the W. R. MEADOWS salesperson in charge of this project. "There were also multiple transitions between these products that needed to be addressed."***

Whatever products used in this project had a tall order to meet; they had to work well with a variety of substrates.

Creating the Foundation

Starting from the ground up, the first part of the project was centered on the foundation of the building.

"We were confronted with needing multiple forms of waterproofing," explained Neundorfer. "The first was called blindside waterproofing, also known as pre-placed waterproofing. This is present when you are faced with having a hole in the ground that is the size of the building as opposed to being over-excavated. You are building the structure within the exact size of the building itself. So, you have to install a shoring system of in order to keep the soil stable. Then, the waterproofing is placed and the concrete is cast against the waterproofing."

It was Firestop Southwest, the waterproofing installer, who ultimately brought W. R. MEADOWS to the table with the University of Arizona. Ryan Olsen, originally the estimator and project manager for Firestop Southwest, and who ended up transitioning into a consulting role three months into the project with a third-party testing agency, explains.

"W. R. MEADOWS wasn't originally in the specs, but we proposed using W. R. MEADOWS for the waterproofing membrane on both the below-grade and podium decks in lieu of what was specified. The specs, ultimately, had multiple products from varied manufacturers, but we thought it would be better to recommend all W. R. MEADOWS products. I went to U of A and presented to them, explaining what W. R. MEADOWS could do and why we should use them on this project. I told them all the benefits," said Olsen.

The University of Arizona ended up agreeing with Olsen's recommendation and awarded the bid.

> ***"I think that using all of the products together is a great benefit to the owner," said Olsen. "If they ever have an issue, they only have one manufacturer to turn to for maintenance or warranties."***

Another waterproofing product needed had to address positive-side below-grade waterproofing. This is when there is an over-excavated hole and the concrete is cast. The waterproofing is then applied from the backfill side of the hole.

Finally, there was also a large breezeway/walkway area that was positioned over the top of the basement. This received two different types of products including a hot-applied material and a cold-applied material.

All in all, the blindside product was PRECON®, the positive-side below-grade was MEL-ROL™, the hot-applied material was HRM 714, and the cold-applied material was HYDRALASTIC™ 836.

Tracy Smith and Henry Rocha, Vice President and Lead Installer, respectively, at Firestop Southwest, noted, "There are many factors that sets W. R. MEADOWS products apart from other competitors on the market—cost savings, ease of use, durability, and local warehousing. It's a superior company. We have been in business for 18 years and using W. R. MEADOWS for 10 of those. We used so many different products with this project. And even though we have worked with other manufacturers, few compare to W. R. MEADOWS. [Their products] bond to anything you apply [them] to, and it is great with the Arizona heat."

A Challenge Arises

The below-grade vertical walls presented the first issue. “The substrates were a little tough,” stated Rocha. “The concrete wasn’t done correctly so it had to be repaired and replaced before we could put the waterproofing down. But Greg was on site the entire time and helped tremendously.”

“It was the manufacturer’s approval process for warranties that was utilized here,” said Smith. “Greg assessed the substrate for warranty, and everything was remedied.”

Brent Elliott, a Superintendent for DPR Construction, was responsible for handling the foundation structure, air barrier, waterproofing, and anything that had to do with the exterior envelope of the building, also reflected on the situation.“It was a big job,” he said. “We had to pour the foundation walls and then had to cast in place elevated slabs that also needed to be poured. So, we had to run the waterproofing up the walls, which then had to tie back into the frame walls. We also had to tie in an existing basement. We had Greg come out and work with us on the strategy here. There was so much going on. From the waterproofing standpoint, it was probably the most technical project I have ever been involved with.”

All in all, Firestop Southwest had a crew of six on site over the course of about a year. There were multiple stages with what the company was involved in and note that Neundorfer’s experience definitely assisted in the process.

> ***“We have a long history with [Greg]. He has been our local rep for a very long time. We love to work with him and have an excellent partnership with him,” said Rocha.***

Firestop Southwest also says that there was a considerable time savings experienced by their team, which led to an overhead and cost reduction. “Workers understand how to use the [products] and can handle them well. PRECON is especially easy to use and install. And for an installer, time savings is a huge benefit in this regard—it goes beyond material cost alone. If we can do single source and not have to have multiple manufacturers involved, that is a great perk, too,” said Rocha.

“I have worked with W. R. MEADOWS before,” continued DPR’s Elliott. “However, it was the first time I worked with Greg. He was always attentive. If it was an emergency or we had a question that needed an immediate answer, he would address it quickly. We didn’t have to put the brakes on and hold up the whole project to wait for him to get back to us.”

The Exterior Façade

When it came to the air barrier installer on site, it was AK&J Sealants that was on the case. Brian Whited is a partner in the company and was the project manager for the University of Arizona's Bioscience Research Laboratory.

> ***"We have used W. R. MEADOWS air and vapor products—as well as their waterproofing products—on and off for several years now. The Air-Shield LMP is one of our go-to air and vapor products. So, when we were looking at the [U of A] project, that was the product that we referenced in order to price it," explained Whited. "I believe [W. R.] MEADOWS was actually our approved manufacturer in the spec when we put the pricing together."***

AK& J Sealants was responsible for installing the air barrier on the entire exterior façade of the building and had a crew of five workers at the site on average. The bulk of the façade was metal panel, but there was also some masonry and glass. The air barrier was set to be placed behind these exterior finishes.

"The normal LMP system is a 60-mils system," said Whited. "However, the specs for this project called for a 90-mils system. It was a bit 'beefier' than what AK&J usually handles. However, very few challenges were experienced, and frankly, the majority of issues that did occur were related to scheduling, the fast pace of the project, and the sheer number of people who were present at the site. [AK&J] had to be precise in our installation. There were masons and metalsmiths there who were also obviously wanting to keep to their own schedules and do their work. At the end of the day, any of the problems we experienced had nothing to do with W. R. MEADOWS. They delivered everything on time, and it was always high quality. We were happy with their product line and with the local support."

Whited went on to also say that working with Neundorfer was definitely a perk. The two regularly interacted and walked the jobsite together.

"The technical assistance he provides is why we feel like we have a good partner. We know we can reach out and ask questions and he is going to get back with us. That helps projects move forward," commends Whited.

The Man on Both Sides of the Job

If there is one person on this project who had one of the most comprehensive views while on site, it was Ryan Olsen. As stated, Olsen originally entered the project while working for Firestop Southwest. He then transitioned into a role with Field Verified—a third-party consultant. Now, instead of being charged with the installation of the waterproofing, he was responsible for observing and ensuring that the products were installed correctly and properly.

"I was on both sides of the fence here," said Olsen. "After I left Firestop and started with Field Verified, I ended up having to go over my recommendations and submittal of the W. R. MEADOWS products with my leadership. I discussed all of the reasons why these products were used. What's more is that instead of only overseeing the below-grade waterproofing, I was actually looking at the entire envelope, including the air and vapor barrier. At the end of the day, everything except the roof was sealed with W. R. MEADOWS products."

Further to consider, per Olsen, was the way all of the products tied together.

> ***"It was nice to see how the W. R. MEADOWS waterproofing products would tie in with the air barrier on the exterior walls—and many times in places that would normally prove difficult. The products were able to transition from one substrate to the next. We didn't have to worry about compatibility because W. R. MEADOWS had that covered," said Olsen.***

Ultimately, many times, when one is working on a jobsite, there may not be details on how to handle a unique situation in the installation process. If the manufacturer is not present, then it definitely can slow down the process as the contractors will need to get special approval before moving forward.

"If the manufacturer is on site and involved, then they can assist directly. This is what W. R. MEADOWS does," praises Olsen. "Now that I am a consultant, I can appreciate the field support. They are one of the leading manufacturers when it comes to customer service. They will come on site when one or more of their products are being installed and will talk with the people handling the products. They operate cross-functionally with everyone involved, make sure things are going smoothly, and offer help and knowledge."

Inspecting the Work

Finally, Mike Seal, of the University of Arizona, was the Senior Building Inspector assigned to the Bioresearch Laboratory. He handled all of the inspection related to structural, architectural, waterproofing, interior, exterior, and roofing.

"I inspected everything that had to do with the building," he confirmed.

He was present on site every day—sometimes for several hours or more. Seal has also worked with W. R. MEADOWS products in other University of Arizona projects.

"Once we got over the first couple of hurdles related to logistics, it was smooth sailing," Seal said. "We had good installers and a lot of access to product information."

Seal regularly interacted with Neundorfer as well as Olsen and performed varied forms of testing on both the waterproofing and air barriers. During all phases of the inspections that were conducted, Seal never ran into a situation where W. R. MEADOWS had to fix something. While there were times that the installer had to go back and apply more sealant because of transitions—it was never a state that could be attributed to a product defect.

> ***"We love MEADOWS," praised Seal. "They are fantastic. We have projects that go back with them 10 or 12 years, and we don't experience problems or failures. They are one of the top companies we use."***

The Bioscience Research Laboratory project was completed in late 2017. And indeed, the University of Arizona has been satisfied with the outcomes on this building. There have been no issues or reports of water intrusion on site.

Brent Elliott, of DPR Construction, confirms this point. "We are still working on campus—and are in and out of this building occasionally. There have been no issues."

A Study on Teamwork

"All around it was a successful project," said Neundorfer. "Everyone worked well together, from the general contractor on down. I like the whole team effort on this job. I was just so impressed with how we all worked together to get it done."

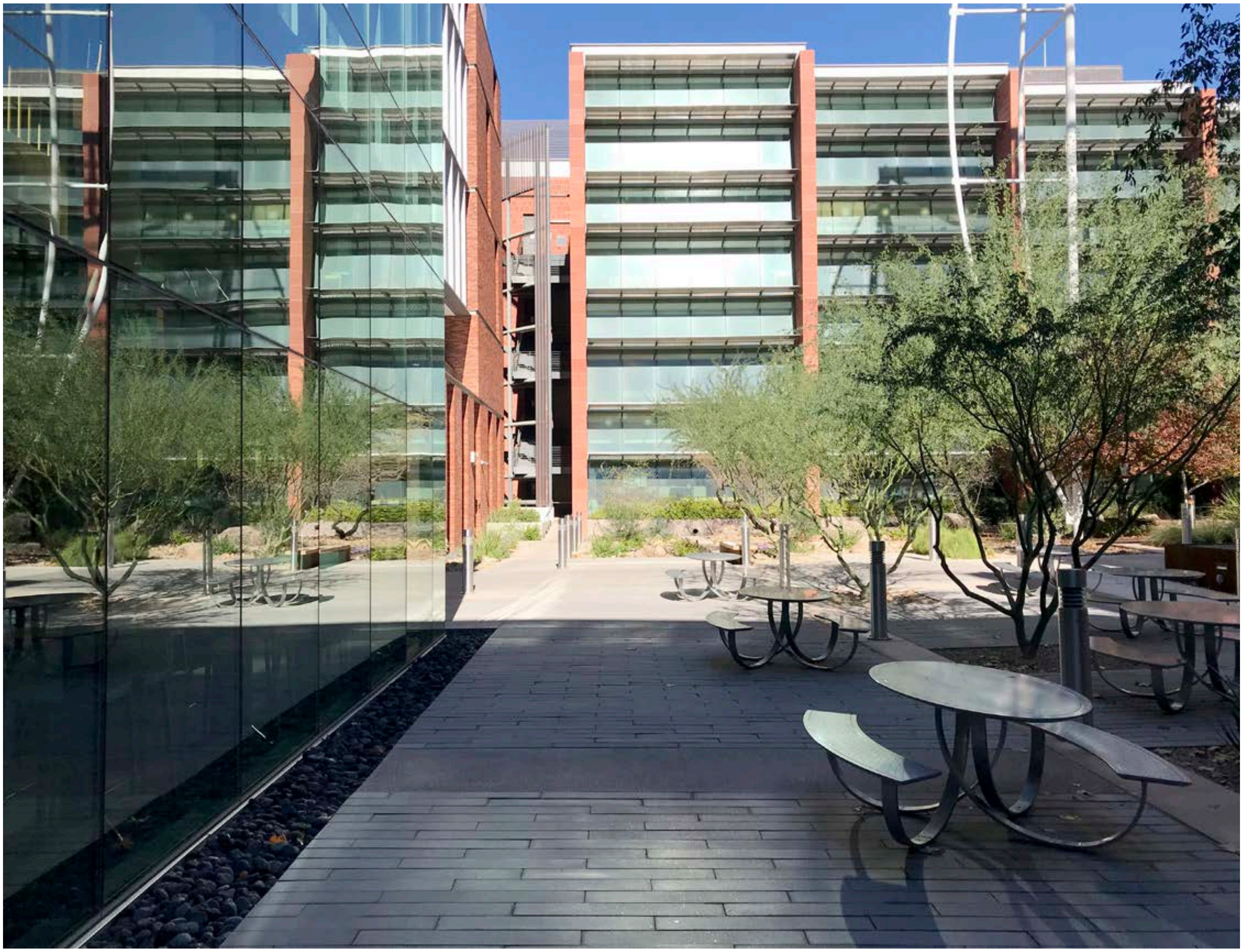
And the general contractor confirmed this point.

> ***"It was a very good dynamic with W. R. MEADOWS," said Elliott, "as well as with Field Verified, Firestop Southwest, DPR, AK&J, and the University of Arizona. The entire experi-ence was positive."***

In turn, because of this cooperation, the Bioscience Research Laboratory at the University of Arizona was able to open in March of 2018 and is currently pursuing its mission of bringing creative people together to advance knowledge, find solutions to medical challenges, and improve health outcomes for Arizonans.

PROJECT SPECS

Architect:	ZGF Architects, LLP
Contractor:	DPR Construction
Subcontractor:	Firestop Southwest
Salesperson:	Greg Neundorfer
Products:	BEM DETAIL FABRIC HRM 714 HYDRALASTIC 836 MEL-DRAIN PRECON
Scope:	140,000 square feet



About W. R. MEADOWS

Since 1926, W. R. MEADOWS has been a leader in developing products that protect structures from moisture infiltration. From below-grade installations to rooftops and in-between, issue-specific products target and prevent potential, costly problems. Today, patented technologies enable more environmentally effective, efficient designs, and many of our products contribute LEED-certification “green” credits. With nine manufacturing facilities throughout the U.S. and Canada, the materials you need are within easy reach. For additional information, call 800.342.5976 or visit www.wrmeadows.com.

W. R. MEADOWS®
SEALTIGHT®
A Family Company Since 1926
QUALITY…SERVICE…INTEGRITY

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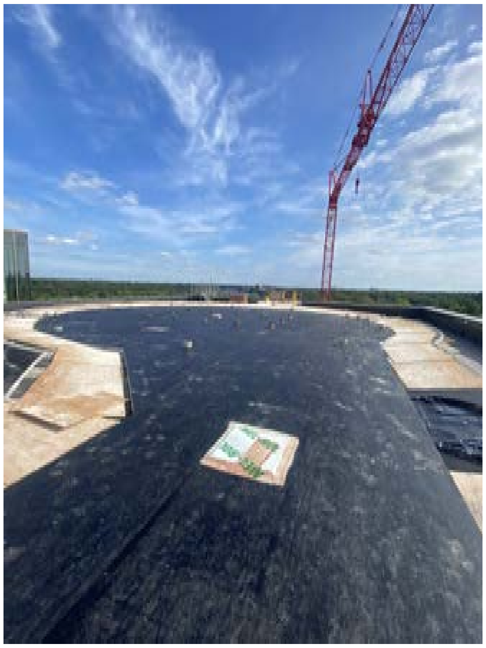

Project Name:	Centra Care St. Cloud Hospital Helipad	Product:	MEL-ROL® PROTECTION COURSE PC-2 MEL-PRIME™ POINTING MASTIC BEM
Location:	St. Cloud, Minnesota, USA		
Architect:	Meyer Borgman Johnson		
Contractor:	McGough Construction		
Subcontractor:	Henkemeyer Coatings		
Salesperson:	Mike Krulas	Scope:	11,000 square feet

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GOODYEAR, AZ / MILTON, ON / SHERWOOD PARK, AB

Project Name:	Joya Child and Family Development
Location:	Spokane, WA, USA
Architect:	NAC
Contractor:	RJ Construction Services
Salesperson:	Bryon Allen

Product:	MEL-ROL® MEL-DRAIN™ 5035 BEM
Scope:	41,000 square feet

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Project Name:	Ridgeline High School	Product:	MEL-ROL®
Location:	Spokane, Washington, USA		MEL-DRAIN™ 5035
Architect:	ALSC Architects		BEM
Contractor:	RJ Construction	Scope:	240,000 square feet
Salesperson:	Bryon Allen		

NO. 714-F **DATA SHEET**

MasterFormat: 07 13 00

JANUARY 2022
(Supersedes March 2021)

PRECON®

Pre-Applied/Underslab Waterproofing Membrane

DESCRIPTION

PRECON is a composite sheet membrane comprised of a non-woven fabric, elastomeric membrane, and W. R. MEADOWS' exclusive, patented PLASMATIC CORE (U.S. Patent No. 7,179,761). The PLASMATIC CORE is a seven-layer matrix designed for toughness and provides the lowest water vapor transmission (WVT) rating on the market. Once concrete is poured against PRECON and the concrete cures, a mechanical bond forms that secures the concrete to the membrane.

USES

PRECON is used as a blindside membrane in vertical applications where access to the positive side is limited. The membrane can also be used for horizontal applications for underslab waterproofing and vaporproofing.

FEATURES/BENEFITS

- Provides a waterproof seal between the membrane and poured concrete wall.
- Helps prevent moisture migration into the structure.
- Reduces methane and radon gas intrusion.

PACKAGING

4' (1.2 m) wide x 50' (15.2 m) long rolls, one roll per carton.

STORAGE AND HANDLING

Store membrane cartons on pallets and cover if left outside. Keep materials away from sparks and flames.

SPECIFICATIONS

- LARR Report 26023

APPLICATION

Surface Preparation ... Inspect all surfaces for any conditions detrimental to the proper completion of the work. Surfaces should be structurally sound. Remove debris or any other foreign material that could damage the membrane.

PRECON can be used with a caisson wall shoring system without the use of a drainage board, such as MEL-DRAIN™ from W. R. MEADOWS. W. R. MEADOWS recommends proper site drainage, but due to certain site conditions this sometimes cannot be done effectively. The decision to remove the drainage board should be at the discretion of the engineer. In situations where a drainage board is not applied, surface preparation is important. The substrate needs to be sound, solid, and smooth. Any gaps or voids >1" (25 mm) need to be grouted. When PRECON is used with MEL-DRAIN from W. R. MEADOWS, the system can bridge gaps <2" (50.8 mm). However, gaps >2" (50.8 mm) will need to be grouted.

Application Method ... PRECON may be applied at temperatures down to 40° F (5° C); however, in less-than-ideal environments or marginal conditions, consider the use of PRECON LOW TEMP below 60° F (16° C). PRECON LOW TEMP can be used in temperatures down to 25° F (-4° C). MEL-PRIME™ from W. R. MEADOWS should be used to enhance the bond at the selvedge edge when conditions warrant with both PRECON and PRECON LOW TEMP. Prior to application of the blindside membrane, attach MEL-DRAIN™ rolled matrix drainage system from W. R. MEADOWS to lagging or soil retention system.

In vertical applications of PRECON, mechanically attach with fasteners every 12" (304.8 mm) across the top, within ½" (13 mm) of the top edge of the membrane. Install the membrane with the fabric side facing toward the concrete pour.

Remove release paper on 6" (152.4 mm) overlap. Apply membrane and roll press into place with a tile type roller.

End Laps ... Overlap membrane 6" (152.4 mm). Prior to overlap, apply BEM, HYDRALASTIC 836, or MEL-ROL® LIQUID MEMBRANE (two-component) from W. R. MEADOWS in area to be lapped. Roll press membrane into BEM, HYDRALASTIC 836, or MEL-ROL LIQUID MEMBRANE. At terminations of membrane, apply BEM, HYDRALASTIC 836, or MEL-ROL LIQUID MEMBRANE 12" (304.8 mm) wide centered over the termination and while still wet, embed 12" (31 cm) wide DETAIL FABRIC into the HYDRALASTIC 836 or MEL-ROL LIQUID MEMBRANE and roll press into place. Ensure that DETAIL FABRIC is centered over the termination with 6" (152.4 mm) on each side of lap edge. Apply

CONTINUED ON THE REVERSE SIDE…

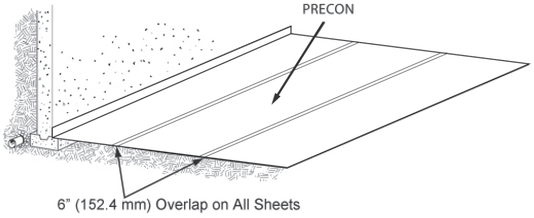
additional HYDRALASTIC 836 on all terminations of DETAIL FABRIC.

Additionally, the use of DETAIL TAPE H and DETAIL TAPE V from W. R. MEADOWS can be used in both horizontal and vertical end laps. View PRECON END LAP TAPING METHOD TECHNICAL BULLETIN available at www.wrmeadows.com for full information.

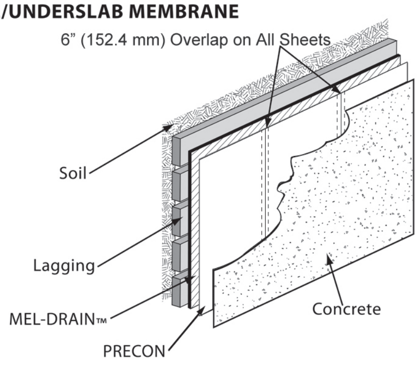
Penetrations and Protrusions … Detail around all horizontal and vertical penetrations using BEM, HYDRALASTIC 836, or MEL-ROL LIQUID MEMBRANE (two-component) from W. R. MEADOWS. Apply BEM, HYDRALASTIC 836, or MEL-ROL LIQUID MEMBRANE by forming a fillet around the pipe or protrusion, overlapping the fabric side of PRECON and the protrusion a minimum of 2.5" (64 mm). If the gap between the protrusion and the membrane is greater than ½" (13 mm), apply DETAIL FABRIC over uncured BEM, HYDRALASTIC 836, or MEL-ROL LIQUID MEMBRANE. All penetration and protrusion surfaces must be clean, rust-free, and sound prior to application of BEM, HYDRALASTIC 836, or MEL-ROL LIQUID MEMBRANE.

*MEL-ROL LIQUID MEMBRANE is a two-component material, not to be confused with MEL-ROL LM.

PRECON
OVERLAP ILLUSTRATION



PRECON
BLINDSIDE/UNDERSLAB MEMBRANE



For horizontal applications involving a cluster of penetrations, consider the use of HYDRALASTIC 836. Prior to application of HYDRALASTIC 836, prepare the surfaces of the penetrations as above and provide a block out using 2' x 4' (.6 x 1.2 m) lumber or other in order to create a "pitch pan" area to receive HYDRALASTIC 836.

Patching … Prior to pouring, inspect membrane for punctures or damage and repair as necessary with HYDRALASTIC 836 and/or DETAIL FABRIC. (BEM or MEL-ROL LIQUID MEMBRANE may be used in place of HYDRALASTIC 836.) In addition, ensure the membrane is free of standing water and has been cleaned of any deleterious materials that will affect the bond of the concrete to the membrane.

Underslab Application … Refer to ACI 302.1R-04: Chapter 4 – Site Preparation and Placing Environment for sub-grade preparation prior to PRECON placement.

PRECAUTIONS

Concrete should be poured within 60 days of membrane installation. For installations below 40° F (4° C), contact W. R. MEADOWS technical services. When using bar supports, use those with a flat bottom.

For CAD details, most recent data sheet, LEED information, and SDS, visit www.wrmeadows.com.

TECHNICAL DATA

Property	Test Method	PRECON Results
Thickness	ASTM D1000	73 mil (1.85 mm)
Low Temp Flexibility	ASTM D1970, 180° @ -20° F (-28.9° C)	Pass
Resistance to Hydrostatic Head	ASTM D5385-93	230' (70 m)
Elongation, Polymeric Membrane	ASTM D412-06	> 400%
Tensile Strength, Film	ASTM D882	9200 psi (63.4 MPa)
Crack Cycling	ASTM C836 @ -15° F (-26° C)	Pass
Puncture Resistance	ASTME 154	> 210 lb. (> 934 N)
Peel Adhesion to Concrete	ASTMD 903	10 lb./in (1754 N/m)
Moisture Vapor Transmission	ASTME 96B	0.0011 perms (0.0004 grains/ft.^{2}/hr) (0.007 gram/m^2/24 hr)
Resistance to Fungi in Soil	GSA-PBS 07115 – 16 Weeks	No Effect
Radon Transmittance (m/s)	k124/02/95	<3.0 x 10^{-9}
Radon Coefficient (m2/s)	k124/02/95	<5.6 x 10^{-12}

LIMITED WARRANTY

Disclaimer

SAFETY DATA SHEET

SECTION 1: PRODUCT AND COMPANY IDENTIFICATION

Product: PRECON® **Part Number:** 5118050
Manufacturer: W. R. MEADOWS, INC. **Address:** 300 Industrial Drive
Hampshire, Illinois 60140
Telephone: (847) 214-2100 In case of emergency, dial (800) 424-9300 (CHEMTREC)
Revision Date: 10/17/2019
Product Use: Waterproofing Membrane

SECTION 2: HAZARDS IDENTIFICATION/EXPOSURE LIMITS

HMIS	
|Health|	|0|
|Flammability|	|1|
|Reactivity|	|0|
|Personal Protection|	| |

Product is classified as non-hazardous per OSHA 1910.1200. PRECON is defined by OSHA as an "article." A manufactured item that is formed to a specific shape or design during manufacture that does not release or result in exposure to a hazardous chemical under normal use conditions.

SECTION 3: HAZARDS COMPONENTS

Chemical Name:	CAS Number	% by Weight	SARA 313	Vapor Pressure (mm Hg@20°C)	LEL (@24°C)
1. Petroleum Asphalt	8052-42-4	55-60	No	N/A	N/A

N/A = Not Applicable

Under the reporting requirements of Section 313 of Title III of the Superfund Amendments and Reauthorization Act of 1966 (SARA) and 40 CFR Part 372, chemicals listed on the 313 List (40 CFR Part 373.65) are identified under the heading "SARA 313."

SECTION 4: EMERGENCY AND FIRST AID PROCEDURES

EYE CONTACT: Not expected to be an exposure route.
SKIN CONTACT: Wash affected areas with soap and water if available
INHALATION: Not expected to be an exposure route.
INGESTION: Not expected to be an exposure source.
MOST IMPORTANT SYMPTOMS/EFFECTS, ACUTE AND CHRONIC: See Section Eleven for Symptoms/Effects.

SECTION 5: FIRE AND EXPLOSIVES HAZARDS

FLASHPOINT: Not applicable; product is a solid.
EXTINGUISHING MEDIA: Water fog, foam, dry chemical.
CHEMICAL/COMBUSTION HAZARDS: Oxides and compounds of nitrogen/sulfur.
PRECAUTIONS/PERSONAL PROTECTIVE EQUIPMENT: Avoid smoke inhalation. Use appropriate respiratory protection.

SECTION 6: ACCIDENTAL RELEASE MEASURES

SPILL OR LEAK PROCEDURES: Not applicable. Product is a solid.

SECTION 7: HANDLING AND STORAGE

SAFE HANDLING PROCEDURES: Avoid direct contact.
SAFE STORAGE: Prevent job-site damage.

SECTION 8: EXPOSURE CONTROLS/PERSONAL PROTECTION

	OSHA				ACGIH			
Chemical Name:	PEL	PEL/CEILING	PEL/STEL	SKIN	TLV	TLV/CEILING	TLV/STEL	SKIN
1. Petroleum Asphalt	5 mg/m^3*	N/E	N/E	No	0.5 mg/m^3*	N/E	N/E	N/E

N/E = Not Established ** = Asphalt Fumes*

ENGINEERING CONTROLS: None required under normal use conditions.
PERSONAL PROTECTIVE EQUIPMENT: Safety glasses, chemical resistant gloves.

SECTION 9: PHYSICAL AND CHEMICAL PROPERTIES

BOILING POINT: N/A
EVAPORATION RATE: N/A
WEIGHT PER GALLON: N/A
ODOR: None
FLASH POINT: See Section 5
VAPOR PRESSURE: N/D
PARTITION COEFFICENT: N/D
VISCOSITY: N/D

VAPOR DENSITY: N/A
pH LEVEL: N/A
PRODUCT APPEARANCE: Black Solid
ODOR THRESHOLD: N/D
FLAMMABILITY: See Section 5
RELATIVE DENSITY: N/D
AUTOIGNITION TEMPERATURE: N/D

% VOLATILE BY VOLUME: N/A
% VOLATILE BY WEIGHT: N/A
VOC CONTENT: N/A
MELTING/FREEZING POINT: N/D
UEL/LEL: N/D
SOLUBILITY: N/D
DECOMPOSITION TEMPERATURE: N/D

N/D: Not Determined

SAFETY DATA SHEET

SECTION 10: STABILITY/REACTIVITY

STABILITY: Stable. **HAZARDOUS POLYMERIZATION:** Will not occur.

CONDITIONS AND MATERIALS TO AVOID: None recognized.

HAZARDOUS DECOMPOSITION PRODUCTS: None recognized.

SECTION 11: TOXICOLOGICAL INFORMATION

EYE CONTACT: Direct contact may cause mild irritation.

SKIN CONTACT: Direct contact may cause slight skin irritation.

INHALATION: Not anticipated to be an exposure route.

INGESTION: Not anticipated to be an exposure route.

SIGNS AND SYMPTOMS: Symptoms of eye irritation include tearing, reddening, and swelling. Symptoms of skin irritation include redness and swelling. Gastrointestinal irritation symptoms include nausea, vomiting, and abdominal discomfort.

AGGRAVATED MEDICAL CONDITIONS: None recognized.

OTHER HEALTH EFFECTS: None recognized.

SECTION 12: ECOLOGICAL INFORMATION

ECOTOXICITY: N/E **DEGRADABILITY:** N/E **BIOACCUMULATIVE POTENTIAL:** N/E

SOIL MOBILITY: N/E **OTHER ADVERSE EFFECTS:** None Recognized

SECTION 13: WASTE DISPOSAL INFORMATION

WASTE DISPOSAL INFORMATION: Product is classified as a non-hazardous waste.

SECTION 14: TRANSPORTATION INFORMATION

HAZARDOUS/NON-HAZARDOUS MATERIAL: Not regulated by DOT.

UN NUMBER: None. **HAZARD CLASS:** N/A **PACKING GROUP:** N/A

UN PROPER SHIPPING NAME: N/A

ENVIRONMENTAL HAZARDS: None recognized.

BULK TRANSPORTATION INFORMATION: None.

SPECIAL PRECAUTIONS: None.

SECTION 15: REGULATORY INFORMATION

OTHER REGULATORY CONSIDERATIONS: None recognized.

SECTION 16: OTHER INFORMATION

PREPARATION DATE: 10/17/2019

PREPARED BY: Dave Carey

The information contained herein is based on the data available to us and is believed to be correct. However, we make no warranty, expressed or implied regarding the accuracy of this data or the results to be obtained from the use thereof. We assume no responsibility for injury from the use of this product described herein.

GUIDE SPECIFICATION FOR PRECON®:
PRE-APPLIED/UNDERSLAB WATERPROOFING MEMBRANE

SECTION 07 13 00

SHEET WATERPROOFING

Revision Date: December 20, 2019

Specifier Notes: This guide specification is written according to Construction Specifications Institute (CSI) MasterFormat. The section must be carefully reviewed and edited by the architect or engineer to meet the requirements of the project. Coordinate this section with other specification sections and the drawings.

Specifier Notes: PRECON is a composite sheet membrane comprised of elastomeric membrane bonded to W. R. MEADOWS®' exclusive plasmatic matrix and a non-woven geotextile fabric. Once concrete is poured against PRECON and the concrete cures, a mechanical bond forms that tightly and permanently secures the concrete to the membrane.

PRECON is used as a waterproofing membrane where vertical positive-side waterproofing is required but access to the positive side is impossible due to the soil retention system. The membrane can also be used for horizontal applications for underslab waterproofing and vaporproofing.

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Surface preparation.

B. Installation of a blindside sheet membrane.

1.02 RELATED SECTIONS

Specifier Notes: Edit the list of related sections as required for the project. List other sections dealing with work directly related to this section.

A. Section 03 30 00 – Cast-in-Place Concrete.

B. Section 07 13 26 – Self-Adhering Sheet Waterproofing.

C. Section 07 21 00 – Thermal Insulation.

D. Section 07 60 00 – Flashing and Sheet Metal.

E. Section 07 92 00 – Joint Sealants.

F. Section 31 50 00 – Excavation Support and Protection.

G. Section 33 46 00 – Subdrainage.

1.03 REFERENCES

A. ACI 302.1R.17 – Guide for Concrete Floor and Slab Construction.

B. ASTM C836 - Standard Specification for High Solids Content, Cold Liquid-Applied Elastomeric Waterproofing Membrane for Use with Separate Wearing Course.

C. ASTM D412-06: Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers - Tension.

D. ASTM D882: Standard Test Method for Tensile Properties of Thin Plastic Sheeting.

E. ASTM D903: Standard Test Method for Peel or Stripping Strength of Adhesive Bonds.

F. ASTM D1970-01 - Standard Specification for Self-Adhering Polymer Modified Bituminous Sheet Materials Used as Steep Roofing Underlayment for Ice Dam Protection.

G. ASTM D5385-93: Standard Test Method for Hydrostatic Pressure Resistance of Waterproofing Membranes.

H. ASTM E96 (Method B): Standard Test Methods for Water Vapor Transmission of Materials.

I. ASTM E154: Standard Test Methods for Water Vapor Retarders Used in Contact with Earth Under Concrete Slabs, on Walls, or as Ground Cover.

J. ASTM F2130: Standard Test Method for Measuring Repellency, Retention, and Penetration of Liquid Pesticide Formulation Through Protective Clothing Materials.

K. GSA-PBS 07115: General Services Administration, Public Building Service - Guide Specification for Elastomeric Waterproofing.

1.04 QUALITY ASSURANCE

A. Contractor will provide the proper equipment, manpower, and supervision at the jobsite to install the membrane in compliance with the project plans and specifications.

B. Installation must be carried out by an experienced contractor with an adequate number of skilled personnel, experienced in the application of the blindside membrane applications.

C. Maintain a record of the batch numbers of all materials supplied for this project.

1.05 PRE-CONSTRUCTION MEETING

A. Convene [one] [_____], week [____] prior to commencing work of this section, in accordance with Section 1.04 - Quality Assurance, meeting with manufacturer’s technical representative, general contractor and site engineer to review the installation procedures.

1.06 SUBMITTALS

A. Comply with Section 01 33 00 - Submittal Procedures.

B. Submit manufacturer's product data and application instructions.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to site in manufacturer's original, unopened containers and packaging, with labels clearly identifying product name and manufacturer.

B. Store materials in a clean, dry area in accordance with manufacturer's instructions.

C. Store adhesive at temperatures of 40° F (4.4° C) and above to facilitate handling.

D. Do not store at temperatures above 90° F (32° C) for extended periods.

E. Protect materials during handling and application to prevent damage or contamination.

1.08 ENVIRONMENTAL REQUIREMENTS

A. Product not intended for uses subject to abuse or permanent exposure to the elements.

B. Apply membrane when conditions are dry and rain is not imminent.

C. Ensure concrete is poured within 60 days of membrane application.

PART 2 PRODUCTS

2.01 MANUFACTURER

A. W. R. MEADOWS, INC., PO Box 338, Hampshire, Illinois 60140-0338. (800) 342-5976. (847) 683-4500. Fax (847) 683-4544. Website: www.wrmeadows.com.

2.02 MATERIALS

A. Blindside Waterproofing Membrane: 73 mil (1.85mm) thick, composite sheet membrane comprised of an elastomeric membrane bonded to a seven-ply plasmatic matrix and a non-woven geotextile fabric.

1. Performance Based Spec: Blindside waterproofing membrane shall have the following properties as determined by laboratory testing:
    - a. Membrane Thickness: 73 mil (1.85 mm)
    - b. Low Temperature Flexibility, ASTM D1970: Pass
    - c. Resistance to Hydrostatic Head, ASTM D5385-93: 230’ (70 m)
    - d. Elongation, ASTM D412-06: >400%
    - e. Tensile Strength (film), ASTM D882: 9,200 psi (63.4 MPa)
    - f. Crack Cycling, ASTM C836: Pass
    - g. Puncture Resistance, ASTM E154: >210 lb. (>934 N)
    - h. Peel Adhesion to Concrete, ASTM D903: 10 lb./in (1,754 N/m)
    - i. Moisture Vapor Transmission, ASTM E96 (Method B): 0.0011 perms
    - j. Resistance to Penetration by Pesticides, ASTM F2130, Percentage of Penetration: 0.0%
    - k. Resistance to Fungi in Soil, GSA-PBS 07115 – 16 weeks: No Effect

2. Proprietary Based Spec:
    - a. PRECON Blindside/Underslab Waterproofing Membrane by W. R. MEADOWS.

Specifier Notes: For temperatures that are below 40° F (5° C), PRECON LOW TEMP must be used. This product can be applied at temperatures down to 25° F (-4° C) and this temperature must be maintained for a period of 24 hours prior and post application. If site conditions are marginal and conditions less than optimal, PRECON LOW TEMP can be considered below 60° F (16° C). W. R. MEADOWS has a low temperature application bulletin with specific installation instructions that needs to be followed.

2.03 ACCESSORIES

A. Rolled Matrix Drainage System: MEL-DRAIN™ by W. R. MEADOWS.

B. Liquid Membrane for Fastener Details:
1. MEL-ROL® LIQUID MEMBRANE (two-component) by W. R. MEADOWS.
2. BEM by W. R. MEADOWS.

C. Liquid Membrane for Overlap Detail: HYDRALASTIC™ 836 by W. R. MEADOWS.

Specifier Notes: HYDRALASTIC 836, MEL-ROL LIQUID MEMBRANE (two-component) and BEM (BUILDING ENVELOPE MEMBRANE) can be interchanged. It must be noted that HYDRALASTIC 836 and BEM can only be applied in temperatures above 30° F (-1° C). MEL-ROL LIQUID MEMBRANE may be used on end laps, penetrations and terminations down to 25° F (-4° C).

D. Detail Fabric for Terminations: DETAIL FABRIC by W. R. MEADOWS.

E. Detail Tape Adhesive: MEL-PRIME™ by W. R. MEADOWS.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine surfaces to receive membrane. Notify architect if surfaces are not acceptable. Do not begin surface preparation or installation until unacceptable conditions have been corrected.

3.02 SURFACE PREPARATION

A. Inspect all surfaces for any conditions detrimental to the proper completion of the work.

B. Ensures surfaces are structurally sound.

C. Remove debris or any other foreign material that could damage the membrane.

3.03 INSTALLATION

A. Vertical Application
  1. Install the membrane with the fabric side facing the interior side of the form to receive the concrete.
  2. Mechanically fasten membrane across the top lagging at 12” (310 mm) on center, ½” (12 mm) from the top, with fasteners approved by the manufacturer.
  3. Apply liquid membrane over the areas where the fasteners have been attached and carry over the top edge.
  4. Remove release paper on 6” (152.4 mm) factory edge.
  5. Mechanically fasten membrane vertically, 24” (620 mm) on center, into the exposed factory edge of the membrane if vertical fastening is required.
  6. Install subsequent sheet of membrane and overlap onto the 6” (152.4 mm) factory edge and roll press into place.
  7. For end-to-end overlap, overlap membrane 6” (152.4 mm).
  8. Apply liquid detail membrane in this area to be lapped and roll press membrane into this liquid detail membrane.
  9. Apply liquid detail membrane at terminations of membrane, 12” (310 mm) wide centered over the termination.
  10. Embed detail fabric into this wet liquid detail membrane centered over the termination, 6” (152.4 mm) on each side of lap edge, and roll press into place.
  11. Apply additional liquid detail membrane on all terminations of detail fabric.
  12. Inspect membrane prior to pouring of concrete for any punctures or damage.
  13. Repair damaged areas as directed by the manufacturer.

B. Horizontal Application
  1. Prepare subgrade prior to membrane application according to ACI 302.1R.17.
  2. Ensure the fabric side of the membrane is facing up.
  3. Remove release paper on 6” (152.4 mm) selvedge edge and overlap edges of additional sheet. Roll press into place.
  4. For end-to-end overlap, overlap membrane 6” (152.4 mm).

5. Apply liquid detail membrane in this area to be lapped and roll press membrane into this liquid detail membrane.
6. Apply liquid detail membrane at terminations of membrane, 12” (310 mm) wide centered over the termination.
7. Embed detail fabric into this wet liquid detail membrane centered over the termination, 6” (152.4 mm) on each side of lap edge, and roll press into place.
8. Apply additional liquid detail membrane on all terminations of detail fabric.
9. Inspect membrane prior to pouring of concrete for any punctures or damage.
10. Repair damaged areas as directed by the manufacturer.

3.04 PROTECTION

A. Ensure membrane is not damaged prior to concrete pour.

B. Ensure concrete is poured within 60 days of membrane application.

END OF SECTION

QUALITY | SERVICE | INTEGRITY
W. R. MEADOWS®
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W. R. MEADOWS, INC.
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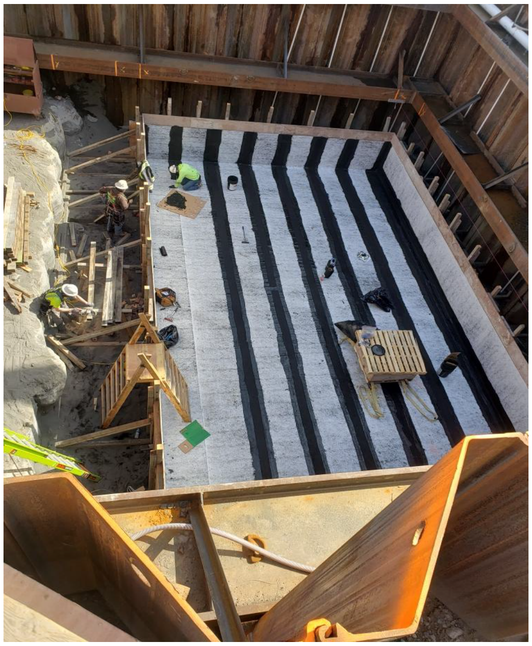

Project Name:	South Park Pump Station	Product:	PRECON®
Location:	Seattle, Washington, USA		MEL-ROL™
Architect:	Cardno		BEM
Contractor:	Pease & Sons Construction		HYDRALASTIC™ 836
Subcontractor:	Hunnicutt's		REINFORCING FABRIC HCR
Salesperson:	Bryon Allen	Scope:	35,000 square feet

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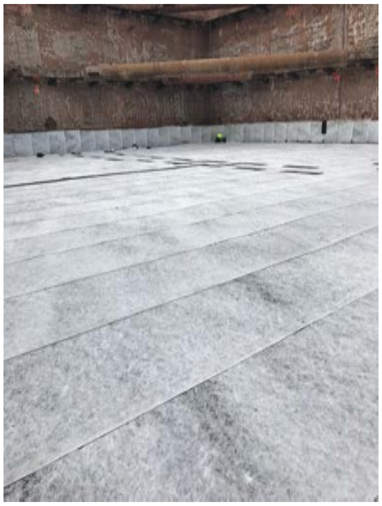

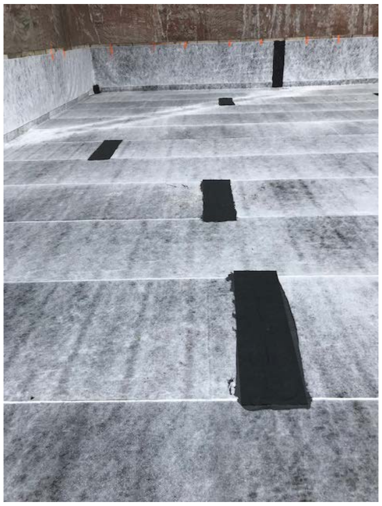

Project Name:	York Street Pump Station	Product:	AIR-SHIELD™ LMP
Location:	Springfield, Massachusetts, USA		BEM
Architect:	Kleinfelder		HYDRALASTIC™ 836
	Stantec		HYDRALASTIC 836 SL
Contractor:	Daniel O'Connell's Sons		MEL-DRAIN™ 5035-B
Subcontractor:	Armani Restoration, Inc.		MEL-ROL®
Salesperson:	Anthony Oropallo		PRECON®
Scope:	10,000 square feet		PROTECTION COURSE
			REINFORCING FABRIC HCR

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Project:	HUB 4 Tucson Off-Campus Student Housing	Products:	PRECON®
Location:	Tucson, Arizona, USA		HYDRALASTIC™ 836
Architect:	Antunovich Associates		MEL-DRAIN™ 5035
Contractor:	J.H. Fidorff & Son, Inc.		BEM
Salesperson:	Greg Neundorfer	Scope:	18,000 square feet

PRECON®

Pre-Applied/Underslab Waterproofing Membrane

A cost-effective, fully bonded solution for blindside or pre-applied waterproofing applications

Waterproofing is not a one-size-fits-all proposition. That's why **W. R. MEADOWS** offers an entire family of products to address different requirements – including **PRECON**, a cost-effective solution for difficult blindside or pre-applied applications.

PRECON is comprised of a non-woven fabric, elastomeric membrane and **W. R. MEADOWS'** exclusive, patented plasmatic core (U.S. Patent No. 7,179,761). The plasmatic core is a seven-layer matrix designed for toughness and provides the lowest water vapor transmission (WVT) rating on the market. Designed to provide a waterproof seal between the membrane and poured concrete, **PRECON** also:

- Reduces methane and radon gas intrusion.
- Forms a mechanical bond between the membrane and the concrete as it cures.
- Serves as a blindside membrane in vertical applications where access to the positive side is limited.
- May be used for horizontal applications for underslab waterproofing and vaporproofing

Need more innovative waterproofing solutions? Visit **www.wrmeadows.com** or call **1-800-342-5976**.

Guardian of the Structure ®

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INSTALLATION GUIDELINES
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This document has been created as an addendum to our PRECON technical data sheet to provide information regarding the application of PRECON waterproofing/vaporproofing membrane when installed up against a soil retention system in a blindside application. Following are the typical installation instructions recommended by W. R. MEADOWS. It is important to review each application as there may be situations that may require this procedure to be modified based on the project requirements. If this situation arises, please contact W. R. MEADOWS technical service.

PRODUCTS REQUIRED

- PRECON waterproofing/vaporproofing membrane: composite sheet membrane comprised of a non-woven fabric, elastomeric membrane, and W. R. MEADOWS' patented plasmatic core.
- HYDRALASTIC 836: cold-applied, solvent-free, single-component waterproofing compound used for detailing of PRECON at end laps, penetrations, and repairs.
- BEM: one-component, cold-applied, non-slump waterproofing material that can be used as an alternate to HYDRALASTIC 836.
- MEL-ROL LIQUID MEMBRANE (two-component): two component, 100% solids, cold-applied, non-slump waterproofing material that can be used as an alternate to HYDRALASTIC 836 and is recommended for low temperature installations of PRECON LOW TEMP.
- DETAIL FABRIC: polypropylene, staple fiber, needle-punched, non-woven geotextile fabric used for end laps and penetration details.
- WATERSTOP EC: regular version waterstop containing bentonite.
- WATERSTOP EC PLUS: combination of hydrophilic rubber and bentonite for use in applications below the water table.
- CLAY-TITE™ MASTIC: used for adhesion of the WATERSTOP EC or WATERSTOP EC PLUS.
- MEL-DRAIN™ drainage board: dimple-raised, molded polystyrene sheet bonded to high strength polypropylene fabric.
- MEL-DRAIN TOTAL-DRAIN™: Prefabricated strip drain consisting of molded polystyrene sheet bonded to high strength polypropylene fabric.
- TERMINATION BAR: high strength plastic strip designed to support PRECON and MEL-DRAIN at the top of wall termination point.
- FASTENERS: Flat-headed steel fasteners with washers are recommended. Must be appropriate for the substrate.

LIMITATIONS

- Concrete should be poured within 60 days of membrane installation.
- PRECON may be applied at temperatures down to 40° F (5° C); however, in less than ideal environments or marginal conditions, consider the use of PRECON LOW TEMP below 60° F (16° C). PRECON LOW TEMP can be used in temperatures down to 25° F (-4° C). Please refer to the PRECON COLD WEATHER APPLICATION TECHNICAL BULLETIN for proper installation procedures.
- Prior to the concrete pour, any ponded water, dirt, or debris that has accumulated on PRECON needs to be removed as this could affect the bond of PRECON to the concrete.

- In situations where there is water accumulation behind the membrane during installation, the presence of this water may inhibit proper bond formation at the edge and end laps due to the stress resulting from the constant hydrostatic pressure exerted by this water.
- Care needs to be taken in high temperature installation situations, as softening of the elastomeric membrane could occur causing sagging.

STORAGE

- Store materials in a clean, dry area in accordance with manufacturer's instructions.
- Store membrane cartons on pallets and cover if left outside. Keep materials away from sparks and flames.
- Store adhesive at temperatures of 40° F (4.4° C) and above to facilitate handling.
- Do not store at temperatures above 90° F (32° C) for extended periods.

SUBSTRATE PREPARATION

Blindside applications are very challenging which includes the substrate upon which the membrane is installed. There are several types of soil retention systems designed to retain the earth. All of these have their own challenges in installation and preparation prior to installation of the PRECON waterproofing system. Several common shoring wall construction techniques include h-piles and timber lagging, corrugated sheet piles, rock, auger cast caissons, and even cement stabilized soil.

For proper performance of the membrane, it is essential that the surface be addressed to ensure that the membrane is not damaged and will adhere fully to the concrete once poured in place. Overlooking this will allow for water intrusion into the structure.

Regardless of the type of soil retention system, all preparation work is similar and is required to provide a monolithic substrate surface upon which the waterproofing can be installed without damage during installation and concrete placement.

W. R. MEADOWS recommends the use of MEL-DRAIN drainage board for all installations of PRECON, but due to certain site conditions and project requirements, this sometimes cannot be done effectively. The decision to remove the drainage board should be at the discretion of the engineer. In situations where a drainage board is not applied, surface preparation is even more important.

Due to the wide variety of these substrates and their conditions, it is recommended to contact your local W. R. MEADOWS technical representative for any questions prior to installation of PRECON. Following are some standard guidelines for surface preparation:

WOOD LAGGING WITH STEEL PILES:

1. Be sure all lagging board nails are pounded flush or removed.
2. Remove all sharp protrusions, mud, debris, ice, or any other materials that will affect the membrane’s performance.
3. Fill or cover any irregularities and voids between lagging board exceeding 1” (25 mm) using spray foam, concrete grout, patching mortar, rigid insulation, or treated plywood to provide a sound substrate.

CAISSONS:

1. If the augered caissons are smooth, PRECON can be installed directly onto the caissons. Any sharp protrusions need to be removed. For the depressed areas between each pile, this area must be filled with a concrete grout prior to PRECON installation.

2. If the augered caissons are rough and irregular, a minimum ¾" (19.1 mm) pressure-treated plywood must be installed. The void behind the plywood at the depressed areas shall be filled with sand, aggregate, or grout to provide a solid substrate for PRECON installation. Plywood selection and installation shall be determined by the project engineer.

SHEET PILING:

1. In areas where PRECON is to be in direct contact with the steel piling, all sharp protrusions need to be removed.
2. In areas where the PRECON is to span the sheet piling, a minimum ¾" (19.1 mm) pressure-treated plywood must be installed. The void behind the plywood at the depressed areas shall be filled with sand, aggregate, or grout to provide a solid substrate for PRECON installation. Plywood selection and installation shall be determined by the project engineer.

SHOTCRETE:

1. Remove all sharp protrusions, mud, debris, ice, or any other materials that will affect the membrane's performance.
2. Fill or cover any voids or irregularities exceeding 1" (25 mm) using a concrete grout or patching mortar.

SLURRY WALL:

1. Remove all sharp protrusions, mud, debris, ice, or any other materials that will affect the membrane's performance.
2. Fill or cover any voids or irregularities exceeding 1" (25 mm) using a concrete grout or patching mortar.

NOTE: For all substrates, if using MEL-DRAIN drainage board prior to PRECON installation, a void of 2" (50 mm) is acceptable.

DETAILING

PENETRATIONS:

1. All penetrations and protrusion surfaces are to be prepared ensuring that all surfaces are clean, rust-free and sound.
2. Ensure that small penetrations, such as nails and fasteners, fully cover the fastener with HYDRALASTIC 836.
3. Larger penetrations:
    a. Apply HYDRALASTIC 836 onto the fabric face of pre-installed PRECON and the penetration a minimum of 2 ½" (64 mm) in all directions.
    b. Form a fillet or cove around the base of the penetration to aid in the transition. Application thickness of this HYDRALASTIC 836 should be 60 mils.
    c. Embed DETAIL FABRIC into the HYDRALASTIC 836 and press into place, ensuring that the DETAIL FABRIC has been fully wetted out with the HYDRALASTIC 836.

TIEBACKS/SOIL NAILS:

1. Install the PRECON waterproofing membrane up to the tieback as close as possible.
2. Apply HYDRALASTIC 836 onto the fabric face of pre-installed PRECON a minimum of 2 ½" (64 mm) in all directions. Form a fillet or cove around the base to aid in the transition.
3. Fully coat the tieback with HYDRALASTIC 836. Application thickness of this HYDRALASTIC 836 should be 60 mils.
4. Embed DETAIL FABRIC into the HYDRALASTIC 836 and press into place, ensuring that the DETAIL FABRIC has been fully wetted out with the HYDRALASTIC 836. This should fully encase the tieback.

INSTALLATION GUIDELINES
PRECON®

CONSTRUCTION JOINTS:

1. Install WATERSTOP EC a minimum of 2" (50 mm) from face of wall.
2. Prior to installation, apply CLAY-TITE MASTIC in all areas to receive WATERSTOP EC or WATERSTOP EC PLUS (below water table). This is used as an adhesive to hold the waterstop in place along with the fasteners.
3. Remove release paper to expose adhesive on WATERSTOP EC.
4. Fasten with nails and washers every 12" (300 mm) O.C.
5. For subsequent applications of WATERSTOP EC, butt ends of waterstop together to ensure continuity.

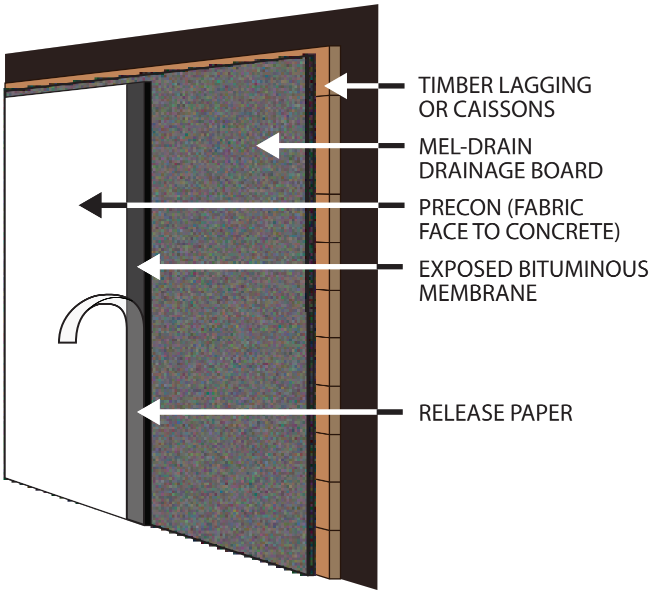
MEMBRANE INSTALLATION

1. Mechanically fasten membrane across the top lagging at 12" (300 mm) on center, ½" (12 mm) from the top, with fasteners and termination bar approved by the manufacturer.
2. Ensure that the fabric side of the membrane is facing the interior side of the installation. This is the side that the concrete is to be poured against.
3. Apply HYDRALASTIC 836 over the areas where the fasteners have been attached.
4. If fasteners are required vertically, install at 24" (600 mm) O.C. in the factory edge of the membrane prior to overlap of subsequent sheet. These fasteners do not need any additional detailing.
5. Any fasteners to be installed in the field of the membrane need to be detailed with HYDRALASTIC 836, fully encasing the fastener.

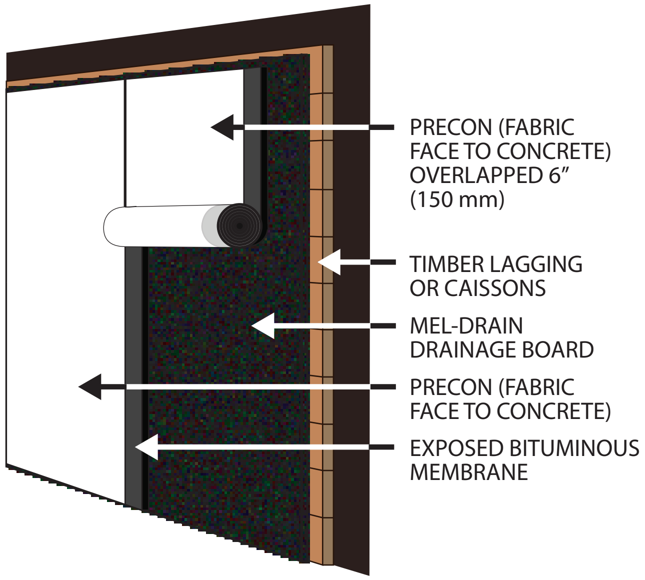
END LAPS/FACTORY EDGE:

FACTORY EDGE

1. Remove release paper on 6" (150 mm) factory edge exposing the bituminous membrane.



2. Overlap the edge of the subsequent sheet. Roll press into place to ensure good adhesion.



INSTALLATION GUIDELINES
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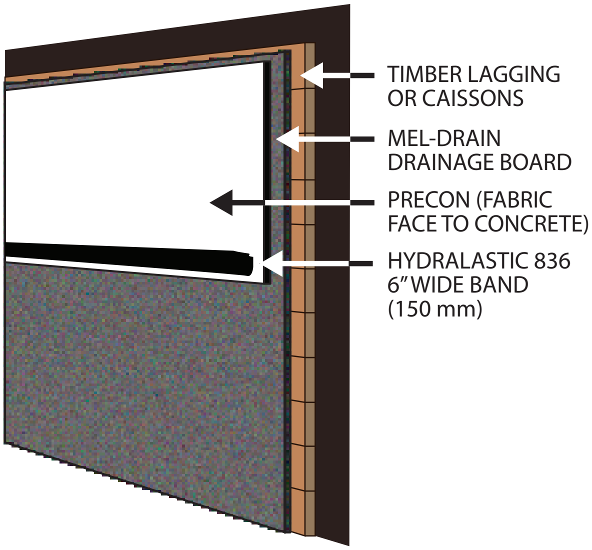
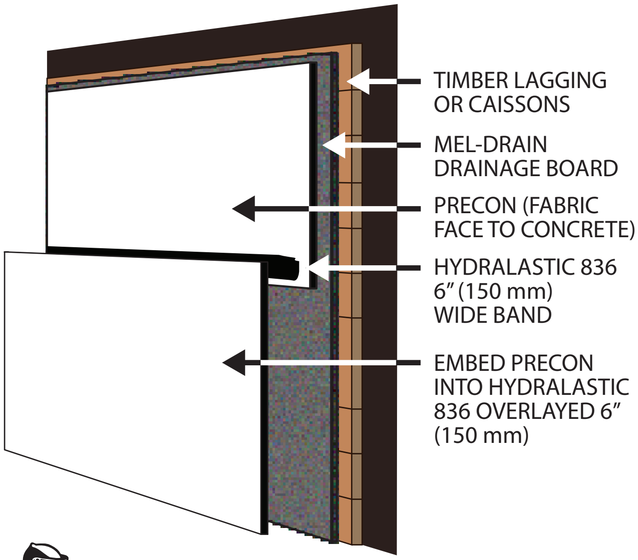
END LAP

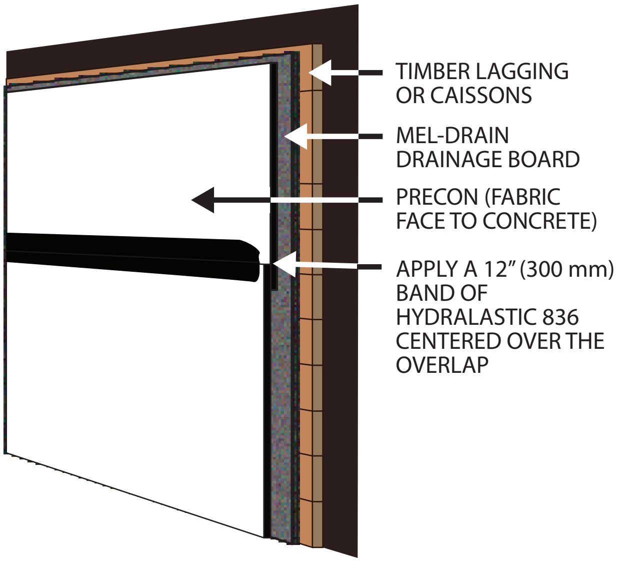
1. Apply HYDRALASTIC 836 in a 6″ (150 mm) band onto the fabric face of the PRECON area to be overlapped at approximately 60 mils thickness.



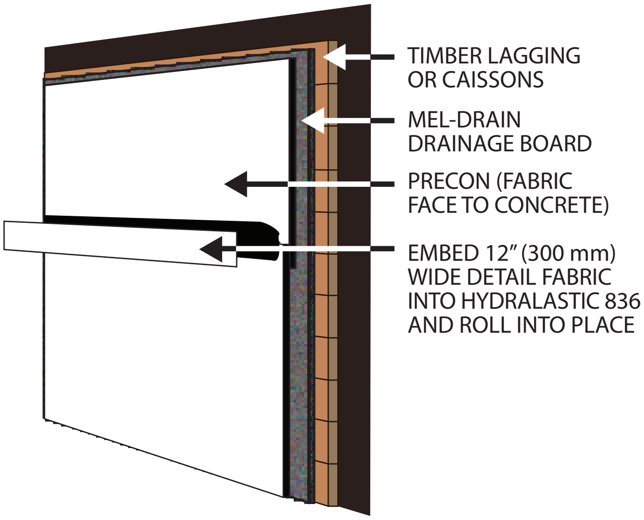
2. Overlap this area with the subsequent sheet of PRECON and roll press into place.



3. Apply HYDRALASTIC 836 in a 12″ (300 mm) band centered over the lap edge and while still wet, embed 12″ (300 mm) wide DETAIL FABRIC into the HYDRALASTIC 836.



4. Ensure that DETAIL FABRIC is centered over the termination with 6″ (150 mm) on each side of lap edge. Press DETAIL FABRIC into place to ensure that the HYDRALASTIC 836 has fully wetted out the fabric.



INSTALLATION GUIDELINES
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REPAIRS

1. Small Punctures [1/2" (12.7 mm) or less]
    a. Apply HYDRALASTIC 836 over the damaged area.
2. Punctures ½" to 1" (12.7 - 25.4 mm)
    a. Apply HYDRALASTIC 836 over the damaged area extending onto PRECON.
    b. Embed a piece of DETAIL FABRIC into the wet HYDRALASTIC 836.
3. Damaged areas greater than 1" (25.4 mm)
    a. Remove the damaged portion of PRECON.
    b. Apply HYDRALASTIC 836 in a 6" (150 mm) band onto the fabric face of the PRECON area to be lapped at approximately 60 mils thickness.
    c. Install a piece of PRECON extending 6" (300 mm) from the damaged area in all directions and embed into the wet HYDRALASTIC 836. Mechanically fasten to hold into place.
    d. Apply HYDRALASTIC 836 in a 12" (300 mm) band centered over the termination and while still wet, embed 12" (300 mm) wide DETAIL FABRIC into the HYDRALASTIC 836.
    e. Ensure that DETAIL FABRIC is centered over the termination with 6" (150 mm) on each side of lap edge. Press DETAIL FABRIC into place to ensure that the HYDRALASTIC 836 has fully wetted out the fabric.

INSPECTION AND PROTECTION

1. Inspect membrane prior to pouring of concrete for any punctures or damage and repair as above.
2. Protect PRECON from other trades prior to concrete placement.
3. Concrete is required to be poured within 60 days of PRECON installation.

INSTALLATION GUIDELINES
PRECON® HORIZONTAL APPLICATION

This document has been created as an addendum to our PRECON technical data sheet to provide information regarding the application of PRECON waterproofing/vaporproofing membrane in a horizontal application. Following are the typical installation instructions recommended by W. R. MEADOWS. It is important to review each application as there may be situations that may require this procedure to be modified based on the project requirements. If this situation arises, please contact W. R. MEADOWS technical service.

PRODUCTS REQUIRED

- PRECON waterproofing/vaporproofing membrane: composite sheet membrane comprised of a nonwoven fabric, elastomeric membrane, and W. R. MEADOWS' patented plasmatic core.
- HYDRALASTIC 836: cold-applied, solvent-free, single-component waterproofing compound used for detailing of PRECON at end laps, penetrations, and repairs.
- BEM: one-component, cold-applied, non-slump waterproofing material that can be used as an alternate to HYDRALASTIC 836.
- MEL-ROL LIQUID MEMBRANE (two-component): two component, 100% solids, cold-applied, non-slump waterproofing material that can be used as an alternate to HYDRALASTIC 836 and is recommended for low temperature installations of PRECON LOW TEMP.
- DETAIL FABRIC: polypropylene, staple fiber, needlepunched, non-woven geotextile fabric used for end laps and penetration details.

LIMITATIONS

- Concrete should be poured within 60 days of membrane installation.
- PRECON may be applied at temperatures down to 40° F (5° C); however, in less than ideal environments or marginal conditions, consider the use of PRECON LOW TEMP below 60° F (16° C). PRECON LOW TEMP can be used in temperatures down to 25° F (-4° C). Please refer to the PRECON COLD WEATHER APPLICATION TECHNICAL BULLETIN for proper installation procedures.
- Prior to the concrete pour, any ponded water, dirt, or debris that has accumulated on PRECON needs to be removed as this could affect the bond of PRECON to the concrete.
- In situations where there is water accumulation behind the membrane during installation, the presence of this water may inhibit proper bond formation at the edge and end laps due to the stress resulting from the constant hydrostatic pressure exerted by this water.
- Care needs to be taken in high temperature installation situations, as softening of the elastomeric membrane could occur causing sagging.

INSTALLATION GUIDELINES
PRECON® HORIZONTAL APPLICATION

STORAGE

- Store materials in a clean, dry area in accordance with manufacturer's instructions.
- Store membrane cartons on pallets and cover if left outside. Keep materials away from sparks and flames.
- Store adhesive at temperatures of 40° F (4.4° C) and above to facilitate handling.
- Do not store at temperatures above 90° F (32° C) for extended periods.

APPLICATION

SURFACE PREPARATION

Inspect all surfaces for any conditions detrimental to the proper completion of the work. Surfaces should be structurally sound. Remove debris or any other foreign material that could damage the membrane.

APPLICATION METHOD

Install PRECON membrane with the fabric side facing towards the concrete floor. Place subsequent rolls of PRECON with a 6″ (152.4 mm) overlap. Remove release paper and roll press into place with a tile type roller.

When a horizontal application meets a vertical application, ensure this overlap is a minimum of 1' (.3 m) from the base of the wall. Follow the end lap detailing instructions to address the overlap in this area.

END LAPS

Overlap membrane 6″ (152.4 mm). Prior to overlap, apply BEM, HYDRALASTIC 836, or MEL-ROL® LIQUID MEMBRANE* (two-component) from W. R. MEADOWS in area to be lapped. Roll press membrane into BEM, HYDRALASTIC 836, or MEL-ROL LIQUID MEMBRANE.

Apply BEM, HYDRALASTIC 836, or MEL-ROL LIQUID MEMBRANE 12″ (304.8 mm) wide centered over the termination and while still wet, embed 12″ (31 cm) wide DETAIL FABRIC into the HYDRALASTIC 836 or MEL-ROL LIQUID MEMBRANE and roll press into place. Ensure that DETAIL FABRIC is centered over the termination with 6″ (152.4 mm) on each side of lap edge. Apply additional HYDRALASTIC 836 on all terminations of DETAIL FABRIC.

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INSTALLATION GUIDELINES
PRECON® HORIZONTAL APPLICATION

PENETRATIONS AND PROTRUSIONS

Detail around all penetrations using BEM or MEL-ROL LIQUID MEMBRANE (two-component) from W. R. MEADOWS. Apply BEM or MEL-ROL LIQUID MEMBRANE by forming a fillet around the pipe or protrusion, overlapping the fabric side of PRECON and the protrusion a minimum of 2.5″ (64 mm). If the gap between the protrusion and the membrane is greater than ½” (13 mm), apply PRECON FABRIC TAPE over uncured BEM or MEL-ROL LIQUID MEMBRANE. All penetration and protrusion surfaces must be clean, rust-free, and sound prior to application of BEM or MEL-ROL LIQUID MEMBRANE.

*MEL-ROL LIQUID MEMBRANE is a two-component material, not to be confused with MEL-ROL LM.

For horizontal applications involving a cluster of penetrations, consider the use of HYDRALASTIC 836. Prior to application of HYDRALASTIC 836, prepare the surfaces of the penetrations as above and provide a block out using 2′ x 4′ (.6 x 1.2 m) lumber or other in order to create a “pitch pan” area to receive HYDRALASTIC 836.

PATCHING REPAIRS

SMALL PUNCTURES 1/2” (12.7 MM) OR LESS

- Apply HYDRALASTIC 836 over the damaged area.

PUNCTURES 1/2” TO 1” (12.7 - 25.4 MM) OR LESS

- Apply HYDRALASTIC 836 over the damaged area extending onto PRECON.
- Embed a piece of DETAIL FABIR into the wet HYDRALASTIC 836.

DAMAGED AREAS GREATER THAN 1” (25.4 MM)

- Remove the damaged portion of PRECON.
- Apply HYDRALASTIC 836 in a 6” (150 mm) band onto the fabric face of the PRECON area to be lapped at approximately 60 mils thickness.
- Install a piece of PRECON extending 6” (300 mm) from the damaged area in all directions and embed into the wet HYDRALASTIC 836. Mechanically fasten to hold into place.
- Apply HYDRALASTIC 836 in a 12” (300 mm) band centered over the termination and while still wet, embed 12” (300 mm) wide DETAIL FABRIC into the HYDRALASTIC 836.
- Ensure that DETAIL FABRIC is centered over the termination with 6” (150 mm) on each side of lap edge. Press DETAIL FABRIC into place to ensure that the HYDRALASTIC 836 has fully wetted out the fabric.

UNDERSLAB APPLICATION

Refer to ACI 302.1R-04: Chapter 4 – Site Preparation and Placing Environment for sub-grade preparation prior to PRECON placement.

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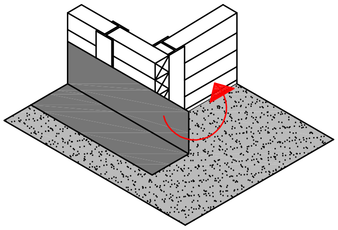
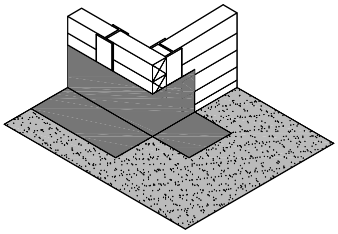
INSTALLATION INSTRUCTIONS
PRECON®

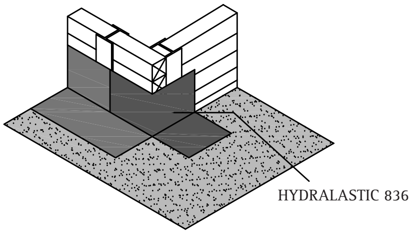
OUTSIDE CORNER INSTALLATION INSTRUCTIONS



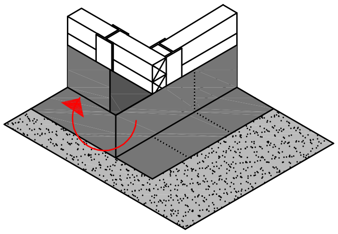
1. Install PRECON according to installation instructions onto soil stabilization system. Allow a minimum of 12” overlap to extend around outside corner.



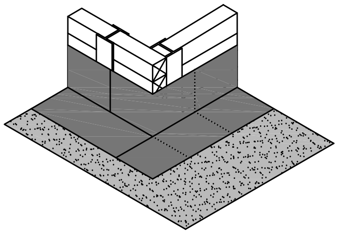
2. Cut PRECON on the horizontal to allow for ease of bending around corner and mechanically fasten according to installation instructions.



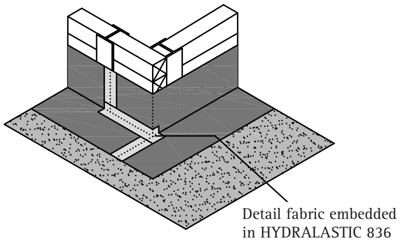
3. Apply HYDRALASTIC 836 to all overlap areas of PRECON that will be accepting the subsequent sheet of PRECON.



4. Install overlapping PRECON according to installation instructions onto soil stabilization system. Cut PRECON on the horizontal to allow for ease of bending around corner.



5. Embed overlaps into pre-applied HYDRALASTIC 836 and roll press into place.



6. Apply HYDRALASTIC 836 at all overlapping joints in a 12” wide application and then fully embed detail fabric into this HYDRALASTIC 836. Terminate all edges with additional HYDRALASTIC 836.

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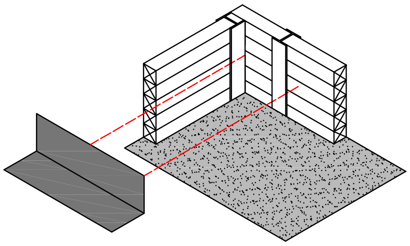
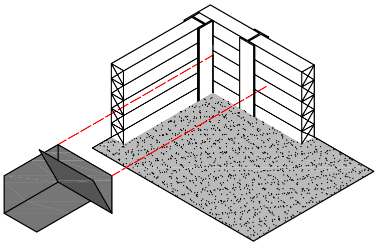
INSTALLATION INSTRUCTIONS
PRECON®

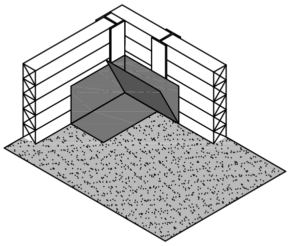
INSIDE CORNER INSTALLATION INSTRUCTIONS



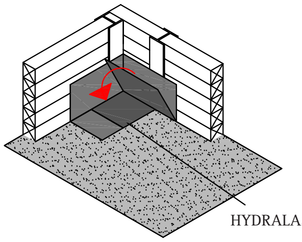
1. Install PRECON according to installation instructions onto soil stabilization system.



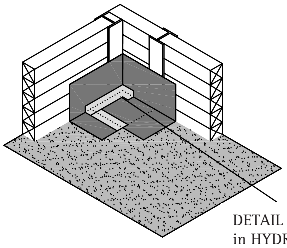
2. Cut PRECON on the horizontal to allow for ease of bending around corner.



3. Mechanically fasten according to installation instructions.



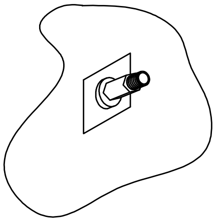
4. Apply HYDRALASTIC 836 to the area of PRECON that will be accepting the PRECON overlap, fold down overlap and embed in the HYDRALASTIC 836. Roll press into place.



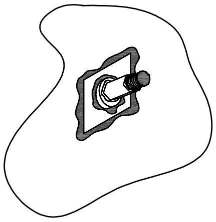
5. Apply HYDRALASTIC 836 at all overlapping joints in a 12" wide application and then fully embed DETAIL FABRIC into this HYDRALASTIC 836. Terminate all edges with additional HYDRALASTIC 836.

INSTALLATION INSTRUCTIONS
PRECON® SOIL NAIL

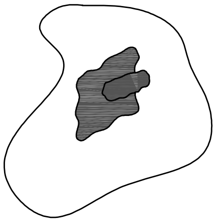
INSTALLATION INSTRUCTIONS



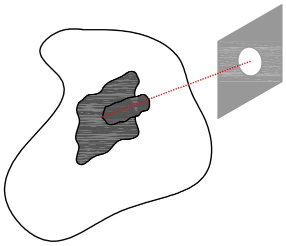
1. Ensure soil nail is clean and clear of any contaminants that could be detrimental to the bond of the HYDRALASTIC 836.



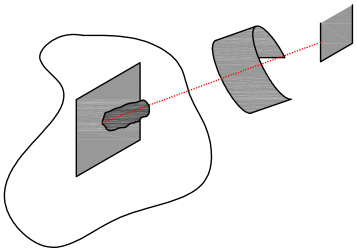
2. Apply BEM around all edges of the soil nail plate and all areas around the nut.



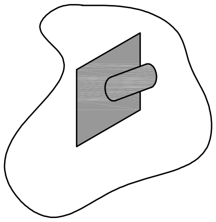
3. Apply HYDRALASTIC 836 over complete soil nail and plate, totally covering the area of the soil nail.



4. Cut a piece of DETAIL FABRIC to the dimensions of the soil nail plate and embed the fabric into the previously applied HYDRALASTIC 836.



5. Cut another two pieces of DETAIL FABRIC, one for the shaft of the soil nail, the other for the top, and embed this fabric into the previously applied HYDRALASTIC 836.



6. Ensure the soil nail is totally encapsulated in the HYDRALASTIC 836 and DETAIL FABRIC prior to application of PRECON blindside membrane.

* Installation guidelines does not show installation of MEL-DRAIN™ or PRECON for ease of viewing each step. Refer to W. R. MEADOWS installation instructions or Technical Services for complete instructions.

2/3/14

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TECHNICAL BULLETIN

PRECON® COLD WEATHER APPLICATION

W. R. MEADOWS has developed a low-temperature version of PRECON for applications below 40° F (5° C). The minimum ambient and substrate temperature for PRECON LOW TEMP is 25° F (-4° C).

PRECON LOW TEMP and any accessory products must be stored in their original, unopened packaging at temperatures above 40° F (5° C). For optimal performance, store materials at temperatures at or near room temperatures until just prior to application.

Installation of PRECON LOW TEMP should not occur in the presence of rain, snow or ice, or if there is any ponded water as a result of melting. The presence of water on the membrane during its installation will prevent the proper adhesion of the joints. Certain environmental conditions may cause the formation of dew on the plasmatic core, which could impede the bond at the selvage edge. This may occur at temperatures above or below 40° F (5° C) and will necessitate the use of MEL-PRIME (solvent-based versions) on the selvage edge to insure a good bond at the seams.

Concrete placement should be completed within 60 days of the installation of the PRECON LOW TEMP and it is recommended it be done as soon as possible to prevent damage to the membrane. After installation, the membrane should be protected from damage.

During installation of PRECON LOW TEMP at lower temperatures and under certain environmental conditions, additional steps in the installation need to be followed to ensure that proper adhesion of the joints and overlaps is obtained.

1. MEL-PRIME (solvent-based versions) is required to be used at all factory edge joints. MEL-PRIME is to be applied at a width of 6″ (152.4 mm) and allowed to dry prior to overlap of the adjoining sheet of PRECON. Following this, all areas of this overlap need to be pressure rolled for proper adhesion.
2. For optimum performance, HYDRALASTIC 836 or MEL-ROL® LIQUID MEMBRANE (two-component) are to be used for all end lap details and terminations. The procedure is as follows:
   a. Apply HYDRALASTIC 836 or MEL-ROL LIQUID MEMBRANE (two-component) in the area to be lapped at a width of 3″ (7.6 cm) and roll press the overlapping PRECON while still wet.
   b. Apply HYDRALASTIC 836 or MEL-ROL LIQUID MEMBRANE (two-component) at the termination of this overlapping sheet 12″ (30 cm) wide centered over the termination.
   c. While the HYDRALASTIC 836 or MEL-ROL LIQUID MEMBRANE (two-component) is still wet, embed 12″ (30 cm) wide strip of PRECON and roll press into place. Then place DETAIL FABRIC from W. R. MEADOWS centered over the termination with 6" (152.44 mm) on each side of lap edge.
   d. Apply additional HYDRALASTIC 836 or MEL-ROL LIQUID MEMBRANE (two-component) on all terminations of the DETAIL FABRIC.

Please note that HYDRALASTIC 836 can only be applied in temperatures above 30° F (-1° C). MEL-ROL LIQUID MEMBRANE (two-component) may be used on end laps, penetrations and terminations down to 25° F (-4° C).

3. Prior to placement of the concrete, ensure that the substrate is clean, dry and frost-free. The temperature of the membrane at time of concrete placement needs to be above 40° F (5° C).

It is important to review each application as there may be situations that would require either of these procedures to be modified based on the project requirements. If there are any concerns during the installation, contact technical support for assistance.

TECHNICAL BULLETIN

DETAIL TAPE END LAP TAPING METHOD FOR PRECON® AND HYDRASTOP™ SA

HORIZONTAL END-LAP DETAILING

On a properly prepared sub-grade, place a strip of 12” (304.8 mm) DETAIL TAPE H with the adhesive side of the tape facing upwards. Remove the release paper on the one side of the tape, exposing 6” (152.4 mm) of the rubberized asphalt and apply the PLASMATIC CORE® side of the PRECON into this and roll press into place. Following this, remove the remaining release paper on the tape and apply the subsequent roll of PRECON into this area, making sure that both rolls are butted together. Roll press this into place. Following that, apply a 12” (304.8 mm) band of the POINTING MASTIC onto this overlap at a thickness of approximately 60 mils, and embed the DETAIL FABRIC into this.

*DETAIL TAPE H is a polymeric waterproofing membrane on a shrink-resistant, heavy-duty, polypropylene woven carrier sheet. It is nominally 65 mils thick and is 12” (304.8 mm)wide.

VERTICAL END-LAP DETAILING

Application of this method requires the use of MEL-DRAIN™ that has been installed up against a soil retention system according to our installation instructions. Ensure the backside of the MEL-DRAIN has been cleaned and there is no residue that will inhibit the bond of the DETAIL TAPE V. Remove the release paper on one side of the tape and roll press this tape onto the MEL-DRAIN. On the side of the tape facing out, remove the release paper on the one side of the tape, exposing 6” (152.4 mm) of the rubberized asphalt and apply the PLASMATIC CORE side of the PRECON into this and roll press into place. Following this, remove the remaining release paper on the tape and apply the subsequent roll of PRECON into this area, making sure that both rolls are butted together. Roll press this into place. Following that, apply a 12” (304.8 m) band of the POINTING MASTIC onto this overlap at a thickness of approximately 60 mils, and embed the DETAIL FABRIC into this.

*DETAIL TAPE V is a polymeric waterproofing membrane with a dual release paper. It is nominally 60 mils thick and is 12” (304.8 m) wide.

Following is a step-by step procedure showing the sequence of a horizontal application using the Tape Method.

On a properly prepared sub-grade, place a strip of 12” (304.8 mm) DETAIL TAPE H with the adhesive side of the tape facing upwards.

Remove the release paper on the one side of the tape and fold back to expose 6” (152.4 mm) of the rubberized asphalt and apply the PLASMATIC CORE side of the PRECON into this and roll press into place.

*If desired, the full 12” (304.8 m) of release paper can be removed, but care must be taken to ensure that the exposed asphalt does not get dirty as that will affect adhesion of the subsequent roll.

TECHNICAL BULLETIN
END LAP TAPING METHOD FOR PRECON AND HYDRASTOP SA

Following this, remove the remaining release paper on the tape and apply the subsequent roll of PRECON into this area, making sure that both rolls are butted together.

Roll press this into place.

Apply a 12" (304.8 m) band of the POINTING MASTIC onto this overlap at a thickness of approximately 60 mils.

TECHNICAL BULLETIN
END LAP TAPING METHOD FOR PRECON AND HYDRASTOP SA

Place the DETAIL FABRIC into the POINTING MASTIC making sure that it is fully embedded and roll press into place.

W. R. MEADOWS, INC.

P.O. Box 338 ▪ Hampshire, IL 60140-338
www.wrmeadows.com ▪ wrmil@wrmeadows.com

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TELEPHONE: 847-214-2100
800-825-5976
FAX: 847-683-4544

January 9, 2023

W. R. MEADOWS certifies the following information for PRECON® Pre-Applied / Underslab / Blindside Waterproofing Membrane:

LEED v4.0 - Building Product Disclosure and Optimization (MRc3 and MRc4):

Manufacturing Location(s):	Hampshire, IL 60140
Raw Material Extraction Point:	Not Available
Recycled Content:	0%

LEED v4.0 – Indoor Environmental Quality (EQc2):

VOC Emissions: N/A - Classified as an exterior product. Not required per LEEDv4 EQc2.

VOC Content: N/A - Not a wet-applied product. Not required per LEEDv4 EQc2.

If field sampling and/or field or laboratory testing be required, W. R. MEADOWS cannot be held responsible for any cost incurred if this product is used prior to receipt of that approval.

Should you have any questions or require additional information, please feel free to contact Technical Services or your local W. R. MEADOWS Representative.

Sincerely,

Kimberly Ann Lombardozzi

Kimberly Ann Lombardozzi, LEED AP ID+C, WELL AP, fitwel Ambassador
Sustainability Manager
W. R. MEADOWS, INC.

APPENDIX F

EXCAVATION WORKPLAN

APPENDIX D – EXCAVATION WORK PLAN (EWP)

D-1 NOTIFICATION

At least 15 days prior to the start of any activity that is anticipated to encounter remaining contamination or breach or alter the site's cover system, the site owner or their representative will notify the NYSDEC contacts listed in the table below. Table 1 includes contact information for the above notification. The information on this table will be updated as necessary to provide accurate contact information. A full listing of site-related contact information is provided in Appendix A.

Table 1: Notifications*

Steven Wu	718-482-6725, steven.wu@dec.ny.gov
Andre A. Obligado	718-482-6412, andre.obligado@dec.ny.gov
Alexandra M. Servis-Oettinger	518-402-9767, Alexandra.Servis@dec.ny.gov

* Note: Notifications are subject to change and will be updated as necessary.

This notification will include:

- A detailed description of the work to be performed, including the location and areal extent of excavation, plans/drawings for site re-grading, intrusive elements or utilities to be installed below the soil cover, estimated volumes of contaminated soil to be excavated, any modifications of truck routes, and any work that may impact an engineering control;
- A summary of environmental conditions anticipated to be encountered in the work areas, including the nature and concentration levels of contaminants of concern, potential presence of grossly contaminated media, and plans for any pre-construction sampling;
- A schedule for the work, detailing the start and completion of all intrusive work, and submittals (e.g., reports) to the NYSDEC documenting the completed intrusive work;
- A summary of the applicable components of this EWP;

- A statement that the work will be performed in compliance with this EWP, 29 CFR 1910.120 and 29 CFR 1926 Subpart P;
- A copy of the contractor's health and safety plan (HASP), in electronic format, if it differs from the HASP provided in Appendix F of this SMP;
- Identification of disposal facilities for potential waste streams; and
- Identification of sources of any anticipated backfill, along with the required request to import form and all supporting documentation including, but not limited to, chemical testing results.

The NYSDEC project manager will review the notification and may impose additional requirements for the excavation that are not listed in this EWP. The alteration, restoration and modification of engineering controls must conform with Article 145 Section 7209 of the Education Law regarding the application professional seals and alterations.

D-2 SOIL SCREENING METHODS

Visual, olfactory and instrument-based (e.g. photoionization detector) soil screening will be performed during all excavations into known or potentially contaminated material (remaining contamination) or a breach of the cover system. A qualified environmental professional as defined in 6 NYCRR Part 375, a PE who is licensed and registered in New York State, or a qualified person who directly reports to a PE who is licensed and registered in New York State will perform the screening. Soil screening will be performed when invasive work is done and will include all excavation and invasive work performed during development, such as excavations for foundations and utility work, after issuance of the COC.

Soils will be segregated based on previous environmental data and screening results into material that requires off-site disposal and material that requires testing to determine if the material can be reused on-site as soil beneath a cover or if the material can be used as cover soil. Further discussion of off-site disposal of materials and on-site reuse is provided in Section D-5 of this Appendix.

D-3 SOIL STAGING METHODS

Soil stockpiles will be continuously encircled with a berm and/or silt fence. Hay bales will be used as needed near catch basins, surface waters and other discharge points.

Stockpiles will be kept covered at all times with appropriately anchored tarps. Stockpiles will be routinely inspected, and damaged tarp covers will be promptly replaced.

Stockpiles will be inspected at a minimum once each week and after every storm event. Results of inspections will be recorded in a logbook and maintained at the site and available for inspection by the NYSDEC.

D-4 MATERIALS EXCAVATION AND LOAD-OUT

A qualified environmental professional as defined in 6 NYCRR Part 375, a PE who is licensed and registered in New York State, or a qualified person who directly reports to a PE who is licensed and registered in New York State will oversee all invasive work and the excavation and load-out of all excavated material.

The owner of the property and remedial party (if applicable) and its contractors are responsible for safe execution of all invasive and other work performed under this Plan.

The presence of utilities and easements on the site will be investigated by the qualified environmental professional. It will be determined whether a risk or impediment to the planned work under this SMP is posed by utilities or easements on the site. A site utility stakeout will be completed for all utilities prior to any ground intrusive activities at the site.

Loaded vehicles leaving the site will be appropriately lined, tarped, securely covered, manifested, and placarded in accordance with appropriate Federal, State, local, and NYSDOT requirements (and all other applicable transportation requirements). Trucks transporting contaminated soil must have either tight-fitting opaque covers that are secured on the sides and/or back, or opaque covers that are locked on all sides.

A truck wash will be operated on-site, as appropriate. The qualified environmental professional will be responsible for ensuring that all outbound trucks will be washed at the truck wash before leaving the site until the activities performed under this section are complete. Truck wash waters will be collected and disposed of off-site in an appropriate manner.

Locations where vehicles enter or exit the site shall be inspected daily for evidence of off-site soil tracking.

The qualified environmental professional will be responsible for ensuring that all egress points for truck and equipment transport from the site are clean of dirt and other materials derived from the site during intrusive excavation activities. Cleaning of the adjacent streets will be performed as needed to maintain a clean condition with respect to site-derived materials. Material accumulated from the street cleaning and egress cleaning activities will be disposed off-site at a permitted landfill facility in accordance with all applicable local, State, and Federal regulations.

D-5 MATERIALS TRANSPORT 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.

Material transported by trucks exiting the site will be secured with either tight-fitting opaque covers that are secured on the sides and/or back, or opaque covers that are locked on all sides. Loose-fitting canvas-type truck covers will be prohibited. If loads contain wet material capable of producing free liquid, truck liners will be used.

Truck transport routes are as follows: Truck traffic would be routed on the most direct course using major thoroughfares where possible and flaggers would be used to protect pedestrians at site entrances and exits. All trucks loaded with site materials will exit the vicinity of the site using only these approved truck routes. This is the most appropriate route and takes into account: (a) limiting transport through residential areas and past sensitive sites; (b) use of city mapped truck routes; (c) prohibiting off-site queuing of trucks entering the facility; (d) limiting total distance to major highways; (e) promoting safety in access to highways; and (f) overall safety in transport. Trucks will be prohibited from stopping and idling in the neighborhood outside the 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. Queuing of trucks will be performed on-site in order to minimize off-site disturbance. Off-site queuing will be prohibited.

D-6 MATERIALS DISPOSAL OFF-SITE

All material excavated and removed from the site will be treated as contaminated and regulated material and will be transported and disposed off-site in a permitted facility in accordance with all local, State and Federal regulations. If disposal of material from this site is proposed for unregulated off-site disposal (i.e. clean soil removed for development purposes), a formal request with an associated plan will be made to the NYSDEC project manager. Unregulated off-site management of materials from this site will not occur without formal NYSDEC project manager approval.

Off-site disposal locations for excavated soils will be identified in the pre-excavation notification. This will include estimated quantities and a breakdown by class of disposal facility if appropriate, (e.g. hazardous waste disposal facility, solid waste landfill, petroleum treatment facility, C&D debris recovery facility). Actual disposal quantities and associated documentation will be reported to the NYSDEC in the Periodic Review Report. This documentation will include, but will not be limited to: waste profiles, test results, facility acceptance letters, manifests, bills of lading and facility receipts.

Non-hazardous historic fill and contaminated soils taken off-site will be handled consistent with 6 NYCRR Parts 360, 361, 362, 363, 364 and 365. Material that does not meet Unrestricted SCOs is prohibited from being taken to a New York State C&D debris recovery facility (6 NYCRR Subpart 360-15 registered or permitted facility).

D-7 MATERIALS REUSE ON-SITE

Impacted materials will be covered by asphalt, concrete or concrete building slab, or a minimum of 1 foot of soils meeting the Allowable Constituent Levels for Imported Fill or Soil for Commercial Uses (Appendix 5 of DER-10) at a minimum. As such, and given the Track 2 cleanup approach, and the nature of the saturated soil remaining on site, any soil that does not meet Track 2 restricted residential SCOs is prohibited from being re used on Site.

Soil/fill material for reuse on-site will be segregated and staged as described in Sections D-2 and D-3 of this EWP. The anticipated size and location of stockpiles will be provided in the 15-day notification to the NYSDEC project manager. Stockpile locations will be based on the location of site excavation activities and proximity to nearby site features. Material reuse on-site will comply with requirements of NYSDEC DER-10 Section 5.4(e)4. Any modifications to the requirements of DER-10 Section 5.4(e)4 must be approved by the NYSDEC project manager.

Any demolition material proposed for reuse on-site will be sampled for asbestos and the results will be reported to the NYSDEC for acceptance. Concrete crushing or processing on-site will not be performed without prior NYSDEC approval. Organic matter (wood, roots, stumps, etc.) or other solid waste derived from clearing and grubbing of the site will not be reused on-site.

D-8 FLUIDS MANAGEMENT

All liquids to be removed from the site, including but not limited to, excavation dewatering, decontamination waters and groundwater monitoring well purge and development waters, will be handled, transported and disposed off-site at a permitted facility in accordance with applicable local, State, and Federal regulations. Dewatering, purge and development fluids will not be recharged back to the land surface or subsurface of the site, and will be managed off-site, unless prior approval is obtained from NYSDEC.

Discharge of water generated during large-scale construction activities to surface waters (i.e. a local pond, stream or river) will be performed under a SPDES permit.

D-9 COVER SYSTEM RESTORATION

After the completion of any invasive activities, the cover system will be restored in a manner that complies with the RAWP and decision document. If the type of cover system changes from that which exists prior to the excavation (i.e., a soil cover is replaced by asphalt), this will constitute a modification of the cover element of the remedy and the upper surface of the remaining contamination. A figure showing the modified surface will be included in the subsequent Periodic Review Report and in any updates to the SMP. The alteration, restoration and modification of engineering controls must conform with Article 145 Section 7209 of the Education Law regarding the application professional seals and alterations.

D-10 BACKFILL FROM OFF-SITE SOURCES

All materials proposed for import onto the site will be approved by the qualified environmental professional and will be in compliance with provisions in this SMP prior to receipt at the site. The qualified environmental personnel will collect representative samples at a frequency consistent with NYSDEC DER-10 (Table 5.4.10). Grab samples would be analyzed for Part 375 VOCs (EPA Method 8260), and the composite samples would be analyzed for SVOCs

(EPA Method 8270), pesticides/PCBs (EPA Method 8082/8081) and NYSDEC Part 375 metals by an NYSDOH ELAP-certified laboratory.

Material from industrial sites, spill sites, or other environmental remediation sites or potentially contaminated sites will not be imported to the site.

All imported soils will meet the NYSDEC DER-10 Allowable Constituent Levels for Imported Fill or Soil Subdivision 5.4 (Appendix 5). Soils that meet ‘exempt’ fill requirements under 6 NYCRR Part 360, but do not meet backfill or cover soil objectives for this site, will not be imported onto the site without prior approval by NYSDEC. Solid waste will not be imported onto the site. Any stone brought onto the Site must be certified clean from a virgin quarry.

Trucks entering the site with imported soils will be securely covered with tight fitting covers. Imported soils will be stockpiled separately from excavated materials and in accordance with the stockpiling procedures described in Section D-3 of this EWP.

D-11 STORMWATER POLLUTION PREVENTION

Barriers and hay bale checks will be installed and inspected once a week and after every storm event. Results of inspections will be recorded in a logbook and maintained at the site and available for inspection by the NYSDEC. All necessary repairs shall be made immediately.

Accumulated sediments will be removed as required to keep the barrier and hay bale check functional.

All undercutting or erosion of the silt fence toe anchor shall be repaired immediately with appropriate backfill materials.

Manufacturer's recommendations will be followed for replacing silt fencing damaged due to weathering.

Erosion and sediment control measures identified in the SMP shall be observed to ensure that they are operating correctly. Where discharge locations or points are accessible, they shall be inspected to ascertain whether erosion control measures are effective in preventing significant impacts to receiving waters.

Silt fencing or hay bales will be installed around the entire perimeter of the construction area.

D-12 EXCAVATION CONTINGENCY PLAN

If underground tanks or other previously unidentified contaminant sources are found during post-remedial subsurface excavations or development related construction, excavation activities will be suspended until sufficient equipment is mobilized to address the condition. The NYSDEC project manager will be promptly notified of the discovery.

Sampling will be performed on product, sediment and surrounding soils, etc. as necessary to determine the nature of the material and proper disposal method. Chemical analysis will be performed for a full list of analytes [TAL metals, TCL volatiles and semi-volatiles (including 1,4-dioxane), TCL pesticides and PCBs, and PFAS], unless the site history and previous sampling results provide sufficient justification to limit the list of analytes. In this case, a reduced list of analytes will be proposed to the NYSDEC project manager for approval prior to sampling. Any tanks will be closed as per NYSDEC regulations and guidance.

Identification of unknown or unexpected contaminated media identified by screening during invasive site work will be promptly communicated by phone within two hours to NYSDEC’s Project Manager. Reportable quantities of petroleum product will also be reported to the NYSDEC spills hotline. These findings will be also included in the Periodic Review Report.

D-13 COMMUNITY AIR MONITORING PLAN

This dust, odor, and organic vapor control and monitoring plan (DOOVCM Plan) was developed in accordance with the NYSDOH Generic Community Air Monitoring Plan (CAMP) and OSHA standards for construction (29 CFR 1926). Continuous monitoring on the perimeter of the work zones for odor, VOCs, and dust will be required for all ground intrusive activities such as site remediation operations and handling activities. Two stationary air-monitoring stations will be set up at Site perimeters (one upwind and one downwind) during intrusive Site work for continuous monitoring. Each station will include a PID and a DustTrak aerosol monitor or equivalent. A portable PID will be used to monitor the work zone and for periodic monitoring for VOCs during activities such as soil sampling. Action levels for the protection of the community and visitors are set forth in the CAMP are included in the HASP and presented in Appendix F of the SMP.

Work practices to minimize odors and vapors will be used during all intrusive activities. Offending odor and organic vapor controls may include the application of foam suppressants or tarps over the odor or VOC source areas. Foam suppressants may include biodegradable foams applied over the source material for short-term control of the odor and VOCs.

If odors develop and cannot be otherwise controlled, additional means to eliminate odor nuisances will include the use of chemical odorants in spray or misting systems and the use of staff to monitor odors in surrounding neighborhoods.

Where odor nuisances have developed during remedial work and cannot be corrected, or where the release of nuisance odors cannot otherwise be avoided due to on-Site conditions or close proximity to sensitive receptors, odor control will be achieved by sheltering excavation and handling areas under tented containment structures equipped with appropriate air venting/filtering systems. These locations will be adjusted on a daily or more frequent basis based on actual wind directions to provide an upwind and at least two downwind monitoring stations. Exceedances of action levels listed in the CAMP will be reported to NYSDEC and NYSDOH Project Managers.

D-13A: Special Requirements for Work Within 20 Feet of Potentially Exposed Individuals or Structures

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

- If total VOC concentrations opposite the walls of occupied structures or next to intake vents exceed 1 part-per-million, monitoring should occur within the occupied structure(s). Depending upon the nature of contamination, chemical-specific colorimetric tubes of sufficient sensitivity may be necessary for comparing the exposure point concentrations with appropriate pre-determined response levels (response actions should also be pre-determined). Background readings in the occupied spaces must be taken prior to commencement of the planned work. Any unusual background readings should be discussed with NYSDOH prior to commencement of the work.

- If total particulate concentrations opposite the walls of occupied structures or next to intake vents exceed 150 micrograms per cubic meter, work activities should be suspended until controls are implemented and are successful in reducing the total particulate concentration to 150 micrograms per cubic meter or less at the monitoring point.
- Depending upon the nature of contamination and remedial activities, other parameters (e.g., explosivity, oxygen, hydrogen sulfide, carbon monoxide) may also need to be monitored. Response levels and actions should be pre-determined, as necessary, for each site.

APPENDIX G

HASP AND CAMP

GZA SITE-SPECIFIC HEALTH, SAFETY & ACCIDENT PREVENTION STANDARD-PLAN

1. CLIENT/SITE/PROJECT INFORMATION

Client: M4778 Broadway LLC

Site Address: 4778 Broadway New York, NY

Site Description (be sure to list pertinent site features, chemicals used at the facility, and other potential hazard sources:
12-story newly developed mixed-use commercial and residential building.

Work Environment (active manufacturing, office, vacant site, undeveloped property, etc.):
Vacant new building that has completed construction but has not been occupied.

Job/Project #: 41.0163310.10	Estimated Start Date: October 21, 2024	Estimated Finish Date: May 31, 2025
Site is Covered by the Following Regulations:	OSHA HAZWOPER Standard ☒	Mine Safety and Health Administration ☐
	OSHA Construction Regulations ☒	OSHA General Industry Regulations ☐

2. EMERGENCY INFORMATION

Hospital Name: New York – Presbyterian Allen Hospital		Hospital Phone: 212-932-4000
Hospital Address: 5141 Broadway New York, NY 10034		Directions and Street Map Attached: ☒ Yes
Local Fire #: 911	Local Ambulance #: 911	Local Police #: 911
WorkCare Incident Intervention Services:	**For non-emergencies, if an employee becomes hurt or sick call 888-449-7787**	
Other Emergency Contact(s): Zachary Landis	Phone #'s: 917-301-5010	

Site-Specific Emergency Preparedness/Response Procedures/Concerns:
Site is known to have historical contamination and has ongoing remedial activities. Personnel on-site will wear proper PPE including nitrile gloves and following decon procedures. Personnel onsite will have first aid kits available and at least one person trained in CPR.

LIFTING Get help lifting or carrying anything over 50 pounds

SITE RECON Walk your site before starting work to find and mark slips/trips/falls and insect nests

DRIVING Don't use your mobile phone while driving

ERGONOMICS Take a 5-minute break for every hour you work, whether it's in the office or the field

CUTS Wear cut-resistant gloves when using knives or other sharp objects

PPE At a minimum, always wear safety glasses and protective footwear in the field

HASP Develop a HASP and have it with you in the field

WORKCARE Without delay, call WorkCare immediately for any minor injury or illness at 888-449-7787

- All EHS Events must be reported immediately to the Project Manager and to the GZA People-Based Safety mobile app.
- In the event of a chemical release greater than 5 gallons, site personnel will evacuate the affected area and relocate to an upwind location. The GZA Field Safety Officer and client site representative shall be contacted immediately.
- Site work shall not be conducted during severe weather, including high winds and lightning. In the event of severe weather, stop work, lower any equipment (drill rigs), and evacuate the affected area.

GZA SITE-SPECIFIC HEALTH, SAFETY & ACCIDENT PREVENTION STANDARD-PLAN

3. SCOPE OF WORK	
General project description, and phase(s) or work to which this H&S Plan applies[1].	Remedial activites including indoor and outdoor ambient air sampling, ISCO injections, and groundwater sampling.
Specific Tasks Performed by GZA:	Air sampling, injection oversight, groundwater sampling
Concurrent Tasks to be Performed by GZA-hired Subcontractors (List Subcontractors by Name):	Regenesis will complete the ISCO injections into 7 existing wells at the propert.
Concurrent Tasks to be Performed by Others:	

Any OSHA PERMIT-REQUIRED CONFINED SPACE entry? ☐ YES ☒ NO IF YES, ADD CONFINED SPACE ENTRY PERMIT FOR THAT PORTION OF THE WORK	Any INDOOR fieldwork? ☒ YES ☐ NO IF YES, EXPLAIN: Air sampling, groundwater sampling, and injections will be completed indoors.

4. SUB-SURFACE WORK, UNDERGROUND UTILITY LOCATION	
Will subsurface explorations be conducted for this work (drilling, excavation, test pits)?	☐ Yes ☒ No
Have GZA project-related files been searched for existing private utility drawings?	☐ Yes ☐ No ☒ N/A
Has GZA requested utility drawings from our Client, property owner, and others?	☐ Yes ☐ No ☒ N/A
Have existing drawings been reviewed for possible conflicts with planned work?	☐ Yes ☐ No ☒ N/A
Will GZA personnel be required to use a hand-auger as part of this work?	☐ Yes ☐ No ☒ N/A
Site property ownership where underground explorations will be conducted on:	Public Access Property ☐ Yes ☒ No Private Property ☒ Yes ☐ No
Have Necessary Underground Utility Notifications for Subsurface Work Been Made?	☐ Yes ☐ Yet to be conducted
Specify Clearance Date & Time, Dig Safe Clearance I.D. #, And Other Relevant Information:	
IMPORTANT! For subsurface work, prior to the initiation of ground penetrating activities, GZA personnel to assess whether the underground utility clearance (UUC) process has been completed in an manner that appears acceptable, based on participation/ confirmation by other responsible parties (utility companies, subcontractor, client, owner, etc.), for the following:	

Electric:	☐ Yes	☐ No	☐ NA	☐ Other________________
Fuel (gas, petroleum, steam):	☐ Yes	☐ No	☐ NA	☐ Other________________
Communication:	☐ Yes	☐ No	☐ NA	☐ Other________________
Water:	☐ Yes	☐ No	☐ NA	☐ Other________________
Sewer:	☐ Yes	☐ No	☐ NA	☐ Other________________
Other:____________	☐ Yes	☐ No	☐ NA	☐ Other________________

Comments: Coastal Environmental will perform geophysical survey to locate utilities at boring locations.

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[1] Copy from or reference proposal or applicable design plan as appropriate.

5. HAZARD ASSESSMENT (CHECK ALL THAT APPLY AND ADDRESS EACH HAZARD IN SECTION 6)

A. GENERAL FIELDWORK HAZARDS

- ☐ Confined Space Entry (Add Confined Space Entry Permit)
- ☐ Abandoned or vacant building/Enclosed Spaces
- ☒ Significant Slip/Trip/Fall Hazards
- ☐ Unsanitary/Infectious Hazards
- ☐ Poisonous Plants
- ☒ Biting/Stinging Insects
- ☐ Feral Animal Hazards
- ☐ Water/Wetlands Hazards
- ☐ Remote Locations/Navigation/Orientation hazards
- ☐ Heavy Traffic or Work Alongside a Roadway
- ☒ Weather-Related Hazards
- ☒ Motor vehicle operation Hazards
- ☐ Heavy Equipment Hazards
- ☐ Structural Hazards (i.e. unsafe floors/stairways/roof)
- ☐ Demolition/Renovation
- ☒ Presence of Pedestrians or the General Public
- ☐ Overhead Hazards (i.e. falling objects, overhead power lines)
- ☐ Portable Hand Tools or Power Tools
- ☒ Significant Lifting or Ergonomic Hazards
- ☐ Electrical Hazards (i.e. Equipment 120 Volts or Greater, Work Inside Electrical Panels, or Maintenance of Electrical Equipment)
- ☐ Other Stored energy Hazards (i.e. Equipment with High Pressure or Stored Chemicals)
- ☐ Fire and/or Explosion Hazard
- ☒ Elevated Noise Levels
- ☐ Subsurface Work (Drilling/Excavations/Test Pits)
- ☐ Explosives or Unexploded Ordinance/MEC
- ☐ Long Distance or Overnight Travel
- ☐ Personal Security or High Crime Area Hazards
- ☐ Working Alone
- ☐ Ionizing Radiation or Non-Ionizing Radiation
- ☒ Chemical/Exposure Hazards (See Part B for Details)
- ☐ Other: Underground Utilities, Outdoor Field Work Hazards

B. CHEMICAL/EXPOSURE HAZARDS (CONTAMINANTS ARE CONTAINED IN X SOIL, X WATER, X GROUNDWATER)

- ☐ No chemical hazards anticipated
- ☐ Hydrogen Sulfide (H2S)
- ☐ Cyanides, Hydrogen Cyanide (HCN)
- ☐ Carbon Monoxide
- ☐ Herbicides, Pesticide, Fungicide, Animal Poisons
- ☐ Metals, Metal Compounds:
- ☐ Corrosives, Acids, Caustics, Strong Irritants
- ☐ Polychlorinated Biphenyls (PCBs)
- ☐ Polycyclic Aromatic Hydrocarbons (PAHs)
- ☐ Compressed Gases
- ☐ Flammable/Combustible Liquids
- ☐ Radiation Hazards (i.e. radioactive sealed/open source, x-rays, ultra violet, infrared, radio-frequency, etc.)
- ☐ Methane
- ☐ Chemicals Subject to OSHA Hazard Communication (attach Safety Data Sheet for each chemical GZA brings to the site)
- ☐ Containerized Waste, Chemicals in Piping & Process Equipment
- ☐ Emissions from Gasoline-, Diesel-, Propane-fired Engine, Heater, Similar Equipment
- ☐ General Work Site Airborne Dust Hazards
- ☒ Volatile Organic Compounds (VOCs), BTEX
- ☐ Chlorinated Organic Compounds
- ☐ Fuel Oil, Gasoline, Petroleum Products, Waste Oil
- ☐ Asbestos
- ☐ Oxygen Deficiency, Asphyxiation Hazards
- ☒ Other: Persulf-OX

6. SITE-SPECIFIC OVERVIEW OF H&S HAZARDS/MITIGATIONS (NOTE: Based on Hazard Assessment, Section 5)

Describe the major hazards expected to be present at the jobsite, and describe the safety measures to be implemented for worker protection (refer to items checked in Section 5 above). Use brief abstract statements or more detailed narrative as may be appropriate.

ON-SITE HAZARDS:	HAZARD MITIGATIONS:
Task Hazard Analyses	Task 2 – Oversight of chemical injections Task 3 – Indoor air sampling Task 4 – Groundwater sampling
Owning Zero	Ensure all GZA personnel on-site have downloaded the People-Based Safety app to their mobile phones and are familiar with using it to report safety events. Prior to work each day, review Owning Zero rules with all on-site during the morning safety meeting.
Abandoned or vacant building/enclosed spaces	Ask the client to validate that the building is structurally safe to enter. Constantly scan surroundings for integrity of floors and stairs and stay alert to debris on the ground or unsafe objects. Do not walk under ceilings or structures showing signs of distress and wear hard hats at all times within structures. Be alert for other people and / or animals in the building. Bring flashlights in case of poor lighting and a charged cell phone for communication. Inform your PM to let her/him know your anticipated hours of work on the site, and call them when you leave the site for the day. Leave the site if it is unsafe for any reason.
Significant Slip/Trip/Fall Hazard	Inspect work area prior to starting work. Mark out or remove any potential hazards. Inspect area for uneven or sloped terrain, or around test pits. Wear sturdy shoes with ankle support and good tread. In winter weather, wear boot grips for more traction when walking. Look for potential natural depressions/holes/animal burrows, downed trees/limbs and other obstructions in the area of work and travel. Maintain one free hand to break falls. Watch for equipment on ground and slippery surfaces. Keep work area clean, no running, be mindful of changing weather conditions that may change footing conditions. Maintain safe distance from open borings. Be aware of surroundings. Ensure that borings are well marked (if left uncovered) or are appropriately filled to reduce trip/fall hazards. Do not leave borings or test pits open at the end of the work shift. Cover with metal plate if hole cannot be backfilled and label.
Weather-Related Hazards	Weather conditions will be assessed prior to on-site work and forecast examined for anticipated period of work. If weather permits fieldwork, then workers will dress appropriately. Should inclement weather be encountered, the project scope may be reduced or rescheduled. Breaks will be taken to reduce exposure to the elements. If conditions change and lightning or thunder is observed, work will be suspended immediately, and workers will seek shelter. Work may resume if thunder and/or lightning cease for 30 minutes. In the case of cold weather, proper warm gear should be worn to minimize cold exposure. Hand warmers (e.g. "Hot Hands") should be used when appropriate to keep extremities warm and multiple breaks within a warm area (vehicle with heat) should be taken. Review the signs of heat stress, hypothermia, and dehydration before the start of fieldwork. Water, sunscreen, hardhat, tinted safety sunglasses, rain gear (if necessary) and periodic breaks should all be planned for. Be sure to consume plenty of liquids on hot summer days and stay out of direct sunlight for extended periods of time to the extent possible. Use protective ointments such as sunscreen and chap stick, and consult the OSHA Heat Safety App daily to determine risk of heat related illnesses for the day. Maintain extra clothing, blankets, etc. in the work vehicle for a change of clothing if necessary.
Motor vehicle operation Hazards	Ensure vehicle is operating properly prior to leaving office. Review directions and check air pressure in vehicle tires prior to departure. Plan to take periodic breaks while driving long distances. Do not use cell phone (handheld or hands-free) while vehicle motor is running. While driving, be observant of other drivers and potential for severe weather conditions. Maintain appropriate speeds for the road conditions. Follow posted speed limit signs and client requirements (even if not posted). Park in designated contractor parking areas, or as directed by the client.
Presence of Pedestrians or the General Public	Establish warning signs and cones to delineate work area and warn pedestrians of work ahead. Maintain site control, do not allow access to unauthorized persons. Wear high

	visibility vest or clothing at all times when working in the roadway or near a sidewalk. Always be aware of pedestrians walking near the exclusion zone. If a pedestrian approaches the job site, work will cease until the pedestrian leaves the area.
Significant Lifting or Ergonomic Hazards	Use proper lifting techniques (lifting with the legs, carrying the load at a reasonable height to allow for proper posture during the carry, and avoiding twisting while carrying loads) should be followed at all times. Caution should be used when lifting equipment. Be aware of hand position during all stages of the lift, transport and placement of equipment. Review equipment to be moved prior to lifting to prevent moving parts from crushing fingers or otherwise pinching skin. Do not stack items prior to carrying, but rather transport one item at a time to prevent shifting during carrying. Get help when items are heavy or awkward to lift. Use lifitng and transport devices whenever possible. Follow GZA Safe Lifting SOP.
Elevated Noise Levels	In accordance with 29 CFR 1910.95(b)(1) When employees are subjected to sound exceeding those listed in Table G-16, feasible administrative or engineering controls shall be utilized. If such controls fail to reduce sound levels within the levels of Table G-16, personal protective equipment shall be provided and used to reduce sound levels within the levels of the table. TABLE G-16 - PERMISSIBLE NOISE EXPOSURES (1) Duration per day, hours | Sound level dBA slow response 8..| 90 6..| 92 4..| 95 3..| 97 2..| 100 1 1/2 ....| 102 1..| 105 1/2 ....| 110 1/4 or less....................................| 115 Hearing protection in the form of disposable ear plugs will be worn during field work with sound levels anticpated above those listed in Table G-16. Use sound meter app on phone to assess required PPE. Be aware that hearing protection can diminish warning sounds - do not stand with back to operating equipment and be alert for changing conditions.
Hazardous Chemicals	Contaminants may be present in soils/ groundwater; wear nitrile gloves and safety glasses when handling soil / groundwater, or equipment exposed to soil / groundwater. Decontaminate equipment following use. Wash hands and arms before leaving work and before eating. VOCs are potentially present in the soil / groundwater. Care will be taken to avoid exposure to potential chemical hazards present during sampling activities through use of nitrile gloves and safety glasses with side shields. In addition, a PID meter will be used to screen for volatiles. Used sampling equipment will be placed in bags for offsite disposal. Hands will be washed at the end of the work day prior to eating/driving. Stop work and evacuate area if readings persist above OSHA permissible exposure limits in the breathing zone. Some common VOCs and their OSHA PELs are as follows: Benzene (1.0 ppm - 8 hr TWA), Toluene (200 ppm 8 hr -TWA), Ethylbenzene (100 ppm - 8hr TWA), Xylene (100 ppm - 8 hr TWA), Naphthalene (10 ppm - 8 hr TWA). Diesel (100 ppm 8-hr TWA _ ACGIH TLV as total hydrocarbons), Gasoline (300 ppm - 8 hr TWA_ACGIH TLV), Hydrogen Cyanide (10 ppm – OSHA 8 hr TWA). If PID detects readings over the OSHA PEL continuously for 5 minutes in the breathing zone, stop work and move away from area. Allow area to ventilate area and retest before resuming work. Oils/gasoline, VOCs, PAH in contaminated soils / groundwater can produce odors, fumes, and present ingestion, inhalation, and skin contact hazards. Compounds associated with gasoline and waste oils include benzene, xylene, toluene, gasoline, and various oils

	(hydrocarbons). These materials can cause eye, skin and respiratory tract irritation, liver and kidney damage, headaches, blurred vision, nausea, and dizziness. Prolonged skin contact with PCBs may cause the formation of comedones, sebaceous cysts, and/or pustules (a condition known as chloracne). PCBs are considered to be suspect carcinogens and may also cause reproductive damage. The OSHA permissible exposure limits (PELs) for PCBs are as follows: Compound PEL (8-hour time-weighted average) Chlorodiphenyl (42% Chlorine) 1 mg/m3-Skin Chlorodiphenyl (54% Chlorine) 0.5 mg/m3 -Skin It should be noted that PCBs have extremely low vapor pressures (0.001 mm Hg @ 42% Chlorine and 0.00006 mm Hg @ 54% Chlorine). PCBs anticipated to be encountered site are in solid materials such as caulks, sealants and glazing or contained in lighting balasts and transformers. This makes it unlikely that any significant vapor concentration (i.e., exposures above the OSHA PEL) will be created in the ambient environment. This minimizes the potential for any health hazards to arise due to inhalation unless the source is heated or generates an airborne mist. If generated, vapor or mists above the PEL may cause irritation of the eyes, nose, and throat. The exposure limits noted above are considered low enough to prevent systemic effects but it is not known if these levels will prevent local effects. It should also be noted that both PELs carry the Skin notation, indicating that these compounds adversely effect or penetrate the skin. OSHA specifies that skin exposure to substances carrying this designation be prevented or reduced through the use of the appropriate personal protective equipment (PPE). Wear appropriate gloves when in contact with materials with suspected PCB content and wash hands prior to eating, drinking, applying make-up or smoking. Wear appropriate PPE, nitrile gloves, and safety glasses. Wash hands and face before eating or applying cosmetics (i.e. sunscreen or chapstick). Do not eat within the work zone. Wash hands and follow good personal hygiene after sampling or being exposed to potentially contaminated soils. Keep samples upright during transport. Sample containers may have broken during transport. Handle containers only while wearing nitrile gloves and use leather work gloves in addition to nitrile gloves to remove any broken or cracked containers. Pack containers in an upright orientation and use packaging (such as bubble wrap) between each glass container to prevent breakage.
Biting/Stinging Insects	Ticks carry risk of Lyme and other Diseases. Tick season is basically any field day above 40 degrees F. Tuck pants into long socks and apply DEET (or permethrin pre-treatment) to clothing in season to control exposure to ticks. Check clothing for ticks frequently. Check whole body immediately upon returning from field and shower. Be aware of intermittent seasonal reports of mosquito borne diseases, such as West Nile disease and Eastern Equine Encephalitis (EEE), and their locations relative to your field site. Use DEET or other mosquito repellant. Be aware of potential cavity, suspended or ground nesting bee/wasp/hornet nests. Avoid undue disturbance or approach with appropriate safety clothing protection and netting.
Significant Lifting or Ergonomic Hazards	Use proper lifting techniques (lifting with the legs, carrying the load at a reasonable height to allow for proper posture during the carry, and avoiding twisting while carrying loads) should be followed at all times. Caution should be used when lifting equipment. Be aware of hand position during all stages of the lift, transport and placement of equipment. Review equipment to be moved prior to lifting to prevent moving parts from crushing fingers or otherwise pinching skin. Do not stack items prior to carrying, but rather transport one item at a time to prevent shifting during carrying. Get help when items are heavy or awkward to lift. Use lifitng and transport devices whenever possible. Follow GZA Safe Lifting SOP.

7. AIR MONITORING ACTION LEVELS – Make sure air monitoring instruments are in working order, calibrated before use, and 'bump-checked' periodically throughout the day and/or over multiple days of use

Is air monitoring to be performed for this project? Yes ☒ No ☐

Action levels for Oxygen Deficiency and Explosive atmospheric hazards **(Action levels apply to occupied work space in general work area)**

☐ Applicable, See Below. ☒ Not Applicable

Parameter	Response Actions for Elevated Airborne Hazards
Oxygen	At 19.5% or below – Exit area, provide adequate ventilation, or proceed to Level B, or discontinue activities Verify presence of adequate oxygen (approx. 12% or more) before taking readings with LEL meter. Note: If oxygen levels are below 12%, LEL meter readings are not valid.
LEL	Less than 10% LEL – Continue working, continue to monitor LEL levels Greater than or Equal to 10% LEL – Discontinue work operations and immediately withdraw from area. Resume work activities ONLY after LEL readings have been reduced to less than 10% through passive dissipation, or through active vapor control measures.

Action levels for inhalation of Toxic/Hazardous Substances **(Action levels are for sustained breathing zone concentrations)**

☒ Applicable, See Below. ☐ Not Applicable

Air Quality Parameters (Check all that apply)	**Remain in Level D or Modified D**	**Response Actions for Elevated Airborne Hazards**
☒ VOCs	0 to 1 ppm	From 1 ppm to 5 ppm: Proceed to Level C, or Ventilate, or Discontinue Activities If greater than 5 ppm: Discontinue Activities and consult EHS Team
☐ Carbon Monoxide	0 to 35 ppm	At greater than 35 ppm, exit area, provide adequate ventilation, proceed to Level B, or discontinue activities.
☐ Hydrogen Sulfide	0 to 10 ppm	At greater than 10 ppm, exit area, provide adequate ventilation, proceed to Level B, or discontinue activities
☐ Dust	0 to 0.150 mg/m^3	Dust mitigation controls such as water spray, misting system.
☐	0 to	

Special Instructions/Comments regarding Air Monitoring (if applicable)

Two Community Air Monitoring Program stations continuously recording Dust and VOC concentrations at a downwind and upwind station will be implemented during all site work. A handheld PID and handheld DusTrak will also be used in the worker area during all site work. If concentrations of VOCs or Dust exceed what is presented in the above table, the work area and practices will be re-assesessed and alternative work methods will be implemented.

8. HEALTH AND SAFETY EQUIPMENT AND CONTROLS

AIR MONITORING INSTRUMENTS

☒ PID Type: PpbRAE 3000+ or equivalent Lamp Energy: 10.6 eV
☐ FID Type:
☐ Carbon Monoxide Meter
☐ Hydrogen Sulfide Meter
☐ O_2/LEL Meter
☐ Particulate (Dust) Meter
☐ Calibration Gas Type
☐ Others:

OTHER H&S EQUIPMENT & GEAR

PERSONAL PROTECTIVE EQUIPMENT

☐ Respirator – Type
☐ Respirator - Cartridge Type:
☒ Hardhat
☒ Outer Gloves Type: Nitrile
☐ Inner Gloves Type:
☒ Steel-toed boots/shoes
☐ Coveralls – Type
☐ Outer Boots – Type
☒ Eye Protection with side shields
☐ Face Shield

☒ Fire Extinguisher
☐ Caution Tape
☐ Traffic Cones or Stanchions
☐ Warning Signs or Placards
☒ Decon Buckets, Brushes, etc.
☐ Portable Ground Fault Interrupter (GFI)
☐ Lockout/Tagout Equipment
☐ Ventilation Equipment
☒ Others: First Aid Kit, Cell Phone, Water, Soap

☒ Traffic Vest
☐ Personal Flotation Device (PFD)
☐ Fire Retardant Clothing
☐ EH (Electrical Hazard) Rated Boots, Gloves, etc.
☒ Noise/Hearing Protection
☐ Others:

Discuss/Clarify, as Appropriate:

9. H&S TRAINING/QUALIFICATIONS FOR FIELD PERSONNEL

☒ Project-Specific H&S Orientation (Required for All Projects/Staff)
☒ OSHA 40-Hour HAZWOPER/8 Hour Refreshers
☐ Hazard Communication (for project-specific chemical products)
☒ First Aid/CPR (required for HAZWOPER for at least one individual on site)
☒ Current Medical Clearance Letter (required for HAZWOPER)
☐ OSHA 10-hour Construction Safety Training
☐ Fall Protection Training
☐ Trenching & Excavation

☐ Lockout/Tagout Training
☐ Electrical Safety Training
☐ Bloodborne Pathogen Training
☐
☐
☐
☐
☐

Discuss/Clarify, as needed:

10. PERSONNEL AND EQUIPMENT DECONTAMINATION (SECTION ONLY REQUIRED FOR HAZWOPER SITES)

Describe personnel decontamination procedures for the project site, including “dry decon” (simple removal of PPE)	Dry Decon, wash hands and other exposed skin before taking breaks or leaving site, Change PPE before leaving site.

11. PROJECT PERSONNEL - ROLES AND RESPONSIBILITIES

GZA ON-SITE PERSONNEL:

Name(s)	Project Title/Assigned Role	Telephone Numbers
Zach Landis	Site Supervisor	Work: 646-929-8940 Cell: 917-301-5010
Jackson Bogach	Field Safety Officer	Work: 646-929-8944 Cell: 332-215-6349
Jackson Bogach	First Aid Personnel	Work: 646-929-8944 Cell: 332-215-6349
Yunmee Han	GZA Project Team Members	Work: 212-594-8140 Cell: 317-999-8432

Site Supervisors and Project Managers (SS/PM): Responsibility for compliance with GZA Health and Safety programs, policies, procedures and applicable laws and regulations is shared by all GZA management and supervisory personnel. This includes the need for effective oversight and supervision of project staff necessary to control the Health and Safety aspects of GZA on-site activities.

Field Safety Officer (FSO): The FSO is responsible for implementation of the Site Specific Health and Safety Plan.

First Aid Personnel: At least one individual designated by GZA who has current training and certification in basic first aid and cardiopulmonary resuscitation (CPR) must be present during on-site activities involving multiple GZA personnel at HAZWOPER sites.

GZA Project Team: Follow instructions relayed by the HASP and GZA manager on-site.

OTHER PROJECT PERSONNEL:

Name	Project Title/Assigned Role	Telephone Numbers
Victoria Whelan	Principal-in-Charge	Work: Cell: 631-793-8821
Zach Landis	Project Manager	Work: 646-929-8940 Cell: 917-301-5010
Reinbill Maniquez	Office Safety Coordinator	Work: 646-929-8925 Cell: 347-443-1059
Richard Ecord	GZA EHS Director	Work: 781-278-3809 Cell: 404-234-2834

Principal-in-Charge: Responsible of overall project oversight, including responsibility for Health and Safety.

Project Manager: Responsible for day-to-day project management, including Health and Safety.

Health and Safety Coordinator: General Health and Safety guidance and assistance.

GZA EHS Director: H &S technical and regulatory guidance, assistance regarding GZA H&S policies and procedures.

12. PLAN ACKNOWLEDGEMENT AND APPROVALS

GZA Project Site Worker Plan Acknowledgement

I have read, understood, and agree to abide by the information set forth in this Safety and Accident Prevention Plan. I will follow guidance in this plan and in the GZA Health and Safety Program Manual. I understand the training and medical monitoring requirements covered by the work outlined in this plan and have met those requirements.

GZA Employee Name	GZA Employee Signature	Date

Subcontractor Site Worker Plan Acknowledgement

GZA has prepared this plan solely for the purpose of protecting the health and safety of GZA employees. Subcontractors, visitors, and others at the site must refer to their organization's health and safety program or site-specific HASP for their protection. Subcontractor employees may use this plan for general informational purposes only. Subcontractor firms are obligated to comply with safety regulations applicable to their work, and understand this plan covers GZA activities only.

Subcontractor Employee Name	Subcontractor Employee Signatures	Date

GZA HASP Approval Signatures

The following individuals indicate their acknowledgement and/or approval of the contents of this Site Specific H&S Plan based on their understanding of project work activities, associated hazards and the appropriateness of health and safety measures to be implemented. A signed copy of this document must be present at the project site at all times work is being performed.

GZA Author/Reviewer Role	Signature	Date
Zach Landis **HASP Preparer**		**October 18, 2024**
Mel Kenerson **EHS Reviewer**		**October 18, 2024**
Victoria Whelan **Principal in Charge**		**October 18, 2024**

ATTACHMENTS

ATTACHMENT - A	HEALTH AND SAFETY BRIEFING/SITE ORIENTATION
ATTACHMENT - B	RECORD DIRECTIONS TO HOSPITAL
ATTACHMENT - C	ACCIDENT AND INJURY REPORT FORM

ATTACHMENT – A
HEALTH AND SAFETY BRIEFING

Health and Safety Briefing/Site Orientation Record/Hazard Communication

This is to verify that I, the undersigned, have been provided with a site (orientation) briefing, including hazard communication, regarding the safety and health considerations at 19 Clay Street and 60-62 Street, Brooklyn, New York (Site). I agree to abide by my employer's Site-specific safety and health plan and other safety or health requirements applicable to the Site.

Name (Print)	Signature	Company	Date

Site (orientation) briefing conducted by:_________________________________

Date:___________

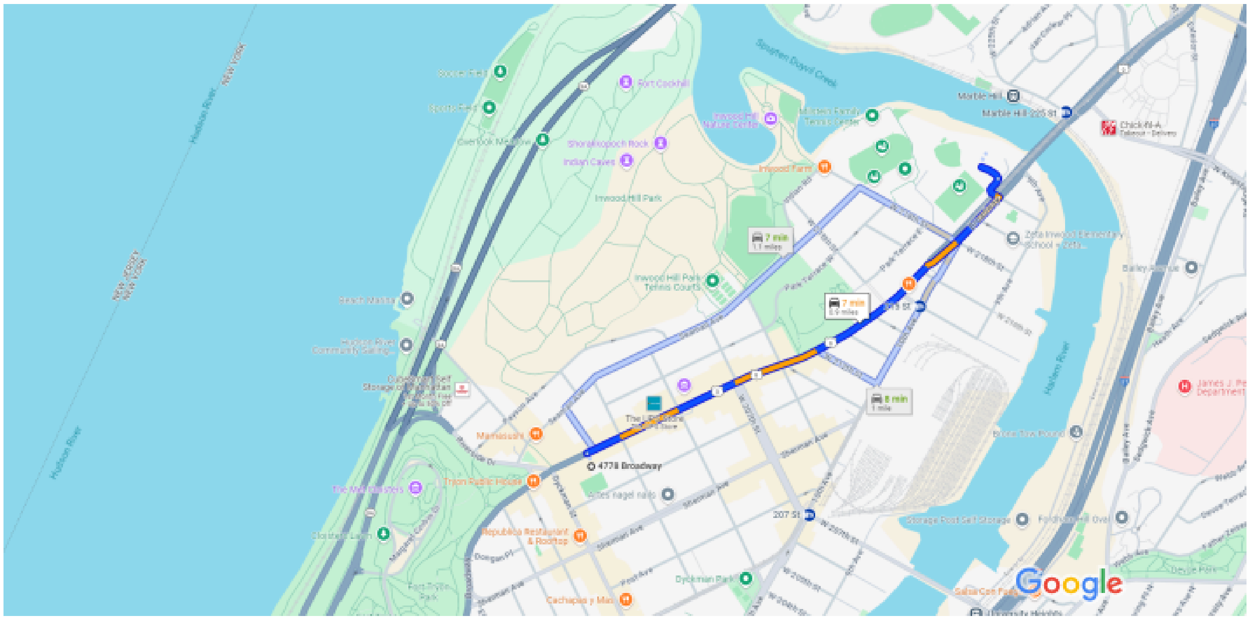
Health and Safety Briefing/Site Orientation Record

ATTACHMENT – B
ROUTE TO HOSPITAL

Google Maps

4778 Broadway, New York, NY 10034 to NewYork-Presbyterian Allen Hospital, 5141 Broadway, New York, NY 10034

Drive 0.9 mile, 7 min



Map data ©2024 Google 500 ft

4778 Broadway
New York, NY 10034

1. Head northeast on Broadway toward Cumming St
   Pass by CTown Supermarkets (on the right in 0.3 mi)

   0.8 mi

2. Turn left onto W 220th St

   240 ft

3. Turn left
   Destination will be on the right

   190 ft

NewYork-Presbyterian Allen Hospital
5141 Broadway, New York, NY 10034

ATTACHMENT – C
ACCIDENT AND INJURY REPORT FORM

SUPERVISOR'S ACCIDENT INVESTIGATION REPORT

Injured Employee ________________________________ Job Title ______________________________________

Home Office ____________________________ Division/Department ____

Location of Accident ____

Witnesses to the Accident ____

Injury Incurred? ___________ Nature of Injury ____

____

Engaged in What Task When Injured? ____

____

Will Lost Time Occur? ____ How Long? _____________ Date Lost Time Began __________________________________

Were Other Persons Involved/Injured? ____

How Did the Accident Occur? ____

____

____

____

____

What Could Be Done to Prevent Recurrence of the Accident? ____

____

____

What Actions Have You Taken Thus Far to Prevent Recurrence? ____

____

____

Supervisor's Signature __________________________________ Title __________________________ Date __________

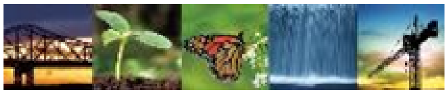
Reviewer's Signature ___________________________________ Title _________________________ Date __________

Note: If the space provided on this form is insufficient, provide additional information on a separate page and attach. The completed accident investigation report must be submitted to the Health and Safety Manager within two days of the occurrence of the accident.

GZA GeoEnvironmental, Inc.

APPENDIX H

SSDS OPERATIONS AND MAINTENANCE PLAN



Appendix H

Sub-Slab Depressurization System Operation and Maintenance Manual

4778 Broadway
New York, New York 10034

June 2025
41.0163314.10

PREPARED FOR:
M4778 Broadway LLC
Floral Park, New York

PREPARED By:
GZA GeoEnvironmental of New York, Inc.
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APPENDICES

1.0 INTRODUCTION

This Operation and Maintenance (O&M) Manual has been developed by GZA GeoEnvironmental of New York (GZA) on behalf of M4778 Broadway, LLC (Client) to describe operation, maintenance, and sampling procedures for the Sub-Slab Depressurization Systems (SSDS) to installed in the newly constructed mixed use building located at 4778 Broadway New York, New York (Site). This plan is submitted to the New York State Department of Environmental Conservation (NYSDEC)as part of the Site Management Plan (SMP) and in accordance with Brownfield Cleanup Program (BCP) guidance.

As built installation information and plans for the mitigation systems is included in Appendix N of the SMP. This O&M Plan identifies the routine O&M tasks, monitoring, laboratory testing, potential operating problems, and record keeping required for the SSDSs and associated components. In the event that modifications to the current SSDS are required, this O&M Plan may be modified to address the O&M requirements for modifications made. Appendix A presents the SSDS plans, specifications and as-built information.

2.0 DESCRIPTION OF SUB-SLAB DEPRESSURIZATION EQUIPMENT

2.1 MITIGATION AREA

The SSDS consists of a branched piping network installed within porous granular material consisting of 3/4-inch clean stone beneath the composite cover system. Prior to the placement of the stone and branch piping, a nonwoven geotextile fabric was placed on the base of the excavation. Each branch will consist of a network of horizontal pipe set in the middle of a gas permeable layer immediately beneath the building slab and up foundation walls. The horizontal piping consists of perforated schedule 40 4-inch PVC pipe connected to a 4-inch steel pipe that penetrates the foundation and vented to the roof. The gas permeable layer consists of a 12-inch thick layer of 3/4-inch trap rock stone. A second layer of geotextile fabric was installed above the stone layer and below the composite cover system. The pipe is finished at the roof line with a 6-inch goose neck pipe to prevent rain infiltration. The active SSDS is hardwired and includes a blower installed on the roof line and a pressure gauge and alarm located in an accessible area in the basement. At the time of this O&M Manual, permanent power to the building is not anticipated to be available until construction is completed in April/May 2024, as such the blower system is not currently operable. Once a permanent power supply is available, the blower system may be powered on, and functionality/effectiveness testing may occur.

2.2 DESCRIPTION OF SSDS COMPONENTS

The primary components of the SSDS are summarized below.

- Laterals/Loops: The SSDS recovers sub-slab vapors from a total of five extraction laterals. Each lateral creates a continuous loop around select slab features (such as the elevator pit) and was design to target a specific portion of the sub slab. The extraction laterals/loops are constructed of 4-inch diameter, 0.020-inch slotted pipe, and are installed within a 12-inch thick layer of 3/4-inch trap rock stone beneath the concrete floor slab and composite cover system. The as built drawings of the laterals/loops are presented in Appendix N of the SMP.

- Riser Pipes: Each lateral/loop is connected to a 4-inch diameter vertical riser pipe that penetrates the concrete floor slab at some point along each lateral loop. Each riser includes a manual flow control valve, vacuum gauge, and sample port. The risers are installed adjacent to building columns or walls, with valves, gauges and sample ports installed approximately 3-5 feet above ground surface for easy access.

- Manifold/Vent Piping: Extraction risers for each lateral/ loop are routed vertically to the basement ceiling space where they are connected to a horizontal manifold and ultimately into one single main ventilation pipe that is routed vertically from the basement ceiling to the building's 2nd floor setback rooftop. The main ventilation pipe is connected to the SSDS blower enclosure via a short horizontal pipe installed at the rooftop.

- SSD Blower: The SSDS includes a vacuum/pressure regenerative blower to recover sub-slab vapors. The blower selected was identified as the Airtech R Vacuum 3BA1430 Regenerative Blower. The Blower specifications/ cut sheet is presented in Appendix B of this O&M Manual. The type of blower for the SSDS was selected based on the required load and vacuum requirements. The selected regenerative blower is utilized in areas that require moderate to high moderate vacuums (approximately 75 to 85 inches of $H2O$ at approximately 105-125 CFM). The regenerative blower includes an in-line particulate filter and a fresh air dilution valve. A variable frequency drive (VFD) is included for the blower to control the flow/vacuum. The blower discharge is connected to a gooseneck to prevent rain infiltration. The discharge point is located at least 10 feet from any window or inlet.

- Equipment Enclosure: The SSDS blower is housed in a small, roof-mounted metal enclosure. The enclosure is ventilated, weatherproof, and lockable. An electrical panel is mounted to the outside of the enclosure to contain the VFD, circuit breakers/overload protection, and a disconnect switch.

2.3 DESCRIPTION OF SYSTEM OPERATIONS

The purpose of the SSDSs is to prevent migration of soil gas and groundwater vapors into the buildings. While the SSDS is designed as an engineering control to prevent vapor intrusion, the system may also provide ancillary benefit of reducing subsurface concentrations over time. The SSDS applies a low vacuum (in the range of 5 to 60 inches of $H2O$) to the sub-slab environment via a series of lateral loops to induce a negative pressure gradient beneath the building to prevent vapor intrusion to indoor air. Sub-slab vapors present beneath the building are subsequently recovered from each of the lateral loops and vented through the vacuum blower to the 2nd story exhaust pipe. The system is designed to operate on a continuous basis with the exception of periodic shut-downs to conduct maintenance.

The minimum target sub-slab differential pressure for the entire SSDS is -0.03 in. $H2O$. The exhaust temperature for the regenerative blower is expected to be approximately 140 to 220 °F. The SSDS is designed to minimize power consumption while maintaining effective vapor mitigation. This is achieved by operating the blower at an optimum flow/vacuum setpoint that will maintain sub-vacuum at or above -0.03 in. $H2O$ across the entire mitigation area while not "over-extracting" vapors by applying excessive flow/vacuum. The optimal operating point may vary based on seasonal conditions (e.g., winter versus summer) and the level of the groundwater table below the lateral piping loops.

The vacuum/flow of each blower can be controlled by adjusting the speed setpoint via the blower's VFD. System operational parameters will be adjusted during regularly scheduled O&M visits, as necessary, to maintain optimal system operation. While the system has been conservatively designed to provide effective sub-slab ventilation during periods of adverse weather, seasonal weather fluctuations and changes in atmospheric pressure may result in modification of the operational ranges. Equipment malfunction and repairs will be addressed in a timely manner to maintain optimal operational parameters to the extent practical.

3.0 SYSTEM MONITORING AND SAMPLING

The goal of the SSDS is to eliminate the potential for sub-slab soil gas and groundwater vapors to intrude into the indoor air of the building, thereby eliminating the potential indoor air exposure pathway. Certain system monitoring and sampling will be conducted in three distinct periods of the SSDS operational life to ensure this goal is achieved: (1) Start-up testing and verification sampling will be conducted between 30- 60 days following system installation to balance the flow/vacuum across the sub-slab extraction points, to verify the system is operating as designed and to document indoor/outdoor concentrations; (2) Once steady state conditions have been achieved, periodic inspections and system monitoring will be implemented to ensure the system continues to operate as designed and as described in the following sections and (3) Sampling to terminate SSDS Operation.

3.1 EQUIPMENT COMMISIIONING AND SSDS START-UP

Commencement of SSDS operations will occur when full/ permanent power is installed within the building (expected in early spring of 2024). A description of SSDS initial Equipment Commissioning and Start-up, and the outdoor air verification sampling and the indoor air confirmation sampling programs that will be implemented upon SSDS Start-up are described in the sections below.

3.1.1 Equipment Commissioning

As described in Section 2.0, the SSDS includes one regenerative vacuum blower. During the start up process initial tasks will include verifying electrical connections and blower rotation, testing all alarms, checking the piping network, and verifying blower operational parameters (i.e., vacuum, air flow, temperature) are within expected ranges. Control valves and vacuum gauges functionality will be verified and tested by opening and closing each valve during blower operation to ensure proper functionality. Once the functionality of the valves are verified, each valve on each respective riser pipe will be adjusted to optimize the desired vacuum and flow (CFM) throughout each respective lateral/loop. The blower speed will also be adjusted as necessary in concert with the valves to optimal parameters. The concrete slab near the vertical riser pipe slab penetrations will be monitored for possible short-circuiting of the sub-slab vacuum. Sealing of cracks will be performed, as needed, to mitigate short-circuiting.

3.1.2 Start-up of Continuous SSDS Operation

Following equipment commissioning SSDS start-up will be commenced – i.e. the blower will be placed into continuous operation. The individual system components will be tested and calibrated during the Equipment Commission phase (as described above) to allow optimum efficiency of the entire system to be reached as quickly as possible during the startup phase. However, it is likely that additional optimizations, such as balancing of the system flowrates, will be needed based on operation of the entire system during the startup period. During the start-up period the system will be closely monitored, and adjustments will be made to optimize performance as quickly as possible if any changes to the operational parameters arise.

SSDS diagnostic testing will include measurements of the blower speed, inlet vacuum, air flow, and exhaust temperature. Data collected from the diagnostic testing will be used to optimize system performance by balancing the air flow and/or adjusting blower operational parameters (e.g., speed setpoint) on an as needed basis.

3.1.3 Indoor Air Confirmation Sampling

One round of indoor air sampling will be implemented at four locations located within the basement of the building, below, to confirm the SSDS is maintaining concentrations of VOCs in the breathing space below the established NYSDOH Matrices. Annual indoor air sampling will also be conducted annually during the heating season for ongoing monitoring as outlined in Section 3.2.2. Prior to sampling, an inspection of each sampling location will be completed in order to rule out any potential influences from building materials or consumer products. One outdoor air sample will also be collected from a location to evaluate ambient air conditions during the indoor air sampling event. Summa canisters will be used at each location, certified by a laboratory and fitted with a regulator that allows ambient air to be collected over a 24-hour period given the Restricted Residential nature of the Site. The air samples will be submitted to a NY certified laboratory for analysis of select VOCs by U.S. EPA Method TO-15. The proposed sample locations are shown in Appendix N of the SMP.

If analytical results exceed the NYSDOH Matrices or applicable EPA VISL (1) the results will be compared to historic analytical results at the affected location to determine if concentrations have increased or decreased; and (2) an evaluation will also be made to determine if materials stored within or as part of new construction may be contributing to the indoor air exceedances. The indoor air sample(s) will be recollected following another 2 to 4 weeks of SSDS operation. If the resampling shows analytical results exceeding the applicable comparison values, system operational adjustments and/or modifications to enhance performance may then be necessary. The results of the confirmatory sampling event(s), including any potential demonstrations, will be reported to NYSDEC in a summary report.

If at any time the SSDS fails to operate effectively (i.e. the system is not achieving the desired target sub- slab differential pressure of 0.004 inches of H2O), or there is a significant alteration that may affect system operation, another sampling event outside of this schedule may be completed to ensure the protection of human receptors. A significant alteration to the building would include any change that could diminish or short circuit the sub-slab vacuum, such as a building add-on, foundation modification, utility installation, HVAC alteration, etc.

3.2 PERIODIC SYSTEM MONITORING

Once proper system operation and effectiveness is confirmed by the testing described in Section 3.1, periodic system monitoring will be conducted to ensure the system continues to operate as designed. The periodic system monitoring will include the following activities.

3.2.1 Visual Inspection and System Measurements

The following routine visual inspections of the SSDS components, and documentation of system operational conditions will be conducted on a yearly basis in accordance with the Site inspection parameters outlined in section 5.0 of the SMP to confirm that the SSDS is effectively operating as designed.

- Visual inspection of system components, including extraction risers, piping, equipment, and enclosure for damage or abnormal conditions;
- Visual inspections to ensure there are no significant changes to the building construction that would impact operation of the mitigation system (e.g., foundational concerns, cracks, remodeled areas, or additions to the building);
- Measurements of the blower speed, inlet vacuum, air flow, exhaust temperature;
- Measurement of the differential pressure across the in-line filters for the regenerative blower.

Flowrate/vacuum measurements will also be collected from the individual extraction risers, as needed, to balance the sub-slab area of influence. Following the startup period (i.e., the initial 3 months of operation), the measurements listed above will be collected at a minimum on an annual basis. The measurements may be conducted more frequently based on observed operations (i.e. if the operational parameters have significantly changed from the previous monitoring event, if the operational parameters are outside the anticipated range listed in Table 2, or if inspections indicate potential damage or malfunction of equipment) and seasonal fluctuations (i.e. temperature or pressure changes that may affect system operations). Specifically, the following measurements will be collected:

1. Visual inspections following construction work near system piping or equipment;
2. Visual inspections and repairs, if needed, in response to a system alarm;
3. System operational measurements and visual inspection when a blower inlet vacuum is outside the anticipated normal range.

3.2.2 Annual Indoor Air Sampling

Indoor air sampling will be conducted annually during the heating season each year between November 15 and March 31. Prior to sampling, NYSDOH Indoor Air Quality Questionnaire and Building Inventory will be completed in order to rule out any potential influences from building materials or consumer products. Four indoor air samples will be collected with summa canisters at locations in the cellar, certified by a laboratory and fitted with a regulator that allows ambient air to be collected over a 24-hour period given the Restricted Residential nature of the Site. Air samples will be collected over a 24-hour period from three to five feet above the ground surface to be collected within the breathing zone. The air samples will be submitted to a NY certified laboratory for analysis of select VOCs by U.S. EPA Method TO-15. The proposed sample locations are shown in Appendix N of the SMP.

4.0 SYSTEM OPERATIONS AND MAINTENANCE

4.1 ROUTINE MAINENANCE OF SYSTEM COMPONENTS

Routine maintenance of system components will be completed to ensure the system is operating at peak performance. The equipment manual provided by the SSDS equipment vendor will be kept on Site and provided to AEI for record keeping when the blower arrives on site and is installed. The regenerative blowers utilized by the SSDS generally require minimal maintenance. Routine maintenance will include the following:

- Regenerative blower - visual inspections/cleaning of dirt/debris on the outside of the blower; monitoring/cleaning of the blower inlet (e.g., inline filter) to prevent restrictions that could resulting in increased operational temperature.
- The influent filters for the regenerative blower will be changed when the differential pressure across the filter exceed approximately 6 to 10 in. H2O above the normal “clean” pressure differential.
- Visual inspections of the SSDS will routinely be completed as summarized in Section 3.2.1, and any system maintenance or repairs will be implemented as needed based on the visual inspections.

4.2 PARTS REPLACEMENT SCHEDULE

The inline particulate filter elements are the only components of the SSDS that require routine replacement. A filter element will be replaced when the differential pressure exceeds 6 to 10 in. H2O above the normal “clean” differential pressure. The replacement frequency of a particulate filters will vary depending on the particulate loading in the recovered vapor stream, but is anticipated to be approximately every 6 to 18 months. Besides the particulate filter elements, a SSDS part will only require replacement when the part is damaged or malfunctions. Damaged components will be replaced using the same component model or an engineer approved equal. Based on experience with similar SSDSs, the following components are more prone to periodic replacement:

- Vacuum Gauge - A vacuum gauge will be replaced when the gauge stops recording or the dial becomes “stuck”. The replacement vacuum gauge will be scaled for the full vacuum range of the SSDS blower.

- Temperature Gauge - A temperature gauge will be replaced when the gauge stops recording or the dial becomes “stuck”. The replacement gauge will be scaled from 0 to 250°F.

- Manual Control valve – A manual control valve will be replaced if it is damaged or stuck in a particular position. The control valve will be replaced using a PVC industrial ball valve with lockable handle.

- Piping component – An extraction pipe or fitting will be replaced if it is shows signs of deterioration or damage, such as warping, cracking, or discoloration. The piping will be replaced with a schedule 40 PVC or higher rated pressure pipe (e.g. schedule 80 PVC).

In addition to the above specific components, any other component that is damaged or malfunctions will be promptly replaced, and the system will be returned to normal operations as quickly as possible.

4.3 POTENTIAL PROBLEMS

The SSDS is relatively simple system with components that typically are durable and long lasting. However, if mechanical problems cause the SSDS to be inoperable, the system will be repaired as quickly as possible. Other than the vacuum blowers, the components of the SSDS (i.e., piping and electrical parts) are off-the-shelf items for which replacements parts should be readily available. If an electrical or piping component fails causing a blower to temporarily shut down, the failed component will be repaired or replaced and the blower restarted as soon as possible, generally within a week or less. Because the typical lead time for a replacement blower is 4 to 6 weeks, if a blower fails and must be replaced or sent offsite for repair, a temporary replacement blower will be installed as a contingency to maintain operation of the extraction network if repair or replacement of the damaged blower is anticipated to take longer than one week. A temporary replacement blower will be kept at the site and will be available to immediately replace a damaged SSDS, if repairs cannot be promptly implemented. The temporary replacement blower will be sized to maintain the desired target sub-slab differential pressure of 0.03 inches of H2O. Potential operating problems are identified below, including procedures that will be used to analyze and diagnose the problems, sources of information regarding the problems, and common or anticipated troubleshooting steps and remedies.

4.3.1 Obstruction or Blockage in System

The SSDS blowers may experience low flow and/or high exhaust temperature if an obstruction develops in the vacuum or discharge piping. Blower inlet vacuum substantially higher than normal operating parameters, and/or blower flowrates substantially lower than normal operating parameters are indicative of a blockage or obstruction. Riser vacuums substantially lower than anticipated may also be indicative of an obstruction between the blower and the riser. If the effluent temperature of the blower exceeds 230°F, an obstruction in the piping may exist. The blower VFDs are equipped with an overload alarm to protect the blower from damage due to abnormal operations. The thermal overload alarm will shut the blower down and trigger a “blower fault” alarm. If a piping obstruction is suspected, the piping will be promptly inspected and repaired. Piping obstruction may include, but or not limited to, a completely closed control valve or discharge damper, a clogged filter, debris, condensate, or ice buildup.

4.3.2 Low Sub-Slab Differential Pressure

A sub-slab differential pressure less than the target of -0.03 in. H2O may result in insufficient vapor mitigation. A low differential pressure may be the result of an “imbalanced” system caused by higher air flow from certain lateral loops than others, indicating the manual flow control valves at each riser need adjusted to generate a near uniform vacuum field across the entire mitigation area. The blower's speed can also be increased as a contingency to garner additional vacuum/flow, as needed. A low sub-slab vacuum could also be caused by a blower malfunction or damage to system piping. If the blower and piping are not damaged, and the sub-slab vacuum cannot be increased above the target level via system balancing, performance improvements to the SSDS may need to be implemented.

4.3.3 Power Loss

The newly constructed building is equipped with a backup generator system that will allow the SSDS to run even during a facility wide loss of power. If the loss of power to the blower is not caused by a building loss of power, the cause of the power loss will be investigated and repaired as quickly as possible.

4.4 ALTERNATE O&M

This section describes alternate O&M procedures that will be employed should the SSDS fail to operate as intended or if unanticipated conditions are encountered.

4.4.1 Sub-Slab Differential Pressure Below Target Level

If the target sub-slab differential pressure of -0.03 in. H2O cannot be achieved for a SSDS following system adjustments and calibration, alternative measures will be taken to ensure effective vapor mitigation is maintained. This may include one or more of the following:

- Additional data collection, such as targeted indoor air sampling, smoke testing, or other measurements to verify if sufficient vapor mitigation is achieved at sub-slab differential pressure less than -0.03 in. H2O;
- Repair or replacement of extraction points that garner minimal sub-slab vacuum influence;
- Repair of any areas causing "short-circuiting" of the vacuum (e.g., cracks in the concrete floor); and/or
- Upsizing the SSDS vacuum blower.

4.4.2 Excessive Moisture Buildup

The lateral loops and collection piping is installed a depth just above the anticipated groundwater table. As such, seasonal influence of the groundwater table as well as other local hydrogeologic factors may raise the groundwater table higher than anticipated leaving the lateral loops flooded. If at any time the system is flooded and rendered inoperable due to an elevated groundwater table, the SSDS will be temporarily shut down and groundwater levels will be monitored within the permanent monitoring wells periodically to assess current groundwater conditions and restart the system when levels recede.

If excessive moisture is encountered within SSDS during normal operations, the extraction piping will be modified to include moisture collection legs and/or a small moisture knockout tank upstream of the blower to facilitate collection and drainage of the moisture. Additionally, if excessive condensation or freezing is encountered in the exterior system piping, heat tracing and insulation will be installed to prevent damage to the system.

4.4.3 Indoor Air Concentration Exceedances

If indoor air concentrations exceedances are detected, one or more of the following will be implemented.

- Conduct additional investigations to identify if an indoor air source may be the cause of the exceedance;
- Conduct additional SSDS inspections and maintenance to ensure the system is not compromised and is operating as designed;
- Implement SSDS adjustments, such as balancing the system or increasing the blower speed to increase the sub-slab vacuum and air flow;
- Enhance vacuum coverage.

5.0 RECORDKEEPING AND REPORTING

5.1 O&M RECORDKEEPING

An SSDS O&M form will be completed during each routine Site visit outlined in the SMP to document system monitoring, inspections, and maintenance. Operational parameters will be recorded on the O&M form (Appendix C), along with the name of the operator, date, time, and weather conditions. The O&M form includes the frequency of which each O&M item should be conducted. An O&M form will also be completed during unanticipated site visits in response to a system alarm or malfunction. The cause of the system alarm/malfunction will be documented, along with corrective actions.

5.2 EMERGENCY REPORTING

Failure of an SSDS blower or operation below the target vacuum by on Site staff outside of periodic inspections should be reported to the Project Staff outlined below. Emergency contacts will include the following:

Owner:
M4778 Broadway LLC

C/O GDI Construction LLC
15 Verbena Avenue, Suite 200
Floral Park, New York 11001
Office: (516) 821-2003
Cell: (718) 501-5972

Consultant:
Victoria Whelan, P.G.
GZA GeoEnvironmental of New York
104 W. 29th Street, 10th Floor
New York, NY 1001
Office: (212) 594-8140
Cell: (631) 793-8821

5.3 ANNUAL O&M REPORT

An annual O&M report will be prepared to document SSDS operation, maintenance, and monitoring activities following the first full year of system operation. Reports will be submitted to the NYSDEC in conjunction with the reporting obligations outlined by the SMP, and will include the following:

- Results from routine inspections of the SSDS;
- A summary of any changes or modifications to the SSDS;
- A demonstration that the SSDS is functioning properly;
- Operational reports;
- Confirmation that the remedial activities remain necessary to achieve or maintain applicable standards, or verification that the remedial activities are no longer needed for the Site to comply with BCP and decision document; and
- Annual indoor air sampling results.

6.0 TERMINATION OF THE OPERATION AND MAINTENANCE PLAN

It is anticipated that all O&M Plan activities may be terminated when they are no longer necessary for the Site to comply with the SMP and BCP decision document. SSDS operation may reduce contaminant levels soil gas to levels no longer resulting in VI. If so, it may be possible to terminate operation of VI mitigation systems. Prior to any tasks related to termination of the VI mitigation system, a workplan will be provided to NYSDEC and NYSDOH for review and approval. After receiving approval, a demonstration that termination of the VI mitigation system will be completed by implementation of the following tasks:

- Prior to sampling for system termination, shut down the mitigation system for a period of at least 30 days to allow re-development of pre-mitigation subsurface conditions.
- Where possible, a combination of indoor air and sub-slab vapor samples will be collected from the original locations initially collected and utilized to determine that vapor mitigation was necessary.
- Analytical results obtained from:
    - The indoor air samples will be compared against their respective NYSDOH matrices and EPA VISL comparison values.
    - Since the active vapor mitigation activities do not include active remediation of the soil gas beneath the building slab, the sub-slab vapor analytical results will be retained for qualitative and/or semi-quantitative purposes in the event that multiple lines of evidence are necessary in order to make the demonstration that implementation of vapor mitigation activities are no longer necessary.

- If the results of the single-chemical comparison to applicable comparison criteria as well as a cumulative adjustment (if necessary), indicate that acceptable hazard and risk goals are met for the vapor intrusion exposure pathway, the system will remain shut down until the next sampling event.

- In the event that acceptable hazard and risk goals are not met for both sampling events, the SSDS will be re-started and will remain operational until applicable standards and the termination monitoring criteria established herein are met.

In the event that termination of the vapor mitigation system can be supported using the approach detailed above, a letter report documenting that the Site complies with acceptable hazard and risk goals for the vapor intrusion exposure pathway without further operations of the engineering control(s) under the O&M Plan will be prepared and submitted to NYSDEC for review and approval. Note that the Owner may prefer to keep the system in place in lieu of removal following termination of active vapor mitigation activities.

Appendix A – SSDS Installation Plans and Specifications

HCS Civil & Environmental Engineering, LLC
Professional Engineering Consultants
Licensed MA, VT, CT, NY

January 27, 2023

GDI Construction, LLC
15 Verbena Avenue, Suite 200
Floral Park, NY 11001

Attn: Mr. Austin Johnson
Project Manager

Subject: M4778 Broadway LLC
NYSDEC BCP Number: C231131
4778 Broadway, New York, New York
Vapor Protection System

HCS File: 20-0799

Dear Mr. Austin:

We are writing to provide information regarding our review of the shop drawings submitted on December 7, 2022, as attached. This letter supersedes the November 14, 2022, submittal cover letter issued by W.R. Meadows. Note that the attached cover letter indicates a warranty of ten (10) years and specifies installation review by a WR Meadows representative prior to pouring the slab. Provided the WR Meadows installation review report is provided to me for review prior to pouring the slab, the attached submittals are accetable as noted herein.

Our review represents acceptance in substantial conformance the approved RAWP based on information provided by your environmental consultant AEI Consultants, Inc. We are providing this review in accordance with NYSDEC requirements as the designated remediation engineer for the project.

Should there be any questions or concerns, please contact the undersigned or David Bausmith.

Sincerely,
HCS CIVIL & ENVIRONMENTAL ENGINEERING, LLC

Philip G. Clark, P.E., LSP
President

Cc: D. Bausmith, AEI Consultants, Inc.

HCS Civil & Environmental Engineering, LLC
169 Upper Valley Road • Washington, MA 01223 (413-281-2797)
Email: philip.clark@hcscepc.com

Submittal Package

QUALITY | SERVICE | INTEGRITY

W. R. MEADOWS®

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800-342-5976

www.wrmeadows.com

W. R. MEADOWS OF PA

W. R. MEADOWS
SEALTIGHT
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QUALITY...SERVICE...INTEGRITY

TELEPHONE: 717-792-2627
FAX: 717-792-0151

2150 Monroe St. • York, PA 17404
www.wrmeadows.com • wrmpa@wrmeadows.com

Centrifugal Concrete
7 West 36th Street
7th Floor
New York, NY 10018

December 7, 2022

C/o Eileen Reynolds

Project: 4778 Broadway Manhattan NYC

Dear Ms. Reynolds,

I have reviewed the application procedures for the above-mentioned project.

Note: Water Table is approximately 14’8”

You plan to install 12” clean stone over the soil with a SSDS system at 4”

Then install our EVOH Perminator on top of the crushed stone base.

PERMINATOR EVOH is a seven-layer co-extruded barrier manufactured from state-of-the-art polyethylene and EVOH resins. Designed to provide superior resistance to gas and moisture transmission, PERMINATOR EVOH is a highly resilient under slab gas/vapor barrier (20 Mil) designed to restrict naturally occurring gases, such as radon, methane, gasoline, solvents, oils, and hydrocarbons, from migrating through the ground and into the concrete slab.

Then installing our Pre Con System over the application of the EVOH Perminator.

PRECON is a composite sheet membrane comprised of a non-woven fabric, elastomeric membrane, and W. R. MEADOWS' exclusive, patented PLASMATIC CORE (U.S. Patent No. 7,179,761). The PLASMATIC CORE is a seven-layer matrix designed for toughness and provides the lowest water vapor transmission (WVT) rating on the market. Once concrete is poured against PRECON and the concrete cures, a mechanical bond forms that secures the concrete to the membrane.

Since the Pre Con System will not be coming in contact with the existing soil conditions, WRM of PA is willing to issue a 10 year material warranty for this project. As long as the material is installed correctly by the waterproofing contractor and the application is reviewed by a WR Meadows representative prior to pouring the mud slab. Visits can be arranged by calling Joseph Talecki WRM of PA at (267) 893-8049.

If you have any questions or concerns, do not hesitate to contact this writer at your earliest convenience.

Thank you for considering WR Meadows of PA for your project.

Sincerely,

Joseph Talecki

Joseph Talecki
Senior Technical Sales Representative
WRM of PA

W. R. MEADOWS OF PA

2150 Monroe St. • York, PA 17404
www.wrmeadows.com • wrmpa@wrmeadows.com

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TELEPHONE: 717-792-2627
FAX: 717-792-0151

To whom it may concern:

Centrifugal Concrete is an acceptable applicator of the Mel Rol Products.

Included products are:

Mel Rol, Mel Prime WB, Detail Strip, Pre-Con, Perminator EVOH & HP, Hydralastic 836 & SL, Detail Fabric, BEM, Cem-Kote Flex CR, Cem-Kote Flex St, Reinforcing Fabric HD, Reinforcing Fabric NW, Mel-Rol LM(all season), Mel-Drain & Mel-Drain Total-Drain, Water-Stop EC.

Please let me know if you need anything else,

Thanks,

Joseph Talecki

NYC Metro Sales

WARRANTY

Sample

PRECON™

Blindside/Underslab Membrane

==

NAME OF BUILDING: ____

LOCATION OF BUILDING: ____

NAME OF OWNER:____

WATERPROOFING CONTRACTOR: ____

DATE OF INSTALLATION COMPLETION:____

W. R. MEADOWS, INC. hereby warranties that for a period of **(10)** year(s) from the date of completion of installation of PRECON at the subject building, PRECON will be of good quality and will conform with our published specifications in force at the time of installation.

If at any time during such **(10)** year period the PRECON does not perform as warranted above, W. R. MEADOWS, INC. will supply replacement PRECON to the owner in exchange for and to the extent that the PRECON is found by W. R. MEADOWS, INC. not to comply with this warranty.

This warranty does not apply to any PRECON sheet unless installed and maintained in conformance with the printed instruction of W. R. MEADOWS, INC. from time to time in effect. Further, this warranty does not cover damage caused by abuse or abnormal use of the PRECON, acts of God, inadequate or faulty design of the subject building, and disclaims all liability where any failure results from structural cracks or defects or repairs, installations, designs, materials or products made by other persons. In addition, this warranty does not cover any costs or expenses associated with the removal, excavation or replacement of concrete or other substrates in connection with the testing, repair, removal or replacement of PRECON.

The foregoing warranty is exclusive and is in lieu of any and all other guarantees or warranties, express or implied, including without limitation the implied warranties of merchantability and fitness for a particular purpose. The remedies of the buyer for any breach of the warranty shall be limited to those herein provided to the exclusion of any and all other remedies, including without limitation incidental or consequential damages. W. R. MEADOWS, INC. shall not be liable in any case for any damage to the building or the contents thereof. Any lawsuit based on this warranty must be filed within one year (or within the shortest time period permitted to be established by agreement, if this period is longer than one year) from the date during the (10) year period described above on which the buyer discovers or should have discovered a breach of this warranty. No agreement varying or extending the foregoing warranty remedies will be binding upon W. R. MEADOWS, INC. unless it is in writing, and is signed by a duly authorized officer of W. R. MEADOWS, INC.

W. R. MEADOWS, INC.

BY: ________ Sample ________

DATE: ______________________

W. R. MEADOWS, INC.
P. O. BOX 338 • HAMPSHIRE, IL 60140 • 847/683-4500

WARRANTY

SAMPLE

PERMINATOR® EVOH

Underslab Gas Vapor Barrier

==

NAME OF BUILDING: ______________________________

LOCATION OF BUILDING: ______________________________

NAME OF OWNER: ______________________________

WATERPROOFING CONTRACTOR: ______________________________

DATE OF SUBSTANTIAL COMPLETION: ______________________________

W. R. MEADOWS, INC. hereby warranties that for a period of (**10**) year(s) from the date of substantial completion of PERMINATOR EVOH Underslab Gas Vapor Barrier at the subject building, PERMINATOR EVOH Underslab Gas Vapor Barrier will be of good quality and will conform with our published specifications in force at the time of installation.

If at any time during such (**10**) year period the PERMINATOR EVOH Underslab Gas Vapor Barrier does not perform as warranted above, W. R. MEADOWS, INC. will supply replacement PERMINATOR EVOH Underslab Gas Vapor Barrier to the owner in exchange for and to the extent that the PERMINATOR EVOH Underslab Gas Vapor Barrier is found by W. R. MEADOWS, INC. not to comply with this warranty.

This warranty does not apply to any PERMINATOR EVOH Underslab Gas Vapor Barrier sheet unless installed and maintained in conformance with the printed instruction of W. R. MEADOWS, INC. from time to time in effect. Further, this warranty does not cover damage caused by abuse or abnormal use of the PERMINATOR EVOH Underslab Gas Vapor Barrier, acts of God, inadequate or faulty design of the subject building, and disclaims all liability where any failure results from structural cracks or defects or repairs, installations, designs, materials or products made by other persons. In addition, this warranty does not cover any costs or expenses associated with the removal, excavation or replacement of concrete or other substrates in connection with the testing, repair, removal or replacement of PERMINATOR EVOH Underslab Gas Vapor Barrier.

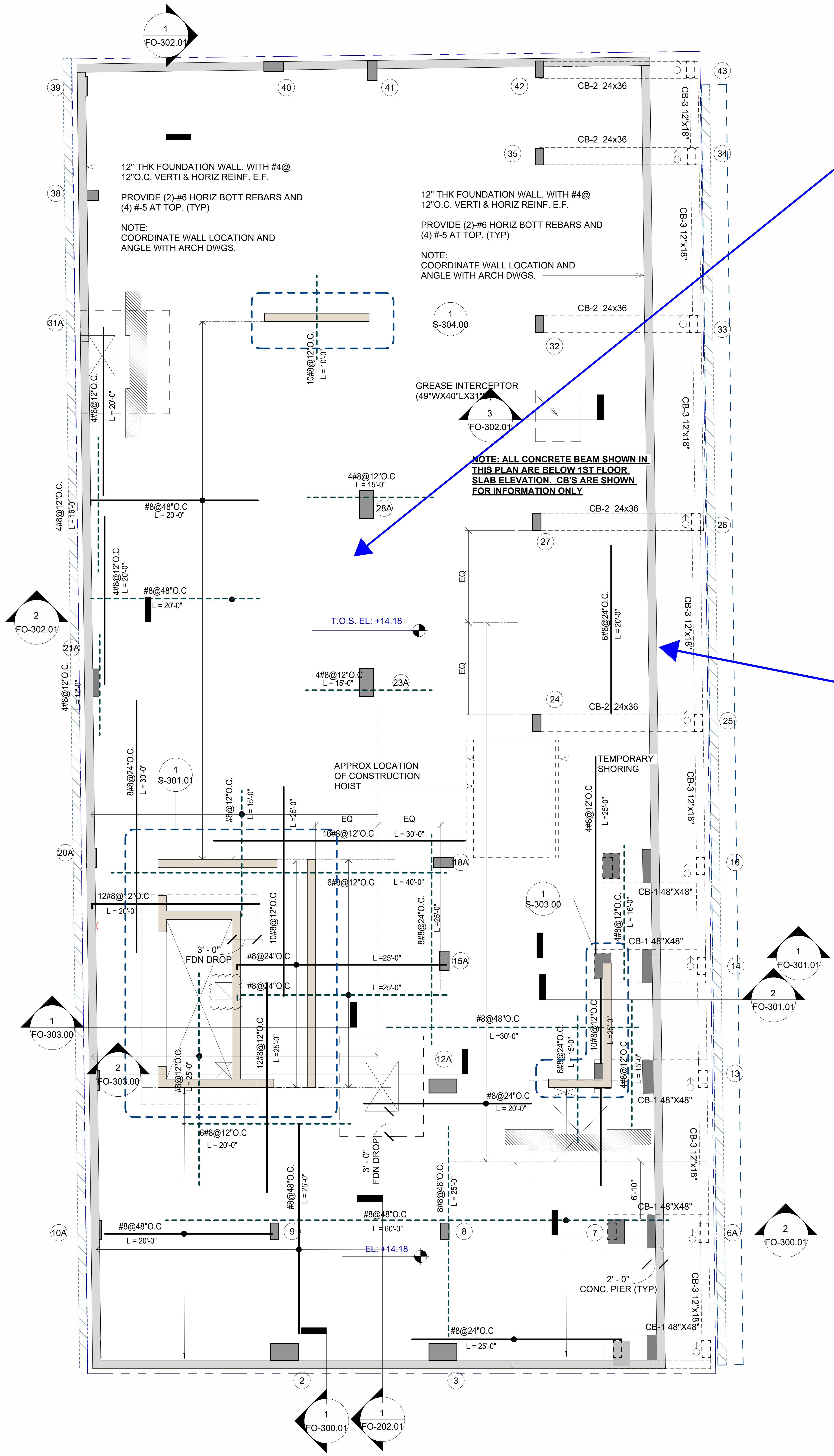
The foregoing warranty is exclusive and is in lieu of any and all other guarantees or warranties, express or implied, including without limitation the implied warranties of merchantability and fitness for a particular purpose. The remedies of the buyer for any breach of the warranty shall be limited to those herein provided to the exclusion of any and all other remedies, including without limitation incidental or consequential damages. W. R. MEADOWS, INC. shall not be liable in any case for any damage to the building or the contents thereof. Any lawsuit based on this warranty must be filed within one year (or within the shortest time period permitted to be established by agreement, if this period is longer than one year) from the date during the (10) year period described above on which the buyer discovers or should have discovered a breach of this warranty. No agreement varying or extending the foregoing warranty remedies will be binding upon W. R. MEADOWS, INC. unless it is in writing, and is signed by a duly authorized officer of W. R. MEADOWS, INC.

W. R. MEADOWS, INC.

BY: SAMPLE ______________________________

DATE: ______________________________

W. R. MEADOWS, INC.
P. O. BOX 338 • HAMPSHIRE, IL 60140 • 847/683-4500



1 Foundation/Cellar
FO-100.01 1/8" = 1'-0"

Steps 1-6 on Waterproofing Procedure

7. Pre-Con will come up 12" on the FDN wall

Waterproofing Procedure

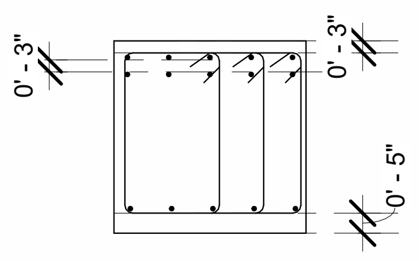
1. Lay Geo-tech fabric on soil
2. Lay 4" of clean stone
3. Place SSDS system (pipe)
4. Lay 8" of crushed stone
5. Lay EVO-H Perminator
6. Lay Pre-Con
7. Pre-Con will come up 12" on the FDN wall

FOUNDATION NOTES:

1. 36" MAT REINFORCED WITH #10@12" TOP AND BOTTOM E.W., UNLESS OTHERWISE NOTED.
2. ADDITIONAL TOP BARS ARE SHOWN THUS ON PLAN.
3. ADDITIONAL BOTTOM BARS ARE SHOWN THUS ON PLAN.
4. TOP CLEAR COVER TO BE 0.75".
5. BOTTOM CLEAR COVER TO BE 3". UNLESS OTHERWISE NOTED ON PLAN AND DETAILS.
6. SEE ARCH. AND MECH. DRAWINGS FOR SIZE AND LOCATION OF WATER DETENTION TANK.
7. REINFORCEMENT SHOWN IN PLAN, CROSSING ELEVATOR PIT, MAT DROP, WALL FDN DOES NOT INCLUDE VERTICAL REBAR LENGTH.
8. FOR TOP OF NEW SLAB ELEVATION SEE PLAN.
9. BOTTOM OF NEW FOOTING SHOWN THUS [-...] ON THE PLAN.
10. ALL SLAB OPENINGS ARE TO BE COORDINATED WITH ARCH. AND MECH. DWG'S. SEE ARCH. DWG'S FOR LOCATION AND DIMENSIONS.
11. FOR DIMENSIONS NOT SHOWN ON THIS PLAN SEE ARCH. DWG'S.
12. SLAB ON GRADE PITCH TO DRAINS AS SHOWN ON ARCH. DWG'S. FOR DRAIN LOCATIONS REFER TO ARCH. AND MECH. DWG'S.
13. ALL REINFORCEMENT AT EXPOSED CONCRETE SLABS SHALL BE EPOXY COATED.
14. FOR COLUMN COORDINATES, SEE ARCH DWGS.
15. SEE ARCH. AND MECH DWGS. FOR LOCATION AND SIZE OF PIPE PENETRATIONS AT MAT FOUNDATION.

BEAM SCHEDULE

MARK	SIZE		REINFORCEMENT		STIRRUPS	REMARKS
	WIDTH	WIDTH	TOP	BOT		
CB-1	48"	48"	10 - #10	6 - #10	3 -#5 @ 9"O.C.	TOP REIN. IN 2 LAYERS
CB-2	24"	36"	6 - #10	3 - #10	2 -#5 @ 9"O.C.	TOP REIN. IN 2 LAYERS
CB-3	12"	18"	2 - #6	2 - #6	#4 @ 12"O.C.	



CB-1 CROSS SECTION
1/4" = 1'-0"

LEGEND:

▮	INDICATES CONCRETE COLUMN
▯	INDICATES COLUMN ABOVE 1ST FLOOR LEVEL
▯	INDICATES CONCRETE PIER
▬	INDICATES 12" THK SHEAR WALL. SEE SHEAR WALL REINF DETAILS ON S-300 SERIES
—·—·—	INDICATES PROPERTY LINE
—··—··—	INDICATES STRESS LINE
- - - - -	INDICATES BUILDING LINE ABOVE SLAB
CB-X	INDICATES CONCRETE BEAM AT AT 1ST FLOOR LEVEL

PROPOSED NEW DEVELOPMENT

4778

BROADWAY
NEW YORK,NY 10034

BLOCK 2233 LOT: 10

Architect:
AUFGANG.
74 Lafayette Avenue
Suite 301
Suffern, NY 10901
845.368.0004
info@aufgang.com

Owner/Developer
OWNER/DEVELOPER:

M4778 BROADWAY LLC
15 VERNENA AVENUE
ANA@MADDEQUITIES.COM
516-821-2004

Structural Engineer
STRUCTURAL COMPANY:

ENGINEERING GROUP ASSOCIATES
19 W 21ST STREET, SUITE 1103
NEW YORK, NY 10018
212-982-0488

MEP Engineer
MEP COMPANY:

AVCON ENGINEER
580 8TH AVENUE, 14TH FLOOR
NEW YORK, NY 10018
646-572-0488

Civil Engineer
CIVIL COMPANY:

BROOKER ENGINEERING
74 LAFAYETTE, SUITE 501
NEW YORK, NY 10901
845-357-4411

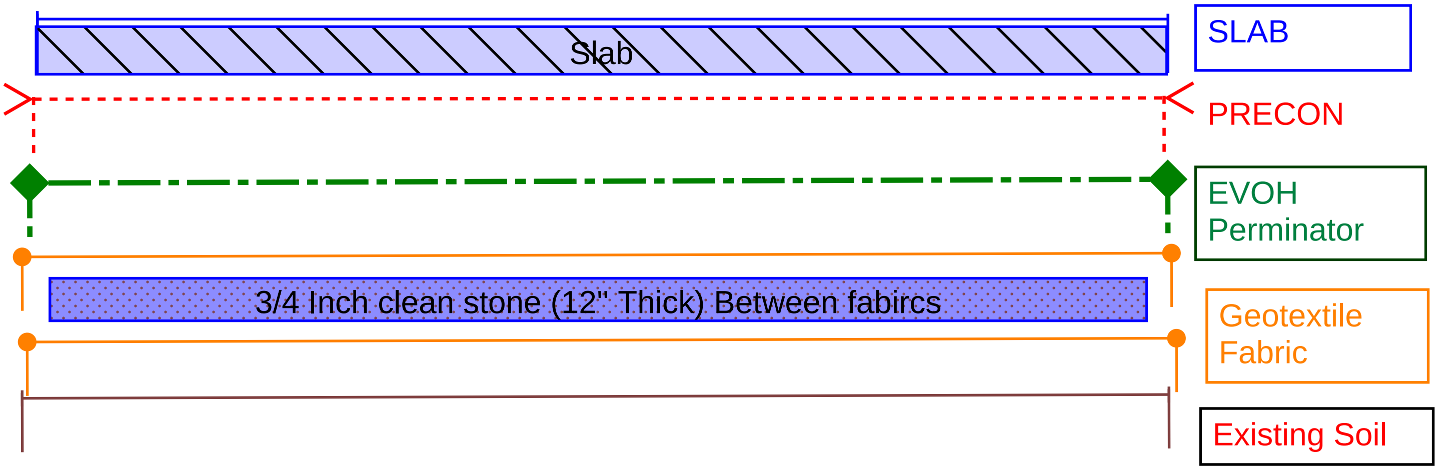
Rev #	Date	Description
	12-21-2022	Structural Fabrication
	11-18-2022	Foundation - For fabrication
	11-09-2022	Foundation - Pricing
	07-21-2022	Progress Set
1	02-04-2022	DOB PAA
	01-27-2021	DOB FILING

SHEET TITLE:
FOUNDATION/CELLAR REINFORCEMENT PLAN

80% CONSTRUCTION DOCUMENTS

SEAL & SIGNATURE
GENNADY SARATOVSKY
075323

ISSUE DATE: 11/17/21
PROJECT NO: 2020.1292
DRAWN BY: Author
CHECKED BY: Checker
SCALE: As indicated
SHEET NO: 4 OF
DRAWING NO: FO-100.01
NYC DOB NUMBER: M00464453-P1


Slab
SLAB
PRECON
EVOH
Permінator
3/4 Inch clean stone (12" Thick) Between fabircs
Geotextile
Fabric
Existing Soil

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ICF Waterproofing Installation Guidelines

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LEED v4 Letter

MEL-ROL

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MEL-ROL

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PRECON

Product Data Sheet

PRECON

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PRECON

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PRECON

Case Study

PRECON

Project Profile

PRECON

Flyer

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PRECON

Cold Weather Application Technical Bulletin

PRECON

End Lap Taping Method Tech Bulletin

PRECON

LEED v4 Letter

NO. 723-D **DATA SHEET**

MasterFormat:
03 33 00
07 26 23
07 26 16

MAY 2018
(Supersedes July 2017)

PERMINATOR® EVOH

Underslab Gas Vapor Barrier

DESCRIPTION

PERMINATOR EVOH is a seven-layer co-extruded barrier manufactured from state-of-the-art polyethylene and EVOH resins. Designed to provide superior resistance to gas and moisture transmission, PERMINATOR EVOH is a highly resilient underslab gas/vapor barrier designed to restrict naturally occurring gases, such as radon, methane, gasoline, solvents, oils, and hydrocarbons, from migrating through the ground and into the concrete slab.

USES

When properly installed, PERMINATOR EVOH resists gas and moisture migration into the building envelope to provide protection from toxic/harmful chemicals. It can be installed as part of a passive or active control system extending across the entire building, including floors, walls, and crawl spaces. PERMINATOR EVOH protects flooring and other moisture-sensitive furnishings in the building's interior from moisture and water vapor migration, greatly reducing condensation, mold, and degradation.

FEATURES/BENEFITS

- Resistant to gasoline, oils, solvents, hydrocarbons, radon, and methane.
- Available in 150' (45.7 m) long rolls.
- Helps reduce the penetration of moisture and water vapor through the slab into the structure.
- Helps reduce fungus, mildew, and mold.
- Tough enough to withstand normal construction jobsite conditions and traffic … will not crack, puncture, snag, split, or tear easily.
- Seven-layer construction with EVOH gas barrier core.

PACKAGING

10' (3 m) x 150' (45.7 m) Rolls

SPECIFICATIONS

- Meets or exceeds all requirements of ASTM E 1745-11 Class A, B & C.

APPLICATION

Surface Preparation … Level, tamp, or roll earth or granular material beneath the slab base as specified by supplied architectural drawings. Follow ASTM E-1643-10 (standard practice and procedure for installation of vapor retarder used in contact with earth or fill under concrete slabs). Reference American Concrete Institute (ACI) 302.1R-15 Section 6.1.4 – Base Material for sub-grade preparation prior to placement of PERMINATOR.

Horizontal Application … Unroll 150' (45.7 m) PERMINATOR EVOH over the area where the slab is to be poured. Cut to size if necessary. PERMINATOR should completely cover the pour area. All joints/seams, both side and end, should be overlapped 12" (304.8 mm) and taped using 4" (101.6 mm) wide PERMINATOR EVOH TAPE. (Note: The PERMINATOR EVOH TAPE area of adhesion should be free from dust, dirt, and moisture to allow maximum adhesion of the pressure-sensitive tape.) To ensure placement of laps, PERMINATOR BUTYL TAPE should be used underneath the overlap area to hold membrane in place as PERMINATOR EVOH TAPE is applied.
The most efficient installation method includes placing PERMINATOR EVOH on top of the footing and against the vertical wall. This will sandwich PERMINATOR EVOH between the footing, vertical wall, and poured concrete floor. This will help protect the concrete slab from external moisture sources once the slab has been placed.
Before placing concrete slab, make sure all penetrations, block outs, and damaged areas are repaired/addressed. For detailed information on detailing penetrations, such as pipe clusters, please refer to INSTALLATION GUIDELINES: PERMINATOR EVOH PENETRATIONS available at www.wrmeadows.com.

Numerous municipal building codes do not allow the placement of vapor barriers over the footing, due to breaking of the bond between the wall and footing. Although this is not an optimal application method, W. R. MEADOWS approves this alternate method when required by building code.

CONTINUED ON THE REVERSE SIDE…

W. R. MEADOWS, INC.
P.O. Box 338 • HAMPSHIRE, IL 60140-0338
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HAMPSHIRE, IL / CARTERSVILLE, GA / YORK, PA
FORT WORTH, TX / BENICIA, CA / POMONA, CA
GOODYEAR, AZ / MILTON, ON / SHERWOOD PARK, AB

TECHNICAL DATA

Properties	Test Method	Result
Appearance		White/Green
Thickness, Nominal		20 Mil (0.51 mm)
Weight		102 lb./MSF (498 g/m^2)
Classification	ASTM E 1745	Class A, B, and C
Tensile Strength	ASTM E 154, Section 9, (D-882)	58 lbf (10.2 Kn/m)
Impact Resistance	ASTM D 1709	2600 g
Permeance (New Material)	ASTM E 154, Section 7 ASTM E 96, Procedure B	0.0098 Perms grains/(ft^2·hr·in·Hg) [0.0064 Perms g/(24hr·m^2·mm Hg)]
Permeance (After Conditioning) (Same Measurement as Above Performance)	ASTM E 154 Section 8, E96 Section 11, E96 Section 12, E96 Section 13, E96	 0.0079 (0.0052) 0.0079 (0.0052) 0.0097 (0.0064) 0.0113 (0.0074)
WVTR	ASTM E 96 Procedure B	0.0040 grains/hr-ft^2 (0.0028 gm/hr-m^2)
Benzene Permeance	Aqueous Phase Film Permeance	1.57E-10 m/s
Toluene Permeance	Aqueous Phase Film Permeance	2.18E-10 m/s
Ethylbenzene Permeance	Aqueous Phase Film Permeance	1.71E-10 m/s
M & P Xylenes Permeance	Aqueous Phase Film Permeance	1.62E-10 m/s
O Xylene Permeance	Aqueous Phase Film Permeance	1.53E-10 m/s
Perchloroethylene (PCE)	Aqueous Phase Film Permeance	1.5 x 10-^{9} m/s
Trichloroethylene (TCE)	Aqueous Phase Film Permeance	2.4 x 10-^{9} m/s
Radon Diffusion Coefficient	K124/02/95	< 1.1 x 10^{-13} m^2/s
Methane Permeance	ASTM D 1434	3.68E-^{12} m/s Gas Transmission Rate (GTR): 0.32 mL/m^2•day•atm
Maximum Static Use Temperature		180° F (82° C)
Minimum Static Use Temperature		-70° F (-57° C)

LEED INFORMATION

May help contribute to LEED credits:

- EAp2: Minimum Energy Performance
- EAc2: Optimize Energy Performance
- MRc9: Construction and Demolition Waste Management

For CAD details, most current data sheet, further LEED information, and SDS, visit www.wrmeadows.com.

LIMITED WARRANTY

W. R. MEADOWS, INC. warrants at the time and place we make shipment, our material will be of good quality and will conform with our published specifications in force on the date of acceptance of the order. Read complete warranty. Copy furnished upon request.

Disclaimer

The information contained herein is included for illustrative purposes only, and to the best of our knowledge, is accurate and reliable. W. R. MEADOWS, INC. cannot however under any circumstances make any guarantee of results or assume any obligation or liability in connection with the use of this information. As W. R. MEADOWS, INC. has no control over the use to which others may put its product, it is recommended that the products be tested to determine if suitable for specific application and/or our information is valid in a particular circumstance. Responsibility remains with the architect or engineer, contractor and owner for the design, application and proper installation of each product. Specifier and user shall determine the suitability of products for specific application and assume all responsibilities in connection therewith.

SAFETY DATA SHEET

SECTION 1: PRODUCT AND COMPANY IDENTIFICATION

Product:	**PERMINATOR® EVOH**	**Part Number: 5244100**	
Manufacturer:	**W. R. MEADOWS, INC.**	**Address:**	300 Industrial Drive Hampshire, Illinois 60140
Telephone:	(847) 214-2100	In case of emergency, dial (800) 424-9300 (CHEMTREC)	
Revision Date:	10/10/2019		
Product Use:	Underslab Gas Vapor Barrier		

SECTION 2: HAZARDS IDENTIFICATION/EXPOSURE LIMITS

HMIS	
|Health|	|0|
|Flammability|	|0|
|Reactivity|	|0|
|Personal Protection|	| |

Product is classified as non-hazardous per OSHA 1910.1200. Perminator is defined by OSHA as an "article." A manufactured item that is formed to a specific shape or design during manufacture that does not release or result in exposure to a hazardous chemical under normal use conditions.

SECTION 3: HAZARDS COMPONENTS

Chemical Name:	**CAS Number**	**% by Weight**	**SARA 313**	**Vapor Pressure (mm Hg@20°C)**	**LEL (@24°C)**
None					

N/A: Not Applicable

Under the reporting requirements of Section 313 of Title III of the Superfund Amendments and Reauthorization Act of 1966 (SARA) and 40 CFR Part 372, chemicals listed on the 313 List (40 CFR Part 373.65) are identified under the heading "SARA" 313."

SECTION 4: EMERGENCY AND FIRST AID PROCEDURES

EYE CONTACT: Not expected to be an exposure route.
SKIN CONTACT: Not Expected to be an exposure route.
INHALATION: Not expected to be an exposure route.
INGESTION: Not expected to be an exposure source.
MOST IMPORTANT SYMPTOMS/EFFECTS, ACUTE AND CHRONIC: See Section Eleven for Symptoms/Effects.

SECTION 5: FIRE AND EXPLOSIVES HAZARDS

FLASHPOINT: Not applicable; product is a solid.
EXTINGUISHING MEDIA: Water fog, foam, dry chemical.
CHEMICAL/COMBUSTION HAZARDS: Carbon monoxide, carbon dioxide, and incomplete combustion products.
PRECAUTIONS/PERSONAL PROTECTIVE EQUIPMENT: Avoid smoke inhalation. Use appropriate respiratory protection.

SECTION 6: ACCIDENTAL RELEASE MEASURES

SPILL OR LEAK PROCEDURES: Not applicable. Product is a solid.

SECTION 7: HANDLING AND STORAGE

SAFE HANDLING PROCEDURES: None.
SAFE STORAGE: Prevent job-site damage.

SECTION 8: EXPOSURE CONTROLS/PERSONAL PROTECTION

	OSHA				**ACGIH**			
Chemical Name:	**PEL**	**PEL/CEILING**	**PEL/STEL**	**SKIN**	**TLV**	**TLV/CEILING**	**TLV/STEL**	**SKIN**
1. Blown Polyethylene	N/E	N/E	N/E	No	N/E	N/E	N/E	N/E

N/E = Not Established

ENGINEERING CONTROLS: None required under normal use conditions.
PERSONAL PROTECTIVE EQUIPMENT: None required under normal use conditions.

SAFETY DATA SHEET

SECTION 9: PHYSICAL AND CHEMICAL PROPERTIES

BOILING POINT: N/A
EVAPORATION RATE: N/A
WEIGHT PER GALLON: N/A
ODOR: None
FLASH POINT: See Section 5
VAPOR PRESSURE: N/D
PARTITION COEFFICENT: N/D
VISCOSITY: N/D

VAPOR DENSITY: N/A
pH LEVEL: N/A
PRODUCT APPEARANCE: White/Gold Film
ODOR THRESHOLD: N/D
FLAMMABILITY: See Section 5
RELATIVE DENSITY: N/D
AUTOIGNITION TEMPERATURE: N/D

% VOLATILE BY VOLUME: N/A
% VOLATILE BY WEIGHT: N/A
VOC CONTENT: N/A
MELTING/FREEZING POINT: N/D
UEL/LEL: N/D
SOLUBILITY: N/D
DECOMPOSITION TEMPERATURE: N/D

N/A : Not Applicable *N/D: Not Determined*

SECTION 10: STABILITY/REACTIVITY

STABILITY: Stable. **HAZARDOUS POLYMERIZATION:** Will not occur.
CONDITIONS AND MATERIALS TO AVOID: None recognized.
HAZARDOUS DECOMPOSITION PRODUCTS: None recognized.

SECTION 11: TOXICOLOGICAL INFORMATION

EYE CONTACT: Not anticipated to be an exposure route.
SKIN CONTACT: Direct contact may cause slight skin irritation.
INHALATION: Not anticipated to be an exposure route.
INGESTION: Not anticipated to be an exposure route.
SIGNS AND SYMPTOMS: None recognized.
AGGRAVATED MEDICAL CONDITIONS: None recognized.
OTHER HEALTH EFFECTS: None recognized

SECTION 12: ECOLOGICAL INFORMATION

ECOTOXICITY: N/E **DEGRADABILITY:** N/E **BIOACCUMULATIVE POTENTIAL:** N/E
SOIL MOBILITY: N/E **OTHER ADVERSE EFFECTS:** None Recognized

SECTION 13: WASTE DISPOSAL INFORMATION

WASTE DISPOSAL INFORMATION: Product is classified as a non-hazardous waste.

SECTION 14: TRANSPORTATION INFORMATION

HAZARDOUS/NON-HAZARDOUS MATERIAL: Not regulated by DOT.
UN NUMBER: None **HAZARD CLASS:** N/A **PACKING GROUP:** N/A
UN PROPER SHIPPING NAME: N/A
ENVIRONMENTAL HAZARDS: None recognized.
BULK TRANSPORTATION INFORMATION: None.
SPECIAL PRECAUTIONS: None.

SECTION 15: REGULATORY INFORMATION

OTHER REGULATORY CONSIDERATIONS: None recognized.

SECTION 16: OTHER INFORMATION

PREPARATION DATE: 10/10/2019
PREPARED BY: Dave Carey

GUIDE SPECIFICATION FOR PERMINATOR® EVOH UNDERSLAB GAS AND VAPOR BARRIER

SECTION 07 26 16

Below Grade Vapor Retarders

Revision Date: July 3, 2019

Specifier Notes: This guide specification is written according to the Construction Specifications Institute (CSI) MasterFormat. The section must be carefully reviewed and edited by the architect or engineer to meet the requirements of the project. Coordinate this section with other specification sections and the drawings.

Specifier Notes: PERMINATOR EVOH is a seven-layer co-extruded barrier manufactured from state-of-the-art polyethylene and EVOH resins. Designed to provide superior resistance to gas and moisture transmission, as well as water vapor, PERMINATOR EVOH is a highly resilient underslab gas/vapor barrier designed to restrict naturally occurring gases, such as radon, methane, gasoline, solvents, oils, and hydrocarbons, from migrating through the ground and into the concrete slab.

When properly installed, PERMINATOR EVOH resists gas and moisture migration into the building envelope to provide protection from toxic/harmful chemicals. It can be installed as part of a passive or active control system extending across the entire building, including floors, walls, and crawl spaces. PERMINATOR EVOH protects flooring and other moisture-sensitive furnishings in the building's interior from moisture and water vapor migration, greatly reducing condensation, mold, and degradation.

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Surface preparation.

B. Application of an underslab soil gas barrier.

1.02 RELATED SECTIONS

Specifier Notes: Edit the list of related sections as required for the project. List other sections dealing with work directly related to this section.

A. Section 03 30 00 - Concrete.

B. Section 07 10 00 – Dampproofing and Waterproofing.

C. Section 09 64 00 - Wood Flooring.

D. Section 09 65 00 - Resilient Flooring.

1.03 REFERENCES

A. ASTM D1434: Standard Test Method for Determining Gas Permeability Characteristics of Plastic Film and Sheeting.

B. ASTM D1709: Standard Test Methods for Impact Resistance of Plastic Film by the Free-Falling Dart Method.

C. ASTM E96: Standard Test Methods for Water Vapor Transmission of Materials.

D. ASTM E154: Standard Test Methods for Water Vapor Retarders Used in Contact with Earth Under Concrete Slabs.

E. ASTM E1643: Standard Practice for Installation of Water Vapor Retarders Used in Contact with Earth or Granular Fill Under Concrete Slabs.

F. ASTM E1745: Standard Specification for Plastic Water Vapor Retarders Used in Contact with Soil or Granular Fill Under Concrete Slabs.

G. ASTM F1249: Standard Test Method for Water Vapor Transmission Rate Through Plastic Film and Sheeting Using a Modulated Infrared Sensor.

H. K124/02/95: Determination of Radon Transmittance.

1.04 SUBMITTALS

A. Comply with Section 01 33 00 - Submittal Procedures.

B. Submit manufacturer's product data and application instructions.

1.05 QUALITY ASSURANCE

A. Use an experienced installer and adequate number of skilled personnel who are thoroughly trained and experienced in the application of the soil gas barrier.

B. Obtain gas barrier materials from a single manufacturer regularly engaged in manufacturing the product.

C. Provide products which comply with all state and local regulations controlling use of volatile organic compounds (VOCs).

1.06 PRECONSTRUCTION MEETING

A. Pre-Construction Meeting: Convene one week prior to installation of underslab soil gas barrier. Attendees to be as follows: - Architect, Engineer, General Contractor, Gas Barrier Installer, and Gas Barrier Manufacturer to discuss the installation in detail.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to site in manufacturer's original, unopened containers and packaging, with labels clearly identifying product name and manufacturer.

B. Store materials in a clean, dry area in accordance with manufacturer's instructions.

C. Protect materials during handling and application to prevent damage or contamination.

D. Ensure membrane is stamped with manufacturer’s name, product name, and membrane thickness at intervals of no more than 85” (220 cm).

1.08 ENVIRONMENTAL REQUIREMENTS

A. Product not intended for uses subject to abuse or permanent exposure to the elements.

B. Do not apply on frozen ground.

PART 2 PRODUCTS

2.01 MANUFACTURER

A. W. R. MEADOWS®, INC., PO Box 338, Hampshire, Illinois 60140-0338. (800) 342-5976. (847) 683-4500. Fax (847) 683-4544. Web Site www.wrmeadows.com.

2.02 MATERIALS

A. Soil Gas Barrier
  1. Performance-Based Specification: Gas barrier membrane shall be a seven layer co-extruded barrier manufactured from polyethylene and ethylene vinyl alcohol (EVOH) resins, meeting the shall meet the following minimum performance requirements:
    a. Maximum Water Vapor Permeance (ASTM E154 Sections 7, 8, 11, 12, 13, by ASTM E96, Method B or ASTM F1249)
      i. As received: 0.0098 perms.
      ii. After Wetting and Drying: 0.0079 perms.
      iii. Resistance to Plastic Flow and Temperature: 0.0079 perms.
      iv. Effect Low Temperature and Flexibility: 0.0097 perms.
      v. Resistance to Deterioration from Organisms and Substances in Contacting Soil: 0.0113 perms.
    b. Puncture Resistance, ASTM D1709: 2,600 grams.
    c. Tensile Strength, ASTM E154, Section 9: 58 Lb. Force/Inch.
    d. Radon Diffusion Coefficient, k124/02/95: <1.1 x 10^{-13} m^2/s.
    e. Methane Permeance, ASTM D1434: 3.68 x 10^{-12} GTR.
    f. Aqueous Phase Film Permeance
      i. Benzene Permeance: 1.57 x 10^{-10} m/s.
      ii. Toluene Permeance: 2.18 x 10^{-10} m/s.
      iii. Ethylbenzene Permeance: 1.71 x 10^{-10} m/s.
      iv. M & P Xylenes Permeance: 1.62 x 10^{-10} m/s.
      v. O Xylene Permeance: 1.53 x 10^{-10} m/s.

  2. Proprietary-Based Specification:
    a. PERMINATOR EVOH by W. R. MEADOWS.

2.03 ACCESSORIES

Specifier Notes: When PERMINATOR EVOH is to be used strictly as a water vapor barrier, only the PERMINATOR EVOH Tape is required to be used. In situations where the PERMINATOR EVOH is to be used as a soil gas barrier, PERMINATOR EVOH BUTYL TAPE is installed within a 12” (304.8 mm) overlap and then the seam is then taped with PERMINATOR EVOH Tape. Select accessories based on project requirements.

A. Seam Tape
  1. High Density Polyethylene Tape with pressure sensitive adhesive. Minimum width 4” (100 mm).
    a. PERMINATOR EVOH TAPE by W. R. MEADOWS.

B. Double Sided Seam Tape
  1. Double sided butyl tape for overlap sealing in gas barrier installations. Minimum width 2” (50 mm).
    a. PERMINATOR EVOH BUTYL TAPE by W. R. MEADOWS.

C. Pipe Collars
  1. Construct pipe collars from gas barrier material and pressure sensitive tape per manufacturer’s instructions.

PART 3 EXECUTION

3.01 SURFACE PREPARATION

Specifier Notes: A base for a gas-reduction system may require a 4” - 6” (101. 6 – 152.4 mm) gas permeable layer of clean coarse aggregate as specified by architectural or structural consultant after installation of the recommended gas collection system. In this situation, a cushion layer consisting of a non-woven geotextile fabric placed directly under PERMINATOR EVOH will help protect the barrier from damage due to possible sharp coarse aggregate. Surface preparation needs to be reviewed based on the specific project requirements.

A. Prepare surfaces in accordance with project requirements.

Specifier Notes: It may also be advisable to reference American Concrete Institute (ACI) 302.1R-15: Chapter 6, Section 6.1.4 – Base Material, for sub-grade preparation prior to placement of PERMINATOR EVOH. As this is a guide, reference to this document shall not be made in contract documents and any items in this document that the Architect/Engineer wants to be part of the contract documents, the items need to be reinstated in mandatory language for incorporation by the Architect/Engineer.

B. Level, tamp, or roll earth or granular material beneath the slab base.

3.02 EXAMINATION

A. Examine surfaces to receive membrane. Notify architect if surfaces are not acceptable. Do not begin surface preparation or application until unacceptable conditions have been corrected.

3.03 INSTALLATION

Specifier Notes: If PERMINATOR EVOH is being used as strictly a vapor barrier, then delete Section B below. If the requirement is for PERMINATOR EVOH to be used as a soil gas barrier for contaminated site installation, then delete Section A. It is also advisable to review the PERMINATOR EVOH Installation Guidelines for additional installation information that may be specific for the project requirements.

A. Vapor Barrier

1. Install the vapor barrier membrane in accordance with manufacturer’s instructions and ASTM E1643.

2. Unroll vapor retarder with the longest dimension parallel with the direction of the pour.

3. Lap vapor barrier over footings and seal to foundation walls with 4” (100 mm) seam tape.

4. Overlap joints 6” (152 mm) and seal with 4” (100 mm) seam tape and roll press into place.

5. Seal all penetrations (including pipes) with manufacturer’s written installation procedures.

6. No penetration of the vapor retarder is allowed except for reinforcing steel and permanent utilities.

7. Repair damaged areas by cutting patches of vapor barrier, overlapping damaged area 6” (150 mm) and taping all four sides with tape.

B. Soil Gas Barrier

1. Install the gas barrier membrane in accordance with manufacturer’s instructions and ASTM E1643.

2. Unroll gas barrier membrane with the longest dimension parallel with the direction of the pour.

3. Lap gas barrier over the footing and seal to foundation walls with 2” (50 mm) double sided butyl tape and roll press into place with rubber roller.

4. Apply gas barrier seam tape to the terminated edge of the gas barrier membrane and onto the concrete foundation.

5. Roll press into place.

4. Joint Overlap
   a. Apply double sided butyl tape 6” (150 mm) from the termination of the gas barrier membrane and press into place.
   b. Overlap the next layer of gas barrier membrane 12” (300 mm) and roll press into place.
   c. Apply gas barrier seam tape centered over the joint and roll press into place.

5. Repair of Damaged Areas
   a. Cut out damaged area of gas barrier membrane allowing for an overlap of 12” (300 mm) in all directions.
   b. Apply double sided butyl tape 6” (150 mm) from the cut edges of the gas barrier membrane in all directions and press into place.
   c. Place the new piece of gas barrier membrane overlapping the existing areas a minimum of 12” (300 mm) and roll press into place.
   d. Apply 4” (100 mm) gas barrier seam tape centered over the joint in all directions and roll press into place.

END OF SECTION

INSTALLATION GUIDELINES
PERMINATOR® EVOH

PERMINATOR EVOH is a seven-layer co-extruded barrier manufactured from state-of-the-art polyethylene and EVOH resins. Designed to provide superior resistance to gas and moisture transmission, PERMINATOR EVOH is a highly resilient underslab gas/vapor barrier designed to restrict naturally occurring gases, such as radon, methane, gasoline, solvents, oils, and hydrocarbons, from migrating through the ground and into the concrete slab. PERMINATOR EVOH is furnished in rolls which are 10' (3 m) wide and 150' (45.7 m) long.

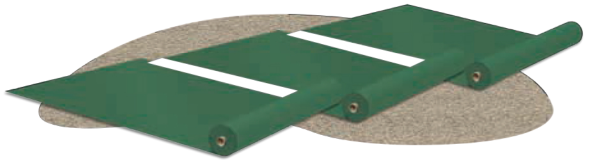
This document has been created as an addendum to the PERMINATOR EVOH technical data sheet to provide the recommended procedure to use when installing PERMINATOR EVOH in applications featuring penetrations.

PLACEMENT

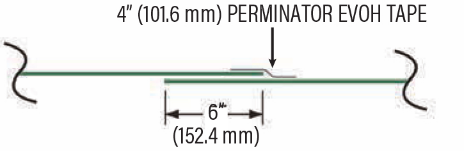
Level and tamp or roll granular base as specified. A base for a gas-reduction system may require a 4" - 6" (101. 6 – 152.4 mm) gas permeable layer of clean coarse aggregate as specified by architectural or structural drawings after installation of the recommended gas collection system. In this situation, a cushion layer consisting of a non-woven geotextile fabric placed directly under PERMINATOR EVOH will help protect the barrier from damage due to possible sharp coarse aggregate.

Unroll PERMINATOR EVOH running the longest dimension parallel with the direction of the pour and pull open all folds to full width.

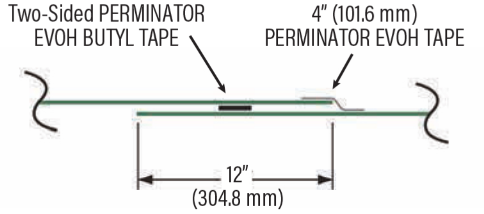
Extend PERMINATOR EVOH across the top of the footing and turn up against the vertical wall. This will sandwich PERMINATOR EVOH between the footing, wall, and poured concrete floor. Terminate PERMINATOR EVOH at full slab thickness and seal to wall with PERMINATOR EVOH BUTYL TAPE. Prime concrete surfaces, when necessary, and assure they are dry and clean prior to applying two-sided PERMINATOR EVOH BUTYL TAPE. Apply even and firm pressure with a rubber roller. Overlap joints a minimum of 6" (101.6 mm) and seal overlap with 4" (101.6 mm) PERMINATOR EVOH TAPE. When used as a gas barrier, overlap joints a minimum of 12" (304.8 mm) and seal in between overlap with two-sided PERMINATOR EVOH BUTYL TAPE. Then seal with 4" (101.6 mm) PERMINATOR EVOH TAPE centered on the overlap seam.



PERMINATOR EVOH Overlapping Roll-out Method



PERMINATOR EVOH Overlap Joint Sealing Method
Vapor Retarder Applications



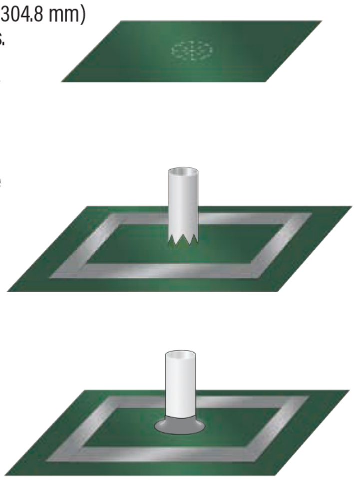
PERMINATOR EVOH Overlap Joint Sealing Method
Gas Barrier Applications

W. R. MEADOWS®
SEALTIGHT®
A Family Company Since 1926
QUALITY...SERVICE...INTEGRITY

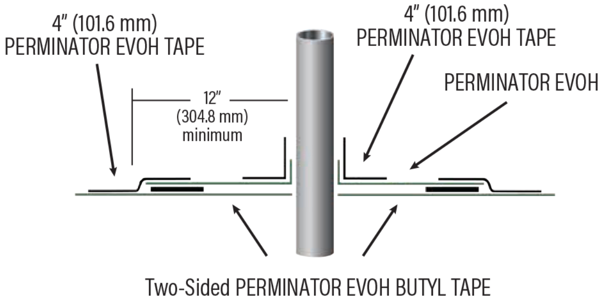
INSTALLATION GUIDELINES
PERMINATOR® EVOH

SINGLE PENETRATION PIPE BOOT INSTALLATION

Seal around all plumbing, conduit, support columns, or other penetrations that protrude through the PERMINATOR EVOH membrane. Fabricate pipe boots from PERMINATOR EVOH excess material. Cut a square large enough to overlap 12″ (304.8 mm) in all directions. Mark where to cut opening on the center of the square and cut four to eight slices about 3/8″ (9.5 mm) less than the diameter of the pipe. Force the square over the pipe leaving the tightly stretched cut area around the bottom of the pipe with approximately a 1/2″ (12.7 mm) of the boot material running vertically up the pipe. No more than a 1/2″ (12.7 mm) of stretched boot material is recommended. Once boot is positioned, seal the perimeter to the membrane by applying two-sided PERMINATOR EVOH BUTYL TAPE in between the two layers. Secure boot down firmly over the membrane taking care not to have any large folds or creases. Use PERMINATOR EVOH TAPE to secure the boot to the pipe. Tape completely around pipe, overlapping the PERMINATOR EVOH square, to create a tight seal against the pipe. Complete the process by taping over the boot perimeter edge with PERMINATOR EVOH TAPE to create a monolithic membrane between the surface of the slab and gas/moisture sources below and at the slab perimeter.



1. Cut a square of PERMINATOR EVOH barrier to extend at least 12″ (304.8 mm) from the pipe in all directions.
2. Cut four to eight slices about 3/8″ (9.5 mm) less than the diameter of the pipe.
3. Force over pipe and tape the underside boot perimeter to existing barrier with two-sided PERMINATOR EVOH BUTYL TAPE.
4. Tape over the boot perimeter edge with PERMINATOR EVOH TAPE.
5. Use PERMINATOR EVOH TAPE and overlap 1″ (25.4 mm) at the seam.

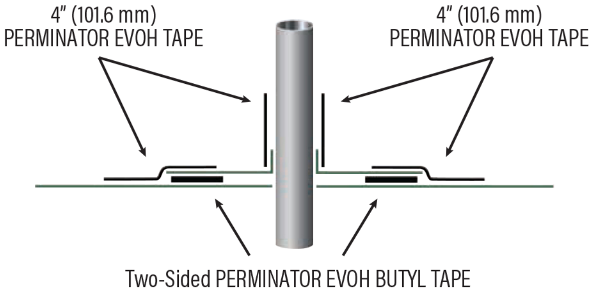


Square Material Pipe Boot

MULTIPLE PENETRATION PIPE BOOT INSTALLATION - OPTION 1

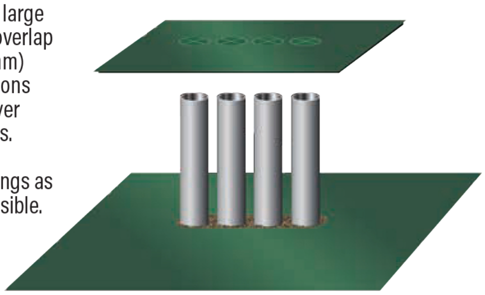
Cut a patch large enough to overlap 12″ (304.8 mm) in all directions of penetrations. Mark where to cut openings and cut four to eight slices about 3/8″ (9.5 mm) less than the diameter of the penetration for each. Force patch material over penetration to achieve a tight fit and form a lip. Once patch is positioned, seal the perimeter to the membrane by

applying two-sided PERMINATOR EVOH BUTYL TAPE in between the two layers. After applying two-sided PERMINATOR EVOH BUTYL TAPE between the patch and membrane, tape around each of the penetrations and the patch with 4″ (101.6 mm) PERMINATOR EVOH TAPE. For additional protection apply, REZI-WELD™ 1000 from W. R. MEADOWS around the penetrations.

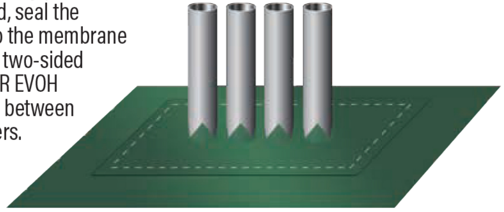


Cut a patch large enough to overlap 12″ (305.8 mm) in all directions and slide over penetrations.

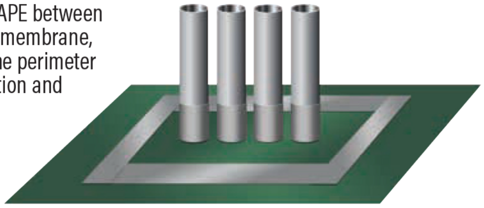
Make openings as tight as possible.



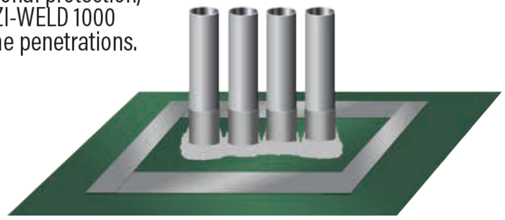
Once the overlay patch is positioned, seal the perimeter to the membrane by applying two-sided PERMINATOR EVOH BUTYL TAPE between the two layers.



After applying PERMINATOR EVOH BUTYL TAPE between the patch and membrane, tape around the perimeter of the penetration and the patch with 4″ (101.6 mm) PERMINATOR EVOH TAPE.



For additional protection, apply REZI-WELD 1000 around the penetrations.



MULTIPLE PENETRATION PIPE BOOT INSTALLATION - OPTION 2

Install PERMINATOR EVOH as closely as possible to pipe penetrations to minimize the amount of REZI-WELD 1000 necessary to seal around all penetrations. Once PERMINATOR EVOH is in place, remove soil or other particles with a dry cloth or a fine broom to allow for improved adhesion to the REZI-WELD 1000 material. Create a dam around the penetration area approximately 2″ (50.8 mm) away from the pipe or other vertical penetrations by removing the release liner from the back of a 1″ (25.4 mm) weather stripping foam and adhere to PERMINATOR EVOH. Form a complete circle to contain the REZI-WELD 1000 material. Once mixed, pour REZI-WELD 1000 around the pipe penetrations. If needed, a brush or a flat wooden stick can be used to direct REZI-WELD 1000 completely around penetrations creating a complete seal.

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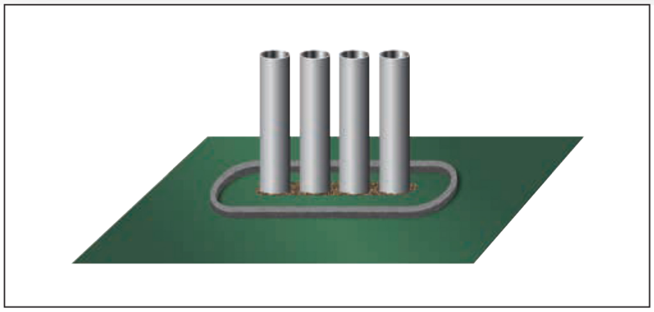
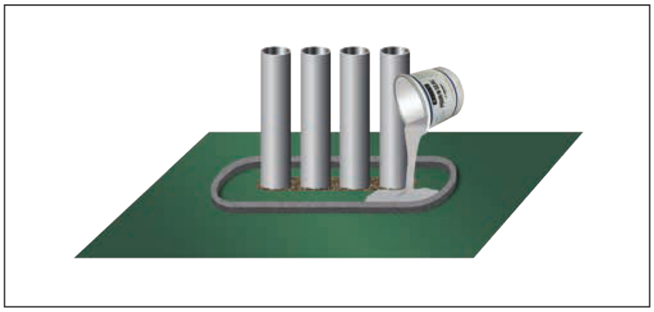
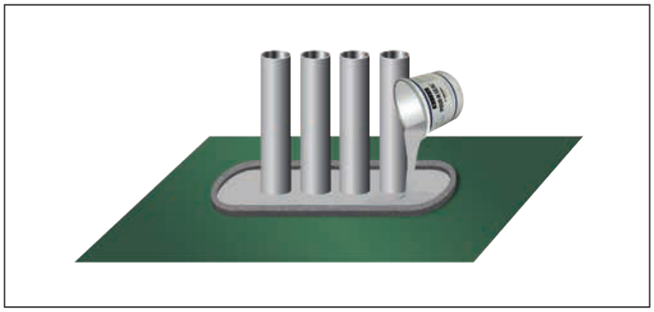
INSTALLATION GUIDELINES
PERMINATOR® EVOH



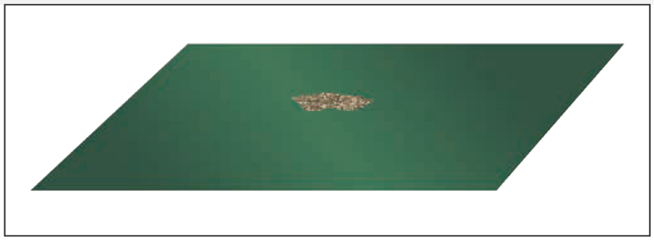


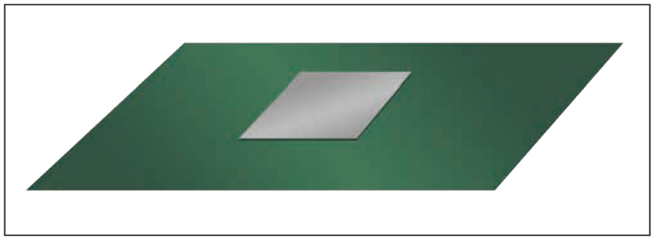


PERMINATOR EVOH REPAIR INSTRUCTIONS

LARGE PATCHES

Proper installation requires all holes and openings are repaired prior to placing concrete. When patching small holes, simply use PERMINATOR EVOH TAPE.





PERMINATOR EVOH REPAIR INSTRUCTIONS

PIPE PENETRATIONS

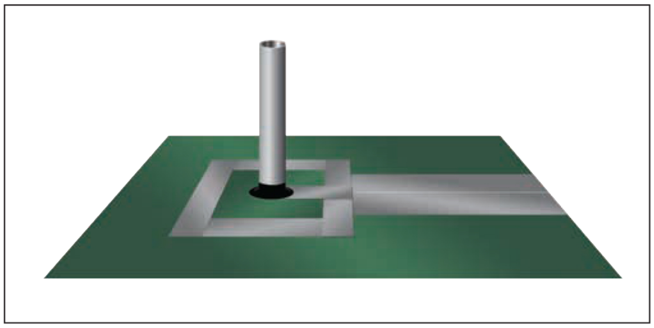
When installing PERMINATOR EVOH around pipe penetrations, vertical columns, electrical ducts, and other obstructions, cut the material to the nearest outside edge. This cut can be sealed with PERMINATOR EVOH TAPE by simply centering it over the cut. Once the tape is placed correctly, apply pressure to assure a complete seal. All holes or penetrations through the membrane will need to be patched with PERMINATOR EVOH TAPE.

PERMINATOR EVOH PROTECTION

When installing reinforcing steel and utilities, in addition to the placement of concrete, take precaution to protect PERMINATOR EVOH. Carelessness during installation can damage the most puncture-resistant membrane. Sheets of plywood cushioned with geotextile fabric temporarily

3/21/18

placed on PERMINATOR EVOH provide for additional protection in high traffic areas including concrete buggies. Use only brick-type or chair-type reinforcing bar supports to protect PERMINATOR EVOH from puncture. Avoid driving stakes through PERMINATOR EVOH. If this cannot be avoided, each individual hole must be repaired. To avoid penetrating PERMINATOR EVOH when installing screed supports, utilize non-penetrating support. If a cushion or blotter layer is required in the design between PERMINATOR EVOH and the slab, additional care should be given if sharp crushed rock is used. Washed rock will provide less chance of damage during placement. Care must be taken to protect blotter layer from precipitation before concrete is placed.



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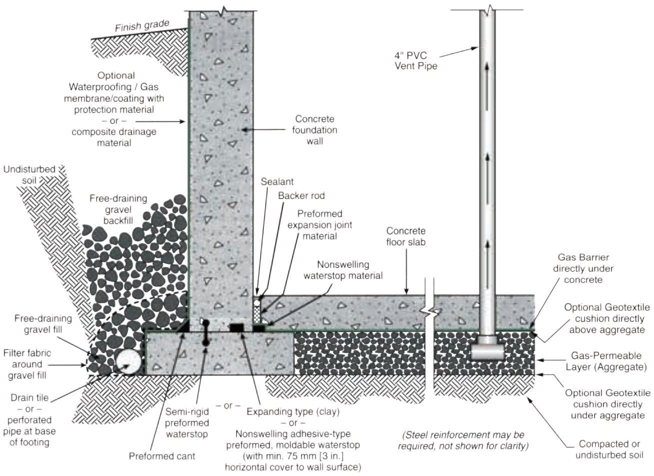
INSTALLATION GUIDELINES
PERMINATOR® EVOH PENETRATIONS

PERMINATOR EVOH is a seven-layer co-extruded barrier manufactured from state-of-the-art polyethylene and EVOH resins. Designed to provide superior resistance to gas and moisture transmission, PERMINATOR EVOH is a highly resilient underslab gas/vapor barrier designed to restrict naturally occurring gases, such as radon, methane, gasoline, solvents, oils, and hydrocarbons, from migrating through the ground and into the concrete slab. PERMINATOR EVOH is furnished in rolls which are 10′ (3 m) wide and 150′ (45.7 m) long.

This document has been created as an addendum to the PERMINATOR EVOH technical data sheet to provide the recommended procedure to use when installing PERMINATOR EVOH in applications featuring penetrations.



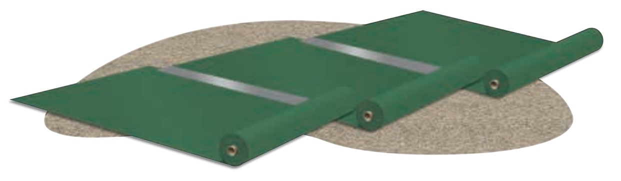
Elements of a moisture/gas-resistant floor system. General illustrations only.
(Note: this example shows multiple options for waterstop placement.)
(Note: the example show multiple options for waterstop placement.)

PLACEMENT

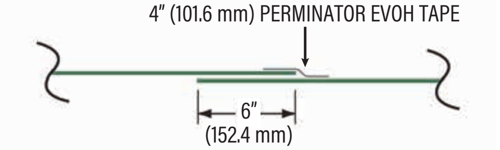
Level and tamp or roll granular base as specified. A base for a gas-reduction system may require a 4″ - 6″ (101. 6 – 152.4 mm) gas permeable layer of clean coarse aggregate as specified by architectural or structural drawings after installation of the recommended gas collection system. In this situation, a cushion layer consisting of a non-woven geotextile fabric placed directly under PERMINATOR EVOH will help protect the barrier from damage due to possible sharp coarse aggregate.

Unroll PERMINATOR EVOH running the longest dimension parallel with the direction of the pour and pull open all folds to full width.

Lap PERMINATOR EVOH over the footings and seal with PERMINATOR EVOH BUTYL TAPE at the footing-wall connection. Prime concrete surfaces, when necessary, and assure they are dry and clean prior to applying two-sided PERMINATOR EVOH BUTYL TAPE. Apply even and firm pressure with a rubber roller. Overlap joints a minimum of 6″ (101.6 mm) and seal overlap with 4″ (101.6 mm) PERMINATOR EVOH TAPE. When used as a gas barrier, overlap joints a minimum of 12″ (304.8 mm) and seal in between overlap with two-sided PERMINATOR EVOH BUTYL TAPE. Then seal with 4″ (101.6 mm) PERMINATOR EVOH TAPE centered on the overlap seam.



PERMINATOR EVOH Overlapping Roll-out Method



PERMINATOR EVOH Overlap Joint Sealing Method
Vapor Retarder Applications

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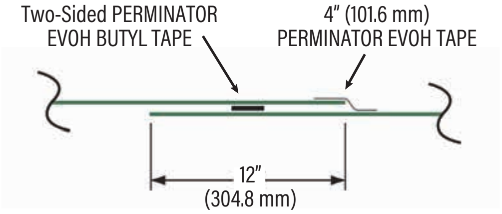
INSTALLATION GUIDELINES
PERMINATOR® EVOH PENETRATIONS



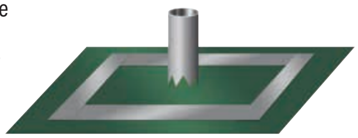
PERMINATOR EVOH Overlap Joint Sealing Method
Gas Barrier Applications

SINGLE PENETRATION PIPE BOOT INSTALLATION

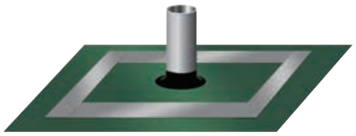
Seal around all plumbing, conduit, support columns, or other penetrations that protrude through the PERMINATOR EVOH membrane. Fabricate pipe boots from PERMINATOR EVOH excess material. Cut a square large enough to overlap 12" (304.8 mm) in all directions. Mark where to cut opening on the center of the square and cut four to eight slices about 3/8" (9.5 mm) less than the diameter of the pipe. Force the square over the pipe leaving the tightly stretched cut area around the bottom of the pipe with approximately a 1/2" (12.7 mm) of the boot material running vertically up the pipe. No more than a 1/2" (12.7 mm) of stretched boot material is recommended. Once boot is positioned, seal the perimeter to the membrane by applying two-sided PERMINATOR EVOH BUTYL TAPE in between the two layers. Secure boot down firmly over the membrane taking care not to have any large folds or creases. Use PERMINATOR EVOH TAPE to secure the boot to the pipe. Tape completely around pipe, overlapping the PERMINATOR EVOH square, to create a tight seal against the pipe. Complete the process by taping over the boot perimeter edge with PERMINATOR EVOH TAPE to create a monolithic membrane between the surface of the slab and gas/moisture sources below and at the slab perimeter.

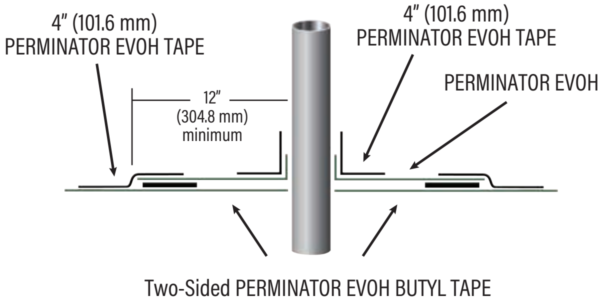
1. Cut a square of PERMINATOR EVOH barrier to extend at least 12" (304.8 mm) from the pipe in all directions.

2. Cut four to eight slices about 3/8" (9.5 mm) less than the diameter of the pipe.
3. Force over pipe and tape the underside boot perimeter to existing barrier with two-sided PERMINATOR EVOH BUTYL TAPE.



4. Tape over the boot perimeter edge with PERMINATOR EVOH TAPE.
5. Use PERMINATOR EVOH TAPE and overlap 1" (25.4 mm) at the seam.



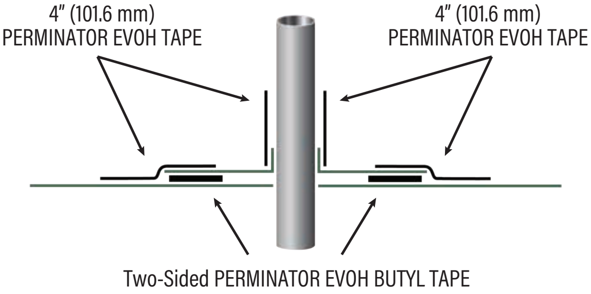


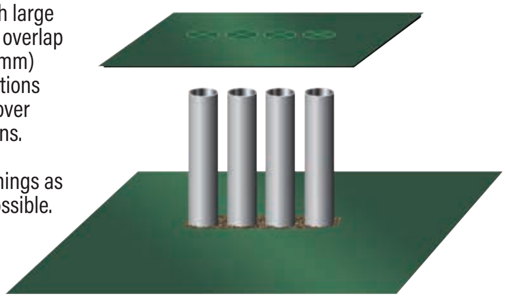
Square Material Pipe Boot

MULTIPLE PENETRATION PIPE BOOT INSTALLATION - OPTION 1

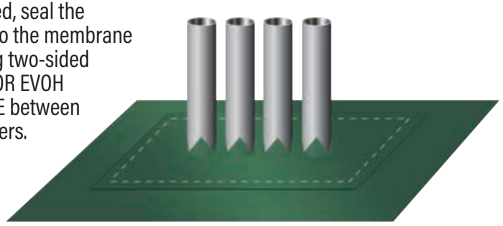
Cut a patch large enough to overlap 12" (304.8 mm) in all directions of penetrations. Mark where to cut openings and cut four to eight slices about 3/8" (9.5 mm) less than the diameter of the penetration for each. Force patch material over penetration to achieve a tight fit and form a lip. Once patch is positioned, seal the perimeter to the membrane by

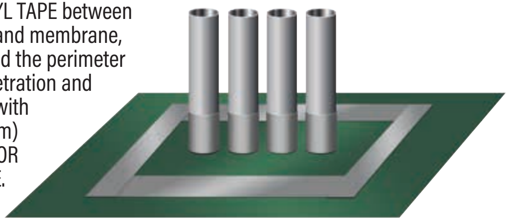
applying two-sided PERMINATOR EVOH BUTYL TAPE in between the two layers. After applying two-sided PERMINATOR EVOH BUTYL TAPE between the patch and membrane, tape around each of the penetrations and the patch with 4" (101.6 mm) PERMINATOR EVOH TAPE. For additional protection apply, REZI-WELD™ 1000 from W. R. MEADOWS around the penetrations.

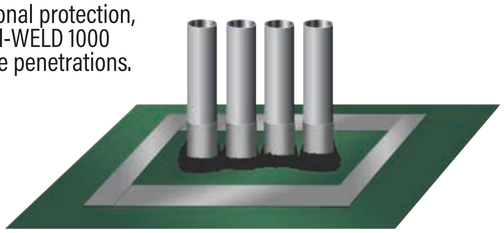



Cut a patch large enough to overlap 12" (305.8 mm) in all directions and slide over penetrations.

Make openings as tight as possible.


Once the overlay patch is positioned, seal the perimeter to the membrane by applying two-sided PERMINATOR EVOH BUTYL TAPE between the two layers.


After applying PERMINATOR EVOH BUTYL TAPE between the patch and membrane, tape around the perimeter of the penetration and the patch with 4" (101.6 mm) PERMINATOR EVOH TAPE.


For additional protection, apply REZI-WELD 1000 around the penetrations.

MULTIPLE PENETRATION PIPE BOOT INSTALLATION - OPTION 2

Install PERMINATOR EVOH as closely as possible to pipe penetrations to minimize the amount of REZI-WELD 1000 necessary to seal around all penetrations. Once PERMINATOR EVOH is in place, remove soil or other particles with a dry cloth or a fine broom to allow for improved adhesion to the REZI-WELD 1000 material. Create a dam around the penetration area approximately 2" (50.8 mm) away from the pipe or other vertical penetrations by removing the release liner from the back of a 1" (25.4 mm) weather stripping foam and adhere to PERMINATOR EVOH. Form a complete circle to contain the REZI-WELD 1000 material. Once mixed, pour REZI-WELD 1000 around the pipe penetrations. If needed, a brush or a flat wooden stick can be used to direct REZI-WELD 1000 completely around penetrations creating a complete seal.

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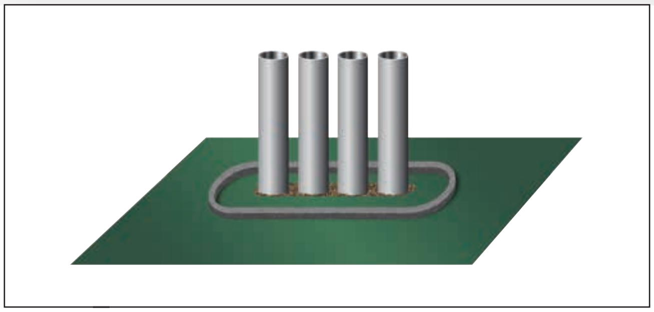
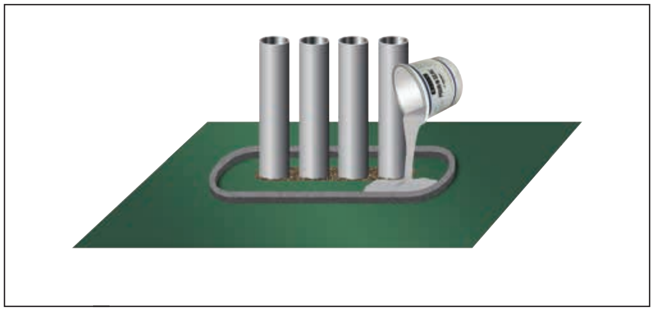
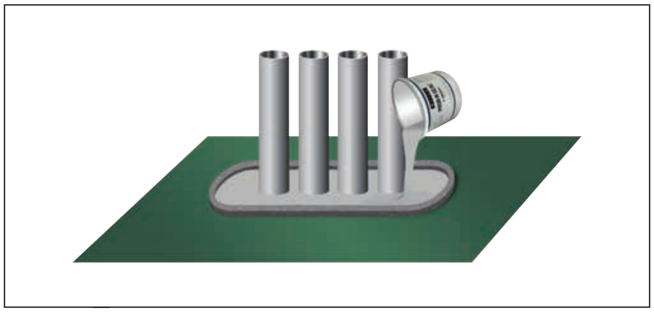
INSTALLATION GUIDELINES
PERMINATOR® EVOH PENETRATIONS







PERMINATOR EVOH REPAIR INSTRUCTIONS

LARGE PATCHES

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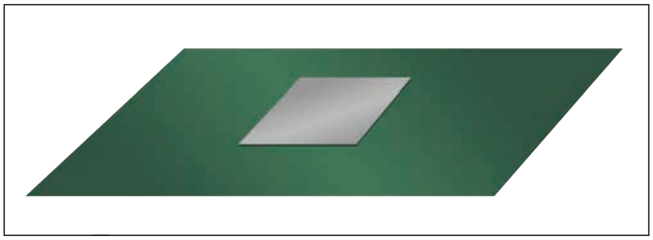

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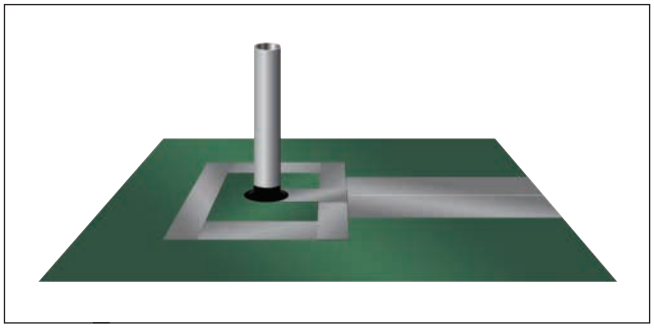
placed on PERMINATOR EVOH provide for additional protection in high traffic areas including concrete buggies. Use only brick-type or chair-type reinforcing bar supports to protect PERMINATOR EVOH from puncture. Avoid driving stakes through PERMINATOR EVOH. If this cannot be avoided, each individual hole must be repaired. To avoid penetrating PERMINATOR EVOH when installing screed supports, utilize non-penetrating support. If a cushion or blotter layer is required in the design between PERMINATOR EVOH and the slab, additional care should be given if sharp crushed rock is used. Washed rock will provide less chance of damage during placement. Care must be taken to protect blotter layer from precipitation before concrete is placed.



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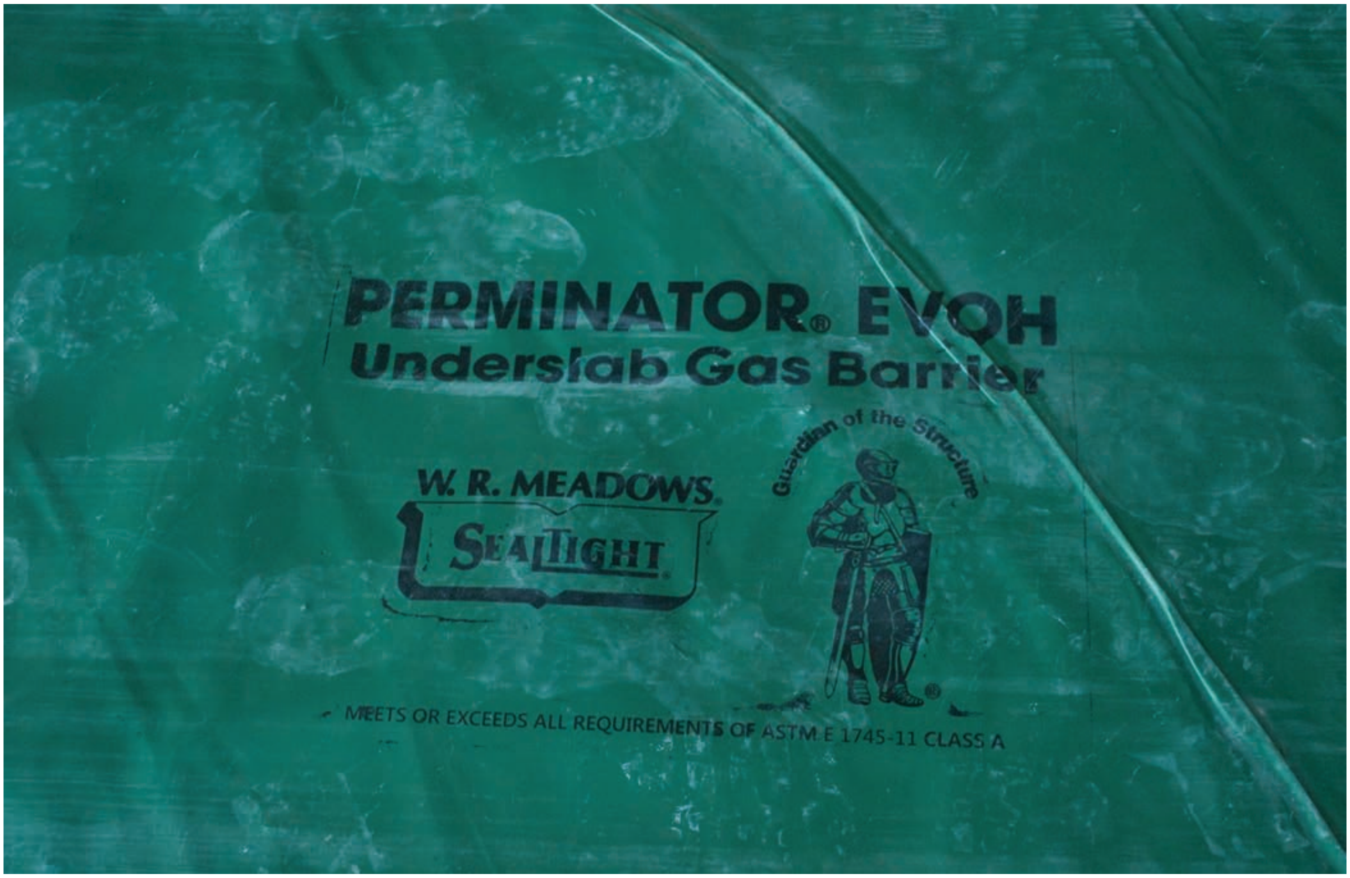
TECHNICAL BULLETIN
SEAM HEAT WELD FOR PERMINATOR® EVOH

Overlap edges 6" (152.4 mm) in preparation for thermal seaming. This overlap area must be cleaned of all dust, dirt, water and foreign debris no more than 30 minutes prior to the heat-seaming operation. Acceptable field-welding methods are thermal fusion and extrusion. The thermal energy for fusion welding can be provided by a single or dual hot wedge welder, hot air or a combination. Extrusion welding rod should be made from the same resin class as the bonding surface of the gas barrier being extruded to. Trial welds, at least 4' (1.2 m) long, shall be made on scraps of the same material being installed.

Three non-destructive test methods are available to verify field welds, including: center air channel pressure testing for double-track fusion seams, vacuum box testing for single-track fusion seams and extrusion seams or patches, and air lance testing for single-track fusion seams.



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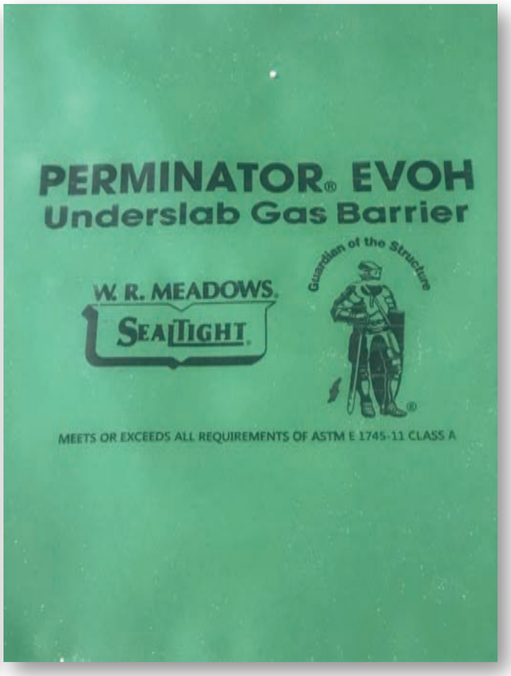
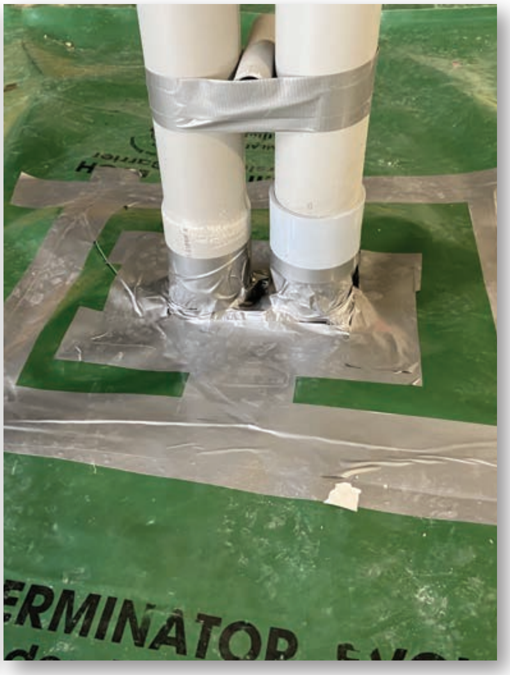
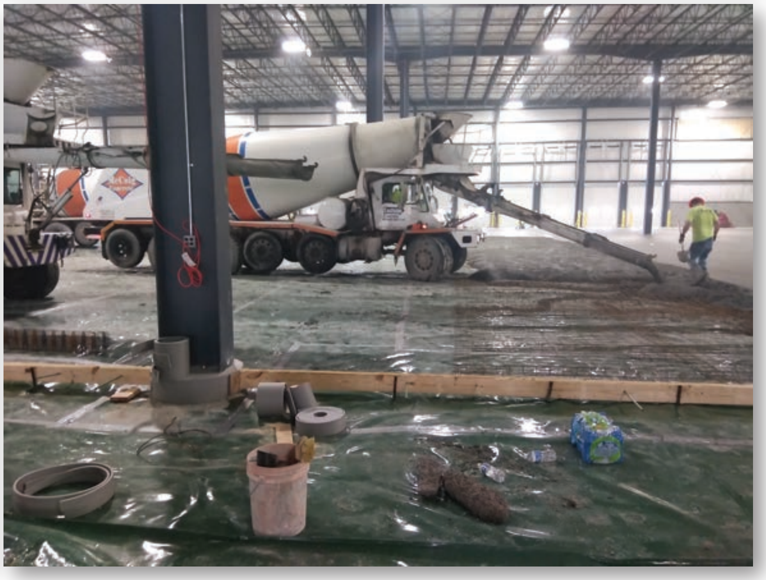
GOODYEAR, AZ / MILTON, ON / SHERWOOD PARK, AB







Project:	FCA Hoover
Location:	Warren, Michigan, USA
Engineer:	IBI Group
General Contractor:	Roncelli
Subcontractor:	Arisco Contracting Group, Inc.
Salesperson:	Jason Everhart

Products:	PERMINATOR® EVOH PERMINATOR EVOH TAPE PERMINATOR BUTYL TAPE SEALMASTIC™ TYPE II
Scope:	500,000 square feet

NO. 714-A

DATA SHEET

MasterFormat: 07 14 16

OCTOBER 2017
(Supersedes November 2013)

MEL-ROL® LM

Single-Component, Water-Based, Polymer-Modified, Cold-Applied, Waterproofing Membrane

DESCRIPTION

MEL-ROL LM is a single-component, polymer-modified, cold-applied, water-based, liquid waterproofing membrane ideal for below-grade vertical seamless waterproofing applications. We have taken the same high quality rubber polymers found in W. R. MEADOWS' successful MEL-ROL "peel and stick" membrane and converted them into a heavy-bodied, high solids, quick drying liquid membrane.

With MEL-ROL LM, installation time is reduced, utilizing either a spray or roller application. A variety of different protection courses, insulation boards, or drainage boards can be embedded into the membrane to create a superior waterproofing system. With the application of PERMINATOR® vapor barrier over the membrane, a composite system can be created that has the combined advantages of both "peel and stick" and liquid-applied membranes.

USES

MEL-ROL LM can be used on new and remedial waterproofing applications on concrete or masonry block substrates. Since the formula is water-based, MEL-ROL LM can also be used on both ICFs and "green concrete" applications.

FEATURES/BENEFITS

- Waterproof – very low vapor permeability (perm rating).
- Superior elongation – bridges minor cracks; will not become brittle with age.
- Fully bonded – water will not run beneath the membrane.
- High solids, single-component, fast drying formulation – easy to apply; low cost application equipment; eliminates two-component mixing problems.
- Cold-applied/water-based – will not adversely affect insulated forms (ICFs) or various protection board options. Allows for application to damp or "green concrete."
- VOC content is 0.0 g/L. Produces no harmful odors.
- Easy application – no heating necessary. Eliminates fire hazards associated with heating kettles. Apply with roller or airless sprayer.

PACKAGING

5 Gallon (18.93 Liter) Pails
55 Gallon (208.20 Liter) Drums*
*Special order only

COVERAGE

20 - 25 ft.^{2}/gal. (0.49 – 0.61 m^2/L) @ 60 mils. Coverage dependent on substrate type, weather, and application conditions.

SPECIFICATIONS

- Complies with all current federal, state, and local maximum allowable VOC requirements, including National EPA VOC Emission Standard for Architectural Coatings, CARB, LADCO, OTC Phase I and II, and SCAQMD.

SHELF LIFE

When stored indoors in original, unopened containers at temperatures between 40° - 90° F (4° - 32° C), optimum performance and best use is obtained within six months of date of manufacture.

APPLICATION

Surface Preparation ... All surfaces must be clean (free of all coatings and curing compounds), free of frost, relatively smooth, and structurally sound. Patch any bug holes, tie holes, large gaps, or cracks with MEADOW-PATCH® 5 or MEADOW-PATCH 20 from W. R. MEADOWS. All loose laitance on the substrates, such as dirt, dust, loose stones, and debris, should be either swept or blown clean. All inside corners should be addressed with a cove of BEM from W. R. MEADOWS prior to application of MEL-ROL LM.

CONTINUED ON THE REVERSE SIDE...

W. R. MEADOWS, INC.
P.O. Box 338 • HAMPSHIRE, IL 60140-0338
Phone: 847/214-2100 • Fax: 847/683-4544
1-800-342-5976
www.wrmeadows.com • info@wrmeadows.com

HAMPSHIRE, IL / CARTERSVILLE, GA / YORK, PA
FORT WORTH, TX / BENICIA, CA / POMONA, CA

All shrinkage cracks less than 1/16" (1.6 mm) should be pretreated with a 60-mil coat of MEL-ROL LM 6" (152.4 mm) wide. All cracks greater than 1/16" (1.6 mm) should be taped with DETAIL STRIP from W. R. MEADOWS prior to application of the membrane. For specific project recommendations, please contact W. R. MEADOWS technical services.

Mixing ... MEL-ROL LM is designed to be used from the pail or drum with little or no mixing. However, if water appears on the surface, mix thoroughly with a low-speed mechanical mixer prior to application.

Priming ... To reduce blistering on concrete surfaces, a thin coat of MEL-ROL LM diluted with water may be required. (Approximate dilution ratio of MEL-ROL LM to water is between 4:1 and 5:1.)

Thoroughly mix primer with a mechanical mixer. Prime the entire concrete surface to be waterproofed by spraying or rolling on a single coat at a coverage rate of 100 - 150 ft.^{2}/gal. (2.45 - 3.68 m^2/L). Allow primer to dry (approximately one hour, depending on temperature and conditions).

TECHNICAL DATA

Membrane		
Property	Typical Value	Test Method
Color	Black	
Solids	70%	
VOC Content	0 g/L	
Total Cure Time	16 - 24 hours	
Service Temperature	-20° - 140° F (-29° - 60° C)	
Application Temperature	40˚ F (4.4° C) minimum	
Shore “00” Hardness	Passes	ASTM C836
Stability	Exceeds	ASTM C836
Elongation	1500%	ASTM D412
Water Absorption	0.7%	ASTM D1970
WVT	0.03 Perms	ASTM E96, B
Composite (55 Mil Membrane/10 Mil PERMINATOR)		
Peel Adhesion	7 lb./in. (125 g/mm)	ASTM C794
Tensile Strength (Film)	5000 psi (36 MPa)	ASTM D412 (Die C)
Elongation	900%	ASTM D412 (Die C)
Water Vapor Permeability	0.02 Perms (0.013 g/m^2/24 h)	ASTM E96, B
Water Absorption	0.1%	ASTM D1970
Resistance to Hydrostatic Head	48 psi (0.3 MPa)	ASTM D751
Puncture Resistance	22 lbf. (98 N)	ASTM D4833

Detailing *…* After surface preparations are complete, detailing should be addressed. The desired thickness of membrane coverage is 120 mils for inside/outside corners and non-moving and hairline cracks, as well as around drains and penetrations. Request and view the W. R. MEADOWS WATERPROOFING CONTRACTORS' HANDBOOK for additional information.

Footing Details *…* Use DETAIL STRIP from W. R. MEADOWS for impaction sheet coverage. First, fold strips lengthwise and then cut at the fold. Material is then ready to install as 4 ½" (114.3 mm) strips on either side of the rebar. Any excess can be turned down on the face of the footing. Next, fill the voids around rebars in the keyway with BEM. Pour the walls. Install DETAIL STRIP horizontally along the wall where it meets the footing, placing half the material up the wall and the other half onto the footing. Extend the material 4 ½" (114.3 mm) beyond outside corners. Slit extended portion of DETAIL STRIP lengthwise. Place the horizontal flap out onto the footing and bend the vertical flap around the wall. Repeat this procedure in the opposite direction. In high water table applications, install WATERSTOP EC from W. R. MEADOWS directly to the cold joint before application of DETAIL STRIP.

Roller Application *…* MEL-ROL LM can be applied directly from the container using a ¾" (19.1 mm) nap roller. Apply in two coats, each 30 mils thick, allowing first coat to reach initial set prior to application of second coat.

Spray Application *…* MEL-ROL LM may be sprayed on at a minimum coverage thickness of 60 mils wet (45 mils dry). To obtain 60 mils wet thickness, and to prevent slumping, apply MEL-ROL LM in two coats of 30 wet mils. Apply the second coat after the first coat has dried (approximately one to two hours).

Spraying Equipment *…* MEL-ROL LM is most effectively applied by using the Graco HydraMax 350 or the Graco GH833 Big Rig. The Graco heavy-duty texture gun is recommended for use with the following tips: For best results, use the 0.051″ (Graco GHD551) heavy-duty switch tip. For spraying of primer coat, a smaller orifice tip such as the 0.035″ (Graco GHD635) can be used. Tips should be reversible types for easy clean out. For more complete spraying equipment information, please view INSTALLATION INSTRUCTIONS: SPRAYER EQUIPMENT GUIDELINES FOR W. R. MEADOWS FLUID-APPLIED MEMBRANES available at www.wrmeadows.com.

Horizontal Application *…* For horizontal applications, use HYDRALASTIC 836 from W. R. MEADOWS.

Thickness Control *…* Frequently inspect surface area with a wet mil gauge to ensure desired consistent thickness is achieved. Porous substrates or masonry block walls may require additional coats to obtain desired thickness.

Cleanup *…* Material should not be left in the pump, lines, or gun when finished spraying. CAUTION: Solvents must not come in contact with MEL-ROL LM in the sprayer, as they will break the emulsion and plug up the entire sprayer system. After spraying, promptly flush water only (no soap) through the system until pump and hose are clear [approx. five gallons (18.9 L)]. Aromatic solvents, such as xylene or toluene [approx. two gallons (7.6 L)], should be used for final flushing after water is flushed through the pump and lines.

Mineral spirits, paint thinner, gasoline, etc., must not be used to flush system. NOTE: Water must be flushed through the machine to remove any solvents prior to spraying of MEL-ROL LM.

Protection *…* Cover vertical applications with PROTECTION COURSE, MEL-DRAIN™, or PERMINATOR (10 mil) from W. R. MEADOWS. Surfaces must be covered within 45 days.

Backfilling *…* Allow 24 hours for complete cure of membrane prior to backfilling.

PRECAUTIONS

Do not freeze. Do not apply MEL-ROL LM if rainfall is forecast or imminent within 12 hours. For horizontal applications, HYDRALASTIC 836 is recommended. Do not apply MEL-ROL LM or primer when air, material, and surface temperatures are expected to fall below 40˚ F (4.4° C) within four hours of completed application. Sprayed urethane foams applied over MEL-ROL LM can melt the membrane and cause delamination and failure due to the exothermic reaction that takes place after spraying the foam. These foams should not be sprayed over MEL-ROL LM. The use of MEL-ROL LM does not negate the need for relief of hydrostatic heads. A complete drain tile system should be placed around the exterior of footing and under slabs, as required.

LEED INFORMATION

May help contribute to LEED credits:

- EAp2: Minimum Energy Performance
- EAc2: Optimize Energy Performance
- MRc9: Construction and Demolition Waste Management
- EQc2: Low-Emitting Materials [For Healthcare and Schools (exterior-applied products) ONLY]

For BIM assemblies, CAD details, most recent data sheet, further LEED information, and SDS, visit www.wrmeadows.com.

GreenLine®
By W. R. MEADOWS
Environmentally Responsible Products
for Concrete Performance

LIMITED WARRANTY

W. R. MEADOWS, INC. warrants at the time and place we make shipment, our material will be of good quality and will conform with our published specifications in force on the date of acceptance of the order. Read complete warranty. Copy furnished upon request.

Disclaimer

The information contained herein is included for illustrative purposes only, and to the best of our knowledge, is accurate and reliable. W. R. MEADOWS, INC. cannot however under any circumstances make any guarantee of results or assume any obligation or liability in connection with the use of this information. As W. R. MEADOWS, INC. has no control over the use to which others may put its product, it is recommended that the products be tested to determine if suitable for specific application and/or our information is valid in a particular circumstance. Responsibility remains with the architect or engineer, contractor and owner for the design, application and proper installation of each product. Specifier and user shall determine the suitability of products for specific application and assume all responsibilities in connection therewith.

SAFETY DATA SHEET

SECTION 1: PRODUCT AND COMPANY IDENTIFICATION

Product:	**MEL-ROL® LM**	**Part Number:**	**6511000**
Manufacturer:	**W. R. MEADOWS, INC.**	**Address:**	300 Industrial Drive Hampshire, Illinois 60140
Telephone:	(847) 214-2100	In case of emergency, dial (800) 424-9300 (CHEMTREC)	
Revision Date:	3/14/2022		
Product Use:	Cold-Applied Waterproofing Membrane		

SECTION 2: HAZARDS IDENTIFICATION/EXPOSURE LIMITS

HMIS		
|Health|	|1|	Product is classified as non-hazardous per OSHA 1910.1200.
|Flammability|	|1|	
|Reactivity|	|0|	
|Personal Protection|	| |	

SECTION 3: HAZARDS COMPONENTS

Chemical Name:	**CAS Number**	**% by Weight**	**SARA 313**	**Vapor Pressure (mm Hg@20°C)**	**LEL (@25°C)**	
1. Petroleum Asphalt	8052-42-4	50-55	No	N/A	N/A	
2. Petroleum Oil Base Stock	64742-65-0	50-55	No	N/A	0.9	*N/A: Not Applicable*

Under the reporting requirements of Section 313 of Title III of the Superfund Amendments and Reauthorization Act of 1966 (SARA) and 40 CFR Part 372, chemicals listed on the 313 List (40 CFR Part 373.65) are identified under the heading "SARA 313."

SECTION 4: EMERGENCY AND FIRST AID PROCEDURES

EYE CONTACT: Flush eyes with water for fifteen (15) minutes. If symptoms persist, seek medical attention.

SKIN CONTACT: Wash affected areas with mild soap and water.

INHALATION: Not expected to be an exposure route as supplied. If respiratory symptoms develop, seek medical attention.

INGESTION: Dilute with liquid unless the victim is unconscious or very drowsy. Do not induce vomiting. If vomiting spontaneously occurs, prevent lung aspiration. Seek immediate medical attention.

MOST IMPORTANT SYMPTOMS/EFFECTS, ACUTE AND CHRONIC: See Section Eleven for Symptoms/Effects.

SECTION 5: FIRE AND EXPLOSIVES HAZARDS

FLASHPOINT: Product will not flash due to water content.

EXTINGUISHING MEDIA: Water fog, foam, dry chemical.

CHEMICAL/COMBUSTION HAZARDS: Oxides and compounds of nitrogen/sulfur, carbon monoxide/dioxide, and incomplete combustion products.

PRECAUTIONS/PERSONAL PROTECTIVE EQUIPMENT: Avoid smoke inhalation. Use appropriate personal protective equipment.

SECTION 6: ACCIDENTAL RELEASE MEASURES

SPILL OR LEAK PROCEDURES: Avoid direct contact. Dike and contain spilled material. Remove source of spill if safe to do so. Apply absorbent and place clean-up material in sealed/marked containers for proper disposal. Clean-up materials will be classified as non-hazardous waste.

SECTION 7: HANDLING AND STORAGE

SAFE HANDLING PROCEDURES: Avoid direct contact.

SAFE STORAGE: Prevent product from freezing.

SECTION 8: EXPOSURE CONTROLS/PERSONAL PROTECTION

	OSHA				**ACGIH**			
Chemical Name:	**PEL**	**PEL/CEILING**	**PEL/STEL**	**SKIN**	**TLV**	**TLV/CEILING**	**TLV/STEL**	**SKIN**
1. Petroleum Asphalt	5 mg/m^3*	N/E	N/E	No	0.5 mg/m^3*	N/E	N/E	N/E
2. Petroleum Oil Base Stock	N/E	N/E	N/E	No	5 mg/m^3+	N/E	N/E	N/E

*: Asphalt Fumes +: Mineral Oil Mist in Air *N/E: Not Established*

ENGINEERING CONTROLS: None required under normal use conditions.

PERSONAL PROTECTIVE EQUIPMENT: Safety glasses, chemical-resistant gloves.

SAFETY DATA SHEET

SECTION 9: PHYSICAL AND CHEMICAL PROPERTIES

BOILING POINT: 212 °F	**VAPOR DENSITY:** N/A	**% VOLATILE BY VOLUME:** N/A
EVAPORATION RATE: <1 (Ether=1)	**pH LEVEL:** N/A	**% VOLATILE BY WEIGHT:** 30
WEIGHT PER GALLON: 8.3	**PRODUCT APPEARANCE:** Black Liquid	**VOC CONTENT:** 0 g/L
ODOR: None	**ODOR THRESHOLD:** N/D	**MELTING/FREEZING POINT:** N/D
FLASH POINT: See Section 5	**FLAMMABILITY:** N/D	**UEL/LEL:** N/D
VAPOR PRESSURE: N/D	**RELATIVE DENSITY:** N/D	**SOLUBILITY:** N/D
PARTITION COEFFICENT: N/D	**AUTOIGNITION TEMPERATURE:** N/D	**DECOMPOSITION TEMPERATURE:** N/D
VISCOSITY: N/D	*N/A: Not Applicable*	*N/D: Not Determined*

SECTION 10: STABILITY/REACTIVITY

STABILITY: Stable. **HAZARDOUS POLYMERIZATION:** Will not occur.

CONDITIONS AND MATERIALS TO AVOID: None recognized.

HAZARDOUS DECOMPOSITION PRODUCTS: None recognized.

SECTION 11: TOXICOLOGICAL INFORMATION

EYE CONTACT: Direct contact may cause mild irritation.

SKIN CONTACT: Direct contact may cause slight skin irritation. Prolonged/repeated contact may result in irritation.

INHALATION: Not anticipated to be an exposure route.

INGESTION: Not anticipated to be an exposure route.

SIGNS AND SYMPTOMS: Symptoms of eye irritation include tearing, reddening, and swelling. Symptoms of skin irritation include redness and swelling. Gastrointestinal irritation symptoms include nausea, vomiting, and abdominal discomfort. Symptoms of respiratory irritation include runny nose, sore throat, coughing, chest discomfort, shortness of breath, and reduced lung function.

AGGRAVATED MEDICAL CONDITIONS: Pre-existing skin, eye, and respiratory disorders may be aggravated by exposure to this product.

OTHER HEALTH EFFECTS: ACGIH classifies asphalt as *Not Classifiable as a Human Carcinogen; A4.*

SECTION 12: ECOLOGICAL INFORMATION

ECOTOXICITY: N/E	**DEGRADABILITY:** N/E	**BIOACCUMULATIVE POTENTIAL:** N/E
SOIL MOBILITY: N/E	**OTHER ADVERSE EFFECTS:** None Recognized	*N/E: Not Established*

SECTION 13: WASTE DISPOSAL INFORMATION

WASTE DISPOSAL INFORMATION: Solidified product can be landfill disposed. No free liquids.

SECTION 14: TRANSPORTATION INFORMATION

HAZARDOUS/NON-HAZARDOUS MATERIAL: Not regulated by DOT.

UN NUMBER: None. **HAZARD CLASS:** N/A **PACKING GROUP:** N/A

UN PROPER SHIPPING NAME: N/A

ENVIRONMENTAL HAZARDS: None recognized.

BULK TRANSPORTATION INFORMATION: None.

SPECIAL PRECAUTIONS: Prevent product from freezing. *N/A: Not Applicable*

SECTION 15: REGULATORY INFORMATION

OTHER REGULATORY CONSIDERATIONS: None recognized.

SECTION 16: OTHER INFORMATION

PREPARATION DATE: 3/14/2022

PREPARED BY: Dave Carey

W. R. MEADOWS®
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HAMPSHIRE, IL / CARTERSVILLE, GA / YORK, PA
FORT WORTH, TX / BENICIA, CA / POMONA, CA
GOODYEAR, AZ / MILTON, ON / SHERWOOD PARK, AB

Project:	Saint Paraskevi Greek Orthodox Monastery
Location:	Washington, Texas, USA
Engineer:	MLAW Forensics, Inc.
Contractor:	Shepperd Construction
Salesperson:	Nick Tam
Products:	MEADOW-PATCH® 20 MEL-ROL® LM MEL-ROL MEL-PRIME™ POINTING MASTIC MEL-DRAIN™ 5035-B PERMINATOR® 15 mil
Scope:	3,400 square feet

The Saint Paraskevi Monastery was experiencing excessive leaks and puddles of water in the basement which prevented use of the interior space. After excavation of the below-grade walls and foundation, it was revealed that the makeup of the wall system was EFIS, with a waterproofing membrane applied directly to the insulated concrete forms. Unfortunately, due to the incompatibility of the waterproofing membrane, the insulation of the concrete forms began to deteriorate and create air/moisture leaks from the ambient conditions.

To repair the envelope system and provide a watertight seal, removal of the insulation from the concrete forms was needed. After the insulation was removed it was apparent that the rough and rigid substrate would not be an adequate surface for any waterproofing membrane, especially when you take into account that aggregate and plastics were exposed in most areas. It was determined that MEADOW-PATCH 20 repair mortar was to be used to repair the concrete substrate and provide a smooth surface for waterproofing application.

Once the walls were ready for waterproofing, MEL-ROL sheet applied waterproofing was used for the base of wall transition, as well as any sharp corners that presented themselves. This was followed by an initial 30mil coat of MEL-ROL LM, finishing off with a second 30mil coat of MEL-ROL LM.

After the waterproofing portion of work was completed, it was time to protect the membrane and provide a drainage layer utilizing MEL-DRAIN 5035-B. To anchor this system, a termination bar was used to mechanically fasten the drainage board at the top of the wall, using POINTING MASTIC to seal or gasket our anchor system. Spray-adhesive was used to adhere all side-laps of the drainage board as extra security in creating a monolithic protection layer.

GUIDE SPECIFICATION FOR MEL- ROL® LM: LIQUID-APPLIED WATERPROOFING MEMBRANE

SECTION 07 14 16

COLD-FLUID APPLIED WATERPROOFING

Specifier Notes: This guide specification is written according to the Construction Specifications Institute (CSI) format. The section must be carefully reviewed and edited by the architect or engineer to meet the requirements of the project. Coordinate this section with other specification sections and the drawings.

Specifier Notes: MEL-ROL LM waterproofing system is a single-component, polymer-modified, cold-applied, liquid waterproofing membrane ideal for vertical waterproofing applications. This heavy bodied, liquid membrane is ideal for immediate application to newly stripped, below-grade concrete walls and for use with insulated concrete forms. It is also suitable for below-grade masonry block walls.

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Surface preparation.

B. Application of single-component, cold-applied, liquid waterproofing membrane.

1.02 RELATED SECTIONS

Specifier Notes: Edit the list of related sections as required for the project. List other sections dealing with work directly related to this section.

A. Section 03 30 00 – Cast-in-Place Concrete.

B. Section 04 20 00 – Unit Masonry.

C. Section 07 13 26 – Self-Adhering Sheet Waterproofing.

D. Section 07 21 00 – Thermal Insulation.

E. Section 07 60 00 – Flashing and Sheet Metal.

F. Section 07 92 00 – Joint Sealants.

G. Section 33 46 13 - Foundation Drainage.

1.03 REFERENCES

A. ASTM D146-97 - Standard Test Methods for Sampling and Testing Bitumen-Saturated Felts and Fabrics Used in Roofing and Waterproofing.

B. ASTM D412-98a(2002)e1 - Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers -Tension.

C. ASTM E96-00e1 (Method B) - Standard Test Methods for Water Vapor Transmission of Materials.

D. ASTM D1228 - Methods of Testing Asphalt Insulating Siding Surfaced with Mineral Granules.

E. ASTM C836 - Standard Specification for High Solids Content, Cold Liquid-Applied Elastomeric Waterproofing Membrane for Use with Separate Wearing Course.

F. ASTM D1970-01 - Standard Specification for Self-Adhering Polymer Modified Bituminous Sheet Materials Used as Steep Roofing Underlayment for Ice Dam Protection.

1.04 SUBMITTALS

A. Comply with Section 01 33 00 - Submittal Procedures.

B. Submit manufacturer's product data and application instructions.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to site in manufacturer's original, unopened containers and packaging, with labels clearly identifying product name and manufacturer.

B. Store materials in a clean, dry area in accordance with manufacturer's instructions.

C. Store adhesives and primers at temperatures of 40° F (5° C) and above to facilitate handling.

D. Do not store at temperatures above 90° F (32° C) for extended periods.

E. Protect materials during handling and application to prevent damage or contamination.

1.06 ENVIRONMENTAL REQUIREMENTS

A. Product not intended for uses subject to abuse or permanent exposure to the elements.

B. Do not apply membrane when air, material, or surface temperatures are expected to fall below 30° F (-1° C) within four hours of completed application.

C. Do not apply membrane if rainfall is forecast or imminent within 12 hours.

D. Do not apply to frozen concrete.

E. Membrane can be applied to green concrete.

PART 2 PRODUCTS

2.01 MANUFACTURER

A. W. R. MEADOWS®, INC., PO Box 338, Hampshire, Illinois 60140-0338. (800) 342-5976. (847) 683-4500. Fax (847) 683-4544. Web Site www.wrmeadows.com.

2.02 MATERIALS

A. Waterproofing Membrane: single-component, polymer-modified, cold-applied, liquid waterproofing membrane.
  1. Performance Based Spec: Waterproofing membrane shall have the following properties as determined by laboratory testing:
    a. Color: Black
    b. Solids: 70%
    c. Total Cure Time: 16-24 hours
    d. Shore “00” Hardness, ASTM C836: Passes
    e. Adhesion to Concrete, ASTM C836: Exceeds
    f. Low Temperature Flex and Crack Bridging, ASTM C836: Passes
    g. Stability, ASTM C836: Exceeds
    h. Elongation, ASTM D412: 1500%

i. Water Absorption, ASTM D1970: 0.7%
j. Water Vapor Transmission, ASTM E96 (Method B): 0.03 perms

2. Proprietary Based Spec:
   a. MEL-ROL LM Waterproofing System by W. R. MEADOWS.

2.03 ACCESSORIES

A. Concrete Repair Materials: MEADOW-PATCH™ 5 and 20 Concrete Repair Mortars.

B. Waterproofing Protection Course: PERMINATOR™ 10 mil.

C. Rolled Matrix Drainage System: MEL-DRAIN™.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine surfaces to receive membrane. Notify architect if surfaces are not acceptable. Do not begin surface preparation or application until unacceptable conditions have been corrected.

3.02 SURFACE PREPARATION

A. Protect adjacent surfaces not designated to receive waterproofing.

B. Clean and prepare surfaces to receive waterproofing in accordance with manufacturer's instructions.

C. Do not apply waterproofing to surfaces unacceptable to manufacturer.

D. Concrete surfaces must be clean, relatively smooth, and free of standing water.

E. Patch all holes and voids and smooth out any surface misalignments.

F. Remove and patch all concrete form ties.

G. Apply primer coat of membrane diluted 4:1 with water if necessary to reduce blistering on concrete surfaces at a coverage rate of 100-150 ft.^{2}/U.S. gal (13.9 m^2/3.78 L) by spraying or rolling.

H. Allow primer coat to dry before proceeding to membrane application.

3.03 APPLICATION

A. Apply waterproofing membrane system in accordance with manufacturer's instructions.

B. Thoroughly mechanically mix membrane prior to application.

C. Apply membrane by spray, roller, or brush at a minimum coverage rate of 20-25 ft.^{2}/U.S. gal (1.9-2.3 m^2/3.78L) providing a thickness of 60 wet mils.

D. Frequently inspect surface area with a wet mil gauge to ensure consistent thickness.

E. Work material into any fluted rib forming indentations.

F. Cured thickness of membrane should be 45 mils dry.

G. Avoid use of products that contain tars, solvents, pitches, polysulfide polymers, or PVC materials that may come into contact with waterproofing membrane system.

3.04 PROTECTION

A. Protect membrane with application of waterproofing protection course, drainage board, or other approved material.

B. Backfill immediately using care to avoid damaging waterproofing membrane system.

END OF SECTION

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INSTALLATION GUIDELINES
MEL-ROL® LM

This document has been created as an addendum to the MEL-ROL LM technical data sheet to provide the recommended procedure to use when installing MEL-ROL LM single-component, polymer-modified, cold-applied, water-based, liquid waterproofing membrane from W. R. MEADOWS.

APPLICATION

SURFACE PREPARATION

All surfaces must be clean (free of all coatings and curing compounds), free of frost, relatively smooth, and structurally sound. Patch any bug holes, tie holes, large gaps, or cracks with MEADOW-PATCH® 5 or MEADOW-PATCH 20 from W. R. MEADOWS. All loose laitance on the substrates, such as dirt, dust, loose stones, and debris, should be either swept or blown clean. All inside corners should be addressed with a cove of BEM from W. R. MEADOWS prior to application of MEL-ROL LM.


MEADOW-PATCH 20

All shrinkage cracks less than 1/16" (1.6 mm) should be pretreated with a 60-mil coat of MEL-ROL LM 6" (152.4 mm) wide. All cracks greater than 1/16" (1.6 mm) should be taped with DETAIL STRIP from W. R. MEADOWS prior to application of the membrane. For specific project recommendations, please contact W. R. MEADOWS technical services.

MIXING

MEL-ROL LM is designed to be used from the pail or drum with little or no mixing. However, if water appears on the surface, mix thoroughly with a low speed mechanical mixer prior to application.

PRIMING

To reduce blistering on concrete surfaces, a thin coat of MEL-ROL LM diluted with water may be required. (Approximate dilution ratio of MEL-ROL LM to water is between 4:1 and 5:1.)
Thoroughly mix primer with a mechanical mixer. Prime the entire concrete surface to be waterproofed by spraying or rolling on a single coat at a coverage rate of 100 - 150 ft.2/gal. (2.45 - 3.68 m2/L). Allow primer to dry (approximately one hour, depending on temperature and conditions).

DETAILING

After surface preparations are complete, detailing should be addressed. The desired thickness of membrane coverage is 120 mils for inside/outside corners and non-moving and hairline cracks, as well as around drains and penetrations. Request and view the W. R. MEADOWS WATERPROOFING CONTRACTORS HANDBOOK for additional information.

FOOTING DETAILS

Use DETAIL STRIP from W. R. MEADOWS for impaction sheet coverage. First, fold strips lengthwise and then cut at the fold. Material is then ready to install as 4 ½” (114.3 mm) strips on either side of the rebar. Any excess can be turned down on the face of the footing. Next, fill the voids around rebars in the keyway with BEM. Pour the walls.

Install DETAIL STRIP horizontally along the wall where it meets the footing, placing half the material up the wall and the other half onto the footing. Extend the material 4 ½” (114.3 mm) beyond outside corners. Slit extended portion of DETAIL STRIP lengthwise. Place the horizontal flap out onto the footing and bend the vertical flap around the wall. Repeat this procedure in the opposite direction.

In applications subject to a high water table, WATERSTOP EC PLUS from W. R. MEADOWS (or approved alternative), must be incorporated in the wall design.

ROLLER APPLICATION

MEL-ROL LM can be applied directly from the container using a ¾” (19.1 mm) nap roller. Apply in two coats, each 30 mils thick, allowing first coat to reach initial set prior to application of second coat.

SPRAYER APPLICATION

MEL-ROL LM may be sprayed on at a minimum coverage thickness of 60 mils wet (45 mils dry). To obtain 60 mils wet thickness, and to prevent slumping, apply MEL-ROL LM in two coats of 30 wet mils. Apply the second coat after the first coat has dried (approximately one to two hours).

INSTALLATION GUIDELINES
MEL-ROL® LM

SPRAYING EQUIPMENT

MEL-ROL LM is most effectively applied by using the Graco HydraMax 350 or the Graco GH833 Big Rig.

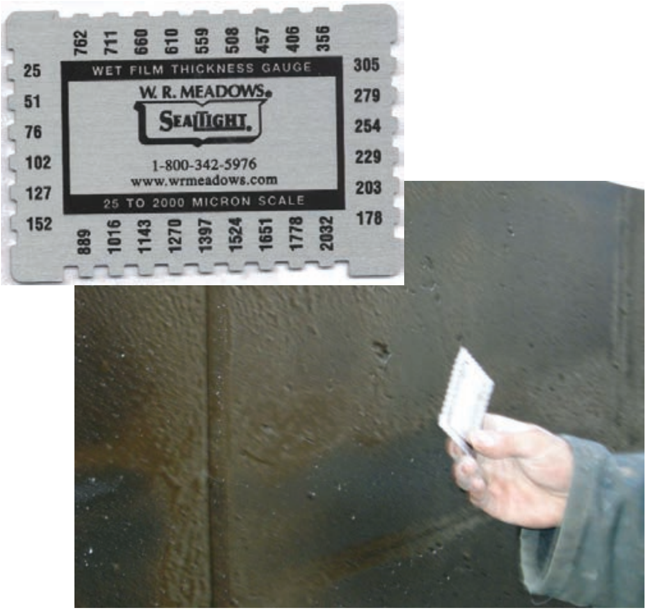
The Graco heavy-duty texture gun is recommended for use with the following tips: For best results, use the 0.051″ (Graco GHD551) heavy-duty switch tip. For spraying of primer coat, a smaller orifice tip such as the 0.035″ (Graco GHD635) can be used. Tips should be reversible types for easy clean out. For more complete spraying equipment information, please view INSTALLATION INSTRUCTIONS: SPRAYER EQUIPMENT GUIDELINES FOR W. R. MEADOWS FLUID-APPLIED MEMBRANES available at www.wrmeadows.com.

HORIZONTAL APPLICATION

For horizontal applications, use HYDRALASTIC 836 from W. R. MEADOWS.

THICKNESS CONTROL

Frequently inspect surface area with a wet mil gauge to ensure desired consistent thickness is achieved. Porous substrates or masonry block walls may require additional coats to obtain desired thickness.



INSTALLATION GUIDELINES
MEL-ROL® LM

CLEANUP

Material should not be left in the pump, lines, or gun when finished spraying. CAUTION: Solvents must not come in contact with MEL-ROL LM in the sprayer, as they will break the emulsion and plug up the entire sprayer system. After spraying, promptly flush water only (no soap) through the system until pump and hose are clear [approx. five gallons (18.9 L)]. Aromatic solvents, such as xylene or toluene [approx. two gallons (7.6 L)], should be used for final flushing after water is flushed through the pump and lines.

Mineral spirits, paint thinner, gasoline, etc., must not be used to flush system. NOTE: Water must be flushed through the machine to remove any solvents prior to spraying of MEL-ROL LM.

PROTECTION

Cover vertical applications with PROTECTION COURSE, MEL-DRAIN™, or PERMINATOR (10 mil) from W. R. MEADOWS. Surfaces must be covered within 45 days.

BACKFILLING

Allow 24 hours for complete cure of membrane prior to backfilling.

W. R. MEADOWS®
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INSTALLATION GUIDELINES
MEL-ROL® AND MEL-ROL LM FOR WATERPROOFING INSULATED CONCRETE FORMS (ICF)

At W. R. MEADOWS, we get many questions about the proper way to waterproof ICFs. The use of our MEL-ROL and MEL-ROL LM as the overall waterproofing membrane will work for this type of application.

The following products will be used in waterproofing ICFs:

MEL-PRIME™ W/B
BEM
MEL-ROL LIQUID MEMBRANE
MEL-ROL
MEL-ROL LM
TERMINATION BAR

RECOMMENDED TOOLS
Broom
Caulking Gun
Chalk Line
Impact Hammer
Paint Brushes and Roller

Surface Preparation … Remove any oxidized foam (rasp) from the surface.

Joint Treatment … All joints in the ICF need to be addressed. For applications of MEL-ROL, if joints in the ICF are wider than ¼" (6.35 mm), they should be filled with either MEL-ROL LIQUID MEMBRANE or BEM prior to priming and installation of the waterproofing membrane. Also pay close attention to where the wall meets the footing. This area should be treated with BEM or MEL-ROL LIQUID MEMBRANE. This treatment creates a cant where the wall meets the footing. In applications of MEL-ROL LM, all joints need to be filled with BEM.

Application Method .... Follow same application procedure as indicated on MEL-ROL and MEL-ROL LM technical data sheet. For more detailed application information, see MEL-ROL INSTALLATION GUIDELINES and MEL-ROL LM INSTALLATION GUIDELINES documents.

Priming … When using MEL-ROL to waterproof the ICF, priming must be done. MEL-PRIME W/B should be used as the primer. The prime-coat should be in the range of 5-10 mils. After proper priming (not required for MEL-ROL LM) and joint detail, the ICF surface is ready for the application of MEL-ROL or MEL-ROL LM. Apply the product as outlined in the applications directions listed previously. When using MEL-ROL, TERMINATION BAR is required to seal the top edge.

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INSTALLATION INSTRUCTIONS
SPRAYER EQUIPMENT GUIDELINES FOR W. R. MEADOWS FLUID-APPLIED MEMBRANES

Extensive field testing has shown that the **Graco GH 833 Big Rig** or **Hydra Max 350** (now obsolete) sprayers work best for spraying of the water-based **AIR-SHIELD**$_{TM}$ **LM**, **AIR-SHIELD LMP**, **AIR-SHIELD LSR**, **AIR-SHIELD TMP**, and **MEL-ROL**$_{®}$ **LM** products. (These sprayers also work well for the spraying of the solvent-based, ALL SEASON versions of these products.) We are not aware of any other types of sprayers being used successfully with our products. Initially, we had used the **Gmax 7900 Roof Rig**, but we have found that the pressures (4000 psi) attained by the **Graco GH 833 Big Rig** and **Hydra Max 350** units yield more consistent, trouble-free results. The **Graco GH 833 Big Rig** and **Hydra Max 350 units** are capable of a 3.5 – 4.0 gal./min. output, compared to a 2.1 gal./min. for the **Gmax 7900 Roof Rig**. The water-based emulsion products are extremely shear sensitive and should NOT be applied through gear-type pumps or pressurized follower plate systems. These systems will cause the emulsions to break, which will then clog the equipment. The ALL SEASON versions of the products are not shear sensitive and will remain stable when applied by most standard spray equipment.

The **Graco GH 833 Big Rig** unit comes equipped with 100' of hose, a texture spray gun, and several tips. NOTE: The standpipe on the sprayer MUST be opened and checked for the presence of a filter element and plastic sleeve. For **AIR-SHIELD LM** and **MEL-ROL LM**, these MUST BOTH be removed prior to use, as they will cause clogging.

Both the **Graco GH 833 Big Rig** and **Hydra Max 350** can be used for five-gal. pails or 55-gal. drums. Extensions on the pumps are able to create enough suction to allow material to be pulled from the top of a standing drum (or tote) of product. (An option available for the **Graco GH 833 Big Rig** allows the pump to be placed directly over a drum for improved pumping of thicker materials in cooler weather.)

GRACO HYDRA MAX 350

GRACO GH 833 BIG RIG

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INSTALLATION INSTRUCTIONS

SPRAYER EQUIPMENT GUIDELINES FOR W. R. MEADOWS FLUID-APPLIED MEMBRANES

EQUIPMENT

HOSE: We have used up to 100’ of hose with these products. (Longer lengths may work; possibly up to 150’.) The hose must be rated for use up to 4000 psi for these units. W. R. MEADOWS recommends using separate hoses specific to each material.

SPRAY GUN: The Graco heavy duty texture gun is required (part #241705). It does not contain a paint filter and works well for these products. Other Graco guns have not worked, as they contain a diverter pin in the spray nozzle that will constantly clog the gun.

SPRAY TIPS: We have used the 0.051” (Graco 551,651) tip successfully for spraying and this is our preferred tip size for MEL-ROL LM/AIR-SHIELD LM products. For spraying of AIR-SHIELD LMP, AIR-SHIELD TMP, and AIR-SHIELD LSR, the 0.051” tip will work, but using the 0.035” or 0.037” tip will yield a smoother finish on the wall. For spraying of a solvent-based ALL SEASON products, we recommend using the 0.035” (Graco 535, 635) tip. NOTE: Tips should be the “reversible” type for easy clean out.

APPLICATION - PRIMER

PRIMING: Priming of poured concrete substrates may be required to minimize the potential for blistering of the membrane after it is applied and when exposed to direct sunlight. Once applied, the primer coat should be allowed to dry and be allowed to “warm up” while exposed to direct sunlight. Allowing the primer to be exposed to direct sunlight prior to the membrane application will allow the surface to “warm up” (due to the black color) and help “de-gas” the surface. This “de-gassing” releases the air/moisture vapors in the pores of the substrate, allowing them to expand and dissipate prior to the membrane application. If the primer is not exposed to direct sunlight for a sufficient time interval prior to membrane application, then blistering of the membrane may occur.

PRIMER DILUTION / APPLICATION

RATE: Dilute the water-based LM products 4-5 parts product to one part water. Apply at 100-150 ft.^{2}/gal. and allow to dry approximately one hour. The solvent-based ALL SEASON products do not need to be diluted and should also be applied at 100-150 ft.^{2}/gal. AIR-SHIELD LMP, AIR-SHIELD LSR, and AIR-SHIELD TMP typically do not require a prime coat.

APPLICATION - MEMBRANE

SPRAY: Several coats may be required to obtain the recommended thickness without excessive running or slumping of the wet membrane in hot weather. Allow the first coat to dry approximately one hour before application of the second coat.

NOTE: MEL-ROL LM and AIR-SHIELD LM can be sprayed easily when the material temperature is 40° F or above.

The material temperature of AIR-SHIELD LMP, AIR-SHIELD LSR, and AIR-SHIELD TMP should be 40° F or above to be successfully sprayed; AIR-SHIELD LM (ALL SEASON) and MEL-ROL LM (ALL SEASON) can be applied below 40° F.

Filter is recommended for use in applications of AIR-SHIELD LMP, AIR-SHIELD LSR, and AIR-SHIELD TMP. The filter is not needed for applications of AIR-SHIELD LM, AIR-SHIELD LM (ALL SEASON), MEL-ROL LM, and MEL-ROL LM (ALL SEASON).

ROLLER: Material can be roller applied if a ¾” minimum nap roller is used. Several coats will typically be required to obtain the desired thickness. Allow the first coat to dry thoroughly before second coat is applied. Foam-type rollers or shorter naps should not be used, as they will simply slide on the substrate. Rinse and store all rollers used for water-based products in a container of water when not in use. This is necessary, as the material will cure very quickly on the rollers if allowed to “dry out.” If this does occur, the rollers will need to be discarded or cleaned with solvent and allowed to dry thoroughly prior to reuse.

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INSTALLATION INSTRUCTIONS
SPRAYER EQUIPMENT GUIDELINES FOR W. R. MEADOWS FLUID-APPLIED MEMBRANES

EQUIPMENT SUMMARY CHART

WRM PRODUCT	Water-Based (W/B) Or Solvent-Based (S/B)	Sprayer Type	Hose	Gun	Spray Tip***
AIR-SHIELD LM	W/B	Graco GH 833 or Hydra Max 350	Rated for 4000 psi	Graco Heavy Duty Texture	Graco GHD 551 (0.051”)
MEL-ROL LM	W/B	Graco GH 833 or Hydra Max 350	Rated for 4000 psi	Graco Heavy Duty Texture	Graco GHD 551 (0.051”)
AIR-SHIELD LMP	W/B	Graco GH 833 or Hydra Max 350	Rated for 4000 psi	Graco Heavy Duty Texture	Graco GHD 551 or 637 (0.051” or 0.037”)
AIR-SHIELD LSR	W/B	Graco GH 833 or Hydra Max 350	Rated for 4000 psi	Graco Heavy Duty Texture	Graco GHD 551 or 637 (0.051” or 0.037”)
AIR-SHIELD LM (ALL SEASON)	S/B	Graco GH 833 or Hydra Max 350**	Rated for 4000 psi	Graco Heavy Duty Texture	Graco GHD 635 (0.035”)
AIR-SHIELD TMP	W/B	Graco GH 833 or Hydra Max 350	Rated for 4000 psi	Graco Heavy Duty Texture	Graco GHD 551 or 637 (0.051” or 0.037”)
MEL-ROL LM (ALL SEASON)	S/B	Graco GH 833 or Hydra Max 350**	Rated for 4000 psi	Graco Heavy Duty Texture	Graco GHD 635 (0.035”)

**OTHER TYPES OF STANDARD SPRAYERS ALSO ACCEPTABLE. ***TIPS SHOULD BE “REVERSIBLE” FOR EASY CLEANOUT.

APPLICATION/CLEANUP

WRM PRODUCT	Primer Coat Dilution Ratio (Product : H2O)	Primer Coat Application Rate	Minimum Product Temperature (When Sprayed)	Membrane Application Method	Sprayer Cleanup
AIR-SHIELD LM	4-5 : 1	100-150 ft.^{2}/gal.	40° F	Sprayer or ¾” (min.) Nap Roller**	Water Flush First
MEL-ROL LM	4-5 : 1	100-150 ft.^{2}/gal.	40° F	Sprayer or ¾” (min.) Nap Roller**	Water Flush First
AIR-SHIELD LMP	N/A	N/A	60° F	Sprayer or ¾” (min.) Nap Roller**	Water Flush First
AIR-SHIELD LSR	N/A	N/A	60° F	Sprayer or ¾” (min.) Nap Roller**	Water Flush First
AIR-SHIELD LM (ALL SEASON)	No Dilution Needed	100-150 ft.^{2}/gal.	60° F	Sprayer or ¾” (min.) Nap Roller**	Solvent Flush First
AIR-SHIELD TMP	N/A	N/A	60° F	Sprayer or ¾” (min.) Nap Roller**	Water Flush First
MEL-ROL LM (ALL SEASON)	No Dilution Needed	100-150 ft.^{2}/gal.	60° F	Sprayer or ¾” (min.) Nap Roller**	Solvent Flush First

**DO NOT USE FOAM OR SHORTER NAP ROLLERS.

INSTALLATION INSTRUCTIONS
SPRAYER EQUIPMENT GUIDELINES FOR W. R. MEADOWS FLUID-APPLIED MEMBRANES

EQUIPMENT CLEANUP

WATER-BASED PRODUCTS:

- Solvents must NOT come in contact with the liquid emulsion AIR-SHIELD LM and MEL-ROL LM products while in the sprayer, as they will immediately break the emulsion and plug up the entire sprayer system.
- Before starting to spray, the sprayer MUST be flushed with clean water.
- When spraying is complete, material must NOT be left in the pump, lines or gun as the MEL-ROL/AIR-SHIELD emulsions will quickly begin to break and cure in the equipment. When finished spraying, WATER ONLY should be PROMPTLY flushed through the system until pump and hose run clear. Do NOT add soap to the flush water, as it too will break the emulsion. “Simple Green” cleaner is the only cleaner found that can be used successfully.
- When spraying is complete, solvents, including xylene, toluene, mineral spirits, paint thinner, gasoline, etc., must NOT be used for the INITIAL flushing of the system. These solvents will break the emulsion and clog the system
- Aromatic solvents (xylene or toluene) are recommended for the FINAL flushing AFTER water has been flushed through the pump and lines. If solvent is pumped through the system after being flushed with water, all equipment MUST be flushed with water before spraying emulsion. All traces of solvent MUST be completely removed. Note: Aromatic solvent may be used to soak and clean the pump housing, gun, and tips. Solvents can be left in the sprayer for short durations (days) to aid in cleaning of the system. Solvents left in the sprayer for extended periods may begin to degrade the seals and hose. Again, all traces of solvent MUST be removed prior to using the equipment with the water-based emulsion products.

SOLVENT-BASED, ALL SEASON PRODUCTS:

- While the ALL SEASON products are stable in the sprayer, once spraying is complete, solvents should be flushed through the system until pump and hose run clear. Aromatic solvents (xylene or toluene) work best, but mineral spirits, paint thinner, etc., can also be used. Solvents can be left in the sprayer for short periods of time, but should NOT be allowed to remain in the sprayer for extended periods of time, as they may begin to degrade the seals and hose.
- When switching from a solvent-based to a water-based product: After flushing with solvent, water MUST be flushed through the ENTIRE system until all traces of solvent have been removed. When beginning to spray a water-based emulsion product, if ANY solvent remains in the sprayer, the pump, hose, gun, and spray tips WILL CLOG and will need to be cleaned out.

NO. 714-B **DATA SHEET**

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MasterFormat: 07 14 16

AUGUST 2009
(Supersedes November 2005)

MEL-ROL® LM (ALL SEASON)

Single-Component, Liquid-Applied, Polymer-Modified Waterproofing Membrane

DESCRIPTION

MEL-ROL LM (ALL SEASON) is a single-component, polymer-modified, cold-applied, liquid waterproofing membrane ideal for below-grade vertical seamless waterproofing applications. MEL-ROL LM (ALL SEASON) is formulated with the same high quality rubber polymers found in MEADOWS' successful MEL-ROL "peel and stick" membrane, converting them into a heavy-bodied, high solids, quick drying liquid membrane. The liquid-membrane technology allows faster installation times using either a spray or roller application.

USES

MEL-ROL LM (ALL SEASON) can be used on new and remedial waterproofing applications on both concrete and masonry block substrates.

FEATURES/BENEFITS

- Waterproof/Very low vapor permeability (perm rating).
- All weather application/Can be applied down to 10° F (-12° C).
- Superior elongation/Bridges minor cracks and will not become brittle with age.
- Excellent adhesion and bond/Water will not run beneath the membrane.
- Single component/Eliminates two-component mixing problems.
- Easy to apply/Apply with roller or airless sprayer.
- Low-cost application equipment. (See recommended spraying equipment section.)
- No heating/Eliminates fire hazards associated with heating kettles.
- Low VOC/Content is <400 g/L.

PACKAGING

5 Gallon (18.93 Liter) Pails
55 Gallon (208.20 Liter) Drums*
*Special order only

LEED INFORMATION

May help contribute to LEED credits:

- EA Credit 1: Optimize Energy Performance
- EQ Credit 3.1: Construction IAQ Management Plan: During Construction
- MR Credit 5.1: Regional Materials: 10% Extracted, Processed & Manufactured Regionally
- MR Credit 5.2: Regional Materials: 20% Extracted, Processed & Manufactured Regionally

APPLICATION

Surface Preparation ... All surfaces must be clean (free of all coatings and curing compounds), free of frost, relatively smooth, and structurally sound. Patch any bug holes, tie holes, large gaps, or cracks with MEADOW-PATCH® 5 or MEADOW-PATCH 20 from W. R. MEADOWS. All loose laitance, such as dirt, dust, loose stones, debris, etc., must be swept or blown clean from the substrate.

NOTE: Do not apply to "green" (fresh) concrete. Concrete must be cured a minimum of 14 days prior to application. Do not use with insulated concrete forms (ICFs). Polystyrene insulation boards may be used only after membrane has thoroughly cured a minimum of 72 hours, and there is no danger of residual solvent degrading the boards.

All shrinkage cracks less than 1/16" (0.16 cm) should be pretreated with a 60 mil (1.52 mm) wet coat of MEL-ROL LM (ALL SEASON) at 6" (15.24 cm) wide. All cracks greater than 1/16" (0.16 cm) should be pretreated with DETAIL STRIP from W. R. MEADOWS prior to application of the membrane.

PRIMING

To reduce blistering on concrete surfaces, a thin coat of MEL-ROL LM (ALL SEASON) may be required. Using a roller or sprayer, prime the entire concrete surface to be waterproofed, with a single coat, at a coverage rate of 100-150 $ft.^2$/gal. Allow the primer to dry, which is approximately 1 - 2 hours, depending on jobsite conditions (temperature, humidity, air flow, etc.). As the primer is allowed to warm by exposure to sunlight, the surface of the concrete will de-gas, helping to eliminate problems with blistering of the membrane.

CONTINUED ON THE REVERSE SIDE...

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HAMPSHIRE, IL / CARTERSVILLE, GA / YORK, PA

FORT WORTH, TX / BENICIA, CA / POMONA, CA

DETAILING

After surface preparations are finished, detailing should be completed. The recommended membrane thickness is 120 mils (3.04 mm) wet for inside and outside corners, non-moving cracks, and hairline cracks, as well as around drains and penetrations.

Roller Application ... MEL-ROL LM (ALL SEASON) can be applied directly from the container using a ¾" nap roller. Apply in multiple coats, each at a 40 mils (1.02 mm) wet thickness. Allow the previous coat to reach initial set prior to application of the next coat, which is approximately one (1) hour, depending on jobsite conditions (temperature, humidity, airflow, etc.).

Sprayer Application ... **NOTE: MEL-ROL LM (ALL SEASON) MUST BE A MINIMUM OF 60° F (15° C) WHEN SPRAYING.** Material will become very thick and difficult to spray at lower temperatures. MEL-ROL LM (ALL SEASON) must be stored in a heated trailer and/or passed through a heat exchanger for successful spraying.

Equipment ... MEL-ROL LM (ALL SEASON) is most effectively and efficiently applied by using either the Graco HydraMax 350 or the Graco GH833 Big Rig sprayer.

The Graco heavy-duty texture gun, with the 0.035" (Graco GHD535) heavy-duty switch tip, is recommended for the best results.

For detailed information on the recommended spray equipment, use, and cleanup, please refer to the W. R. MEADOWS sprayer equipment guide available on the building envelope page of www.wrmeadows.com and the softbound catalog.

MEL-ROL LM (ALL SEASON) can be sprayed on vertical surfaces at a minimum coverage thickness of 80 mils (2.03 mm) wet [45 mils (1.14 mm) dry]. The recommended coating thickness can be achieved in a single coat; however, if product slumps due to temperature or substrate conditions, two coats [each at 40 mils (1.02 mm) wet] may be necessary. Apply the second coat after the first coat has dried, which is approximately one (1) hour, depending on jobsite conditions (temperature, humidity, airflow, etc.).

Thickness Control ... Frequently inspect surface with a wet mil gauge to ensure the recommended thickness is achieved, and that the thickness is consistent. Porous substrates or masonry block walls may require additional coats to obtain the recommended thickness.

COVERAGE

Approximately 17-20 ft.²/gal. at 80 mils (2.03 mm) wet [45 mils (1.14 mm) dry]. Coverage depends on substrate type, weather, and application conditions.

CLEANUP

Material should not be left in the pump, lines, or gun when finished spraying. Aromatic solvents such as xylene and toluene should be flushed through the sprayer until the pump and hose run clear.

CAUTION: A final flush of the spraying equipment, with water, must be completed to remove any traces of solvent prior to spraying a water-based product. The presence of any residual solvent will cause the water-based product to solidify and clog the pump and hose.

PROTECTION

Allow membrane to cure a minimum of 48 hours prior to application of a protection course. Membrane should be covered within 30 days after application. Cover with PROTECTION COURSE, MEL-DRAIN™ or 10 mil PERMINATOR® from W. R. MEADOWS. A primer coat of POINTING MASTIC from W. R. MEADOWS can be used to secure the protection to the wall.

NOTE: Polystyrene insulation boards can be applied only if the membrane has thoroughly cured a minimum of 72 hours and all traces of residual solvent have evaporated. Failure to allow the 72-hour cure time, and complete solvent evaporation, may degrade the boards.

BACKFILLING

Allow membrane to cure 48 hours prior to backfilling.

SHELF LIFE (TYPICAL)

Twelve (12) months in original, unopened container. Store at 40-90° F (4-32° C).

PRECAUTIONS

For exterior use only. Use with adequate ventilation. Do not apply MEL-ROL LM (ALL SEASON) if rainfall is forecast or imminent within two hours of application. Do not apply to ICFs. Sprayed urethane foams should not be applied over MEL-ROL LM (ALL SEASON). These foams can melt the membrane and cause delamination and failure due to the exothermic reaction that takes place after application. A complete drain tile system should be placed around the exterior of footing and under slabs, as required. The use of MEL-ROL LM (ALL SEASON) does not negate the need for relief of hydrostatic heads.

HEALTH AND SAFETY

FOR EXTERIOR USE ONLY. AVOID IGNITION SOURCES. AVOID PROLONGED BREATHING OF VAPORS. Use proper personal protective equipment, including chemical resistant gloves and eye and respiratory protection. Keep out of reach of children. Do not swallow. Should adverse effects occur, remove subject from area immediately. Refer to Material Safety Data Sheet for complete health and safety information. Flash point is 103° F (39° C).

For CAD details, most recent data sheet, further LEED information, and MSDS, visit www.wrmeadows.com.

PHYSICAL PROPERTIES MEMBRANE

Color:	Black	
Solids, wt. %:	65	
Total Cure Time, hours:	48	
Application Temperature, °F, (°C) minimum:	10 (-12)	
Coverage, ft.²/gal.	17-20	
Shore “00” Hardness:	Pass	ASTM C 836
Adhesion to Concrete:	Exceeds Requirements	ASTM C 836
Low Temp Flex & Crack Bridging:	Pass	ASTM C 836
Stability:	Exceeds Requirements	ASTM C 836
Tensile Strength, psi:	30	ASTM D 412
Elongation, %:	1000	ASTM D 412
Water Absorption @ 72 hours, %:	<0.5	ASTM D 1970
WVT, perms:	0.06	ASTM E 96, B

LIMITED WARRANTY

W. R. MEADOWS, INC. warrants at the time and place we make shipment, our material will be of good quality and will conform with our published specifications in force on the date of acceptance of the order. Read complete warranty. Copy furnished upon request.

Disclaimer

The information contained herein is included for illustrative purposes only, and to the best of our knowledge, is accurate and reliable. W. R. MEADOWS, INC. cannot however under any circumstances make any guarantee of results or assume any obligation or liability in connection with the use of this information. As W. R. MEADOWS, INC. has no control over the use to which others may put its product, it is recommended that the products be tested to determine if suitable for specific application and/or our information is valid in a particular circumstance. Responsibility remains with the architect or engineer, contractor and owner for the design, application and proper installation of each product. Specifier and user shall determine the suitability of products for specific application and assume all responsibilities in connection therewith.

SAFETY DATA SHEET

SECTION 1: PRODUCT AND COMPANY IDENTIFICATION

Product: MEL-ROL® LM (ALL SEASON)
Part Number: 6516000
Manufacturer: W. R. MEADOWS, INC.
Address: 300 Industrial Drive
Hampshire, Illinois 60140
Telephone: (847) 214-2100
In case of emergency, dial (800) 424-9300 (CHEMTREC
Revision Date: 4/20/2020
Product Use: Liquid Applied Water-Proofing Membrane

SECTION 2: HAZARDS IDENTIFICATION/EXPOSURE LIMITS

HMIS	
|Health|	| 1 |
|Flammability|	| 2 |
|Reactivity|	| 0 |
|Personal Protection|	| |

HAZARD STATEMENTS

WARNING!

Flammable Liquid and vapor.
Causes skin, eye, respiratory irritation.
Suspected of causing genetic defects.
Causes damage to liver, kidneys, lungs, and blood.
Harmful if inhaled.
May be fatal if ingested and enters airway.

PRECAUTIONARY STATEMENTS

Use only in well-ventilated areas.
Avoid breathing vapors and direct contact.
Store in well-ventilated location.
Wear appropriate personal protective equipment.
Keep away from ignition sources.
Control vapors in confined spaces utilizing mechanical ventilation.

SECTION 3: HAZARDS COMPONENTS

Chemical Name:	CAS Number	% by Weight	SARA 313	Vapor Pressure (mm Hg@20°C)	LEL (@25°C)
1. Xylene	1330-20-7	1-5	Yes	6.6	1.1
2. Light Aromatic Naphtha	64742-95-6	20-25	No	<10 @ 25°C	0.9
3. Petroleum Asphalt	8052-42-4	30-35	No	N/A	N/A
4. Petroleum Oil	64742-52-5	5-10	No	N/A	N/A
5. 1,2,4-Trimethylbenzene	95-63-6	5-10	Yes	N/A	0.9

N/A = Not Applicable

Under the reporting requirements of Section 313 of Title III of the Superfund Amendments and Reauthorization Act of 1966 (SARA) and 40 CFR Part 372, chemicals listed on the 313 List (40 CFR Part 373.65) are identified under the heading "SARA 313."

SECTION 4: EMERGENCY AND FIRST AID PROCEDURES

EYE CONTACT: Move victim from exposure source and into fresh air. Flush eyes with water for Fifteen (15) minutes. If symptoms persist, seek medical attention.

SKIN CONTACT: Wash affected areas with mild soap and water. Product may be difficult to remove. Do not use petroleum solvents.

INHALATION: If respiratory symptoms develop, move victim from exposure source and into fresh air. If symptoms persist, seek medical attention.

INGESTION: Not anticipated to be an exposure route. If ingested, do not induce vomiting. Dilute by giving victim water or milk. Seek immediate medical attention.

MOST IMPORTANT SYMPTOMS/EFFECTS, ACUTE AND CHRONIC: See Section Eleven for Symptoms/Effects.

SECTION 5: FIRE AND EXPLOSIVES HAZARDS

FLASHPOINT: 150 °F (Method 1010 A-M)

EXTINGUISHING MEDIA: Water fog, foam, dry chemical, or carbon dioxide.

CHEMICAL/COMBUSTION HAZARDS: Oxides/compounds of nitrogen/sulfur, carbon dioxide, carbon monoxide, and incomplete combustion products.

PRECAUTIONS/PERSONAL PROTECTIVE EQUIPMENT: Avoid direct contact. Use of eye protection and chemical-resistant gloves is recommended. Respiratory protection may be required if excessive vapor concentrations are present.

SECTION 6: ACCIDENTAL RELEASE MEASURES

SPILL OR LEAK PROCEDURES: Evacuate the hazard area of unprotected personnel. Remove/extinguish ignition sources. Dike and contain. Wear appropriate personal protective equipment. Place spilled material in sealed/marked containers for disposal.

SECTION 7: HANDLING AND STORAGE

SAFE HANDLING PROCEDURES: Avoid direct contact. For exterior use only. Avoid ignition sources.

SAFE STORAGE: Keep containers closed when not in use. Store away from ignition sources.

SECTION 8: EXPOSURE CONTROLS/PERSONAL PROTECTION

	OSHA				ACGIH			
Chemical Name:	**PEL**	**PEL/CEILING**	**PEL/STEL**	**SKIN**	**TWA**	**TLV/CEILING**	**TLV/STEL**	**SKIN**
1. Xylene	100 ppm	N/E	N/E	N/E	100 ppm	N/E	150 ppm	N/E
2. Light Aromatic Naphtha	N/E	N/E	N/E	N/E	N/E	N/E	N/E	N/E
3. Petroleum Asphalt	5 mg/m^{3*}	N/E	N/E	N/E	5 mg/m^{3*}	N/E	N/E	N/E
4. Petroleum Oil	5 mg/m^{3+}	N/E	N/E	N/E	5 mg/m^{3+}	N/E	10 mg/m^{3+}	N/E
5. 1,2,4-Trimethylbenzene	25 ppm	N/E	N/E	No	25 ppm	N/E	N/E	No

** : Asphalt Fumes* *+ : Petroleum Oil mist in air* *N/E: Not Established*

ENGINEERING CONTROLS: Use with adequate ventilation. Use explosion-proof equipment.

PERSONAL PROTECTIVE EQUIPMENT: Safety glasses, chemical-resistant gloves.

SECTION 9: PHYSICAL AND CHEMICAL PROPERTIES

BOILING POINT: 284°F
EVAPORATION RATE: <1 (ether=1)
WEIGHT PER GALLON: 8.62
ODOR: Mild Organic
FLASH POINT: See Section 5
VAPOR PRESSURE: N/D
PARTITION COEFFICENT: N/D
VISCOSITY: N/D

VAPOR DENSITY: >1 (air=1)
pH LEVEL: N/A
PRODUCT APPEARANCE: Black, Heavy Liquid
ODOR THRESHOLD: N/D
FLAMMABILITY: N/D
RELATIVE DENSITY: N/D
AUTOIGNITION TEMPERATURE: N/D

% VOLATILE BY VOLUME: N/E
% VOLATILE BY WEIGHT: 36 (approximate)
VOC CONTENT: 371 g/L
MELTING/FREEZING POINT: N/D
UEL/LEL: N/D
SOLUBILITY: N/D
DECOMPOSITION TEMPERATURE: N/D

N/D: Not Determined

SECTION 10: STABILITY/REACTIVITY

STABILITY: Stable.
HAZARDOUS POLYMERIZATION: Will not occur.

CONDITIONS AND MATERIALS TO AVOID: Oxidizing agents, strong acids, strong alkalies.

HAZARDOUS DECOMPOSITION PRODUCTS: Carbon dioxide, carbon monoxide, oxides/compounds of nitrogen/sulfur, and incomplete combustion products.

SECTION 11: TOXICOLOGICAL INFORMATION

EYE CONTACT: Direct contact may result in moderate irritation. Product vapors/mists may also cause irritation.

SKIN CONTACT: Direct contact may cause mild skin irritation. Prolonged/repeated contact may result in skin irritation/dermatitis.

INHALATION: Exposure to excessive vapor concentrations may result in transient central nervous system depression (headache, fatigue, drowsiness, loss of coordination). Intentional misuse by deliberately concentrating/inhaling vapors may be harmful or fatal. Repeated/prolonged occupational exposures to solvents may cause permanent brain and nervous system damage.

INGESTION: Not anticipated to be an exposure route. Ingestion will cause irritation of the digestive tract.

SIGNS AND SYMPTOMS: Symptoms of eye irritation include tearing, reddening, and swelling. Symptoms of skin irritation include redness and swelling. Gastrointestinal irritation symptoms include nausea, vomiting, and abdominal discomfort. Symptoms of respiratory irritation include runny nose, sore throat, coughing, chest discomfort, shortness of breath, and reduced lung function. Symptoms of transient central nervous system depression include: headache, fatigue, drowsiness, dizziness, and loss of coordination.

AGGRAVATED MEDICAL CONDITIONS: Pre-existing skin, eye, and respiratory disorders may be aggravated by exposure to this product.

OTHER HEALTH EFFECTS: Xylene may cause damage to the following organs: blood, kidneys, lungs, liver, mucous membranes, heart, upper respiratory tract, auditory system, central nervous system, and eyes. Some asphalts may possess weak carcinogenic activity. Repeated direct skin contact should be avoided. Occasional contact with asphalt is not expected to have serious health effects as long as good personal hygiene measures are followed.

SECTION 12: ECOLOGICAL INFORMATION

ECOTOXICITY: N/E
DEGRADABILITY: N/E
BIOACCUMULATIVE POTENTIAL: N/E
SOIL MOBILITY: N/E
OTHER ADVERSE EFFECTS: N/E

SAFETY DATA SHEET

SECTION 13: WASTE DISPOSAL INFORMATION

WASTE DISPOSAL INFORMATION: Product will be classified as a hazardous waste (D001). Suitable for fuel blending.

SECTION 14: TRANSPORTATION INFORMATION

HAZARDOUS/NON-HAZARDOUS MATERIAL: Not regulated by domestic ground shipment.

UN NUMBER: None **HAZARD CLASS:** None **PACKING GROUP:** None

UN PROPER SHIPPING NAME: None.

ENVIRONMENTAL HAZARDS: None recognized.

BULK TRANSPORTATION INFORMATION: Not applicable. Product not supplied in bulk configuration.

SPECIAL PRECAUTIONS: None.

SECTION 15: REGULATORY INFORMATION

OTHER REGULATORY CONSIDERATIONS: None recognized.

SECTION 16: OTHER INFORMATION

PREPARATION DATE: 4/20/2020

PREPARED BY: Dave Carey

GUIDE SPECIFICATION FOR MEL-ROL® LM (ALL SEASON): LIQUID APPLIED WATERPROOFING MEMBRANE

SECTION 07140

FLUID APPLIED WATERPROOFING MEMBRANE SYSTEM

> Specifier Notes: This guide specification is written according to the Construction Specifications Institute (CSI) format. The section must be carefully reviewed and edited by the architect or engineer to meet the requirements of the project. Coordinate this section with other specification sections and the drawings.

> Specifier Notes: W. R. MEADOWS® MEL-ROL® LM (ALL SEASON) waterproofing system is a single-component, polymer-modified, cold-applied, liquid waterproofing membrane ideal for vertical waterproofing applications. MEL-ROL LM (ALL SEASON) can be used on new and remedial waterproofing applications on concrete or masonry block substrates. Application can be performed in colder weather when water-based products cannot be used.

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Surface preparation.

B. Application of single-component, cold-applied, liquid waterproofing membrane.

1.02 RELATED SECTIONS

> Specifier Notes: Edit the list of related sections as required for the project. List other sections dealing with work directly related to this section.

A. Section 03 30 00 – Cast-in-Place Concrete.

B. Section 04 20 00 – Unit Masonry.

C. Section 07 13 26 – Self-Adhering Sheet Waterproofing.

D. Section 07 21 00 – Thermal Insulation.

E. Section 07 60 00 – Flashing and Sheet Metal.

F. Section 07 92 00 – Joint Sealants.

G. Section 33 46 13 - Foundation Drainage.

1.03 REFERENCES

A. ASTM D146-97 - Standard Test Methods for Sampling and Testing Bitumen-Saturated Felts and Fabrics Used in Roofing and Waterproofing.

B. ASTM D412-98a(2002)e1 - Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers-Tension.

C. ASTM E96-00e1 (Method B) - Standard Test Methods for Water Vapor Transmission of Materials.

D. ASTM D1228 - Methods of Testing Asphalt Insulating Siding Surfaced with Mineral Granules.

E. ASTM C836 - Standard Specification for High Solids Content, Cold Liquid-Applied Elastomeric Waterproofing Membrane for Use with Separate Wearing Course.

F. ASTM D1970-01 - Standard Specification for Self-Adhering Polymer Modified Bituminous Sheet Materials Used as Steep Roofing Underlayment for Ice Dam Protection.

1.04 SUBMITTALS

A. Comply with Section 01330 - Submittal Procedures.

B. Submit manufacturer's product data and application instructions.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to site in manufacturer's original, unopened containers and packaging, with labels clearly identifying product name and manufacturer.

B. Store materials in a clean, dry area in accordance with manufacturer's instructions.

C. Store the material at room temperature or heat material to a minimum of 50°F (10 °C) prior to application.

D. Ensure concrete has been cured for a minimum of 14 days prior to application.

E. Do not store at temperatures above 90° F (32° C) for extended periods.

F. Protect materials during handling and application to prevent damage or contamination.

1.06 ENVIRONMENTAL REQUIREMENTS

A. Product not intended for uses subject to abuse or permanent exposure to the elements.

B. Do not apply membrane when air, material, or surface temperatures are expected to fall below 10° F (-12° C) within four hours of completed application.

C. Do not apply membrane if rainfall is forecast or imminent within two hours.

D. Do not apply to frozen concrete.

E. For spray applications, ensure material has been stored at room temperature or heated to a minimum of 50° F (10° C) prior to application.

PART 2 PRODUCTS

2.01 MANUFACTURER

A. W. R. MEADOWS, INC., PO Box 338, Hampshire, Illinois 60140-0338. (800) 342-5976. (847) 683-4500. Fax (847) 683-4544. Web Site www.wrmeadows.com.

2.02 MATERIALS

A. Waterproofing Membrane: A single-component, polymer-modified, cold-applied, liquid waterproofing membrane.
  1. Performance Based Spec: Waterproofing membrane shall have the following properties as determined by laboratory testing:
    a. Color: Black
    b. Solids: 65 %

  - c. Total Cure Time: 48 hours
  - d. Shore “00” Hardness, ASTM C836: Passes
  - e. Adhesion to Concrete, ASTM C836: Exceeds
  - f. Low Temperature Flex and Crack Bridging, ASTM C836: Passes
  - g. Stability, ASTM C836: Exceeds
  - h. Tensile Strength, ASTM D412: 30 psi
  - i. Elongation, ASTM D412: 1000%
  - j. Water Absorption, ASTM D1970: <0.5%
  - k. Water Vapor Transmission, ASTM E96 (Method B): 0.06 perms

2. Proprietary Based Spec:
   - a. MEL-ROL LM (ALL SEASON) Waterproofing System by W. R. MEADOWS.

2.03 ACCESSORIES

A. Concrete Repair Materials: MEADOW-PATCH™ 5 AND 20 CONCRETE REPAIR MORTARS.

B. Waterproofing Protection Course: PERMINATOR® 10 mil or PC-1 PROTECTION COURSE.

C. Rolled Matrix Drainage System: MEL-DRAIN™.

D. Reinforced Self-Adhesive Joint Tape: DETAIL STRIP

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine surfaces to receive membrane. Notify architect if surfaces are not acceptable. Do not begin surface preparation or application until unacceptable conditions have been corrected.

3.02 SURFACE PREPARATION

A. Protect adjacent surfaces not designated to receive waterproofing.

B. Clean and prepare surfaces to receive waterproofing in accordance with manufacturer's instructions.

C. Do not apply waterproofing to surfaces unacceptable to manufacturer.

D. Concrete surfaces must be clean, relatively smooth, and free of standing water.

E. Patch all holes and voids and smooth out any surface misalignments.

F. Remove and patch all concrete form ties.

G. Pre-treat all shrinkage cracks less than 1/16" with a 60-mil coat of material 6" (1.5 mm) wide.

H. Pre-treat all cracks greater then 1/16" with reinforced self-adhesive tape, as approved by manufacturer, prior to application of the membrane.

I. Apply primer coat of membrane diluted 4:1 with water if necessary to reduce blistering on concrete surfaces at a coverage rate of 100-150 ft.^{2}/U.S. gal (13.9 m^2/3.78 L) by spraying or rolling.

J. Allow primer coat to dry before proceeding to membrane application.

3.03 APPLICATION

A. Apply waterproofing membrane system in accordance with manufacturer's instructions.

B. Thoroughly mechanically mix membrane prior to application.

C. Apply membrane by spray or roller at a minimum coverage rate of 20-25 ft.^{2}/U.S. gal (1.9-2.3 m^2/3.78 L) providing a thickness of 80 wet mils.

D. Frequently inspect surface area with a wet mil gauge to ensure consistent thickness.

E. Ensure membrane coverage is 120 mils for inside/outside corners and non-moving and hairline cracks, as well as around drains and penetrations.

F. Work material into any fluted rib forming indentations.

G. Cured thickness of membrane should be 45 mils dry.

H. Avoid use of products which contain tars, solvents, pitches, polysulfide polymers, or PVC materials that may come into contact with waterproofing membrane system.

3.04 PROTECTION

A. Protect membrane with application of waterproofing protection course, drainage board, or other approved material after a minimum of 48 hours.

B. Backfill immediately using care to avoid damaging waterproofing membrane system.

END OF SECTION

NO. 711 **DATA SHEET**

Master Format: 07 13 26

FEBRUARY 2022
(Supersedes October 2013)

MEL-ROL®

Rolled, Self-Adhering Waterproofing Membrane

DESCRIPTION

MEL-ROL waterproofing system is a flexible, versatile, dependable, bituminous, roll-type waterproofing membrane. It is a 60 mil-membrane composed of a nominally 56 mil thick layer of polymeric waterproofing membrane on a heavy duty, four-mil thick, cross-laminated polyethylene carrier film. The two components are laminated together under strict quality-controlled production procedures.

A handy overlap guideline is printed 2 ½” (63.5 mm) in from the material edge on each side to assure proper overlap coverage and to assist in maintaining a straight application. Special exposed polymeric membrane strips are provided on both sides for positive membrane-to-membrane adhesion in the overlap area. The membrane strips are protected by a pull-off release strip. All components of the MEL-ROL waterproofing system work together to provide a cost-effective, positive waterproofing system that’s quick and easy to apply.

W. R. MEADOWS accessory products included in the MEL-ROL waterproofing system are: BEM, MEL-ROL LIQUID MEMBRANE, MEL-PRIME™ adhesive (solvent-based and water-based), POINTING MASTIC, DETAIL STRIP, CATALYTIC BONDING ASPHALT, TERMINATION BAR, PROTECTION COURSE and MEL-DRAIN™ drainage board.

USES

MEL-ROL waterproofing system provides a cost-effective answer to properly waterproof foundations, vertical walls, and below-grade floors in residential and commercial construction. It is equally effective for use as between-the-slab waterproofing on plaza decks, parking decks, and structural slabs. Use it as a waterproofing membrane to isolate mechanical and electronic rooms, laboratories, kitchens, and bathrooms. MEL-ROL offers positive protection when “wrapped around” major rapid transit, vehicular, utility, and pedestrian tunnel projects. MEL-ROL can also be used on insulated concrete forms (ICF). MEL-ROL can be applied to concrete, masonry surfaces, wood, insulated wall systems, and metal.

Installation of PROTECTION COURSE from W. R. MEADOWS is recommended before backfilling. MEL-ROL can also be used with drainage boards when specified.

FEATURES/BENEFITS

- Provides cost-effective, flexible, versatile, dependable, positive waterproofing protection against damaging moisture migration and the infiltration of free water.
- Offers a quick and easy-to-apply system for maximum productivity.
- Special membrane-to-membrane adhesion provides additional overlap security.
- Meets or exceeds the test requirements of all currently applicable specifications.
- Components work together for positive waterproofing protection.
- Handles with ease on the jobsite.
- Available in a low temperature version for use when air and surface temperatures are between 20° F (-7° C) and 60° F (16° C). An extra-low temp version is also available, ideal for application in extra-low temperatures down to 0º F (-18º C).

PACKAGING

38.5” (977.9 mm) wide x 62.5’ (19.1 m) long, one roll per carton.

COVERAGE

Provides 200 ft.^{2} (18.6 m^2) per roll. Gross coverage is 200 ft.^{2} (18.6 m^2). [Net coverage is 187.5 ft.^{2} (17.4 m^2) with overlap of 2 ½” (63.5 mm).]

SPECIFICATIONS

- A.R.E.M.A.® Specifications Chapter 29, Waterproofing
- LARR Report 26022

APPLICATION

Surface Preparation … Concrete should be cured at least 72 hours, be clean, dry, smooth, and free of voids. Repair spalled areas; fill all voids and remove all sharp protrusions.

CONTINUED ON THE REVERSE SIDE…

MEL-ROL COMBINES POSITIVE WATERPROOFING PROTECTION WITH EASE OF HANDLING

EXCLUSIVE FEATURES

A handy overlap guideline is printed 2 ½” (63.5 mm) in from the material edge on each side, assuring proper overlap coverage and assisting in maintaining a straight application. The polymeric waterproofing membrane is protected by a special, easy-to-remove release paper. The exposed membrane strips on the material edges are protected by a pull-off release strip. Exposed polymeric membrane strips are provided on both sides of MEL-ROL for positive membrane-to-membrane adhesion in the overlap area ... Note the detail, as shown in inset photo.

	TECHNICAL DATA	
PROPERTY	**TYPICAL VALUE**	**TEST METHOD**
COLOR … Carrier Film Polymeric Membrane	White Black	
THICKNESS … Carrier Film Polymeric Membrane	4 mils 56 mils	
TENSILE STRENGTH ... Carrier Film Membrane	5900 psi min. (40.71 MPa) 460 psi (3230 KPa)	ASTM D 412 (Die C)
ELONGATION	971.3%	ASTM D 412
LOW TEMP CRACK BRIDGING 100 Cycle -25° F (-32° C)	Pass	ASTM C 836
PEEL ADHESION	11.8 lb./in. (2068 N/m)	ASTM D 903
LAP ADHESION	8.62 lbf/in. (1508.5 N/m)	ASTM D 1876
WATER VAPOR PERMEABILITY ASTM E-96, B	0.036 Perms	
WATER ABSORPTION	0.1%, 72 hrs. max.	ASTM D570
HYDROSTATIC RESISTANCE	Equiv. to 230.9’ (70.38 m) of water	ASTM D 5385
PUNCTURE RESISTANCE	50 lbf (222 N)	ASTM E154
EXPOSURE TO FUNGI	Pass, 16 weeks	Soil Test
FLEXIBILITY @ -20° F (-29° C)	Pass	ASTM D 1970

MEL-ROL IS QUICK AND EASY TO APPLY

Temperature ... Apply in dry, fair weather when the air and surface temperatures are above 40° F (4° C). Do not apply to frozen concrete.

MEL-ROL LOW TEMP can be used when air and surface temperatures are between 20° F (-7° C) and 60° F (16° C).

Surface Conditioning … Apply MEL-PRIME adhesive to surfaces that will be covered within one working day. If left exposed overnight, additional adhesive must be applied. Follow all instructions and precautions on containers. All substrates must be clean, dry, and free of all surface irregularities.

DIAGRAM A
Outside Corner

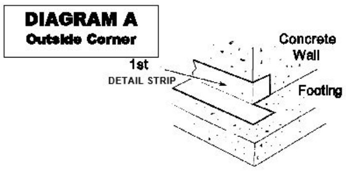
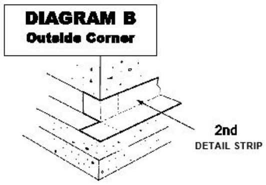


DIAGRAM B
Outside Corner



Footing Details … Use DETAIL STRIP for impaction sheet coverage. First, fold strips lengthwise and then cut at the fold. Material is then ready to install as 4 ½” (114.3 mm) strips on either side of the rebar. Any excess can be turned down on the face of the footing. Next, fill the voids around rebars in the keyway with CATALYTIC BONDING ASPHALT. Pour the walls. Install DETAIL STRIP horizontally along the wall where it meets the footing, placing half the material up the wall and the other half onto the footing. Extend the material 4 ½” (114.3 mm) beyond outside corners. Slit extended portion of DETAIL STRIP lengthwise. Place the horizontal flap out onto the footing and bend the vertical flap around the wall. (See Diagram A.) Repeat this procedure in the opposite direction as shown in Diagram B.

Horizontal Application … REMOVE release paper from MEL-ROL from the top edge of the roll and firmly press exposed area to the wall. Remove the release paper from the rolls in a downward direction, pressing MEL-ROL into place on the wall. Remove release paper on edge, then position the MEL-ROL membrane. Pull balance of release paper off, running the roll from low to high points, so all laps will shed water. Stagger end laps and overlap all seams at least 2 ½” (63.5 mm). Apply a double-thickness of the MEL-ROL membrane over construction, control, all expansion joints and over cracks greater than 1/16” (1.59 mm) wide.

Vertical Wall Application … Masonry walls may require the application of a cementitious parge-coat. Allow the parge-coat to dry before priming and applying MEL-ROL. When applied, the parge-coat will produce a smooth, uniform, and well-bonded surface. Remove release paper, then apply vertically in lengths approximately 8' (2.44 m) long over the top of the horizontal DETAIL STRIP at the footing. Overlap seams at least 2 ½" (63.5 mm). Tightly butt edges of membrane and apply POINTING MASTIC in corner applications. (See Diagram C.)

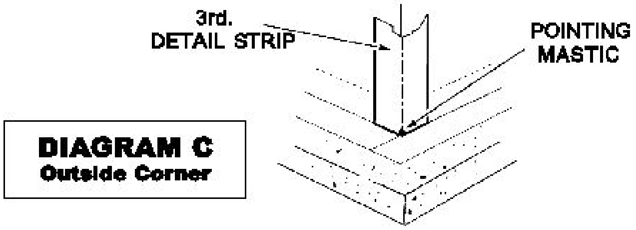


DIAGRAM C
Outside Corner

To the top terminations, apply POINTING MASTIC at least 1/8" (3.18 mm) thick and 1" (25.4 mm) wide. As an option, TERMINATION BAR may be used to mechanically fasten the membrane.

Hand-Rub and Roll Press … Once positioned, immediately hand-rub the MEL-ROL membrane firmly to the surface, removing any bubbles or wrinkles, then pressure roll the complete surface to assure positive adhesion.

Inside Corners ... Before MEL-ROL is applied, place a vertical DETAIL STRIP on inside corners extending the material 4 ½" (114.3 mm) beyond each side of the corner. (See Diagram D.) Terminate at the footing and finish the corner with POINTING MASTIC.

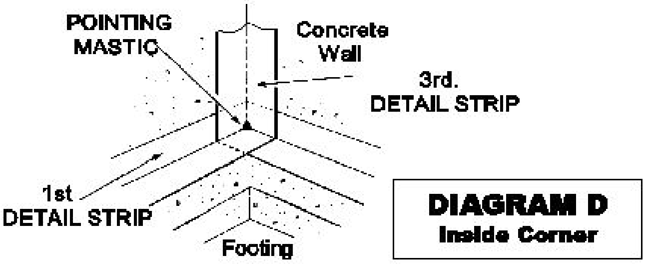
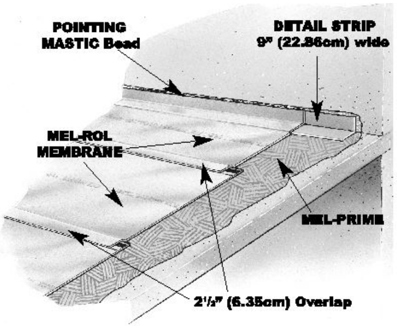


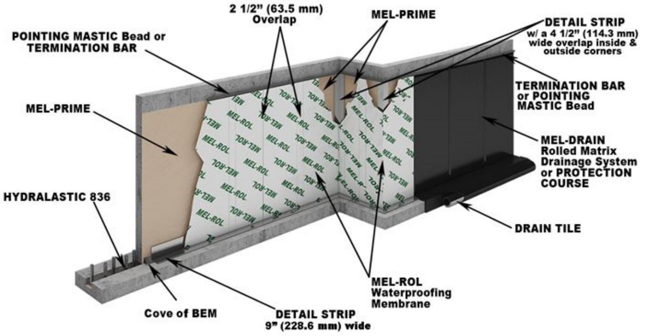
DIAGRAM D
Inside Corner

Outside Corners … Bend DETAIL STRIP vertically over the outside corner and extend 4 ½" (114.3 mm) beyond each side of the corner. Terminate the material at the footing. Finish the corner with POINTING MASTIC. (See Diagram C.)

If MEL-ROL is proposed to be used in place of DETAIL STRIP, contact W. R. MEADOWS Technical Services to determine the suitability of the installation.

Drains and Protrusions … All protrusions should be sealed with two layers of membrane applied at least 6" (152.4 mm) in all directions. Seal all terminations with POINTING MASTIC. Around drains, apply two layers of MEL-ROL and put a bead of POINTING MASTIC between the membrane and clamping rings and at all terminations, drains, and protrusions. See ASTM D 5898.





Inspect and Repair … A thorough inspection should be made before covering and all necessary repairs made immediately. Tears and inadequate overlaps should be covered with MEL-ROL ... slit fish mouths and patch. Seal edges of all patches with POINTING MASTIC. Where applicable, horizontal applications can be flood-tested for 24 hours. All leaks should be marked and repaired when membrane dries.

Protect the Membrane … on all vertical and horizontal installations with the immediate application of PROTECTION COURSE if no drainage system is used, or MEL-DRAIN. To secure PROTECTION COURSE, use POINTING MASTIC as an adhesive, and/or physically attach at the top edge using TERMINATION BAR. Backfilling should be done immediately, using care and caution to avoid damaging the waterproofing application.

PRECAUTIONS

Avoid the use of products that contain tars, solvents, pitches, polysulfide polymers, or flexible PVC and vinyl materials that may come into contact with MEL-ROL. As part of a complete waterproofing solution, W. R. MEADOWS recommends proper site drainage, but due to certain site conditions this sometimes cannot be done effectively. Proper design and suitability of the use of MEL-ROL should be at the discretion of the design consultant.

ACCESSORIES

MEL-PRIME W/B ... This water-based adhesive prepares surfaces for MEL-ROL application. Applies easily with manual sprayer or roller; VOC-compliant. MEL-PRIME W/B is for use at temperatures of 40° F (4° C) and up.

COVERAGE: 150 - 200 ft.^{2}/gal. (3.7 - 4.9 m^2/L)

PACKAGING: 1 Gallon (3.79 Liter) Units (4 units per carton), 5 Gallon (18.93 Liter) Pails

MEL-PRIME ... This solvent-based adhesive is for use at temperatures of 25° F (-4° C) and above. Apply by roller.

COVERAGE: 250-350 ft.^{2}/gal. (6.14 to 8.59 m^2/L) PACKAGING: 5 Gallon (18.93 Liter) Pails

MEL-PRIME N.E. ... MEL-PRIME N.E. solvent-based VOC adhesive is a ready-to-use adhesive specifically formulated to meet the maximum VOC content limits of 200 g/L for quick dry primers as required by VOC regulations in the northeastern U.S.

COVERAGE: 150 - 250 ft.^{2}/gal.

PACKAGING: 1 Gallon Can, 5 Gallon Pail

MEL-ROL LIQUID MEMBRANE ... A two-component material used as a flashing to form fillets at corners and at protrusions. May be used as a substitute for POINTING MASTIC. Product can also be used in between walls and footings in lieu of DETAIL STRIP.

COVERAGE: As a fillet, approximately 135 lineal feet per gallon (10.87 m per liter) PACKAGING: 1 Gallon (3.79 Liter) Units, 4 Units per carton.

BEM ... BEM can be used as a fillet to round out 90° angles, such as the wall-footing connection, and can be used as a substitute for MEL-ROL LIQUID MEMBRANE.

COVERAGE: As a fillet, approximately 135 lineal ft./gal. (10.9 m/L). PACKAGING: 28 Oz. (828 mL) Cartridges (12 per Carton)

POINTING MASTIC ... Used as an adhesive and for sealing top edge terminations on DETAIL STRIP and membrane, and to adhere PROTECTION COURSE.

COVERAGE: 1/8" x 1" x 200'/gal. (3.18 mm x 25.4 mm x 16.10 ml). PACKAGING: 5 Gallon (18.93 Liter) Pails, 29 Oz. (857.65

CATALYTIC BONDING ASPHALT ... Easy-to-apply, one-component material for sealing around rebar.

COVERAGE: 5 gal./1000 ft.^{2}/gal. (4.9 m^2/L) PACKAGING: 5 Gallon (18.93 Liter) Pails.

DETAIL STRIP ... Convenient, easy-to-use DETAIL STRIP provides an economical and effective method for sealing vertical and horizontal butt joints, i.e. inside or outside corners and where walls and footings meet.

PACKAGING: 9" x 50' (.23 x 15.24 m) roll, 4 rolls per carton.

PROTECTION COURSE ... Use for vertical and horizontal applications. Adhere with POINTING MASTIC or use mechanical fasteners.

PACKAGING: 4' x 8' (1.22 x 2.44 m) panels.

MEL-DRAIN ... is a dimple-raised molded polystyrene fabric designed to provide high flow capacity to reduce hydrostatic pressure buildup around waterproofing and vaporproofing membranes. Choice of drain types are available for vertical, horizontal, and site applications. Use MEL-PRIME to condition surface prior to application of MEL-DRAIN.

TERMINATION BAR ... is a high strength, pre-formed, multi-purpose, plastic strip designed to support vertical membrane systems and PROTECTION COURSE at their termination point.

PACKAGING: 10' (Holes every 6" o/c, 2" from either end), 25 pieces per carton.

MAINTAIN ENERGY EFFICIENCY

Wet insulating materials lose much of their "R" factor performance characteristics, reducing the energy efficiency of the structure. W. R. MEADOWS thermal and moisture protection products play a key role in *maintaining* the structure's energy efficiency and aiding in the integrity of other structural systems, such as insulation.

For CAD details, most recent data sheet, further LEED information, and SDS, visit www.wrmeadows.com.

SAFETY DATA SHEET

SECTION 1: PRODUCT AND COMPANY IDENTIFICATION

Product: MEL-ROL® **Part Number: 5110060**

Manufacturer: W. R. MEADOWS, INC. **Address:** 300 Industrial Drive
Hampshire, Illinois 60140

Telephone: (847) 214-2100 In case of emergency, dial (800) 424-9300 (CHEMTREC)

Revision Date: 8/15/2019

Product Use: Waterproofing Membrane

SECTION 2: HAZARDS IDENTIFICATION/EXPOSURE LIMITS

HMIS	
|Health|	|0|
|Flammability|	|1|
|Reactivity|	|0|
|Personal Protection|	| |

Product is classified as non-hazardous per OSHA 1910.1200. Mel-Rol is defined by OSHA as an "article." A manufactured item that is formed to a specific shape or design during manufacture that does not release or result in exposure to a hazardous chemical under normal use conditions.

SECTION 3: HAZARDS COMPONENTS

Chemical Name:	CAS Number	% by Weight	SARA 313	Vapor Pressure (mm Hg@20°C)	LEL (@24°C)
1. Petroleum Asphalt	8052-42-4	55-60	No	N/A	N/A

N/A = Not Applicable

Under the reporting requirements of Section 313 of Title III of the Superfund Amendments and Reauthorization Act of 1966 (SARA) and 40 CFR Part 372, chemicals listed on the 313 List (40 CFR Part 373.65) are identified under the heading "SARA 313."

SECTION 4: EMERGENCY AND FIRST AID PROCEDURES

EYE CONTACT: Not expected to be an exposure route.

SKIN CONTACT: Wash affected areas with soap and water if available.

INHALATION: Not expected to be an exposure route.

INGESTION: Not expected to be an exposure source.

MOST IMPORTANT SYMPTOMS/EFFECTS, ACUTE AND CHRONIC: See Section Eleven for Symptoms/Effects.

SECTION 5: FIRE AND EXPLOSIVES HAZARDS

FLASHPOINT: Not applicable; product is a solid.

EXTINGUISHING MEDIA: Water fog, foam, dry chemical.

CHEMICAL/COMBUSTION HAZARDS: Oxides and compounds of nitrogen/sulfur.

PRECAUTIONS/PERSONAL PROTECTIVE EQUIPMENT: Avoid smoke inhalation. Use appropriate respiratory protection.

SECTION 6: ACCIDENTAL RELEASE MEASURES

SPILL OR LEAK PROCEDURES: Not applicable. Product is a solid.

SECTION 7: HANDLING AND STORAGE

SAFE HANDLING PROCEDURES: Avoid direct contact.

SAFE STORAGE: Prevent job-site damage.

SECTION 8: EXPOSURE CONTROLS/PERSONAL PROTECTION

	OSHA				ACGIH			
Chemical Name:	PEL	PEL/CEILING	PEL/STEL	SKIN	TLV	TLV/CEILING	TLV/STEL	SKIN
1. Petroleum Asphalt	5 mg/m^3*	N/E	N/E	No	0.5 mg/m^3*	N/E	N/E	N/E

ENGINEERING CONTROLS: None required under normal use conditions.

PERSONAL PROTECTIVE EQUIPMENT: Safety glasses, chemical-resistant gloves.

N/E = Not Established

*: Asphalt Fumes

SECTION 9: PHYSICAL AND CHEMICAL PROPERTIES

BOILING POINT: N/A
EVAPORATION RATE: N/A
WEIGHT PER GALLON: N/A
ODOR: Mild Asphaltic
FLASH POINT: See Section 5
VAPOR PRESSURE: N/D
PARTITION COEFFICENT: N/D
VISCOSITY: N/D

VAPOR DENSITY: N/A
pH LEVEL: N/A
PRODUCT APPEARANCE: Black Solid
ODOR THRESHOLD: N/D
FLAMMABILITY: N/D
RELATIVE DENSITY: N/D
AUTOIGNITION TEMPERATURE: N/D

% VOLATILE BY VOLUME: N/A
% VOLATILE BY WEIGHT: N/A
VOC CONTENT: N/A
MELTING/FREEZING POINT: N/D
UEL/LEL: N/D
SOLUBILITY: N/D
DECOMPOSITION TEMPERATURE: N/D

N/D: Not Determined

SAFETY DATA SHEET

SECTION 10: STABILITY/REACTIVITY

STABILITY: Stable. **HAZARDOUS POLYMERIZATION:** Will not occur.

CONDITIONS AND MATERIALS TO AVOID: None recognized.

HAZARDOUS DECOMPOSITION PRODUCTS: None recognized.

SECTION 11: TOXICOLOGICAL INFORMATION

EYE CONTACT: Direct contact may cause mild irritation.

SKIN CONTACT: Direct contact may cause slight skin irritation.

INHALATION: Not anticipated to be an exposure route.

INGESTION: Not anticipated to be an exposure route.

SIGNS AND SYMPTOMS: Symptoms of eye irritation include tearing, reddening, and swelling. Symptoms of skin irritation include redness and swelling. Gastrointestinal irritation symptoms include nausea, vomiting, and abdominal discomfort.

AGGRAVATED MEDICAL CONDITIONS: None recognized.

OTHER HEALTH EFFECTS: None recognized.

SECTION 12: ECOLOGICAL INFORMATION

ECOTOXICITY: N/E **DEGRADABILITY:** N/E **BIOACCUMULATIVE POTENTIAL:** N/E

SOIL MOBILITY: N/E **OTHER ADVERSE EFFECTS:** None Recognized

SECTION 13: WASTE DISPOSAL INFORMATION

WASTE DISPOSAL INFORMATION: Product is classified as a non-hazardous waste.

SECTION 14: TRANSPORTATION INFORMATION

HAZARDOUS/NON-HAZARDOUS MATERIAL: Not regulated by DOT.

UN NUMBER: None **HAZARD CLASS:** N/A **PACKING GROUP:** N/A

UN PROPER SHIPPING NAME: N/A

ENVIRONMENTAL HAZARDS: None recognized.

BULK TRANSPORTATION INFORMATION: None.

SPECIAL PRECAUTIONS: None.

SECTION 15: REGULATORY INFORMATION

OTHER REGULATORY CONSIDERATIONS: None recognized.

SECTION 16: OTHER INFORMATION

PREPARATION DATE: 8/15/2019

PREPARED BY: Dave Carey

GUIDE SPECIFICATION FOR MEL-ROL: ROLLED, SELF ADHERING WATERPROOFING MEMBRANE

SECTION 07 13 26

SELF-ADHERING SHEET WATERPROOFING

Specifier Notes: This guide specification is written according to the Construction Specifications Institute (CSI) MasterFormat 2010. The section must be carefully reviewed and edited by the Architect or Engineer to meet the requirements of the project. Coordinate this section with other specification sections and the drawings.

Specifier Notes: W.R. Meadows SEALTIGHT® MEL-ROL® waterproofing system is a flexible, versatile, dependable, roll-type waterproofing membrane. It is composed of a nominally 56 mil thick layer of polymeric waterproofing membrane on a heavy duty, 4 mil thick, cross-laminated polyethylene carrier film. The two components are laminated together under strict quality-controlled production procedures. A handy overlap guideline is printed 2 ½" (63.5 mm) in from the material edge on each side to assure proper overlap coverage and to assist in maintaining a straight application. Special exposed polymeric membrane strips are provided on both sides for positive membrane-to-membrane adhesion in the overlap area. The membrane strips are protected by a pull-off release strip.

MEL-ROL waterproofing system provides a cost-effective answer to properly waterproof foundations, vertical walls and below-grade floors in residential and commercial construction. It is equally effective for use as between-the-slab waterproofing on plaza decks, parking decks and structural slabs. Use it as a waterproofing membrane to isolate mechanical and electronic rooms, laboratories, kitchens and bathrooms. MEL-ROL offers positive protection when "wrapped around" major rapid transit, vehicular, utility and pedestrian tunnel projects. MEL-ROL can also be used on insulated concrete forms (ICF).

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Surface preparation.

B. Application of rolled, self-adhering waterproofing membrane system.

1.02 RELATED SECTIONS

Specifier Notes: Edit the list of related sections as required for the project. List other sections dealing with work directly related to this section.

A. Section 03 30 00 - Cast-in-Place Concrete.

B. Section 07 21 00 – Thermal Insulation.

C. Section 07 60 00 – Flashing and Sheet Metal.

D. Section 07 92 00 – Joint Sealants.

E. Section 33 46 00 - Subdrainage.

1.03 REFERENCES

A. American Railway Engineering & Maintenance of Way Association (AREMA) Specification Chapter 29 - Waterproofing.

B. ASTM D146 - Standard Test Methods for Sampling and Testing Bitumen-Saturated Felts and Fabrics Used in Roofing and Waterproofing.

C. ASTM D412 - Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers-Tension.

D. ASTM D570 - Standard Test Method for Water Absorption of Plastics.

E. ASTM D903 - Standard Test Method for Peel or Stripping Strength of Adhesive Bonds.

F. ASTM D1876 – Standard Test Method for Peel Resistance of Adhesives. (T-Peel Test).

G. ASTM D1970 - Standard Specification for Self-Adhering Polymer Modified Bituminous Sheet Materials Used as Steep Roofing Underlayment for Ice Dam Protection.

H. ASTM E96 (Method B) - Standard Test Methods for Water Vapor Transmission of Materials.

I. ASTM E154 - Standard Test Methods for Water Vapor Retarders Used in Contact with Earth Under Concrete Slabs, on Walls, or as Ground Cover.

1.04 SUBMITTALS

A. Comply with Section 01 33 00 - Submittal Procedures.

B. Submit manufacturer's product data and application instructions.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to site in manufacturer's original, unopened containers and packaging, with labels clearly identifying product name and manufacturer.

B. Store materials in a clean dry area in accordance with manufacturer's instructions.

C. Store adhesives and primers at temperatures of 40ºF (5ºC) and above to facilitate handling.

D. Store membrane cartons on pallets.

E. Do not store at temperatures above 90ºF (32ºC) for extended periods.

F. Keep away from sparks and flames.

G. Completely cover when stored outside. Protect from rain.

H. Protect materials during handling and application to prevent damage or contamination.

I. Avoid use of products which contain tars, solvents, pitches, polysulfide polymers, or PVC materials that may come into contact with waterproofing membrane system.

1.06 ENVIRONMENTAL REQUIREMENTS

A. Product not intended for uses subject to abuse or permanent exposure to the elements.

B. Protect rolls from direct sunlight until ready for use

C. Do not apply membrane when air or surface temperatures are below 40ºF (4ºC).

D. Do not apply to frozen concrete.

PART 2 PRODUCTS

2.01 MANUFACTURER

A. W.R. MEADOWS, Inc., PO Box 338, Hampshire, Illinois 60140-0338. (800) 342-5976. (847) 683-4500. Fax (847) 683-4544. Web Site www.wrmeadows.com.

2.02 MATERIALS

A. Rolled, Self-Adhering Waterproofing Membrane: Polymeric waterproofing membrane protected by release paper on cross-laminated polyethylene carrier film with exposed polymeric membrane strips on both sides protected by pull-off release strips.
  1. Performance Based Specification: Waterproofing membrane shall have the following characteristics:
    a. Compliance: AREMA Specification Chapter 29 - Waterproofing.
    b. Thickness:
      1) Carrier Film: 4 mils.
      2) Polymeric Membrane: 56 mils.
    c. Tensile Strength, ASTM D412, Die C:
      1) Carrier Film: 5,900 psi (40.71 MPa) minimum.
      2) Polymeric Membrane: 460 psi (3.23 MPa) minimum.
    d. Elongation, ASTM D412, Die C: Polymeric Membrane: 971 % minimum.
    e. Peel Adhesion, ASTM D903: 11.8 lbf/in. (2068 N/m).
    f. Lap Adhesion, ASTM D1876: 8.62 lbf/in. (1508 N/m)
    g. Water Vapor Permeability, ASTM E96, Method B: 0.036 perms.
    h. Water Absorption, ASTM D570: 0.1 percent, 72 hours maximum.
    i. Resistance to Hydrostatic Head: Equivalent to 230.9 feet (70.3 m) of water.
    j. Puncture Resistance, ASTM E154: 48.2 lbf (214.6 N).
    k. Exposure to Fungi, Soil Test: Pass, 16 weeks.
    l. Color:
      1) Carrier Film: White.
      2) Polymeric Membrane: Black.

  2. Proprietary Based Specification: MEL-ROL Waterproofing System by W.R. MEADOWS.

Specifier Notes: Select one of the following MEL-ROL products based on air and surface temperatures during time of application.

    a. MEL-ROL: For use at temperatures of 40ºF (4ºC) and above.
    b. MEL-ROL LT (Low Temperature): For use at temperatures of 20ºF (-7ºC) to 60ºF (16ºC).
    c. MEL-ROL XLT (Extra Low Temperature): For use at temperatures of 0ºF (-18ºC) to 60ºF (16ºC).

2.03 ACCESSORIES

A. Surface Conditioner:
  1. Temperatures Above 40ºF (4ºC): Mel-Prime Water Base Primer.
  2. Temperatures Above 0ºF (-18ºC): Mel-Prime VOC Compliant Solvent Base Primer or Standard Solvent Base Primer.

B. Flashing and Fillets: MEL-ROL LIQUID MEMBRANE.

C. Pointing Mastic: POINTING MASTIC.

D. Termination Bar: TERMINATION BAR.

E. Corner Tape: DETAIL STRIP.

F. Waterproofing Protection Course: PROTECTION COURSE

G. Rolled Matrix Drainage System: MEL-DRAIN Rolled Matrix Drainage System.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine surfaces to receive self-adhering membrane. Notify Architect if surfaces are not acceptable. Do not begin surface preparation or application until unacceptable conditions have been corrected.

3.02 SURFACE PREPARATION

A. Protect adjacent surfaces not designated to receive waterproofing.

B. Clean and prepare surfaces to receive waterproofing in accordance with manufacturer's instructions.

C. Do not apply waterproofing to surfaces unacceptable to manufacturer.

D. Concrete surfaces must be clean, smooth and free of standing water.

E. Patch all holes and voids and smooth out any surface misalignments.

F. Apply surface conditioner to surfaces that will be covered within one working day according to manufacturer’s recommended coverage rates.

G. Install corner tape on all inside and outside corners, including the footing.

H. Apply a 9” (229 mm) strip of self-adhering membrane over construction, control and expansion joints and over cracks greater than 1/16” (1.59 mm) wide.

I. Seal all terminations with pointing mastic.

3.03 APPLICATION

Specifier Notes: Select A (Horizontal Application), or B (Vertical Application) based on project requirements

A. Horizontal Application
  1. Apply waterproofing membrane system in accordance with manufacturer's instructions.
  2. Ensure accessory materials are compatible with membrane and approved by membrane manufacturer.
  3. Remove release paper on edge, then position the membrane.
  4. Pull balance of release paper off, running the roll from low to high points, so all laps will shed water.
  5. Immediately hand-rub the membrane firmly to the surface, removing any bubbles or wrinkles, then pressure roll the complete surface to assure positive adhesion.
  6. Stagger end laps and overlap all seams at least 2 ½” (63.5 mm).
  7. Seal all terminations with pointing mastic.
  8. Inspect membrane before covering and repair as necessary. Cover tears and inadequate overlaps with membrane. Seal edges of patches with pointing mastic.
  9. Perform flood testing of horizontal applications, as required. Mark leaks and repair when membrane dries.

B. Vertical Application
  1. Apply waterproofing membrane system in accordance with manufacturer's instructions.

2. Ensure accessory materials are compatible with membrane and approved by membrane manufacturer.
3. Remove release paper on edge and position the membrane.
4. Pull balance of release paper off, running the roll vertically over the top of the corner tape at the footing.
5. Immediately hand-rub the membrane firmly to the surface, removing any bubbles or wrinkles, then pressure roll the complete surface to assure positive adhesion.
6. Overlap all seams and stagger end laps at least 2 ½” (63.5 mm).
7. Seal all terminations with pointing mastic.
8. Inspect membrane before covering and repair as necessary. Cover tears and inadequate overlaps with membrane. Seal edges of patches with pointing mastic.

3.04 PROTECTION

A. Protect membrane on vertical and horizontal applications with immediate application of waterproofing protection course, rolled matrix drainage board.

B. Backfill immediately using care to avoid damaging waterproofing membrane system.

END OF SECTION

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INSTALLATION GUIDELINES
MEL-ROL®

This document has been created as an addendum to the MEL-ROL technical data sheet to provide the recommended procedure to use when installing MEL-ROL self-adhesive waterproofing membrane from W. R. MEADOWS. The guide will cover recommended tools to use, surface preparation prior to membrane installation, and the membrane installation on both vertical and horizontal surfaces.

TOOLS RECOMMENDED

- Utility knife
- Chalk line
- Stiff bristle broom
- 6' (1.8 m) broom handle or equivalent
- 1.5" (38.1 mm) or 2" (50.8 mm) margin trowel
- Medium nap (3/8" - 1/2") lambswool paint roller
- Tape measurer
- Gloves (solvent-resistant)
- Screwdriver
- Small diamond point trowel
- 35 lb. or heavier linoleum roller
- Hammer
- Rags
- Cleanup solvent similar to xylene or toluene or SEALTIGHT CLEANER or SEALTIGHT SOLVENT from W. R. MEADOWS

The above tools are enough to perform a proper installation; however, more tools may be used.

W. R. MEADOWS MATERIALS NEEDED

- MEL-ROL self-adhesive waterproofing membrane
- MEL-PRIME, MEL-PRIME N.E., or MEL-PRIME W/B adhesive
- DETAIL STRIP
- POINTING MASTIC
- BEM
- PC protection board and/or MEL-DRAIN drainage board
- MEADOW-CRETE GPS
- MEADOW-PATCH 20

SURFACE PREPARATION

Concrete should be cured at least 72 hours, be clean, dry, smooth, and free of voids. Repair spalled areas; fill all voids and remove all sharp protrusions. Apply in dry, fair weather when the air and surface temperature are above 40° F (4° C). Do not apply to frozen concrete. MEL-ROL LOW TEMP can be used when air and surface temperatures are between 20° F (-7° C) and 60° F (16° C),

Apply MEL-PRIME adhesive to surfaces that will be covered within one working day. If left exposed overnight, additional adhesive must be applied. Follow all instructions and precautions on containers.

MEL-ROL can be applied to concrete, masonry surfaces, wood, insulated wall systems, and metal. All substrates must be clean, dry, and free of all surface irregularities.

Masonry walls may require the application of a cementitious parge-coat. Allow the parge-coat to dry before priming and applying MEL-ROL. When applied, the parge-coat will produce a smooth, uniform, and well-bonded surface. Apply MEL-PRIME to all areas to receive MEL-ROL.

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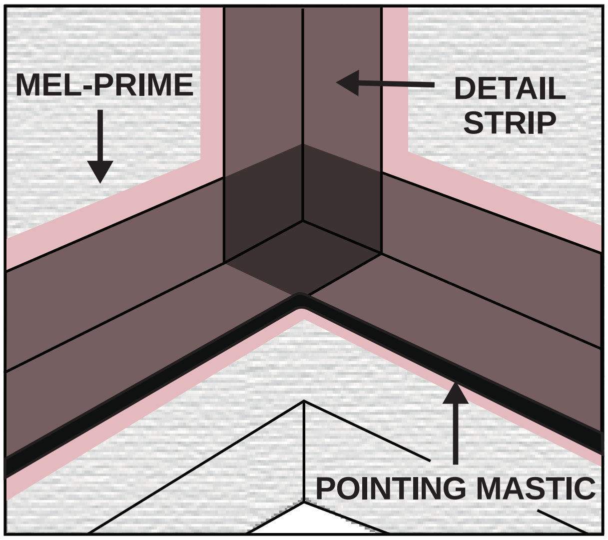
INSTALLATION GUIDELINES
MEL-ROL®

DETAILING

INSIDE CORNERS

Before MEL-ROL is applied, place a vertical DETAIL STRIP on inside corners extending the material 4 ½" (114.3 mm) beyond each side of the corner. Terminate at the footing and finish the corner with POINTING MASTIC.



OUTSIDE CORNERS

Bend DETAIL STRIP vertically over the outside corner and extend 4 ½" (114.3 mm) beyond each side of the corner. Terminate the material at the footing. Finish the corner with POINTING MASTIC.

DRAINS AND PROTRUSIONS

All protrusions should be sealed by forming a collar of MEL-ROL or DETAIL STRIP applied at least 3" (76.2 mm) in all directions. Seal all terminations with POINTING MASTIC. Around drains, apply in the same method and put a bead of POINTING MASTIC between the membrane and clamping rings at all terminations, drains, and protrusions.

FOOTING DETAILS

Fill 90° interior angles with a cove of BEM. Apply MEL-PRIME in all the inside and outside corners prior to installing DETAIL STRIP. Install DETAIL STRIP 4 ½" (114.3 mm) up the wall and 4 ½" (114.3 mm) on the footing. Extend the material 4 ½" (114.3 mm) beyond outside corners. Slit extended portion of DETAIL STRIP lengthwise. Place the horizontal flap out onto the footing and bend the vertical flap around the wall. Repeat this procedure in the opposite direction. Apply a bead of POINTING MASTIC on the exposed edge of installed DETAIL STRIP at footing. Please note: use POINTING MASTIC in place of BEM when using MEL-ROL XLT.

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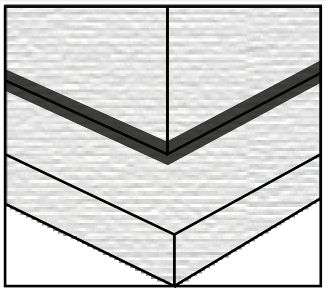
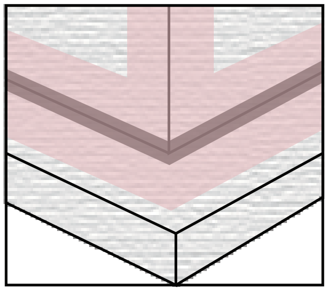
INSTALLATION GUIDELINES
MEL-ROL®

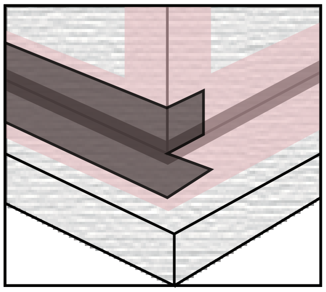
1. Cove of BEM



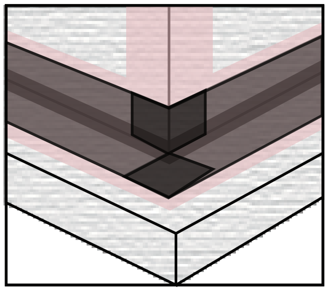
2. MEL-PRIME



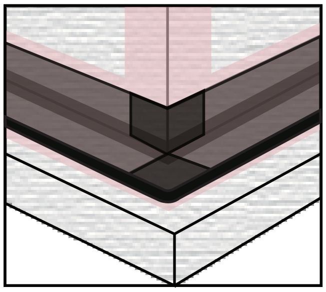
3. 1st DETAIL STRIP



4. 2nd DETAIL STRIP



5. POINTING MASTIC



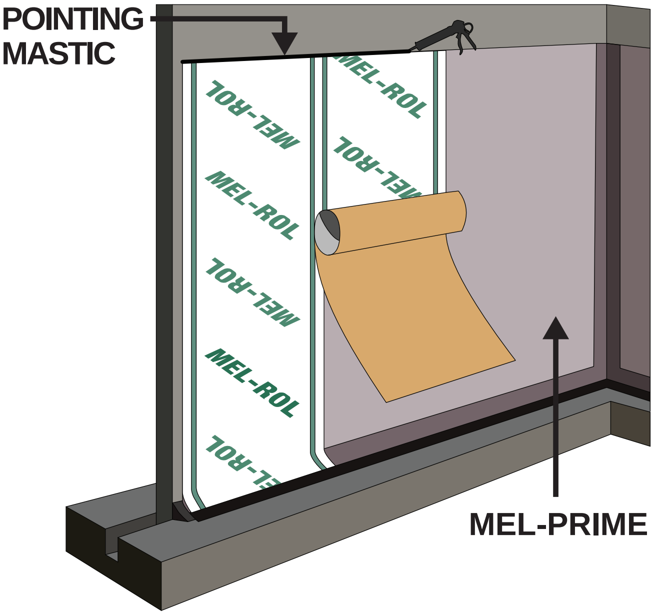
VERTICAL WALL APPLICATION

Remove the release paper, then apply vertically in lengths approximately 8' (2.44 m) long over the top of the horizontal DETAIL STRIP at the footing. Overlap the seams at least 2 ½" (63.5 mm). Tightly butt edges of membrane and apply POINTING MASTIC in corner applications.

To aid in a proper overlap, position the membrane so that it covers the "W. R. MEADOWS" wording running along the edge.

Apply POINTING MASTIC to the top terminations at least 1/8" (3.18 mm) thick and 1" (25.4 mm) wide. As an option, TERMINATION BAR may be used to fasten and membrane mechanically.

Once positioned, immediately hand-rub the MEL-ROL membrane firmly to the surface removing any bubbles or wrinkles, then pressure roll the complete surface to assure positive adhesion. Apply POINTING MASTIC to the leading edge of the membrane at the end of each working day.



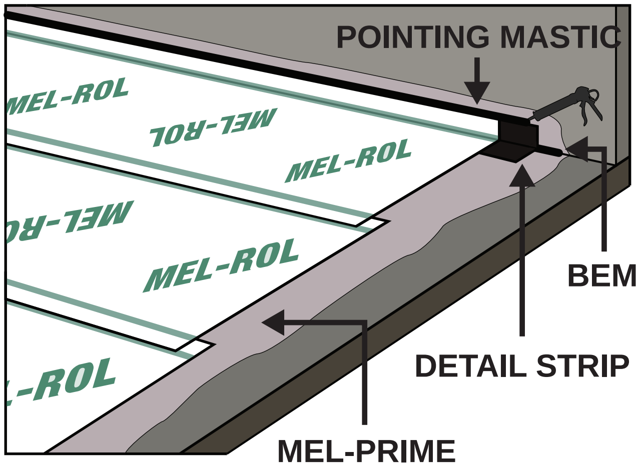
INSTALLATION GUIDELINES
MEL-ROL®

HORIZONTAL APPLICATION

Remove the release paper on the edge, then position the MEL-ROL membrane. Pull the balance of the release paper off, running the roll from low to high points so that all the laps will shed water. Stagger end laps and overlap all seams at least 2 ½" (63.5 mm). All terminations of MEL-ROL must be detailed with a bead of POINTING MASTIC. Apply a double-thickness of the MEL-ROL membrane over construction, control, and all expansion joints and cracks greater than 1/16" (1.59 mm) wide.

Once positioned, immediately hand-rub the MEL-ROL membrane firmly to the surface removing any bubbles or wrinkles. Pressure roll the complete surface to assure positive adhesion.

A thorough inspection should be made before covering and all necessary repairs made immediately. Tears and inadequate overlaps should be covered with MEL-ROL. Slit fish mouths and patch. If flooding test is required, allow a minimum of 24 hours following the membrane installation. Flood testing should be performed accordingly to ASTM D5957.



INSPECT AND REPAIR

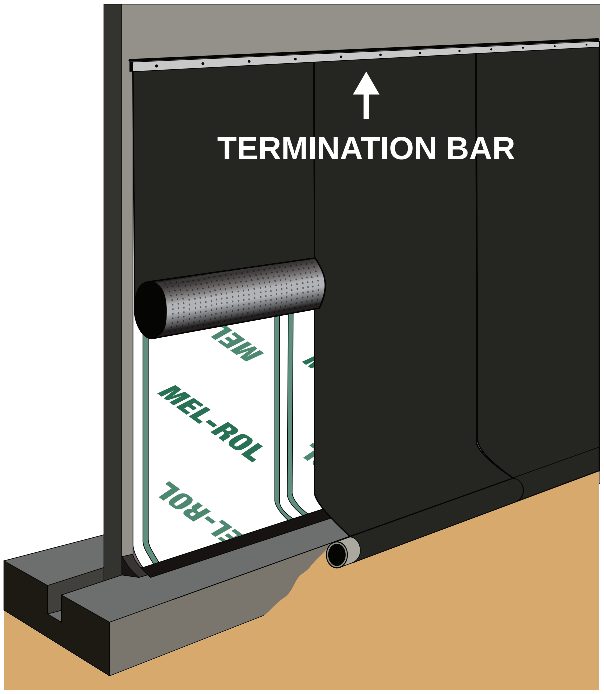
A thorough inspection should be made before covering and all necessary repairs made immediately. Tears and inadequate overlaps should be covered with MEL-ROL. Slit fish mouths and patch. Seal edges of all patches with POINTING MASTIC. Where applicable, horizontal applications can be flood-tested for 24 hours. All leaks should be marked and repaired when membrane dries.

PROTECT THE MEMBRANE

Immediately apply PROTECTION COURSE on all vertical and horizontal installations if no drainage system is used, or apply MEL-DRAIN. To secure PROTECTION COURSE, use POINTING MASTIC as an adhesive, and/or physically attach at the top edge using TERMINATION BAR.

When using MEL-DRAIN on a vertical wall application, align the first roll and mechanically fasten in place. Roll MEL-DRAIN down the wall, overlapping the footing. Continue MEL-DRAIN installation to cover installed MEL-ROL. Pull away the fabric layer of MEL-DRAIN to expose dimples. Install drainage tile and wrap excess fabric over the drainage tile. Install TERMINATION BAR and fasted at 12" on center to hold MEL-DRAIN in place and apply a bead of POINTING MASTIC on the top edge of the TERMINATION BAR.

INSTALLATION GUIDELINES
MEL-ROL®



Backfilling should be done immediately, using care and caution to avoid damaging the waterproofing application.

PRECAUTIONS

Avoid the use of products that contain tars, solvents, pitches, polysulfide polymers, or PVC materials that may come into contact with MEL-ROL. The use of MEL-ROL does not negate the need for relief of hydrostatic heads. A complete drain tile system should be placed around the exterior of footings and under slabs, as required.

W. R. MEADOWS, INC.

P.O. Box 338 ▪ Hampshire, IL 60140-338
www.wrmeadows.com ▪ wrmil@wrmeadows.com

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TELEPHONE: 847-214-2100
800-825-5976
FAX: 847-683-4544

January 9, 2023

W. R. MEADOWS certifies the following information for MEL-ROL® Self-Adhering Waterproofing Membrane:

LEED v4.0 - Building Product Disclosure and Optimization (MRc3 and MRc4):

Manufacturing Location(s):	Hampshire, IL 60140
Raw Material Extraction Point:	Not Available
Recycled Content:	0%

LEED v4.0 Low-Emitting Materials (EQc2):

VOC Emissions:	N/A - Classified as an exterior product. Not required per LEEDv4 EQc2.
VOC Content:	N/A - Not a wet-applied product. Not required per LEEDv4 EQc2.

If field sampling and/or field or laboratory testing be required, W. R. MEADOWS cannot be held responsible for any cost incurred if this product is used prior to receipt of that approval.

Should you have any questions or require additional information, please feel free to contact Technical Services or your local W. R. MEADOWS Representative.

Sincerely,

Kimberly Ann Lombardozzi

Kimberly Ann Lombardozzi, LEED AP ID+C, WELL AP, fitwel Ambassador
Sustainability Manager
W. R. MEADOWS, INC.

PROVIDING A FULL BUILDING
ENVELOPE
SYSTEM

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A NEW HOME FOR BIOSCIENCE RESEARCH:

W. R. MEADOWS on Campus at the University of Arizona

Pursuing the cutting edge in research and education has always been a focus at the University of Arizona—located in Tucson. And this intent was evident when the University first set out to build a new hub, on campus, to house bioscience research themes that included work on biosensors, bioimaging, bioinformatics, healthy aging, genomics technology, and precision medicine. The building itself is a joint collaboration between the University of Arizona Office for Research, Discovery, and Innovation and the University's Department of Health Sciences. It was designed by ZGF Architects and BWS Architects, and the general contractor was DPR Construction.

The goal of the building was to house 50 faculty members and over 300 graduate students, post-docs, and technical support staff. Some of these individuals would be moving from other places on campus to pursue interdisciplinary research, and many would be new to the University—especially recruited because of the promise associated with this new space. The building was also set to be home to a clinical-certified genetics facility focused on testing tumor biopsies in order to set the best course of treatment for individual patients.

Ultimately, the demand for innovation was primary in this construction project. And the teams associated with the groundbreaking and realization of this building had to be able to rise to the challenge.

A Trifecta of Beauty, Functionality, and Sustainability

With a price tag of $107M and comprised of square footage equaling just over 140K, the new construction of this state-of-the-art facility began in 2015. It was significant in nature and involved many moving parts—and project teams. There was a need for collaboration, communication, and synergy alongside the requirement of hitting quality assurance targets. And it just so happened that W. R. MEADOWS happened to be listed in the construction specifications as a potential manufacturer who could get the job done.

> ***"An air barrier and numerous waterproofing products were needed for this project," states Greg Neundorfer, the W. R. MEADOWS salesperson in charge of this project. "There were also multiple transitions between these products that needed to be addressed."***

Whatever products used in this project had a tall order to meet; they had to work well with a variety of substrates.

Creating the Foundation

Starting from the ground up, the first part of the project was centered on the foundation of the building.

“We were confronted with needing multiple forms of waterproofing,” explained Neundorfer. “The first was called blindside waterproofing, also known as pre-placed waterproofing. This is present when you are faced with having a hole in the ground that is the size of the building as opposed to being over-excavated. You are building the structure within the exact size of the building itself. So, you have to install a shoring system of in order to keep the soil stable. Then, the waterproofing is placed and the concrete is cast against the waterproofing.”

It was Firestop Southwest, the waterproofing installer, who ultimately brought W. R. MEADOWS to the table with the University of Arizona. Ryan Olsen, originally the estimator and project manager for Firestop Southwest, and who ended up transitioning into a consulting role three months into the project with a third-party testing agency, explains.

“W. R. MEADOWS wasn’t originally in the specs, but we proposed using W. R. MEADOWS for the waterproofing membrane on both the below-grade and podium decks in lieu of what was specified. The specs, ultimately, had multiple products from varied manufacturers, but we thought it would be better to recommend all W. R. MEADOWS products. I went to U of A and presented to them, explaining what W. R. MEADOWS could do and why we should use them on this project. I told them all the benefits,” said Olsen.

The University of Arizona ended up agreeing with Olsen’s recommendation and awarded the bid.

> ***“I think that using all of the products together is a great benefit to the owner,” said Olsen. “If they ever have an issue, they only have one manufacturer to turn to for maintenance or warranties.”***

Another waterproofing product needed had to address positive-side below-grade waterproofing. This is when there is an over-excavated hole and the concrete is cast. The waterproofing is then applied from the backfill side of the hole.

Finally, there was also a large breezeway/walkway area that was positioned over the top of the basement. This received two different types of products including a hot-applied material and a cold-applied material.

All in all, the blindside product was PRECON®, the positive-side below-grade was MEL-ROL™, the hot-applied material was HRM 714, and the cold-applied material was HYDRALASTIC™ 836.

Tracy Smith and Henry Rocha, Vice President and Lead Installer, respectively, at Firestop Southwest, noted, “There are many factors that sets W. R. MEADOWS products apart from other competitors on the market—cost savings, ease of use, durability, and local warehousing. It’s a superior company. We have been in business for 18 years and using W. R. MEADOWS for 10 of those. We used so many different products with this project. And even though we have worked with other manufacturers, few compare to W. R. MEADOWS. [Their products] bond to anything you apply [them] to, and it is great with the Arizona heat.”

A Challenge Arises

The below-grade vertical walls presented the first issue. “The substrates were a little tough,” stated Rocha. “The concrete wasn’t done correctly so it had to be repaired and replaced before we could put the waterproofing down. But Greg was on site the entire time and helped tremendously.”

“It was the manufacturer’s approval process for warranties that was utilized here,” said Smith. “Greg assessed the substrate for warranty, and everything was remedied.”

Brent Elliott, a Superintendent for DPR Construction, was responsible for handling the foundation structure, air barrier, waterproofing, and anything that had to do with the exterior envelope of the building, also reflected on the situation.“It was a big job,” he said. “We had to pour the foundation walls and then had to cast in place elevated slabs that also needed to be poured. So, we had to run the waterproofing up the walls, which then had to tie back into the frame walls. We also had to tie in an existing basement. We had Greg come out and work with us on the strategy here. There was so much going on. From the waterproofing standpoint, it was probably the most technical project I have ever been involved with.”

All in all, Firestop Southwest had a crew of six on site over the course of about a year. There were multiple stages with what the company was involved in and note that Neundorfer’s experience definitely assisted in the process.

> ***“We have a long history with [Greg]. He has been our local rep for a very long time. We love to work with him and have an excellent partnership with him,” said Rocha.***

Firestop Southwest also says that there was a considerable time savings experienced by their team, which led to an overhead and cost reduction. “Workers understand how to use the [products] and can handle them well. PRECON is especially easy to use and install. And for an installer, time savings is a huge benefit in this regard—it goes beyond material cost alone. If we can do single source and not have to have multiple manufacturers involved, that is a great perk, too,” said Rocha.

“I have worked with W. R. MEADOWS before,” continued DPR’s Elliott. “However, it was the first time I worked with Greg. He was always attentive. If it was an emergency or we had a question that needed an immediate answer, he would address it quickly. We didn’t have to put the brakes on and hold up the whole project to wait for him to get back to us.”

The Exterior Façade

When it came to the air barrier installer on site, it was AK&J Sealants that was on the case. Brian Whited is a partner in the company and was the project manager for the University of Arizona's Bioscience Research Laboratory.

> ***"We have used W. R. MEADOWS air and vapor products—as well as their waterproofing products—on and off for several years now. The Air-Shield LMP is one of our go-to air and vapor products. So, when we were looking at the [U of A] project, that was the product that we referenced in order to price it," explained Whited. "I believe [W. R.] MEADOWS was actually our approved manufacturer in the spec when we put the pricing together."***

AK& J Sealants was responsible for installing the air barrier on the entire exterior façade of the building and had a crew of five workers at the site on average. The bulk of the façade was metal panel, but there was also some masonry and glass. The air barrier was set to be placed behind these exterior finishes.

"The normal LMP system is a 60-mils system," said Whited. "However, the specs for this project called for a 90-mils system. It was a bit 'beefier' than what AK&J usually handles. However, very few challenges were experienced, and frankly, the majority of issues that did occur were related to scheduling, the fast pace of the project, and the sheer number of people who were present at the site. [AK&J] had to be precise in our installation. There were masons and metalsmiths there who were also obviously wanting to keep to their own schedules and do their work. At the end of the day, any of the problems we experienced had nothing to do with W. R. MEADOWS. They delivered everything on time, and it was always high quality. We were happy with their product line and with the local support."

Whited went on to also say that working with Neundorfer was definitely a perk. The two regularly interacted and walked the jobsite together.

"The technical assistance he provides is why we feel like we have a good partner. We know we can reach out and ask questions and he is going to get back with us. That helps projects move forward," commends Whited.

The Man on Both Sides of the Job

If there is one person on this project who had one of the most comprehensive views while on site, it was Ryan Olsen. As stated, Olsen originally entered the project while working for Firestop Southwest. He then transitioned into a role with Field Verified—a third-party consultant. Now, instead of being charged with the installation of the waterproofing, he was responsible for observing and ensuring that the products were installed correctly and properly.

"I was on both sides of the fence here," said Olsen. "After I left Firestop and started with Field Verified, I ended up having to go over my recommendations and submittal of the W. R. MEADOWS products with my leadership. I discussed all of the reasons why these products were used. What's more is that instead of only overseeing the below-grade waterproofing, I was actually looking at the entire envelope, including the air and vapor barrier. At the end of the day, everything except the roof was sealed with W. R. MEADOWS products."

Further to consider, per Olsen, was the way all of the products tied together.

> ***"It was nice to see how the W. R. MEADOWS waterproofing products would tie in with the air barrier on the exterior walls—and many times in places that would normally prove difficult. The products were able to transition from one substrate to the next. We didn't have to worry about compatibility because W. R. MEADOWS had that covered," said Olsen.***

Ultimately, many times, when one is working on a jobsite, there may not be details on how to handle a unique situation in the installation process. If the manufacturer is not present, then it definitely can slow down the process as the contractors will need to get special approval before moving forward.

"If the manufacturer is on site and involved, then they can assist directly. This is what W. R. MEADOWS does," praises Olsen. "Now that I am a consultant, I can appreciate the field support. They are one of the leading manufacturers when it comes to customer service. They will come on site when one or more of their products are being installed and will talk with the people handling the products. They operate cross-functionally with everyone involved, make sure things are going smoothly, and offer help and knowledge."

Inspecting the Work

Finally, Mike Seal, of the University of Arizona, was the Senior Building Inspector assigned to the Bioresearch Laboratory. He handled all of the inspection related to structural, architectural, waterproofing, interior, exterior, and roofing.

"I inspected everything that had to do with the building," he confirmed.

He was present on site every day—sometimes for several hours or more. Seal has also worked with W. R. MEADOWS products in other University of Arizona projects.

"Once we got over the first couple of hurdles related to logistics, it was smooth sailing," Seal said. "We had good installers and a lot of access to product information."

Seal regularly interacted with Neundorfer as well as Olsen and performed varied forms of testing on both the waterproofing and air barriers. During all phases of the inspections that were conducted, Seal never ran into a situation where W. R. MEADOWS had to fix something. While there were times that the installer had to go back and apply more sealant because of transitions—it was never a state that could be attributed to a product defect.

> ***"We love MEADOWS," praised Seal. "They are fantastic. We have projects that go back with them 10 or 12 years, and we don't experience problems or failures. They are one of the top companies we use."***

The Bioscience Research Laboratory project was completed in late 2017. And indeed, the University of Arizona has been satisfied with the outcomes on this building. There have been no issues or reports of water intrusion on site.

Brent Elliott, of DPR Construction, confirms this point. "We are still working on campus—and are in and out of this building occasionally. There have been no issues."

A Study on Teamwork

"All around it was a successful project," said Neundorfer. "Everyone worked well together, from the general contractor on down. I like the whole team effort on this job. I was just so impressed with how we all worked together to get it done."

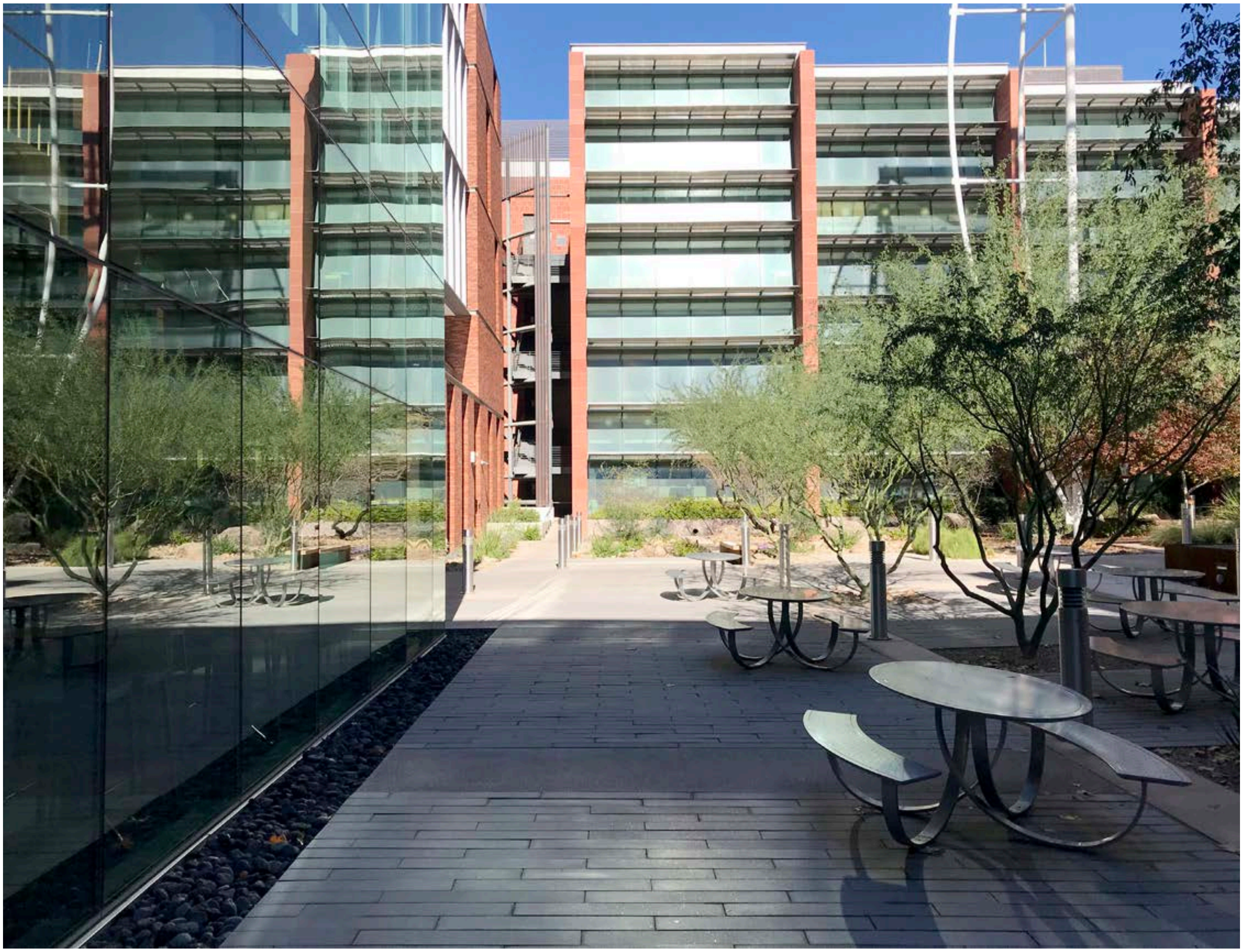
And the general contractor confirmed this point.

> ***"It was a very good dynamic with W. R. MEADOWS," said Elliott, "as well as with Field Verified, Firestop Southwest, DPR, AK&J, and the University of Arizona. The entire experi-ence was positive."***

In turn, because of this cooperation, the Bioscience Research Laboratory at the University of Arizona was able to open in March of 2018 and is currently pursuing its mission of bringing creative people together to advance knowledge, find solutions to medical challenges, and improve health outcomes for Arizonans.

PROJECT SPECS

Architect:	ZGF Architects, LLP
Contractor:	DPR Construction
Subcontractor:	Firestop Southwest
Salesperson:	Greg Neundorfer
Products:	BEM DETAIL FABRIC HRM 714 HYDRALASTIC 836 MEL-DRAIN PRECON
Scope:	140,000 square feet



About W. R. MEADOWS

Since 1926, W. R. MEADOWS has been a leader in developing products that protect structures from moisture infiltration. From below-grade installations to rooftops and in-between, issue-specific products target and prevent potential, costly problems. Today, patented technologies enable more environmentally effective, efficient designs, and many of our products contribute LEED-certification "green" credits. With nine manufacturing facilities throughout the U.S. and Canada, the materials you need are within easy reach. For additional information, call 800.342.5976 or visit www.wrmeadows.com.

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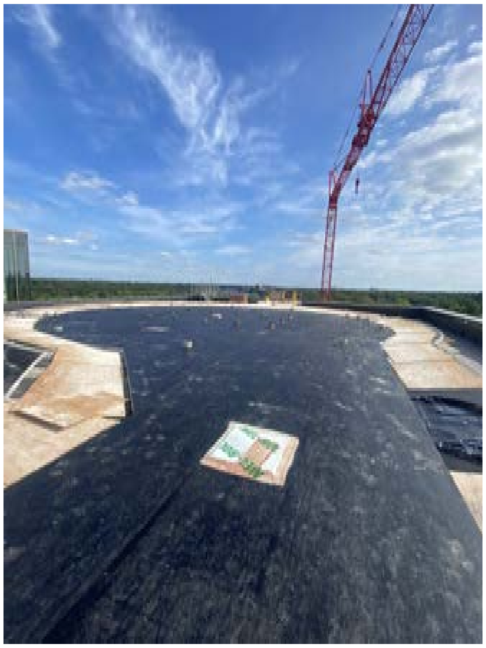

Project Name:	Centra Care St. Cloud Hospital Helipad	Product:	MEL-ROL® PROTECTION COURSE PC-2 MEL-PRIME™ POINTING MASTIC BEM
Location:	St. Cloud, Minnesota, USA		
Architect:	Meyer Borgman Johnson		
Contractor:	McGough Construction		
Subcontractor:	Henkemeyer Coatings		
Salesperson:	Mike Krulas	Scope:	11,000 square feet

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GOODYEAR, AZ / MILTON, ON / SHERWOOD PARK, AB

Project Name:	Joya Child and Family Development	Product:	MEL-ROL®
Location:	Spokane, WA, USA		MEL-DRAIN™ 5035
Architect:	NAC		BEM
Contractor:	RJ Construction Services	Scope:	41,000 square feet
Salesperson:	Bryon Allen		

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Project Name:	Ridgeline High School	Product:	MEL-ROL®
Location:	Spokane, Washington, USA		MEL-DRAIN™ 5035
Architect:	ALSC Architects		BEM
Contractor:	RJ Construction	Scope:	240,000 square feet
Salesperson:	Bryon Allen		

NO. 714-F **DATA SHEET**

MasterFormat: 07 13 00

JANUARY 2022
(Supersedes March 2021)

PRECON®

Pre-Applied/Underslab Waterproofing Membrane

DESCRIPTION

PRECON is a composite sheet membrane comprised of a non-woven fabric, elastomeric membrane, and W. R. MEADOWS' exclusive, patented PLASMATIC CORE (U.S. Patent No. 7,179,761). The PLASMATIC CORE is a seven-layer matrix designed for toughness and provides the lowest water vapor transmission (WVT) rating on the market. Once concrete is poured against PRECON and the concrete cures, a mechanical bond forms that secures the concrete to the membrane.

USES

PRECON is used as a blindside membrane in vertical applications where access to the positive side is limited. The membrane can also be used for horizontal applications for underslab waterproofing and vaporproofing.

FEATURES/BENEFITS

- Provides a waterproof seal between the membrane and poured concrete wall.
- Helps prevent moisture migration into the structure.
- Reduces methane and radon gas intrusion.

PACKAGING

4' (1.2 m) wide x 50' (15.2 m) long rolls, one roll per carton.

STORAGE AND HANDLING

Store membrane cartons on pallets and cover if left outside. Keep materials away from sparks and flames.

SPECIFICATIONS

- LARR Report 26023

APPLICATION

Surface Preparation ... Inspect all surfaces for any conditions detrimental to the proper completion of the work. Surfaces should be structurally sound. Remove debris or any other foreign material that could damage the membrane.

PRECON can be used with a caisson wall shoring system without the use of a drainage board, such as MEL-DRAIN™ from W. R. MEADOWS. W. R. MEADOWS recommends proper site drainage, but due to certain site conditions this sometimes cannot be done effectively. The decision to remove the drainage board should be at the discretion of the engineer. In situations where a drainage board is not applied, surface preparation is important. The substrate needs to be sound, solid, and smooth. Any gaps or voids >1" (25 mm) need to be grouted. When PRECON is used with MEL-DRAIN from W. R. MEADOWS, the system can bridge gaps <2" (50.8 mm). However, gaps >2" (50.8 mm) will need to be grouted.

Application Method ... PRECON may be applied at temperatures down to 40° F (5° C); however, in less-than-ideal environments or marginal conditions, consider the use of PRECON LOW TEMP below 60° F (16° C). PRECON LOW TEMP can be used in temperatures down to 25° F (-4° C). MEL-PRIME™ from W. R. MEADOWS should be used to enhance the bond at the selvedge edge when conditions warrant with both PRECON and PRECON LOW TEMP. Prior to application of the blindside membrane, attach MEL-DRAIN™ rolled matrix drainage system from W. R. MEADOWS to lagging or soil retention system.

In vertical applications of PRECON, mechanically attach with fasteners every 12" (304.8 mm) across the top, within ½" (13 mm) of the top edge of the membrane. Install the membrane with the fabric side facing toward the concrete pour.

Remove release paper on 6" (152.4 mm) overlap. Apply membrane and roll press into place with a tile type roller.

End Laps ... Overlap membrane 6" (152.4 mm). Prior to overlap, apply BEM, HYDRALASTIC 836, or MEL-ROL® LIQUID MEMBRANE (two-component) from W. R. MEADOWS in area to be lapped. Roll press membrane into BEM, HYDRALASTIC 836, or MEL-ROL LIQUID MEMBRANE. At terminations of membrane, apply BEM, HYDRALASTIC 836, or MEL-ROL LIQUID MEMBRANE 12" (304.8 mm) wide centered over the termination and while still wet, embed 12" (31 cm) wide DETAIL FABRIC into the HYDRALASTIC 836 or MEL-ROL LIQUID MEMBRANE and roll press into place. Ensure that DETAIL FABRIC is centered over the termination with 6" (152.4 mm) on each side of lap edge. Apply

CONTINUED ON THE REVERSE SIDE...

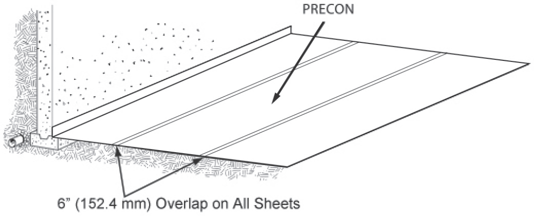
additional HYDRALASTIC 836 on all terminations of DETAIL FABRIC.

Additionally, the use of DETAIL TAPE H and DETAIL TAPE V from W. R. MEADOWS can be used in both horizontal and vertical end laps. View PRECON END LAP TAPING METHOD TECHNICAL BULLETIN available at www.wrmeadows.com for full information.

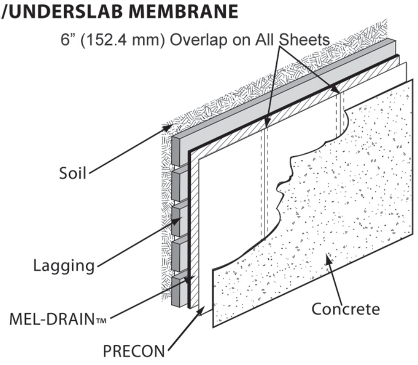
Penetrations and Protrusions ... Detail around all horizontal and vertical penetrations using BEM, HYDRALASTIC 836, or MEL-ROL LIQUID MEMBRANE (two-component) from W. R. MEADOWS. Apply BEM, HYDRALASTIC 836, or MEL-ROL LIQUID MEMBRANE by forming a fillet around the pipe or protrusion, overlapping the fabric side of PRECON and the protrusion a minimum of 2.5" (64 mm). If the gap between the protrusion and the membrane is greater than ½" (13 mm), apply DETAIL FABRIC over uncured BEM, HYDRALASTIC 836, or MEL-ROL LIQUID MEMBRANE. All penetration and protrusion surfaces must be clean, rust-free, and sound prior to application of BEM, HYDRALASTIC 836, or MEL-ROL LIQUID MEMBRANE.

*MEL-ROL LIQUID MEMBRANE is a two-component material, not to be confused with MEL-ROL LM.

PRECON
OVERLAP ILLUSTRATION



PRECON
BLINDSIDE/UNDERSLAB MEMBRANE



For horizontal applications involving a cluster of penetrations, consider the use of HYDRALASTIC 836. Prior to application of HYDRALASTIC 836, prepare the surfaces of the penetrations as above and provide a block out using 2' x 4' (.6 x 1.2 m) lumber or other in order to create a "pitch pan" area to receive HYDRALASTIC 836.

Patching ... Prior to pouring, inspect membrane for punctures or damage and repair as necessary with HYDRALASTIC 836 and/or DETAIL FABRIC. (BEM or MEL-ROL LIQUID MEMBRANE may be used in place of HYDRALASTIC 836.) In addition, ensure the membrane is free of standing water and has been cleaned of any deleterious materials that will affect the bond of the concrete to the membrane.

Underslab Application ... Refer to ACI 302.1R-04: Chapter 4 – Site Preparation and Placing Environment for subgrade preparation prior to PRECON placement.

PRECAUTIONS

Concrete should be poured within 60 days of membrane installation. For installations below 40° F (4° C), contact W. R. MEADOWS technical services. When using bar supports, use those with a flat bottom.

For CAD details, most recent data sheet, LEED information, and SDS, visit www.wrmeadows.com.

TECHNICAL DATA

Property	**Test Method**	**PRECON Results**
Thickness	ASTM D1000	73 mil (1.85 mm)
Low Temp Flexibility	ASTM D1970, 180° @ -20° F (-28.9° C)	Pass
Resistance to Hydrostatic Head	ASTM D5385-93	230' (70 m)
Elongation, Polymeric Membrane	ASTM D412-06	> 400%
Tensile Strength, Film	ASTM D882	9200 psi (63.4 MPa)
Crack Cycling	ASTM C836 @ -15° F (-26° C)	Pass
Puncture Resistance	ASTME 154	> 210 lb. (> 934 N)
Peel Adhesion to Concrete	ASTMD 903	10 lb./in (1754 N/m)
Moisture Vapor Transmission	ASTME 96B	0.0011 perms (0.0004 grains/ft.^{2}/hr) (0.007 gram/m^2/24 hr)
Resistance to Fungi in Soil	GSA-PBS 07115 – 16 Weeks	No Effect
Radon Transmittance (m/s)	k124/02/95	$<3.0 \times 10^{-9}$
Radon Coefficient (m2/s)	k124/02/95	$<5.6 \times 10^{-12}$

W. R. MEADOWS
SEALTIGHT®

SAFETY DATA SHEET

SECTION 1: PRODUCT AND COMPANY IDENTIFICATION

Product: **PRECON®** **Part Number: 5118050**
Manufacturer: **W. R. MEADOWS, INC.** **Address:** 300 Industrial Drive
Hampshire, Illinois 60140
Telephone: (847) 214-2100 In case of emergency, dial (800) 424-9300 (CHEMTREC)
Revision Date: 10/17/2019
Product Use: Waterproofing Membrane

SECTION 2: HAZARDS IDENTIFICATION/EXPOSURE LIMITS

HMIS	
|Health|	|0|
|Flammability|	|1|
|Reactivity|	|0|
|Personal Protection|	| |

Product is classified as non-hazardous per OSHA 1910.1200. PRECON is defined by OSHA as an "article." A manufactured item that is formed to a specific shape or design during manufacture that does not release or result in exposure to a hazardous chemical under normal use conditions.

SECTION 3: HAZARDS COMPONENTS

Chemical Name:	**CAS Number**	**% by Weight**	**SARA 313**	**Vapor Pressure (mm Hg@20°C)**	**LEL (@24°C)**
1. Petroleum Asphalt	8052-42-4	55-60	No	N/A	N/A

N/A = Not Applicable

Under the reporting requirements of Section 313 of Title III of the Superfund Amendments and Reauthorization Act of 1966 (SARA) and 40 CFR Part 372, chemicals listed on the 313 List (40 CFR Part 373.65) are identified under the heading "SARA 313."

SECTION 4: EMERGENCY AND FIRST AID PROCEDURES

EYE CONTACT: Not expected to be an exposure route.
SKIN CONTACT: Wash affected areas with soap and water if available
INHALATION: Not expected to be an exposure route.
INGESTION: Not expected to be an exposure source.
MOST IMPORTANT SYMPTOMS/EFFECTS, ACUTE AND CHRONIC: See Section Eleven for Symptoms/Effects.

SECTION 5: FIRE AND EXPLOSIVES HAZARDS

FLASHPOINT: Not applicable; product is a solid.
EXTINGUISHING MEDIA: Water fog, foam, dry chemical.
CHEMICAL/COMBUSTION HAZARDS: Oxides and compounds of nitrogen/sulfur.
PRECAUTIONS/PERSONAL PROTECTIVE EQUIPMENT: Avoid smoke inhalation. Use appropriate respiratory protection.

SECTION 6: ACCIDENTAL RELEASE MEASURES

SPILL OR LEAK PROCEDURES: Not applicable. Product is a solid.

SECTION 7: HANDLING AND STORAGE

SAFE HANDLING PROCEDURES: Avoid direct contact.
SAFE STORAGE: Prevent job-site damage.

SECTION 8: EXPOSURE CONTROLS/PERSONAL PROTECTION

	OSHA				**ACGIH**			
Chemical Name:	**PEL**	**PEL/CEILING**	**PEL/STEL**	**SKIN**	**TLV**	**TLV/CEILING**	**TLV/STEL**	**SKIN**
1. Petroleum Asphalt	5 mg/m^3*	N/E	N/E	No	0.5 mg/m^3*	N/E	N/E	N/E

N/E = Not Established ** = Asphalt Fumes*

ENGINEERING CONTROLS: None required under normal use conditions.
PERSONAL PROTECTIVE EQUIPMENT: Safety glasses, chemical resistant gloves.

SECTION 9: PHYSICAL AND CHEMICAL PROPERTIES

BOILING POINT: N/A
EVAPORATION RATE: N/A
WEIGHT PER GALLON: N/A
ODOR: None
FLASH POINT: See Section 5
VAPOR PRESSURE: N/D
PARTITION COEFFICENT: N/D
VISCOSITY: N/D

VAPOR DENSITY: N/A
pH LEVEL: N/A
PRODUCT APPEARANCE: Black Solid
ODOR THRESHOLD: N/D
FLAMMABILITY: See Section 5
RELATIVE DENSITY: N/D
AUTOIGNITION TEMPERATURE: N/D

% VOLATILE BY VOLUME: N/A
% VOLATILE BY WEIGHT: N/A
VOC CONTENT: N/A
MELTING/FREEZING POINT: N/D
UEL/LEL: N/D
SOLUBILITY: N/D
DECOMPOSITION TEMPERATURE: N/D

N/D: Not Determined

SAFETY DATA SHEET

Date of Preparation: 10/17/19 **Page 2 of 2** **5118050**

SECTION 10: STABILITY/REACTIVITY

STABILITY: Stable. **HAZARDOUS POLYMERIZATION:** Will not occur.

CONDITIONS AND MATERIALS TO AVOID: None recognized.

HAZARDOUS DECOMPOSITION PRODUCTS: None recognized.

SECTION 11: TOXICOLOGICAL INFORMATION

EYE CONTACT: Direct contact may cause mild irritation.

SKIN CONTACT: Direct contact may cause slight skin irritation.

INHALATION: Not anticipated to be an exposure route.

INGESTION: Not anticipated to be an exposure route.

SIGNS AND SYMPTOMS: Symptoms of eye irritation include tearing, reddening, and swelling. Symptoms of skin irritation include redness and swelling. Gastrointestinal irritation symptoms include nausea, vomiting, and abdominal discomfort.

AGGRAVATED MEDICAL CONDITIONS: None recognized.

OTHER HEALTH EFFECTS: None recognized.

SECTION 12: ECOLOGICAL INFORMATION

ECOTOXICITY: N/E **DEGRADABILITY:** N/E **BIOACCUMULATIVE POTENTIAL:** N/E

SOIL MOBILITY: N/E **OTHER ADVERSE EFFECTS:** None Recognized

SECTION 13: WASTE DISPOSAL INFORMATION

WASTE DISPOSAL INFORMATION: Product is classified as a non-hazardous waste.

SECTION 14: TRANSPORTATION INFORMATION

HAZARDOUS/NON-HAZARDOUS MATERIAL: Not regulated by DOT.

UN NUMBER: None. **HAZARD CLASS:** N/A **PACKING GROUP:** N/A

UN PROPER SHIPPING NAME: N/A

ENVIRONMENTAL HAZARDS: None recognized.

BULK TRANSPORTATION INFORMATION: None.

SPECIAL PRECAUTIONS: None.

SECTION 15: REGULATORY INFORMATION

OTHER REGULATORY CONSIDERATIONS: None recognized.

SECTION 16: OTHER INFORMATION

PREPARATION DATE: 10/17/2019

PREPARED BY: Dave Carey

GUIDE SPECIFICATION FOR PRECON®: PRE-APPLIED/UNDERSLAB WATERPROOFING MEMBRANE

SECTION 07 13 00

SHEET WATERPROOFING

Revision Date: December 20, 2019

Specifier Notes: This guide specification is written according to Construction Specifications Institute (CSI) MasterFormat. The section must be carefully reviewed and edited by the architect or engineer to meet the requirements of the project. Coordinate this section with other specification sections and the drawings.

Specifier Notes: PRECON is a composite sheet membrane comprised of elastomeric membrane bonded to W. R. MEADOWS®' exclusive plasmatic matrix and a non-woven geotextile fabric. Once concrete is poured against PRECON and the concrete cures, a mechanical bond forms that tightly and permanently secures the concrete to the membrane.

PRECON is used as a waterproofing membrane where vertical positive-side waterproofing is required but access to the positive side is impossible due to the soil retention system. The membrane can also be used for horizontal applications for underslab waterproofing and vaporproofing.

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Surface preparation.

B. Installation of a blindside sheet membrane.

1.02 RELATED SECTIONS

Specifier Notes: Edit the list of related sections as required for the project. List other sections dealing with work directly related to this section.

A. Section 03 30 00 – Cast-in-Place Concrete.

B. Section 07 13 26 – Self-Adhering Sheet Waterproofing.

C. Section 07 21 00 – Thermal Insulation.

D. Section 07 60 00 – Flashing and Sheet Metal.

E. Section 07 92 00 – Joint Sealants.

F. Section 31 50 00 – Excavation Support and Protection.

G. Section 33 46 00 – Subdrainage.

1.03 REFERENCES

A. ACI 302.1R.17 – Guide for Concrete Floor and Slab Construction.

B. ASTM C836 - Standard Specification for High Solids Content, Cold Liquid-Applied Elastomeric Waterproofing Membrane for Use with Separate Wearing Course.

C. ASTM D412-06: Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers - Tension.

D. ASTM D882: Standard Test Method for Tensile Properties of Thin Plastic Sheeting.

E. ASTM D903: Standard Test Method for Peel or Stripping Strength of Adhesive Bonds.

F. ASTM D1970-01 - Standard Specification for Self-Adhering Polymer Modified Bituminous Sheet Materials Used as Steep Roofing Underlayment for Ice Dam Protection.

G. ASTM D5385-93: Standard Test Method for Hydrostatic Pressure Resistance of Waterproofing Membranes.

H. ASTM E96 (Method B): Standard Test Methods for Water Vapor Transmission of Materials.

I. ASTM E154: Standard Test Methods for Water Vapor Retarders Used in Contact with Earth Under Concrete Slabs, on Walls, or as Ground Cover.

J. ASTM F2130: Standard Test Method for Measuring Repellency, Retention, and Penetration of Liquid Pesticide Formulation Through Protective Clothing Materials.

K. GSA-PBS 07115: General Services Administration, Public Building Service - Guide Specification for Elastomeric Waterproofing.

1.04 QUALITY ASSURANCE

A. Contractor will provide the proper equipment, manpower, and supervision at the jobsite to install the membrane in compliance with the project plans and specifications.

B. Installation must be carried out by an experienced contractor with an adequate number of skilled personnel, experienced in the application of the blindside membrane applications.

C. Maintain a record of the batch numbers of all materials supplied for this project.

1.05 PRE-CONSTRUCTION MEETING

A. Convene [one] [_____], week [____] prior to commencing work of this section, in accordance with Section 1.04 - Quality Assurance, meeting with manufacturer’s technical representative, general contractor and site engineer to review the installation procedures.

1.06 SUBMITTALS

A. Comply with Section 01 33 00 - Submittal Procedures.

B. Submit manufacturer's product data and application instructions.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to site in manufacturer's original, unopened containers and packaging, with labels clearly identifying product name and manufacturer.

B. Store materials in a clean, dry area in accordance with manufacturer's instructions.

C. Store adhesive at temperatures of 40° F (4.4° C) and above to facilitate handling.

D. Do not store at temperatures above 90° F (32° C) for extended periods.

E. Protect materials during handling and application to prevent damage or contamination.

1.08 ENVIRONMENTAL REQUIREMENTS

A. Product not intended for uses subject to abuse or permanent exposure to the elements.

B. Apply membrane when conditions are dry and rain is not imminent.

C. Ensure concrete is poured within 60 days of membrane application.

PART 2 PRODUCTS

2.01 MANUFACTURER

A. W. R. MEADOWS, INC., PO Box 338, Hampshire, Illinois 60140-0338. (800) 342-5976. (847) 683-4500. Fax (847) 683-4544. Website: www.wrmeadows.com.

2.02 MATERIALS

A. Blindside Waterproofing Membrane: 73 mil (1.85mm) thick, composite sheet membrane comprised of an elastomeric membrane bonded to a seven-ply plasmatic matrix and a non-woven geotextile fabric.
  1. Performance Based Spec: Blindside waterproofing membrane shall have the following properties as determined by laboratory testing:
    a. Membrane Thickness: 73 mil (1.85 mm)
    b. Low Temperature Flexibility, ASTM D1970: Pass
    c. Resistance to Hydrostatic Head, ASTM D5385-93: 230' (70 m)
    d. Elongation, ASTM D412-06: >400%
    e. Tensile Strength (film), ASTM D882: 9,200 psi (63.4 MPa)
    f. Crack Cycling, ASTM C836: Pass
    g. Puncture Resistance, ASTM E154: >210 lb. (>934 N)
    h. Peel Adhesion to Concrete, ASTM D903: 10 lb./in (1,754 N/m)
    i. Moisture Vapor Transmission, ASTM E96 (Method B): 0.0011 perms
    j. Resistance to Penetration by Pesticides, ASTM F2130, Percentage of Penetration: 0.0%
    k. Resistance to Fungi in Soil, GSA-PBS 07115 – 16 weeks: No Effect

  2. Proprietary Based Spec:
    a. PRECON Blindside/Underslab Waterproofing Membrane by W. R. MEADOWS.

Specifier Notes: For temperatures that are below 40° F (5° C), PRECON LOW TEMP must be used. This product can be applied at temperatures down to 25° F (-4° C) and this temperature must be maintained for a period of 24 hours prior and post application. If site conditions are marginal and conditions less than optimal, PRECON LOW TEMP can be considered below 60° F (16° C). W. R. MEADOWS has a low temperature application bulletin with specific installation instructions that needs to be followed.

2.03 ACCESSORIES

A. Rolled Matrix Drainage System: MEL-DRAIN™ by W. R. MEADOWS.

B. Liquid Membrane for Fastener Details:
  1. MEL-ROL® LIQUID MEMBRANE (two-component) by W. R. MEADOWS.
  2. BEM by W. R. MEADOWS.

C. Liquid Membrane for Overlap Detail: HYDRALASTIC™ 836 by W. R. MEADOWS.

Specifier Notes: HYDRALASTIC 836, MEL-ROL LIQUID MEMBRANE (two-component) and BEM (BUILDING ENVELOPE MEMBRANE) can be interchanged. It must be noted that HYDRALASTIC 836 and BEM can only be applied in temperatures above 30° F (-1° C). MEL-ROL LIQUID MEMBRANE may be used on end laps, penetrations and terminations down to 25° F (-4° C).

D. Detail Fabric for Terminations: DETAIL FABRIC by W. R. MEADOWS.

E. Detail Tape Adhesive: MEL-PRIME™ by W. R. MEADOWS.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine surfaces to receive membrane. Notify architect if surfaces are not acceptable. Do not begin surface preparation or installation until unacceptable conditions have been corrected.

3.02 SURFACE PREPARATION

A. Inspect all surfaces for any conditions detrimental to the proper completion of the work.

B. Ensures surfaces are structurally sound.

C. Remove debris or any other foreign material that could damage the membrane.

3.03 INSTALLATION

A. Vertical Application
1. Install the membrane with the fabric side facing the interior side of the form to receive the concrete.
2. Mechanically fasten membrane across the top lagging at 12” (310 mm) on center, ½” (12 mm) from the top, with fasteners approved by the manufacturer.
3. Apply liquid membrane over the areas where the fasteners have been attached and carry over the top edge.
4. Remove release paper on 6” (152.4 mm) factory edge.
5. Mechanically fasten membrane vertically, 24” (620 mm) on center, into the exposed factory edge of the membrane if vertical fastening is required.
6. Install subsequent sheet of membrane and overlap onto the 6” (152.4 mm) factory edge and roll press into place.
7. For end-to-end overlap, overlap membrane 6” (152.4 mm).
8. Apply liquid detail membrane in this area to be lapped and roll press membrane into this liquid detail membrane.
9. Apply liquid detail membrane at terminations of membrane, 12” (310 mm) wide centered over the termination.
10. Embed detail fabric into this wet liquid detail membrane centered over the termination, 6” (152.4 mm) on each side of lap edge, and roll press into place.
11. Apply additional liquid detail membrane on all terminations of detail fabric.
12. Inspect membrane prior to pouring of concrete for any punctures or damage.
13. Repair damaged areas as directed by the manufacturer.

B. Horizontal Application
1. Prepare subgrade prior to membrane application according to ACI 302.1R.17.
2. Ensure the fabric side of the membrane is facing up.
3. Remove release paper on 6” (152.4 mm) selvedge edge and overlap edges of additional sheet. Roll press into place.
4. For end-to-end overlap, overlap membrane 6” (152.4 mm).

5. Apply liquid detail membrane in this area to be lapped and roll press membrane into this liquid detail membrane.
6. Apply liquid detail membrane at terminations of membrane, 12” (310 mm) wide centered over the termination.
7. Embed detail fabric into this wet liquid detail membrane centered over the termination, 6” (152.4 mm) on each side of lap edge, and roll press into place.
8. Apply additional liquid detail membrane on all terminations of detail fabric.
9. Inspect membrane prior to pouring of concrete for any punctures or damage.
10. Repair damaged areas as directed by the manufacturer.

3.04 PROTECTION

A. Ensure membrane is not damaged prior to concrete pour.

B. Ensure concrete is poured within 60 days of membrane application.

END OF SECTION

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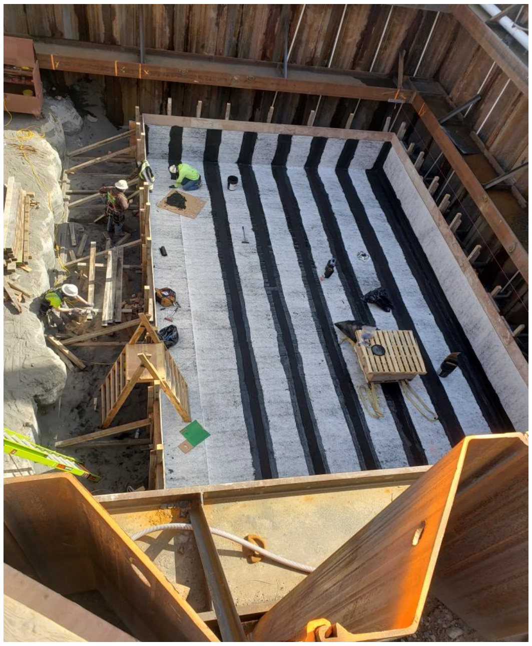

Project Name:	South Park Pump Station	Product:	PRECON®
Location:	Seattle, Washington, USA		MEL-ROL™
Architect:	Cardno		BEM
Contractor:	Pease & Sons Construction		HYDRALASTIC™ 836
Subcontractor:	Hunnicutt's		REINFORCING FABRIC HCR
Salesperson:	Bryon Allen	Scope:	35,000 square feet

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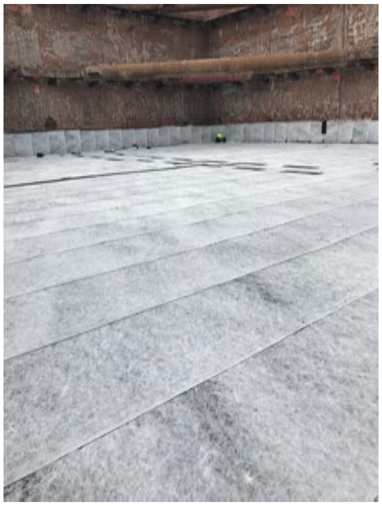

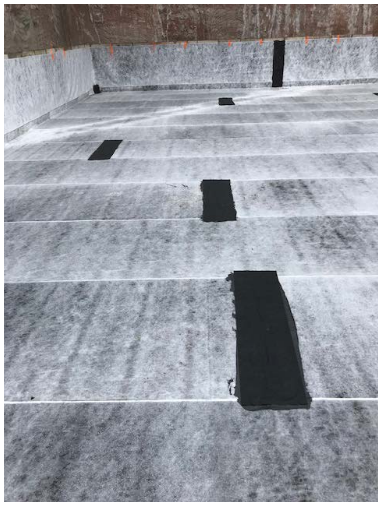

Project Name: York Street Pump Station
Location: Springfield, Massachusetts, USA
Architect: Kleinfelder
Stantec
Contractor: Daniel O'Connell's Sons
Subcontractor: Armani Restoration, Inc.
Salesperson: Anthony Oropallo
Scope: 10,000 square feet

Product:
AIR-SHIELD™ LMP
BEM
HYDRALASTIC™ 836
HYDRALASTIC 836 SL
MEL-DRAIN™ 5035-B
MEL-ROL®
PRECON®
PROTECTION COURSE
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Project:	HUB 4 Tucson Off-Campus Student Housing	Products:	PRECON®
Location:	Tucson, Arizona, USA		HYDRALASTIC™ 836
Architect:	Antunovich Associates		MEL-DRAIN™ 5035
Contractor:	J.H. Fidorff & Son, Inc.		BEM
Salesperson:	Greg Neundorfer	Scope:	18,000 square feet

PRECON®

Pre-Applied/Underslab Waterproofing Membrane

A cost-effective, fully bonded solution for blindside or pre-applied waterproofing applications

Waterproofing is not a one-size-fits-all proposition. That's why **W. R. MEADOWS** offers an entire family of products to address different requirements – including **PRECON**, a cost-effective solution for difficult blindside or pre-applied applications.

PRECON is comprised of a non-woven fabric, elastomeric membrane and **W. R. MEADOWS'** exclusive, patented plasmatic core (U.S. Patent No. 7,179,761). The plasmatic core is a seven-layer matrix designed for toughness and provides the lowest water vapor transmission (WVT) rating on the market. Designed to provide a waterproof seal between the membrane and poured concrete, **PRECON** also:

- Reduces methane and radon gas intrusion.
- Forms a mechanical bond between the membrane and the concrete as it cures.
- Serves as a blindside membrane in vertical applications where access to the positive side is limited.
- May be used for horizontal applications for underslab waterproofing and vaporproofing

Need more innovative waterproofing solutions? Visit **www.wrmeadows.com** or call **1-800-342-5976**.

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INSTALLATION GUIDELINES
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This document has been created as an addendum to our PRECON technical data sheet to provide information regarding the application of PRECON waterproofing/vaporproofing membrane when installed up against a soil retention system in a blindside application. Following are the typical installation instructions recommended by W. R. MEADOWS. It is important to review each application as there may be situations that may require this procedure to be modified based on the project requirements. If this situation arises, please contact W. R. MEADOWS technical service.

PRODUCTS REQUIRED

- PRECON waterproofing/vaporproofing membrane: composite sheet membrane comprised of a non-woven fabric, elastomeric membrane, and W. R. MEADOWS' patented plasmatic core.
- HYDRALASTIC 836: cold-applied, solvent-free, single-component waterproofing compound used for detailing of PRECON at end laps, penetrations, and repairs.
- BEM: one-component, cold-applied, non-slump waterproofing material that can be used as an alternate to HYDRALASTIC 836.
- MEL-ROL LIQUID MEMBRANE (two-component): two component, 100% solids, cold-applied, non-slump waterproofing material that can be used as an alternate to HYDRALASTIC 836 and is recommended for low temperature installations of PRECON LOW TEMP.
- DETAIL FABRIC: polypropylene, staple fiber, needle-punched, non-woven geotextile fabric used for end laps and penetration details.
- WATERSTOP EC: regular version waterstop containing bentonite.
- WATERSTOP EC PLUS: combination of hydrophilic rubber and bentonite for use in applications below the water table.
- CLAY-TITE™ MASTIC: used for adhesion of the WATERSTOP EC or WATERSTOP EC PLUS.
- MEL-DRAIN™ drainage board: dimple-raised, molded polystyrene sheet bonded to high strength polypropylene fabric.
- MEL-DRAIN TOTAL-DRAIN™: Prefabricated strip drain consisting of molded polystyrene sheet bonded to high strength polypropylene fabric.
- TERMINATION BAR: high strength plastic strip designed to support PRECON and MEL-DRAIN at the top of wall termination point.
- FASTENERS: Flat-headed steel fasteners with washers are recommended. Must be appropriate for the substrate.

LIMITATIONS

- Concrete should be poured within 60 days of membrane installation.
- PRECON may be applied at temperatures down to 40° F (5° C); however, in less than ideal environments or marginal conditions, consider the use of PRECON LOW TEMP below 60° F (16° C). PRECON LOW TEMP can be used in temperatures down to 25° F (-4° C). Please refer to the PRECON COLD WEATHER APPLICATION TECHNICAL BULLETIN for proper installation procedures.
- Prior to the concrete pour, any ponded water, dirt, or debris that has accumulated on PRECON needs to be removed as this could affect the bond of PRECON to the concrete.

- In situations where there is water accumulation behind the membrane during installation, the presence of this water may inhibit proper bond formation at the edge and end laps due to the stress resulting from the constant hydrostatic pressure exerted by this water.
- Care needs to be taken in high temperature installation situations, as softening of the elastomeric membrane could occur causing sagging.

STORAGE

- Store materials in a clean, dry area in accordance with manufacturer's instructions.
- Store membrane cartons on pallets and cover if left outside. Keep materials away from sparks and flames.
- Store adhesive at temperatures of 40° F (4.4° C) and above to facilitate handling.
- Do not store at temperatures above 90° F (32° C) for extended periods.

SUBSTRATE PREPARATION

Blindside applications are very challenging which includes the substrate upon which the membrane is installed. There are several types of soil retention systems designed to retain the earth. All of these have their own challenges in installation and preparation prior to installation of the PRECON waterproofing system. Several common shoring wall construction techniques include h-piles and timber lagging, corrugated sheet piles, rock, auger cast caissons, and even cement stabilized soil.

For proper performance of the membrane, it is essential that the surface be addressed to ensure that the membrane is not damaged and will adhere fully to the concrete once poured in place. Overlooking this will allow for water intrusion into the structure.

Regardless of the type of soil retention system, all preparation work is similar and is required to provide a monolithic substrate surface upon which the waterproofing can be installed without damage during installation and concrete placement.

W. R. MEADOWS recommends the use of MEL-DRAIN drainage board for all installations of PRECON, but due to certain site conditions and project requirements, this sometimes cannot be done effectively. The decision to remove the drainage board should be at the discretion of the engineer. In situations where a drainage board is not applied, surface preparation is even more important.

Due to the wide variety of these substrates and their conditions, it is recommended to contact your local W. R. MEADOWS technical representative for any questions prior to installation of PRECON. Following are some standard guidelines for surface preparation:

WOOD LAGGING WITH STEEL PILES:

1. Be sure all lagging board nails are pounded flush or removed.
2. Remove all sharp protrusions, mud, debris, ice, or any other materials that will affect the membrane's performance.
3. Fill or cover any irregularities and voids between lagging board exceeding 1" (25 mm) using spray foam, concrete grout, patching mortar, rigid insulation, or treated plywood to provide a sound substrate.

CAISSONS:

1. If the augered caissons are smooth, PRECON can be installed directly onto the caissons. Any sharp protrusions need to be removed. For the depressed areas between each pile, this area must be filled with a concrete grout prior to PRECON installation.

2. If the augered caissons are rough and irregular, a minimum ¾" (19.1 mm) pressure-treated plywood must be installed. The void behind the plywood at the depressed areas shall be filled with sand, aggregate, or grout to provide a solid substrate for PRECON installation. Plywood selection and installation shall be determined by the project engineer.

SHEET PILING:

1. In areas where PRECON is to be in direct contact with the steel piling, all sharp protrustions need to be removed.
2. In areas where the PRECON is to span the sheet piling, a minimum ¾" (19.1 mm) pressure-treated plywood must be installed. The void behind the plywood at the depressed areas shall be filled with sand, aggregate, or grout to provide a solid substrate for PRECON installation. Plywood selection and installation shall be determined by the project engineer.

SHOTCRETE:

1. Remove all sharp protrusions, mud, debris, ice, or any other materials that will affect the membrane's performance.
2. Fill or cover any voids or irregularities exceeding 1" (25 mm) using a concrete grout or patching mortar.

SLURRY WALL:

1. Remove all sharp protrusions, mud, debris, ice, or any other materials that will affect the membrane's performance.
2. Fill or cover any voids or irregularities exceeding 1" (25 mm) using a concrete grout or patching mortar.

NOTE: For all substrates, if using MEL-DRAIN drainage board prior to PRECON installation, a void of 2" (50 mm) is acceptable.

DETAILING

PENETRATIONS:

1. All penetrations and protrusion surfaces are to be prepared ensuring that all surfaces are clean, rust-free and sound.
2. Ensure that small penetrations, such as nails and fasteners, fully cover the fastener with HYDRALASTIC 836.
3. Larger penetrations:
   a. Apply HYDRALASTIC 836 onto the fabric face of pre-installed PRECON and the penetration a minimum of 2 ½" (64 mm) in all directions.
   b. Form a fillet or cove around the base of the penetration to aid in the transition. Application thickness of this HYDRALASTIC 836 should be 60 mils.
   c. Embed DETAIL FABRIC into the HYDRALASTIC 836 and press into place, ensuring that the DETAIL FABRIC has been fully wetted out with the HYDRALASTIC 836.

TIEBACKS/SOIL NAILS:

1. Install the PRECON waterproofing membrane up to the tieback as close as possible.
2. Apply HYDRALASTIC 836 onto the fabric face of pre-installed PRECON a minimum of 2 ½" (64 mm) in all directions. Form a fillet or cove around the base to aid in the transition.
3. Fully coat the tieback with HYDRALASTIC 836. Application thickness of this HYDRALASTIC 836 should be 60 mils.
4. Embed DETAIL FABRIC into the HYDRALASTIC 836 and press into place, ensuring that the DETAIL FABRIC has been fully wetted out with the HYDRALASTIC 836. This should fully encase the tieback.

INSTALLATION GUIDELINES
PRECON®

CONSTRUCTION JOINTS:

1. Install WATERSTOP EC a minimum of 2" (50 mm) from face of wall.
2. Prior to installation, apply CLAY-TITE MASTIC in all areas to receive WATERSTOP EC or WATERSTOP EC PLUS (below water table). This is used as an adhesive to hold the waterstop in place along with the fasteners.
3. Remove release paper to expose adhesive on WATERSTOP EC.
4. Fasten with nails and washers every 12" (300 mm) O.C.
5. For subsequent applications of WATERSTOP EC, butt ends of waterstop together to ensure continuity.

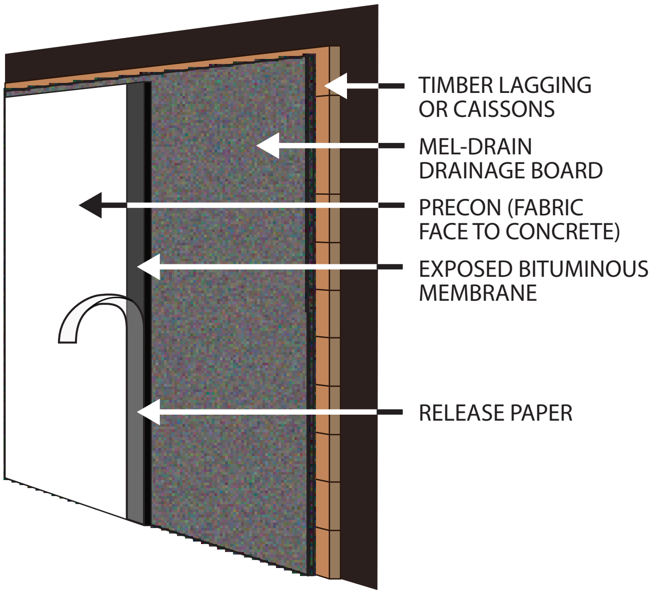
MEMBRANE INSTALLATION

1. Mechanically fasten membrane across the top lagging at 12" (300 mm) on center, ½" (12 mm) from the top, with fasteners and termination bar approved by the manufacturer.
2. Ensure that the fabric side of the membrane is facing the interior side of the installation. This is the side that the concrete is to be poured against.
3. Apply HYDRALASTIC 836 over the areas where the fasteners have been attached.
4. If fasteners are required vertically, install at 24" (600 mm) O.C. in the factory edge of the membrane prior to overlap of subsequent sheet. These fasteners do not need any additional detailing.
5. Any fasteners to be installed in the field of the membrane need to be detailed with HYDRALASTIC 836, fully encasing the fastener.

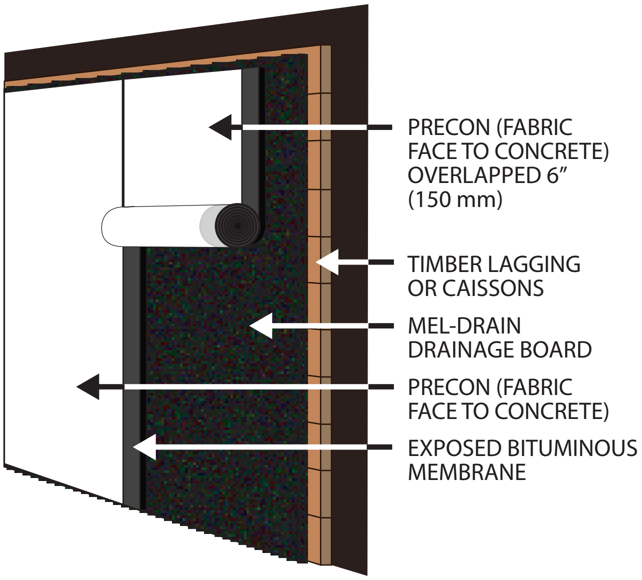
END LAPS/FACTORY EDGE:

FACTORY EDGE

1. Remove release paper on 6" (150 mm) factory edge exposing the bituminous membrane.



2. Overlap the edge of the subsequent sheet. Roll press into place to ensure good adhesion.



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INSTALLATION GUIDELINES
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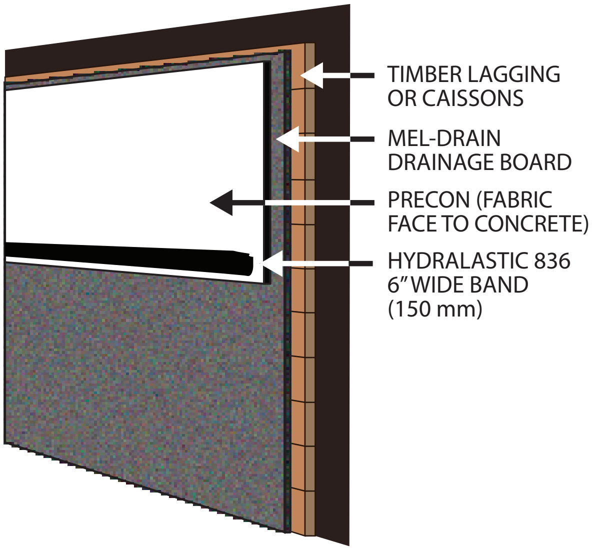
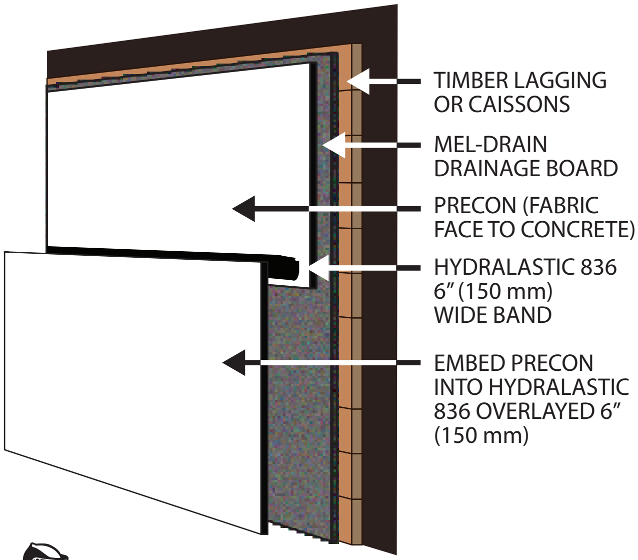
END LAP

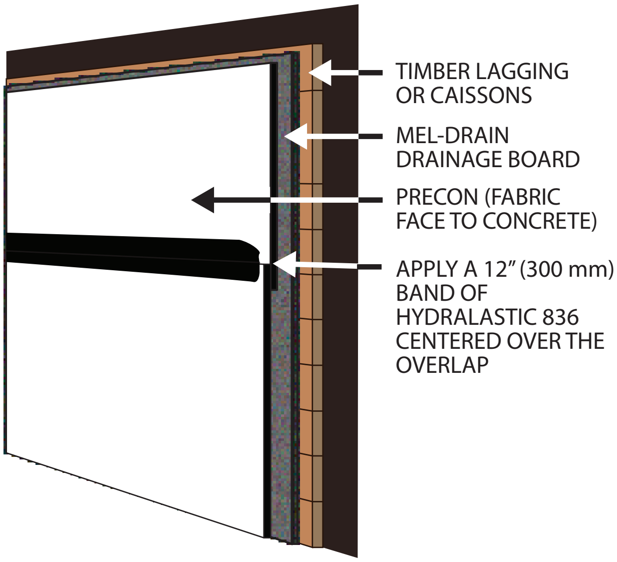
1. Apply HYDRALASTIC 836 in a 6" (150 mm) band onto the fabric face of the PRECON area to be overlapped at approximately 60 mils thickness.



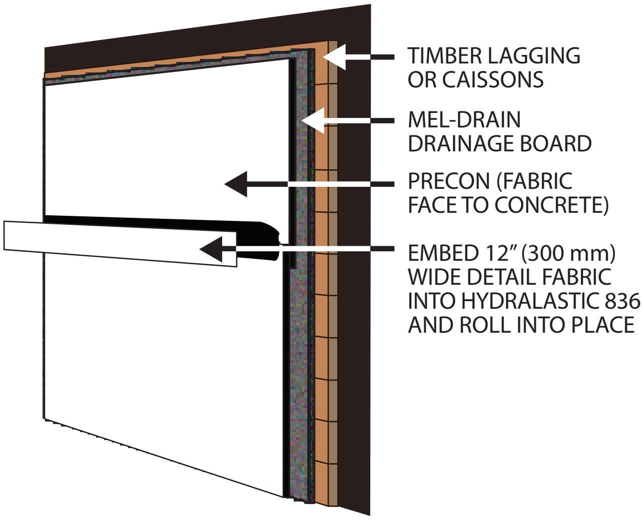
2. Overlap this area with the subsequent sheet of PRECON and roll press into place.



3. Apply HYDRALASTIC 836 in a 12" (300 mm) band centered over the lap edge and while still wet, embed 12" (300 mm) wide DETAIL FABRIC into the HYDRALASTIC 836.



4. Ensure that DETAIL FABRIC is centered over the termination with 6" (150 mm) on each side of lap edge. Press DETAIL FABRIC into place to ensure that the HYDRALASTIC 836 has fully wetted out the fabric.



INSTALLATION GUIDELINES
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REPAIRS

1. Small Punctures [1/2" (12.7 mm) or less]
    a. Apply HYDRALASTIC 836 over the damaged area.
2. Punctures ½" to 1" (12.7 - 25.4 mm)
    a. Apply HYDRALASTIC 836 over the damaged area extending onto PRECON.
    b. Embed a piece of DETAIL FABRIC into the wet HYDRALASTIC 836.
3. Damaged areas greater than 1" (25.4 mm)
    a. Remove the damaged portion of PRECON.
    b. Apply HYDRALASTIC 836 in a 6" (150 mm) band onto the fabric face of the PRECON area to be lapped at approximately 60 mils thickness.
    c. Install a piece of PRECON extending 6" (300 mm) from the damaged area in all directions and embed into the wet HYDRALASTIC 836. Mechanically fasten to hold into place.
    d. Apply HYDRALASTIC 836 in a 12" (300 mm) band centered over the termination and while still wet, embed 12" (300 mm) wide DETAIL FABRIC into the HYDRALASTIC 836.
    e. Ensure that DETAIL FABRIC is centered over the termination with 6" (150 mm) on each side of lap edge. Press DETAIL FABRIC into place to ensure that the HYDRALASTIC 836 has fully wetted out the fabric.

INSPECTION AND PROTECTION

1. Inspect membrane prior to pouring of concrete for any punctures or damage and repair as above.
2. Protect PRECON from other trades prior to concrete placement.
3. Concrete is required to be poured within 60 days of PRECON installation.

INSTALLATION GUIDELINES
PRECON® HORIZONTAL APPLICATION

This document has been created as an addendum to our PRECON technical data sheet to provide information regarding the application of PRECON waterproofing/vaporproofing membrane in a horizontal application. Following are the typical installation instructions recommended by W. R. MEADOWS. It is important to review each application as there may be situations that may require this procedure to be modified based on the project requirements. If this situation arises, please contact W. R. MEADOWS technical service.

PRODUCTS REQUIRED

- PRECON waterproofing/vaporproofing membrane: composite sheet membrane comprised of a nonwoven fabric, elastomeric membrane, and W. R. MEADOWS' patented plasmatic core.
- HYDRALASTIC 836: cold-applied, solvent-free, single-component waterproofing compound used for detailing of PRECON at end laps, penetrations, and repairs.
- BEM: one-component, cold-applied, non-slump waterproofing material that can be used as an alternate to HYDRALASTIC 836.
- MEL-ROL LIQUID MEMBRANE (two-component): two component, 100% solids, cold-applied, non-slump waterproofing material that can be used as an alternate to HYDRALASTIC 836 and is recommended for low temperature installations of PRECON LOW TEMP.
- DETAIL FABRIC: polypropylene, staple fiber, needlepunched, non-woven geotextile fabric used for end laps and penetration details.

LIMITATIONS

- Concrete should be poured within 60 days of membrane installation.
- PRECON may be applied at temperatures down to 40° F (5° C); however, in less than ideal environments or marginal conditions, consider the use of PRECON LOW TEMP below 60° F (16° C). PRECON LOW TEMP can be used in temperatures down to 25° F (-4° C). Please refer to the PRECON COLD WEATHER APPLICATION TECHNICAL BULLETIN for proper installation procedures.
- Prior to the concrete pour, any ponded water, dirt, or debris that has accumulated on PRECON needs to be removed as this could affect the bond of PRECON to the concrete.
- In situations where there is water accumulation behind the membrane during installation, the presence of this water may inhibit proper bond formation at the edge and end laps due to the stress resulting from the constant hydrostatic pressure exerted by this water.
- Care needs to be taken in high temperature installation situations, as softening of the elastomeric membrane could occur causing sagging.

06/10/20

INSTALLATION GUIDELINES
PRECON® HORIZONTAL APPLICATION

STORAGE

- Store materials in a clean, dry area in accordance with manufacturer's instructions.
- Store membrane cartons on pallets and cover if left outside. Keep materials away from sparks and flames.
- Store adhesive at temperatures of 40° F (4.4° C) and above to facilitate handling.
- Do not store at temperatures above 90° F (32° C) for extended periods.

APPLICATION

SURFACE PREPARATION

Inspect all surfaces for any conditions detrimental to the proper completion of the work. Surfaces should be structurally sound. Remove debris or any other foreign material that could damage the membrane.

APPLICATION METHOD

Install PRECON membrane with the fabric side facing towards the concrete floor. Place subsequent rolls of PRECON with a 6″ (152.4 mm) overlap. Remove release paper and roll press into place with a tile type roller.

When a horizontal application meets a vertical application, ensure this overlap is a minimum of 1' (.3 m) from the base of the wall. Follow the end lap detailing instructions to address the overlap in this area.

END LAPS

Overlap membrane 6″ (152.4 mm). Prior to overlap, apply BEM, HYDRALASTIC 836, or MEL-ROL® LIQUID MEMBRANE* (two-component) from W. R. MEADOWS in area to be lapped. Roll press membrane into BEM, HYDRALASTIC 836, or MEL-ROL LIQUID MEMBRANE.

Apply BEM, HYDRALASTIC 836, or MEL-ROL LIQUID MEMBRANE 12″ (304.8 mm) wide centered over the termination and while still wet, embed 12″ (31 cm) wide DETAIL FABRIC into the HYDRALASTIC 836 or MEL-ROL LIQUID MEMBRANE and roll press into place. Ensure that DETAIL FABRIC is centered over the termination with 6″ (152.4 mm) on each side of lap edge. Apply additional HYDRALASTIC 836 on all terminations of DETAIL FABRIC.

INSTALLATION GUIDELINES
PRECON® HORIZONTAL APPLICATION

PENETRATIONS AND PROTRUSIONS

Detail around all penetrations using BEM or MEL-ROL LIQUID MEMBRANE (two-component) from W. R. MEADOWS. Apply BEM or MEL-ROL LIQUID MEMBRANE by forming a fillet around the pipe or protrusion, overlapping the fabric side of PRECON and the protrusion a minimum of 2.5″ (64 mm). If the gap between the protrusion and the membrane is greater than ½” (13 mm), apply PRECON FABRIC TAPE over uncured BEM or MEL-ROL LIQUID MEMBRANE. All penetration and protrusion surfaces must be clean, rust-free, and sound prior to application of BEM or MEL-ROL LIQUID MEMBRANE.

*MEL-ROL LIQUID MEMBRANE is a two-component material, not to be confused with MEL-ROL LM.

For horizontal applications involving a cluster of penetrations, consider the use of HYDRALASTIC 836. Prior to application of HYDRALASTIC 836, prepare the surfaces of the penetrations as above and provide a block out using 2′ x 4′ (.6 x 1.2 m) lumber or other in order to create a “pitch pan” area to receive HYDRALASTIC 836.

PATCHING REPAIRS

SMALL PUNCTURES 1/2” (12.7 MM) OR LESS

- Apply HYDRALASTIC 836 over the damaged area.

PUNCTURES 1/2” TO 1” (12.7 - 25.4 MM) OR LESS

- Apply HYDRALASTIC 836 over the damaged area extending onto PRECON.
- Embed a piece of DETAIL FABIR into the wet HYDRALASTIC 836.

DAMAGED AREAS GREATER THAN 1” (25.4 MM)

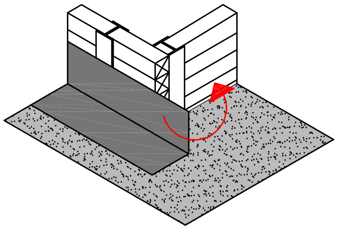
- Remove the damaged portion of PRECON.
- Apply HYDRALASTIC 836 in a 6” (150 mm) band onto the fabric face of the PRECON area to be lapped at approximately 60 mils thickness.
- Install a piece of PRECON extending 6” (300 mm) from the damaged area in all directions and embed into the wet HYDRALASTIC 836. Mechanically fasten to hold into place.
- Apply HYDRALASTIC 836 in a 12” (300 mm) band centered over the termination and while still wet, embed 12” (300 mm) wide DETAIL FABRIC into the HYDRALASTIC 836.
- Ensure that DETAIL FABRIC is centered over the termination with 6” (150 mm) on each side of lap edge. Press DETAIL FABRIC into place to ensure that the HYDRALASTIC 836 has fully wetted out the fabric.

UNDERSLAB APPLICATION

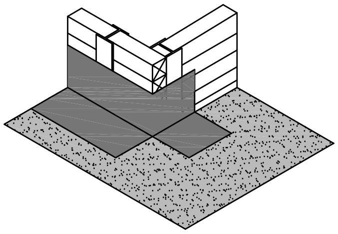
Refer to ACI 302.1R-04: Chapter 4 – Site Preparation and Placing Environment for sub-grade preparation prior to PRECON placement.

INSTALLATION INSTRUCTIONS
PRECON®

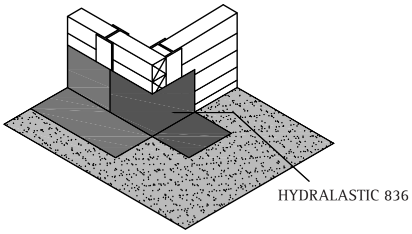
OUTSIDE CORNER INSTALLATION INSTRUCTIONS



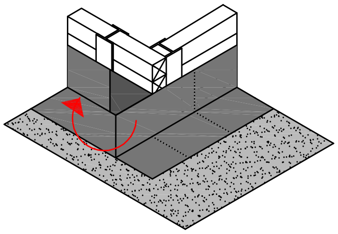
1. Install PRECON according to installation instructions onto soil stabilization system. Allow a minimum of 12” overlap to extend around outside corner.



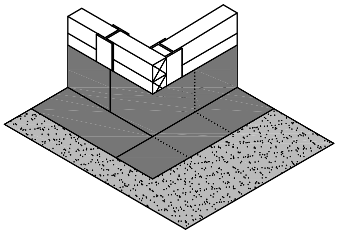
2. Cut PRECON on the horizontal to allow for ease of bending around corner and mechanically fasten according to installation instructions.



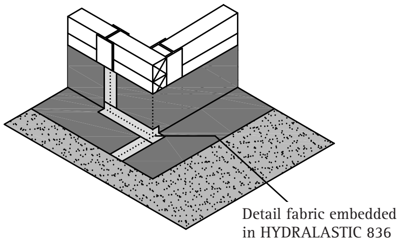
3. Apply HYDRALASTIC 836 to all overlap areas of PRECON that will be accepting the subsequent sheet of PRECON.



4. Install overlapping PRECON according to installation instructions onto soil stabilization system. Cut PRECON on the horizontal to allow for ease of bending around corner.



5. Embed overlaps into pre-applied HYDRALASTIC 836 and roll press into place.



6. Apply HYDRALASTIC 836 at all overlapping joints in a 12” wide application and then fully embed detail fabric into this HYDRALASTIC 836. Terminate all edges with additional HYDRALASTIC 836.

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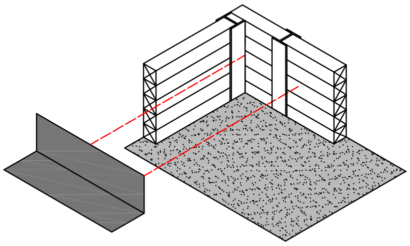
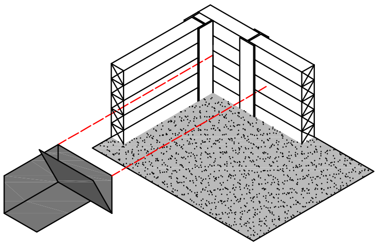
INSTALLATION INSTRUCTIONS
PRECON®

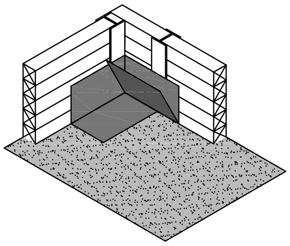
INSIDE CORNER INSTALLATION INSTRUCTIONS



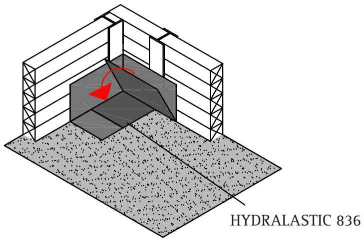
1. Install PRECON according to installation instructions onto soil stabilization system.



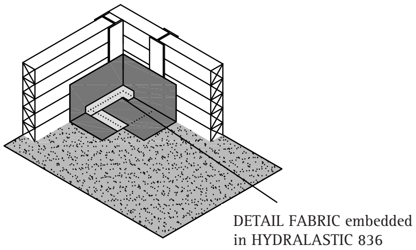
2. Cut PRECON on the horizontal to allow for ease of bending around corner.



3. Mechanically fasten according to installation instructions.



4. Apply HYDRALASTIC 836 to the area of PRECON that will be accepting the PRECON overlap, fold down overlap and embed in the HYDRALASTIC 836. Roll press into place.



5. Apply HYDRALASTIC 836 at all overlapping joints in a 12" wide application and then fully embed DETAIL FABRIC into this HYDRALASTIC 836. Terminate all edges with additional HYDRALASTIC 836.

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12/16/13

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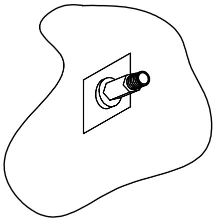
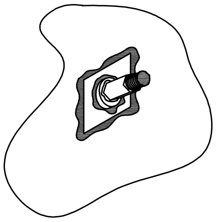
INSTALLATION INSTRUCTIONS
PRECON® SOIL NAIL

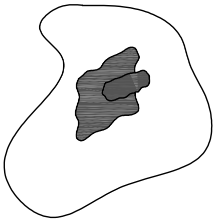
INSTALLATION INSTRUCTIONS



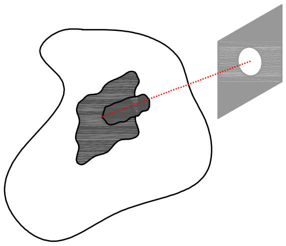
1. Ensure soil nail is clean and clear of any contaminants that could be detrimental to the bond of the HYDRALASTIC 836.



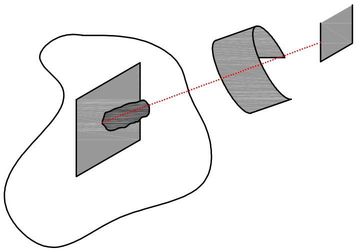
2. Apply BEM around all edges of the soil nail plate and all areas around the nut.



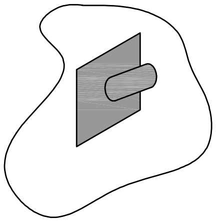
3. Apply HYDRALASTIC 836 over complete soil nail and plate, totally covering the area of the soil nail.



4. Cut a piece of DETAIL FABRIC to the dimensions of the soil nail plate and embed the fabric into the previously applied HYDRALASTIC 836.



5. Cut another two pieces of DETAIL FABRIC, one for the shaft of the soil nail, the other for the top, and embed this fabric into the previously applied HYDRALASTIC 836.



6. Ensure the soil nail is totally encapsulated in the HYDRALASTIC 836 and DETAIL FABRIC prior to application of PRECON blindside membrane.

* Installation guidelines does not show installation of MEL-DRAIN™ or PRECON for ease of viewing each step. Refer to W. R. MEADOWS installation instructions or Technical Services for complete instructions.

TECHNICAL BULLETIN

PRECON® COLD WEATHER APPLICATION

W. R. MEADOWS has developed a low-temperature version of PRECON for applications below 40° F (5° C). The minimum ambient and substrate temperature for PRECON LOW TEMP is 25° F (-4° C).

PRECON LOW TEMP and any accessory products must be stored in their original, unopened packaging at temperatures above 40° F (5° C). For optimal performance, store materials at temperatures at or near room temperatures until just prior to application.

Installation of PRECON LOW TEMP should not occur in the presence of rain, snow or ice, or if there is any ponded water as a result of melting. The presence of water on the membrane during its installation will prevent the proper adhesion of the joints. Certain environmental conditions may cause the formation of dew on the plasmatic core, which could impede the bond at the selvage edge. This may occur at temperatures above or below 40° F (5° C) and will necessitate the use of MEL-PRIME (solvent-based versions) on the selvage edge to insure a good bond at the seams.

Concrete placement should be completed within 60 days of the installation of the PRECON LOW TEMP and it is recommended it be done as soon as possible to prevent damage to the membrane. After installation, the membrane should be protected from damage.

During installation of PRECON LOW TEMP at lower temperatures and under certain environmental conditions, additional steps in the installation need to be followed to ensure that proper adhesion of the joints and overlaps is obtained.

1. MEL-PRIME (solvent-based versions) is required to be used at all factory edge joints. MEL-PRIME is to be applied at a width of 6" (152.4 mm) and allowed to dry prior to overlap of the adjoining sheet of PRECON. Following this, all areas of this overlap need to be pressure rolled for proper adhesion.
2. For optimum performance, HYDRALASTIC 836 or MEL-ROL® LIQUID MEMBRANE (two-component) are to be used for all end lap details and terminations. The procedure is as follows:
   a. Apply HYDRALASTIC 836 or MEL-ROL LIQUID MEMBRANE (two-component) in the area to be lapped at a width of 3" (7.6 cm) and roll press the overlapping PRECON while still wet.

   b. Apply HYDRALASTIC 836 or MEL-ROL LIQUID MEMBRANE (two-component) at the termination of this overlapping sheet 12" (30 cm) wide centered over the termination.

   c. While the HYDRALASTIC 836 or MEL-ROL LIQUID MEMBRANE (two-component) is still wet, embed 12" (30 cm) wide strip of PRECON and roll press into place. Then place DETAIL FABRIC from W. R. MEADOWS centered over the termination with 6" (152.44 mm) on each side of lap edge.

   d. Apply additional HYDRALASTIC 836 or MEL-ROL LIQUID MEMBRANE (two-component) on all terminations of the DETAIL FABRIC.

Please note that HYDRALASTIC 836 can only be applied in temperatures above 30° F (-1° C). MEL-ROL LIQUID MEMBRANE (two-component) may be used on end laps, penetrations and terminations down to 25° F (-4° C).

3. Prior to placement of the concrete, ensure that the substrate is clean, dry and frost-free. The temperature of the membrane at time of concrete placement needs to be above 40° F (5° C).

It is important to review each application as there may be situations that would require either of these procedures to be modified based on the project requirements. If there are any concerns during the installation, contact technical support for assistance.

TECHNICAL BULLETIN

DETAIL TAPE END LAP TAPING METHOD FOR PRECON® AND HYDRASTOP™ SA

HORIZONTAL END-LAP DETAILING

On a properly prepared sub-grade, place a strip of 12" (304.8 mm) DETAIL TAPE H with the adhesive side of the tape facing upwards. Remove the release paper on the one side of the tape, exposing 6" (152.4 mm) of the rubberized asphalt and apply the PLASMATIC CORE® side of the PRECON into this and roll press into place. Following this, remove the remaining release paper on the tape and apply the subsequent roll of PRECON into this area, making sure that both rolls are butted together. Roll press this into place. Following that, apply a 12" (304.8 mm) band of the POINTING MASTIC onto this overlap at a thickness of approximately 60 mils, and embed the DETAIL FABRIC into this.

*DETAIL TAPE H is a polymeric waterproofing membrane on a shrink-resistant, heavy-duty, polypropylene woven carrier sheet. It is nominally 65 mils thick and is 12" (304.8 mm)wide.

VERTICAL END-LAP DETAILING

Application of this method requires the use of MEL-DRAIN™ that has been installed up against a soil retention system according to our installation instructions. Ensure the backside of the MEL-DRAIN has been cleaned and there is no residue that will inhibit the bond of the DETAIL TAPE V. Remove the release paper on one side of the tape and roll press this tape onto the MEL-DRAIN. On the side of the tape facing out, remove the release paper on the one side of the tape, exposing 6" (152.4 mm) of the rubberized asphalt and apply the PLASMATIC CORE side of the PRECON into this and roll press into place. Following this, remove the remaining release paper on the tape and apply the subsequent roll of PRECON into this area, making sure that both rolls are butted together. Roll press this into place. Following that, apply a 12" (304.8 m) band of the POINTING MASTIC onto this overlap at a thickness of approximately 60 mils, and embed the DETAIL FABRIC into this.

*DETAIL TAPE V is a polymeric waterproofing membrane with a dual release paper. It is nominally 60 mils thick and is 12" (304.8 m) wide.

Following is a step-by step procedure showing the sequence of a horizontal application using the Tape Method.

On a properly prepared sub-grade, place a strip of 12" (304.8 mm) DETAIL TAPE H with the adhesive side of the tape facing upwards.

Remove the release paper on the one side of the tape and fold back to expose 6" (152.4 mm) of the rubberized asphalt and apply the PLASMATIC CORE side of the PRECON into this and roll press into place.

*If desired, the full 12" (304.8 m) of release paper can be removed, but care must be taken to ensure that the exposed asphalt does not get dirty as that will affect adhesion of the subsequent roll.

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Following this, remove the remaining release paper on the tape and apply the subsequent roll of PRECON into this area, making sure that both rolls are butted together.

Roll press this into place.

Apply a 12" (304.8 m) band of the POINTING MASTIC onto this overlap at a thickness of approximately 60 mils.

TECHNICAL BULLETIN
END LAP TAPING METHOD FOR PRECON AND HYDRASTOP SA

Place the DETAIL FABRIC into the POINTING MASTIC making sure that it is fully embedded and roll press into place.

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January 9, 2023

W. R. MEADOWS certifies the following information for PRECON® Pre-Applied / Underslab / Blindside Waterproofing Membrane:

LEED v4.0 - Building Product Disclosure and Optimization (MRc3 and MRc4):

Manufacturing Location(s): Hampshire, IL 60140

Raw Material Extraction Point: Not Available

Recycled Content: 0%

LEED v4.0 – Indoor Environmental Quality (EQc2):

VOC Emissions: N/A - Classified as an exterior product. Not required per LEEDv4 EQc2.

VOC Content: N/A - Not a wet-applied product. Not required per LEEDv4 EQc2.

If field sampling and/or field or laboratory testing be required, W. R. MEADOWS cannot be held responsible for any cost incurred if this product is used prior to receipt of that approval.

Should you have any questions or require additional information, please feel free to contact Technical Services or your local W. R. MEADOWS Representative.

Sincerely,

Kimberly Ann Lombardozzi

Kimberly Ann Lombardozzi, LEED AP ID+C, WELL AP, fitwel Ambassador
Sustainability Manager
W. R. MEADOWS, INC.

Appendix B – Manufacturer’s Manual

AIRTECH® VACUUM

Operating and Maintenance Instructions

3BA Regenerative Blowers

INSTALLATION & OPERATING MANUAL
3BA REGENERATIVE BLOWERS

Table of Contents

Section: **Page Number:**

1. Safety

1.1 General Safety Precautions

WARNING: Improper operation of 3BA units can result in serious or even fatal injuries. Please make sure all personnel have read and understood this manual before operating the unit.

All personnel should familiarize themselves with the units' specifications and be careful not to exceed the unit's capacity.

Transport, installation, operation, shut-down, maintenance and disposal of 3BA units should be carried out by qualified professionals.

Do not attempt to start or run the unit unless it has been completely assembled. Particular attention should be paid to: the vacuum pump/compressor cover, the muffler on the inlet and discharge connections, and the fan guard.

The standard 3BA unit must never come into contact with flammable substances.

1.2 Clothing and Protective Gear

It is recommended that all personnel wear proper protective gear while operating the unit. This may include eye protection, gloves and helmets.

Please be aware that it is possible for hair and clothing to be pulled into the unit. Avoid wearing loose-fitting clothing near the unit while it is operating and wear a hairnet if necessary.

1.3 Electrical Safety

Electrical installation should only be done by qualified electricians. Before doing any electrical work on a 3BA unit, please ensure that **power to the unit has been disconnected.** Do not attempt to open the unit's terminal box until you have made certain that the unit is not connected to a power source.

The terminal box must be kept free of dirt and moisture at all times. Make sure the terminal box cover and cable entries are tightly sealed so they remain dustproof and waterproof. Check the terminal box regularly to make sure it is sealed and free of debris and moisture.

1.4 Vacuum and Gauge Pressure Safety

In order to avoid dangerous situations associated with vacuum and gauge pressure, please utilize secure mounting elements, connections, lines, fittings, and containers. Pipes/hoses must be securely connected to the inlet and discharge connections. The inlet and discharge connections and the pipes/hoses connected to them must not be closed, clogged, or soiled. Check regularly to ensure that these connections and mountings are not becoming unseated. If necessary, support pipes and hoses to ensure that there is no tension on the connections. **Failure to observe these precautions can lead to sudden evacuation of hazardous fluids or dangerous suction that can pull hair or clothing into the unit.**

1.5 Installation/Start-up

The unit and any lines connected to it must be securely installed. In particular, the feed pipes must be securely routed, e.g. in cable ducts, in the floor, etc.

If a separate control panel or other such interface will be used to start and stop the unit, it should be installed in an area with an unobstructed view of the unit to ensure that it is not switched on while being serviced.

Excess vibration can cause damage to the unit and/or unsafe conditions. Install the unit on a solid foundation or a solid mounting surface. Check screw glands/unions for strength and firm seating.

Cables and pipes should be installed in a recess in the floor or duct so they do not present a tripping hazard.

To ensure sufficient cooling of the unit, ventilation screens and openings must remain clear. Ensure that discharge air from other units cannot be pulled into the unit.

Make sure that the inlet and pressure lines are clearly marked to avoid confusion. **Interchanged inlet and pressure lines can lead to damage to the unit and/or serious injury.**

Install a filter in the inlet pipe and replace it regularly. If particulates or debris enter the unit, the blades of the impellers can be damaged and blades could potentially break off, potentially creating a hazardous situation.

If re-starting the unit after it has been idle for a long period of time, measure the insulation resistance of the motor. If values are less than 1 k Ω per volt of nominal voltage, the winding may be too dry.

If the unit is installed or stored in an environment with a temperature of over 104°F (40°C) be aware that the winding may be damaged and the grease might need to be changed more often.

1.6 Maintenance Procedures

Before beginning work on the pump-motor unit, please take the following precautions:

- Make sure power has been completely disconnected
- Wait for the unit to come to a complete stop.
- Allow the unit time to cool.
- Shut off lines and release pressure
- Make certain that no vacuum or gauge pressure is present in the lines/tanks to be opened.
- Make sure that no fluids can escape

Please note that the rotating impeller is accessible when the inlet and discharge connections are open. Do not reach into the unit through open connections or insert objects into the unit through any openings. Serious injury could occur. If the unit is running without piping or tubing, provide the inlet and discharge of the unit with either additional mufflers or piping of a sufficient length to prevent access to the impeller.

Check regularly to ensure the terminal box is free of any dirt or foreign substances and there is no moisture or humidity present. Make certain the terminal box cover and cable entries are tightly closed.

1.7 Hot Surfaces

During operation, the surface of the unit can reach temperatures of 320° F (160° C). It is advisable to cover the unit with suitable touch protection (e.g. a perforated plate or wire cover). Do not touch the unit during operation, and allow time to cool after shut-down. Temperature-sensitive parts such as lines or electronic components should not come into contact with the surface of the unit.

1.8 Hearing Protection

Make certain any missing or defective silencers are replaced. Noise emitted by the unit can cause serious hearing damage. Conduct a noise measurement test while the unit is running. If the unit operates over 90 dB(A), please place a warning sign in the area where the unit has been installed and make certain that any personnel working in the vicinity wear ear protection at all times while the unit is running.

1.9 Safety Guidelines for Transport of the unit:

Prior to transport and handling, please make sure that all components are properly assembled and secure. Any machinery used to transport these units must have the proper lifting capacity. Please consult the table on page 27 to find the weight of the unit being handled. Do not stand or walk under suspended loads.

If a 3BA unit has come in contact with any dangerous substances, it must be decontaminated before being sent to Airtech for repair evaluation.

2 Technical Data

These operating instructions cover the Airtech 3BA side channel vacuum pumps and compressors supplied with standard TEFC motors. Other configurations are available including V-belt driven units, units with explosion proof motors, mechanical seals, magnetic drives, coatings and modifications for high pressure service. Airtech can provide any combination of modifications to meet your application requirements. Such blowers, however, are outside the scope of this manual.

Description

All regenerative blowers are dynamic compression devices and utilize a non-contacting impeller to accelerate the gas and a specially designed housing to compress the gas. Cooling is accomplished by using the motor fan to blow air over the housing. In larger models, the housing is specially designed with cooling fins to allow a wider range of operation. Both the inlet and outlet ports have built-in silencers and mesh screens. Both the inlet and outlet have an inside connection thread corresponding to DIN ISO 228. On larger units, multiple suction and discharge connection configurations may be available.

The wetted parts are constructed of Aluminum on all models. The blower shares a bearing with the motor. The seal between the bearing and the motor is not gas tight in most models, therefore these blowers are not recommended for handling of toxic or explosive gases. (Contact Airtech Vacuum, Inc. for additional options if explosive or toxic gases will be handled.)

A full range of accessory items are available, including vacuum or pressure relief valves, check valves, suction filters, motor starters, vacuum/pressure cross-over valves, and in-line filters.

Application/Installation Environment

CAUTION! These blowers are designed for use in general industry. Suitable personnel protection according to OSHA requirements is provided, but the equipment should not be operated in residential settings.

Airtech blowers can be operated as either vacuum pumps or compressors. They are suitable for use with air having a relative humidity up to 90 percent, but not generally suitable for handling corrosive or erosive gases. Special versions for toxic or aggressive gases may be available. Use of the standard blower in aggressive environments may cause damage to the blower or exposure to gases being handled in the local environment.

CAUTION! Dangerous (flammable or explosive) or aggressive (corrosive) gases should not be handled by the standard blower.

Handling of flammable or aggressive gases and vapors may be possible by using a specially configured or modified blower. Contact factory for additional information. The standard blower is not suitable for operation in explosive environments as defined by NFPA 70. Contact factory for assistance.

CAUTION! The ambient and suction temperatures should be between 40 and 105 F. For temperatures outside this region, please contact the factory.

The maximum permissible pressure difference for vacuum or pressure is dependent on the motor rating (See Tables 1 to 4 for detailed information by model number.) and power supply frequency. The figures in Tables 1 to 4 are computed assuming an ambient temperature of 77 F (25 C) and a local barometric pressure of 1013 mbar (sea level). Operation at an ambient temperature of 104 F (40C) is the maximum permissible, and will result in a reduction of 10 percent on maximum vacuum or pressure attainable by the unit. For temperatures between 77 F and 104 F, reduce the maximum pressure reduction is a linear function of temperature.

Table 1. Three-phase, Single Stage, 50 Hertz

Model	Rated Power HP/kW	Voltage	Motor Current (Amps)	Open Flow Capacity CFM/m3/hr	Maximum Pressure (mbar)	Sound Pressure Level (dBA)
3BA1300-7AT06	.33/.25	200-240/345-415	2.1/1.2	48/82	-100/100	53
2BA1300-7AT16	.54/.4	200-240/345-415	2.6/1.5	48/82	-120/130	53
3BA1400-7AT06	.94/.7	200-240/345-415	3.8/2.2	84/142	-120/120	63
2BA1400-7AT16	1.15/.85	200-240/345-415	4.2/2.4	84/142	-160/160	63
3BA1400-7AT26	1.75/1.3	200-240/345-415	5.7/3.3	84/142	-170/200	63
3BA1500-7AT06	1.15/.85	200-240/345-415	4.2/2.4	120/204	-100/100	64
3BA1500-7AT16	1.75/1.3	200-240/345-415	5.7/3.3	120/204	-170/170	64
3BA1500-7AT26	2.15/1.6	220-250/415-460	7.5/4.3	120/204	-200/190	64
3BA1500-7AT36	2.96/2.2	200-240/345-415	9.7/5.6	120/204	-220/270	64
3BA1530-7AT16	1.75/1.3	200-240/345-415	5.7/3.3	165/280	-120/110	65
3BA1530-7AT26	2.15/1.6	200-240/345-415	7.5/4.3	165/280	-160/150	65
3BA1530-7AT36	2.96/2.2	200-240/345-415	9.7/5.6	165/280	-220/230	65
3BA1600-7AT06	2.15/1.6	200-240/345-415	8.5/4.9	188/320	-160/150	69
3BA1600-7AT16	2.96/2.2	200-240/345-415	9.7/5.6	188/320	-190/190	69
3BA1600-7AT26	4.04/3.0	200-240/345-415	12.5/7.2	188/320	-260/270	69
3BA1600-7AT36	5.4/4.0	200-240/345-415	13.0/7.5	188/320	-290/360	69
3BA1630-7AT06	2.15/1.6	200-240/345-415	8.5/4.9	240/408	-160/150	69
3BA1630-7AT16	2.96/2.2	200-240/345-415	9.7/5.6	240/408	-190/190	69
3BA1630-7AT26	4.04/3.0	200-240/345-415	12.5/7.2	240/408	-260/270	69
3BA1630-7AT36	5.4/4.0	200-240/345-415	15.6/9.0	240/408	-260/290	69
3BA1800-7AT06	5.4/4.0	200-240/345-415	15.6/9.0	280/476	-200/200	70
3BA1800-7AT16	7.4/5.5	200-240/345-415	23/13.3	280/476	-300/300	70
3BA1800-7AT26	10/7.5	200-240/345-415	29/16.7	280/476	-320/430	70
3BA1830-7AT06	5.4/4	200-240/345-415	15.6/9	400/680	-150/140	76
3BA1830-7AT16	7.4/5.5	200-240/345-415	23/13.3	400/680	-200/190	76
3BA1830-7AT26	10/7.5	200-240/345-415	29/16.7	400/680	-270/260	76
3BA1900-7AT06	10.8/8	200-240/345-415	31.5/18.2	568/965	-190/190	74
3BA1900-7AT16	16.8/12.5	200-240/345-415	48.5/28	568/965	-290/280	74
3BA1900-7AT36	25/18.5	200-240/345-415	64.5/37	568/965	-362/462	74
3BA1930-7AT16	16.8/12.5	200-240/345-415	48.5/28	744/1264	-290/280	71
3BA1930-7AT36	25/18.5	200-240/345-415	64.5/37	744/1264	-310/310	71
3BA1930-7AT36	25/18.5	200-240/345-415	64.5/37	744/1264	-310/310	71
3BA7310-0AT167	.75/.55	200-240/345-415	2.8/1.6	40/68	-250/250	57
3BA7410-0AT167	1.5/1.1	200-240/345-415	5.4/3.1	50/84	-300/380	58
3BA7510-0AT168	2/1.5	200-240/345-415	7.5/4.3	70/120	-370/650	64
3BA7510-0AT268	3/2.2	200-240/345-415	9.7/5.6	70/120	-310/430	64
3BA7610-0AT168	3/2.2	200-240/345-415	9.7/5.6	96/163	-310/430	65
3BA7610-0AT368	4.4/3.3	200-240/345-415	13/7.5	96/163	-500/750	65

Table 2. Three-phase, Single-stage, 60 Hz

Model	Rated Power HP/kW	Voltage	Motor Current (Amps)	Open Flow Capacity CFM/m3/hr	Maximum Pressure (mbar)	Sound Pressure Level (dBA)
3BA1300-7AT06	.39/.29	220-250/415-460	1.74/1.0	60/102	-100/100	56
2BA1300-7AT16	.67/.5	220-250/415-460	2.6/1.5	60/102	-150/160	56
3BA1400-7AT06	1.12/.83	220-250/415-460	3.75/2.15	105/179	-130/130	64
3BA1400-7AT16	1.28/.95	220-250/415-460	4.35/2.5	105/179	-160/160	64
3BA1400-7AT26	2/1.5	220-250/415-460	5.5/3.2	105/179	-210/200	64
3BA1500-7AT06	1.28/.95	220-250/415-460	4.35/2.5	150/255	-80/70	70
3BA1500-7AT16	2/1.5	220-250/415-460	5.5/3.2	150/255	-150/140	70
3BA1500-7AT26	2.7/2.05	220-250/415-460	7.5/4.4	150/255	-220/210	70
3BA1500-7AT36	3.4/2.55	220-250/415-460	9.0/5.3	150/255	-260/290	70
3BA1530-7AT16	2/1.5	220-250/415-460	5.7/3.3	200/340	-90/80	71
3BA1530-7AT26	2.7/2.05	220-250/415-460	7.6/4.4	200/340	-260/270	70
3BA1530-7AT36	3.4/2.55	220-250/415-460	10.3/6.0	200/340	-260/250	70
3BA1600-7AT06	2.7/2.05	220-250/415-460	7.5/4.4	235/400	-160/150	72
3BA1600-7AT16	3.4/2.55	220-250/415-460	9.0/5.3	235/400	-190/190	72
3BA1600-7AT26	4.6/3.45	220-250/415-460	12.0/6.5	235/400	-240/230	72
3BA1600-7AT36	6.1/4.6	220-250/415-460	15.2/8.5	235/400	-320/310	72
3BA1630-7AT06	2.7/2.05	220-250/415-460	7.5/4.4	300/510	-160/150	72
3BA1630-7AT16	3.4/2.55	220-250/415-460	9.0/5.3	300/510	-190/190	72
3BA1630-7AT26	4.6/3.45	220-250/415-460	12.0/6.5	300/510	-240/230	72
3BA1630-7AT36	6.1/4.6	220-250/415-460	15.2/8.5	300/510	-260/260	72
3BA1800-7AT06	6.1/4.6	220-250/415-460	15.2/8.5	350/595	-160/160	74
3BA1800-7AT16	8.4/6.3	220-250/415-460	20/11.2	350/595	-300/280	74
3BA1800-7AT26	11.5/8.6	220-250/415-460	27.5/15	350/595	-350/400	74
3BA1830-7AT06	6.2/4.6	220-250/415-460	15.2/8.5	500/850	-90/90	79
3BA1830-7AT16	8.4/6.3	220-250/415-460	20/11.2	500/850	-180/180	79
3BA1830-7AT26	11.5/8.6	220-250/415-460	27.5/15	500/850	-270/260	79
3BA1900-7AT06	12.1/9	220-250/415-460	31.5/18.2	710/1207	-150/140	79
3BA1900-7AT16	19.5/14.5	220-250/415-460	50/29	710/1207	-270/260	79
3BA1900-7AT36	28.7/21.3	220-250/415-460	68/39	710/1207	-382/422	79
3BA1930-7AT16	19.5/14.5	220-250/415-460	50/29	930/1581	-270/260	75
3BA1930-7AT36	28.7/21.3	220-250/415-460	68/39	930/1581	-300/280	75
3BA7210-0AT167	1.1/.83	220-250/415-460	3.75/2.15	35/60	-270/320	62
3BA7310-0AT167	1.1/.83	220-250/415-460	3.75/2.15	48/82	-260/250	62
3BA7410-0AT167	2/1.5	220-250/415-460	5.5/3.2	60/102	-340/370	62

When operating at altitudes above 3280 feet (1000 m) above mean sea level, contact Airtech Inc.

CAUTION! Operation of the unit outside the recommended range of pressures and ambient conditions will result in shorted operating life.

Table 3. 3 Phase, Two/Three Stage, 50 Hertz

Model	Rated Power HP/kW	Voltage	Motor Current (Amps)	Open Flow Capacity CFM/m3/hr	Maximum Pressure (mbar)	Sound Pressure Level (dBA)
3BA1310-7AT26	.94/.7	200-240/345-415	3.8/2.2	48/81.6	-120/120	55
3BA1410-7AT36	2.15/1.6	200-240/345-415	7.5/4.3	84/142.8	-200/190	66
3BA1410-7AT46	2.96/2.2	200-240/345-415	9.7/5.6	84/142.8	-320/420	66
3BA1510-7AT46	4.04/3.0	200-240/345-415	12.5/7.2	121.6/206.7	-340/410	72
3BA1510-7AT56	5.39/4.0	200-240/345-415	17.4/10	121.6/206.7	-390/440	72
3BA1610-7AT36	2.9/2.2	200-240/345-415	9.7/5.6	188/319.6	-190/190	73
3BA1610-7AT26	4.04/3.0	200-240/345-415	12.5/7.2	188/319.6	-260/270	73
3BA1610-7AT36	5.39/4.0	200-240/345-415	13.0/7.5	188/319.6	-290/360	73
3BA1610-7AT46	7.41/5.5	200-240/345-415	23/13.3	188/319.6	-420/500	73
3BA1610-7AT56	10.1/7.5	200-240/345-415	29/16.7	188/319.6	-420/610	73
3BA1640-7AT36	5.39/4.0	200-240/345-415	13.0/7.5	280/476	-290/360	74
3BA1640-7AT46	7.41/5.5	200-240/345-415	23/13.3	280/476	-420/500	74
3BA1640-7AT56	10.1/7.5	200-240/345-415	29/16.7	280/476	-420/610	74
3BA1810-7AT16	7.4/5.5	200-240/345-415	23/13.3	280/476	-420/500	74
3BA1810-7AT26	10.1/7.5	200-240/345-415	29/16.7	280/476	-320/430	74
3BA1810-7AT36	14.8/11	200-240/345-415	29/16.7	280/476	-430/600	74
3BA1810-7AT46	20.2/15	200-240/345-415	56.5/32.5	280/476	-460/670	74
3BA1840-7AT26	10.1/7.5	200-240/345-415	29.0/16.7	280/476	-320/430	74
3BA1840-7AT36	14.8/11.0	200-240/345-415	48.5/28.0	280/476	-430/600	74
3BA1910-7AT16	16.8/12.5	200-240/345-415	48.5/28	624/1061	-290/280	74
3BA1910-7AT36	26.95/20.0	200-240/345-415	69/40	624/1061	-443/502	74
3BA1910-7AT46	33.51/24.98	200-240/345-415	90/52	624/1061	-443/592	84
3BA19437AT26	20.1/15	200-240/345-415	59/34	1200/2040	-160/170	75
3BA19437AT36	26.8/20	200-240/345-415	69/40	1200/2040	-250/230	75
3BA19437AT46	33.5/25	200-240/345-415	90/52	1200/2040	-310/280	75
3BA7220-0AT567	2/1.5	200-240/345-415	7.5/4.3	28/48	-370/650	58
3BA7320-0AT467	1.5/1.1	200-240/345-415	5.4/3.1	40/68	-300/380	58
3BA7320-0AT567	2/1.5	200-240/345-415	7.5/4.3	40/68	-480/450	59
3BA7420-0AT267	2/1.5	200-240/345-415	7.5/4.3	50/84	-480/450	61
3BA7420-0AT567	4.4/3.3	200-240/345-415	13/7.5	50/84	-500/750	61
3BA7520-0AT268	3/2.2	200-240/345-415	9.7/5.6	70/120	-470/460	64
3BA7620-0AT368	4.4/3.3	200-240/345-415	13/7.5	96/163	-500/750	68
3BA7620-0AT468	5.4/4	200-240/345-415	14/8.1	96/163	-370/650	67
3BA7620-0AT568	7.5/5.5	200-240/345-415	19.9/11.5	96/163	-520/750	68
3BA7630-0AT668	10.1/7.5	200-240/345-415	29/16.7	96/163	-420/610	77

Table 4. 3 Phase, Two/Three Stage, 60 Hertz

Model	Rated Power HP/kW	Voltage	Motor Current (Amps)	Open Flow Capacity CFM/m3/hr	Maximum Pressure (mbar)	Sound Pressure Level (dBA)
3BA1310-7AT26	1.11/.83	220-250/415-460	3.75/2.15	60/102	-130/130	61
3BA1410-7AT36	2.7/2.05	220-250/415-460	7.5/4.4	105/179	-220/210	69
3BA1410-7AT46	3.4/2.55	220-250/415-460	9.0/5.3	105/179	-350/440	69
3BA1510-7AT46	4.6/3.45	220-250/415-460	12.0/6.5	152/258	-380/360	74
3BA1510-7AT56	6.1/4.6	220-250/415-460	15.2/8.5	152/258	-410/480	74
3BA1610-7AT36	3.4/2.55	220-250/415-460	9.0/5.3	235/400	-190/190	76
3BA1610-7AT26	4.6/3.45	220-250/415-460	12.0/6.5	235/400	-240/230	76
3BA1610-7AT36	6.4/4.8	220-250/415-460	16.5/9.8	235/400	-320/310	76
3BA1610-7AT46	8.4/6.3	220-250/415-460	20/11.2	235/400	-440/440	76
3BA1610-7AT56	11.5/8.6	220-250/415-460	27.5/15.0	235/400	-440/670	76
3BA1640-7AT36	6.1/4.6	220-250/415-460	15.2/8.5	350/595	-320/310	78
3BA1640-7AT46	8.4/6.3	220-250/415-460	20.0/11.2	350/595	-440/440	78
3BA1640-7AT56	11.5/8.6	220-250/415-460	27.5/15.0	350/595	-440/670	78
3BA1810-7AT16	8.4/6.3	220-250/415-460	20.0/11.2	350/595	-440/440	78
3BA1810-7AT26	11.5/8.6	220-250/415-460	27.5/15.0	350/595	-350/400	78
3BA1810-7AT36	17/12.6	220-250/415-460	50.2/29.0	350/595	-460/600	78
3BA1810-7AT46	23.3/17.3	220-250/415-460	60.0/34.5	350/595	-490/750	78
3BA1840-7AT26	11.5/8.6	220-250/415-460	27.5/15.0	350/595	-350/400	78
3BA1840-7AT36	17/12.6	220-250/415-460	50.2/29.0	350/595	-460/600	78
3BA1910-7AT16	19.5/14.5	220-250/415-460	50.0/29.0	780/1326	-270/260	84
3BA1910-7AT36	31/23	220-250/415-460	72 /42	780/1326	-443/433	84
3BA1910-7AT46	38.9/28.9	220-250/415-460	90/52	780/1326	-443/542	84
3BA19437AT26	23.4/17.5	220-250/415-460	63/36.5	1440/2447	-120/110	84
3BA19437AT36	30.8/23	220-250/415-460	72/42	1440/2447	-190/180	84
3BA19437AT46	38.8/28.9	220-250/415-460	90/52	1440/2447	-265/230	84
3BA7220-0AT567	2.7/2.05	220-250/415-460	7.5/4.4	35/60	-500/740	62
3BA7320-0AT467	2/1.5	220-250/415-460	5.5/3.2	48/82	-340/370	63
3BA7320-0AT567	2.7/2.05	220-250/415-460	7.5/4.4	48/82	-430/410	63
3BA7420-0AT267	2.7/2.05	220-250/415-460	7.5/4.4	60/102	-430/410	66
3BA7420-0AT567	5.1/3.8	220-250/415-460	13.5/7.8	60/102	-510/850	66
3BA7520-0AT268	3.4/2.55	220-250/415-460	9/5.3	84/143	-500/450	70
3BA7620-0AT368	5.1/3.8	220-250/415-460	13.5/7.8	115/196	-510/850	71
3BA7620-0AT468	6.1/4.6	220-250/415-460	15.2/8.5	115/196	-480/500	71
3BA7620-0AT568	8.4/6.6	220-250/415-460	22.5/12.6	115/196	-520/820	72
3BA7630-0AT668	11.5/8.6	220-250/415-460	27.5/15	115/196	-440/670	80
3BA7530-7AT76	6.2/4.6	220-250/415-460	16.3/9.5	82/139	-639/729	73

Table 5. Single Phase, 50 Hertz

Model	Rated Power HP/kW	Voltage	Motor Current (Amps)	Open Flow Capacity CFM/m3/hr	Maximum Pressure (mbar)	Sound Pressure Level (dBA)
3BA1100-7AS05	0.27/0.2	230	1.45	24/40	-60/70	50
3BA1200-7AS05	0.33/0.25	115/230	3.5/1.7	35/60	-100/100	50
3BA1300-7AS15	0.5/0.37	115/230	5.4/2.7	48/82	-110/110	53
3BA1330-7AS15	0.5/0.37	115/230	5.4/2.7	60/102	-110/110	54
3BA1400-7AS25	1.47/1.09	115/230	13/6.5	84/142	-149/189	64
3BA1410-7AS25	2/1.49	115/230	22/11	84/142.8	-279/259	66
3BA1500-7AS35	2/1.49	115/230	22/11	120/204	-189/199	64
3BA7210-0AS75	0.74/0.55	115/230	13/6.5	28/48	-229/289	57
3BA7220-0AS75	2/1.49	115/230	19.4/9.7	29/49	-371/600	57
3BA7310-0AS75	1.26/0.93	115/230	15.2/7.6	40/68	-249/351	58
3BA7320-0AS75	2/1.49	115/230	19.4/9.7	40/68	-401/550	59
3BA7410-OAS45	1.47/1.09	115/230	13/6.5	50/84	-299/381	59

Table 6. Single Phase, 60 Hertz

Model	Rated Power HP/kW	Voltage	Motor Current (Amps)	Open Flow Capacity CFM/m3/hr	Maximum Pressure (mbar)	Sound Pressure Level (dBA)
3BA1100-7AS05	0.31/0.23	230	1.3	30/51	-75/80	53
3BA1200-7AS05	0.38/0.28	115/230	5/2.8	48/82	-112/112	53
3BA1300-7AS15	0.6/0.44	115/230	6.0/3.0	60/102	-130/139	56
3BA1330-7AS15	0.6/0.44	115/230	6.0/3.0	74/126	-130/139	57
3BA1400-7AS25	1.74/1.29	115/230	14.0/7.0	105/179	-179/189	64
3BA1410-7AS25	2.35/1.75	115/230	24.0/12.0	105/179	-249/229	69
3BA1500-7AS35	2.35/1.75	115/230	24.0/12.0	150/255	-179/179	70
3BA7210-0AS75	0.84/0.63	115/230	14.2/7.1	35/60	-259/309	62
3BA7220-0AS75	2.35/1.75	115/230	20.6/10.3	35/60	-421/660	62
3BA7310-0AS75	1.47/1.09	115/230	18.0/9.0	48/82	-279/391	62
3BA7320-0AS75	2.35/1.75	115/230	20.6/10.3	48/82	-391/541	63
3BA7410-OAS45	1.74/1.29	115/230	14.0/7.0	60/102	-338/391	62

Operation of any blower is possible at 87 Hertz without modification in most cases. When using a VFD to operate the blower at this frequency, refer to the nameplate for limits on vacuum and pressure, current draw and motor performance.

If your specific model number is not listed above, please consult the nameplate on the unit for electrical data. If the model you are installing is listed above, please confirm the data on the nameplate. Data in Tables 1 through 4 is subject to change and is approximate. Be sure to confirm necessary operating data what that on the nameplate before commissioning the unit.

CAUTION! Do not operate any 3BA blower above 87 Hz without consultation with the factory. Failure of the blower motor is possible when operating out of range. Consult with the factory for assistance.

Expected temperature rise of the handled gas at maximum allowable pressure differential and when operating at sea level is indicated below:

Table 7: Single Stage – Approximate Temperature Rise

Blower Model	Maximum Rise at 50 Hz speed		Maximum Rise at 60 Hz speed	
	Degrees F	Degrees C	Degrees F	Degrees C
3BA1100-7..0.	115	64	136	76
3BA1200-7..0.	65	36	101	56
3BA1300-7..0.	90	50	77	43
3BA1300-7..1.	90	50	140	78
3BA1300-7..2.	90	50	158	88
3BA1400-7..0.	99	55	86	48
3BA1400-7..1.	129	72	122	68
3BA1400-7..2.	149	83	167	93
3BA1500-7..0.	86	48	72	40
3BA1500-7..1.	115	64	97	54
3BA1500-7..2.	138	77	122	68
3BA1500-7..3.	203	113	180	100
3BA1500-7..6.	248	138	248	138
3BA1600-7..0.	81	45	68	38
3BA1600-7..1.	145	81	104	58
3BA1600-7..2.	171	95	176	98
3BA1600-7..3.	225	125	185	103
3BA1600-7..6.	248	138	194	108
3BA1600-7..7.	248	138	248	138
3BA1800-7..0.	104	58	104	58
3BA1800-7..1.	153	85	185	103
3BA1800-7..2.	248	138	221	123
3BA1900-7..0.	97	54	95	53
3BA1900-7..1.	182	101	155	86
3BA1900-7..3.	230	128	212	118
3BA1943-7..2.	85	47	75	42
3BA1943-7..3.	130	72	100	56
3BA1943-7..4.	180	100	140	78
3BA7210-0..1..	126	70	142	79
3BA7310-0..1..	142	79	142	79
3BA7310-0..2..	178	99	187	104
3BA7410-0..1..	194	108	214	119
3BA7510-0..1..	199	111	232	129
3BA7510-0..2..	248	138	234	130
3BA7610-0..1..	244	136	255	142
3BA7610-0..3..	244	136	255	142

Table 8: Two/Three Stage – Approximate Temperature Rise

Blower Model	Maximum Rise at 50 Hz speed		Maximum Rise at 60 Hz speed	
	Degrees F	Degrees C	Degrees F	Degrees C
3BA1310-7..2.	127	71	165	92
3BA1410-7..3.	154	86	149	83
3BA1410-7..4.	181	101	180	100
3BA1510-7..4.	190	106	176	98
3BA1510-7..5.	194	108	201	112
3BA1610-7..1.	92	51	86	48
3BA1610-7..2.	129	72	118	66
3BA1610-7..3.	176	98	167	93
3BA1610-7..4.	221	123	190	106
3BA1610-7..5.	246	137	266	148
3BA1610-7..7.	176	98	167	93
3BA1610-7..8.	176	98	248	138
3BA1810-7..1.	113	63	80	45
3BA1810-7..2.	185	103	140	78
3BA1810-7..3.	248	138	248	138
3BA1910-7..1.	119	66	115	64
3BA1910-7..2.	203	113	169	94
3BA1910-7..3.	248	138	274	152
3BA1910-7..4.	248	138	274	152
3BA7220-0..2..	131	73	171	95
3BA7220-0..5..	165	92	230	128
3BA7320-0..5..	178	99	255	142
3BA7420-0..2..	192	107	176	98
3BA7420-0..5..	250	139	243	135
3BA7520-0..2..	192	107	216	120
3BA7520-0..7..	257	143	262	128
3BA7530-0..7..	250	121	250	121
3BA7620-0..3..	255	142	259	144
3BA7620-0..5..	255	142	262	146
3BA7630-0..6..	248	138	248	138

Table 9: Tightening Torque Specifications

For non-electrical connections

Thread	Ft-lbs maximum torque	Nm maximum torque
M4	2.43	3.3
M5	3.25	4.4
M6	6.49	8.8
M8	19.47	26.4
M10	34.10	46.2
M12	56.76	77

For electrical connections

Thread	Ft-lbs torque	Nm torque
M4	0.6 to 0.9	0.8 to 1.2
M5	1.3 to 1.8	1.3 to 1.8

For metal threaded glands/unions

Thread	Ft-lbs maximum torque	Nm maximum torque
M12x1.5	3 to 4.5	4 to 6
M16x1.5	3.7 to 5.5	5 to 7.5
M20x1.5	4.4 to 6.6	6 to 9
M32x1.5	5.9 to 8.9	8 to 12
M40x1.5	5.9 to 8.9	8 to 12

For plastic threaded glands/unions

Thread	Ft-lbs maximum torque	Nm maximum torque
M12x1.5	1.5 to 2.6	2 to 3.5
M16x1.5	2.2 to 3	3 to 4
M20x1.5	3 to 3.7	4 to 5
M32x1.5	3.7 to 5.2	5 to 7
M40x1.5	3.7 to 5.2	5 to 7

Operating above the indicated maximum pressure or vacuum would overload the motor and/or overheat the unit. In addition to the maximum allowable pressure difference, careful consideration should be given to matching the motor protection devices (provided by others) to the expected current draw. In no case should the blower be operated with inadequate motor overload protection.

Since regenerative blowers are dynamic compression devices, the performance limits shown in Tables 1 to 4 are applicable only for a gas with the same specific gravity, dynamic viscosity and chemical characteristics as air. For gases with different physical properties than air, the limits will be different from those shown in the tables. Please contact Airtech for assistance in determining the proper blower size and configuration if handling gases other than air.

A vacuum relief valve or pressure relief valve should always be installed at the suction or discharge of the regenerative blower. This will prevent operation outside the applicable ranges shown in Tables 1 to 4. If the relief valves were not specified in the ordering process, please contact Airtech for details, price and availability of the needed valves before commissioning the unit. Failure to use the proper relief valve may result in failure of the blower due to operation outside the applicable limits; any such failure is outside the scope of Airtech's standard warranty.

WARNING! Be sure to install the necessary personnel protection devices if unexpected shut-down of the unit presents danger of death or injury.

3. Installation

As illustrated in Figure 1, the Airtech 3BA blower can be installed in any physical configuration.

CAUTION! Regenerative blowers can have surface temperatures in excess of 320° F. To avoid burns or other physical injury, take care to avoid contact with the surfaces of the blower during and immediately after operation.

To ensure adequate cooling of the blower during operation, install the blower with the minimum clearance as indicated in the table below.

Minimum installation clearances, 3BA blowers

Range	Distance from fan guard to closest obstruction. (inches/mm)	Distance from cover (opposite of fan) to closest obstruction. (inches/mm)
3BA11 through 3BA14	1.4/34	0.79/20
3BA15 through 3BA19	2.1/53	1.57/40
3BA72 and 3BA73	1.3/34	1.18/30
3BA74 through 3BA76	2.1/54	1.18/30

Please note that it may be desirable, where possible, to allow for larger clearances to allow access for maintenance or repair personnel. The noted clearances are to ensure adequate air flow for cooling only and are a minimum requirement.

Failure to allow for the noted clearances may result in premature failure of the blower due to lack of cooling, even if all other precautions are taken as recommended. For specific advice about installations requiring closer clearances, please contact Airtech, Inc. for recommendations.

Airtech regenerative blowers can be mounted in any configuration, either horizontally or vertically mounted. It is not usually necessary to bolt the smaller blowers to a rigid surface during operation, though this may be desirable to reduce pipe vibration, movement and noise. Larger models should be bolted in place, especially when installed vertically, to prevent possible rotation, damage or injury due to start-up torque.

CAUTION! For installations at altitudes greater than 3250 Feet above sea level there will be a loss in capacity. Please contact your factory representative for assistance in determining the extent of the loss of capacity likely at your specific location.

WARNING! Be sure to follow all local codes and regulations with respect to installation and operation of the blower. The blower motor should be wired to a branch circuit disconnect and all other safety devices recommended by the relevant sections of NFPA 70, National Electrical Code, and in accordance with all applicable state and local regulations and requirements.

3.1 Installation Procedure

Perform the installation exactly in accordance with the following steps:

1. For vacuum operation, connect the suction pipe to connection A, and for pressure operation connect the pressure pipe to connection B (See Figure 1). Install startup screens before startup to protect pump from debris.

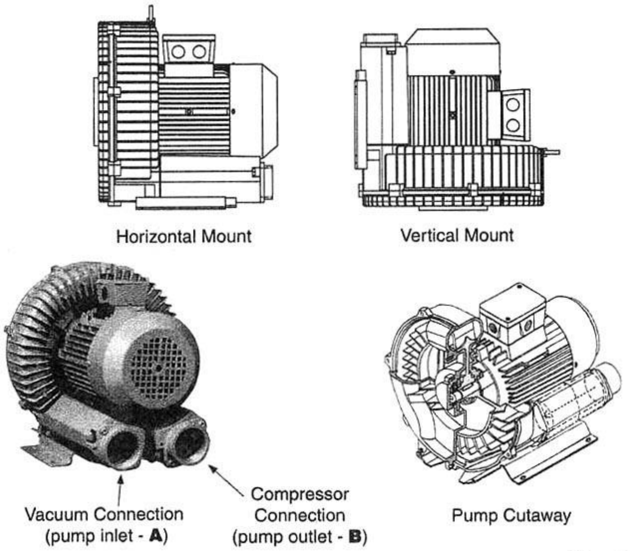


Figure 1

CAUTION! Design your piping system to avoid unnecessary pressure loss, which may significantly affect the operation of any regenerative blower. Contact your Airtech representative for assistance in designing and configuring an appropriate piping system for your application.

For alternation between vacuum and pressure in any application, changeover valves are available. Use of the changeover valve allows the same connection to be used for both vacuum and pressure.

2. The electrical data shown in Tables 1 to 4 (pages 10-14) should be confirmed by examination of the motor data plate on your 3BA blower. The standard motor features Class F insulation as a standard and are UL recognized for applications in both Canada and the United States (CUL). Motors are IEC design IP55, equal to a NEMA TEFC motor design. The connection diagram for the motors can be found in the inside of the terminal box cover. Be sure to confirm that your electrical supply has sufficient capacity to operate the blower according to the nameplate requirements.

3. A magnetic motor starter should always be used to connect the motor to the power supply. It is advisable to use thermal overload motor starters to provide maximum protection for the motor and wiring. All cabling used on starters should be secured with good quality cable clamps.

We recommend that the motor starters used feature a time delay trip on high amperage to avoid nuisance trips on start-up. When the unit is started cold, over amperage may be experienced for a short time due to the higher resistance of the windings at lower temperatures.

If using a change over or solenoid valve, ensure that the voltage connected to the valve matches that shown on the valve instructions or nameplate. Most valves are rated for 110 Volts 60Hz or 220 Volts 50 Hz. Connection of these valves to higher voltages may result in immediate valve failure.

WARNING! The electrical installation should be made by a qualified electrician and in complete compliance with all NFPA 70 (National Electrical Code) requirements along with all state and local code requirements. The main disconnect and motors starters are assumed to be provided by others.

4. Install the necessary relief valves and confirm their proper operation.

4. Start-up

CAUTION! Do not start the blower motor more than 10 times in one hour. If multiple and frequent start-ups are required by your application, install a minimum run timer in the motor control circuit to avoid decreased motor life and possible fire due to over-starting of the motor.

1.1 Start-up Procedure

1. Before operation, confirm the correct direction of rotation by jogging (switching rapidly on and off) the motor and observing the motor fan rotation in the same direction as the arrow. If the direction of rotation is incorrect, lock out the power and switch two leads (three phase) or rewire (single phase) to effect the opposite rotation direction. Recheck the direction of rotation before proceeding.

2. Do not operate the blower at pressure or vacuum ranges that exceed those shown in Tables one through four for the model being installed. This can be achieved by use of the recommended relief valve shown in Table 5.

Note: Relief valves that have been factory pre-set have a label indicating the set pressure and an arrow indicating the direction of flow. The arrow will point into the pipe when installed in vacuum applications and out of the pipe when installed in pressure applications. Do not re-set the relief valve if it has been pre-set from the factory.

In the event the relief valve setting needs to be reset, adjust the set screw to increase or decrease the tension on the spring. Place the blower in operation and note the current draw of the motor. When the current draw of the motor is near the maximum noted on the motor nameplate, tighten the locking nut on the valve and proceed.

3. When checking the current draw of the motor with an ammeter, be sure to confirm the voltage at the motor junction box. Low voltage conditions may result in difficulty starting or in unexpected motor failure or motor starter trips.

1.2 Potential Risks For Operators

Noise emission: Free field noise limits are indicated in Tables 1-4 (pages 10-14). Hearing protection is not normally required at the expected noise generation levels in the table; however, local conditions may result in higher ambient noise. If this is the case and local noise exceeds OSHA recommended levels for expected exposure time (typically 85 dBA for eight hours), hearing protection should be used.

5. Maintenance and Servicing

WARNING! Be sure the power supply is disconnected and locked out before attempting to do any maintenance on the unit. It is critical that the unit be locked out from starting during maintenance as severe injury or death could result from exposure to high voltage or rotating parts.

CAUTION! Allow the blower to cool to a surface temperature of less than 100 F before attempting maintenance. Prolonged exposure to temperatures above 120F can cause severe burns.

Clean the blower surfaces periodically to avoid build up of dust or other debris. Build up of debris can cause overheating and premature failure of the blower.

If an inlet filter is being use, ensure that it remains clean during operation by examining the filter cartridge for debris build up. Replace dirty or clogged filter cartridges.

On pressure units, periodically clean the inlet mesh screen to avoid loss of capacity. If an external inlet filter is used, the filter element should be cleaned monthly or as frequently as required by local conditions. Excessive pressure drop will develop from use of clogged or dirty filters. This pressure drop will degrade blower performance and increase operating temperatures, leading possibly to premature pump failure.

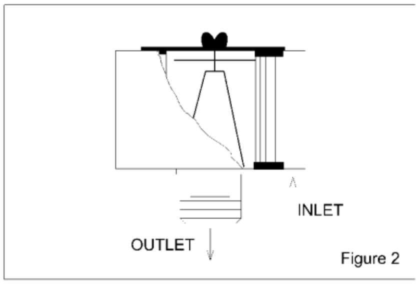


Figure 2

To replace the filter, remove the wing nut and cover. Remove the element and either clean with compressed air or replace. Reassemble in reverse order.

For vacuum applications, the optional in-line vacuum filter must be cleaned regularly, depending on local conditions. Cleaning can be achieved by blowing out with compressed air. If cleaning is not possible, replace the cartridge. Access the cartridge by unhooking the relevant clips and removing the cover.

CAUTION! Do not attempt to check the filter cartridge during operation of the blower. Only check the cartridge after disconnecting the power from the blower and locking out the power to prevent an unexpected start.

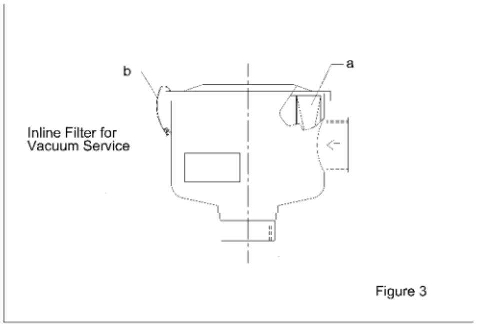


Figure 3

Bearings are grease-packed for life.

5.1 Troubleshooting Chart

Fault	Cause	Remedy	Responsible Party
Motor does not start, no noise.	Two or more power legs interrupted	Check fuses, terminals, etc.. for source of interruption and correct.	Electrician
Motor does not start, humming noise.	One power supply lead interrupted	Check fuses, terminals, etc.. for source of interruption and correct.	Electrician
	Impeller is jammed.	Open blower cover, remove debris, clean.	Service Technician
		Check impeller clearance and reset if necessary.	
	Defective Impeller	Replace impeller.	Service Technician
	Defective Bearing	Replace defective bearing.	Service Technician
Trip of motor starter at start-up	Incorrect starter setting	Ensure starter setting is correct (check current on nameplate)	Electrician
	Winding short-circuit	Megger motor	Electrician
	Motor overloaded due to operation of pump at excessive differential pressures.	Inspect filters, mufflers and connection pipes and clean as required. Check relief valve operation. Reset or replace as necessary.	Operator
	Impeller Jammed	See above fault Motor does not start, humming noise, cause jammed impeller.	Operator
Excessive Power Consumption	Lime or other deposits	Decalcify or clean unit as required (see Maintenance Chart)	Operator
No Vacuum or Pressure.	Severe leak in system	Close off pump and run deadheaded to confirm pump is operating properly. If so, find and fix leak in the system.	Operator
	Wrong direction of rotation	Check air flow direction and change direction of rotation if necessary.	Operator Electrician

Fault	**Cause**	**Remedy**	**Responsible Party**
Insufficient Vacuum	System too small	Use larger system	Operator
	Inlet piping too long or too small.	Increase pipe diameter to reduce pressure loss in inlet piping. Contact Airtech for assistance in determining correct pipe size.	Operator
	Leak at connection to vacuum system.	Check for leaks and repair if necessary.	Operator
	Density of gas handles different from air.	Consider increased limits on operation due to density differences. Consult Airtech, Inc. for assistance.	Airtech Engineering
	Change in impeller geometry due to erosion	Clean impeller and examine for wear. Replace if necessary.	Service Technician
	Inlet filter clogged.	Change filter element; remove clog.	Operator
	Vacuum relief valve incorrectly set.	Reset or replace vacuum relief valve. Contact Airtech for assistance.	Operator
	Seal defective.	Replace seal.	Service Technician
Abnormal flow noises.	Flow speed too high.	Clean pipes or use larger pipes to connect unit to process.	Operator
	Muffler soiled.	Clean muffler inserts, replace if necessary.	Operator
Abnormal running noise	Ball bearing defective or insufficient lubrication on bearing.	Replace bearing if required.	Service Technician
Compressor leaky	Seals on muffler defective.	Tighten muffler connection. Replace gasket if necessary.	Operator
	Seals in motor area defective	Replace as necessary.	Service Technician

WARNING! Before attempting an on-site repair, ensure that a qualified electrician has disconnected the motor from the power supply so that accidental starting of the motor is impossible.

After repairing the unit, be sure to follow the instructions noted in this manual in the **Installation** section (page 20).

5.2 Lifting

For smaller units (less than 65 lbs/ 30 kgs), it may be possible to lift the units manually. When doing so, be sure to understand the weight of the unit being lifted and to follow good lifting safety procedures.

Model	Weight Lbs/kgs	Model	Weight Lbs/kgs
3BA1300-7AT06	20/9	3BA1310-7AT26	33/15
2BA1300-7AT16	22/10	3BA1410-7AT36	55/25
3BA1400-7AT06	29/13	3BA1410-7AT46	59.5/29
3BA1400-7AT26	37.5/17	3BA1510-7AT46	86/39
3BA1500-7AT06	40/18	3BA1510-7AT56	97/44
3BA1500-7AT16	46.5/21	3BA1610-7AT26	104/47
3BA1500-7AT26	51/23	3BA1610-7AT36	119/54
3BA1500-7AT36	55/25	3BA1610-7AT46	163/74
3BA1600-7AT06	57.5/26	3BA1610-7AT56	172/78
3BA1600-7AT16	64/29	3BA1640-7AT36	128/58
3BA1600-7AT26	75/34	3BA1640-7AT46	172/78
3BA1600-7AT36	90.5/41	3BA1640-7AT56	181/82
3BA1800-7AT06	128/58	3BA1810-7AT16	250/113
3BA1800-7AT16	143/65	3BA1810-7AT26	260/118
3BA1800-7AT26	150/68	3BA1810-7AT36	316/143
3BA1900-7AT06	265/120	3BA1810-7AT46	341/155
3BA1900-7AT16	314/142	3BA1840-7AT26	260/118
3BA19437AT26	417/190	3BA1840-7AT36	316/143
3BA19437AT36	463/210	3BA1910-7AT16	409/186
3BA19437AT46	509/231	3BA1910-7AT36	455/206
3BA7210-0AT167	35.3/16	3BA1910-7AT46	500/226
3BA7310-0AT167	35.3/16	3BA7220-0AT567	61.7/28
3BA7410-0AT167	50.7/23	3BA7320-0AT567	66.1/30
3BA7510-0AT168	57.3/26	3BA7420-0AT267	72.7/33
3BA7510-0AT268	63.9/29	3BA7420-0AT567	86/39
3BA7610-0AT168	70.5/32	3BA7520-0AT268	88.2/40
3BA7610-0AT368	77.2/35	3BA7620-0AT368	106/48
3BA7530-0AT768	200/91	3BA7620-0AT568	143/65
		3BA7630-0AT668	207/94

When lifting 3BA15 through 3BA19 (but not 3BA1943 units) or the 3BA75 through the 3BA76, use the eye bolt provided (eye bolts are not included on smaller units). One attachment point should be sufficient. Ensure that the crane is rated for the weight being lifted.

For the 3BA1943, use the eye bolt and the holes in the feet of the blower to lift and maintain a balanced load.

5.3 Storage

The 3BA units should be stored in a clean, dry environment. If stored in an area with a humidity of greater than 80 percent, store in a closed container with desiccant drying agents to avoid damage.

5.4 Disposal

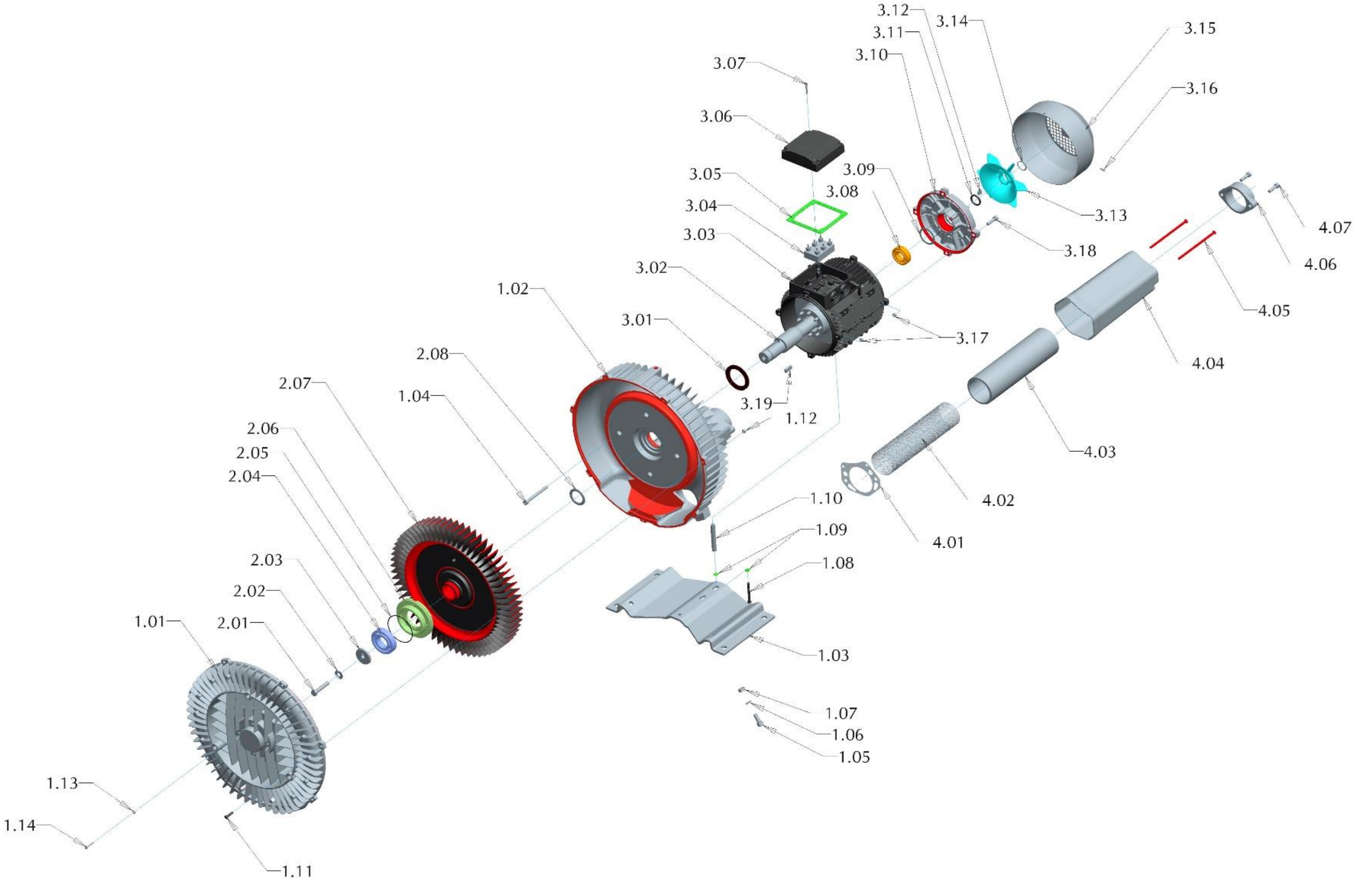
Dispose in accordance with all local health and safety regulations.

Spare parts list are available from your local Airtech service center. Please contact your local Airtech representative for assistance.

For additional assistance, please contact:

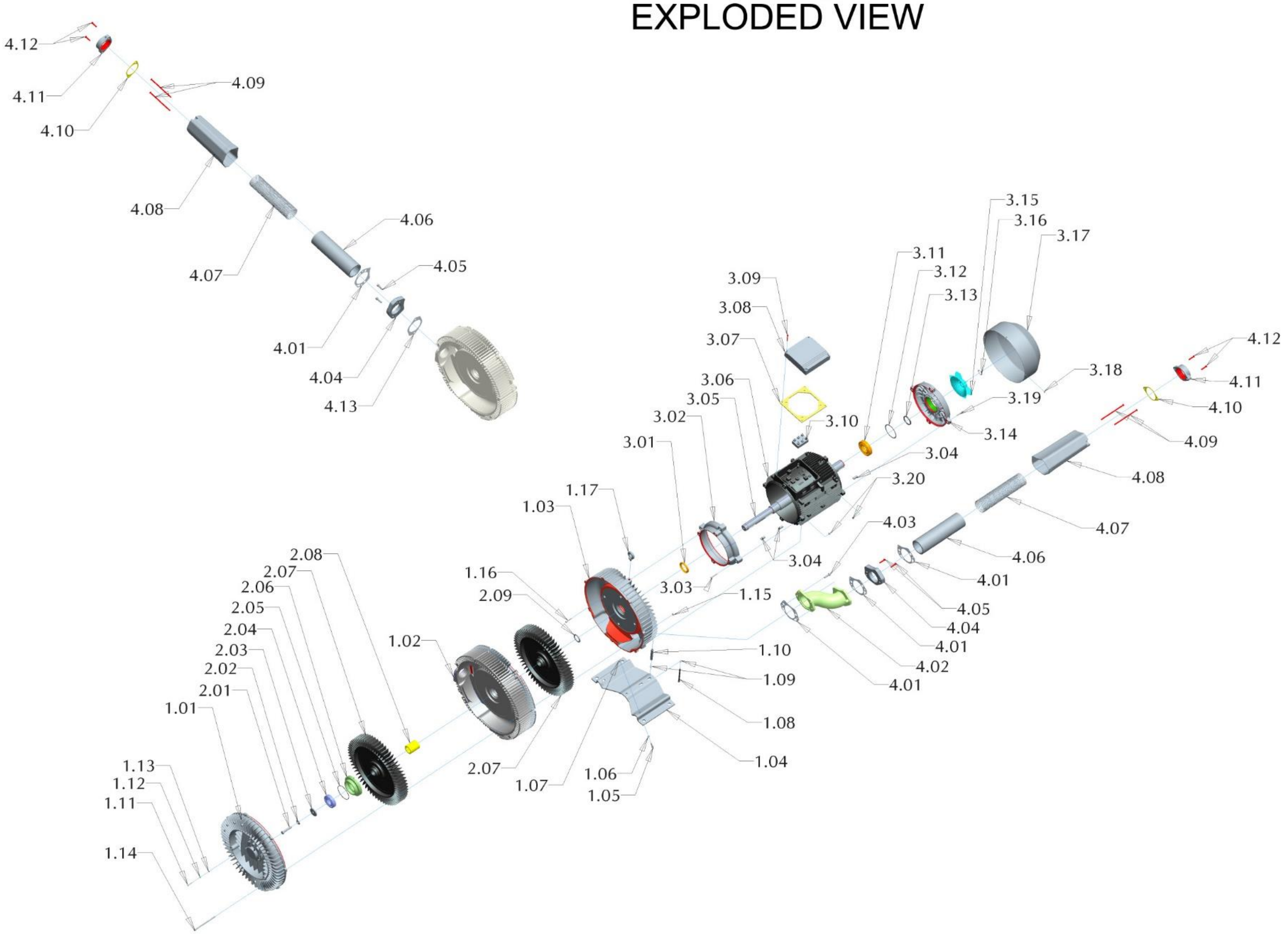
Airtech, Inc.,
301 Veterans Boulevard
Rutherford, NJ, 07070
Phone: 1-201-569-1173
Fax: 201-569-1696.

3BA1 SINGLE STAGE
EXPLODED VIEW



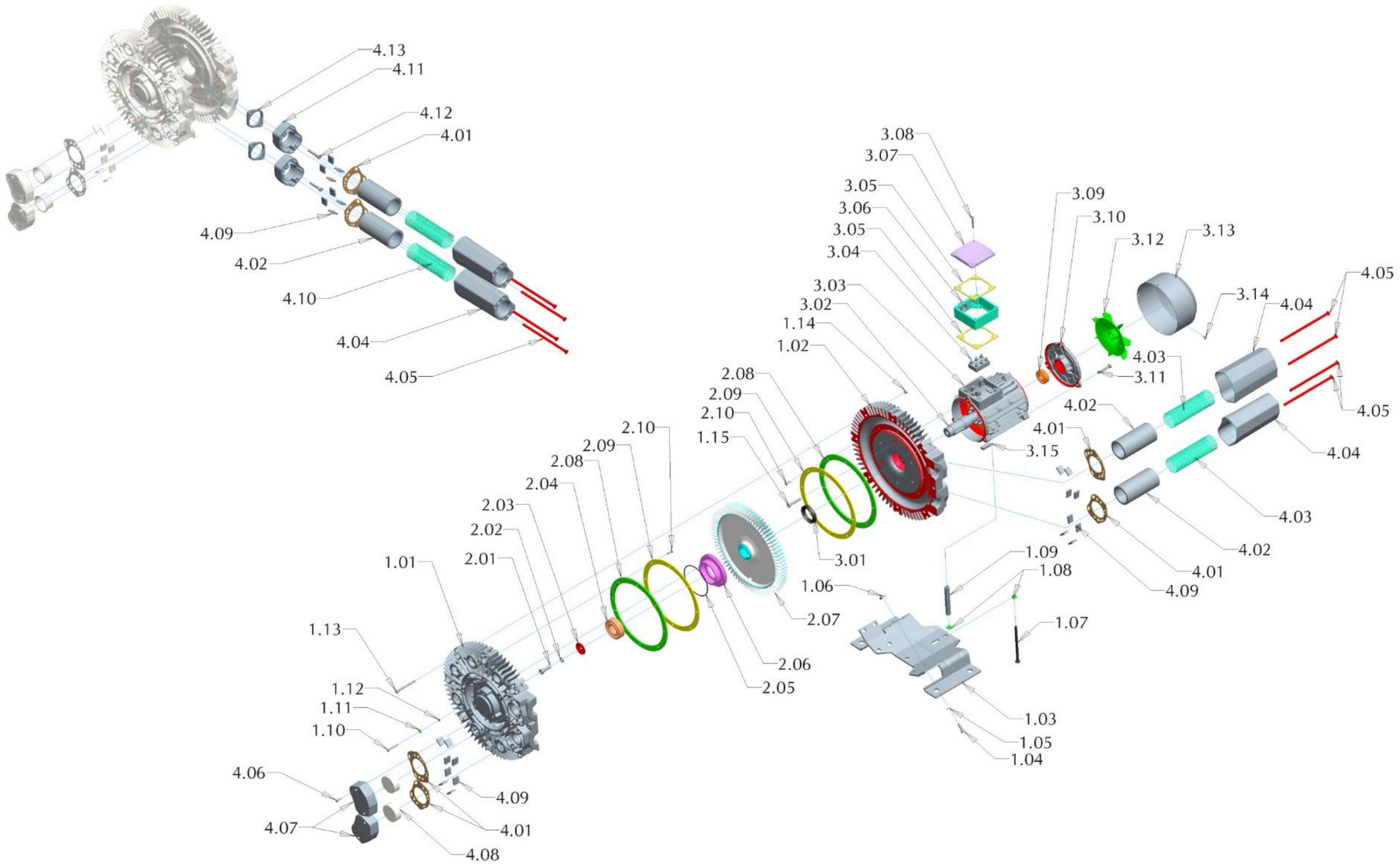
No.	Qty.	Description
1.01	1	Cover
1.02	1	Housing
1.03	1	Mounting Plate
1.04	4	Motor Mounting Screw
1.05	2	Mouting Plate Screw
1.06	2	Mounting Plate Washer
1.07	2	Mouting Plate Nut
1.08	1	Stator Support Screw
1.09	2	Stator Support Washer
1.10	1	Stator Support Sleeve
1.11	8	Cover Mounting Screw
1.12	8	Cover Mounting Nut
1.13	4	Bearing Cover Washer
1.14	4	Bearing Cover Screw
2.01	1	Shaft Screw
2.02	1	Shaft Lock Washer
2.03	1	Disc
2.04	1	Bearing
2.05	1	Bearing Cover O-Ring
2.06	1	Bearing Cover
2.07	1	Impeller
2.08	1	Disc
3.01	1	Seal
3.02	1	Motor Rotor
3.03	1	Stator
3.04	1	Terminal Block
3.05	1	Motor Terminal Box Gasket
3.06	1	Cover For Terminal Box
3.07	4	Terminal Box Cover Screw
3.08	1	Rear Bearing
3.09	1	Bearing Preloading Ring
3.10	1	End Shield
3.11	1	Tolerance Ring
3.12	1	Shaft Key
3.13	1	External Fan
3.14	1	Retaining Ring
3.15	1	Fan Cowl
3.16	4	Fan Cowl Screw
3.17	8	Stator Nut
3.18	4	End Shield Screw
3.19	1	Parallel Key
4.01	2	Silencer Gasket
4.02	2	Silencer Insert
4.03	2	Silencer Insert Filler
4.04	2	Silencer Casing
4.05	4	Silencer Screw
4.06	2	Flange
4.07	4	Flange Screw

3BA1 TWO STAGE
EXPLODED VIEW



No.	Qty.	Description
1.01	1	Cover
1.02	1	Center Section
1.03	1	Blower Housing
1.04	1	Mounting Plate
1.05	2	Plate Mounting Screw
1.06	2	Mouting Plate Washer
1.07	2	Mounting Plate Nut
1.08	1	Stator Support Screw
1.09	2	Stator Support Washer
1.10	1	Stator Support Sleeve
1.11	4	Bearing Cover Screw
1.12	4	Bearing Screw Washer
1.13	4	Bearing Ring Seal
1.14	8	Cover Mounting Screw
1.15	8	Cover Mounting Nut
1.16	4	Motor Mounting Screw
1.17	1	Lifting Ring
2.01	1	Shaft Screw
2.02	1	Shaft Lock Washer
2.03	1	Disc
2.04	1	Bearing
2.05	1	Bearing Cover O-Ring
2.06	1	Bearing Cover
2.07	2	Impeller
2.08	1	Sleeve
2.09	1	Disk
3.01	1	Shaft Seal Ring
3.02	1	Motor Attachment
3.03	4	Motor Attachment Screw
3.04	3	Parallel Key
3.05	1	Motor Rotor
3.06	1	Stator
3.07	1	Motor Terminal Box Gasket
3.08	1	Cover For Terminal Box
3.09	4	Terminal Box Cover Screw
3.10	1	Terminal Block
3.11	1	Rear Bearing
3.12	1	End Shield Seal
3.13	1	Rotary Shaft Lip Seal
3.14	1	End Shield
3.15	1	External Fan
3.16	1	Retaining Ring
3.17	1	Fan Cowl
3.18	4	Fan Cowl Screw
3.19	4	End Shield Screw
3.20	8	Stator Nut
4.01	4	Silencer Gasket
4.02	1	Silencer Attachment
4.03	2	Silencer Attachment Screw
4.04	2	Silencer Flange
4.05	4	Silencer Flange Screw
4.06	2	Silencer Insert Filler
4.07	2	Silencer Insert
4.08	2	Silencer Casing
4.09	4	Silencer Screw
4.10	2	Flange Gasket
4.11	2	Flnage
4.12	4	Flange Screw
4.13	1	Side Silencer Gasket

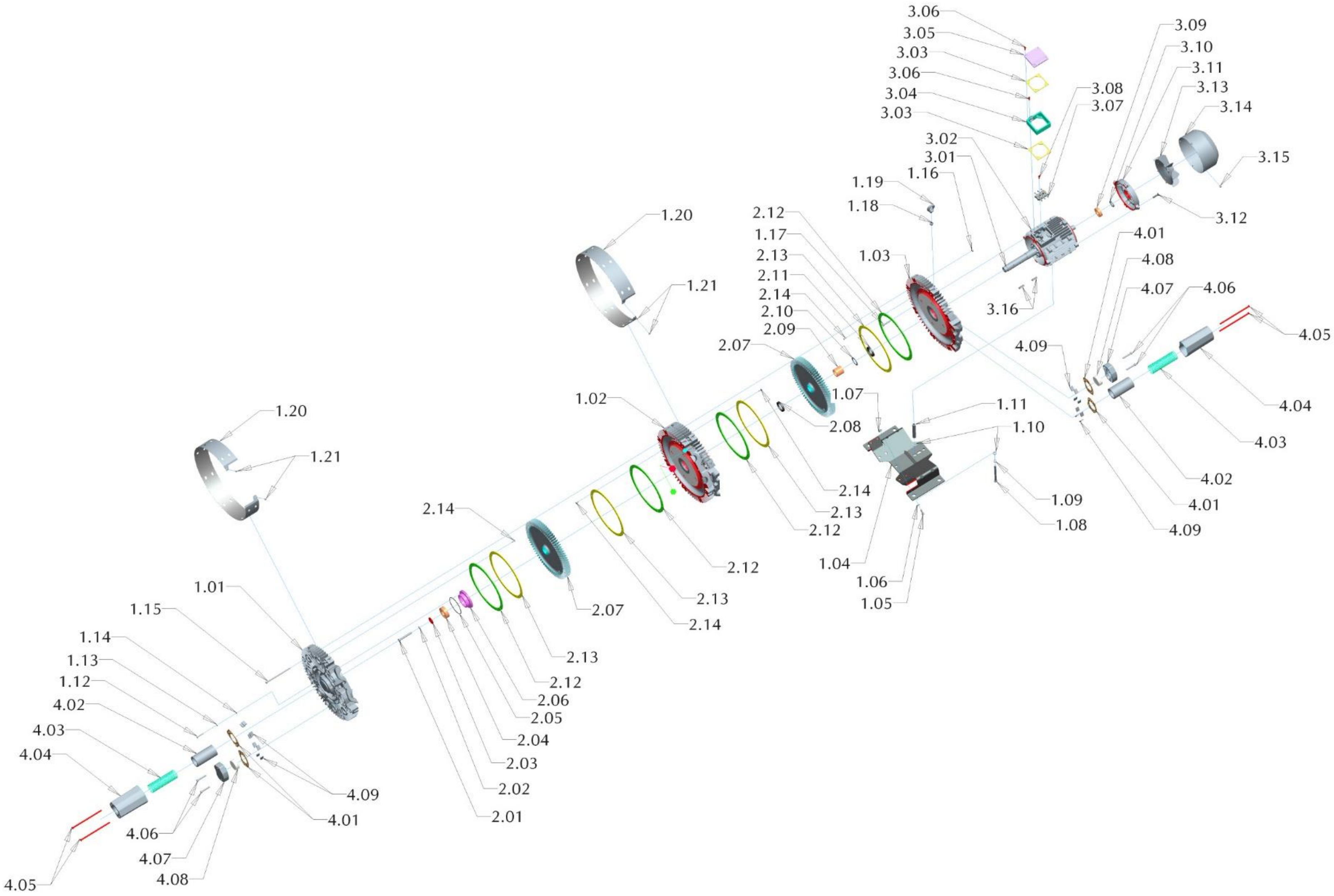
3BA7 SINGLE STAGE
EXPLODED VIEW



No.	Qty.	Description
1.01	1	Cover
1.02	1	Housing
1.03	1	Mounting Plate
1.04	4	Plate Mounting Screw
1.05	4	Mouting Plate Washer
1.06	4	Mounting Plate Nut
1.07	1	Stator Support Screw
1.08	2	Stator Support Washer
1.09	1	Stator Support Sleeve
1.10	3	Bearing Cover Screw
1.11	3	Bearing Screw Washer
1.12	3	Bearing Ring Seal
1.13	8	Cover Mounting Screw
1.14	8	Cover Mounting Nut
1.15	3	Motor Mounting Screw
2.01	1	Shaft Screw
2.02	1	Shaft Lock Washer
2.03	1	Disc
2.04	1	Bearing
2.05	1	Bearing Cover O-Ring
2.06	1	Bearing Cover
2.07	1	Impeller
2.08	2	Teflon Seal
2.09	2	Retaining Ring
2.10	16	Inner Seal Screw
3.01	1	Shaft Seal Ring
3.02	1	Motor Rotor
3.03	1	Stator
3.04	1	Terminal Block
3.05	2	Motor Terminal Box Gasket
3.06	1	Terminal Box
3.07	1	Cover For Terminal Box
3.08	4	Terminal Box Cover Screw
3.09	1	Rear Bearing
3.10	1	End Shield
3.11	3	End Shield Screw
3.12	1	External Fan
3.13	1	Fan Cowl
3.14	4	Fan Cowl Screw
3.15	1	Parallel Key
4.01	4	Silencer Gasket
4.02	2	Silencer Insert Filler
4.03	2	Silencer Insert
4.04	2	Silencer Casing
4.05	4	Silencer Screw
4.06	4	Flange Screw
4.07	2	Flange Cap
4.08	2	Flange Filler
4.09	16	Filler
4.10	2	Silencer Insert
4.11	2	Flange
4.12	4	Flange Screw
4.13	2	Flange Gasket

*Does not apply for 3BA76XX Blowers

3BA7 TWO STAGE EXPLODED VIEW



No.	Qty.	Description
1.01	1	Cover
1.02	1	Center Section
1.03	1	Housing
1.04	1	Mounting Plate
1.05	4	Plate Mounting Screw
1.06	4	Mouting Plate Washer
1.07	4	Mounting Plate Nut
1.08	1	Stator Support Screw
1.09	1	Stator Support Lock Washer
1.10	2	Stator Support Washer
1.11	1	Stator Support Sleeve
1.12	3	Bearing Cover Screw
1.13	3	Bearing Screw Washer
1.14	3	Bearing Ring Seal
1.15	8	Cover Mounting Screw
1.16	8	Cover Mounting Nut
1.17	4	Motor Mounting Screw
1.18	1	Lifting Ring Nut
1.19	1	Lifting Ring
1.20	2	Blower Cowl
1.21	4	Blower Cowl Screw
2.01	1	Shaft Screw
2.02	1	Shaft Lock Washer
2.03	1	Disc
2.04	1	Bearing
2.05	1	Bearing Cover O-Ring
2.06	1	Bearing Cover
2.07	2	Impeller
2.08	1	Rotary Shaft Seal
2.09	1	Sleeve
2.10	1	Disk
2.11	1	Shaft Seal Ring
2.12	4	Teflon Seal*
2.13	4	Retaining Ring
2.14	32	Inner Seal Screw
3.01	1	Motor Rotor
3.02	1	Stator
3.03	2	Motor Terminal Box Gasket
3.04	1	Terminal Box
3.05	1	Cover For Terminal Box
3.06	8	Terminal Box Screw
3.07	1	Terminal Block
3.08	1	Terminal Block Screw
3.09	1	Rear Bearing
3.10	1	End Shield Disk
3.11	1	End Shield
3.12	4	End Shield Screw
3.13	1	External Fan
3.14	1	Fan Cowl
3.15	4	Fan Cowl Screw
3.16	2	Parallel Key
4.01	4	Silencer Gasket
4.02	2	Silencer Insert Filler
4.03	2	Silencer Insert
4.04	2	Silencer Casing
4.05	4	Silencer Screw
4.06	4	Flange Screw
4.07	2	Flange Cap
4.08	2	Flange Filler
4.09	16	Filler

*Does not apply for 3BA76XX Blowers

Airtech, Inc. (“Company”) Warranty Statement

Company warrants that on the date of shipment to Purchaser the goods will be of the kind and quality described herein, merchantable, and free of all defects in workmanship and materials.

If within one year from the date of initial operation, but not more than eighteen months from date of shipment by the Company, of any item of the goods, Purchaser discovers that such item was not as warranted above and promptly notifies Company in writing thereof, Company shall remedy such defect by, at the Company’s option, adjustment, repair or replacement of the item and any affected part of the good. Purchaser shall assume all responsibility and expense for removal, reinstallation and freight in connection with the foregoing remedy. The same obligations and conditions shall extend to replacement items furnished by the Company hereunder. Company shall have the right of disposal of items replaced by it. Purchaser shall grant Company access to the goods at all reasonable times in order for Company to determine any defect in the goods. In the event that adjustment, repair or replacement does not remedy the defect, the Company and Purchaser shall negotiate in good faith an equitable adjustment in the contract price.

The Company’s responsibility does not extend to any item of the goods which has not been manufactured and sold by the Company. Such item shall be covered only by the express warranty, if any, by the manufacturer thereof. The Company and its suppliers shall also have no responsibility if the goods have been improperly stored, handled or installed, or if the goods have not been operated or maintained according to their ratings or according to the instructions in Company or supplier furnished manuals, or if unauthorized repairs or modifications have been made to the goods.

THIS WARRANTY IS EXPRESSLY IN LIEU OF ALL OTHER WARRANTIES (EXCEPT TITLE) INCLUDING BUT NOT LIMITED TO IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS, AND CONSTITUTES THE ONLY WARRANTY OF COMPANY WITH RESPECT TO THE GOODS.

The forgoing states Purchaser’s exclusive remedy against Company and its suppliers for any defect in the good or for failure of the goods to be as warranted, whether Purchaser’s remedy is based on contract, warranty, failure of such remedy to achieve its essential purpose, tort (including negligence), strict liability, indemnity, or any other legal theory, and whether arising out of warranties, representations, instructions, installations, or defects from any cause.

Neither Company nor its suppliers shall be liable, whether in contract, warranty, failure of a remedy to meet its essential purpose, tort (including negligence), strict liability, indemnity or any other legal theory, for loss of use, revenue or profit or for cost of capital or of substitute use or performance or for indirect, liquidated, incidental or consequential damages or for any other loss or cost of a similar type, or for claims by Purchaser for damages of Purchaser’s customers.

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Appendix C – System O&M Form

O&M FIELD DATA SHEET
FOR THE SSDS SYSTEM LOCATED AT 4778 BROADWAY, NY, NY

Date/Time Arrived: ______________________
Time Departed: ______________________
Operator: ______________________

Barometric Pressure: ______________________
Weather Conditions: ______________________
Approx. Temperature: ______________________

SYSTEM MEASUREMENTS

Location ID	VFD Speed Setting (Hz)	Inlet Vacuum Pre-Filter (in. H2O)	Post-Filter Vacuum (in. H2O)	Monitoring point vacuum (in. H2O)	Exhaust Temp (deg. F)	Flowrate (cfm)	Valve Position (% Open)	Other (specify)
Blower				NA			NA	
Loop 1	NA	NA	NA					
Loop 2	NA	NA	NA					
Loop 3	NA	NA	NA					
Loop 4	NA	NA	NA					
Loop 5	NA	NA	NA					

SYSTEM INSPECTIONS AND MAINTENANCE

Item	Frequency	Results/Comments
Visual Inspection of SSDS Piping and Fittings	Annually	
Visual Inspection of Building Floor for cracks/damage	Annually	
Visual Inspection of SSDS	Annually	
Inspection of Building/Slab for Modifications	Annually	
Clean or Change In-line Filter	Diff. pressure 6 to 10 in. H_2O above normal.	
Blower Inspections & Maintenance	Consult Blower Manual for Schedule	
Other (Specify)		

ABNORMAL OPERATING CONDITIONS

Description of Alarm or Malfunction	Date/Time	Blower ID	Describe Troubleshooting/Corrective Actions

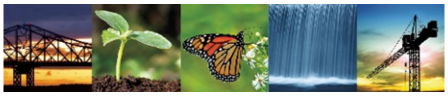
SEPTEMBER 2023

Notes/Comments

GZA GeoEnvironmental, Inc.

APPENDIX I

QUALITY ASSURANCE PROJECT PLAN



Known for excellence.
Built on trust.

QUALITY ASSURANCE PROJECT PLAN

4778 Broadway
New York, New York 10034
Block 2233, Lot 10
NYSDEC BCP Site No. C231131

March 2025

PREPARED FOR:
M4778 Broadway LLC
C/O GDI Construction LLC
15 Verbana Avenue, Suite 200
Floral Park, New York 11001

PREPARED BY:

Goldberg Zoino Associates of New York, P.C.
d/b/a GZA GeoEnvironmental of New York
104 West 29th Street - 10th Floor | New York, NY 10001

File No. 41.0163310.10

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ATTACHMENTS

1.0 INTRODUCTION

This Quality Assurance Project Plan (QAPP) presents the organization, objectives, planned activities, and specific quality assurance/quality control (QA/QC) procedures associated with the Site Management Plan (SMP) at 4778 Broadway, New York, New York (Site). **Figure 1** presents a Site location map.

This QAPP describes specific protocols for field sampling, sample handling and storage, chain-of-custody, laboratory analysis, and data handling and management. Preparation of the Plan was based on EPA Quality Assurance Project Plan guidance documents, including:

- *EPA Requirements for Quality Assurance Project Plans* (EPA QA/R-5, March 2001); and
- *Guidance for Quality Assurance Project Plans* (EPA QA/G-5, December 2002).

Potential parameters to be analyzed, including their respective quantitation limits (QLs), and data quality levels (DQLs), are provided in **Tables 1A through 1C**.

2.0 PROJECT ORGANIZATION AND RESPONSIBILITY

A qualified person will coordinate and manage the Site sampling and analysis program, data reduction, QA/QC, data validation, analysis, and reporting. A Victoria Whalen, P.G. is a qualified environmental professional (QEP), as defined by the New York State Department of Environmental Conservation (NYSDEC) and will direct the sampling activities and coordinate with the laboratory. The intent of this QAPP is to be performed in accordance with the technical guidance applicable to Technical Guidance for Site Investigation and Remediation (DER-10), and Sampling, Analysis and Assessment of Per- and Polyfluoroalykly Substances (PFAS) under NYSDEC's Part 375 Remedial Programs dated April 2023.

A qualified person will ensure that the QA/QC plan is implemented. GZA's Senior Technical Specialist, Dr. Chunhua Liu will provide oversight and technical support for the sampling and analytical procedures followed acting as the project QA Officer. This individual has the broad authority to approve or disapprove project plans, specific analyses, and final reports. The QEP is independent from the data generation activities. In general, the QA officer will be responsible for reviewing and advising on all QA/QC aspects of this program.

Laboratories used will be New York State Department of Health Environmental (NYSDOH) Laboratory Approval Program (ELAP) certified laboratories. The anticipated ELAP certified laboratory to be used during sampling is Alpha Analytical, Inc.'s Mansfield, Massachusetts Laboratory. The laboratories will communicate directly with the sampler regarding the analytical results and reporting and will be responsible for providing all labels, sample containers, field blank water, trip blanks, shipping coolers, and laboratory documentation. Qualifications of the QA officer are provided in **Attachment A.**

3.0 QA OBJECTIVES FOR DATA MANAGEMENT

The analytical data will be provided by the laboratory using the NYSDEC Category B deliverable format. Analytical data collected for disposal characteristics that may be requested by off-site wastewater disposal facilities will be provided in the format that the facility requests.

All analytical measurements will be made so that the results are representative of the media sampled and the conditions measured. Data will be reported in micrograms per liter (µg/L) or milligrams per liter (mg/L) for aqueous samples. **Table 2** presents the proposed samples, sampling and analytical parameters, analytical methods, sample preservation requirements and containers.

Quantitation Limits (QLs) are laboratory-specific and reflect those values achievable by the laboratory performing the analyses. Data Quality Levels (DQLs) are those reporting limits required to meet the objectives of the program (i.e., program action levels, cleanup standards, etc.). Data Quality Objectives (DQOs) define the quality of data and documentation required to support decisions made in the various phases of the data collection activities. The DQOs are dependent on the end uses of the data to be collected and are also expressed in terms of objectives for precision, accuracy, representativeness, completeness, and comparability.

The analytical methods to be used at this Site provide the highest level of data quality and can be used for purposes of risk assessment, evaluation of remedial alternatives and verification that cleanup standards have been met. However, in order to ensure that the analytical methodologies are capable of achieving the DQOs, measurement performance criteria have been set for the analytical measurements in terms of accuracy, precision, and completeness.

The overall QA objective is to develop and implement procedures for field sampling, chain-of-custody, laboratory analysis, and reporting which will provide results that are scientifically valid, and the levels of which are sufficient to meet DQOs. Specific procedures for sampling, chain of custody, laboratory instrument calibration, laboratory analysis, reporting of data, internal quality control, and corrective action are described in other sections of this QAPP.

Tables 3, **4**, and **5** present the precision and accuracy requirements for each parameter to be analyzed. For quantitation limits for parameters associated with groundwater samples, the laboratory will be required to attempt to meet or surpass the parameter-specific limits for groundwater from the Division of Water Technical and Operational Guidance Series (TOGS 1.1.1) Ambient Water Quality Standards and Guidance Values. In certain instances, if the TOGS criteria are not achievable due to analytical limitations, the laboratory will report the lowest possible quantitation limit.

The QA objectives are defined as follows:

> ***Accuracy*** is the closeness of agreement between an observed value and an accepted reference value. The difference between the observed value and the reference value includes components of both systematic error (bias) and random error.
>
> Accuracy in the field is assessed through the adherence to all field instrument calibration procedures, sample handling, preservation, and holding time requirements, and through the collection of equipment blanks prior to the collection of samples for each type of equipment being used (e.g., groundwater sampling pumps).
>
> The laboratory will assess the overall accuracy of their instruments and analytical methods (independent of sample or matrix effects) through the measurement of “standards,” materials of accepted reference value. Accuracy will vary from analysis to analysis because of individual sample and matrix effects. In an individual analysis, accuracy will be measured in terms of blank results, the percent recovery (%R) of surrogate compounds in organic analyses, or %R of spiked compounds

in matrix spikes (MSs), matrix spike duplicates (MSDs) and/or laboratory control samples (LCSs). This gives an indication of expected recovery for analytes tending to behave chemically like the spiked or surrogate compounds. **Tables 3**, **4**, and **5** summarize the laboratory accuracy requirements.

Precision is the agreement among a set of replicate measurements without consideration of the "true" or accurate value: i.e., variability between measurements of the same material for the same analyte. Precision is measured in a variety of ways including statistically, such as calculating variance or standard deviation.

Precision in the field is assessed through the collection and measurement of field duplicates (one extra sample in addition to the original field sample). Field duplicates will be collected at a frequency of one per twenty investigative samples per matrix per analytical parameter. Precision will be measured through the calculation of relative percent differences (RPDs). The resulting information will be used to assess sampling and analytical variability. Field duplicate RPDs must be ≤ 50 for soil samples and ≤ 30 for aqueous samples. These criteria apply only if the sample and/or duplicate results are >5x the quantitation limit; if both results are ≤ 5x the quantitation limit, the criterion will be doubled. Due to the uncertainty of available representative soil gas volume, field duplicates will not be collected for this matrix.

Precision in the laboratory is assessed through the calculation of RPD for duplicate samples. For water analyses, laboratory precision will be assessed through the analysis of MS/MSD samples and field duplicates. For the inorganic analyses, laboratory precision will be assessed through the analysis of matrix duplicates and field duplicates. MS/MSD samples or matrix duplicates will be performed at a frequency of one per twenty investigative samples per matrix per parameter. **Tables 3**, **4**, and **5** summarize the laboratory precision requirements.

Completeness is a measure of the amount of valid data obtained from a measurement system compared to the amount that was expected to be obtained under normal conditions. "Normal conditions" are defined as the conditions expected if the sampling plan was implemented as planned.

Field completeness is a measure of the amount of (1) valid measurements obtained from all the measurements taken in the project and (2) valid samples collected. The field completeness objective is greater than 90 percent.

Laboratory completeness is a measure of the amount of valid measurements obtained from all valid samples submitted to the laboratory. The laboratory completeness objective is greater than 95 percent.

Representativeness is a qualitative parameter that expresses the degree to which data accurately and precisely represent either a characteristic of a population, parameter variations at a sampling point, a process condition, or an environmental condition within a defined spatial and/or temporal boundary. To ensure representativeness, the sampling locations have been selected to provide coverage over a wide area and to highlight potential trends in the data. In addition, field duplicate samples will provide an additional measure of representativeness at a given location.

Representativeness is dependent upon the proper design of the sampling program and will be satisfied by ensuring that the Work Plans and QAPP are followed, and that proper sampling, sample handling, and sample preservation techniques are used.

Representativeness in the laboratory is ensured by using the proper analytical procedures, appropriate methods, and meeting sample holding times.

Comparability expresses the confidence with which one data set can be compared to another. Comparability is dependent upon the proper design of the sampling program and will be satisfied by ensuring that the Work Plans and QAPP are followed and that proper sampling techniques are used. Maximization of comparability with previous data sets is expected because the sampling design and field protocols are consistent with those previously used.

Comparability is dependent on the use of recognized EPA or equivalent analytical methods and the reporting of data in standardized units. Laboratory procedures are consistent with those used for previous sampling efforts.

4.0 SAMPLING PLAN

Environmental sampling will include groundwater sampling. Additionally, purge water generated during groundwater monitoring events will be sampled and tested for characterization for disposal. Groundwater samples will be collected using bailers or peristaltic, bladder or submersible pumps.

4.1. Groundwater Sampling

Groundwater sampling of permanent monitoring wells is described according to the following distinct phases of this work: well installation/construction, well development, well purging, and well sampling.

4.1.1. Well Purging

The objective is to purge monitoring wells until turbidity stabilizes to a level as low as possible and this parameter will be given the greatest weight in determining when groundwater sampling may begin. With this objective in mind, a low-flow pump will be used to avoid entrainment of particulates within the well or from the formation. Groundwater from each well will be purged until parameters have stabilized. A turbidity level of fifty NTUs or less is the well purging goal, but not an absolute value before sampling. Other field parameters including temperature, conductivity, pH, and dissolved oxygen (DO) will also be monitored. As practical, all field measurements will be taken from the flow cell and will be recorded during and after purging, and before sampling. Field parameters should generally be within ±10 percent for three consecutive readings, one minute apart, prior to sampling.

Upon opening each monitoring well and point, the concentration of VOCs in the headspace will be measured using a PID and water level measurements will be recorded using an electronic interface probe. The depth to product (if present), depth to water, and the total depth will be measured from the top of the marked PVC casings. Water level and free product measurements will first be made and the volume of water in the well determined. The volume of water in the well will be calculated so that the number of well volumes purged and an estimate of the time required to purge the well can be made. Before sampling, the wells will be purged utilizing a low-flow submersible stainless steel pump using dedicated Teflon® or Teflon®-lined polyethylene tubing connected to a flow cell. Very low purging rates are proposed, on the order of 100 ml/minute to 500 ml/minute, to minimize suspension of particulate matter in the well.

Purging will be done with the pump intake placed at the midpoint of the well screen or the midpoint of the water column (to be determined based on the depth and length of the screen interval) to ensure that all stagnant water in the well is removed, while not stirring up sediment that may have accumulated on the bottom of the well. Equipment will be lowered into the well very carefully to prevent suspension of bottom sediment and subsequent entrainment onto sampling equipment. Surging will be avoided. Tubing will be replaced between each well. Pumps must be carefully cleaned between wells according to the procedures specified in **Section 4.15,** below. It is anticipated that no more than three well volumes will be purged in order for turbidity to reach a minimum and the other parameters to stabilize. Ideally, pumping rates will be at a rate so that no drawdown of the groundwater level occurs (i.e., pumping rate is less than recharge rate). During purging, the sampler will actively monitor and track the volume of water purged and the field parameter readings. Data will be recorded in the field logbook. For example, the sampler will record the running total volume purged from each well and note the readings for the corresponding field parameters.

4.1.2. Well Sampling

Once groundwater conditions have stabilized and groundwater levels have recovered, samples will be collected from the flow cell outlet (connected to the low-flow submersible or peristaltic pump). All non-disposable/non-dedicated (re-usable) sampling equipment will be cleaned according to the procedures specified in **Section 4.15**.

Sampling will be performed with the pump intake at the same location used for purging. Pumping rates for withdrawing the samples will be similar to those followed for well purging.

The samples will be collected in sample bottles (pre-preserved, if appropriate), placed in iced coolers and removed from light immediately after collection. In addition, all sample bottles must be filled to the top so that no aeration of the samples occurs during transport. All bottles will be filled to avoid cascading and aeration of the samples, the goal being to minimize any precipitation of colloidal matter. Samples will be transported to a NYSDOH ELAP certified laboratory under proper chain of custody procedures for analysis. Samples for dissolved metals will be collected in unpreserved containers and will be filtered and preserved at the laboratory within 24 hours of sampling.

4.2. Monitoring Well Abandonment

There may be occasions when monitoring wells will require abandonment. For temporary monitoring wells, the approach will be to pull the PVC well materials from the borehole and backfill the remaining open portion of the borehole with cement/bentonite grout to approximately 0.5 feet below the ground surface. The ground surface will be restored to a similar condition as the surrounding grade (e.g., topsoil, asphalt, or concrete). For permanent overburden and bedrock monitoring wells, depending on the site-specific subsurface geologic conditions and nature of contamination, the abandonment approach will be in accordance with NYSDEC Policy CP-43 – Groundwater Monitoring Well Decommissioning Policy.

4.3. <u>Waste Characterization Sampling</u>

Waste classification sampling may be conducted to characterize soil, liquids and/or groundwater for the purpose of proper off-site waste disposal. Specific methods for sampling liquid wastes are briefly discussed below.

4.3.1. Liquid Waste

Liquid sampling methods include utilizing dedicated dippers, glass tube samplers, pump and tubing, kemmerer bottles, and Bacon Bomb samplers. Dippers are used to collect samples from the surface of the liquid and are appropriate for wastes that are homogeneous. Glass tube samplers consist of glass tubes of varying length and diameter used to collect a full-depth liquid sample from a drum or similar container. Pump and tubing (e.g., bladder pump or peristaltic pump) are used to collect liquid samples from a depth (up to approximately 20 feet below grade), and are typically relied upon for sampling subsurface structures, such as underground storage tanks. To minimize the loss of volatile organic components in the liquid, the lowest achievable flow rate is utilized for collecting the sample by this method. Kemmerer bottles and Bacon Bomb samplers are discrete-depth samplers. These samplers are lowered into the liquid and opened to collect a sample at a desired depth.

4.3.2. Grab versus Composite Sampling

Waste characterization of a liquid can involve grab or composite sampling depending upon the homogeneity and the volume of the waste. Grab sampling consists of collecting a discrete sample or samples of a material and submitting each sample for separate analysis. Grab sampling is appropriate for characterizing small quantities of waste as well as waste streams of varying content (e.g., drums of different contents). Composite sampling consists of taking discrete grab samples of a material and combining them into a smaller number of samples for analysis. Composite sampling generally is appropriate for large volumes of a homogenous waste material. The specific number of composite and grab samples largely will depend upon the size, nature of the waste, as well as the analysis required for characterization of the waste.

4.4. <u>QC Sample Collection</u>

QC samples will include equipment blanks, trip blanks, field duplicates and MS/MSDs.

Equipment blanks will consist of distilled water and will be used to check for potential contamination of the equipment that may cause sample contamination. Equipment blanks will be collected by routing the distilled water through the sampling equipment prior to sample collection. Equipment blanks will be submitted to the laboratory at a frequency of one per day per matrix per type of equipment being used per parameter. Equipment blanks will not be collected with samples for analysis for parameters associated with wastewater samples and samples collected for disposal purposes.

Trip blanks will consist of distilled water (supplied by the laboratory) and will be used to assess the potential for volatile organic compound contamination of groundwater samples due to contaminant migration during sample shipment and storage. Trip blanks will be transported to the site unopened, stored with the investigative samples, and kept closed until analyzed by the laboratory. Trip blanks will be submitted to the laboratory at a frequency of one per cooler that contains groundwater samples for analysis for VOCs.

Field duplicates are an additional aliquot of the same sample submitted for the same parameters as the original sample. Field duplicates will be used to assess the sampling and analytical reproducibility. Field duplicates will be collected by alternately filling sample bottles from the source being sampled. Field duplicates will be submitted at a frequency of one per 20 samples for all matrices and all parameters with the exception of TCLP parameters, parameters associated with wastewater samples, and samples collected for waste characterization purposes.

MSs and MSDs are two additional aliquots of the same sample submitted for the same parameters as the original sample. However, the additional aliquots are spiked with the compounds of concern. Matrix spikes provide information about the effect of the sample matrix on the measurement methodology. MS/MSDs will be submitted at a frequency of one per 20 investigative samples per matrix for organic parameters for soil, sediment, and groundwater. MS/MSDs will be submitted at a frequency of one per 20 investigative samples per matrix for inorganic parameters.

4.5. Sample Preservation and Containerization

The analytical laboratory will supply the sample containers for the chemical samples. These containers will be cleaned by the manufacturer to meet or exceed all analyte specifications established in the latest U.S. EPA's *Specifications and Guidance for Contaminant-Free Sample Containers*. Certificates of analysis are provided with each bottle lot and maintained on file to document conformance to EPA specifications. The containers will be pre-preserved, where appropriate (see **Table 2**).

Table 6 presents a summary of QC sample preservation and container requirements.

4.6. Equipment Decontamination

Re-usable Teflon®, stainless steel, and aluminum sampling equipment shall be cleaned between each use in the following manner:

- Tap water rinse
- Wash and scrub with Alconox and water mixture
- Tap water rinse
- Distilled/deionized water rinse
- Air dry

Cleaned equipment shall be wrapped in aluminum foil if not used immediately after air-drying.

Groundwater sampling pumps will be cleaned by washing and scrubbing with an Alconox/water mixture, rinsing with tap water and irrigating with distilled/deionized water.

5.0 DOCUMENTATION AND CHAIN-OF-CUSTODY

5.1. <u>Sample Collection Documentation</u>

5.1.1. Field Notes

Field team members will keep a field logbook to document all field activities. Field logbooks will provide the means of recording the chronology of data collection activities performed during the remediation. As such, entries will be described in as much detail as possible so that a particular situation could be reconstructed without reliance on memory.

The logbook will be a bound notebook with water-resistant pages. Logbook entries will be dated, legible, and contain accurate and inclusive documentation of the activity. The title page of each logbook should contain the following:

- Person to whom the logbook is assigned
- The logbook number
- Project name and number
- Site name and location
- Project start date
- End date

Entries into the logbook will contain a variety of information. At the beginning of each entry, the date, start time, weather, and names of sampling team members present will be entered. Each page of the logbook will be signed and dated by the person making the entry. All entries will be made in permanent ink, signed, and dated and no erasures or obliterations will be made. If an incorrect entry is made, the information will be crossed out with a single strike mark that is signed and dated by the sampler. The correction shall be written adjacent to the error.

Field activities will be fully documented. Information included in the logbook should include, but may not be limited to, the following:

- Chronology of activities, including entry and exit times
- Names of all people involved in sampling activities
- Level of personal protection used
- Any changes made to planned protocol
- Names of visitors to the site during sampling and reason for their visit
- Sample location and identification
- Changes in weather conditions
- Dates (month/day/year) and times (military) of sample collection
- Measurement equipment identification (model/manufacturer) and calibration information
- Sample collection methods and equipment
- Sample depths
- Whether grab or composite sample collected
- How sample composited, if applicable
- Sample description (color, odor, texture, etc.)
- Sample identification code
- Tests or analyses to be performed
- Sample preservation and storage conditions
- Equipment decontamination procedures
- QC sample collection
- Unusual observations
- Record of photographs
- Sketches or diagrams
- Signature of person recording the information

Field logbooks will be reviewed on a daily basis by the Field Team Leader. Logbooks will be supported by standardized forms.

5.1.2. Chain-of-Custody Records

On a regular basis (daily or on such a basis that all holding times will be met), samples will be transferred to the custody of the respective laboratories, via third-party commercial carriers or via laboratory courier service.

Chain-of-custody records are initiated by the samplers in the field. The field portion of the custody documentation should include: (1) the project name; (2) signatures of samplers; (3) the sample number, date and time of collection, and whether the sample is grab or composite; (4) signatures of individuals involved in sampling; and (5) if applicable, air bill or other shipping number. Sample receipt and log-in procedures at the laboratory are described in **Section 5.2.2** of this Plan.

5.1.3. Sample Labeling

Immediately upon collection, each sample will be labeled with a pre-printed adhesive label, which includes the date and time of collection, sampler's initials, tests to be performed, preservative (if applicable), and a unique identifier.

A. The following identification scheme will be used:

Groundwater wells will be assigned sequential numbers. Groundwater samples will be identified by the well that the sample was collected from.

Examples:
GMW-01 = groundwater sample collected from permanent well point #1

Duplicate samples will be labeled as blind duplicates by giving them sample numbers indistinguishable from a normal sample.

Blanks should be spelled out and identify the associated matrix, e.g., Equipment Blank, Soil

MS/MSDs will be noted in the Comments column of the COC.

B. The analysis required will be indicated for each sample.
Example: SVOC

C. Date taken will be the date the sample was collected, using the format: MM-DD-YY.
Example: 04-22-22

D. Time will be the time the sample was collected, using military time.
Example: 14:30

E. The sampler's name will be printed in the "Sampled By" section.

F. Other information relevant to the sample.
Example: Equipment Blank

An example sample label is presented below:

Job No. ______________________________
Client: ______________________________
Sample Number ______________________________
Date ____________________ Sample Time ____________________
Sample Matrix ______________________________
Grab or Composite (explain) ______________________________

Preservatives ____
Analyses ____
Sampler Signature____

This sample label contains the authoritative information for the sample. Inconsistencies with other documents will be settled in favor of the vial or container label unless otherwise corrected in writing from the field personnel collecting samples or the QEP.

5.2. Sample Custody

Custody is one of several factors that are necessary for the admissibility of environmental data as evidence in a court of law. Custody procedures help to satisfy the two major requirements for admissibility: relevance and authenticity. Sample custody is addressed in three parts: field sample collection, laboratory analysis, and final evidence files.

A sample or evidence file is considered to be under a person's custody if

- the item is in the actual possession of a person
- the item is in the view of the person after being in actual possession of the person
- the item was in the actual physical possession of the person but is locked up to prevent tampering
- the item is in a designated and identified secure area

5.2.1. Field Custody Procedures

Samples will be collected following the sampling procedures documented in **Section 4.0** of this Plan. Documentation of sample collection is described in **Section 5.1** of this Plan. Sample chain-of-custody and packaging procedures are summarized below. These procedures are intended to ensure that the samples will arrive at the laboratory with the chain-of-custody intact.

- The field sampler is personally responsible for the care and custody of the samples until they are transferred or dispatched properly. Field procedures have been designed such that as few people as possible will handle the samples.

- All bottles will be identified by the use of sample labels with sample numbers, sampling locations, date/time of collection, and type of analysis.

- Sample labels will be completed for each sample using waterproof ink unless prohibited by weather conditions. For example, a logbook notation would explain that a pencil was used to fill out the sample label because the pen would not function in wet weather.

- Samples will be accompanied by a properly completed chain-of-custody form. The sample numbers and locations will be listed on the chain-of-custody form. When transferring the possession of samples, the individuals relinquishing and receiving will sign, date, and note the time on the record. This record documents the transfer of custody of samples from the sampler to another person, to a mobile laboratory, to the permanent laboratory, or to/from a secure storage location.

- All shipments will be accompanied by the chain-of-custody record identifying the contents. The original record will accompany the shipment, and copies will be retained by the sampler and placed in the project files.

- Samples will be properly packaged for shipment and dispatched to the appropriate laboratory for analysis, with a separate signed custody record enclosed in and secured to the inside top of each sample box or cooler. If third party commercial carriers are used for transfer to the laboratory, shipping containers will be secured with strapping tape and custody seals prior to shipment. The custody seals will be attached to the front right and back left of the cooler and covered with clear plastic tape after being signed by field personnel. The cooler will be strapped shut with strapping tape in at least two locations.

- If the samples are sent by third party commercial carrier, the air bill will be used. Air bills will be retained as part of the permanent documentation. Commercial carriers are not required to sign off on the custody forms since the custody forms will be sealed inside the sample cooler and the custody seals will remain intact.

- Samples remain in the custody of the sampler until transfer of custody is completed. This consists of delivery of samples to the laboratory courier or sample custodian, and signature of the laboratory courier or sample custodian on chain-of-custody document as receiving the samples and signature of sampler as relinquishing samples.

5.2.2. Laboratory Custody Procedures

Samples will be received and logged in by a designated sample custodian or his/her designee. Upon sample receipt, the sample custodian will

- Examine the shipping containers to verify that the custody tape is intact,
- Examine all sample containers for damage,
- Determine if the temperature required for the requested testing program has been maintained during shipment and document the temperature on the chain-of-custody records,
- Compare samples received against those listed on the chain-of-custody,
- Verify that sample holding times have not been exceeded,
- Examine all shipping records for accuracy and completeness,
- Determine sample pH (if applicable) and record on chain-of-custody forms,
- Sign and date the chain-of-custody immediately (if shipment is accepted) and attach the air bill,
- Note any problems associated with the coolers and/or samples on the cooler receipt form and notify the Laboratory Project Manager, who will be responsible for contacting the QEP,

- Attach laboratory sample container labels with unique laboratory identification and test, and
- Place the samples in the proper laboratory storage.

Following receipt, samples will be logged in according to the following procedure:

- The samples will be entered into the laboratory tracking system. At a minimum, the following information will be entered: project name or identification, unique sample numbers (both client and internal laboratory), type of sample, required tests, date and time of laboratory receipt of samples, and field ID provided by field personnel.
- The Laboratory Project Manager will be notified of sample arrival.
- The completed chain-of-custody, air bills, and any additional documentation will be placed in the final evidence file.

6.0 CALIBRATION PROCEDURES

6.1. Field Instruments

Field instruments will be calibrated according to the manufacturer's specifications. Calibration procedures performed will be documented in the field logbook and will include the date/time of calibration, name of person performing the calibration, reference standard used, temperature at which the readings were taken, and the readings.

6.2. Laboratory Instruments

Calibration procedures for a specific laboratory instrument will consist of initial calibrations, initial calibration verifications, and/or continuing calibration verification. Detailed descriptions of the calibration procedures for a specific laboratory instrument are included in the laboratory's standard operating procedures (SOPs), which describe the calibration procedures, their frequency, acceptance criteria, and the conditions that will require recalibration. These procedures are as required in the respective analytical methodologies (summarized in **Table 2** of this Plan). The initial calibration associated with all analyses must contain a low-level calibration standard which is less than or equal to the quantitation limit.

7.0 SAMPLE PREPARATION AND ANALYTICAL PROCEDURES

No field analyses are anticipated for this program. If site conditions were to warrant field analysis, the responsible contractor will prepare an addendum establishing the field analytical procedures. Analyses of all samples will be performed by NYSDOH ELAP certified laboratories. **Table 2** summarizes the analytical methods to be used during the groundwater monitoring events.

8.0 DATA REDUCTION, VALIDATION, AND REPORTING

Appropriate QC measures will be used to ensure the generation of reliable data from sampling and analysis activities. Proper collection and organization of accurate information followed by clear and concise reporting of the data is a primary goal in this project. Complete data packages suitable for data validation will be provided by the analytical laboratory.

For all analyses, the laboratory will report results that are below the laboratory's reporting limit; these results will be qualified as estimated (J) by the laboratory. The laboratory may be required to report tentatively identified compounds (TICs) for the VOC and SVOC analyses; this will be requested by the sampler on an as-needed basis. A Data Usability Summary Report (DUSR) will be prepared and will be included in the Periodic Review Report (PRR). The third party data validator for this project is Ms. Christin Camardella. Qualifications of the data validator can be found in **Attachment A.**

8.1. Data Evaluation/Validation

8.1.1. Field Data Evaluation

Measurements and sample collection information will be transcribed directly into the field logbook or onto standardized forms. If errors are made, results will be legibly crossed out, initialed and dated by the person recording the data, and corrected in a space adjacent to the original (erroneous) entry. Daily reviews of the field records by the Field Team Leader will ensure that:

- Logbooks and standardized forms have been filled out completely and that the information recorded accurately reflects the activities that were performed.
- Records are legible and in accordance with good record keeping procedures, i.e., entries are signed and dated, data are not obliterated, changes are initialed, dated, and explained.
- Sample collection, handling, preservation, and storage procedures were conducted in accordance with the protocols described in the Plan, and that any deviations were documented and approved by the appropriate personnel.

8.1.2. Data Usability

A DUSR will be prepared in accordance with the DER Technical Guidance for Site Investigation and Remediation (DER-10).

The data usability evaluation will include reviewing the quality assurance/quality control (QA/QC) information including: (1) chain-of-custody; (2) the summary QA/QC information provided by the laboratory; and (3) the project narrative.

For each data package the following questions will be evaluated:

- Is the data package complete as defined under the requirements for the NYSDEC ASP Category B, USEPA CLP deliverables or other standards/guidance?
- Have all holding times and preservation requirements been met?
- Does the QC data fall within the laboratory and project established limits and specifications?

8.2. Identification and Treatment of Outliers

Any data point which deviates markedly from others in its set of measurements will be investigated; however, the suspected outlier will be recorded and retained in the data set. One or both of the following tests will be used to identify outliers.

Dixon's test for extreme observations is an easily computed procedure for determining whether a single very large or very small value is consistent with the remaining data. The one-tailed t-test for difference may also be used in this case. It should be noted that these tests are designed for testing a single value. If more than one outlier is suspected in the same data set, other statistical sources may be consulted and the most appropriate test of hypothesis will be used and documented, if warranted.

Since an outlier may result from unique circumstances at the time of sample analysis or data collection, those persons involved in the analysis and data reduction will be consulted. This may provide an experimental reason for the outlier. Further statistical analysis may be performed with and without the outlier to determine its effect on the conclusions. In many cases, two data sets may be reported, one including, and one excluding the outlier.

In summary, every effort will be made to include the outlying values in the reported data. If the value is rejected, it will be identified as an outlier, reported with its data set and its omission noted.

9.0 INTERNAL QUALITY CONTROL

The subcontracting laboratories' Quality Assurance Project Plans will identify the supplemental internal analytical quality control procedures to be used. At a minimum, this will include:

- Matrix spike and/or matrix spike duplicate samples
- Matrix duplicate analyses
- Laboratory control samples
- Instrument calibrations
- Instrument tunes for SW-846 8260B and 8270C analyses
- Method and/or instrument blanks
- Surrogate spikes for organic analyses
- Internal standard spikes for SW-846 8260B and 8270C analyses
- Quantitation limit determination and confirmation by analysis of low-level calibration standard

As outline on **Table 5** and summarized in **Section 4.13**, field quality control samples will include:

- Equipment blanks
- Field duplicate samples
- Trip blanks
- MS/MSDs

10.0 CORRECTIVE ACTION

The entire sampling program will be under the direction of the QEP. The emphasis in this program is on preventing problems by identifying potential errors, discrepancies, and gaps in the data-collection-laboratory-analysis-interpretation process. Any problems identified will be promptly resolved. Likewise, follow-up corrective action is always an option in the event that preventative corrective actions are not totally effective.

The acceptance limits for the sampling and analyses to be conducted in this program will be those stated in the method or defined by other means in the Plan. Corrective actions are likely to be immediate in nature and most often will be implemented by the contracted laboratory analyst or the Program Manager. The corrective action will usually involve recalculation, reanalysis, or resampling.

10.1. Immediate Corrective Action

Corrective action in the field may be needed when the sample network is changed (i.e., more/less samples, sampling locations other than those specified in the Plan), or when sampling procedures and/or field analytical procedures require modification, etc. due to unexpected conditions. The field team may identify the need for corrective action. The Field Team Leader will approve the corrective action and notify the Program Manager. The Program Manager will approve the corrective measure. The Field Team Leader will ensure that the corrective measure is implemented by the field team.

Corrective actions will be implemented and documented in the field logbook. Documentation will include:

- A description of the circumstances that initiated the corrective action,
- The action taken in response,
- The final resolution, and
- Any necessary approvals

No staff member will initiate corrective action without prior communication of findings through the proper channels.

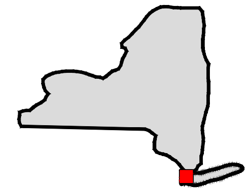
Corrective action in the laboratory may occur prior to, during, and after initial analyses. A number of conditions such as broken sample containers, omissions or discrepancies with chain-of-custody documentation, low/high pH readings, and potentially high concentration samples may be identified during sample log-in or just prior to analysis. Following consultation with laboratory analysts and Laboratory Section Leaders, it may be necessary for the Laboratory QA Manager to approve the implementation of corrective action. The laboratory SOPs specify some conditions during or after analysis that may automatically trigger corrective action or optional procedures. These conditions may include dilution of samples, additional sample extract cleanup, automatic reinjection/reanalysis when certain QC criteria are not met, loss of sample through breakage or spillage, etc.

The analyst may identify the need for corrective action. The Laboratory Section Leader, in consultation with the staff, will approve the required corrective action to be implemented by the laboratory staff. The Laboratory QA Manager will ensure implementation and documentation of the corrective action. If the nonconformance causes project objectives not to be achieved, the QEP will be notified. The QEP will notify the Program Manager, who in turn will contact all levels of project management for concurrence with the proposed corrective action.

These corrective actions are performed prior to release of the data from the laboratory. The corrective action will be documented in both the laboratory's corrective action files, and the narrative data report sent from the laboratory to the Program Manager. If the corrective action does not rectify the situation, the laboratory will contact the Program Manager, who will determine the action to be taken and inform the appropriate personnel.

If potential problems are not solved as an immediate corrective action, the contractor will apply formalized long-term corrective action, if necessary.

FIGURES

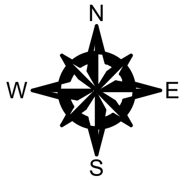


NEW YORK

QUADRANGLE LOCATION

SOURCE:

USGS TOPOGRAPHIC MAPS: CENTRAL PARK, NY, NJ (2023). CONTOUR INTERVAL 10FT., NAVD-1988, ORIGINAL SCALE 1:24,000 (1IN.=2,000FT.).



4778 BROADWAY
NEW YORK, NY 10034

PREPARED BY:

GZA GeoEnvironmental of NY
Engineers and Scientists
www.gza.com

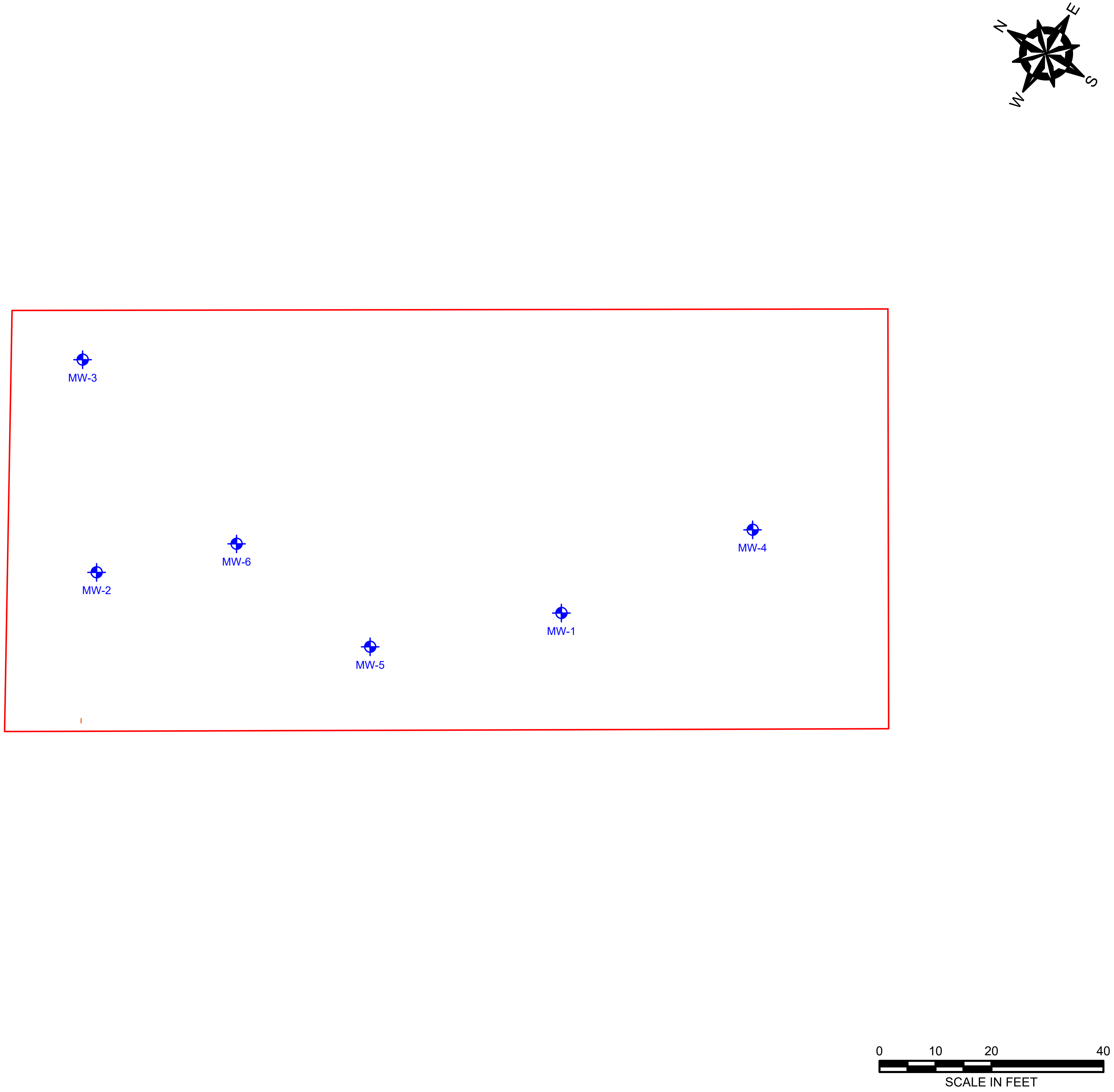
PREPARED FOR:

M4778 BROADWAY, LLC

SITE LOCATION MAP

PROJ MGR: ZL	REVIEWED BY: ZL	CHECKED BY: VW	FIGURE
DESIGNED BY: SG	DRAWN BY: SG	SCALE: 1"=2000'	1
DATE: FEBRUARY 2025	PROJECT NO. 41.0163310.10	REVISION NO. -	SHEET NO.

GZA–\\GZANYMan1\Jobs\Active 163300 to 163399\163310.10 – M44778 Broadway Remedial Closure Consulting\Drawings\GZA CAD\41.0163310.10 FER.dwg [FIG 5A] May 15, 2025 – 2:37pm Seila.Gupta



GENERAL NOTES

1. BASE MAP DEVELOPED FROM DRAWING TITLED "SAMPLE LOCATION MAP", PREPARED BY AEI CONSULTANTS, ORIGINAL SCALE 1"=16', DATED APRIL 13, 2020.
2. VERTICAL DATUM REFERENCED TO THE NORTH AMERICAN VERTICAL DATUM OF 1988 (NAVD88).

LEGEND

▭	APPROXIMATE SITE BOUNDARY
⌖ SB–13	APPROXIMATE RI SOIL BORING LOCATION (FEB 2020)
⌖ MW-1	APPROXIMATE RI MONITORING WELL LOCATION (FEB 2020)

NO.	ISSUE/DESCRIPTION	BY	DATE

4778 BROADWAY
NEW YORK, NY 10034

Groundwater Sampling Locations

PREPARED BY:
GZA GeoEnvironmental of NY
Engineers and Scientists
www.gza.com

PREPARED FOR:
M4778 BROADWAY, LLC

PROJ MGR: ZL	REVIEWED BY: ZL	CHECKED BY: VW	FIGURE 2 SHEET NO.
DESIGNED BY: SG	DRAWN BY: SG	SCALE: 1"=20'	
DATE: MAY 2025	PROJECT NO. 41.0163310.10	REVISION NO.	

TABLES

Table 1 A
Soil Criteria Table

4778 Broadway, New York, NY
BCP Site No. C231131
QAPP

Contaminant	Protection of Public Health					Protection of Ecological Resources[n]	Protection of Groundwater
	Unrestricted Use	Residential	Restricted-Residential	Commercial	Industrial		
All soil cleanup objectives (SCOs) are in parts per million (ppm); approximately equivalent to mg/kg.							
Metals							
Arsenic	13 [m]	16 [f]	17 [f]	18 [f]	19 [f]	13 [f]	16 [f]
Barium	350 [m]	350 [f]	400	400	10,000 [d]	433	820
Beryllium	7.2	14	72	590	2,700	10	47
Cadmium	2.5 [m]	2.5 [f]	4.3	9.3	60	4	7.5
Chromium, hexavalent [h]	1 [l]	22	110	400	800	1 [e]	19
Chromium, trivalent[h]	30 [m]	36	180	1,500	6,800	41	NS
Copper	50	270	270	270	10,000 [d]	50	1,720
Total Cyanide [h]	27	27	27	27	10,000 [d]	NS	40
Lead	63 [m]	400	400	1,000	3,900	63 [f]	450
Manganese	1600 [m]	2,000 [f]	2,000 [f]	10,000 [d]	10,000 [d]	1600 [f]	2,000 [f]
Total Mercury	0.18 [m]	0.81 [j]	0.81 [j]	2.8 [j]	5.7 [j]	0.18 [f]	0.73
Nickel	30	140	310	310	10,000 [d]	30	130
Selenium	3.9 [m]	36	180	1,500	6,800	3.9 [f]	4 [f]
Silver	2	36	180	1,500	6,800	2	8.3
Zinc	109 [m]	2200	10,000 [d]	10,000 [d]	10,000 [d]	109 [f]	2,480
PCBs/Pesticides							
2,4,5-TP Acid (Silvex)	3.8	58	100 [a]	500 [b]	1,000 [c]	NS	3.8
4,4'-DDE	0.0033 [l]	1.8	8.9	62	120	0.0033 [e]	17
4,4'-DDT	0.0033 [l]	1.7	7.9	47	94	0.0033 [e]	136
4,4'-DDD	0.0033 [l]	2.6	13	92	180	0.0033 [e]	14
Aldrin	0.005 [m]	0.019	0.097	0.68	1.4	0.14	0.19
alpha-BHC	0.02	0.097	0.48	3.4	6.8	0.04 [g]	0.02
beta-BHC	0.036	0.072	0.36	3	14	0.6	0.09
Chlordane (alpha)	0.094	0.91	4.2	24	47	1.3	2.9
delta-BHC	0.04	100 [a]	100 [a]	500 [b]	1,000 [c]	0.04 [g]	0.25
Dibenzofuran	7	14	59	350	1,000 [c]	NS	210
Dieldrin	0.005 [m]	0.039	0.2	1.4	2.8	0.006	0.1
Endosulfan I	2.4	4.8 [i]	24 [i]	200 [i]	920 [i]	NS	102
Endosulfan II	2.4	4.8 [i]	24 [i]	200 [i]	920 [i]	NS	102
Endosulfan sulfate	2.4	4.8 [i]	24 [i]	200 [i]	920 [i]	NS	1,000 [c]
Endrin	0.014	2.2	11	89	410	0.014	0.06
Heptachlor	0.042	0.42	2.1	15	29	0.14	0.38
Lindane	0.1	0.28	1.3	9.2	23	6	0.1
Polychlorinated biphenyls	0.1	1	1	1	25	1	3.2
Semivolatiles							
Acenaphthene	20	100 [a]	100 [a]	500 [b]	1,000 [c]	20	98
Acenapthylene	100 [k]	100 [a]	100 [a]	501 [b]	1,000 [c]	NS	107
Anthracene	100 [k]	100 [a]	100 [a]	502 [b]	1,000 [c]	NS	1,000 [c]
Benz(a)anthracene	1 [m]	1 [f]	1 [f]	5.6	11	NS	1[f]
Benzo(a)pyrene	1 [m]	1 [f]	1 [f]	1 [f]	1.1	2.6	22
Benzo(b)fluoranthene	1 [m]	1 [f]	1 [f]	5.6	11	NS	1.7
Benzo(g,h,i)perylene	100	100 [a]	100 [a]	500 [b]	1,000 [c]	NS	1,000 [c]
Benzo(k)fluoranthene	0.8 [m]	1	3.9	56	110	NS	1.7
Chrysene	1 [m]	1[f]	3.9	56	110	NS	1[f]
Dibenz(a,h)anthracene	0.33 [l]	0.33 [e]	0.33 [e]	0.56	1.1	NS	1,000 [c]
Fluoranthene	100 [k]	100 [a]	100 [a]	500 [b]	1,000 [c]	NS	1,000 [c]
Fluorene	30	100 [a]	100 [a]	500 [b]	1,000 [c]	30	386
Indeno(1,2,3-cd)pyrene	0.5 [m]	0.5 [f]	0.5 [f]	5.6	11	NS	8.2
m-Cresol	0.33 [l]	100 [a]	100 [a]	500 [b]	1,000 [c]	NS	0.33 [e]
Naphthalene	12	100 [a]	100 [a]	500 [b]	1,000 [c]	NS	12
o-Cresol	0.33 [l]	100 [a]	100 [a]	500 [b]	1,000 [c]	NS	0.33 [e]
p-Cresol	0.33 [l]	34	100 [a]	500 [b]	1,000 [c]	NS	0.33 [e]
Pentachlorophenol	0.8 [l]	2.4	6.7	6.7	55	0.8 [e]	0.8 [e]
Phenanthrene	100	100 [a]	100 [a]	500 [b]	1,000 [c]	NS	1,000 [c]
Phenol	0.33 [l]	100 [a]	100 [a]	500 [b]	1,000 [c]	30	0.33 [e]
Pyrene	100	100 [a]	100 [a]	500 [b]	1,000 [c]	NS	1,000 [c]

Table 1 A
Soil Criteria Table

4778 Broadway, New York, NY
BCP Site No. C231131
QAPP

Contaminant	Protection of Public Health					Protection of Ecological Resources[n]	Protection of Groundwater
	Unrestricted Use	Residential	Restricted-Residential	Commercial	Industrial		
All soil cleanup objectives (SCOs) are in parts per million (ppm); approximately equivalent to mg/kg.							
Volatiles							
1,1,1-Trichloroethane	0.68	100 [a]	100 [a]	500 [b]	1,000 [c]	NS	0.68
1,1-Dichloroethane	0.27	19	26	240	480	NS	0.27
1,1-Dichloroethene	0.33	100 [a]	100 [a]	500 [b]	1,000 [c]	NS	0.33
1,2-Dichlorobenzene	1.1	100 [a]	100 [a]	500 [b]	1,000 [c]	NS	1.1
1,2-Dichloroethane	0.02 [m]	2.3	3.1	30	60	10	0.02 [f]
cis-1,2-Dichloroethene	0.25	59	100 [a]	500 [b]	1,000 [c]	NS	0.25
trans-1,2-Dichloroethene	0.19	100 [a]	100 [a]	500 [b]	1,000 [c]	NS	0.19
1,3-Dichlorobenzene	2.4	17	49	280	560	NS	2.4
1,4-Dichlorobenzene	1.8	9.8	13	130	250	20	1.8
1,4-Dioxane	0.1 [l]	9.8	13	130	250	0.1 [e]	0.1 [e]
Acetone	0.05	100[a]	100[b]	500 [b]	1,000 [c]	2.2	0.05
Benzene	0.06	2.9	4.8	44	89	70	0.06
Butylbenzene	12	100[a]	100[a]	500 [b]	1,000 [c]	NS	12
Carbon tetrachloride	0.76	1.4	2.4	22	44	NS	0.76
Chlorobenzene	1.1	100[a]	100[a]	500 [b]	1,000 [c]	40	1.1
Chloroform	0.37	10	49	350	700	12	0.37
Ethylbenzene	1	30	41	390	780	NS	1
Hexachlorobenzene	0.33 [l]	0.33[e]	1.2	6	12	NS	3.2
Methyl ethyl ketone	0.12	100 [a]	100 [a]	500 [b]	1,000 [c]	100 [a]	0.12
Methyl tert-butyl ether	0.93	62	100 [a]	500 [b]	1,000 [c]	NS	0.93
Methylene chloride	0.05	51	100 [a]	500 [b]	1,000 [c]	12	0.05
n-Propylbenzene	3.9	100 [a]	100 [a]	500 [b]	1,000 [c]	NS	3.9
sec-Butylbenzene	11	100 [a]	100 [a]	500 [b]	1,000 [c]	NS	11
tert-Butylbenzene	5.9	100 [a]	100 [a]	500 [b]	1,000 [c]	NS	5.9
Tetrachloroethene	1.3	5.5	19	150	300	2	1.3
Toluene	0.7	100 [a]	100 [a]	500 [b]	1,000 [c]	36	0.7
Trichloroethene	0.47	10	21	200	400	2	0.47
1,2,4-Trimethylbenzene	3.6	47	52	190	380	NS	3.6
1,3,5- Trimethylbenzene	8.4	47	52	190	380	NS	8.4
Vinyl chloride	0.02	0.21	0.9	13	27	NS	0.02
Xylene (mixed)	0.26	100 [a]	100 [a]	500 [b]	1,000 [c]	0.26	1.6
Per-and Polyfluoroalkyl Substances (PFAs)[o]							
PFOA	0.00066	0.0066	0.033	0.5	0.6	NS	0.0011
PFOS	0.00088	0.0088	0.044	0.44	0.44	NS	0.0037

Notes:

[a] The SCOs for residential, restricted-residential and ecological resources use were capped at a maximum value of 100 ppm.

[b] The SCOs for commercial use were capped at a maximum value of 500 ppm.

[c] The SCOs for industrial use and the protection of groundwater were capped at a maximum value of 1000 ppm.

[d] The SCOs for metals were capped at a maximum value of 10,000 ppm.

[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.

[g] This SCO is derived from data on mixed isomers of BHC.

[h] 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.

[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).

[k] The SCOs for unrestricted use were capped at a maximum value of 100 ppm.

[l] 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.

[m] 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.

[n] 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.

[o] SCOs for PFAs are taken from the NYSDEC Sampling, Analysis, and Assessment of Per-and-Polyfluoroalkyl Substances (PFAS) under NYSDEC's Part 375 Remedial Programs, dated April 2023.

Table 1B

Groundwater Criteria Table

4778 Broadway New York, NY
BCP Site No. C231131

Contaminant	Aqueous Water Quality Standards[1], ug/L
Metals	
Antimony	3
Arsenic	---
Arsenic	25
Barium	1,000
Beryllium	3
Cadmium	5
Chromium, hexavalent	---
Chromium, trivalent	50
Copper	200
Cyanide	---
Iron	300
Lead	25
Magnesium	35,000
Manganese	300
Mercury	0.7
Nickel	100
Selenium	10
Silver	50
Sodium	20,000
Thallium	0.5
Zinc	2000
PCBs/Pesticides	
alpha-BHC	0.01
2,4,5-TP Acid (Silvex)	---
4,4'-DDD	0.3
4,4'-DDE	0.2
4,4'-DDT	0.2
Aldrin	---
beta-BHC	0.04
Chlordane (alpha)	---
Dibenzofuran	---
Dieldrin	0.004
Endosulfan I	0.12
Endosulfan II	0.12
Endosulfan sulfate	0.12
Endrin	---
Endrin aldehyde	5
Endrin ketone	5
gamma-BHC (Lindane)	0.05

Table 1B

Groundwater Criteria Table

4778 Broadway New York, NY

BCP Site No. C231131

Contaminant	Aqueous Water Quality Standards[1], ug/L
PCBs/Pesticides, Con't.	
gamma-Chlordane	0.12
Heptachlor	0.04
Heptachlor epoxide	0.03
Lindane	---
Methoxychlor	35
Polychlorinated biphenyls	---
Toxaphene	0.06
Semivolatiles	
1,1'-Biphenyl	5
2,2'-oxybis(1-Chloropropane)	5
2,4,5-Trichlorophenol	1
2,4-Dichlorophenol	1
2,4-Dimethylphenol	50
2,4-Dinitrophenol	10
2,4-Dinitrotoluene	5
2,6-Dinitrotoluene	5
2-Chloronaphthalene	10
2-Chlorophenol	1
2-Methylnaphthalene	502
2-Methylphenol	1
2-Nitroaniline	5
2-Nitrophenol	1
3,3'-Dichlorobenzidine	5
3-Nitroaniline	5
4-Chloro-3-methylphenol	1
4-Chloroaniline	5
4-Methylphenol	1
4-Nitroaniline	5
4-Nitrophenol	1
Acenaphthene	20
Acenapthylene	202
Anthracene	50
Atrazine	7.5
Benz(a)anthracene	0.002
Benzo(a)pyrene	---
Benzo(b)fluoranthene	0.002
Benzo(g,h,i)perylene	52
Benzo(k)fluoranthene	0.002
bis(2-Chloroethoxy)methane	5

Table 1B

Groundwater Criteria Table

4778 Broadway New York, NY
BCP Site No. C231131

Contaminant	Aqueous Water Quality Standards[1], ug/L
Semivolatiles, Con't.	
Bis(2-Chloroethyl)ether	1
bis(2-Ethylhexyl)phthalate	5
Butylbenzylphthalate	50
Chrysene	0.002
Dibenz(a,h)anthracene	502
Dibenzofuran	52
Diethylphthalate	50
Dimethylphthalate	50
Di-n-butylphthalate	50
Di-n-octylphthalate	50
Fluoranthene	50
Fluorene	50
Hexachlorobenzene	0.04
Hexachlorobutadiene	0.5
Hexachlorocyclopentadiene	5
Hexachloroethane	5
Indeno(1,2,3-cd)pyrene	0.002
Isophorone	50
m-Cresol	---
Naphthalene	10
Nitrobenzene	0.4
N-Nitrosodiphenylamine	50
o-Cresol	---
p-Cresol	---
Pentachlorophenol	1
Phenanthrene	50
Phenol	1
Pyrene	50
Volatiles	
1,1,1-Trichloroethane	5
1,1,2,2-Tetrachloroethane	5
1,1,2-Trichloro-1,2,2-trifluoroethane	5
1,1,2-Trichloroethane	1
1,1-Dichloroethane	5
1,1-Dichloroethene	5
1,1-Dichloroethylene	---
1,2,4-Trichlorobenzene	---

Table 1B

Groundwater Criteria Table

4778 Broadway New York, NY

BCP Site No. C231131

Contaminant	Aqueous Water Quality Standards[1], ug/L
Volatiles, Con't.	
1,2,4-Trimethylbenzene	5
1,2-Dibromo-3-chloropropane	0.04
1,2-Dibromoethane	0.0006
1,2-Dichlorobenzene	3
1,2-Dichloroethane	0.6
1,2-Dichloropropane	1
1,3,5- Trimethylbenzene	---
1,3-Butadiene	---
1,3-Dichlorobenzene	3
1,3-Dichlorobenzene	---
1,4-Dichlorobenzene	3
1,4-Dichlorobenzene	---
1,4-Dioxane	1[2]
2-Butanone	50
2-Hexanone	50
4-Methyl-2-pentanone	502
Acetone	50
Benzene	1
Bromodichloromethane	50
Bromoform	50
Bromomethane	5
Butylbenzene	---
Carbon Disulfide	60
Carbon tetrachloride	5
Chlorobenzene	5
Chloroethane	5
Chloroform	7
Chloromethane	5
Cis- 1,3-Dichloropropene	0.4
cis-1,2-Dichloroethene	5
cis-1,2-Dichloroethylene	---
Cyclohexane	---
Dibromochloromethane	50
Dichlorodifluoromethane	5
Ethyl Acetate	---
Ethylbenzene	5
Freon 113	---
Hexachlorobenzene	---

Table 1B

Groundwater Criteria Table

4778 Broadway New York, NY
BCP Site No. C231131

Contaminant	Aqueous Water Quality Standards[1], ug/L
Volatiles, Con't.	
Hexachlorobutadiene	---
Hexane	---
Isopropylbenzene	5
m,p-Xylene	---
m-Dichlorobenzene	---
Methyl Acetate	NS
Methyl ethyl ketone	---
Methyl Isobutyl Ketone	---
Methyl tert-butyl ether	10
Methylcyclohexane	---
Methylene chloride	5
n-Propylbenzene	---
o-Dichlorobenzene	---
o-Xylene	---
p-Dichlorobenzene	---
sec-Butylbenzene	---
Styrene	5
tert-Butylbenzene	---
Tertiary Butyl Alcohol	---
Tetrachloroethene	5
Toluene	5
trans-1,2-Dichloroethene	5
trans-l,3-Dichloropropene	0.4
Trichloroethene	5
Trichlorofluoromethane	5
Vinyl Acetate	---
Vinyl Chloride	2
Xylene (mixed)	5
Per- and Polyfluoroalkyl Substances (PFAS)	
PFOA	0.01[2]
PFOS	0.01[2]

Notes:

[1] - Division of Water Technical and Operational Guidance Values (TOGS) Ambient Water Quality Standards and Guidance Values (AWQS), ug/L

[2] - Guidance value for 1,4-Dioxane, PFOA, and PFOS is from the NYSDEC Guidance to Regulate PFOA, PFOS, and 1,4-Dioxane in State Waters, dated October 5, 2021

ug/L - micro gram per liter

Table 1C
Soil Vapor Criteria Table

4778 Broadway, New York, NY
NYSDEC BCP No. C231131

Volatile Organics in Air	CAS No.	NYSDOH Soil Vapor Intrusion Guidance Criteria				Toxicity	Decision Matrix
		1	2	3	4		
1,1,1-Trichloroethane	71556	2.5	20.6	-	-	L	**B**
1,1,2,2-Tetrachloroethane	79345	0.4	-	-	-	M	TD
1,1,2-Trichloroethane	79005	0.4	<1.5	-	-	H	TD
1,1-Dichloroethane	75343	0.4	<0.7	-	-	L	TD
1,1-Dichloroethene	75354	0.4	<1.4	-	-	M	B
1,2,4-Trichlorobenzene	120821	0.5	<6.8	-	-	NA	TD
1,2,4-Trimethylbenzene	95636	9.8	9.5	-	-	NA	D
1,2-Dibromoethane	106934	0.4	<1.5	-	-	H	TD
1,2-Dichlorobenzene	95501	0.5	<1.2	-	-	M	TD
1,2-Dichloroethane	107062	0.4	<0.9	-	-	H	TD
1,2-Dichloropropane	78875	0.4	<1.6	-	-	M	TD
1,3,5-Trimethybenzene	108678	3.9	3.7	-	-	M	D
1,3-Butadiene	106990	-	<3.0	-	-	H	TD
1,3-Dichlorobenzene	541731	0.5	<2.4	-	-	M	TD
1,4-Dichlorobenzene	106467	1.2	5.5	344	-	M	TD
1,4-Dioxane	123911	-	-	-	-	M	TD
2,2,4-Trimethylpentane	540841	5	-	-	-	M	D
2-Butanone	78933	16	12	-	-	M	TD
2-Hexanone	591786	-	-	-	-	NA	TD
3-Chloropropene	107051	-	-	-	-	M	TD
4-Ethyltoluene	622968	-	3.6	-	-	NA	TD
4-Methyl-2-pentanone	108101	1.9	6	-	-	M	TD
Acetone	67641	115	98.9	45.8	-	L	TD
Benzene	71432	13	9.4	10	-	H	D
Benzyl chloride	100447	-	<6.8	-	-	H	TD
Bromodichloromethane	75274	-	-	-	-	M	TD
Bromoform	75252	-	-	-	-	M	TD
Bromomethane	74839	0.5	<1.7	-	-	M	TD
Carbon disulfide	75150	-	4.2	-	-	M	TD
Carbon tetrachloride	56235	1.3	<1.3	1.1	-	H	A
Chlorobenzene	108907	0.4	<0.9	-	-	M	TD
Chloroethane	75003	0.4	<1.1	-	-	L	TD
Chloroform	67663	1.2	1.1	6.34	-	H	TD
Chloromethane	74873	4.2	3.7	-	-	M	TD
cis-1,2-Dichloroethene	156592	0.4	<1.9	-	-	M	B
cis-1,3-Dichloropropene	10061015	0.4	<2.3	-	-	NA	TD
Cyclohexane	110827	6.3	-	-	-	L	D

Table 1C
Soil Vapor Criteria Table

4778 Broadway, New York, NY
NYSDEC BCP No. C231131

Volatile Organics in Air	CAS No.	NYSDOH Soil Vapor Intrusion Guidance Criteria				Toxicity	Decision Matrix
		1	2	3	4		
Dibromochloromethane	124481	-	-	-	-	NA	TD
Dichlorodifluoromethane	75718	10	16.5	-	-	NA	TD
Ethanol	64175	1300	210	-	-	L	TD
Ethyl Acetate	141786	-	5.4	-	-	M	TD
Ethylbenzene	100414	6.4	5.7	7.62	-	M	D
Freon-113	76131	2.5	3.5	-	-	L	TD
Freon-114	76142	0.4	<6.8	-	-	NA	TD
Heptane	142825	18	-	-	-	M	E
Hexachlorobutadiene	87683	0.5	<6.8	-	-	M	TD
Isopropanol	67630	-	-	-	-	M	TD
Methyl tert butyl ether	1634044	14	11.5	36	-	M	TD
Methylene chloride	75092	16	10	7.5	60	NA	TD
n-Hexane	110543	14	10.2	-	-	M	E
o-Xylene	95476	7.1	7.9	7.24	-	M	D
p/m-Xylene	179601231	11	22.2	22.2	-	M	E
Styrene	100-42-5	1.4	1.9	5.13	-	M	TD
Tertiary butyl Alcohol	75-65-0	-	-	-	-	NA	TD
Tetrachloroethene (PCE)	127184	2.5	15.9	6.01	30	H	B
Tetrahydrofuran	109999	0.8	-	-	-	M	TD
Toluene	108883	57	43	39.8	-	L	F
trans-1,2-Dichloroethene	156605	-	-	-	-	NA	TD
trans-1,3-Dichloropropene	10061026	NC	<1.3	-	-	NA	TD
Trichloroethene	79016	0.5	4.2	1.36	2	H	A
Trichlorofluoromethane	75694	12	18.1	-	-	L	TD
Vinyl bromide	593602	-	-	-	-	H	TD
Vinyl chloride	75014	0.4	<1.9	-	-	H	A

Notes
Decision Criteria used:
Martix A: Sub-Slab >5, Indoor Air >5
Martix B: Sub-Slab >100, Indoor Air >30
Toxicities from DAR-1 Appendix C/SCG/ACG
(H) HIGH Toxicity Contaminant.
(M) MODERATE Toxicity Contaminant.
(L) LOW Toxicity Contaminant.

ND - Non-detect
NA - Not applicable
NFA - No further action
TD - To be determined based on the NYSDOH VI Decision
Reasonable - Take reasonable/practical actions to identify source/reduce exposure

NYSDOH Soil Vapor Intrusion Guidance Criteria
1 - Table C-1 2003 Upper Fence Study of Volatile Organic Chemicals in air of Fuel Oil Heated Homes for Indoor Air
2 - Table C-2 2001 USEPA BASE 90th Percentile for Indoor Air
3 -Table C-5 2005 Health Effects Institute 95th Percentile for Indoor Air
4 -NYSDOH Air Guidance Value
NYSDOH Specific Compounds for Matrix Eval

Table 2
Typical Analytical Parameters, Methods, Preservation, Holding Time and Container Requirements

4778 Broadway, New York, NY
NYSDEC BCP Site No. C231131

Sample Matrix	Analytical Parameter	Numer of Samples[1]	EPA Analytical Method	Sample Preservation	Holding Time[2]	Sample Container[3]
Soil	VOCs (TCL)	45	SW-846 Method 8260C/5035	1 - Methanol, 2 - Water; Cool to 4° C; no headspace	14 days to analysis	(3) Vial
Soil	PCBs	45	SW-846 Method 8082A	Cool to 4^0 C	365 days to analysis	(1) 250 mL amber glass jar
Soil	Pesticides (TCL)	45	SW-846 Method 8081A	Cool to 4^0 C	14 days to extraction	(1) 250 mL amber glass jar
Soil	SVOCs (TCL)	45	SW-846 Method 8270D	Cool to 4° C	14 days to extraction	(1) 250 mL amber glass jar
Soil	1,4-Dioxane	45	SW-846 Method 8270D	Cool to 4° C	7 days to extraction	(2) 250 mL amber glass jars
Soil	Metals	45	SW-846 Method 6010DSeries	Cool to 4^0 C	180 days to analysis	(1) 60 mL glass jar
Soil	Mercury	45	SW-846 Method 7471B	Cool to 4^0 C	28 days to analysis	(1) 60 mL glass jar
Soil	Cyanide	45	SW-846 Method 9010C/9012B	Cool to 4^0 C	14 days to analysis	(1) 250 mL amber glass jar
Soil	Herbicides	45	SW-846 Method 8151A	Cool to 4^0 C	14 days to extraction	(1) 250 mL amber glass jar
Soil	PFAs	45	EPA Method 1633	Cool to 4^0 C	14 Days	(1) 250 mL plastic container
Groundwater	VOCs (TCL)	10	SW-846 Method 8260C	HCl; Cool to 4^0 C; no headspace	14 days to analysis	(3) Vial
Groundwater	VOCs with TICs, including 1,4-Dioxane (TCL)	10	SW-846 Method 8260C	HCl; Cool to 4^0 C; no headspace	14 days to analysis	(3) Vial
Groundwater	1,4-Dioxane	10	SW-846 Method 8270D	Cool to 4^0 C	7 days to analysis	(2) 250 mL amber glass jar
Groundwater	SVOCs (TCL)	10	SW-846 Method 8270D	Cool to 4^0 C	7 days to extraction	(2) 250 mL amber glass jar
Groundwater	SVOCs with TICs (TCL)	10	SW-846 Method 8270D	Cool to 4^0 C	7 days to extraction	(2) 250 mL amber glass jar
Groundwater	Metals- total (TAL)	10	SW-846 Method 6020B/7470A Series	HNO_3; Cool to 4° C	28 days to analysis for Hg; 180 days to analysis for other	(1) 500 mL plastic container
Groundwater	Metals-dissolved (TAL)	10	SW-846 Method 6020B/7470A Series	HNO3; Cool to 4° C	28 days to analysis for Hg; 180 days to analysis for other metals	(1) 500 mL plastic container
Groundwater	Pesticides (TCL)	10	SW-846 Method 8081B	Cool to 4^0 C	7 days to extraction	(2) 120 mL amber glass jar
Groundwater	Herbicides (TCL)	10	SW-846 Method 8151A	Cool to 4^0 C	7 days to extraction	(2) 1000 mL amber glass jar
Groundwater	PCBs	10	SW-846 Method 8082A	Cool to 4^0 C	365 days to analysis	(1) 250 mL amber glass jar
Groundwater	Cyanide	10	SW-846 Method 9012A	Cool to 4^0 C	14 days to analysis	(1) 250 mL amber glass jar
Groundwater	Mercury	10	SW-846 Method 7470 A	HNO3; Cool to 4° C	28 days to analysis	(1) 250 mL plastic container
Groundwater	PFAs	10	EPA Method 1633	Cool to 4^0 C	14 Days	(1) 250 mL plastic container
Soil Gas	VOCs	10	EPA Method TO-15	None	14 days to analysis	(1) Evacuated 6-Liter SUMMA® canister

Notes:

[1] Actual number of samples may vary depending on field conditions, sample material availability, and field observations. See RIWP for estimates.

[2] Holding times listed are method holding time calculated from time of collection and not NYSDEC ASP holding times.

[3] MS/MSDs require duplicate volume for all parameters for solid matrices; MS/MSDs require triplicate volume for organic parameters for aqueous matrices and duplicate volume for inorganic parameters for aqueous matrices

Table 3

Typical Laboratory Data Quality Objectives
Soil Samples

4778 Broadway, New York, NY
NYCDEC BCP Site No. C231131

Parameter	Method	Matrix	Accuracy Control Limits	Accuracy Frequency Requirements	Precision (RPD) Control Limits	Precision Frequency Requirements
VOCs (TCL)	SW-846 Methods 8260B/5035	Soil	Surrogates % Rec. 1,2-Dichloroethane-d4 70-130 4-Bromofluorobenzene 70-130 Dibromofluoromethane 70-130 Toluene-d8 70-130 2-Chloroethoxyethane 70-130 Matrix Spikes 30-151% recovery	Surrogates: All samples, standards, QC samples Matrix Spikes: One per 30 per matrix type	Field Duplicates RPD <30 MS/MSDs (RPD) RPD <30	Field Duplicates: One per 20 per soils MS/MSDs: One per 30 per matrix type
VOCs with Tentatively Identified Compounds (TICs)	SW-846 Method 8260C	Soil	Surrogates % Rec. 1,2-Dichloroethane-d4 70-130 4-Bromofluorobenzene 70-130 Dibromofluoromethane 70-130 Toluene-d8 70-130 Matrix Spikes 36-162 % recovery	Surrogates: All samples, standards, QC samples Matrix Spikes: One per 20	Field Duplicates RPD <30 MS/MSDs RPD RPD<30	Field Duplicates: One per 20 MS/MSDs: One per 20
PCBs	SW-846 Method 8082A	Soil	Surrogates % Rec. 2,4,5,6-Tetrachloro-m-xylene 30-150 Decachlorobiphenyl 30-150 Matrix Spikes 40-140% recovery	Surrogates: All samples, standards, QC samples Matrix Spikes: One per 20 per matrix type	Field Duplicates RPD <50 MS/MSDs (RPD) RPD<50	Field Duplicates: One per 20 per soils MS/MSDs: One per 20 per matrix type
SVOCs	SW-846 Method 8270D	Soil	Surrogates % Rec. Phenol-d6 10-120 2-Fluorophenol 25-120 2,4,6-Tribromophenol 10-136 Nitrobenzene-d5 23-120 2-Fluorobiphenyl 30-120 4-Terphenyl-d14 18-120 Matrix Spikes 14-144% recovery	Surrogates: All samples, standards, QC samples Matrix Spikes: One per 50 per matrix type	Field Duplicates RPD <50 MS/MSDs (RPD)	Field Duplicates: One per 20 per soils MS/MSDs: One per 20 per matrix type
SVOCs with TICs	SW-846 Method 8270D	Soil	Surrogates % Rec. Phenol-d5 10-120 2-Fluorophenol 21-120 2,4,6-Tribromophenol 10-120 Nitrobenzene-d5 23-120 2-Fluorobiphenyl 15-120 4-Terphenyl-d14 41-149 Matrix Spikes 14-144%	Surrogates: All samples, standards, QC samples Matrix Spikes: One per 20	Field Duplicates RPD <50 MS/MSDs RPD RPD<50	Field Duplicates: One per 20 MS/MSDs: One per 20
1,4-Dioxane	SW-846 Method 8270D	Soil	Surrogates % Rec. 1,4-Dioxane-d8 15-110 Matrix Spikes 40-140% recovery	Surrogates: All samples, standards, QC samples	Field Duplicates RPD <30 MS/MSDs (RPD) RPD<30	Field Duplicates: One per 20 per soils MS/MSDs: One per 20
Pesticides (TCL)	SW-846 Method 8081A	Soil	Surrogates % Rec. Decachlorobiphenyl 30-150 Tetrachloro-m-xylene 30-150 Matrix Spikes 30-150% Recovery	Surrogates: All samples, standards, QC samples Matrix Spikes: One per 20 per matrix type	Field Duplicates RPD <50 MS/MSDs (RPD) RPD<50	Field Duplicates: One per 20 per soils MS/MSDs: One per 20 per matrix type
Total Petroleum Hydrocarbons	SW-846 Method 8015B	Soil	Surrogates % Rec. o-Terphenyl 27-153 Tetracosane-d50 28-148 5α-androstane 27-148 TPH-DRO 10-149	Surrogates: All samples, standards, QC samples One per 20 per matrix type	Field Duplicates RPD <50 TPH-DRO 44	Field Duplicates: One per 20 per soils One per 20 per matrix type
Herbicides	SW-846 Method 8151A	Soil	Surrogates % Rec. 2,4-DCAA 30-150 Matrix Spikes 30-150% Recovery	Surrogates: All samples, standards, QC samples Matrix Spikes: One per 20 per matrix type	Field Duplicates RPD <50 MS/MSDs (RPD) RPD<50	Field Duplicates: One per 20 per soils MS/MSDs: One per 20 per matrix type
Metals (TAL)	SW-846 Method 6010D	Soil	Surrogates % Rec. Matrix Spikes 75-125% recovery	Surrogates: Matrix Spikes: One per 20 per matrix type	Field Duplicates RPD <20 MS/MSDs (RPD) RPD <20	Field Duplicates: One per 20 per soils MS/MSDs: One per 20 per matrix type

Table 3
Typical Laboratory Data Quality Objectives
Soil Samples

4778 Broadway, New York, NY
NYCDEC BCP Site No. C231131

Parameter	Method	Matrix	Accuracy Control Limits	Accuracy Frequency Requirements	Precision (RPD) Control Limits	Precision Frequency Requirements
PFAs	LCMSMS- Isotope Dilution	Soil	Surrogates % Rec. Perfluoro[13C4]Butanoic Acid (MPFBA) 61-135 Perfluoro[13C4]Butanoic Acid (MPFBA) 58-132 Perfluoro[13C5]Pentanoic Acid (M5PFPEA) 62-163 Perfluoro[13C5]Pentanoic Acid (M5PFPEA) 58-150 Perfluoro[2,3,4-13C3]Butanesulfonic Acid (M3PFBS) 70-131 Perfluoro[2,3,4-13C3]Butanesulfonic Acid (M3PFBS) 74-139 Perfluoro[1,2,3,4,6-13C5]Hexanoic Acid (M5PFHxA) 57-129 Perfluoro[1,2,3,4,6-13C5]Hexanoic Acid (M5PFHxA) 66-128 Perfluoro[1,2,3,4-13C4]Heptanoic Acid (M4PFHpA) 60-129 Perfluoro[1,2,3,4-13C4]Heptanoic Acid (M4PFHpA) 71-129 Perfluoro[1,2,3-13C3]Hexanesulfonic Acid (M3PFHxS) 71-134 Perfluoro[1,2,3-13C3]Hexanesulfonic Acid (M3PFHxS) 78-139 Perfluoro[13C8]Octanoic Acid (M8PFOA) 62-129 Perfluoro[13C8]Octanoic Acid (M8PFOA) 75-130 1H,1H,2H,2H-Perfluoro[1,2-13C2]Octanesulfonic Acid (M2-6:2FTS) 14-147 1H,1H,2H,2H-Perfluoro[1,2-13C2]Octanesulfonic Acid (M2-6:2FTS) 20-154 Perfluoro[13C9]Nonanoic Acid (M9PFNA) 59-139 Perfluoro[13C9]Nonanoic Acid (M9PFNA) 72-140 Perfluoro[13C8]Octanesulfonic Acid (M8PFOS) 79-136 Perfluoro[13C8]Octanesulfonic Acid (M8PFOS) 69-131 Perfluoro[1,2,3,4,5,6-13C6]Decanoic Acid (M6PFDA) 75-130 Perfluoro[1,2,3,4,5,6-13C6]Decanoic Acid (M6PFDA) 62-124 1H,1H,2H,2H-Perfluoro[1,2-13C2]Decanesulfonic Acid (M2-8:2FTS) 19-175 1H,1H,2H,2H-Perfluoro[1,2-13C2]Decanesulfonic Acid (M2-8:2FTS) 10-162 N-Deuteriomethylperfluoro-1-octanesulfonamidoacetic Acid (d3-NMeFOSAA) 24-116 N-Deuteriomethylperfluoro-1-octanesulfonamidoacetic Acid (d3-NMeFOSAA) 31-134 Perfluoro[1,2,3,4,5,6,7-13C7]Undecanoic Acid (M7-PFUDA) 61-155 Perfluoro[1,2,3,4,5,6,7-13C7]Undecanoic Acid (M7-PFUDA) 55-137 Perfluoro[13C8]Octanesulfonamide (M8FOSA) 10-112 Perfluoro[13C8]Octanesulfonamide (M8FOSA) 10-117 N-Deuterioethylperfluoro-1-octanesulfonamidoacetic Acid (d5-NEtFOSAA) 34-137 N-Deuterioethylperfluoro-1-octanesulfonamidoacetic Acid (d5-NEtFOSAA) 27-126 Perfluoro[1,2-13C2]Dodecanoic Acid (MPFDOA) 48-131 Perfluoro[1,2-13C2]Dodecanoic Acid (MPFDOA) 54-150 Perfluoro[1,2-13C2]Tetradecanoic Acid (M2PFTEDA) 22-136 Perfluoro[1,2-13C2]Tetradecanoic Acid (M2PFTEDA) 24-159 Matrix Spikes 46-182% recovery	Surrogates: All samples, standards, QC samples Matrix Spikes: One per 20 per matrix type	Field Duplicates RPD <30 MS/MSDs (RPD) RPD <30	Field Duplicates: One per 20 per soils MS/MSDs: One per 20 per matrix type
Mercury	SW-846 Method 7471B	Soil	Surrogates % Rec. Matrix Spikes 80-125% recovery	Surrogates: Matrix Spikes: One per 20 per matrix type	Field Duplicates RPD <20 MS/MSDs (RPD) RPD <20	Field Duplicates: One per 20 per soils MS/MSDs: One per 20 per matrix type
Cyanide	SW-846 Method 9012A	Soil	Surrogates % Rec. Matrix Spikes 75-125% Recovery	Surrogates: Matrix Spikes: One per 35 per matrix type	Field Duplicates RPD <35 MS/MSDs (RPD) RPD <35	Field Duplicates: One per 20 per soils MS/MSDs: One per 20 per matrix type

Recovery criteria for laboratory control samples must be at least as stringent as MS/MSD criteria.
Laboratory control limits are periodically updated. The latest control limits will be utilized at the time of sample analysis.

Table 4

Typical Laboratory Data Quality Objectives
Groundwater Samples

4778 Broadway, New York, NY
NYSDEC BCP Site No. C231131

Parameter	Method	Matrix	Accuracy Control Limits	Accuracy Frequency Requirements	Precision (RPD) Control Limits	Precision Frequency Requirements
VOCs (TCL)	SW-846 Method 8260C	Groundwater	Surrogates % Rec. 1,2-Dichloroethane-d4 70-130 4-Bromofluorobenzene 70-130 Dibromofluoromethane 70-130 Toluene-d8 70-130 Matrix Spikes 36-162 % recovery	Surrogates: All samples, standards, QC samples Matrix Spikes: One per 20	Field Duplicates RPD <20 MS/MSDs RPD RPD <20	Field Duplicates: One per 20 MS/MSDs: One per 20
VOCs with Tentatively Identified Compounds (TICs)	SW-846 Method 8260C	Groundwater	Surrogates % Rec. 1,2-Dichloroethane-d4 70-130 4-Bromofluorobenzene 70-130 Dibromofluoromethane 70-130 Toluene-d8 70-130 Matrix Spikes 36-162 % recovery	Surrogates: All samples, standards, QC samples Matrix Spikes: One per 20	Field Duplicates RPD <20 MS/MSDs RPD RPD <20	Field Duplicates: One per 20 MS/MSDs: One per 20
SVOCs TCL	SW-846 Method 8270D	Groundwater	Surrogates % Rec. Phenol-d5 10-120 2-Fluorophenol 21-120 2,4,6-Tribromophenol 10-120 Nitrobenzene-d5 23-120 2-Fluorobiphenyl 15-120 4-Terphenyl-d14 41-149 Matrix Spikes 14-144%	Surrogates: All samples, standards, QC samples Matrix Spikes: One per 20	Field Duplicates RPD <50 MS/MSDs RPD RPD <50	Field Duplicates: One per 20 MS/MSDs: One per 20
SVOCs with TICs	SW-846 Method 8270D	Groundwater	Surrogates % Rec. Phenol-d5 10-120 2-Fluorophenol 21-120 2,4,6-Tribromophenol 10-120 Nitrobenzene-d5 23-120 2-Fluorobiphenyl 15-120 4-Terphenyl-d14 41-149 Matrix Spikes 14-144%	Surrogates: All samples, standards, QC samples Matrix Spikes: One per 20	Field Duplicates: RPD <50 MS/MSDs RPD RPD <50	Field Duplicates: One per 20 MS/MSDs: One per 20
1,4-Dioxane	SW-846 Method 8270D	Groundwater	Surrogates % Rec. 1,4-Dioxane-d8 15-110 Matrix Spikes 40-140% recovery	Surrogates: All samples, standards, QC samples	Field Duplicates RPD <30 Matrix Duplicates RPD<30	Field Duplicates: One per 20 per soils MS/MSDs: One per 20
Metals (Total and Dissolved)	SW-846 Methods 6020B	Groundwater	Matrix Spikes 75-125% recovery	Surrogates: All samples, standards, QC samples Matrix Spikes: One per 20	Field Duplicates RPD <20 Matrix Duplicates RPD <20	Field Duplicates: One per 20 MS/MSDs: One per 20
Mercury (Total and Dissolved)	SW-846 Methods 7470A	Groundwater	Matrix Spikes 75-125% recovery	Surrogates: All samples, standards, QC samples Matrix Spikes: One per 20	Field Duplicates RPD <35 (dissolved) RPD<20 (Total) Matrix Duplicates RPD <35 (dissolved) RPD<20 (Total)	Field Duplicates: One per 20 MS/MSDs: One per 20
PCBs	SW-846 Method 8082A	Groundwater	Surrogates % Rec. 2,4,5,6-Tetrachloro-m-xylene 30-150 Decachlorobiphenyl 30-150 Matrix Spikes 40-140% recovery	Surrogates: All samples, standards, QC samples Matrix Spikes: One per 20 per matrix type	Field Duplicates RPD <50 MS/MSDs (RPD) RPD<50	Field Duplicates: One per 20 MS/MSDs: One per 20 per matrix type
Herbicides	SW-846 Method 8151A	Groundwater	Surrogates % Rec. 2,4-DCAA 30-150 Matrix Spikes 30-150% Recovery	Surrogates: All samples, standards, QC samples Matrix Spikes: One per 20 per matrix type	Field Duplicates: RPD <50 MS/MSDs (RPD) RPD<50	Field Duplicates: One per 20 MS/MSDs: One per 20 per matrix type

Table 4
Typical Laboratory Data Quality Objectives
Groundwater Samples

4778 Broadway, New York, NY
NYSDEC BCP Site No. C231131

Parameter	Method	Matrix	Accuracy Control Limits	Accuracy Frequency Requirements	Precision (RPD) Control Limits	Precision Frequency Requirements
Pesticides (TCL)	SW-846 Method 8081B	Groundwater	Surrogates % Rec. Decachlorobiphenyl 15-142 2,4,5,6-Tetrachloro-m-xylene 36-126 Matrix Spikes 30-150% recovery	Surrogates: All samples, standards, QC samples Matrix Spikes: One per 20	Field Duplicates RPD <30 MS/MSDs RPD RPD <30	Field Duplicates: One per 20 MS/MSDs: One per 20
PFAs	EPA Method 1633	Grounwater	Surrogates Perfluoro[13C4]Butanoic Acid (MPFBA) Perfluoro[13C4]Butanoic Acid (MPFBA) Perfluoro[13C5]Pentanoic Acid (M5PFPEA) Perfluoro[13C5]Pentanoic Acid (M5PFPEA) Perfluoro[2,3,4-13C3]Butanesulfonic Acid (M3PFBS) Perfluoro[2,3,4-13C3]Butanesulfonic Acid (M3PFBS) Perfluoro[1,2,3,4,6-13C5]Hexanoic Acid (M5PFHxA) Perfluoro[1,2,3,4,6-13C5]Hexanoic Acid (M5PFHxA) Perfluoro[1,2,3,4-13C4]Heptanoic Acid (M4PFHpA) Perfluoro[1,2,3,4-13C4]Heptanoic Acid (M4PFHpA) Perfluoro[1,2,3-13C3]Hexanesulfonic Acid (M3PFHxS) Perfluoro[1,2,3-13C3]Hexanesulfonic Acid (M3PFHxS) Perfluoro[13C8]Octanoic Acid (M8PFOA) Perfluoro[13C8]Octanoic Acid (M8PFOA) 1H,1H,2H,2H-Perfluoro[1,2-13C2]Octanesulfonic Acid (M2- 1H,1H,2H,2H-Perfluoro[1,2-13C2]Octanesulfonic Acid (M2- Perfluoro[13C9]Nonanoic Acid (M9PFNA) Perfluoro[13C9]Nonanoic Acid (M9PFNA) Perfluoro[13C8]Octanesulfonic Acid (M8PFOS) Perfluoro[13C8]Octanesulfonic Acid (M8PFOS) Perfluoro[1,2,3,4,5,6-13C6]Decanoic Acid (M6PFDA) Perfluoro[1,2,3,4,5,6-13C6]Decanoic Acid (M6PFDA) 1H,1H,2H,2H-Perfluoro[1,2-13C2]Decanesulfonic Acid (M2- 1H,1H,2H,2H-Perfluoro[1,2-13C2]Decanesulfonic Acid (M2- N-Deuteriomethylperfluoro-1-octanesulfonamidoacetic Acid N-Deuteriomethylperfluoro-1-octanesulfonamidoacetic Acid Perfluoro[1,2,3,4,5,6,7-13C7]Undecanoic Acid (M7-PFUDA) Perfluoro[1,2,3,4,5,6,7-13C7]Undecanoic Acid (M7-PFUDA) Perfluoro[13C8]Octanesulfonamide (M8FOSA) Perfluoro[13C8]Octanesulfonamide (M8FOSA) N-Deuterioethylperfluoro-1-octanesulfonamidoacetic Acid (d5- N-Deuterioethylperfluoro-1-octanesulfonamidoacetic Acid (d5- Perfluoro[1,2-13C2]Dodecanoic Acid (MPFDOA) Perfluoro[1,2-13C2]Dodecanoic Acid (MPFDOA) Perfluoro[1,2-13C2]Tetradecanoic Acid (M2PFTEDA) Perfluoro[1,2-13C2]Tetradecanoic Acid (M2PFTEDA) Matrix Spikes 46-182% recovery	Surrogates: All samples, standards, QC samples Matrix Spikes: One per 20 per matrix type	Field Duplicates RPD <30 MS/MSDs (RPD) RPD <30	Field Duplicates: One per 20 MS/MSDs: One per 20 per matrix
Cyanide	EPA Method 9012B	Groundwater	Matrix Spikes 75-125% recovery	Surrogates: All samples, standards, QC samples Matrix Spikes: One per 35	Field Duplicates RPD <35 Matrix Duplicates RPD <35	Field Duplicates: One per 20 Matrix Duplicates: One per 20

Recovery criteria for laboratory control samples must be at least as stringent as MS/MSD criteria.

Laboratory control limits are periodically updated. The latest control limits will be utilized at the time of sample analysis.

Table 5

Typical Laboratory Data Quality Objectives
Soil Vapor Samples

4778 Broadway, New York, NY
NYSDEC BCP Site No. C231131

Parameter	Method	Matrix	Accuracy Control Limits	Accuracy Frequency Requirements	Precision (RPD) Control Limits	Precision Frequency Requirements
VOCs	EPA Method TO-15	Soil Gas	Surrogates % Rec. 4-Bromofluorobenzene 78-124	Surrogates: All samples, standards, QC samples	Matrix Duplicates RPD £30	Matrix Duplicates One per 20

Table 6

QC Sample Preservation and Container Requirements

4778 Broadway, New York, NY
NYSDEC BCP Site No. C231131

Sample Matrix	Analytical Parameter	No. of Samples	EPA Analytical Method	Sample Preservation	Holding Time[1]	Sample Container
Soil	VOCs (TCL)	2	SW-846 Method 8260C/5035	1 - Methanol, 2 - Water; Cool to 4° C; no headspace	14 days to analysis	(3) Vial Preserved
Soil	PCBs	2	SW-846 Method 8082A	Cool to 4^0 C	365 days to analysis	(1) 250 mL amber glass jar
Soil	SVOCs (TCL)	2	SW-846 Method 8270D	Cool to 4˚ C	14 days to extraction	(1) 250 mL amber glass jar
Soil	1,4-Dioxane	2	SW-846 Method 8270D	Cool to 4˚ C	7 days to extraction	(2) 250 mL amber glass jars
Soil	Metals (TAL)	2	SW-846 Method 6010DSeries	Cool to 4^0 C	180 days to analysis	(1) 60 mL glass jar
Soil	Mercury	2	SW-846 Method 7471B	Cool to 4^0 C	28 days to analysis	(1) 60 mL glass jar
Soil	Cyanide	2	SW-846 Method 9010C/9012B	Cool to 4^0 C	14 days to analysis	(1) 250 mL amber glass jar
Soil	Herbicides	2	SW-846 Method 8151A	Cool to 4^0 C	14 days to extraction	(1) 250 mL amber glass jar
Soil	Pesticides	2	SW-846 Method 8141A[6]	Cool to 4^0 C	14 days to extraction	(1) 300 mL amber glass jar
Soil	PFAs	2	EPA Method 1633	Cool to 4^0 C	14 Days	(1) 250 mL plastic container

Table 6
QC Sample Preservation and Container Requirements

4778 Broadway, New York, NY
NYSDEC BCP Site No. C231131

Groundwater	VOCs (TCL)	1	SW-846 Method 8260C	HCl; Cool to 4^0 C; no headspace	14 days to analysis	(3) Vial
Groundwater	1,4-Dioxane	1	SW-846 Method 8270D	Cool to 4^0 C	7 days to analysis	(2) 250 mL amber glass jar
Groundwater	SVOCs (TCL)	1	SW-846 Method 8270D	Cool to 4^0 C	7 days to extraction	(2) 250 mL amber glass jar
Groundwater	Metals- total (TAL)	1	SW-846 Method 6020B/7470A Series	HNO$_3$; Cool to 4° C	28 days to analysis for Hg; 180 days to analysis for other metals	(1) 500 mL plastic container
Groundwater	Metals-dissolved (TAL)	1	SW-846 Method 6020B/7470A Series	HNO3; Cool to 4° C	28 days to analysis for Hg; 180 days to analysis for other metals	(1) 500 mL plastic container
Groundwater	Pesticides (TCL)	1	SW-846 Method 8081B	Cool to 4^0 C	7 days to extraction	(2) 120 mL amber glass jar
Groundwater	Herbicides (TCL)	1	SW-846 Method 8151A	Cool to 4^0 C	7 days to extraction	(2) 1000 mL amber glass jar
Groundwater	PCBs	1	SW-846 Method 8082A	Cool to 4^0 C	365 days to analysis	(1) 250 mL amber glass jar
Groundwater	Cyanide	1	SW-846 Method 9012A	Cool to 4^0 C	14 days to analysis	(1) 250 mL amber glass jar
Groundwater	Mercury	1	SW-846 Method 7470 A	HNO3; Cool to 4° C	28 days to analysis	(1) 250 mL plastic container
Groundwater	PFAs	1	EPA Method 1633	Cool to 4^0 C	14 Days	(1) 250 mL plastic container
Soil Gas	VOCs	1	EPA Method TO-15	None	14 days to analysis	(1) Evacuated 6-Liter SUMMA® canister

Notes:

1 Holding times listed are method holding time calculated from time of collection and not NYSDEC ASP holding times.

ATTACHMENTS

Christine A. Camardella, P.G., PMP
54 Prentice Road
Levittown, New York 11756
chriscamardella@hotmail.com
516-946-1121

Data Validation/Data Review/ Environmental Consultant

Providing consultation, data validation and data review services. These services include evaluation of analytical data with the objective of determining whether the data presented meets the site/project specific criteria for data quality and data use. Validation and review will be performed in accordance with the NYSDEC DER10 and USEPA 600/8-91/003, EPA 540/R/94/093 & EPA 540/R/94/097, USEPA National Functional Guidelines for Data Validation and EPA Region 2 SOPs for Data Validation.

Over 25 years of experience in both the laboratory and the environmental consulting field, with expertise in chemistry and environmental technology. Working knowledge of state and federal laws, regulations, and guidelines for the environment, water quality, and health including NYSDEC, NYCDEP, OER and NYSDOH. Additional skills are in quality control and quality assurance, data validation, expert technical review, chemical analysis, client communication and service, staff supervision and mentoring, regulatory interface, compliance management, work plan and proposal preparation, soil and groundwater investigation oversight, project scheduling and tracking, and technical editing as well as extensive financial management experience including forecasting and budget management. Manage and train junior staff.

Experience:

Lead Project Manager, Complex Project Management – Gas
National Grid – April 2018 - Present

- Prioritize, plan and coordinate project development activities according to stakeholder requirements.
- Supervise project team on daily basis to execute assigned projects within deadlines and budget.
- Prepare project proposals and develop project plan, schedule, and budget.
- Determine resource requirements and identify resources with the right skills to successfully execute projects.
- Assess potential risks and technical challenges and develop appropriate mitigation plans.
- Perform cash flow analysis and process invoices in a timely fashion.
- Develop cost reduction initiatives while maintaining quality and productivity.
- Analyze and resolve project issues in a timely and accurate manner.
- Provide technical guidance for large-scale projects.

Senior Project Manager
Advanced Site Restoration, LLC – September 2016 - February 2017

- Provided management and support for several retail petroleum clients.
- Prepared Phase I and Phase II Environmental Site Assessments.
- Knowledge in state and federal laws, regulations, and guidelines for the environment, water quality, and health including NYSDEC, NYCDEP, NYC OER and NYSDOH.
- Prepared high-level technical reports including Remedial Action Plans.
- Provided high level technical review of reports.
- Acted as a liaison between client and regulatory agencies.
- Provided data validation and data summary usability reports for clients.
- Managed and train junior staff while providing mentoring and support.
- Prepared proposals for clients.
- Managed several complex projects involving chemistry data QA/QC, asbestos removal, shoring installation, soil excavation, UST removal, and remediation system installation, in-situ bioremediation and soil and groundwater remediation.

Project Manager
Impact Environmental Consulting, Inc. - January 2011 - September 2016

- Managed retail petroleum client portfolios for projects in Nassau, Suffolk, Brooklyn, Queens, Bronx and Westchester.
- Advised clients on most cost-effective remedial strategies to obtain cleanup objectives.
- Expertise in Phase I and Phase II Environmental Site Assessments, remedial systems, in-situ bioremediation, UST removal, excavation, Site redevelopment, and soil and groundwater chemistry.
- Worked closely with regulatory agencies as well as local municipalities.
- Prepared and reviewed technical reports for client and/or regulatory submittal.

Pro Developed budgets and cost estimates.

- Managed and trained junior staff.

Senior Project Manager
Sovereign Consulting, Inc.- February 2009 - August 2010

- Provided project management and support for a multi-million-dollar project for a major retail petroleum company.
- Served as technical support on project with client and other team members, which has resulted in additional assessment work to obtain soil and groundwater characteristics in area of major plume.
- Managed quarterly sampling activities for an extensive groundwater monitoring well network including staffing, equipment, regulatory coordination and permits.
- Provided additional project management support for several retail petroleum projects in Brooklyn, Queens, and Nassau & Suffolk Counties.
- Maintained excellent client relationship and adhere to client expectations.
- Prepared and review technical reports for the client and regulatory agency.
- Documented cost savings of over $500,000 resulting in an award from the client.

Senior Project Manager
Kleinfelder, Inc. - January 2004 - February 2009

- Provided project management for a multi-million-dollar portfolio in Kings County for a major retail petroleum company.
- Supervised a staff of 5 professionals and provide mentorship and guidance.
- Communicated with regulatory agencies and maintain a working relationship with key regulators.
- Provided financial management and support.
- Assisted in providing technical guidance for large-scale projects, including reviewing and recommending new technologies.
- Provided management and support for several complex projects involving asbestos removal, shoring install, excavation, UST removal, and remediation system install and groundwater and soil remediation.
- Adhered to all company and client health and safety programs.

Project Environmental Scientist
Groundwater & Environmental Services, Inc.- December 2001 - December 2003

- Provided project management support activities including client involvement, work plan and proposal preparation, project scheduling and tracking, budget evaluation and analysis, and technical editing and report finalization.
- Developed and implemented Site work plans and proposals.
- Communicated with regulatory agencies.
- Performed oversight of soil and groundwater investigations.
- Conducted Phase I/II Site assessments for acquisitions and divestments of properties: including all associated fieldwork and reports.

Water Quality Specialist/Assistant Laboratory Director
Long Island Water Corporation - January 1992 – November 2001

- Responsible for maintaining laboratory certification for potable water via EPA and Nassau County Dept. of Health (NCDOH) approved testing methods.
- Assisted in evaluating laboratory programs, coordinated sampling/testing procedures to assure regulatory compliance.
- Established and directed quality assurance programs. Prepared reports and made recommendations as needed.

Chemist
Nassau County Department of Health, Division of Labs & Research - January 1990 - January 1992

- Analyzed potable and non-potable waters through EPA and NYSDOH requirements.
- Provided assistance with quality control systems and techniques.

Education:

New York Institute of Technology
Master Degree with Distinction, Environmental Technology, 2002

Adelphi University
Master Degree, Chemistry, 1994

St. Bonaventure University
Bachelor of Science Degree, Chemistry, 1990

Nassau Community College
Courses taken in Biology & Microbiology, 1998

Licenses:

Professional Geologist, License No. 1003

Certifications:

Project Management Professional (PMP)

Professional Memberships:

Project Management Institute (PMI)
Project Management Institute (PMI) Long Island Chapter
New York State Council of Professional Geologists (NYSCPG)
Long Island Association of Professional Geologists (LIAPG)

Chunhua Liu, PhD

Senior Technical Specialist

Education

B.E., 1992, Environmental Engineering, Tsinghua University, Beijing, China
M.E., 1995, Environmental Engineering, Tsinghua University, Beijing, China
M.S., 1998, Environmental Health, Harvard School of Public Health
D.S., 2000, Environmental Chemistry, Harvard School of Public Health

Areas of Specialization

- Human Health Risk Assessment
- Ecological Risk Assessment
- Data Usability Evaluation
- Project Quality Control and Assurance
- Fate and Transport Modeling

Summary of Experience

Dr. Liu is a senior chemist with more than 10 years of experience in analytical chemistry, data validation and management, and quality control and quality assurance for remedial investigations and remedial actions. Her experience includes laboratory chemical analysis, EPA Region I and Region II data validation and data usability evaluation, data usability evaluation for Massachusetts Contingency Plan (MCP), sampling and analysis plan development in accordance with the NYSDEC Analytical Service Protocol and Massachusetts Compendium of Quality Assurance and Quality Control Requirements (QA/QC) and Performance Standards for Selected Analytical Methods, and quality control and quality assurance for Superfund and MCP projects.

Dr. Liu majored in environmental chemistry and during her doctoral study at Harvard School of Public Health, she researched analytical methods for sediment and evaluated metal fate and transport in sediment. Dr. Liu worked at Parsons for over seven years and at Gradient for one year before joining GZA. At Parsons, Dr. Liu led the quality control and assurance and data management efforts from developing Quality Assurance Project Plan (QAPP) to assuring implementation of QA/QC requirements and from field sampling preparation and arrangement to chemical data management. Dr. Liu was responsible for the QA/QC and data validation and data usability evaluation for a 10,000-acre BRAC and Superfund NPL site in New York and assisted in the successful transfer of over 8,000 acres of land. Dr. Liu performed data usability evaluation for various Massachusetts Contingency Plan sites at Gradient and GZA.

Relevant Project Experience

Senior Technical Specialist. Leads GZA human health risk assessment efforts for federal and state level superfund and MCP projects. Dr. Liu is also responsible for data usability evaluation for various projects.

Technical Director. Directed preparation and submittal of the Site-Wide Sampling and Analysis Plan (SAP) and the Site-Wide Quality Assurance Project Plan (QAPP) for a 10,000-acre Superfund site in New York in accordance with the Department of Defense (DOD), NYSDEC ASP, EPA Region II and EPA guidance. Directed project field sampling and data management. Supervised data validation in accordance with EPA Region II SOPs and NYSDEC ASP based on the NYSDEC ASP Category B deliverables. Identified laboratories qualified for project chemical analyses and interfaced with various analytical laboratories to address analytical deficiencies. Submitted data summary report to EPA Region II on a quarterly basis.

Lead Chemist and Risk Assessor. Led data usability evaluation and supported the successful closure of a 125-acre Hingham Annex Guaranteed Fixed Price Remediation Project. Dr. Liu also led the risk assessment effort and the effort of evaluating pesticide fate and transport at the site and successfully demonstrated that the pesticide conditions at the site were related to the past normal use of pesticides and therefore were not associated with the release at the Site.

Technical Director. Directed preparation and submittal of the SAP and the QAPP for various Formerly Used Defense (FUD) Sites. Supervised field sampling and data validation in accordance with guidance from various EPA regions. Reviewed data validation and data usability report.

Technical Director. Directed data validation for various Superfund sites in EPA Region I and Region II in accordance with the EPA regional and state SOPs and the EPA Functional Guidelines. Led data validation for numerous MCP sites for various analytical analyses including metal, VOC, SVOC, pesticide, PCB, EPH, VPH, and TPH analyses.

Project Chemist. Evaluated different analytical methods for hexavalent chromium analysis. Compared analytical methods developed by NJDEP and EPA and identified the appropriate method for a CERCLA site in New Jersey.

Project Chemist. Evaluated quantitatively potential impacts to metal data usability by interference caused by common metals in environmental samples for a CERCLA site in New York.

Project Chemist. Performed data validation for indoor air samples for various CERCLA and MCP Sites to assist evaluation of potential vapor intrusion pathway.

Project Chemist. Performed Level IV data validation for a Superfund site in New York for various analytical analyses including metal, VOC, SVOC, pesticide, and PCB analyses. Reviewed TIC identification and quantitation and assessed chromatograms and mass spectrums for VOCs and SVOCs.

Project Chemist. Provided technical support, prepared QAPPs, established proper data quality objectives (DQOs) for various projects, maintained project quality control, trained junior scientists, coordinated project field sampling and laboratory analyses, addressed non-conformance issues associated with the data produced by the laboratory, conducted statistical analysis, and prepared data validation reports on numerous RCRA/CERCLA and MCP projects.

ENVIRONMENTAL ASSESSMENT AND REMEDIATION PROJECTS

(Former Malden MGP) Senior Scientist - Lead Risk Assessor, Chemist, Site Assessment, Malden, Massachusetts. Leading ongoing risk assessment work at large, complex former MGP that encompasses more than 16 acres of land and more than 10 different properties. Work has included vapor intrusion pathway evaluation, imminent hazard evaluation, substantial hazard evaluation, data usability evaluation, and risk characterizations for evaluation of effectiveness of sub-slab depressurization systems and remediation, direction of Site remediation and investigations, and verification of the need for AULs. GZA was able to demonstrate that indoor air impacts in a residential area were not related to MGP residuals, allowing for closure of that portion of the Site. Risk characterizations also demonstrated that Site conditions did not pose substantial hazards, confirming the effectiveness of the Temporary Solution.

(Commercial Point LNG Facility) Senior Scientist - Lead Risk Assessor, Site Assessment and Closure, Dorchester Massachusetts. Directed risk characterization to support MCP closure of former MGP facility that was currently being used as a Liquefied Natural Gas (LNG) storage and distribution facility. Performed risk characterization to support supplemental Phase II – IV MCP investigations and Permanent Solution status while allowing for beneficial reuse of the facility for LNG operations and a solar power generating facility. Also performed focused risk characterizations in support of an AUL filing and potential reuse options for portions of the Site.

(Former Haverhill Holder Site) Senior Scientist - Lead Risk Assessor, Site Closure, Haverhill Massachusetts. Directed risk characterization to support MCP closure of former MGP gas holder facility where wastes had been disposed. Conducted risk characterization to facilitate development of cost-effective cleanup plan involving focused soil excavation and use restrictions that allowed for achievement of a Permanent Solution. Performed a Method 3 risk characterization to support the complex supplemental Phase II investigation. This complex site encompassed properties owned by seven different parties, including residential land and portions of a river/tributary system.

(Gloucester Former MGP) Senior Scientist - Lead Risk Assessor, Human Health Risk Assessment, North Shore, Massachusetts. Performed Method 3 Risk Characterization for multiple parcels to support the Supplemental Phase II Comprehensive Site Assessment initiated by other consultants under the Massachusetts Contingency Plan. This Site included MGP impacts to approximately 45 acres of Gloucester Harbor sediment. GZA evaluated potential human health risks via exposure to soil, groundwater, sediment, surface water, homegrown produce, and consumption of fish. In addition, Risk Characterization was used in the early stages of the project to assist identification of data gaps and Site investigation.

(Salem Power Plant) Project Manager, Cost Recovery Negotiations, Salem, Massachusetts. Working through counsel, provided advice to a prior owner with respect to remedial obligations under the Massachusetts Contingency Plan (MCP) associated with impacts to soil at this power generating facility. Work included review of hot spot evaluation, risk characterization, and remediation performed at the Site. Given the Site use, we concluded that most of the claimed costs that had been incurred by the current owner were not necessary under the MCP and thus should not be subject to recovery from our client.

(Sawyer Passway) Senior Scientist - Lead Risk Assessor, Chemist, MGP Site Closure, Fitchburg, Massachusetts. Performed a Substantial Hazard Evaluation and a Method 3 Risk Characterization to support fast-track Massachusetts Contingency Plan (MCP) Phase II/III study of large, complex former MGP facility on the banks of a major New England river. The work had to be completed within two months to meet a key regulatory deadline. Work included a risk evaluation to support a streamlined supplemental field exploration program, a risk evaluation to direct the focused soil excavation, and a substantial hazard evaluation for the cost-effective temporary solution within the required regulatory deadlines. GZA's continuing work on this project has included technical support for an insurance cost-recovery claim, periodic evaluations of the temporary solution, completion of soil stabilization/solidification pilot studies, implementation of focused remedial programs during site building demolition work and development of remedial, plans directed at achieving a Permanent Solution (PS). Based on updated evaluations, a cost-effective approach to a PS was developed in 2014 and a Method 3 Risk Characterization was performed to support a PSS in 2015.

(Former Army Depot Activity Site), Technical Director, Syracuse, New York. Directed preparation and submittal of the Site-Wide Sampling and Analysis Plan (SAP) and the Site-Wide QAPP for a 10,000-acre Superfund site in New York in accordance with the Department of Defense (DOD), NYSDEC ASP, USEPA Region II and USEPA guidance. Directed project field sampling and data management. Supervised data validation in accordance with USEPA Region II SOPs and NYSDEC ASP based on the NYSDEC ASP Category B deliverables. Identified laboratories qualified for project chemical analyses and interfaced with various analytical laboratories to address analytical deficiencies. Submitted data summary report to USEPA Region II on a quarterly basis.

(Waverley Oaks Road), Senior Scientist - Lead Risk Assessor, Human Health Risk Assessment, Waltham, Massachusetts. This property has been impacted by improper storage of large quantities of waste oil that was to be used to heat on-site green houses, or to be processed and resold. This Site is regulated under the Massachusetts Contingency Plan; Massachusetts Department of Environmental Protection reviewed and approved all work plans and reports for the site investigation and risk assessment; it was downgraded from a Tier 1A to a Tier 1B Site following completion of the Phase II investigations.

Waste oil releases have impacted nearly 10-acres of an on-Site pond, stream and wetland, including 3 acres that have visible oil presented within surficial wetland soil and sediment. GZA conducted a Method 3 Risk Characterization to support the permanent solution of the Site. For the Vapor Intrusion pathway, GZA identified constituents not related to Site release and verified the conclusion based on the evaluation of Site-specific attenuation factors.

Publications and Presentations

Liu, C., J. Jay, T. Ford. Evaluation of Environmental Effects on Metal Transport from Capped Contaminated Sediment under Conditions of Submarine Groundwater Discharge. Env. Sci. Tech. 2001 35: 4549-4555.

Liu, C., J. Jay, R. Ika, S. James, and T. Ford. Capping efficiency for metal-contaminated marine sediment under conditions of groundwater inflow. Env. Sci. Tech. 2001 35: 2334-2340.

Blanchet, R., Liu, C., Bowers, T. Summary of Available Freshwater and Marine Sediment Quality Guidelines and Their Use in North America. Abstract accepted at SEATEC Conference, November, 2001

Blanchet, R., Liu, C., Bowers, T. Estimation of Average Exposure Point Concentrations for Pesticides Assuming Accumulation and Degradation in the Environment. Abstract accepted at SEATEC Conference, November, 2001

Chunhua Liu, PhD

Senior Technical Specialist

Seeley, M.R., Schettler, S., Liu, C., Blanchet, R.J., Bowers, T.S. Assessing Cancer Risks Due to Use of Insecticides to Control the Mosquito-borne West Nile Virus: Use of the Margin of Exposure Approach. Abstract accepted at Society of Toxicology, 41st Annual Meeting, March 17-21, 2002.

Chunhua Liu, Jennifer Jay, Ravi Ika, Shine James, Timothy Ford. Capping Efficiency for Metal-Contaminated Marine Sediment under Conditions of Submarine Groundwater Discharge. Poster presentation at Conference on Dredged Material Management: Options and Environmental Considerations. December 3-6, 2000

Chunhua Liu, Jennifer Jay, Timothy Ford. Evaluation of Environmental Effects on Metal Transport from Capped Contaminated Sediment Under Conditions of Submarine Groundwater Discharge. Poster presentation at Conference on Dredged Material Management: Options and Environmental Considerations. December 3-6, 2000

Chunhua Liu, Jennifer Jay, Timothy Ford. Core analysis: Is it a good indicator of metal release and capping efficiency? Poster presentation at Conference on Dredged Material Management: Options and Environmental Considerations. December 3-6, 2000

Chunhua Liu. 2000. Capping Efficiency for Metal Contaminated Marine Sediment under Conditions of Submarine Groundwater Discharge. Doctoral Thesis. Harvard School of Public Health

Chunhua Liu, Ravi Ika, Tim Ford. 1998. Metal flux in near shore capping sites under conditions of submarine groundwater discharge. In: Fourth Marine & Estuarine Shallow Water Science & Management Conference. March 15-19, 1998

Wei Lin, Guowei Fu, Chunhua Liu. 1996. Study on allocating permissible pollutants discharge based on axioms system. Chin. J. Environ. Sci. 1996 17(3):35-37

Wei Lin, Chunhua Liu, Guowei Fu. 1995. Environmental conflict analysis and its application in environmental planning and management: siting of public facilities. Chin. J. Environ. Sci. 1995 16(6): 36-39

Chunhua Liu, Yongfeng Nie, Wei Lin. 1995. Application prospects of landfill gas utilization technique in China. Pollution Control Technology 1995 8(3): 143-145

Chunhua Liu. 1995. Evaluation of gas production from sanitary landfill. Master's thesis. Tsinghua University, Beijing, P.R.China

Wei Lin, Chunhua Liu. 1994. Rudimentary study on countermeasure to comprehensively control air pollution caused by motor vehicles in China. Pollution Control Technology 1994 7(4): 1-3

Xiurong Zhang, Chunhua Liu, Yanru Yang, Qingzhong Bai. 1993. Environmental impact report of wastewater treatment plant project in Xuanhua City, China.

Chunhua Liu, Yongfeng Nie. 1993. Water balance evaluation in Hongmei hazardous waste landfill. In: Environmental Impact Assessment of Hongmei Hazardous Waste Landfill: 25-33

Chunhua Liu. 1992. Modeling landfill leachate production and migration. Bachelor Thesis. Tsinghua University, Beijing, P.R.China

Chunhua Liu. 1991. A discussion with the author of "clean water extraction from ocean water". Technology of Water Purification 1991(1): 39-41

Affiliations/Memberships

- Member, LSP Association
- Member, Society for Risk Analysis
- Certified EIT in Massachusetts

Victoria Whelan, PG, QEP

Associate Principal

Education

B.S., Geology, State University of New York at Oswego, 2001-2005; James Cook University 2004-2005

Licenses & Registrations

Registered Professional Geologist – 2017, New York, # 000318

Certified Professional Geologist, New York State

Qualified Environmental Professional, Institute of Professional Environmental Practice

Areas of Specialization

- Geology
- NYCOER VCP
- NYSBCP
- Environmental Assessments
- Environmental Site Investigation and Remediation
- UST Closures/Assessments
- Regulatory Compliance Planning and Permitting

Summary of Experience

Ms. Whelan is a Certified Professional Geologist and Qualified Environmental Professional with nearly 20 years of experience in environmental assessment. She has performed and managed field investigations and remedial activities at numerous sites on Long Island and throughout the Metro New York area. She has skillfully conducted all aspects of environmental investigations and remediation. Her primary focus is to accurately assess, investigate, remediate, and maintain environmental integrity for real estate transactions and the redevelopment of brownfield or similarly environmental impaired properties.

She manages all aspects of projects with the New York State Department of Environmental Conservation (NYSDEC) Brownfield (BCP) and Voluntary Cleanup Program (VCP), the New York City Office of Environmental Remediation (NYC OER), the New York City Department of Environmental Protection (NYCDEP) and the United States Environmental Protection Agency (USEPA).

Relevant Project Experience (Prior to GZA)

NYCOER PROJECTS

Project Manager, Chester Street Brooklyn Supportive Housing Project, Brooklyn, New York. Managed all aspects of environmental project from due diligence investigation services, Phase I Environmental Site Assessment, and Phase II Environmental Site Investigation services to assisting client through NYCOER Voluntary Cleanup Program (VCP). Submitted and received approval for remedial investigation work plan, remedial investigation report, remedial action work plan, and construction health and safety plan, including a community air monitoring program. Managed removal of 12 buried aboveground storage tanks (ASTs). Managed waste characterization study to evaluate various soil types for disposal. Cost effectively utilized the NYC Clean Soil Bank as a disposal site and backfill source. Secured grant funding after receiving Notice of Satisfaction (NOS) for a Track 1 Cleanup.

Environmental Project Manager, Manhattan Avenue, Affordable Housing Project, Brookyn, New York. Member of team that helped Ownership develop a new seven-story residential building on former factory site. Proposed development covered nearly 8,000 square feet of the property, including affordable housing with amenities such as a rear yard, recreation space, and children's play place. Site's contaminants included heavy metals and semi-volatile organic compounds. Hazardous and non-hazardous waste and non-hazardous was removed from the property as part of remediation efforts to address source material. Goal Soil Cleanup Objectives (SCOs) could not be achieved after remediation due to shallow groundwater. A track 4 Cleanup was achieved on this site by installing a composite cover inclusive of a vapor barrier. The project was completed on-time and on budget for the client to receive a NOS.

Project Manager, Bronx Community Development Project, Bronx, New York. Provided environmental services as client purchased, investigated, and remediated site for 81-unit community development, parking area and recreational area. The project is enrolled in NYC OER's VCP. Completed a Phase I ESA, VEA, Phase II ESI, RAWP and RAR.

Victoria Whelan, PG, QEP

Associate Principal

During remediation perimeter air monitoring was performed as per the CAMP. Designed oversaw removal of contaminated soil and installation of chemical vapor barrier during redevelopment.

NYSDEC BROWNFIELD PROJECTS

Principal-in-Charge, Former Auto Wreckers Site, Bronx, New York. Project is in the NYSDEC BCP with a planned Track 1 Cleanup. The site was successfully rezoned, and the proposed project will include 212 affordable housing apartments, 22,000 square feet (sf) of retail space, and parking. As remedial excavation was conducted it was quickly determined that the initial remedial plan would not satisfy the requirements for the project. As PIC, worked with the ownership, architect, accountant and construction team to steer the project towards new remedial goals without impacting project schedule. Remedial elements include a large-scale groundwater treatment system to address petroleum impacted groundwater and excavation of all source material ranging from depths of 2 to 15 feet below grade.

Environmental Project Manager, Confidential Residential Development, Bronx, New York. The 1.5-acre property was enrolled in the NYSDEC Brownfield Cleanup Program. Remedial components included excavation of soil exceeding the Site-specific Track 4 SCOs ranging from 2-22 feet, construction and maintenance of a composite cover system, removal of multiple underground storage tanks (USTs) and injection of Regenox and ORC Advanced (ISCO treatment) into the groundwater. Remediation also involved implementation of a CAMP. The site building was equipped with a vapor barrier and an active sub-slab depressurization system (SSDS). Throughout the process, assisted with design, maintaining a schedule and development of a Site Management Plan (SMP) and Final Engineering Report (FER).

Principal-in-Charge, Clay Street, NYCOER to NYSBCP Site, Brooklyn New York. Project consists of three parcels that share a property boundary and is in an area known to have heavy contamination. As the Principal-in-Charge, guided a team including ownership, developer and architect from the NYCOER VCP to the NYSDEC BCP based on contamination identified during the initial Remedial Investigation. Strategically conducted additional investigation to get multiple parts of the project eligible for the program and to maximize the tax credits available. Development will include a much-needed community facility in the way of a medical center, an indoor children's play center, and residential house.

USEPA PROJECTS

Project Manager, Remediation System, Confidential Client, Hicksville, New York. Managed this USEPA Superfund site for nearly 15 years through the operations and maintenance phase including a long-term groundwater treatment program, off-site soil vapor intrusion evaluations, and a large-scale groundwater sampling program. Contaminants of concern included PCBs and volatile organic compounds (VOCs). The site was complicated by multiple overlapping plumes of groundwater contamination. Collaborated with multiple property owners and their consultants to successfully drive the remediation.

NYS SPILLS PROJECTS

Project Manager, Spill Investigation and Remediation Services, Hempstead, New York. Performed a Phase I Environmental Site Assessment (ESA) that identified a gas station on the Site from 1940 through 1962, until redevelopment in the 1970s as a current commercial building. A subsequent Phase II Environmental Site Investigation (ESI) identified petroleum impacted soils, groundwater, and the presence of light non-aqueous phase liquids (LNAPL). A NYSDEC Spill Case was opened, and a Spill Investigation Work Plan was approved. Managed the spill investigation activities which included a work plan of Vacuum Enhanced Fluid Recovery (VEFR) events to evaluate feasibility of collecting residual petroleum contamination from beneath the Site building using VEFR. As part of long-term remedial plan, Monitored Natural Attenuation (MNA) and biodegradation to assess MNA is viable remedial strategy for the Site after the remediation of the LNAPL.

Certifications/Training

- 40-Hour OSHA HAZWOPER Training and 8-Hour Refreshers
- 10-Hour OSHA Construction Safety Course

Victoria Whelan, PG, QEP

Associate Principal

- First Aid/CPR Training
- LIRR Roadway Worker Training required by 49 CFR Part 214 Subpart C
- ARC Flash Training
- Confined Space Entry

Affiliations/Memberships

- Board Member - New York City Brownfield Partnership (NYCBP) 2022- present
- Committee Chair - Small Business Committee (NYCBP) 2022- present
- Member, New York State Council of Professional Geologists (NYSCPG)
- Member, American Council of Engineering Companies
- Member, Long Island Association of Professional Geologist

Honors & Awards

- Big Apple Brownfield Award - Hour Apartment House III
- Supportive Living Affordable Housing Award - Putnam Court
- Who's Who in Green Award - Atlantic Terrace

Zachary Landis, P.E.

Project Manager

Education

B.S., Earth and Environmental Sciences, Virginia Wesleyan University, 2017

M.E., Environmental Engineering, Old Dominion University, 2018

Licenses & Registrations

Professional Engineer – Virginia, #0402066593

Areas of Specialization

- Environmental Site Investigation and Remediation
- Construction Management
- Permitting & Compliance
- Soil, Groundwater, Air Sampling
- Air Quality and Surface Water Modeling
- Technical Specification Preparation
- Bid Evaluation
- Remediation Oversight

Summary of Experience

Mr. Landis is a Licensed Engineer with six years of environmental consulting, engineering, and research experience. His focus is on site investigations for contaminated soil, groundwater, and surface water and remedial construction. He has managed and implemented environmental activities in multiple states at residential, commercial, industrial, and publicly owned sites. Mr. Landis performs field work and supports the closure of sites utilizing source removal, in-situ and ex-situ remedial technologies, and waste removal and risk-based corrective action methods in accordance with state and federal regulations. He has managed complex multi-site projects requiring significant planning and coordination with subcontractors and vendors.

Prior to consulting, Mr. Landis worked as a researcher for the National Science Foundation and Virginia Tech. His projects were focused on water quality and erosion management in urban, rural, and suburban areas.

Relevant Project Experience

ENVIRONMENTAL CONSULTING

Site Supervisor, 645 Gates Avenue Redevelopment/The Astra, Brooklyn, New York. Oversaw remedial actions for construction of a six-story, mixed-income affordable housing building. The project involved excavation and removal of 11 underground storage tanks (USTs) and approximately 7,500 CY of impacted soils. During excavation and backfilling activities, completed confirmation sampling of each UST and completed excavation area. Conducted Community Air Monitoring Program (CAMP). Designed and oversaw installation of building’s vapor barrier system.

Project Engineer, DLA Pipeline Spill, Atlantic Undersea Test and Evaluation Center, NAVFAC Southeast, Andros Island, Bahamas. Provided technical support for design and implementation of air sparging system at the US Navy's AUTEC Facility. Provided analysis of the effectiveness of varying air sparging system layouts and long-term monitoring of groundwater sampling at the facility after previous soil delineation and remedial actions for a pipeline spill and a tidal influence investigation had been completed. Coordinated complex field event logistics with subcontractors, field personnel, and clients at remote military installation.

Project Engineer, Bethany Hills Wells PFAS Response Action, USACE Omaha District, Off Base from Luke AFB, Arizona. Oversaw installation of a bypass pipeline at an existing municipal PFAS water treatment facility and designed and installed a treatment media evaluation study at the facility. The bypass pipeline was installed to divert an emergency source of previously treated municipal water supply around the PFAS treatments system to avoid chlorinated water from impacting treatment media. The treatment media evaluation study consisted of a four-column test skid that diverted untreated effluent from the PFAS treatment system to test four separate treatment medias (ion exchange resins, granular activated carbon, and an organoclay) and reintroduce treated water into the treatment system. The study was used to evaluate effectiveness of each media and design a full-scale treatment at this facility as well as additional Air Force operated facilities. Also conducted monthly analysis of

PFAS breakthrough for the treatment system, prepared engineering evaluation and cost analysis of new PFAS extraction and treatment system at David-Monthan AFB.

Project Engineer and Quality Control Manager, MSFIH Site 67, 4915, Navy Facilities Engineering Systems command, Naval Support Facility Indian Head, Maryland. Provided quality control and health and safety oversight for project involving excavation of seven soil removal areas with contaminants including heavy metals and VOCs. One area required removal of riverbed sediment from the shoreline to approximately 45 feet into a creek. Each removal area's excavated soils were stockpiled and evaluated separately until transportation and disposal to an offsite facility. Site restoration included backfilling, replanting of wetland/river areas that were disturbed, grass seeding, and repairing the stormwater drainage system. Reviewed executed work, provided client with progress updates and changes in conditions, and prepared all required submittals.

Project Engineer and Technical Lead - Fried Industries Superfund Site, East Brunswick, New Jersey. Provided technical support and design for excavation of approximately 8,000 CY of VOC impacted soils and installation and testing of a monitoring well and extraction well for the existing groundwater treatment facility. Excavation was completed within a wetland area and required a combination of slide rail shoring and open excavation with sloped sides. After backfilling and compaction, two wells were installed to 90 feet within the competent bedrock and tested for contaminant concentrations and yield. The more significantly impacted well was constructed as an extraction well; a below grade pipeline was installed to connect it to the existing groundwater treatment plant at the site. The other well was constructed as a monitoring well to be added to site’s existing monitoring well network. After completion of well installation, wetland area was restored with native plantings and an impacted roadway was restored in kind.

Project Engineer and Technical Lead – Peck Iron and Metal Superfund Site, Portsmouth, Virginia. Provided technical support, investigation design, and onsite management for the supplemental investigation of a 33-acre former scrap yard in support of the remedial design overseen by the USEPA. The investigation focused on delineating source areas of contamination for heavy metals, PCBs, and radioactive isotopes, such as Radium-226, Lead-214 and Bismuth-214, within the upland areas and within the wetlands along the Paradise Creek. The investigation sampled soil, sediment, groundwater, and porewater in heavily wooded and wetland conditions. The investigation included the screening and removal of unexploded ordnances from investigations areas, including the successful onsite detonation of 6 ordnances and safe removal of 4 ordnances for offsite decommissioning. The project included significant coordination with local fire and police departments and local navy munitions response for the safe execution of the investigation and maintaining site safety in a highly populated area with extensive public outreach.

Project Manager – 252 Victory Blvd, Staten Island, New York. Provided the project management and technical support for the Phase I Environmental Site Assessment (ESA), waste characterization sampling, a Part 58 Environmental Assessment (EA) under the National environmental Policy Act (NEPA) requirements, and the New York City air quality and noise E-designation services in support of the development of a mixed-use residential and commercial building in the Tompkinsville neighborhood of Staten Island. The site is a steep hillside and contains serpentinite, a rock known to contain naturally occurring asbestos, in the bedrock and weather bedrock. The Phase I ESA reviewed the site and surrounding area conditions and the historical records for the area including a nearby auto repair shop and a Department of Sanitation transfer station. The waste characterization sampling was completed for the estimated excavation and removal of up to 10,000 cubic yards under NYSDEC CP-51 guidance. Upon the discovery of limited SVOCs detections, additional delineation sampling was completed to provide a soil disposal and recycling facility with sufficient data to accept a majority of the material for beneficial reuse and the remaining soil for disposal. The Part 58 EA was completed for the development to evaluate the impacts of the development in support of the use of Department of Housing and Urban Development funding. The site had been given E-designation for noise and air quality requirements during a past rezoning. GZA completed a noise investigation to lower the requirements of the noise attenuation through the NYC Mayor’s Office of Environmental Remediation (OER) and provided the Remedial Action Plan for OER approval to receive the Notice to Proceed with Construction.

Project Manager – Agliex Fragrances, Somerset, New Jersey. Provided the project management and technical support for the construction, commissioning and startup, and permitting for an odor mitigation system at a fragrance manufacturer’s compounding facility. The system treats between 30,000 and 50,000 CFM and includes a ductwork and fan system drawing air from

Zachary Landis, P.E.

Project Manager

the facility's production, storage, and laboratory areas, a paper filter unit, a granular activated carbon unit, a rotary concentrator wheel, and regenerative thermal oxidizer (RTO) with treated emissions exiting a 50-foot stack. The project included the review of installation contractor submittals and oversight of the system commissioning and startup, updating the related air permit based on operating conditions, developing a production model for the facilities emissions based on specific formula production, and coordinating and overseeing the stack testing of the system for NJDEP compliance.

Project Manager – Columbia University, New York, New York. Provides the project management and technical support of the University's Title V permit reporting to NYSDEC and USEPA. The University's permit covers multiple boilers and co-generation turbines at their power plant. Provides the quarterly, semi-annual, and annual reporting required under the Title V permit and evaluates the recorded system data for compliance with permit requirements. The project requires ongoing coordination with University Facility Engineering staff and the NYSDEC.

Project Manager – Wildlife Preserves, East Hanover, New York. Provides the project management and engineering support for the permitting of a major landfill disruption permit under NJDEP. Wildlife Preserves was seeking the approval to place a gravel parking lot on their property which was a former landfill remediated under the USEPA's Superfund Program. Developed the permit application including design drawings and construction operating procedures to install the gravel lot and relocate a section of the entrance gate fencing. Successfully obtained the disruption permit with significant savings for the client.

Environmental Engineer – Atlantic Motion Pictures Studios, Egg Harbor Township, New Jersey. Provided the engineering support for the permitting of a minor landfill disruption permit under NJDEP. The studio was in the design phase of their new production studio with a portion of the property containing a former unregulated landfill. In support of their geotechnical investigation for their facility design, he provided the engineering support for developing design drawings and operating procedures for the minor landfill disruption permit. Successfully obtained the disruption permit on an expediated schedule to obtain state funding for the project.

Project Manager – Broadway Square LLC, Queens, New York. Provided the project management and technical support for the development of the remedial design and remedial action workplan (RAWP) for the Broadway Square LLC NYSDEC Brownfield site. The Site was a former foundry and is in the NYSDEC Brownfield Cleanup Program for heavy metals contamination with the investigation completed under a previous consultant. The owner is developing the site with an 11-story mixed-use residential and commercial building encompassing the entire city block. He provided the remedial design for limited excavation across the site for hotspot removal in shallow soils, in-situ soil stabilization (ISS) for the containment of deeper metals contamination, and a sub-slab depressurization system. The project is completing the design phase of the project and getting ready to begin the treatability study for the ISS mix design.

Project Manager – Hofstra University, Hempstead, New York. Provided the project management and engineering support for the completion of the analysis required under the Climate Leadership and Community Protection Act (CLCPA) for a state air facility permit through NYSDEC. The University recently reduced air emissions with cessation of their co-generation operations and were reduced from their Title V permit requirement to a state air facility permit. In support of their application, he provided the air emissions analysis for the operation of the University's boilers under the new permit to meet the requirements of CLCPA. The analysis was completed on an expedited schedule to meet the University's requirement to the State.

Project Manager – 128 E.125th Street, New York, New York. Provided the project management and technical support for the Phase II investigation and remedial design in support of a new mixed-use residential and commercial development. The Phase I investigation by a former consultant identified spills at the site associated with a former AST in the basement of the property. The property is located on shallow bedrock with portions of the cellar slab directly on bedrock and the developer left the existing buildings cellar foundation on place for reuse in the new development. Completed the design and execution of a Phase II environmental Site Investigation (ESI) under NYC OER oversight for soil, groundwater, and soil vapor. The investigation was completed during the demolition of the existing building and required significant coordination with other contractors and the client for safety and site access. Successful completed the Phase II investigation and obtained OER approval for limited excavation below the existing cellar grade and installation of a vapor barrier beneath the building footprint.

Zachary Landis, P.E.

Project Manager

STORMWATER MANAGEMENT

Project Engineer, Underserved Communities Stormwater Management, Virginia Department of Emergency Management, Multiple Locations, Virginia. Provided engineering support for FEMA applications for stormwater management funds, including engineering estimates and evaluations for project feasibility for stormwater management projects including home elevations, installation of subsurface drainage systems, wet ponds, breakwaters, and culverts. For several localities, provided onsite investigations and prepared full design packages and specifications for projects including a breakwater, a wet pond and subsurface drainage system, multiple culverts along arterial and rural roadways, and a towns stormwater sewer system.

Project Manager, Realterm Logistics, Hamilton, New Jersey. Provided the project management and technical support for the ongoing annual stormwater facility inspections and reporting for one of Realterm's warehouse facilities. The Township of Hamilton requires the annual inspection, maintenance, and reporting of stormwater facilities submitted to their Division of Engineering. He provided the onsite inspection of the three stormwater basins and upland drainage structures, provided recommendations for maintenance to the client and developed an annual report to document the existing conditions and future actions to be taken by the facility.

Project Manager, DealerTrack, New Hyde Park, New York. Provided the project management, engineering support, and construction oversight for the completion of stormwater management improvements at DealerTrack's New Hyde Park office building. The facility experiences regular flooding in the parking areas during minor storm events due to insufficient drainage and a substantial clay layer beneath the property. He provided the support during the engineering design of the drainage improvement including additional perforated and solid drainage pipe, manholes, silt separators, and inlet structures for tie into the city sewer system, as wells as restoring the condition of existing manholes and drainage galley. He oversaw the construction to inspect for completion inline with the design and provided design revisions based on observed field conditions.

Research Aid, Virginia Tech, Biological Systems Engineering Department, Virginia Beach, Virginia. Aided research on stormwater management and water quality in the Hampton Roads, Virginia area, including rural, suburban, and urban, runoff assessments and modeling impacts to the Chesapeake Bay Watershed. Responsible for data collection and management, setting up sampling and monitoring equipment at various site locations, conducting particle size distribution analyses, and maintaining equipment in compliance with research targets.

International Researcher, National Science Foundation, Xilingol, China. He researched the aeolian and fluvial erosion conditions of the steppe grasslands of northern China within the Inner Mongolia Region. The research included the development of a mobile air tunnel and rainfall simulator for the testing of bare and vegetated portions of the grassland for the development of an erosion model for the region. He was responsible for the field testing and sampling of the air tunnel and rainfall simulator for data collection, analysis of the results, and the development of the model to account for both aeolian and fluvial erosion factors.

Certifications/Training

- Professional Engineer – Virginia (0402066593)
- Transportation Worker Identification Credential – Nationwide, 05860698
- First Aid and CPR
- Hazardous Materials Supervisor, Nationwide, UMD201285
- OSHA 10-hr Construction Safety & Health
- OSHA 30-hr Construction Safety & Health
- OSHA 40-hr Hazardous Waste Operations
- OSHA 8-hr Fall Protection
- OSHA 2-hour Drug & Alcohol Awareness
- US Army Corps of Engineers Construction Quality Management for Contractors

Publications and Presentations

Zachary Landis, P.E.

Project Manager

Zachary Landis, Xixi Wang, Nicholas Potter, Measuring and Modeling Bare Topsoil Erosion by Wind from a Steppe Grassland of China, AGU Fall Meeting, Washington D.C., 2018

Zachary Landis, International Research in Environmental Science and Engineering, Virginia Wesleyan University's Honors and Scholars Lecture Series, Virginia Beach, VA, 2018

Determination of Volatile Organic Compounds in Air Using Specially-Prepared Canisters and Analyzed by GC/MS

References: **Compendium of Methods for the Determination of Toxic Organic Compounds in Ambient Air - Second Edition.** U.S. Environmental Protection Agency. EPA/625/R-96/010b. Office of Research and Development National Risk Management Research Laboratory. Center for Environmental Research Information. Cincinnati, Ohio. January 1999.

Method TO-15: Determination of Volatile Organic Compounds (VOCs) In Air Collected In Specially-Prepared Canisters and Analyzed By Gas Chromatography Mass Spectrometry (GC/MS). U.S. Environmental Protection Agency. EPA/625/R-96/010b. Office of Research and Development National Risk Management Research Laboratory. Center for Environmental Research Information. Cincinnati, Ohio. January 1999.

1. Scope and Application

Matrices: Ambient Air, Soil Gas, Soil Vapor

Definitions: Refer to Section 16 and Alpha Analytical Quality Systems Manual

This SOP describes the procedure for the analysis of volatile organic compounds (VOCS) in ambient air. The whole air samples are collected in fused-silica lined (FSL) stainless steel canisters, or Tedlar® bags. The VOCs are subsequently separated by gas chromatography (GC) and measured by mass selective detector (MSD).

The organic compounds that are amenable to this method are listed in Table 9. Other compounds may also be amenable provided they meet the QA/QC requirements of the method.

The data report packages present the documentation of any method modification related to the samples tested. Depending upon the nature of the modification and the extent of intended use, the laboratory may be required to demonstrate that the modifications will produce equivalent results for the matrix. Approval of all method modifications is by one or more of the following laboratory personnel before performing the modification: Area Supervisor, Department Supervisor, Laboratory Director, or Quality Assurance Officer.

This method is restricted to use by or under the supervision of analysts experienced in the operation of the GC/MS and in the interpretation of GC/MS data. Each analyst must demonstrate the ability to generate acceptable results with this method by performing an initial demonstration of capability.

This SOP contains addendums for various state-specific requirements. The criteria in these addenda (Addendum C-F) must be adhered to for projects conducted under the state programs.

2. Summary of Method

Samples are collected in precleaned, evacuated FSL canisters or Tedlar® bags.

Samples are pre-concentrated using the Entech 7200 or 7200A Cryogenic Concentrator. A specified volume of sample is pulled using a vacuum pump through a mass flow controller. The sample is cryogenically concentrated to a volume of less than one mL on a Tenax® trap.

Following pre-concentration, the sample is refocused on the GC transfer line. This step further reduces the sample volume to less than one microliter for injection.

The sample is then injected into the GC, which is used to separate the compounds of interest. All compounds are detected using an MSD.

2.1 Method Modifications from Reference

Initial Calibration modifications: If a target analyte cannot meet the %RSD criteria for relative response factor calibration, then linear regression may be used. A minimum of five calibration points must be incorporated and a correlation coefficient of 0.995 or greater must be achieved. The calibration plot must be printed and approval by a supervisor must be obtained prior to calibration acceptance. If any compound is calibrated using linear regression then after the ICV and prior to any sample analysis, a low point standard must be analyzed to confirm there is no bias resulting from the linear regression calibration used. Recovery of the low point standard must be 60-140% using the linear regression curve.

Continuing calibration and laboratory controlled spike (LCS) modifications: The recoveries of all analytes must be within 70% to 130% of the true value. If more than 10% of the compounds fail these criteria, or if one compound has a recovery less than 50% or greater than 150% the LCS must be re-analyzed. If failure occurs a second time, the instrument must be re-calibrated. Recoveries greater than 150% may be acceptable, provided analytes are not detected in the samples.

Initial Calibration Verification modification: Two analytes are allowed to be greater than 30% RSD, but less than 40%.

Sample Duplicate modifications: Up to 10% of the target analyte detections may exceed acceptance criteria. If more variation occurs, the sample analysis must be repeated. If an analyte detected in one of the analysis at >5x the reporting limit, and not detected in the duplicate analysis, the analysis must be repeated. If an analyte is detected in one analysis at <5x the reporting limit and not detected in the duplicate analysis, the RPD is not calculable (NC) and the analysis does not have to be repeated. If an analyte is not detected in both the original and duplicate analysis, the RPD is NC.

Section 8.4.1.2 of the TO-15 method requires all canisters to be leak checked for a period of 24 hr via pressurization of the canister. The laboratory conducts the leak check by measuring the vacuum of the canister after a minimum of a 24 hr. period has elapsed, not by pressurizing the canister as per the method.

The % RSD for any analyte must be < 30%, as outlined in Section 10.2.2.7 of this SOP.

Humidified nitrogen is used in place of zero air due to the frequency of detection of VOCs in zero air, particularly at SIM detection limits.

There is no NIST-traceable second source standard currently available for the analytes listed in Table 1, Table 3B, and Table A-7.

3. Reporting Limits

Table 9 lists target analytes and Reported Detection Limit information.

4. Interferences

4.1 Contamination may occur in the sampling system if canisters are not properly cleaned before use. Additionally, all other sampling equipment (e.g., pump and flow controllers) must be thoroughly cleaned to ensure that the filling apparatus will not contaminate samples.

4.2 System carryover can be a potential problem, particularly for the heavier molecular weight hydrocarbons. Carryover can occur after the analysis of standards or high-level samples. Measures that must be taken to remove this contamination can include the analysis of multiple blanks, lab air, and the purging of the autosampler with nitrogen.

4.3 High moisture content, methane levels and/or carbon dioxide levels may interfere with the chromatography and trapping of target analytes. Dilutions may be performed on these samples; however, the reporting limits will then be elevated.

5. Health and Safety

The toxicity or carcinogenicity of each reagent and standard used in this method is not fully established; however, each chemical compound should be treated as a potential health hazard. From this viewpoint, exposure to these chemicals must be reduced to the lowest possible level by whatever means available. A reference file of material safety data sheets is available to all personnel involved in the chemical analysis. Additional references to laboratory safety are available in the Chemical Hygiene Plan.

All personnel handling environmental samples known to contain or to have been in contact with municipal waste must follow safety practices for handling known disease causative agents.

All employees performing laboratory procedures must have read and understood the Alpha Analytical Chemical Hygiene Plan. All laboratory procedures must be performed in accordance with the provisions and policies of the manual. All accidents, injuries, spills, or unsafe conditions must be reported immediately to the laboratory manager, and such occurrences must be thoroughly documented.

The analyst must wear a lab coat, gloves, and safety glasses while preparing solutions or handling samples.

Preparation of liquid standards must be performed under a properly functioning fume hood. Preparation and venting of gaseous standards must also be performed under a properly functioning fume hood.

6. Sample Collection, Preservation, Shipping and Handling

6.1 Sample Collection

6.1.1 FSL canister samples can be collected as grab samples or as time-integrated samples. Time-integrated samples can be collected for a maximum of 12 hours using 2.7-liter canisters, or a maximum of 24 hours to 7 days using 6-liter canisters. One liter canisters are typically used for soil vapor sampling with a sampling flowrate of 100-200 ml/min.

6.1.1.1 Grab samples are collected by opening the canister valve and allowing the canister to fill to ambient pressure. This process takes approximately one minute.

6.1.1.2 Time-integrated samples require the use of a properly calibrated flow controller. The flow controller, if provided by Alpha, is calibrated prior to sample collection and is documented in the Alpha ACS LIMs (Refer to Alpha SOP # 2190 for Canister and Flow Controller Preparation).

6.1.2 Tedlar® bag samples typically can be collected as grab or composite samples and may require a pumping system or evacuated box.

6.1.3 Upon receipt at the laboratory, all samples are assigned unique laboratory identification numbers, checked for possible discrepancies, etc. (See SOP # 1559.)

6.2 Sample Preservation

Canisters-None. Tedlar® bags-should be protected from light.

6.3 Sample Shipping

All samples must be accompanied by a chain of custody form, which documents the date, and time of sample collection.

6.4 Sample Handling

The pressure of all FSL canister samples is measured upon receipt at the laboratory and documented in the ACS LIMs (See Alpha SOP #2190). A pressure gauge is attached to the canister inlet, the canister valve is briefly opened and the pressure is recorded. The gauge apparatus used to measure ambient air samples must be separate from that used to measure soil vapor or other matrices known to have elevated levels of VOCs to avoid cross-contamination.

Samples with pressures greater than -15 inches Hg are considered acceptable for analysis.

Samples with less than -15 inches Hg should be pressurized to > -15 inches Hg in order for the concentrator system to accurately draw the correct volume, resulting in a dilution of the sample. For ambient air samples, the client must be notified prior to sample analysis since this dilution may cause reporting limits to be elevated above project action levels.

Any samples that undergo pressurization prior to analysis are documented in the instrument software. Refer to Section 10.3.3.6 for the calculation of dilution factors due to pressurization of samples.

Refer to SOP # 1559 for Sample Management information.

FSL canister and Tedlar® bag samples are stored in the Volatiles Laboratory until analysis has been completed. Tedlar® bag samples are stored in opaque containers.

The recommended holding time for the analysis of FSL canister samples for TO-15 is 30 days from date of collection. The recommended holding time for the analysis of Tedlar® bag samples for TO-15 is 48-72 hours from date of collection. Tedlar® bag samples requiring TO-15 analysis may be transferred into canisters upon receipt at the laboratory in order to extend the holding time of the sample to 30 days.

Samples designated by client to be held for subsequent analyses or are “on hold” are to be kept in a designated area in the laboratory. “Hold” samples are discarded upon client authorization or after holding time expiration date.

7. Equipment and Supplies

7.1 Microliter syringes: 10, 25,and 500 µL

7.2 Gas tight syringes: 1 mL, 5 mL, 25 mL, 50 mL, and 100 mL

7.3 FSL canisters: 1.0, 2.7, 6.0 and 15 Liter

7.4 Tedlar® bags: Various sizes. Alpha supplies 5-Liter sizes. All bags must have polypropylene fittings which are recommended for the analysis of Sulfides and Mercaptans (see App. A).

7.5 Stop watch

7.6 Sample Concentrator

7.6.1 The concentrator system consists of two separate pieces of equipment: (1) Entech Model 7016D VOC Autosampler, and (2) Entech Model 7200 or 7200A Cryogenic Concentrator using liquid nitrogen.

7.6.2 A vacuum pump (Vaccubrand Model ME2 or similar) delivers the sample from the autosampler to the cryogenic concentrator FSL-lined steel tubing.

7.7 Gas Chromatograph System

7.7.1 Gas chromatograph - Shimadzu 2010, 2030

7.7.2 Chromatographic column: Restek RTX-1; 60 meters, 0.25 mm or 0.32 mm ID, 1 micron film thickness

7.7.3 Transfer line from column to GC injection port: Hydroguard ™ 0.32 mm capillary tubing connected to column with Restek Vu-Union connector.

7.8 Mass Spectrometer System

7.8.1 Mass spectrometer - Shimadzu 2010, 2020

7.8.2 The mass spectrometer must be capable of scanning from 29 to 270 amu every 3 seconds or less, utilizing 70 volts (nominal) electron energy in the electron impact ionization mode and producing a mass spectrum that meets all the criteria in Table 5 when 50 ng of 4- bromofluorobenzene is injected. For SIM (selective ion monitoring) analysis, the system must be capable of simultaneous SIM/full scan acquisition.

7.8.3 Data System - Shimadzu GC/MS Solutions software for data acquisition and Agilent Enviroquant version E.02.00 for data processing.

7.9 Dilution Systems

7.9.1 Entech 4600A Dynamic Dilution System- for performing sample dilutions in canisters and Entech 4700 Precision Diluter preparing calibration standards in canisters. .

7.10 Primary flow measurement device: BIOS Cell Defender 510 or equivalent

8. Reagents and Standards

8.1 DI Water or Carbon-filtered tap water

8.2 High purity purge and trap grade methanol (Fisher part # A453-1 or equivalent) for MS source cleaning

8.3 Ultra high purity (UHP) helium for the GC/MS system

8.4 Ultra high purity (UHP) nitrogen for standard preparation

8.5 NIST certified TO-15 gas standards, purchased from Linde (formerly Spectra Gases). Standards are stored at room temperature and expire per vendor's expiration date, unless re-certified. Recertified standards are received with an updated certificate of analysis which includes a new expiration date.

8.6 Neat chemicals: Listed in Table 1, Table A-1, and Table 3B, $\geq$ 98% purity.

8.7 Liquid nitrogen: For the concentrator system and/or GC cooling

8.8 Primary Standards

8.8.1 Primary standard mixtures of TO-15 analytes are purchased certified gaseous standards already prepared as well as gaseous standards prepared in the laboratory by injecting neat chemicals into Tedlar® bags (See Table 1).

8.8.2 Table 1 indicates volumes of neat chemicals that are injected into 20 L of zero air or UHP nitrogen to obtain primary standard concentrations for all analytes.

8.8.3 Purchased primary standards are assigned a CSS # (commercially supplied standard) upon receipt for tracking purposes. Preparation of primary standards must be entered into the primary standard preparation logbook (Form No.: 117-11).

8.8.4 Standards are valid per the manufacturer's expiration date as noted.

8.9 Secondary Standards

8.9.1 Prepare secondary standards in canisters using the Entech 4700 Precision Diluter at a minimum of two concentration levels. Table 3A and 3B outlines the preparation steps for each secondary standard.

8.9.2 Prior to preparation of the standards, verify that an appropriate vacuum exists in the canister (>0.5 psia). Figure 3 demonstrates the standard preparation system. Primary standards prepared in Tedlar bags are injected into a canister (typically

15 L) using an injection tee with a septum or transferred from purchased and / or prepared cylinders via the precision diluter.

8.9.3 Attach the transfer lines from the primary standards to the dynamic diluter.

8.9.4 Prior to the injection of the gaseous standards, allow the dynamic diluter to equilibrate for a approximately 25 minutes by allowing each standard channel to flush for a minimum of 5 min. Be sure the vent line is attached to the outlet.

8.9.5 After equilibrating the system, attach the canister to the outlet of the diluter. Flush line with nitrogen for 20 sec prior to attaching canister. Load in the appropriate configuration and standard preparation method (TO15 ICAL, DIAZ, or TO15 LCS) into the precision dilution software for the corresponding target concentration (TO15 ICAL 100 ppbV, TO15 ICAL 10 ppbV).

Equation 1: Flow rate calculation:

$$\mathbf{T_f = V_{std} / F_{std}}$$

Where:

T_f = standard transfer time, minutes
V_{std} = standard volume, mL
F_{std} = standard flowrate, mL/min

8.9.6 Inject the appropriate amount of Tedlar bag primary standard and/or the low vapor pressure compounds listed in Table 3B into the injection port tee. This injection must be done while the canister is below atmospheric pressure.

8.9.7 When all the primary standards have been added to the canister, the canister will be pressurized to the programmed final pressure using the precision diluter.

NOTE: Standard canisters prepared for analysis using the autosampler must have a maximum pressure of 30 psia to ensure proper and consistent sampling by the instrument.

8.9.8 Label the canister accordingly and record the standard preparation in the secondary standard (SS) preparation logbook (Form No.: 12925).

8.9.9 The ICV/LCS standard is prepared in the same manner, using primary standards of differing lot #s, at a concentration of 10 ppbV

Secondary standards are valid for 6 months.

8.10 Internal Standard and BFB Tuning Standard/Surrogate Standard

An internal standard (Bromochloromethane, 1,4-Difluorobenzene, and Chlorobenzene-D5) and tuning/surrogate standard containing Toluene-D8, 1,2-Dichloroethane-D4, and Bromofluorobenzene (BFB) are prepared as two separate gas standards at 25 ppbV (2 year expiration date). The internal standards and BFB / surrogates are loaded onto the sample trap prior to the calibration standard(s), sample, or QC sample(s) via a mass flow controller. The concentration of the internal standard and BFB / surrogates added is based upon the nominal concentration of sample that is analyzed. If the nominal volume of sample is 250 mL, then 100 mL of the 25 ppbV internal standard mix will yield a true value of 10 ppbV for the internal standards and BFB. Using equation 7, the ug/m^3 equivalent of BFB injected 179 ug/m^3 or 179 ng/L (MW of BFB = 175). Thus, the total ng injected is:

$$\text{Total ng} = 179 \text{ ng/L} \times 0.100 \text{ L} = 17.9 \text{ ng}$$

8.11 Instrument Calibration Standards

Calibration standards are prepared by injecting different volumes of the secondary standards into the concentrator/GC/MS system. The low standard will be used to establish the reporting limit for sample analyses. These are described in more detail in Section 10.

9. Quality Control

The laboratory must maintain records to document the quality of data that is generated. Ongoing data quality checks are compared with established performance criteria to determine if the results of analyses meet the performance characteristics of the method. Quality control limits may also be found in the Laboratory Information Management System(LIMs)

At a minimum, for each day of analysis, a Continuing Calibration standard, Laboratory Method Blank, Laboratory Control Spike and Laboratory Duplicate must be analyzed. Laboratory Control Spike Duplicate (LCSD) will be analyzed only upon client request.

9.1 Laboratory Method Blank(s)

A FSL canister pressurized to 30 psia with humidified nitrogen is utilized as the Laboratory Method Blank. This method blank must be free of target analyte contamination at or above the reporting limit. If it is not, the system must be evaluated for possible sources of contamination. Once the source is determined and eliminated, the Blank must be reanalyzed.

A Laboratory Method Blank must be run after samples suspected of being highly contaminated to determine if sample carryover has occurred. If samples have been analyzed using an autosampler, data must be evaluated for potential carryover and re-analyses conducted, as appropriate.

9.2 Laboratory Control Sample (LCS) / Laboratory Control Spike Duplicate (LCSD)

NOTE: A Laboratory Control Spike Duplicate is only performed when specified by the project requirements and/or upon Client request.

Laboratory Control Spike - A Laboratory Control Spike (LCS) is prepared by spiking an evacuated FSL canister with a different primary standard solution than that used for the calibration or a purchased gaseous standard with the components of interest may be used. If the recovery is not within acceptance criteria, the LCS may be analyzed a second time. If the LCS failure continues, the instrument must be recalibrated. Refer to Section 12 for appropriate corrective actions to be taken. QC limits are subject to change for any particular analyte, if deemed necessary after review of QC control limits.

9.3 Initial Calibration Verification (ICV)

A mid-range calibration standard must be analyzed after the initial calibration and prior to sample analysis, and must be a different source than that used for the initial calibration. See section 10.4.1 for additional criteria. Otherwise, sample analysis may proceed.

9.4 Continuing Calibration Verification (CCV)

A mid-range calibration standard must be analyzed prior to sample analysis. This standard is of a different source than that used for the LCS/LCSD pair, typically the same source as the initial calibration standards. See section 10.4. or additional criteria. If repeated failure of the CCV occurs, the instrument must be recalibrated. Otherwise, sample analysis may proceed. The LCS may also be utilized as the continuing calibration unless otherwise defined in an addendum.

9.5 Matrix Spike

Not applicable.

9.6 Laboratory Duplicate

Laboratory Duplicate is a replicate analysis of a sample. The RPD of duplicate analyses must not exceed 25. Up to 10% of the target analyte detections may exceed acceptance criteria. The criteria does not need to be applied to concentrations less than 5X the reporting limit. If more variation occurs, the sample analysis must be repeated. If an analyte is detected in one analysis at >5x the reporting limit and not detected in the duplicate analysis, the analysis must be repeated. If an analyte is detected in one analysis at <5x the reporting limit and not detected in the duplicate analysis, the RPD is not calculable (NC) and the analysis does not have to be repeated. If an analyte is not detected in both the original and duplicate analyses, the RPD is NC. Equation 9 is used to calculate the RPD.
The sample chosen for duplicate analysis should not be a trip blank, field blank, or equipment blank. The sample chosen for duplicate analysis must be rotated among clients and/or sites. If possible, field duplicates should not be chosen for duplicate analysis, nor should outside air samples if indoor air samples are also included in the analytical batch. Refer to Appendices D - F for agency –specific criteria on laboratory duplicate criteria.

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Equation 9: RPD Calculation

$$\mathbf{RPD = ABS(C_s - C_d) / [(C_s + C_d)/2]*100}$$

where:

RPD = relative percent difference
C_s = concentration in original sample analysis
C_d = concentration in duplicate sample analysis

9.7 Method-specific Quality Control Samples

9.7.1 **BFB Tune -** A successful BFB spectrum must meet the criteria in Table 5 prior to sample analysis. If a successful BFB spectrum is not obtained, the MS must be retuned and the BFB spectrum re-evaluated prior to analyzing samples.

9.7.2 **Internal Standards -** The internal standard area counts of each sample, blank, and Laboratory Control Sample are evaluated against the corresponding continuing calibration standard. The internal standard area counts must be within 60-140% of the continuing calibration standard area counts. If the retention times of the internal standards must be within +/- 0.33 min. If the internal standards fall outside this range, the sample, blank, or Laboratory Control Sample must be reanalyzed. In addition, area counts for internal standards for continuing calibration must be within 60-140% recovery of initial calibration. Refer to Sect. 12 for contingencies on samples exhibiting internal standard recovery failures.

9.7.3 **TIC Internal Standards -** Internal standards used for the quantitation of TICs must be evaluated by comparing the total ion area counts of the internal standards in the samples to the total ion area counts of the internal standards in the blanks. The internal standard area counts must be within 50-200% of the blank area counts. If the internal standards fall outside this range, a different internal standard or an estimated internal standard total ion area must be used to quantitate the TIC. This estimate can be done by using the total ion area from a blank or a clean sample within the analytical batch.

9.8 Method Sequence

- BFB Tune Check
- Calibration Standards (initial) or Continuing Calibration
- Laboratory Control Sample (may be used as the ICV or CCV)
- Laboratory Control Sample Duplicate (if needed)
- Laboratory Method Blank
- Samples
- Laboratory Duplicate

Injections may be made until 24 hours after the injection used to check the BFB tune.

All analytical sequences must be recorded in the instrument software and documented in the instrument logbook (Form 117-09).

10. Procedure

10.1 Equipment Set-up

10.1.1 Canister Cleaning and Certification

Refer to Alpha SOP #2190 for canister and flow controller preparation.

10.1.2 Sample Preparation and Concentration

Ensure the integrity of the canister sample as described in Section 6.4. General description of procedure: A 3-stage concentration technique called Cold-Trap Dehydration is used to analyze VOC's in air. The air sample is first concentrated to about a 0.5cc volume by drawing an aliquot of sample simultaneously through a cold trap (no packing material) and then through a Tenax trap. The cold trap is then heated to 10 °C and is held there while slowly passing helium through it to transfer these compounds to the Tenax trap, leaving most of the moisture in the cold trap. Sweeping the VOC's from the first to the second trap with only 20cc of helium results in a transfer of less than 0.5 µL of water (40 mL @ 100% RH @ 10 °C) which can be easily handled by benchtop mass spectrometers. The 20 cc transfer volume also serves to flush the CO_2 through the Tenax trap. After transfer to the second trap, the VOC's are back-flushed while heating to be further focused on an open-tubular focusing trap (cryofocuser) for rapid injection onto the analytical column. Internal standard is added directly to the first stage cryogenic trap prior to the sample by a mass flow controller (MFC). MFC controlled introduction is advantageous over loop injection as it remains consistent with the mechanism used to measure the sample volume.

Connect the canisters or Tedlar® bag(s) to the Entech 7016D Autosampler. For FSL canisters: Align the tubing from one of the 16 positions to the canister inlet position. Push the inlet line into the orifice of the canister and hold in place while tightening the fitting finger tight. Turn the stainless steel nut ¼ turn more with a wrench. The canister valves must be closed at this point. For Tedlar® bags: Connect the valve of the Tedlar® bag with the autosampler line using an adapter fitting.

For canister samples, leak check all inlet connections using the leak check procedure included with the Entech software. The software will indicate if there is a change in vacuum over a period of 30 sec. The vacuum must not increase more than 2 psia. Analysis cannot begin until the leak check has passed for each canister being tested and/or the source of the leak has been determined..

Open the canister or bag valves.

Set up the sequence of the Entech system to withdraw 250 mL from each sample. If high concentrations are expected, lower volumes can be used (minimum of 25 mL).. Samples suspected to contain elevated concentrations (i.e. soil vapor, sub-slab, landfill gas) should be pre-screened prior to analysis to obtain more precise dilution information. If screening results indicate elevated concentrations of non-target analytes, the sample should be diluted such that the peak height of the non-target analyte is approximately 10X greater than the peak height of the first internal standard. Recommended concentrator operating parameters are provided in Table 6.

10.2 Initial Calibration

10.2.1 GC Conditions (Shimadzu 2010, 2030)

Oven program: 25° C, hold for 5.0 minutes, then:

Ramp 1: 100° C at 8.0° C / min.; hold for 0.0 min

Ramp 2: 220° C at 25° C / min.; hold for 4.0 min

Gas Flows

Helium carrier gas flow program: 2.0 mL/min for entire run (23.18 min)

Sample Injection

Injection mode:	split
Injection port temperature:	250° C
Inlet pressure:	27.3 psi
Total flow:	39.3 mL/min
Split ratio:	17.3
Split flow:	34.6 mL/min
Gas saver flow:	OFF

10.2.2 MS Conditions

Temperature of MSD transfer line: 250° C

Temperature of MS Quad: 150° C

Temperature of MS Source: 230° C

Solvent Delay: 3.0 minutes

Scanning Parameters: 29-270 amu until 10 min, scan rate = 5.52 scans/sec; then 35-270 amu, scan rate = 3.1 scans/sec. Threshold = 150. Sampling rate = 2. EM offset-variable to achieve response of 200K area counts (+/- 25K) for the internal standard bromochloromethane.

10.2.3 Daily GC/MS Performance Check

10.2.3.1 The first analysis of the day is typically a tune evaluation. The GC/MS system is checked to confirm that acceptable performance criteria for bromofluorobenzene (BFB), which is in surrogate mixture, are achieved. These criteria must be met prior to analyzing further standards, blanks and samples.

10.2.3.2 A maximum injection of 50 ng must successfully meet the BFB spectrum criteria in Table 5.

10.2.3.3 If the spectrum of BFB does not meet the above stated criteria, the analysis must be repeated. If the spectrum of BFB still does not meet these criteria, the GC/MS instrument must be re-tuned.

10.2.3.4 The Daily GC/MS Performance Check must be analyzed every 24 hours or less.

10.2.4 Initial Calibration

10.2.4.1 Analyze a minimum of five different levels by analyzing various volumes of the secondary standards prepared in Table 3 (Table A-3 for sulfide/mercaptan analysis). The lowest standard will be at or below the reporting limit. If the response is not linear at the lowest level for the higher molecular weight compounds, this point must not be included in the calibration curve for these compounds. As a result, the analysis of more than five levels may be required in order to ensure a minimum of five calibration points for each analyte.

Table 4 lists the calibration standard levels and the volumes of the secondary standards needed to achieve these levels.

10.2.4.2 The true value of each of these calibration points is determined by applying a dilution factor that is based on the volume of sample extracted from the canister for each calibration point. Assuming that a volume of 250 mL will be the maximum volume extracted from the samples; this will be the “1X” volume. A dilution factor can be calculated using Equation 2.

Equation 2: Calculation of Instrument Dilution Factor

$$\mathbf{DF = V_{1X} / V_{actual}}$$

where:

DF = dilution factor
V_{1X} = maximum volume sampled, mL
V_{actual} = actual volume sampled for samples and standards

10.2.4.3 Analyze each calibration standard according to the procedures specified in Section 10. The true value of each calibration point is determined by dividing the concentration of the canister by the dilution factor determined using Equation 2.

10.2.4.4 Tabulate the area response of the characteristic ions against the amount for each analyte and internal standard and calculate relative response factors (RRF) for each compound using Equation 3. Perform this calculation for each calibration standard.

Equation 3: Relative Response Factor for Individual Target Analytes

$$\mathbf{RRF = [(A_{EC}) * (C_i)] / [(A_{EI}) * (C_c)]}$$

where:

RRF = relative response factor
A_{EC} = area count of the extracted ion for the analyte of interest
C_i= amount of internal standard (ppbV)
A_{EI} = area count of the extracted ion for the associated internal standard
C_c = amount of analyte of interest (ppbV)

Table 7 lists all TO-15 analytes, internal standards and the associated quantitation ion.

Table 8 lists the internal standards and the associated TO-15 analytes.

10.2.4.5 Calculate the average response factor for each of the target analytes by the following equation (AVG_x = SUM(RFs) / total # of RFs).

10.2.4.6 Calculate the percent relative standard deviation (%RSD) of the response factors over the secondary range of the curve for each of the target analytes using Equation 4.

Equation 4: Percent Relative Standard Deviation

$$\%RSD = [(SD_n - 1) / (AVG_x)] * 100]$$

where:

%RSD = percent relative standard deviation
SD_n -1 = standard deviation (n-1 degrees of freedom)
AVG_x = average response factor from the initial calibration curve

This task can also be accomplished using the quantitation software provided by the instrument manufacturer.

10.2.4.7 If the %RSD is <30 for each analyte, linearity can be assumed for the associated target analyte and sample analysis may proceed. If the curve fit is using average response factor, RSD (analogous to RSE) is the measure of relative error, and no additional calculation is required.

If the %RSD is >30 for any analyte, the integrations must be evaluated and the calculations verified. If a %RSD <30 cannot be achieved, it is acceptable for two (2) of the analytes to be above 30%, but below 40% RSD (applies to analytes flagged with a “C” on the Enviroquant initial calibration summary table).

Alpha may use the following modified acceptance criteria only for projects that have documentation and approval within the QAPP by the quality assurance project planners, and also for analytes not listed in EPA Method TO-15:

10.2.4.8 If the %RSD is >30 for any analyte, the integrations must be evaluated and the calculations verified. If a %RSD <30 cannot be achieved, it is acceptable for 10% of the total analytes to be above 30%, but below 50% RSD. Before acceptance of such a Calibration Curve, it must be confirmed with the approval of the Section Supervisor and/or the Project Manager that these analytes are typically and historically "trouble" analytes or "poor performers" (typically compounds listed in Table 3B), and that all Client and Project Data Quality Objectives (DQOs) will still be met when analyzing samples using this calibration. Refer to Appendices D - F for agency –specific criteria regarding initial calibration acceptance criteria.

Calibration points may be removed from the calibration curve to meet the 30% RSD criteria, so long as five consecutive points remain in the calibration curve, and the following procedure is followed:

- Remove high level calibration points
- Remove low-level calibration points; reporting limits will need to be elevated, however.

10.2.4.9 If calibration points in the mid-level range need to be removed due to a sequence error or instrument malfunction, the entire calibration level must be removed from the calibration curve. If the %RSD >30, a calibration curve is generated using the EnviroQuant quantitation software.

Correlation Coefficient calculation is performed by the Enviroquant software as follows;

$$r = \frac{n(\Sigma xy) - (\Sigma x)(\Sigma y)}{\sqrt{[\, n\Sigma x^2 - (\Sigma x)^2 \,]\,[\, n\Sigma y^2 - (\Sigma y)^2 \,]}}$$

Where:

r = Correlation Coefficient

n = number of standards measured

x = true concentration of the standard

y = observed concentration of the standard

The correlation coefficient (linear) for the calibration curve must be greater than 0.995. If these criteria cannot be met, prepare a new set of calibration standards and recalibrate the instrument. NOTE: Quadratic calibration in any form is not acceptable.

Authorization from the department supervisor is required prior to using linear regression calibration. Linear regression is only allowed if certain criteria listed below are met:

- The minimum number of points for a linear regression curve is five points.
- The curve must be plotted and printed and turned in with the raw data.
- A calibration standard must be analyzed at the low point of the curve. Recovery of the low point standard must be 60-140% using the linear regression curve.

  The recovery of the compound for the continuing calibration / LCS must be within 70-130%.

10.2.4.10 The reference spectra for all target analytes are reviewed for both assignments and purity for all instruments. In addition, this process of reviewing all spectra continues whenever a new calibration is completed.

Reference spectra should be updated with each initial calibration performed with the midpoint standard of the calibration.

10.2.4.11 Internal Standard Criteria for Initial Calibration Levels and ICV.

The mean response for each internal standard compound is calculated over the initial calibration range. The area response at each calibration level must be within 60-140% of the midpoint area response over the initial calibration range for each internal standard. If recovery is outside the range, re-analyze calibration level. This criteria must be met prior to sample analysis.

All of these criteria must be met prior to sample analysis.

10.3 Equipment Operation and Sample Processing

10.3.1 GC/MS ANALYSIS

10.3.1.1 The Entech 7200 or 7200A Concentrator is programmed to the specific analytical conditions listed in Table 6 (Entech method Alpha_TO15.CTD) and the GC/MS parameters are set to those listed in Sections 10.3.1 and 10.3.2. (Enviroquant method TO15-SFS.M (SIM and full scan) or TO15_FS_35C.M (full scan only, for sulfide & mercaptan analysis in App. A)).

10.3.1.2 The BFB spectrum is evaluated by analyzing a Laboratory Method Blank and adding 100 mL of the BFB/surrogate mix.

10.3.1.3 A continuing calibration and/or a laboratory control spike is analyzed. See sect. 9.2 for acceptable criteria, and refer to Appendices D - F for agency – specific criteria on continuing calibration and laboratory control spike criteria.

10.3.1.4 A Laboratory Method Blank is analyzed. The Laboratory Method Blank consists of the analysis of 250 mL from a canister of humidified nitrogen. The method blank must be free of target analyte contamination at or above the reporting limit.

10.3.1.5 A 250-mL aliquot of sample is preconcentrated on the Entech 7200 or 7200A concentrator and injected onto the GC column. For soil vapor samples, or other samples that may contain elevated levels, the aliquot amount must be determined using the results from a pre-screening analysis. Sample concentrations are determined using the following equation:

$$\text{ppbV} = [(A_{EC}) * (C_i)] / [(A_{EI}) * (RRF)]$$

10.3.1.6 Instrument Dilutions and Sub-Atmospheric Sample dilutions

10.3.1.6.1 For dilutions, smaller sample volumes (<250 mL) are analyzed. The smallest volume that can be analyzed with accuracy using the Entech concentrator is 10 mL. The dilution factor is accounted for by entering the volume analyzed in the sample calculation discussed in Section 10.2.2.2 (Equation 2).

10.3.1.6.2 Samples that arrive at the laboratory with pressures below -15 inches Hg should be pressurized with nitrogen to greater than -15 inches Hg, as discussed in Section 6.4. This pressurization results in a dilution factor. The dilution factor is calculated using Equation 6, and the canister dilution spreadsheet (Form No.: 117-05). Attach a green tag to the canister with the pressurization information (initial pressure and final pressure) recorded on the tag.

Equation 6: Dilution Factor for Pressurization of Subatmospheric Samples: Three Steps

Step 1: Calculate the volume in the canister prior to pressurization (Assume a 2.7-liter canister is used).

$$V_{ci} = 2.7 * P_I / 14.696$$

Step 2: Calculate the volume in the canister after pressurization.

$$V_{cf} = 2.7 * P_F / 14.696$$

Step 3: Calculate the dilution factor.

$$DF = V_{cf} / V_{ci}$$

where:

V_{ci}= volume of air in canister prior to pressurization, L
P_I = pressure reading of canister prior to pressurization (psia)
V_{cf} = volume of air in canister after pressurization, L
P_F = pressure reading of canister after pressurization (psia)
DF = dilution factor

14.696 = atmospheric pressure (psia)

10.3.1.6.3 If samples require larger dilutions than pressurization and instrument dilutions, a syringe dilution into an additional canister or Tedlar bag (typically used only for App. A analytes) with a known volume of nitrogen is required.

10.3.1.6.4 Fit a VCO® adapter with a septa to the pressurized sample canister. With a gastight syringe remove appropriate sample size for dilution. Allow sample to flow through syringe for 1 – 2 seconds to flush syringe prior to volumizing. Inject the sample aliquot into a Tedlar bag. If using an evacuated canister, connect the canister to an injection port tee (see Figure 3) attached to the dynamic diluter. Inject the aliquot of sample while a steady stream of Nitrogen is flowing into the dilution canister. Pressurize this canister to 30 psia. Attach a green tag to the canister with dilution information recorded on the tag. Use the dilution calculation worksheet (Form No.: 117-05) to calculate resulting dilutions.

10.3.2 Qualitative Identifications

10.3.2.1 An analyst competent in the interpretation of mass spectra must identify the target analytes by comparison of the sample mass spectrum to the mass spectrum of the standard. Two criteria must be satisfied to verify the identification: (1) elution of the component in the sample at the same GC relative retention time (RRT) as the component in the standard, and (2) agreement of the sample component and standard component mass spectra.

10.3.2.2 For establishing correspondence of the GC RRT, the RRT of the component in the sample must compare within ± 0.06 RRT units of the RRT of the component in the standard. If co-elution of interfering components prohibits accurate assignment of the sample component RRT from the total ion chromatogram, the RRT must be assigned using extracted ion current profiles for the ion unique to the component of interest.

10.3.2.3 For comparison of the standard and sample component mass spectra, mass spectra of standards obtained on the GC/MS under the same instrument conditions are required. Reference spectra should be updated for each initial calibration performed, using the mid-level standard. Once obtained, these standard spectra may be used for identification and reference purposes.

10.3.2.4 The requirements for qualitative verification by comparison of mass spectra are as follows:

- All ions present in the standard mass spectra at a relative intensity greater than 10% (most abundant ion in the spectrum equals 100%) must be present in the sample spectrum.
- The relative intensities of ions specified must agree within ± 20% between the standard and sample spectra.
- Ions greater than 10% in the sample spectrum must be considered and accounted for by the analyst making the comparison.

Table 7 lists the primary and secondary ions for all analytes.

10.3.2.5 Manual integrations: for peaks that are observed to be not integrated correctly by the quantitation software, manual integrations must be performed. Please refer to the manual integration SOP for further instruction on how to properly perform and document manual integrations (Alpha SOP # 1731).

10.3.2.6 **Tentatively identified compounds (TICs)-**A library search may be performed for non-target sample components for the purpose of tentative identification, as requested by the client. Mass spectra are compared to the National Institute of Standards and Technology Mass Spectral Library (2002 version), and a qualitative match is determined by the analyst. Computer generated library search routines must not use normalization routines that would misrepresent the library or unknown spectra when compared to each other. Refer to Appendices D - F for agency –specific criteria on TIC reporting.

10.3.2.7 Guidelines for making tentative identification:

- Relative intensities of major ions in the reference spectrum (ions greater than 20% of the most abundant ion) must be present in the sample spectrum.
- The relative intensities of the major ions must agree within ± 30%.
- Molecular ions present in the reference spectrum must be present in the sample spectrum.
- Ions present in the sample spectrum but not in the reference spectrum must be reviewed for possible background contamination or presence of coeluting compounds.
- If, in the technical judgment of the mass spectral interpretation specialist, no valid tentative identification can be made, the compound will be reported as "Unknown". The mass spectral interpretation specialist should give additional classification of the unknown compound, if possible (i.e., unknown aromatic, unknown hydrocarbon, unknown acid, unknown chlorinated compound)..

10.4 Continuing Calibration

10.4.1 Calibration Verification

10.4.1.1 The initial calibration must be verified through the analysis of an Initial Calibration Verification (ICV) sample. (The ICV may also be used to satisfy LCS requirements.) This analysis must be performed every time an initial calibration is performed.

10.4.1.2 The ICV must be prepared using a purchased gaseous standard (from a different lot # or separate vendor) with the components of interest in an evacuated FSL canister. Follow the standard preparation procedure for the calibration standards outlined in Section 8.0. The standard must be prepared at or below the midpoint of the calibration curve.

See section 10.4.2.6 for acceptable criteria and Section 12 for corrective actions.

10.4.2 Continuing Calibration

10.4.2.1 A continuing calibration check must be performed daily prior to sample analysis. The continuing calibration standard must be one of the initial calibration levels.

10.4.2.2 Analyze a calibration standard that is at the midpoint of the calibration curve.

10.4.2.3 The LCS standard may be utilized as the continuing calibration check, provided that all target analytes of interest are present in the LCS standard.. Refer to Appendices D - F for agency –specific criteria on LCS criteria.

10.4.2.4 Evaluate continuing calibration for internal standard recoveries. Recoveries must be between 60-140%. If not, the CCV will be re-analyzed.

10.4.2.5 Calculate the percent difference (%D) of the continuing calibration response factor from the initial calibration average response factor using Equation 5.

Equation 5: Percent Difference

$$\% D = [(C_{found})-(C_{true}) / (C_{true})] * 100$$

where:

%D = percent difference

C_{found} = amount of the analyte detected in the standard (ppbV)
C_{true} = true amount of the analyte in the standard (ppbV)

This task can also be accomplished using the quantitation software provided by the instrument manufacturer.

10.4.2.6 **Acceptance Criteria**

The acceptance criteria is less than 30% RSD for any analyte, with an allowance of two analytes to be greater than 30%, but less than 40%.

Alpha may use the following modified acceptance criteria only for projects that have documentation and approval within the QAPP by the quality assurance project planners, and also for analytes not listed in EPA Method TO-15:

If the %RSD is <30 for each analyte, linearity can be assumed for the associated target analyte and sample analysis may proceed.

10.4.2.7 If the %RSD is >30 for any analyte, the integrations must be evaluated and the calculations verified. If a %RSD <30 cannot be achieved, it is acceptable for 10% of the total analytes to be above 30%, but below 50% RSD. Before acceptance of such a Calibration Curve, it must be confirmed with the approval of the Section Supervisor and/or the Project Manager that these analytes are typically and historically "trouble" analytes or "poor performers" (typically compounds listed in Table 3B), and that all Client and Project Data Quality Objectives (DQOs) will still be met when analyzing samples using this calibration. . Refer to Appendices D - F for agency –specific criteria on initial calibration acceptance criteria.

10.4.2.8 Refer to Sect. 12 for additional procedures regarding continuing calibration acceptance criteria and corrective actions if criteria are not met.

10.5 Preventive Maintenance

Ion source cleaning – typically prior to initial calibration.

Electron Multiplier (EM)-changed when the voltage setting required to achieve adequate response approaches 1900. (Agilent MS only).

Rough pump oil changed annually.

Transfer lines, concentrator traps, and the GC guard column should be changed semi-annually, or when system repeatedly fails initial calibration.

11. Data Evaluation, Calculations and Reporting

11.1 Calculations

11.1.1 **Individual Target Analytes:** The average response factor from the initial calibration is used to calculate the amount of analyte detected in the sample analyses. Standards are prepared on a ppbV basis, so if no dilution is performed, values can be reported from the quantitation report without any calculations. Dilution factors are calculated using Equation 2. Equation 7 shows the conversion of ppbV to µg/m^3 .

Equation 7: Conversion of ppbV to µg/m^3

$$\mu g/m^3 = (ppbV) * MW / 24.45$$

where:

24.45 = molar gas constant (g/g-mole)
MW = molecular weight of the compound of interest (Table 1 and 2 lists the molecular weights of the target analytes)

11.1.2 **TICS:** An estimated amount for the TIC is calculated using the total area of the TIC, the total area of the internal standard assigned by the quantitation software, and a response factor of 1.000 (Equation 8). If the internal standard assigned by the quantitation software exhibits significant interference from other analytes, the next closest eluting internal standard will be utilized. Refer to Appendices D – F for agency-specific criteria on reporting TICS.

Equation 8: Calculation of TIC Results in ppbV

$$ppbV = [(A_T) * (C_{IS})] / [(A_{IS-T}) * (1.000)]$$

where:

A_T = total ion area of the TIC to be measured

C_{IS} = amount of the internal standard

A_{IS-T} = total ion area of the closest eluting internal standard

The integration of target analytes and internal standards must be performed from valley to valley.

11.1.3 Percent Recovery

$$\% \text{ Recovery} = \frac{C_x}{C_t} \text{ X } 100$$

where:
C_x = measured concentration of compound
C_t = true concentration of compound

11.2 Data Package

11.2.1 Canister Cleaning Information

A copy of the data for the batch certification analysis associated with the FSL canisters must be on file. The raw data must include a sample chromatogram, quantitation report, and spectra of all positive results.

11.2.2 BFB Tune Checks

Tune checks must be included for all days of analysis, including initial calibration. Raw data must include the chromatogram, mass spectra, and summary of relative abundances of the BFB ions.

11.2.3 Calibration Data

- Initial calibration summary (including average response factors, %RSDs, and copies of calibration curves, if appropriate) for target analytes and all calibration chromatograms must be on file.
- Continuing calibration summaries (including %Ds) for individual analytes.
- Chromatograms and quantitation reports associated with all standards used, in the initial and continuing calibrations.

11.2.4 QA/QC

- Internal standard responses and % recoveries vs. the continuing calibration.
- Quantitation report and chromatogram for laboratory control spike (and laboratory control spike duplicate, if requested).
- Quantitation reports, chromatograms, and spectra of positive results for all blanks.
- Copy of the instrument runlog.

11.2.5 Sample Data

- Quantitation reports, chromatograms, spectra of positive results, negative proofs, and pre- and post-manual integrations for all LCSs, samples, and duplicates.
- A copy of the canister dilution worksheet, Form No.: 117-05 (if any canister pressurizations or canister dilutions are performed).

12. Contingencies for Handling Out-of-Control Data or Unacceptable Data

The laboratory must maintain records to document the quality of data that is generated. Ongoing data quality checks are compared with established performance criteria to determine if the results of analyses meet the performance characteristics of the method. When results indicate atypical method performance, a calibration verification standard is used to confirm the measurements were performed in an in-control mode of operation.

Holding time exceedence and/or container damage is noted on the Sample Delivery Group form.

Perform routine preventative maintenance following manufacturer's specification. Record all maintenance in the instrument logbook.

Review of standards, blanks and standard response for acceptable performance occurs for each batch of samples. Record any trends or unusual performance on a nonconformance action form. The method blank must be free of target analyte contamination at or above the reporting limit. If it is not, the system must be evaluated for possible sources of contamination. Once the source is determined and eliminated, the method blank must be reanalyzed.

If the ICV, CCV, LCS or LCSD recovery of any parameter falls outside the designated acceptance range, the laboratory performance for that parameter is judged to be out of control, and the problem must be immediately identified and corrected. The analytical result for that parameter in the unspiked samples is suspect and is only reported for regulatory compliance purposes with the appropriate Narratives. Immediate corrective action includes reanalyzing all affected samples (provided sufficient volume of sample remains) by using any retained sample before the expiration of the holding time. If sufficient volume is not available, Alpha will narrate accordingly. Analytes that fail ICV, CCV and LCS criteria due to elevated recoveries may be reported, provided there are no detections in the associated samples.

Samples exhibiting internal standard recovery failures must be re-analyzed at the same dilution level if instrument malfunction is suspected to be the cause, or at a lesser dilution if sample matrix or concentration levels of target and/or non-target analytes are suspected of being the cause. If recovery failures are observed upon re-analysis, narrate bias accordingly (negative if high recovery, positive if low recovery).

When applicable criteria is not met (ICV, CCV, LCS, IS), Alpha will narrate bias which will be included in the opening narrative of the report.

13. Method Performance

13.1 Method Detection Limit Study (MDL) / Limit of Detection Study (LOD) / Limit of Quantitation (LOQ)

The laboratory follows the procedure to determine the MDL, LOD, and/or LOQ as outlined in Alpha SOP # 1732. These studies performed by the laboratory are maintained on file for review.

13.2 Demonstration of Capability Studies

Refer to Alpha SOP # 1739 for further information regarding IDC/DOC Generation.

13.2.1 Initial (IDC)

The analyst must make an initial, one-time, demonstration of the ability to generate acceptable accuracy and precision with this method, prior to the processing of any samples.

13.2.2 Continuing (DOC)

The analyst must make a continuing, annual, demonstration of the ability to generate acceptable accuracy and precision with this method.

14. Pollution Prevention and Waste Management

Refer to Alpha's Chemical Hygiene Plan and Waste Management and Disposal SOP for further pollution prevention and waste management information.

15. Referenced Documents

Chemical Hygiene Plan

SOP # 1732 MDL/LOD/LOQ Generation

SOP # 1739 IDC/DOC Generation

SOP # 1797 Hazardous Waste & Sample Disposal

SOP # 1731 Manual Integration

Form 117-05: Canister Dilution Worksheet Template

Form 117-09: Instrument Run Log

Form 117-11: Primary Standard Preparation Log

Form 12925: Secondary Standard Preparation Log

16. Attachments

Table 1	TO-15 Tedlar® Bag Stock Standard Preparation for LCS
Table 2A	TO-14 Primary Mix #1 & TO-15 Mix #2 Stock Standard Cylinder
Table 2B	TO-15 Custom Mix #3 Stock Standard Cylinder
Table 2C	TO-15 Custom Mix #4 Stock Standard Cylinder
Table 2D	TO-15 Custom Mix #5 Stock Standard Cylinder
Table 3A	Summary of Working Standard Preparation
Table 3B	Preparation of Calibration Standards for Low Vapor Pressure Compounds
Table 4	Calibration Standard Levels
Table 5	BFB Key Ions and Abundance Criteria
Table 6	Entech 7200 or 7200A /7016D Operating Parameters
Table 7	Quantitation and Secondary Ions for TO-15 Analytes and Internal Standards
Table 8	Internal Standards and the Associated Target Analytes
Table 9A	TO-15 Target Analytes and Reporting Limits-Standard List
Table 9B	TO-15 Target Analytes and Reporting Limits-Additional Analytes

Appendix A	Cold Trap Dehydration technique (CTD) for Analysis of Sulifides and Mercaptans
Appendix B	Data Acquisition Parameters and Analysis Modifications for Conducting SIM Analysis
Appendix C	Modifications to Data Review and Case Narrative to Comply with MADEP MCP-TO-15 Method
Appendix E	Modifications to Data Review and Case Narrative to Comply with 2014 NJDEP Technical Guidance for EPA Method TO-15
Appendix F	Modifications to Data Review and Case Narrative to Comply with Ohio EPA Voluntary Action Program (VAP) Requirements for EPA Method TO-15

DEFINITIONS

Absolute canister pressure - Pg + Pa, where Pg = gauge pressure in the canister (psig) and Pa = barometric pressure.

Absolute pressure - Pressure measured with reference to absolute zero pressure (as opposed to atmospheric pressure), usually expressed as kPA, mm Hg, or psia (pounds per square inch absolute).

Cryogen - The refrigerant used to obtain very low temperatures in the cryogenic trap of the analytical system. A typical cryogen is liquid nitrogen (bp = -196^{0}C).

Gauge pressure - Pressure measured above atmospheric pressure (as opposed to absolute pressure). Zero gauge is equal to ambient atmospheric (barometric) pressure. Units = psig (pounds per square inch gauge).

ppmV – parts per million on a volume basis.

ppbV – parts per billion on a volume basis

psia – pounds per square inch absolute

Relative retention time (RRT)– retention time (RT) ratio of the target analyte and the internal standard used to quantitate (RT target / RT internal standard).

Table 1

TO-15 Tedlar® Bag Stock Standard Preparation- LCS/ICV Standard

ICV / LCS Standard				
COMPOUND (liquids)	**MOL WGT**	**Density ug/uL**	**uL injected***	**FINAL ppmV**
Acetone	58.1	791	12.0	200
Isopropyl alcohol	60.1	785	4.8	76.7

All neat chemicals are injected into a Tedlar® bag containing 20 Liters of zero air or UHP nitrogen.

See Table A-1 & Table A-4 for sulfide/mercaptan stock standard preparation

Table 2A

TO-15 Purchased Primary Standard Mix

TO-14 Primary Standard Mix #1					
COMPOUND	**MOL WGT**	**Conc. ppmV**	**COMPOUND**	**MOL WGT**	**Conc. ppmV**
dichlorodifluoromethane	120.92	1.0	cis-1,3-dichloropropene	110.97	1.0
chloromethane	50.49	1.0	trans-1,3-dichloropropene	110.97	1.0
Freon-114	170.92	1.0	1,1,2-trichloroethane	133.41	1.0
vinyl chloride	62.5	1.0	toluene	92.14	1.0
bromomethane	94.94	1.0	1,2-dibromoethane	187.87	1.0
chloroethane	64.52	1.0	tetrachloroethene	165.83	1.0
trichlorofluoromethane	137.37	1.0	chlorobenzene	112.56	1.0
1,1-dichloroethene	96.94	1.0	ethylbenzene	106.17	1.0
methylene chloride	84.93	1.0	m-xylene	106.17	1.0
Freon-113	187.38	1.0	p-xylene	106.17	1.0
trans-1,2-dichloroethene	98.96	1.0	styrene	104.15	1.0
1,1-dichloroethane	98.96	1.0	1,1,2,2-tetrachloroethane	167.85	1.0
cis-1,2-dichloroethene	96.94	1.0	o-xylene	106.17	1.0
chloroform	119.38	1.0	1,3,5-trimethylbenzene	120.2	1.0
1,2-dichloroethane	98.96	1.0	1,2,4-trimethylbenzene	120.2	1.0
1,1,1-trichloroethane	133.41	1.0	1,3-dichlorobenzene	147.0	1.0
benzene	78.11	1.0	1,4-dichlorobenzene	147.0	1.0
carbon tetrachloride	153.82	1.0	1,2-dichlorobenzene	147.0	1.0
1,2-dichloropropane	113	1.0	1,2,4-trichlorobenzene	181.45	1.0
trichloroethene	131.38	1.0	hexachlorobutadiene	260.76	1.0

TO-15 Primary Standard Mix #2		
COMPOUND	**MOL WGT**	**Conc. ppmV**
Propylene	42.08	1.0
1,3-butadiene	54.09	1.0
Vinyl bromide	106.96	1.0
Acetone	58.08	1.0
Isopropyl alcohol	60.1	1.0
Carbon disulfide	76.14	1.0
3-chloropropene	76.53	1.0
Trans-1,2-dichloroethene	96.94	1.0
Methyl-tert butyl ether	88.15	1.0
Vinyl acetate	86.09	1.0
2-butanone (MEK)	72.11	1.0
Hexane	86.18	1.0
Ethyl acetate	88.11	1.0
Tetrahydrofuran	72.11	1.0
Cyclohexane	84.16	1.0
Bromodichloromethane	163.83	1.0
1,4-dioxane	88.11	1.0
2,2,4-trimethylpentane	114.23	1.0
Heptane	100.21	1.0
4-methyl-2-pentanone (MIBK)	100.16	1.0
2-hexanone	100.16	1.0
Dibromochloromethane	208.29	1.0
Bromoform	252.75	1.0
Benzyl chloride	126.59	1.0
4-ethyl toluene	120.2	1.0

Table 2B

TO-15 Purchased Custom Mix #3

TO-15 Custom Standard Mix					
COMPOUND	**MOL WGT**	**Conc. ppmV**	**COMPOUND**	**MOL WGT**	**Conc. ppmV**
Propane	44.10	1.0	n-Octane	114.23	1.0
Chlorodifluoromethane	86.47	1.0	1,1,1,2-Tetrachloroethane	167.85	1.0
Methanol	32.04	5.0	1,2,3-Trichloropropane	147.43	1.0
n-Butane	58.12	1.0	Nonane	128.26	1.0
Dichlorofluoromethane	102.92	1.0	Isopropylbenzene	120.19	1.0
Ethanol	46.07	5.0	Bromobenzene	157.01	1.0
Acetonitrile	41.05	1.0	2-Chlorotoluene	126.58	1.0
Acrolein	56.10	1.0	n-Propylbenzene	120.19	1.0
n-Pentane	72.20	1.0	4-Chlorotoluene	126.58	1.0
Acrylonitrile	53.10	1.0	tert-Butylbenzene	134.20	1.0
Ethyl Ether	74.12	1.0	n-Decane	142.28	1.0
tert-Butyl Alcohol	74.12	1.0	sec-Butylbenzene	134.20	1.0
2,2-Dichloropropane	112.99	1.0	p-Isopropyltoluene	134.22	1.0
Di-Isopropyl Ether	102.17	1.0	n-Butylbenzene	134.20	1.0
Tert-Butyl Ethyl Ether	102.20	1.0	1,2-Dibromo-3-chloropropane	236.33	1.0
1,1-Dichloropropene	110.97	1.0	n-Undecane	156.31	1.0
Tert Amyl Methyl Ether	102.17	1.0	Naphthalene	128.17	1.0
Dibromomethane	173.83	1.0	n-Dodecane	170.33	1.0
1,3-Dichloropropane	112.99	1.0	1,2,3-Trichlorobenzene	181.45	1.0
n-Butyl Acetate	116.16	1.0			

All mixes currently purchased fromPraxair (formerly Linde and Spectra Gases)

Table 2C

TO-15 / PIANO Custom Mix #4

COMPOUND (liquids)	Boiling Pt, deg C	Molecular Weight	Density ug/uL	uL injected*	FINAL ppmV
1,1-difluoroethane (gas)	-24.7	66.05	NA	10 mL	5.0
1-ethyl-1-methylcyclopentane	121.55	112.21	785.4	11.9	1.0
Indan	177	118.18	965.0	10.2	1.0
Indene	182	116.16	996.0	9.7	1.0
1,2,3-trimethylbenzene	176	120.19	890.0	11.2	1.0
Acetaldehyde	20.2	44.05	785	23.3	5.0
Acetone	56.1	58.08	784.5	24.6	4.0
isopropyl alcohol	82.6	60.1	786	9.5	1.5
methyl methacrylate	101	100.1	940	8.8	1.0

Table 2D

TO-15 / PIANO Custom Mix #5

COMPOUND (liquids)	Boiling Pt, deg C	Molecular Weight	Density ug/uL	uL injected*	FINAL ppmV
Thiophene	83	84.14	1060	6.6	1.0
2-Ethylthiophene	133	112.19	990	9.4	1.0
2-methyllthiophene	114	98.17	1016	8.0	1.0
3-Methylthiophene	113	98.17	1017	8.0	1.0

* both mixes #4 and #5 prepared in 29.5 L high pressure cylinders, pressurized to 995 psia with UHP nitrogen. Total volume of standard is 1997 L. Two year expiration date.

Table 3A

Summary of Secondary Standards Preparation

Primary Standard	Primary Standard Conc. ppmV	Volume of Primary Standard Injected into canister	Primary Standard Transfer Method	Final Volume canister (L)	Final Concentration ppbV **
Secondary standards prepared using precision dilution system (Entech 4700)					
TO-15 Mixes #1 - #5	1.0	3000 mL	Pressure differential	30	100
TO-15 Mixes #1 - #5	1.0	300 mL	Pressure differential	51	10 ***
Secondary standards prepared via serial dilution					
100 ppbV ICAL mix	1.0	300 mL	Syringe Injection	30	1.0
100 ppbV ICAL mix	0.1 *	30 mL	Syringe Injection	30	0.1

All standards prepared using humidified nitrogen.

* This calibration standard is used for TO-15 SIM analysis only (see Appendix B).

** The following analytes have concentrations that are greater than the listed concentration

Methanol, acetylaldehyde, and ethanol – 5 times greater

m&p-xylene- 2 times greater

Isopropyl alcohol-2.5 times greater

*** 10 ppbV standards that are prepared at a pressure of 50 psia are split out into additional empty 15L canisters to reduce the pressure in the standard and allow for additional canisters to be prepared for continuing calibration usage.

Table 3B

Preparation of Calibration Standards for Low Vapor Pressure Compounds

COMPOUND (solids)	Vapor Pressure* (P), atm	Molecular Weight	Volume (V) extracted, mL	Gas Constant (R) (L atm/gm mol K)	T, °K	n**	Final Volume, L	mg	ug/m^3	ppbV
1-methylnaphthalene	7.11E-05	142.20	7.1	0.082057	298.1	2.44E-08	51	0.00347	115.7	10
1-methylnaphthalene	7.11E-05	142.00	42	0.082057	298.1	1.22E-07	30	0.0173255	577.5	100
2-methylnaphthalene	8.96E-05	142.00	5.8	0.082057	298.1	2.491E-08	51	0.0035373	117.9	10.2
2-methylnaphthalene	8.96E-05	142.00	34	0.082057	298.1	1.246E-07	30	0.0176867	589.6	101.6
benzothiophene	7.70E-05	134.20	6.5	0.082057	291.5	2.446E-08	51	0.0032824	109.4	10.0
benzothiophene	7.70E-05	134.20	38	0.082057	291.5	1.223E-07	30	0.016412	547.1	100

Approximately 5.0 g of solid material was allowed to stand in a 250 mL jar w/ septa cap for 30 min prior to removal of vapor phase aliquot. The aliquot was then spiked directly into secondary standard.

All vapor pressure values from Lange's Handbook of Chemistry & Physics

Table 4

Calibration Standard Levels

Calibration Level	Amount (ppbV)	Volume / Secondary Standard
1	0.20	50 mL of 1.0 ppbV sec. standard
2	0.50	125 mL of 1.0 ppbV sec. standard
3	1.0	250 mL of 1.0 ppbV sec. standard
4	5.0	125 mL of 10 ppbV sec. standard
5	10	250 mL of 10 ppbV sec. standard
6	20	50 mL of 100 ppbV sec. standard
7	50	125 mL of 100 ppbV sec. standard
8	100	250 mL of 100 ppbV sec. standard

Table 5

BFB Key Ions and Abundance Criteria

Mass	Ion Abundance Criteria
50	8.0-40.0 percent of the base peak
75	30.0-66.0 percent of the base peak
95	Base peak, 100 percent relative abundance
96	5.0-9.0 percent of the base peak
173	Less than 2.0% of mass 174
174	50.0 to 120.0% of mass 95
175	4.0-9.0 percent of mass 174
176	Greater than 93.0 percent but less than 101.0 percent of mass 174
177	5.0-9.0 percent of mass 176

Table 6

ENTECH 7016D/ 7200 or 7200A Operating Parameters

Module 1 (Cold Trap)	
Parameter	**Setting**
Trapping Temperature	-40° C
Internal standard / surrogate volume	100 mL
Internal standard / surrogate flow rate	100 mL / min
Nominal Sample volume (may vary depending on sample concentrations)	250 mL
Sample flow rate, mL / min	100 mL / min
Preheat Temperature	10° C
Desorb Temperature	10° C
Bake Temperature	220° C
Bake Time	10 min
Module 1 to Module 2 transfer volume / rate	20 cc @ 5.0 cc/min
Module 2 (Tenax trap)	
Parameter	**Setting**
Trapping Temperature	-65° C to -75° C
Desorb Temperature	220° C
Bake Temperature	220° C
Module 2 to Module 3 desorb time	3.5 min
Module 3 (Cryofocusser)	
Parameter	**Setting**
Cryofocusing Temperature	-130° C to -190° C
Desorb Temperature	Approx. 90° C
Module 3 to GC desorb time	3.0-3.5 min
Bake temperature / event	Approx. 90° C / event 3
Delay time	13-17 min

Table 7
Quantitation and Secondary Ions for TO-15 Analytes and Internal Standards

Compound	Quant. Ion	Sec. Ion(s)
bromochloromethane	49	130
chlorodifluoromethane	51	67
propylene	41	39, 42
propane	29	43,39
dichlorodifluoromethane	85	87
chloromethane	50	52
Freon-114	85	87, 135
methanol	31	32,29
vinyl chloride	62	64,
1,3-butadiene	54	39
butane	43	41,58
bromomethane	94	96
chloroethane	64	66
dichlorofluoromethane	67	69, 47
ethanol	31	45
acetonitrile	41	40
vinyl bromide	106	108
acrolein	56	55,29
acetone	43	58
trichlorofluoromethane	101	103
isopropyl alcohol	45	59
acrylonitrile	53	52,51
pentane	43	57,72
ethyl ether	31	59,45
1,1-dichloroethene	61	96, 63
Tertiary butyl Alcohol	59	41, 43
methylene chloride	49	84
3-chloropropene	41	39, 76
carbon disulfide	76	44
Freon 113	101	85, 151
trans-1,2-dichloroethene	61	96, 98
1,1-dichloroethane	63	65
MTBE	73	57, 43
vinyl acetate	43	86
2-butanone	43	72
cis-1,2-dichloroethene	61	96, 98
chloroform	83	85, 47
1,2-dichloroethane	62	49, 63, 64
acetaldehyde	29	43, 44

Compound	Quant. Ion	Sec. Ion(s)
1,4-difluorobenzene	114	63
n-hexane	57	43, 86
diisopropyl ether	87	45, 59
ethyl acetate	61	43, 70
2,2-dichloropropane	77	41, 97
tetrahydrofuran	42	71, 72
tert-butyl ethyl ether	59	87, 57
1,2-dichloroethane-D4	65	67, 102
1,1,1-trichloroethane	97	61, 119
1,1-dichloropropene	75	39,110
benzene	78	52
carbon tetrachloride	117	119, 82
cyclohexane	56	84, 41
tert-amyl methyl ether	73	43, 87
dibromomethane	93	95, 174
1,2-dichloropropane	63	39, 62
bromodichloromethane	83	85, 129
trichloroethene	130	132, 97
1,4-dioxane	88	58
2,2,4-trimethylpentane	57	41, 99
n-heptane	43	57, 100
cis-1,3-dichloropropene	75	39, 77
4-methyl-2-pentanone	43	58, 100
methyl methacrylate	41	69, 100
trans-1,3-dichloropropene	75	39, 77
1,1,2-trichloroethane	97	61, 83
Thiophene	84	45, 58
chlorobenzene-D5	54	82, 117
toluene	91	92
toluene-D8	98	100
1,3-dichloropropane	76	41,49
2-hexanone	43	58, 100
dibromochloromethane	129	127, 131
1,2-dibromoethane	107	109
butyl acetate	73	43, 56
octane	85	43, 57, 114
tetrachloroethene	166	94, 131
1,1,1,2-tetrachloroethane	131	95, 133
chlorobenzene	112	77, 114
ethylbenzene	91	106
m+p-xylene	91	106

Compound	Quant. Ion	Sec. Ion(s)
bromoform	173	171, 175
styrene	104	103, 78
1,1,2,2-tetrachloroethane	83	85
o-xylene	91	106
1,2,3-trichloropropane	75	39, 110
nonane	43	57, 128
bromofluorobenzene	95	75, 174
isopropylbenzene	105	120
bromobenzene	77	156
2-chlorotoluene	126	91
n-propylbenzene	120	91
4-chlorotoluene	91	126
4-ethyl toluene	105	91, 120
1,3,5-trimethylbenzene	105	91, 120
tert-butlybenzene	119	134
1,2,4-trimethylbenzene	105	91, 120
decane	57	43, 142
benzyl chloride	91	126
1,3-dichlorobenzene	146	75, 111
1,4-dichlorobenzene	146	75, 111
sec-butylbenzene	105	134
p-isopropyltoluene	119	134
1,2-dichlorobenzene	146	75, 111
n-butylbenzene	91	134
1,2-dibromo-3-chloropropane	75	39, 157
undecane	57	43, 71, 156
dodecane	57	43
1,2,4-trichlorobenzene	180	109, 145
naphthalene	128	102
1,2,3-trichlorobenzene	180	109, 145
hexachlorobutadiene	225	118, 260
2-methylthiophene	97	45, 98
3-methylthiophene	97	45, 98
2-ethylthiophene	97	45, 112
1,2,3-trimethylbenzene	105	120
indan	117	91, 118
indene	115	89, 116
1,2,4,5-tetramethylbenzene	119	91, 134
benzothiophene	134	63, 89
2-methylnaphthalene	142	115, 141
1-methylnaphthalene	142	115, 141

Table 8

Internal Standards and the Associated Target Analytes

bromochloromethane		**1,4-difluorobenzene**	**chlorobenzene-D5**	
chlorodifluoromethane	trans-1,2-dichloroethene	hexane	toluene	decane
propylene	1,1-dichloroethane	diisopropyl ether	toluene-D8	benzyl chloride
propane	MTBE	tert-butyl ethyl ether	1,3-dichloropropane	1,3-dichlorobenzene
dichlorodifluoromethane	vinyl acetate	1,2-dichloroethane-D4	2-hexanone	1,4-dichlorobenzene
chloromethane	2-butanone	1,1,1-trichloroethane	dibromochloromethane	sec-butylbenzene
Freon-114	cis-1,2-dichloroethene	1,1-dichloropropene	1,2-dibromoethane	p-isopropyltoluene
methanol	chloroform	benzene	butyl acetate	1,2-dichlorobenzene
vinyl chloride	1,2-dichloroethane	carbon tetrachloride	Octane	n-butylbenzene
1,3-butadiene	trans-1,2-dichloroethene	cyclohexane	tetrachloroethene	1,2-dibromo-3-chloropropane
butane	1,1-dichloroethane	tert-amyl methyl ether	1,1,1,2-tetrachloroethane	undecane
bromomethane	acetaldehyde	dibromomethane	Chlorobenzene	dodecane
chloroethane	ethyl acetate	1,2-dichloropropane	Ethylbenzene	1,2,4-trichlorobenzene
dichlorofluoromethane	2,2-dichloropropane	bromodichloromethane	m+p-xylene	naphthalene
ethanol	tetrahydrofuran	trichloroethene	Bromoform	1,2,3-trichlorobenzene
acetonitrile		1,4-dioxane	Styrene	hexachlorobutadiene
vinyl bromide		2,2,4-trimethylpentane	1,1,2,2-tetrachloroethane	2-methylthiophene
acrolein		heptane	o-xylene	3-methylthiophene
acetone		cis-1,3-dichloropropene	1,2,3-trichloropropane	2-ethylthiophene
trichlorofluoromethane		4-methyl-2-pentanone	Nonane	1,2,3-trimethylbenzene
isopropyl alcohol		methyl methacrylate	bromofluorobenzene	indan
acrylonitrile		trans-1,3-dichloropropene	isopropylbenzene	indene
pentane		1,1,2-trichloroethane	bromobenzene	1,2,4,5-tetramethylbenzene
ethyl ether		thiophene	2-chlorotoluene	benzothiophene
1,1-dichloroethene			n-propylbenzene	2-methylnaphthalene
Tertiary butyl Alcohol			4-chlorotoluene	1-methylnaphthalene
methylene chloride			4-ethyl toluene	
3-chloropropene			1,3,5-trimethylbenzene	
carbon disulfide			tert-butlybenzene	
Freon 113			1,2,4-trimethylbenzene	

Table 9A

TO-15 Target Analytes and Reporting Limits
Standard List

COMPOUND	CAS #	Standard Reporting Limit, ppbV	Standard Reporting Limit, ug/m^3
1,1,1-trichloroethane	71-55-6	0.2	1.09
1,1,2,2-tetrachloroethane	79-34-5	0.2	1.37
1,1,2-trichloroethane	79-00-5	0.2	1.09
1,1-dichloroethane	75-34-3	0.2	0.81
1,1-dichloroethene	75-35-5	0.2	0.79
1,2,4-trichlorobenzene	120-82-1	0.2	1.48
1,2,4-trimethylbenzene	95-63-6	0.2	0.98
1,2-dibromoethane	106-93-4	0.2	1.54
1,2-dichlorobenzene	95-50-1	0.2	1.2
1,2-dichloroethane	107-06-2	0.2	0.81
1,2-dichloropropane	78-87-5	0.2	0.92
1,3,5-trimethylbenzene	108-67-8	0.2	0.98
1,3-butadiene	106-99-0	0.2	0.44
1,3-dichlorobenzene	541-73-1	0.2	1.2
1,4-dichlorobenzene	106-46-7	0.2	1.2
1,4-dioxane	123-91-1	0.2	0.72
2,2,4-trimethylpentane	540-84-1	0.2	0.93
2-butanone	78-93-3	0.5	1.48
2-hexanone	591-78-6	0.2	0.82
3-chloropropene	107-05-1	0.2	0.63
4-Ethyltoluene	622-96-8	0.2	0.98
Acetone	67-64-1	1.0	2.38
benzene	71-43-2	0.2	0.64
Benzyl Chloride	100-44-7	0.2	1.03
bromodichloromethane	75-27-4	0.2	1.34
bromoform	75-25-2	0.2	2.07
bromomethane	74-83-9	0.2	0.78
carbon disulfide	75-15-0	0.2	0.62
carbon tetrachloride	56-23-5	0.2	1.26
chlorobenzene	108-90-7	0.2	0.92
chloroethane	75-00-3	0.2	0.53
chloroform	67-66-3	0.2	0.98

COMPOUND	CAS #	Standard Reporting Limit, ppbV	Standard Reporting Limit, ug/m^3
chloromethane	74-87-3	0.2	0.41
cis-1,2-dichloroethene	156-59-2	0.2	0.79
cis-1,3-dichloropropene	10061-01-5	0.2	0.91
cyclohexane	110-82-7	0.2	0.69
dibromochloromethane	124-48-1	0.2	1.7
dichlorodifluoromethane	75-71-8	0.2	0.99
ethanol	64-17-5	2.5	4.71
ethyl acetate	141-78-6	0.5	1.8
ethylbenzene	100-41-4	0.2	0.87
Freon-113	76-13-1	0.2	1.53
Freon-114	76-14-2	0.2	1.4
hexachlorobutadiene	87-68-3	0.2	2.13
hexane	110-54-3	0.2	0.7
isopropyl alcohol	67-63-0	0.5	1.23
methylene chloride	75-09-2	0.5	1.74
MIBK	108-10-1	0.5	2.1
MTBE	1634-04-4	0.2	0.72
m+p-xylene	108-38-3 106-42-3	0.4	1.74
n-heptane	142-82-5	0.2	0.82
o-xylene	95-47-6	0.2	0.87
propylene	115-7-1	0.5	0.85
styrene	100-42-5	0.2	0.85
tetrachloroethene	127-18-4	0.2	1.36
tetrahydrofuran	109-99-9	0.5	1.48
toluene	108-88-3	0.2	0.75
trans-1,2-dichloroethene	156-60-5	0.2	0.79
trans-1,3-dichloropropene	10061-02-6	0.2	0.91
trichloroethene	79-01-6	0.2	1.07
trichlorofluoromethane	75-69-4	0.2	1.12
vinyl acetate	108-05-4	0.5	1.75
vinyl bromide	593-60-2	0.2	0.87
vinyl chloride	75-01-4	0.2	0.51

Table 9B

TO-15 Target Analytes and Reporting Limits
Additional Analytes

COMPOUND	CAS #	Standard Reporting Limit, ppbV	Standard Reporting Limit, ug/m^3
AP-42 Analytes			
acrolein	107-02-8	0.50	1.15
acrylonitrile	107-13-1	0.50	1.08
butane	106-97-8	0.20	0.48
Chlorodifluoromethane	75-45-6	0.20	0.71
Dichlorofluoromethane	75-71-8	0.20	0.84
n-Pentane	109-66-0	0.20	0.59
Propane	74-98-6	0.50	0.90
MADEP MCP 8260 Analytes			
1,1,1,2-tetrachloroethene	630-20-6	0.20	1.37
1,1-dichloropropene	563-58-6	0.20	0.91
1,2,3-trichlorobenzene	87-61-6	0.20	1.48
1,2,3-Trichloropropane	96-18-4	0.20	1.20
1,3-dichloropropane	142-28-9	0.20	0.92
2,2-dichloropropane	594-20-7	0.20	0.92
2-chlorotoluene	95-49-8	0.20	1.03
4-chlorotoluene	106-43-4	0.20	1.03
bromobenzene	108-86-1	0.20	1.28
1,2-dibromo-3-chloropropane	96-12-8	0.20	1.93
dibromomethane	74-95-3	0.20	1.42
diisopropyl ether	108-20-3	0.20	0.84
isopropylbenzene	98-82-8	0.20	0.98
isopropyltoluene	99-87-6	0.20	1.10
naphthalene	91-20-3	0.20	1.05
n-butylbenzene	104-51-8	0.20	1.10
n-propylbenzene	103-65-1	0.20	0.98
sec-butylbenzene	135-98-8	0.20	1.10
tert-amyl methyl ether	994-05-8	0.20	0.84
tert-Butyl ethyl ether	637-92-3	0.20	0.84
tert-butylbenzene	98-06-6	0.20	1.10

COMPOUND	CAS #	Standard Reporting Limit, ppbV	Standard Reporting Limit, ug/m^3
NYDEC Petroleum Indicator Compounds			
nonane	111-84-2	0.20	1.05
octane	111-65-9	0.20	0.93
undecane	1120-21-4	0.20	1.28
decane	124-18-5	0.20	1.16
dodecane	112-40-3	0.20	1.39
indene	95-13-6	0.20	0.95
Indan	496-11-7	0.20	0.97
thiophene	110-02-1	0.20	0.69
2-methylthiophene	554-13-3	0.20	0.80
3-methylthiophene	616-44-4	0.20	0.80
2-ethyl thiophene	872-55-9	0.20	0.92
benzothiophene	934-80-5	0.50	2.74
1,2,3-trimethylbenzene	526-73-8	0.20	0.98
1,2,4,5-tetramethylbenzene	95-93-2	0.20	1.10
2-methylnaphthalene	91-57-6	1.0	5.8
1-methylnaphthalene	90-12-0	1.0	5.8
Project Specific Analytes			
acetaldehyde	75-07-0	2.5	4.51
Acetonitrile	75-05-8	0.20	0.34
butyl acetate	123-86-4	0.50	2.38
ethyl ether	60-29-7	0.20	0.61
methanol	67-56-1	5.0	6.55
tert-butyl alcohol	75-65-0	0.50	1.51
Methyl methacrylate	80-62-6	0.50	2.05
All reporting limits are subject to change.			

Appendix A

Cold Trap Dehydration technique (CTD) for Analysis of Sulfides and Mercaptans by EPA TO-15

Target analytes:

Compound	CAS#	Reporting Limit, ppbV
Hydrogen sulfide	7783-06-4	2.0
Carbonyl sulfide	463-58-1	2.0
Methyl mercaptan	74-93-1	2.0
Ethyl mercaptan	75-08-1	0.5
Dimethyl sulfide	75-18-3	0.5
carbon disulfide	75-15-0	0.5
Isopropyl Mercaptan	75-33-2	0.5
tert-Butyl Mercaptan	75-66-1	0.5
n-Propyl Mercaptan	107-03-9	0.5
Ethyl Methyl Sulfide	624-89-5	0.5

Compound	CAS#	Reporting Limit, ppbV
Thiophene	110-02-1	0.5
Isobutyl Mercaptan	513-44-0	0.5
diethyl sulfide	352-93-2	0.5
Butyl Mercaptan	109-75-5	2.0
dimethyl disulfide	624-92-0	0.5
3-Methylthiophene	616-44-4	0.5
Tetrahydrothiophene	110-01-0	0.5
2-Ethylthiophene	872-55-9	0.5
2,5-Dimethylthiophene	638-02-8	0.5
Diethyl Disulfide	110-81-6	0.5
All reporting limits are subject to change.		

The cold trap dehydration method requires a blank trap (i.e. no trapping material) be installed in module 1 of the Entech 7200 or 7200A concentrator. This trap is cooled and a 250 mL aliquot of sample is allowed to pass through this trap and then directly onto the Tenax trap in module 2, which is also cooled (see Table A-5 for setpoints). The sample is then transferred to module 3 (cryofocusser) via ballistic heating. All requirements stated in this SOP must be applied to any TO15-Sulfide/Mercaptan analysis conducted in the laboratory.

SOP modifications:

Standard preparation and calibration procedures for these analytes are listed in Table A-1 through A-5. Quantitation parameters are listed in Table A-8. Table A-7 lists modified GC conditions.

Section 9.2.5 and 9.5.3.1: Use the Entech method alpha_H2S&SULF.CTD in place of the alpha_TO15.MPT method.

A second source laboratory check standard (LCS) is not readily available for these analytes. An LCS standard is prepared at a different concentration than the initial calibration standards using the same stock standard.

Table A-1

Sulfide/Mercaptan Primary Standard Mix #1

COMPOUND	CAS#	Molecular Weight	Concentration, ppmV
hydrogen sulfide	7783-06-4	34.08	5.0
Carbonyl sulfide	463-58-1	60.08	5.0
Methyl mercaptan	74-93-1	48.11	5.0
ethyl mercaptan	75-08-1	62.14	1.0
dimethyl sulfide	75-18-3	62.14	1.0
carbon disulfide	75-15-0	76.1	1.0
Isopropyl Mercaptan	75-33-2	76.2	1.0
tert-Butyl Mercaptan	75-66-1	90.19	1.0
n-Propyl Mercaptan	107-03-9	76.16	1.0
Ethyl Methyl Sulfide	624-89-5	76.16	1.0
Thiophene	110-02-1	84.1	1.0
Isobutyl Mercaptan	513-44-0	90.19	1.0
diethyl sulfide	352-93-2	90.2	1.0
Butyl Mercaptan	109-79-5	90.19	4.0
3-Methylthiophene	616-44-4	98.17	1.0
Tetrahydrothiophene	110-01-0	88.17	1.0
2-Ethylthiophene	872-55-9	112.19	1.0
2,5-Dimethylthiophene	638-02-8	112.19	1.0

Table A-2

Sulfide/Mercaptan Primary Standard Mix #2

COMPOUND	CAS#	Molecular Weight	Concentration, ppmV
dimethyl disulfide	624-92-0	94.2	1.0

Table A-3

Sulfide/Mercaptan Primary Standard Mix #3

COMPOUND	CAS#	Molecular Weight	Concentration, ppmV
Diethyl Disulfide	110-81-6	122.25	1.0

Table A-4

Summary of Secondary Standards Preparation for Sulfides and Mercaptan Analysis

Primary Standard	Primary Standard Conc. ppmV	Volume of Primary Standard Injected into Tedlar® Bag	Primary Standard Transfer Data	Final Volume Tedlar® Bag (L)	Final Concentration ppbV
Secondary standards prepared using gas-tight syringes					
Tedlar® bag primary standard-Low	1- 5ppmV	20 mL	Syringe Injection	4.0	5.0 / 20.0 / 20
Tedlar® bag primary standard-High	1- 5ppmV	400 mL	Syringe Injection	4.0	100 / 400 / 500
Tedlar® bag primary standard-LCS	1- 5ppmV	40 mL	Syringe Injection	4.0	10 / 40 / 50

Table A-5

Calibration Standard Levels

Calibration Level	Amount (ppbV)	Volume / Secondary Standard
1	0.50	25 mL of 5.0 ppbV sec. standard
2	1.0	50 mL of 5.0 ppbV sec. standard
3	5.0	250 mL of 5.0 ppbV sec. standard
4	10	25 mL of 100 ppbV sec. standard
5	20	50 mL of 100 ppbV sec. standard
6	50	125 mL of 100 ppbV sec. standard
7	80	200 mL of 100 ppbV sec. standard
8	100	250 mL of 100 ppbV sec. standard

Table A-6

ENTECH & 7016D/7200 or 7200A Operating Parameters for CTD Method

Module 1 (Blank Trap)	
Parameter	**Setting**
Trapping Temperature	-20° C
Internal standard volume	100 mL
Internal standard flow rate	60 mL / min
Sample volume (may vary depending on sample concentrations)	250 mL
Sample flow rate	100 mL / min
Preheat Temperature	10° C
Desorb Temperature	10° C
Bake Temperature	220° C
Bake Time	10 min.
Module 2 (Tenax trap)	
Parameter	**Setting**
Trapping Temperature	-70° C
Desorb Temperature	180° C
Bake Temperature	220° C
Module 2 to Module 3 desorb time	3.5 min
Module 3 (Cryofocusser)	
Parameter	**Setting**
Cryofocusing Temperature	-130° C
Desorb Temperature	Approx. 70° C
Module 3 to GC desorb time	2 min
Bake temperature / event	Approx. 90° C / event 3
Delay time	10 min

Table A-7

Internal Standard (IS) Assignments and Quantitation Ions for Sulfides & Mercaptans

Compound	Quant Ion	Sec. Ion(s)
Bromochloromethane (IS)	49	130
Hydrogen sulfide	34	33, 36
Carbonyl sulfide	60	62, 32
Methyl mercaptan	47	48, 45
ethyl mercaptan	62	47, 29
dimethyl sulfide	62	45, 47
carbon disulfide	76	44, 78
Isopropyl Mercaptan	43	41, 76
tert-Butyl Mercaptan	41	57, 90
n-Propyl Mercaptan	76	47, 43
Ethyl Methyl Sulfide	61	76, 48

Compound	Quant Ion	Sec. Ion(s)
1,4-difluorobenzene (IS)	114	63
Thiophene	84	58, 45
Isobutyl Mercaptan	41	56, 90
diethyl sulfide	75	90, 47
Butyl Mercaptan	56	41, 90
dimethyl disulfide	94	79, 45

Compound	Quant Ion	Sec. Ion(s)
Chlorobenzene-D5 (IS)	54	82, 117
3-Methylthiophene	97	98, 45
Tetrahydrothiophene	60	88, 45
2-Ethylthiophene	97	112, 45
2,5-Dimethylthiophene	111	112,97
Diethyl Disulfide	122	66, 94

Appendix B

Data Acquistion Parameters and Analysis Modifications for Conducting SIM Analysis

SIM analysis is conducted when full scan sensitivity does not meet the data quality objectives (DQO) of the project and/or regulatory criteria. The acquisition method used to acquire full scan data simultaneously acquires SIM data using the SIM ions and windows specified in Table B-1. The following modifications to the full scan SOP must be done to generate data using the SIM signal:

- SIM level calibration standards must be analyzed w/ the full scan curve (0.02,0.05, and 0.1 ppbV)
- A calibration curve is generated using the SIM signal utilizing the lower level calibration standards and must meet the same criteria as the full scan calibration criteria.
- The continuing calibration /LCS should be analyzed at a lower concentration (5.0 ppbV). If a separate continuing calibration run is needed, the continuing calibration level of 10 ppbV may be utilized. Laboratory Method Blanks must be evaluated for the SIM reporting limit as listed in Table B-2.

The SIM signal only acquires data for a limited target analyte list. These target analytes and reporting limits are listed in Table B-2. Additional ions have been added to allow for more analytes to be added, if requested by client. All requirements stated in this SOP must be applied to any TO15-SIM analysis conducted in the laboratory.

Table B-1

Calibration Standard Levels for SIM Analysis

Calibration Level	Amount (ppbV)	Volume / Secondary Standard
1	0.02	50 mL of 0.10 ppbV sec. standard
2	0.05	125 mL of 0.1 ppbV sec. standard
3	0.10	250 mL of 0.1 ppbV sec. standard
4	0.20	50 mL of 1.0 ppbV sec. standard
5	0.50	125 mL of 1.0 ppbV sec. standard
6	1.0	250 mL of 1.0 ppbV sec. standard
7	5.0	125 mL of 10 ppbV sec. standard
8	10	250 mL of 10 ppbV sec. standard
9	20	50 mL of 100 ppbV sec. standard
10	50	125 mL of 100 ppbV sec. standard

Table B-2

Seletive Ion Monitoring (SIM) Groupings

Group #	**1**	**2**		**3**	**5**	**6**	**7**		**8**	**9**		**10**		**11**	**12**
Group Start Time, min	**0**	**5.9**		**8.75**	**10.1**	**10.9**	**11.6**		**13.8**	**14.6**		**16.6**		**18.8**	**20.5**
Dwell time, sec	**25**	**10**		**25**	**25**	**25**	**15**		**25**	**15**		**3**		**5**	**25**
Cycles/sec (calc)	**2**	**2.5**		**3.3**	**2.1**	**2.3**	**1.8**		**5.7**	**2.2**		**7**		**7**	**2.3**
Analyte Range, Compund #	**C2-C7**	**C8-C20**		**C21-C26**	**C27-C29, BCM (IS)**	**C30-C34**	**C35-C44, 1,4-DFB (IS)**		**C45-C46**	**C47-C55**		**C56-C67, CHB-D5 (IS)**		**C68-C76**	**C77-C80**
Ions	29	29	63	43	41	42	39	85	39	39	92	39	106	39	43
	31	31	64	57	43	49	41	87	43	41	94	43	110	43	57
	32	39	66	61	45	51	43	88	58	43	97	45	112	57	63
	39	40	67	63	47	57	45	93	75	45	98	54	114	71	89
	41	41	69	65	49	59	52	95	77	49	100	57	117	75	102
	42	43	72	72	57	62	56	97	100	56	107	75	120	89	109
	43	44	76	73	59	63	57	99		57	109	77	126	91	115
	44	45	84	86	61	64	58	100		58	114	78	128	105	118
	50	47	85	96	70	65	62	110		61	127	82	131	111	128
	51	49	94	98	77	67	63	114		73	129	83	133	115	134
	52	51	96	117	83	71	69	117		75	131	85	156	116	141
	54	52	101	198	85	72	73	119		76	166	91	171	117	142
	58	53	103		86	87	75	129		77		95	173	118	145
	62	55	106		87	97	78	130		83		97	174	119	180
	64	56	108		96	102	82	132		85		103	175	120	225
	67	57	151		97	119	83	174		91		104		126	260
	85	58			98		84					105		134	
	87	59			130									142	
	135	61												146	
														156	
														157	

Table B-3

TO15-SIM Target Analytes and Reporting Limits

COMPOUND	CAS #	SIM Reporting Limit, ppbV	SIM Reporting Limit, ug/m^3
1,1,1-trichloroethane	71-55-6	0.02	0.109
1,1,2,2-tetrachloroethane	79-34-5	0.02	0.137
1,1,2-trichloroethane	79-00-5	0.02	0.109
1,1-dichloroethane	75-34-3	0.02	0.081
1,1-dichloroethene	75-35-5	0.02	0.079
1,2,4-trimethylbenzene	95-63-6	0.02	0.098
1,2-dibromoethane	106-93-4	0.02	0.154
1,2-dichlorobenzene	95-50-1	0.02	0.12
1,2-dichloroethane	107-06-2	0.02	0.081
1,2-dichloropropane	78-87-5	0.02	0.092
1,2-dibromo-3-chloropropane	96-12-8	0.02	0.193
1,3,5-trimethylbenzene	108-67-8	0.02	0.098
1,3-butadiene	106-99-0	0.02	0.044
1,3-dichlorobenzene	541-73-1	0.02	0.12
1,4-dichlorobenzene	106-46-7	0.02	0.12
1,4-dioxane	123-91-1	0.10	0.36
2-hexanone	591-78-6	0.20	0.82
2,2,4-trimethylpentane	540-84-1	0.20	0.93
3-chloropropene	107-05-1	0.20	0.63
4-Ethyltoluene	622-96-8	0.02	0.098
benzene	71-43-2	0.10	0.223
benzyl chloride	100-44-7	0.20	1.03
bromodichloromethane	75-27-4	0.02	0.134
bromoform	75-25-2	0.02	0.207
bromomethane	74-83-9	0.02	0.078
carbon disulfide	75-15-0	0.20	0.62

COMPOUND	CAS #	SIM Reporting Limit, ppbV	SIM Reporting Limit, ug/m^3
hexachlorobutadiene	87-68-3	0.05	533
hexane	110-54-3	0.20	0.7
heptane	142-82-5	0.20	0.82
isopropyl alcohol	67-63-0	0.50	1.23
methylene chloride	75-09-2	0.50	1.74
MTBE	1634-04-4	0.02	0.072
m+p-xylene	108-38-3 106-42-3	0.04	0.174
o-xylene	95-47-6	0.02	0.087
propylene	115-7-1	0.50	0.85
styrene	100-42-5	0.02	0.085
tetrachloroethene	127-18-4	0.02	0.136
tetrahydrofuran	109-99-9	0.5	1.48
toluene	108-88-3	0.05	0.188
trans-1,2-dichloroethene	156-60-5	0.02	0.079
trans-1,3-dichloropropene	10061-02-6	0.02	0.091
trichlorofluoromethane	75-69-4	0.05	0.280
trichloroethene	79-01-6	0.02	0.107
1,2,4-trichlorobenzene	120-82-1	0.05	0.371
vinyl acetate	108-05-4	1.00	3.50
vinyl bromide	593-60-2	0.20	0.87
vinyl chloride	75-01-4	0.02	0.051
CT RSR Additional Analytes			
1,1,1,2-tetrachloroethane	630-20-6	0.02	0.137
acrylonitrile	107-13-1	0.50	1.08
isopropyltoluene	99-87-6	0.20	1.1
n-butylbenzene	104-51-8	0.20	1.1

carbon tetrachloride	56-23-5	0.02	0.126
chlorobenzene	108-90-7	0.10	0.460
chloroethane	75-00-3	0.10	0.265
chloroform	67-66-3	0.02	0.098
chloromethane	74-87-3	0.20	0.41
cis-1,2-dichloroethene	156-59-2	0.02	0.079
cis-1,3-dichloropropene	10061-01-5	0.02	0.091
cyclohexane	110-82-7	0.2	0.69
dibromochloromethane	124-48-1	0.02	0.17
dichlorodifluoromethane	75-71-8	0.20	0.99
ethanol	64-17-5	5.0	9.42
ethyl acetate	141-78-6	0.50	1.8
ethylbenzene	100-41-4	0.02	0.087
Freon-113	76-13-1	0.05	0.383
Freon-114	76-14-2	0.05	0.349

sec-butylbenzene	135-98-8	0.20	1.1
tert-butylbenzene	98-06-6	0.20	1.1
isopropylbenzene	98-82-8	0.20	0.98
2-butanone (MEK)	78-93-3	0.50	1.48
Acetone	67-64-1	1.00	2.35
4-methyl-2-pentanone (MIBK)	108-10-1	0.50	2.05
Project & State Specific Analytes			
1,2,3-trichlorobenzene	87-61-6	0.05	0.371
1,2,3-Trichloropropane	96-18-4	0.02	0.12
acrolein	107-02-8	0.05	0.115
bromobenzene	108-86-1	0.20	1.28
Dibromomethane	74-95-3	0.20	1.42
Naphthalene	91-20-3	0.05	0.262
tertiary butyl alcohol	75-65-0	0.50	1.51
All reporting limits are subject to change.			

Appendix C

Modifications to Data Review and Case Narrative to Comply with MADEP MCP TO-15 Method

This addendum addresses modifications to this SOP required to be in compliance with the MADEP MCP TO-15 method, specifically "Quality Control Requirements and Performance Standards for the ***Analysis of Volatile Organic Compounds in Air Samples (TO-15) by Gas Chromatography/Mass Spectrometry (GC/MS)*** in Support of Response Actions under the Massachusetts Contingency Plan (MCP)" Revision No. 0, Section IX B.

1) For duplicate analyses, the 25% RPD criteria stated in Sect. 9.6 of this SOP does not need to be applied to concentrations less than 5X the reporting limit.

2) Samples cannot be analyzed if any of the target analytes if the LCS recovery criteria stated in sect. 9.2 of this SOP is below 70% recovery. For compounds listed as difficult analytes (hexachlorobutadiene, 1,2,4-trichlorobenzene, naphthalene, acetone, and 1,4-dioxane), LCS recovery cannot be less than 50%.

3) Any analyte exceeding %RSD criteria of 30% during initial calibration that is a not listed in the MCP TO-15 method, but may still be reported to the client, must be noted in the case narrative.

Appendix E

Modifications to Data Review and Case Narrative to Comply with 2014 NJDEP Technical Guidance for EPA Method TO-15

This addendum addresses modifications to this SOP required to be in compliance with the NJDEP 2014 Technical Guidance, **"NJDEP Site Remediation Program, Data of Known Quality Protocol, Version 1, April 2014**". This guidance is to be used when analyzing samples via the EPA Method TO-15.

1) Per the Data of Know Quality Protocols Technical Guidance, surrogates are not required to be reported via EPA Method TO-15.

2) A target analyte list and reporting limits are specified in Table E-1, per the Analytical Laboratory Data Generation, Assessment and Usability Technical Guidance.

3) For the analytes ethanol and isopropyl alcohol, results are allowed to be reported outside the calibration range of the instrument, per the Analytical Laboratory Data Generation, Assessment and Usability Technical Guidance. Results reported that exceed the calibration range will be designated with an "E" qualifier.

4) **Laboratory Control Sample (LCS) criteria -** Must contain all target analytes, recovery range is 70-130%. Exceptions for difficult analytes (hexachlorobutadiene, 1,2,4-trichlorobenzene, naphthalene, acetone, dichlorodifluoromethane, and 1,4-dioxane) must exhibit percent recoveries between 40-160%. In addition, the CCAL analysis cannot be reported as the LCS even if it meets LCS requirements. The LCS must be a separate analysis, analyzed after a passing CCAL standard.

5) **Duplicate analyses** - The 25% RPD criteria stated in Sect. 9.6 of this SOP does not need to be applied to concentrations less than 5X the reporting limit.

6) **Tentatively Identified Compounds (TICs)** – up to 15 TICs must be reported, if present. If a reduced target analyte list is requested by client, TICs are not reported.

Table E-1

NJDEP 2014 Target Analytes and Reporting Limits via EPA Method TO-15

Required Compound Name	CAS Number	Molecular Weight	Reporting Limit ppbV	Reporting Limit ug/m^3
Acetone	67-64-1	58.08	5.0	12
Allyl chloride	107-05-1	76.53	0.2	0.6
Benzene	71-43-2	78.11	0.2	0.6
Bromodichloromethane	75-27-4	163.8	0.2	1
Bromoform	75-25-2	252.8	0.2	2
Bromomethane	74-83-9	94.94	0.2	0.8
1,3-Butadiene	106-99-0	54.09	0.2	0.4
Chlorobenzene	108-90-7	112.6	0.2	0.9
Chloroethane	75-00-3	64.52	0.5	1
Chloroform	67-66-3	119.4	0.2	1
Chloromethane	74-87-3	50.49	0.5	1
Carbon disulfide	75-15-0	76.14	0.5	2
Carbon tetrachloride	56-23-5	153.8	0.2	1
2-Chlorotoluene	95-49-8	126.6	0.2	1
Cyclohexane	110-82-7	84.16	0.2	0.7
Dibromochloromethane	124-48-1	208.3	0.2	2
1,2-Dibromoethane	106-93-4	187.9	0.2	2
1,2-Dichlorobenzene	95-50-1	147.0	0.2	1
1,3-Dichlorobenzene	541-73-1	147.0	0.2	1
1,4-Dichlorobenzene	106-46-7	147.0	0.2	1
Dichlorodifluoromethane	75-71-8	120.9	0.5	2
1,1-Dichloroethane	75-34-3	98.96	0.2	0.8
1,2-Dichloroethane	107-06-2	98.96	0.2	0.8
1,1-Dichloroethene	75-35-4	96.94	0.2	0.8
1,2-Dichloroethene (cis)	156-59-2	96.94	0.2	0.8
1,2-Dichloroethene (trans)	156-60-5	96.94	0.2	0.8
1,2-Dichloropropane	78-87-5	113.0	0.2	0.9
1,3-Dichloropropene (cis)	10061-01-5	111.0	0.2	0.9
1,3-Dichloropropene (trans)	10061-02-6	111.0	0.2	0.9
1,2-Dichlorotetrafluoroethane	76-14-2	170.9	0.2	1
1,4-Dioxane	123-91-1	88.12	5	18
Ethanol	64-17-5	46.07	5	9
Ethylbenzene	100-41-4	106.2	0.2	0.9
4-Ethyltoluene	622-96-8	120.2	0.2	1
n-Heptane	142-82-5	100.2	0.2	0.8
1,3-Hexachlorobutadiene	87-68-3	260.8	0.2	2
n-Hexane	110-54-3	86.17	0.2	0.7
Isopropanol	67-63-0	60.10	5	12

Table E-1 continued

Required Compound Name	CAS Number	Molecular Weight	Reporting Limit ppbV	Reporting Limit ug/m^3
Methylene chloride	75-09-2	84.94	0.5	2
Methyl ethyl ketone	78-93-3	72.11	0.5	1
Methyl isobutyl ketone	108-10-1	100.2	0.5	2
Methyl methacrylate	80-62-6	100.1	0.5	2
Methyl tert-butyl ether	1634-04-4	88.15	0.2	0.7
Styrene	100-42-5	104.1	0.2	0.9
Tert-butyl alcohol	75-65-0	74.12	5	15
1,1,2,2-Tetrachloroethane	79-34-5	167.9	0.2	1
Tetrachloroethene	127-18-4	165.8	0.2	1
Tetrahydrofuran	109-99-9	72.11	5	15
Toluene	108-88-3	92.14	0.2	0.8
1,2,4-Trichlorobenzene	120-82-1	181.5	0.5	4
1,1,1-Trichloroethane	71-55-6	133.4	0.2	1
1,1,2-Trichloroethane	79-00-5	133.4	0.2	1
Trichloroethene	79-01-6	131.4	0.2	1
Trichlorofluoromethane	75-69-4	137.4	0.2	1
1,1,2-Trichloro-1,2,2-trifluoroethane	76-13-1	187.4	0.2	2
1,2,4-Trimethylbenzene	95-63-6	120.2	0.2	1
1,3,5-Trimethylbenzene	108-67-8	120.2	0.2	1
2,2,4-Trimethylpentane	540-84-1	114.2	0.2	0.9
Vinyl bromide	593-60-2	106.9	0.2	0.9
Vinyl chloride	75-01-4	62.50	0.2	0.5
Xylenes (m&p)	179601-23-1	106.2	0.5	2
Xylenes (o)	95-47-6	106.2	0.2	0.9
Naphthalene (reported on request)	91-20-3	128.2	0.2	1

All reporting limits are subject to change.

Appendix F

Modifications to EPA TO-15 SOP to comply with Ohio EPA Voluntary Action Program (VAP) Requirements

This Appendix defines requirements that are necessary to perform TO-15 analysis for any samples submitted via the VAP Program. No deviations from the SOP are allowed under the VAP program.

1) Sec. 3 caveat – reporting limits defined in this SOP are subject to change.

2) Sec. 7 caveat – Equipment and supplies are subject to change.

3) Initial calibration acceptance – %RSD criteria must be as defined in the EPA TO-15 method; only 2 analytes allowed greater than 30% RSD, and must be less than 40%.

4) The Laboratory check standard (LCS) may not be used as the continuing calibration verification (CCV). A CCV and LCS must be analyzed prior to samples.

5) Tentatively Identified Compounds (TICs) may not be reported as certified values.

6) CCV-10% rule not allowed. All analytes reported must be +/- 30% D. (Criteria in sections 10.4.2.6 and 2.1 do not apply to VAP samples.) All analytes in the CCV must be less than 30% RSD for VAP samples (criteria in Section 2.1, 10.4.2.6 and 10.4.2.7 do not apply.)

7) 10% Duplicate criteria not allowed. All duplicate %RPD results must be below 25%.

8) For Ohio projects, only the analytes listed in Table F-1 or as explained in the footnote to Table F-1 will be reported as certified data.

9) Affidavits are required with each report or for a series of reports generated for a particular project.

10) Surrogates are not required and will not be added to Ohio VAP samples.

11) The analysis of a Laboratory Control Sample Duplicate (LCSD) is not required and will not be analyzed for Ohio VAP samples.

12) The LCS is evaluated at +/- 30. Criteria in section 2.1 does not apply to VAP samples.

13) Corrective actions for the method blank are required if it contains analyte concentrations at or above the RL for reportable analytes.

Table F-1

Ohio EPA VAP Program Target Analyte List *		
chloromethane	1,2-dichloropropane	1,1-Dichloropropene
vinyl chloride	1,4-dioxane	1,2,3-Trichloropropane
1,3-butadiene	trichloroethene	1,2,4-Trimethylbenzene
acetaldehyde	2,2,4-trimethylpentane	1,2-Dichlorobenzene
bromomethane	cis-1,3-dichloropropene	1,3,5-Trimethylbenzene
chloroethane	4-methyl-2-pentanone	1,3-Dichlorobenzene
vinyl bromide	1,1,2-trichloroethane	1,3-Dichloropropane
acrolein	toluene	Acetone
acetonitrile	1,2-dibromoethane	Bromodichloromethane
acrylonitrile	tetrachloroethene	Butyl acetate
1,1-dichloroethene	chlorobenzene	cis-1,2-Dichloroethene
methylene chloride	ethylbenzene	Cyclohexane
3-chloropropene	m+p-xylene	Dibromochloromethane
carbon disulfide	bromoform	Dibromomethane
1,1-dichloroethane	styrene	Dichlorodifluoromethane
MTBE	1,1,2,2-tetrachloroethane	Ethyl acetate
vinyl acetate	o-xylene	Ethyl ether
2-butanone	isopropylbenzene	Methyl alcohol (methanol)
chloroform	Benzyl Chloride	Methyl Methacrylate
1,2-dichloroethane	1,4-dichlorobenzene	Naphthalene
hexane	1,2-dibromo-3-chloropropane	Tetrahydrofuran
1,1,1-trichloroethane	1,2,4-trichlorobenzene	trans-1,2-Dichloroethene
benzene	hexachlorobutadiene	trans-1,3-Dichloropropene
carbon tetrachloride	1,1,1,2-Tetrachloroethane	Trichlorofluoromethane

* The analytes appearing in this table are subject to change, however, any changes will not include identification of compounds that are not included in the TO-15 method referenced at the beginning of this document. However, it is acceptable to analyze and report, as certified data, compound(s) not included in the TO-15 method referenced at the beginning of this document if the compound(s) appear on the current and valid certificate issued by VAP on the date of analysis and if the laboratory has followed all applicable VAP approved documents.

Analysis of

Chlorinated Herbicides by GC Using Methylation Derivatization

Reference Methods: **EPA 8151A,** SW-846, Test Methods for Evaluating Solid Waste: Physical/Chemical Methods, EPA SW-846, Update III, 1997.

MA BWS-CAM Section VC, Quality Assurance and Quality Control Requirements and Performance Standards for SW-846 Method 8151A, for the Massachusetts Contingency Plan (MCP). Revision 1. July 1, 2010.

SW-846 Chlorinated Herbicides by 8151, State of Connecticut Department of Environmental Protection Reasonable Confidence Protocol **(RCP)**, Version 2.0, July 2006

1. Scope and Application

Matrices: Aqueous, soil and waste.

Definitions: See Alpha Laboratories Quality Manual Appendix A

Specifically, Method 8151A may be used to determine the following compounds:

Parameter	**CAS No.**[a]
2,4-D [1, 2, 3]	94-75-7
2,4-DB	94-82-6
2,4,5-TP (silvex) [1, 2, 3]	93-72-1
2,4,5-T [1, 2]	93-76-5
Dalapon	75-99-0
Dicamba	1918-00-9
Dichloroprop	120-36-5
Dinoseb	88-85-7
MCPA	94-74-6
MCPP	93-65-2

[a] Chemical Abstract Service Registry Number

[1] RCRA List

[2] APA List

[3] TCLP List

Method 8151A is a capillary gas chromatographic (GC) method for determining certain chlorinated acid herbicides and related compounds in aqueous, soil and waste matrices.

Because these compounds are produced and used in various forms (i.e., acid, salt, ester, etc.), Method 8151A describes a hydrolysis step than can be used to convert herbicide esters into the acid form prior to analysis. Herbicide esters generally have a half-life of less than one week in soil.

When Method 8151A is used to analyze unfamiliar samples, compound identifications should be supported by at least one additional qualitative technique. Section 10.1 provides gas chromatograph/mass spectrometer (GC/MS) criteria appropriate for the qualitative confirmation of compound identifications.

The data report packages present the documentation of any method modification related to the samples tested. Depending upon the nature of the modification and the extent of intended use, the laboratory may be required to demonstrate that the modifications will produce equivalent results for the matrix. Approval of all method modifications is by one of the following laboratory personnel before performing the modification: Area Supervisor, Laboratory Services Manager, Laboratory Director, or Quality Assurance Officer.

This method is restricted to use by or under the supervision of analysts experienced in the use of gas chromatography and skilled in the interpretation of gas chromatograms. Only experienced analysts should be allowed to work with diazomethane due to the potential hazards associated with its use (explosive, carcinogenic). Each analyst must demonstrate the ability to generate acceptable results with this method by performing an initial demonstration of capability.

2. Summary of Method

This SOP for Method 8151A details gas chromatographic conditions for the analysis of chlorinated acid herbicides in water, soil, and waste samples. The hydrolysis of esters is also described in SOP number 1964.

Water, soil, and waste samples are extracted with diethyl ether and then derivatized with diazomethane. The derivatives are determined by gas chromatography with an electron capture detector (GC/ECD). The results are reported as acid equivalents.

3. Reporting Limits

The sensitivity of Method 8151A depends on the level of interferences, in addition to instrumental limitations. Table 1 lists the estimated GC/ECD detection limits that can be obtained in aqueous and soil matrices in the absence of interferences. Detection limits for a typical waste sample should be greater.

4. Interferences

4.1 Refer to Method 8000 for instrumental interferences.

4.2 Method interferences may be caused by contaminants in solvents, reagents, glassware, and other sample processing hardware that lead to discrete artifacts or elevated baselines in gas chromatograms. All these materials must be routinely demonstrated to be free from interferences under the conditions of the analysis, by analyzing reagent blanks.

4.2.1 Glassware must be scrupulously cleaned. Clean each piece of glassware as soon as possible after use by rinsing it with the last solvent used in it. This should be followed by detergent washing with hot water and rinses with tap water, then with organic-free reagent water. Glassware should be solvent-rinsed with acetone and pesticide-quality hexane. After rinsing and drying, glassware should be sealed and stored in a clean environment to prevent any accumulation of dust or other contaminants. Store glassware inverted or capped with aluminum foil. Immediately prior to use, glassware should be rinsed with the next solvent to be used.

4.2.2 The use of high purity reagents and solvents helps to minimize interference problems.

4.3 Matrix interferences may be caused by contaminants that are coextracted from the sample. The extent of matrix interferences will vary considerably from waste to waste, depending upon the nature and diversity of the waste being sampled.

4.4 Organic acids, especially chlorinated acids, cause the most direct interference with the determination by methylation. Phenols, including chlorophenols, may also interfere with this procedure.

4.5 Alkaline hydrolysis and subsequent extraction of the basic solution removes many chlorinated hydrocarbons and phthalate esters that might otherwise interfere with the electron capture analysis. However, hydrolysis may result in the loss of Dinoseb and the formation of aldol condensation products if any residual Acetone remains from the extraction of solids.

4.6 The herbicides, being strong organic acids, react readily with alkaline substances and may be lost during analysis. Therefore, glassware must be acid-rinsed and then rinsed to constant pH with organic-free reagent water. Sodium Sulfate must be acidified.

4.7 Sample extracts must be dry prior to methylation otherwise poor recoveries will be obtained.

5. Health and Safety

The toxicity or carcinogenicity of each reagent and standard used in this method is not fully established; however, each chemical compound should be treated as a potential health hazard. From this viewpoint, exposure to these chemicals must be reduced to the lowest possible level by whatever means available. A reference file of material data handling sheets is available to all personnel involved in the chemical analysis. Additional references to laboratory safety are available in the Chemical Hygiene Plan.

All personnel handling environmental samples known to contain or to have been in contact with municipal waste must follow safety practices for handling known disease causative agents.

5.1 Lab coats, safety glasses, and gloves must be worn when handling supplies, samples, extracts, standards or solvents, and when washing glassware.

5.2 All extract concentration steps must be performed in extraction hoods. All solvent and extract transfers must also be handled in a hood.

5.3 All expired stock standards, working standards, and spent sample extracts must be placed into the waste bucket in the laboratory for future disposal by the Hazardous Waste Manager. The container must be properly labeled with hazard warning labels indicating the container contents.

5.4 Bottles containing flammable solvents must be stored in the flammables cabinet or in the vented cabinets found under the hoods. All ether bottles are to be checked for peroxide immediately upon opening.

5.5 All waste solvents must be transferred to the satellite waste storage containers located in the extraction laboratory. Separate containers are provided for chlorinated and non-chlorinated solvents and must be used accordingly. Under no circumstances are solvents to be poured down the sink drains.

5.6 Inspect all glassware prior to use. Do not use any glassware that is chipped or cracked if it could present a safety hazard. Damaged glassware is put aside for repair; otherwise the piece is discarded. A number is etched onto each KD concentrator tube to keep track of calibration (Refer to SOP/08-04, KD Tube Calibration).

6. Sample Collection, Preservation, Shipping and Handling

6.1 Sample Collection

Aqueous samples are collected in two one-liter amber glass containers. Soil samples are collected in 8oz. glass jars.

6.2 Sample Preservation

Both aqueous and soil/solid samples are stored in refrigerators to maintain a temperature of 2 – 6 °C.

6.3 Sample Shipping

No special shipping requirements.

6.4 Sample Handling

Both aqueous and soil/solid samples and extracts are stored under refrigeration (2 – 6 ºC) and protected from light. Aqueous samples must be extracted within 7 days from the time of collection; soil samples, within 14 days from collection. Sample extracts must be analyzed within 40 days following extraction.

After the extraction is completed, the sample extract is stored in a stoppered KD tube before being transferred to a crimp-top or screw cap vial for analysis and long-term storage.

7. Equipment and Supplies

7.1 Gas Chromatograph, Agilent 7890 (or equivalent): An analytical system complete with gas chromatograph configured for split-splitless injection and all required accessories including syringes, analytical columns, gases, electron capture detectors (ECD), and data system.

7.2 GC Columns: Alpha utilizes dual-column analyses. The dual-column approach involves either a single injection that is split between two columns that are mounted in a single gas chromatograph, or dual injections of the split extract on a single GC equipped with two columns. Typical column pairs used are listed below. Other columns may be used as long as method performance criteria can be met.

Column Pair:

STX-CLP: Cat.: #11546 from Restek or equivalent, 30m, 0.32mm, 0.32 µm
STX-CLPII: Cat.: #11444 from Restek or equivalent, 30m, 0.32mm, 0.25µm

7.3 Guard Column: Cat. #10027 from Restek or equivalent; 5m, 0.32mm

7.4 Class “A” Volumetric Flasks: 10mL and 25mL (and other volumes), for standards preparation

7.5 Microsyringes: 10 µL – 1000 µL

7.6 Gooseneck splitless injecton liner, Cat #23303 from Restek or equivalent

7.7 Universal “Y” Press-tight tee split: Cat. #20406 from Restek or equivalent **/**
Siltek MXT Connector: Cat. #21388 from Restek or equivalent

8. Reagents and Standards

Reagent grade chemicals shall be used in all tests. Unless otherwise indicated, it is intended that all reagents shall conform to the specifications of the Committee on Analytical Reagents of the American Chemical Society, where such specifications are available. Other grades may be used, provided it is first ascertained that the reagent is of sufficiently high purity to permit its use without lessening the accuracy of the determination.

NOTE: Store the standard solutions (stock, composite, calibration, internal, and surrogate) at 4±2 °C in Teflon(R)-sealed containers in the dark. When a large volume of standard is prepared, aliquots of that lot are stored in individual small vials.

All stock standard solutions must be replaced ***after one year or sooner*** if routine QC tests indicate a problem.

All other standard solutions must be replaced ***after six months or sooner*** if routine QC indicates a problem.

8.1 Reagent water: All references to water in this method refer to reagent water from Alpha's DI water treatment system.

8.2 n-Hexane: Pesticide grade or equivalent

8.3 Acetone: Pesticide grade or equivalent

8.4 Internal Standard Stock Solution: 4,4'-dibromooctafluorobiphenyl (DBOB) (AccuStandard, Cat # M-8151-IS) is used as the internal standard.

- **Working Internal Standard Solution**: To a 10mL volumetric flask, add 1mL of the 4,4'-dibromooctafluorobiphenyl (DBOB) (AccuStandard, Cat # M-8151-IS) and bring to volume with Acetone. Final concentration is 25µg/mL. 10µL of this solution is added to the 1mL sample and QC sample extracts as well as to all Calibration Standards to achieve a concentration of 0.25µg/mL for analysis.

8.5 Calibration Standards: Appropriate vendor derivatized standard(s) are volumetrically diluted with Hexane to obtain Initial Calibration Stock Standard which is used to prepare Initial Calibration Working Standards.

8.5.1 **<u>Initial Calibration Stock Standard</u>:** to a 10mL volumetric flask, add few mLs of Hexane:

- **1mL 2,4-Dichlorophenyl acetic acid (DCAA) methyl ester solution: (**100µg/mL in MTBE, Accustandard, Cat # M515-SS) and
- **1mL of Chlorinated Herbicides Methyl Derivatives** (100/10000µg/mL in MTBE, Accustandard, Cat # M-8151) Bring to volume using Hexane. Final concentration is 10µg/mL for all analytes except MCPP and MCPA at 1000µg/mL.

8.5.1.1 Initial Calibration Working Standards

8.5.1.1.1 Cal Level 1: To a 10mL volumetric flask, add 50µL of Initial Calibration Stock Standard. Bring to volume with Hexane. Final concentration is 0.05µg/mL for all analytes except MCPP and MCPA at 5.0µg/mL.

8.5.1.1.2 Cal Level 2: To a 10mL volumetric flask, add 100µL of Initial Calibration Stock Standard. Bring to volume with Hexane. Final concentration is 0.10µg/mL for all analytes except MCPP and MCPA at 10.0µg/mL.

8.5.1.1.3 Cal Level 3: To a 10mL volumetric flask, add 200µL of Initial Calibration Stock Standard. Bring to volume with Hexane. Final concentration is 0.20µg/mL for all analytes except MCPP and MCPA at 20.0µg/mL.

8.5.1.1.4 Cal Level 4: To a 10mL volumetric flask, add 500µL of Initial Calibration Stock Standard. Bring to volume with Hexane. Final concentration is 0.50µg/mL for all analytes except MCPP and MCPA at 50.0µg/mL.

8.5.1.1.5 Cal Level 5: To a 10mL volumetric flask, add 1.0mL of Initial Calibration Stock Standard. Bring to volume with Hexane. Final concentration is 1.0µg/mL for all analytes except MCPP and MCPA at 100µg/mL.

8.5.1.1.6 Cal Level 6: To a 10mL volumetric flask, add 2.0mL of Initial Calibration Stock Standard. Bring to volume with Hexane. Final concentration is 2.0µg/mL for all analytes except MCPP and MCPA at 200µg/mL.

8.6 Second Source Standard: (ICV) Appropriate vendor derivatized standard(s) are volumetrically diluted with Hexane to obtain Initial Calibration Verification Stock Standard which is used to prepare ICV Working Standard.

8.6.1 **ICV Stock Standard:** to a 10mL volumetric flask, add a few mLs of Acetone (to ensure mix of Methanol from the Herbicides Mixture):

- **1mL of Methylated Herbicides Mixture** (100/10000µg/mL in Methanol, Agilent, Cat # HBM-8151M) and
- **1mL of DCAA Methyl Ester Solution: 2,4-Dichlorophenyl acetic acid (DCAA) methyl ester solution –SURROGATE (**100µg/mL in Acetone, Agilent, Cat # PPS-166). Bring to volume using Hexane. Final concentration is 10µg/mL for all analytes except MCPP and MCPA at 1000µg/mL.

8.6.1.1 **ICV Working Standard**: To a 50mL volumetric flask, add 1mL ICV Stock Solution. Bring to volume with Hexane. Final concentration is 0.2µg/mL for all analytes except MCPP and MCPA at 20µg/mL.

8.6.2 **ICV Standard (2,4-DB only):** to a 50mL volumetric flask, add few mLs of Hexane and **2,4-DB methyl ester** (1000µg/mL in Hexane, Restek, Cat # 70931). Bring to final volume using Hexane. Final concentration is 0.2µg/mL.

8.7 Extraction Surrogate Standard: 2,4-Diclorophenylacetic Acid (DCAA) (1000µg/mL in Acetone, AccuStandard, M-8150B-SS-10X) The Surrogate standard is spiked into all samples and QC samples prior to extraction.

- To a 1000mL volumetric flask, add 10mL of ampulated surrogate solution. Bring to volume with Acetone. Final concentration is 10µg/mL.

8.8 LCS/MS Spiking Solutions: The LCS/MS spiking solutions are prepared volumetrically by diluting Underivatized Chlorinated Herbicides (100/10000µg/mL in Acetone, AccuStandard, Cat # M8151A.) in Acetone

- To a 200mL volumetric flask, add 20mL of ampulated LCS/MS solution. Bring to volume with Acetone. Final concentration is 10µg/mL for all analytes except MCPP and MCPA at 1000µg/mL.

9. Quality Control

The laboratory must maintain records to document the quality of data that is generated. Ongoing data quality checks are compared with established performance criteria to determine if the results of analyses meet the performance characteristics of the method.

9.1 Blank(s)

A matrix-specific extraction blank is performed with each extraction batch of 20 or fewer samples, according to the extraction SOPs. The extraction blank must not contain any of the reportable analytes at or above the reporting limit. If any reportable analytes are detected in the blank, the entire extraction batch is suspect and re-extraction of all associated samples is required, unless the associated samples are non-detect or concentration of the analyte in the samples is 10 times greater than the concentration of this analyte in the blank. The surrogate recoveries must also be within the acceptance criteria listed in Table 3. If surrogate acceptance criteria are exceeded, the extraction batch must be evaluated to determine if re-extraction or re-analysis is necessary. Actions associated with blank failures are listed in Table 4.

9.2 Laboratory Control Sample (LCS) / LCS Duplicate

A Laboratory Control Sample (LCS) and an LCS Duplicate (LCSD) is extracted with each analytical batch. The LCS consists of an aliquot of a clean (control) matrix similar to the sample matrix and of the same weight or volume. The LCS is spiked with all target analytes. The concentrations of the spiking solutions are listed in Table 2. The recovery and RPD acceptance criteria are listed in Table 3. If any recovery criteria are not met, the extract should be reanalyzed. If the criteria are still not met, the entire batch should be re-extracted, unless the recoveries are high and the associated samples are non-detect. If this is not possible, due to insufficient sample or holding time exceedance, the analyst must write up the failure on a narrative sheet for inclusion in the client report. Actions associated with LCS/LCSD failures are listed in Table 4.

9.3 Initial Calibration Verification (ICV)

Refer to Section 10.2.7

9.4 Continuing Calibration Verification (CCV)

Refer to Section 10.4

9.5 Matrix Spike (MS)/MS Duplicate

A matrix spike/matrix spike duplicate pair is extracted and analyzed for each batch of 20 or less samples only upon client request. MS and MSDs are field samples spiked with a known quantity of the target analyte(s). They are prepared by taking additional sample aliquots of the same weight or volume and adding the appropriate amounts of surrogate and spiking solutions. The spike compounds and levels are listed in Table 2. The recovery and RPD acceptance criteria are listed in Table 3. If the recovery criteria are not met, but are met in the LCS, the failure may be attributed to sample matrix. Actions associated with MS/MSD failure are listed in Table 4.

9.6 Laboratory Duplicate (DUP)

A duplicate sample is extracted and analyzed upon Client request for each batch of 20 or less samples. Duplicates are laboratory selected replicate samples, prepared by taking an additional sample aliquot of the same weight or volume of a sample. The % RPD criteria are listed in Table 3. If the %RPD is not met, the failure may be attributed to sample matrix effects and must be noted on a narrative sheet for inclusion in the client report. Actions associated with duplicate failures are listed in Table 4.

For samples with a state of origin of New Jersey, a MS and MSD/DUP must be extracted for every twenty samples within a 24hr period.

9.7 Extraction Surrogates

All extracted samples and associated QC are spiked with surrogates at the levels listed in Table 2. The laboratory must evaluate surrogate recovery data from individual samples and QC samples versus the surrogate control limits for both columns listed in Table 3. If the surrogate limits are not met, the extract should be reanalyzed to determine if the failure was due to an instrument problem. If the criteria are still not met, the affected samples should be re-extracted to confirm that the failure was due to sample matrix. If matrix effect is confirmed, this must be noted on a narrative sheet for inclusion in the client report.

9.8 Method Sequence

Typical Initial Calibration (each level has to be identified with the standard lot number)

1. Instrument Prime
2. Blank
3. Std Level 1
4. Std Level 2
5. Std Level 3
6. Std Level 4
7. Std Level 5
8. Std Level 6
9. Initial Calibration Verification Standard (ICV)
10. Initial Calibration Verification Standard (ICV)

Typical Daily Sequence:

1. Instrument Prime
2. Blank
3. Herbicide Continuing Calibration Standard **(identified with the standard lot number**)
4. Extraction Blank
5. Laboratory Control Sample
6. Laboratory Control Sample Duplicate
7. Matrix Spike (Upon Client Request)
8. Duplicate/Matrix Spike Duplicate (Upon Client Request)
9. Samples (10 field samples)
10. Repeat 3 – 9 (as needed)

10. Procedure

10.1 Equipment Set-up

The dual-column / dual-detector approach involves the use of the columns listed in section 7.2. The columns are connected to an Y-split or similar or dual injection GC, and separate electron capture detectors. Alpha typical GC conditions are listed below but may be altered as long as method performance criteria are met.

Temperature 1:	80 °C	**Detector temperature:**	350 °C
Ramp 1:	15°C/minute	**Carrier gas:**	Hydrogen
Temperature 2:	200°C	**Carrier flow:**	2.5 mL/min
Ramp 2:	20°C/minute	**Carrier mode:**	Constant flow
Temperature 3:	280°C	**Makeup gas:**	Nitrogen
Hold Time:	3 minutes	**Total detector flow:**	55 mL/min
Injector Temperature:	250°C		
Injector Mode:	Split		
Injector Flow:	36.5 mL/min		
Septum Purge Flow:	24 mL/min		
Split Flow:	10 mL/min		
Split Ratio:	4:1		
Injection Volume	1 µL		

10.2 Initial Calibration

10.2.1 Prepare calibration standards using the procedures in Section 8.5 and Table 2. The calibration standards are aliquoted into autosampler vials and capped prior to loading onto the autosampler tray. The calibration standards are analyzed and the curve is calculated prior to sample analysis.

10.2.2 Establish the GC operating conditions by loading the appropriate GC method. Typical instrument conditions are listed in section 10.1. The same operating conditions are used for calibrations and sample analyses. Create the analytical sequence using the Agilent Chemstation data acquisition software. Record the calibration standard, unique lot number (PP#) and analyst’s initials in the analytical sequence list.

10.2.3 A 1µL injection volume of each calibration standard is typically used. Other injection volumes may be employed, provided that the analyst can demonstrate adequate sensitivity for the compounds of interest. The same injection volume must be used for all standards and samples.

10.2.4 Column adsorption may be a problem when the GC has not been used for a day or more or after system maintenance. The GC column may be primed (or deactivated) by injecting a Herbicides standard mixture approximately 20 times more concentrated than the mid-concentration standard. Inject this standard mixture prior to beginning the initial calibration or calibration verification.

Alternately, the system may be primed by baking at the final analytical temperature for approximately 30 minutes.

Several analytes may be observed in the injection just following system priming. Always run an instrument blank after system priming.

10.2.5 Calibration Factors

Internal standard calibration techniques are employed in this method.

10.2.5.1 Internal Standard Procedure. In each standard, calculate the response factor (RF) for each analyte, the average RF, and the relative standard deviation (RSD) of the RFs, using the Enviroquant data processing software. The calculations are performed automatically, using the formulae listed in Alpha's Quality Manual.

10.2.6 Initial Calibration Criteria

- If the **<u>RSD for an analyte is < 20%,</u>** then the response of the instrument for this compound is considered linear over the range and the mean calibration factor (Avg. RF) can be used to quantitate sample results.

- If the **<u>RSD for any analyte is > 20%</u>**, then linearity through the origin cannot be assumed. The mean response factor cannot be used for quantitation. An alternative calculation may be done by the use of **linear regression** or **quadratic regression** (minimum of six ICAL points are needed and regression must be weighted inversely proportional to concentration) as long as the **correlation coefficient is >0.990**. If both of these quantitation methods fail criteria for any compound in the initial calibration, then the system must be reevaluated and a new calibration curve must be analyzed. If quadratic regression is used for calibration, this must be noted in the laboratory narrative. The regression equation cannot be forced through the origin. The equation for linear regression may be found in Alpha's Quality Manual.

- **<u>MCP requirement:</u>** If linear or non-linear regression is used, RL must to be verified by recalculating concentrations in the lowest calibration standard using the final calibration curve. Recoveries must be **70-130%.**

- Minimum of five standards must be used for the linear regression and minimum of six for non-linear regression.
- Percent Relative Error (%RE): For linear and quadratic fit compounds, the %RE must be calculated for the standard at or near the midpoint and at the lowest level of the initial calibration. The %RE between the calculated and expected concentration of an analyte must be ≤ 30%, otherwise recalibration is necessary.

10.2.7 Initial Calibration Verification

An Initial Calibration Verification standards must be run immediately after each initial calibration, near the midpoint of the curve. The standards must be prepared using a second source that is different than the source used for the initial calibration. (Standards listed in Section 8.6). The **<u>%D</u>** has to be within **<u>20%</u>** <u>(**15% for CT RCP**)</u> when compared to the mean response factor from the initial calibration.

10.2.8 Retention Time Windows

- The retention time windows used for the identification of target analytes is ± 0.03 minutes. These criteria have been adopted from the EPA CLP Statement of Work (OLM04.2). It has been found that these limits work well, being wide enough to eliminate false-negatives while being tight enough to eliminate false-positives. Windows that are calculated using the procedure recommended in Method 8000 tend to be very narrow, creating the risk of false negative results.
- The windows listed above are used as guidance, however the experience of the analyst weighs heavily in the interpretation of the chromatograms. For example, it has been observed that certain oil matrices can cause the retention times to shift more dramatically. Additionally, if any positive results are questionable and at a sufficiently high concentration, GC/MS analysis is used for confirmation.

10.3 Sample Processing

10.3.1 The same GC operating conditions used for the initial calibration must be employed for sample analyses, including sample injection volume.

10.3.2 Tentative identification of an analyte occurs when a peak from a sample extract falls within the retention time window for the compound. Each tentative identification is confirmed using a second GC column of dissimilar stationary phase. In particularly difficult matrices, confirmation by GC/MS may be advisable.

10.3.3 The concentration reported for an identified target analyte in an extract is calculated using the Enviroquant data processing software. The Enviroquant methods have been configured to utilize the quantitation formulas found in Alpha's Quality Manual. Proper quantitation requires the appropriate selection of a baseline from which the peak area or height can be determined. See the Manual Integration SOP for integration guidelines. Also refer to Section 11 for calculations.

10.3.3.1 If the responses exceed the calibration range of the system, dilute the extract and reanalyze.

10.3.4 The laboratory must report **HIGHER** of the two results unless obvious interference is present on one of the columns.

10.3.4.1 The **Relative Percent Difference (RPD)** should be 40 or lower. If the RPD exceeds 40, this will be denoted with a P flag. If the RPD exceedance is due to interference, the lower of the dual column values can be reported with I and P flags.

10.3.5 If compound identification or quantitation is precluded due to interference (e.g. broad, rounded peaks or ill-defined baselines are present) cleanup of the extract may be needed. If instrument problems are suspected, rerun the extract on another instrument to determine if the problem results from analytical hardware or the sample matrix. Refer to the extraction SOPs for the procedures to be followed in sample cleanup.

10.3.6 GC/MS Confirmation

GC/MS confirmation may be used in conjunction with either single-column or dual-column analysis if the concentration is sufficient for detection by GC/MS.

10.4 Continuing Calibration

10.4.1 Verify calibration each **12-hours** shift by injecting Continuing Calibration standard prior to conducting any sample analyses. A calibration standard must also be injected at intervals of **not less than once every 10 filed samples.**

A bracketing CCV is not required with the use of internal standard calibration method with the exception of samples ran under CT RCP method.

10.4.2 The Response Factor (for internal standard compounds) for each analyte to be quantitated must not exceed a **± 20% difference (± 15% for MCP and CT RCP**) when compared to the initial calibration curve. The Enviroquant data processing software automatically calculates the %D for all analytes according to the formula in Alpha's Quality Manual.

If this criterion is exceeded, inspect the gas chromatographic system to determine the cause and perform whatever maintenance is necessary before verifying calibration and proceeding with sample analysis.

10.4.3 If routine maintenance does not return the instrument performance to meet the QC requirements based on the last initial calibration, then a new initial calibration must be performed. Due to the large number of analytes present, allowances may be made for a CF or RF that drifts out high, as long as there are no positive hits for that particular analyte in any of the associated samples.

10.5 Internal Standard

The use of internal standard calibration does not require that all sample results be bracketed with CCV standard. However, when internal standard calibration is used, the retention times of internal standards and the area response of internal standards should be checked for each analysis.

10.5.1 **IS in CCAL** – The measured area of the internal standard must be no more than + 50% different from the average area calculated during initial calibration (-50 to 150%).

10.5.2 **IS in samples** - The measured area of the internal standard must be no more than -50% to +100% different from the area calculated from opening CCV (-50 to 200%)

Retention time shifts of more than 30 sec from the retention time of the most recent calibration standard are cause for concern and must be investigated.

10.6 Preventive Maintenance

- Routine preventive maintenance should be performed to maintain GC system performance. This includes periodic replacement of injector septa, replacement of injector liner(s), and replacement of injector seals. All maintenance is noted in individual Instrument Maintenance Logbooks.
- Other Maintenance: ECD detectors may become contaminated, requiring bake out at elevated temperatures, (no greater than 375̊C) or repair by the manufacturer.

11. Data Evaluation, Calculations and Reporting

Herbicides are calculated as described in Section 11.1, 11.2, and reported in µg/L or µg/Kg units. After performing technical data review, validating that all QC criteria have been met and confirming all positive hits, the data report is sent electronically to the LIMS computer for generation of the client report. Two levels of review of the data in the LIMS system are preferred prior to release of data. These reviews include analyst review and review by the Department Supervisor or other trained analyst.

11.1 Aqueous Calculation

$$\mu g/L = \frac{(A_s)\,(C_{IS})\,(D)\,(V_f)}{(A_{IS})\,(\overline{RF})\,(V_s)\,(1000)}$$

Where:

A_s = Peak area of analyte
A_{IS} = Peak area of Internal Standard
C_{IS} = Concentration of IS (µg/L)
D = Dilution factor (D = 1 for no dilution)
V_f = Final extract volume (mL)
Vs = Initial volume extracted (mL)

$\overline{RF}$ = Mean response factor

11.2 Soil/Solid Calculation

$$\mu g/Kg = \frac{(A_s)\,(C_{IS})\,(D)\,(V_f)}{(A_{IS})\,(\overline{RF})\,(W_s)\,(1000)}$$

Where:

A_s = Peak area of analyte
A_{IS} = Peak area of Internal Standard
C_{IS} = Concentration of IS (µg/L)
D = Dilution factor (D = 1 for no dilution)
V_f = Final extract volume (mL)
Ws = Initial weight extracted (g)

$\overline{RF}$ = Mean response factor

11.2.1 Response Factor Calculation

$$RF = \frac{(A_s)\,(C_{IS})}{(A_{IS})\,(C_s)}$$

Where:

A_s = Peak area of analyte
A_{IS} = Peak area of Internal Standard
C_s = Concentration of analyte (µg/L)
C_{IS} = Concentration of IS (µg/L)

11.3 Molecular Weight Correction

In addition, conversion factors for the molecular weights have been listed for all analytes reported under EPA Method 8151.

The calibration is performed using the methyl ester compounds; therefore the calculation of the concentration includes a correction for the molecular weight of the methyl ester versus the acid herbicide.

Derivatized herbicides are used for the standard curve, and they are supplied as methyl esters as opposed to acid herbicide form which is used for the LCS. The difference between the acid form and the methyl ester is + 14 (i.e. In Derivatization, a $-CH_3$ group replaces the -H, (15-1 = 14)). The factors used for correction (listed in the Table below) vary for each herbicide and are applied to the standard concentration at each level of the calibration within the target processing software.

Example: 2,4-D

2,4-D MW = 221.04 2,4-D Methyl ester MW = 235.06

If you spike 10 ug of 2,4-D, and derivatized it, you end up with 10.634 ug of 2,4-D Methyl ester that you are measure, as you've stripped the -H and added a -CH3, increasing the molecular weight. The true value for the spike is 10 ug as the acid herbicide, and 10.634 ug as the methyl ester. So a spike of 10 ug of acid, would measure 10.634 ug of the methyl ester to get 100% recovery. The true value for the spike would be 10.634 as methyl ester, which you use to divide your measured value by.

If measuring recoveries, the value of the 10 ug of the methyl ester, would be 10 ug measured (as methyl ester)/10.634 ug spiked (as methyl ester) = 94.04%.

If, on the other hand you want to convert your final result using a correction factor, you would use the MW of the acid/MW of the ester (221.04/235.06 = 0.94).

Conversion Factors applied in EQ software:

Parameter	CAS No.[a]	MOL WT.	WT as methyl ester	Conversion Factor
2,4-D [1, 2, 3]	94-75-7	221.04	235.06	0.94
2,4-DB	94-82-6	326.18	340.18	0.96
2,4,5-TP (silvex) [1, 2, 3]	93-72-1	269.51	283.51	0.95
2,4,5-T [1, 2]	93-76-5	255.48	269.48	0.95
Dalapon	75-99-0	142.96	156.96	0.91
Dicamba	1918-00-9	221.04	235.04	0.94
Dichloroprop	120-36-5	235.06	249.06	0.94
Dinoseb	88-85-7	240.21	254.21	0.95
MCPA	94-74-6	200.62	214.62	0.93
MCPP	93-65-2	214.65	228.65	0.94

12. Contingencies for Handling Out-of-Control Data or Unacceptable Data

Refer to Section 10 for specific corrective actions.

13. Method Performance

13.1 Method Detection Limit Study (MDL) / Limit of Detection Study (LOD) / Limit of Quantitation (LOQ)

The laboratory follows the procedure to determine the MDL, LOD, and/or LOQ as outlined in Qualtrax Document ID 1732. These studies performed by the laboratory are maintained on file for review.

13.2 Demonstration of Capability Studies

Refer to Alpha SOP/08-12 for further information regarding IDC/DOC Generation.

13.2.1 Initial (IDC)

The analyst must make an initial, one-time, demonstration of the ability to generate acceptable accuracy and precision with this method, prior to the processing of any samples.

13.2.2 Continuing (DOC)

The analyst must make a continuing, annual, demonstration of the ability to generate acceptable accuracy and precision with this method.

14. Pollution Prevention and Waste Management

Refer to Alpha's Chemical Hygiene Plan and Waste Management and Disposal SOP for further pollution prevention and waste management information.

15. Referenced Documents

- Chemical Hygiene Plan
- Qualtrax ID 1732 MDL/LOQ Generation
- Qualtrax ID 1739 IDC/DOC Generation
- Qualtrax ID 1728 Waste Management and Disposal SOP

16. Attachments

Table 1: REPORTING LIMITS

Table 2: STANDARD SOLUTIONS

Table 3: QC ACCEPTANCE CRITERIA

Table 4: QC FAILURE ACTION PLAN

TABLE 1

REPORTING LIMITS

Herbicides	RL (Aqueous)	RL (Soil)
2,4-D	1.0 ug/L	33 ug/kg
Dalapon	1.0 ug/L	33 ug/kg
2,4-DB	1.0 ug/L	33 ug/kg
Dicamba	1.0 ug/L	33 ug/kg
Dichloroprop	1.0 ug/L	33 ug/kg
Dinoseb	1.0 ug/L	33 ug/kg
MCPA	100.0 ug/L	3300 ug/kg
MCPP	100.0 ug/L	3300 ug/kg
Silvex (2,4,5-TP)	1.0 ug/L	33 ug/kg
2,4,5-T	1.0 ug/L	33 ug/kg

TABLE 2

STANDARD SOLUTIONS

Compound	Level 6	Level 5	Level 4	Level 3	Level 2	Level 1	Std. Spike Concentration *	Std. LCS Concentration *
	(µg/mL)	(µg/mL)	(µg/mL)	(µg/mL)	(µg/mL)	(µg/mL)	(µg/mL)	(µg/mL)
2,4-D	2.0	1.0	0.5	0.2	0.1	0.05	10	10
Dalapon	2.0	1.0	0.5	0.2	0.1	0.05	10	10
2,4-DB	2.0	1.0	0.5	0.2	0.1	0.05	10	10
Dicamba	2.0	1.0	0.5	0.2	0.1	0.05	10	10
Dichloroprop	2.0	1.0	0.5	0.2	0.1	0.05	10	10
Dinoseb	2.0	1.0	0.5	0.2	0.1	0.05	10	10
MCPA	200	100	50	20	10	5	1000	1000
MCPP	200	100	50	20	10	5	1000	1000
Silvex (2,4,5-TP)	2.0	1.0	0.5	0.2	0.1	0.05	10	10
2,4,5-T	2.0	1.0	0.5	0.2	0.1	0.05	10	10
DCAA (Surrogate)	2.0	1.0	0.5	0.2	0.1	0.05	10	10

* Calculations are based on an initial aqueous sample volume of 1L, initial soil sample weight of 30g, and final extract volume of 10mL.

TABLE 3

QC ACCEPTANCE CRITERIA

	Aqueous/Soil	
Surrogate % Recovery	**Lower Control Limit**	**Upper Control Limit**
2,4-Diclorophenylacetic acid (DCAA)	30%	150%

	% Recovery		% RPD		MCP %RPD	
LCS/LCSD	**Lower Control Limit**	**Upper Control Limit**	**waters**	**soils**	**waters**	**soils**
2,4-D	40%	140%	≤ 50%	≤ 50%	≤ 20%	≤ 30%
dalapon						
2,4-DB						
dicamba						
dichloroprop						
dinoseb						
MCPA						
MCPP						
Silvex (2,4,5-TP)						
2,4,5-T						

	% Recovery		% RPD		MCP % RPD	
MS / MSD	**Lower Control Limit**	**Upper Control Limit**	**waters**	**soils**	**waters**	**soils**
2,4-D	30%	150%	< 30%	< 30%	< 20%	< 30%
dalapon						
2,4-DB						
dicamba						
dichloroprop						
dinoseb						
MCPA						
MCPP						
Silvex (2,4,5-TP)						
2,4,5-T						

TABLE 4

QC FAILURE ACTION PLAN

Blank Failures	Failure Situation	Action(s)
Surrogate Failure	1 of 2 high or low	Report as is
	Both high	Report as is
	Both low, samples are non-detect with passing surrogates	Report as is
	Both low, samples have hits and/or failing surrogates	Revial/rerun Re-extract if still failing
IS Failure	IS not present (less than 10% recovery)	Add IS Rerun
	IS out high or low	Revial/rerun Re-extract if still failing
Contamination	Below RL; sample(s) non-detect, below RL, or concentration 10 times or more above the blank	Report as is
	Below RL, sample(s) concentration above RL	See team leader/manager
	Above RL, sample(s) concentration 10 times or more above the blank	Report as is
	Above RL with non-detect sample(s)	Report as is
	Above RL, sample(s) concentration less than 10 times above the blank and volume available	Revial/rerun Re-extract if contamination still present
	Above RL, sample(s) concentration less than 10 times above the blank and no volume available	Revial/rerun B-flag affected data

LCS/LCSD Failures	Failure Situation	Action(s)
Surrogate Failure	1 of 2 high or low	Report as is
	Both high or low	Report as is
IS Failure	IS not present (less than 10% recovery)	Add IS Rerun
	IS out high or low	Revial/rerun Re-extract if still failing
Spike Failure	Spike compounds out high and sample(s) are non-detect with passing surrogates	Report as is
	Spike compounds out high and sample(s) have hits	Revial/rerun Re-extract if still high
	Spike compounds out low	Revial/rerun Re-extract if still low
	RPD failure	Report as is

MS/MSD/DUP Failures	Failure Situation	Action(s)
Surrogate Failure	(MS/MSD) 1 of 2 high or low	Report as is
	(MS/MSD) Both high or low	Report as is
	(DUP) 1 or more high, parent sample non-detect	Report as is
	(DUP) 1 of 2 low, parent sample matches	Report as is
	(DUP) 1 or more low, parent sample doesn’t match	Revial/rerun Re-extract if still failing
IS Failure	IS not present (less than 10% recovery)	Add IS Rerun
	IS out high or low	Revial/rerun Re-extract if still failing
Spike Failure (MS/MSD only)	Compounds out high or low due to sample matrix or hits	Report as is
	Compounds out high or low due to extraction error	Revial/rerun Re-extract if still failing
	RDP failure	Report as is

Mercury in Solid or Semisolid Waste
(Manual Cold-Vapor Technique)

Reference Method No.: **EPA 7471B**

Reference: SW-846, Test Methods for Evaluating Solid Waste: Physical/Chemical Methods, EPA SW-846, Update III, February 2007.

1. Scope and Application

Matrices: Method 7471 is approved for measuring total mercury (organic and inorganic) in soils, sediments, bottom deposits, and sludge-type materials. All samples must be subjected to an appropriate dissolution step prior to analysis. If this dissolution procedure is not sufficient to dissolve a specific matrix type or sample, then this method is not applicable for that matrix.

Definitions: Refer to Alpha Analytical Quality Manual.

The data report packages present the documentation of any method modification related to the samples tested. Depending upon the nature of the modification and the extent of intended use, the laboratory may be required to demonstrate that the modifications will produce equivalent results for the matrix. Approval of all method modifications is by one or more of the following laboratory personnel before performing the modification: Area Supervisor, Department Supervisor, Laboratory Director, or Quality Assurance Officer.

This method is restricted to use by or under the supervision of analysts experienced in the operation of the Mercury Analyzer and in the interpretation of Mercury data. Each analyst must demonstrate the ability to generate acceptable results with this method by performing an initial demonstration of capability..

2. Summary of Method

Prior to analysis, the solid or semi-solid samples must be prepared according to the procedures discussed in this method.

Method 7471, a cold-vapor atomic absorption method, is based on the absorption of radiation at the 253.7-nm wavelength by mercury vapor. The mercury is reduced to the elemental state and aerated from solution in a closed system. The mercury vapor passes through a cell positioned in the light path of an atomic absorption spectrophotometer. Absorbance (peak height) is measured as a function of mercury concentration.

2.1 Method Modifications from Reference

Alpha analyzes only one 0.3g aliquot of sample. The original method does not address the automated instrument procedure. A reduced volume of sample is digested in disposable digestion tubes on a hot block digestor.

3. Reporting Limits

The reporting limit for this method is 0.08mg/Kg.

4. Interferences

Potassium permanganate is added to eliminate possible interference from sulfide. Concentrations as high as 20 mg/Kg of sulfide, as sodium sulfide, do not interfere with the recovery of added inorganic mercury in reagent water.

Copper has also been reported to interfere; however, copper concentrations as high as 10 mg/Kg had no effect on recovery of mercury from spiked samples.

Samples high in chlorides require additional permanganate (as much as 25 mL) because, during the oxidation step, chlorides are converted to free chlorine, which also absorbs radiation of 253 nm. Care must therefore be taken to ensure that free chlorine is absent before the mercury is reduced and swept into the cell. This may be accomplished by using an excess of hydroxylamine sulfate reagent (25 mL).

Certain volatile organic materials that absorb at this wavelength may also cause interference. A preliminary run without reagents should determine if this type of interference is present.

5. Health and Safety

The toxicity or carcinogenicity of each reagent and standard used in this method is not fully established; however, each chemical compound should be treated as a potential health hazard. From this viewpoint, exposure to these chemicals must be reduced to the lowest possible level by whatever means available. A reference file of material safety data sheets is available to all personnel involved in the chemical analysis. Additional references to laboratory safety are available in the Chemical Hygiene Plan.

All personnel handling environmental samples known to contain or to have been in contact with municipal waste must follow safety practices for handling known disease causative agents.

Because mercury vapor is toxic, precaution must be taken to avoid its inhalation.

6. Sample Collection, Preservation, Shipping and Handling

6.1 Sample Collection

Samples may be collected in plastic or glass containers.

6.2 Sample Preservation

None.

6.3 Sample Shipping

No special shipping requirements.

6.4 Sample Handling

Samples are stored under refrigeration at 4°C and analyzed as soon as possible after collection. The samples have a 28-day holding time from the time of collection.

7. Equipment and Supplies

7.1 Instrumentation:

Perkin Elmer FIMS 100 Atomic absorption spectrophotometer: Use instrument settings recommended by the manufacturer. The PE FIMS is designed specifically for the measurement of mercury using the cold-vapor technique with BOC (background offset correction) performed by a survey scan prior to each sample introduction. PE S10 autosampler is coupled to the instrument.

Cetac M-6100 Atomic absorption spectrophotometer: Use instrument settings recommended by the manufacturer. This instrument employs a reference cell off-set correction and full automation through the CETAC software. A Cetac ASX-260 autosampler is coupled to the instrument.

Nippon Instrument model# RA-4300A analyzer with integrated 80 position autosampler:
The instrument adds a stannous chloride (II) solution to the sample post digestion, the divalent mercury ion (Hg2+) is reduced to zero-valent metallic mercury and turns into mercury gas by bubbling. Hg2++SnCl2 → Hg0 ↑
After removing the acid mist and water vapor generated by bubbling with an electronic cooling unit, the instrument measures the absorbance of mercury at 253.7 nm absorption wavelength. It measures the known mercury amount, creates a calibration curve, and then calculates the mercury amount from the absorbance.

7.2 Hot Block Digestor: Environmental Express, 54 position, capable of maintaining a temperature of 95°C +/-3°C.

7.3 Graduated cylinder. Rinse once with 50% Nitric Acid, then rinse with reagent water prior to use.

7.4 Volumetric Flasks, Class A, various volumes. Rinse once with 50% Nitric Acid, then rinse with reagent water prior to use.

7.5 Polypropylene Digestion Vessels: 50 mL volume, with plastic screw caps

7.6 Pump Tubing: Environmental Express, three stop and two stop tubing in various IDs.

7.7 PTFE membranes: Pall TF1000 disks

7.8 Dilution vials: 20mL capacity, used when making analytical dilutions.

7.9 Laboratory Wipes

7.10 Compressed Air

7.11 Whatman 41 or equivalent filter paper

7.12 Eppendorf pipets: Accurate means to make trace standards

8. Reagents and Standards

8.1 Reagent Water: Reagent water is DI water shown to be interference free. All references to water in this method refer to reagent water unless otherwise specified.

8.2 Aqua regia: Prepare immediately before use by carefully adding three volumes of concentrated HCl to one volume of concentrated HNO_3.

8.3 Concentrated Nitric Acid, (HNO_3): Trace grade. Store at room temperature in the appropriately marked acid cabinet.

8.4 Concentrated Hydrochloric Acid, (HCl): Trace grade. Store at room temperature in the appropriately marked acid cabinet.

8.5 Reductant, Stannous Chloride in 3% HCl: This is the ***reductant*** for the Instrument. In a 1L volumetric flask, add 30mL concentrated trace grade HCl and 11g $SnCl_2 \cdot 2H_20$. Mix to dissolve the solid and bring to volume with reagent water. Store at room temperature, prepare as needed.

8.6 Carrier, Hydrochloric Acid, 3%: This is the ***carrier*** for the instrument. In a 1L volumetric flask, add 30mL concentrated trace grade HCl (Section 8.4). Bring to volume with reagent water. Store at room temperature, prepare as needed.

8.7 Potassium permanganate, mercury-free, 5% solution (w/v): Dissolve 5 g of potassium permanganate in 100 mL of reagent water. Store at room temperature.

8.8 Sodium chloride-hydroxylamine hydrochloride solution: Dissolve 12 g of sodium chloride and 12 g of hydroxylamine hydrochloride in reagent water and dilute to 100 mL. Store at room temperature.

8.9 Mercury stock solution, 1000ppm: This solution is purchased commercially prepared with a certificate of analysis. Three solutions are purchased, each from a different source. Store at room temperature. Expires according to manufacturer's specifications.

8.9.1 10ppm Mercury Stock Standard: To a 100mL volumetric flask, add 5mL of concentrated HNO_3 and 1.0mL of 1000ppm Mercury Stock Solution (Section 8.9). Bring to volume with reagent water. Store at room temperature. Expires one month from date of preparation.

8.9.1.1 0.1ppm Mercury Working Stock / Matrix Spike Solution: To a 500mL volumetric flask, add 5mL of concentrated HNO_3 and 5 mL of 10ppm Mercury Stock Standard (Section 8.9.1). Bring to volume with reagent water. Store at room temperature. Expires one week from date of preparation.

8.9.2 10ppm Mercury ICV Stock Standard: To a 100mL volumetric flask, add 5mL of concentrated HNO_3 and 1.0mL of Mercury Stock Solution (Section 8.9, from an alternate source than that used in Section 8.9.1). Bring to volume with reagent water. Store at room temperature. Expires one month from date of preparation.

8.9.2.1 0.3ppm Mercury ICV Working Stock: To a 100mL volumetric flask, add 5mL of concentrated HNO_3 and 3.0mL of 10ppm Hg ICV Stock Standard (Section 8.9.2). Bring to volume with reagent water. Store at room temperature. Expires one week from date of preparation.

8.9.3 10ppm Mercury LCS Stock Standard: To a 100mL volumetric flask, add 5mL of concentrated HNO_3 and 1.0mL of 1000ppm Mercury Stock Solution (Section 8.9, from an alternate source than that used in Sections 8.9.1 and 8.9.2). Bring to volume with reagent water. Store at room temperature. Expires one month from date of preparation.

8.9.3.1 0.1ppm Mercury LCS Working Stock: To a 100mL volumetric flask, add 5mL of concentrated HNO_3 and 1.0mL of 10ppm Mercury LCS Stock Standard (Section

8.9.3). Bring to volume with reagent water. Store at room temperature. Expires one week from date of preparation.

8.10 SRM: Purchased from ERA in 300-500g lots.

9. Quality Control and Data Assessment

The laboratory must maintain records to document the quality of data that is generated. Ongoing data quality checks are compared with established performance criteria to determine if the results of analyses meet the performance characteristics of the method.

9.1 Blank(s)

The Method Blank consists of the 0ppm standard as prepared in Section 10.1.2.1.1. Analyze one Method Blank per analytical batch of twenty samples or less. The Method Blank must be less than the Reporting Limit (RL). See Section 12.1 for corrective action.

9.1.1 PBS

A preparation blank is analyzed once per batch of twenty samples or less. It is prepared in the same manner as the 0ppm standard (Section 10.1.2.1.1). The PBS must be recovered within ± 0.2 µg/L.

9.1.2 ICB

The ICB is analyzed after the ICV, and is prepared in the same manner as the 0ppm standard (Section 10.1.2.1.1). The ICB must be recovered within ± 0.2 µg/L.

9.1.3 CCB

The CCB is analyzed after the CCV. It is prepared in the same manner as the 0ppm standard (Section 10.1.2.1.1). The CCB must be recovered within ± 0.2 µg/L.

9.2 Laboratory Control Sample (LCS)

The LCS is analyzed once per each analytical batch of twenty samples or less. It is prepared in the same manner as in Section 10.1.2.3. The LCS must be recovered within 80 – 120% of the true value. See Section 12.3 for corrective action.

9.3 Initial Calibration Verification (ICV)

The ICV is analyzed after the calibration curve. It is prepared in the manner specified in Section 10.1.2.2. The ICV must be recovered within ± 10% of the true value. See Section 12.2 for corrective action.

9.4 Continuing Calibration Verification (CCV)

The CCV is analyzed after every ten analytical samples. It is prepared in the same manner as the 5.0ppb calibration standard (Section 10.1.2.1.5). The CCV must be recovered within 20% of the true value. See Section 12.2 for corrective action.

9.5 Matrix Spike

Analyze one matrix spike per twenty or less analytical samples. The recovery of the matrix spike must be between 80 – 120%. Calculate percent recovery using Section 11.2.

If the recovery of the matrix spike is out of range, a post-analytical spike is analyzed. Prepare the post analytical spike by adding 1.25mL of 0.020ppm Calibration Standard

(Section 10.1.2.1.6) and 1.25mL of the sample digestate to a 15mL centrifuge tube for a final concentration of 0.0105mg/L. Analyze the post spike as outlined in Section 10.3.

Calculate the post spike concentration as follows:

Post Analytical Spike Sample Concentration (mg/L) =

[Sample Concentration (mg/L) x (0.5)] + 0.010mg/L

The percent recovery of the post-analytical spike must be between 75 – 125%.

See Section 12.4 for corrective action.

9.6 Laboratory Duplicate

Analyze one sample in duplicate per twenty or less analytical samples. The RPD between the sample and its duplicate must be $\leq$ 20% (as calculated in Section 11.3). See Section 12.5 for corrective action.

9.7 Method-specific Quality Control Samples

None

9.8 Method Sequence

- Sample preparation
- Sample digestion
- Standards preparation:
  - Calibration standards
  - ICV standard
  - LCS standard
- Standards digestion
- Analysis of calibration standards
- Generation of calibration curve
- Analysis of samples and standards:
  - ICV
  - ICB
  - analytical samples
  - CCV
  - CCB
  - analytical samples
  - CCV
  - CCB
  - etc.

10. Procedure

10.1 Equipment Set-Up

10.1.1 Sample preparation: Weigh a 0.3-g portion of untreated and homogenized sample and place in the bottom of a polypropylene digestion vessel. Record the weight in the laboratory notebook. NOTE: When preparing the batch, include one sample duplicate aliquot to be prepared in the same manner.

Add 2.5 mL of reagent water and 2.5 mL of aqua regia (Section 8.2). Heat 2 min on a hot block at 95°C +/-3°C. Cool; then add 15 mL reagent water, and 7.5 mL potassium permanganate solution (Section 8.7) to the digestion vessel. Wait 15 minutes to be sure the potassium permanganate is not exhausted (purple color disappears), if it does add additional potassium permanganate to all samples and QC until stable. Mix thoroughly and place in the hot block for 30 min at 95°C +/-3°C. Cool and add 3 mL of sodium chloride-hydroxylamine hydrochloride (Section 8.8) to reduce the excess permanganate.

CAUTION: Perform this addition under a hood, as Cl_2 could be evolved.

Bring up to a final volume of 50 mL with reagent water. Continue as described under Section 10.3.1.

10.1.2 Standard preparation: Standard preparation is performed each time samples are digested.

10.1.2.1 Calibration Standards

10.1.2.1.1 0 ppb: Add 10mL of reagent water to a polypropylene digestion vessel. This aliquot may be used for the CCB. Another separate aliquot is prepared for use as the ICB and the diluent for any samples with concentration greater than 90% the highest calibration standard used to determine the linear range.

10.1.2.1.2 0.5ppb: Add 10 mL of reagent water to a polypropylene digestion vessel. Using a volumetric pipet, add 0.25 mL of 0.1ppm Mercury Working Stock (Section 8.9.1.1) to the digestion vesel.

10.1.2.1.3 1.0ppb: Add 10 mL of reagent water to a polypropylene digestion vessel.. Using a volumetric pipet, add 0.5 mL of 0.1ppm Mercury Working Stock (Section 8.9.1.1) to the digestion vessel.

10.1.2.1.4 2.0ppb: Add 10 mL of reagent water to a polypropylene digestion vessel.. Using a volumetric pipet, add 1.0mL of 0.1ppm Mercury Working Stock (Section 8.9.1.1) to the digestion vessel.

10.1.2.1.5 5.0ppb/CCV: Add 10 mL of reagent water to a polypropylene digestion vessel.. Using a volumetric pipet, add 2.5 mL of 0.1ppm Mercury Working Stock (Section 8.9.1.1) to the digestion vessel.

10.1.2.1.6 10ppb: Add 10 mL of reagent water to a polypropylene digestion vessel.Using a volumetric pipet, add 5.0 mL of 0.1ppm Mercury Working Stock (Section 8.9.1.1) to the digestion vessel.

10.1.2.1.7 20ppb: Add 10 mL of reagent water to a polypropylene digestion vessel.Using a volumetric pipet, add 10.0 mL of 0.1ppm Mercury Working Stock (Section 8.9.1.1) to the digestion vessel.

10.1.2.2 ICV Standard, 3.0ppb: This standard is used for calibration verification.

Add 10.0 mL of reagent water to a digestion vessel. Using a volumetric pipet, add 0.5 mL of 0.3ppm Mercury Working Stock (Section 8.9.2.1) to the digestion vessel. Digest the ICV Standard as in Section 10.1.3.

10.1.2.3 LCS Standard, 1.0ppb: This standard is prepared and analyzed with each analytical batch.

Add 5.0mL of reagent water to a digestion vessel. Add 0.15g of SRM (Section 8.10). Digest the LCS Standard as in Section 10.1.3.

10.1.2.4 Matrix Spike, 0.001mg/L: Weigh two aliquots of the sample designated to be the batch matrix spike.

Add 10.0 mL of the reagent water to the digestion vessel containing the weighed sample aliquot. Add a 5 mL aliquot of 0.1ppm Mercury LCS Working Stock (Section 8.9.3.1). Digest the MS as in Section 10.1.3.

10.1.3 Standard Digestion:

To each standard (Sections 10.1.2.1 through 10.1.2.3), add 2.5 mL of reagent water and 2.5 mL of aqua regia (Section 8.2) and heat 2 min on the hot block at 95°C +/- 3°C. Allow the standard to cool; add 15 mL reagent water and 7.5 mL of $KMnO_4$ solution (Section 8.7) to each bottle and return to the hot block for 30 min. Cool and add 3 mL of sodium chloride-hydroxylamine hydrochloride solution (Section 8.8) to reduce the excess permanganate. Bring up to final volume of 50 mL with reagent water, continue as described in Section 10.3.3.

Note: Alternate volumes of standards may be made base on need as long as they are made with the same proportions as describe above.

10.2 Initial Calibration

Construct a calibration curve by plotting the absorbances of prepared standards (Section 10.1.2) versus micrograms of mercury. (See Section 11.1.) Determine the peak height of the unknown from the absorbance maxima on the spectrometer, and read the mercury value from the standard curve.

The curve correlation coefficient (cc) must be greater than or equal to 0.995 in order for the curve to be linear. If the correlation coefficient is less than 0.995, find and correct the problem. When the problem has been corrected, re-analyze either the previous standards or new standards. When the curve has generated an acceptable cc, then the analysis can continue with the ICV/ICB.

Analyze an Initial Calibration Verification Standard (ICV) (Section 9.3), an Initial Calibration Blank sample (ICB) (Section 9.1.2) at the start of the analytical run. The results for the ICV must be within 10% of the true value. If results are outside this range, refer to Section 12.2 for corrective action.

10.3 Equipment Operation and Sample Processing

10.3.1 Instrument Setup

10.3.1.1 Turn the instrument on. The autosampler will initialize itself.

10.3.1.2 Choose the instrument software from the desktop menu. The autosampler will initialize again.

FIMS 100 NOTE: The instrument must be turned on before the application is started. Otherwise, an error message will result.

10.3.1.3 Enter the appropriate fields for sample identification, and data storage.

10.3.1.4 Fill the carrier and reductant bottles.

10.3.1.4.1 The Carrier is 3% HCl (Section 8.6).

10.3.1.4.2 The Reductant is 1.1% $SnCl_2$ in 3% HCl (Section 8.5).

10.3.1.5 Allow the instrument to warm up while clearing samples. Samples that are cloudy or with particulate present after clearing must be filtered through Whatman 41 filter paper (Section 7.11) before analysis.

10.3.1.6 Place carrier uptake line and reductant uptake line.

10.3.1.7 Load carrier and reductant lines into pump magazines

10.3.1.8 Load the two waste lines into the pump magazines below the roller.

10.3.1.9 Lock the magazines into place.

FIMS100 only:

10.3.1.10 Remove the cap from the liquid/vapor separator and wipe dry with a Lab Wipe (Section 7.9). Compressed air (Section 7.10) through the vapor transfer line to dry it out.

10.3.1.11 Place a PTFE membrane (Section 7.7), rough side up, in the liquid/vapor separator; replace the cap and reattach the vapor transfer line to the sample absorption cell.

10.3.1.12 Adjust the gas flow by turning the black knob below the air flow meter to obtain a reading of just over 50.

10.3.2 Calibration and Sample Analysis

10.3.2.1 The instrument will now run the calibration standards; verify a CC of 0.995 or better before proceeding with the ICV and ICB. Ten analytical samples, a CCV and CCB, ten analytical samples, CCV, CCB, etc. The CCBs and CCVs must be recovered within the proper ranges (Sections 9.4 and 9.1.3) for analysis to continue.

10.3.2.2 If the sample result is beyond 90% of the concentration of the highest point on the calibration curve or LDR study used to establish the linear range, dilute the sample extract with a portion of one of the prepared blanks (ICB, CCB or PBS) to produce an analytical result that is within the range.

10.3.3 Instrument Shut Down

10.3.3.1 When analysis is complete place reagent uptake lines in a beaker of DI water.

10.3.3.1.1 Continue to run the pumps for several minutes to flush reagents out of the lines.

10.3.3.1.2 Continue to run the pumps for several more minutes to flush the lines thoroughly with DI water.

10.3.3.2 Pull the reagent uptake lines out of the DI water beaker to allow the pump to draw air completely through the lines.

10.3.3.3 Unlock the top and bottom pump magazines and remove tubing from the magazines.

10.3.3.4 Exit from the software application.

Note: This procedure must be followed every time the instrument is shut down to prevent water or reagents from being draw back into the instrument which can cause severe damage.

10.3.3.4.1 Dump the samples and instrument waste in the Metals/WetChem waste drum located in the transfer room only after all data has been processed through final review and package generation.

10.4 Continuing Calibration

After every 10 samples, analyze a Continuing Calibration Verification Standard (CCV), and a Continuing Calibration Blank sample (CCB). Determine the concentrations from the calibration curve. The results for the CCV must be within 20% of the true value.

10.5 Preventive Maintenance

Preventative maintenance is conducted per the manufacturer's instructions. All preventative maintenance is recorded in the Instrument Maintenance Logbook.

11. Data Evaluation, Calculations and Reporting

11.1 Calculate Mercury Concentration From the Daily Calibration Curve

The curve is generated utilizing a straight-line equation defined as:

$$A = k_1 + k_2C$$

Where:

A = Average peak height of the sample/standard integrations
C = Sample/Standard Concentration, µg/L
k_1 = y-intercept
k2 = slope

The instrument will plot peak height against concentration (µg/L). The result is generated in µg/L. This value is divided by 1000 to convert the units to mg/L. The mg/L units are converted to mg/Kg by multiplying by L/Kg. A dilution factor (DF) is applied if necessary. The Result is then divided by the % Total Solids prior to release to the client.

$$\text{Result, mg/Kg} = (\text{concentration, µg/L}) \times (1\text{mg}/1000\text{µg}) \times (\text{DF}) \times (\text{L/Kg})$$

Where:

$$\text{L/Kg} = \frac{\text{Final volume of digestate, in L}}{\text{Weight of original sample, in Kg}}$$

11.2 Calculate Percent Recovery for the Matrix Spike corrected for concentrations measured in the unfortified sample. Percent recovery is calculated using the following equation:

$$\%\ \text{Recovery} = \frac{(Cm - C)}{s} \times 100$$

Where:

Cm = measured Mercury in the fortified sample
C = measured native mercury sample concentration
S = concentration equivalent of spike added to sample

11.3 Calculate the Relative Percent Difference (RPD) for each Duplicate of the initial quantitated concentration (IC) and duplicate quantitated concentration (Dc) using the following formula:

$$RPD = \frac{|(IC - Dc)|}{\{(IC + Dc) / 2\}} \quad x \quad 100$$

12. Contingencies for Handling Out-of-Control Data or Unacceptable Data

12.1 Method Blank Failure

When a prep blank mercury concentration is $\geq$10% of the mercury concentration determined for any associated sample, or is greater than 2.2x the MDL value (whichever is greater), the entire batch associated with the prep blank must be redigested.

12.2 ICV / CCV Failure

If the ICV %Recovery is outside of acceptance criteria, analysis is terminated until the problem is found and corrected. If the CCV %Recovery is outside of acceptance criteria, all samples analyzed since the last acceptable CCV must be reanalyzed following correction of the problem.

12.3 LCS Failure

If the LCS is not recovered within acceptance criteria, the associated batch and another LCS must be redigested (Section 10.1).

12.4 Matrix Spike/Post Digestion Spike Failure

If the recovery of the matrix spike is outside of the acceptance criteria of 80 – 120%, a post digestion spike is performed (Section 9.5). If the post digestion spike is beyond 75 – 125%, the sample and its spike are redigested (Section 10.1).

12.5 Duplicate Failure

If the RPD between the sample and its duplicate is greater than 20%, visually evaluate the sample matrix. If the sample matrix appears clean, the sample and its duplicate are removed from the batch and redigested (Section 10.1). If the matrix appears problematic, the sample digestate may be diluted and reanalyzed, or a narrative included with the data to explain the matrix problem.

13. Method Performance

13.1 Method Detection Limit Study (MDL) / Limit of Detection Study (LOD) / Limit of Quantitation (LOQ)

The laboratory follows the procedure to determine the MDL, LOD, and/or LOQ as outlined in Alpha SOP 1732. These studies performed by the laboratory are maintained on file for review.

13.2 Demonstration of Capability Studies

Refer to Alpha SOP 1739 for further information regarding IDC/DOC Generation.

13.2.1 Initial (IDC)

The analyst must make an initial, one-time, demonstration of the ability to generate acceptable accuracy and precision with this method, prior to the processing of any samples.

13.2.2 Continuing (DOC)

The analyst must make a continuing, annual, demonstration of the ability to generate acceptable accuracy and precision with this method.

14. Pollution Prevention and Waste Management

Refer to Alpha's Chemical Hygiene Plan and Waste Management and Disposal SOP for further pollution prevention and waste management information.

15. Referenced Documents

Chemical Hygiene Plan

SOP/1732 DL/LOD/LOQ Generation

SOP/1739 IDC/DOC Generation

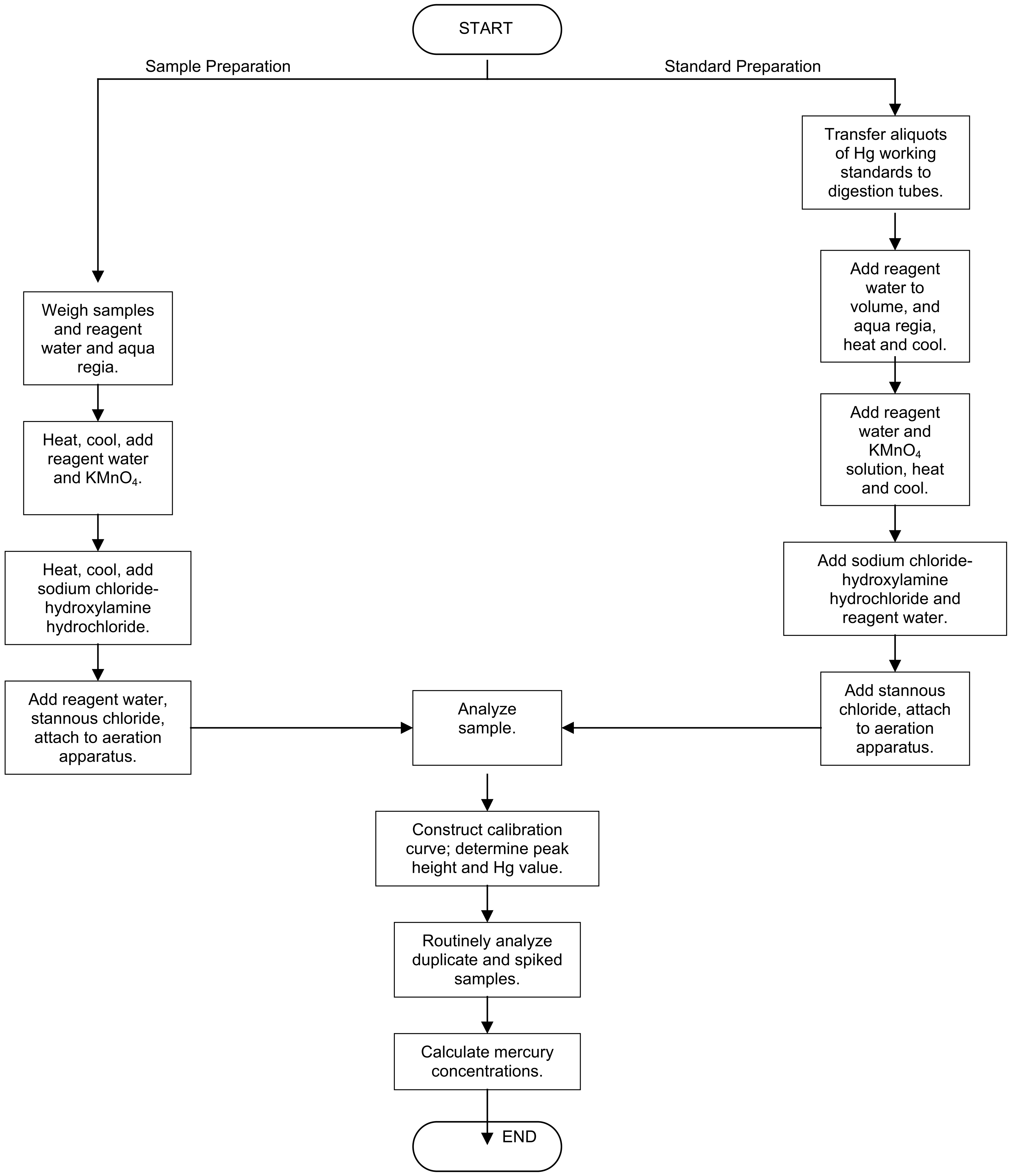
SOP/1797 Waste Management and Disposal SOP

16. Attachments

FIGURE 1: Flow Chart for Method 7471B

Figure 1

Method 7471B Flow Chart



Inductively Coupled Plasma - Atomic Emission Spectrometry

Reference Method No.: **Method 6010D** SW-846, Test Methods for Evaluating Solid Waste: Physical/Chemical Methods, EPA SW-846, Update V, July, 2014.

SM 2340B, Hardness by Calculation, Standard Methods for the Examination of Water and Wastewater, APHA-AWWA-WPCF, 21st Edition, 1997.

1. Scope and Application

Matrices: Digestates from all matrices.

Definitions: See Alpha Laboratories Quality Manual Appendix A

Inductively coupled plasma-atomic emission spectrometry (ICP-AES) determines trace elements, including metals, in solution. The method is applicable to all of the elements listed in Table 1. All matrices, excluding filtered groundwater samples but including ground water, aqueous samples, TCLP and EP extracts, industrial and organic wastes, soils, sludge, sediments, and other solid wastes, require digestion prior to analysis. Groundwater samples that have been prefiltered and acidified will not need acid digestion unless chemical interferences are suspected. Samples which are not digested are matrix matched with the standards. Refer to Metals Preparation SOPs for the appropriate digestion procedures.

Table 1 lists the elements for which this method is applicable. Detection limits, sensitivity, and the optimum and linear concentration ranges of the elements can vary with the wavelength, spectrometer, matrix and operating conditions. Table 1 lists the recommended analytical wavelengths for the elements in clean aqueous matrices. Table 3 lists the Reported Detection Limits. The reported detection limit data may be used to estimate instrument and method performance for other sample matrices. Elements other than those listed in Table 1 may be analyzed by this method if performance at the concentration levels of interest (see Section 9) is demonstrated.

Users of the method should state the data quality objectives prior to analysis and must document and have on file the required initial demonstration performance data described in the following sections prior to using the method for analysis.

The data report packages present the documentation of any method modification related to the samples tested. Depending upon the nature of the modification and the extent of intended use, the laboratory may be required to demonstrate that the modifications will produce equivalent results for the matrix. Approval of all method modifications is made by one of the following laboratory personnel before performing the modification: Area Supervisor, Metals Manager, Laboratory Services Manager, Laboratory Director, or Quality Assurance Officer.

Use of this method is restricted to spectroscopists who are knowledgeable in the correction of spectral, chemical, and physical interferences described in this method. Each analyst must demonstrate the ability to generate acceptable results with this method by performing an initial demonstration of capability.

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2. Summary of Method

Prior to analysis, samples must be solubilized or digested using appropriate Sample Preparation Methods. When analyzing groundwater samples for dissolved constituents, acid digestion is not necessary if the samples are filtered and acid preserved prior to analysis.

This method describes multielemental determinations by ICP-AES using sequential or simultaneous optical systems and axial or radial viewing of the plasma. The instrument measures characteristic emission spectra by optical spectrometry. Samples are nebulized and the resulting aerosol is transported to the plasma torch. Element-specific emission spectra are produced by a radio-frequency inductively coupled plasma. The spectra are dispersed by a grating spectrometer, and the intensities of the emission lines are monitored by photosensitive devices. Background correction is required for trace element determination. Background must be measured adjacent to analyte lines on samples during analysis. The position selected for the background-intensity measurement, on either or both sides of the analytical line, will be determined by the complexity of the spectrum adjacent to the analyte line. In one mode of analysis the position used must be as free as possible from spectral interference and must reflect the same change in background intensity as occurs at the analyte wavelength measured. Background correction is not required in cases of line broadening where a background correction measurement would actually degrade the analytical result. The possibility of additional interferences named in Section 4.0 must also be recognized and appropriate corrections made; tests for their presence are described in Section 9.7. Alternatively, users may choose multivariate calibration methods. In this case, point selections for background correction are superfluous since whole spectral regions are processed.

This SOP includes the manual calculations for Total Hardness and Calcium Hardness, according to SM 2340B.

2.1 Method Modifications from Reference

None.

3. Reporting Limits

Refer to Table 3 for method Reporting Limits.

4. Interferences

4.1 Spectral

Spectral interferences are caused by background emission from continuous or recombination phenomena, stray light from the line emission of high concentration elements, overlap of a spectral line from another element, or unresolved overlap of molecular band spectra.

4.1.1 Background emission and stray light can usually be compensated for by subtracting the background emission determined by measurements adjacent to the analyte wavelength peak. Spectral scans of samples or single element solutions in the analyte regions may indicate when alternate wavelengths are desirable because of severe spectral interference. These scans will also show whether the most appropriate estimate of the background emission is provided by an interpolation from measurements on both sides of the wavelength peak or by measured emission on only one side. The locations selected for the measurement of background intensity will be determined by the complexity of the spectrum adjacent to the wavelength peak. The locations used for routine measurement must be free of off-line spectral interference (interelement or molecular) or adequately corrected to reflect the same change in background intensity as occurs at the wavelength peak. For multivariate methods using whole spectral regions, background scans must be included in the correction algorithm. Off-line spectral interferences are handled by including spectra on interfering species in the algorithm.

4.1.2 To determine the appropriate location for off-line background correction, the user must scan the area on either side adjacent to the wavelength and record the apparent emission intensity from all other method analytes. This spectral information must be documented and kept on file. The location selected for background correction must be either free of off-line interelement spectral interference or a computer routine must be used for automatic correction on all determinations. If a wavelength other than the recommended wavelength is used, the analyst must determine and document both the overlapping and nearby spectral interference effects from all method analytes and common elements and provide for their automatic correction on all analyses. Tests to determine spectral interference must be done using analyte concentrations that will adequately describe the interference. Normally, 100 mg/L single element solutions are sufficient; however, for analytes such as iron that may be found at high concentration, a more appropriate test would be to use a concentration near the upper analytical range limit.

4.1.3 Spectral overlaps may be avoided by using an alternate wavelength or can be compensated by equations that correct for interelement contributions. Instruments that use equations for interelement correction require the interfering elements be analyzed at the same time as the element of interest. When operative and uncorrected, interferences will produce false positive determinations and be reported as analyte concentrations. More extensive information on interferant effects at various wavelengths and resolutions is available in reference wavelength tables and books. Users may apply interelement correction equations determined on their instruments with tested concentration ranges to compensate (off line or on line) for the effects of interfering elements. For multivariate methods using whole spectral regions, spectral interferences are handled by including spectra of the interfering elements in the algorithm. The interferences listed are only those that occur between method analytes. Only interferences of a direct overlap nature are listed. These overlaps were observed with a single instrument having a working resolution of 0.035 nm.

4.1.4 When using inter-element correction equations, the interference may be expressed as analyte concentration equivalents (i.e. false analyte concentrations) arising from 100 mg/L of the interference element. For example, assume that As is to be determined (at 193.696 nm) in a sample containing approximately 10 mg/L of Al. 100 mg/L of Al would yield a false signal for As equivalent to approximately 1.3 mg/L. Therefore, the presence of 10 mg/L of Al would result in a false signal for As equivalent to approximately 0.13 mg/L. The user is cautioned that each instrument may exhibit somewhat different levels of interference. The interference effects must be evaluated for each individual instrument since the intensities will vary.

Major known interferences are Fe, Al, Ca, Mg, V, Ni, Cu, and Cr. To minimize any of these interferences, every analyte is analyzed on each instrument at or near its linear range and corrected for these interferences. This is done on an annual basis, and data is kept on file.

4.1.5 Inter-element corrections will vary for the same emission line among instruments because of differences in resolution, as determined by the grating, the entrance and exit slit widths, and by the order of dispersion. Inter-element corrections will also vary depending upon the choice of background correction points. Selecting a background correction point where an interfering emission line may appear must be avoided when practical. Inter-element corrections that constitute a major portion of an emission signal may not yield accurate data. Users must not forget that some samples may contain uncommon elements that could contribute spectral interferences.

4.1.6 The interference effects must be evaluated for each individual instrument whether configured as a sequential or simultaneous instrument. For each instrument, intensities will vary not only with optical resolution but also with operating conditions (such as power, viewing height and argon flow rate). When using the recommended wavelengths, the analyst is required to determine and document for each wavelength the effect from referenced interferences as well as any other suspected interferences that may be specific to the instrument or matrix. The analyst is encouraged to utilize a computer routine for automatic correction on all analyses.

4.1.7 The primary wavelength for each analyte is based upon the instrument manufacturer's recommendations. An alternate wavelength is chosen if there is an indication of elevated background or overlap of another spectral wavelength. The wavelength for each analyte must be as free from interferences as possible.

4.1.8 If the correction routine is operating properly, the determined apparent analyte(s) concentration from analysis of each interference solution must fall within a specific concentration range around the calibration blank. The concentration range is calculated by multiplying the concentration of the interfering element by the value of the correction factor being tested and divided by 10. If after the subtraction of the calibration blank the apparent analyte concentration falls outside of this range in either a positive or negative direction, a change in the correction factor of more than 10% should be suspected. The cause of the change must be determined and corrected and the correction factor updated. The interference check solutions must be analyzed more than once to confirm a change has occurred. Adequate rinse time between solutions and before analysis of the calibration blank will assist in the confirmation.

4.1.9 When inter-element corrections are applied, their accuracy must be verified, daily, by analyzing the spectral interference check solution. The correction factor or multivariate correction matrices tested on a daily basis. All inter-element spectral correction factors or multivariate correction matrices are verified and updated when an instrumentation change, such as in the torch, nebulizer, injector, or plasma conditions occurs. The standard solution must be inspected to ensure that there is no contamination that may be perceived as a spectral interference.

4.1.10 When inter-element corrections are <u>not</u> used, verification of absence of interferences is required.

4.1.10.1 One method is to use a computer software routine for comparing the determinative data to limits, files for notifying the analyst when an interfering element is detected in the sample at a concentration that will produce either an apparent false positive concentration, (i.e., greater than) the analyte instrument detection limit, or false negative analyte concentration, (i.e., less than the lower control limit of the calibration blank defined for a 99% confidence interval).

4.1.10.2 Another method is to analyze an Interference Check Solution(s) which contains similar concentrations of the major components of the samples (>10 mg/L) on a continuing basis to verify the absence of effects at the wavelengths selected. These data must be kept on file with the sample analysis data. If the check solution confirms an operative interference that is >20% of the analyte concentration, the analyte must be determined using (1) analytical and background correction wavelengths (or spectral regions) free of the interference, (2) by an alternative wavelength, or (3) by another documented test procedure.

4.2 Physical

Physical interferences are effects associated with the sample nebulization and transport processes. Changes in viscosity and surface tension can cause significant inaccuracies, especially in samples containing high dissolved solids or high acid concentrations. If physical interferences are present, they must be reduced by diluting the sample, using a peristaltic pump, use of an internal standard or by using a high solids nebulizer. Another problem that can occur with high dissolved solids is salt buildup at the tip of the nebulizer, affecting aerosol flow rate and causing instrumental drift. The problem can be controlled by wetting the argon prior to nebulization, using a tip washer, using a high solids nebulizer or diluting the sample. Also, it has been reported that better control of the argon flow rate, especially to the nebulizer, improves instrument performance: this may be accomplished with the use of mass flow controllers. The test described in Section 10.3.4.1 will help determine if a physical interference is present.

4.3 Chemical

Chemical interferences include molecular compound formation, ionization effects, and solute vaporization effects. Normally, these effects are not significant with the ICP technique, but if observed, can be minimized by careful selection of operating conditions (incident power, observation position, and so forth), by buffering of the sample, by matrix matching, and by standard addition procedures. Additionally, if filtered samples are found to have an organic or sulfur like odor they are processed by heating after the addition of the acids to matrix match. Chemical interferences are highly dependent on matrix type and the specific analyte element.

4.4 Memory

Memory interferences result when analytes in a previous sample contribute to the signals measured in a new sample. Memory effects can result from sample deposition on the uptake tubing to the nebulizer and from the build-up of sample material in the plasma torch and spray chamber. The site where these effects occur is dependent on the element and can be minimized by flushing the system with a rinse blank between samples. The possibility of memory interferences must be recognized within an analytical run and suitable rinse times must be used to reduce them. The rinse times necessary for a particular element must be estimated prior to analysis. This may be achieved by aspirating a standard containing elements at a concentration ten times the usual amount or at the top of the linear dynamic range. The aspiration time for this sample must be the same as a normal sample analysis period, followed by analysis of the rinse blank at designated intervals. The length of time required to reduce analyte signals to within a factor of two of the method detection limit must be noted. Until the required rinse time is established, this method suggests a rinse period of at least 60 seconds between samples and standards. If memory interference is suspected, the sample must be reanalyzed after a rinse period of sufficient length. Alternate rinse times may be established by the analyst based upon their DQOs.

4.5 Other Interferences

4.5.1 Users are advised that high salt concentrations can cause analyte signal suppressions and confuse interference tests. If the instrument does not display negative values, fortify the interference check solution with the elements of interest at 0.5 to 1 mg/L and measure the added standard concentration accordingly. Concentrations must be within 20% of the true spiked concentration or dilution of the samples will be necessary. In the absence of measurable analyte, overcorrection could go undetected if a negative value is reported as zero.

5. Health and Safety

The toxicity or carcinogenicity of each reagent and standard used in this method is not fully established; however, each chemical compound must be treated as a potential health hazard. From this viewpoint, exposure to these chemicals must be reduced to the lowest possible level by whatever means available. A reference file of material data handling sheets is available to all personnel involved in the chemical analysis. Additional references to laboratory safety are available in the Chemical Hygiene Plan.

All personnel handling environmental samples known to contain or to have been in contact with municipal waste must follow safety practices for handling known disease causative agents.

6. Sample Collection, Preservation, Shipping and Handling

6.1 Sample Collection

Samples are collected in plastic bottles.

6.2 Sample Preservation

If samples are for soluble metals analysis, filtration must take place prior to preservation with 1:1 HNO_3 to a pH < 2. Soluble samples must be held at pH < 2 for at least 24 hours prior to digestion if not preserved at the time of filtration. Samples for total metals analysis are preserved with 1:1 HNO_3 to a pH < 2. Samples must be pH <2 for at least 24 hours prior to digestion if not preserved at the time of collection.

6.3 Sample Shipping

No special shipping requirements.

6.4 Sample Handling

Samples to be analyzed for soluble metals, that have not been filtered, must be filtered and preserved within 24 hours of sample collection.

Preserved samples have a hold time of 6 months, and are stored at ambient temperature.

7. Equipment and Supplies

7.1 Inductively coupled argon plasma emission spectrometer:

- **Thermo Scientific ICAP Duo 6500 (Trace7)**

7.1.1 Computer-controlled emission spectrometer with background correction.

7.1.2 Radio-frequency generator compliant with FCC regulations.

7.1.3 Optional mass flow controller for argon nebulizer gas supply.

7.1.4 Optional peristaltic pump.

7.1.5 Optional Autosampler.

7.1.6 Argon gas supply - high purity.

7.2 Volumetric flasks of suitable precision and accuracy.

7.3 Volumetric pipets of suitable precision and accuracy.

8. Standards and Reagents

Reagent semiconductor and/or trace grade chemicals shall be used in all tests. Unless otherwise indicated, it is intended that all reagents shall conform to the specifications of the Committee on Analytical Reagents of the American Chemical Society, where such specifications are available. Other grades may be used, provided it is first ascertained that the reagent is of sufficiently high purity to permit its use without lessening the accuracy of the determination. If the purity of a reagent is in question, analyze for contamination. If the concentration of the contamination is less than the MDL then the reagent is acceptable.

8.1 Hydrochloric acid (conc), HCl. Stored at room temperature in acid resistant cabinet. Expiration date if defined by vendor.

8.2 Hydrochloric acid (1:1), HCl. Add 500 mL concentrated HCl to 400 mL DI water and dilute to 1 liter in an appropriately sized beaker. Stored at room temperature in polypropylene bottle, expiration date if defined by vendor..

8.3 Nitric acid (conc), HNO_3. Stored at room temperature in acid resistant cabinet. Expiration date if defined by vendor.

8.4 Nitric acid (1:1), HNO_3. Add 500 mL concentrated HNO_3 to 400 mL DI water and dilute to 1 liter in an appropriately sized beaker. Stored at room temperature in polypropylene bottle, expiration date if defined by vendor..

8.5 Reagent Water. All references to water in the method refer to reagent water unless otherwise specified. Reagent water will be interference free. Refer to Chapter One for a definition of reagent water.

8.6 Standard stock solutions may be purchased or prepared from ultra- high purity grade chemicals or metals (99.99% pure or greater). All stock standards are ordered through ISO and American Association for Lab Accreditation vendors. All standards are in aqueous solutions and are generally at concentrations of 1000ppm and 10,000ppm.

8.7 Mixed calibration standard solutions

Prepare mixed calibration standard solutions by combining appropriate volumes of the stock solutions in volumetric flasks. Add the appropriate types and volumes of acids so that the standards are matrix matched with the sample digestates. Care must be taken when preparing the mixed standards to ensure that the elements are compatible and stable together. Transfer the mixed standard solutions to HDPE or polypropylene bottles for storage. Fresh mixed standards must be prepared, as needed, with the realization that concentration can change on aging as evidenced by failures in the ICV.

NOTE: If the addition of silver to the recommended acid combination results in an initial precipitation, add 15 mL of water and warm the flask until the solution clears. Cool and dilute to 100 mL with water. For this acid combination, the silver concentration must be limited to 2 mg/L. Silver under these conditions is stable in a tap-water matrix for 30 days. Higher concentrations of silver require additional HCl.
Additionally, sulfur standards are stand-alone single element standards and therefore are not to be combined in a mixed calibration standard solution.

8.8 Blanks

Three types of blanks are required for the analysis for samples. The calibration blank is used in establishing the analytical curve, and the method blank is used to identify possible contamination resulting from varying amounts of the acids used in the sample processing. The rinse blank is used to flush the system between all samples and standards.

8.8.1 **The calibration blank** is prepared by acidifying reagent water to the same concentrations of the acids found in the standards. Prepare a sufficient quantity to flush the system between standards and samples. The calibration blank will also be used for all initial (ICB) and continuing calibration blank (CCB) determinations (see Sections 10.2 and 10.4). Refer to Section 10.4.1.2 for acceptance criteria and/or corrective actions.

8.8.2 **The method blank** must contain all of the reagents in the same volumes as used in the processing of the samples. The method blank must be carried through the complete procedure and contain the same acid concentration in the final solution as the sample solution used for analysis. Refer to Section 9.1 for acceptance criteria and/or corrective actions.

8.8.3 **The rinse blank** consists of HNO_3 (1% or 2%) (v/v) in reagent water. Prepare a sufficient quantity to flush the system between standards and samples.

8.9 The Initial Calibration Verification Standard (ICV) and the Continuing Calibration Verification Standard (CCV)

These ICV is prepared by the analyst by combining compatible elements from a standard source different than that of the calibration standard at a concentration at or near the mid-point of the calibration curve. The CCV is prepared from the same source as the calibration standards and must be at a concentration near the mid-point of the calibration curve.

8.10 Low Level of Quantification, (LLOQ)

The LLOQ is initially verified by the analysis of at least 7 replicate samples, spiked at the LLOQ and processed through all preparation and analysis steps of the method at or below the lowest calibration point. The mean recovery and relative standard deviation of these samples provide an initial statement of precision and accuracy at the LLOQ. In most cases the mean recovery should be +/- 35% of the true value and RSD should be < 20%. In-house limits may be calculated when sufficient data points exist. Monitoring recovery of LLOQ over time is useful for assessing precision and bias.

Ongoing LLOQ verification, at a minimum, is on a quarterly basis to validate quantitation capability at low analyte concentration levels. This verification may be accomplished either with clean control material (e.g., reagent water, method blanks. Optimally, the LLOQ should be less than the desired regulatory action levels based on the stated project-specific requirements.

8.11 Spectral Interference Check Solution

These solutions are prepared to contain known concentrations of interfering elements that will provide an adequate test of the correction factors. Analysts are advised that high salt concentrations can cause analyte signal suppressions and confuse interference tests.

Single element interference checks - At a minimum, single element SIC checks must be performed for the following elements: Aluminum 500mg/L; Boron 50mg/L, Barium, 50mg/L, Calcium 500mg/L; Copper 50mg/L; Iron 200mg/L; Magnesium 500mg/L; Manganese 50mg/L; Molybdenum 20mg/L; Sodium 1000mg/L; Nickel 20mg/L; Selenium 20mg/L; Silicon 200mg/L; Tin 20mg/L; Vanadium 20mg/L; Zinc 20mg/L The absolute value of the concentration observed for any unspiked analyte in the single element SIC checks must be less than two times the analytes' LLOQ.

The concentration of the SIC checks are suggested, but become the highest concentration allowed in a sample analysis, and cannot be higher than the highest established linear range. Samples with concentrations of elements higher than the SIC check must be diluted until the concentration is less than the SIC check solution. Note that reanalysis of a diluted sample is required even if the high concentration element is not required to be reported for the specific sample, since the function of the SIC check is to evaluate spectral interferences on other elements. The single element SIC checks are performed when the instrument is setup and periodically (at least once every 6 months) thereafter.

Mixed element interference check - The mixed element SIC solution is analyzed at least once per day, immediately after the initial calibration. The concentration measured for any target analytes must be less than +/- the LLOQ. If this criterion is not met then sample analysis may not proceed until the problem is corrected, or alternatively the LLOQ may be raised to twice the concentration observed in the SIC solution. The only exceptions are those elements that have been demonstrated to be contaminants in the SIC solutions These may be present up to the concentration documented plus the LLOQ.

Mixed element SIC solution: Aluminum, 500mg/L; Calcium, 500mg/L; Iron, 200mg/L; Magnesium, 500mg/L

8.12 Ongoing Low Level of Quantification, (LLOQ)

Ongoing LLOQ verification, at a minimum, is on a quarterly basis to validate quantitation capability at low analyte concentration levels. This verification may be accomplished either with clean control material (e.g., reagent water, method blanks. Optimally, the LLOQ should be less than the desired regulatory action levels based on the stated project-specific requirements.

8.13 Internal Standard

The internal standard consists of a multi-element solution; each internal standard covers a range of the spectrum (low, middle, or high wavelengths) and the elements within that range.

5.0ug/mL Scandium

3.0ug/mL Yttrium

Note: The standard is used to monitor instrument fluctuations including but not limited to nebulization efficiency, plasma variations, environmental temperature changes, peristaltic pump pulsations, etc. Therefore, the solution used to start an analysis calibration cannot be added to or changed out during analysis without requiring subsequent full recalibration.

9. Quality Control

The laboratory must maintain records to document the quality of data that is generated. Ongoing data quality checks are compared with established performance criteria to determine if the results of analyses meet the performance characteristics of the method.

9.1 Blank(s)

Employ a minimum of one method blank per sample batch to determine if contamination or any memory effects are occurring. A method blank is a volume of reagent water carried through the same preparation process as a sample.

The method blank results must be less than ½ of the LLOQ for all analytes of concern. If the results of the method blank exceed the RDL for any analyte, perform re-analysis of a new aliquot of the method blank.

If the results continue to exceed the RDL, proceed as follows:

If all of the samples for the analyte are non-detected, and the method blank is at or above the RDL, no action is required.

If one or more associated samples for that analyte have positive results at or above the RDL, those samples must be considered to be out of control, and are re-digested and reanalyzed.

9.2 Laboratory Control Sample (LCS)

Analyze one LCSW/SRM per sample batch. A LCS/SRM sample is a spiked volume of reagent water that is brought through the entire preparation and analytical process. The LCSW must have a % Recovery of ± 20% within the actual value or within vendor control limits (95% confidence limits) for the solid SRM.

If the LCSW or SRM % Recovery is outside the acceptable limits as stated in Table 2, or outside any vendor control limits, the LCS is rerun once. If upon reanalysis the LCS is still out of control, the failed analytes are re-prepped and re-analyzed. Otherwise, a nonconformance report form is raised to document the exact problem and this form is then authorized by the QA/QC Director and/or the Laboratory Manager(s).

9.3 Initial Calibration Verification (ICV)

For all analytes and determinations, the laboratory must analyze an ICV (Section 8.9), and a calibration blank (ICB, Section 8.8.1), immediately following daily calibration. The results of the ICV are to agree within 10% of the expected value; if not, re-analyze once, if still failing terminate the analysis, correct the problem, and recalibrate the instrument.

9.4 Continuing Calibration Verification (CCV)

A calibration blank (CCB, Section 8.8.1) and a calibration verification standard (CCV, Section 8.9) must be analyzed after every tenth sample and at the end of the sample run. Analysis of the calibration verification (CCV) must verify that the instrument is within 10% of the calibration with the relative standard deviation < 5% from replicate (minimum of two) integrations.

Immediate corrective action for a failing CCV/CCB includes reanalyzing the failing standard. If the standard passes the second time then the analysis may be continued. The batch sheet is noted. If the standard fails again, instrument maintenance must be performed and the CCV/CCB standard is reanalyzed. If the standard passes, then all samples run after the last passing CCV/CCB pair must be re-analyzed.

If the standard fails after instrument maintenance, the instrument is recalibrated. A new ICV/ICB is performed, and all previous data after the last passing CCV/CCB is reanalyzed.

9.5 Matrix Spike

Analyze matrix spike samples at a frequency of one per matrix batch. The matrix spike is the same solution as used for the LCS (Table 4). A matrix spike sample is a sample brought through the entire sample preparation and analytical process.

9.5.1 The percent recovery is to be calculated as follows:

$$\% \text{ Recovery} = \frac{MS - S}{C} \times 100$$

where:

MS = Matrix Spike value
S = Sample value.
C = Concentration of the Spiking solution.

9.5.2 If the Matrix Spike falls outside of the limits as stated in Table 2, or outside any historical documentation for analytes of interest a post analytical spike is performed for the failed analytes. The same sample from which the MS/MSD aliquots were prepared should be spiked with a post digestion spike at a minimum level of 10 times and a maximum of 100 times the lower limit of quantitation. The acceptable % Recovery of the post analytical spike is 75-125%%. A nonconformance is noted in the LIMS and approved in secondary peer review and/or by the Metals Manager.

9.5.3 If the Post Spike fails the dilution test should be performed**.** If the analyte concentration is sufficiently high (minimally, a factor of 25 above the lower limit of quantitation after dilution), an analysis of a 1:5 dilution should agree within ± 20% of the original determination. If not, then a chemical or physical interference effect should be suspected.

9.6 Laboratory Duplicate

A duplicate sample is analyzed once per matrix batch. This sample is brought through the entire sample preparation and analytical process.

9.6.1 The relative percent difference between duplicate determinations is to be calculated as follows:

$$\text{RPD} = \frac{| D, - D_2 |}{(| D, + D_2 |) / 2} \times 100$$

where:

RPD = relative percent difference.
D, = first sample value.
D_2 = second sample value (replicate).

9.6.2 If the Duplicate falls outside of the limits as stated in Table 2, or outside any historical documentation and the concentrations of the failing analytes are less than 5x the RL or a matrix interference is found a nonconformance is noted in the LIMS and approved in secondary peer review and/or by the Metals Manager.

9.7 Method-specific Quality Control Samples

9.7.1 Spectra Interference Check Standard

A mixed check solution is analyzed once daily (section 8.11). One solution (SIC) has only elevated concentrations of Fe, Al, Ca, Mg to ensure no interferences occur. The concentrations of the analytes of interest must have an absolute value of the LLOQ. This solution is analyzed at the beginning of the first analytical run of the day.

The high level interferences are not evaluated for recovery. If the SIC fails take corrective action which may include re-evaluation of the inter-element correction values (IECs) after running single element SIC. The instrument calibration routine must then be performed and confirmed by the ICV/ICB pair and the SIC re-analyzed before proceeding with analysis. Otherwise, the nonconformance issue is raised to the Department Supervisor and/or the QA Department.

9.7.2 Internal Standard

The internal standards are added prior to the nebulizer and corrects for intensity differences in the instrument response between the standard's and sample's matrix. They are monitored for any variation in response during the sample analyses and used to ratio the sample response to the internal standard response of the calibration blank. The ratio is applied to compensate for instrument conditions in the plasma or nebulization caused by the matrix. The internal standard is monitored for 50-150% recovery or laboratory generated control ranges difference from the calibration blank IS response to ensure the proper functioning of the internal standard introduction system and matrix interferences. If an injection falls outside of this acceptance range the sample or QC check is rerun once to check for an introduction error.

If a sample continues to fail it's to be run on successive increasing dilutions until the internal standards associated with the elements of interest are within range. If a QC check fails on the single rerun the analysis is stopped, the root cause investigated, corrected and the instrument re-calibrated/verified. The analysis begins again with all samples that were run after the last acceptable CCV/CCB pair.

9.7.3 LDR Check Solution: A multiple element or single element solution run at a point above the highest calibration standard under the same calibration used to quantify the associated sample data. The LDR check must be within +/-10% of the true value of each element of interest to be considered valid.

9.8 Method Sequence

- Calibration of instrument
- Initial Calibration Verification Standard
- Initial Calibration Blank
- Mixed SIC Solution
- Continuing Calibration Verification Standard
- Continuing Calibration Blank

- 10 samples
- Continuing Calibration Verification Standard
- Continuing Calibration Blank
- 10 Samples
- Continuing Calibration Verification Standard
- Continuing Calibration Blank

10. Procedure

10.1 Equipment Set-up

10.1.1 Sample Preparation

Preliminary treatment of most matrices is necessary because of the complexity and variability of sample matrices. Groundwater samples which have been prefiltered and acidified will not need acid digestion. Samples which are not digested must be matrix matched with the standards.

NOTE: Sample digestates intended for Silver analysis must be analyzed as soon as possible.

10.1.2 Instrument Set-Up

Set up the instrument with proper operating parameters established as detailed below. The instrument must be allowed to become thermally stable before beginning (usually requiring at least 30 minutes of operation prior to calibration).

Startup Procedures

For iCAP Duo 6500

- Turn on power to the chiller
- Click on ThermoSpec Icon; enter analyst initials in login screen
- Click on Plasma icon to start instrument
- Allow to warm up for 30 minutes
- Enter analytical workgroup number (obtained from LIMS) globally under the Instrument menu by selecting Tools, then Options, then Analyst.
- Click on the Sequence tab and enter the sequence by selecting New Autosampler Table, Add Sequence, Add # of spaces.
- Enter the sample locations and IDs
- Press Run Auto-Session button (►) in menu bar.

10.1.2.1 Specific wavelengths are listed in Table 1. Other wavelengths may be substituted if they can provide the needed sensitivity and are corrected for spectral interference. The instrument and operating conditions utilized for determination must be capable of providing data of acceptable quality to the program and data user.

Operating conditions for axial plasma will vary from 1100 – 1500 watts forward power, 15-19 Liters/min argon coolant flow, 0.5 – 0.7 L/min argon nebulizer flow, 140 – 200 rpm pump rate and a default 1 minute preflush time and 10 second measurement time is recommended for all simultaneous instruments.

10.1.2.2 The plasma operating conditions need to be optimized prior to use of the instrument. This routine is not required on a daily basis, but only when first setting up a new instrument or following a change in operating conditions. The following procedure is recommended or follow manufacturer's recommendations. The purpose of plasma optimization is to provide a maximum signal to background ratio for some of the least sensitive elements in the analytical array. The use of a mass flow controller to regulate the nebulizer gas flow or source optimization software greatly facilitates the procedure.

10.1.2.2.1 The Thermo ICP's typically use a Meinhard Nebulizer. The nebulizer flow for each instrument is 1.0 +/- 0.2 mL/min.

10.1.2.2.2 The 6500 Duo instruments automatically perform a wavelength check at start up without user interaction.

10.1.2.2.3 The instrument operating condition finally selected as being optimum must provide the lowest reliable instrument detection limits and method detection limits.

10.1.2.2.4 If either the instrument operating conditions, such as incident power or nebulizer gas flow rate are changed, or a new torch injector tube with a different orifice internal diameter is installed, the plasma and argon pressures must be reoptimized.

10.1.2.2.5 After completing the initial optimization of operating conditions, but before analyzing samples, the laboratory must establish and initially verify an interelement spectral interference correction routine to be used during sample analysis. A general description concerning spectral interference and the analytical requirements for background correction in particular are discussed in the section on interferences. Criteria for determining an interelement spectral interference is an apparent positive or negative concentration for the analyte that falls within ± ½ LLOQ. The upper control limit is the analyte instrument detection limit. Once established, the entire routine is periodically verified every six months. In between that time, IEC's are done on a need be basis per analyte. Only a portion of the correction routine must be verified more frequently or on a daily basis. Initial and periodic verification of the routine must be kept on file. Special cases where continual verification is required are described elsewhere.

10.1.2.3 Sensitivity, instrumental detection limit, precision, linear dynamic range, and interference effects must be established for each individual analyte line on each particular instrument. All measurements must be within the instrument linear range where the correction equations are valid.

10.1.2.3.1 Method detection limits must be established for all wavelengths utilized for each type of matrix commonly analyzed. The matrix used for the MDL calculation must contain analytes of known concentrations within 3-5 times the anticipated detection limit.

10.1.2.3.2 Determination of limits using reagent water MDLs represent a best case situation and do not represent possible matrix effects of real world samples.

10.1.2.3.3 If additional confirmation is desired, reanalyze the seven replicate aliquots on two more non-consecutive days and again calculate the method detection limit values for each day. An average of the three values for each analyte may provide for a more appropriate estimate.

10.1.2.3.4 The upper limit of the linear dynamic range must be established for each wavelength utilized by determining the signal responses with 10% of the true value of each element from a concentration standard at the upper limit of the range run on the same calibration as required by the sample responses above the calibration range. The range which may be used for the analysis of samples must be no more than 90% of the resulting data. Determined analyte concentrations that are above the upper range limit must be diluted and reanalyzed. The analyst must also be aware that if an inter-element correction from an analyte above the linear range exists, a second analyte where the inter-element correction has been applied may be inaccurately reported.

NOTE: Many of the alkali and alkaline earth metals have non-linear response curves due to ionization and self-absorption effects. These curves may be used if the instrument allows; however the effective range must be checked and the second order curve fit must have a correlation coefficient of 0.995 or better. Third order fits are not acceptable. These curves are much more sensitive to changes in operating conditions than the linear lines and must be checked whenever there have been moderate equipment changes.

10.1.2.4 The analyst must (1) verify that the instrument configuration and operating conditions satisfy the analytical requirements and (2) maintain quality control data confirming instrument performance and analytical results.

10.2 Initial Calibration

Calibrate the instrument according to the instrument manufacturer's recommended procedures, using the typical mixed calibration standard solutions described in Section 8.7. Flush the system with the calibration blank (Section 8.8.1) between each standard or as the manufacturer recommends. (Use the average intensity of multiple exposures for both standardization and sample analysis to reduce random error.) The calibration curve consists of a calibration blank, RL standard and a high level standard. Calibration curve verification is accomplished through the analysis of the ICV, ICB and SIC standards.

10.3 Equipment Operation and Sample Processing

10.3.1 For all analytes and determinations, the laboratory must analyze an ICV (Section 8.9), and a calibration blank (ICB, Section 8.8.1), immediately following daily calibration.

A calibration blank (CCB, Section 8.8.1) and a calibration verification standard (CCV, Section 8.9) must be analyzed after every tenth sample and at the end of the sample run. Analysis of the calibration verification (CCV) must verify that the instrument is within 10% of the calibration with the relative standard deviation < 5% from replicate (minimum of three) integrations.

If the calibration cannot be verified within the specified limits, the sample analysis must be discontinued, the cause determined and the instrument recalibrated. All samples following the last acceptable ICV/ICB, or CCV/CCB must be reanalyzed. The analysis data for the calibration blank, check standard, and ICV or CCV must be kept on file with the sample analysis data.

10.3.2 Rinse the system with the rinse blank solution (Section 8.8.3) before the analysis of each sample. The suggested default rinse time is one minute. Each ICP instrument may establish a reduction in this rinse time through a suitable demonstration.

10.3.3 Dilute and reanalyze samples that exceed the linear range or use a calibrated alternate, less sensitive line for which quality control data is already established.

10.3.4 If less than acceptable accuracy and precision data are generated a series of tests are performed prior to reporting concentration data for analyte elements. At a minimum, these tests should be performed with each batch of samples prepared/analyzed with corresponding unacceptable data quality results. These tests, as outlined in Sections 10.3.5 and 10.3.6, will ensure that neither positive nor negative interferences are operating on any of the analyte elements to distort the accuracy of the reported values.

10.3.5 **Post Digestion Spike Addition:** If the sample concentrations are insufficient to perform a dilution test a post digestion spike added to a portion of a prepared sample, or its dilution for the elements failing the matrix spike recoveries must be run, recovery limits equal to 75% to 125% of the known spike value. If the spike is not recovered within the specified limits If the post-digestion recovery fails to meet the acceptance criteria, the sample results must be reported as estimated values

10.3.6 **Dilution Test:** If the analyte concentration is sufficiently high (minimally, a factor of 25 above the lower limit of quantitation after dilution), an analysis of a 1:5 dilution must agree within ± 20% of the original determination. Elements that fail the dilution test are reported as estimated values.

10.3.7 **CAUTION:** If spectral overlap is suspected, use of computerized compensation, an alternate wavelength, or comparison with an alternate method is recommended.

10.4 Continuing Calibration

10.4.1 Check calibration with an ICV following the initial calibration (Section 8.9). Verify calibration with the Continuing Calibration Verification (CCV) Standard (Section 8.9) at the end of the initial calibration sequence (ICV, ICB), after every ten samples, and at the end of an analytical run. Use a calibration blank (Section 8.8.1) immediately following daily calibration, after every 10 samples and at the end of the analytical run.

10.4.1.1 The results of the ICV are to agree within 10% of the expected value, and CCVs are to agree within 10% of the expected value; if not, terminate the analysis, correct the problem, and recalibrate the instrument. Each may be rerun once to confirm or cure the initial failure.

10.4.1.2 The results of the calibration blank should be below ½ of LLOQ or RL (whichever is lower). If not, repeat the analysis and if the failure is repeated terminate the analysis, correct the problem, recalibrate, and reanalyze the previous 10 samples. If the blank is less than 1/10 the concentration of the action level of interest, and no sample is within ten percent of the action limit, analyses need not be rerun and recalibration need not be performed before continuation of the run.

10.4.2 Verify the inter-element and background correction factors at the beginning of each analytical run. Do this by analyzing the SIC (Section 8.10). Results must be less than +/- LLOQ for all non-spiked elements.

10.4.3 When low-level sensitivity is required, a check standard at the requested limit of quantitation is analyzed to confirm the reported detection limit (RDL). This is performed on a project-by-project basis.

10.5 Preventive Maintenance

Whenever instrument maintenance is performed, it is noted in the instrument's Maintenance Logbook.

10.5.1 Daily

Inspect the nebulizer pump tubing from the Autosampler to the Nebulizer. Replace if necessary.

10.5.2 Monthly or as needed

Remove the torch, "shot glass", nebulizer and spray chamber. Clean each with 10% Nitric Acid and rinse with tap water. Coat the inside of the spray chamber and shot glass with concentrated Sulfuric Acid and soak for one hour, then rinse well with DI water. Soak the torch and nebulizer in aqua regia overnight, then rinse with DI water.

10.5.3 Every 6 months

Preventive Maintenance is performed by the Vendor or in-house personnel as follows:

- check the cooling system
- flush/refill the chiller with distilled water and antibacterial conditioner
- clean the instrument to regain intensity
- clean/replace air filters.

11. Data Evaluation, Calculations and Reporting

11.1 If dilutions were performed, the appropriate factors must be applied to sample values. All results must be reported with up to three significant figures.

11.2 Soil samples

Soil samples are calculated as follows:

$$\mathbf{A} = \frac{\text{Sample weight (grams)}}{\text{Final Volume (mL)}}$$

$$\mathbf{B}\ \text{(concentration in mg/Kg)} = \frac{\text{Concentration of analyte (mg/L)}}{\mathbf{A}}$$

11.2.1 Dry weight correction

The LIMS calculates the dry weight correction, however it is calculated as follows:

$$\text{Final concentration in mg/Kg dry weight} = \frac{\mathbf{B}}{\%\ \text{Solids}}$$

11.3 Liquid samples

Liquid samples are calculated as follows:

$$\text{Dilution Factor} = \frac{\text{Final Volume (mL)}}{\text{Sample Volume (mL)}}$$

Final concentration in mg/L = Concentration of analyte (mg/L) x Dilution Factor

11.4 Calculations for Hardness

The method for determining hardness is to compute it from the results of separate determinations of Calcium and Magnesium on aqueous samples.

11.4.1 Total Hardness

Total Hardness, mg equivalent $CaCO_3$/L = [2.497 (Ca, mg/L)] + [4.118 (Mg, mg/L)]

11.4.2 Calcium Hardness

Calcium Hardness, mg equivalent $CaCO_3$/L = [2.497 (Ca, mg/L)]

12. Contingencies for Handling Out-of-Control Data or Unacceptable Data

Also refer to Section 9 for Quality Control and acceptance criteria.

If the SIC is outside of the recovery window, then the standard is reanalyzed. If the standard failure continues, the IECs for the element/elements in question are reviewed and recalculated if necessary.

Immediate corrective action for a failing CCV/CCB includes reanalyzing the failing standard. If the standard passes the second time then the analysis may be continued. The raw data is noted. If the standard fails again, the problem must be found and corrected and the instrument is recalibrated. The ICV/ICB standard is reanalyzed and all previous data that had failed back to the previous passing CCV/CCB is reanalyzed.

The reanalysis procedure outline above is also conducted for a failing LCS or Method Blank; they may be rerun alone on the new or any subsequent passing bracket. The LCS or Method Blank do not qualify a bracket of samples but the batch run itself.

If the Matrix Spike does not meet acceptance criteria, a dilution test is performed. If the levels of the native sample is inadequate (see section 10.3.6) The RPD must be within 20% of the true value of the native sample. If the dilution test fails or the concentrations in the native sample are inadequate, the post spike is analyzed and evaluated (section 10.3.5). If these criteria are met, then the Matrix Spike data is reported, with the post spike narrated on the final report. If the post spike fails the data is reported as estimated.

If sample Duplicates are outside of the acceptance criteria, the analyst examines the sample for homogeneity. If the sample is not homogenous, this is narrated on the final report. Clean, homogenous samples are reanalyzed and if still outside of the acceptance limits, redigested and reanalyzed.

Sample nonconformance regarding a Matrix Spike recovery or a duplicate %RSD is narrated on the final report along with the corrective action(s) taken.

The mixed element SIC solution is analyzed at least once per day, immediately after the initial calibration. The concentration measured for any target analytes must be less than +/- the LLOQ. If this criterion is not met then sample analysis may not proceed until the problem is corrected, instrument is recalibrated, verified with the ICV/ICB and the SIC is then re-analyzed. Alternatively, the LLOQ may be raised to twice the concentration observed in the SIC solution if approved by the Department Manger or QA Department and the level is below the regulatory action limit or project specific requirements. The only exceptions are those elements that have been demonstrated to be contaminants in the SIC solutions These may be present up to the concentration documented plus the LLOQ. If failure continues notify the Department Supervisor or Manager.

Silver is only slightly soluble in the presence of chloride unless there is a sufficient chloride concentration to form the soluble chloride complex. Therefore, low recoveries of silver may occur in samples, matrix spikes and even laboratory control samples.

Silver is flagged in our data software during analysis if the concentration of silver is >100ug/L. Liquid samples that exceed 100ug/L will be redigested at dilution. Soil and solid samples that exceed 500ug/L (approximately 20mg/kg) will be re-digested at a reduced weight of 0.625g to allow more silver to become soluble during digestion.

13. Method Performance

13.1 Method Detection Limit Study (MDL) / Limit of Detection Study (LOD) / Limit of Quantitation (LOQ)

The laboratory follows the procedure to determine the MDL, LOD, and/or LOQ as outlined in Alpha SOP/08-05 unless supersede within this SOP. These studies performed by the laboratory are maintained on file for review.

13.2 Demonstration of Capability Studies

Refer to Alpha SOP/08-12 for further information regarding IDC/DOC Generation.

13.2.1 Initial (IDC)

The analyst must make an initial, one-time, demonstration of the ability to generate acceptable accuracy and precision with this method, prior to the processing of any samples.

13.2.2 Continuing (DOC)

The analyst must make a continuing, annual, demonstration of the ability to generate acceptable accuracy and precision with this method.

14. Pollution Prevention and Waste Management

Refer to Alpha's Chemical Hygiene Plan and Waste Management and Disposal SOP for further pollution prevention and waste management information.

15. Referenced Documents

Chemical Hygiene Plan

SOP #1732 MDL/LOD/LOQ Generation

SOP# 1739 IDC/DOC Generation

SOP# 1728 Waste Management and Disposal

16. Attachments

TABLE 1: Element Wavelengths
TABLE 2: Precision and Accuracy Acceptance Criteria
TABLE 3: Reporting Limits
TABLE 4: LCS and Matrix Spike Concentrations

TABLE 1
ELEMENT WAVELENGTHS

Element	6500 Duo wavelength (nm)
Pb	220.3
Se	196.0
Sb	206.8
As	189.0
Ba	455.4
Be	313.0
Cd	214.4
Co	228.6
Cu	324.7
Cr	267.7
Fe	259.9
Mn	257.6
Mo	202.0
Ni	231.6
Ag	328.0
Tl	190.8
V	292.4
Zn	206.2
Al	396.1
Ca	315.8
Mg	279.0
B	208.9
Si	212.9
Sn	189.9
Sr	421.5
Ti	334.9
Bi	223.0
Na	589.5
K	766.4
S	180.7
Li	

TABLE 2
PRECISION AND ACCURACY ACCEPTANCE CRITERIA

	% Recovery LCS		**Aqueous % Recovery MS**		**Soil % Recovery SRM ***		**Duplicate**	
Element	**Lower Control Limit**	**Upper Control Limit**	**Lower Control Limit**	**Upper Control Limit**	**Lower Control Limit**	**Upper Control Limit**	**Aqueous %RPD**	**Soil %RPD**
Aluminum	80	120	75	125	29	171	20	20
Antimony	80	120	75	125	4	196	20	20
Arsenic	80	120	75	125	81	119	20	20
Barium	80	120	75	125	83	118	20	20
Beryllium	80	120	75	125	83	117	20	20
Boron	80	120	75	125	70	129	20	20
Cadmium	80	120	75	125	82	117	20	20
Calcium	80	120	75	125	83	117	20	20
Chromium	80	120	75	125	80	119	20	20
Cobalt	80	120	75	125	83	117	20	20
Copper	80	120	75	125	83	117	20	20
Iron	80	120	75	125	51	150	20	20
Lead	80	120	75	125	80	120	20	20
Lithium	80	120	75	125	80	120	20	20
Magnesium	80	120	75	125	74	126	20	20
Manganese	80	120	75	125	83	117	20	20
Molybdenum	80	120	75	125	81	119	20	20
Nickel	80	120	75	125	82	117	20	20
Potassium	80	120	75	125	74	126	20	20
Sulfur	80	120	75	125	NA	NA	20	20
Selenium	80	120	75	125	80	120	20	20
Silica (SiO_2)	80	120	75	125	NA	NA	20	20
Silver	80	120	75	125	66	134	20	20
Sodium	80	120	75	125	74	127	20	20
Strontium	80	120	75	125	80	120	20	20
Thallium	80	120	75	125	79	120	20	20
Tin	80	120	75	125	69	131	20	20
Titanium	80	120	75	125	82	118	20	20
Vanadium	80	120	75	125	79	121	20	20
Zinc	80	120	75	125	82	119	20	20

** Ranges of the SRM are presented as an example of a typical SRM; actual limits may vary by lot provided by the vendor.

TABLE 3
REPORTING LIMITS

Element	Aqueous (mg/L)	Soil (mg/Kg)
ALUMINUM	0.10	4.0
ANTIMONY	0.05	2.0
ARSENIC	0.005	0.40
BARIUM	0.01	0.40
BERYLLIUM	0.005	0.20
BORON	0.03	1.2
CADMIUM	0.005	0.40
CALCIUM	0.10	4.0
CHROMIUM	0.01	0.40
COBALT	0.02	0.80
COPPER	0.01	0.40
IRON	0.05	2.0
LEAD	0.01	2.0
LITHIUM	0.009	0.36
MAGNESIUM	0.10	4.0
MANGANESE	0.01	0.40
MOLYBDENUM	0.05	2.0
NICKEL	0.025	1.0
POTASSIUM	2.5	100
SULFUR	0.25	10
SELENIUM	0.01	0.80
SILICA	0.50	20
SILVER	0.007	0.40
SODIUM	2.0	80
STRONTIUM	0.01	2.0
THALLIUM	0.02	0.80
TIN	0.05	4.0
TITANIUM	0.01	0.40
VANADIUM	0.01	0.40
ZINC	0.05	2.0

TABLE 4
LCS and Matrix Spike

Analyte	Liquid Concentration (mg/L)	Soil Concentration * (MS spike only) (mg/Kg)
Antimony	0.5	160
Arsenic	0.12	160
Barium	2.00	160
Beryllium	0.05	80
Cadmium	0.051	80
Chromium	0.20	160
Copper	0.25	160
Lead	0.51	160
Nickel	0.50	160
Selenium	0.12	160
Silver	0.05	40
Thallium	0.12	160
Zinc	0.50	160
Iron	1.00	800
Manganese	0.50	160
Calcium	10.0	800
Magnesium	10.0	800
Potassium	10.0	800
Sodium	10.0	800
Silica	1.0	800
Aluminum	2.00	800
Cobalt	0.50	160
Vanadium	0.50	160
Boron	1.0	NA
Molybdenum	1.0	NA
Lithium	1.0	800
Titanium	1.0	NA

*MS spike of a solid based on 1.25g and a final volume of 50 mL.

Note: Solids LCS is an SRM with certified value provided by the vendor on a lot basis.

Organochlorine Pesticides
By Capillary Column Gas Chromatography

Reference Method No.: **Method 8081B**

References: SW-846, Test Methods for Evaluating Solid Waste: Physical/Chemical Methods, EPA SW-846, Update IV, 2007.

Mass DEP CAM QC Requirements and Performance Standards for the Analysis of Chlorinated Pesticides by Gas Chromatography (GC), Revision 2, April 12, 2024.

SW-846 Pesticides by 8081, State of Connecticut Department of Environmental Protection Reasonable Confidence Protocol (RCP), Version 3.0, May 2024

1. Scope and Application

Method 8081B is used to determine the concentrations of various organochlorine pesticides in extracts from solid and liquid matrices. This SOP details the analysis for these compounds using fused-silica, open-tubular, capillary columns with electron capture detectors (ECD).

Matrices: Extracts from solid and liquid matrices.

Definitions: See Pace Analytical Quality Manual

Regulatory Parameter List: The compounds listed below are determined by this method:

Parameter	CAS
Aldrin	309-00-2
Alpha-BHC	319-84-6
Beta-BHC	319-85-7
Gamma-BHC (Lindane)	58-89-9
Delta-BHC	319-86-8
Alpha-chlordane	5103-71-9
Gamma-chlordane	5103-74-2
4,4'-DDD	72-54-8
4,4'-DDE	72-55-9
4,4'-DDT	50-29-3
Dieldrin	60-57-1
Endosulfan I	959-98-8
Endosulfan II	33213-65-9
Endosulfan Sulfate	1031-07-8
Endrin	72-20-8
Endrin Aldehyde	7421-93-4
Endrin Ketone	53494-70-5
Heptachlor	76-44-8
Heptachlor Epoxide	1024-57-3
Methoxychlor	72-43-5
Toxaphene	8001-35-2
Chlordane	57-74-9
Alachlor $^{+}$	15972-60-8
Hexachlorobenzene $^{++}$	118-74-1

$^{+}$ CT-RCP only compound $^{++}$ MCP/CT only compound

The data report packages present the documentation of any method modification related to the samples tested. Depending upon the nature of the modification and the extent of intended use, the laboratory may be required to demonstrate that the modifications will produce equivalent results for the matrix. Approval of all method modifications is by one of the following laboratory personnel before performing the modification: Area Supervisor, Laboratory Services Manager, Laboratory Director, or Quality Assurance Officer

This method is restricted to use by or under the supervision of analysts experienced in the operation of the gas chromatograph (GC) and in the interpretation of gas chromatograms. Each analyst must demonstrate the ability to generate acceptable results with this method by performing an initial demonstration of capability (see section 13), analyzing a proficiency test sample and completing the record of training.

After initial demonstration, ongoing demonstration is based on acceptable laboratory performance of at least a quarterly laboratory control sample or acceptable performance from an annual proficiency test sample. A major modification to this procedure requires demonstration of performance. The identification of major method modification requiring performance demonstration is directed by the QA Officer and/or Laboratory Director on a case-by-case basis.

2. Summary of Method

A measured volume or weight of sample (for liquids: 100mL, for solids: 15g) is extracted using the appropriate matrix-specific sample extraction technique.

Liquid samples are extracted at neutral pH with methylene chloride using Method 3510C (separatory funnel), or other appropriate technique.

Solid samples are extracted with methylene chloride: acetone (1:1) using Method 3540C (Soxhlet), Method 3546 (microwave extraction), or other appropriate technique.

Wipe samples are extracted with methylene chloride: acetone (1:1) using Method 3540C (Soxhlet) or other appropriate technique.

Oil samples are diluted with hexane following the procedure outlined in the extraction SOP.

After cleanup, the extract is analyzed by injecting a 1µL sample into a gas chromatograph equipped with narrow- or wide-bore fused silica capillary columns and electron capture (GC/ECD) detectors.

2.1 Method Modifications from Reference

None.

3. Reporting Limits

Table 1 lists our routine reporting limits.

4. Interferences

4.1 Only high purity gases are used in the GC system to eliminate this source of possible contamination. Both the hydrogen (carrier gas – 99.999%) and argon-methane (detector make-up gas) are certified by the gas supplier.

4.2 Preventive instrument maintenance is performed routinely, and whenever highly contaminated extracts are analyzed that could result in chromatographic interferences or result in degradation of system performance. Section 9.5 details the maintenance steps.

4.3 Glassware must be scrupulously cleaned. This procedure is detailed in the extraction SOPs. Store dry glassware in a clean environment.

4.4 All solvents used are pesticide grade or equivalent, and reagents are purchased as certified contaminant free. All of these materials are routinely determined to be free of interferences by analysis of extraction blanks with every extraction batch performed.

4.5 Certain compounds (i.e. phthalates) can be extracted from the sample matrix and be detected by the ECD that could possibly result in false positive results or complicate the data interpretation. The use of the cleanup procedures detailed in the extraction SOPs minimize these possible interferences. Analyst experience is also crucial in making compound determinations.

4.6 Interferences co-extracted from the samples will vary considerably from waste to waste. While general cleanup techniques are referenced or provided as part of the method, unique samples may require additional cleanup approaches to achieve desired degrees of discrimination and quantitation.

4.7 Interferences by phthalate esters introduced during sample preparation can pose a major problem in pesticide determinations.

4.7.1 Common flexible plastics contain varying amounts of phthalate esters which are easily extracted or leached from such materials during laboratory operations.

4.7.2 Cross-contamination of clean glassware routinely occurs when plastics are handled during extraction steps, especially when solvent-wetted surfaces are handled.

4.7.3 Interferences from phthalate esters are minimized by avoiding contact with any plastic materials and checking all solvents and reagents for phthalate contamination.

4.8 The presence of elemental sulfur will result in broad peaks that interfere with the detection of early-eluting organochlorine pesticides. Sulfur contamination is often seen in sediment and some soil samples.

4.9 Other halogenated pesticides or industrial chemicals may interfere with the analysis of pesticides. Coeluting chlorophenols are eliminated by using Method 3620B (Florisil).

5. Health and Safety

The toxicity or carcinogenicity of each reagent and standard used in this method is not fully established; however, each chemical compound should be treated as a potential health hazard. From this viewpoint, exposure to these chemicals must be reduced to the lowest possible level by whatever means available. A reference file of material data handling sheets is available to all personnel involved in the chemical analysis. The following analytes covered by this method have been tentatively classified as known or suspected human or mammalian carcinogens: 4,4’-DDT, 4,4’-

DDD, and BHCs. Additional references to laboratory safety are available in the Chemical Hygiene Plan.

All personnel handling environmental samples known to contain or to have been in contact with municipal waste must follow safety practices for handling known disease causative agents.

5.1 Lab coats, safety glasses, and gloves must be worn when handling samples, extracts, standards or solvents.

5.2 All solvent and extract transfers must be handled in the vented bench area in the GC laboratory.

5.3 All stock standards, working standards, and vialed sample extracts must be placed into the waste bucket in the lab, for future disposal by the Hazardous Waste Manager. The container must be labeled properly with hazard warning labels indicating the container contents.

5.4 Bottles containing flammable solvents must be stored in the flammables cabinet.

6. Sample Collection, Preservation, Shipping and Handling

6.1 Sample Collection

Aqueous samples are collected in either two 500 ml amber glass jars or two 1L amber glass jars with teflon-lined lids. Solid samples are collected in one 250 mL wide-mouth glass jar with a teflon-lined lid. All containers are purchased pre-cleaned and certified from commercial vendors.

6.2 Sample Preservation

Both aqueous and solid samples are then preserved by packing in coolers with ice or ice packs, to maintain a temperature of 4 ± 2^{o} C. Upon receipt at the laboratory, the samples are transferred into sample storage refrigerators to maintain at a temperature of 4 ± 2^{o} C.

6.3 Sample Shipping

No special shipping requirements.

6.4 Sample Handling

Aqueous samples must be extracted within 7 days of sample collection, solid samples within 14 days of collection. Once extracted, the samples must be analyzed within 40 days of the extraction date.

7. Equipment and Supplies

7.1 Gas Chromatograph, Hewlett Packard 6890 (or equivalent): An analytical system completes with gas chromatograph configured for split-splitless injection and all required accessories including syringes, analytical columns, gases, electron capture detectors (ECD), and data system.

7.1.1 Data System: A computer system is interfaced to the GC for collection of data. Data acquisition is performed using Agilent Technologies GC ChemStation (Rev. A.10.02 [1757]).

7.2 GC Columns: Pace utilizes dual-column analyses. The dual-column approach involves either a single injection that is split between two columns that are mounted in a single gas chromatograph, or dual injections of the split extract on a single GC equipped with two columns. Typical column pairs used are listed below. Other columns may be used as long as method performance criteria can be met.

7.2.1 Column pair 1

30m x 0.32mm ID fused silica capillary column (RTX-clpesticide), 0.32µm film thickness.

30m x 0.32mm ID fused silica capillary column (RTX-clpesticideII) 0.25µm film thickness.

7.2.2 Column pair 2

30m x 0.32mm ID fused silica capillary column (STX-clpesticide), 0.32µm film thickness.

30m x 0.32mm ID fused silica capillary column (STX-clpesticideII) 0.25µm film thickness.

7.3 Guard Column: Cat. #10027 from Restek or equivalent: 5m, 0.32mm

7.4 Gooseneck splitless injection liner: Cat. #23303 from Restek or equivalent

7.5 Universal "Y" Press-tight tee split: Cat. #20406 from Restek or equivalent **/ Siltek MXT Connector:**

7.6 Class "A" Volumetric Flasks: 10mL, 25mL, 50mL, 100mL, 200mL, and 2000mL, for the preparation of standards.

7.7 Microsyringes/Wiretrol syringes: 10 µL – 1000 µL

7.8 Disposable Borosilicate Pipets

7.9 Vials: 2 mL clear glass, crimp-top and screw-cap.

8. Reagents and Standards

Reagent grade or pesticide grade chemicals are used in all tests. Unless otherwise indicated, it is intended that all reagents shall conform to specifications of the Committee on Analytical Reagents of the American Chemical Society, where such specifications are available. Other grades may be used, provided it is first ascertained that the reagent is of sufficient high purity to permit its use without lessening the accuracy of the determination.

NOTE: Store the standard solutions (stock, composite, calibration, internal, and surrogate) at 4 ± 2°C in Teflon(R)-sealed containers in the dark. When a lot of standards is prepared, aliquots of that lot are stored in individual small vials. All stock standard solutions must be replaced after one year or sooner if routine QC tests indicate a problem. All other standard solutions must be replaced after six months or sooner if routine QC indicates a problem.

8.1 n-Hexane: Pesticide quality or equivalent.

8.2 Acetone: Pesticide quality or equivalent.

8.3 Methylene chloride: Pesticide quality or equivalent.

8.4 Organic-free Reagent Water: All references to water in this method refer to organic-free reagent water from Alpha's RO water treatment system.

8.5 Stock Standard Solutions: All stock standard solutions are purchased from commercial vendors as ampulated certified solutions. When an ampulated stock solution is opened, it is transferred to a labeled amber screw-cap vial. The expiration date of the stock solution is either the vendor specified expiration date, or 6 months from the date the ampule was opened, whichever is sooner. Typical stock standard concentrations are listed in Table 2.

8.6 Calibration Standards: Calibration standards are prepared volumetrically by diluting the appropriate stock standard(s) with hexane. Calibration standards expire 6 months from the date of preparation, or on the earliest expiration date of any of the stock solutions used to prepare the calibration standard. Calibrations are typically performed at 11 concentration levels for individual pesticides, Chlordane and Toxaphene; concentrations for all levels are listed in Table 2. Below are suggested procedures for preparation of individual pesticides (Sec. 8.6.1), Chlordane (Sec. 8.6.2), and Toxaphene (Sec. 8.6.3) initial calibration standards.

8.6.1 Preparation of individual pesticides initial calibration standards;

(syringes needed: *100µL [A], 500µL [B], 1000µL [C]*)
(solvent: *Hexane)*
(glassware: *9x10mL, 2x25mL, 1x50mL, 2x100mL, volumetric flasks*)

ICAL (Initial Calibration) STOCK #1: *2000µg/L; 25mL*
50µL[A] of AccuStandard M-8081-SC (Pesticides mix; 1000µg/mL)
250µL[B] of AccuStandard CLP-032-R (TCMX, Deca; 200µg/mL)
500µL[B] of AccuStandard P-102S (Alachlor; 100µg/mL)
500µL[B] of AccuStandard APP-9-112 (Hexachlorobenzene; 100µg/mL)

ICAL STOCK #2 (=LEVEL 10)**:** *200µg/L; 25mL.*
2500µL[B] of STOCK #1
…..
LEVEL 1, 0.5 µg/L: 25µL[A] of ICAL STOCK #2, 10mL
LEVEL 2, 1.0 µg/L: 50µL[A] of ICAL STOCK #2, 10mL
LEVEL 3, 2.0 µg/L: 100µL[A] of ICAL STOCK #2, 10mL
LEVEL 4, 3.0 µg/L: 150µL[B] of ICAL STOCK #2, 10mL
LEVEL 5, 4.0 µg/L: 200µL[B] of ICAL STOCK #2, 10mL
LEVEL 6, 5.0 µg/L: 250µL[B] of ICAL STOCK #2, 10mL
LEVEL 7, 10 µg/L: 500µL[B] of ICAL STOCK #2, 10mL
LEVEL 8, 50 µg/L: 2500µL[C] of ICAL STOCK #2, 10mL
LEVEL 9, 100 µg/L: 5000µL[C] of ICAL STOCK #2, 10mL
LEVEL 10, 200 µg/L: 2500µL[C] of ICAL STOCK #1, 25mL
LEVEL 11, 400 µg/L: 2000µL[C] of ICAL STOCK #1, 10mL

ICV (Initial Calibration Verification) STOCK #1: *2000µg/L; 100mL*
1000µL[C] of Restek 579104 (Custom Pesticides Mix; 200µg/mL)

ICV STOCK #2: *1000µg/L; 50mL*
250µL[B] of Agilent ISM-320-1 (TCMX, Deca; 200µg/mL)
…..
ICV, 50 µg/L: 2500µL[C] of ICV STOCK #1 with
5000µL[C] of ICV STOCK #2, 100mL

8.6.2 Preparation of Chlordane initial calibration standards:

(syringes needed: *100µL [A], 500µL [B], 1000µL [C]*)
(solvent: *Hexane)*
(glassware: *11x10mL, 1x25mL, 1x50mL, volumetric flasks*)

ICAL STOCK #1: *50µg/mL (Chlordane);10mL*
100µL[A] of Agilent EPA-1086-1 (Chlordane Standard; 5000µg/mL)

ICAL STOCK #2 (=LEVEL 9)**:** *2000µg/L; 25mL.*
1000µL[C] of STOCK #1

LEVEL 1, 2µg/L: 10µL[A] of ICAL STOCK #2, 10mL
LEVEL 2, 5µg/L: 25µL[A] of ICAL STOCK #2, 10mL
LEVEL 3, 10µg/L: 50µL[A] of ICAL STOCK #2, 10mL
LEVEL 4, 20µg/L: 100µL[A] of ICAL STOCK #2, 10mL
LEVEL 5, 100µg/L: 500µL[B] of ICAL STOCK #2, 10mL
LEVEL 6, 250µg/L: 1250µL[B] of ICAL STOCK #2, 10mL
LEVEL 7, 500µg/L: 2500µL[C] of ICAL STOCK #2, 10mL
LEVEL 8, 1000µg/L: 5000µL[C] of ICAL STOCK #2, 10mL
LEVEL 9, 2000µg/L: 1000µL[C] of ICAL STOCK #1, 25mL
LEVEL 10, 5000µg/L: 1000µL[C] of ICAL STOCK #1, 10mL

ICV STOCK: *50µg/mL; 10mL*
500µL[B] of Restek 32021 (Chlordane Standard; 1000µg/mL)
…..
ICV, 1000µg/L: 1000µL[C] of ICV STOCK, 50mL

8.6.3 Preparation of Toxaphene initial calibration standards;

(syringes needed: *100µL [A], 500µL [B], 1000µL [C]*)
(solvent: *Hexane)*
(glassware: *11x10mL, 1x50mL, volumetric flasks*)

ICAL STOCK #1: *100µg/mL (Toxaphene);10mL*
1000µL[C] of Absolute Standards 20021 (Toxaphene; 1000µg/mL)

ICAL STOCK #2 (=LEVEL 8)**:** *2000µg/L; 10mL.*
200µL[A] of STOCK #1

LEVEL 1, 5 µg/L: 25µL[A] of ICAL STOCK #2, 10mL
LEVEL 2, 10 µg/L: 50µL[A] of ICAL STOCK #2, 10mL
LEVEL 3, 20 µg/L: 100µL[A] of ICAL STOCK #2, 10mL
LEVEL 4, 100 µg/L: 500µL[B] of ICAL STOCK #2, 10mL
LEVEL 5, 200 µg/L: 1000µL[C] of ICAL STOCK #2, 10mL
LEVEL 6, 500 µg/L: 50µL[A] of ICAL STOCK #1, 10mL
LEVEL 7, 1000 µg/L: 100µL[A] of ICAL STOCK #1, 10mL
LEVEL 8, 2000 µg/L: 200µL[B] of ICAL STOCK #1, 10mL
LEVEL 9, 5000 µg/L: 500µL[B] of ICAL STOCK #1, 10mL
LEVEL 10, 10000 µg/L: 1000µL[C] of ICAL STOCK #1, 10mL

ICV: *2000µg/L; 50mL*
1000µL[C] of Agilent PP-271-1 (Toxaphene Standard; 100µg/mL)

8.7 Internal Standard Solution:

1-Bromo-2-nitrobenzene is used as the internal standard and is added to all single-component calibration standards and sample extracts to achieve a concentration of 0.25 µg/mL. Standard solution expires 6 months after the date of preparation. Below are suggested procedures for preparation of PCB Internal Standard which is diluted to prepare Pesticides Internal Standard.

8.7.1 Preparation of Internal Standard solution:

(syringe needed: *1000µL [A]*)
(solvent: *Hexane)*
(glassware: *2x200mL, volumetric flasks*)

PCB INTERNAL STANDARD: *25µg/mL; 200mL*
1000µL[A] of Agilent PPS-351-1 (1-Bromo-2-nitrobenzene Standard; 5000µg/mL)

PESTICIDES INTERNAL STANDARD: *2.5µg/mL; 200mL*
20mL[A] of PCB INTERNAL STANDARD

8.8 PEM/DEG Solution:

is prepared volumetrically by diluting stock standard in Hexane. Solution expires 6 months from the date of preparation, or on the earliest expiration date of any of the stock solution used to prepare the standard.

- 5mL of Pesticides Deg. Check Solution, Ultra. #ISM-450-1 into 100mL of Hexane

8.9 Surrogate Standards:

Tetrachloro-m-xylene and decachlorobiphenyl are used as surrogates. They are added to the calibration standards at the concentrations listed in Table 2, and are spiked into all samples and QC samples prior to extraction. The spiking solution is prepared in acetone at the concentrations listed in Table 2. Standard expires 6 months after the date of preparation. Below are suggested procedures for preparation of surrogate standard.

8.9.1 Preparation of surrogate standard:

(syringe needed: *1000µL [A]*)
(solvent: *Acetone)*
(glassware: *1x2000mL, volumetric flasks*)

- **EXTRACTION SURROGATES:** *2000µg/L; 2000mL*
  20mL[A] of AccuStandard CLP-032-R (Deca. & TCMX; 0.2mg/mL)
- **ICV Surrogate Stock:** is prepared by diluting of 250µL of Pesticides Surrogate Standard (Ultra, Cat. #CS-1947) to 50mL of Hexane to achieve concentration of TCMX and DCB at 1.0µg/mL.

8.10 LCS/MS Spiking Solutions:

The LCS/MS spiking solutions are prepared volumetrically by diluting the appropriate stock standards in acetone. The spiking solution concentrations are listed in Table 2. Spiking solution expires 6 months after the date of preparation. Below are suggested procedures for preparation of individual pesticides, Chlordane, and Toxaphene spiking solutions.

8.10.1 Preparation of spiking solutions:

(syringes needed: *250μL [A], 1000μL [B]*)
(solvent: *Acetone)*
(glassware: *1x25mL, 1x50mL, 1x200mL, volumetric flasks*)

INDIVIDUAL PESTICIDES SPIKE: *2000μg/L; 200mL*
2000μL[B] of Restek 579104 (Custom Pesticides Mix; 200μg/mL)

CHLORDANE SPIKE: *25μg/mL; 50mL*
250μL[A] of Agilent EPA-1086-1 (Chlordane Standard; 5000μg/mL)

TOXAPHENE SPIKE: *25μg/mL; 25mL*
625μL[A] of Absolute Standards 20021 (Toxaphene; 1000μg/mL)

9. Quality Control

The laboratory must maintain records to document the quality of data that is generated. Ongoing data quality checks are compared with established performance criteria to determine if the results of analyses meet the performance characteristics of the method.

9.1 Blank(s)

Extraction blanks are performed with each extraction batch of 20 or less samples, according to the extraction SOPs. The extraction blank must not contain any of the reportable analytes above the reporting limit. If any reportable analytes are detected in the blank, the entire extraction batch is suspect and re-extraction of all associated samples is required. Actions associated with blank failures are listed in Table 5.

9.2 Laboratory Control Sample (LCS)

A Laboratory Control Sample (LCS) is extracted with each analytical batch. The LCS consists of an aliquot of a clean (control) matrix similar to the sample matrix and of the same weight or volume. The LCS is spiked with single component pesticide analytes. The concentration of the spiking solution is listed in Table 2. The recovery acceptance criteria are listed in Table 3. If any recovery criteria are not met, the extract should be reanalyzed. If the criteria are still not met, the entire batch should be re-extracted. If this is not possible, due to insufficient sample or holding time exceedance, the analyst must write up the failure on a narrative sheet for inclusion in the client report. Actions associated with LCS/LCSD failures are listed in Table 5.

9.2.1 LCS Duplicate (LCSD)

A Laboratory Control Sample Duplicate is extracted with each analytical batch. The LCSD consists of an aliquot of a clean (control) matrix similar to the sample matrix and of the same weight or volume. The LCSD is spiked with the single component pesticide analytes. The concentration of the spiking solution is listed in Table 2. The recovery acceptance criteria are listed in Table 3. If Recovery limits are outside acceptance criteria, the non-conformance is narrated.

9.2.2 Connecticut RCP/MCP/NJ LCS Requirements

For CT- Reasonable Confidence Protocol (RCP) 8081B samples, Massachusetts Contingency Plan (MCP) samples, and samples with a state of origin of New Jersey, the LCS recovery criteria is 40 – 140%. MCP allows for up to 10% of reported spike compounds to fail in the LCS/LCSD and still report.

9.3 Initial Calibration Verification (ICV)

Refer to Section 10.2.

9.4 Continuing Calibration Verification (CCV)

Refer to Section 10.4

9.5 Matrix Spike

A matrix spike (MS)/matrix spike duplicate (MSD) is extracted and analyzed upon Client request for each batch of 20 or less samples. MS and MSDs are field samples spiked with a known quantity of the target analyte(s). They are prepared by taking additional sample aliquots of the same weight or volume and adding the appropriate amounts of surrogate and spiking solutions. The spike compounds and levels are listed in Table 2. The recovery acceptance criteria are 30-150%. If the recovery criteria are not met, but are met in the LCS, the failure may be attributed to sample matrix effects. Actions associated with MS/MSD failures are listed in Table 5.

9.6 Laboratory Duplicate (DUP)

A duplicate sample is extracted and analyzed upon Client request for each batch of 20 or less samples. Duplicates are laboratory selected replicate samples, prepared by taking an additional sample aliquot of the same weight or volume of a sample. The % RPD criteria are listed in Table 3. If the %RPD is not met, the failure may be attributed to sample matrix effects. Actions associated with duplicate failures are listed in Table 5.

For samples with a state of origin of New Jersey, a MS and MSD/DUP must be extracted for every twenty samples within a 24hr period.

9.7 Surrogates:

All extracted samples and associated QC are spiked with surrogates at the levels listed in Table 2. The laboratory must evaluate surrogate recovery data from individual samples and QC samples versus the surrogate control limits listed in Table 3. If the surrogate limits are not met, the extract should be reanalyzed to determine if the failure was due to an instrument problem. If the criteria are still not met, the affected samples should be re-extracted to confirm that the failure was due to sample matrix. If matrix effect is confirmed, this must be noted on a narrative sheet for inclusion in the client report.

9.8 Method Sequence

Typical Initial Calibration (each level to identify the standard lot number)

1. Instrument Blank (may be omitted to conserve tray space)
2. Degradation check standard
3. Std Level 1

4. Std Level 2
5. Std Level 3
6. Std Level 4
7. Std Level 5
8. Std Level 6
9. Std Level 7
10. Std Level 8
11. Std Level 9
12. Std Level 10
13. Std Level 11 (Individual Pesticides only)
14. Initial Calibration Verification Standard (ICV)
15. Repeat std Levels 1 –10 for other mixes until curve is complete.

    [**NOTE:** If multiple calibration mixtures are analyzed, it is acceptable to analyze appropriate ICVs after all calibration standards have been injected.]

Typical Daily sequence (each standard must be identified with lot number)

1. Degradation Check Standard
2. Pesticide Continuing Calibration Standard
3. Chlordane Continuing Calibration Standard
4. Toxaphene Continuing Calibration Standard
5. Extraction Blank
6. Laboratory Control Sample
7. Laboratory Control Sample Duplicate
8. Matrix Spike (Upon Client Request)
9. Duplicate/Matrix Spike Duplicate (Upon Client Request)
10. Samples (up to **20 field samples may be analyzed**)
11. Cal check
12. Repeat 1 – 10 (as needed)

10. Procedure

10.1 Equipment Set-up

10.1.1 Sample Extraction

Water samples are extracted at a neutral pH with methylene chloride using a separatory funnel (Method 3510C). See extraction SOP for details.

Solid samples are extracted with methylene chloride: acetone (1:1) using Soxhlet extraction (Method 3540C) or microwave extraction (Method 3546). See extraction SOP for details.

10.1.2 Extract Cleanup

Cleanup procedures may not be necessary for a relatively clean sample matrix, but most extracts from environmental and waste samples will require additional preparation before analysis. The specific cleanup procedure used will depend on the nature of the sample to be analyzed and the data quality objectives for the measurements. See extraction SOPs for details.

10.1.3 GC Conditions:

The dual-column / dual-detector approach involves the use of the columns listed in section 7.2. The columns are connected to an injection tee or dual injection GC, and separate electron capture detectors. Typical GC conditions for the HP 6890 instruments are listed below but may be altered as long as method performance criteria are met.

Temperature 1:	120 °C
Time 1:	0 minute
Ramp 1:	45 °C/minute
Temperature 2	200 °C
Time 2:	0 minutes
Ramp 2:	15 ° C/minute
Temperature 3:	230 °C
Time 3:	0 minutes
Injector temperature:	250 °C
Ramp 3:	30 °C/minute
Final Temperature:	330 °C
Final Time:	2.0 minutes

Injector mode:	Pulsed Split
	4:1 split
Injector Flow:	20 mL/min split flow
Detector temperature:	350 °C
Carrier gas:	Hydrogen
Carrier flow:	28 mL/min
Carrier mode:	Constant flow
Makeup gas:	Nitrogen
Total detector flow:	60 mL/min
Injection volume:	1 μL

10.1.4 DDT and Endrin Breakdown

The breakdown of DDT and Endrin must be measured before samples are analyzed and at the beginning of each 12-hour shift. Injector maintenance must be completed if the breakdown is greater than 15% for either compound (See Section 10.5.1). Both analytical columns must pass DDT/Endrin breakdown criteria prior to sample analysis.

10.2 Initial Calibration

10.2.1 Prepare calibration standards using the procedures in Section 8.6 and the concentrations listed in Table 2. The calibration standards are aliquoted into autosampler vials and capped prior to loading onto the autosampler tray.

10.2.2 Single point calibration might be employed for analysis of the multi-component analytes (Chlordane, Toxaphene). A single calibration standard near the mid-point of the expected calibration range of each multi-component analyte is included with the initial calibration of the single component analytes for pattern recognition, so that the analyst is familiar with the patterns and retention times on each column. The calibration standard may be at a lower concentration than the mid-point of the expected range, if appropriate for the project.

10.2.3 Establish the GC operating conditions by loading the appropriate GC method. Typical instrument conditions are listed in section 10.1.3. The same operating conditions are used for calibrations and sample analyses. Create the analytical sequence using the Agilent Chemstation data acquisition software.

10.2.3.1 Record the calibration standard, unique lab identifier code (lot), the analytical sequence list.

10.2.4 A 1µL injection volume of each calibration standard is used. Other injection volumes may be employed, provided that the analyst can demonstrate adequate sensitivity for the compounds of interest. The same injection volume must be used for all standards and samples.

10.2.5 Because of the low concentration of pesticide standards injected on a GC/ECD, column adsorption may be a problem when the GC has not been used for a day or more or after system maintenance. The GC column may be primed (or deactivated) by injecting a pesticide standard mixture approximately 20 times more concentrated than the mid-concentration standard. Inject this standard mixture prior to beginning the initial calibration or calibration verification.

Alternately, the system may be primed by baking at the final analytical temperature for approximately 30 minutes.

Several analytes may be observed in the injection just following system priming. Always run an instrument blank after system priming.

10.2.6 Calibration Factors

10.2.6.1 Internal Standard Procedure

Internal standard calibration techniques are employed in this method. In each standard, calculate the response factor (RF) for each analyte, the average RF, and the relative standard deviation (RSD) of the RFs, using the Enviroquant data processing software. The calculations are performed automatically, using the formulae listed in Pace's Quality Manual.

10.2.7 Initial Calibration Criteria

- If the **RSD for an analyte is < 20%,** then the response of the instrument for this compound is considered linear over the range and the mean calibration factor can be used to quantitate sample results.
- If the **RSD for any analyte is > 20%,** then linearity through the origin cannot be assumed. The mean response factor cannot be used for quantitation. An

alternative calculation may be done using **linear regression or quadratic regression** as long as the correlation coefficient is >0.990. If both quantitation methods fail criteria for any compound in the initial calibration, then the system must be reevaluated, and a new calibration curve must be analyzed. If quadratic regression is used for calibration, this must be noted in the laboratory narrative (MCP/RCP-CT only).

- **Percent Relative Error (%RE):** For linear and quadratic fit compounds, the %RE must be calculated for the standard at or near the midpoint and at the lowest level of the initial calibration. The %RE between the calculated and expected concentration of an analyte must be ≤ 30%, otherwise recalibration is necessary.

- **Chlordane/Toxaphene peaks requirements**:

Analyte	**Number of Peaks**
Chlordane	3-5
Toxaphene	4-6

- **The minimum number of calibration standards based on the type of calibration curve is listed below**:

Type of Calibration Curve	**Minimum Number of Calibration Standards**
Linear Fit/Avg Response	5
Quadratic Fit	6

- **Removal and replacement of the calibration standards:**
  - The Analyst may remove individual analyte from the lowest (cannot remove RL level) and or the highest calibration levels of the curve. Removal of the individual analyte of interior levels is not permitted.
  - The Analyst may remove an entire single standard calibration level from the interior of the calibration curve when the instrument response demonstrates that the standard was not properly introduced to the instrument, or an incorrect standard was analyzed. The Analyst who chooses to remove a calibration standard from the interior of the calibration shall remove that particular standard calibration level for all analytes.
  - The Analyst may replace a calibration standard provided that:
    - the replacement standard will be analyzed within **twenty-four (24) hours** of the original calibration standard analysis for that particular calibration level;

- all analytes of the replacement calibration standard must be replaced if a standard within the interior of the calibration is replaced;
- the laboratory limits the replacement of calibration standards to one calibration standard concentration.

10.2.8 Retention Time Windows

10.2.8.1 The retention time windows used for the identification of target analytes are calculated using the procedure recommended in Method 8000 and were found to be ± 0.015 minutes.

10.2.8.2 The windows listed above are used as guidance; however, the experience of the analyst weighs heavily in the interpretation of the chromatograms. For example, it has been observed that certain oil matrices can cause the retention times to shift more dramatically. Additionally, if any positive results are questionable and at sufficiently high concentration, GC/MS analysis is used for confirmation.

10.2.9 Initial Calibration Verification

An **Initial Calibration Verification** standard must be run immediately after each initial calibration, near the midpoint of the curve. This standard must be prepared using a second source that is different than the source used for the initial calibration. The **%D** for each analyte to be quantitated must not exceed a **± 20%** difference when compared to the initial calibration curve.

If recovery is outside the 80-120% criteria, the following steps should be taken:

- Analyze the replacement standard. The cause of the failure of the first calibration verification result should be documented.
- If the reanalysis still didn’t achieve the criteria, the source of the problem must be investigated, and the instrument must be recalibrated.

10.3 Equipment Operation and Sample Processing

10.3.1 The same GC operating conditions used for the initial calibration must be employed for sample analyses, including sample injection volume (Section 10.1.3).

10.3.2 Tentative identification of an analyte occurs when a peak from a sample extract falls within the retention time window for the compound. Each tentative identification is confirmed using a second GC column of dissimilar stationary phase. Confirmation is positive when the %RPD is $\leq$ 40% from the results of the two columns. In particularly difficult matrices, confirmation by GC/MS may be advisable (see Section 10.3.11).

10.3.3 The concentration reported for an identified target analyte in an extract is calculated using the Enviroquant data processing software. The Enviroquant methods have been configured to utilize the quantitation formulas found in Quality Manual. Proper quantitation requires the appropriate selection of a baseline from which the peak area or height can be determined. See the Manual Integration SOP for integration guidelines.

10.3.3.1 If the responses exceed the calibration range of the system, dilute the extract and reanalyze.

10.3.4 Each sample analysis must begin with an acceptable initial calibration, breakdown standard (PEM) calibration verification standard(s) (each **12-hour analytical shift**), or calibration standards interspersed within the samples.

The **Internal Standard area of the samples must be within 50%-200% of the starting CCV.** When a calibration verification standard fails to meet the QC criteria, all samples that were injected after the last standard that last met the QC criteria must be re-injected.

10.3.5 Sample injections may continue as long as the calibration verification standards and standards interspersed with the samples meet instrument QC requirements. The sequence ends when the set of samples has been injected or when qualitative and/or quantitative QC criteria are exceeded.

10.3.6 Use the calibration standards analyzed during the sequence to evaluate retention time stability. The retention time windows are established using the absolute retention time of each analyte in the mid-concentration standard during the initial calibration as the mid-point of the window. The widths of the windows are defined in Section 10.2.7.

10.3.7 Each subsequent injection of a standard during the 12-hour analytical shift (i.e., those standards injected every 20 field samples, or more frequently) must be checked against the retention time windows. If any of these subsequent standards fall outside their absolute retention time windows, the GC system is out of control. Determine the cause of the problem and correct it. If the problem cannot be corrected, a new initial calibration must be performed.

10.3.8 Identification of mixtures (i.e. Chlordane and Toxaphene) is based on the characteristic 'fingerprint' retention time and shape of the indicator peak(s); and quantitation is based on the area under the characteristic peaks as compared to the area under the corresponding calibration peaks(s) of the same retention time and shape generated using internal calibration procedures.

10.3.9 If compound identification or quantitation is precluded due to interference (e.g., broad, rounded peaks or ill-defined baselines are present) cleanup of the extract may be needed. If instrument problems are suspected, rerun the extract on another instrument to determine if the problem results from analytical hardware or the sample matrix. Refer to the extraction SOPs for the procedures to be followed in sample cleanup.

10.3.10 For secondary column analysis, a second dissimilar column is utilized to confirm positive pesticide results. The laboratory must report the **higher of the two results** unless obvious interference is present on one of the columns. All required QA/QC parameters (e.g. calibrations, LCSs, etc.) must be met on the second column as well.

10.3.10.1 The **Relative Percent Difference (RPD)** should be 40 or lower. If the RPD exceeds 40, this will be denoted with a P flag. If the RPD exceedance is due to interference, the lower of the dual column values can be reported with I and P flags.

10.3.11 GC/MS Confirmation

GC/MS confirmation may be used in conjunction with either single-column or dual-column analysis if the concentration is sufficient for detection by GC/MS.

10.3.11.1 Full-scan GC/MS will normally require a concentration of approximately 10ng/µL in the final extract for each single-component compound.

10.3.11.2 The GC/MS must be calibrated for the specific target pesticides when it is used for quantitative analysis.

10.3.11.3 GC/MS may not be used for confirmation when concentrations are below the sensitivity of the instrument.

10.3.11.4 GC/MS confirmation should be accomplished by analyzing the same extract that is used for GC/ECD analysis.

10.3.11.5 The base/neutral/acid extract and the associated blank may be used for GC/MS confirmation if the surrogates and internal standards do not interfere and if it is demonstrated that the analyte is stable during acid/base partitioning. However, if the compounds are not detected in the base/neutral/acid extract, then GC/MS analysis of the pesticide extract should be performed.

10.3.11.6 A QC reference sample containing the compound should also be analyzed by GC/MS. The concentration of the QC reference sample must demonstrate that those pesticides identified by GC/ECD can be confirmed by GC/MS.

10.4 Continuing Calibration Verification

10.4.1 Verify calibration each 12-hour shift by injecting calibration verification standards (CCV) prior to conducting any sample analyses. A calibration standard must be injected at intervals of not less than once every twenty field samples.

10.4.1.1 The calibration factor (for external standard compounds) and response factor (for internal standard compounds) for each analyte to be quantitated must not exceed a **± 20%** difference when compared to the initial calibration curve. The Enviroquant data processing software automatically calculates the %D for all analytes according to the formulae in Quality Manual. **The Internal Standard area of the CCV must be within 50%-150%** of the Initial Calibration Internal Standard area.

10.4.1.2 If this criterion is exceeded, inspect the gas chromatographic system to determine the cause and perform whatever maintenance is necessary before verifying calibration and proceeding with sample analysis.

10.4.1.3 If routine maintenance does not return the instrument performance to meet the QC requirements (Section 10) based on the last initial calibration, then a new initial calibration must be performed. Due to the large number of analytes present, allowances may be made for a CF or RF that drifts out high, as long as there are no positive hits for that particular analyte in any of the associated samples. Any QC failures must be written up by the analyst on narrative sheets for inclusion with the sample data.

10.4.2 Compare the retention time of each analyte in the calibration standard with the absolute retention time windows described in section 10.2.7. The center of the absolute retention time window for each analyte is its retention time in the mid-concentration standard analyzed during the initial calibration. Each analyte in each standard must fall within its respective retention time window. If not, the gas chromatographic system must either be adjusted so that a second analysis of the standard does result in all analytes falling within their retention time windows, or a new initial calibration must be performed and new retention time windows established.

10.5 Internal Standard

The use of internal standard calibration does not require that all sample results be bracketed with CCV standard. However, when internal standard calibration is used, the retention times of internal standards and the area response of internal standards should be checked for each analysis.

10.5.1 **IS in CCAL** – The measured area of the internal standard must be no more than ± 50% different from the average area calculated during initial calibration (-50 to 150%).

10.5.2 **IS in samples** - The measured area of the internal standard must be no more than -50% to +100% different from the area calculated from opening CCV (-50 to 200%)

Retention time shifts of more than 30 seconds from the retention time of the most recent calibration standard are cause for concern and must be investigated.

10.6 Preventive Maintenance

Routine preventive maintenance should be performed to maintain GC system performance. This includes periodic replacement of injector septa, replacement of injector liner(s), and replacement of injector seals.

10.6.1 Other Maintenance

Additional maintenance may be required if system performance degrades.

10.6.1.1.1 GC injector ports are of critical concern, especially in the analysis of DDT and Endrin.

10.6.1.1.1.1 Injectors that are contaminated or chemically active can cause the degradation (“breakdown”) of the analytes. Endrin and DDT breakdown to Endrin aldehyde, Endrin ketone, DDD, or DDE.

Check for degradation problems by injecting a standard containing only 4,4’-DDT and Endrin. The presence of 4,4’-DDE, 4,4’-DDD, Endrin ketone or Endrin indicates breakdown. If degradation of either DDT or Endrin exceeds 15%, take corrective action before proceeding with calibration.

When such a breakdown is observed, replacement of the injector liner and seal may solve the problem. If not, clip approximately 3 – 6 inches from the injector end of the GC column. If the degradation does not improve, it may be necessary to replace the column(s).

Calculate percent breakdown as follows:

$$\%\ breakdown\ of\ DDT = \frac{sum\ of\ degradation\ peak\ areas\ (DDE + DDD)}{sum\ of\ all\ peak\ areas\ (DDT + DDE + DDD)} * 100$$

$$\%\ breakdown\ of\ Endrin = \frac{sum\ of\ degradation\ peak\ areas\ (Aldehyde + Ketone)}{sum\ of\ all\ peak\ areas\ (Endrin + Aldehyde + Ketone)} * 100$$

10.6.1.1.2 ECD detectors may also become contaminated, requiring bake out at elevated temperatures, or repair by the manufacturer.

11. Data Evaluation, Calculations and Reporting

11.1 Quantitation of Single Component Pesticides

The single component pesticide compounds are calculated as described in Section 10.3.3 and reported in µg/L or µg/Kg units. After performing technical data review, validating that all QC criteria have been met and confirming all positive hits, the data report is sent electronically to the LIMS computer for generation of the client report. There are two levels of review of the data in the LIMS system prior to release of data. These reviews should be done by two separate individuals.

11.1.1 Quantitation of Multiple-Component Analytes

Quantitation is based on use of 3-5 of the major peaks present for chlordane and 4-6 of the major peaks present for Toxaphene. Each of these peaks is individually calibrated with a 10-point calibration based on average response factors. The %RSD must meet the criteria of $\leq$20%. The 3 to 5 or 4 – 6 major peaks are calculated as described in Section 10.3.3. After individual calculation meets criteria, the average of the major 3-5 or 4 – 6 peaks is used to determine the final concentration.

11.1.1.1 Toxaphene

Toxaphene is quantitated by the internal standard method, using the 4 – 6 largest peaks found in the standard and averaging the resulting concentrations.

11.1.1.2 Chlordane

Chlordane is a mixture of at least 11 major components and 30 or more minor components. Trans- and cis-Chlordane (alpha and gamma, respectively), are the two major components of Chlordane. However, the exact percentage of each in the chlordane material is not completely defined and is not consistent from batch to batch.

11.1.1.2.1 The GC pattern of a Chlordane residue may differ considerably from that of the chlordane standard. Depending on the sample substrate and its history, residues of Chlordane can consist of almost any combination of constituents from the Chlordane, plant and/or animal metabolites, and products of degradation caused by exposure to environmental factors such as water and sunlight.

11.1.1.2.2 Whenever possible, when Chlordane residue does not resemble Chlordane, the analyst should quantitate the peaks of alpha-Chlordane, gamma-

Chlordane, Heptachlor, and trans-Nonachlor separately against the appropriate reference materials, and report the individual residues.

11.1.1.2.3 When the GC pattern of the residue resembles that of Chlordane, the analyst may quantitate Chlordane residues by comparing the total area of the Chlordane chromatogram using the 3-5 major peaks.

12. Contingencies for Handling Out-of-Control Data or Unacceptable Data

Holding time exceedance and/or improper preservation are noted on the nonconformance report form.

All non-conformances, sample preparatory extraction methods and clean-up methods must be addressed in a case narrative and included in the data report.

Perform instrument maintenance as described throughout this SOP as needed when instrument calibration criteria are not met. Record all maintenance in the instrument logbook.

All batch and sample specific QC criteria outlined in Section 10 are evaluated by the analyst prior to approval of the data. When any QC criteria fail, the cause for the failure must be identified and corrected. This may include instrument recalibration followed by sample reanalysis, sample cleanup, or sample re-extraction. If it is determined that the failure is due to sample matrix effects, a project narrative report is written by the analyst for inclusion in the data report. If there is insufficient sample volume to perform the re-analysis for confirmation, this is also noted in the narrative and included in the client report.

13. Method Performance

13.1 Method Detection Limit Study (MDL) / Limit of Detection Study (LOD) / Limit of Quantitation (LOQ)

The laboratory follows the procedure to determine the MDL, LOD, and/or LOQ as outlined in Qualtrax ID 1732. These studies performed by the laboratory are maintained on file for review

13.2 Demonstration of Capability Studies

Refer to Qualtrax ID 1739 for further information regarding IDC/DOC Generation.

13.2.1 Initial (IDC)

The analyst must make an initial, one-time, demonstration of the ability to generate acceptable accuracy and precision with this method, prior to the processing of any samples.

13.2.2 Continuing (DOC)

The analyst must make a continuing, annual, demonstration of the ability to generate acceptable accuracy and precision with this method.

14. Pollution Prevention and Waste Management

Refer to Alpha's Chemical Hygiene Plan and Waste Management and Disposal SOP for further pollution prevention and waste management information.

15. Referenced Documents

Chemical Hygiene Plan

Qualtrax ID 1732 MDL/LOQ Generation

Qualtrax ID1739 IDC/DOC Generation

Qualtrax ID 1728 Waste Management and Disposal SOP

16. Attachments

Table 1: REPORTING LIMITS
Table 2: STANDARD SOLUTIONS
Table 3: QC ACCEPTANCE CRITERIA
Table 4: MCP/CT/NJ SPECIFIC ACCEPTANCE CRITERIA
Table 5: QC FAILURE ACTION PLAN

TABLE 1

REPORTING LIMITS*

	RL (Aqueous)	RL (Soil)
Pesticides		
Alpha-BHC	0.02 µg/L	3.33 µg/Kg
Gamma-BHC (Lindane)	0.02 µg/L	2.67 µg/Kg
Heptachlor	0.02 µg/L	4 µg/Kg
Endosulfan I	0.02 µg/L	10 µg/Kg
Dieldrin	0.04 µg/L	5 µg/Kg
Endrin	0.04 µg/L	3.33 µg/Kg
4, 4'-DDD	0.04 µg/L	10 µg/Kg
4, 4'-DDT	0.04 µg/L	15 µg/Kg
Methoxychlor	0.2 µg/L	15 µg/Kg
Aldrin	0.02 µg/L	10 µg/Kg
Beta-BHC	0.02 µg/L	10 µg/Kg
Delta-BHC	0.02 µg/L	10 µg/Kg
Heptachlor Epoxide	0.02 µg/L	15 µg/Kg
trans-Chlordane	0.02 µg/L	10 µg/Kg
cis-Chlordane	0.02 µg/L	10 µg/Kg
4, 4'- DDE	0.04 µg/L	15 µg/Kg
Endosulfan II	0.04 µg/L	15 µg/Kg
Endrin Aldehyde	0.04 µg/L	10 µg/Kg
Endosulfan Sulfate	0.04 µg/L	3.33 µg/Kg
Endrin Ketone	0.04 µg/L	10 µg/Kg
Chlordane	0.2 µg/L	65 µg/Kg
Toxaphene	0.2 µg/L	150 µg/Kg
Alachlor $^{+}$	0.1 µg/L	10 µg/Kg
Hexachlorobenzene $^{++}$	0.02ug/L	8 µg/Kg

*** RL:** Typical laboratory reporting limit. Actual RLs may be higher depending on sample matrix. RLs are not adjusted for % Moisture.

$^{+}$ CT-RCP only compound.
$^{++}$ MCP/RCP-CT only compound.

TABLE 2

STANDARD SOLUTIONS

	Stock 1 solution (µg/mL)	**Stock 2 solution (µg/mL)**	**Level 11 (µg/L)**	**Level 10 (µg/L)**	**Level 9 (µg/L)**	**Level 8 (µg/L)**	**Level 7 (µg/L)**	**Level 6 (µg/L)**	**Level 5 (µg/L)**	**Level 4 (µg/L)**	**Level 3 (µg/L)**	**Level 2 (µg/L)**	**Level 1 (µg/L)**	**Std. Spike Solution (µg/mL)**	**Std. LCS Solution (µg/mL)**
Hexachlorobenzene	2	0.1	400	200	100	50	10	5	4	3	2	1	0.5	2.0	2.0
Alpha-BHC	2	0.1	400	200	100	50	10	5	4	3	2	1	0.5	2.0	2.0
Lindane	2	0.1	400	200	100	50	10	5	4	3	2	1	0.5	2.0	2.0
Heptachlor	2	0.1	400	200	100	50	10	5	4	3	2	1	0.5	2.0	2.0
Endosulfan I	2	0.1	400	200	100	50	10	5	4	3	2	1	0.5	2.0	2.0
Dieldrin	2	0.1	400	200	100	50	10	5	4	3	2	1	0.5	2.0	2.0
Endrin	2	0.1	400	200	100	50	10	5	4	3	2	1	0.5	2.0	2.0
4, 4'-DDD	2	0.1	400	200	100	50	10	5	4	3	2	1	0.5	2.0	2.0
4, 4'-DDT	2	0.1	400	200	100	50	10	5	4	3	2	1	0.5	2.0	2.0
Methoxychlor	2	0.1	400	200	100	50	10	5	4	3	2	1	0.5	2.0	2.0
Tetrachloro-m-Xylene *	2	0.1	400	200	100	50	10	5	4	3	2	1	0.5	2.0	2.0
Decachloro-Biphenyl *	2	0.1	400	200	100	50	10	5	4	3	2	1	0.5	2.0	2.0
Aldrin	2	0.1	400	200	100	50	10	5	4	3	2	1	0.5	2.0	2.0
Beta-BHC	2	0.1	400	200	100	50	10	5	4	3	2	1	0.5	2.0	2.0
Delta-BHC	2	0.1	400	200	100	50	10	5	4	3	2	1	0.5	2.0	2.0
Heptachlor Epoxide	2	0.1	400	200	100	50	10	5	4	3	2	1	0.5	2.0	2.0
Trans-Chlordane	2	0.1	400	200	100	50	10	5	4	3	2	1	0.5	2.0	2.0
Cis-Chlordane	2	0.1	400	200	100	50	10	5	4	3	2	1	0.5	2.0	2.0
4, 4'- DDE	2	0.1	400	200	100	50	10	5	4	3	2	1	0.5	2.0	2.0
Endosulfan II	2	0.1	400	200	100	50	10	5	4	3	2	1	0.5	2.0	2.0
Endrin Aldehyde	2	0.1	400	200	100	50	10	5	4	3	2	1	0.5	2.0	2.0
Endosulfan Sulfate	2	0.1	400	200	100	50	10	5	4	3	2	1	0.5	2.0	2.0
Endrin Ketone	2	0.1	400	200	100	50	10	5	4	3	2	1	0.5	2.0	2.0
Alachlor	2	0.1	400	200	100	50	10	5	4	3	2	1	0.5	2.0	2.0
Chlordane	50000	1000	10000	5000	2000	1000	500	250	100	20	10	5	2	25	25
Toxaphene	100000	2000	20000	10000	5000	2000	1000	500	200	100	20	10	5	25	25
Internal Standard															
1-Bromo-2-Nitrobenzene	5000	5000	25	25	25	25	25	25	25	25	25	25	25		

* - surrogates

TABLE 3

QC ACCEPTANCE CRITERIA**

	Aqueous		Soil	
Surrogate % Recovery*	**Lower Control Limit**	**Upper Control Limit**	**Lower Control Limit**	**Upper Control Limit**
2,4,5,6-Tetrachloro-m-xylene	30%	150%	30%	150%
Decachlorobiphenyl	30%	150%	30%	150%

*One surrogate on one column is allowed to be outside of the control limits and still be within criteria.

Compound	LCS % Recovery (Aqueous)		LCS % Recovery (Soil)		Duplicate and/or MSD %RPD	
	Lower Control Limit	**Upper Control Limit**	**Target Analyte Limits**	**Marginal Exceedance Limits**	**Aqueous RPD**	**Soil RPD**
Target Analytes LCS/LCSD	30%	150%	30%	150%	< 30%	< 50%
Target Analytes MS/MSD	30%	150%	30%	150%	< 30%	< 50%

TABLE 4

MCP/CT/NJ SPECIFIC QC ACCEPTANCE CRITERIA

Compound	LCS % Recovery (Aqueous)		LCS % Recovery (Soil)		Duplicate and/or MSD %RPD	
	Lower Control Limit	**Upper Control Limit**	**Target Analyte Limits**	**Marginal Exceedance Limits**	**Aqueous RPD**	**Soil RPD**
Target Analytes LCS/LCSD	40%	140%	40%	140%	< 20%	< 30%
Target Analytes MS/MSD	40%	140%	40%	140%	< 20%	< 30%

TABLE 5

QC FAILURE ACTION PLAN

Blank Failures	Failure Situation	Action(s)
Surrogate Failure	1 of 4 high or low	Report as is
	2 or more high	Report as is
	2 or more low, samples are non-detect with passing surrogates	Report as is
	2 or more low, samples have hits and/or failing surrogates	Revial/rerun Re-extract if still failing
IS Failure	IS not present (less than 10% recovery)	Add IS Rerun
	IS out high or low	Revial/rerun Re-extract if still failing
Contamination	Below RL; sample(s) non-detect, below RL, or concentration 10 times or more above the blank	Report as is
	Below RL, sample(s) concentration above RL	See team leader/manager
	Above RL, sample(s) concentration 10 times or more above the blank	Report as is
	Above RL with non-detect sample(s)	Report as is
	Above RL, sample(s) concentration less than 10 times above the blank and volume available	Revial/rerun Re-extract if contamination still present
	Above RL, sample(s) concentration less than 10 times above the blank and no volume available	Revial/rerun B-flag affected data

LCS/LCSD Failures	Failure Situation	Action(s)
Surrogate Failure	1 or more high or low	Report as is
IS Failure	IS not present (less than 10% recovery)	Add IS Rerun
	IS out high or low	Revial/rerun Re-extract if still failing
Spike Failure	Spike compounds out high and sample(s) are non-detect with passing surrogates	Report as is
	Spike compounds out high and sample(s) have hits	Revial/rerun Re-extract if still high
	Spike compounds out low	Revial/rerun Re-extract if still low
	RPD failure	Report as is

MS/MSD/DUP Failures	Failure Situation	Action(s)
Surrogate Failure	(MS/MSD) 1 or more high or low	Report as is
	(MS/MSD) 2 or more high or low	Report as is
	(DUP) 1 or more high, parent sample non-detect	Report as is
	(DUP) 1 or more low, parent sample matches	Report as is
	(DUP) 1 or more low, parent sample doesn’t match	Revial/rerun Re-extract if still failing
IS Failure	IS not present (less than 10% recovery)	Add IS Rerun
	IS out high or low	Revial/rerun Re-extract if still failing
Spike Failure (MS/MSD only)	Compounds out high or low due to sample matrix or hits	Report as is
	Compounds out high or low due to extraction error	Revial/rerun Re-extract if still failing
	RDP failure	Report as is

PCBs

By Capillary Column Gas Chromatography

Reference Methods: Method 8082A SW-846, Test Methods for Evaluating Solid Waste: Physical/Chemical Methods, EPA SW-846, Update IV, 2007.

Quality Control Requirements and Performance Standards for Analysis of Polychlorinated Biphenyls (PCBs) by Gas Chromatography (GC) in Support of Response Action under the Massachusetts Contingency Plan (MCP), Revision No.2, February 15, 2024.

State of Connecticut, Department of Environmental Protection, RRCP, Version 3.0, May 2024.

1. Scope and Application

Method 8082A is used to determine the concentrations of Polychlorinated Biphenyls (PCBs) as Aroclors in extracts from solid, oil and liquid matrices. This SOP details the analysis for PCBs using fused-silica, open-tubular, capillary columns with electron capture detectors (ECD).

Matrices: Extracts from solid, oil and liquid matrices.

Definitions: See Alpha Laboratories Quality Manual Appendix A

Regulatory Parameter List: The standard compounds listed below are determined by this method.

Parameter	CAS#
Aroclor 1016	12674-11-2
Aroclor 1221	11104-28-2
Aroclor 1232	11141-16-5
Aroclor 1242	53469-21-9
Aroclor 1248	12672-29-6
Aroclor 1254	11097-69-1
Aroclor 1260	11096-82-5
* Aroclor 1262	37324-23-5
*Aroclor 1268	11100-14-4

*Note – not certified by NJ for the oil matrix

The data report packages present the documentation of any method modification related to the samples tested. Depending upon the nature of the modification and the extent of intended use, the laboratory may be required to demonstrate that the modifications will produce equivalent results for the matrix. Approval of all method modifications is by one of the following laboratory personnel before performing the modification: Area Supervisor, Laboratory Director, or Quality Assurance Officer.

This method is restricted to use by or under the supervision of analysts experienced in the operation of the gas chromatograph (GC) and in the interpretation of gas chromatograms. Each analyst must demonstrate the ability to generate acceptable results with this method by performing an initial demonstration of capability (see section 13.2).

2. Summary of Method

A measured volume or weight of sample (100mL for liquids, 1g for oil and up to 15g for solids) is extracted using the appropriate matrix-specific sample extraction technique.

Liquid samples are extracted at neutral pH with methylene chloride using Method 3510C (separatory funnel), or other appropriate technique. See extraction SOP for details.

Solid samples are extracted with methylene chloride: acetone (1:1) using Method 3540C (Soxhlet), or other appropriate technique. Solid samples may also be extracted with hexane: acetone (1:1) using Method 3546 (microwave). See extraction SOP for details.

Wipe samples are extracted with methylene chloride: acetone (1:1) using Method 3540C (Soxhlet) or other appropriate technique. See extraction SOP for details.

Oil samples are diluted with hexane following the procedure outlined in the extraction SOP.

Sulfuric acid cleanup (Method 3665A), Copper cleanup (Method 3660B) and Silica Gel cleanup (Method 3630) are utilized for PCB extracts. See extraction SOP for details.

After cleanup, the extract is analyzed by injecting 1µL into a gas chromatograph equipped with narrow- or wide-bore fused silica capillary columns and electron capture (GC/ECD) detectors.

2.1 Method Modifications from Reference

Not applicable.

3. Reporting Limits

The reporting limits for this method as outlined is as follows:

- **Aqueous samples**: 0.04 ug/L / Aroclor based on a 100mL extraction
- **Soil Samples**:
    - 33.3 ug/kg / Aroclor based on 15g extraction
    - 50.0 ug/kg / Aroclor based on 10g extraction
    - 100.0 ug/kg / Aroclor based on 5g extraction
    - 250.0 ug/kg / Aroclor based on 2g extraction
- **Oil Samples**: 5 mg/kg based on 1g extraction
- **Solid of Difficult Matrices** (i.e Caulking, Concrete, etc. are logged using the Alpha Low Level 8082 products): based on a 15g extraction
    - Aroclors 1016, 1221, 1232, 1242, 1254: 20 ug/kg
    - Aroclors 1248, 1260: 13.3 ug/kg
    - Aroclors 1262, 1268: 6.67 ug/kg

4. Interferences

4.1 Instrumental

4.1.1 Only high purity gases are used in the GC system to eliminate this source of possible contamination. Both the Hydrogen (carrier gas) and Nitrogen (detector make-up gas) are certified by the gas supplier.

4.1.2 Preventive instrument maintenance is performed routinely, and whenever highly contaminated extracts are analyzed that could result in chromatographic interferences or result in degradation of system performance. Section 10.6 describes the maintenance steps.

4.1.3 Glassware must be scrupulously cleaned. This procedure is detailed in the Organic Extraction Cleaning and Handling SOP/1953. Store dry glassware in a clean environment.

4.2 Parameters

4.2.1 All solvents used are pesticide grade or equivalent, and reagents are purchased as certified contaminant free. All these materials are routinely determined to be free of interferences by analysis of extraction blanks with every extraction batch performed.

4.2.2 Certain compounds (i.e. phthalates) can be extracted from the sample matrix and be detected by the ECD that could possibly result in false positive results or complicate the data interpretation. The use of the cleanup procedures detailed in the extraction SOP minimizes these possible interferences. Analyst experience is also crucial in making compound determinations.

4.2.3 Interferences co-extracted from the samples will vary considerably from waste to waste. While a general cleanup technique is referenced or provided as part of the method, unique samples may require additional cleanup approaches to achieve desired degrees of discrimination and quantitation.

5. Health and Safety

The toxicity or carcinogenicity of each reagent and standard used in this method is not fully established; however, each chemical compound must be treated as a potential health hazard. From this viewpoint, exposure to these chemicals must be reduced to the lowest possible level by whatever means available. A reference file of material data handling sheets is available to all personnel involved in the chemical analysis. PCBs have been tentatively classified as known or suspected human or mammalian carcinogens. Additional references to laboratory safety are available in the Chemical Hygiene Plan.
All personnel handling environmental samples known to contain or to have been in contact with municipal waste must follow safety practices for handling known disease causative agents.

5.1 Lab coats, safety glasses, and gloves must be worn when handling samples, extracts, standards or solvents.

5.2 All solvent and extract transfers must be handled in the vented bench area in the GC laboratory.

5.3 All stock standards, working standards, and vialed sample extracts must be placed into the waste bucket in the lab, for future disposal by the Hazardous Waste Manager. The container must be labeled properly with hazard warning labels indicating the container contents.

5.4 Bottles containing flammable solvents must be stored in the flammable cabinet.

6. Sample Collection, Preservation, Shipping and Handling

6.1 Sample Collection

Aqueous samples are collected in two 100mL amber glass jars with Teflon-lined lids. Solid samples are collected in one 250mL wide-mouth glass jar with a Teflon-lined lid. Oil samples are collected in a glass jar with Teflon-lined lids. All containers are purchased pre-cleaned and certified from commercial vendors.

6.2 Sample Preservation

Both aqueous and solid samples are then preserved by packing in coolers with ice or ice packs, to maintain a temperature of 4 ± 2° C. Upon receipt at the laboratory, the samples are transferred into sample storage refrigerators to maintain at a temperature of 4 ± 2° C. Preservation is not required for oil samples.

6.3 Sample Handling

- TCLP/SPLP tumbled extracts, NJ DKQP aqueous samples must be extracted within 7 days of sample collection.
- NJ DKQP soil/solid and oil samples within 14 days of collection (NJ DKQP allows 365 days for solids if frozen).
- All other samples, both aqueous and solids, have a 365-day hold time.
- Once extracted, the samples must be analyzed within 40 days of the extraction date.

7. Equipment and Supplies

7.1 Gas Chromatograph, Agilent 6890, 7890: An analytical system completed with gas chromatograph configured for split-splitless injection and all required accessories including syringes, analytical columns, gases, electron capture detectors (ECD), and data system.

7.2 GC Columns: Alpha utilizes dual-column analyses. The dual-column approach involves a single injection that is split between two columns that are mounted in a single gas chromatograph. Typical column pair used is listed below. Other columns may be used as long as method performance criteria can be met.

Column pair:

RTX-CLP: Cat. #11141 from Restek or equivalent; 30m, 0.32mm, 0.32µm

RTX-CLPII Cat. #11324 from Restek or equivalent; 30m, 0.32mm, 0.25µm

7.3 Guard Column: Cat. #10027 from Restek or equivalent; 5m, 0.32mm

7.4 Class "A" Volumetric Flasks: 10mL and 25mL (and other volumes), for standards preparation

7.5 Microsyringes: **10 µL – 1000 µL**

7.6 Gooseneck splitless injecton liner, Cat #20799-214.5 from Restek or equivalent

7.7 Universal "Y" Press-tight tee split: Cat. #20406 from Restek or equivalent / **Siltek MXT Connector:** Cat. #21388 from Restek or equivalent

8. Reagents and Standards

Reagent grade or pesticide grade chemicals are used in all tests. Unless otherwise indicated, it is intended that all reagents shall conform to specifications of the Committee on Analytical Reagents of the American Chemical Society, where such specifications are available. Other grades may be used, provided it is first ascertained that the reagent is of sufficient high purity to permit its use without lessening the accuracy of the determination.
NOTE: Store the standard solutions (stock, composite, calibration, internal, and surrogate) at 4 ± 2° C in Teflon(R)-sealed containers in the dark. When a Lot of standards is prepared, aliquots of that Lot are stored in individual small vials. All stock standard solutions must be replaced after one year or sooner if routine QC tests indicate a problem. All other standard solutions must be replaced after six months or sooner if routine QC indicates a problem.

8.1 n-Hexane: Pesticide quality or equivalent.

8.2 Acetone: Pesticide quality or equivalent.

8.3 Organic-free Reagent Water: All references to water in this method refer to organic-free reagent water from Alpha's RO water treatment system.

8.4 Stock Standard Solutions: All stock standard solutions are purchased from commercial vendors as ampullated certified solutions. When an ampullated stock solution is opened, it is transferred to a labeled amber screw-cap vial. The expiration date of the stock solution is either the vendor specified expiration date, or 1 year from the date the ampule was opened, whichever is sooner.

8.5 Calibration Standards: Calibration standards are prepared volumetrically by diluting the appropriate stock standard(s) with hexane. Calibration standards expire 6 months from the date of preparation, or on the earliest expiration date of any of the stock solutions used to prepare the calibration standard. Calibrations are performed at the 6 concentration levels listed in Table 1. The list of ampullated calibration standards is obtain from **Agilent**:

- Aroclor 1016, Cat. #PP-282, at 100ug/mL
- Aroclor 1260, Cat. #PP-361, at 100ug/mL
- Aroclor 1262, Cat. #PP-371, at 100ug/mL
- Aroclor 1268, Cat. #PP-382, at 100ug/mL
- Aroclor 1221, Cat. #PP-292, at 100ug/mL
- Aroclor 1232, Cat. #PP-302, at 100ug/mL

- Aroclor 1242, Cat. #PP-312, at 100ug/mL
- Aroclor 1248, Cat. #PP-342, at 100ug/mL
- Aroclor 1254, Cat. #PP-351, at 100ug/mL

8.5.1 Preparation of Initial Calibration Standards:

8.5.1.1 SOIL ICAL:

- **1660 L7**: (mix of Aroclors 1016 and 1260) is prepared by diluting
    - ➢ 5mL 1016 Standard (Agilent, Cat. #PP-282)
    - ➢ 5mL 1260 Standard (Agilent, Cat. #PP-361)
    - ➢ 6.4mL of PCB ICAL Surrogate Stock

  to 25ml of Hexane to achieve concentration of
    - ➢ 1016 and 1260 at 20ug/mL
    - ➢ TCMX at 1.28ug/mL and DCB at 2.56ug/mL.

- **2154 L7:** (mix of Aroclors 1221 and 1254) is prepared by diluting
    - ➢ 5mL 1221 Standard (Agilent, Cat. #PP-292)
    - ➢ 5mL 1254 Standard (Agilent, Cat. #PP-351)

  to 25ml of Hexane to achieve concentration of
    - ➢ 1221 and 1254 at 20ug/mL
- **4268 L7** (mix of Aroclors 1242 and 1268), **3262 L7** (mix of Aroclors 1232 and 1262) and **1248 L7;** all are prepared from their respective Stock Standards according to the formula used for L7 of 2154.
- Levels 1-6 are prepared by serial dilutions and a formula with volumes needed can be found in Table 2.

8.5.1.2 RVT ICAL:

- Prepare 2 Intermediate ICAL Standards by diluting 1016/1260 L7 of Soil ICAL:
    - ➢ **Stock#1** (10ug/mL): 500uL of 1660 L7 + 500uL of Hexane
    - ➢ **Stock#2** (0.5ug/mL): 25uL of 1660 L7 + 975uL of Hexane
- Use the VYPER programs: **pcb_rvt_L1-L6** and **pcb_rvt_L7-L10** to vial 1660 ICAL according to the formula and to achieve the concentrations provided in Table 3.
- Prepare one-point cal standards for all other Aroclors by diluting respective L7 stock solutions by using the VYPER program:

  12.5uL of L7 + 987.5uL of Hexane
  pcb_rvt_1point_set

8.6 Second Source Standards: (ICV) Initial Calibration Verification standards are prepared volumetrically by diluting the appropriate stock standard(s) with hexane. Initial Calibration Verification standards expire 6 months from the date of preparation, or on the

earliest expiration date of any of the stock solutions used to prepare the standard. The list of ampullated standards is obtain from **Accustandard**:

- Aroclor 1016, Cat. #C-216S-H-10X, at 1000ug/ml
- Aroclor 1260, Cat. #C-260S-H-10X, at 1000ug/ml
- Aroclor 1262, Cat. #C-262S-H-10X, at 1000ug/ml
- Aroclor 1268, Cat. #C-268S-H-10X, at 1000ug/ml
- Aroclor 1221, Cat. #C-221S-H-10X, at 1000ug/ml
- Aroclor 1232, Cat. #C-232S-H-10X, at 1000ug/ml
- Aroclor 1242, Cat. #C-242S-H-10X, at 1000ug/ml
- Aroclor 1248, Cat. #C-248S-H-10X, at 1000ug/ml
- Aroclor 1254, Cat. #C-254S-H-10X, at 1000ug/ml

8.6.1 Preparation of ICV Standards:

- **1660 ICV:** is prepared by diluting
  - 50uL 1016 Standard (AccuStandard, Cat. #C-216S-H-10X)
  - 50uL 1260 Standard (AccuStandard, Cat. #C-260S-H-10X)
  - 320uL of PCB CCAL Surrogate Stock

  to 20ml of Hexane to achieve concentration of
  - 1016 and 1260 at 2.5ug/mL
  - TCMX at 0.16ug/mL and DCB at 0.32ug/mL

- **2154, 4268, 3262 and 1248 ICVs** are prepared from their respective Stock Standards according to the formula used for 1660 ICV.

- Prepare **RVT ICVs** for all Aroclor standard solutions by diluting respective ICV stocks by using VYPER's pcb_rvt_icv program:
  - 100uL of ICV to 900uL of Hexane, achieving a concentration of
  - 1016 and 1260 at 0.25ug/mL
  - TCMX at 0.016ug/mL and DCB at 0.032ug/mL

8.7 Internal Standard Solution:

1-Bromo-2-nitrobenzene (Ultra, Cat. #PPS-351) is used as the internal standard and is added to all single-component calibration standards and sample extracts to achieve a concentration of 0.25µg/mL. For RVT, this solution is diluted 10X more, achieving a concentration of 0.025µg/mL.

8.8 Surrogate Standards:

Tetrachloro-m-xylene (TCMX) and Decachlorobiphenyl (DCB) are used as surrogates for Aroclor analysis. They are added to the calibration standards at the concentrations listed in Table 1, Continuing Calibration Standards and are spiked into all samples and QC samples prior to extraction.

- **ICAL Surrogates Stock:** is prepared by diluting 500uL of Pesticides Surrogates Standard Spiking Solution (Ultra, Cat. #ISM-320-1) and 500uL of Decachlorobiphenyl (Accustandard, Cat. #CLP-032-R-01) to 20mL of Hexane to achieve concentration of TCMX at 5ug/mL and DCB at 10ug/mL.

- **CCAL Surrogates Stock:** is prepared by diluting 1mL of TCMX&DCB (Accustandard, Cat. #CLP-032-R) and 1mL of Decachlorobiphenyl (Accustandard, Cat. #CLP-032-R-01) to 20mL of Hexane to achieve concentration of TCMX at 10ug/mL and DCB at 20ug/mL.
- **Extraction Surrogates Stock:** is prepared by diluting 10mL of TCMX&DCB (Accustandard, Cat. #CLP-032-R) to 1000mL of Acetone to achieve concentration of TCMX and DCB at 2ug/mL.
- **RVT Extraction Surrogates Stock**: is prepared by diluting 1.25mL of TCMX&DCB (Accustandard, Cat. #CLP-032-R) to 500mL of Acetone to achieve concentration of TCMX and DCB at 0.5ug/mL.
- **PCB Caulking Surrogates Stock:** is prepared by diluting 10mL of TCMX&DCB (Accustandard, Cat. #CLP-032-R) to 100mL of Acetone to achieve concentration of TCMX and DCB at 20ug/mL.
- **PCB Oil Surrogate Stock:** is prepared by diluting 5mL of TCMX&DCB (Accustandard, Cat. #CLP-032-R) to 500mL of Hexane to achieve concentration of TCMX and DCB at 2.0ug/mL.

8.9 LCS/MS Spiking Solutions:

- **PCB Matrix Spike:** The LCS/MS spiking solution is prepared by diluting 6.25mL of Arochlor 1016/1260 (Restek, Cat. #32039) to 500mL of Acetone to achieve concentration of Arochlor 1016/1260 at 12.5ug/ml. For **RVT**, 1.25mL of the stock solution is diluted to 500mL of Acetone to achieve a concentration of Aroclor 1016/1260 at 2.5 ug/mL.

- **PCB Caulking Matrix Spike:** The LCS/MS spiking solution is prepared by diluting 6.25mL of Arochlor 1016/1260 (Restek, Cat. #32039) to 50mL of Acetone to achieve concentration of Arochlor 1016/1260 at 125ug/mL.

- **PCB Oil Matrix Spike:** The LCS/MS spiking solution is prepared by diluting 2.5mL of Arochlor 1016/1260 (Restek, Cat. #32039) to 200mL of Hexane to achieve concentration of Arochlor 1016/1260 at 12.5ug/mL.

9. Quality Control

The laboratory must maintain records to document the quality of data that is generated. Ongoing data quality checks are compared with established performance criteria to determine if the results of analyses meet the performance characteristics of the method.

9.1 Blank(s)

A Method Blank is an aliquot of a clean reference matrix (reagent water for water samples, Ottawa sand for soil/sediment samples, or PCB free transformer oil for oil samples) that is carried through the entire analytical procedure. Extraction blanks are performed with each extraction batch of 20 or less samples, according to the extraction SOPs. The extraction blank must not contain any of the reportable analytes above the reporting limit. If any reportable analytes are detected in the blank, the entire extraction batch is suspect and re-extraction of all associated samples is required, unless the associated samples are non-detect or concentration of the analyte in the samples is 10 times greater than the concentration of this analyte in the blank. The surrogate recoveries must also be within the acceptance criteria listed in Table 4. If surrogate acceptance criteria are exceeded, the extraction batch must be evaluated to determine if re-extraction or re-analysis is necessary. Actions associated with Method Blank failures are listed in Table 6.

9.2 Laboratory Control Sample (LCS)

A Laboratory Control Sample (LCS)/ Laboratory Control Sample Duplicate (LCSD) pair is extracted with each analytical batch. The LCS/LCSD consist of an aliquot of a clean (control) matrix similar to the sample matrix and of the same weight or volume. For Aroclor analysis, the LCS/LCSD are spiked with a mixture of Aroclor 1016 and 1260 (1660) at the levels listed in Table 5. The recovery acceptance criteria are listed in Table 4. If any recovery criteria are not met, the extract may be re-analyzed. If the criteria are still not met, the **entire batch is re-extracted**, unless the recoveries are high, and the associated samples are non-detect. If this is not possible, due to insufficient sample or holding time exceedances, the analyst must narrate the failure in the LIMS for inclusion in the client report. Actions associated with LCS/LCSD failures are listed in Table 6.

9.3 Initial Calibration Verification (ICV)

Refer to Section 10.2.7.

9.4 Continuing Calibration Verification (CCV)

Refer to Section 10.4.

9.5 Matrix Spike/ Matrix Spike Duplicate (MS/MSD)

Matrix Spike and Matrix Spike Duplicate are field samples spiked with known target analyte(s) at the levels listed in Table 5. Upon client request, an MS/MSD pair is extracted and analyzed with each batch of 20 or less samples. MS samples serve as a measure of extraction accuracy, by allowing the comparison of the found amount(s) of target analyte(s) with the spiked amount(s). An MS/MSD set also allows for the calculation of the extraction precision, by comparing the results of the two samples. The recovery acceptance criteria are listed in Table 4. If the recovery criteria are not met, but are met in the LCS, the failure may be attributed to sample matrix effects. Actions associated with MS/MSD failures are listed in Table 6.

For samples with a state of origin of New Jersey, a MS must be extracted for every twenty samples within a 24hr period.

9.6 Laboratory Duplicate (DUP)

Duplicates are laboratory selected replicate samples, prepared by taking an additional sample aliquot of a sample. Upon client request, a DUP is extracted and analyzed with batch of 20 or less samples. Duplicates serve as a measure of the extraction precision, by comparing the results of the sample and duplicate. The relative percent difference (RPD) acceptance criteria are listed in Table 4. If the RPD criteria are not met, the failure may be attributed to matrix effect. Actions associated with DUP failures are listed in Table 6.

For samples with a state of origin of New Jersey, a DUP must be extracted for every twenty samples within a 24hr period.

9.7 Surrogates

All extracted samples and associated QC are spiked with surrogates at the levels listed in Table 5. The laboratory must evaluate surrogate recovery data from individual samples and QC samples versus the surrogate control limits listed in Table 4. If the surrogate limits are not met, the extract may be reanalyzed to determine if the failure was due to an instrument problem. If the criteria are still not met, the affected samples must be re-extracted to confirm that the failure was due to sample matrix, unless the surrogate recovery is high, and the associated sample is non-detect. If matrix effect is confirmed, this must be noted on a narrative sheet for inclusion in the client report.

9.8 Method Sequence

Typical Initial calibration (each level and ICV to identified with the standard lot number)

1. Prime
2. Blank
3. Standard Level 1
4. Standard Level 2
5. Standard Level 3
6. Standard Level 4
7. Standard Level 5
8. Standard Level 6
9. Standard Level 7
10. Initial Calibration Verification Standard (ICV)

Repeat steps 3 – 9 as needed for each Aroclor necessary for calibration.

NOTE: If multiple calibration mixtures are analyzed, it is acceptable to analyze appropriate ICVs after all calibration standards have been injected.

Typical Daily Sequence

1. 1660 Continuing Calibration Standard **(identified with the standard lot number)**
2. Extraction Blank

3. Laboratory Control Sample / Laboratory Control Sample Duplicate
4. Matrix Spike / Matrix Spike Duplicate (if requested by Client)
5. Duplicate (if included with batch QC)
6. Samples - **up to 20 field samples**
7. Repeat 1 – 6 as needed.

10. Procedure

10.1 Equipment Set-up

10.1.1 GC Conditions:

The dual-column / dual-detector approach involves the use of the columns listed in section 7.2. The columns are connected to an injection tee or dual injection GC, and separate electron capture detectors. Alpha typical GC conditions are listed below but may be altered as long as method performance criteria are met.

	INSTRUMENT CONDITIONS
Injector temperature	250^{0}C
Injector mode	Split 10:1
Split Flow	60.1 mL/min
Total Flow	78.2 mL/min
Detector temperature	350^{0}C
Carrier gas	Hydrogen
Carrier flow	20mL/min
Carrier mode	Constant flow
Makeup gas	Nitrogen
Total detector flow	60mL/min
Injection Volume	1μL

	OVEN TEMP PROGRAM
Temperature 1	150 ^{0}C
Time 1	0 min
Ramp 1	45^{0}C/minute
Temperature 2	230^{0}C
Time 2	0 min
Ramp 2	30^{0}C/minute
Temperature 3	330^{0}C
Time 3	1 min

10.2 Initial Calibration

10.2.1 Prepare calibration standards using the standards listed in Section 8.5 to achieve the concentrations from Table 1.

For Analysis of Aroclors which use an **Average Response Factor model (AVG)** the minimum requirement is to perform an initial multi-point calibration for a mixture of 1016/1260 and to use a **one-point initial calibration** to determine the calibration factor and pattern recognition for the remaining Aroclors (TNI standard 1.7.1.1.m). The concentrations of the other Aroclors should generally correspond to the mid-point of the linear range of the detector, but lower concentrations may be employed.

10.2.2 Establish the GC operating conditions by loading the appropriate GC method. Typical instrument conditions are listed in section 10.1.1. The same operating conditions are used for calibrations and sample analyses. Create the analytical sequence using the Agilent Chemstation data acquisition software. Record the calibration standard, unique lot number (PP#) and analyst's initials in the analytical sequence list.

10.2.3 A 1µL injection volume of each calibration standard is typically used. Other injection volumes may be employed, provided that the analyst can demonstrate adequate sensitivity for the compounds of interest. The same injection volume must be used for all standards and samples.

10.2.4 Column adsorption may be a problem when the GC has not been used for a day or more or after system maintenance. The GC column may be primed (or deactivated) by injecting a PCB standard mixture approximately 20 times more concentrated than the mid-concentration standard. Inject this standard mixture prior to beginning the initial calibration or calibration verification.

Alternately, the system may be primed by baking at the final analytical temperature for approximately 30 minutes.

Several analytes may be observed in the injection just following system priming. Always run an instrument blank after system priming.

10.2.5 **Calibration Factor:** Internal Standard Calibration techniques are employed in this method.

10.2.7.1 Internal Standard Procedure. In each standard, calculate the response factor (RF) for each analyte, the average RF, and the relative standard deviation (RSD) of the RFs, using the Enviroquant data processing software. The calculations are performed automatically, using the formula listed in Quality Manual.

Alternatively, standards of the other seven Aroclors are necessary for pattern recognition. When employing the traditional model of a linear calibration through the origin, these standards are also used to determine a single-point calibration factor for each Aroclor, assuming that the Aroclor 1660 mixture has been used to describe the detector response.

The standards for these seven Aroclors should be analyzed before the analysis of any samples with hits above the RL. For example, an Aroclor 1254 standard should be analyzed before a sample with a hit of Aroclor 1254.

10.2.6 **Initial Calibration Criteria**

- If the **<u>RSD for an analyte is < 20%</u>**, then the response of the instrument for this compound is considered linear over the range and the mean calibration factor can be used to quantitate sample results.
- If the **<u>RSD for any analyte is > 20%</u>**, then linearity through the origin cannot be assumed. The mean response factor cannot be used for quantitation. An alternative calculation may be done using **linear regression** or **quadratic regression** (minimum of six ICAL points are needed and regression must be weighted inversely proportional to concentration) if the correlation coefficient is **>0.990**. If both quantitation methods fail criteria for any compound in the initial calibration, then the system must be reevaluated, and a new calibration curve must be analyzed. If quadratic regression is used for calibration, this must be noted in the laboratory narrative.

- **A minimum of 3 peaks must be chosen** for each Aroclor and preferably 5 peaks (11.4.6.1 8082A).

- **The minimum number of calibration standards** based on the type of calibration curve is listed below:

Type of Calibration Curve	Minimum Number of Calibration Standards
Linear Fit/Avg Response	5
Quadratic Fit	6

- **Removal and replacement of the calibration standards:**
    - The Analyst may remove individual analyte from the lowest (cannot remove RL level) and or the highest calibration levels of the curve. Removal of the individual analyte of interior levels is not permitted.
    - The Analyst may remove an entire single standard calibration level from the interior of the calibration curve when the instrument response demonstrates that the standard was not properly introduced to the instrument, or an incorrect standard was analyzed. The Analyst who chooses to remove a calibration standard from the interior of the calibration shall remove that particular standard calibration level for all analytes.
    - The Analyst may replace a calibration standard provided that:
        - the replacement standard will be analyzed within twenty-four (24) hours of the original calibration standard analysis for that particular calibration level;
        - all analytes of the replacement calibration standard must be replaced if a standard within the interior of the calibration is replaced;
        - the laboratory limits the replacement of calibration standards to one calibration standard concentration.
- **Percent Relative Error (%RE)**: For linear and quadratic fit compounds, the %RE must be calculated for the standard at or near the midpoint and at the lowest level of the initial calibration. The %RE between the calculated and expected concentration of an analyte must be **≤ 30%**, otherwise recalibration is necessary.

10.2.7 Initial Calibration Verification

An initial calibration verification standard must be run immediately after each initial calibration, near the midpoint of the curve. The standard must be prepared using a second source that is different than the source used for the initial calibration. (Standards listed in Section 8.6). The **%D** has to be within **20%** when compared to the mean response factor from the initial calibration.

If recovery is **outside the 80-120% criteria**, the following steps should be taken:

- Analyze the replacement standard. The cause of the failure of the first calibration verification result should be documented.
- If the reanalysis still didn't achieve the criteria, the source of the problem must be investigated, and instrument must be recalibrated.

10.2.8 Retention Time Window

10.2.8.1 The retention time window used for the identification of target analytes is ± 0.07 minutes. These criteria have been adopted from the EPA CLP Statement of Work (OLM04.2). It has been found that these limits work well, being wide enough to eliminate false-negatives while being tight enough to eliminate false-positives. Windows that are calculated using the procedure recommended in Method 8000 tend to be very narrow, creating the risk of false negative results.

10.2.8.2 The windows listed above are used as guidance; however, the experience of the analyst weighs heavily in the interpretation of the chromatograms. For example, it has been observed that certain oil matrices can cause the retention times to shift more dramatically.

10.3 Sample Processing

The determination of PCB Aroclors is accomplished by comparing the sample chromatogram to that of the most similar Aroclor standard. The use of PCB overlays is extremely helpful, either by using hardcopies of chromatograms or by utilizing the Enviroquant software. A choice must be made as to which Aroclor is most similar and whether that standard is truly representative of the PCB in the sample. Both retention time and pattern are important when determining PCBs in a sample.

Samples that contained weathered PCB present special analytical challenges. Weathering could alter the Aroclor pattern to the extent that different peaks have to be selected for quantitation. Samples that contained more than one Aroclor present similar problems. For these samples, the Analyst may have to consider selecting the earlier eluting peaks for the lower boiling Aroclor and selecting the later eluting peaks for the higher boiling Aroclors to minimize overlapping peaks.

Minimum of 3 peaks must be chosen for each Aroclor. In these instances, the Analyst may need request the assistance of someone with more expertise in determining the presence of PCB Aroclor.

If compound identification or quantitation is precluded due to interference (e.g., broad, rounded peaks or ill-defined baselines are present) cleanup of the extract may be needed. If instrument problems are suspected, rerun the extract on another instrument to determine if the problem results from analytical hardware or the sample matrix. Refer to the extraction SOPs for the procedures to be followed in sample cleanup.

- The laboratory must report the ***HIGHER*** of the two results unless obvious interference is present on of the columns.

- The **Relative Percent Difference (RPD)** should be **≤ 40%.** If the RPD exceeds 40, this will be denoted with a P flag. If the RPD exceedance is due to interference, the lower of the dual column values can be reported with I and P flags.

If any peaks are above the calibration, a dilution must be done. The dilution reported is the least dilute level at which the peak area is within the calibration range.

10.4 Continuing Calibration

10.4.1 Verify calibration each **12-hours** shift by injecting calibration verification standards prior to conducting any sample analyses. A calibration standard must also be injected at intervals of not less than **once every twenty filed samples**.

A bracketing CCV is not required with the use of internal standard calibration (Method 8082A 11.6.8)

For Aroclor analysis, the calibration verification standard should be a mixture of Aroclor 1016 and 1260 (1660). The calibration verification process does not require analysis of the other Aroclor standards used for pattern recognition (Method 8082A 11.6.2). However, if the one-point calibration is used for the seven other Aroclor, a calibration standard must be analyzed before the sample for any hits.

10.4.2 The **Response Factor** (for internal standard compounds) for each analyte to be quantitated must not exceed a **± 20% difference** when compared to the initial calibration curve The Enviroquant data processing software automatically calculates the **%D** for all analytes.

10.5 Internal Standard

The use of internal standard calibration does not require that all sample results be bracketed with CCV standard. However, when internal standard calibration is used, the retention times of internal standards and the area response of internal standards should be checked for each analysis (10.4.3).

10.5.1 **IS in CCAL** – The measured area of the internal standard must be no more than ± 50% different from the average area calculated during initial calibration **(-50 to 150%).**

10.5.2 **IS in samples** - The measured area of the internal standard must be no more than -50% to +100% different from the area calculated from opening CCV **(-50 to 200%)**

Retention Time shift >30 seconds from the retention time of the most recent calibration standard are cause for concern and must be investigated.

10.6 Preventive Maintenance

10.6.1 **Preventive Maintenance:** Routine preventive maintenance is performed to maintain GC system performance. This includes periodic replacement of injector septa, replacement of injector liner(s), and replacement of injector seals.

10.6.2 **Other Maintenance:** ECD detectors may become contaminated, requiring bake out at elevated temperatures, (no greater than 375°C) or repair by the manufacturer.

11. Data Evaluation, Calculations and Reporting

11.1 Quantitation of Aroclors

Per Method 8082A, quantitation is based on the use of a minimum of 3 of the major peaks present in the analyte, although the use of 5 of the major peaks is recommended. Each of these peaks is individually calibrated with a **minimum of five calibration points** based on average response factors. The %RSD must meet the criteria of $\leq$20% for the ICAL. The five major peaks are calculated as described below. After individual calculation meets criteria, the average of the peaks selected for quantitation is used to determine the final concentration.

11.1.1 Aqueous samples

$$\text{Concentration } (\mu g/L) = \frac{C \times DF \times Vf \times 1000}{Vo}$$

where:

C = Extract concentration (µg/mL), **NOTE**: ng on column = ng/injection volume = ng/uL = ug/mL
DF = Dilution factor
Vf = Final extract volume (mL)
Vo = Sample volume (mL)

11.1.2 Soil/sediment samples

$$\text{Concentration } (\mu g/Kg, \text{ dry weight}) = \frac{C \times DF \times Vf \times 1000}{W\ (gm)} \div \%S$$

where:

C = Extract concentration (µg/mL), **NOTE**: ng on column = ng/injection volume = ng/uL = ug/mL
DF = Dilution factor
Vf = Final extract volume (mL)
W = Weight of the sample extracted (10g for high, 30g for low)
%S = Percent solids, as a decimal value

11.1.3 Reporting Results

11.1.3.1 After performing technical data review, validating that all QC criteria have been met and confirming all positive hits, the data report is sent electronically to the LIMS computer for generation of the client report. There are two levels of review of the data in the LIMS system prior to release of data. These reviews must be done by two separate individuals.

11.1.3.2 **Reporting Results for PCBs in Caulking Samples**

If in the screen sample Aroclor concentration as calculated above is **≥20000ppm**, the Client is contacted by a Customer Service Representative and these results are sent to the LIMS and reported to the Client.

If the sample concentration as calculated above for any Aroclor is **<20000ppm**, the sample is sent for re-extraction by Method 3540C (Alpha SOP/1954).

11.1.3.3 Summation Rules

"TOTAL" concentrations are calculated for **ALL samples and Quality Control Samples** (i.e. LCS, MS, DUP, BLK).

TOTAL = sum of "reportable" Aroclors

Reportable- all Aroclors reported for associated project.

For dual-column analysis, Total is reported as part of column "A" data, unless all individuals are reported from "B" column. "Total" is calculated based on the associated "Report List". See Work Instruction #14335 for details.

12. Contingencies for Handling Out-of-Control Data or Unacceptable Data

Holding time exceedance and/or improper preservation are noted on the nonconformance report form.

Perform instrument maintenance as described throughout this SOP as needed when instrument calibration criteria are not met. Record all maintenance in the instrument logbook.

All batch and sample specific QC criteria outlined in Section 10 are evaluated by the analyst prior to approval of the data. When any QC criteria fail, the cause for the failure must be identified and corrected. This may include instrument recalibration followed by sample reanalysis, sample cleanup, or sample re-extraction. If it is determined that the failure is due to sample matrix effects, a project narrative report is written into the LIMS by the analyst for inclusion in the data report. If there is insufficient sample volume to perform the re-analysis for confirmation, this is also noted in the narrative and included in the client report.

13. Method Performance

13.1 Method Detection Limit Study (MDL) / Limit of Quantitation (LOQ)

The laboratory follows the procedure to determine the MDL, LOD, and/or LOQ as outlined in Pace SOP/1732. These studies performed by the laboratory are maintained on file for review.

13.2 Demonstration of Capability Studies

Refer to Pace SOP/1739 for further information regarding IDC/DOC Generation.

13.2.1 Initial (IDC)

The analyst must make an initial, one-time, demonstration of the ability to generate acceptable accuracy and precision with this method, prior to the processing of any samples.

13.2.2 Continuing (DOC)

The analyst must make a continuing, annual, demonstration of the ability to generate acceptable accuracy and precision with this method.

14. Pollution Prevention and Waste Management

Refer to Pace's Chemical Hygiene Plan and Waste Management and Disposal SOP for further pollution prevention and waste management information.

15. Referenced Documents

Chemical Hygiene Plan

SOP/1732 MDL/LOQ Generation

SOP/1739 IDC/DOC Generation

SOP/1728 Waste Management and Disposal SOP

16. Attachments

Table 1: STANDARD SOLUTIONS

Table 2: PCB ICAL PREPARATION

Table 3: PCB RVT ICAL PREPARATION

Table 4: QC ACCEPTANCE CRITERIA

Table 5: SPIKING LEVEL

Table 6: QC FAILURE ACTION PLAN

TABLE 1

STANDARD SOLUTIONS – Suggested Concentrations

STANDARD SOLUTIONS	Stock Solution (ug/mL)	Level 1 (ug/mL)	Level 2 (ug/mL)	Level 3 (ug/mL)	Level 4 (ug/mL)	Level 5 (ug/mL)	Level 6 (ug/mL)	Level 7 (ug/mL)
AROCLORS								
1016,1221,1232,1242, 1248,1254, 1260,1262,1268	100	0.1	0.5	1	2.5	5	10	20
Aroclors 1221, 1232, 1242, 1254, 1262, 1268	100	0.1	0.5	1	2.5	5	10	20
Internal Standard								
1-Bromo-2-Nitrobenzene	5000	0.25	0.25	0.25	0.25	0.25	0.25	0.25
Surrogates:								
Tetrachloro-m-xylene	2.0	0.0064	0.032	0.064	0.16	0.32	0.64	1.28
Decachlorobiphenyl	2.0	0.0126	0.064	0.128	0.32	0.64	1.28	2.56

TABLE 2

PCB SOIL ICAL PREPARATION:

Aroclors: 1660, 2154, 4268, 3262, 1248				
Level	**Conc [ug/L]**	**Spike**	**Spike [uL]**	**Hexane [uL]**
6	10000	L7	5000	10000
5	5000	L6	500	500
4	2500	L6	250	750
3	1000	L6	100	900
2	500	L6	50	950
1	100	L6	10	990

TABLE 3

PCB RVT ICAL PREPARATION:

Level	**Aroclor Conc**	**TCMX/DCB Conc**	**Stock#**	**VYPER Program**	**Stock Vol used**	**FV**
	ug/L	ug/L			uL	mL
L1	4	0.256/0.512	2	**pcb_rvt_L1-L6**	8	1
L2	10	0.64/1.28			20	
L3	20	1.28/2.56			40	
L4	30	1.92/3.84			60	
L5	40	2.56/5.12			80	
L6	50	3.20/6.40			100	
L7	100	6.40/12.8	1	**pcb_rvt_L7-L10**	10	
L8	250	16/32			25	
L9	500	32/64			50	
L10	1000	64/128			100	

TABLE 4

QC ACCEPTANCE CRITERIA

Aqueous, Soils, Oils		
Surrogate	Lower Control Limit	Upper Control Limit
2,4,5,6-Tetrachloro-m-xylene	30%	150%
Decachlorobiphenyl		

	Aqueous, Soils % Recovery	**RPD%**	
		Waters	**Soils**
MS/MSD LCS/LCSD	40-140%	50%	50%
		20% (NJ/CT/MCP)	30% (NJ/CT/MCP)

TABLE 5

SPIKING LEVEL

	LCS\MS\Surr Spiking Level			
	Spike Solution [ug/mL]	**Surr. Solution [ug/mL]**	**Spike Conc [ug/L]**	**Surr Conc [ug/L]**
RVT	2.5	0.5	250	50
Soil/Water	12.5	2	3125	500
Oil	12.5	2	1250	200
Caulking	125	20	3125	200

TABLE 6

QC FAILURE ACTION PLAN

Blank Failures	**Failure Situation**	**Action(s)**
Surrogate Failure	1 of 4 high or low	Report as is
	2 or more high	Report as is
	2 or more low, samples are non-detect with passing surrogates	Report as is
	2 or more low, samples have hits and/or failing surrogates	Revial/rerun Re-extract if still failing
IS Failure	IS not present (less than 10% recovery)	Add IS Rerun
	IS out high or low	Revial/rerun Re-extract if still failing
Contamination	Below RL; sample(s) non-detect, below RL, or concentration 10 times or more above the blank	Report as is
	Below RL, sample(s) concentration above RL	See team leader/manager
	Above RL, sample(s) concentration 10 times or more above the blank	Report as is
	Above RL with non-detect sample(s)	Report as is
	Above RL, sample(s) concentration less than 10 times above the blank and volume available	Revial/rerun Re-extract if contamination still present
	Above RL, sample(s) concentration less than 10 times above the blank and no volume available	Revial/rerun B-flag affected data

LCS/LCSD Failures	**Failure Situation**	**Action(s)**
Surrogate Failure	1 or more high or low	Report as is
IS Failure	IS not present (less than 10% recovery)	Add IS

		Rerun
	IS out high or low	Revial/rerun Re-extract if still failing
Spike Failure	Spike compounds out high and sample(s) are non-detect with passing surrogates	Report as is
	Spike compounds out high and sample(s) have hits	Revial/rerun Re-extract if still high
	Spike compounds out low	Revial/rerun Re-extract if still low
	RPD failure	Report as is

MS/MSD/DUP Failures	Failure Situation	Action(s)
Surrogate Failure	(MS/MSD) 1 or more high or low	Report as is
	(MS/MSD) 2 or more high or low	Report as is
	(DUP) 1 or more high, parent sample non-detect	Report as is
	(DUP) 1 or more low, parent sample matches	Report as is
	(DUP) 1 or more low, parent sample doesn't match	Revial/rerun Re-extract if still failing
IS Failure	IS not present (less than 10% recovery)	Add IS Rerun
	IS out high or low	Revial/rerun Re-extract if still failing
Spike Failure (MS/MSD only)	Compounds out high or low due to sample matrix or hits	Report as is
	Compounds out high or low due to extraction error	Revial/rerun Re-extract if still failing
	RDP failure	Report as is

Method 1633 Analysis of Per- and Polyfluoroalkyl Substances (PFAS) in Aqueous, Solid, Biosolids, Oil and Tissue Samples by LC-MS/MS

References: Method 1633 - Analysis of Per- and Polyfluoroalkyl Substances (PFAS) in Aqueous, Solid, Biosolids, Oil and Tissue Samples by LC-MS/MS (2nd Draft -June 2022)

DOD QSM (US Department of Defense Quality Systems Manual for Environmental Laboratories, version 5.4, 20221)

1. Scope and Application

Matrices: Drinking water, Non-potable Water, Tissues, Oils, Biosolids and Solid Matrices

Definitions: Refer to Alpha Analytical Quality Manual.

1.1 Method 1633 is for use in the Clean Water Act (CWA) for the determination of the per- and polyfluoroalkyl substances (PFAS) in Table 1 in aqueous, solid (soil, biosolids, sediment) and tissue samples by liquid chromatography/mass spectrometry (LC-MS/MS).

1.2 The method calibrates and quantifies PFAS analytes using isotopically labeled standards. Where linear and branched isomers are present in the sample and either qualitative or quantitative standards containing branched and linear isomers are commercially available, the PFAS analyte is reported as a single analyte consisting of the sum of the linear and branched isomer concentrations

1.3 This is a liquid chromatography/tandem mass spectrometry (LC/MS/MS) method for the determination of selected perfluorinated alkyl substances (PFAS) in Non-Drinking Water, tissue soil and biosolid Matrices. Accuracy and precision data have been generated for the compounds listed in Table 1.

1.4 The data report packages present the documentation of any method modification related to the samples tested. Depending upon the nature of the modification and the extent of intended use, the laboratory may be required to demonstrate that the modifications will produce equivalent results for the matrix. Approval of all method modifications is by one or more of the following laboratory personnel before performing the modification: Area Supervisor, Department Supervisor, Laboratory Director, or Quality Assurance Officer.

1.5 This method is restricted to use by or under the supervision of analysts experienced in the operation of the LC/MS/MS and in the interpretation of LC/MS/MS data. Each analyst must demonstrate the ability to generate acceptable results with this method by performing an initial demonstration of capability.

2. Summary of Method

2.1 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 LC-MS/MS in the multiple reaction monitoring (MRM) mode. Sample concentrations are determined by isotope dilution or extracted internal standard quantification using isotopically labeled compounds added to the samples before extraction.

2.2 Aqueous samples are spiked with isotopically labeled standards, extracted using solid-phase extraction (SPE) cartridges and undergo cleanup using carbon before analysis.

2.3 Solid and Oil samples are spiked with isotopically labeled standards, extracted into basic methanol, and cleaned up by carbon and SPE cartridges before analysis

2.4 Tissue samples are spiked with isotopically labeled standards, extracted in potassium hydroxide and acetonitrile followed by basic methanol, and cleaned up by carbon and SPE cartridges before analysis.

2.5 A sample extract is injected into an LC equipped with a C18 column that is interfaced to an MS/MS). The analytes are separated and identified by comparing the acquired mass spectra and retention times to reference spectra and retention times for calibration standards acquired under identical LC/MS/MS conditions. The concentration of each analyte is determined by using the isotope dilution technique. Extracted Internal Standards (EIS) analytes are used to monitor the extraction efficiency of the method analytes.

2.6 Method Modifications from Reference

N/A

3. Reporting Limits

The reporting limit for PFAS's are listed in Table 8.

4. Interferences

4.1 PFAS standards, extracts and samples should not come in contact with any glass containers or pipettes as these analytes can potentially adsorb to glass surfaces. PFAS analyte and EIS standards commercially purchased in glass ampoules are acceptable; however, all subsequent transfers or dilutions performed by the analyst must be prepared and stored in polypropylene containers.

4.2 Method interferences may be caused by contaminants in solvents, reagents (including reagent water), sample bottles and caps, and other sample processing hardware that lead to discrete artifacts and/or elevated baselines in the chromatograms. The method analytes in this method can also be found in many common laboratory supplies and equipment, such as PTFE (polytetrafluoroethylene) products, LC solvent lines, methanol, aluminum foil, SPE sample transfer lines, etc. All items such as these must be routinely demonstrated to be free from interferences (less than 1/2 the RL for each method analyte) under the conditions of the analysis by analyzing laboratory reagent blanks as described in Section 9.1. Subtracting blank values from sample results is not permitted.

4.3 Matrix interferences may be caused by contaminants that are co-extracted from the sample. The extent of matrix interferences will vary considerably from source to source, depending upon the nature of the water. Humic and/or fulvic material can be co-extracted during SPE and high levels can cause enhancement and/or suppression in the electrospray ionization source or low recoveries on the SPE sorbent. Total organic carbon (TOC) is a good indicator of humic content of the sample.

4.4 SPE cartridges can 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. Brands and lots of SPE devices should be tested to ensure that contamination does not preclude analyte identification and quantitation.

5. Health and Safety

5.1 The toxicity or carcinogenicity of each reagent and standard used in this method is not fully established; however, each chemical compound should be treated as a potential health hazard. From this viewpoint, exposure to these chemicals must be reduced to the lowest possible level by whatever means available. A reference file of material safety data sheets is available to all personnel involved in the chemical analysis. Additional references to laboratory safety are available in the Chemical Hygiene Plan.

5.2 All personnel handling environmental samples known to contain or to have been in contact with municipal waste must follow safety practices for handling known disease causative agents.

5.3 PFOA has been described as “likely to be carcinogenic to humans.” Pure standard materials and stock standard solutions of these method analytes should be handled with suitable protection to skin and eyes, and care should be taken not to breathe the vapors or ingest the materials.

6. Sample Collection, Preservation, Shipping and Handling

6.1 Sample Collection for Aqueous Samples

6.1.1 Samples must be collected in two (2) 500-mL or 250-mL high density polyethylene (HDPE) container with an unlined plastic screw cap. All sample containers must have linerless HDPE or polypropylene caps.

6.1.2 The sample handler must wash their hands before sampling and wear nitrile gloves while filling and sealing the sample bottles. PFAS contamination during sampling can occur from a number of common sources, such as food packaging and certain foods and beverages. Proper hand washing and wearing nitrile gloves will aid in minimizing this type of accidental contamination of the samples.

6.1.3 Open the tap and allow the system to flush until the water temperature has stabilized (approximately 3 to 5 min). Collect samples from the flowing system.

6.1.4 Fill sample bottles. Samples do not need to be collected headspace free.

6.1.5 After collecting the sample and cap the bottle. Keep the sample sealed from time of collection until extraction.

6.1.6 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 and 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 must be stored at ≤ -20 ºC until sample preparation.

6.2 Sample Collection for Solid and Oil samples.

6.2.1 Grab samples are collected in polypropylene containers. Sample containers and contact surfaces containing PTFE shall be avoided. Samples should fill no more than ¾ full.

6.2.2 Maintain solid samples protected from light (in HDPE containers) at 0 - 6 ºC from the time of collection until receipt at the laboratory. The laboratory must confirm that the sample temperature is 0 - 6 ºC upon receipt. Once received by the laboratory, the samples must be stored at ≤ -20 ºC until sample preparation.

6.3 Sample Collection for fish and other tissue samples

6.3.1 If the time of collection to the time of receipt at the laboratory is expected to exceed 24 hours, the tissue samples must be frozen upon collection and shipped to the laboratory on dry ice.

6.3.2 Once received by the laboratory, the samples must be maintained protected from light at ≤ -20 ºC until prepared. Store unused samples in HDPE containers or wrapped in aluminum foil at ≤ -20 ºC.

6.3.3 The nature of the tissues of interest may vary by project. Field sampling plans and protocols should explicitly state the samples to be collected and if any processing will be conducted in the field (e.g., filleting of whole fish or removal of organs). All field procedures must involve materials and equipment that have been shown to be free of PFAS.

6.4 Sample Preservation

Not applicable.

6.5 Sample Shipping

Samples must be chilled during shipment and must not exceed 0 – 6 °C during the first 48 hours after collection. Sample temperature must be confirmed to be at or below 0 – 6 °C when the samples are received at the laboratory. Samples stored in the lab must be held at or below 6 °C until extraction but should not be frozen.

NOTE: Samples that are significantly above 0 – 6 ° C, at the time of collection, may need to be iced or refrigerated for a period of time, in order to chill them prior to shipping. This will allow them to be shipped with sufficient ice to meet the above requirements.

6.6 Sample Handling

6.6.1 Aqueous samples (including leachates) should be analyzed as soon as possible; however, 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.

6.6.2 Solid samples (soils and sediments), Oil and tissue samples may be held for up to 90 days, if stored by the laboratory 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 if NFDHA is an important analyte.

6.6.3 Biosolids samples may be held for up to 90 days, if stored by the laboratory in the dark at 0 - 6 ºC or at -20 ºC. Because microbiological activity in biosolids samples at 0 - 6 ºC may lead to production of gases which may cause the sample to be expelled from the container when it is opened, as well as producing noxious odors, EPA recommends that samples be frozen if they need to be stored for more than a few days before extraction. 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.

7. Equipment and Supplies

7.1 SAMPLE CONTAINERS – 500-mL or 250-mL high density polyethylene (HDPE) bottles fitted with unlined screw caps. Sample bottles must be discarded after use.

7.2 SAMPLE JARS – 8-ounce wide mouth high density polyethylene (HDPE) bottles fitted with unlined screw caps. Sample bottles must be discarded after use.

7.3 POLYPROPYLENE BOTTLES – 4-mL narrow-mouth polypropylene bottles.

7.4 CENTRIFUGE TUBES – 50-mL conical polypropylene tubes with polypropylene screw caps for storing standard solutions and for collection of the extracts.

7.5 AUTOSAMPLER VIALS – Polypropylene 0.7-mL autosampler vials with polypropylene caps.

7.5.1 NOTE: Polypropylene vials and caps are necessary to prevent contamination of the sample from PTFE coated septa. However, polypropylene caps do not reseal, so evaporation occurs after injection. Thus, multiple injections from the same vial are not possible.

7.6 POLYPROPYLENE GRADUATED CYLINDERS – Suggested sizes include 25, 50, 100 and 1000-mL cylinders.

7.7 Auto Pipets – Suggested sizes include 5, 10, 25, 50, 100, 250, 500, 1000, 5000 and 10,000-µls.

7.8 PLASTIC PIPETS – Polypropylene or polyethylene disposable pipets.

7.9 Silanized glass wool (Sigma-Aldrich, Cat # 20411 or equivalent) – store in a clean glass jar and rinsed with methanol (2 times) prior to use.

7.10 Disposable syringe filter, 25-mm, 0.2-µm Nylon membrane, PALL/Acrodisc or equivalent

7.11 Variable volume pipettes with disposable HDPE or polypropylene tips (10 µL to 5 mL) used for preparation of calibration standards and spiked samples.

7.12 ANALYTICAL BALANCE – Capable of weighing to the nearest 0.0001 g.

7.13 ANALYTICAL BALANCE – Capable of weighing to the nearest 0.1 g.

7.14 SOLID PHASE EXTRACTION (SPE) APPARATUS FOR USING CARTRIDGES

7.14.1 SPE CARTRIDGES – (Phenomenex WAX 150 or 250mg or equivalent). The SPE sorbent must have a pKa above 8 so that it remains positively charged during the extraction.

7.14.1.1 Note: SPE cartridges with different bed volume (e.g., 500 mg) may be used; however, the laboratory must demonstrate that the bed volume does not negatively affect analyte absorption and elution, by performing the initial demonstration of capability analyses described in Section 13.

7.14.2 VACUUM EXTRACTION MANIFOLD – A manual vacuum manifold with large volume sampler for cartridge extractions, or an automatic/robotic sample preparation system designed for use with SPE cartridges, may be used if all QC requirements discussed in Section 9 are met. Extraction and/or elution steps may not be changed or omitted to accommodate the use of an automated system. Care must be taken with automated SPE systems to ensure the PTFE commonly used in these systems does not contribute to unacceptable analyte concentrations in the MB.

7.14.3 SAMPLE DELIVERY SYSTEM – Use of a polypropylene transfer tube system, which transfers the sample directly from the sample container to the SPE cartridge, is recommended, but not mandatory. Standard extraction manifolds come equipped with PTFE transfer tube systems. These can be replaced with 1/8” O.D. x 1/16” I.D. polypropylene or polyethylene tubing cut to an appropriate length to ensure no sample contamination from the sample transfer lines. Other types of non-PTFE tubing may be used provided it meets the MB and LCS QC requirements.

7.15 EXTRACT CONCENTRATION SYSTEM – Extracts are concentrated by evaporation with nitrogen using a water bath set no higher than 55 °C.

7.16 LABORATORY OR ASPIRATOR VACUUM SYSTEM – Sufficient capacity to maintain a vacuum of approximately 10 to 15 inches of mercury for extraction cartridges.

7.17 LIQUID CHROMATOGRAPHY (LC)/TANDEM MASS SPECTROMETER (MS/MS) WITH DATA SYSTEM

7.17.1 LC SYSTEM – Instrument capable of reproducibly injecting up to 10-µL aliquots and performing binary linear gradients at a constant flow rate near the flow rate used for development of this method (0.4 mL/min). The LC must be capable of pumping the water/methanol mobile phase without the use of a degasser which pulls vacuum on the mobile phase bottle (other types of degassers are acceptable). Degassers which pull vacuum on the mobile phase bottle will volatilize the ammonium acetate mobile phase causing the analyte peaks to shift to earlier retention times over the course of the analysis batch. The usage of a column heater is optional.

7.17.2 LC/TANDEM MASS SPECTROMETER – The LC/MS/MS must be capable of negative ion electrospray ionization (ESI) near the suggested LC flow rate of 0.4 mL/min. The system must be capable of performing MS/MS to produce unique product ions for the method analytes within specified retention time segments. A minimum of 10 scans across the chromatographic peak is required to ensure adequate precision.

7.17.3 DATA SYSTEM – An interfaced data system is required to acquire, store, reduce, and output mass spectral data. The computer software should have the capability of processing stored LC/MS/MS data by recognizing an LC peak within any given retention time window. The software must allow integration of the ion abundance of any specific ion within specified time or scan number limits. The software must be able to calculate relative response factors, construct linear regressions or quadratic calibration curves, and calculate analyte concentrations.

7.17.4 INSTRUMENT COLUMNS

7.17.4.1 ANALYTICAL: C18 column, 1.7 µm, 50 x 2.1 mm (Waters Acquity UPLC® BEH or equivalent)

7.17.4.2 OPTIONAL GUARD COLUMN: (Phenomenex Kinetex® Evo C18 or equivalent)

8. Reagents and Standards

8.1 GASES, REAGENTS, AND SOLVENTS – Reagent grade or better chemicals must be used.

8.1.1 REAGENT WATER – Purified water which does not contain any measurable quantities of any method analytes or interfering compounds greater than 1/2 the RL for each method analyte of interest. Prior to daily use, at least 3 L of reagent water should be flushed from the purification system to rinse out any build-up of analytes in the system's tubing.

8.1.2 METHANOL (CH_3OH, CAS#: 67-56-1) – High purity, demonstrated to be free of analytes and interferences.

8.1.3 AMMONIUM ACETATE ($NH_4C_2H_3O_2$, CAS#: 631-61-8) – High purity, demonstrated to be free of analytes and interferences. Store at 2-8° and replace 2 years after opening date.

8.1.4 ACETIC ACID (H_3CCOOH, CAS#: 64-19-7) - High purity, demonstrated to be free of analytes and interferences and stored at room temperature.

8.1.4.1 Acetic Acid (0.1%) – Dissolve acetic acid (1 mL) in reagent water (1 L), store at room temperature, replace after 3 months.

8.1.5 1M AMMONIUM ACETATE/REAGENT WATER – High purity, demonstrated to be free of analytes and interferences.

8.1.6 2mM AMMONIUM ACETATE/METHANOL:WATER (5:95) – To prepare, mix 2 ml of 1M AMMONIUM ACETATE,1 ml ACETIC ACID and 50 ml METHANOL into l Liter of REAGENT WATER.

8.1.7 ACETONITRILE – UPLC grade or equivalent, store at room temperature

8.1.8 TOLUENE – HPLC grade or equivalent.

8.1.9 ACETONE – pesticide grade or equivalent

8.1.10 AMMONIUM HYDROXIDE (NH_3, CAS#: 1336-21-6) – High purity, demonstrated to be free of analytes and interferences, and stored at room temperature.

8.1.11 AQUEOUS AMMONIUM HYDROXIDE (3%) – Add ammonium hydroxide (10 mL, 30%) to reagent water (90 mL), store at room temperature, replace after 3 months.

8.1.12 METHANOLIC AMMONIUM HYDROXIDE (0.3%) - add ammonium hydroxide (1 mL, 30%) to methanol (99 mL), store at room temperature, replace after 1 month

8.1.13 METHANOLIC AMMONIUM HYDROXIDE (1%) - add ammonium hydroxide (3.3 mL, 30%) to methanol (97 mL), store at room temperature, replace after 1 month

8.1.14 METHANOLIC AMMONIUM HYDROXIDE (2%) - add ammonium hydroxide (6.6 mL, 30%) to methanol (93.4 mL), store at room temperature, replace after 1 month

8.1.15 METHANOLIC POTASSIUM HYDROXIDE (0.05 M) – add 3.3 g of potassium hydroxide to 1 L of methanol, store at room temperature, replace after 3 months

8.1.16 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 and calibration standards (Section 8.3.2).

8.1.17 FORMIC ACID – (greater than 96% purity or equivalent). Store at room temperature and replace after 2 years.

8.1.18 FORMIC ACID (aqueous, 0.1 M) - dissolve formic acid (4.6 g) in reagent water (1 L), store at room temperature, replace after 2 years.

8.1.19 FORMIC ACID (aqueous, 0.3 M) - dissolve formic acid (13.8 g) in reagent water (1 L), store at room temperature, replace after 2 years.

8.1.20 FORMIC ACID (aqueous, 5% v/v) - mix 5 mL formic acid with 95 mL reagent water, store at room temperature, replace after 2 years.

8.1.21 FORMIC ACID (methanolic 1:1, 0.1 M formic acid/methanol) - mix equal volumes of methanol and 0.1 M formic acid, store at room temperature, replace after 2 years.

8.1.22 FORMIC ACID (aqueous, 50% v/v) - mix 50 mL formic acid with 50 mL reagent water, store at room temperature, replace after 2 years.

8.1.23 POTASSIUM HYDROXIDE – certified ACS or equivalent, store at room temperature, replace after 2 years.

8.1.24 CARBON - – EnviCarb® 1-M-USP or equivalent, verified by lot number before use, stored at room temperature. Loose carbon allows for better adsorption of interferent organics. Note: The single-laboratory validation laboratory achieved better performance with loose carbon than carbon cartridges. Loose carbon will be used for the multi-laboratory validation to set statistically based method criteria.

8.1.25 NITROGEN – Used for the following purposes: Nitrogen aids in aerosol generation of the ESI liquid spray and is used as collision gas in some MS/MS instruments. The nitrogen used should meet or exceed instrument manufacturer's specifications. In addition, Nitrogen is used to concentrate sample extracts (Ultra High Purity or equivalent).

8.1.26 ARGON – Used as collision gas in some MS/MS instruments. Argon should meet or exceed instrument manufacturer's specifications. Nitrogen gas may be used as the collision gas provided sufficient sensitivity (product ion formation) is achieved.

8.2 REFERENCE MATRICES - Matrices in which PFAS and interfering compounds are not detected by this method. These matrices are to be used to prepare the batch QC samples, LOQ/MDL, and IDOC samples.

8.2.1 Reagent water - purified water, Type I

8.2.2 Solid reference matrix Ottawa Sand or equivalent

8.2.3 Tissue Reference matrix – Cod loin or other animal tissue demonstrated to be PFAS free.

8.3 STANDARD SOLUTIONS – When a compound purity is assayed to be 96% or greater, the weight can be used without correction to calculate the concentration of the stock standard. PFAS analyte and IS standards commercially purchased in glass ampoules are acceptable; however, all subsequent transfers or dilutions performed by the analyst must be prepared and stored in polypropylene containers and are stored at ≤4 °C. Standards for sample fortification generally should be prepared in the smallest volume that can be accurately measured to minimize the addition of excess organic solvent to aqueous samples.

8.3.1 Stock standards and diluted stock standards are stored at ≤4 °C. Prepare a spiking solution, containing the method analytes listed in Table 1, in methanol from prime stocks. The solution is used to prepare the calibration standards and to spike the known reference QC samples that are analyzed with every batch. Quantitative standards containing a mixture of branched and linear isomers must be used for method analytes if they are commercially available. Currently, these include PFOS, PFHxS, NEtFOSAA, and NMeFOSAA.

8.3.2 Calibration standard solutions – A series of calibration solutions containing the target analytes and the Labeled extracted internal standards (EIS) and non-extracted internal standards (NIS) is used to establish the initial calibration of the analytical instrument. Table 4 represents the concentrations of the native, EIS and NIS analytes of the calibration curve. Calibration standard solutions are made using the solution described in section 8.1.16.

8.3.3 ISOTOPE DILUTION EXTRACTED INTERNAL STANDARD (EIS) – Isotopically labelled analogs of the target analytes to be used for the quantification of target analytes. EIS stock standard solutions are purchased in glass ampoules and are stored in accordance with the manufacturer's recommendations. The EIS stock solution to be used for the fortification of samples and QC in accordance with the isotope dilution procedure. Table 2 represents the EIS concentrations and nominal sample amounts added to each field sample and QC element.

8.3.4 ISOTOPE DILUTION NON-EXTRACTED INTERNAL STANDARDS (NIS) – Isotopically labelled analogs to be added post extraction for the measurement of EIS extraction efficiency and is added to the final volume of all extractions. Table 3 represents the EIS concentrations and nominal sample amounts added to each field sample and QC element.

9. Quality Control

9.1 Method Blank

9.1.1 A Method Blank (MB) is required with each extraction batch to confirm that potential background contaminants are not interfering with the identification or quantitation of method analytes. An aliquot of reagent water that is treated exactly as a sample including exposure to all glassware, equipment, solvents, reagents and standards. Prep and analyze a MB for every 20 samples. If the MB produces a peak within the retention time window of any analyte that would prevent the determination of that analyte, determine the source of contamination, and eliminate the interference before processing samples. Background contamination must be reduced to an acceptable level before proceeding. Background from method analytes or other contaminants that interfere with the measurement of method analytes must be below the RL. If the method analytes are detected in the MB at concentrations equal to or greater than this level, then all data for the problem analyte(s) must be considered invalid for all samples in the extraction batch.

9.2 Laboratory Control Sample (LCS)

9.2.1 Low Level LCS or OPR (Ongoing Precision Recovery) sample is required with each extraction batch. A LLCS or OPR samples is a method blank spiked with known quantities of analytes. The fortified concentration of the LCS is spiked at 2X the LOQ. Default limits of 70-130% of the true value may be used for analytes until sufficient replicates have been analyzed to generate proper control limits. Calculate the percent recovery (%*R*) for each analyte using the equation:

9.2.2 An LCS or OPR (Ongoing Precision Recovery) sample is required with each extraction batch. A LCS or OPR samples is a method blank spiked with known quantities of analytes. The fortified concentration of the LCS is spiked at the midpoint of the calibration curve. Default limits of 70-130% of the true value may be used for analytes until sufficient replicates have been analyzed to generate proper control limits. Calculate the percent recovery (%*R*) for each analyte using the equation:

$$\%R = \frac{A \times 100}{B}$$

Where:

A = measured concentration in the fortified sample
B =fortification concentration.

9.1.1 Where applicable, in the absence of additional sample volume required to perform matrix specific QC, LCSD's are to be extracted and analyzed. The concentration and analyte recovery criteria for the LCSD must be the same as the batch LCS The RSD's must fall within ≤30% of the true value for medium and high-level replicates, and ≤50% for low level replicates. Calculate the relative percent difference (RPD) for duplicate MSs (MS and MSD) using the equation:

$$RPD = \frac{|LCS - LCSD|}{(LCS + LCSD) / 2} \times 100$$

9.1.2 If the LCS and or LCSD results do not meet these criteria for method analytes, then all data for the problem analyte(s) must be considered invalid for all samples in the extraction batch.

9.3 Non-extracted Internal Standard Area (NIS)

Each time an initial calibration is performed, use the data from all the initial calibration standards used to meet the linearity test in Section 10.3.3.3 to calculate the mean area response for each of the NIS compounds, using the equation below.

$$\text{Mean Area}_{NISi} = \sum \text{AREA}_{NISi} / n$$

where:

AreaNISi = Area counts for the ith NIS, where i ranges from 1 to 7, for the seven NIS compounds listed in Table 1
n = The number of ICAL standards (the default value is n = 6). If a different number of standards is used for the ICAL, for example, to increase the calibration range or by dropping a point at either end of the range to meet the linearity criterion, change 6 to match the actual number of standards used)

Record the mean areas for each NIS for use in evaluating results for sample analyses. There is no acceptance criterion associated with the mean NIS area data.

9.4 Extracted Internal Standards (EIS)

9.4.1 The EIS standard is fortified into all samples, CCVs, MBs, LCSs, MSs, MSDs, FD, and FRB prior to extraction. It is also added to the CAL standards. The EIS is a means of assessing method performance from extraction to final chromatographic measurement. Calculate the recovery (%R) for the EIS using the following equation:

$$\%R = (A / B) \times 100$$

Where:
A = calculated EIS concentration for the QC or Field Sample
B = fortified concentration of the EIS.

9.4.2 Default limits of 50-150% may be used for analytes until sufficient replicates have been analyzed to generate proper control limits. A low or high percent recovery for a sample, blank, or CCV does not require discarding the analytical data but it may indicate a potential problem with future analytical data. When EIS recovery from a sample, blank, or CCV are outside control limits, check 1) calculations to locate possible errors, 2) standard solutions for degradation, 3) contamination, and 4) instrument performance. For CCVs and QC elements spiked with all target analytes, if the recovery of the corresponding target analytes meet the acceptance criteria for the EIS in question, the data can be used but all potential biases in the recovery of the EIS must be documented in the sample report. If the associated target analytes do not meet the acceptance criteria, the data must be reanalyzed.

9.5 Matrix Spike (MS/MSD)

9.5.1 Analysis of an MS is prepared one per preparation batch (if required).

9.5.2 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. Aliquots of field samples

9.5.3 Analyte recoveries may exhibit matrix bias. For samples fortified at or above their native concentration, recoveries should range between 50-150%. If the accuracy of any analyte falls outside the designated range, and the laboratory performance for that analyte is shown to be in control in the LCS, the recovery is judged to be matrix biased. The result for that analyte in the unfortified sample is labeled suspect/matrix to inform the data user that the results are suspect due to matrix effects.

9.6 Laboratory Duplicate

9.6.1 FIELD DUPLICATE OR LABORATORY FORTIFIED SAMPLE MATRIX DUPLICATE (FD or MSD) – Within each extraction batch (not to exceed 20 Field Samples), a minimum of one FD or MSD must be analyzed. Duplicates check the precision associated with sample collection, preservation, storage, and laboratory procedures. If method analytes are not routinely observed in Field Samples, an MSD should be analyzed rather than an FD.

9.6.2 Calculate the relative percent difference (*RPD*) for duplicate measurements (*FD1* and *FD2*) using the equation:

$$RPD = \frac{|FD1 - FD2|}{(FD1 + FD2) / 2} \times 100$$

9.6.3 RPDs for FDs should be ≤30%. Greater variability may be observed when FDs have analyte concentrations that are within a factor of 2 of the RL. At these concentrations, FDs should have RPDs that are ≤50%. If the RPD of any analyte falls outside the designated range, and the laboratory performance for that analyte is shown to be in control in the CCV, the recovery is judged to be matrix biased. The result for that analyte in the unfortified sample is labeled suspect/matrix to inform the data user that the results are suspect due to matrix effects.

9.6.4 If an MSD is analyzed instead of a FD, calculate the relative percent difference (RPD) for duplicate MSs (MS and MSD) using the equation:

$$\text{RPD} = \frac{|\text{MS} - \text{MSD}|}{(\text{MS} + \text{MSD}) / 2} \times 100$$

9.6.5 RPDs for duplicate MSs should be ≤30% for samples fortified at or above their native concentration. Greater variability may be observed when MSs are fortified at analyte concentrations that are within a factor of 2 of the RL. MSs fortified at these concentrations should have RPDs that are ≤50% for samples fortified at or above their native concentration. If the RPD of any analyte falls outside the designated range, and the laboratory performance for that analyte is shown to be in control in the LCSD where applicable, the result is judged to be matrix biased. If no LCSD is present, the associated MS and MSD are to be re-analyzed to determine if any analytical has occurred. If the resulting RPDs are still outside control limits, the result for that analyte in the unfortified sample is labeled suspect/matrix to inform the data user that the results are suspect due to matrix effects.

9.7 Bile Salt Interference Check

9.7.1 The laboratory must analyze a TDCA standard after the initial calibration, prior to the analysis of tissue samples, to check for interferences caused by bile salts. If an interference is present, the chromatographic conditions must be modified to eliminate the interference from TDCA (e.g., changing the retention time of TDCA such that it falls outside the

9.8 Initial Calibration Verification (ICV)

9.8.1 After each ICAL, analyze a QCS sample from a source different from the source of the CAL standards. If a second vendor is not available, then a different lot of the standard should be used. The QCS should be prepared and analyzed just like a CCV. Acceptance criteria for the QCS are identical to the CCVs; the calculated amount for each analyte must be ± 30% of the expected value. If measured analyte concentrations are not of acceptable accuracy, check the entire analytical procedure to locate and correct the problem.

9.9 Instrument Sensitivity Check (ISC)

9.9.1 At the start of each 12-hour shift, analyze a standard at the LOQ. The signal-to-noise ratio of the ISC standard must be greater than or equal to 3:1. If the requirements cannot be met, the problem must be corrected before analyses can proceed.

9.10 Continuing Calibration Verification (CCV)

9.10.1 CCV Standards must be analyzed at the beginning of each analysis batch, after every 10 Field Samples, and at the end of the analysis batch.

9.10.2 The recovery of native and isotopically labeled compounds for the CVs must be within 70 - 130%

9.11 Method-specific Quality Control Samples

9.11.1 Instrument Blank – During the analysis of a batch of samples, a solvent blank is analyzed after samples containing high level of target compounds (e.g., calibration, CV) to monitor carryover from the previous injection. The injection blank consists of the solution in Section 8.1.16 fortified with the EIS and NIS for quantitation purposes.

9.12 Example Method Sequence

- INSTRUMENT BLANK
- INSTRUMENT SENSITIVITY CHECK
- CALIBRATION VERIFICATION STANDARD
- QUALITATIVE IDENTIFICATION STANDARDS
- TDCA STANDARD (only if analyzing tissues)
- INSTRUMENT BLANK
- METHOD BLANK
- LOW-LEVEL LCS/OPR
- OPR/LCS
- SAMPLE (10 or fewer)
- CALIBRATION VERIFICATION STANDARD
- INSTRUMENT BLANK
- SAMPLE (10 or fewer)
- CALIBRATION VERIFICATION STANDARD
- INSTRUMENT BLANK

10. Procedure

10.1 Equipment Set-up

10.1.1 This procedure may be performed manually or in an automated mode using a robotic or automatic sample preparation device. If an automated system is used to prepare samples, follow the manufacturer's operating instructions, but all extraction and elution steps must be the same as in the manual procedure. Extraction and/or elution steps may not be changed or omitted to accommodate the use of an automated system. If an automated system is used, the MBs should be rotated among the ports to ensure that all the valves and tubing meet the MB requirements.

10.1.2 Some of the PFAS's adsorb to surfaces, including polypropylene. Therefore, the aqueous sample bottles must be rinsed with the elution solvent whether extractions are performed manually or by automation. The bottle rinse is passed through the cartridge to elute the method analytes and is then collected.

10.1.3 The SPE cartridges and sample bottles described in this section are designed as single use items and should be discarded after use. They may not be refurbished for reuse in subsequent analyses.

10.1.4 All SPE apparatus, including manifolds, tubing and sample ports must be thoroughly rinsed following each use with 1% methanolic ammonium hydroxide, followed by Methanol and then DI water. Additionally, sample manifold ports and transfer tubing should be inspected regularly for signs of wear and/or discoloration. When such observations are made, the associated components should be replaced.

10.1.5 Prior to the start of any extraction, sample site information must be evaluated for any potentially high level PFAS concentrations or sample matrix irregularities that may impact the extraction process. If such samples are identified, aqueous samples may be pre-screened via direct aqueous injection prior to analysis to estimate the potential PFAS concentrations present.

10.1.6 To perform a direct aqueous injection (DAI) screen, the sample should be inverted several times to try and evenly disperse any organic matter present. A 1 ml aliquot (or less depending on the matrix) is to be taken from the parent sample, volume adjusted to 1 ml with reagent water if less than 1ml, fortified with EIS and NIS spiking solutions to match the concentrations of an extracted sample (typically 5 µl per 1 ml DAI), and then analyzed under the same analytical conditions as field samples.

10.2 Sample Preparation of Aqueous Samples

10.2.1 Samples are preserved, collected, and stored as presented in Section 6.

10.2.2 Determine sample volume. Weigh all samples to the nearest 1g. If visible sediment is present, centrifuge and decant into a new HDPE bottle and record the weight of the new container.

NOTE: Some of the PFAS's adsorb to surfaces, thus the sample volume may not be transferred to a graduated cylinder for volume measurement.

10.2.3 The MB, LCS and FRB may be prepared by measuring reagent water with a polypropylene graduated cylinder or filling an HDPE sample bottle near the top.

10.2.4 Check that the pH is 6.5 ± 0.5. If necessary, adjust pH with 50% formic acid or ammonium hydroxide and 3% aqueous ammonium hydroxide. The extract is now ready for solid-phase extraction (SPE) and cleanup.

10.2.5 Add 20 µL of the EIS to each sample and QC, cap and invert to mix.

10.2.6 If the sample is an LCS, LCSD, MS, or MSD, add the necessary amount of analyte PDS. Cap and invert each sample to mix.

10.3 Sample Prep and Extraction Protocol for Solids.

10.3.1 Homogenize and weigh 5 grams of sample (measured to the nearest hundredth of a gram) into a 50 ml polypropylene centrifuge tube. For laboratory control blanks and spikes, 5 grams of clean sand is used.

10.3.1.1 For Biosolids and other complex matrices, a small aliquot may be required due to co-extracted matrix interferences.

10.3.1.2 For batch QC samples using 5 g of reference solid, add 2.5 g of reagent water. The addition of reagent water to the sand provides a matrix closer in composition to real-world samples.

10.3.2 Add 20 µL of the EIS to each sample and QC.

10.3.3 If the sample is an LCS, LCSD, MS, or MSD, add the necessary amount of analyte PDS. Cap and invert each sample to mix.

10.3.4 Vortex the samples to evenly disperse the spiking solutions and allow to equilibrate for 30 minutes.

10.3.5 To all samples, add 10 ml of 0.3% methanolic ammonium hydroxide, cap, vortex for 25 seconds.

10.3.6 Following mixing, shake each sample for 30 minutes on a shaker table.

10.3.7 Centrifuge each sample at 2800RPM for 10 minutes.

10.3.8 Remove the supernatant and transfer to a clean 50 ml polypropylene centrifuge tube.

10.3.9 Repeat steps 10.3.4 to 10.3.7, with 15 ml of 0.3% methanolic ammonium hydroxide, combining the supernatants.

10.3.10 Add 5ml of 0.3% methanolic ammonium hydroxide to the sample, vortex for 25 seconds and centrifuge each sample at 2800RPM for 10 minutes.

10.3.11 Remove the supernatant and transfer to the same 50 ml polypropylene centrifuge tube containing eluates from the previous cycles.

10.3.12 Add 10 mg of carbon to the combined extract, mix by occasional hand shaking for no more than five minutes and then centrifuge at 2800 rpm for 10 minutes. Immediately decant the extract into a 50 ml polypropylene centrifuge tube.

10.3.13 Dilute to approximately 35 mL with reagent water. Samples containing more than 50% water may yield extracts that are greater than 35 mL in volume; therefore, do not add water to these. Determine the water content in the sample as follows (percent moisture is determined from the % solids):

Water Content in Sample = (Sample Weight * Percent moisture) / 100

10.3.14 Concentrate each extract at approximately 55 ºC with a gentle N2 flow to a final volume that is based on the water content of the sample (see table below). Allow extracts to concentrate for 10 minutes, then mix (by vortex if the volume is < 20. Continue concentrating and mixing every 5 minutes until the extract has been reduced to the required volume as specified in the table below. If the extract volume appears to stop dropping, the concentration must be stopped and the volume at which it was stopped recorded.

Water Content in Sample	Concentrated Final Volume
< 5 grams	15 ml
5-8 grams	15-20 ml
8-9 grams	20-22.5 ml
9-10 grams	22.5-25 ml

10.3.15 Add 40 - 50 mL of reagent water to the extract and vortex. Check that the pH is 6.5 ±0.5 and adjust as necessary with 50% formic acid or 30% ammonium hydroxide, or with 5% formic acid and 3% aqueous ammonium hydroxide. The extracts are ready for SPE and cleanup.

10.4 Sample Prep and Extraction Protocol for Oils.

10.4.1 Weigh 1-2 grams of sample (measured to the nearest hundredth of a gram) into a 50 ml polypropylene centrifuge tube. For laboratory control blanks and spikes, 1 grams of mineral oil is used.

10.4.1.1 For batch QC samples use 1 g of reference oil.

10.4.2 Add 20 µL of the EIS to each sample and QC.

10.4.3 If the sample is an LCS, LCSD, MS, or MSD, add the necessary amount of analyte PDS. Cap and invert each sample to mix.

10.4.4 Vortex the samples to evenly disperse the spiking solutions and allow to equilibrate for 30 minutes.

10.4.5 To all samples, add 10 ml of 0.3% methanolic ammonium hydroxide, cap, vortex for 25 seconds.

10.4.6 Following mixing, shake each sample for 30 minutes on a shaker table.

10.4.7 Centrifuge each sample at 2800RPM for 10 minutes.

10.4.8 Remove the supernatant and transfer to a clean 50 ml polypropylene centrifuge tube.

10.4.9 Repeat steps 10.3.4 to 10.3.7, with 15 ml of 0.3% methanolic ammonium hydroxide, combining the supernatants.

10.4.10 Add 5ml of 0.3% methanolic ammonium hydroxide to the sample, vortex for 25 seconds and centrifuge each sample at 2800RPM for 10 minutes.

10.4.11 Remove the supernatant and transfer to the same 50 ml polypropylene centrifuge tube containing eluates from the previous cycles.

10.4.12 Add 10 mg of carbon to the combined extract, mix by occasional hand shaking for no more than five minutes and then centrifuge at 2800 rpm for 10 minutes. Immediately decant the extract into a 50 ml polypropylene centrifuge tube.

10.5 Sample Prep and Extraction Protocol for Tissues.

10.5.1 Homogenize and weigh 2 grams of sample (measured to the nearest hundredth of a gram) into a 50 ml polypropylene centrifuge tube. For laboratory control blanks and spikes, 2 grams of clean tissue is used.

10.5.2 Add 20 µL of the EIS PDS to each sample and QC.

10.5.3 If the sample is an LCS, LCSD, MS, or MSD, add the necessary amount of analyte PDS. Cap and invert each sample to mix.

10.5.4 Add 10 mL of 0.05M KOH in methanol to each sample. Vortex to disperse the tissue then place tubes on a mixing table to extract for at 16 hours. Centrifuge at 2800 rpm for 10 minutes and collect the supernatant in a 50-mL polypropylene centrifuge tube.

10.5.5 Add 10 mL of acetonitrile to remaining tissue in the 50-mL centrifuge tube, vortex to mix and disperse the tissue. Sonicate for 30 minutes. Centrifuge at 2800 rpm for 10 minutes and collect the supernatant, adding it to the 50-mL centrifuge tube containing the initial extract.

10.5.6 Add 5 mL of 0.05M KOH in methanol to the remaining sample in each centrifuge tube. Vortex to disperse the tissue and hand mix briefly. Centrifuge at 2800 rpm for 10 minutes and collect the supernatant, adding it to the 50-mL centrifuge tube containing the first two extracts.

10.5.7 Add 10 mg of carbon to the combined extract, mix by occasional hand shaking over a period of no more than five minutes and then centrifuge at 2800 rpm for 10 minutes. Immediately decant the extract into a 50-mL centrifuge tube.

10.5.8 Add 1 mL of reagent water to each tube and concentrate each extract at approximately 55 °C with a gentle N2 flow to a final volume of 2.5 ml.

10.5.9 Add reagent water to each evaporation/concentrator tube to dilute the extracts to 50 mL. Check that the pH = 6.5 ± 0.5 and adjust as needed with 50% formic acid, or ammonium hydroxide or with 5% formic acid and 3% aqueous ammonium hydroxide. The extracts are ready for SPE and cleanup.

10.6 SPE Extract: All matrices

10.6.1 Pack clean silanized glass wool to half the height of the WAX SPE cartridge barrel.

10.6.2 Pre-condition the cartridges by washing them with 3 X 5 mL of 1% methanolic ammonium hydroxide, discarding the wash volumes.

10.6.3 Rinse the cartridge with 5 mL of 0.3M formic acid, allowing the cartridge to drain using gravity only, discarding the rinse volume. Do not allow the cartridge to go dry

10.6.4 Adjust the vacuum so that the approximate flow rate is ~5 mL/min and load the sample across the cartridge. Do not allow the cartridge to go dry before all the sample has passed through.

10.6.5 Once all the sample has passed across the cartridge, rinse the walls of the reservoir with 2 X 5 mL reagent water, loading the rinse across the cartridge.

10.6.6 Rinse the walls of the reservoir with 5 mL of 1:1 0.1M formic acid/methanol and pass the rinse through the cartridge using vacuum. Dry the cartridge by pulling air through for 15 seconds.

10.6.7 Rinse the inside of the sample bottle with 5 mL of 1% methanolic ammonium hydroxide. Use vacuum to pull the elution solvent through the cartridge and into the collection tubes. When the cartridge bed and glass wool are submerged, stop the cartridge flow by closing the valve, keeping the sorbent bed and wool submerged.

10.6.8 Let the wetted sorbent bed and wool soak for 1 minute.

10.6.9 Open the cartridge valve and collect the eluate into a 15 ml polypropylene collection tube.

10.6.10 Add 25 µL of concentrated acetic acid to each sample eluted in the collection tubes and vortex to mix.

10.6.11 Add 10 mg of carbon to each sample and batch QC extract, using a 10-mg scoop. Handshake occasionally for no more than 5 minutes. It is important to minimize the time the sample extract is in contact with the carbon. Immediately vortex (30 seconds) and centrifuge at 2800 rpm for 10 minutes.

10.6.12 Add NIS solution to a clean collection tube. Place a syringe filter (25-mm filter, 0.2-µm nylon membrane) on a 5-mL polypropylene syringe. Take the plunger out and carefully decant the sample supernatant into the syringe barrel. Replace the plunger and filter the entire extract into the new collection tube containing the NIS.

10.6.13 Vortex to mix and transfer a portion of the extract into a .7-mL polypropylene LC vial for LC-MS/MS analysis. Cap the collection tube containing the remaining extract and store at 4 °C

10.7 Sample Volume Determination

10.7.1 If using weight to determine volume, weigh the empty bottle to the nearest 1 g and determine the sample weight by subtraction of the empty bottle weight from the original sample weight. Assume a sample density of 1.0 g/mL. In either case, the sample volume will be used in the final calculations of the analyte concentration.

10.8 Initial Calibration - Demonstration and documentation of acceptable initial calibration is required before any samples are analyzed. After the initial calibration is successful, a CCV is required at the beginning and end of each period in which analyses are performed, and after every tenth Field Sample.

10.8.1 ESI-MS/MS TUNE

10.8.1.1 Calibrate the mass scale of the MS with the calibration compounds and procedures prescribed by the manufacturer.

10.8.1.2 Optimize the [M-H]- or [M-CO_2]- for each method analyte by infusing approximately 0.5-1.0 µg/mL of each analyte (prepared in the initial mobile phase conditions) directly into the MS at the chosen LC mobile phase flow rate (0.4 mL/min). This tune can be done on a mix of the method analytes. The MS parameters (voltages, temperatures, gas flows, etc.) are varied until optimal analyte responses are determined. The method analytes may have different optima requiring some compromise between the optima.

The Mass spec conditions found in Table 7 show the Sciex Triple Quad 5500+ operation conditions used in this method.

10.8.1.3 Optimize the product ion for each analyte by infusing approximately 0.5-1.0 µg/mL of each analyte (prepared in the initial mobile phase conditions) directly into the MS at the chosen LC mobile phase flow rate (approximately 0.4 mL/min). This tune can be done on a mix of the method analytes. The MS/MS parameters (collision gas pressure, collision energy, etc.) are varied until optimal analyte responses are determined. Typically, the carboxylic acids have very similar MS/MS conditions, and the sulfonic acids have similar MS/MS conditions.

The conditions found on table 5 are representative of expected tune optimizations for each analyte. If conditions other the ones close to the values provided in table 5 are achieved, the process should be re-performed and/or instrument maintenance performed to resolve the problem.

10.8.2 Establish LC operating parameters that optimize resolution and peak shape. Modifying the standard or extract composition to more aqueous content to prevent poor shape is not permitted.

Table 6 represents the operation conditions of a Sciex Exion LC system when running this method.

10.8.3 Inject 2µl of a mid-level CAL standard under LC/MS conditions to obtain the retention times of each method analyte. Divide the chromatogram into retention time windows each of which contains one or more chromatographic peaks. During MS/MS analysis, fragment a small number of selected precursor ions ([M-H]-) for the analytes in each window and choose the most abundant product ion. For maximum sensitivity, small mass windows of ±0.5 daltons around the product ion mass were used for quantitation.

10.8.4 Inject a mid-level CAL standard under optimized LC/MS/MS conditions to ensure that each method analyte is observed in its MS/MS window and that there are at least 10 scans across the peak for optimum precision.

NOTE: PFHxS, PFOS, NMeFOSAA, and NEtFOSAA have multiple chromatographic peaks using the LC conditions in Table 7 due to chromatographic resolution of the linear and branched isomers of these compounds. Most PFAS's are produced by two different processes. One process gives rise to linear PFAS's only while the other process produces both linear and branched isomers. Thus, both branched and linear PFAS's can potentially be found in the environment. For the aforementioned compounds that give rise to more than one peak, all the chromatographic peaks observed in the standard must be integrated and the areas totaled. Chromatographic peaks in a sample must be integrated in the same way as the CAL standard.

10.8.5 Prepare a set of CAL standards as outlined in table 5. The lowest concentration CAL standard must be at or below the LOQ.

10.8.6 The LC/MS/MS system is calibrated using the isotope dilution technique. Target analytes are quantitated against their isotopically labeled analog (Extracted Internal Standard) where commercially available. If a labeled analog is not commercially available, the extracted internal standard with the closest retention time and /or closest chemical similarity is to be used. Use the LC/MS/MS data system software to generate a linear regression or quadratic calibration curve for each of the analytes. This curve must always be forced through zero and may be concentration weighted, if necessary. Forcing zero allows for a better estimate of the background levels of method analytes. A minimum of 6 calibration points are required for a linear or quadratic calibration model.

10.8.7 **CALIBRATION ACCEPTANCE CRITERIA** – A linear fit is acceptable if the calculated RSD or RSE for each target analyte is ≤20%. If linear or Quadratic regressions are used, coefficient of determination (r^2) values must be greater than 0.99. When quantitated using the initial calibration curve, each calibration point at or above the LOQ for each analyte must calculate to be within 70-130% of its true value. The calculate value of each EIS analyte must be within 50-150% of its true value. If these criteria cannot be met, corrective action is taken to reanalyze the CAL standards, restrict the range of calibration.

10.8.8 **Bile salts interference check -** The laboratory must analyze a TDCA standard after the initial calibration, prior to the analysis of tissue samples, to check for interferences caused by bile salts. If an interference is present, the chromatographic conditions must be modified to eliminate the interference from TDCA (e.g., changing the retention time of TDCA such that it falls outside the retention window for PFOS by at least one minute), and the initial calibration repeated.

10.9 CONTINUING CALIBRATION CHECK (CCV) – Minimum daily calibration verification is as follows. Verify the initial calibration at the beginning and end of each group of analyses, and after every tenth sample during analyses. In this context, a “sample” is considered to be a Field Sample. MBs, CCVs, LCSs, MSs, FDs FRBs and MSDs are not counted as samples. The beginning CCV of each analysis batch must be at or below the RL in order to verify instrument sensitivity prior to any analyses. If standards have been prepared such that all low CAL points are not in the same CAL solution, it may be necessary to analyze two CAL standards to meet this requirement. Alternatively, the analyte concentrations in the analyte PDS may be customized to meet these criteria. Subsequent CCVs should alternate between a medium and Low concentration CAL standard.

10.9.1 Inject an aliquot of the appropriate concentration CAL standard and analyze with the same conditions used during the initial calibration.

10.9.2 Calculate the concentration of each analyte and EIS in the CCV. The calculated amount for each native and EIS analyte for medium level CCVs must be within ± 30% of the true. If these conditions do not exist, then all data for the problem analyte must be considered invalid, and remedial action should be taken which may require recalibration. Any Field or QC Samples that have been analyzed since the last acceptable calibration verification should be reanalyzed after adequate calibration has been restored, with the following exception. If the CCV fails because the calculated concentration is greater than 130% for a particular method analyte, and Field Sample extracts show no detection for that method analyte, non-detects may be reported without re-analysis.

10.9.3 REMEDIAL ACTION – Failure to meet CCV QC performance criteria may require remedial action. Major maintenance, such as cleaning the electrospray probe, atmospheric pressure ionization source, cleaning the mass analyzer, replacing the LC column, etc., requires recalibration and verification of sensitivity by analyzing a CCV at or below the LOQ.

10.10 EXTRACT ANALYSIS

10.10.1 The same operating conditions used for the initial calibration and summarized in Tables 6 and 7 are to be used.

10.10.2 Prior to analysis of sample extracts, the Instrument mass calibration verification must be performed using standards whose mass range brackets the masses of interest and performed in the negative ion mode. The mass calibration is verified if the calculated mass is within ± .2 daltons of the specified mass.

10.10.3 Establish an appropriate retention time window for each analyte. This should be based on measurements of actual retention time variation for each method analyte in CAL standard solutions analyzed on the LC over the course of time. A value of plus or minus three times the standard deviation of the retention time obtained for each method analyte while establishing the initial calibration can be used to calculate a suggested window size. However, the experience of the analyst should weigh heavily on the determination of the appropriate retention window size.

10.10.4 Calibrate the system by either the analysis of a calibration curve or by confirming the initial calibration is still valid by analyzing a CCV.

10.10.5 Begin analyzing Field Samples, including QC samples, at their appropriate frequency by injecting the same size aliquots under the same conditions used to analyze the CAL standards.

10.10.6 For concentrations at or above the method LOQ, the total (branched and linear isomer) quantification ion response to the total (branched and linear isomer) confirmation ion response ratio must fall within ± 50% of the ratio observed in the midpoint initial calibration standard.

10.10.7 At the conclusion of data acquisition, use the same software that was used in the calibration procedure to identify peaks of interest in predetermined retention time windows. Use the data system software to examine the ion abundances of the peaks in the chromatogram. Identify an analyte by comparison of its retention time with that of the corresponding method analyte peak in a reference standard.

10.10.7.1 Method analyte, EIS analyte, and NIS analyte RTs must fall within 0.4 minutes of the predicted retention times from the midpoint standard of the ICAL or initial daily CV, whichever was used to establish the RT window position for the analytical batch. All branched isomer peaks identified in either the calibration standard or the qualitative (technical grade) standard must fall within in the retention time window for that analyte.

10.10.7.2 For all method analytes with exact corresponding isotopically labeled analogs, method analytes must elute within 0.1 minutes of the associated EIS.

10.10.8 The analyst must not extrapolate beyond the established calibration range. If an analyte peak area exceeds the range of the initial calibration curve, the sample should be re-extracted with a reduced sample volume in order to bring the out of range target analytes into the calibration range. If a smaller sample size would not be representative of the entire sample, the following options are recommended. Re-extract an additional aliquot of sufficient size to ensure that it is representative of the entire sample. Spike it with a higher concentration of internal standard. Prior to LC/MS analysis, dilute the sample so that it has a concentration of internal standard equivalent to that present in the calibration standard. Then, analyze the diluted extract.3

10.10.9 In instances where re-extraction is not an option, dilute a subsample of the sample extract with 0.1% acetic acid by a factor no greater than 10x adjust the amount of the NIS in the diluted extract, and analyze the diluted extract. If the responses for each EIS in the diluted extract meet the S/N and retention time, and the EIS recoveries from the analysis of the diluted extract are greater than 5%, then the compounds associated with those EISs may be quantified using isotope dilution. Use the EIS recoveries from the original analysis to select the dilution factor, with the objective of keeping the EIS recoveries in the dilution above that 5% lower limit. If the adjusted EIS recoveries are below 5%, the dilution is assumed invalid. If the adjusted EIS recoveries are greater than 5%, adjust the compound concentrations, detection limits, and minimum levels to account for the dilution.

11. Data Evaluation, Calculations and Reporting

11.1 Complete chromatographic resolution is not necessary for accurate and precise measurements of analyte concentrations using MS/MS. In validating this method, concentrations were calculated by measuring the product ions listed in Table 9.

11.2 Calculate analyte concentrations using the multipoint calibration established in Section 10.9. Do not use daily calibration verification data to quantitate analytes in samples. Adjust final analyte concentrations to reflect the actual sample volume determined in Section 10.8

C_{ex} = (Area of target analyte * Concentration of Labeled analog) / (area of labeled analog * CF)

C_s = (C_{ex} / sample volume in ml) * 1000

C_{ex} = The concentration of the analyte in the extract
CF = calibration factor from calibration.

11.3 Prior to reporting the data, the chromatogram should be reviewed for any incorrect peak identification or poor integration.

11.4 PFHxS, PFOS, PFOA, NMeFOSAA, and NEtFOSAA have multiple chromatographic peaks using the LC conditions in Table 7 due to the linear and branch isomers of these compounds (Sect. 10.10.4.). The areas of all the linear and branched isomer peaks observed in the CAL standards for each of these analytes must be summed and the concentrations reported as a total for each of these analytes.

11.5 Calculations must utilize all available digits of precision, but final reported concentrations should be rounded to an appropriate number of significant figures (one digit of uncertainty), typically two, and not more than three significant figures.

12. Contingencies for Handling Out-of-Control Data or Unacceptable Data

12.1 Section 9.0 outlines sample batch QC acceptance criteria. If non-compliant organic compound results are to be reported, the Organic Section Head and/or the Laboratory Director, and the Operations Manager must approve the reporting of these results. The laboratory Project Manager shall be notified and may choose to relay the non-compliance to the client, for approval, or other corrective action, such as re-sampling and re-analysis. The analyst, Data Reviewer, or Department Supervisor performing the secondary review initiates the project narrative, and the narrative must clearly document the non-compliance and provide a reason for acceptance of these results.

12.2 All results for the organic compounds of interest are reportable without qualification if extraction and analytical holding times are met, preservation requirements (including cooler temperatures) are met, all QC criteria are met, and matrix interference is not suspected during extraction or analysis of the samples. If any of the below QC parameters are not met, all associated samples must be evaluated for re-extraction and/or re-analysis.

13. Method Performance

13.1 Detection Limit Study (DL) / Limit of Detection Study (LOD) / Limit of Quantitation (LOQ)

13.1.1 The laboratory follows the procedure to determine the DL, LOD, and/or LOQ as outlined in Alpha SOP ID 1732. These studies performed by the laboratory are maintained on file for review.

13.2 Demonstration of Capability Studies

13.2.1 Refer to Alpha SOP ID 1739 for further information regarding IDC/DOC Generation.

13.2.2 The analyst must make a continuing, annual, demonstration of the ability to generate acceptable accuracy and precision with this method.

14. Pollution Prevention and Waste Management

14.1 Refer to Alpha's Chemical Hygiene Plan and Hazardous Waste Management and Disposal SOP for further pollution prevention and waste management information.

14.2 This method utilizes SPE to extract analytes from water. It requires the use of very small volumes of organic solvent and very small quantities of pure analytes, thereby minimizing the potential hazards to both the analyst and the environment as compared to the use of large volumes of organic solvents in conventional liquid-liquid extractions.

14.3 The analytical procedures described in this method generate relatively small amounts of waste since only small amounts of reagents and solvents are used. The matrices of concern are finished drinking water or source water. However, laboratory waste management practices must be conducted consistent with all applicable rules and regulations, and that laboratories protect the air, water, and land by minimizing and controlling all releases from fume hoods and bench operations. Also, compliance is required with any sewage discharge permits and regulations, particularly the hazardous waste identification rules and land disposal restrictions.

15. Referenced Documents

Chemical Hygiene Plan – ID 2124

SOP ID 1732 Detection Limit (DL), Limit of Detection (LOD) & Limit of Quantitation (LOQ) SOP

SOP ID 1739 Demonstration of Capability (DOC) Generation SOP

SOP ID 1728 Hazardous Waste Management and Disposal SOP

16. Attachments

Table 1: Names, Abbreviations, and CAS Registry Numbers for Target PFAS, Extracted Internal Standards and Non-extracted Internal Standards

Parameter	Acronym	CAS
PER- and POLYFLUOROALKYLETHER CARBOXYLIC ACIDS (PFECAs)		
Tetrafluoro-2-(heptafluoropropoxy)propanoic acid	HFPO-DA	13252-13-6
4,8-dioxa-3H-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
PERFLUOROALKYLCARBOXILIC ACIDS (PFCAs)		
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
Perfluoorotetradecanoic acid	PFTeDA	376-06-7
PERFLUOROALKYL SULFONIC ACIDS (PFASs)		
Perfluorobutanesulfonic acid	PFBS	375-73-5
Perfluoropentanesulfonic 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
CHLORO-PERFLUOROALKYLSULFONATE		
11-chloroeicosafluoro-3-oxaundecane-1-sulfonic acid	11Cl-PF3OUdS	763051-92-9
Perfluoro(2-ethoxyethane)sulfonic acid	PFEESA	113507-82-7
9-chlorohexadecafluoro-3-oxanone-1-sulfonic acid	9Cl-PF3ONS	756426-58-1
FLUOROTELOMER CARBOXYLIC ACIDS		
3-Perfluoropropyl propanoic acid	3:3FTCA	356-02-5
2H,2H,3H,3H-Perfluorooctanoic acid	5:3FTCA	914637-49-3
Perfluoroheptyl propanoic acid	7:3FTCA	812-70-4
PERFLUOROOCTANESULFONAMIDES		

Perfluorooctanesulfonamide	PFOSA	754-91-6
N-methylperfluoro-1-octanesulfonamide	NMeFOSA	31506-32-8
N-ethylperfluoro-1-octanesulfonamide	NEtFOSA	4151-50-2
PERFLUOROCTANE SULFONAMIDE ETHANOLS		
N-Methyl perfluorooctanesulfonamidoethanol	NMeFOSE	24448-09-7
N-ethyl perfluorooctanesulfonamidoethanol	NEtFOSE	1691-99-2
TELOMER SULFONIC ACIDS		
1H,1H,2H,2H-perfluorohexanesulfonic acid (4:2)	4:2FTS	757124-72-4
1H,1H,2H,2H-perfluorooctanesulfonic acid (6:2)	6:2FTS	27619-97-2
1H,1H,2H,2H-perfluorodecanesulfonic acid (8:2)	8:2FTS	39108-34-4
PERFLUOROOCTANESULFONAMIDOACETIC ACIDS		
N-methyl perfluorooctanesulfonamidoacetic acid	NMeFOSAA	2355-31-9
N-ethyl perfluorooctanesulfonamidoacetic acid	NEtFOSAA	2991-50-6
PERFLUOROETHER AND POLYETHER CARBOXYLIC ACIDS		
Perfluoro-3-methoxypropanoic acid	PFMPA	377-73-1
Perfluoro-4-methoxybutanoic acid	PFMBA	863090-89-5
Perfluoro(2-ethoxyethane)sulfonic acid	PFEESA	113507-82-7
Nonafluoro-3,6-dioxaheptanoic acid	NFDHA	151772-58-6

Table 2: Stock and Nominal Extracted Internal Standard Concentrations

Isotope Labeled Standard	Conc. of EIS Stock (ng/mL)	Nominal amount of EIS added to extracts (ng)
M4PFBA	2000	40
M5PFPeA	1000	20
M5PFHxA	500	10
M4PFHpA	500	10
M8PFOA	500	10
M9PFNA	250	5
M6PFDA	250	5
M7PFUdA	250	5
MPFDoA	250	5
M2PFTeDA	250	5
M3PFBS	466	9.32
M3PFHxS	474	9.48
M8PFOS	479	9.58
M2-4:2FTS	938	18.8
M2-6:2FTS	951	19
M2-8:2FTS	960	19.2
M8FOSA	500	10
d3-N-MeFOSA	500	10
d5-N-EtFOSA	500	10
d3-N-MeFOSAA	1000	20
d5-N-EtFOSAA	1000	20
d7-N-MeFOSE	5000	100
d9-N-EtFOSE	5000	100
M3HFPO-DA	2000	40

Table 3: Stock and Nominal Non-Extracted Internal Standard Concentrations

Isotope Labeled Standard	Conc. of EIS Stock (ng/mL)	Nominal amount of EIS added to extracts (ng)
M3PFBA	1000	40
M2PFHxA	500	10
M4PFOA	500	10
M5PFNA	250	5
M2PFDA	250	5
18O2PFHxS	474	9.48
M4PFOS	479	9.58

Table 4: Initial Calibration levels and Concentrations

Analyte	Cal A	Cal B (LOQ)	CAL C	Cal D	Cal E (CCV)	Cal F	Cal G	Cal H	Cal I
PFBA	.4	.8	2	5	10	20	50	250	500
PFPeA	.2	.4	1	2.5	5	10	25	125	250
PFHxA	.1	.2	.5	1.25	2.5	5	12.5	62.5	125
PFHpA	.1	.2	.5	1.25	2.5	5	12.5	62.5	125
PFOA	.1	.2	.5	1.25	2.5	5	12.5	62.5	125
PFNA	.1	.2	.5	1.25	2.5	5	12.5	62.5	125
PFDA	.1	.2	.5	1.25	2.5	5	12.5	62.5	125
PFUnA	.1	.2	.5	1.25	2.5	5	12.5	62.5	125
PFDoA	.1	.2	.5	1.25	2.5	5	12.5	62.5	125
PFTrDA	.1	.2	.5	1.25	2.5	5	12.5	62.5	125
PFTA	.1	.2	.5	1.25	2.5	5	12.5	62.5	125
PFBS	0.089	0.177	0.444	1.11	2.22	4.44	11.1	55.4	111
PFPeS	0.094	0.188	0.471	1.18	2.35	4.71	11.8	58.8	118
PFHxS	0.091	0.183	0.457	1.14	2.29	4.57	11.4	57.1	114
PFHpS	0.095	0.191	0.477	1.19	2.38	4.77	11.9	59.6	119
PFOS	0.093	0.186	0.464	1.16	2.32	4.64	11.6	58	116
PFNS	0.096	0.192	0.481	1.20	2.41	4.81	12	60.1	120
PFDS	0.097	0.193	0.483	1.21	2.41	4.83	12.1	60.3	121
PFDOS	0.097	0.194	0.485	1.21	2.43	4.85	12.1	60.6	121.
4:2FTS	0.375	0.75	1.88	4.69	9.38	18.8	46.9	234	469
6:2FTS	0.38	0.76	1.9	4.75	9.5	19	47.5	238	475
8:2FTS	0.384	0.768	1.92	4.8	9.6	19.2	48	240	480
PFOSA	.1	.2	.5	1.25	2.5	5	12.5	62.5	125
NMeFOSA	.1	.2	.5	1.25	2.5	5	12.5	62.5	125
NEtFOSA	.1	.2	.5	1.25	2.5	5	12.5	62.5	125
NMeFOSAA	.1	.2	.5	1.25	2.5	5	12.5	62.5	125
NEtFOSAA	.1	.2	.5	1.25	2.5	5	12.5	62.5	125
NMeFOSE	1	2	5	12.5	25	50	125	625	1250
NEtFOSE	1	2	5	12.5	25	50	125	625	1250
HFPO-DA	.4	.8	2	5	10	20	50	250	500
ADONA	0.378	0.756	1.89	4.73	9.45	18.9	47.3	236	473
9Cl-PFONS	0.374	0.748	1.87	4.68	9.35	18.7	46.8	234	468
11Cl-PFOUdS	0.378	0.756	1.89	4.73	9.45	18.9	47.3	236	473
PFMPA	.2	.4	1	2.5	5	10	25	125	250
PFMBA	.2	.4	1	2.5	5	10	25	125	250
PFEESA	0.178	0.356	0.89	2.23	4.45	8.9	22.3	111	223
NFDHA	.2	.4	1	2.5	5	10	25	125	250

3:3FTCA	.5	1	2.5	6.25	12.5	25	62.5	312	624
5:3FTCA	2.5	5	12.5	31.3	62.5	125	312	1560	3120
7:3FTCA	2.5	5	12.5	31.3	62.5	125	312	1560	3125
M4PFBA	10	10	10	10	10	10	10	10	10
M5PFPeA	5	5	5	5	5	5	5	5	5
M5PFHxA	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5
M4PFHpA	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5
M8PFOA	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5
M9PFNA	1.25	1.25	1.25	1.25	1.25	1.25	1.25	1.25	1.25
M6PFDA	1.25	1.25	1.25	1.25	1.25	1.25	1.25	1.25	1.25
M7PFUdA	1.25	1.25	1.25	1.25	1.25	1.25	1.25	1.25	1.25
MPFDoA	1.25	1.25	1.25	1.25	1.25	1.25	1.25	1.25	1.25
M2PFTeDA	1.25	1.25	1.25	1.25	1.25	1.25	1.25	1.25	1.25
M3PFBS	2.33	2.33	2.33	2.33	2.33	2.33	2.33	2.33	2.33
M3PFHxS	2.37	2.37	2.37	2.37	2.37	2.37	2.37	2.37	2.37
M8PFOS	2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.4
M2-4:2FTS	4.69	4.69	4.69	4.69	4.69	4.69	4.69	4.69	4.69
M2-6:2FTS	4.76	4.76	4.76	4.76	4.76	4.76	4.76	4.76	4.76
M2-8:2FTS	4.8	4.8	4.8	4.8	4.8	4.8	4.8	4.8	4.8
M8FOSA	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5
d3-N-MeFOSA	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5
d5-N-EtFOSA	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5
d3-N-MeFOSAA	5	5	5	5	5	5	5	5	5
d5-N-EtFOSAA	5	5	5	5	5	5	5	5	5
d7-N-MeFOSE	25	25	25	25	25	25	25	25	25
d9-N-EtFOSE	25	25	25	25	25	25	25	25	25
M3HFPO-DA	10	10	10	10	10	10	10	10	10
M3PFBA	5	5	5	5	5	5	5	5	5
M2PFHxA	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5
M4PFOA	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5
M5PFNA	1.25	1.25	1.25	1.25	1.25	1.25	1.25	1.25	1.25
M2PFDA	1.25	1.25	1.25	1.25	1.25	1.25	1.25	1.25	1.25
18O2PFHxS	2.37	2.37	2.37	2.37	2.37	2.37	2.37	2.37	2.37
M4PFOS	2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.4

Table 5: Expected Mass Transitions and instrument conditions.

Q1	Q2	Analyte	DP Volts	CE Volts
213.032	169.022	PFBA	-50	-14
263.039	219.03	PFPeA	-55	-12
263.039	68.9	PFPeA_2	-55	-55
313.047	269.037	PFHxA	-45	-12
313.047	119	PFHxA_2	-45	-28
363.055	319.045	PFHpA	-60	-12
363.055	169.022	PFHpA_2	-60	-24
413.063	369.053	PFOA	-65	-14
413.063	169.022	PFOA_2	-65	-23
463.071	419.061	PFNA	-70	-14
463.071	219.03	PFNA_2	-70	-24
513.078	469.069	PFDA	-80	-16
513.078	219.03	PFDA_2	-80	-30
563.086	519.076	PFUnA	-85	-18
563.086	269.037	PFUnA_2	-85	-25
613.094	569.084	PFDoA	-85	-18
613.094	319.045	PFDoA_2	-85	-28
663.102	619.092	PFTrDA	-85	-20
663.102	169.022	PFTrDA_2	-85	-36
713.11	669.1	PFTA	-70	-22
713.11	169.022	PFTA_2	-70	-38
299.092	80.062	PFBS	-100	-65
299.092	99.061	PFBS_2	-100	-40
349.1	80.062	PFPeS	-100	-75
349.1	99.061	PFPeS_2	-100	-60
399.107	80.062	PFHxS	-120	-75
399.107	99.061	PFHxS_2	-120	-80
449.115	80.062	PFHpS	-140	-95
449.115	99.061	PFHpS_2	-140	-80
499.113	80.062	PFOS	-145	-108
499.113	99.061	PFOS_2	-145	-85
549.131	80.062	PFNS	-180	-100
549.131	99.061	PFNS_2	-180	-100
599.139	80.062	PFDS	-170	-110
599.138	99.061	PFDS_2	-170	-100
699.154	80.062	PFDoS	-160	-150
699.154	99.061	PFDoS_2	-160	-130

327.146	307.139	4:2FTS	-100	-28
327.146	81.07	4:2FTS_2	-100	-50
427.161	407.155	6:2FTS	-120	-33
427.161	81.07	6:2FTS_2	-120	-65
527.177	507.17	8:2FTS	-140	-39
527.177	81.07	8:2FTS_2	-140	-85
498.146	78.07	FOSA	-150	-90
498.146	478	FOSA_2	-150	-35
512.163	219.03	NMeFOSA	-130	-35
512.163	169.022	NMeFOSA_2	-130	-40
526.192	219.03	NEtFOSA	-140	-35
526.192	169.022	NEtFOSA_2	-140	-35
570.202	419.061	NMeFOSAA	-100	-28
570.202	483	NMeFOSAA_2	-100	-22
584.229	419.061	NEtFOSAA	-100	-28
584.229	526.192	NEtFOSAA_2	-100	-38
616.1	58.9	NMeFOSE	-90	-70
630	58.9	NEtFOSE	-80	-75
285.035	169.022	HFPO-DA	-60	-12
285.035	184.9	HFPO-DA_2	-60	-18
377.06	251.028	ADONA	-65	-18
377.06	84.8	ADONA_2	-65	-48
530.8	351.05	9Cl-PFONS	-130	-38
532.8	353	9Cl-PFONS_2	-130	-38
630.9	451.031	11Cl-PFOUdS	-145	-41
632.9	452.9	11Cl-PFOUdS_2	-145	-41
241.085	177.069	3:3FTCA	-60	-12
241.085	117	3:3FTCA_2	-60	-50
341.101	237.072	5:3FTCA	-70	-20
341.101	217	5:3FTCA_2	-70	-35
441.117	316.9	7:3FTCA	-85	-30
441.117	337.088	7:3FTCA_2	-85	-20
315.093	135.013	PFEESA	-100	-35
315.093	82.9	PFEESA_2	-100	-25
229.032	85.006	PFMPA	-40	-25
279.042	85.006	PFMBA	-45	-25
295.032	201	NFDHA	-30	-15
295.032	84.9	NFDHA_2	-30	-40
217.001	171.999	MPFBA	-50	-14

268.001	222.999	M5PFPeA	-55	-12
318.009	273.007	M5PFHxA	-45	-12
367.024	322.022	M4PFHpA	-60	-12
421.002	376	M8PFOA	-65	-14
472.002	427	M9PFNA	-70	-14
519.033	474.03	M6PFDA	-80	-16
570.033	525.031	M7-PFUdA	-85	-18
615.079	570.033	MPFDoA	-85	-18
715.094	670.092	M2PFTeDA	-70	-22
302.069	80.062	M3PFBS	-100	-65
402.084	80.062	M3PFHxS	-120	-74
507.062	80.062	M8PFOS	-145	-85
329.13	81.07	M2-4:2FTS	-100	-50
429.162	81.07	M2-6:2FTS	-120	-65
529.162	81.07	M2-8:2FTS	-140	-85
506.077	78.07	M8FOSA	-150	-90
515.183	219.03	d3-NMeFOSA	-130	-35
531.222	219.03	d5-NEtFOSA	-140	-35
573.22	419.061	d3-NMeFOSAA	-75	-28
589.259	419.061	d5-NEtFOSAA	-90	-28
623.2	58.9	d7-NMeFOSE	-100	-28
639.2	58.9	d9-NEtFOSE	-100	-28
287.02	169.022	M3HFPO-DA	-60	-12
216.009	171.999	M3PFBA	-50	-14
315.032	270.03	M2PFHxA	-45	-12
417.032	372.03	M4PFOA	-65	-14
468.032	423.03	M5PFNA	-70	-14
515.063	470.061	M2PFDA	-80	-16
403.107	84.062	18O2-PFHxS	-120	-74
503.093	80.062	M4PFOS	-145	-85

Table 6: LC Method Conditions

Time (min)	2 mM Ammonium Acetate (5:95 CH/H_2O)	100% Acetonitrile	Gradient Curve
Initial	100.0	0.0	0
.2	100.0	0.0	2
4	70	30	7
7	45	55	8
9	25	80	8
10	5	95	6
10.4	98	2	10
11.8	100	0	7
12	100	0	1
Waters Aquity UPLC ® BEHC_{18} 2.1 x 50 mm packed with 1.7 µm BEH C_{18} stationary phase Flow rate of 0.4 mL/min 2 µL injection			

Table 7: ESI-MS Method Conditions

ESI Conditions	
Polarity	Negative ion
Curtain Gas	30
Collision gas	9
Ion Spray Voltage	-4500
Desolvation gas temp.	500 ºC
Ion Source Gas 1	30
Ion Source Gas 2	50
Entrance Poitential	-10
Exic Cell Potential	-11

Table 8. Reporting Limits by Matrix

Compound	Aqueous (ng/L)	Solid (ng/g)	Tissue (ng/g)
PFBA	6.4	0.8	2
PFPeA	3.2	0.4	1
PFHxA	1.6	0.2	0.5
PFHpA	1.6	0.2	0.5
PFOA	1.6	0.2	0.5
PFNA	1.6	0.2	0.5
PFDA	1.6	0.2	0.5
PFUnA	1.6	0.2	0.5
PFDoA	1.6	0.2	0.5
PFTrDA	1.6	0.2	0.5
PFTA	1.6	0.2	0.5
PFBS	1.6	0.2	0.5
PFPeS	1.6	0.2	0.5
PFHxS	1.6	0.2	0.5
PFHpS	1.6	0.2	0.5
PFOS	1.6	0.2	0.5
PFNS	1.6	0.2	0.5
PFDS	1.6	0.2	0.5
PFDoS	1.6	0.2	0.5
4:2FTS	6.4	0.8	2
6:2FTS	6.4	0.8	2
8:2FTS	6.4	0.8	2
FOSA	1.6	0.2	2
NMeFOSA	1.6	0.2	0.5
NEtFOSA	1.6	0.2	0.5
NMeFOSAA	1.6	0.2	0.5
NEtFOSAA	1.6	0.2	0.5
NMeFOSE	16	2	5
NEtFOSE	16	2	5
HFPO-DA	6.4	0.8	2
ADONA	6.4	0.8	2
9Cl-PFONS	6.4	0.8	2
11Cl-PFOUdS	6.4	0.8	2
3:3FTCA	8	1	2.5
5:3FTCA	40	5	12.5
7:3FTCA	40	5	12.5
PFEESA	3.2	0.4	1
PFMPA	3.2	0.4	1
PFMBA	3.2	0.4	1
NFDHA	3.2	0.4	1

17. TOP Assay SOP Addendum

The following modifications are applied to this SOP;

Section 7: Water Bath – Capable of monitoring recording to .1 C maintaining 85 C.

Section 8.1

1. Sodium Hydroxide (NaOH, CAS#: 1310-73-2) – High purity, demonstrated to be free of analytes and interferences.

2. Potassium Persulfate ($K_2S_2O_8$, CAS#: 7727-21-1) - High purity, demonstrated to be free of analytes and interferences.

3. Hydrochloric Acid (HCl, CAS#: 7647-01-0) - High purity, demonstrated to be free of analytes and interferences.

Table 1

Isotope Labeled Standard	**Conc. Top Surr Stock (ng/mL)**	**Vol. of Top Surr Stock (µl)**	**Final Vol. of Top Surr PDS (mL)**	**Final Conc. of Top Surr PDS (ng/mL)**
$^{13}C_2$-PFOA	50,000	40	4.0	500
$^{13}C_2D_4$-4:2FTS	50,000	80	4.0	1000

Section 10

1. Pretreatment of Samples - For Aqueous samples, prior to Section 10.1, add to each 125 ml sample with Potassium Persulfate until 60 mM (about 2 grams). Add Sodium Hydroxide until the sample is 125 mM (about .625 grams). Sample should have a pH >12.

2. Fortify each sample with 20 µl of TOP pre-assay surrogate containing 1 negative control surrogates and 1 positive control surrogates from table 1.

3. Place sample in a water bath at 85 C for 6 hours.

4. Remove sample from water bath and adjust pH 6-8 with Hydrochloric Acid.

5. Following pre-treatment, follow the aqueous extraction protocol from section 10 of SOP 45852 unaltered.

Section 11 - An additional calculation is added for the final reporting of the TOP assay results.

TOP Assay = Result of Post TOP assay extraction – Result of analysis from Pre-Top Assay extraction.

Semivolatile Organic Compounds by Gas Chromatography/ Mass Spectrometry (GC/MS)

Reference Method No.: **EPA 8270 E**

Reference: SW-846, Test Methods for Evaluating Solid Waste: Physical/Chemical Methods, EPA SW-846, Update VI (Phase II), June, 2018.

1. Scope and Application

Matrices: This method is used to determine the concentration of semivolatile organic compounds in extracts prepared from many types of solid waste matrices, soils, and wastewater samples.

This method is used to quantitate most neutral, acidic, and basic organic compounds that are soluble in methylene chloride and capable of being eluted, without derivatization, as sharp peaks from a gas chromatographic fused-silica capillary column coated with a slightly polar silicone.

Table 9 lists “difficult” compounds that may require special treatment when being determined by this method.

Approval of any method modifications is by one of the following laboratory personnel before performing the modification: Area Supervisor, Laboratory Director, or Quality Assurance Officer.

This method is restricted to use by or under the supervision of analysts experienced in the operation of a gas chromatograph/mass spectrometer and in the interpretation of mass spectra. Each analyst must demonstrate the ability to generate acceptable results with this method by performing an initial demonstration of capability (Section 13.2).

2. Summary of Method

The samples are introduced into the GC/MS by injecting 1µL of the sample extract into a gas chromatograph (GC) with a narrow-bore fused-silica capillary column. The GC column is temperature-programmed to separate the analytes, which are then detected with a mass spectrometer (MS) connected to the gas chromatograph.

Analytes eluted from the capillary column are introduced into the mass spectrometer via direct connection. Identification of target analytes is accomplished by comparing their mass spectra with the electron impact spectra of standards run on the same GC/MS system. Quantitation is accomplished by comparing the response of quantitation ion relative to an internal standard using a calibration curve.

2.1 Method Modifications from Reference

None.

3. Reporting Limits

Table 6 lists our routine reporting limits.

4. Interferences

4.1 Only high purity helium is used in the GC system to eliminate this source of possible contamination. The helium (carrier gas) is certified by the gas supplier.

4.2 Preventive instrument maintenance is performed routinely. Section 10.5 details the maintenance steps.

4.3 Glassware must be scrupulously cleaned. This procedure is detailed in the Organic Extraction Glassware Cleaning & Handling SOP/1953.

4.4 Contaminated solvents or reagents are also possible sources of contamination. All solvents used are pesticide grade or equivalent, and reagents are purchased as certified contaminant free.

4.5 Contamination by carry-over can occur whenever high-concentration and low-concentration samples are sequentially analyzed. Whenever an unusually concentrated sample is encountered (concentrations greater than 2x the highest concentration) and the next sample has reportable hits this sample should to be re-analyzed for confirmation based on analyst discretion.

5. Health and Safety

The toxicity or carcinogenicity of each reagent and standard used in this method is not fully established; however, each chemical compound must be treated as a potential health hazard. From this viewpoint, exposure to these chemicals must be reduced to the lowest possible level by whatever means available. A reference file of material data handling sheets is available to all personnel involved in the chemical analysis. Additional references to laboratory safety are available in the Chemical Hygiene Plan.

All personnel handling environmental samples known to contain or to have been in contact with municipal waste must follow safety practices for handling known disease causative agents.

5.1 Lab coats, safety glasses, and gloves must be worn when handling samples, extracts, standards or solvents.

5.2 All solvent and extract transfers must be handled in the vented bench area in the GC/MS laboratory.

5.3 All stock standards, working standards, and vialed sample extracts must be placed into the waste bucket in the lab for future disposal by the Health and Safety Officer. The container must be labeled properly with hazard warning labels indicating the container contents.

5.4 Flammable solvent bottles must be stored in the flammables cabinet.

6. Sample Collection, Preservation, Shipping and Handling

6.1 Sample Collection

Aqueous samples are collected in two 1L amber glass jars with teflon-lined lids. For LVI, aqueous samples are collected in two 275mL amber glass jars with teflon-lined lids. Solid samples are collected in 250mL wide-mouth glass jars with teflon-lined lids. All containers are purchased pre-cleaned and certified from commercial vendors.

6.2 Sample Preservation

Both aqueous and solid samples are then preserved by packing in coolers with ice or ice packs, to maintain a temperature of 4 ± 2ºC. Upon receipt at the laboratory, the samples are transferred into sample storage refrigerators to maintain at a temperature of 4 ± 2ºC.

6.3 Sample Handling

Aqueous samples must be extracted within 7 days of sample collection, solid samples within 14 days of collection. Once extracted, the samples must be analyzed within 40 days of the extraction date.

7. Equipment and Supplies

7.1 Gas Chromatograph/Mass Spectrometer System:

7.1.1 Gas Chromatograph, Hewlett Packard 6890 (or equivalent): An analytical system complete with a temperature-programmable gas chromatograph configured for split/splitless-injection and all required accessories, including syringes, analytical columns, and gases. The capillary column is directly coupled to the source.

7.1.2 Column: Rxi-5Sil MS30m x 0.32mm ID, 0.25µm film thickness or column of similar configuration.

7.1.3 Mass Spectrometer, Hewlett Packard 5973 (or equivalent): Scanning from 35 to 500 amu every 1 second or less, using 70 volts (nominal) electron energy in the electron impact ionization mode. The mass spectrometer is capable of producing a mass spectrum for decafluorotriphenylphosphine (DFTPP) which meets the criteria in Table 1 when 1 µL of the GC/MS tuning standard is injected through the GC (50ng of DFTPP).

7.1.4 Data System: A computer system is interfaced to the Mass Spectrometer. The system allows the continuous acquisition and storage on machine-readable media of all mass spectra obtained throughout the duration of the chromatographic program. The computer software allows the analyst to search for any GC/MS data file for ions of specific mass and plot such ion abundances versus time or scan number. *HP ChemServer* software is used for data acquisition and *MSD Chemstation/Enviroquant version E.02.02* is used for data reduction.

7.2 Syringe: 10 µL.

7.3 Volumetric Flasks, Class A: Appropriate sizes with ground-glass stoppers.

7.4 Vials: Glass autosampler vials with polytetrafluoroethylene (PTFE)-lined crimp top caps.

8. Reagents and Standards

8.1 Stock Standard Solutions

Certified stock standard solutions, traceable to NIST, when available, are purchased from commercial vendors. They can be replaced with different standards as long as they contain all target analytes.

All stock standards, lot number, catalog number, expiration date, preparation date and initials are recorded in a logbook. Standards are stored in the refrigerator or freezer. Store away from any light source at 6 °C when not in use (−10 °C is recommended).

Stock standard expire 6 months from the date of preparation or on the earliest expiration date of any of the stock solution used to prepare it.

Please note that the following preparation instructions and stock standards are included for illustration purposes and may be modified as needed (ex. to accommodate standard availability or client requests), however final concentrations for the initial calibration levels shall always follow the example in 8.1.4.

Vendor	Standard	Catalog#	Concentration
Restek			
	8270 Mega Mix	31850	500-1000ug/mL
	Benzoic Acid Mix	31879	2000ug/mL
	Acid Surrogate Mix	31087	10000ug/mL
	B/N Surrogate Mix	31086	5000ug/mL
	Benzaldehyde Standard	33017	2000ug/mL
	Custom AP9 ICAL Standard	571813-FL	2000ug/mL
	Custom ADP Standard	572745-FL	2000ug/mL
	Benzidine Mix	31834	2000ug/mL
	SV Internal Standard Mix	31206	2000ug/mL
	1,4-Dioxane	30287	2000ug/mL
	Custom CLP 04.1 BNA Surrogate Mix	571320-FL	1000ug/mL
Absolute	Aromatic Amines Mix	99410	2000ug/ml
Ultra	Semi-Volatiles GC/MS Tuning Standard	GCM-150-1	1000ug/mL

8.1.1 ABN Stock Standard, 200ug/mL

Use 5mL of each of the following:
- Benzoic Acid Mix
- Benzidine Mix

and use 10mL of each of the following:
- 8270 Mega Mix
- Custom CLP 04.1 BNA Surrogate Mix

Bring up to 50mL volume with DCM.

8.1.2 AP9 Additional Compounds Stock Standard, 200ug/mL

Use 5mL of each of the following:
- Custom AP9 ICAL Standard
- Benzaldehyde Standard

Bring up to 50mL volume with DCM.

8.1.3 ADP Stock Standard, 200ug/ml

Use 5ml of:
- Custom ADP Standard

Bring up to 50mL volume with DCM.

8.1.4 Calibration Standard

A minimum of 5 calibration standards must be included for each analyte:

Calibration Curve Levels	
Level	Concentration ug/mL
1	1.0
2	2.0
3	3.0
4	5.0
5	10
6	20
7	50
8	100
9	150
10	200

LVI Calibration Curve Levels	
Level	Concentration ug/mL
1	0.2
2	0.4
3	1.0
4	2.0
5	3.0
6	5.0
7	10
8	15
9	35
10	50

*LVI- Low Volume Initiative

8.2 Internal Standard Solution

The internal standards are:

1,4-dichlorobenzene-d_4
naphthalene-d_8
acenaphthene-d_{10}
phenanthrene-d_{10}
chrysene-d_{12}
perylene-d_{12}

Each 500µL of standards, blank and sample extracts are spiked with 10µL of SV Internal Standard Mix, resulting in a concentration of 40ng/ µL.

For the LVI method, a 1:10 dilution is made of the Internal Standard Stock Solution. 500µL of standards, blank and sample extracts are spiked with 10µL of this preparation, resulting in a concentration of 4ng/ µL.

8.3 GC/MS Tuning Standard

The tuning standard is a methylene chloride solution containing 50ng/µL of decafluorotriphenylphosphine (DFTPP). The standard also contains 50ng/µL each of 4,4'DDT, pentachlorophenol, and benzidine to verify injection port inertness and GC column performance.

Prepare the GC/MS Tuning Standard with 25µL GCM-150 and 475µL Dichloromethane.

8.4 Surrogate Spiking Solution

8.4.1 Extraction Surrogate Preparation

In a 1000mL volumetric flask, add 5ml of 31086 and 31087. Bring up to volume with Acetone. The final concentration is 50µg/mL for the acid surrogates and 25µg/mL for the B/N surrogates.

8.4.2 LVI Extraction Surrogate Preparation

The LVI surrogate is a 10 fold dilution of the surrogate solution prepared in 8.4.1. For example, to make 200mL of LVI surrogate, add 20mL of 8.4.1 to a 200mL volumetric flask and fill to volume with Acetone. The resulting surrogate concentration is 5µg/mL for the acid surrogates and 2.5µg/mL for the B/N surrogates.

8.5 Spike Solution (LCS, MS, MSD)

Spike Solution Preparation

ABN SPK1:
In a 500ml volumetric flask, add 20ml of 8270 Mega Mix #31850, 10ml of Benzoic Acid Mix #31879, 10ml Custom AP9 ICAL Standard #571813-FL and 10ml Benzaldehyde Standard #33017. Bring up to volume with Acetone. The final concentration is 40µg/ml.

Note: the LVI ABN SPK1 is prepared by making an 8 fold dilution of the 40µg/ml ABN SPK (in acetone), resulting in a 5µg/ml LVI ABN SPK1.

ABN SPK2:
In a 500ml volumetric flask, add 10ml Benzidine Mix #31834 and 10mL Custom ADP Standard #572945-FL. Bring up to volume with Acetone. The final concentration is 40µg/ml.

Note: the LVI ABN SPK2 is prepared by making an 8 fold dilution of the 40µg/ml ABN SPK (in acetone), resulting in a 5µg/ml LVI ABN SPK2.

8.6 Dichloromethane (DCM): Pesticide quality.

8.7 Acetone: Pesticide quality.

9. Quality Control

9.1 Blank(s)

Extraction blanks are performed with each extraction batch of 20 or less samples. The extraction blank must not contain any of the reportable analytes above the reporting limit. Corrective actions:

- No corrective action required if concentration of contaminant in sample is >10x concentration in blank or if contaminant not detected in sample

- If the blank have reportable hits and re-extraction could not be performed due to lack of additional sample volume, the sample results are reported and qualified with “B” flag for any associated samples that concentration is less than 10x the blank concentration

For NJ regulatory work the method blank must have all the target analytes less than RL except for Phthalates which must be less than 5x of the RL. Sample results are qualified with “B” flag for analytes observed in the blank greater than RL and the Phthalates observed in the blank greater than 5x RL

The surrogate recoveries must also be within the acceptance criteria listed in Table 2. If surrogate acceptance criteria are exceeded, the extraction batch must be evaluated to determine if re-extraction or re-analysis is necessary.

9.2 Laboratory Control Sample and Laboratory Control Sample Duplicate (LCS / LCSD)

A Laboratory Control Sample/Laboratory Control Sample Duplicate pair (LCS/LCSD) are extracted and analyzed with each analytical batch of 20 or fewer samples.

The LCS/LCSD acceptance criteria are based the performance standard control limits. These performance standards are based on commonly used state programs RCP,MCP etc. See table 3. Less than 10% of total compounds may be outside of control limits provided that recoveries are >10%. Note: this does not apply to difficult analytes listed in Table 9 which may be accepted at recoveries <10. If >10% of analytes are recovered above control limits, this is deemed acceptable as long as the analytes in question are not detected in associated samples.

If these criteria are not met, the entire batch is re-extracted. If re-extraction is not possible, due to insufficient sample or holding time exceedance, the analyst must write up the failure on a narrative sheet for inclusion in the client report.

9.3 Initial Calibration Verification (ICV)

Refer to Section 10.2.7.

9.4 Continuing Calibration Verification (CCV)

Refer to Section 10.4.

9.5 Matrix Spike and Matrix Spike Duplicate (MS / MSD)

A matrix spike/matrix spike duplicate pair is extracted and analyzed for each batch of 20 or fewer samples per client request. The MS/MSD acceptance criteria are based on performance standards. See table 3 for individual control limits. If the recovery criteria are not met, but are met in the LCS/LCSD, this is noted on a narrative sheet for inclusion in the client report.

9.6 Laboratory Duplicate

Not applicable.

9.7 Method-specific Quality Control Samples

9.7.1 Surrogates

All extracted samples and associated QC are spiked with surrogates. The acceptable surrogate recovery limits are listed in Table 2.

Corrective action: Up to one surrogate can be out in each fraction (Acid and Base/Neutral) but not less than 10% recovery, before any corrective action is necessary. Otherwise, analysis must be repeated once to see if an analytical error has occurred. If the % recovery still exceeds the control limits the sample must be re-extracted and re-analyzed to confirm sample matrix. If matrix effect is confirmed, this must be noted on a narrative sheet for inclusion in the client report.

Re-extraction is not required if surrogate recoveries are high and target analytes are not detected in the sample.

9.7.2 Internal Standards

If the area for any of the internal standards in the samples changes by a factor of two (-50% to +100%) from that in the CCV, the mass spectrometer must be inspected for malfunctions and corrections must be made, as appropriate. When corrections are made, reanalysis of samples analyzed while the system was malfunctioning is required.

9.8 Method Sequence

In a 12-hour period, the typical analytical sequence is:

- Degradation Check
- DFTPP
- Continuing or Daily Standards (1 – 3)*
    (1) ABN 50 ppm
    (2) AP9 50 ppm
    (3) ADP 50 ppm
- Method/Instrument Blank
- Samples
- QC (as required)

***Additional Continuing standards may be run at the analyst's discretion or by client request.**

10. Procedure

10.1 Equipment Set-up

10.1.1 GC/MS Operating Conditions:

Typical GC/MS operating conditions are listed below, but may be altered as long as method performance criteria are met.

Mass range: 35 – 500 amu
Scan time: 3.15 second / scan
Initial temperature: 50°C, hold for 1.5 minutes
Temperature program: 28°C/minute to 250°C then 9°C/minute to 320°C
Final temperature: 320°C for 1.50 min
Injector temperature: 300°C
Transfer line temperature: 280°C
Source temperature: 230ºC
Injector: split ratio 5:1; 11.7mL/min
Injection volume: 1µL
Carrier gas: helium at 523 cm/second (2.0 mL/min) constant flow

GC/MS Operating Conditions for LVI method:

Mass range: 35 – 550 amu
Scan time: 3.15 second / scan
Initial temperature: 45°C, hold for 4 minutes
Temperature program: 25°C/minute to 250°C then 20°C/minute to 320°C
Final temperature: 320°C for 4.3 min
Injector temperature: 270°C
Transfer line temperature: 280°C
Source temperature: 320ºC
Injector: split ratio 5:1; 8.57mL/min
Injection volume: 2µL
Carrier gas: helium at 1.7148mL/min) constant flow

10.1.2 GC/MS Tune:

At the beginning of every 12 hour sequence, analyze DFTPP tuning solution (Section 8.3).

The resultant mass spectrum for DFTPP must meet the criteria given in Table 1 before sample analysis begins. The mass spectrum of DFTPP should be acquired in the following manner:

(1) Three scans (the peak apex scan, the scan immediately preceding the apex and the scan immediately following the apex) are acquired and averaged.
(2) Background subtraction is performed using a single scan of no more than 20 scans prior to the elution of DFTPP.

The GC/MS tuning standard is also used to assess GC column performance and injection port inertness. Degradation of DDT to DDE and DDD must not exceed 20%. Benzidine and pentachlorophenol must be present at their normal responses and no peak tailing must be visible.

The tailing factor for benzidine and pentachlorophenol must be calculated in every DFTPP run. (See Table 4)

If degradation is excessive and/or poor chromatography is noted, the system needs maintenance (see Section 10.5).

10.2 Initial Calibration

10.2.1 Prepare calibration standards for all target analytes at a minimum of five concentration levels as specified in Section 8.1.4.

10.2.2 Add 10µL of Internal Standard to each calibration standard directly into the autosampler vial containing 500µL of standard. Analyze each calibration standard under the conditions specified in Section 10.1.1.

10.2.3 Record the calibration standard, unique lab identifier code (lot), concentration, and analyst’s initials in the analytical sequence list.

10.2.4 In each standard, calculate the response factor (RF) for each analyte, the average RF, and the relative standard deviation (RSD) of the RFs, using the Enviroquant data processing software. The calculations are performed automatically, using the formulae listed in Alpha’s Quality Manual.

It is recommended that a minimum response factor for the most common target analytes, as noted in Table 8, be demonstrated for each individual calibration level as a means to ensure that these compounds are behaving as expected. In addition, meeting the minimum response factor criteria for the lowest calibration standard is critical in establishing and demonstrating the desired sensitivity.

10.2.5 Initial Calibration %RSD Criteria:

For all analytes, the RSD must be ≤ 20% for the mean response factor to be used for sample quantitation.

If the RSD for any target analyte exceeds 20%, the fit must be ≥0.99 quadratic or ≥ 0.995 linear fit for all target analytes. A minimum of 5 levels are required for a linear calibration model and a minimum of 6 levels are required for a quadratic calibration model. When calculating calibration using the linear regression model, a quantitation check must be performed on the lowest calibration point, or the point that corresponds to that compound's established reporting limit.
For RCP, the RSD must be ≤ 15% for the mean response factor to be used for sample quantitation

Percent Relative Error (%RE): For linear and quadratic fit compounds, the %RE must be calculated for the standard at or near the midpoint and at the lowest level of the initial calibration. The %RE between the calculated and expected concentration of an analyte must be ≤ 30%, otherwise recalibration is necessary.

10.2.6 Evaluation of Retention Times:

The relative retention time (RRT) of each target analyte in each calibration standard should agree within 0.06 RRT units.

10.2.7 Initial Calibration Verification (Second Source Verification)

10.2.7.1 The initial calibration (Section 10.2) for each compound of interest must be verified prior to sample analysis. This is accomplished by analyzing second source calibration standards at a concentration near the midpoint concentration for the calibrating range of the GC/MS.

10.2.7.2 Analyze the standards and calculate the % Difference for each analyte according to the formula in Alpha's Quality Manual.

If the % Difference for each analyte is ± 30%, then the calibration is assumed to be valid. If this criterion is not met, then corrective action must be taken prior to the analysis.

For RCP, if the % Difference for each analyte is ± 20%, then the calibration is assumed to be valid. If this criterion is not met, then corrective action must be taken prior to the analysis.

10.2.7.3 In cases where compounds fail (greater than 30% difference), they may still be reported as non-detects.

10.2.7.4 Once the calibration curve is accepted and prior to processing any samples, the analyst must demonstrate through the analysis of a Method Blank or Instrument Blank that equipment and reagents are free from contaminants and interferences. If a peak is found in the blank that would prevent the identification or bias the measurement of an analyte, the analyst should determine the source of the contaminant peak and eliminate it, if possible. Blank are generally considered to be acceptable if target analyte concentration are less than one half the LLOQ or are less than project specific requirements. Blanks may contain analyte concentrations are greater than acceptance limits if the associated samples in the batch are unaffected.

10.3 Equipment Operation and Sample Processing

10.3.1 GC/MS Analysis of Samples

10.3.1.1 Allow the sample extracts to warm to room temperature.

10.3.1.2 Transfer all of the sample extract to a 1.5mL vial. Remove 500µL of sample extract to another vial, and add 10µL of the internal standard solution (Section 8.2).

10.3.1.3 The autosampler is programmed to inject 1µL aliquot of the sample extract into the GC/MS system, using the same instrument conditions that were used for calibration. The injection volume of the sample must be the same as the volume used for the calibration standard.

10.3.1.4 If the response of any quantitation ion exceeds the initial calibration range of the GC/MS system, the sample extract must be diluted and reanalyzed.

10.3.2 Qualitative Identification

Perform first level data review. Obtain the primary m/z (Table 5) masses for each parameter of interest. The following criteria must be met to make qualitative identification:

- Compare the background subtracted mass spectra for the sample to the reference spectra. The characteristic masses of each parameter of interest must maximize in the same or within one scan of each other.

- The retention time must fall within ± 0.1 minutes of the retention time of the compound in the analytical standard. However, analyst experience must be used in making the qualitative identification.

- The relative peak height of the one characteristic mass must fall within 30% of the relative intensity of the mass in a reference mass spectrum. The reference spectrum is obtained from a standard analyzed on the GC/MS system.

Structural isomers that have very similar mass spectra are identified only if the resolution between authentic isomers in a standard mix is less than 25% of the sum of the two peak heights. Otherwise, structural isomers are identified as isomeric pairs.

10.4 Continuing Calibration

10.4.1 The initial calibration (Section 10.2) for each compound of interest must be verified once every 12 hours prior to sample analysis. This is accomplished by analyzing calibration standards at a concentration near the midpoint concentration for the calibrating range of the GC/MS.

10.4.2 Analyze the standards and calculate the % Difference for each analyte according to the formula in Alpha's Quality Manual.

If the % Difference for each CCV analyte is $\leq$ 20%, then the calibration is assumed to be valid. If the criterion is not met for more than 20% of the compounds then corrective action must be taken.

Due to the large number of analytes present, allowances may be made for a RF that drifts out high, as long as there are no positive hits for that particular analyte in any of the associated samples.

10.4.3 If this criterion is exceeded, inspect the gas chromatographic system to determine the cause and perform whatever maintenance is necessary before verifying calibration and proceeding with sample analysis.

10.4.4 If routine maintenance does not return the instrument performance to meet the QC requirements based on the last initial calibration, then a new initial calibration must be performed.

10.4.5 Internal Standard Retention Time

The retention times of the internal standards in the calibration verification standard is evaluated after data acquisition. If the retention time for any internal standard changes by more than 30 seconds from that in the mid-point standard of the most recent initial calibration, then the chromatographic system must be inspected for malfunctions and corrections must be made, as required. When corrections are made, reanalysis of samples analyzed while the system was malfunctioning is required.

10.4.6 Internal Standard Response

Refer to section 9.7.2

10.5 Preventive Maintenance

When poor sensitivity is observed, replacement of the injector liner and seal may solve the problem. If not, clip approximately 3 – 6 inches from the injector end of the GC column. If the sensitivity does not improve it may be necessary to replace the split line or the injector weldment assembly. If the problem persists, it may be necessary to replace the GC column.

Periodic cleaning (typically twice per year) of the mass spectrometer ion source is required. More frequent source cleaning may be needed, especially if dirty samples are analyzed.

11. Data Evaluation, Calculations and Reporting

When a parameter is identified, the quantitation of that parameter must be based on the integrated abundance of the quantitation characteristic m/z given in Table 5

Calculate the concentration in the sample using the average response factor (RF) from the initial calibration curve according to the formula in Alpha's Quality Manual.

After performing technical data review, validating that all QC criteria have been met and confirming all positive hits, the data report is sent electronically to the LIMS computer for generation of the client report. There are two levels of review of the data in the LIMS system prior to release of data. These reviews must be done by two separate individuals.

12. Contingencies for Handling Out-of-Control Data or Unacceptable Data

Holding time exceedence and improper preservation are noted on the nonconformance report form.

Perform instrument maintenance as described throughout this SOP as needed when instrument calibration criteria are not met. Record all maintenance in the instrument logbook.

All batch and sample specific QC criteria outlined in Section 9 are evaluated by the analyst prior to approval of the data. When any QC criteria fail, the cause for the failure must be identified and corrected. This may include instrument recalibration followed by sample reanalysis, sample cleanup, or sample re-extraction. If it is determined that the failure is due to sample matrix effects, a project narrative report is written by the analyst for inclusion in the data report. If there is insufficient sample volume to perform the re-analysis for confirmation, this is also noted in the narrative and included in the client report.

13. Method Performance

13.1 Detection Limit Study (DL) / Limit of Detection Study (LOD) / Limit of Quantitation (LOQ)

The laboratory follows the procedure to determine the DL, LOD, and/or LOQ as outlined in Alpha SOP/1732. These studies performed by the laboratory are maintained on file for review.

13.2 Demonstration of Capability Studies

Refer to Alpha SOP/1739 for further information regarding IDC/DOC Generation.

13.2.1 Initial (IDC)

The analyst must make an initial, one-time, demonstration of the ability to generate acceptable accuracy and precision with this method, prior to the processing of any samples.

13.2.2 Continuing (DOC)

The analyst must make a continuing, annual, demonstration of the ability to generate acceptable accuracy and precision with this method.

14. Pollution Prevention and Waste Management

Refer to Alpha's Chemical Hygiene Plan and Waste Management and Disposal SOP for further pollution prevention and waste management information.

15. Referenced Documents

Chemical Hygiene Plan

Alpha SOP/1732 DL/LOD/LOQ Generation

Alpha SOP/1739 IDC/DOC Generation

Alpha SOP/1729 Waste Management and Disposal SOP

16. Attachments

Table 1: DFTPP Key Ions and Ion Abundance Criteria

Table 2: Acceptable Surrogate Spike Recovery Limits

Table 3A: Acceptable Aqueous QC Limits

Table 3B: Acceptable Soil QC Limits

Table 4: Tailing Factor Calculation

Table 5: Characteristic Ions for Semivolatile Compounds

Table 6: Reported Detection Limits

Table 7: Semivolatile Internal Standards with Corresponding Target Compounds and Surrogates Assigned for Quantitation

Table 8: Recommended Minimum Response Factor Criteria

Table 9: Difficult analytes

TABLE 1

DFTPP KEY IONS AND ION ABUNDANCE CRITERIA

Mass	Ion Abundance Criteria
68	**< 2% of mass 69**
69	**Present**
70	**< 2% of mass 69**
197	**< 2% of mass 198**
198	**Base peak or present**
199	**5-9% of mass 198**
365	**> 1% of Base Peak**
441	**Present but less than 24% mass 442**
442	**Base peak, or present**
443	**15-24% of mass 442**

TABLE 2

ACCEPTABLE SURROGATE SPIKE RECOVERY LIMITS

Analytical Fraction	**Surrogate Compound**	**Water**	**Soil/Sediment**
BN-8270D	**Nitrobenzene-d_5**	**23-120%**	**23-120%**
BN-8270D	**2-Fluorobiphenyl**	**15-120%**	**30-120%**
BN-8270D	**p-Terphenyl-d_{14}**	**41-149%**	**18-120%**
Acid-8270D	**Phenol-d_6**	**10-120%**	**10-120%**
Acid-8270D	**2-Fluorophenol**	**21-120%**	**25-120%**
Acid-8270D	**2,4,6-Tribromophenol**	**10-120%**	**10-136%**

It is allowable for one surrogate from each fraction be outside acceptance criteria, provided a minimum recovery of 10% has been achieved.

TABLE 3A

ACCEPTABLE AQUEOUS QC LIMITS

	STANDARD TARGET COMPOUND LIST (Aqueous)		NEW JERSEY TARGET COMPOUND LIST (Aqueous)		CT TARGET COMPOUND LIST (Aqueous)	
Analyte	**Acceptance Criteria**	**Duplicate RPD**	**Acceptance Criteria**	**Duplicate RPD**	**Acceptance Criteria**	**Duplicate RPD**
1,2,4,5-Tetrachlorobenzene			70-130	20	40-140	20
1,2,4-Trichlorobenzene	39-98	30	70-130	20	40-140	20
1,2-Dichlorobenzene	40-140	30	70-130	20		
1,3-Dichlorobenzene	40-140	30	70-130	20		
1,3-Dinitrobenzene	15-130	30				
1,4-Dichlorobenzene	36-97	30	70-130	20		
1-Methylnaphthalene	41-103	30				
2,3,4,6-Tetrachlorophenol			70-130	20		
2,4,5-Trichlorophenol	30-130	30	70-130	20	30-130	20
2,4,6-Trichlorophenol	30-130	30	70-130	20	30-130	20
2,4-Dichlorophenol	30-130	30	70-130	20	30-130	20
2,4-Dimethylphenol	30-130	30	70-130	20	30-130	20
2,4- Dimethylaniline	40-140	30	70-130	20		
3,4- Dimethylaniline	40-140	30	70-130	20		
2,3- Dimethylaniline	40-140	30	70-130	20		
2,4,5-Dimethylaniline	40-140	30	70-130	20		
4-Chlorotoluidine	40-140	30	70-130	20		
2-Ethylaniline	40-140	30	70-130	20		
O-toluidine	40-140	30	70-130	20		
2-Napthylamine	40-140	30	70-130	20		
2,4-Dinitrophenol	20-130	30	20-130	20	30-130	20
2,4-Dinitrotoluene	24-96	30	70-130	20	40-140	20
2,6-Dinitrotoluene	40-140	30	70-130	20	40-140	20
2-Chloronaphthalene	40-140	30	70-130	20	40-140	20
2-Chlorophenol	27-123	30	70-130	20	30-130	20
2-Methylnaphthalene	40-140	30	70-130	20	40-140	20
2-Methylphenol	30-130	30	70-130	20	30-130	20
2-Nitroaniline	52-143	30	70-130	20	40-140	20
2-Nitrophenol	30-130	30	70-130	20	30-130	20
3,3'-Dichlorobenzidine	40-140	30	70-130	20	40-140	20
3,3'-Dimethylbenzidine			20-160	20		
3-Methylphenol/4-Methylphenol	30-130	30	20-160	20	30-130	20
3-Nitroaniline	25-145	30	70-130	20	40-140	20
4,6-Dinitro-o-cresol	20-164	30	70-130	20	30-130	20
4-Bromophenyl phenyl ether	40-140	30	70-130	20	40-140	20
4-Chloroaniline	40-140	30	20-160	20	40-140	20
4-Chlorophenyl phenyl ether	40-140	30	70-130	20	40-140	20
4-Nitroaniline	51-143	30	70-130	20	40-140	20
4-Nitrophenol	10-80	30	20-160	20	30-130	20
Acenaphthene	37-111	30	70-130	20	40-140	20
Acenaphthylene	45-123	30	70-130	20	40-140	20

	STANDARD TARGET COMPOUND LIST (Aqueous)		**NEW JERSEY TARGET COMPOUND LIST (Aqueous)**		**CT TARGET COMPOUND LIST (Aqueous)**	
Analyte	**Acceptance Criteria**	**Duplicate RPD**	**Acceptance Criteria**	**Duplicate RPD**	**Acceptance Criteria**	**Duplicate RPD**
Acetophenone	39-129	30	70-130	20		
Aniline	40-140	30	20-160	20	40-140	20
Anthracene	40-140	30	70-130	20	40-140	20
Atrazine			70-130	20		
Azobenzene	40-140	30	70-130	20		
Benzaldehyde			20-160	20		
Benzidine	10-75	30	20-160	20		
Benzo(a)anthracene	40-140	30	70-130	20	40-140	20
Benzo(a)pyrene	40-140	30	70-130	20	40-140	20
Benzo(b)fluoranthene	40-140	30	70-130	20	40-140	20
Benzo(ghi)perylene	40-140	30	70-130	20	40-140	20
Benzo(k)fluoranthene	40-140	30	70-130	20	40-140	20
Benzoic Acid	10-164	30	20-160	20		
Benzyl Alcohol	26-116	30	20-160	20		
Biphenyl	40-140	30	70-130	20		
Bis(2-chloroethoxy)methane	40-140	30	70-130	20	40-140	20
Bis(2-chloroethyl)ether	40-140	30	70-130	20	40-140	20
Bis(2-chloroisopropyl)ether	40-140	30	70-130	20	40-140	20
Bis(2-Ethylhexyl)phthalate	40-140	30	70-130	20	40-140	20
Butyl benzyl phthalate	40-140	30	70-130	20	40-140	20
Caprolactam			20-160	20		
Carbazole	55-144	30	70-130	20	40-140	20
Chrysene	40-140	30	70-130	20	40-140	20
Dibenzo(a,h)anthracene	40-140	30	70-130	20	40-140	20
Dibenzofuran	40-140	30	70-130	20	40-140	20
Diethyl phthalate	40-140	30	70-130	20	40-140	20
Dimethyl phthalate	40-140	30	70-130	20	40-140	20
Di-n-butylphthalate	40-140	30	70-130	20	40-140	20
Di-n-octylphthalate	40-140	30	70-130	20	40-140	20
Fluoranthene	40-140	30	70-130	20	40-140	20
Fluorene	40-140	30	70-130	20	40-140	20
Hexachlorobenzene	40-140	30	70-130	20	40-140	20
Hexachlorobutadiene	40-140	30	70-130	20	40-140	20
Hexachlorocyclopentadiene	40-140	30	20-160	20	40-140	20
Hexachloroethane	40-140	30	20-160	20	40-140	20
Indeno(1,2,3-cd)Pyrene	40-140	30	70-130	20	40-140	20
Isophorone	40-140	30	70-130	20	40-140	20
Naphthalene	40-140	30	70-130	20	40-140	20
Nitrobenzene	40-140	30	70-130	20	40-140	20
NitrosoDiPhenylAmine(NDPA)/ Diphenylamine (DPA)	40-140	30	70-130	20	40-140	20
n-Nitrosodimethylamine	22-74	30	20-160	20		
n-Nitrosodi-n-propylamine	29-132	30	70-130	20	40-140	20
P-Chloro-M-Cresol	23-97	30	70-130	20	30-130	20
Pentachlorophenol	9-103	30	20-160	20	30-130	20
Pentachloronitrobenzene					40-140	20

	STANDARD TARGET COMPOUND LIST (Aqueous)		**NEW JERSEY TARGET COMPOUND LIST (Aqueous)**		**CT TARGET COMPOUND LIST (Aqueous)**	
Analyte	**Acceptance Criteria**	**Duplicate RPD**	**Acceptance Criteria**	**Duplicate RPD**	**Acceptance Criteria**	**Duplicate RPD**
Phenanthrene	40-140	30	70-130	20	40-140	20
Phenol	12-110	30	20-160	20	30-130	20
Pyrene	26-127	30	70-130	20	40-140	20
Pyridine	10-66	30			40-140	20
2-Fluorophenol	*21-120*		*15-110*		*15-110*	
Phenol-d6	*10-120*		*15-110*		*15-110*	
Nitrobenzene-d5	*23-120*		*30-130*		*30-130*	
2-Fluorobiphenyl	*15-120*		*30-130*		*30-130*	
2,4,6-Tribromophenol	*10-120*		*15-110*		*15-110*	
4-Terphenyl-d14	*41-149*		*30-130*		*30-130*	

TABLE 3B

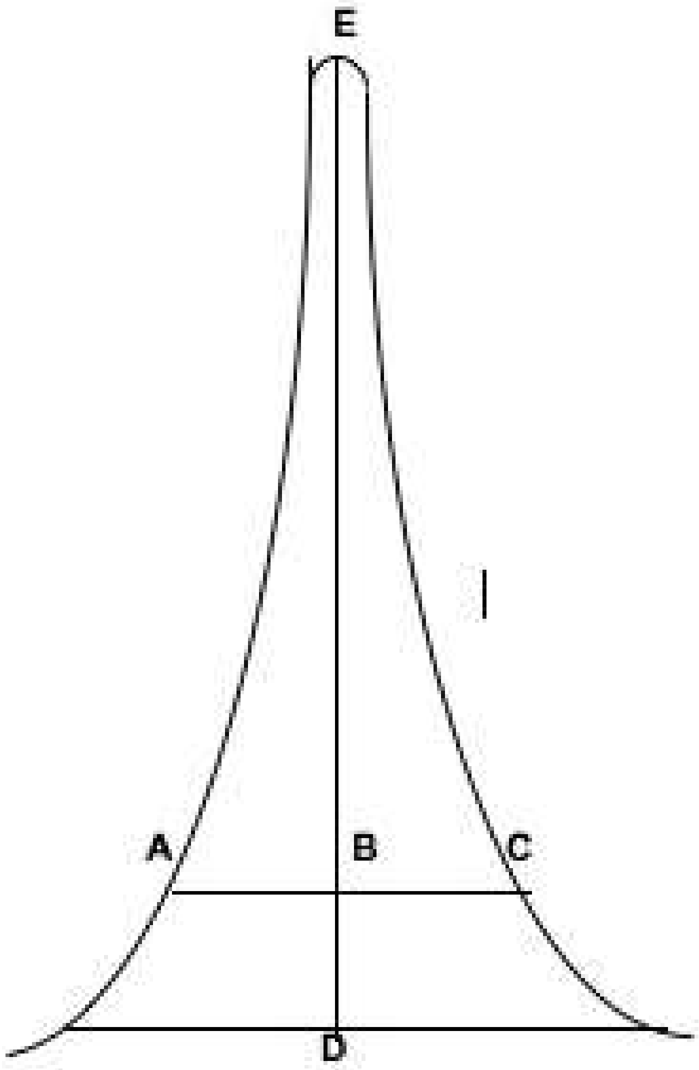
ACCEPTABLE SOIL QC LIMITS

	STANDARD TARGET COMPOUND LIST (Soil)		**NEW JERSEY TARGET COMPOUND LIST (Soil)**		**CT TARGET COMPOUND LIST (Soil)**	
Analyte	**Acceptance Criteria**	**Duplicate RPD**	**Acceptance Criteria**	**Duplicate RPD**	**Acceptance Criteria**	**Duplicate RPD**
1,2,4,5-Tetrachlorobenzene	40-117	50	70-130	30	40-140	30
1,2,4-Trichlorobenzene	38-107	50	70-130	30	40-140	30
1,2-Dichlorobenzene	40-140	50	70-130	30		
1,3-Dichlorobenzene	40-140	50	70-130	30		
1,3-Dinitrobenzene	40-140	50				
1,4-Dichlorobenzene	28-104	50	70-130	30		
1-Methylnaphthalene	26-130	50				
2,3,4,6-Tetrachlorophenol	40-140	50	70-130	30		
2,4,5-Trichlorophenol	30-130	50	70-130	30	30-130	30
2,4,6-Trichlorophenol	30-130	50	70-130	30	30-130	30
2,4-Dichlorophenol	30-130	50	70-130	30	30-130	30
2,4-Dimethylphenol	30-130	50	70-130	30	30-130	30
2,4-Dinitrophenol	4-130	50	20-160	30	30-130	30
2,4-Dinitrotoluene	28-89	50	70-130	30	40-140	30
2,6-Dinitrotoluene	40-140	50	70-130	30	40-140	30
2-Chloroaniline	30-130	50				
2-Chloronaphthalene	40-140	50	70-130	30	40-140	30
2-Chlorophenol	25-102	50	70-130	30	30-130	30
2-Methylnaphthalene	40-140	50	70-130	30	40-140	30
2-Methylphenol	30-130.	50	70-130	30	30-130	30
2-Nitroaniline	47-134	50	70-130	30	40-140	30
2-Nitrophenol	30-130	50	70-130	30	30-130	30
3,3'-Dichlorobenzidine	40-140	50	70-130	30	40-140	30
3,3'-Dimethylbenzidine	15-115	50				
3-Methylphenol/4-Methylphenol	30-130	50	20-160	30	30-130	30
3-Nitroaniline	26-129	50	70-130	30	40-140	30
4,6-Dinitro-o-cresol	10-130	50	70-130	30	30-130	30
4-Bromophenyl phenyl ether	40-140	50	70-130	30	40-140	30
4-Chloroaniline	40-140	50	20-160	30	40-140	30
4-Chlorophenyl phenyl ether	40-140	50	70-130	30	40-140	30
4-Nitroaniline	41-125	50	70-130	30	40-140	30
4-Nitrophenol	11-114	50	20-160	30	30-130	30
Acenaphthene	31-137	50	70-130	30	40-140	30

	STANDARD TARGET COMPOUND LIST (Soil)		**NEW JERSEY TARGET COMPOUND LIST (Soil)**		**CT TARGET COMPOUND LIST (Soil)**	
Analyte	**Acceptance Criteria**	**Duplicate RPD**	**Acceptance Criteria**	**Duplicate RPD**	**Acceptance Criteria**	**Duplicate RPD**
Acenaphthylene	40-140	50	70-130	30	40-140	30
Acetophenone	14-144	50	70-130	30	40-140	30
Aniline	40-140	50	20-160	30	40-140	30
Anthracene	40-140	50	70-130	30	40-140	30
Atrazine	40-140	50	70-130	30		
Azobenzene	40-140	50	70-130	30		
Benzaldehyde	40-140	50	20-160	30		
Benzidine	10-66	50	20-160	30		
Benzo(a)anthracene	40-140	50	70-130	30	40-140	30
Benzo(a)pyrene	40-140	50	70-130	30	40-140	30
Benzo(b)fluoranthene	40-140	50	70-130	30	40-140	30
Benzo(e)pyrene	40-140	50				
Benzo(ghi)perylene	40-140	50	70-130	30	40-140	30
Benzo(k)fluoranthene	40-140	50	70-130	30	40-140	30
Benzoic Acid	10-110	50	20-160	30		
Benzyl Alcohol	40-140	50	20-160	30		
Biphenyl	37-127	50	70-130	30		
Bis(2-chloroethoxy)methane	40-117	50	70-130	30	40-140	30
Bis(2-chloroethyl)ether	40-140	50	70-130	30	40-140	30
Bis(2-chloroisopropyl)ether	40-140	50	70-130	30	40-140	30
Bis(2-Ethylhexyl)phthalate	40-140	50	70-130	30	40-140	30
Butyl benzyl phthalate	40-140	50	70-130	30	40-140	30
Caprolactam	15-130	50	20-160	30		
Carbazole	54-128	50	70-130	30	40-140	30
Chrysene	40-140	50	70-130	30	40-140	30
Dibenzo(a,h)anthracene	40-140	50	70-130	30	40-140	30
Dibenzofuran	40-140	50	70-130	30	40-140	30
Diethyl phthalate	40-140	50	70-130	30	40-140	30
Dimethyl phthalate	40-140	50	70-130	30	40-140	30
Di-n-butylphthalate	40-140	50	70-130	30	40-140	30
Di-n-octylphthalate	40-140	50	70-130	30	40-140	30
Diphenamid	40-140	50				
Fluoranthene	40-140	50	70-130	30	40-140	30
Fluorene	40-140	50	70-130	30	40-140	30
Hexachlorobenzene	40-140	50	70-130	30	40-140	30
Hexachlorobutadiene	40-140	50	70-130	30	40-140	30
Hexachlorocyclopentadiene	40-140	50	20-160	30	40-140	30
Hexachloroethane	40-140	50	20-160	30	40-140	30
Indeno(1,2,3-cd)Pyrene	40-140	50	70-130	30	40-140	30
Isophorone	40-140	50	70-130	30	40-140	30

	STANDARD TARGET COMPOUND LIST (Soil)		**NEW JERSEY TARGET COMPOUND LIST (Soil)**		**CT TARGET COMPOUND LIST (Soil)**	
Analyte	**Acceptance Criteria**	**Duplicate RPD**	**Acceptance Criteria**	**Duplicate RPD**	**Acceptance Criteria**	**Duplicate RPD**
Naphthalene	40-140	50	70-130	30	40-140	30
Nitrobenzene	40-140	50	70-130	30	40-140	30
NitrosoDiPhenylAmine(NDPA)/ Diphenylamine (DPA)	36-157	50	70-130	30	40-140	30
n-Nitrosodimethylamine	22-100	50	20-160	30		
n-Nitrosodi-n-propylamine	32-121	50	70-130	30	40-140	30
Parathion, ethyl	40-140	50	20-160	30		
P-Chloro-M-Cresol	26-103	50	70-130	30	30-130	30
Pentachloronitrobenzene	42-153	50			40-140	30
Pentachlorophenol	17-109	50	20-160	30	30-130	30
Phenanthrene	40-140	50	70-130	30	40-140	30
Phenol	26-90	50	20-160	30	30-130	30
Pyrene	35-142	50	70-130	30	40-140	30
Pyridine	10-93	50	20-160	30	40-140	30
Thionazin	40-140	50				
2-Fluorophenol	*25-120*		*30-130*		*30-130*	
Phenol-d6	*10-120*		*30-130*		*30-130*	
Nitrobenzene-d5	*23-120*		*30-130*		*30-130*	
2-Fluorobiphenyl	*30-120*		*30-130*		*30-130*	
2,4,6-Tribromophenol	*10-136*		*30-130*		*30-130*	
4-Terphenyl-d14	*18-120*		*30-130*		*30-130*	

TABLE 4 – Tailing Factor Calculation



Tailing Factor = $\frac{BC}{AB}$

Example calculation:

Peak Height = DE = 100mm
10% Peak Height = BD = 10mm
Peak Width at 10% Peak Height = AC = 23mm

AB = 11mm
BC = 12mm

Therefore: Tailing Factor = $\frac{12}{11}$ **= 1.1**

Tailing factor for benzidine < 2.0

Tailing factor for pentachlorophenol <2.0

TABLE 5

CHARACTERISTIC IONS FOR SEMIVOLATILE COMPOUNDS

Compound	Primary Ion	Secondary Ion(s)
Acenaphthene	154	153, 152
Acenaphthylene	152	151, 153
Acetophenone	105	71, 51, 120
Aniline	93	66, 65
Anthracene	178	176, 179
Atrazine	200	202, 215
Azobenzene	77	182, 105
Benzaldehyde	105	77
Benzidine	184	92, 185
Benzo(a)anthracene	228	229, 226
Benzo(a)pyrene	252	253, 125
Benzo(b)fluoranthene	252	253, 125
Benzo(g,h,i)perylene	276	138, 277
Benzo(k)fluoranthene	252	253, 125
Benzoic acid	105	122, 77
Benzyl alcohol	79	77,108
Biphenyl	154	153,152
Bis (2-chloroethoxy) methane	93	95, 123
Bis (2-chloroethyl) ether	93	63, 95
Bis (2-chloroisopropyl) ether	45	77, 121
Bis (2-ethylhexyl) phthalate	149	167, 279
4-Bromophenyl phenyl ether	248	250, 141
Butyl Benzyl phthalate	149	91, 206
Caprolactam	55	85, 113
Carbazole	167	168, 166
4-Chloro-3-methylphenol	107	144, 142
2-Chloroaniline	127	129, 65
3-Chloroaniline	65	127, 129
4-Chloroaniline	65	127,129
2-Chloronaphthalene	162	127, 164
4-Chlorophenyl phenyl ether	204	206, 141
2-Chlorophenol	128	64,130
Chrysene	228	226, 229
Dibenzo(a,h)anthracene	278	139, 279
Dibenzofuran	168	139
1,2-Dichlorobenzene	146	148, 111

1,3-Dichlorobenzene	**146**	**148, 111**
1,4-Dichlorobenzene	**146**	**148, 111**
3,3’-Dichlorobenzidine	**252**	**254, 126**
2,4-Dichlorophenol	**162**	**164, 98**
Diethyl phthalate	**149**	**177, 150**

TABLE 5 (continued)

CHARACTERISTIC IONS FOR SEMIVOLATILE COMPOUNDS

Compound	**Primary Ion**	**Secondary Ion(s)**
3,3-Dimethylbenzidine	**212**	**211, 213**
Dimethyl phthalate	**163**	**194, 164**
2,4-Dimethylphenol	**107**	**121,122**
Di-n-butyl phthalate	**149**	**150, 104**
Di-n-octyl phthalate	**149**	**167, 43**
4,6-Dinitro-2-methylphenol	**198**	**51, 105**
O-Toluidine	**106**	**107, 77**
2-Ethylaniline	**106**	**121, 77**
2,4-Dimethylaniline	**121**	**120, 106**
2,3-Dimethylaniline	**106**	**121, 120**
3,4- Dimethylaniline	**121**	**120,106**
2,4,5-Trimethylaniline	**120**	**135, 134**
4-Chlorotoluidine	**106**	**141, 140**
2-Napthylamine	**143**	**115, 116**
2,4-Dinitrophenol	**184**	**107,91**
2,4-Dinitrotoluene	**165**	**63, 89**
2,6-Dinitrotoluene	**165**	**63, 89**
Diphenamide	**167**	**72, 165**
1,4-Dioxane	**88**	**58,43**
Ethyl parathion	**109**	**97, 291**
Fluoranthene	**202**	**101, 203**
Fluorene	**166**	**165, 167**
Hexachlorobenzene	**284**	**142, 249**
Hexachlorobutadiene	**225**	**223, 227**
Hexachlorocyclopentadiene	**237**	**235, 272**
Hexachloroethane	**117**	**201, 199**
Indeno(1,2,3-cd)pyrene	**276**	**138, 227**
Isophorone	**82**	**95, 138**
1-Methylnaphthalene	**115**	**141, 142**
2-Methylnaphthalene	**142**	**141**
2-Methylphenol	**108**	**107,90**
3/4-Methylphenol	**108**	**107,90**

Naphthalene	**128**	**129, 127**
2-Nitroaniline	**65**	**92, 138**
3-Nitroaniline	**138**	**92,65**
4-Nitroaniline	**138**	**65, 108, 92, 80, 39**
Nitrobenzene	**77**	**123, 65**

TABLE 5 (continued)

CHARACTERISTIC IONS FOR SEMIVOLATILE COMPOUNDS

Compound	Primary Ion	Secondary Ion(s)
2-Nitrophenol	**139**	**109, 65**
4-Nitrophenol	**65**	**109, 139**
n-Nitrosodimethylamine	**74**	**42,44**
n-Nitrosodi-n-butylamine	**84**	**57, 41, 116, 158**
n-Nitrosodi-n-propylamine	**70**	**42, 101, 130**
n-Nitrosodiphenylamine/Diphenylamine	**169**	**168, 167**
Pentachlorobenzene	**250**	**252, 108, 248, 215, 254**
Pentachloronitrobenzene	**237**	**142, 214, 249, 295, 265**
Pentachlorophenol	**266**	**264, 268**
Phenanthrene	**178**	**179, 176**
Phenol	**94**	**65, 66**
Pyrene	**202**	**200, 203**
Pyridine	**79**	**52**
1,2,4,5-Tetrachlorobenzene	**216**	**214, 179, 108, 143, 218**
2,3,4,6-Tetrachlorophenol	**232**	**131, 230, 166, 234, 168**
m-Toluidine	**106**	**107, 79**
1,2,4-Trichlorobenzene	**180**	**182, 145**
2,4,5-Trichlorophenol	**196**	**200,198**
2,4,6-Trichlorophenol	**196**	**198, 200**
Acenaphthene-d_{10} (IS)	**164**	**162, 160**
Chrysene-d_{12} (IS)	**240**	**120, 236**
1,4-Dichlorobenzene-d_4 (IS)	**152**	**150, 115**
Naphthalene-d_8 (IS)	**136**	**68**
Perylene-d_{12} (IS)	**264**	**260, 265**
Phenanthrene-d_{10} (IS)	**188**	**94, 80**
2-Fluorobiphenyl (Surrogate)	**172**	**171**
2-Fluoroophenol (Surrogate)	**112**	**64**
Nitrobenzene-d_5 (Surrogate)	**82**	**128, 54**
Phenol-d_6 (Surrogate)	**99**	**42, 71**
Terphenyl-d_{14} (Surrogate)	**244**	**122, 212**
2,4,6-Tribromophenol (Surrogate)	**330**	**62,141**

TABLE 6

REPORTED DETECTION LIMITS FOR SEMIVOLATILE ORGANIC COMPOUNDS*

Analyte	**RDL (µg/L)**	**RDL (µg/Kg)**
Acenaphthene	2	133.34
Acenaphthylene	2	133.34
Acetophenone	5	333.34
Aniline	2	133.34
Anthracene	2	133.34
Atrazine	10	666.67
Azobenzene	2	500
Benzaldehyde	5	333.34
Benzidine	20	1333.34
Benzo(a)anthracene	2	133.34
Benzo(b)fluoranthene	2	133.34
Benzo(k)fluoranthene	2	133.34
Benzo(ghi)perylene	2	133.34
Benzo(a)pyrene	2	133.34
Benzoic acid	50.0	3333.34
Benzyl alcohol	2	133.34
Biphenyl	2	366.67
Bis(2-chloroethyl)ether	2	133.34
Bis(2-chloroisopropyl)ether	2	133.34
Bis(2-chloroethoxy)methane	5.0	333.34
Bis(2-ethylhexyl)phthalate	3	200
4-Bromophenyl phenyl ether	2	133.34
Butyl benzyl phthalate	5.0	333.34
Caprolactam	10	666.67
Carbazole	2	166.67
2-Chloroaniline	2	na
3-Chloroaniline	10	na
4-Chloroaniline	5	333.34
p-Chloro-m-cresol (4-chloro-3-cresol)	2	133.34
2-Chloronaphthalene	2	133.34
2-Chlorophenol	2	133.34
4-Chlorophenyl phenyl ether	2	133.34
Chrysene	2	133.34
m/p-Methylphenol (3/4-methylphenol)	5.0	333.34
o-Methylphenol (2-methylphenol)	5.0	333.34

Dibenzo(a,h)anthracene	2	133.34
Dibenzofuran	2	133.34
Di-n-butylphthalate	5.0	333.34
1,2-Dichlorobenzene	2	133.34

TABLE 6 (continued)

REPORTED DETECTION LIMITS FOR SEMIVOLATILE ORGANIC COMPOUNDS*

Analyte	RDL (µg/L)	RDL (µg/Kg)
1,3-Dichlorobenzene	2	133.34
1,3-Dinitrobenzene	2	N/A
1,4-Dichlorobenzene	2	133.34
3,3-Dichlorobenzidine	5	333.34
2,4-Dichlorophenol	5	333.34
O-Toluidine	2	N/A
2-Ethylaniline	2	N/A
2,4-Dimethylaniline	2	N/A
2,3-Dimethylaniline	2	N/A
3,4-Dimetylaniline	2	N/A
2,4,5-Trimethylaniline	2	N/A
4-Chlorotoluidine	2	N/A
2-Napthylamine	2	N/A
2,6-Dichlorophenol	10.0	666.67
Diethyl phthalate	5.0	333.34
3,3-Dimethylbenzidine	4	500
2,4-Dimethylphenol	5	333.34
Dimethyl phthalate	5.0	333.34
4,6-Dinitro-o-cresol	10	666.67
2,4-Dinitrophenol	20	1333.4
2,4-Dinitrotoluene	5.0	333.34
2,6-Dinitrotoluene	5.0	333.34
Di-n-octylphthalate	5.0	333.34
Diphenamide	5	N/A
1,4-Dioxane	5	166.67
Ethyl Parathion	N/A	166.67
Fluoranthene	2	133.34
Fluorene	2	133.34
Hexachlorobenzene	2	133.34
Hexachlorobutadiene	2	133.34
Hexachlorocyclopentadiene	20	1333.34
Hexachloroethane	2	133.34
Indeno(1,2,3-cd)pyrene	2	133.34
Isophorone	5.0	333.34

1-Methylnaphthalene	2	166.67
2-Methylnaphthalene	2	133.34
Naphthalene	2	133.34
2-Nitroaniline	5.0	333.34

TABLE 6 (continued)

REPORTED DETECTION LIMITS FOR SEMIVOLATILE ORGANIC COMPOUNDS*

Analyte	RDL (µg/L)	RDL (µg/Kg)
3-Nitroaniline	5.0	333.34
4-Nitroaniline	5.0	333.34
Nitrobenzene	2	133.34
2-Nitrophenol	10.0	666.67
4-Nitrophenol	10.0	666.67
Nitrosodi-n-butylamine	10.0	666.67
n-Nitrosodimethylamine	2	133.34
n-Nitrosodiphenylamine/Diphenylamine	2	133.34
Nitrosodipiperidine	20.0	2000
n-Nitrosodi-n-propylamine	5.0	333.34
Pentachlorobenzene	20.0	1333.34
Pentachloronitrobenzene	10.0	150
Pentachlorophenol	10.0	666.67
Phenanthrene	2	133.34
Phenol	5.0	333.34
Pyrene	2	133.34
Piridine	5	666.67
1,2,4,5-Tetrachlorobenzene	10	666.67
1,2,4-Trichlorobenzene	5.0	333.34
2,4,5-Trichlorophenol	5.0	333.34
2,4,6-Trichlorophenol	5.0	333.34
2,3,4,6-Tetrachlorophenol	5.0	166.66
m-Toluidine	5	300

* **Note**: Reporting Limits are based on standard 8270 reporting list. RLs may vary for other reporting lists.

Table 7
Semivolatile Internal Standards with Corresponding Target Compounds and Surrogates Assigned for Quantitation

1,4-dichlorobenzene-d4	Naphthalene-d8	Acenaphthene-d10	Phenanthrene-d10	Chrysene-d12	Perylene-d12
O-Toluidine	2-Ethylaniline	2-Naphthylamine	3,3-Dimethylbenzidine	3,3'-Dichlorobenzidine	Benzo(g,h,i)perylene
1,2,4-Trichlorobenzene	2,4-Dimethylaniline	2,3,4,6-Tetrachlorophenol	Anthracene	Benzo(a)Anthracene	Dibenzo(a,h)anthracene
1,2-Dichlorobenzene	3,4-Dimethylaniline	2,3,5,6-Tetrachlorophenol	Benzidine	Benzo(a)pyrene	Indeno(1,2,3-cd)pyrene
1,3-Dichlorobenzene	2,3-Dimethylaniline	2,4,6-Tribromophenol, surr	Benzyl butyl phthalate	Benzo(b)fluoranthene	
1,4-Dichlorobenezne	2,4,5-Trimethylaniline	2,4-Dinitrophenol	Carbazole	Benzo(k)fluoranthene	
2,4-Dichlorophenol	4-Chlorotoludine	2,4-Dinitrotoluene	Di-n-Butylphthalate	Bis(2-ethylhexyl) phthalate	
2,4-Dimethylphenol	1,2,4,5-Tetrachlorobenzene	3-Nitroaniline	Diphenamid	Chrysene	
2-Chloroaniline	1,2-Dichlorobenzene	4,6-Dinitro-2-methylphenol	Fluoranthene	Di-n-octylphthalate	
2-Chlorophenol	1,3-Dichlorobenzene	4-Bromophenyl-phenyl ether	n-Octadecane		
2-Fluorophenol, surr	1,4-Diclorobenzene	4-Chlorophenyl-phenyl ether	Parathion		
2-Methylphenol	1-chloror-2-nitrobenzene	4-Nitroaniline	Phenanthrene		
2-Nitrophenol	1-Methylnapthalene	4-Nitrophenol	Pyrene		
3-Methylphenol / 4-Methylphenol	2,4,5-Trichlorphenol	Acenaphthene	Terphenyl-d14, surr		
Acetophenone	2,4,6-Trichlorophenol	Atrazine			
Aniline	2,6-Dichlorophenol	Azobenzene			
Benzaldehyde	2,6-Dinitrotoluene	Dibenzofuran			
Benzyl Alcohol	2-Chloronaphthalene	Dichloran			
Bis(2-chloroethoxy)methane	2-Fluorobiphenyl, surr	Diethyl phthalate			
Bis(2-chloroethyl)ether	2-Methylnaphthalene	Fluorene			

Table 7 (cont.)
Semivolatile Internal Standards with Corresponding Target Compounds and Surrogates Assigned for Quantitation

1,4-dichlorobenzene-d4	Naphthalene-d8	Acenaphthene-d10	Phenanthrene-d10	Chrysene-d12	Perylene-d12
bis(2-Chloroisopropyl)ether	2-Nitroaniline	Hexachlorobenzene			
Hexachloroethane	3-Choloroaniline	NDPA/DPA			
Isophorone	4-Chloro-3-Methylphenol	Pentachloronitrobenzene			
m-Toluidine	4-Chloroaniline	Pentachlorophenol			
n-Decane	Acenaphthylene				
Nitrobenzene	a-Terpineol				
Nitrobenzene-d5, surr	Benzoic Acid				
N-Nitrosodimethylamine	Biphenyl				
N-Nitrosodi-n-propylamine	Caprolactam				
Phenol	Dimethyl Phthalate				
Phenol-d6, surr	Hexachlorobutadiene				
Pyridine 1,4-Dioxane	Hexachlorocyclopentadiene				
Phenol-d6, surr	Naphthalene				

Table 8

Recommended Minimum Response Factor Criteria from Initial and Continuing Calibration Verification Using the Suggested Ions in Table 5

Analyte	MRF
Benzaldehyde	0.010
Phenol	0.800
Bis(2-chloroethyl)ether	0.700
2-Chlorophenol	0.800
2-Methylphenol	0.700
2,2'-Oxybis-(1-chloropropane)	0.010
Acetophenone	0.010
4-Methylphenol	0.600
N-Nitroso-di-n-propylamine	0.500
Hexachloroethane	0.300
Nitrobenzene	0.200
Isophorone	0.400
2-Nitrophenol	0.100
2,4-Dimethylphenol	0.200
Bis(2-chloroethoxy)methane	0.300
2,4-Dichlorophenol	0.200
Naphthalene	0.700
4-Chloroaniline	0.010
Hexachlorobutadiene	0.010
Caprolactam	0.010
4-Chloro-3-methylphenol	0.200
2-Methylnaphthalene	0.400
Hexachlorocyclopentadiene	0.050
2,4,6-Trichlorophenol	0.200
2,4,5-Trichlorophenol	0.200
1,1'-Biphenyl	0.010
2-Chloronaphthalene	0.800
2-Nitroaniline	0.010
Dimethyl phthalate	0.010
2,6-Dinitrotoluene	0.200
Acenaphthylene	0.900
3-Nitroaniline	0.010
Acenaphthene	0.900
2,4-Dinitrophenol	0.010
4-Nitrophenol	0.010
Dibenzofuran	0.800
2,4-Dinitrotoluene	0.200
Diethyl phthalate	0.010
1,2,4,5-Tetrachlorobenzene	0.010

Table 8 (cont.)

Recommended Minimum Response Factor Criteria from Initial and Continuing Calibration Verification Using the Suggested Ions in Table 5

Analyte	MRF
4-Chlorophenyl-phenyl ether	0.400
Fluorene	0.900
4-Nitroaniline	0.010
4,6-Dinitro-2-methylphenol	0.010
4-Bromophenyl-phenyl ether	0.100
N-Nitrosodiphenylamine	0.010
Hexachlorobenzene	0.100
Atrazine	0.010
Pentachlorophenol	0.050
Phenanthrene	0.700
Anthracene	0.700
Carbazole	0.010
Di-n-butyl phthalate	0.010
Fluoranthene	0.600
Pyrene	0.600
Butyl benzyl phthalate	0.010
3,3'-Dichlorobenzidine	0.010
Benzo(a)anthracene	0.800
Chrysene	0.700
Bis-(2-ethylhexyl)phthalate	0.010
Di-n-octyl phthalate	0.010
Benzo(b)fluoranthene	0.700
Benzo(k)fluoranthene	0.700
Benzo(a)pyrene	0.700
Indeno(1,2,3-cd)pyrene	0.500
Dibenz(a,h)anthracene	0.400
Benzo(g,h,i)perylene	0.500
2,3,4,6-Tetrachlorophenol	0.010

Table 9
Difficult analytes

Aniline

Benzaldehyde
Benzidine
Benzoic acid
Benzyl alcohol

Caprolactam
4-Chloroaniline
4-chloro-3-methylphenol (p-chloro-m-cresol)

3,3-Dimethylbenzidine
1,4-Dioxane
Dimethylphthalate
2,4 Dinitrophenol
4,6-dinitro-2-methylphenol (4,6-dinitro-o-cresol)

Hexachlorocyclopentadiene
Hexachloroethane

2-Methylphenol
3-Methylphenol/4-Methylphenol

2-nitroaniline
3-nitroaniline
4-nitroaniline
4-Nitrophenol
Nitrosodiphenylamine and diphenylamine (NDPA/DPA)
n-Nitrosodimethylamine

Parathion
Pentachloronitrobenzene
Pentachlorophenol
Phenol
Pyridine

Total and Amenable Cyanide

Reference: **Method 9010C / 9012B,** SW-846, Test Methods for Evaluating Solid Waste: Physical/Chemical Methods, EPA SW-846, Revision 2 and Revision 3 2004

SM 4500CN-CEG. Standard Methods for the Examination of Water and Wastewater. APHA-AWWA-WEF. Standard Methods Online.

Method 10-204-00-1-A, Lachat Instruments, 6645 West Mill Road, Milwaukee, WI 53218, 1994.

Method 9014 (Modified). SW-846, Test Methods for Evaluating Solid Waste: Physical / Chemical Methods, EPA SW-846, Update III, 1997

1. Scope and Application

Matrices: This method is applicable to waters, liquids, solids, soils and sludges

Definitions: Refer to Alpha Analytical Quality Manual.

The following SOP is a reflux-distillation procedure used to extract soluble cyanide salts and many insoluble cyanide complexes from wastes and leachates. It is based on the decomposition of nearly all cyanides by a reflux distillation procedure using a strong acid and a magnesium catalyst. Cyanide, in the form of hydrocyanic acid (HCN) is purged from the sample and captured into an alkaline scrubber solution. The concentration of cyanide in the scrubber solution is then determined by flow injection analysis on a Lachat Analyzer.

This method was designed to address the problem of “trace” analyses (<1000ppm). The method may also be used for “minor” (1000ppm – 10,000ppm) and “major” (>10,000ppm) analyses by adapting the appropriate sample dilution. However, the amount of sodium hydroxide in the standards and the sample analyzed must be the same.

The data report packages present the documentation of any method modification related to the samples tested. Depending upon the nature of the modification and the extent of intended use, the laboratory may be required to demonstrate that the modifications will produce equivalent results for the matrix. Approval of all method modifications is by one or more of the following laboratory personnel before performing the modification: Area Supervisor, Department Supervisor, Laboratory Director, or Quality Assurance Officer.

This method is restricted to use by or under the supervision of analysts experienced in the operation of the Lachat and in the interpretation of Lachat data. Each analyst must demonstrate the ability to generate acceptable results with this method by performing an initial demonstration of capability.

2. Summary of Method

The cyanide, as hydrocyanic acid (HCN), is released from samples containing cyanide by means of a reflux-distillation operation under acidic conditions and absorbed in a scrubber containing sodium hydroxide solution. The cyanide concentration in the absorbing solution is then determined colorimetrically by Lachat flow injection analysis.

2.1 Method Modifications from Reference

The sample size used is 50mL. The Midi distillation unit has demonstrated the ability to achieve the same RDL using 50mL instead of 500mL sample volume. Refer to EPA Method 335.4.

Modification for Method 9014: An automated determination of cyanide using the Lachat instrument is used instead of manual spectrophotometric determination.

Modification for amenable cyanide: Analysis is not prepped under amber light.

3. Reporting Limits

The Reported Limit for aqueous samples is 0.005mg/L; soil and solid samples is 1mg/Kg

4. Interferences

4.1 Interferences are eliminated or reduced by using the distillation procedure. However, chlorine and sulfide are interferences. Refer to Section 10.1.1.

4.2 High results may be obtained for samples that contain nitrate and/or nitrite. During the distillation, nitrate and nitrite will form nitrous acid, which will react with some organic compounds to form oximes. These compounds once formed will decompose under test conditions to generate HCN. The possibility of interference of nitrate and nitrite is eliminated by pretreatment with sulfamic acid just before distillation. Nitrate and nitrite are interferences when present at levels higher than 10mg/L and in conjunction with certain organic compounds.

4.3 Thiocyanate is reported to be an interference when present at very high levels. Levels of 10mg/L were not found to interfere.

4.4 Fatty acids, detergents, surfactants, and other compounds may cause foaming during the distillation when they are present in high concentrations. Add anti-foaming agent to the sample during the distillation procedure (Section 10.3.1).

4.5 Carbonates and aldehydes are possible interferences.

5. Health and Safety

The toxicity or carcinogenicity of each reagent and standard used in this method is not fully established; however, each chemical compound should be treated as a potential health hazard. From this viewpoint, exposure to these chemicals must be reduced to the lowest possible level by whatever means available. A reference file of material safety data sheets is available to all personnel involved in the chemical analysis. Additional references to laboratory safety are available in the Chemical Hygiene Plan.

All personnel handling environmental samples known to contain or to have been in contact with municipal waste must follow safety practices for handling known disease causative agents.

The following chemicals have the potential to be highly toxic or hazardous. For detailed explanations consult the MSDS:

- Cyanide
- Sulfuric acid
- Pyridine
- Chloramine-T

6. Sample Collection, Preservation, Shipping and Handling

6.1 Sample Collection

Samples are collected in plastic or glass containers. All containers must be thoroughly cleaned and rinsed.

Oxidizing agents such as chlorine decompose most cyanides. Testing for chlorine must be done in the field prior to sample preservation.

6.2 Sample Preservation

Prior to preservation, samples must be tested for chlorine (Section 6.1).

Aqueous samples are preserved with 50% sodium hydroxide in the field to a pH $\geq$ 12 at the time of collection.

Samples and distillates are stored in the refrigerator at 4 ±2 °C.

6.3 Sample Shipping

No specific requirements.

6.4 Sample Handling

When properly preserved, cyanide samples are stored for up to 14 days prior to sample preparation steps.

Distillates must be analyzed within 14 days of distillation. Samples must be analyzed within 14 days of receipt.

Note: for MCP-TCN samples must be analyzed within 24h after distillation

7. Equipment and Supplies

7.1 Cyanide Midi Distillation Unit: Lab Crest, BGL or comparable midi distillation unit. With reaction vessels, collection vessels, cold fingers and impingers.

7.2 pH paper: Range 1-14

7.3 Lead Acetate Paper

7.4 Vacuum source

7.5 50mL centrifuge tubes: New, plastic, with caps.

7.6 KI starch paper: Residual Chlorine sensitivity

7.7 Class A volumetric flasks: 25, 50, 100, 500 and 1000mL

7.8 Graduated cylinders: 50mL glass or plastic

7.9 Eppendorf pipettor or pipets: 0.5, 1, 2, and 5mL

7.10 Lachat 8500 Flow Analyzer: Including Quick Chem software, autosampler, pump and accessories.

7.11 Balance: Capable of weighing to 0.0001gram

7.12 Beakers: 100mL

7.13 Chiller

7.14 Stir plate

7.15 Stir bars

7.16 Dilution vials

8. Reagents and Standards

Reagent grade chemicals are used in all tests. Unless otherwise indicated, it is intended that all reagents shall conform to the specifications of the Committee on Analytical Reagents of the American Chemical Society, where such specifications are available. Other grades may be used, provided it is first ascertained that the reagent is of sufficient high purity to permit its use without lessening the accuracy of the determination.

8.1 Standards and Reagents for Distillation

8.1.1 **Reagent Water:** All references to water in this method refer to Deionized Water (DI) from Alpha's water treatment system.

8.1.2 **Ascorbic Acid, $C_6H_8O_6$:** Powder. Store at room temperature. Expires upon manufacturer's specified date.

8.1.3 **Sodium hydroxide solution (1N), NaOH:** In a 1L volumetric flask, dissolve 40g of NaOH. Bring to volume with DI water. Store at room temperature. Expires one month from date of preparation.

8.1.4 **Sulfamic acid (0.4N), H_2NSO_3H:** In a 1L volumetric flask, dissolve 40g H_2NSO_3H. Bring to volume with DI water. Store at room temperature. Expires 6 months from date of preparation.

8.1.5 **Sulfuric acid (1:1), H_2SO_4:** To a 1L volumetric flask, add 500mL DI water. Slowly and carefully add 500mL of concentrated H_2SO_4. Store at room temperature. Expires one month from date of preparation.

8.1.6 **Magnesium chloride solution (2.5M), $MgCl_2 \cdot 6H_2O$:** In a 1L volumetric flask, dissolve 510g of $MgCl_2 \cdot 6H_2O$. Bring to volume with DI water. Store at room temperature. Expires 6 months from date of preparation.

8.1.7 **LCS, 1000ppm cyanide stock solution:** Commercially available standard with a certificate of analysis and from a different source than the Lachat calibration standards. Purchased from Ricca, Catalog # 2543-32. Store refrigerated at 4 ± 2 °C. Expires upon manufacturer's specified date.

8.1.8 **LCS 10ppm cyanide working solution:** Pipet 1mL of 1000ppm cyanide stock solution (Section 8.1.7) into a 100mL volumetric flask. Add 10mL of 1N NaOH (Section 8.1.3). Bring to volume with DI water. Prepare each day of use.

8.1.8.1 **This can also be made by taking 5mL of 10ppm (Section 8.1.8) up to 500mL with 0.**1N NaOH. This would be distilled as a whole volume (50mL). Prepare daily.

8.1.9 **1000ppm Stock Spiking Solution:** 1000ppm cyanide standard available commercially with a certificate of analysis. This is from a different source than the LCS (8.1.7). Purchased from LabChem Inc., Catalog # LC13545. Store refrigerated at 4 ± 2 °C. Expires upon manufacturer's specified date.

8.1.10 **10ppm Working Cyanide Spiking Solution:** Pipet 1mL of the 1000ppm Stock Spiking Solution (Section 8.1.9) into a 100mL volumetric flask. Add 10mL 1N NaOH (Section 8.1.3). Bring to volume with DI water. Prepare fresh each day of use.**pH 4 Acetate Buffer solution:** In a 500mL volumetric flask, dissolve 410g of sodium acetate trihydrate. Bring to volume with DI water. Adjust to pH of 4.5 with acetic acid (Section 8.1.13). Store at room temperature. Expires 6 months from date of preparation.

8.1.11 **Lead Carbonate Powder, [Pb (CO3)]**

8.1.12 **LCS 0.5 ppm Cyanide Working Solution:** Pipet 5mL of the 10ppm Working Cyanide Spiking Solution (Section 8.1.10) into a 100mL volumetric flask . Add 1mL of 10N NaOH (Section 8.1.16). Bring to volume with DI water. Prepare each day of use.

8.1.13 **Concentrated Acetic Acid:** Store at room temperature. Expires upon manufacturer's specified date.

8.1.14 **Ottawa Sand or Boiling chips**

8.1.15 **Sodium hydroxide solution (10N), NaOH:** In a 1L volumetric flask, dissolve 400g of NaOH. Bring to volume with DI water. Store at room temperature. Expires 6 months from date of preparation.

8.1.16 **Sodium hydroxide solution (0.1N), NaOH:** In a 10L carboy mix 100mL of 10N NaOH. Bring to volume with DI water. Store at room temperature. Expires daily.

8.1.17 **Total Cyanide SRM:** ERA catalog # 541. Store in room temperature. Expires upon manufacturer's specified date.

8.1.18 **Calcium Hypochlorite Solution:** Dissolve 5g Ca(OCl)2 in 100mL Deionized water. Store in an amber colored bottle in the dark. Expires monthly.

8.2 Standards and Reagents for Lachat Analysis

8.2.1 **Helium gas:** To prevent bubble formation, degas all solutions except the standards with helium. Use He at 140kPa (20 lb/in^2) through a helium degassing tube (Lachat part number 50100). Bubble He vigorously through the solution for one minute.

8.2.2 **Reagent 1. Carrier, 0.1N Sodium Hydroxide:** In a 1L plastic container add 10mL of 10N NaOH (Section 8.1.16). Bring to 1L volume with DI. Store at room temperature. Prepare fresh bi-weekly.

8.2.3 **Reagent 2. Acetate Buffer, 2.68M:** In a 1L volumetric flask, dissolve 163g spdium acetate trihydrate (acetic acid, sodium salt trihydrate, $CH_3CO_2NA{\bullet}H_2O$) in approximately 800mL of water. Add 40mL of acetic acid to solution. Dilute to the mark and invert to mix. Store at room temperature. Prepare fresh monthly.

8.2.4 **Reagent 3. Chloramine-T:** Dissolve 2.0g chloramine-T hydrate in 500mL DI. Prepare fresh daily.

8.2.5 **Reagent 4. Pyridine-Barbituric Acid Reagent:** Under a fume hood, place 15g barbituric acid in a 1L beaker and add 100mL water, rinsing down the sides of the beaker to wet the barbituric acid. Add 75mL pyridine (C_5H_5N) while stirring and mix until the barbituric acid dissolves. Add the 15mL concentrated hydrochloric acid (12M HCl) and mix. Store at room temperature. Prepare fresh weekly.

8.2.6 **0.5ppm Calibration standard:** Pipet 5mL of the 10ppm working cyanide spiking solution (Section 8.1.10) into a 100mL volumetric flask. Bring to volume with 0.1N NaOH. Prepare each day of use.

8.2.7 **0.2ppm Calibration standard:** Pipet 2mL of the 10ppm working cyanide spiking solution (Section 8.1.10) into a 100mL volumetric flask. Bring to volume with 0.1N NaOH. Prepare each day of use.

8.2.8 **0.1ppm Calibration standard:** Pipet 1mL of the 10ppm working cyanide spiking solution (Section 8.1.10) into a 100mL volumetric flask. Bring to volume with 0.1N NaOH. Prepare each day of use. This calibration standard is also used as the Continuing Calibration Verification sample.

8.2.9 **0.04ppm Calibration standard:** Pipet 5mL of the 0.2ppm calibration standard (Section 8.2.7) into a 25mL volumetric flask. Bring to volume with 0.1N NaOH. Prepare each day of use.

8.2.10 **0.02ppm Calibration standard:** Pipet 1mL of the 0.5ppm calibration standard (Section 8.2.6) into a 25mL volumetric flask. Bring to volume with 0.1N NaOH. Prepare each day of use.

8.2.11 **0.01ppm Calibration standard:** Pipet 10mL of the 0.02ppm calibration standard (Section 8.2.10) and 10mL of 0.1N NaOH into a container and mix. Prepare each day of use.

8.2.12 **0.004ppm Calibration standard:** Pipet 5mL of 0.04ppm calibration standard (Section 8.2.9) into a 50mL volumetric flask. Bring to volume with 0.1N NaOH. Prepare each day of use.

8.2.13 **0.1ppm ICV standard:** Pipet 1mL of the 10ppm LCS cyanide working solution (8.1.8) into a 100mL volumetric flask. Bring to volume with 0.1N NaOH. Prepare each day of use.

9. Quality Control

The laboratory must maintain records to document the quality of data that is generated. Ongoing data quality checks are compared with established performance criteria to determine if the results of analyses meet the performance characteristics of the method.

9.1 Blank

A minimum of one method blank is distilled and analyzed per batch of 20 or less samples. The Method Blank is utilized to determine if contamination or any memory effects are occurring. (Section 10.3.1.1) The blank result must be less than the reporting limit of 0.005 mg/L for liquids and 1 mg/kg for soils. If the blank result is outside of acceptance criteria, it is injected another time. If failure continues, sample analysis is terminated and the source of the problem is found and corrected. All samples analyzed since the last acceptable blank analysis must be reanalyzed.

9.2 Laboratory Control Sample (LCS)

Distill and analyze two LCSs per batch of 20 samples. A Low LCS is analyzed at 0.1mg/L and a high LCS is analyzed at 0.2mg/L. (Section 10.3.1.2)

LCS measurements for Method SM 4500 CN-CE must be within ±10%. For Method 9010C/9012B, the LCS measurements must be within ± 15% for liquids and +/- 20% for soils.

Samples for Method 9010C/9012B: LCSDs are distilled and analyzed along with the LCSs, as described above. The RPD between LCS and LCSD must be $\leq$ 20% for liquids and <35% for soils.

For soil samples: LCS and LCSD recovery must be within vendor specified acceptance criteria (it will be different for different lots of SRM)

If any LCS fails acceptance criteria for either % Recovery or RPD, analysis is terminated and samples are redigested and analyzed

9.3 Initial Calibration Verification (ICV)

The Initial Calibration Verification Standard (ICV) (Section 8.2.13) is analyzed immediately following the calibration to verify the curve. If the measurements exceeds ±10% of 0.1ppm, the analysis is terminated and recalibration must occur. An acceptable result for the ICV must be obtained prior to any sample analysis.

9.4 Continuing Calibration Verification (CCV)

The Continuing Calibration Verification Standard (CCV) (Section 8.2.8) is analyzed after every 10 injections. The CCV measurements cannot exceed ±10% of the 0.1ppm. If the CCV is not within acceptance criteria, the standard is injected again. If failure continues, sample analysis is terminated and the source of the problem is found and corrected. All samples analyzed since the last acceptable calibration verification must be reanalyzed.

9.5 Matrix Spike

Distill and analyze one spike per batch of 20 samples. For Method 9010C/9012B distill and analyze one spike per batch of 10 samples.

For Method 9010C/9012B, the % Recovery must be within ±20% for liquids and ±35% for solids. For SM 4500CN-CE, the % Recovery must be within ±10%. (Section 10.3.1.4).

Samples for Method 9010C/9012B: A Matrix Spike Duplicate (MSD) is distilled and analyzed along with the MS, as described above. The RPD between MS and MCSD must be $\leq$ 20% for liquids and <35% for soils

9.6 Laboratory Duplicate

Analyze one duplicate sample for every 20 samples. A duplicate sample is a sample brought through the entire sample preparation and analytical process. (Section 10.3.1.5)

The RPD must be 20% or less for liquids and 35% or less for soils and solids. See Section 12 for Corrective Action if these criteria are not met.

9.7 Method-specific Quality Control Samples

None.

9.8 Method Sequence

The analytical sequence is:

- Screening of samples for chlorine and sulfide
- Prep of amenable cyanide, if needed
- Distillation:
  - Samples

  - LCS Low
  - LCS High
  - Blank
  - Matrix Spike
  - Duplicate
- Analysis:
  - Calibration and Standardization of Lachat Instrument
  - CCV
  - CCB
  - ICV
  - ICB
  - 10 samples
  - CCV
  - CCB
  - 10 samples
  - CCV
  - CCB
  - Calculation of sample cyanide concentration

10. Procedure

10.1 Equipment Set-up

10.1.1 Screening for Chlorine and Sulfide Interference

10.1.1.1 Chlorine Interference

Oxidizing agents, such as chlorine, decompose most cyanides. Test by placing a drop of sample on a strip of potassium iodide (KI) - starch paper previously moistened with acetate buffer solution, pH 4. If positive indication is noted, then treat an aliquot of sample with Ascorbic Acid (Section 8.1.2). Repeat this test until the KI paper is negative. Immediately inform the Department Supervisor of this interference.

Manganese dioxide, nitrosyl chloride, etc., if present also may cause discoloration of the test paper

10.1.1.2 Sulfide Interference

Oxidized products of sulfide convert CN- to SCN- rapidly, especially at high pH. Test for S^{-2} by placing a drop of sample on lead acetate test paper previously moistened with acetic acid buffer solution, pH 4 (Section 8.1.11). Darkening of the paper indicates presence of S^{-2}. Add powdered lead carbonate [Pb (CO3)] in 1g increments to the whole sample volume. Re-test with acetate paper. Repeat test until a drop of treated sample no longer darkens the acidified lead acetate test paper. Record in the sample prep logbook the amount of lead carbonate added to the sample.

10.1.2 Amenable Cyanide Prep

10.1.2.1 Add 25mL, or 1g and 25mL of DI (8.1.1), to a 100mL beaker with a stir bar.

10.1.2.2 Add 1mL of 10ppm LCS cyanide working solution (8.1.8) to beaker.

10.1.2.3 Prep one sample in duplicate.

10.1.2.4 Add 1-2mL of calcium hypochlorite solution (8.1.18) to all samples and QC under the hood.

10.1.2.5 Check for the presence of chlorine by placing a drop of the sample on a KI-starch paper (7.6). It should turn blue if there is sufficient chlorine.

10.1.2.6 Check samples every 15 minutes for one hour for the presence of chlorine and add more calcium hypochlorite if needed.

10.1.2.7 After one hour of digesting, add ascorbic acid (8.1.2) until KI strip no longer turns blue.

10.1.2.8 Bring sample volume up to 50mL and distill following steps 10.3.1.6 thru 10.3.1.15.

10.2 Initial Calibration

10.2.1 Allow 15 minutes for heating unit to warm up to 60 °C.

10.2.2 Prepare a series of 7 calibration standards (Sections 8.2.6 – 8.2.12) and a 0.1N NaOH blank. Alternatively, calibration standards may be prepared by auto-diluting a 0.5ppm calibration standard (Section 8.2.6). Perform this function per the Lachat manufacturer's instructions for the Quick Chem 8500.

10.2.3 Set up manifold as shown in Table 1.

10.2.4 Input data system parameters as shown in Table 2.

10.2.5 Place standards and blank in the autosampler, per the manufacturer's instructions. Input the information required by the data system, such as concentration, replicates and QC scheme.

10.2.6 Inject the standards, per the manufacturer's instructions.

10.2.7 Prepare a standard curve by plotting instrument response against standard concentration values. A calibration curve is fitted to the calibration solution concentration/response data using the computer. The calibration coefficient of the curve must be greater than or equal to 0.995 before sample analysis can begin.

Calibration coefficient will be calculated using Lachat software. All calibration points are back calculated by Lachat software and should be within 10% from true concentration, except 2 lowest points of calibration curve. %recoveries for low range will be wider, but shouldn't exceed 100% and correlation coefficient will not be worse than 0.995.

10.3 Equipment Operation and Sample Processing

10.3.1 Distillation

10.3.1.1 Add 50mL of shaken liquid sample, or 1gram of a well-homogenized solid sample and 50mL of DI, to the 50mL reaction vessel.

10.3.1.2 For the Liquid High LCS, fill one 50mL reaction vessel with 50mL DI. For the soil High LCS, add 1g Ottawa Sand (Section 8.1.15) and 50mL of DI. After the system has been charged with air, add 1mL of 10ppm LCS cyanide working solution (8.1.8) to the closed system. (Final concentration equals 0.2mg/L.)

For the Liquid Low LCS, fill one 50mL reaction vessel with 50mL of DI. For a soil Low LCS, add 0.2-0.3 g (depending on actual SRM stock concentration) of SRM (sec 8.1.17) and 50mL of DI. Record exact SRM weight. For liquid samples: After the system has been charged with air, add 0.5mL of 10ppm LCS cyanide working solution (Section 8.1.8) to the closed system. (Final concentration equals 0.1mg/L.) **Don't add liquid Cyanide Standard for soil samples!** Final LCS soil concentration will change based on SRM lot

Samples for Method 9010C/9012B: Prepare a LCS Duplicate along with the LCSs described above.

10.3.1.3 For the method blank for liquid samples, fill one 50mL reaction vessel with 50mL of DI. For the method blank for soil samples, fill a 50mL reaction vessel with 1g of Ottawa Sand (Section 8.1.15) and 50mL DI.

10.3.1.4 For the matrix spike, fill a 50mL reaction vessel with 50mL of sample that has been chosen to be spiked. For soil samples, use 1g of soil and add 50mL of DI water. After the system has been charged with air, add 1mL of 10ppm working cyanide spiking solution (8.1.10) to the closed system.

Samples for Method 9010C/9012B: Prepare a Matrix Spike Duplicate (MSD) in the same manner as the MS, as described above.

10.3.1.5 For the duplicate, fill a 50mL reaction vessel with a duplicate aliquot of 50mL, or 1g soil and 50mL DI water of a sample that has been chosen to be duplicated.

10.3.1.6 Into the receiver or scrubber tube add 5mL of a 1N NaOH solution and add 40mL of DI water.

10.3.1.7 Arrange tubes in the distillation unit noting in the logbook which sample is in which glassware. The glassware is numbered and consistently placed in the same position in the distillation unit.

10.3.1.8 Assemble the unit completely. Turn on the pump. There must be gas bubbling in each tube. Check to make sure all connections are tight and bubbles are flowing at an equal rate in each sample tube. If not, adjust flow rate with the knobs in front of each receiver tube and/or check lines to ensure they are not obstructed.

10.3.1.9 Add 5mL of 0.4N sulfamic acid (8.1.4) to each sample tube and rinse the closed 50mL reaction vessel with a squirt of DI. No residue is to be left of the vessel wall.

10.3.1.10 Add 5mL of 1:1 H_2SO_4 (8.1.5) to each sample tube and rinse the closed 50mL reaction vessel with a squirt of DI. No residue is to be left on the vessel wall. Turn on the heat. Samples are to come to a boil on all of the midi-still units.

10.3.1.11 After 2 minutes of heating, add 2mL of 2.5M $MgCl_2$ Solution (8.1.6) to each sample tube, followed by a rinse with DI. If foaming occurs, an additional 2mL of $MgCl_2$ Solution may be added. If foaming continues, stop the distillation for that sample and reduce the sample size by 2 – 5x (as determined by the severity of the foaming). Contact the Inorganics Supervisor for guidance.

10.3.1.12 Turn on the chiller.

10.3.1.13 Set the timer-dial on the distillation unit to "110".

10.3.1.14 After 110 minutes the unit will shut off; leave the chiller running for an additional 30 minutes while the tubes cool down.

10.3.1.15 Pour contents of the scrubber tube into a new, labeled, centrifuge tube (Section 7.5). Carefully rinse the scrubber tube with DI water and add rinseate to the centrifuge tube to bring to 50mL volume. Cap and refrigerate for later analysis by the Lachat Instrument.

10.3.2 Lachat Analysis

10.3.2.1 Following initial calibration and standardization, (Section 10.2 and 10.4), place the samples in the autosampler, per the manufacturer's instructions. Input the information required by the data system, such as concentration, replicates and QC scheme.

10.3.2.2 Inject the samples, per the manufacturer's instructions.

10.3.2.3 The data system calculates sample concentration using the regression equation. Results are mg/L for Aqueous samples and mg/Kg for soil and solid samples.

10.3.2.4 If sample concentrations are greater than the highest calibration standard, the distilled sample is diluted with 0.1N sodium hydroxide (NaOH) diluent (Section 8.2.2), and reanalyzed. When the automated diluter is used, 0.1N NaOH is also used. **Do not dilute distilled samples or standards with DI water.**

10.4 Continuing Calibration

10.4.1 After the calibration has been established, it must be verified by the analysis of an Initial Calibration Verification Standard (ICV) (Section 8.2.13). The ICV of 0.1ppm must be made from a different source than the calibration standards. If the measurements exceed ±10% of 0.1ppm, the analysis is terminated. See Section 9.3 for Corrective Actions.

10.4.2 A Blank and a Continuing Calibration Verification (CCV) sample (Section 8.2.8) are analyzed after every 10 injections. The CCV measurements cannot exceed ±10% of the CCV value of 0.1ppm and the blank result must be less than the reporting limit of 0.005 mg/L. See Section 9.4 for CCV Corrective Actions and Section 9.1 for Blank corrective actions.

10.5 Preventive Maintenance

Preventative maintenance is recorded in the instrument maintenance logbook and is performed on the Lachat instrument as follows:

Daily:

1) Clean the autosampler
2) Clean the surfaces on the auto-dilutor
3) Prime the dilutor with fresh DI water
4) Clean the pump surfaces
5) Clean the detector with DI and dry with Kim-Wipes
6) Clean the instrument surfaces with DI, wipe clean with a paper towel

Bi-weekly:

1) Clean the injection ports with DI. Take apart the injection valve and inspect it for corrosion. Make sure that the valve connectors are tight and the o-rings are not worn. If the O-rings look worn replace with new ones.

Monthly:

1) Using DI water, clean the unions and the tees that are associated with the manifold.
2) Delete Temporary files on the computer

Every 6 months:

1) Replace the o-rings in the injection valve.
2) Replace the o-rings in the manifold

3) Back up the files on the computer

11. Data Evaluation, Calculations and Reporting

11.1 The Lachat data system calculates sample concentration using the regression equation.

11.2 Report only those values that fall between the lowest and the highest calibration standards.

11.3 Report results in mg CN/L for liquids and in mg CN/kg for soils.

12. Contingencies for Handling Out-of-Control Data or Unacceptable Data

Holding time exceedance and improper preservation are noted on the nonconformance report form. The analyst narrates the nonconformance when the project is turned in for review. The narration must state what the nonconformance was and any corrective action taken.

Perform routine preventative maintenance according to Section 10.5. Record all maintenance in the instrument logbook. Notify the Department Manager if the instrument problems are not routine in nature. The Department Manager determines whether the problem can be corrected with in-house technical staff or if the instrument vendor should be contacted to schedule service. All service calls are documented in the Instrument logbook, and a copy of the service report is given to the Department Manager.

Review of standards, blanks and standard response for acceptable performance occurs for each batch of samples. If any part of batch quality control does not meet acceptance criteria, the Department Manager is notified. If enough sample remains and holding time has not expired, then the batch is redistilled and reanalyzed. If there is not sufficient sample remaining to allow redistillation, then that analysis is repeated and both sets of data are reported with the nonconformance narrated on the final report.

If either the ICV, ICB, Method Blank, LCS, LCSD, CCV, or CCB recovery falls outside the designated acceptance range, the laboratory performance is judged to be out of control, and the problem must be immediately identified and corrected. The analytical result in the unspiked samples is suspect and is only reported for regulatory compliance purposes with the appropriate nonconformance action form.

Immediate corrective action for a failing CCV/CCB includes reanalyzing the failing standard. If the standard passes the second time then the analysis may be continued. The raw data is noted. If the standard fails again, the problem must be found and corrected. The CCV/CCB standard is remade and reanalyzed. If the standard passes, all samples analyzed since the previous passing standard are reanalyzed. The raw data is noted and all data associated with the failing standard must have one line drawn through the data, indicating it’s unable.

If the standard fails after instrument maintenance, the instrument is recalibrated. A new ICV/ICB is performed, and all samples analyzed since the previous passing CCV/CCB are reanalyzed.

If following reanalysis of the LCS, it is found to still be outside acceptance criteria, the entire sample batch must be redistilled and reanalyzed. If the %RPD between the LCS/LCSD fails after reinjection, then the entire sample batch must be redistilled and reanalyzed.

If the Method Blank fails it is re-poured and reinjected. If failure continues, the associated sample data is evaluated as follows: Sample results below the detection limit may be reported with a narrative included. If samples have positive results, and the results are greater than 10x the concentration found in the method blank, the data may be reported with a narrative included. Any positive samples with results less than 10x the concentration found in the method blank must be redistilled and reanalyzed.

If the Matrix Spike recovery does not meet acceptance criteria, and the LCS recovery is acceptable, matrix interference may be assumed. The associated data may be reported with a narrative included.

If sample Duplicates are outside of the acceptance criteria, the analyst examines the sample for homogeneity. If the sample is not homogenous, this is narrated on the final report. Clean, homogenous samples are redistilled and reanalyzed within holding time.

Sample nonconformance regarding a Matrix Spike recovery or a duplicate %RSD is narrated on the final report along with the corrective action(s) taken.

13. Method Performance

13.1 Detection Limit Study (DL) / Limit of Detection Study (LOD) / Limit of Quantitation (LOQ)

The laboratory follows the procedure to determine the DL, LOD, and/or LOQ as outlined in Alpha SOP ID 1732. These studies performed by the laboratory are maintained on file for review.

The quarterly method reporting limit (MRL) verification requirement is satisfied by the quarterly LOQ analysis, as per SOP/1732.

13.2 Demonstration of Capability Studies

Refer to Alpha SOP ID 1739 for further information regarding IDC/DOC Generation.

13.2.1 Initial (IDC)

The analyst must make an initial, one-time, demonstration of the ability to generate acceptable accuracy and precision with this method, prior to the processing of any samples.

13.2.2 Continuing (DOC)

The analyst must make a continuing, annual, demonstration of the ability to generate acceptable accuracy and precision with this method.

14. Pollution Prevention and Waste Management

Refer to Alpha’s Chemical Hygiene Plan and Hazardous Waste Management and Disposal SOP for further pollution prevention and waste management information.

15. Referenced Documents

2121 Chemical Hygiene Plan

1732 Detection Limit (DL), Limit of Detection (LOD) & Limit of Quantitation (LOQ) SOP

1739 Demonstration of Capability (DOC) Generation SOP

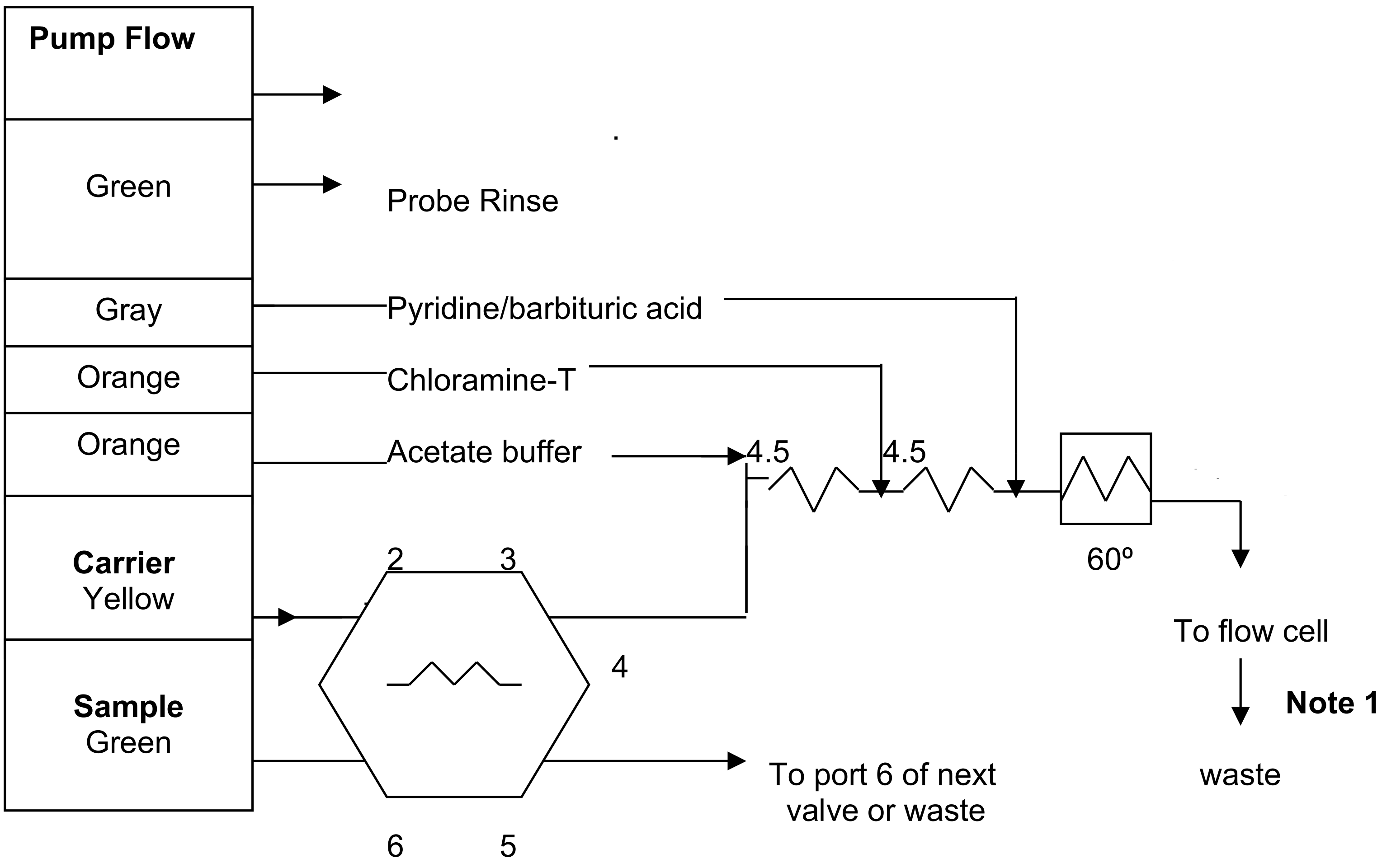
1728 Hazardous Waste Management and Disposal SOP

16. Attachments

TABLE 1: Cyanide Manifold Diagram

TABLE 2: Data System Parameters for QC 8500

TABLE 1
Cyanide Manifold Diagram



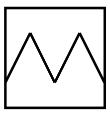
Sample Loop = 150cm x 0.8mm i.d.   Interference Filter = 570nm
QC8000 Sample loop = 150cm x 0.8mm i.d.

CARRIER is 0.1 N sodium hydroxide solution.

All manifold tubing is 0.8mm (0.030 in) i.d. This is 5.2µL/cm.

4.5 is 70.0cm of tubing on a 4.5cm coil support

APPARATUS: An injection valve, flow cell, a 10mm path length flow cell, and a colorimetric detector module are required.

The box  shows 650cm of tubing wrapped around the heater block at the specified temperature.

Note 1: 2 meter back pressure loop, 0.52mm i.d.

TABLE 2
Data system Parameters for QC 8500

The timing values listed below are approximate and will need to be optimized using graphical events programming.

Sample Throughput:	65 samples/hour, 55 s/sample
Pump Speed:	35
Cycle Period:	55

Analyte Data:

Concentration Units:	mg CN^-/L
Peak Base Width:	60.5 s
% Width Tolerance:	100
Threshold:	none
Inject to Peak Start:	55 s
Chemistry:	Direct

Calibration Data:

Levels	1	2	3	4	5	6	7	8
Concentration ug/50mL	25	10	5	2	1	0.5	0.2	0

Calibration Fit Type:	1st Order Polynomial
Calibration Rep. Handling:	Replace
Weighting Method:	1/X
Concentration Scaling:	None
Force Through Zero:	No

Sampler Timing:

Min. Probe in Wash Period:	14 s
Probe in Sample Period:	13 s

Valve Timing:

Load Time:	0.0 s
Load Period:	9 s
Inject Period:	20 s

Volatile Organic Compounds by Gas Chromatography/Mass Spectrometry (GC/MS)

References: **Method 8260D**, SW-846, Test Methods for Evaluating Solid Waste: Physical/Chemical Methods, EPA SW-846, Update VI (Phase II), June 2018.

Method 5035A, SW-846, Closed System Purge & Trap and Extraction for Volatile Organics in Soil and Waste Samples. Test Methods for Evaluating Solid Waste: Physical/Chemical Methods, Draft Revision I, July 2002.

Method 5030B, Purge & Trap for Aqueous Samples. SW-846, Test Methods for Evaluating Solid Waste: Physical/Chemical Methods, EPA SW-846, Update III, December 1996.

Method 5030C, Purge & Trap for Aqueous Samples. SW-846, Test Methods for Evaluating Solid Waste: Physical/Chemical Methods, EPA SW-846, Update IV, May 2003.

1. Scope and Application

Matrices: Method 8260 is used to determine volatile organic compounds in a variety of solid waste matrices. This method is applicable to nearly all types of samples, regardless of water content, including various air sampling trapping media, ground and surface water, aqueous sludges, caustic liquors, acid liquors, waste solvents, oily wastes, mousses, tars, fibrous wastes, polymeric emulsions, filter cakes, spent carbons, spent catalysts, soils, and sediments.

Definitions: Refer to Alpha Analytical Quality Manual.

The compounds listed in Table 5 may be determined by this method.

There are various techniques by which these components may be introduced into the GC/MS system. Purge-and-trap, by Methods 5030C (aqueous samples) and 5035A (solid and waste oil samples), is the most commonly used technique for volatile organic analytes. However, other techniques are also appropriate and necessary for some analytes. One technique is direct injection of an aqueous sample (concentration permitting).

The data report packages present the documentation of any method modification related to the samples tested. Depending upon the nature of the modification and the extent of intended use, the laboratory may be required to demonstrate that the modifications will produce equivalent results for the matrix. Approval of all method modifications is by one or more of the following laboratory personnel before performing the modification: Department Manager, Department Supervisor, Laboratory Director, or Quality Assurance Officer.

This method is restricted to use by or under the supervision of analysts experienced in the operation of the gas chromatograph/mass spectrometers and in the interpretation of mass spectra and their use as a quantitative tool. Each analyst must demonstrate the ability to generate acceptable results with this method by performing an initial demonstration of capability.

2. Summary of Method

The volatile compounds are introduced into the gas chromatograph by the purge-and-trap method or by direct injection. The analytes are introduced to a narrow-bore capillary column for analysis. The Gas Chromatograph (GC) is temperature-programmed to separate the analytes, which are then detected with a mass spectrometer (MS) interfaced to the GC.

Analytes eluted from the capillary column are introduced into the mass spectrometer via a direct connection. Identification of target analytes is accomplished by comparing their mass spectra with the electron impact (or electron impact-like) spectra of authentic standards. Quantitation is accomplished by comparing the response of a major (quantitation) ion relative to an internal standard, comparing sample response to the calibration standards.

2.1 Method Modifications from Reference

None.

3. Reporting Limits

Table 1 lists our typical reporting limits.

4. Interferences

4.1 Impurities in the purge gas, organic compounds out-gassing from the plumbing ahead of the trap, and solvent vapors in the laboratory account for the majority of contamination problems. The analytical system must be free from contamination under the conditions of the analysis. Running laboratory reagent blanks as described in Section 9.1 and 10.3 demonstrates the system is free of contamination. The use of non-Teflon plastic tubing, non-Teflon thread sealants, or flow controllers with rubber components in the purge and trap system must be avoided.

4.2 Sample contamination occurs by diffusion of volatile organics (particularly fluorocarbons and methylene chloride) through the septum seal into the sample during shipment and storage. A trip blank or a field reagent blank prepared from reagent water and carried through the sampling and handling protocol serves as a check on such contamination.

4.2.1 Storage blanks shall be analyzed if contamination is suspect. If contamination is confirmed by positive detections in the sample storage blanks, all data from samples contained in the relative refrigerator or freezer shall be evaluated for possible contamination. If the samples contain suspected contamination, the Client Services department shall be notified in order to contact the necessary clients regarding the contamination. Samples shall be reanalyzed if so desired by the client. If suspected contamination is not confirmed by storage blanks, no further action shall be pursued concerning said blanks. It is recommended that further action be taken to determine the possible cause of suspected contamination.

4.3 Contamination by carry-over can occur whenever high level and low level samples are sequentially analyzed. Whenever a highly concentrated sample is being encountered, it should be followed by an analysis of reagent water (instrument blank) to check for potential contamination. If carry-over is suspected, then numerous instrument blanks may be required; additionally, all affected samples are rerun for confirmation. In case of severe contamination, preventive maintenance of the entire system may be required.

5. Health and Safety

The toxicity or carcinogenicity of each reagent and standard used in this method is not fully established; however, each chemical compound should be treated as a potential health hazard. From this viewpoint, exposure to these chemicals must be reduced to the lowest possible level by whatever means available. A reference file of safety data sheets (SDS) is available to all personnel involved in the chemical analysis. Additional references to laboratory safety are available in the Chemical Hygiene Plan.

All personnel handling environmental samples known to contain or to have been in contact with municipal waste must follow safety practices for handling known disease causative agents.

The following method analytes have been tentatively classified as known or suspected human or mammalian carcinogens: benzene, carbon tetrachloride, 1,4-dichlorobenzene, 1,2-dichloroethane, hexachlorobutadiene, 1,1,2,2-tetrachloroethane, 1,1,2-trichloroethane, chloroform, 1,2-dibromoethane, tetrachloroethene, trichloroethene, and vinyl chloride. Pure standard materials and stock standard solutions of these compounds should be handled in a hood. A NIOSH/MESA approved toxic gas respirator should be worn when the analyst handles high concentrations of these toxic compounds.

5.1 Lab coats, safety glasses, and gloves must be worn when handling samples, standards, or solvents.

5.2 All stock solution standard preparation must be performed in the volatiles hood. Initial calibration, continuing calibration, laboratory control sample and client sample dilutions do not need to be performed in the hood.

5.3 All expired standards must be placed into the waste bucket in the lab for future disposal. The container must be labeled properly with hazard warning labels indicating the container contents.

5.4 Bottles containing Methanol must be stored in the flammables cabinet.

6. Sample Collection, Preservation, Storage, Shipping and Handling

6.1 Sample Collection and Preservation

6.1.1 Aqueous Samples

Grab samples are collected in standard 40mL glass screw-cap vials with Teflon lined silicon septa (VOA vial). Two or more VOA vials should be filled per sample location. EPA Method 8260 requires that samples be acidified to eliminate the possibility of biological degradation. Unless otherwise directed for project-specific reasons, all VOA vials are delivered to the client with approximately 2 – 4 drops of 1:1 HCl added to the vial, which is sufficient to adjust the pH of the sample to < 2. Prepared trip blanks are provided to the client to accompany field samples for QC purposes.

Fill the sample vial to the point of overflowing so that no headspace is contained within. Samples must be introduced into the vials gently to reduce agitation, which might drive off volatile compounds or cause loss of the HCl preservative.

Seal the bottle so that no air bubbles are in the VOA vial. If preservative has been added, shake vigorously for one minute. Invert the bottle and tap to check for air bubbles. Recollect the samples if any air bubbles are present.

Maintain the hermetic seal on the VOA vial until time of analysis.

6.1.2 Soil Samples

The recommended sampling method for soil samples is EPA 5035A. Method 5035A provides for two distinct sampling procedures, depending on the required reporting limits and suspected or known concentration levels of target analytes. These methods are referred to as the High Level and Low Level methods. Both are listed below but depending on the samples only one of the methods may be required. If concentration levels are unknown, it is recommended that samples be collected using both procedures.

The Lab will analyze the high level sample first, followed by the low level sample if the results from the high level analysis show that the sample is clean or contains analytes at low levels. The typical reporting levels of the two methods are listed in Table 1.

6.1.2.1 High Level Soil Samples

Collect sample in a standard 40mL glass screw-cap vial with Teflon lined silicon septa (VOA vial). The vial is provided containing 15mL of Purge and Trap Grade methanol and is labeled and weighed prior to addition of sample. Record the weight of the vial with methanol on the vial label. Prepared trip blanks are provided to the client to accompany field samples for QC purposes.

Approximately 15g of soil is added to the vial in the field, making sure that the sample is completely covered by the methanol.

Maintain the hermetic seal on the VOA vial until the time of analysis.

An additional sample of the soil must also be obtained (without methanol) to be used for the determination of soil moisture content to allow for the calculation of the dry weight results, and to calculate the methanol dilution effect. (See Sections 11.2.2.2 and 11.2.2.2.1)

6.1.2.2 Low Level Soil Samples

Collect sample in a standard 40mL glass screw-cap vials with Teflon lined silicon septa (VOA vial). Two samples should be taken per sample location. Vials are provided containing a magnetic stirring bar and 5 mL of either 200g/L sodium bisulfate solution or water, prepared by a certified vendor. These vials are labeled and weighed prior to addition of sample. Record the weight of the vial with the stirring bar and preservative on the vial label.

Approximately 5g of soil is added to the vial in the field, making sure that the sample is completely covered by the sodium bisulfate solution or water.

Maintain the hermetic seal on the VOA until the time of analysis.

6.2 Sample Handling and Storage

Document client specific sample handling, preservation and collection criteria in the project file. The laboratory Log-in staff documents sample temperature at the time of receipt.

Record deviations from this SOP or client specific criteria on the chain of custody form.

Record holding time exceedance, improper preservation and observed sample headspace on the nonconformance report form.

6.2.1 Aqueous Samples

Ice or refrigerate all samples from the time of collection until analysis, maintaining the sample temperature between 1 and 4 °C. Sample receiving personnel must note on the sample delivery group form when samples received at the laboratory are not within the temperature criteria. If more than one vial is received for a sample, the vials are stored in separate refrigerators. Storing the vials apart provides a useful check if laboratory contamination of a sample is suspected. Samples must be analyzed within 14 days of collection. Unpreserved samples must be analyzed within 7 days of collection.

6.2.2 High Level Soil Samples

Ice or refrigerate all samples from the time of collection until analysis, maintaining the sample temperature between 2 and 6 °C. Sample receiving personnel note on the nonconformance report form when samples received at the laboratory are not within the temperature criteria. Samples must be analyzed within 14 days of collection.

6.2.3 Low Level Soil Samples

Ice or refrigerate samples preserved with water or sodium bisulfate from the time of collection until analysis, maintaining the sample temperature between 2 and 6 °C. Samples preserved with water are to be immediately frozen after sampling. Sample receiving personnel note on the nonconformance report form when samples received at the laboratory are not within the temperature criteria. Samples must be analyzed within 14 days of collection.

6.3 Sample Shipping

Samples requiring shipment to the laboratory are shipped in ice-packed coolers via an overnight delivery service in accordance with applicable Department of Transportation regulations.

7. Equipment and Supplies

7.1 Purge and Trap System (For Aqueous samples): The purge-and-trap system consists of two separate pieces of equipment: a purging device (autosampler) (TekmarAtomxXYZ, EST Centurion or equivalents) coupled to the desorber (concentrator) (EST Encon or Encon EV, or equivalents).

7.1.1 Purge gas = Helium analytical grade (99.999%) or Nitrogen analytical grade (99.999%).

7.1.2 The purging device is configured with 25 mL sample purge tubes, and the purge gas is introduced at the bottom of the water column as finely divided bubbles.

7.1.3 The trap used in the desorber is typically a Supelco “K” trap. Different traps may be used if equivalent performance is demonstrated.

7.1.4 The desorber is capable of rapidly heating the trap to 260°C. The trap is not heated above manufacturer’s specifications.

7.2. Purge and Trap System (For Low Level and High Level Soil Samples): The purge and trap system consists of two separate pieces of equipment: a purging device (autosampler) (Tekmar AtomxXYZ, EST Centurion or equivalents) coupled to the desorber (concentrator) (Tekmar Velocity or Atomx, or EST Encon or Encon EV, or equivalents).

7.2.1 Purge gas = Helium analytical grade (99.999%) Nitrogen analytical grade (99.999%).

7.2.2 The autosampler purging device is a closed system, designed to accept the 40mL VOA vials. The VOA vial, containing the soil sample, water (or sodium bisulfate), and stirring bar is placed into the autosampler tray. The instrument automatically adds reagent water, internal standards, and surrogates to the unopened VOA vial. The vial is heated to 40 °C, and the purge gas is introduced into the aqueous portion to purge the volatile components onto the trap.

7.2.3 The trap used in the desorber is typically a Supelco “K” trap. Different traps may be used if equivalent performance is demonstrated.The desorber is capable of rapidly heating the trap to 260 °C. The trap is not heated above manufacturer specifications.

7.3 Gas Chromatography/Mass Spectrometer/Data System:

7.3.1 Gas Chromatograph, Agilent 6890/7890 or equivalent: An analytical system complete with a temperature-programmable gas chromatograph with appropriate interface for sample introduction device. The system includes all required accessories, including syringes, analytical columns, and gases. The capillary column is directly coupled to the source of the GC/MS system.

7.3.2 Typical Gas Chromatographic Columns:

7.3.2.1 Column 1: Restek 502.2, 40 meter, 0.18mm ID, 1.0um, or equivalent.

7.3.2.2 Column 2: Restek RTX-VMS, 30 meter, 0.25mm ID, 1.4um, or equivalent.
7.3.2.3 Column 3: Restek RTX-VMS, 20 meter, 0.18mm ID, 1.5um, or equivalent.

7.3.3 Mass Spectrometer, Agilent 5973/5975/5978 or equivalent: Capable of acquiring mass spectra from mass/charge (m/z) 35 to 270 at a rate fast enough to acquire at least five (but preferably 10 or more) mass spectra across each chromatographic peak of interest, using 70 volts (nominal) electron energy in the electron impact ionization mode. The mass spectrometer must be capable of producing a mass spectrum for 4-Bromofluorobenzene (BFB) which meets all of the criteria in Table 3, when 50ng of the GC/MS tuning standard (BFB) are injected through the GC. For all SIM analysis, the mass spectrometer must also be able to acquire data in a dual acquisition mode (SIM and full scan).

7.3.4 Data System: Hewlett-Packard EnviroQuant software is used for data acquisition and allows the continuous acquisition and storage on machine-readable media of all mass spectra obtained throughout the duration of the chromatographic program.

EnviroQuant E.02.02 (or equivalent) is used for data processing and allows searching of any GC/MS data file for ions of a specified m/z, and plotting such ion abundances versus time or scan-number.

The most recent version of the EPA/NIST Mass Spectral Library is loaded onto the Target / EnviroQuant data system.

7.4 Wiretrol or Micro syringes: 10µL - 1,000µL.

7.5 Syringes: 5mL, 10mL, or 25mL, glass with Luerlock tip.

7.6 Balances: Top-loading, capable of weighing 0.01g.

7.7 Vials: 2mL, 4mL.

7.8 Disposable Pipets.

7.9 Volumetric Flasks: Class A, appropriate sizes, with ground-glass stoppers.

7.10 Eppendorf pipets.

7.11 Ottawa Sand: SiO_2

8. Reagents and Standards

Reagent grade organic chemicals shall be used in all tests. Unless otherwise indicated, it is intended that all organic reagents shall conform to the specifications of the Committee on Analytical Reagents of the American Chemical Society, where such specifications are available. Other grades may be used, provided it is first ascertained that the reagent is of sufficiently high purity to permit its use without lessening the accuracy of the determination.

Great care must be taken to maintain the integrity of all standard solutions. Standards in methanol are stored at –10ºC or less, in amber vials with PTFE-lined screw-caps.

8.1 Organic-free Reagent Water:

All references to water in this method refer to organic-free reagent water, which is tap water passed through activated carbon and air bubbled through.

8.2 Methanol:

Purge and Trap Grade or equivalent. Store in flammables cabinet.

8.3 Stock Solutions:

All stock standards are purchased from commercial vendors as certified ampule solutions. When an ampule of stock solution is opened, it is transferred to a labeled amber screw-cap vial with minimal headspace. The expiration date of the stock solution is either the vendor specified expiration date or 6 months from the date the ampule was opened, whichever is sooner. Typical stock standard concentrations are listed in Table 4.

8.4 Intermediate Standards: Intermediate standards are prepared volumetrically by diluting the appropriate stock standard(s) with methanol. Initial Calibration solutions expire 2 months from the date of preparation, or sooner if daily continuing calibration checks do not achieve the method acceptance criteria. If the Intermediate Standards are used as a second source to verify a valid Initial Calibration solution, there is no expiration date.

8.4.1 Internal Standard Solutions:

The internal standards are Fluorobenzene, Chlorobenzene-d_5, and 1,4-Dichlorobenzene-d_4. The intermediate IS solution is prepared by diluting the stock solution(s) with methanol to a concentration of 100 µg/mL. The appropriate amount of IS solution is added to the water or soil sample or QC sample to achieve a final concentration of 100 ng/sample or standard. Internal standard is added at the same concentration to all standards, samples, and QC samples.

8.4.2 Surrogate Standard Solutions:

The surrogate standards are Dibromofluoromethane, 1,2-Dichloroethane-d_4, Toluene-d_8, and 4-Bromofluorobenzene. The intermediate surrogate solution is prepared by diluting the stock solution(s) with methanol to a concentration of 100 µg/mL. The appropriate amount of surrogate solution is added to the water or soil sample or QC sample to achieve a final concentration of 100 ng/sample.

8.4.3 Target Compound Solutions:

The target analytes routinely reported by this method are listed in Table 1 and 4. The intermediate target compound solutions are prepared by diluting the stock solution(s) with methanol. This set of solutions, at concentrations of 200 µg/mL, is used for preparation of the calibration standards.

8.4.4 4-Bromofluorobenzene (BFB) Tune solution:

8.4.4.1 A solution containing BFB at a concentration of 50 µg/mL is prepared by volumetrically diluting the BFB stock solution. 1 µL of this solution is direct-injected or purged into the GC/MS system to verify system performance prior to any standard or sample analysis.

8.4.4.2 BFB may be analyzed in full scan mode while standards, samples, and QC are analyzed in SIM

8.5 Calibration Standards:

There are two types of calibration standards used for this method – initial calibration standards and calibration verification standards.

8.5.1 Initial Calibration Standards:

Initial calibration standards can be prepared at the levels listed in Table 4 (other/different levels are allowed). The Initial Calibration needs to have a minimum of 5 standards, 6 if a quadratic curve fit is used. Prepare these solutions in organic-free reagent water. The standards correspond to the range of concentrations found in typical samples and do not exceed the working range of the GC/MS system. Initial calibration should be mixed from fresh stock standards and dilution standards when generating an initial calibration curve.

8.5.2 Initial Calibration Verification Standard (ICV):

The initial calibration verification standard is at the same concentration as the level 3 for liquids and level 4 for soils initial calibration standard. This standard is prepared from source materials from a second manufacturer or from a manufacturer's batch prepared independently from the batch used for calibration. A second lot# from the same manufacturer may be adequate to meet this requirement. The standard must contain all calibrated target analytes that will be reported for the project, if readily available.

8.5.3 Continuing Calibration Verification Standard:

The continuing calibration verification standard, or calibration check standard, should be analyzed near the action level of the project. Since most projects are focused on achieving low reporting limits, the continuing calibration verification standard is at the same concentrations as the level 3 for liquids and level 4 for soils initial calibration standard. This standard is run at the beginning of each analytical sequence, following the BFB tune standard, to verify system performance.

9. Quality Control

The laboratory must maintain records to document the quality of data that is generated. Ongoing data quality checks are compared with established performance criteria to determine if the results of analyses meet the performance characteristics of the method.

9.1 Blank(s)

9.1.1 Before processing any samples, the analyst must demonstrate through the analysis of a method blank (MB) or instrument blank that equipment and reagents are free from contaminants and interferences. The blank must contain the internal standards and surrogates and must be from the same source of water used for preparing the standards, QC samples and sample dilutions.

9.1.2 Analyze a matrix-specific blank, i.e. methanol samples need to have methanol in the blank; sodium bisulfate samples need to have a sodium bisulfate blank analyzed;

TCLP samples need a TCLP blank, after each ICAL and CCV, and prior to any sample analysis to demonstrate that interferences from the analytical system are under control.

9.1.3 Low level soil blanks must include 5g of Ottawa sand and be vortexed.

9.1.4 Blanks are considered to be acceptable if target analyte concentrations are less than one half the LOQ or are less than project-specific requirements. Blanks may contain analyte concentrations greater than acceptance limits if the associated samples in the batch are unaffected (i.e., target analytes are not present in samples or sample concentrations/responses are >10X the blank).

9.1.5 If an analyte of interest is found in a sample in the batch near a concentration detected in the blank, the presence and/or concentration of that analyte should be considered suspect and may require qualification. Reanalysis is not necessary if the analyte concentration falls well below the action or regulatory limit or if the analyte is deemed not important for the project.

9.1.6 The laboratory must not subtract the results of the MB (or any blank) from those of any associated samples.

9.2 Laboratory Control Sample (LCS)/ Laboratory Control Sample Duplicate (LCSD)

An LCS/LCSD pair is analyzed at the beginning of each analytical sequence. Since the LCS contains the same compounds at the same concentrations as the continuing calibration check standard, the same analysis is used to satisfy both QC elements. The LCS/LCSD acceptance criteria are based on in-house control limits, unless specified by project/regulation. Less than 10% of total compounds may be outside of control limits if recoveries are >10%. (Note: this does not apply to difficult analytes listed in Table 7 which may be accepted at recoveries <10.) If >10% of analytes are recovered above control limits, this is deemed acceptable as long as the analytes in question are not detected in associated samples. If these criteria are not met, the entire batch is re-extracted. If re-extraction is not possible, due to insufficient sample or holding time exceedance, the analyst must write up the failure on a narrative sheet for inclusion in the client report.

9.3 Initial Calibration Verification (ICV)

Refer to 12

9.4 Continuing Calibration Verification (CCV)

Refer to Section 11.2.

9.5 Matrix Spike/ Matrix Spike Duplicate

Upon Client Request or state mandate, a matrix spike/matrix spike duplicate pair may be analyzed with each batch of 20 or less samples. The MS/MSD are sample aliquots spiked with the target compounds at the same concentration as the continuing calibration standard for water analysis and level 6 for soils. The MS/MSD acceptance criteria are based on in-house control limits. If the MS/MSD does not meet the criteria, but the LCSD does, the failure may be attributed to sample matrix. Report the MS/MSD, including a narrative sheet for inclusion with the client report.

9.6 Laboratory Duplicate

Not applicable.

9.7 Method-specific Quality Control Samples

9.7.1 Internal Standards

Area counts of the internal standard peaks in all samples and QC samples must be between 50-200% of the areas of the internal standards in the QC check standard.

If any individual percent recovery falls outside the range, that parameter has failed the acceptance criteria. For calibration standards, CCVs, LCS/LCSD or blanks the internal standard must be within the range for data to be reported to the clients. For samples, matrix spikes and duplicates: if the data is not within the range, the sample is rerun to confirm that the failure is due to sample matrix. A nonconformance report form is completed to ensure client notification and reporting if matrix effect is confirmed.

9.7.2 Surrogates

Surrogates are added to each field sample and QC sample. The laboratory must evaluate surrogate recovery data from individual samples versus the surrogate control limits developed by the laboratory. The surrogate acceptance criteria are listed in Table 2. Since the SIM analysis is acquired in dual mode, the surrogates from the full scan are used to evaluate the entire sample (SIM and full scan).

9.8 Method Sequence

In a 12-hour period, the typical analytical sequence is as follows:

- BFB
- QC Check Standard/Laboratory Control Sample/LCSD
- Method Blank
- Samples
- MS/MSD (upon Client request, may be run any time after the Method Blank)

10. Procedure

10.1 Equipment Set-up

Typical instrument operating conditions are listed below. Alternate conditions are allowed if method performance criteria can be met.

10.1.1 GC Conditions:

Temperature 1: 35°C
Hold Time 1: 4 minutes
Ramp 1: 6°C/minute
Temperature 2: 150°C
Hold Time 2: 0 minutes
Ramp 2: 8°C/minute
Temperature 3: 220°C
Final Time: 1 minute

Carrier gas: Helium 99.999% or Nitrogen 99.999%
Carrier mode: Constant flow
Carrier flow: 1 mL/minute

10.1.2 MS Conditions:

Mass range:	m/z of 35 – 270 amu
Scan time:	0.5 minutes/scan
Source temperature:	230°C or according to manufacturer's specifications.

10.1.3 Velocity Concentrator Purge and Trap Conditions:

Purge time:	11 minutes
Dry purge:	2 minutes
Desorb preheat:	250°C
Desorb temp:	255°C
Desorb time:	2 minutes
Bake temp:	290°C
Bake time:	10 minutes

10.1.4 Encon Concentrator Purge and Trap Conditions:

Purge time:	11 minutes
Dry purge:	1 minute
Desorb preheat:	245°C
Desorb temp:	255°C
Desorb time:	1 minute
Bake temp:	270°C
Bake time:	10 minutes

10.2 Initial Calibration

10.2.1 The initial calibration is performed at a minimum of five (5) concentration levels listed in Table 4, the low level either at or below the reporting limit. The calibration is performed using instrument conditions listed in 10.1.

BFB must be analyzed prior to analysis of the initial calibration standards and must pass the criteria listed in Table 3. The mass spectrum of BFB should be acquired in the following manner:

(1) Three scans (the peak apex scan, the scan immediately preceding the apex and the scan immediately following the apex) are acquired and averaged.
(2) Background subtraction is performed using a single scan of no more than 20 scans prior to the elution of BFB.

This is done automatically with the EnviroQuant software.

10.2.1.1 Low Level/High Level Soil Curve on Centurion: To prepare a calibration standard, add the appropriate volume of standard solution(s) to a 50mL volumetric flask using a micro syringe. Remove the needle quickly and mix by inverting the flask 3 times. Pour several mLs of the aqueous standard into the waste vessel, then gently fill a 5mL syringe with standard and transfer to a 40mL VOA vial containing a magnetic stir bar. Load the vial onto autosampler.

10.2.1.2 Aqueous/High Level Soil Curve on Solatek or Centurion: To prepare a calibration standard, add the appropriate volume of standard solution(s) to a 100mL volumetric flask using a micro syringe. Remove the needle quickly and mix by inverting the flask 3 times. Pour several mLs of the aqueous standard into the waste vessel, and then gently fill a 40mL VOA vial to the top. Load the vial onto the autosampler.

10.2.2 Establish the GC operating conditions by loading the appropriate GC method. Typical instrument conditions are listed in Section 10.1. The same operating conditions are used for calibration and sample analyses. Create the analytical sequence using the HP EnviroQuant data acquisition software.

Relative Response Factors: The internal standard calibration technique is used. In each calibration standard, calculate the relative response factor for each analyte and the relative standard deviation (RSD) of the response factors using the EnviroQuant data processing software. The response factors are calculated using the areas of the characteristic (quantitation) ion for each target analyte and internal standard. The calculations are performed automatically using the EnviroQuant software, using the formulae listed in Alpha's Quality Manual.

10.2.3 Initial Calibration Criteria: The following sections outline the method acceptance criteria for an initial calibration curve. All criteria must be met for the calibration to be deemed acceptable, and for sample analysis to proceed. For MCP and CT projects see the related project specific addenda for modifications.

10.2.3.1 Relative Standard Deviation Criteria: If the RSD for each target analyte is less than or equal to 20%, then the response for this compound is considered linear over the calibration range and the mean calibration factor can be used to quantitate sample results. If the 20% RSD criterion is not met for an analyte linear regression may be used if $\mathbf{r^2} \geq 0.990$, weighted linear with a weighting factor of 1/SD2 and $r > 0.995$, or quadratic fit if $\mathbf{r^2} \geq 0.990$. A minimum of five points are required for linear fit and six points is required for quadratic fit. The calibration must be repeated for any compounds that fail. If more than 10% of the compounds exceed the 20% RSD limit and do not achieve the minimum correlation coefficient for alternative curve fits, sample analysis cannot proceed.

10.2.3.1.1 Percent Relative Error (%RE): For linear and quadratic fit compounds the %RE relative error must be calculated for the standard at or near the midpoint of the initial calibration and at the lowest level. The %RE between the calculated and expected amounts of an analyte should be ≤ 30% for all standards, otherwise recalibration is necessary.

10.2.4 Evaluation of Retention Times: The relative retention times used for identification of target analytes are +/- 0.06 RRT (Relative Retention Time) units, based on the most recent standard run. It has been determined that these limits work well, being wide enough to eliminate false-negative results while being tight enough to eliminate false positive results. Due to the selectivity of the mass spectrometer, compound identification is more definitive than when using a less selective detector.

10.2.5 Initial Calibration Verification: After each calibration and before the analysis of samples, an ICV must be analyzed at or near the midpoint of the curve. The ICV must be prepared using a different source than the Initial Calibration and must contain all target analytes. The percent recoveries must be between 70% and 130% for target analytes except for “difficult” analytes (Table 7), which must exhibit percent recoveries between 40% and 160%. Corrective action is required if greater than 10% of all analytes are outside the prescribed criteria.

10.2.5.1 The ICV used for the initial calibration can be used as the continuing calibration verification. See Section 10.4 for criteria.

10.2.6 Additional considerations for SIM analysis

10.2.6.1 SIM may be useful for applications requiring quantitation limits below the normal range of electron impact quadrupole mass spectrometry, and both are allowable options for this method. Using the primary m/z for quantitation and at least one secondary m/z (or product ion) for confirmation, set up the descriptor windows based on their retention times. The selected m/z values should include any mass defect noted in the target analyte mass spectra acquired on the instrument, usually less than 0.2 amu. The dwell time for each ion may be automatically calculated by the instrument software or may be calculated based on the peak widths of the analytes of interest, the number of spectra needed to be acquired across each peak, and the number of concurrent ions that need to be acquired in each segment. When fewer m/z values are monitored in each segment, the acquisition time for each m/z can be increased, thereby increasing the sensitivity of the system. The total cycle time for the MS should be short enough that at least five, but preferably ten or more, spectra are acquired per chromatographic peak.

10.2.6.2 When compounds are analyzed in SIM mode, the following best practices are recommended:

10.2.6.2.1 Monitor at least two ions for each target analyte and use the mid-point of the calibration curve to establish proper ion ratios for each compound. The ratios of primary and secondary ions are the only qualitative tools available in SIM runs (other than RT), which increases their importance in proper identification. When interferences are expected or observed in a given matrix, acquiring multiple secondary ions may aid in qualitative identification.

10.2.6.2.2 Verify that all monitored ions are correctly integrated in order to achieve proper ion ratios. Update the primary/secondary ion ratios and reference mass spectra after each ICAL using a mid-range ICAL standard.

10.3 Equipment Operation and Sample Processing

The same GC, MS, and Purge and Trap conditions used for the initial calibration must be employed for sample analysis. After verification of system performance by analysis of BFB, the continuing calibration standard and method blank, samples are analyzed and processed as described below.

10.3.1 All samples are initially screened using Tekmar 7000 Headspace Autosamplers.

10.3.2 Retrieve sample VOA vials from the sample refrigerator just prior to loading onto the purge and trap system.

10.3.3 Aqueous samples:
Load the VOA vial directly on the sampling rack. Dilutions may be prepared volumetrically and poured into VOA vials ensuring there is no headspace left in the vial. The autosampler will then sample 10mL from the VOA vial.

10.3.4 Low level soil samples:
Low level soil sample should be shaken briefly to ensure that the stir bar is loose, and will spin on the autosampler unit. Take the low level VOA vial and place directly into the rack of the autosampler unit. Surrogate and internal standards are added automatically by the autosampler prior to sample purging.

10.3.5 High level soil samples:

Shake or vortex the sample for 15 seconds, ensuring the methanol has completely penetrated the soil in the vial. Let sample settle prior to taking methanol aliquot.

10.3.5.1 Through liquid path
Load a maximum of 860µL or appropriate dilution of the methanol into a half-full VOA vial. Fill the VOA vial up to the top with water and cap with no headspace. Allow the auto-sampler to sample 10mL out of the VOA vial which would be equivalent to injecting 100µL of the methanol extract. Prepare dilutions accordingly.

10.3.5.2 Through soil path
Into a VOA vial with a stir bar added, load 4.9mL of water plus a maximum of 100 µL of methanol or appropriate dilution of methanol extract from a 5mL luerlock syringe. Cap the vial and load onto the auto-sampler.

10.3.6 Qualitative Analysis:

10.3.6.1 The qualitative identification of each compound is based on retention time and on comparison of the sample mass spectrum with the reference mass spectrum. The reference mass spectrum must be generated by the laboratory on the same GC/MS system. The characteristic ions from the reference mass spectrum are defined to be the three ions of greatest relative intensity, or any ions over 30% relative intensity if less than three such ions occur in the reference spectrum. Compounds are identified as present when the following criteria are met:

10.3.6.1.1 The intensities of the characteristic ions of a compound maximize in the same scan or within one scan of each other. The EnviroQuant data system is configured to make this check.

10.3.6.1.2 The relative retention time (RRT) of the sample component is within ±0.06 RRT units of the RRT of the standard component.

10.3.6.1.3 The relative intensities of the characteristic ions agree within 30% of the relative intensities of these ions in the reference spectrum. (Example: For an ion with an abundance of 50% in the reference spectrum, the corresponding abundance in a sample spectrum can range between 20% and 80%.)

10.3.6.1.4 Structural isomers that produce very similar mass spectra should be identified as individual isomers if they have sufficiently different GC retention times. Sufficient GC resolution is achieved if the height of the valley between two isomer peaks is ≤ 50% of the average of the two peak heights. Otherwise, structural isomers are identified as isomeric pairs (i.e., m and p-xylene).

10.3.6.1.5 Identification is hampered when sample components are not resolved chromatographically and produce mass spectra containing ions contributed by more than one analyte. When gas chromatographic peaks obviously represent more than one sample component (i.e., a broadened peak with shoulder(s) or a valley between two or more maxima), appropriate selection of analyte spectra and background spectra is important.

10.3.6.1.6 Examination of extracted ion current profiles of appropriate ions can aid in the selection of spectra, and in qualitative identification of compounds. When analytes coelute (i.e., only one chromatographic peak is apparent), the identification criteria may be met, but each analyte spectrum will contain extraneous ions contributed by the coeluting compound.

10.3.6.2 For samples containing non-target analytes, a library search will be performed at client request. Compound identification will be classified as "tentative", and the concentration will be reported as an estimate as no quantitative standards are run for these compounds.

10.3.6.2.1 Relative intensities of major ions in the reference spectrum (ions greater than 10% of the most abundant ion) are present in the sample spectrum.

10.3.6.2.2 The relative intensities of the major ions should agree within ±20%. (Example: For an ion with an abundance of 50% in the standard spectrum, the corresponding sample ion abundance must be between 30 and 70%.)

10.3.6.2.3 Molecular ions present in the reference spectrum are present in the sample spectrum. If the molecular ion is not present, carefully review library matches in order to avoid misidentification.

10.3.6.2.4 Ions present in the sample spectrum but not in the reference spectrum should be reviewed for possible background contamination or presence of coeluting compounds.

10.3.6.2.5 Ions present in the reference spectrum but not in the sample spectrum are reviewed for possible subtraction from the sample spectrum because of background contamination or coeluting peaks.

10.3.6.2.6 Mass spectral library search algorithms typically assign a match factor to the peak identity based on comparison of an unknown mass spectrum to library spectra. For spectra meeting the above conditions, match factors greater than 0.85 (85%) may be considered confirming evidence. Where a known limitation in data collection is identified (e.g., the presence of an incompletely resolved spectral interference), a lower match factor may be considered confirmatory. For multiple library spectra with similar match factors (e.g., for hydrocarbons with low abundance molecular ions, or structural isomers), the tentative identification assigned to the unknown may be better represented as a more generic structure (e.g., unknown hydrocarbon, C4 benzene structural isomer).

10.3.7 Quantitative Analysis:

10.3.7.1 Quantitation of a target compound detected in a sample is performed automatically by the EnviroQuant data processing software, using the formulae found in Alpha's Quality Manual. Either the average response factor or calibration curve will be used for sample quantitation, depending on how the particular analyte was processed in the initial calibration curve. If non-target compounds are to be reported, the quantitation is performed automatically by the EnviroQuant software using the total area of the compound and the nearest internal standard, and assuming a relative response factor of 1.0.

10.4 Continuing Calibration

Calibration verification consists of three steps that are performed at the beginning of each 12-hour analytical shift. For MCP and CT projects see the related project specific addenda for modifications.

10.4.1 Prior to the analysis of samples or calibration standards, inject or purge 1 µL (50 ng) of the 4-Bromofluorobenzene standard (Section 8.4.4) into the GC/MS system. The resultant mass spectra for the BFB must meet the criteria given in Table 3 before sample analysis begins.

10.4.2 The initial calibration curve for each compound of interest must be verified once every 12 hours prior to sample analysis. This is accomplished by analyzing the continuing calibration check standard (Section 8.5.3).

10.4.3 A method blank must be analyzed prior to any samples, typically immediately following the continuing calibration check standard, to ensure that the analytical system is free of contaminants. The method blank must not contain any target analytes at or above the required compound reporting limits.

10.4.4 The percent difference or drift for each target analyte must be less than or equal to 20% (30% for all SIM compounds). If greater than 20% of target analytes exceed the %D criteria corrective action must be taken prior to the analysis of samples. If less than or equal to 20% of compounds exceed the criteria, corrective action is not required.

10.4.5 Internal Standard Retention Time:

The absolute retention times of the internal standards in the calibration verification standard are evaluated after data acquisition. If the absolute retention time for any internal standard changes by more than 30 seconds from that in the mid-point standard level of the most recent initial calibration sequence, then the chromatographic system must be inspected for malfunctions and corrections must be made, as required. When corrections are made, reanalysis of samples analyzed while the system was malfunctioning is required.

10.4.6 Internal Standard Response:

If the area for any of the internal standards in the calibration verification standard changes by a factor of two (50% to 200%) from that in the mid-point standard level of the most recent initial calibration sequence, the mass spectrometer must be inspected for malfunctions and corrections must be made, as appropriate. When corrections are made, re-analysis of samples analyzed while the system was malfunctioning is required.

10.5 Preventive Maintenance

Routine preventive maintenance should be performed on the analytical system. This includes replacement of GC septa and periodic rinsing or replacement of purge and trap tubes and sparge needles. The trap should be replaced every six months or sooner if performance criteria cannot be met. Periodic cleaning (typically twice per year) of the mass spectrometer ion source is required. More frequent source cleaning may be needed, especially if dirty samples are analyzed.

If system performance deteriorates, additional maintenance may be required. This includes replacement of injector ports and seals, clipping several inches off of the front end of the GC column, or in extreme cases the replacement of the GC column. Flushing or replacement of purge and trap lines may be necessary if they become contaminated or develop active sites.

Perform routine preventative maintenance as described throughout this SOP. Record all maintenance in the instrument logbook.

11. Data Evaluation, Calculations and Reporting

11.1 LIMS Data Corrections

Please note that the Laboratory Information Management System (LIMS) automatically adjusts soil sample results to account for the % Total Solids of the sample (as determined per Alpha SOP/07-38) and the methanol preservation dilution effect.

11.2 Data Calculations

11.2.1 Results of Aqueous Sample Analysis:

$$\text{Concentration (ug/L)} = \frac{(\text{Conc.})(Vp)(DF)}{(Vs)}$$

where:

Conc. = On-column concentration obtained from the quantitation report.
Vp = Volume purged, 10 mL is standard
Vs = Volume of sample purged
DF = Dilution factor, for manually prepared dilutions, not instrumental "dilutions".

11.2.2 Results of Sediment/Soil, Sludge, and Waste Analysis:

All solids including soils, sediments, and sludges must be reported on a dry-weight basis.

11.2.2.1 Low-Level Samples:

$$\text{Concentration (ug/Kg)} = \frac{(\text{Conc.})(Vp)(DF)}{(W)(\%S)}$$

11.2.2.2 High-Level Samples:

$$\text{Concentration (ug/Kg)} = \frac{(Conc.)\,(Vp)\,(5000)\,(DF)}{(W)\,(Ve)\,(\%S)}$$

where:

Conc. = On-column concentration obtained from the quantitation report.
DF = Dilution factor, for manually prepared dilutions, not instrumental "dilutions".
Ve = Extract volume, mL
Vp = Volume purged, 5 mL is standard
W = Aliquot of sample (wet), g
%S = Sample % solid
5000 = Constant representing the final volume of the methanol extraction.

11.2.2.2.1 High-Level Samples Corrected for Total Water/Solvent Mixture (V_t):

Samples that are extracted prior to analysis in a water miscible solvent such as methanol are diluted by the total volume of the water/solvent mixture. The total mixture volume can only be calculated based on the sample moisture present as determined by the % moisture calculation.

$$\%\ \text{moisture} = \frac{\text{g of sample} - \text{g of dry sample}}{\text{g of sample}} \times 100$$

$$V_t = \frac{[\text{mL of solvent} + (\%\text{moisture} \times \text{g of sample})]}{100} \times 1000\text{mL/mL}$$

The calculated V_t value is now added to the volume of methanol in the sample (typically 5000µL), and the corrected concentration is calculated using the equation below:

$$\text{Corrected concentration (mg/Kg)} = \frac{(Conc.)\,(V_t + \text{methanol vol.})\,(Vp)\,(DF)}{(W)\,(Ve)\,(\%S)}$$

12. Contingencies for Handling Out-of-Control Data or Unacceptable Data

All batch and sample specific QC criteria outlined in section 10 are evaluated by the analyst prior to approval of the data. When any QC criteria fail, the cause for the failure must be identified and corrected. This may include instrument recalibration followed by sample reanalysis, sample cleanup, or sample re-extraction. If it is determined that the failure is due to sample matrix effects, a project narrative report is written by the analyst for inclusion in the data report. If there is insufficient sample volume to perform the re-analysis for confirmation, this is also noted in the narrative and included in the client report.

13. Method Performance

13.1 Detection Limit Study (DL) / Limit of Detection Study (LOD) / Limit of Quantitation (LOQ)

The laboratory follows the procedure to determine the DL, LOD, and/or LOQ as outlined in Alpha SOP/1732. These studies performed by the laboratory are maintained on file for review.

13.2 Demonstration of Capability Studies

Refer to Alpha SOP/1739 for further information regarding IDC/DOC Generation.

13.2.1 Initial (IDC)

The analyst must make an initial, one-time, demonstration of the ability to generate acceptable accuracy and precision with this method, prior to the processing of any samples.

13.2.2 Continuing (DOC)

The analyst must make a continuing, annual, demonstration of the ability to generate acceptable accuracy and precision with this method.

14. Pollution Prevention and Waste Management

Refer to Alpha's Chemical Hygiene Plan and Waste Management and Disposal SOP for further pollution prevention and waste management information.

15. Referenced Documents

Chemical Hygiene Plan

SOP/1732 DL/LOD/LOQ Generation

SOP/1739 IDC/DOC Generation

SOP/1728 Waste Management and Disposal SOP

16. Attachments

Table 1: 8260 REPORTING LIMITS

Table 2: 8260 QC ACCEPTANCE CRITERIA

Table 3: BFB TUNING CRITERIA

Table 4: STANDARD SOLUTIONS and ICAL Levels

Table 5: 8260D Volatile Internal Standards with Corresponding Target Compounds and Surrogates Assigned for Quantitation

Table 6: 8260D Quantitation Ions

Table 7: Difficult Analytes

Table 8: ICAL Low Point re-quantitation ranges

Table 1

Standard Reported Detection Limits

US EPA METHOD 8260D and 5035A/8260D

Analyte	Recommended Minimum Response Factor	RDL (µg/L)	RDL(µg/KG)(1)	RDL (µg/KG) (2)
Acetone (3,4,5)	0.01	5.0	25	1250
Acrolein (5)		5.0	25	1250
Acrylonitrile (3,4)		5.0	4	200
Allyl Chloride (7)		N/A	5	250
Benzene (3,4,5)	0.2	0.5	0.5	25
Bromobenzene (3,4)		2.5	2	100
Bromochloromethane (3,4,5)	0.1	2.5	2	100
Bromodichloromethane (3,4,5)	0.300	0.5	0.5	25
Bromoform (3,4,5)	0.100	2.0	4	200
Bromomethane (3,4,5)	0.01	1.0	2	100
2-Butanone (3,4,5)	0.01	5.0	10	500
Butyl acetate (7)		N/A	5	50
n-Butylbenzene (3,4)		0.5	1	50
sec-Butylbenzene (3,4)		0.5	1	50
tert-Butylbenzene (3,4)		2.5	2	100
Carbon disulfide (3,4,5)	0.100	5.0	10	500
Carbon tetrachloride (3,4,5)	0.100	0.5	1	50
Chlorobenzene (3,4,5)	0.400	0.5	0.5	25
Chlorodifluoromethane (7)		N/A	5	250
Chloroethane (3,4,5)	0.01	1.0	2	100
2-Chloroethylvinyl ether (3)		10.0	20	1000
Chloroform (3,4,5)	0.300	0.75	1.5	75
Chloromethane (3,4,5)	0.01	2.5	4	200
o-Chlorotoluene (3,4)		2.5	2	100
Cyclohexane (5)	0.01	10	10	500
Cyclohexanone		10	20	1000
p-Chlorotoluene (3,4)		2.5	2	100
cis-Decahydronaphthalene (7)		N/A	5	250
trans-Decahydronaphthalene (7)		N/A	5	250
n-Decane (7)		N/A	5	250
Dibromochloromethane (3,4,5)	0.200	0.5	1	50
1,2-Dibromo-3-chloropropane (3,4,5)	0.01	2.5	3	150
1,2-Dibromoethane (3,4,5)	0.200	2.0	1	50
Dibromomethane (3,4)		5.0	2	100
1,2-Dichlorobenzene (3,4,5)	0.600	2.5	2	100
1,3-Dichlorobenzene (3,4,5)	0.500	2.5	2	100
1,4-Dichlorobenzene (3,4,5)	0.600	2.5	2	100
1,4-Dichlorobutane (3,4)		5.0	10	500
trans-1,4-Dichloro-2-butene (3,4)		2.5	5	250

Table 1 (continued)
Standard Reported Detection Limits
US EPA METHOD 8260D and 5035A/8260D

Analyte	Recommended Minimum Response Factor	RDL (µg/L)	RDL(µg/KG)$^{(1)}$	RDL (µg/KG) $^{(2)}$
Dichlorodifluoromethane $^{(3,4,5)}$	0.01	5.0	10	500
1,1-Dichloroethane $^{(3,4,5)}$	0.300	0.75	1	50
1,2-Dichloroethane $^{(3,4,5)}$	0.07	0.5	1	50
1,1-Dichloroethene $^{(3,4,5)}$	0.06	0.5	1	50
cis-1,2-Dichloroethene $^{(3,4,5)}$	0.200	0.5	1	50
trans-1,2-Dichloroethene $^{(3,4,5)}$	0.100	0.75	1.5	75
1,2-Dichloropropane $^{(3,4,5)}$	0.200	1.75	1	50
1,3-Dichloropropane $^{(3,4)}$		2.5	2	100
2,2-Dichloropropane $^{(3,4)}$		2.5	2	100
1,1-Dichloropropene $^{(3,4)}$		2.5	0.5	25
cis-1,3-Dichloropropene $^{(3,4,5)}$	0.300	0.5	0.5	25
p-Diethylbenzene $^{(4)}$		2.0	2	100
Diisopropyl Ether $^{(6)}$		2.0	2	100
1,4-Dioxane $^{(5)}$ (non-SIM)		250.0	80	4000
trans-1,3-Dichloropropene $^{(3,4,5)}$	0.300	0.5	1	50
Ethanol $^{(7)}$		250.0	1000	50000
Ethyl acetate		10.0	10	500
Ethylbenzene $^{(3,4,5)}$	0.400	0.5	1	50
Ethyl ether $^{(3,4)}$		2.5	2	100
4-Ethyltoluene $^{(4)}$		2.0	2	100
Ethyl methacrylate $^{(3,4)}$		5.0	10	500
Ethyl-Tert-Butyl-Ether $^{(6)}$		2.0	2	100
Freon-113 $^{(5)}$	0.05	10.0	4	200
n-Heptane $^{(7)}$		N/A	5	250
Hexachlorobutadiene $^{(3,4)}$		0.5	4	200
Hexachloroethane $^{(7)}$		N/A	5	250
Hexane		1.0	5	250
2-Hexanone $^{(3,4,5)}$	0.01	5.0	10	500
Iodomethane		5.0	10	500
Isopropyl Alcohol (IPA)		100.0	100	5000
Isopropylbenzene $^{(3,4,5)}$	0.400	0.5	1	50
p-Isopropyltoluene $^{(3,4)}$		0.5	1	50
Limonene $^{(7)}$		N/A	5	250
Methyl Acetate $^{(5)}$	0.01	10.0	4	200
Methylene chloride $^{(3,4,5)}$	0.01	3.0	5	250
Methyl Cyclohexane $^{(5)}$	0.05	10.0	4	200
Methyl isothiocyanate $^{(7)}$		N/A	5	250
Methyl Methacrylate		2.5	5	250
4-Methyl-2-pentanone $^{(3,4,5)}$	0.03	5.0	10	500

Methyl-tert-butyl-ether (3,4,5)	0.100	1.0	2	100
Naphthalene (3,4)		2.5	4	200
Nitrobenzene (7)		N/A	5	250
2-Nitropropane (7)		N/A	5	250
n-Nonane (7)		N/A	5	250
n-Octane (7)		N/A	5	250
n-Butanol (5)		100.0	300	15000
n-Propylbenzene (3,4)		0.5	1	50
n-Propyl bromide		5.0	N/A	N/A
Pentachloroethane		2.0	N/A	N/A
Styrene (3,4,5)	0.200	1.0	1	50
Tert-Butyl Alcohol (5)		10.0	20	1000
Tertiary-Amyl Methyl Ether (6)		2.0	2	100
1,1,1,2-Tetrachloroethane (3,4)		0.5	0.5	25
1,2,4,5-Tetramethylbenzene (4)		2.0	2	100
1,1,2,2-Tetrachloroethane (3,4,5)	0.200	0.5	0.5	25
Tetrachloroethene (3,4,5)	0.100	0.5	0.5	25
Tetrahydrofuran (3)		5.0	4	200
Toluene (3,4,5)	0.300	0.75	1	50
1,2,3-Trichlorobenzene (3,4,5)	0.400	2.5	2	100
1,2,4-Trichlorobenzene (3,4,5)	0.400	2.5	2	100
1,3,5-Trichlorobenzene (6)		2.0	2	100
1,1,1-Trichloroethane (3,4,5)	0.05	0.5	0.5	25
1,1,2-Trichloroethane (3,4,5)	0.200	0.75	1	50
Trichloroethene (3,4,5)	0.200	0.5	0.5	25
Trichlorofluoromethane (3,4,5)	0.01	2.5	4	200
1,2,3-Trichloropropane (3,4)		5.0	10	500
1,2,4-Trimethylbenzene (3,4)		2.5	2	100
1,3,5-Trimethylbenzene (3,4)		2.5	2	100
n-Undecane (7)		N/A	5	250
Vinyl acetate (3,4)		5.0	10	500
Vinyl chloride (3,4,5)	0.01	1.0	1	50
m/p-Xylenes (3,4,5)	0.200	1.0	2	100
o-Xylene (3,4,5)	0.200	1.0	1	50
Isobutyl Alcohol		10.0	N/A	N/A
2-Butanol		25.0	N/A	N/A
4-penten-2-ol		100.0	N/A	N/A
2-methyl-2-butanol		25.0	N/A	N/A
4-methyl-2-pentanol		25.0	N/A	N/A
Chloropicrin		20.0	100	5000
Halothane		2.5	10	500
1,4-Dioxane (5) SIM		3.0	N/A	N/A
1,1,2,2-Tetrachloroethane SIM		0.1	N/A	N/A

(1) Detection Limits are for Low-level Aqueous preserved samples.

(2) Detection Limits are for High-level Methanol preserved samples.
(3) Analyte reported by standard 8260 reporting list.
(4) Analyte reported by New York TCL reporting list.
(5) Analyte reported by New Jersey TCL reporting list.
(6) Analyte reported for New Hampshire in addition to standard 8260 reporting list.
(7) Analyte only reported for New York TCL report upon client request.
(8) Note: Reporting Limits are based on standard 8260 reporting list, RL's may vary for NY and NJ reporting lists.

Table 2

QUALITY CONTROL ACCEPTANCE CRITERIA

Surrogate Spike Percent Recovery	**Aqueous Limits**		**Soil Limits**	
	Lower Control Limit	**Upper Control Limit**	**Lower Control Limit**	**Upper Control Limit**
1,2-Dichloroethane-d_4	70%	130%	70%	130%
4-Bromofluorobenzene	70%	130%	70%	130%
Toluene-d_8	70%	130%	70%	130%
Dibromofluoromethane	70%	130%	70%	130%

Table 3

BFB (4-BROMOFLUOROBENZENE) MASS INTENSITY CRITERIA

m/z	**Required Intensity (relative abundance)**
50	**15 to 40% of m/z 95 (not required)**
75	**30 to 60% of m/z 95 (not required)**
95	**50 to 200% of m/z 174**
96	**5 to 9% of m/z 95**
173	**Less than 2% of m/z 174**
174	**50 to 200% of m/z 95**
175	**5 to 9% of m/z 174**
176	**95% to 105% of m/z 174**
177	**5 to 10% of m/z 176**

Table 4

Stock Standard Concentrations and Suggested Calibration Concentration Levels

Soil	**Stock (µg/mL)**	**Level 0 (ug/kg)**	**Level 1 (ug/kg)**	**Level 1.5 (ug/kg)**	**Level 2 (ug/kg)**	**Level 3 (ug/kg)**	**Level 4 (ug/kg)**	**Level 5 (ug/kg)**	**Level 6 (ug/kg)**	**Level 7 (ug/kg)**	**Level 8 (ug/kg)**
Fluorobenzene	2500	20	20	20	20	20	20	20	20	20	20
Dichlorodifluoromethane	2000	0.5	1	2	4	20	40	60	100	200	300
Chlorodifluoromethane	2000	0.5	1	2	4	20	40	60	100	200	300
Chloromethane	2000	0.5	1	2	4	20	40	60	100	200	300
Vinyl chloride	2000	0.5	1	2	4	20	40	60	100	200	300
Bromomethane	2000	0.5	1	2	4	20	40	60	100	200	300
Chloroethane	2000	0.5	1	2	4	20	40	60	100	200	300
Trichlorofluoromethane	2000	0.5	1	2	4	20	40	60	100	200	300
Ethyl ether	2000	0.5	1	2	4	20	40	60	100	200	300
Ethanol	2000	N/A	20	N/A	80	200	400	600	1000	3000	4000
1,1-Dichloroethene	2000	0.5	1	2	4	20	40	60	100	200	300
Carbon disulfide	2000	0.5	1	2	4	20	40	60	100	200	300
Freon-113	2000	0.5	1	2	4	20	40	60	100	200	300
Iodomethane	2000	0.5	1	2	4	20	40	60	100	200	300
Acrolein	2000	0.5	1	2	4	20	40	60	100	200	300
Allyl chloride	2000	0.5	1	2	4	20	40	60	100	200	300
Methylene chloride	2000	0.5	1	2	4	20	40	60	100	200	300
Isopropyl alcohol	2000	N/A	20	N/A	80	200	400	600	1000	3000	4000
Acetone	2000	0.5	1	2	4	20	40	60	100	200	300
trans-1,2-Dichloroethene	2000	0.5	1	2	4	20	40	60	100	200	300
Methyl acetate	2000	0.5	1	2	4	20	40	60	100	200	300
Hexane	2000	0.5	1	2	4	20	40	60	100	200	300
Methyl tert-butyl ether	2000	0.5	1	2	4	20	40	60	100	200	300
tert-Butyl alcohol	2000	2.5	5	10	20	100	200	300	500	1000	1500
Diisopropyl ether	2000	0.5	1	2	4	20	40	60	100	200	300
1,1-Dichloroethane	2000	0.5	1	2	4	20	40	60	100	200	300
Halothane	2000	0.5	1	2	4	20	40	60	100	200	300
Acrylonitrile	2000	0.5	1	2	4	20	40	60	100	200	300
Ethyl tert-butyl ether	2000	0.5	1	2	4	20	40	60	100	200	300
Vinyl acetate	2000	0.5	1	2	4	20	40	60	100	200	300
cis-1,2-Dichloroethene	2000	0.5	1	2	4	20	40	60	100	200	300
2,2-Dichloropropane	2000	0.5	1	2	4	20	40	60	100	200	300
Bromochloromethane	2000	0.5	1	2	4	20	40	60	100	200	300
Cyclohexane	2000	0.5	1	2	4	20	40	60	100	200	300

Soil	**Stock (µg/mL)**	**Level 0 (ug/kg)**	**Level 1 (ug/kg)**	**Level 1.5 (ug/kg)**	**Level 2 (ug/kg)**	**Level 3 (ug/kg)**	**Level 4 (ug/kg)**	**Level 5 (ug/kg)**	**Level 6 (ug/kg)**	**Level 7 (ug/kg)**	**Level 8 (ug/kg)**
Chloroform	2000	0.5	1	2	4	20	40	60	100	200	300
Ethyl acetate	2000	0.5	1	2	4	20	40	60	100	200	300
Carbon tetrachloride	2000	0.5	1	2	4	20	40	60	100	200	300
Tetrahydrofuran	2000	0.5	1	2	4	20	40	60	100	200	300
Dibromofluoromethane	2500	20	20	20	20	20	20	20	20	20	20
1,1,1-Trichloroethane	2000	0.5	1	2	4	20	40	60	100	200	300
2-Butanol	2000	N/A	20	N/A	80	200	400	600	1000	3000	4000
2-Butanone	2000	0.5	1	2	4	20	40	60	100	200	300
1,1-Dichloropropene	2000	0.5	1	2	4	20	40	60	100	200	300
Heptane	2000	0.5	1	2	4	20	40	60	100	200	300
Benzene	2000	0.5	1	2	4	20	40	60	100	200	300
tert-Amyl methyl ether	2000	0.5	1	2	4	20	40	60	100	200	300
1,2-Dichloroethane-d4	2500	20	20	20	20	20	20	20	20	20	20
1,2-Dichloroethane	2000	0.5	1	2	4	20	40	60	100	200	300
Isobutyl alcohol	2000	N/A	20	N/A	80	200	400	600	1000	3000	4000
2-Methyl-2-butanol	2000	2.5	5	10	20	100	200	300	500	1000	1500
Methyl cyclohexane	2000	0.5	1	2	4	20	40	60	100	200	300
Trichloroethene	2000	0.5	1	2	4	20	40	60	100	200	300
n-Butanol	2000	N/A	20	N/A	80	200	400	600	1000	3000	4000
Dibromomethane	2000	0.5	1	2	4	20	40	60	100	200	300
1,2-Dichloropropane	2000	0.5	1	2	4	20	40	60	100	200	300
4-penten-2-ol	2000	2.5	5	10	20	100	200	300	500	1000	1500
2-Chloroethyl vinyl ether	2000	0.5	1	2	4	20	40	60	100	200	300
Bromodichloromethane	2000	0.5	1	2	4	20	40	60	100	200	300
Ethyl acrylate	2000	0.5	1	2	4	20	40	60	100	200	300
Methyl methacrylate	2000	0.5	1	2	4	20	40	60	100	200	300
1,4-Dioxane	2000	N/A	40	80	200	1000	2000	3000	5000	10000	15000
cis-1,3-Dichloropropene	2000	0.5	1	2	4	20	40	60	100	200	300
Chlorobenzene-d5	2500	20	20	20	20	20	20	20	20	20	20
Octane	2000	0.5	1	2	4	20	40	60	100	200	300
Toluene-d8	2500	20	20	20	20	20	20	20	20	20	20
Toluene	2000	0.5	1	2	4	20	40	60	100	200	300
4-Methyl-2-pentanone	2000	0.5	1	2	4	20	40	60	100	200	300
Tetrachloroethene	2000	0.5	1	2	4	20	40	60	100	200	300
2-Nitropropane	2000	0.5	1	2	4	20	40	60	100	200	300

Soil	**Stock (µg/mL)**	**Level 0 (ug/kg)**	**Level 1 (ug/kg)**	**Level 1.5 (ug/kg)**	**Level 2 (ug/kg)**	**Level 3 (ug/kg)**	**Level 4 (ug/kg)**	**Level 5 (ug/kg)**	**Level 6 (ug/kg)**	**Level 7 (ug/kg)**	**Level 8 (ug/kg)**
Chloropicrin	2000	N/A	50	N/A	100	200	300	400	500	600	700
trans-1,3-Dichloropropene	2000	0.5	1	2	4	20	40	60	100	200	300
Methyl isothiocyanate	2000	0.5	1	2	4	20	40	60	100	200	300
4-Methyl-2-pentanol	2000	N/A	20	N/A	80	200	400	600	1000	3000	4000
Ethyl methacrylate	2000	0.5	1	2	4	20	40	60	100	200	300
1,1,2-Trichloroethane	2000	0.5	1	2	4	20	40	60	100	200	300
Chlorodibromomethane	2000	0.5	1	2	4	20	40	60	100	200	300
1,3-Dichloropropane	2000	0.5	1	2	4	20	40	60	100	200	300
1,2-Dibromoethane	2000	0.5	1	2	4	20	40	60	100	200	300
n-Butyl Acetate	2000	0.5	1	2	4	20	40	60	100	200	300
2-Hexanone	2000	0.5	1	2	4	20	40	60	100	200	300
Nonane	2000	0.5	1	2	4	20	40	60	100	200	300
Chlorobenzene	2000	0.5	1	2	4	20	40	60	100	200	300
Ethylbenzene	2000	0.5	1	2	4	20	40	60	100	200	300
1,1,1,2-Tetrachloroethane	2000	0.5	1	2	4	20	40	60	100	200	300
p/m Xylene	2000	1	2	4	8	40	80	120	200	400	600
o Xylene	2000	1	2	4	8	40	80	120	200	400	600
Styrene	2000	1	2	4	8	40	80	120	200	400	600
1,4-Dichlorobenzene-d4	2500	20	20	20	20	20	20	20	20	20	20
Bromoform	2000	0.5	1	2	4	20	40	60	100	200	300
Butyl acrylate	2000	0.5	1	2	4	20	40	60	100	200	300
Isopropylbenzene	2000	0.5	1	2	4	20	40	60	100	200	300
4-Bromofluorobenzene	2500	20	20	20	20	20	20	20	20	20	20
Bromobenzene	2000	0.5	1	2	4	20	40	60	100	200	300
Decane	2000	0.5	1	2	4	20	40	60	100	200	300
n-Propylbenzene	2000	0.5	1	2	4	20	40	60	100	200	300
1,4-Dichlorobutane	2000	0.5	1	2	4	20	40	60	100	200	300
1,1,2,2-Tetrachloroethane	2000	0.5	1	2	4	20	40	60	100	200	300
4-Ethyltoluene	2000	0.5	1	2	4	20	40	60	100	200	300
2-Chlorotoluene	2000	0.5	1	2	4	20	40	60	100	200	300
1,3,5-Trimethylbenzene	2000	0.5	1	2	4	20	40	60	100	200	300
1,2,3-Trichloropropane	2000	0.5	1	2	4	20	40	60	100	200	300
trans-1,4-Dichloro-2-butene	2000	0.5	1	2	4	20	40	60	100	200	300
4-Chlorotoluene	2000	0.5	1	2	4	20	40	60	100	200	300

Soil	**Stock (µg/mL)**	**Level 0 (ug/kg)**	**Level 1 (ug/kg)**	**Level 1.5 (ug/kg)**	**Level 2 (ug/kg)**	**Level 3 (ug/kg)**	**Level 4 (ug/kg)**	**Level 5 (ug/kg)**	**Level 6 (ug/kg)**	**Level 7 (ug/kg)**	**Level 8 (ug/kg)**
tert-Butylbenzene	2000	0.5	1	2	4	20	40	60	100	200	300
Pentachloroethane	2000	0.5	1	2	4	20	40	60	100	200	300
n-Butyl methacrylate	2000	0.5	1	2	4	20	40	60	100	200	300
1,2,4-Trimethylbenzene	2000	0.5	1	2	4	20	40	60	100	200	300
Limonene	2000	0.5	1	2	4	20	40	60	100	200	300
sec-Butylbenzene	2000	0.5	1	2	4	20	40	60	100	200	300
p-Isopropyltoluene	2000	0.5	1	2	4	20	40	60	100	200	300
1,3-Dichlorobenzene	2000	0.5	1	2	4	20	40	60	100	200	300
1,4-Dichlorobenzene	2000	0.5	1	2	4	20	40	60	100	200	300
trans-Decahydronaphthalene	2000	0.5	1	2	4	20	40	60	100	200	300
Undecane	2000	0.5	1	2	4	20	40	60	100	200	300
p-Diethylbenzene	2000	0.5	1	2	4	20	40	60	100	200	300
n-Butylbenzene	2000	0.5	1	2	4	20	40	60	100	200	300
Hexachloroethane	2000	0.5	1	2	4	20	40	60	100	200	300
1,2-Dichlorobenzene	2000	0.5	1	2	4	20	40	60	100	200	300
cis-Decahydronaphthalene	2000	0.5	1	2	4	20	40	60	100	200	300
1,2,4,5-Tetramethylbenzene	2000	0.5	1	2	4	20	40	60	100	200	300
1,2-Dibromo-3-chloropropane	2000	0.5	1	2	4	20	40	60	100	200	300
1,3,5-Trichlorobenzene	2000	0.5	1	2	4	20	40	60	100	200	300
Nitrobenzene	2000	0.5	1	2	4	20	40	60	100	200	300
Hexachlorobutadiene	2000	0.5	1	2	4	20	40	60	100	200	300
1,2,4-Trichlorobenzene	2000	0.5	1	2	4	20	40	60	100	200	300
Naphthalene	2000	0.5	1	2	4	20	40	60	100	200	300
1,2,3-Trichlorobenzene	2000	0.5	1	2	4	20	40	60	100	200	300
1,3-Dioxolane	2000	N/A	25	N/A	50	100	250	500	1000	1500	2000

Stock Standard Concentrations and Suggested Calibration Concentration Levels

Water	Stock (µg/mL)	Level 11 (ug/L)	Level 1 (ug/L)	Level 2 (ug/L)	Level 3 (ug/L)	Level 4 (ug/L)	Level 5 (ug/L)	Level 6 (ug/L)	Level 7 (ug/L)	Level 8 (ug/L)	Level 9 (ug/L)	Level 10 (ug/L)
							Optional		Optional		Optional	
Fluorobenzene	2500	10	10	10	10	10	10	10	10	10	10	10
Dichlorodifluoromethane	2000		0.5	2	10	30	50	80	100	120	160	200
Chloromethane	2000		0.5	2	10	30	50	80	100	120	160	200
Vinyl chloride	2000	0.19	0.5	2	10	30	50	80	100	120	160	200
Bromomethane	2000		0.5	2	10	30	50	80	100	120	160	200
Chloroethane	2000		0.5	2	10	30	50	80	100	120	160	200
Trichlorofluoromethane	2000		0.5	2	10	30	50	80	100	120	160	200
Ethyl ether	2000		0.5	2	10	30	50	80	100	120	160	200
Ethanol	2000		0.5	2	10	30	50	80	100	120	160	200
1,1-Dichloroethene	2000		0.5	2	10	30	50	80	100	120	160	200
Carbon disulfide	2000		0.5	2	10	30	50	80	100	120	160	200
Freon-113	2000		0.5	2	10	30	50	80	100	120	160	200
Iodomethane	2000		0.5	2	10	30	50	80	100	120	160	200
Acrolein	2000		0.5	2	10	30	50	80	100	120	160	200
Methylene chloride	2000		0.5	2	10	30	50	80	100	120	160	200
Isopropyl alcohol	2000		2.5	10	50	150	250	400	500	600	800	1000
Acetone	2000		0.5	2	10	30	50	80	100	120	160	200
trans-1,2-Dichloroethene	2000		0.5	2	10	30	50	80	100	120	160	200
Methyl acetate	2000		0.5	2	10	30	50	80	100	120	160	200
Methyl tert-butyl ether	2000		0.5	2	10	30	50	80	100	120	160	200
tert-Butyl alcohol	2000		2.5	10	50	150	250	400	500	600	800	1000
Diisopropyl ether	2000		0.5	2	10	30	50	80	100	120	160	200
1,1-Dichloroethane	2000		0.5	2	10	30	50	80	100	120	160	200
Halothane	2000		0.5	2	10	30	50	80	100	120	160	200
Acrylonitrile	2000		0.5	2	10	30	50	80	100	120	160	200
Ethyl tert-butyl ether	2000		0.5	2	10	30	50	80	100	120	160	200
Vinyl acetate	2000		0.5	2	10	30	50	80	100	120	160	200
cis-1,2-Dichloroethene	2000		0.5	2	10	30	50	80	100	120	160	200
2,2-Dichloropropane	2000		0.5	2	10	30	50	80	100	120	160	200
Bromochloromethane	2000		0.5	2	10	30	50	80	100	120	160	200
Cyclohexane	2000		0.5	2	10	30	50	80	100	120	160	200
Chloroform	2000		0.5	2	10	30	50	80	100	120	160	200
Ethyl acetate	2000		0.5	2	10	30	50	80	100	120	160	200

Water	**Stock (µg/mL)**	**Level 11 (ug/L)**	**Level 1 (ug/L)**	**Level 2 (ug/L)**	**Level 3 (ug/L)**	**Level 4 (ug/L)**	**Level 5 (ug/L)**	**Level 6 (ug/L)**	**Level 7 (ug/L)**	**Level 8 (ug/L)**	**Level 9 (ug/L)**	**Level 10 (ug/L)**
							Optional		**Optional**		**Optional**	
Carbon tetrachloride	2000	0.19	0.5	2	10	30	50	80	100	120	160	200
Tetrahydrofuran	2000		0.5	2	10	30	50	80	100	120	160	200
Dibromofluoromethane	2500	10	10	10	10	10	10	10	10	10	10	10
1,1,1-Trichloroethane	2000		0.5	2	10	30	50	80	100	120	160	200
2-Butanol	2000		2.5	10	50	150	250	400	500	600	800	1000
2-Butanone	2000		0.5	2	10	30	50	80	100	120	160	200
1,1-Dichloropropene	2000		0.5	2	10	30	50	80	100	120	160	200
Benzene	2000	0.19	0.5	2	10	30	50	80	100	120	160	200
tert-Amyl methyl ether	2000		0.5	2	10	30	50	80	100	120	160	200
1,2-Dichloroethane-d4	2500	10	10	10	10	10	10	10	10	10	10	10
1,2-Dichloroethane	2000		0.5	2	10	30	50	80	100	120	160	200
Isobutyl alcohol	2000		2.5	10	50	150	250	400	500	600	800	1000
2-Methyl-2-butanol	2000		2.5	10	50	150	250	400	500	600	800	1000
Methyl cyclohexane	2000		0.5	2	10	30	50	80	100	120	160	200
Trichloroethene	2000	0.19	0.5	2	10	30	50	80	100	120	160	200
n-Butanol	2000		2.5	10	50	150	250	400	500	600	800	1000
Dibromomethane	2000		0.5	2	10	30	50	80	100	120	160	200
1,2-Dichloropropane	2000		0.5	2	10	30	50	80	100	120	160	200
4-penten-2-ol	2000		2.5	10	50	150	250	400	500	600	800	1000
2-Chloroethyl vinyl ether	2000		0.5	2	10	30	50	80	100	120	160	200
Bromodichloromethane	2000		0.5	2	10	30	50	80	100	120	160	200
Ethyl acrylate	2000		0.25	1	5	15	25	40	50	60	80	100
Methyl methacrylate	2000		0.25	1	5	15	25	40	50	60	80	100
1,4-Dioxane	2000		100	400	500	600	1000	800	1000	1200	1600	2000
cis-1,3-Dichloropropene	2000		0.5	2	10	30	50	80	100	120	160	200
Chlorobenzene-d5	2500	10	10	10	10	10	10	10	10	10	10	10
Toluene-d8	2500	10	10	10	10	10	10	10	10	10	10	10
Toluene	2000		0.5	2	10	30	50	80	100	120	160	200
4-Methyl-2-pentanone	2000		0.5	2	10	30	50	80	100	120	160	200
Tetrachloroethene	2000		0.5	2	10	30	50	80	100	120	160	200
Chloropicrin	2000		30	50	80	120	200	160	400	200	320	400
trans-1,3-Dichloropropene	2000		0.5	2	10	30	50	80	100	120	160	200
4-Methyl-2-pentanol	2000		2.5	10	50	150	250	400	500	600	800	1000

Water	Stock (µg/mL)	Level 11 (ug/L)	Level 1 (ug/L)	Level 2 (ug/L)	Level 3 (ug/L)	Level 4 (ug/L)	Level 5 (ug/L)	Level 6 (ug/L)	Level 7 (ug/L)	Level 8 (ug/L)	Level 9 (ug/L)	Level 10 (ug/L)
							Optional		Optional		Optional	
Ethyl methacrylate	2000		0.5	2	10	30	50	80	100	120	160	200
1,1,2-Trichloroethane	2000		0.5	2	10	30	50	80	100	120	160	200
Chlorodibromomethane	2000		0.5	2	10	30	50	80	100	120	160	200
1,3-Dichloropropane	2000		0.5	2	10	30	50	80	100	120	160	200
1,2-Dibromoethane	2000		0.5	2	10	30	50	80	100	120	160	200
2-Hexanone	2000		0.5	2	10	30	50	80	100	120	160	200
Chlorobenzene	2000		0.5	2	10	30	50	80	100	120	160	200
Ethylbenzene	2000		0.5	2	10	30	50	80	100	120	160	200
1,1,1,2-Tetrachloroethane	2000		0.5	2	10	30	50	80	100	120	160	200
p/m Xylene	2000		1	4	20	60	100	160	200	240	320	400
o Xylene	2000		1	4	20	60	100	160	200	240	320	400
Styrene	2000		1	4	20	60	100	160	200	240	320	400
1,4-Dichlorobenzene-d4	2500	10	10	10	10	10	10	10	10	10	10	10
Bromoform	2000		0.5	2	10	30	50	80	100	120	160	200
Butyl acrylate	2000		0.25	1	5	15	25	40	50	60	80	100
Isopropylbenzene	2000		0.5	2	10	30	50	80	100	120	160	200
4-Bromofluorobenzene	2500	10	10	10	10	10	10	10	10	10	10	10
Bromobenzene	2000		0.5	2	10	30	50	80	100	120	160	200
n-Propylbenzene	2000		0.5	2	10	30	50	80	100	120	160	200
1,4-Dichlorobutane	2000		0.5	2	10	30	50	80	100	120	160	200
1,1,2,2-Tetrachloroethane	2000		0.5	2	10	30	50	80	100	120	160	200
4-Ethyltoluene	2000		0.5	2	10	30	50	80	100	120	160	200
2-Chlorotoluene	2000		0.5	2	10	30	50	80	100	120	160	200
1,3,5-Trimethylbenzene	2000		0.5	2	10	30	50	80	100	120	160	200
1,2,3-Trichloropropane	2000		0.5	2	10	30	50	80	100	120	160	200
trans-1,4-Dichloro-2-butene	2000		0.5	2	10	30	50	80	100	120	160	200
4-Chlorotoluene	2000		0.5	2	10	30	50	80	100	120	160	200
tert-Butylbenzene	2000		0.5	2	10	30	50	80	100	120	160	200
Pentachloroethane	2000		0.5	2	10	30	50	80	100	120	160	200
n-Butyl methacrylate	2000		0.25	1	5	15	25	40	50	60	80	100
1,2,4-Trimethylbenzene	2000		0.5	2	10	30	50	80	100	120	160	200
sec-Butylbenzene	2000		0.5	2	10	30	50	80	100	120	160	200

Water	Stock (µg/mL)	Level 11 (ug/L)	Level 1 (ug/L)	Level 2 (ug/L)	Level 3 (ug/L)	Level 4 (ug/L)	Level 5 (ug/L)	Level 6 (ug/L)	Level 7 (ug/L)	Level 8 (ug/L)	Level 9 (ug/L)	Level 10 (ug/L)
							Optional		Optional		Optional	
p-Isopropyltoluene	2000		0.5	2	10	30	50	80	100	120	160	200
1,3-Dichlorobenzene	2000		0.5	2	10	30	50	80	100	120	160	200
1,4-Dichlorobenzene	2000		0.5	2	10	30	50	80	100	120	160	200
p-Diethylbenzene	2000		0.5	2	10	30	50	80	100	120	160	200
n-Butylbenzene	2000		0.5	2	10	30	50	80	100	120	160	200
1,2-Dichlorobenzene	2000		0.5	2	10	30	50	80	100	120	160	200
1,2,4,5-Tetramethylbenzene	2000		0.5	2	10	30	50	80	100	120	160	200
1,2-Dibromo-3-chloropropane	2000		0.5	2	10	30	50	80	100	120	160	200
1,3,5-Trichlorobenzene	2000		0.5	2	10	30	50	80	100	120	160	200
Hexachlorobutadiene	2000		0.5	2	10	30	50	80	100	120	160	200
1,2,4-Trichlorobenzene	2000		0.5	2	10	30	50	80	100	120	160	200
Naphthalene	2000		0.5	2	10	30	50	80	100	120	160	200
1,2,3-Trichlorobenzene	2000		0.5	2	10	30	50	80	100	120	160	200
1,3-Dioxolane	2000		10	40	100	250	N/A	500	N/A	750	N/A	1000
Pentachloroethane	2000		0.5	2	10	30	50	80	100	120	160	200
1,4-Dioxane (SIM)	100		0.5	2	10	20	30	50	100	200	N/A	N/A
1,1,2,2-Tetrachloroethane (SIM)	100		0.05	0.1	0.2	0.5	1	2	5	10	N/A	N/A

- For Low Level Soil analysis, the calibration levels are the same in µg/Kg units.
- For High Level Soil analysis, the calibration levels are at 50x the levels listed due to sample preparation requirements.

Table 5

8260D Volatile Internal Standards with Corresponding Target Compounds and Surrogates Assigned for Quantitation

Fluorobenzene	Chlorobenzene-d5	1,4-Dichlorobenzene-d4
Dichlorodifluoromethane	Toluene-d8 (surr)	Isopropylbenzene
Chloromethane	Toluene	Bromoform
Vinyl Chloride	Ethyl Methacrylate	1,4-dichloro-2-butane
Bromomethane	Trans-1,3-dichloropropene	1,1,2,2,-tetrachloroethane
Chloroethane	1,1,2-trichloroethane	4-bromofluorobenzene (surr)
Trichlorofluoromethane	2-hexanone	1,2,3-trichloropropane
Ethyl Ether	1,3-dichloropropane	trans-1,4-dichloro-2-butene
Freon 113	Tetrachloroethene	n-propylbenzene
Acrolein	Chlorodibromomethane	Bromobenzene
Acetone	1,2-dibromoethane	4-ethyltoluene
Ethanol	Chlorobenzene	1,3,5-trimethybenzene
1,1,-dichloroethene	1,1,1,2-tetrachloroethane	2-chlorotoluene
Tert-Butyl Alcohol	Ethylbenzene	4-chorotoluene
Methyl Acetate	p/m xylene	tert-butylbenzene
Carbon Disulfide	o xylene	1,2,4-trimethylbenzene
Methylene Chloride	Styrene	sec-butylbenzene
Acrylonitrile	Octane	p-isopropyltoluene
Methyl Tert Butyl Ether	2-Nitropropane	1,3-dichlorobenzene
Halothane	Methyl isothiocyanate	1,4-dichlorobenzene
Trans-1,2-dichloroethene	n-Butyl acetate	n-butylbenzene
Diisopropyl Ether	Nonane	p-diethylbenzene
Vinyl Acetate		1,2-dichlorobenzene
1,1-dichloroethane		1,2,4,5-tetramethylbenzene
Ethyl-Tert-Butyl-Ether		1,2-dibromo-3-chloropropane
2-butanone		1,3,5-trichlorobenzene
2,2-dichloropropane		1,2,4-trichlorobenzene
Cis-1,2-dichloroethene		Hexachlorobutadiene
Chloroform		Naphthalene
Bromochloromethane		1,2,3-trichlorobenzene
Tetrahydrofuran		Cyclohexanone
Dibromofluoromethane (surr)		Nitrobenzene

1,1,1-trichloroethane		Pentachloroethane
Cyclohexane		Decane
1,1-dichloropropene		Limonene
carbon Tetrachloride		trans-Decahydronaphthalene
Tertiary-Amyl Methyl Ether		Undecane
1,2-dichloroethane-d4 (surr)		Hexachloroethane
1,2-dichloroethane		cis-Decahydronaphthalene
Benzene		
Trichloroethene		
Methyl cyclohexane		
1,2-Dichloropropane		
Bromodichloromethane		
1,4-Dioxane		
Dibromomethane		
2-Chloroethylvinyl Ether		
4-methyl-2-pentanone		
cis-1,3-Dichloropropene		
Iodomethane		
Methyl methacrylate		
n-Butanol		
Ethyl acetate		
Isopropyl alcohol (IPA)		
Hexane		
n-Propyl bromide		
Chlorodifluoromethane		
Allyl chloride		
Heptane		

Table 6

8260D Quantitation Ions

Analyte	Quantitation Ion	Analyte	Quantitation Ion
Dichlorodifluoromethane	85	Ethyl Methacrylate	69
Chloromethane	50	Trans-1,3-dichloropropene	75
Vinyl Chloride	62	1,1,2-trichloroethane	83
Bromomethane	94	2-hexanone	43
Chloroethane	64	1,3-dichloropropane	76
Trichlorofluoromethane	101	Tetrachloroethene	166
Ethyl Ether	74	Chlorodibromomethane	129
Freon 113	101	1,2-dibromoethane	107
Acrolein	56	Chlorobenzene	112
Acetone	43	1,1,1,2-tetrachloroethane	131
1,1,-dichloroethene	96	Ethylbenzene	91
Tert-Butyl Alcohol	59	p/m xylene	106
Methyl Acetate	43	o xylene	106
Carbon Disulfide	84	Styrene	104
Methylene Chloride	76	Isopropylbenzene	105
Acrylonitrile	53	Bromoform	173
Methyl Tert Butyl Ether	73	1,4-dichloro-2-butane	55
Halothane	117	1,1,2,2,-tetrachloroethane	83
Trans-1,2-dichloroethene	96	1,2,3-trichloropropane	75
Diisopropyl Ether	45	Trans-1,4-dichloro-2-butene	53
Vinyl Acetate	43	n-propylbenzene	91
1,1-dichloroethane	63	Bromobenzene	156
Ethyl-Tert-Butyl-Ether	59	4-ethyltoluene	105
2-butanone	43	1,3,5-trimethybenzene	105
2,2-dichloropropane	77	2-chlorotoluene	91
Cis-1,2-dichloroethene	96	4-chlorotoluene	91
Chloroform	83	tert-butylbenzene	119
Bromochloromethane	128	1,2,4-trimethylbenzene	105
Tetrahydrofuran	42	sec-butylbenzene	105
1,1,1-trichloroethane	97	p-isopropyltoluene	119
Cyclohexane	56	1,3-dichlorobenzene	146
1,1-dichloropropene	75	1,4-dichlorobenzene	146
Carbon Tetrachloride	117	n-butylbenzene	91
Tertiary-Amyl Methyl Ether	73	p-diethylbenzene	119
1,2-dichloroethane	62	1,2-dichlorobenzene	146
Benzene	78	1,2,4,5-Tetramethylbenzene	119
Trichloroethene	95	1,2-Dibromo-3-chloropropane	75
Methyl Cyclohexane	83	1,3,5-Trichlorobenzene	180
1,2-Dichloropropane	63	1,2,4-Trichlorobenzene	180
Bromodichloromethane	83	Hexachlorobutadiene	225
1,4-dioxane	88	Naphthalene	128
Dibromomethane	93	1,2,3-trichlorobenzene	180
2-Chloroethylvinyl Ether	63	Ethanol	45
4-methyl-2-pentanone	58	Cyclohexanone	55
Cis-1,3-dichloropropene	75	Ethyl acetate	43

Table 6

8260D Quantitation Ions (continued)

Analyte	Quantitation Ion	Analyte	Quantitation Ion
Toluene	92	Iodomethane	142
Methyl methacrylate	69	n-Butanol	56
Pentachloroethane	167	Isopropyl Alcohol (IPA)	45
Hexane	57	n-Propyl bromide	43
Chlorodifluoromethane	51	Iodomethane	142
Allyl chloride	76	Heptane	71
Octane	85	2-Nitropropane	41
Methyl isothiocyanate	73	n-Butyl Acetate	43
Nonane	57	Decane	57
Limonene	68	Undecane	57
trans-Decahydronaphthalene	138	cis-Decahydronaphthalene	138
Hexachloroethane	117	Nitrobenzene	77

Table 7

List of 8260 Difficult Analytes:

1,1,2,2-Tetrachloroethane
1,2-Dibromo-3-chloropropane (DBCP)
1,4-Dioxane
2-Butanone
2-chloroethylvinyl ether
2-Hexanone
2,2-dichloropropane
4-Methyl-2-pentanone
Acetone
Bromoform
Bromomethane
Carbon disulfide
Chloroethane
Chloromethane
cis-1,3-Dichloropropene
Dichlorodifluoromethane (Freon 12)
Ethanol
Iodomethane
Isobutyl Alcohol
Naphthalene
Nitrobenzene
n-butanol
Styrene
Tert-Butyl Alcohol
Trichlorofluoromethane (Freon 11)
Isopropyl Alcohol (IPA)

Table 8

ICAL Low Point re-quantitation ranges

Water	Level 11 (ug/L)	L11 (70% - 130%)	Level 1 (ug/L)	L1 (70% - 130%)	Level 2 (ug/L)	L2 (70% - 130%)	Level 3 (ug/L)	L3 (70% - 130%)
Dichlorodifluoromethane			0.5	0.35 - 0.65	2	1.4 - 2.6	10	7 - 13.0
Chloromethane			0.5	0.35 - 0.65	2	1.4 - 2.6	10	7 - 13.0
Vinyl chloride	0.19	0.133 - 0.247	0.5	0.35 - 0.65	2	1.4 - 2.6	10	7 - 13.0
Bromomethane			0.5	0.35 - 0.65	2	1.4 - 2.6	10	7 - 13.0
Chloroethane			0.5	0.35 - 0.65	2	1.4 - 2.6	10	7 - 13.0
Trichlorofluoromethane			0.5	0.35 - 0.65	2	1.4 - 2.6	10	7 - 13.0
Ethyl ether			0.5	0.35 - 0.65	2	1.4 - 2.6	10	7 - 13.0
Ethanol			0.5	0.35 - 0.65	2	1.4 - 2.6	10	7 - 13.0
1,1-Dichloroethene			0.5	0.35 - 0.65	2	1.4 - 2.6	10	7 - 13.0
Carbon disulfide			0.5	0.35 - 0.65	2	1.4 - 2.6	10	7 - 13.0
Freon-113			0.5	0.35 - 0.65	2	1.4 - 2.6	10	7 - 13.0
Iodomethane			0.5	0.35 - 0.65	2	1.4 - 2.6	10	7 - 13.0
Acrolein			0.5	0.35 - 0.65	2	1.4 - 2.6	10	7 - 13.0
Methylene chloride			0.5	0.35 - 0.65	2	1.4 - 2.6	10	7 - 13.0
Isopropyl alcohol			2.5	1.75 - 3.25	10	7 - 13.0	50	35 - 65

Water	Level 11 (ug/L)	L11 (70% - 130%)	Level 1 (ug/L)	L1 (70% - 130%)	Level 2 (ug/L)	L2 (70% - 130%)	Level 3 (ug/L)	L3 (70% - 130%)
Acetone			0.5	0.35 - 0.65	2	1.4 - 2.6	10	7 - 13.0
trans-1,2-Dichloroethene			0.5	0.35 - 0.65	2	1.4 - 2.6	10	7 - 13.0
Methyl acetate			0.5	0.35 - 0.65	2	1.4 - 2.6	10	7 - 13.0
Methyl tert-butyl ether			0.5	0.35 - 0.65	2	1.4 - 2.6	10	7 - 13.0
tert-Butyl alcohol			2.5	1.75 - 3.25	10	7 - 13.0	50	35 - 65
Diisopropyl ether			0.5	0.35 - 0.65	2	1.4 - 2.6	10	7 - 13.0
1,1-Dichloroethane			0.5	0.35 - 0.65	2	1.4 - 2.6	10	7 - 13.0
Halothane			0.5	0.35 - 0.65	2	1.4 - 2.6	10	7 - 13.0
Acrylonitrile			0.5	0.35 - 0.65	2	1.4 - 2.6	10	7 - 13.0
Ethyl tert-butyl ether			0.5	0.35 - 0.65	2	1.4 - 2.6	10	7 - 13.0
Vinyl acetate			0.5	0.35 - 0.65	2	1.4 - 2.6	10	7 - 13.0
cis-1,2-Dichloroethene			0.5	0.35 - 0.65	2	1.4 - 2.6	10	7 - 13.0
2,2-Dichloropropane			0.5	0.35 - 0.65	2	1.4 - 2.6	10	7 - 13.0
Bromochloromethane			0.5	0.35 - 0.65	2	1.4 - 2.6	10	7 - 13.0
Cyclohexane			0.5	0.35 - 0.65	2	1.4 - 2.6	10	7 - 13.0
Chloroform			0.5	0.35 - 0.65	2	1.4 - 2.6	10	7 - 13.0
Ethyl acetate			0.5	0.35 - 0.65	2	1.4 - 2.6	10	7 - 13.0
Carbon tetrachloride	0.19	0.133 - 0.247	0.5	0.35 - 0.65	2	1.4 - 2.6	10	7 - 13.0
Tetrahydrofuran			0.5	0.35 - 0.65	2	1.4 - 2.6	10	7 - 13.0
1,1,1-Trichloroethane			0.5	0.35 - 0.65	2	1.4 - 2.6	10	7 - 13.0
2-Butanol			2.5	1.75 - 3.25	10	7 - 13.0	50	35 - 65
2-Butanone			0.5	0.35 - 0.65	2	1.4 - 2.6	10	7 - 13.0
1,1-Dichloropropene			0.5	0.35 - 0.65	2	1.4 - 2.6	10	7 - 13.0
Benzene	0.19	0.133 - 0.247	0.5	0.35 - 0.65	2	1.4 - 2.6	10	7 - 13.0
tert-Amyl methyl ether			0.5	0.35 - 0.65	2	1.4 - 2.6	10	7 - 13.0
1,2-Dichloroethane			0.5	0.35 - 0.65	2	1.4 - 2.6	10	7 - 13.0
Isobutyl alcohol			2.5	1.75 - 3.25	10	7 - 13.0	50	35 - 65
2-Methyl-2-butanol			2.5	1.75 - 3.25	10	7 - 13.0	50	35 - 65
Methyl cyclohexane			0.5	0.35 - 0.65	2	1.4 - 2.6	10	7 - 13.0
Trichloroethene	0.19	0.133 - 0.247	0.5	0.35 - 0.65	2	1.4 - 2.6	10	7 - 13.0
n-Butanol			2.5	1.75 - 3.25	10	7 - 13.0	50	35 - 65
Dibromomethane			0.5	0.35 - 0.65	2	1.4 - 2.6	10	7 - 13.0
1,2-Dichloropropane			0.5	0.35 - 0.65	2	1.4 - 2.6	10	7 - 13.0
4-penten-2-ol			2.5	1.75 - 3.25	10	7 - 13.0	50	35 - 65
2-Chloroethyl vinyl ether			0.5	0.35 - 0.65	2	1.4 - 2.6	10	7 - 13.0
Bromodichloromethane			0.5	0.35 - 0.65	2	1.4 - 2.6	10	7 - 13.0
Ethyl acrylate			0.25	0.175 - 0.325	1	0.7 - 1.3	5	3.5 - 6.5
Methyl methacrylate			0.25	0.175 - 0.325	1	0.7 - 1.3	5	3.5 - 6.5
1,4-Dioxane			100	70 - 130	400	280 - 520	500	350 - 650
cis-1,3-Dichloropropene			0.5	0.35 - 0.65	2	1.4 - 2.6	10	7 - 13.0
Toluene			0.5	0.35 - 0.65	2	1.4 - 2.6	10	7 - 13.0
4-Methyl-2-pentanone			0.5	0.35 - 0.65	2	1.4 - 2.6	10	7 - 13.0
Tetrachloroethene			0.5	0.35 - 0.65	2	1.4 - 2.6	10	7 - 13.0

Water	Level 11 (ug/L)	L11 (70% - 130%)	Level 1 (ug/L)	L1 (70% - 130%)	Level 2 (ug/L)	L2 (70% - 130%)	Level 3 (ug/L)	L3 (70% - 130%)
Chloropicrin			30	21 - 39	50	35 - 65	80	56 - 104
trans-1,3-Dichloropropene			0.5	0.35 - 0.65	2	1.4 - 2.6	10	7 - 13.0
4-Methyl-2-pentanol			2.5	1.75 - 3.25	10	7 - 13.0	50	35 - 65
Ethyl methacrylate			0.5	0.35 - 0.65	2	1.4 - 2.6	10	7 - 13.0
1,1,2-Trichloroethane			0.5	0.35 - 0.65	2	1.4 - 2.6	10	7 - 13.0
Chlorodibromomethane			0.5	0.35 - 0.65	2	1.4 - 2.6	10	7 - 13.0
1,3-Dichloropropane			0.5	0.35 - 0.65	2	1.4 - 2.6	10	7 - 13.0
1,2-Dibromoethane			0.5	0.35 - 0.65	2	1.4 - 2.6	10	7 - 13.0
2-Hexanone			0.5	0.35 - 0.65	2	1.4 - 2.6	10	7 - 13.0
Chlorobenzene			0.5	0.35 - 0.65	2	1.4 - 2.6	10	7 - 13.0
Ethylbenzene			0.5	0.35 - 0.65	2	1.4 - 2.6	10	7 - 13.0
1,1,1,2-Tetrachloroethane			0.5	0.35 - 0.65	2	1.4 - 2.6	10	7 - 13.0
p/m Xylene			1	0.7 - 1.3	4	2.8 - 5.2	20	14 - 26
o Xylene			1	0.7 - 1.3	4	2.8 - 5.2	20	14 - 26
Styrene			1	0.7 - 1.3	4	2.8 - 5.2	20	14 - 26
Bromoform			0.5	0.35 - 0.65	2	1.4 - 2.6	10	7 - 13.0
Butyl acrylate			0.25	0.175 - 0.325	1	0.7 - 1.3	5	3.5 - 6.5
Isopropylbenzene			0.5	0.35 - 0.65	2	1.4 - 2.6	10	7 - 13.0
Bromobenzene			0.5	0.35 - 0.65	2	1.4 - 2.6	10	7 - 13.0
n-Propylbenzene			0.5	0.35 - 0.65	2	1.4 - 2.6	10	7 - 13.0
1,4-Dichlorobutane			0.5	0.35 - 0.65	2	1.4 - 2.6	10	7 - 13.0
1,1,2,2-Tetrachloroethane			0.5	0.35 - 0.65	2	1.4 - 2.6	10	7 - 13.0
4-Ethyltoluene			0.5	0.35 - 0.65	2	1.4 - 2.6	10	7 - 13.0
2-Chlorotoluene			0.5	0.35 - 0.65	2	1.4 - 2.6	10	7 - 13.0
1,3,5-Trimethylbenzene			0.5	0.35 - 0.65	2	1.4 - 2.6	10	7 - 13.0
1,2,3-Trichloropropane			0.5	0.35 - 0.65	2	1.4 - 2.6	10	7 - 13.0
trans-1,4-Dichloro-2-butene			0.5	0.35 - 0.65	2	1.4 - 2.6	10	7 - 13.0
4-Chlorotoluene			0.5	0.35 - 0.65	2	1.4 - 2.6	10	7 - 13.0
tert-Butylbenzene			0.5	0.35 - 0.65	2	1.4 - 2.6	10	7 - 13.0
Pentachloroethane			0.5	0.35 - 0.65	2	1.4 - 2.6	10	7 - 13.0
n-Butyl methacrylate			0.25	0.175 - 0.325	1	0.7 - 1.3	5	3.5 - 6.5
1,2,4-Trimethylbenzene			0.5	0.35 - 0.65	2	1.4 - 2.6	10	7 - 13.0
sec-Butylbenzene			0.5	0.35 - 0.65	2	1.4 - 2.6	10	7 - 13.0
p-Isopropyltoluene			0.5	0.35 - 0.65	2	1.4 - 2.6	10	7 - 13.0
1,3-Dichlorobenzene			0.5	0.35 - 0.65	2	1.4 - 2.6	10	7 - 13.0
1,4-Dichlorobenzene			0.5	0.35 - 0.65	2	1.4 - 2.6	10	7 - 13.0
p-Diethylbenzene			0.5	0.35 - 0.65	2	1.4 - 2.6	10	7 - 13.0
n-Butylbenzene			0.5	0.35 - 0.65	2	1.4 - 2.6	10	7 - 13.0
1,2-Dichlorobenzene			0.5	0.35 - 0.65	2	1.4 - 2.6	10	7 - 13.0
1,2,4,5-Tetramethylbenzene			0.5	0.35 - 0.65	2	1.4 - 2.6	10	7 - 13.0
1,2-Dibromo-3-chloropropane			0.5	0.35 - 0.65	2	1.4 - 2.6	10	7 - 13.0
1,3,5-Trichlorobenzene			0.5	0.35 - 0.65	2	1.4 - 2.6	10	7 - 13.0
Hexachlorobutadiene			0.5	0.35 - 0.65	2	1.4 - 2.6	10	7 - 13.0
1,2,4-Trichlorobenzene			0.5	0.35 - 0.65	2	1.4 - 2.6	10	7 - 13.0

Naphthalene			0.5	0.35 - 0.65	2	1.4 - 2.6	10	7 - 13.0
1,2,3-Trichlorobenzene			0.5	0.35 - 0.65	2	1.4 - 2.6	10	7 - 13.0
1,3-Dioxolane			10	7 - 13.0	40	28 - 52	100	70 - 130
Pentachloroethane			0.5	0.35 - 0.65	2	1.4 - 2.6	10	7 - 13.0
1,4-Dioxane (SIM)			0.5	0.35 - 0.65	2	1.4 - 2.6	10	7 - 13.0
1,1,2,2-Tetrachloroethane (SIM)			0.05	0.035 - 0.065	0.1	0.07 - 0.13	0.2	0.14 - 0.26

ICAL Low Point re-quantitation ranges

Soil	Level 0 (ug/kg)	L0 (70% - 130%)	Level 1 (ug/kg)	L1 (70% - 130%)	Level 1.5 (ug/kg)	L1.5 (70% - 130%)	Level 2 (ug/kg)	L2 (70% - 130%)	Level 3 (ug/kg)	L3 (70% - 130%)
Dichlorodifluoromethane	0.5	0.35 - 0.65	1	0.7 - 1.3	2	1.4 - 2.6	4	2.8 - 5.2	20	14 - 26
Chlorodifluoromethane	0.5	0.35 - 0.65	1	0.7 - 1.3	2	1.4 - 2.6	4	2.8 - 5.2	20	14 - 26
Chloromethane	0.5	0.35 - 0.65	1	0.7 - 1.3	2	1.4 - 2.6	4	2.8 - 5.2	20	14 - 26
Vinyl chloride	0.5	0.35 - 0.65	1	0.7 - 1.3	2	1.4 - 2.6	4	2.8 - 5.2	20	14 - 26
Bromomethane	0.5	0.35 - 0.65	1	0.7 - 1.3	2	1.4 - 2.6	4	2.8 - 5.2	20	14 - 26
Chloroethane	0.5	0.35 - 0.65	1	0.7 - 1.3	2	1.4 - 2.6	4	2.8 - 5.2	20	14 - 26
Trichlorofluoromethane	0.5	0.35 - 0.65	1	0.7 - 1.3	2	1.4 - 2.6	4	2.8 - 5.2	20	14 - 26
Ethyl ether	0.5	0.35 - 0.65	1	0.7 - 1.3	2	1.4 - 2.6	4	2.8 - 5.2	20	14 - 26
Ethanol	N/A	N/A	20	14 - 26	N/A	N/A	80	56 -104	200	140 - 260
1,1-Dichloroethene	0.5	0.35 - 0.65	1	0.7 - 1.3	2	1.4 - 2.6	4	2.8 - 5.2	20	14 - 26
Carbon disulfide	0.5	0.35 - 0.65	1	0.7 - 1.3	2	1.4 - 2.6	4	2.8 - 5.2	20	14 - 26
Freon-113	0.5	0.35 - 0.65	1	0.7 - 1.3	2	1.4 - 2.6	4	2.8 - 5.2	20	14 - 26
Iodomethane	0.5	0.35 - 0.65	1	0.7 - 1.3	2	1.4 - 2.6	4	2.8 - 5.2	20	14 - 26
Acrolein	0.5	0.35 - 0.65	1	0.7 - 1.3	2	1.4 - 2.6	4	2.8 - 5.2	20	14 - 26
Allyl chloride	0.5	0.35 - 0.65	1	0.7 - 1.3	2	1.4 - 2.6	4	2.8 - 5.2	20	14 - 26
Methylene chloride	0.5	0.35 - 0.65	1	0.7 - 1.3	2	1.4 - 2.6	4	2.8 - 5.2	20	14 - 26
Isopropyl alcohol	N/A	N/A	20	14 - 26	N/A	N/A	80	56 -104	200	140 - 260
Acetone	0.5	0.35 - 0.65	1	0.7 - 1.3	2	1.4 - 2.6	4	2.8 - 5.2	20	14 - 26
trans-1,2-Dichloroethene	0.5	0.35 - 0.65	1	0.7 - 1.3	2	1.4 - 2.6	4	2.8 - 5.2	20	14 - 26
Methyl acetate	0.5	0.35 - 0.65	1	0.7 - 1.3	2	1.4 - 2.6	4	2.8 - 5.2	20	14 - 26
Hexane	0.5	0.35 - 0.65	1	0.7 - 1.3	2	1.4 - 2.6	4	2.8 - 5.2	20	14 - 26

Soil	Level 0 (ug/kg)	L0 (70% - 130%)	Level 1 (ug/kg)	L1 (70% - 130%)	Level 1.5 (ug/kg)	L1.5 (70% - 130%)	Level 2 (ug/kg)	L2 (70% - 130%)	Level 3 (ug/kg)	L3 (70% - 130%)
Methyl tert-butyl ether	0.5	0.35 - 0.65	1	0.7 - 1.3	2	1.4 - 2.6	4	2.8 - 5.2	20	14 - 26
tert-Butyl alcohol	2.5	1.75 - 3.25	5	3.5 - 6.5	10	7.0 - 13.	20	14 - 26	100	70 - 130
Diisopropyl ether	0.5	0.35 - 0.65	1	0.7 - 1.3	2	1.4 - 2.6	4	2.8 - 5.2	20	14 - 26
1,1-Dichloroethane	0.5	0.35 - 0.65	1	0.7 - 1.3	2	1.4 - 2.6	4	2.8 - 5.2	20	14 - 26
Halothane	0.5	0.35 - 0.65	1	0.7 - 1.3	2	1.4 - 2.6	4	2.8 - 5.2	20	14 - 26
Acrylonitrile	0.5	0.35 - 0.65	1	0.7 - 1.3	2	1.4 - 2.6	4	2.8 - 5.2	20	14 - 26
Ethyl tert-butyl ether	0.5	0.35 - 0.65	1	0.7 - 1.3	2	1.4 - 2.6	4	2.8 - 5.2	20	14 - 26
Vinyl acetate	0.5	0.35 - 0.65	1	0.7 - 1.3	2	1.4 - 2.6	4	2.8 - 5.2	20	14 - 26
cis-1,2-Dichloroethene	0.5	0.35 - 0.65	1	0.7 - 1.3	2	1.4 - 2.6	4	2.8 - 5.2	20	14 - 26
2,2-Dichloropropane	0.5	0.35 - 0.65	1	0.7 - 1.3	2	1.4 - 2.6	4	2.8 - 5.2	20	14 - 26
Bromochloromethane	0.5	0.35 - 0.65	1	0.7 - 1.3	2	1.4 - 2.6	4	2.8 - 5.2	20	14 - 26
Cyclohexane	0.5	0.35 - 0.65	1	0.7 - 1.3	2	1.4 - 2.6	4	2.8 - 5.2	20	14 - 26
Chloroform	0.5	0.35 - 0.65	1	0.7 - 1.3	2	1.4 - 2.6	4	2.8 - 5.2	20	14 - 26
Ethyl acetate	0.5	0.35 - 0.65	1	0.7 - 1.3	2	1.4 - 2.6	4	2.8 - 5.2	20	14 - 26
Carbon tetrachloride	0.5	0.35 - 0.65	1	0.7 - 1.3	2	1.4 - 2.6	4	2.8 - 5.2	20	14 - 26
Tetrahydrofuran	0.5	0.35 - 0.65	1	0.7 - 1.3	2	1.4 - 2.6	4	2.8 - 5.2	20	14 - 26
1,1,1-Trichloroethane	0.5	0.35 - 0.65	1	0.7 - 1.3	2	1.4 - 2.6	4	2.8 - 5.2	20	14 - 26
2-Butanol	N/A	N/A	20	14 - 26	N/A	N/A	80	56 - 104	200	140 - 260
2-Butanone	0.5	0.35 - 0.65	1	0.7 - 1.3	2	1.4 - 2.6	4	2.8 - 5.2	20	14 - 26
1,1-Dichloropropene	0.5	0.35 - 0.65	1	0.7 - 1.3	2	1.4 - 2.6	4	2.8 - 5.2	20	14 - 26
Heptane	0.5	0.35 - 0.65	1	0.7 - 1.3	2	1.4 - 2.6	4	2.8 - 5.2	20	14 - 26
Benzene	0.5	0.35 - 0.65	1	0.7 - 1.3	2	1.4 - 2.6	4	2.8 - 5.2	20	14 - 26
tert-Amyl methyl ether	0.5	0.35 - 0.65	1	0.7 - 1.3	2	1.4 - 2.6	4	2.8 - 5.2	20	14 - 26
1,2-Dichloroethane	0.5	0.35 - 0.65	1	0.7 - 1.3	2	1.4 - 2.6	4	2.8 - 5.2	20	14 - 26
Isobutyl alcohol	N/A	N/A	20	14 - 26	N/A	N/A	80	56 - 104	200	140 - 260
2-Methyl-2-butanol	2.5	1.75 - 3.25	5	3.5 - 6.5	10	7	20	14 - 26	100	70 - 130
Methyl cyclohexane	0.5	0.35 - 0.65	1	0.7 - 1.3	2	1.4 - 2.6	4	2.8 - 5.2	20	14 - 26

Soil	Level 0 (ug/kg)	L0 (70% - 130%)	Level 1 (ug/kg)	L1 (70% - 130%)	Level 1.5 (ug/kg)	L1.5 (70% - 130%)	Level 2 (ug/kg)	L2 (70% - 130%)	Level 3 (ug/kg)	L3 (70% - 130%)
Trichloroethene	0.5	0.35 - 0.65	1	0.7 - 1.3	2	1.4 - 2.6	4	2.8 - 5.2	20	14 - 26
n-Butanol	N/A	N/A	20	14 - 26	N/A	N/A	80	56 - 104	200	140 - 260
Dibromomethane	0.5	0.35 - 0.65	1	0.7 - 1.3	2	1.4 - 2.6	4	2.8 - 5.2	20	14 - 26
1,2-Dichloropropane	0.5	0.35 - 0.65	1	0.7 - 1.3	2	1.4 - 2.6	4	2.8 - 5.2	20	14 - 26
4-penten-2-ol	2.5	1.75 - 3.25	5	3.5 - 6.5	10	7	20	14 - 26	100	70 - 130
2-Chloroethyl vinyl ether	0.5	0.35 - 0.65	1	0.7 - 1.3	2	1.4 - 2.6	4	2.8 - 5.2	20	14 - 26
Bromodichloromethane	0.5	0.35 - 0.65	1	0.7 - 1.3	2	1.4 - 2.6	4	2.8 - 5.2	20	14 - 26
Ethyl acrylate	0.5	0.35 - 0.65	1	0.7 - 1.3	2	1.4 - 2.6	4	2.8 - 5.2	20	14 - 26
Methyl methacrylate	0.5	0.35 - 0.65	1	0.7 - 1.3	2	1.4 - 2.6	4	2.8 - 5.2	20	14 - 26
1,4-Dioxane	N/A	N/A	40	28 - 52	80	56 – 104	200	140 - 260	1000	700 - 1300
cis-1,3-Dichloropropene	0.5	0.35 - 0.65	1	0.7 - 1.3	2	1.4 - 2.6	4	2.8 - 5.2	20	14 - 26
Octane	0.5	0.35 - 0.65	1	0.7 - 1.3	2	1.4 - 2.6	4	2.8 - 5.2	20	14 - 26
Toluene	0.5	0.35 - 0.65	1	0.7 - 1.3	2	1.4 - 2.6	4	2.8 - 5.2	20	14 - 26
4-Methyl-2-pentanone	0.5	0.35 - 0.65	1	0.7 - 1.3	2	1.4 - 2.6	4	2.8 - 5.2	20	14 - 26
Tetrachloroethene	0.5	0.35 - 0.65	1	0.7 - 1.3	2	1.4 - 2.6	4	2.8 - 5.2	20	14 - 26
2-Nitropropane	0.5	0.35 - 0.65	1	0.7 - 1.3	2	1.4 - 2.6	4	2.8 - 5.2	20	14 - 26
Chloropicrin	N/A	N/A	50	35 - 65	N/A	N/A	100	70 - 130	200	140 - 260
trans-1,3-Dichloropropene	0.5	0.35 - 0.65	1	0.7 - 1.3	2	1.4 - 2.6	4	2.8 - 5.2	20	14 - 26
Methyl isothiocyanate	0.5	0.35 - 0.65	1	0.7 - 1.3	2	1.4 - 2.6	4	2.8 - 5.2	20	14 - 26
4-Methyl-2-pentanol	N/A	N/A	20	14 - 26	N/A	N/A	80	56 - 104	200	140 - 260
Ethyl methacrylate	0.5	0.35 - 0.65	1	0.7 - 1.3	2	1.4 - 2.6	4	2.8 - 5.2	20	14 - 26
1,1,2-Trichloroethane	0.5	0.35 - 0.65	1	0.7 - 1.3	2	1.4 - 2.6	4	2.8 - 5.2	20	14 - 26
Chlorodibromomethane	0.5	0.35 - 0.65	1	0.7 - 1.3	2	1.4 - 2.6	4	2.8 - 5.2	20	14 - 26
1,3-Dichloropropane	0.5	0.35 - 0.65	1	0.7 - 1.3	2	1.4 - 2.6	4	2.8 - 5.2	20	14 - 26
1,2-Dibromoethane	0.5	0.35 - 0.65	1	0.7 - 1.3	2	1.4 - 2.6	4	2.8 - 5.2	20	14 - 26
n-Butyl Acetate	0.5	0.35 - 0.65	1	0.7 - 1.3	2	1.4 - 2.6	4	2.8 - 5.2	20	14 - 26

Soil	Level 0 (ug/kg)	L0 (70% - 130%)	Level 1 (ug/kg)	L1 (70% - 130%)	Level 1.5 (ug/kg)	L1.5 (70% - 130%)	Level 2 (ug/kg)	L2 (70% - 130%)	Level 3 (ug/kg)	L3 (70% - 130%)
2-Hexanone	0.5	0.35 - 0.65	1	0.7 - 1.3	2	1.4 - 2.6	4	2.8 - 5.2	20	14 - 26
Nonane	0.5	0.35 - 0.65	1	0.7 - 1.3	2	1.4 - 2.6	4	2.8 - 5.2	20	14 - 26
Chlorobenzene	0.5	0.35 - 0.65	1	0.7 - 1.3	2	1.4 - 2.6	4	2.8 - 5.2	20	14 - 26
Ethylbenzene	0.5	0.35 - 0.65	1	0.7 - 1.3	2	1.4 - 2.6	4	2.8 - 5.2	20	14 - 26
1,1,1,2-Tetrachloroethane	0.5	0.35 - 0.65	1	0.7 - 1.3	2	1.4 - 2.6	4	2.8 - 5.2	20	14 - 26
p/m Xylene	1	0.7 - 1.3	2	1.4 - 2.6	4	2.8 - 5.2	8	5.6 - 10.4	40	28 - 52
o Xylene	1	0.7 - 1.3	2	1.4 - 2.6	4	2.8 - 5.2	8	5.6 - 10.4	40	28 - 52
Styrene	1	0.7 - 1.3	2	1.4 - 2.6	4	2.8 - 5.2	8	5.6 - 10.4	40	28 - 52
Bromoform	0.5	0.35 - 0.65	1	0.7 - 1.3	2	1.4 - 2.6	4	2.8 - 5.2	20	14 - 26
Butyl acrylate	0.5	0.35 - 0.65	1	0.7 - 1.3	2	1.4 - 2.6	4	2.8 - 5.2	20	14 - 26
Isopropylbenzene	0.5	0.35 - 0.65	1	0.7 - 1.3	2	1.4 - 2.6	4	2.8 - 5.2	20	14 - 26
Bromobenzene	0.5	0.35 - 0.65	1	0.7 - 1.3	2	1.4 - 2.6	4	2.8 - 5.2	20	14 - 26
Decane	0.5	0.35 - 0.65	1	0.7 - 1.3	2	1.4 - 2.6	4	2.8 - 5.2	20	14 - 26
n-Propylbenzene	0.5	0.35 - 0.65	1	0.7 - 1.3	2	1.4 - 2.6	4	2.8 - 5.2	20	14 - 26
1,4-Dichlorobutane	0.5	0.35 - 0.65	1	0.7 - 1.3	2	1.4 - 2.6	4	2.8 - 5.2	20	14 - 26
1,1,2,2-Tetrachloroethane	0.5	0.35 - 0.65	1	0.7 - 1.3	2	1.4 - 2.6	4	2.8 - 5.2	20	14 - 26
4-Ethyltoluene	0.5	0.35 - 0.65	1	0.7 - 1.3	2	1.4 - 2.6	4	2.8 - 5.2	20	14 - 26
2-Chlorotoluene	0.5	0.35 - 0.65	1	0.7 - 1.3	2	1.4 - 2.6	4	2.8 - 5.2	20	14 - 26
1,3,5-Trimethylbenzene	0.5	0.35 - 0.65	1	0.7 - 1.3	2	1.4 - 2.6	4	2.8 - 5.2	20	14 - 26
1,2,3-Trichloropropane	0.5	0.35 - 0.65	1	0.7 - 1.3	2	1.4 - 2.6	4	2.8 - 5.2	20	14 - 26
trans-1,4-Dichloro-2-butene	0.5	0.35 - 0.65	1	0.7 - 1.3	2	1.4 - 2.6	4	2.8 - 5.2	20	14 - 26
4-Chlorotoluene	0.5	0.35 - 0.65	1	0.7 - 1.3	2	1.4 - 2.6	4	2.8 - 5.2	20	14 - 26
tert-Butylbenzene	0.5	0.35 - 0.65	1	0.7 - 1.3	2	1.4 - 2.6	4	2.8 - 5.2	20	14 - 26
Pentachloroethane	0.5	0.35 - 0.65	1	0.7 - 1.3	2	1.4 - 2.6	4	2.8 - 5.2	20	14 - 26
n-Butyl methacrylate	0.5	0.35 - 0.65	1	0.7 - 1.3	2	1.4 - 2.6	4	2.8 - 5.2	20	14 - 26
1,2,4-Trimethylbenzene	0.5	0.35 - 0.65	1	0.7 - 1.3	2	1.4 - 2.6	4	2.8 - 5.2	20	14 - 26

Soil	Level 0 (ug/kg)	L0 (70% - 130%)	Level 1 (ug/kg)	L1 (70% - 130%)	Level 1.5 (ug/kg)	L1.5 (70% - 130%)	Level 2 (ug/kg)	L2 (70% - 130%)	Level 3 (ug/kg)	L3 (70% - 130%)
Limonene	0.5	0.35 - 0.65	1	0.7 - 1.3	2	1.4 - 2.6	4	2.8 - 5.2	20	14 - 26
sec-Butylbenzene	0.5	0.35 - 0.65	1	0.7 - 1.3	2	1.4 - 2.6	4	2.8 - 5.2	20	14 - 26
p-Isopropyltoluene	0.5	0.35 - 0.65	1	0.7 - 1.3	2	1.4 - 2.6	4	2.8 - 5.2	20	14 - 26
1,3-Dichlorobenzene	0.5	0.35 - 0.65	1	0.7 - 1.3	2	1.4 - 2.6	4	2.8 - 5.2	20	14 - 26
1,4-Dichlorobenzene	0.5	0.35 - 0.65	1	0.7 - 1.3	2	1.4 - 2.6	4	2.8 - 5.2	20	14 - 26
trans-Decahydronaphthalene	0.5	0.35 - 0.65	1	0.7 - 1.3	2	1.4 - 2.6	4	2.8 - 5.2	20	14 - 26
Undecane	0.5	0.35 - 0.65	1	0.7 - 1.3	2	1.4 - 2.6	4	2.8 - 5.2	20	14 - 26
p-Diethylbenzene	0.5	0.35 - 0.65	1	0.7 - 1.3	2	1.4 - 2.6	4	2.8 - 5.2	20	14 - 26
n-Butylbenzene	0.5	0.35 - 0.65	1	0.7 - 1.3	2	1.4 - 2.6	4	2.8 - 5.2	20	14 - 26
Hexachloroethane	0.5	0.35 - 0.65	1	0.7 - 1.3	2	1.4 - 2.6	4	2.8 - 5.2	20	14 - 26
1,2-Dichlorobenzene	0.5	0.35 - 0.65	1	0.7 - 1.3	2	1.4 - 2.6	4	2.8 - 5.2	20	14 - 26
cis-Decahydronaphthalene	0.5	0.35 - 0.65	1	0.7 - 1.3	2	1.4 - 2.6	4	2.8 - 5.2	20	14 - 26
1,2,4,5-Tetramethylbenzene	0.5	0.35 - 0.65	1	0.7 - 1.3	2	1.4 - 2.6	4	2.8 - 5.2	20	14 - 26
1,2-Dibromo-3-chloropropane	0.5	0.35 - 0.65	1	0.7 - 1.3	2	1.4 - 2.6	4	2.8 - 5.2	20	14 - 26
1,3,5-Trichlorobenzene	0.5	0.35 - 0.65	1	0.7 - 1.3	2	1.4 - 2.6	4	2.8 - 5.2	20	14 - 26
Nitrobenzene	0.5	0.35 - 0.65	1	0.7 - 1.3	2	1.4 - 2.6	4	2.8 - 5.2	20	14 - 26
Hexachlorobutadiene	0.5	0.35 - 0.65	1	0.7 - 1.3	2	1.4 - 2.6	4	2.8 - 5.2	20	14 - 26
1,2,4-Trichlorobenzene	0.5	0.35 - 0.65	1	0.7 - 1.3	2	1.4 - 2.6	4	2.8 - 5.2	20	14 - 26
Naphthalene	0.5	0.35 - 0.65	1	0.7 - 1.3	2	1.4 - 2.6	4	2.8 - 5.2	20	14 - 26
1,2,3-Trichlorobenzene	0.5	0.35 - 0.65	1	0.7 - 1.3	2	1.4 - 2.6	4	2.8 - 5.2	20	14 - 26
1,3-Dioxolane	N/A	N/A	25	17.5 - 32.5	N/A	N/A	50	35 - 65	100	70 - 130

APPENDIX J

SITE MANAGEMENT FORMS

SSDS INSPECTION CHECKLIST

Site Name:_______ Location:_______ Project Number:

Inspector Name: _______ Date: _____Weather Conditions: ________

Reason for Inspection (i.e., routine, maintenance, severe condition, etc.):

SMD and/or Building Number:

Check one of the following: **Y:** Yes **N:** No **NA**: Not Applicable

		Y	N	NA	Normal Situation	Remarks
Records						
1	Is the Operations & Maintenance Plan readily available on-site?					
2	Based on site records, when was the last inspection, maintenance, or repair event?					
3	Based on site records, was the system inoperational for any amount of time since the last inspection, maintenance, or repair event? For how long? Provide details.					
Alarm System						
4	Do the alarm lights indicate that the system is operational?					
General System						
5	Is there any construction activity, or indication of any construction activity within the past certification year (including any tenant improvements), that included the breaching of the floor slab, on-site at the time of this inspection?					
6	If YES to number 5, is there documentation that the Soil Management Plan, HASP, and CAMP for the site was/is being followed?					
7	If YES to number 5, is there documentation that all breaches in the floor slab have been sealed?					
8	Does all visible SMD piping appear intact and undamaged?					
9	Have any intake points been constructed at the roof near (less than 10 feet) the SMD blower discharge point?					

SSDS INSPECTION CHECKLIST

Site Name:_______ Location:_______ Project Number:

Inspector Name: _______ Date: _____Weather Conditions: ________

Reason for Inspection (i.e., routine, maintenance, severe condition, etc.):

SMD and/or Building Number:

Check one of the following: **Y:** Yes **N:** No **NA**: Not Applicable

		Y	N	NA	Normal Situation	Remarks
SMD Blower Unit						
10	Is the SMD blower operational at the time of the inspection?					
11	What is the VelociCalc Meter reading?					
12	Is the SMD blower expelling air at the discharge point?					
Routine Blower Maintenance						
13	Remove dust and debris from surface of blower.					
14	Replace dirty or clogged filter cartridge.					

** **If the answer to any of the above questions indicate the SMD system is non-operational or malfunctioning, or that this EC is in non-compliance, additional remarks must be provided and, where applicable, documentation attached to this checklist detailing**
* **additional inspection and repair activities.**

Additional remarks: ____

____

____

____

____

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Minimum Inspection Schedule: SMD inspections will be conducted quarterly for the first certification year at a minimum. Additional inspections will also be conducted at times of maintenance, repair, or severe condition events. Inspections will be conducted annually, at a minimum, following the first certification year. Inspection frequency is subject to change with the approval of NYSDEC. All inspection events will utilize this checklist.

COMPOSITE COVER SYSTEM INSPECTION CHECKLIST

Site Name:_______ Location:_______

Project Number: Inspector Name: __ Date: _________

______________________Weather

Conditions: Reason for Inspection

Check one of the following: **Y:** Yes **N:** No **NA**: Not Applicable

		Y	N	NA	Normal Situation	Remarks
General						
1	What are the current site conditions?					
Site Cover System						
2	Are there any indications of a breach in the site cover system at the time of this inspection?					
3	Is there any construction activity, or indication of any construction activity within the past certification year (including any tenant improvements), that included the breaching of the site cover system, on-site at the time of this inspection?					
4	If YES to number 3, is there documentation that the Soil Management Plan, HASP, and CAMP for the site was/is being followed? Any breach of the cover system into residual contaminated material (or the SMDS) should be overseen by the remedial engineer, and documented and reported in the periodic review report.					

If the answer to any of the above questions indicate non-compliance with ECs for the site, additional remarks must be provided and, where applicable, documentation attached to this checklist detailing additional inspection and repair activities.

Additional remarks: ____

Minimum Inspection Schedule: Site-wide inspections will be conducted annually, per certification year, at a minimum. Additional inspections will also be conducted at times of severe condition events. All inspection events will utilize this checklist.

SITE WIDE INSPECTION CHECKLIST

Site Name: ________________________ Location: ____________________________ Project Number: ______________________________

Inspector Name: ___________________ Date: _______________ Weather Conditions: ____

Reason for Inspection (i.e., routine, severe condition, etc.): ________ Annual Inspection____

Check one of the following: **Y:** Yes **N:** No **NA**: Not Applicable

		Y	N	NA	Normal Situation	Remarks
General						
1	What are the current site conditions?	--	--	--	--	
2	Are all applicable site records (e.g., documentation of construction activity, most current deed restriction, etc.) complete and up to date?					
Deed Restriction						
3	Has site use (restricted residential) remained the same?					
4	Does it appear that all deed restriction stipulations have been followed?					
Impermeable Site Cover						
5	Are there any indications of a breach in the cover system at the time of this inspection?					
6	Are there any cracks in the building slabs?					
7	Are there any cracks in the building walls?					
8	Is there any construction activity, or indication of any construction activity within the past certification year (including any tenant improvements), that included the breaching of the cover system, on-site at the time of this inspection?					
9	If YES to number 8, is there documentation that the Soil Management Plan, HASP, and CAMP for the site was/is being followed?					

***** If the answer to any of the above questions indicate non-compliance with any IC/ECs for the site, additional remarks must be provided and, where applicable, documentation attached to this checklist detailing additional inspection and repair activities.**

Additional remarks ____

Minimum Inspection Schedule: Site-wide inspections will be conducted annually, per certification year, at a minimum. Additional inspections will also be conducted at times of severe condition events. All inspection events will utilize this checklist.

APPENDIX K

FIELD ACTIVITIES PLAN

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Field Activities Plan

4778 Broadway
New York, New York 10034

BCP# C231131

February 2025
41.0163310.10

PREPARED FOR:
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15 Verbana Avenue, Suite 200
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PREPARED By:

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APPENDICES

1.0 PURPOSE

The purpose of this Field Activities plan is to outline the proposed media sampling frequency, quality, methodology and analytical parameters to demonstrate compliance with the Site Management Plan. Proposed media sampling includes:

- Groundwater sampling of existing permanent monitoring wells for a minimum of two years.
- Evaluate if significant changes in groundwater flow have occurred over time;
- Monitor the effectiveness of natural attenuation and in situ chemical oxidation injections by evaluating the quality of groundwater to evaluate the trends and distribution of Site-related petroleum constituents over time;
- Evaluate if improvement in response to contaminant source removal and treatment is required; and,
- Determine if/when cessation of continued groundwater monitoring is appropriate.

1.1 PROJECT OVERVIEW

The following environmental work plans and reports were developed for the Site:

- Phase I Environmental Site Assessment, (AEI Consultants, March 2018);
- Phase II Subsurface Investigation Report, (AEI Consultants, April 2017);
- Remedial Investigation Work Plan, (AEI Consultants, November 2019);
- Remedial Investigation Report, (AEI Consultants, December 2020);
- Remedial Action Work Plan, (AEI Consultants, April 2021); and
- Supplemental Remedial Action Plan (HCS Civil & Environmental Engineering LLC, October 2024).

M4778 Broadway LLC entered into a Brownfield Cleanup Agreement (BCA), in September 2019 with the NYSDEC to remediate the site. The Remedial Investigation (RI) was performed to compile and evaluate data and information necessary to develop the RAWP in a manner that renders the Site protective of public health and the environment consistent with the contemplated end use. The previous investigation activities identified impacts to soil and groundwater that was likely related to petroleum underground storage tanks (USTs) formerly located at the Site. The RAWP established remedial action objectives and the selected remedial action which complies with applicable environmental standards, criteria and guidance and applicable laws and regulations. The New York State Department of Environmental Conservation (NYSDEC) approved the RAWP in May of 2021.

1.2 SITE DESCRIPTION

The Site is located in the Inwood section of Manhattan, New York and is identified as Block 2233, Lot 10 on the New York City Tax Map. The Site is 11,800-square feet and is bounded by Broadway to the north, Harold O. Levy School to the south, a mixed-use residential and commercial building to the east, and a supermarket to the west. Currently, the upper 15 feet of overburden soils on Lot 10 have been excavated and removed except for a 10 feet by 90 feet “bench” adjacent to supermarket that was only excavated to 9 feet to maintain structural support. The excavation was completed in support of the construction of the sub-grade foundation and basement for the 12-story residential building. Construction of development has been completed. In-Situ Chemical Oxidation (ISCO) injections for treatment of residual contamination within the saturated soils and groundwater were completed at the site In October 2023 and November 2024.

2.0 GROUNDWATER MONITORING

In accordance with the approved RAWP, the Groundwater Treatment Plan dated October 27, 2022, and the Supplemental Remedial Action Plan dated October 4, 2024, ISCO injections were completed at the Site over two separate rounds. The initial ISCO injections conducted in October 2023 with post-injection sampling completed in December 2023 and March 2024. In accordance with the approved plan, 11 injection wells (IWs) constructed of 4-inch PVC screen and riser pipe and six monitoring wells (MWs) constructed of 2-inch PVC screen and riser pipe were installed in March 2023. Each screened interval extends to the encountered bedrock surface or 15 feet below the existing basement slab grade, whichever comes first, well within the zone of saturated soils and impacted groundwater. After completion of the injections, the six MWs were sampled and analyzed for volatile organic compounds (VOCs) and semi-volatile organic compounds (SVOCs) in December 2023. A follow up round of sampling was completed in March 2024 in the six MWs with sampling only analyzed for VOCs. Initial monitoring results from after the first round of injections indicated that additional contamination may have been mobilized from impacted soils to the groundwater and additional treatment would be necessary to remediate.

The supplemental round of Isco Injections was completed in November 2024 with 8-week and 12-week post injection sampling completed in January 2025. After completion of the injections, 8-week post-injection groundwater samples were collected from the six MWs and analyzed for VOCs, SVOCs, and sulfate. 12-week post-injection groundwater samples were collected from the six MWs and analyzed for VOCs, SVOCs, sulfate, and total petroleum hydrocarbons (TPH). Post-injection monitoring indicated similar results after the first round of ISCO injections with increases in petroleum related contaminants in groundwater which may have mobilized from impacted soils.

This field activities plan outlines the quarterly groundwater monitoring for a total of eight consecutive quarters to assess groundwater quality and improvements. During the groundwater monitoring events, all six installed monitoring wells are proposed to be used to monitor the general groundwater flow direction and groundwater quality. All monitoring wells are depicted on Figure 3 of the Site Management Plan (SMP).

2.1 MONITORING WELL WATER LEVEL GAUGING

Prior to collecting water quality data, water level data will be collected from the monitoring wells by first conducting a round of synoptic well gauging. Immediately upon opening the protective casing of the monitoring well, a MiniRAE 3000 photoionization detector (PID) or equivalent will be used to collect and record an initial reading. An interface probe will then be used to obtain the depth to water from the top of the inner casing (TIC) and the total depth of the well. This data will be tabulated and presented in a table. This data will be used to assess groundwater flow direction and current elevation. The on-site monitoring wells were previously surveyed by a New York-licensed land surveyor to facilitate calculation of groundwater surface elevations at each monitoring well.

2.2 GROUNDWATER QUALITY MONITORING

Groundwater sampling will be conducted on a quarterly basis with the minimum time between events no less than 6 weeks. Groundwater samples from each of the six the monitoring wells will be collected and analyzed for a minimum of Target Compound List (TCL) VOCs via EPA Method 8260 and TCL SVOCs via EPA Method 8270.

2.2.1 Groundwater Sampling

Groundwater samples will be collected utilizing low-flow purging and sampling techniques. The wells will be purged with dedicated disposable polyethylene tubing connected to a peristaltic pump. The depth of the tubing intake will be adjusted during purging to help ensure removal of the water column in the well, and collection of groundwater samples representative of the shallow aquifer as needed.

Using a flow-through cell with a calibrated water quality meter and probes, the general water quality indicator parameters (pH, conductivity, temperature, dissolved oxygen [DO], and redox potential [eH]) will be measured during purging. All wells will be purged at a flow rate ranging from 100 to 300 milliliters per minute. Water quality indicator parameters and water level measurements will be collected every 5 minutes until an equilibrium condition was established (i.e., three consecutive readings of: pH ± 0.1 units; conductivity ± 3%; temperature ± 3%; turbidity ± 10%, and ± 10% DO). Any down-hole, non-dedicated sampling equipment will be decontaminated between each use. Field data will be recorded on standard groundwater purge logs as provided in Appendix A. Development water and sampling purge water will be collected in buckets and disposed of to the ground within the Site borders after passing through a bucket of granular activated carbon.

Once equilibrium is established, the dedicated tubing will be disconnected from the flow-through cell and the groundwater to be sampled will be directed from the dedicated tubing into laboratory-supplied containers for VOCs and SVOCs. Once sealed and labeled the sample bottles will placed in coolers and transported to Alpha Analytical of Westborough, Massachusetts (New York Certification No. 11148) for analysis under the proper chain of custody documentation.

2.2.2 Deviations from the Field Activities Plan

If any deviations from the workplan described herein occur during any of the proposed sampling events they will be discussed along with a proposed solution or remedy to prevent the deviation from occurring again, if able.

3.0 PRESENTATION OF FINDINGS

The results of each quarterly groundwater sampling event will be compiled into a Quarterly Groundwater Monitoring report. The report will include discussion of the following:

- Well gauging and PID screening results along with a table presenting these results,
- A figure depicting the groundwater flow direction,
- Groundwater sampling methodology,
- Deviations from the workplan, if encountered,

- Groundwater sampling analytical results summary and table,
- A cumulative data table encompassing all quarters of groundwater sampling, and;
- Interpretation, conclusions, and discussion of the results/groundwater data trends,

At the end of the final quarter of groundwater sampling, if the data is favorable, GZA will recommend discontinuation of groundwater monitoring.

Appendix A

Groundwater Purge Log

WELL PURGE DATA SHEET
WELL ID:

CLIENT: M4778 Broadway LLC
SITE: 4778 Broadway, New York, NY 10034
WEATHER:

PROJECT NO: 41.0163281.00
Date:
SAMPLER(S):

COLUMN OF WATER IN WELL:

T = Depth to Bottom (ft) - Static Water Level (ft)
= ________ - ________
Water Column (T) = ________ (ft)

TOTAL VOLUME PURGED:

Design = ________ (gallons)
Actual = ________ [1] (gallons)

PURGE RATE: Variable (mL / min)
PURGE METHOD: Peristaltic Pump, Low Flow Sampling

GALLONS OF WATER PER WELL VOLUME:

Well Volume = Water Column (T) (ft) x Multiplier
= ________ x ________
Well Volume (V) = ________ (Gallons)

well diameter	multiplier
1	0.041
1.5	0.092
2	**0.163**
4	0.653
6	1.469

SCREENED INTERVAL: approximately to ft bgs

WATER QUALITY:

Time	Elapsed Time (Mins)	Purged Volume (gal)	Depth to Water (ft)	pH (SU)	Specific Conductivity (mS/cm)	Turbidity (NTU)	Dissolved Oxygen (mg/l)	Temp (^{0}C)	ORP	Notes

UNITS:

gal. - gallons
ft. - feet
SU - standard units
ORP - Oxygen Reduction Potential

mS/cm - millisiemens per centimeter
NTU -nephelometric turbidity units
mg/l -milligrams per liter
^{0}C - degrees Celsius
bgs - below ground surface
NA - not applicable

NOTES AND OBSERVATIONS:

GZA GeoEnvironmental, Inc.

APPENDIX L

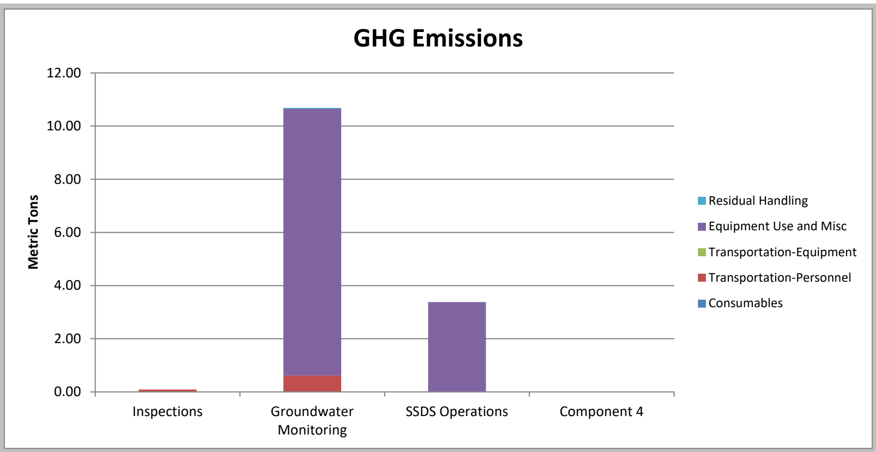
GREEN SUSTAINABLE REMEDIATION EVALUATION

SiteWise Project Summary
Overall

Sustainable Remediation - Environmental Footprint Summary
4778 Broadway SMP

Phase	Activities	GHG Emissions	Total Energy Used	Water Consumption	Electricity Usage	Onsite NOx Emissions	Onsite SOx Emissions	Onsite PM10 Emissions	Total NOx Emissions	Total SOx Emissions	Total PM10 Emissions	Accident Risk Fatality	Accident Risk Injury
		metric ton	MMBTU	gallons	MWH	metric ton	metric ton	metric ton	metric ton	metric ton	metric ton		
Inspections	Consumables	0.00	0.0E+00	NA	NA	NA	NA	NA	0.0E+00	0.0E+00	0.0E+00	NA	NA
	Transportation-Personnel	0.09	1.1E+00	NA	NA	NA	NA	NA	3.3E-05	1.2E-06	6.7E-06	1.8E-06	1.5E-04
	Transportation-Equipment	0.00	0.0E+00	NA	NA	NA	NA	NA	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	Equipment Use and Misc	0.00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	7.2E-08	8.8E-05
	Residual Handling	0.00	0.0E+00	NA	NA	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	Sub-Total	0.09	1.13E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.33E-05	1.17E-06	6.75E-06	1.91E-06	2.36E-04
Groundwater Monitoring	Consumables	0.00	1.5E-01	NA	NA	NA	NA	NA	1.1E-05	2.0E-05	3.9E-06	NA	NA
	Transportation-Personnel	0.61	7.7E+00	NA	NA	NA	NA	NA	1.9E-04	8.0E-06	3.8E-05	1.0E-05	8.3E-04
	Transportation-Equipment	0.00	0.0E+00	NA	NA	NA	NA	NA	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	Equipment Use and Misc	10.04	1.4E+02	2.3E+02	2.3E-03	0.0E+00	0.0E+00	0.0E+00	4.8E-02	3.6E-02	4.0E-03	2.9E-07	3.5E-04
	Residual Handling	0.03	3.7E-01	NA	NA	0.0E+00	0.0E+00	0.0E+00	8.9E-06	1.6E-07	7.9E-07	1.6E-07	1.3E-05
	Sub-Total	10.68	1.52E+02	2.25E+02	2.30E-03	0.00E+00	0.00E+00	0.00E+00	4.84E-02	3.62E-02	4.06E-03	1.08E-05	1.20E-03
SSDS Operations	Consumables	0.00	0.0E+00	NA	NA	NA	NA	NA	0.0E+00	0.0E+00	0.0E+00	NA	NA
	Transportation-Personnel	0.00	0.0E+00	NA	NA	NA	NA	NA	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	Transportation-Equipment	0.00	0.0E+00	NA	NA	NA	NA	NA	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	Equipment Use and Misc	3.38	7.8E+01	5.4E+03	1.1E+01	0.0E+00	0.0E+00	0.0E+00	3.3E-03	4.4E-03	2.4E-03	0.0E+00	0.0E+00
	Residual Handling	0.00	0.0E+00	NA	NA	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	Sub-Total	3.38	7.79E+01	5.41E+03	1.06E+01	0.00E+00	0.00E+00	0.00E+00	3.26E-03	4.37E-03	2.44E-03	0.00E+00	0.00E+00
Component 4	Consumables	0.00	0.0E+00	NA	NA	NA	NA	NA	0.0E+00	0.0E+00	0.0E+00	NA	NA
	Transportation-Personnel	0.00	0.0E+00	NA	NA	NA	NA	NA	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	Transportation-Equipment	0.00	0.0E+00	NA	NA	NA	NA	NA	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	Equipment Use and Misc	0.00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	Residual Handling	0.00	0.0E+00	NA	NA	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	Sub-Total	0.00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Total		**1.4E+01**	**2.3E+02**	**5.6E+03**	**1.1E+01**	**0.0E+00**	**0.0E+00**	**0.0E+00**	**5.2E-02**	**4.1E-02**	**6.5E-03**	**1.3E-05**	**1.4E-03**

Remedial Alternative Phase	Non-Hazardous Waste Landfill Space	Hazardous Waste Landfill Space	Topsoil Consumption	Costing	Lost Hours - Injury	Percent electricity from renewable sources	Total Cost with Footprint Reduction
	tons	tons	cubic yards	$		%	
Inspections	0.0E+00	0.0E+00	0.0E+00	0	1.9E-03	0.0%	**$0**
Groundwater Monitoring	0.0E+00	0.0E+00	0.0E+00	0	9.6E-03	24.2%	
SSDS Operations	0.0E+00	0.0E+00	0.0E+00	0	0.0E+00	24.2%	
Component 4	0.0E+00	0.0E+00	0.0E+00	0	0.0E+00	0.0%	
Total	**0.0E+00**	**0.0E+00**	**0.0E+00**	**$0**	**1.1E-02**	**12.1%**	


GHG Emissions
Metric Tons
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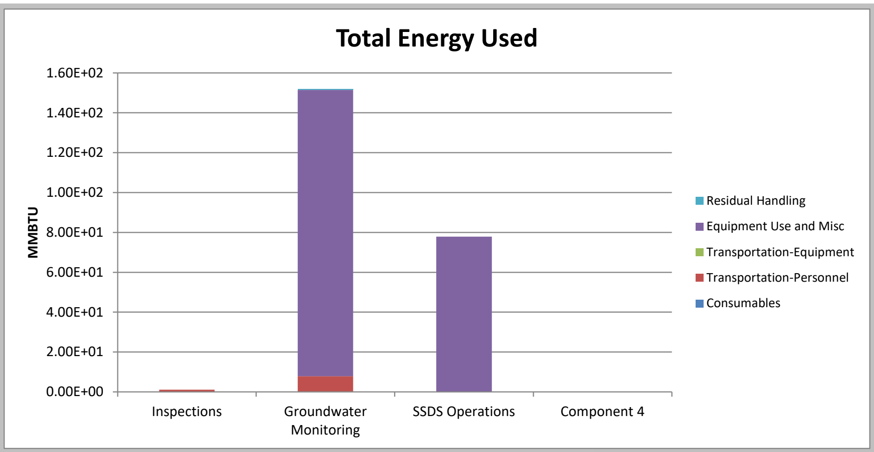
10.00
8.00
6.00
4.00
2.00
0.00
Inspections
Groundwater Monitoring
SSDS Operations
Component 4
Residual Handling
Equipment Use and Misc
Transportation-Equipment
Transportation-Personnel
Consumables


Total Energy Used
MMBTU
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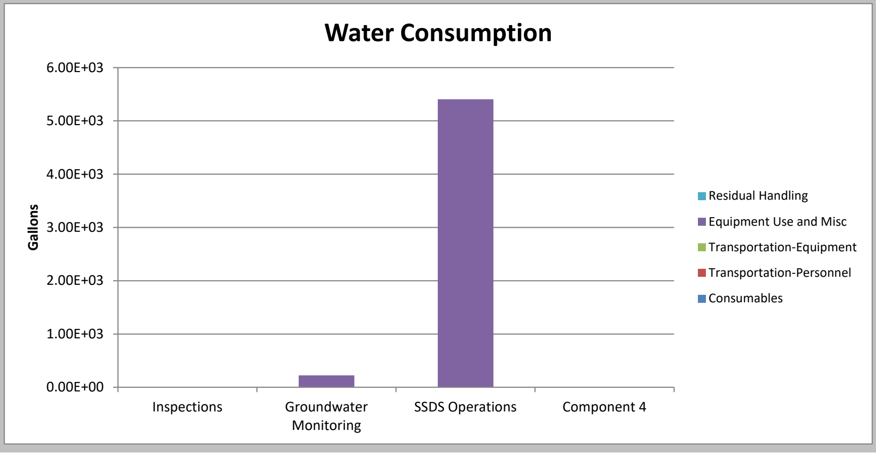
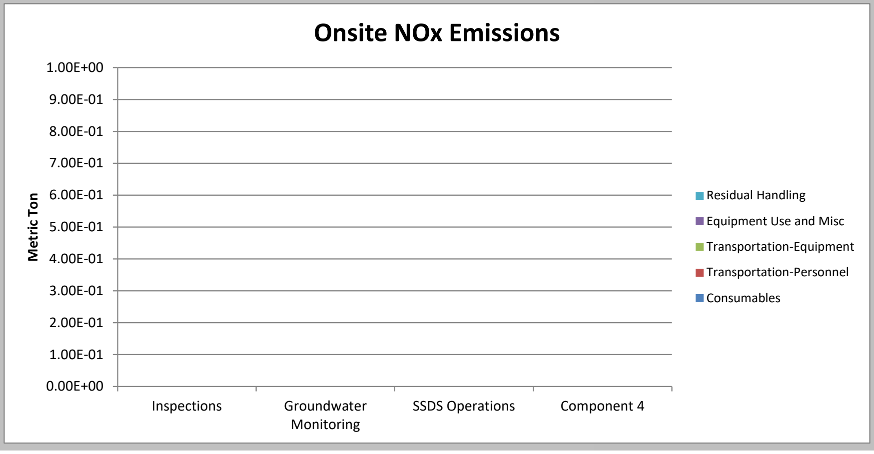
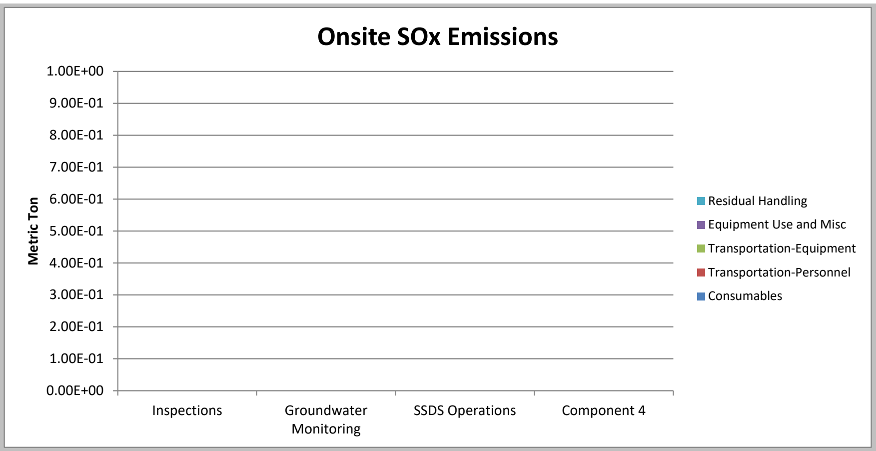
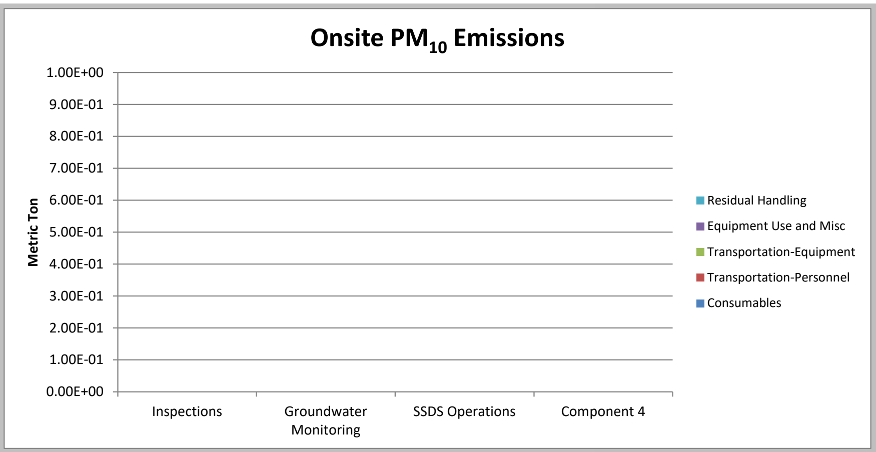
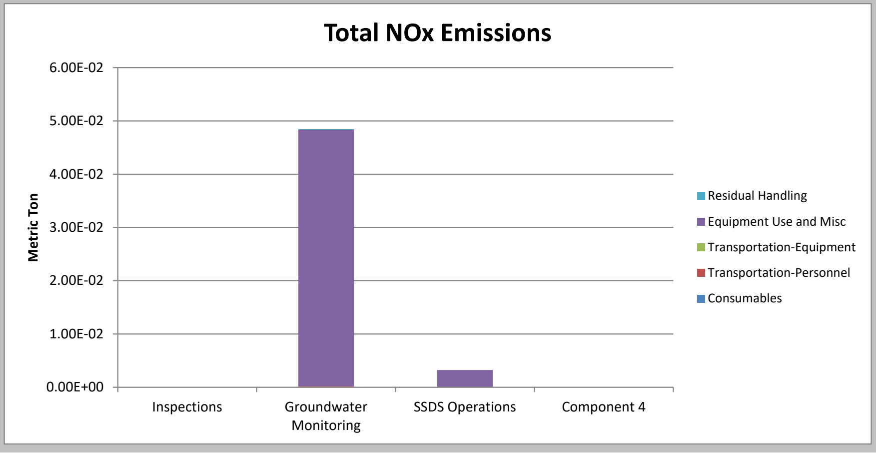
1.40E+02
1.20E+02
1.00E+02
8.00E+01
6.00E+01
4.00E+01
2.00E+01
0.00E+00
Inspections
Groundwater Monitoring
SSDS Operations
Component 4
Residual Handling
Equipment Use and Misc
Transportation-Equipment
Transportation-Personnel
Consumables

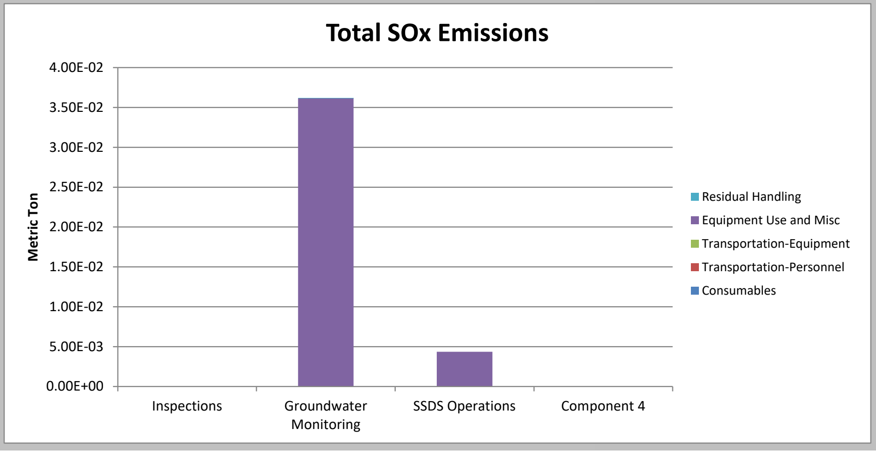

Water Consumption
Gallons
6.00E+03
5.00E+03
4.00E+03
3.00E+03
2.00E+03
1.00E+03
0.00E+00
Inspections
Groundwater Monitoring
SSDS Operations
Component 4
Residual Handling
Equipment Use and Misc
Transportation-Equipment
Transportation-Personnel
Consumables

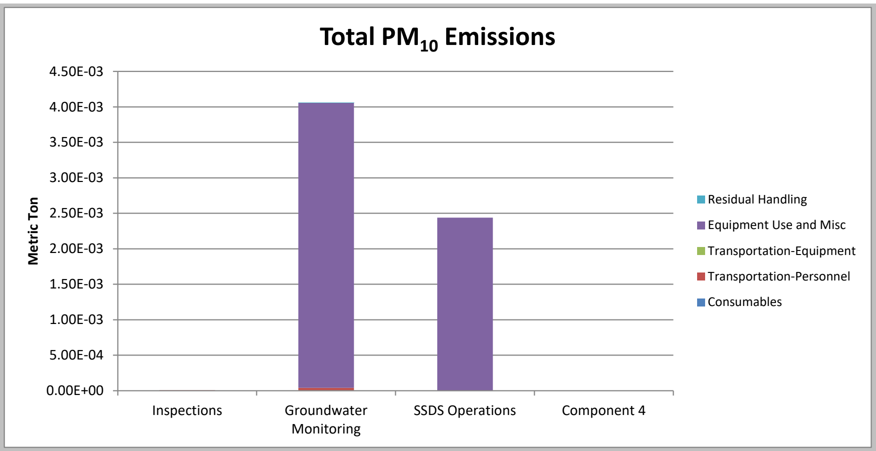

Onsite NOx Emissions
Metric Ton
1.00E+00
9.00E-01
8.00E-01
7.00E-01
6.00E-01
5.00E-01
4.00E-01
3.00E-01
2.00E-01
1.00E-01
0.00E+00
Inspections
Groundwater Monitoring
SSDS Operations
Component 4
Residual Handling
Equipment Use and Misc
Transportation-Equipment
Transportation-Personnel
Consumables


Onsite SOx Emissions
Metric Ton
1.00E+00
9.00E-01
8.00E-01
7.00E-01
6.00E-01
5.00E-01
4.00E-01
3.00E-01
2.00E-01
1.00E-01
0.00E+00
Inspections
Groundwater Monitoring
SSDS Operations
Component 4
Residual Handling
Equipment Use and Misc
Transportation-Equipment
Transportation-Personnel
Consumables


Onsite PM_{10} Emissions
Metric Ton
1.00E+00
9.00E-01
8.00E-01
7.00E-01
6.00E-01
5.00E-01
4.00E-01
3.00E-01
2.00E-01
1.00E-01
0.00E+00
Inspections
Groundwater Monitoring
SSDS Operations
Component 4
Residual Handling
Equipment Use and Misc
Transportation-Equipment
Transportation-Personnel
Consumables


Total NOx Emissions
Metric Ton
6.00E-02
5.00E-02
4.00E-02
3.00E-02
2.00E-02
1.00E-02
0.00E+00
Inspections
Groundwater Monitoring
SSDS Operations
Component 4
Residual Handling
Equipment Use and Misc
Transportation-Equipment
Transportation-Personnel
Consumables


Total SOx Emissions
Metric Ton
4.00E-02
3.50E-02
3.00E-02
2.50E-02
2.00E-02
1.50E-02
1.00E-02
5.00E-03
0.00E+00
Inspections
Groundwater Monitoring
SSDS Operations
Component 4
Residual Handling
Equipment Use and Misc
Transportation-Equipment
Transportation-Personnel
Consumables


Total PM$_{10}$ Emissions
Metric Ton
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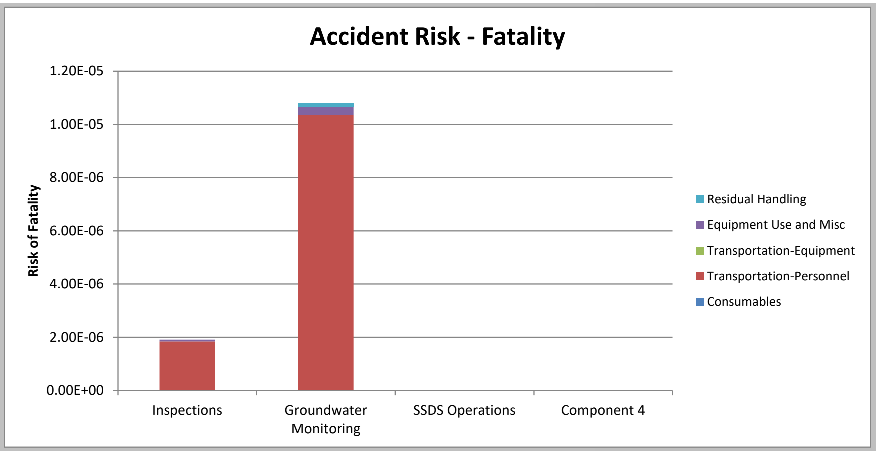
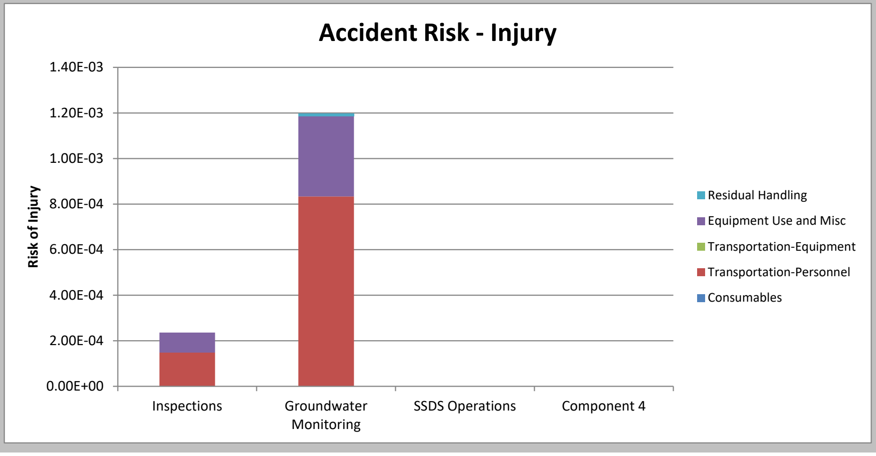
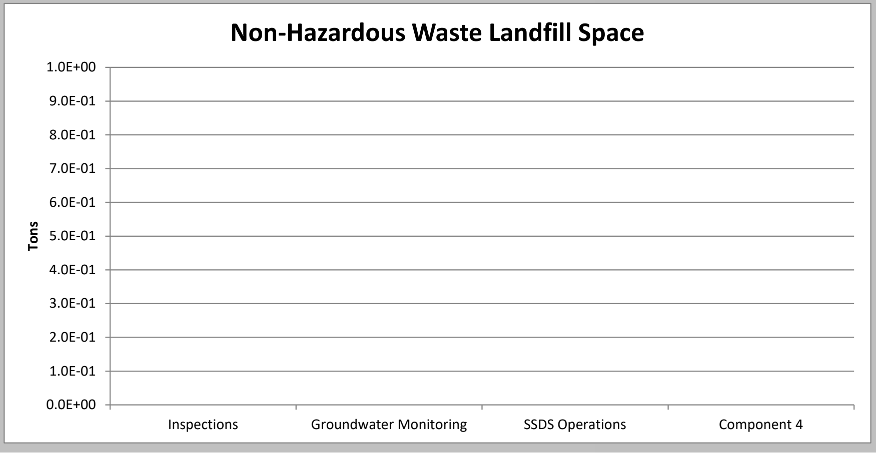
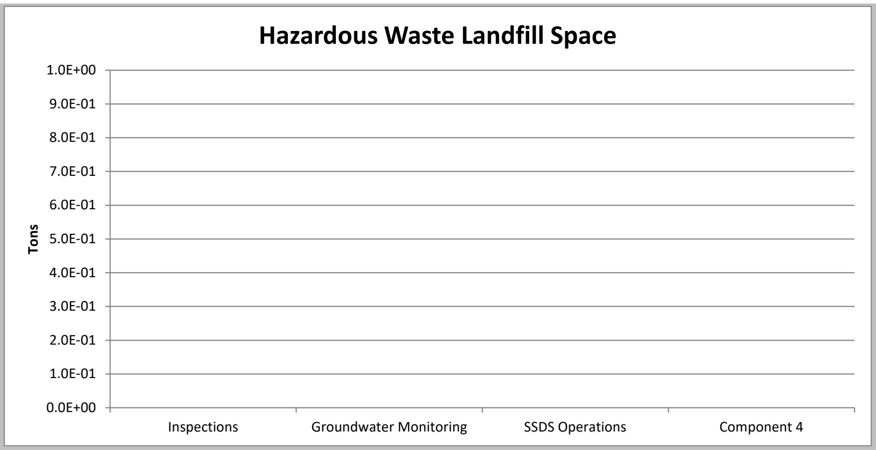
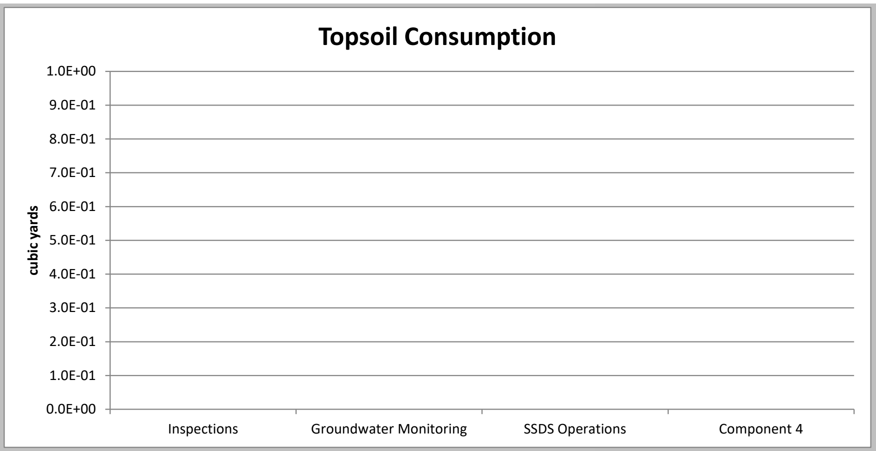
4.00E-03
3.50E-03
3.00E-03
2.50E-03
2.00E-03
1.50E-03
1.00E-03
5.00E-04
0.00E+00
Inspections
Groundwater Monitoring
SSDS Operations
Component 4
Residual Handling
Equipment Use and Misc
Transportation-Equipment
Transportation-Personnel
Consumables

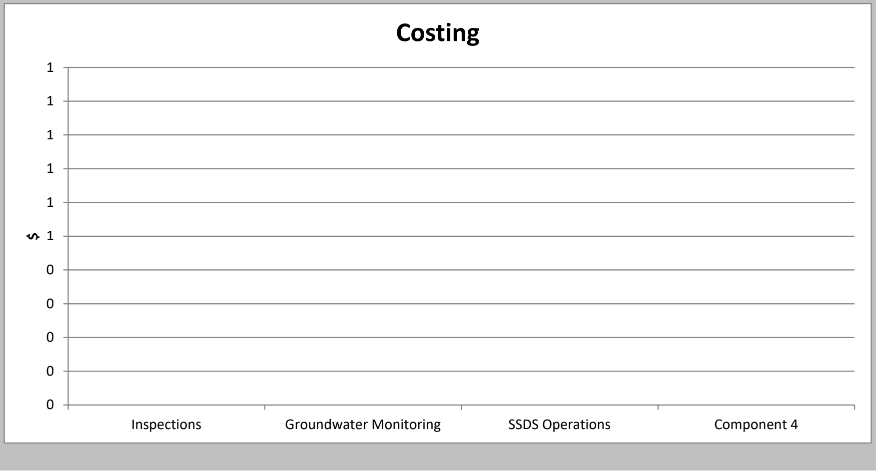

Accident Risk - Fatality
Risk of Fatality
1.20E-05
1.00E-05
8.00E-06
6.00E-06
4.00E-06
2.00E-06
0.00E+00
Inspections
Groundwater Monitoring
SSDS Operations
Component 4
Residual Handling
Equipment Use and Misc
Transportation-Equipment
Transportation-Personnel
Consumables


Accident Risk - Injury
Risk of Injury
1.40E-03
1.20E-03
1.00E-03
8.00E-04
6.00E-04
4.00E-04
2.00E-04
0.00E+00
Inspections
Groundwater Monitoring
SSDS Operations
Component 4
Residual Handling
Equipment Use and Misc
Transportation-Equipment
Transportation-Personnel
Consumables


Non-Hazardous Waste Landfill Space
Tons
1.0E+00
9.0E-01
8.0E-01
7.0E-01
6.0E-01
5.0E-01
4.0E-01
3.0E-01
2.0E-01
1.0E-01
0.0E+00
Inspections
Groundwater Monitoring
SSDS Operations
Component 4


Hazardous Waste Landfill Space
Tons
1.0E+00
9.0E-01
8.0E-01
7.0E-01
6.0E-01
5.0E-01
4.0E-01
3.0E-01
2.0E-01
1.0E-01
0.0E+00
Inspections
Groundwater Monitoring
SSDS Operations
Component 4


Topsoil Consumption
cubic yards
1.0E+00
9.0E-01
8.0E-01
7.0E-01
6.0E-01
5.0E-01
4.0E-01
3.0E-01
2.0E-01
1.0E-01
0.0E+00
Inspections
Groundwater Monitoring
SSDS Operations
Component 4


Costing
$
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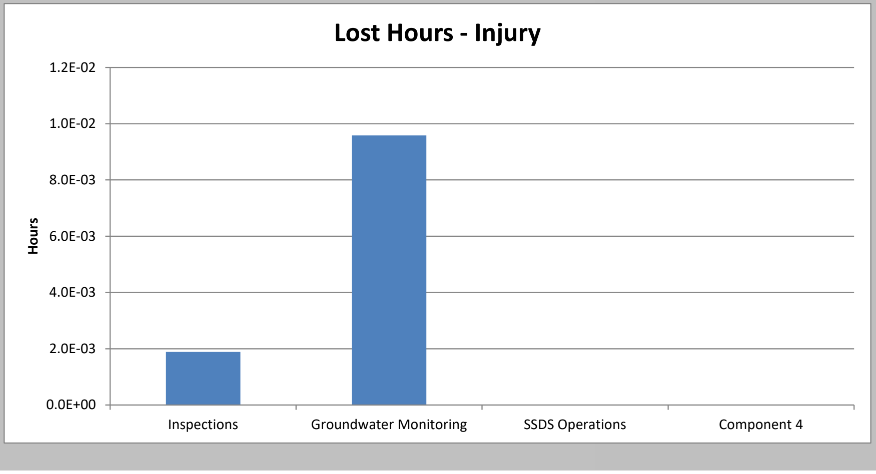
1
1
0
0
0
0
0
Inspections
Groundwater Monitoring
SSDS Operations
Component 4


Lost Hours - Injury
Hours
1.2E-02
1.0E-02
8.0E-03
6.0E-03
4.0E-03
2.0E-03
0.0E+00
Inspections
Groundwater Monitoring
SSDS Operations
Component 4

SiteWise Component 1
Site Inspections

Sustainable Remediation Summary - Inspections

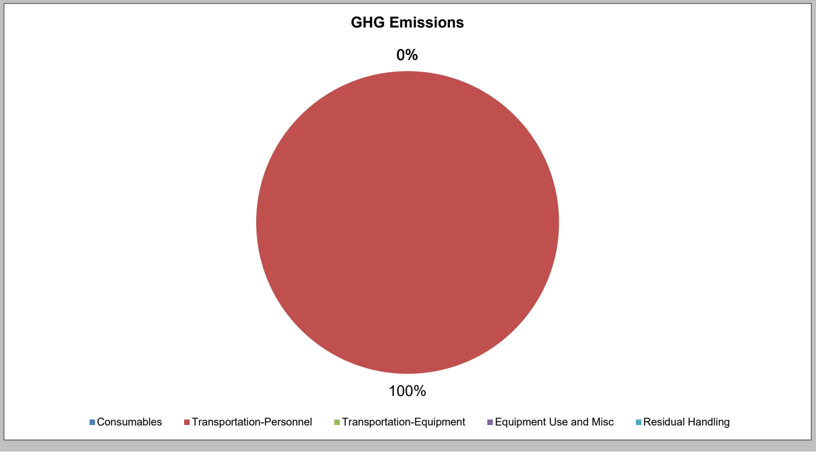
Activities	GHG Emissions	Percent Total	Total Energy Used	Percent Total	Water Consumption	Percent Total	Electricity Usage	Percent Total	Onsite NOx Emissions	Percent Total	Onsite SOx Emissions	Percent Total	Onsite PM10 Emissions	Percent Total	Total NOx Emissions	Percent Total	Total SOx Emissions	Percent Total	Total PM10 Emissions	Percent Total	Accident Risk Fatality	Percent Total	Accident Risk Injury	Percent Total
	metric ton	%	MMBTU	%	gallons	%	MWH	%	metric ton	%	metric ton	%	metric ton	%	metric ton	%	metric ton	%	metric ton	%		%		%
Consumables	0.00	-	0.0E+00	-	NA	NA	NA	NA	NA	-	NA	-	NA	-	0.0E+00	-	0.0E+00	-	0.0E+00	-	NA	NA	NA	NA
Transportation-Personnel	0.09	100.0	1.1E+00	100.0	NA	NA	NA	NA	NA	-	NA	-	NA	-	3.3E-05	100.0	1.2E-06	100.0	6.7E-06	100.0	1.8E-06	96.2	1.5E-04	62.7
Transportation-Equipment	0.00	-	0.0E+00	-	NA	NA	NA	NA	NA	-	NA	-	NA	-	0.0E+00	-	0.0E+00	-	0.0E+00	-	0.0E+00	-	0.0E+00	-
Equipment Use and Misc	0.00	-	0.0E+00	-	0.0E+00	0.0	0.0E+00	0.0	0.0E+00	-	0.0E+00	-	0.0E+00	-	0.0E+00	-	0.0E+00	-	0.0E+00	-	7.2E-08	3.8	8.8E-05	37.3
Residual Handling	0.00	-	0.0E+00	-	NA	NA	NA	NA	0.0E+00	-	0.0E+00	-	0.0E+00	-	0.0E+00	-	0.0E+00	-	0.0E+00	-	0.0E+00	-	0.0E+00	-
Total	0.09	100.0	1.13E+00	100.0	0.00E+00	0.0	0.00E+00	0.0	0.00E+00	0.0	0.00E+00	0.0	0.00E+00	0.0	3.33E-05	100.0	1.17E-06	100.0	6.75E-06	100.0	1.91E-06	100.0	2.36E-04	100.0

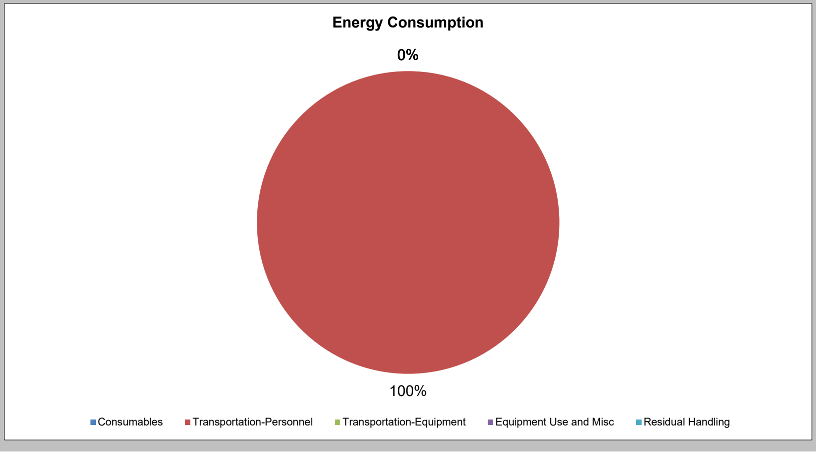
Additional Sustainability Metrics

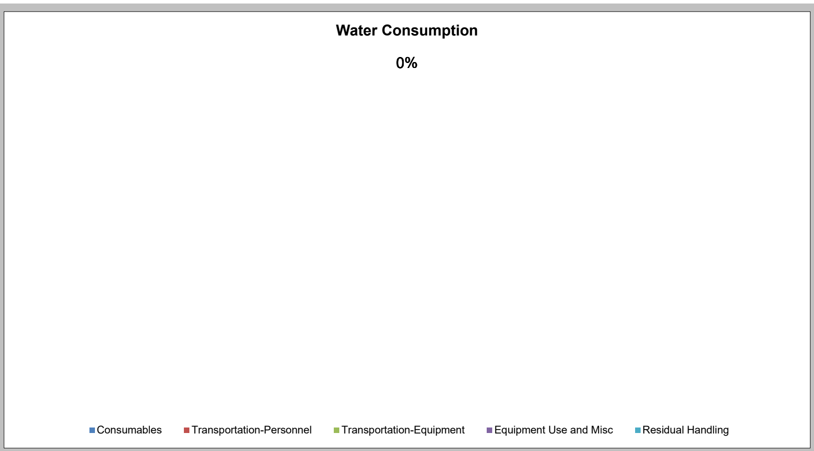
Non-Hazardous Waste Landfill Space (tons)	0.0
Hazardous Waste Landfill Space (tons)	0.0
Topsoil Consumption (yd^3)	0.0
Cost of Phase ($)	0.0
Lost Hours - Injury	0.0

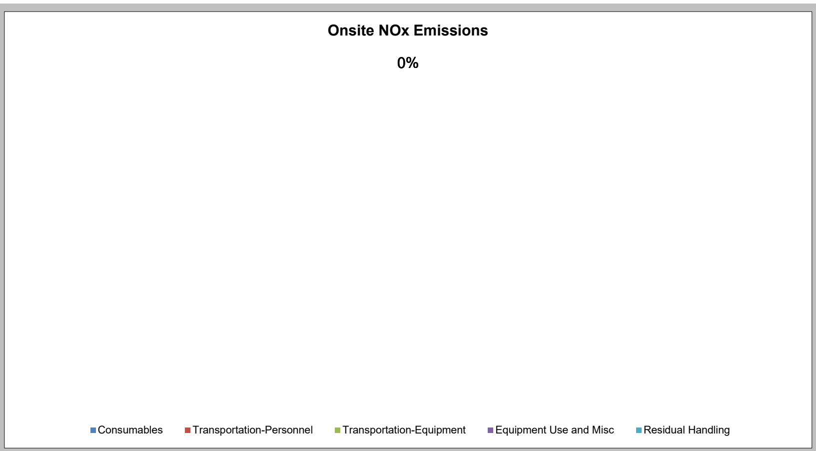
Footprint Reduction

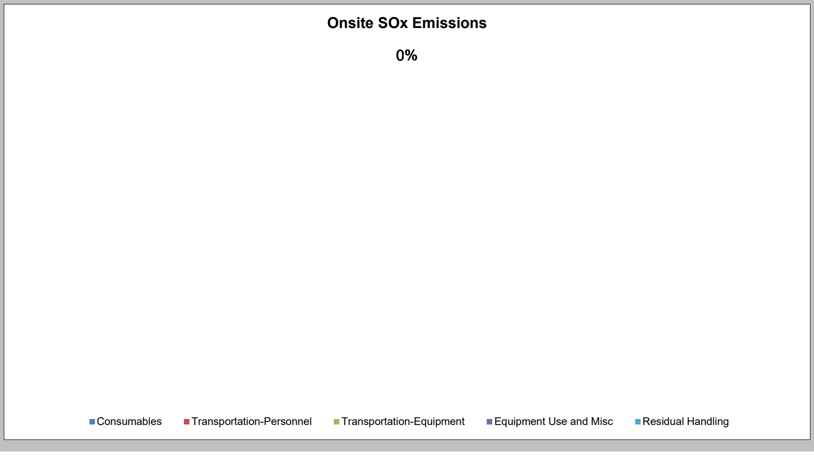
Total electricity replacement (MWh)	0.00E+00
Total electricity replacement (mmBtu)	0.00E+00
Percent electricity from renewable sources (%)	0.0%
Landfill gas reduction (metric ton CO_2 e)	0.00E+00
GHG emissions (metric ton CO2 e)	0.00E+00
NOx emissions (metric ton)	0.00E+00
SOx emissions (metric ton)	0.00E+00
PM10 emissions (metric ton)	0.00E+00

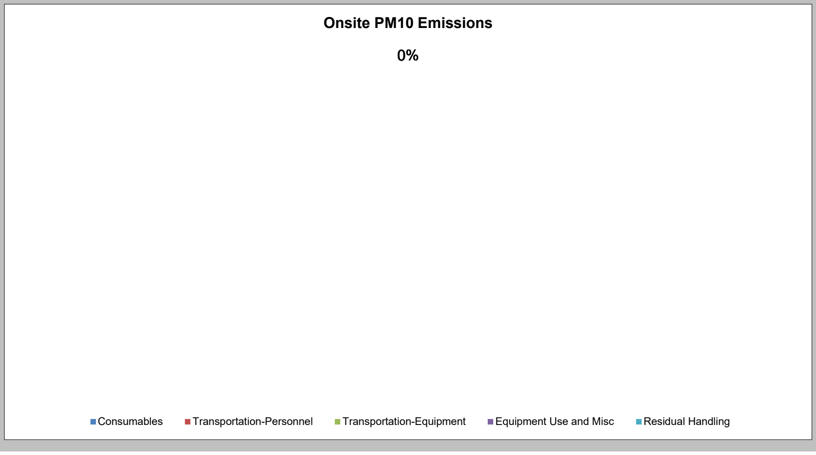

GHG Emissions

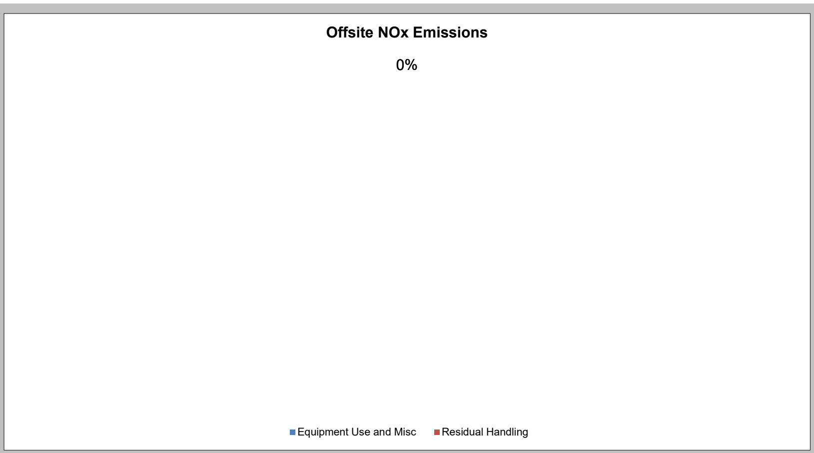

Energy Consumption

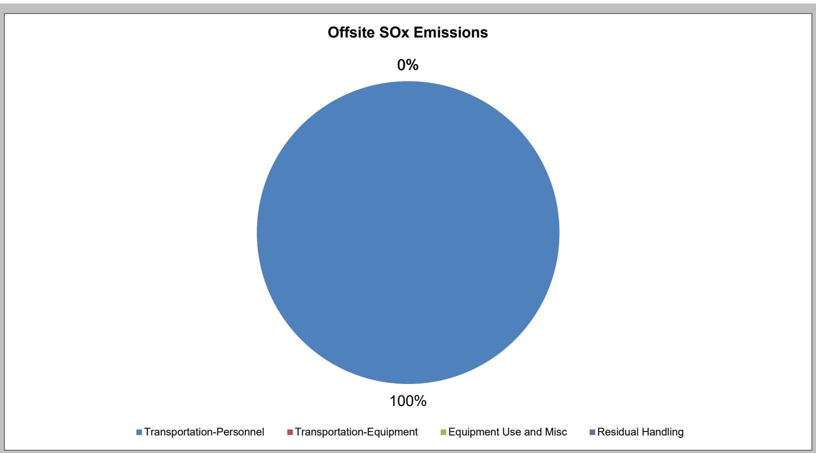

Water Consumption

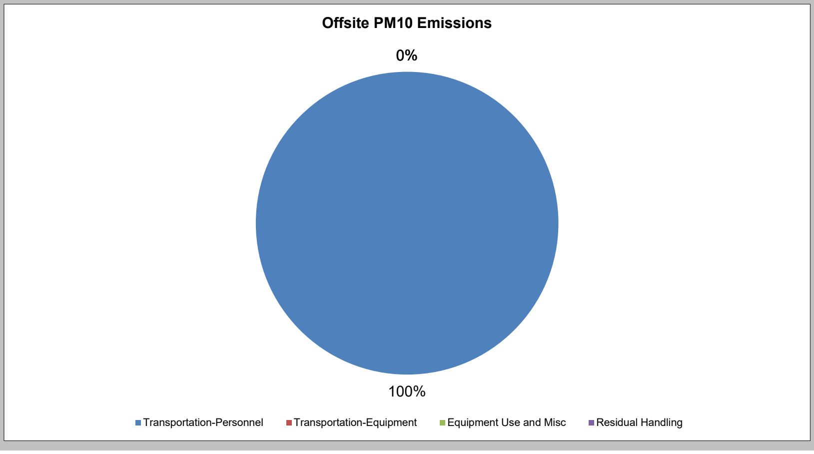

Onsite NOx Emissions

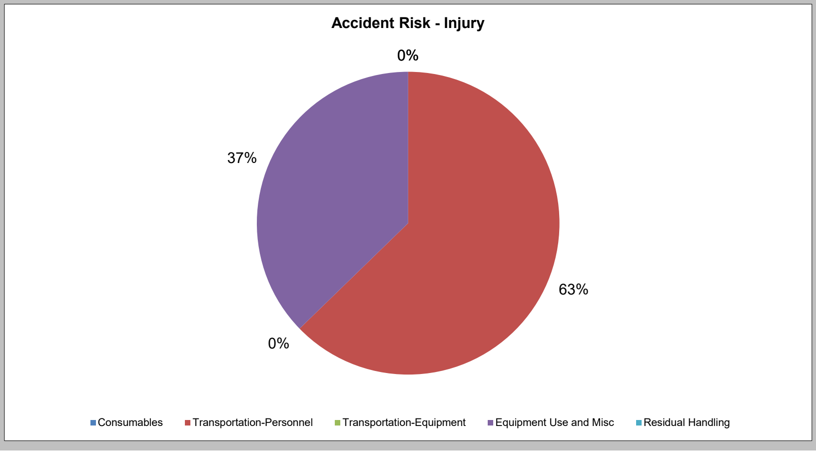

Onsite SOx Emissions

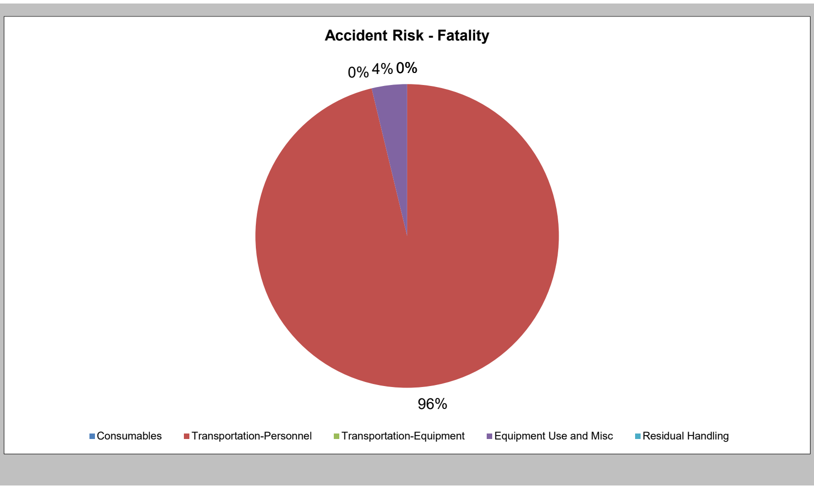

Onsite PM10 Emissions


Offsite NOx Emissions
0%
Equipment Use and Misc
Residual Handling


Offsite SOx Emissions
0%
100%
Transportation-Personnel
Transportation-Equipment
Equipment Use and Misc
Residual Handling


Offsite PM10 Emissions
0%
100%
Transportation-Personnel
Transportation-Equipment
Equipment Use and Misc
Residual Handling


Accident Risk - Injury
0%
37%
63%
0%
Consumables
Transportation-Personnel
Transportation-Equipment
Equipment Use and Misc
Residual Handling


Accident Risk - Fatality
0%
4%
0%
96%
Consumables
Transportation-Personnel
Transportation-Equipment
Equipment Use and Misc
Residual Handling

SiteWise Component 2
Groundwater Monitoring

Sustainable Remediation Summary - Groundwater Monitoring

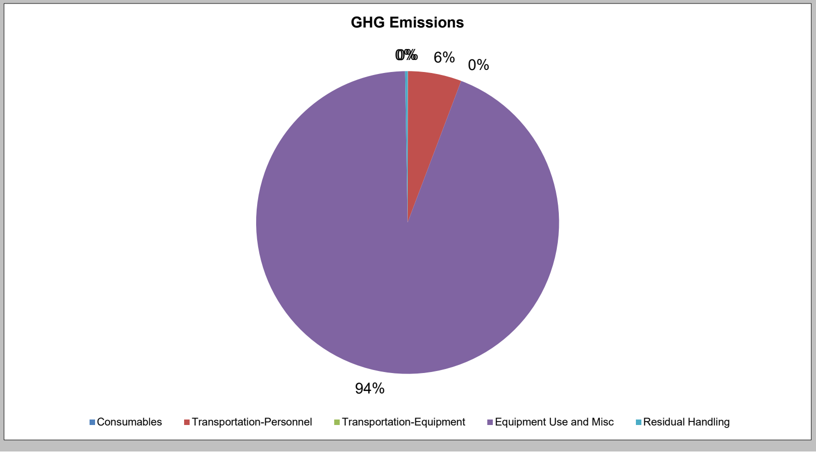
Activities	GHG Emissions	Percent Total	Total Energy Used	Percent Total	Water Consumption	Percent Total	Electricity Usage	Percent Total	Onsite NOx Emissions	Percent Total	Onsite SOx Emissions	Percent Total	Onsite PM10 Emissions	Percent Total	Total NOx Emissions	Percent Total	Total SOx Emissions	Percent Total	Total PM10 Emissions	Percent Total	Accident Risk Fatality	Percent Total	Accident Risk Injury	Percent Total
	metric ton	%	MMBTU	%	gallons	%	MWH	%	metric ton	%	metric ton	%	metric ton	%	metric ton	%	metric ton	%	metric ton	%		%		%
Consumables	0.00	0.0	1.5E-01	0.1	NA	NA	NA	NA	NA	-	NA	-	NA	-	1.1E-05	0.0	2.0E-05	0.1	3.9E-06	0.1	NA	NA	NA	NA
Transportation-Personnel	0.61	5.7	7.7E+00	5.1	NA	NA	NA	NA	NA	-	NA	-	NA	-	1.9E-04	0.4	8.0E-06	0.0	3.8E-05	0.9	1.0E-05	95.9	8.3E-04	69.6
Transportation-Equipment	0.00	-	0.0E+00	-	NA	NA	NA	NA	NA	-	NA	-	NA	-	0.0E+00	-	0.0E+00	-	0.0E+00	-	0.0E+00	-	0.0E+00	-
Equipment Use and Misc	10.04	94.0	1.4E+02	94.6	2.3E+02	100.0	2.3E-03	100.0	0.0E+00	-	0.0E+00	-	0.0E+00	-	4.8E-02	99.6	3.6E-02	99.9	4.0E-03	98.9	2.9E-07	2.7	3.5E-04	29.4
Residual Handling	0.03	0.3	3.7E-01	0.2	NA	NA	NA	NA	0.0E+00	-	0.0E+00	-	0.0E+00	-	8.9E-06	0.0	1.6E-07	0.0	7.9E-07	0.0	1.6E-07	1.4	1.3E-05	1.0
Total	10.68	100.0	1.52E+02	100.0	2.25E+02	100.0	2.30E-03	100.0	0.00E+00	0.0	0.00E+00	0.0	0.00E+00	0.0	4.84E-02	100.0	3.62E-02	100.0	4.06E-03	100.0	1.08E-05	100.0	1.20E-03	100.0

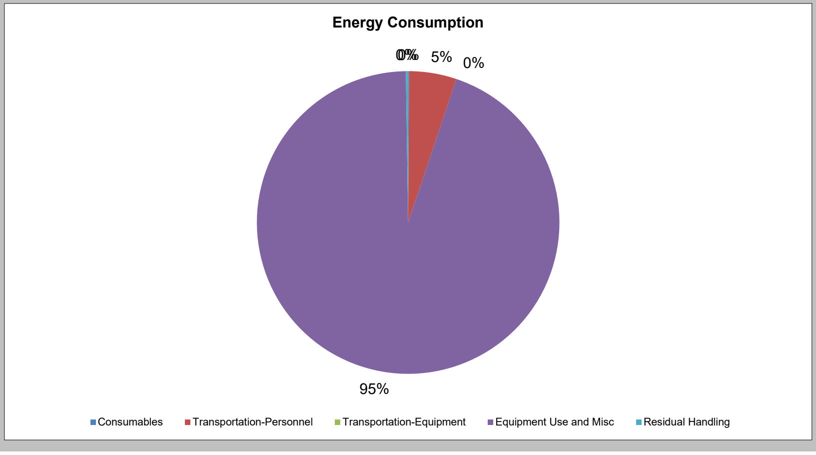
Additional Sustainability Metrics

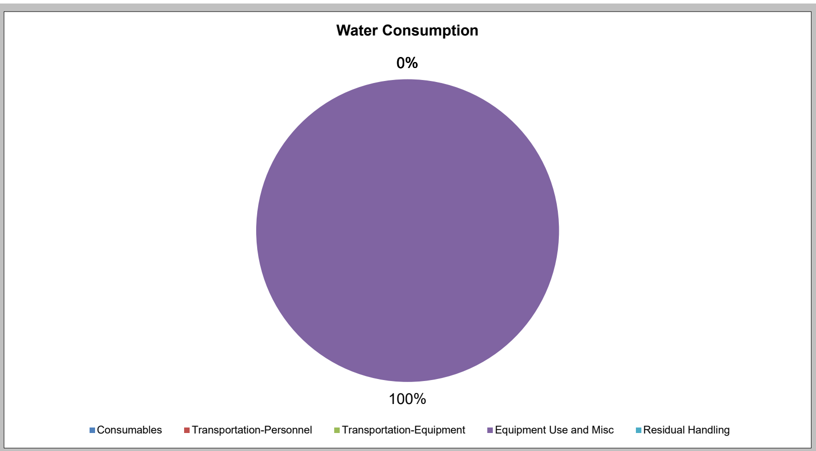
Non-Hazardous Waste Landfill Space (tons)	0.0
Hazardous Waste Landfill Space (tons)	0.0
Topsoil Consumption (yd^3)	0.0
Cost of Phase ($)	0.0
Lost Hours - Injury	0.0

Footprint Reduction

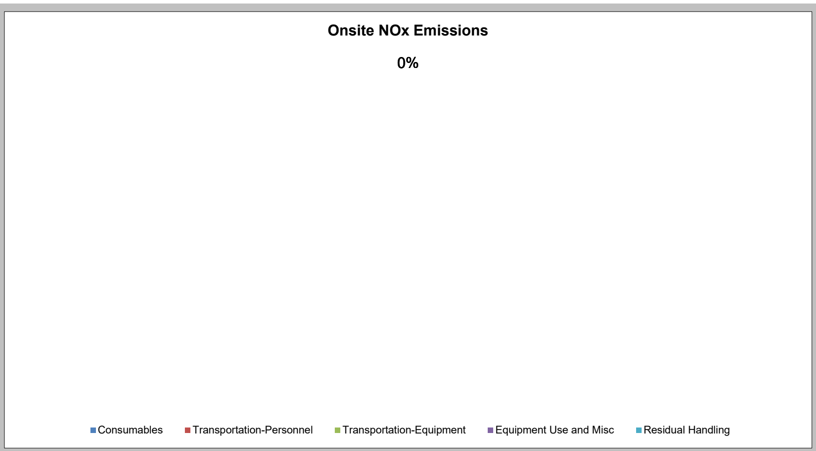
Total electricity replacement (MWh)	0.00E+00
Total electricity replacement (mmBtu)	0.00E+00
Percent electricity from renewable sources (%)	24.2%
Landfill gas reduction (metric ton CO_2 e)	0.00E+00
GHG emissions (metric ton CO2 e)	0.00E+00
NOx emissions (metric ton)	0.00E+00
SOx emissions (metric ton)	0.00E+00
PM10 emissions (metric ton)	0.00E+00



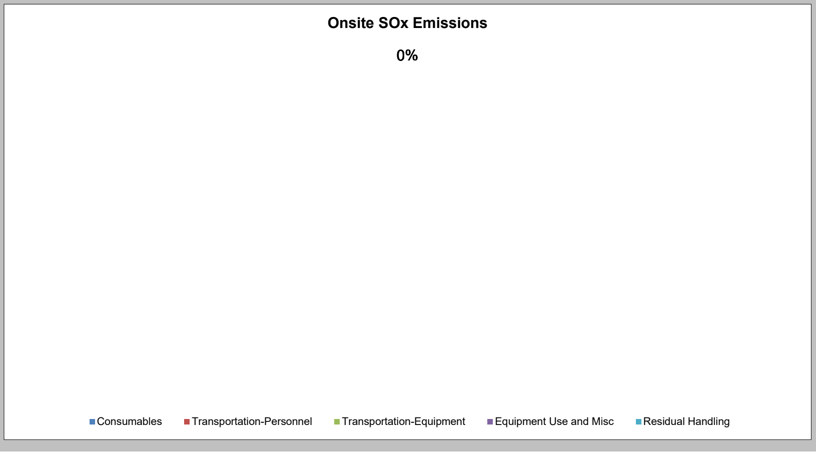




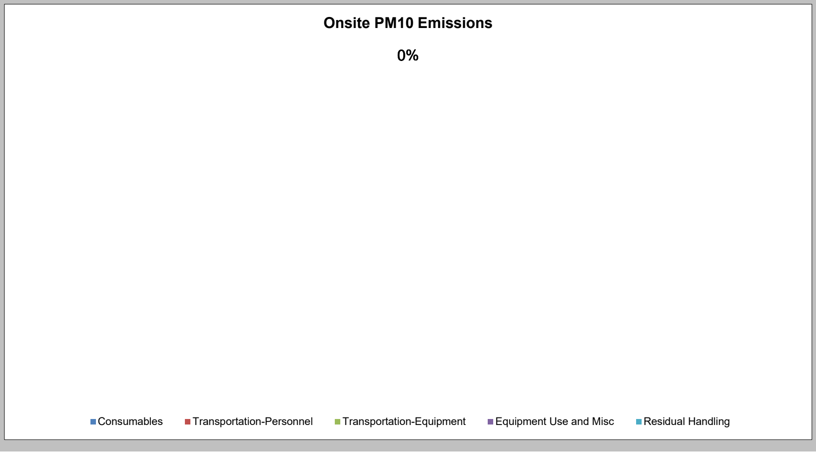
Water Consumption



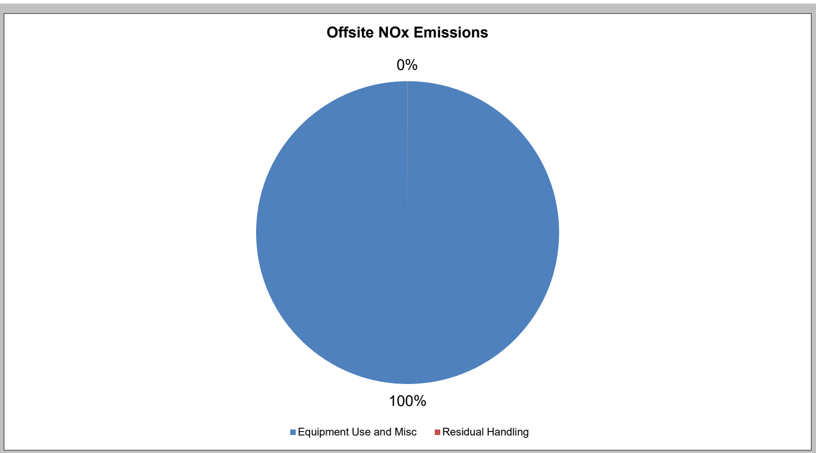
Onsite NOx Emissions

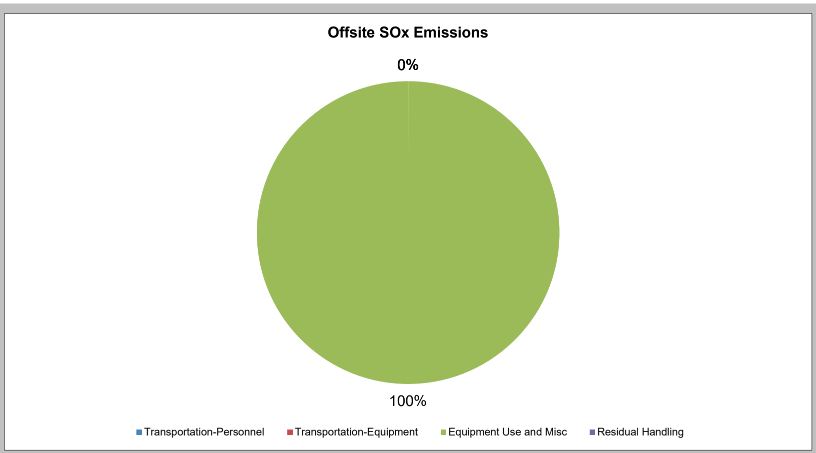


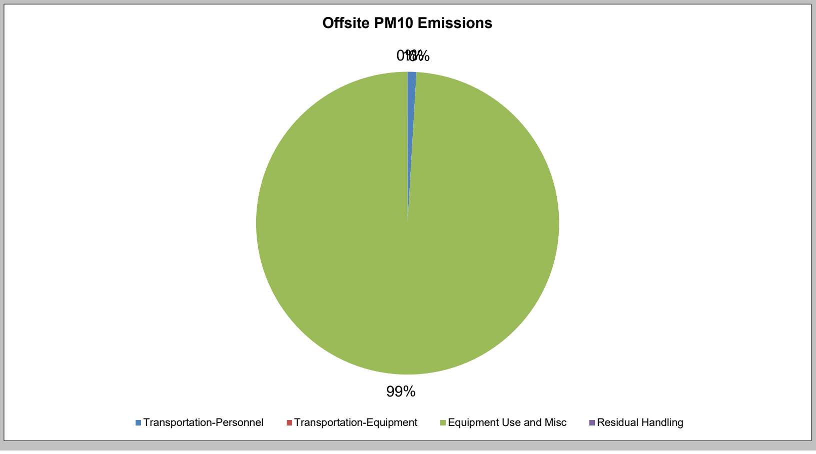
Onsite SOx Emissions

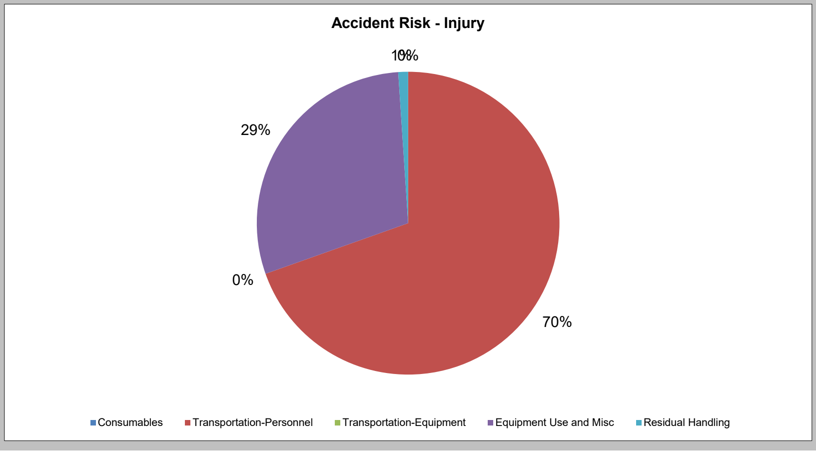


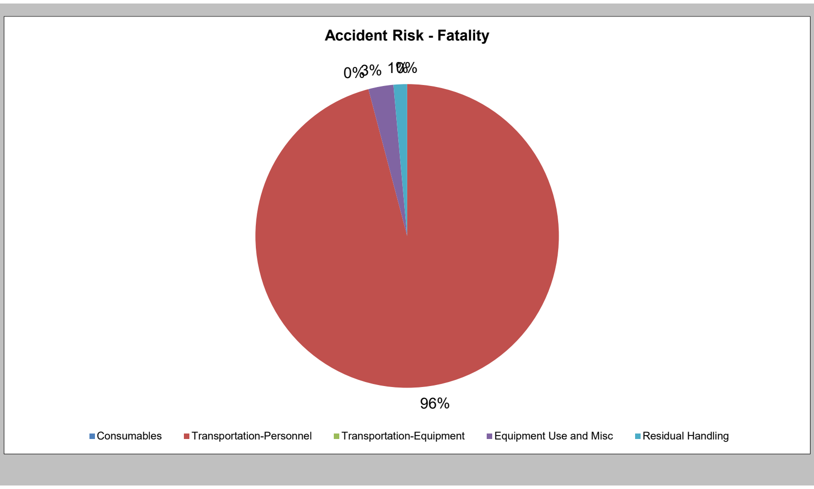
Onsite PM10 Emissions


Offsite NOx Emissions


Offsite SOx Emissions


Offsite PM10 Emissions


Accident Risk - Injury


Accident Risk - Fatality
0%
3%
1%
0%
96%
Consumables
Transportation-Personnel
Transportation-Equipment
Equipment Use and Misc
Residual Handling

SiteWise Component 3
SSDS Operation (per year)

Sustainable Remediation Summary - SSDS Operations

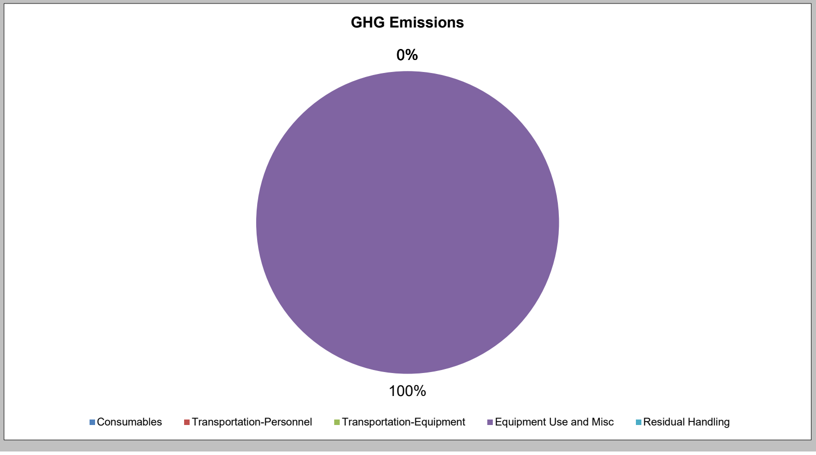
Activities	GHG Emissions	Percent Total	Total Energy Used	Percent Total	Water Consumption	Percent Total	Electricity Usage	Percent Total	Onsite NOx Emissions	Percent Total	Onsite SOx Emissions	Percent Total	Onsite PM10 Emissions	Percent Total	Total NOx Emissions	Percent Total	Total SOx Emissions	Percent Total	Total PM10 Emissions	Percent Total	Accident Risk Fatality	Percent Total	Accident Risk Injury	Percent Total
	metric ton	%	MMBTU	%	gallons	%	MWH	%	metric ton	%	metric ton	%	metric ton	%	metric ton	%	metric ton	%	metric ton	%		%		%
Consumables	0.00	-	0.0E+00	-	NA	NA	NA	NA	NA	-	NA	-	NA	-	0.0E+00	-	0.0E+00	-	0.0E+00	-	NA	NA	NA	NA
Transportation-Personnel	0.00	-	0.0E+00	-	NA	NA	NA	NA	NA	-	NA	-	NA	-	0.0E+00	-	0.0E+00	-	0.0E+00	-	0.0E+00	-	0.0E+00	-
Transportation-Equipment	0.00	-	0.0E+00	-	NA	NA	NA	NA	NA	-	NA	-	NA	-	0.0E+00	-	0.0E+00	-	0.0E+00	-	0.0E+00	-	0.0E+00	-
Equipment Use and Misc	3.38	100.0	7.8E+01	100.0	5.4E+03	100.0	1.1E+01	100.0	0.0E+00	-	0.0E+00	-	0.0E+00	-	3.3E-03	100.0	4.4E-03	100.0	2.4E-03	100.0	0.0E+00	-	0.0E+00	-
Residual Handling	0.00	-	0.0E+00	-	NA	NA	NA	NA	0.0E+00	-	0.0E+00	-	0.0E+00	-	0.0E+00	-	0.0E+00	-	0.0E+00	-	0.0E+00	-	0.0E+00	-
Total	3.38	100.0	7.79E+01	100.0	5.41E+03	100.0	1.06E+01	100.0	0.00E+00	0.0	0.00E+00	0.0	0.00E+00	0.0	3.26E-03	100.0	4.37E-03	100.0	2.44E-03	100.0	0.00E+00	0.0	0.00E+00	0.0

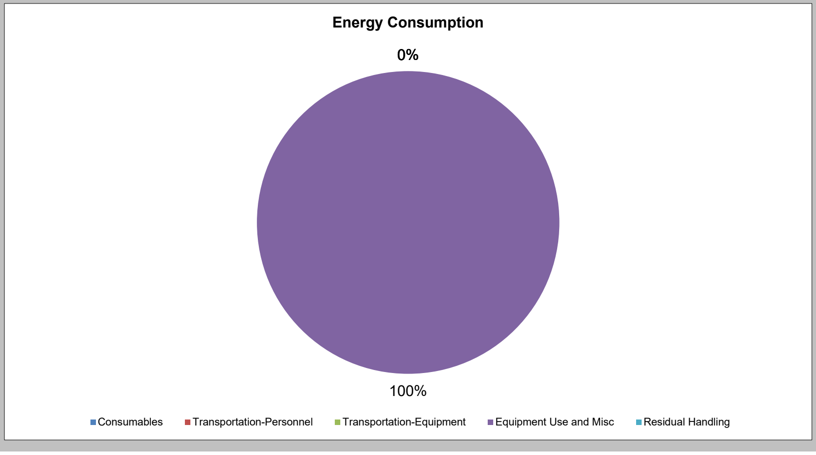
Additional Sustainability Metrics

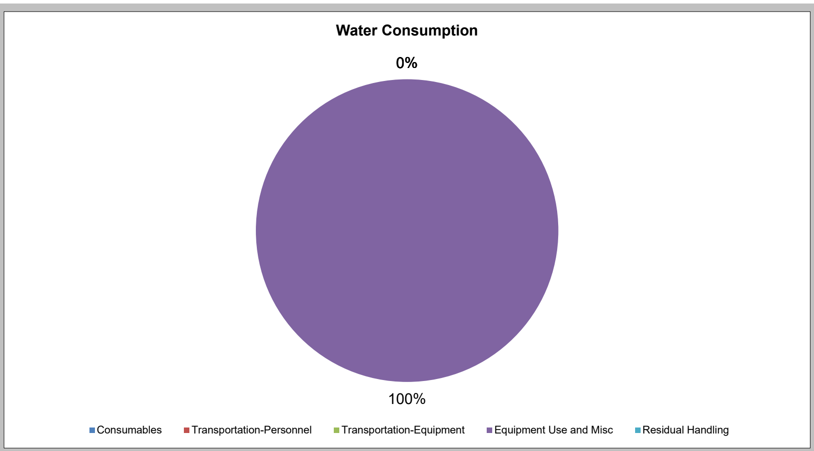
Non-Hazardous Waste Landfill Space (tons)	0.0
Hazardous Waste Landfill Space (tons)	0.0
Topsoil Consumption (yd^3)	0.0
Cost of Phase ($)	0.0
Lost Hours - Injury	0.0

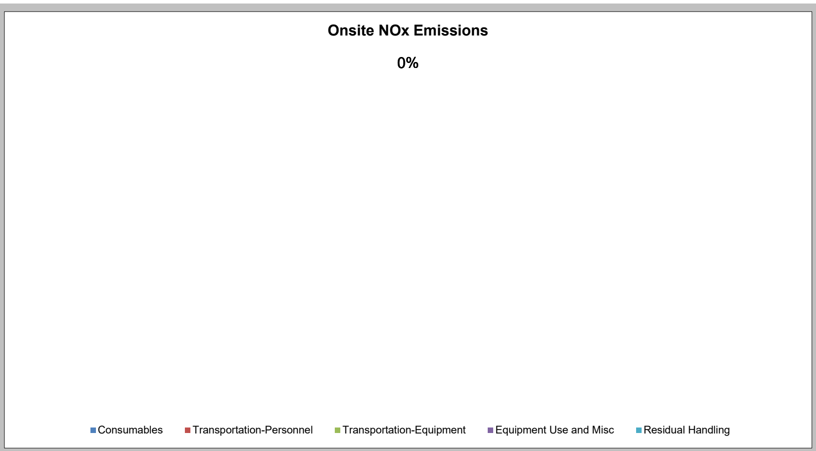
Footprint Reduction

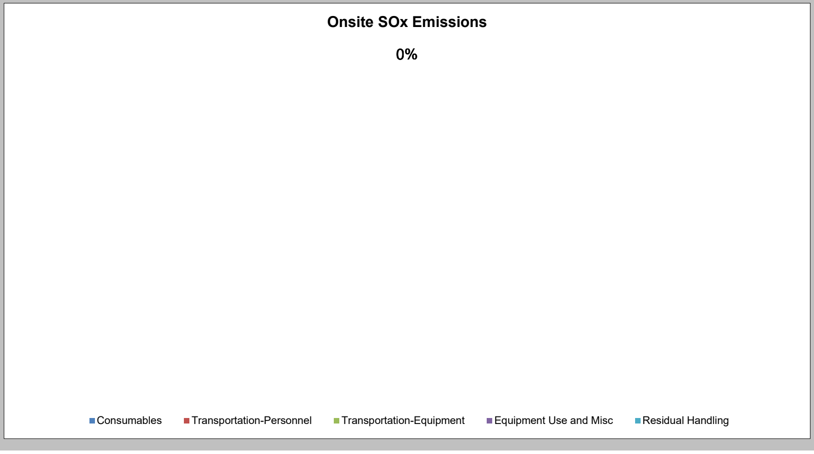
Total electricity replacement (MWh)	0.00E+00
Total electricity replacement (mmBtu)	0.00E+00
Percent electricity from renewable sources (%)	24.2%
Landfill gas reduction (metric ton CO_2 e)	0.00E+00
GHG emissions (metric ton CO2 e)	0.00E+00
NOx emissions (metric ton)	0.00E+00
SOx emissions (metric ton)	0.00E+00
PM10 emissions (metric ton)	0.00E+00

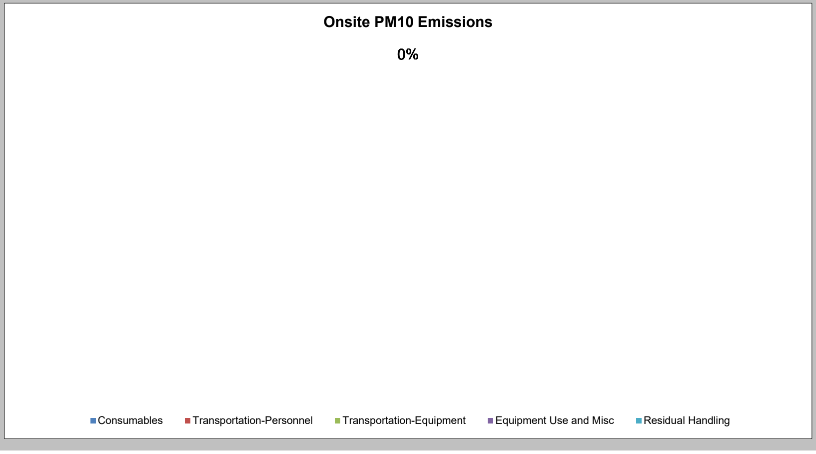

GHG Emissions

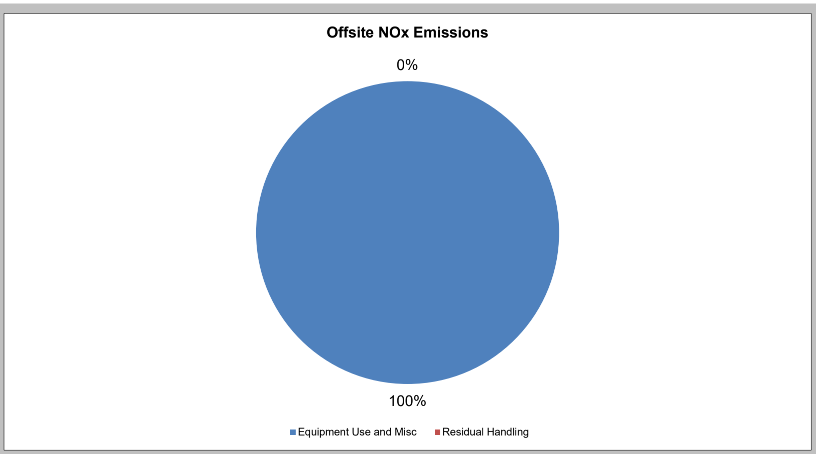

Energy Consumption

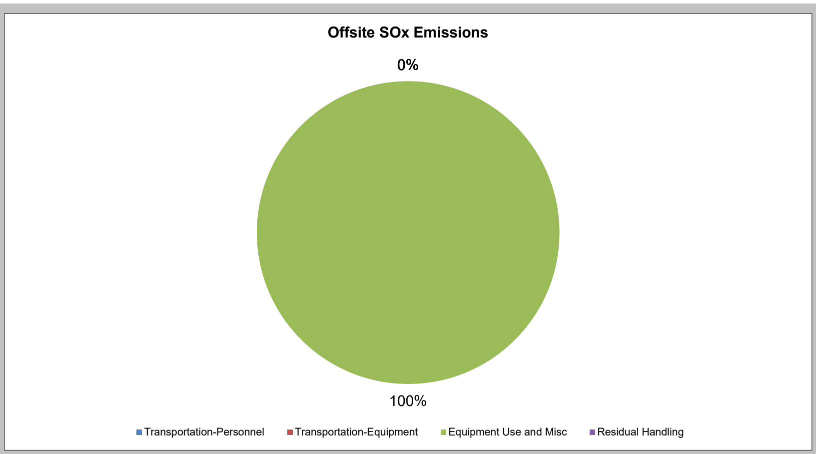

Water Consumption
0%
100%
Consumables
Transportation-Personnel
Transportation-Equipment
Equipment Use and Misc
Residual Handling

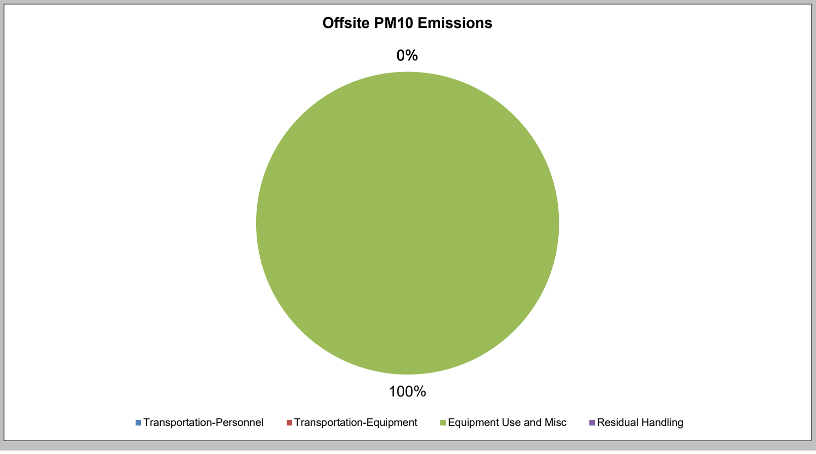

Onsite NOx Emissions
0%
Consumables
Transportation-Personnel
Transportation-Equipment
Equipment Use and Misc
Residual Handling

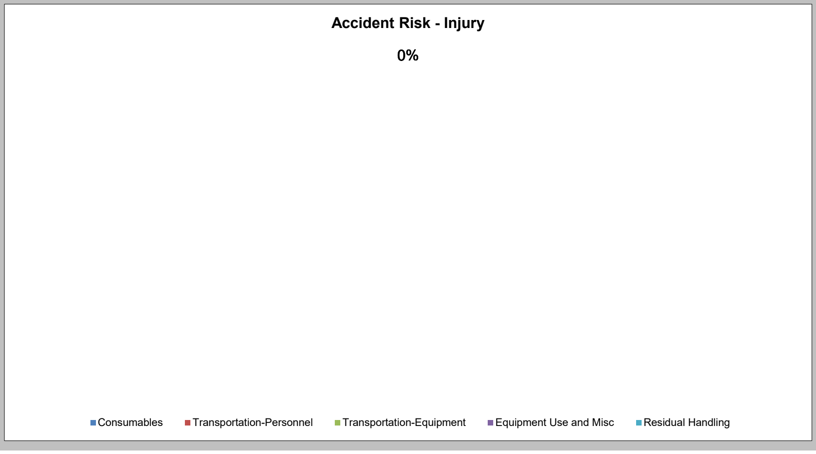

Onsite SOx Emissions
0%
Consumables
Transportation-Personnel
Transportation-Equipment
Equipment Use and Misc
Residual Handling


Onsite PM10 Emissions
0%
Consumables
Transportation-Personnel
Transportation-Equipment
Equipment Use and Misc
Residual Handling


Offsite NOx Emissions


Offsite SOx Emissions


Offsite PM10 Emissions


Accident Risk - Injury

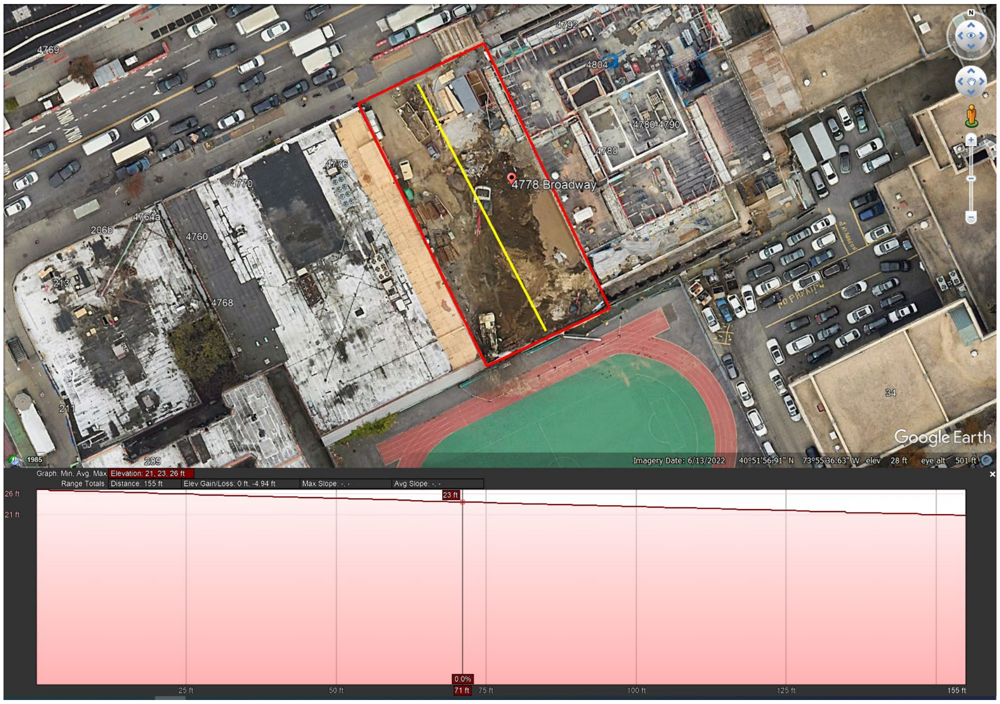

Accident Risk - Fatality
0%
Consumables
Transportation-Personnel
Transportation-Equipment
Equipment Use and Misc
Residual Handling

Climate Screen Checklist

Climate Screening Checklist

Background

- Project Manager: David Grupp
- Site Name: 4778 Broadway
- Site Number: C231131
- Site Location: 4778 Broadway, New York, New York
- Site Elevation (average above sea level): Approximately 23 feet above sea level (from google earth).



- ClimAID region: Region 4—New York City and Long Island

- Remedial Stage/Site Classification: Remedial Action - Class A

- Contamination -- Media Impacted/Contaminants of Concern:

  - Soil, Vapor Intrusion, Groundwater- COCs:
    - VOCs: 2,2,4-trimethylpentane, benzene, benzo(b)fluoranthene, ethylbenzene, indeno(1,2,3-cd)pyrene, naphthalene, phenol, toluene, xylene (mixed)

- Proposed/Current Remedy: The selected remedy included the excavation and disposal of impacted soil within the basement footprint above the groundwater table, the treatment of soil below the groundwater table with in-situ chemical oxidation (ISCO) injections, the installation of a soil cover system and sub-slab depressurization system (SSDS), groundwater monitoring, and the implementation of a Site Management Plan and Environmental Easement for the property.

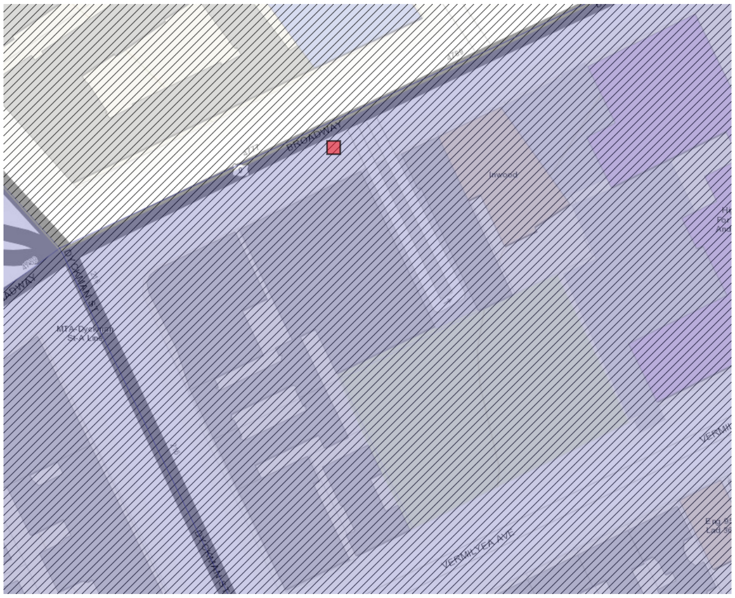
- What is the predicted timeframe of the remedy? Will components of the remedy still be in place in 10+ years?
  - The remedy is projected to be in place for life of the residential building. Groundwater monitoring for the observation of the ISCO injections effectiveness is planned for 2 years. The soil cover system, SSDS, Site Management Plan, and Environmental Easement are intended for ongoing implementation as long as the residential building is occupied.

Is the site in a disadvantaged community (DAC) or potential environmental justice area (PEJA) (Use DECinfolocator: DECinfo Locator (ny.gov))?

☒Yes ☐ No

If the site is in a DAC or PEJA, will climate impacts be magnified? If yes, list how and why.

☐Yes ☒ No



Should thresholds of concern be lowered to account for magnification of impacts? If yes, indicate how lower thresholds will be used in the screening.

☐Yes ☒ No

Climate Screening Table*

Potential Climate Hazards	**Relevant to the Site Location (Y/N/NA)** [1]	**Projected Change (**Put the reference document/model used here) [3]	**Potential to Impact Remedy (Y/N)**	**Is remedy/site already resilient? (Y/N)** [4]
Precipitation	Y	Based upon FEMA's Resiliency Analysis Planning Tool the annual rain fall is projected to increase between 7.25 and 11.16 inches by the end of the century	Y	Y – The blower for the SSDS is located within a weather-proof enclosure on the roof. The SSDS also has alarms to indicate if flow/vacuum are impacted by sub-slab piping being flooded by a high groundwater table.
Temperature (Extreme Heat or Cold Weather Impacts) [2]	Y	Based upon FEMA's Resiliency Analysis Planning Tool, by the middle of the century there will be an estimated increase of 515.28 cooling degree days.	N	Y – Remedy is not susceptible to extreme temperatures.
Sea Level Rise	N	N - Based upon the NOAA's Sea Level Rise Viewer the site is not impacted at 10 feet of SLR.	N	N/A

Flooding[5]	N	Based upon FEMA's Resiliency Analysis Planning Tool, the site does not fall within the 1% or 0.2% annual chance flood hazard area.	N	N
Storm Surge	Y	Y – NOAA's Storm Surge Risk Maps tool indicates that the site could be impacted by 3 to 6 ft of water during category 2 and 3 hurricanes and over 9 ft of water for category 4 and higher hurricanes	N	Y – Soil cover system and injections are not impacted by high water levels. The SSDS system blower is installed on the roof away from the potential storm surge flooding levels.
Wildfire	N	N/A	N/A	N/A
Drought	N	N/A	N/A	N/A
Storm Severity (could include high winds, lightening, etc.)	Y	N - Based upon FEMA's Resiliency Analysis Planning Tool, there is no increase in storm severity outlook.	N	Y – Soil cover system and injections are not impacted by severe weather. The SSDS has alarms and meters within the basement to indicate any lapses in operation and a backup power source to operate during outages.
Landslides	N	N/A	N/A	N/A

Other Hazards:	Seismic Activity – N/A	N/A	N/A	N/A

*Links to potential data sources can be found on the following page

[1] If the first column is N --> The rest of the columns will be N/A, the hazard is not applicable to the site.

[2] Extreme Heat: periods of three or more days above 90°F- Extreme Cold: Individual days with minimum temperatures at or below 30 degrees F (NYSERDA ClimAID report), Note: this is important for sites with active remedial systems/sites where the remedy relies on the electrical grid

[3] List the projected change in specific terms or units e.g. inches of rain fall, feet of sea level rise, etc.

[4] If final column is Y, provide reasoning, if the final column is N --> Climate Vulnerability Assessment (CVA) required.

[5] For system sites- components (e.g. electrical wiring and panels) should be evaluated to determine if they would need to be raised to avoid flooding.

Required Next Steps (If no further action, provide justification):

No further action is required for the evaluation of the remedy resiliency. Climate related impacts are related to high groundwater table flooding of the sub-slab piping of the SSDS system. Groundwater level will be monitored to initiate restart of the SSDS once sub-slab piping is above the groundwater table.

APPENDIX M

REMEDIAL SYSTEM OPTIMIZATION REPORT OUTLINE

REMEDIAL SYSTEM OPTIMIZATION FOR 4778 BROADWAY

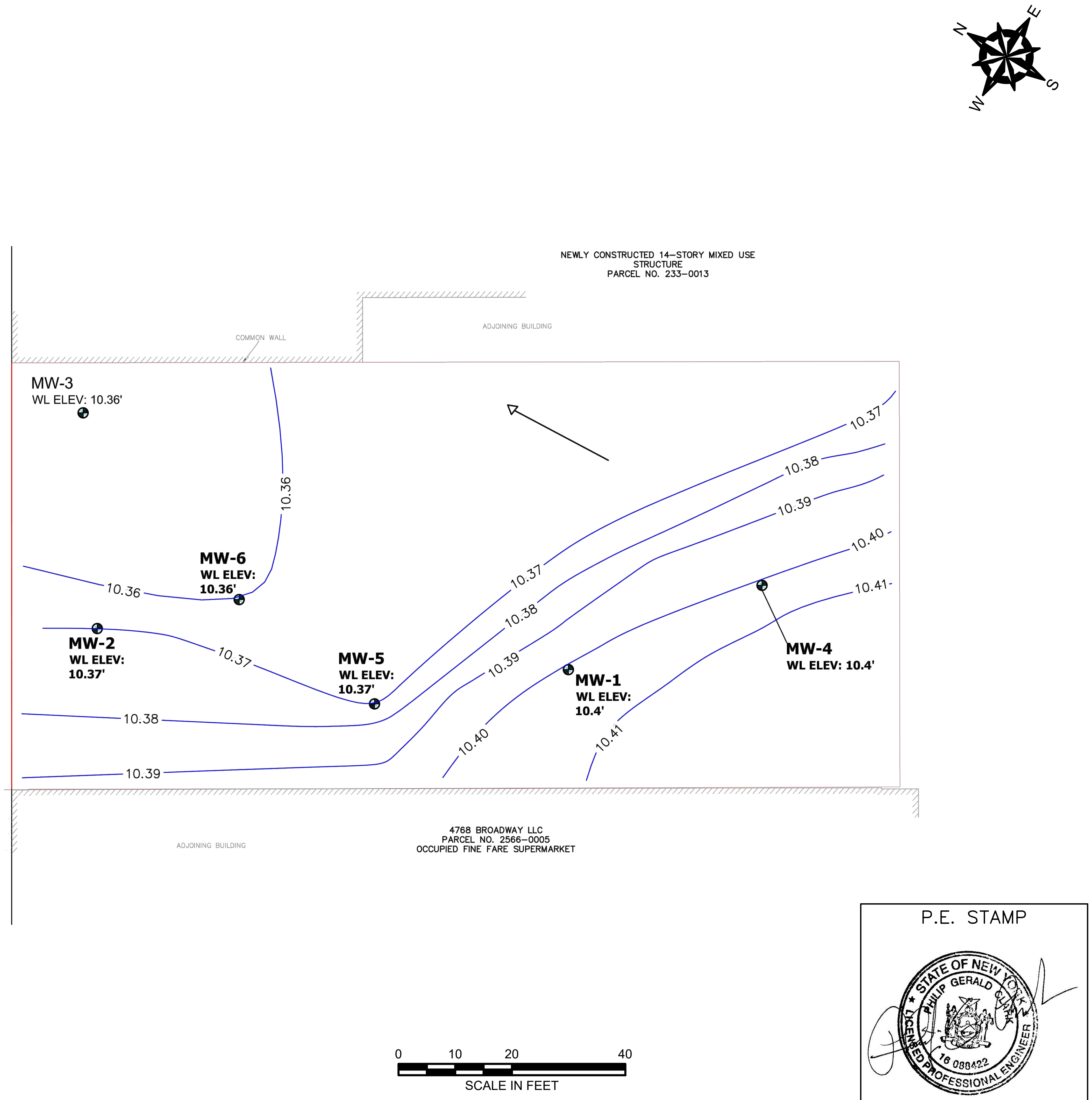
TABLE OF CONTENTS

APPENDIX N

PROFESSIONAL ENGINEER STAMPED FIGURES

Static Water Levels May 10, 2023

Well ID	Water Level (feet btoc)	Water Elevation (feet AMSL)
MW–1	6.45	10.4
MW–2	6.61	10.37
MW–3	7.08	10.36
MW–4	6.66	10.4
MW–5	6.47	10.37
MW–6	6.63	10.36



GENERAL NOTES

1. BASE MAP DEVELOPED FROM DRAWING TITLED "GROUNDWATER CONTOUR MAP", PREPARED BY AEI CONSULTANTS, ORIGINAL SCALE 1"=16', DATED SEPTEMBER 15, 2023.
2. LOCATION OF WELLS ARE BASED ON SURVEY PREPARED BY AREK SURVEYING P.C., ORDERED BY GDI CONSTRUCTION LLC, DATED APRIL 28, 2023.
3. ALL WATER ELEVATIONS ARE IN FEET ABOVE MEAN SEA LEVEL (ASML).
4. CONTOURS ARE INFERRED BASED ON STATIC DEPTH TO WATER MEASUREMENTS COLLECTED BY AEI CONSULTANTS ON MAY 10, 2023, USING AN ELECTRONIC WATER LEVEL INDICATOR ACCURATE TO ±0.01 FEET.
5. LOCAL GROUNDWATER FLOW MAY BE INFLUENCED BY NEWLY CONSTRUCTED BUILDING FOUNDATION AND COMPONENTS INSTALLED BELOW THE ENCOUNTERED GROUNDWATER TABLE.
6. FEET BTOC – FEET BELOW TOP OF CASING.
7. ELEVATIONS ARE REFERENCED TO THE NORTH AMERICAN VERTICAL DATUM OF 1988 (NAVD88).

LEGEND

🟥	APPROXIMATE SITE BOUNDARY
⊕ MW-1	APPROXIMATE PERMANENT MONITORING WELL LOCATION
WL ELEV: 10.4'	MEASURED STATIC WATER LEVEL ELEVATION ON MAY 10, 2023 (NAVD88)
—10.36	INFERRED GROUNDWATER CONTOUR (FEET ABOVE MEAN SEA LEVEL)
⟶	INFERRED GROUNDWATER FLOW DIRECTION

NO.	ISSUE/DESCRIPTION	BY	DATE

P.E. STAMP

STATE OF NEW YORK
PHILIP GERALD CLARK
088422
LICENSED PROFESSIONAL ENGINEER

4778 BROADWAY
NEW YORK, NY 10034

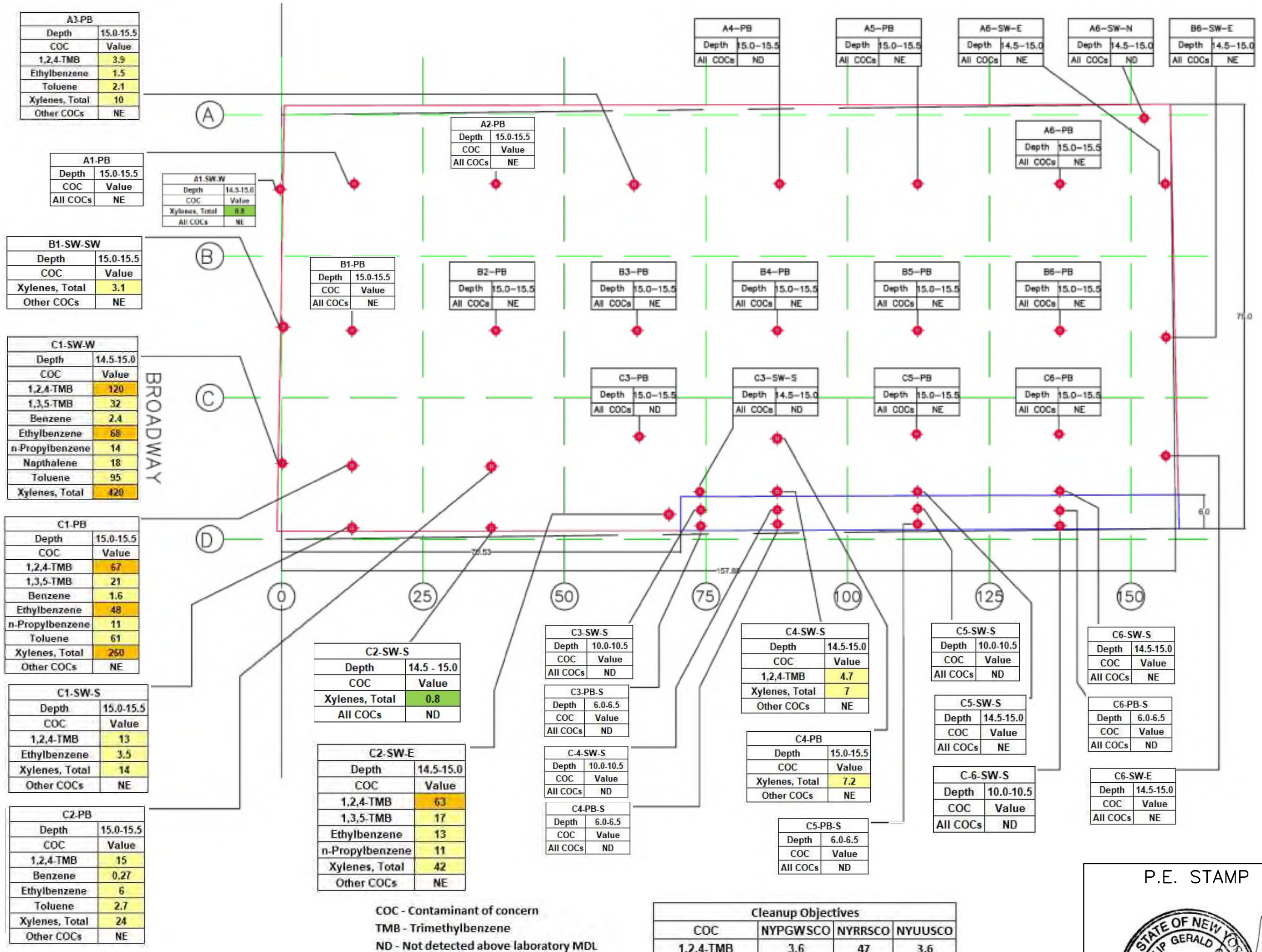
GROUNDWATER CONTOUR MAP

Appendix N

PREPARED FOR:
M4778 BROADWAY, LLC

PROJ MGR: ZL	REVIEWED BY: ZL	CHECKED BY: VW	FIGURE 1 SHEET NO.
DESIGNED BY: SG	DRAWN BY: SG	SCALE: 1"=20'	
DATE: March 2025	PROJECT NO. 41.0163310.10	REVISION NO.	

GZA-J:\Active 163300 to 163399\163310.10 – M44778 Broadway Remedial Closure Consulting\Drawings\GZA CAD\41.0163310.10 SMP.dwg [F3] March 17, 2025 – 1:38pm Selia.Gupta



A3-PB	
Depth	15.0-15.5
COC	Value
1,2,4-TMB	3.9
Ethylbenzene	1.5
Toluene	2.1
Xylenes, Total	10
Other COCs	NE

A1-PB	
Depth	15.0-15.5
COC	Value
All COCs	NE

A1-SW-W	
Depth	14.5-15.0
COC	Value
Xylenes, Total	0.8
All COCs	NE

B1-SW-SW	
Depth	15.0-15.5
COC	Value
Xylenes, Total	3.1
Other COCs	NE

C1-SW-W	
Depth	14.5-15.0
COC	Value
1,2,4-TMB	120
1,3,5-TMB	32
Benzene	2.4
Ethylbenzene	68
n-Propylbenzene	14
Napthalene	18
Toluene	95
Xylenes, Total	420

C1-PB	
Depth	15.0-15.5
COC	Value
1,2,4-TMB	67
1,3,5-TMB	21
Benzene	1.6
Ethylbenzene	48
n-Propylbenzene	11
Toluene	61
Xylenes, Total	260
Other COCs	NE

C1-SW-S	
Depth	15.0-15.5
COC	Value
1,2,4-TMB	13
Ethylbenzene	3.5
Xylenes, Total	14
Other COCs	NE

C2-PB	
Depth	15.0-15.5
COC	Value
1,2,4-TMB	15
Benzene	0.27
Ethylbenzene	6
Toluene	2.7
Xylenes, Total	24
Other COCs	NE

A4–PB	
Depth	15.0–15.5
All COCs	ND

A5–PB	
Depth	15.0–15.5
All COCs	NE

A6–SW–E	
Depth	14.5–15.0
All COCs	NE

A6–SW–N	
Depth	14.5–15.0
All COCs	ND

B6–SW–E	
Depth	14.5–15.0
All COCs	NE

A2-PB	
Depth	15.0-15.5
COC	Value
All COCs	NE

A6–PB	
Depth	15.0–15.5
All COCs	NE

B1-PB	
Depth	15.0-15.5
COC	Value
All COCs	NE

B2–PB	
Depth	15.0–15.5
All COCs	NE

B3–PB	
Depth	15.0–15.5
All COCs	NE

B4–PB	
Depth	15.0–15.5
All COCs	NE

B5–PB	
Depth	15.0–15.5
All COCs	NE

B6–PB	
Depth	15.0–15.5
All COCs	NE

C3–PB	
Depth	15.0–15.5
All COCs	ND

C3–SW–S	
Depth	14.5–15.0
All COCs	ND

C5–PB	
Depth	15.0–15.5
All COCs	NE

C6–PB	
Depth	15.0–15.5
All COCs	NE

C2-SW-S	
Depth	14.5 - 15.0
COC	Value
Xylenes, Total	0.8
All COCs	ND

C2-SW-E	
Depth	14.5-15.0
COC	Value
1,2,4-TMB	63
1,3,5-TMB	17
Ethylbenzene	13
n-Propylbenzene	11
Xylenes, Total	42
Other COCs	NE

C3-SW-S	
Depth	10.0-10.5
COC	Value
All COCs	ND

C3-PB-S	
Depth	6.0-6.5
COC	Value
All COCs	ND

C-4-SW-S	
Depth	10.0-10.5
COC	Value
All COCs	ND

C4-PB-S	
Depth	6.0-6.5
COC	Value
All COCs	ND

C4-SW-S	
Depth	14.5-15.0
COC	Value
1,2,4-TMB	4.7
Xylenes, Total	7
Other COCs	NE

C4-PB	
Depth	15.0-15.5
COC	Value
Xylenes, Total	7.2
Other COCs	NE

C5-PB-S	
Depth	6.0-6.5
COC	Value
All COCs	ND

C5-SW-S	
Depth	10.0-10.5
COC	Value
All COCs	ND

C5-SW-S	
Depth	14.5-15.0
COC	Value
All COCs	NE

C-6-SW-S	
Depth	10.0-10.5
COC	Value
All COCs	ND

C6-SW-S	
Depth	14.5-15.0
COC	Value
All COCs	NE

C6-PB-S	
Depth	6.0-6.5
COC	Value
All COCs	ND

C6-SW-E	
Depth	14.5-15.0
COC	Value
All COCs	NE

COC - Contaminant of concern
TMB - Trimethylbenzene
ND - Not detected above laboratory MDL
NE - Not in exceedance of SCOs

Yellow Highlight	Concentration exceeds NYSDEC Protection of Groundwater SCO
Orange Highlight	Concentration exceeds NYSDEC Restricted Residential SCO
Green Highlight	Concentration exceeds NYSDEC Unresricted Use SCO

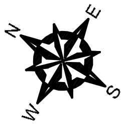
Cleanup Objectives			
COC	NYPGWSCO	NYRRSCO	NYUUSCO
1,2,4-TMB	3.6	47	3.6
1,3,5-TMB	8.4	47	8.4
Benzene	0.06	2.9	0.06
Ethylbenzene	1	30	1
n-Propylbenzene	3.9	100	3.9
Napthalene	12	100	12
Toluene	0.7	100	0.7
Xylenes, Total	1.6	100	0.26

GENERAL NOTES

1. BASE MAP DEVELOPED FROM DRAWING TITLED "REMAINING SOIL EXCEEDANCES MAP", PREPARED BY AEI CONSULTANTS, ORIGINAL SCALE 1"=16', DATED SEPTEMBER 15, 2023.
2. ALL SAMPLE DEPTHS ARE IN FEET BELOW GROUND SURFACE (BGS). CONCENTRATIONS ARE IN MILIGRAMS PER KILOGRAM (MG/KG).
3. ELEVATIONS ARE REFERENCED TO THE NORTH AMERICAN VERTICAL DATUM OF 1988 (NAVD88).

LEGEND

☐	APPROXIMATE SITE BOUNDARY
🟥	COMPLETED EXCAVATION AREA TO 15 FT BGS
🟦	COMPLETED EXCAVATION AREA TO 6 FT BGS
⊕ A1–PB	APPROXIMATE POST–EXCAVATION SOIL SAMPLE LOCATION



0 10 20 40
SCALE IN FEET

NO.	ISSUE/DESCRIPTION	BY	DATE

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PHILIP GERALD CLARK
088422

4778 BROADWAY
NEW YORK, NY 10034

POST EXCAVATION SOIL RESULTS

Appendix N

PREPARED FOR:
M4778 BROADWAY, LLC

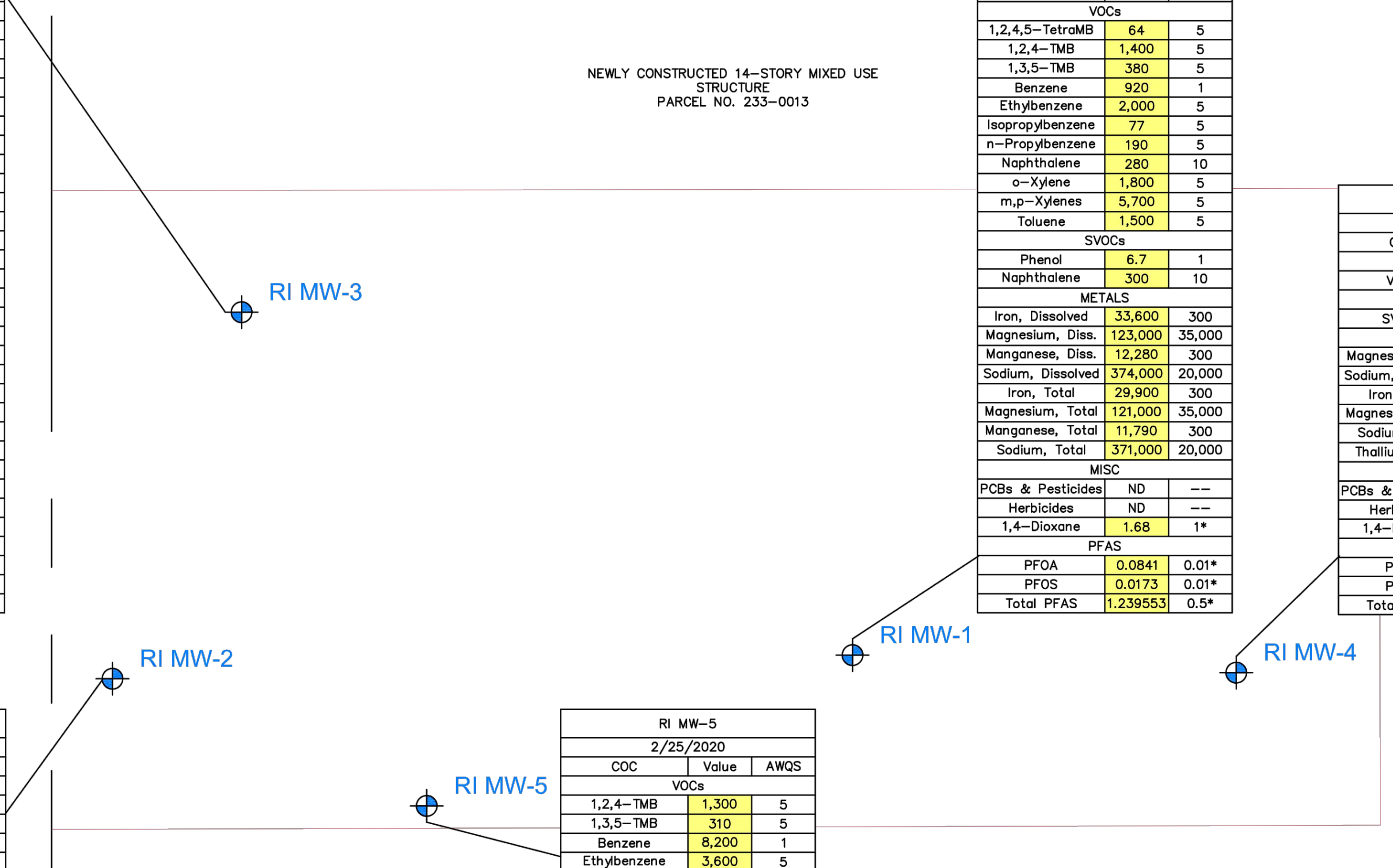
PROJ MGR: ZL	REVIEWED BY: ZL	CHECKED BY: VW	FIGURE 2 SHEET NO.
DESIGNED BY: SG	DRAWN BY: SG	SCALE: 1"=20'	
DATE: March 2025	PROJECT NO. 41.0163310.10	REVISION NO.	

RI MW-3		
2/25/2020		
COC	Value	AWQS
VOCs		
1,2,4,5–TetraMB	50	5
1,2,4–TMB	140	5
1,3,5–TMB	23	5
Benzene	120	1
Ethylbenzene	410	5
Isopropylbenzene	32	5
n–Propylbenzene	71	5
Naphthalene	13	10
o–Xylene	160	5
m,p–Xylenes	500	5
sec–Butylbenzene	6.5	5
Toluene	490	5
SVOCs		
SVOCs	NE	––
DISSOLVED METALS		
Arsenic, Dissolved	28	25
Iron, Dissolved	687	300
Manganese, Diss.	324	300
Sodium, Dissolved	441,000	20,000
TOTAL METALS		
Iron, Total	1,800	300
Manganese, Total	314	300
Sodium, Total	473,000	20,000
MISC		
PCBs & Pesticides	ND	––
Herbicides	ND	––
1,4–Dioxane	ND	1*
PFAS		
PFOA	0.1720	0.01*
PFOS	1.37	0.01*
Total PFAS	4.47311	0.5*

NEWLY CONSTRUCTED 14–STORY MIXED USE
STRUCTURE
PARCEL NO. 233–0013

RI MW-1		
2/25/2020		
COC	Value	AWQS
VOCs		
1,2,4,5–TetraMB	64	5
1,2,4–TMB	1,400	5
1,3,5–TMB	380	5
Benzene	920	1
Ethylbenzene	2,000	5
Isopropylbenzene	77	5
n–Propylbenzene	190	5
Naphthalene	280	10
o–Xylene	1,800	5
m,p–Xylenes	5,700	5
Toluene	1,500	5
SVOCs		
Phenol	6.7	1
Naphthalene	300	10
METALS		
Iron, Dissolved	33,600	300
Magnesium, Diss.	123,000	35,000
Manganese, Diss.	12,280	300
Sodium, Dissolved	374,000	20,000
Iron, Total	29,900	300
Magnesium, Total	121,000	35,000
Manganese, Total	11,790	300
Sodium, Total	371,000	20,000
MISC		
PCBs & Pesticides	ND	––
Herbicides	ND	––
1,4–Dioxane	1.68	1*
PFAS		
PFOA	0.0841	0.01*
PFOS	0.0173	0.01*
Total PFAS	1.239553	0.5*

RI MW-4		
2/25/2020		
COC	Value	AWQS
VOCs		
VOCs	ND	––
SVOCs		
SVOCs	<AWQS	––
METALS		
Magnesium, Diss.	41,000	35,000
Sodium, Dissolved	95,300	20,000
Iron, Total	4,530	300
Magnesium, Total	45,800	35,000
Sodium, Total	95,400	20,000
Thallium, Total	0.74	0.5
MISC		
PCBs & Pesticides	ND	––
Herbicides	ND	––
1,4–Dioxane	ND	1*
PFAS		
PFOA	0.0676	0.01*
PFOS	0.0452	0.01*
Total PFAS	<AWQS	0.5*



RI MW-2		
2/25/2020		
COC	Value	AWQS
VOCs		
1,2,4–TMB	1,800	5
1,3,5–TMB	450	5
Benzene	8,000	1
Ethylbenzene	5,300	5
Naphthalene	360	10
o–Xylene	6,600	5
m,p–Xylenes	16,000	5
Toluene	39,000	5
2,4–Dimethylphenol	72	50
SVOCs		
Phenol	6.7	1
Naphthalene	380	10
METALS		
Iron, Dissolved	1,680	300
Manganese, Diss.	727	300
Sodium, Dissolved	566,000	20,000
Iron, Total	4,450	300
Manganese, Total	879	300
Sodium, Total	642,000	20,000
MISC		
PCBs & Pesticides	ND	––
Herbicides	ND	––
1,4–Dioxane	ND	1*
PFAS		
PFOA	0.1050	0.01*
PFOS	0.745	0.01*
Total PFAS	4.27755	0.5*

RI MW-5		
2/25/2020		
COC	Value	AWQS
VOCs		
1,2,4–TMB	1,300	5
1,3,5–TMB	310	5
Benzene	8,200	1
Ethylbenzene	3,600	5
o–Xylene	5,100	5
m,p–Xylenes	11,00	5
Toluene	34,000	5
SVOCs		
2,4–Dimethylphenol	87	50
METALs		
Barium, Dissolved	2,194	1,000
Iron, Dissolved	20,400	300
Magnesium, Diss.	68,600	35,000
Manganese, Diss.	4,363	300
Sodium, Dissolved	1,100,000	20,000
Barium, Total	2,251	1,000
Iron, Total	22,700	300
Magnesium, Total	72,700	35,000
Manganese, Total	3,925	300
Sodium, Total	1,130,000	20,000
MISC		
PCBs & Pesticides	ND	––
Herbicides	ND	––
1,4–Dioxane	ND	1*
PFAS		
PFOA	0.2	0.01*
PFOS	1.53	0.01*
Total PFAS	6.199794	0.5*

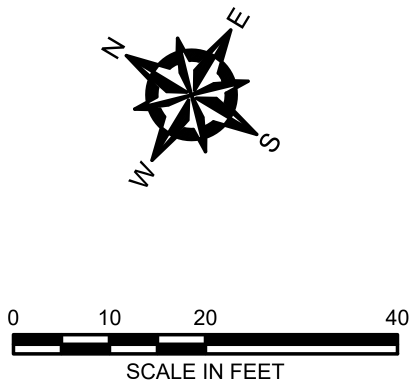
4768 BROADWAY LLC
PARCEL NO. 2566–0005
OCCUPIED FINE FARE SUPERMARKET

GENERAL NOTES

1. BASE MAP DEVELOPED FROM DRAWING TITLED "GROUNDWATER CONCENTRATION MAP – RI", PREPARED BY AEI CONSULTANTS, ORIGINAL SCALE 1"=16', DATED SEPTEMBER 15, 2023.
2. ALL CONCENTRATIONS ARE IN MICROGRAMS PER LITER (μG/L).
3. ONLY ANALYTES WITH DETECTED CONCENTRATIONS IN EXCESS OF NYSDEC AWQS OR SCREENING LEVELS ARE SHOWN.

LEGEND

▭	APPROXIMATE SITE BOUNDARY
⊕ RI MW-1	APPROXIMATE RI GROUNDWATER MONITORING WELL SAMPLE LOCATION (FEBRUARY 25, 2020)



COC - contaminant of concern
AWQS - Ambient Water Quality Standard
VOCs - Volatile organic compounds
TetraMB - Tetramethylbenzene
TMB - Trimethylbenzene
SVOCs - Semivolatile organic compounds
PCBs - Polychlorinated biphenyls
PFAS - Per- and polyfluoroalkyl substances
PFOA - Perfluorooctanoic acid
ND - Not detected above laboratory MDL
--- - Not applicable
<AWQS - Not in exceedance of AWQS
*Based on finalized Ambient Water Quality Guidance Values by NYSDEC

Yellow Highlight - Concentration exceeds NYSDEC AWQS or screening level

P.E. STAMP

STATE OF NEW YORK
PHILIP GERALD CLARK
088422
LICENSED PROFESSIONAL ENGINEER

NO.	ISSUE/DESCRIPTION	BY	DATE

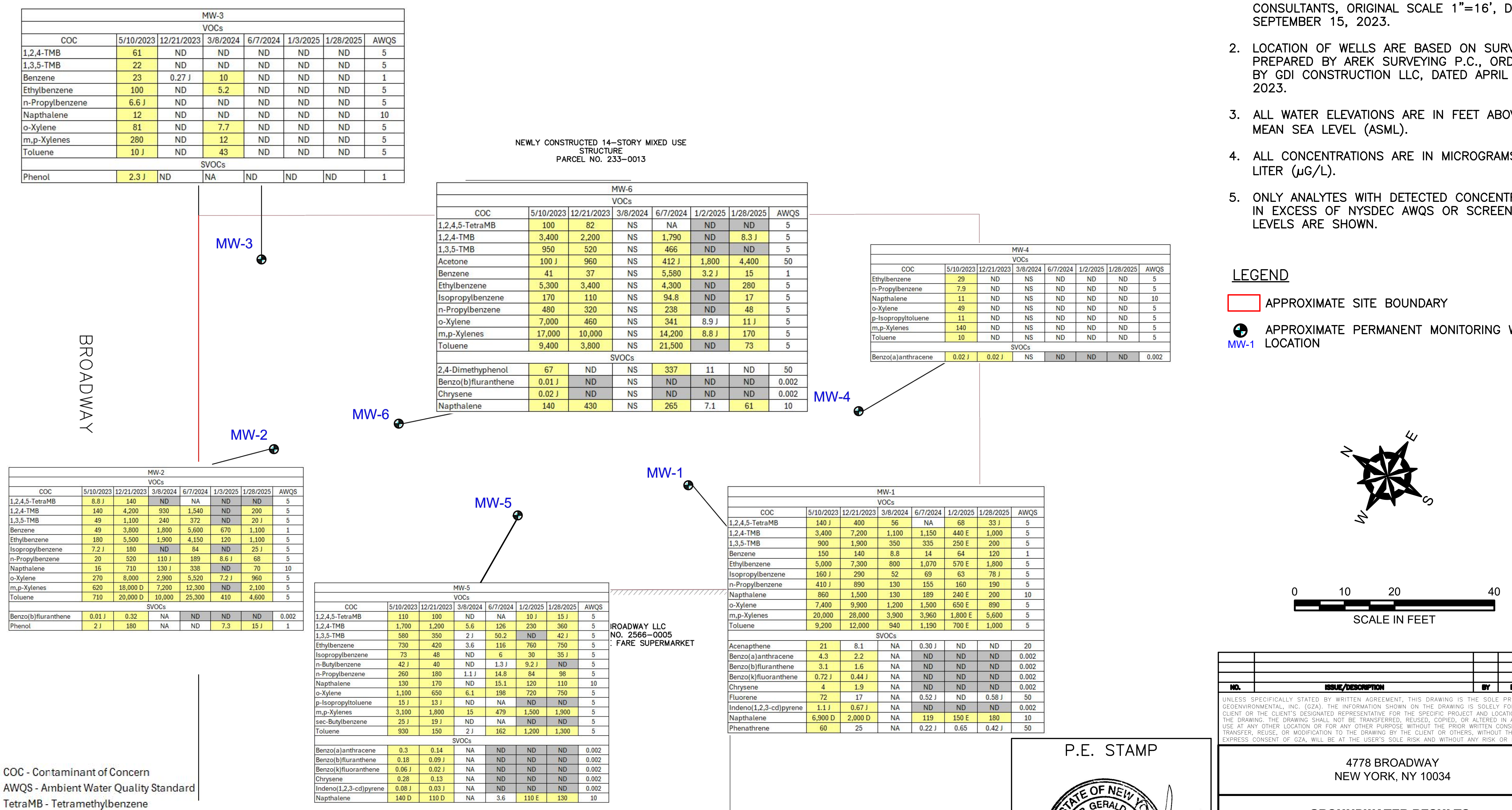
4778 BROADWAY
NEW YORK, NY 10034

GROUNDWATER RESULTS - FEBRUARY 2020 RI

Appendix N

PREPARED FOR:
M4778 BROADWAY, LLC

PROJ MGR: ZL	REVIEWED BY: ZL	CHECKED BY: VW	FIGURE 3
DESIGNED BY: SG	DRAWN BY: SG	SCALE: 1"=20'	
DATE: March 2025	PROJECT NO. 41.0163310.10	REVISION NO.	SHEET NO.



MW-3							
VOCs							
COC	5/10/2023	12/21/2023	3/8/2024	6/7/2024	1/3/2025	1/28/2025	AWQS
1,2,4-TMB	61	ND	ND	ND	ND	ND	5
1,3,5-TMB	22	ND	ND	ND	ND	ND	5
Benzene	23	0.27 J	10	ND	ND	ND	1
Ethylbenzene	100	ND	5.2	ND	ND	ND	5
n-Propylbenzene	6.6 J	ND	ND	ND	ND	ND	5
Napthalene	12	ND	ND	ND	ND	ND	10
o-Xylene	81	ND	7.7	ND	ND	ND	5
m,p-Xylenes	280	ND	12	ND	ND	ND	5
Toluene	10 J	ND	43	ND	ND	ND	5
SVOCs							
Phenol	2.3 J	ND	NA	ND	ND	ND	1

MW-6							
VOCs							
COC	5/10/2023	12/21/2023	3/8/2024	6/7/2024	1/2/2025	1/28/2025	AWQS
1,2,4,5-TetraMB	100	82	NS	NA	ND	ND	5
1,2,4-TMB	3,400	2,200	NS	1,790	ND	8.3 J	5
1,3,5-TMB	950	520	NS	466	ND	ND	5
Acetone	100 J	960	NS	412 J	1,800	4,400	50
Benzene	41	37	NS	5,580	3.2 J	15	1
Ethylbenzene	5,300	3,400	NS	4,300	ND	280	5
Isopropylbenzene	170	110	NS	94.8	ND	17	5
n-Propylbenzene	480	320	NS	238	ND	48	5
o-Xylene	7,000	460	NS	341	8.9 J	11 J	5
m,p-Xylenes	17,000	10,000	NS	14,200	8.8 J	170	5
Toluene	9,400	3,800	NS	21,500	ND	73	5
SVOCs							
2,4-Dimethyphenol	67	ND	NS	337	11	ND	50
Benzo(b)fluranthene	0.01 J	ND	NS	ND	ND	ND	0.002
Chrysene	0.02 J	ND	NS	ND	ND	ND	0.002
Napthalene	140	430	NS	265	7.1	61	10

MW-4							
VOCs							
COC	5/10/2023	12/21/2023	3/8/2024	6/7/2024	1/2/2025	1/28/2025	AWQS
Ethylbenzene	29	ND	NS	ND	ND	ND	5
n-Propylbenzene	7.9	ND	NS	ND	ND	ND	5
Napthalene	11	ND	NS	ND	ND	ND	10
o-Xylene	49	ND	NS	ND	ND	ND	5
p-Isopropyltoluene	11	ND	NS	ND	ND	ND	5
m,p-Xylenes	140	ND	NS	ND	ND	ND	5
Toluene	10	ND	NS	ND	ND	ND	5
SVOCs							
Benzo(a)anthracene	0.02 J	0.02 J	NS	ND	ND	ND	0.002

MW-2							
VOCs							
COC	5/10/2023	12/21/2023	3/8/2024	6/7/2024	1/3/2025	1/28/2025	AWQS
1,2,4,5-TetraMB	8.8 J	140	ND	NA	ND	ND	5
1,2,4-TMB	140	4,200	930	1,540	ND	200	5
1,3,5-TMB	49	1,100	240	372	ND	20 J	5
Benzene	49	3,800	1,800	5,600	670	1,100	1
Ethylbenzene	180	5,500	1,900	4,150	120	1,100	5
Isopropylbenzene	7.2 J	180	ND	84	ND	25 J	5
n-Propylbenzene	20	520	110 J	189	8.6 J	68	5
Napthalene	16	710	130 J	338	ND	70	10
o-Xylene	270	8,000	2,900	5,520	7.2 J	960	5
m,p-Xylenes	620	18,000 D	7,200	12,300	ND	2,100	5
Toluene	710	20,000 D	10,000	25,300	410	4,600	5
SVOCs							
Benzo(b)fluranthene	0.01 J	0.32	NA	ND	ND	ND	0.002
Phenol	2 J	180	NA	ND	7.3	15 J	1

MW-5							
VOCs							
COC	5/10/2023	12/21/2023	3/8/2024	6/7/2024	1/2/2025	1/28/2025	AWQS
1,2,4,5-TetraMB	110	100	ND	NA	10 J	15 J	5
1,2,4-TMB	1,700	1,200	5.6	126	230	360	5
1,3,5-TMB	580	350	2 J	50.2	ND	42 J	5
Ethylbenzene	730	420	3.6	116	760	750	5
Isopropylbenzene	73	48	ND	6	30	35 J	5
n-Butylbenzene	42 J	40	ND	1.3 J	9.2 J	ND	5
n-Propylbenzene	260	180	1.1 J	14.8	84	98	5
Napthalene	130	170	ND	15.1	120	110	10
o-Xylene	1,100	650	6.1	198	720	750	5
p-Isopropyltoluene	15 J	13 J	ND	NA	ND	ND	5
m,p-Xylenes	3,100	1,800	15	479	1,500	1,900	5
sec-Butylbenzene	25 J	19 J	ND	NA	ND	ND	5
Toluene	930	150	2 J	162	1,200	1,300	5
SVOCs							
Benzo(a)anthracene	0.3	0.14	NA	ND	ND	ND	0.002
Benzo(b)fluranthene	0.18	0.09 J	NA	ND	ND	ND	0.002
Benzo(k)fluoranthene	0.06 J	0.02 J	NA	ND	ND	ND	0.002
Chrysene	0.28	0.13	NA	ND	ND	ND	0.002
Indeno(1,2,3-cd)pyrene	0.08 J	0.03 J	NA	ND	ND	ND	0.002
Napthalene	140 D	110 D	NA	3.6	110 E	130	10

MW-1							
VOCs							
COC	5/10/2023	12/21/2023	3/8/2024	6/7/2024	1/2/2025	1/28/2025	AWQS
1,2,4,5-TetraMB	140 J	400	56	NA	68	33 J	5
1,2,4-TMB	3,400	7,200	1,100	1,150	440 E	1,000	5
1,3,5-TMB	900	1,900	350	335	250 E	200	5
Benzene	150	140	8.8	14	64	120	1
Ethylbenzene	5,000	7,300	800	1,070	570 E	1,800	5
Isopropylbenzene	160 J	290	52	69	63	78 J	5
n-Propylbenzene	410 J	890	130	155	160	190	5
Napthalene	860	1,500	130	189	240 E	200	10
o-Xylene	7,400	9,900	1,200	1,500	650 E	890	5
m,p-Xylenes	20,000	28,000	3,900	3,960	1,800 E	5,600	5
Toluene	9,200	12,000	940	1,190	700 E	1,000	5
SVOCs							
Acenapthene	21	8.1	NA	0.30 J	ND	ND	20
Benzo(a)anthracene	4.3	2.2	NA	ND	ND	ND	0.002
Benzo(b)fluranthene	3.1	1.6	NA	ND	ND	ND	0.002
Benzo(k)fluoranthene	0.72 J	0.44 J	NA	ND	ND	ND	0.002
Chrysene	4	1.9	NA	ND	ND	ND	0.002
Fluorene	72	17	NA	0.52 J	ND	0.58 J	50
Indeno(1,2,3-cd)pyrene	1.1 J	0.67 J	NA	ND	ND	ND	0.002
Napthalene	6,900 D	2,000 D	NA	119	150 E	180	10
Phenathrene	60	25	NA	0.22 J	0.65	0.42 J	50

COC - Contaminant of Concern
AWQS - Ambient Water Quality Standard
TetraMB - Tetramethylbenzene
TMB - Trimethylbenzene
MW - Permanent Monitoring Well
J - Estimated Value. The analyte co--entration is below the quantitative limit (RL), but above the method detection limit (MDL) or estimated detection limit (EDL)
ND - not detected at the reprted detection limit
E - Concentration of analyte exceeds the range of the calibration curve and/or linear range of the instrument
D - Concentration of analyte was quantified from diluted analysis
🟨 Concentration exceeds NYSDEC AWQS
▨ Laboratory reporting limit exceeds NYSDEC AWQS

GENERAL NOTES

1. BASE MAP DEVELOPED FROM DRAWING TITLED "GROUNDWATER CONCENTRATION MAP – PRE–INJECTION", PREPARED BY AEI CONSULTANTS, ORIGINAL SCALE 1"=16', DATED SEPTEMBER 15, 2023.
2. LOCATION OF WELLS ARE BASED ON SURVEY PREPARED BY AREK SURVEYING P.C., ORDERED BY GDI CONSTRUCTION LLC, DATED APRIL 28, 2023.
3. ALL WATER ELEVATIONS ARE IN FEET ABOVE MEAN SEA LEVEL (ASML).
4. ALL CONCENTRATIONS ARE IN MICROGRAMS PER LITER (µG/L).
5. ONLY ANALYTES WITH DETECTED CONCENTRATIONS IN EXCESS OF NYSDEC AWQS OR SCREENING LEVELS ARE SHOWN.

LEGEND

🟥 APPROXIMATE SITE BOUNDARY

● MW-1 APPROXIMATE PERMANENT MONITORING WELL LOCATION

NO.	ISSUE/DESCRIPTION	BY	DATE

P.E. STAMP

PHILIP GERALD CLARK
088422

4778 BROADWAY
NEW YORK, NY 10034

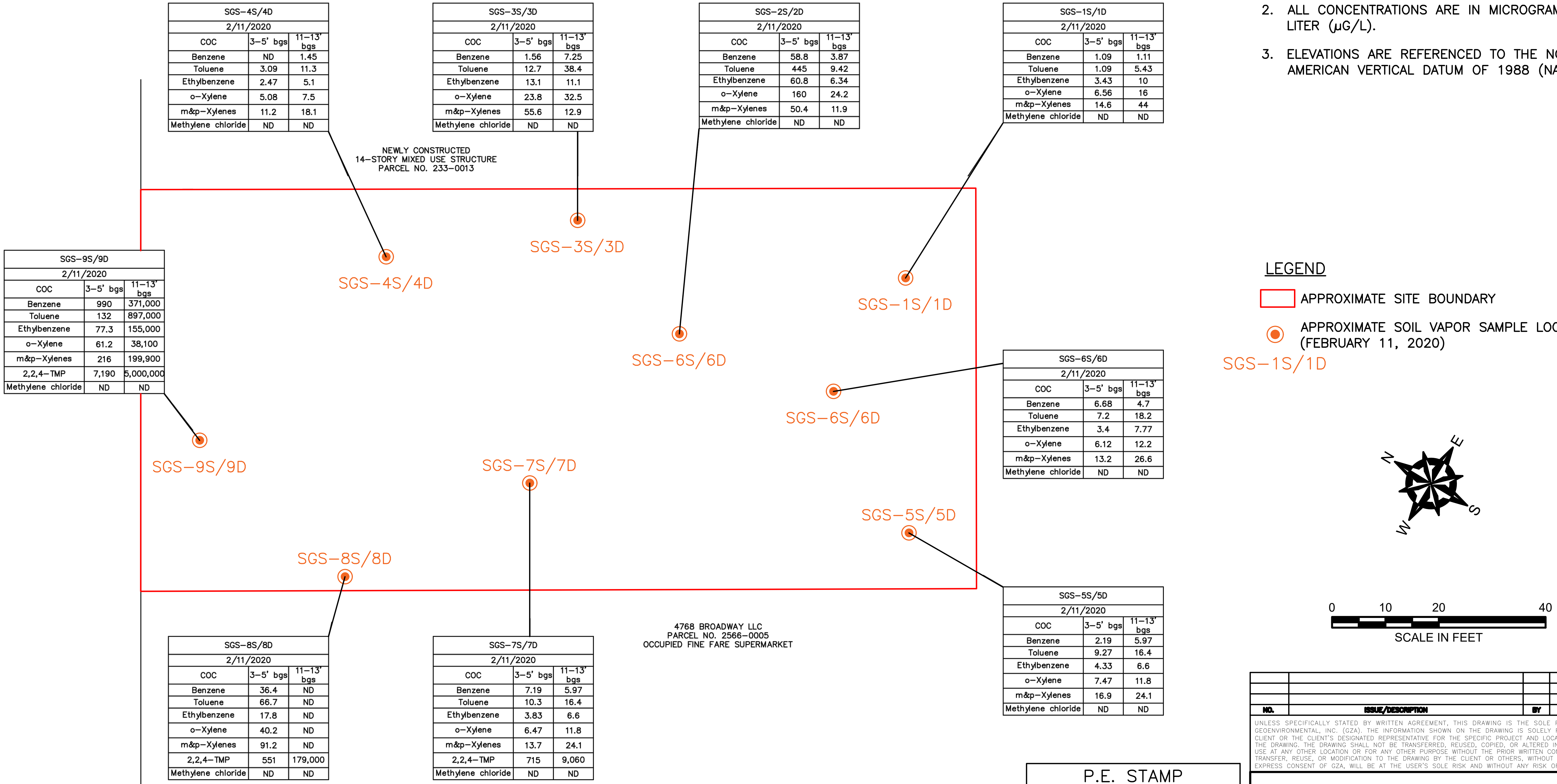
GROUNDWATER RESULTS - PRE-/POST-INJECTION

Appendix N

PREPARED FOR:
M4778 BROADWAY, LLC

PROJ MGR: ZL	REVIEWED BY: ZL	CHECKED BY: VW	FIGURE 4
DESIGNED BY: SG	DRAWN BY: SG	SCALE: 1"=20'	
DATE: April 2025	PROJECT NO. 41.0163310.10	REVISION NO.	SHEET NO.

GZA–J:\Active 163300 to 163399\163310.10 – M44778 Broadway Remedial Closure Consulting\Drawings\GZA CAD\41.0163310.10 SMP.dwg [F6] March 17, 2025 – 2:34pm Selia.Gupta



SGS–4S/4D 2/11/2020 COC	3–5' bgs	11–13' bgs
Benzene	ND	1.45
Toluene	3.09	11.3
Ethylbenzene	2.47	5.1
o–Xylene	5.08	7.5
m&p–Xylenes	11.2	18.1
Methylene chloride	ND	ND

SGS–3S/3D 2/11/2020 COC	3–5' bgs	11–13' bgs
Benzene	1.56	7.25
Toluene	12.7	38.4
Ethylbenzene	13.1	11.1
o–Xylene	23.8	32.5
m&p–Xylenes	55.6	12.9
Methylene chloride	ND	ND

SGS–2S/2D 2/11/2020 COC	3–5' bgs	11–13' bgs
Benzene	58.8	3.87
Toluene	445	9.42
Ethylbenzene	60.8	6.34
o–Xylene	160	24.2
m&p–Xylenes	50.4	11.9
Methylene chloride	ND	ND

SGS–1S/1D 2/11/2020 COC	3–5' bgs	11–13' bgs
Benzene	1.09	1.11
Toluene	1.09	5.43
Ethylbenzene	3.43	10
o–Xylene	6.56	16
m&p–Xylenes	14.6	44
Methylene chloride	ND	ND

SGS–9S/9D 2/11/2020 COC	3–5' bgs	11–13' bgs
Benzene	990	371,000
Toluene	132	897,000
Ethylbenzene	77.3	155,000
o–Xylene	61.2	38,100
m&p–Xylenes	216	199,900
2,2,4–TMP	7,190	5,000,000
Methylene chloride	ND	ND

SGS–6S/6D 2/11/2020 COC	3–5' bgs	11–13' bgs
Benzene	6.68	4.7
Toluene	7.2	18.2
Ethylbenzene	3.4	7.77
o–Xylene	6.12	12.2
m&p–Xylenes	13.2	26.6
Methylene chloride	ND	ND

SGS–5S/5D 2/11/2020 COC	3–5' bgs	11–13' bgs
Benzene	2.19	5.97
Toluene	9.27	16.4
Ethylbenzene	4.33	6.6
o–Xylene	7.47	11.8
m&p–Xylenes	16.9	24.1
Methylene chloride	ND	ND

SGS–8S/8D 2/11/2020 COC	3–5' bgs	11–13' bgs
Benzene	36.4	ND
Toluene	66.7	ND
Ethylbenzene	17.8	ND
o–Xylene	40.2	ND
m&p–Xylenes	91.2	ND
2,2,4–TMP	551	179,000
Methylene chloride	ND	ND

SGS–7S/7D 2/11/2020 COC	3–5' bgs	11–13' bgs
Benzene	7.19	5.97
Toluene	10.3	16.4
Ethylbenzene	3.83	6.6
o–Xylene	6.47	11.8
m&p–Xylenes	13.7	24.1
2,2,4–TMP	715	9,060
Methylene chloride	ND	ND

GENERAL NOTES

1. BASE MAP DEVELOPED FROM DRAWING TITLED "SOIL VAPOR EXCEEDANCES MAP", PREPARED BY AEI CONSULTANTS, ORIGINAL SCALE 1"=16', DATED SEPTEMBER 15, 2023.
2. ALL CONCENTRATIONS ARE IN MICROGRAMS PER LITER (µG/L).
3. ELEVATIONS ARE REFERENCED TO THE NORTH AMERICAN VERTICAL DATUM OF 1988 (NAVD88).

LEGEND

🟥 APPROXIMATE SITE BOUNDARY

◉ APPROXIMATE SOIL VAPOR SAMPLE LOCATION (FEBRUARY 11, 2020)
SGS–1S/1D

NO.	ISSUE/DESCRIPTION	BY	DATE

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088422

4778 BROADWAY
NEW YORK, NY 10034

SOIL VAPOR RESULTS - FEBRUARY 2020 RI

Appendix N

PREPARED FOR:
M4778 BROADWAY, LLC

PROJ MGR: ZL
REVIEWED BY: ZL
CHECKED BY: VW
DESIGNED BY: SG
DRAWN BY: SG
SCALE: 1"=20'
DATE: March 2025
PROJECT NO. 41.0163310.10
REVISION NO.
FIGURE 5
SHEET NO.

GZA–J:\Active 163300 to 163399\163310.10 – M44778 Broadway Remedial Closure Consulting\Drawings\GZA CAD\41.0163310.10 SMP.dwg [F7] March 17, 2025 – 2:55pm Selia.Gupta

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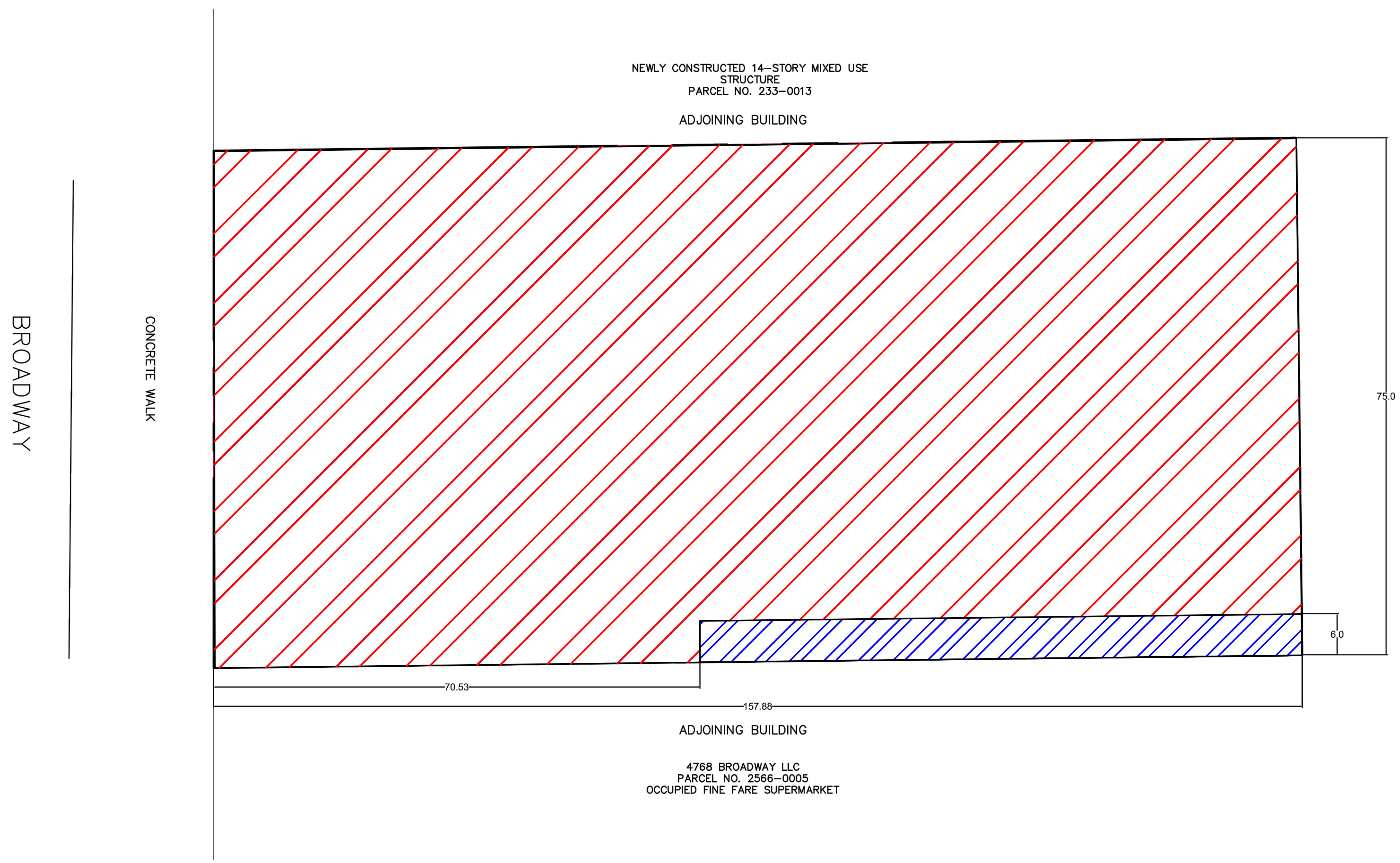
GZA–J:\Active 163300 to 163399\163310.10 – M44778 Broadway Remedial Closure Consulting\Drawings\GZA CAD\41.0163310.10 SMP.dwg [F8] March 17, 2025 – 4:00pm Selia.Gupta

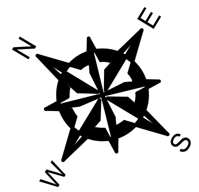
GENERAL NOTES

1. BASE MAP DEVELOPED FROM DRAWING TITLED "INSTITUTIONAL CONTROL BOUNDARIES", PREPARED BY AEI CONSULTANTS, ORIGINAL SCALE 1"=16', DATED SEPTEMBER 15, 2023.
2. TRACK 2 CLEANUP WAS ACHIEVED.



LEGEND

☐ APPROXIMATE SITE BOUNDARY
▨ COMPLETED EXCAVATION AREA TO 15 FT BGS
▨ COMPLETED EXCAVATION AREA TO 6 FT BGS



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088422

NO.	ISSUE/DESCRIPTION	BY	DATE

4778 BROADWAY
NEW YORK, NY 10034

INSTITUTIONAL CONTROL BOUNDARIES

Appendix N

PREPARED FOR:
M4778 BROADWAY, LLC

PROJ MGR: ZL
REVIEWED BY: ZL
CHECKED BY: VW
DESIGNED BY: SG
DRAWN BY: SG
SCALE: 1"=20'
DATE: March 2025
PROJECT NO. 41.0163310.10
REVISION NO.
FIGURE 6
SHEET NO.

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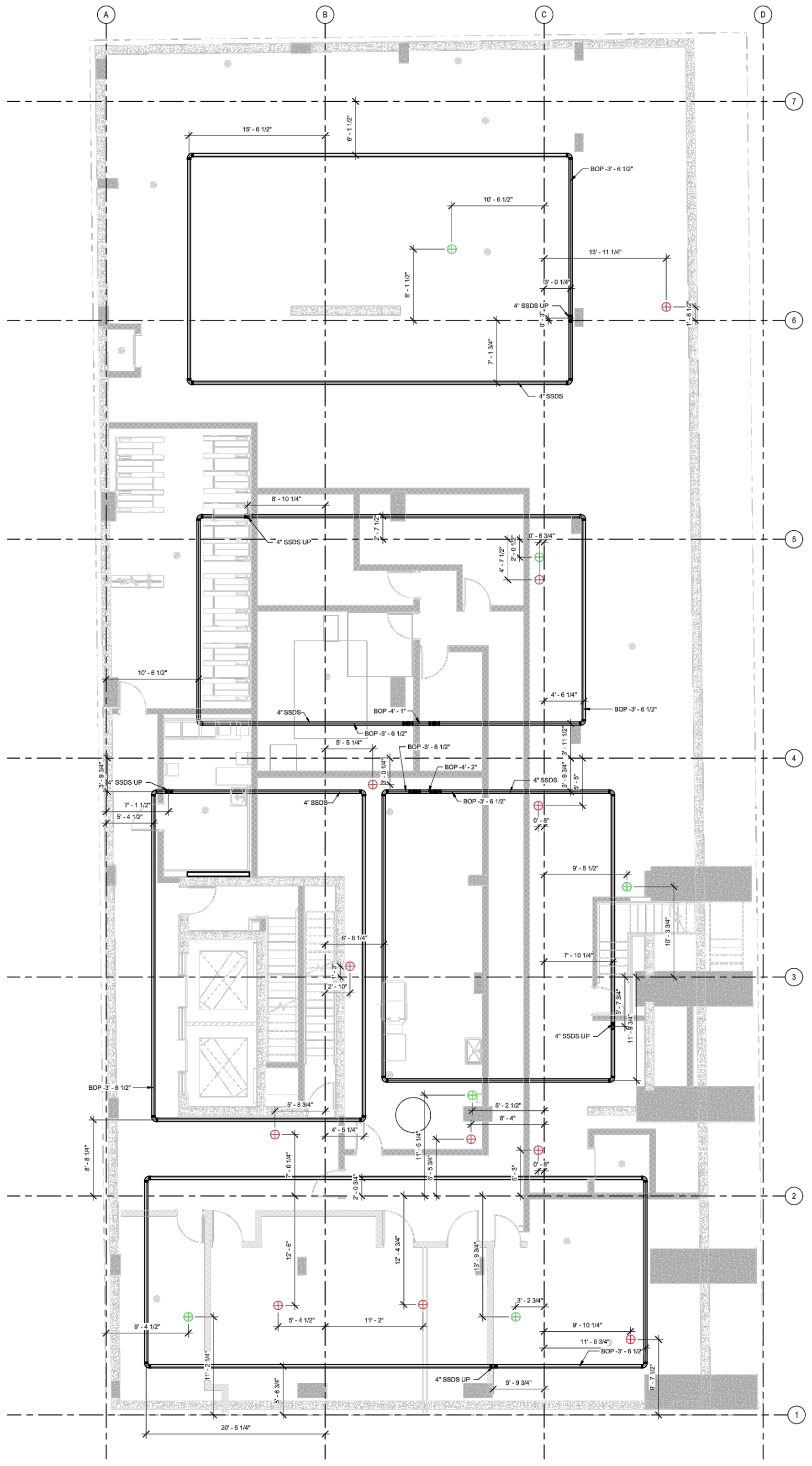
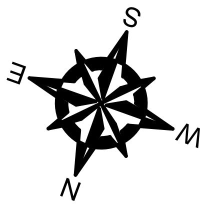
GZA-J:\Active 163300 to 163399\163310.10 – M44778 Broadway Remedial Closure Consulting\Drawings\GZA CAD\41.0163310.10 SMP.dwg [F10A] March 24, 2025 – 1:55pm Selia.Gupta





GENERAL NOTES

1. BASE MAP DEVELOPED FROM DRAWING TITLED "PLUMBING UNDERGROUND", PREPARED BY REXIS TECHNOLOGY SERVICES, LLC, ORIGINAL SCALE 3/16"=1'–0", DATED JUNE 12, 2023.
2. SSDS – SUB–SLAB DEPRESSURIZATION SYSTEM
3. BOP – BOTTOM OF PIPE

LEGEND

R 0' - 6" ⊕	PERMANENT MONITORING WELL
R 0' - 6" ⊕	PROPOSED INJECTION WELL

0 10 20 40
SCALE IN FEET

P.E. STAMP

PHILIP GERALD CLARK
16 080422

NO.	ISSUE/DESCRIPTION	BY	DATE

4778 BROADWAY
NEW YORK, NY 10034

UNDER SLAB SSDS AS-BUILT

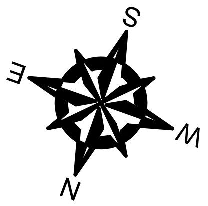
Appendix N

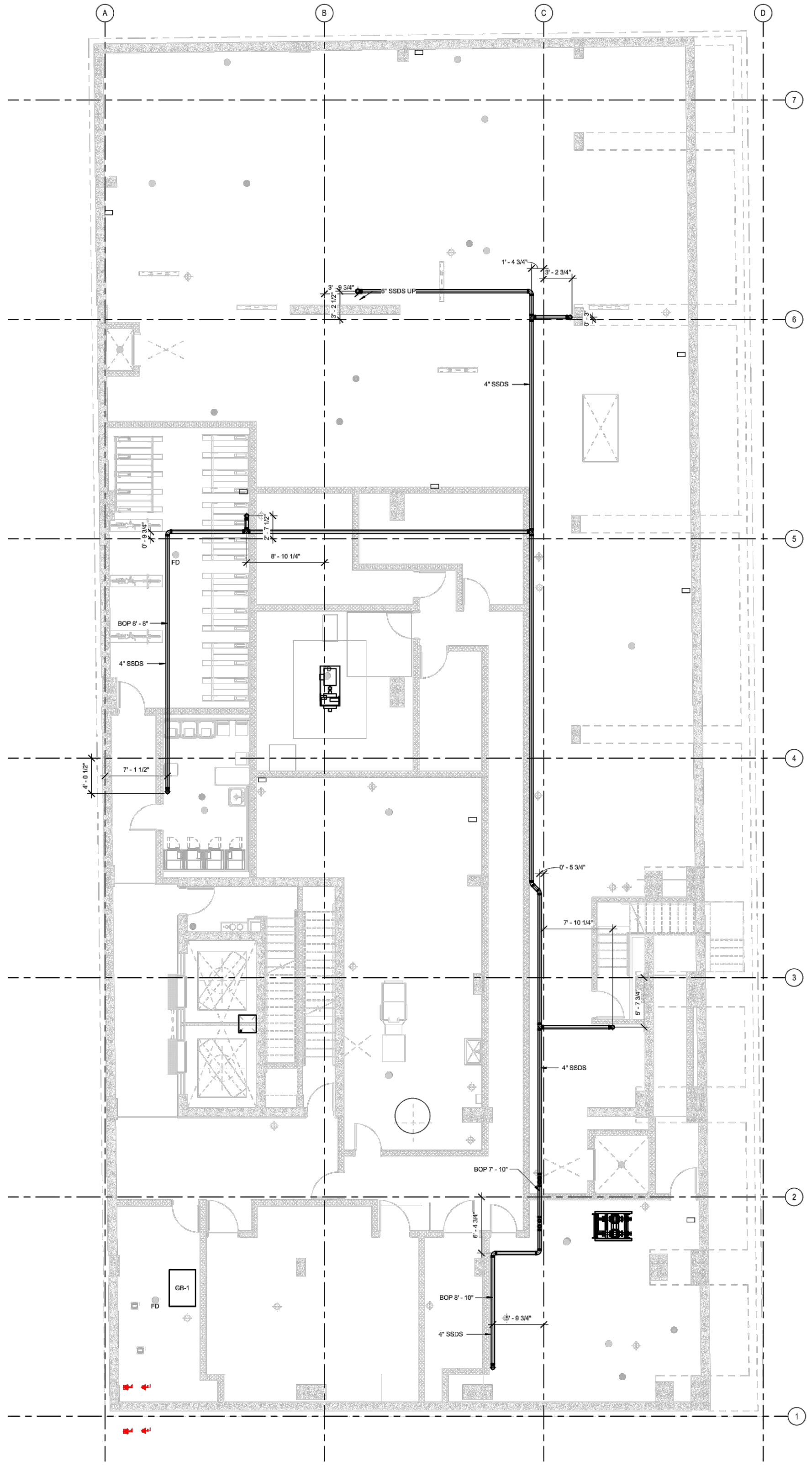
PREPARED FOR:
M4778 BROADWAY, LLC

PROJ MGR: ZL	REVIEWED BY: ZL	CHECKED BY: VW	FIGURE
DESIGNED BY: SG	DRAWN BY: SG	SCALE: 1"=20'	7A
DATE: March 2025	PROJECT NO. 41.0163310.10	REVISION NO.	SHEET NO.

GENERAL NOTES

1. BASE MAP DEVELOPED FROM DRAWING TITLED "PLUMBING CELLAR SSDS", PREPARED BY REXIS TECHNOLOGY SERVICES, LLC, ORIGINAL SCALE 3/16"=1'–0", DATED JUNE 12, 2023.
2. SSDS – SUB–SLAB DEPRESSURIZATION SYSTEM
3. BOP – BOTTOM OF PIPE





0 10 20 40

SCALE IN FEET

P.E. STAMP

PHILIP GERALD CLARK

16 088422

NO.	ISSUE/DESCRIPTION	BY	DATE

4778 BROADWAY
NEW YORK, NY 10034

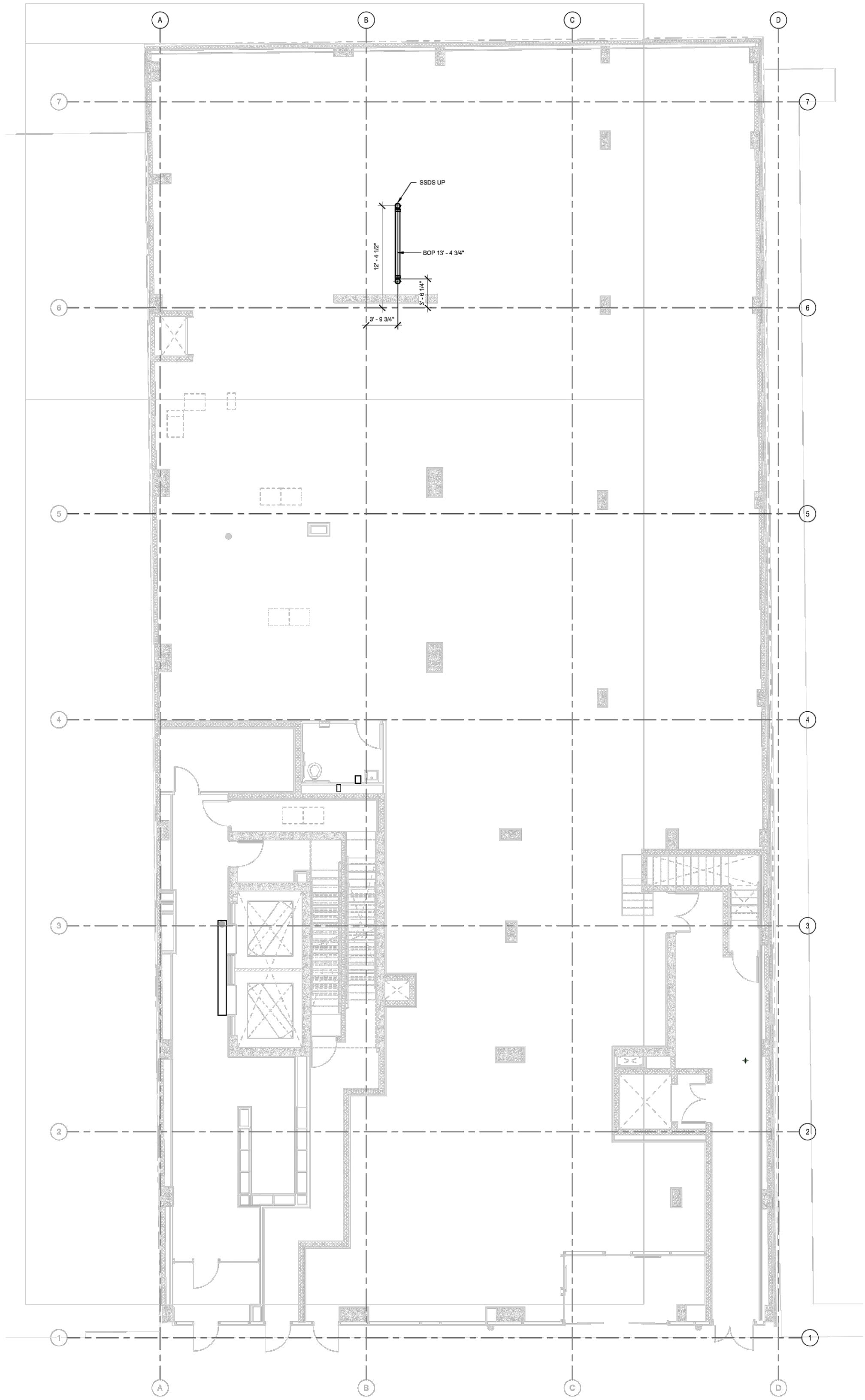
CELLAR SSDS AS-BUILT

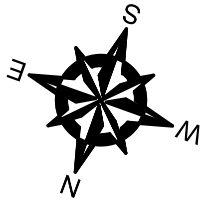
Appendix N

PREPARED FOR:
M4778 BROADWAY, LLC

PROJ MGR: ZL	REVIEWED BY: ZL	CHECKED BY: VW	FIGURE 7B
DESIGNED BY: SG	DRAWN BY: SG	SCALE: 1"=20'	
DATE: March 2025	PROJECT NO. 41.0163310.10	REVISION NO.	SHEET NO.

GZA-J:\Active 163300 to 163399\163310.10 – M44778 Broadway Remedial Closure Consulting\Drawings\GZA CAD\41.0163310.10 SMP.dwg [F10B] March 24, 2025 – 2:00pm Seila.Gupta





GENERAL NOTES

1. BASE MAP DEVELOPED FROM DRAWING TITLED "PLUMBING FIRST FLOOR SSDS", PREPARED BY REXIS TECHNOLOGY SERVICES, LLC, ORIGINAL SCALE 3/16"=1'–0", DATED JUNE 12, 2023.
2. SSDS – SUB–SLAB DEPRESSURIZATION SYSTEM
3. BOP – BOTTOM OF PIPE

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PHILIP GERALD CLARK
16 088422

NO.	ISSUE/DESCRIPTION	BY	DATE

4778 BROADWAY
NEW YORK, NY 10034

FIRST FLOOR SSDS AS-BUILT

Appendix N

PREPARED FOR:
M4778 BROADWAY, LLC

0 10 20 40
SCALE IN FEET

PROJ MGR: ZL	REVIEWED BY: ZL	CHECKED BY: VW	FIGURE 7C SHEET NO.
DESIGNED BY: SG	DRAWN BY: SG	SCALE: 1"=20'	
DATE: March 2025	PROJECT NO. 41.0163310.10	REVISION NO.	

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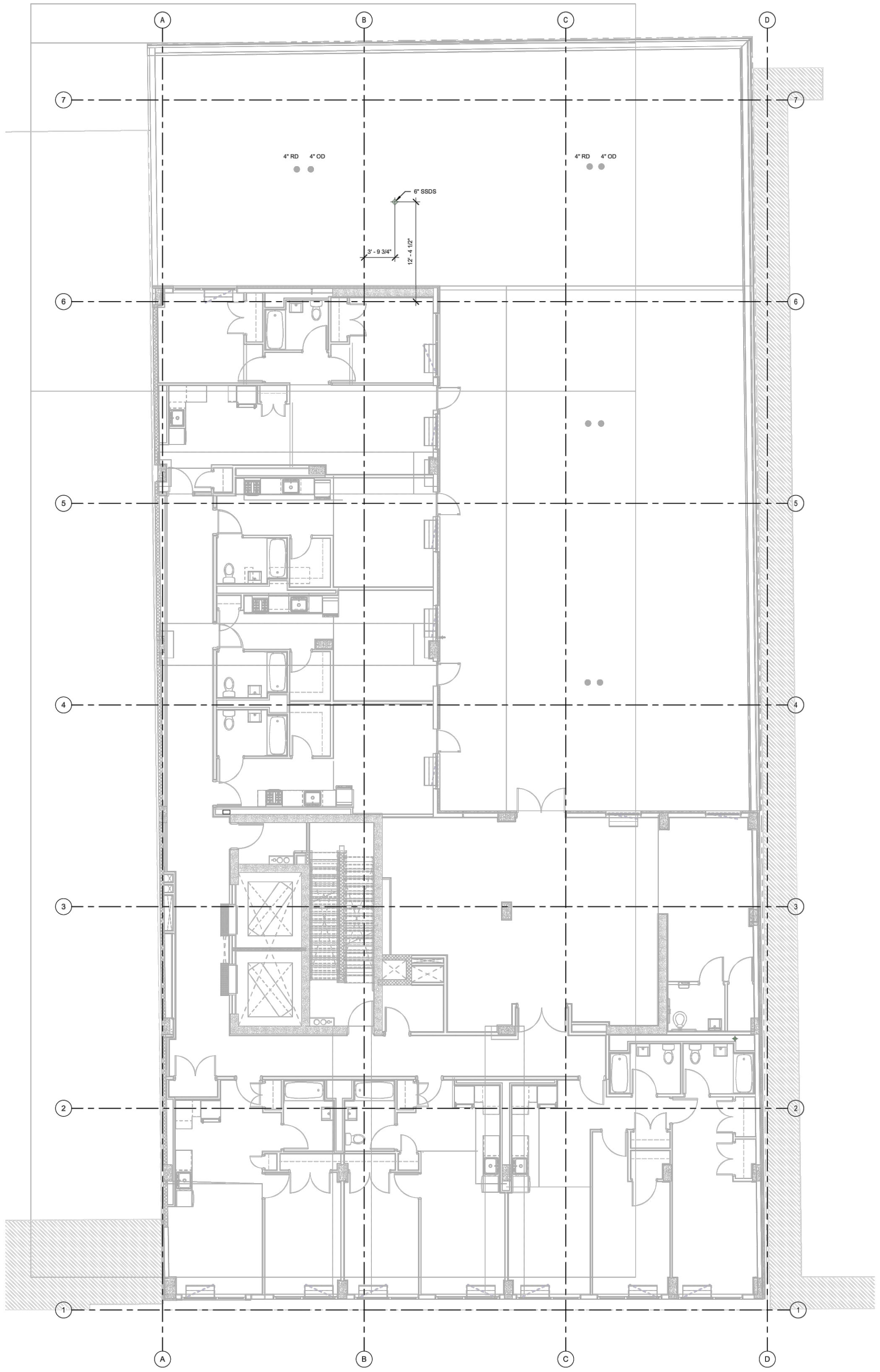
GZA-J:\Active 163300 to 163399\163310.10 – M44778 Broadway Remedial Closure Consulting\Drawings\GZA CAD\41.0163310.10 SMP.dwg [F10D] March 24, 2025 – 2:01pm Selia.Gupta



GENERAL NOTES

1. BASE MAP DEVELOPED FROM DRAWING TITLED "PLUMBING SECOND FLOOR SSDS", PREPARED BY REXIS TECHNOLOGY SERVICES, LLC, ORIGINAL SCALE 3/16"=1'-0", DATED JUNE 12, 2023.
2. SSDS – SUB-SLAB DEPRESSURIZATION SYSTEM
3. BOP – BOTTOM OF PIPE

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16 080422

0 10 20 40
SCALE IN FEET

NO.	ISSUE/DESCRIPTION	BY	DATE

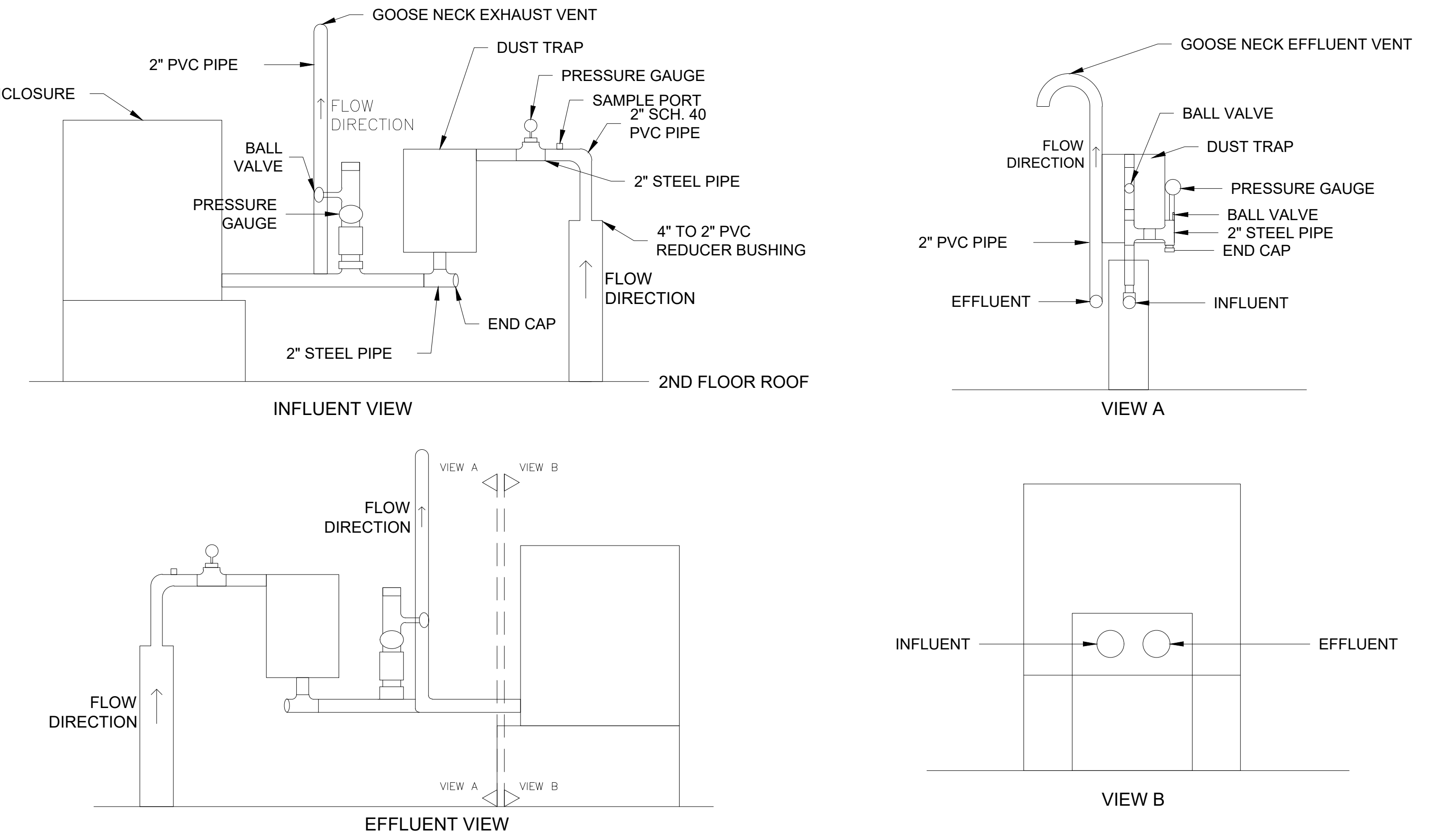
4778 BROADWAY
NEW YORK, NY 10034

SECOND FLOOR SSDS AS-BUILT

PREPARED BY: **Appendix N**

PREPARED FOR: M4778 BROADWAY, LLC

PROJ MGR: ZL
REVIEWED BY: ZL
CHECKED BY: VW
DESIGNED BY: SG
DRAWN BY: SG
SCALE: 1"=20'
DATE: March 2025
PROJECT NO. 41.0163310.10
REVISION NO.
FIGURE 7D
SHEET NO.



INFLUENT VIEW

VIEW A

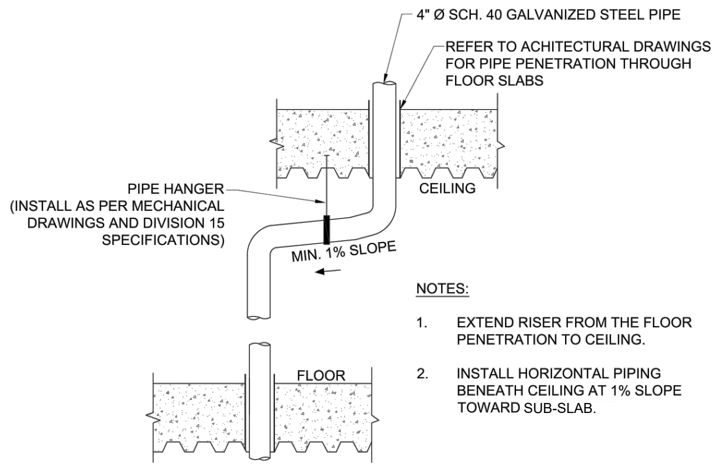
EFFLUENT VIEW

VIEW B

FAN DETAIL (TYP.)

FAN NOTES:

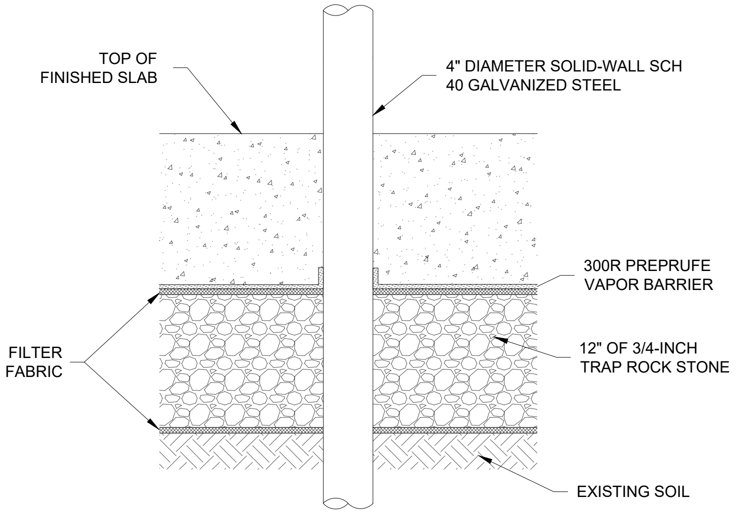
1. TOP OF STACK TO BE AT LEAST 10' FROM ANY WINDOWS, DOORS, OR OTHER BUILDING OPENINGS, OR FROM ANY WINDOWS OR OTHER OPENINGS IN ADJACENT BUILDINGS, INCLUDING AIR INTAKES, LOUVERS, VENTS, ETC.
2. FAN TO BE FANTECH RN4 OR ENGINEER APPROVAL EQUAL.
3. FAN AND ON/OFF SWITCH TO BE HARD-WIRED TOGETHER TO 115 VOLT CIRCUIT. ON/OFF SWITCH TO BE MOUNTED ON WALL NEXT TO FAN ON ROOF, COORDINATE WITH ELECTRICAL CONTRACTOR.
4. FAN CONTROLS TO INCLUDE AUDIBLE ALARM, START/STOP, EMERGENCY STOP, AND WATER COLUMN PRESSURE GAUGE.



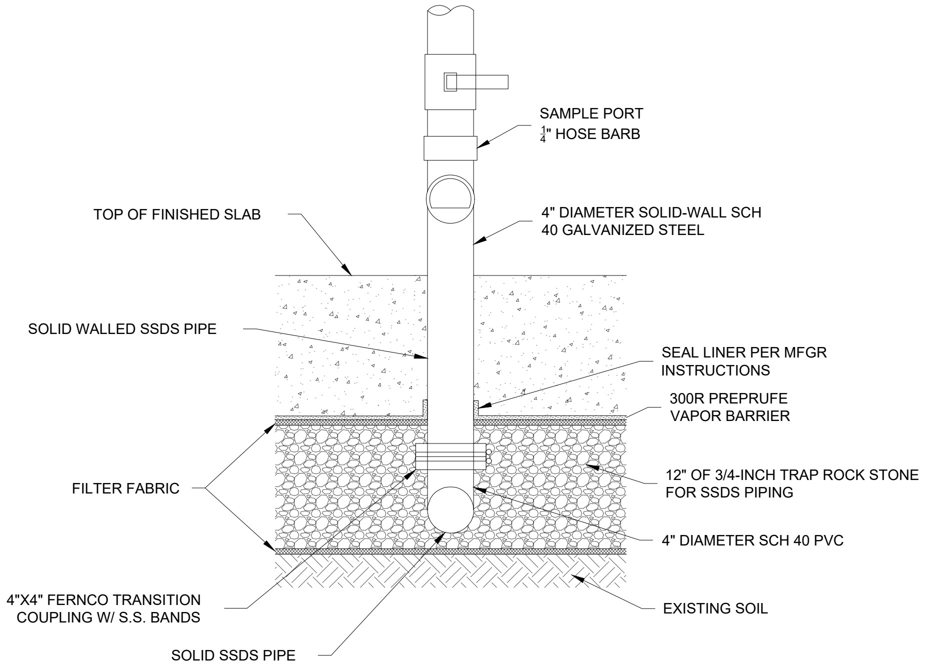
NOTES:

1. EXTEND RISER FROM THE FLOOR PENETRATION TO CEILING.
2. INSTALL HORIZONTAL PIPING BENEATH CEILING AT 1% SLOPE TOWARD SUB-SLAB.

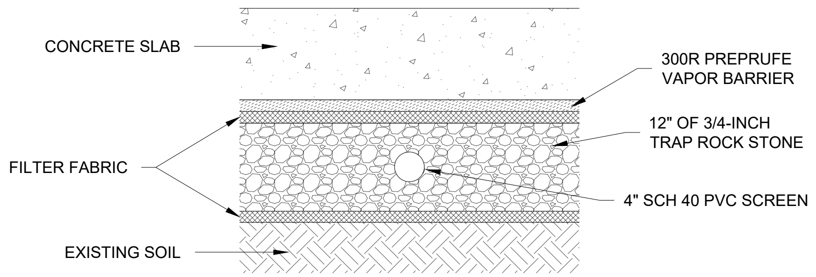
TYPICAL PIPING OFFSET



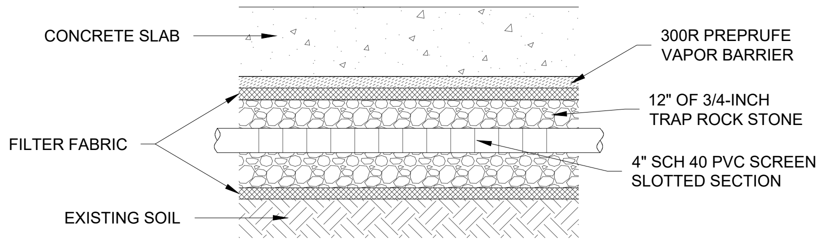
VAPOR BARRIER PENETRATION DETAIL



SUB-SLAB DEPRESSURIZATION RISE PIPE PENETRATION CROSS SECTION DETAIL



CONSTRUCTION AND INSTALLATION OF SSDS PIPING



TYP. SSDS INSTALLATION

P.E. STAMP

080422

NO.	ISSUE/DESCRIPTION	BY	DATE

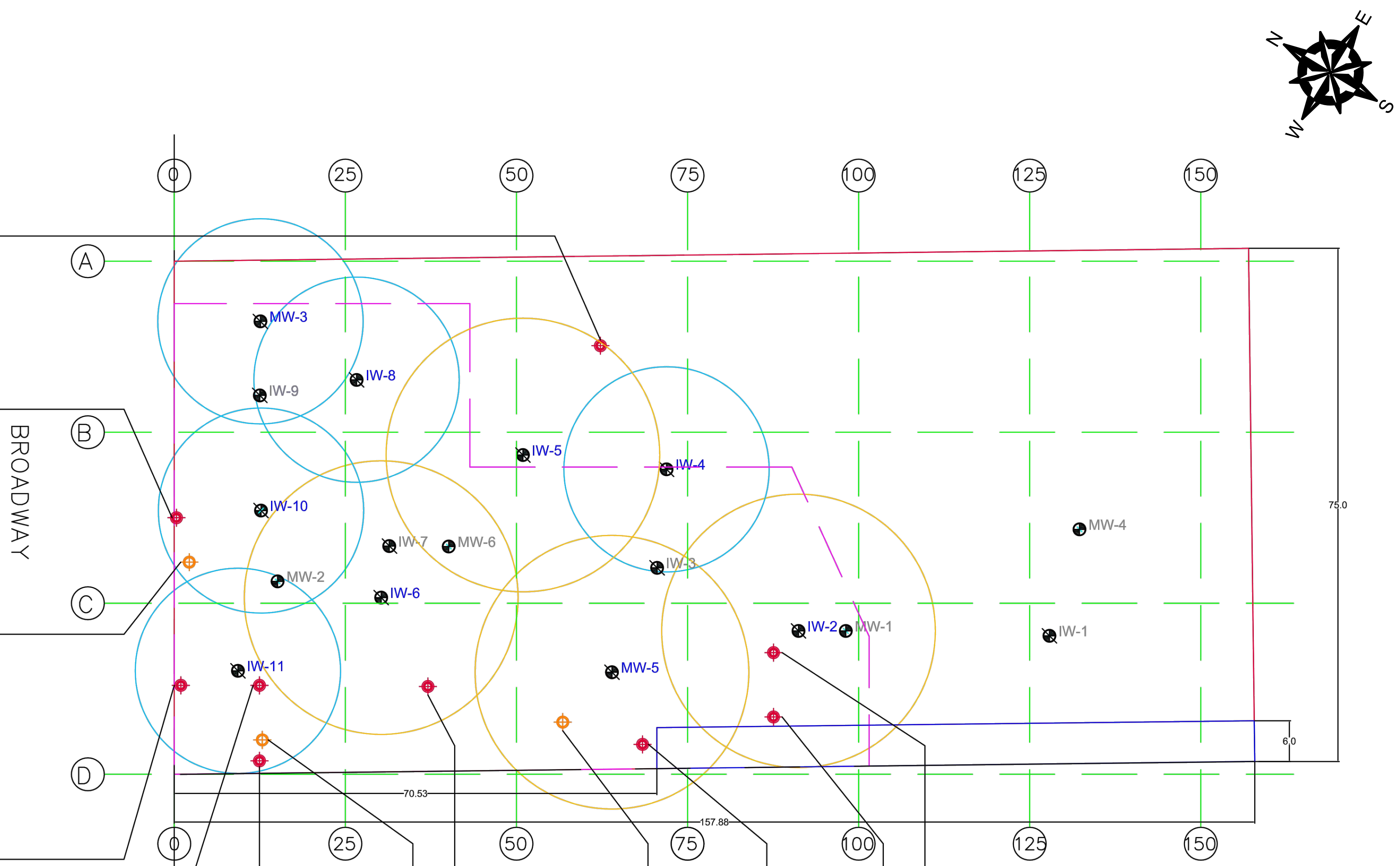
4778 BROADWAY
NEW YORK, NY 10034

AS-BUILT DETAILS FOR
SUB-SLAB DEPRESSURIZATION SYSTEM

APPENDIX N

PREPARED FOR:
M4778 BROADWAY, LLC

PROJ MGR: ZL
DESIGNED BY: SG
DATE: MAY 2025
REVIEWED BY: ZL
DRAWN BY: SG
PROJECT NO. 41.0163310.10
CHECKED BY: VW
SCALE: N.T.S.
REVISION NO.
FIGURE 7E
SHEET NO.



A3–PB	
Depth	15.0–15.5
COC	Value
1,2,4–TMB	3.9
1,3,5–TMB	1.4
Benzene	0.039
Ethybenzene	1.5
n–Propylbenzene	0.41
Naphthalene	0.52
Toluene	2.1
Xylenes, Total	10

B1–SW–W	
Depth	14.5–15.0
COC	Value
1,2,4–TMB	2.1
1,3,5–TMB	0.66
Benzene	0.011J
Ethybenzene	0.72
n–Propylbenzene	0.39
Naphthalene	0.27
Toluene	ND
Xylenes, Total	3.1

SB–19	
Depth	17.5–18
COC	Value
1,2,4–TMB	1.2
1,3,5–TMB	0.36
Benzene	3.1
Ethybenzene	5
n–Propylbenzene	0.18
Naphthalene	ND
Toluene	17
Xylenes, Total	10

C1–SW–W	
Depth	14.5–15.0
COC	Value
1,2,4–TMB	120
1,3,5–TMB	32
Benzene	2.4
Ethybenzene	68
n–Propylbenzene	14
Naphthalene	18
Toluene	95
Xylenes, Total	420

C1–PB	
Depth	15.0–15.5
COC	Value
1,2,4–TMB	67
1,3,5–TMB	21
Benzene	1.6
Ethybenzene	48
n–Propylbenzene	11
Naphthalene	9.3
Toluene	61
Xylenes, Total	260

C1–SW–S	
Depth	14.5–15.0
COC	Value
1,2,4–TMB	13
1,3,5–TMB	4.9
Benzene	0.034J
Ethybenzene	3.5
n–Propylbenzene	2.1
Naphthalene	1.9
Toluene	0.075J
Xylenes, Total	14

C2–PB	
Depth	15.0–15.5
COC	Value
1,2,4–TMB	15
1,3,5–TMB	6.1
Benzene	0.27
Ethybenzene	6
n–Propylbenzene	3.8
Naphthalene	2.8
Toluene	2.7
Xylenes, Total	24

C2–SW–E	
Depth	14.5–15.0
COC	Value
1,2,4–TMB	63
1,3,5–TMB	17
Benzene	ND
Ethybenzene	13
n–Propylbenzene	11
Naphthalene	2.6
Toluene	0.24
Xylenes, Total	42

C4–PB	
Depth	15.0–15.5
COC	Value
1,2,4–TMB	3.6
1,3,5–TMB	1.2
Benzene	ND
Ethybenzene	ND
n–Propylbenzene	0.43
Naphthalene	0.36
Toluene	0.33
Xylenes, Total	7.2

COC - contaminant of concern
TMB - Trimethylbenzene
J - Estimated concentration
ND - Not detected above laboratory MDL
ROI - Radius of influence
Yellow Highlight- Concentration exceeds NYSDEC Protection of Groundwater SCO
Orange Highlight- Concentration exceeds NYSDEC Restricted-Residential SCO

Cleanup Objectives		
COC	NYGWSCO	NYRCSCO
1,2,4–TMB	3.6	47
1,3,5–TMB	8.4	47
Benzene	0.06	2.9
Ethybenzene	1	30
n–Propylbenzene	3.9	100
Naphthalene	12	100
Toluene	0.7	100
Xylenes, Total	1.6	100

SB–18	
Depth	17.5–18
COC	Value
1,2,4–TMB	420
1,3,5–TMB	120
Benzene	54
Ethybenzene	360
n–Propylbenzene	66
Naphthalene	56
Toluene	810
Xylenes, Total	1700

SB–16	
Depth	17.5–18
COC	Value
1,2,4–TMB	190
1,3,5–TMB	59
Benzene	1.9
Ethybenzene	110
n–Propylbenzene	33
Naphthalene	20
Toluene	46
Xylenes, Total	570

C4–SW–S	
Depth	14.5–15.0
COC	Value
1,2,4–TMB	4.7
1,3,5–TMB	1.5
Benzene	ND
Ethybenzene	0.98
n–Propylbenzene	0.40
Naphthalene	0.46
Toluene	0.24
Xylenes, Total	7

GENERAL NOTES

1. BASE MAP DEVELOPED FROM DRAWING TITLED "INJECTION WELL LOCATIONS AND ANTICIPATED ROI", PREPARED BY AEI CONSULTANTS, ORIGINAL SCALE 1"=16', DATED SEPTEMBER 15, 2023.
2. LOCATION OF WELLS ARE BASED ON SURVEY PREPARED BY AREK SURVEYING P.C., ORDERED BY GDI CONSTRUCTION LLC, DATED APRIL 28, 2023.
3. ONLY RI SOIL BORING/POST–EXCAVATION SAMPLE LOCATIONS WHICH RESULTED IN SOIL SAMPLE RESULTS IN EXCEEDANCE OF NYSDEC SOIL CLEANUP OBJECTIVE (SCOS) AT DEPTHS GREATER THAN OR EQUAL TO 15 FEET BGS ARE DEPICTED.
4. ALL SAMPLE DEPTHS ARE IN FEET BELOW GROUND SURFACE (BGS). CONCENTRATIONS ARE IN MILIGRAMS PER KILOGRAM (MG/KG).
5. ELEVATIONS ARE REFERENCED TO THE NORTH AMERICAN VERTICAL DATUM OF 1988 (NAVD88).

LEGEND

☐	APPROXIMATE SITE BOUNDARY
🟥	COMPLETED EXCAVATION AREA TO 15 FT BGS
🟦	COMPLETED EXCAVATION AREA TO 6 FT BGS
⊕	APPROXIMATE POST–EXCAVATION SOIL SAMPLE LOCATION
● MW-1	APPROXIMATE PERMANENT MONITORING WELL LOCATION
⊗ IW-1	APPROXIMATE INJECTION WELL LOCATION
⊕	RI SOIL BORING LOCATION (FEBRUARY 2020)
○	MEDIUM VOLUME (15–FOOT ROI) INJECTION LOCATION
○	HIGH VOLUME (20–FOOT) ROI INJECTION LOCATION
– –	APPROXIMATE GROUNDWATER TREATMENT AREA BASED ON THE GROUNDWATER TREATMENT PLAN DATED OCTOBER 27, 2022

0 10 20 40
SCALE IN FEET

NO.	ISSUE/DESCRIPTION	BY	DATE

P.E. STAMP

PHILIP GERALD CLARK
16 088422

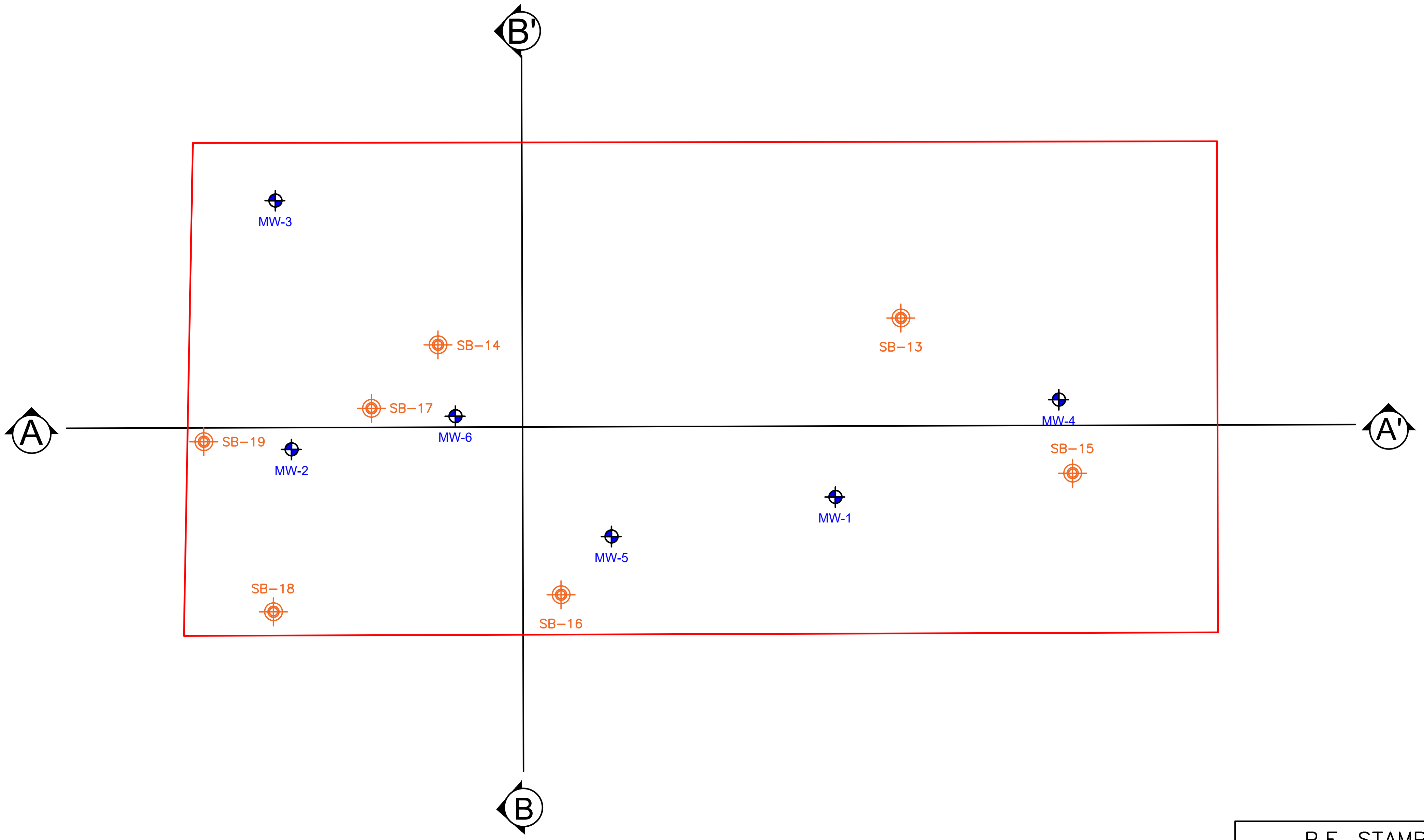
4778 BROADWAY
NEW YORK, NY 10034

INJECTION WELL AND ANTICIPATED ROI MAP

Appendix N

PREPARED FOR:
M4778 BROADWAY, LLC

PROJ MGR: ZL	REVIEWED BY: ZL	CHECKED BY: VW	FIGURE 8 SHEET NO.
DESIGNED BY: SG	DRAWN BY: SG	SCALE: 1"=20'	
DATE: March 2025	PROJECT NO. 41.0163310.10	REVISION NO.	

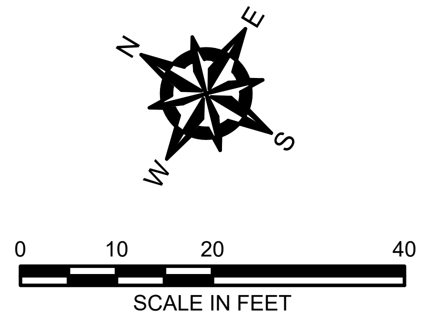


GENERAL NOTES

1. BASE MAP DEVELOPED FROM DRAWING TITLED "SAMPLE LOCATION MAP", PREPARED BY AEI CONSULTANTS, ORIGINAL SCALE 1"=16', DATED APRIL 13, 2020.
2. SEE FIGURES 12B AND 12C FOR SUBSURFACE PROFILES.
3. VERTICAL DATUM REFERENCED TO THE NORTH AMERICAN VERTICAL DATUM OF 1988 (NAVD88).

LEGEND

▭	APPROXIMATE SITE BOUNDARY
⊕ SB–13	APPROXIMATE RI SOIL BORING LOCATION (FEB 2020)
⊕ MW-1	APPROXIMATE RI MONITORING WELL LOCATION (FEB 2020)



NO.	ISSUE/DESCRIPTION	BY	DATE

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PHILIP GERALD CLARK
088422

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NEW YORK, NY 10034

SUBSURFACE PROFILE LAYOUT MAP - FEB 2020

Appendix N

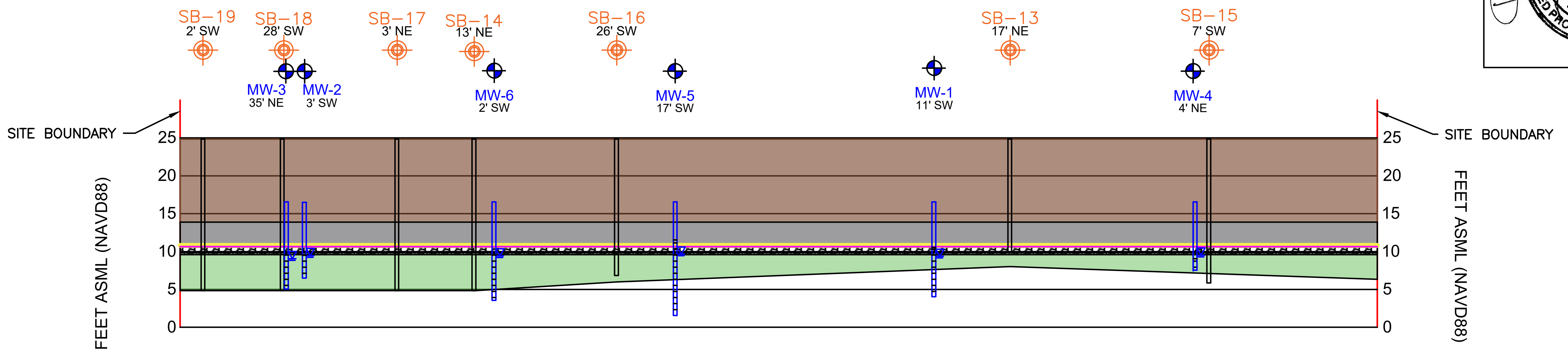
PREPARED FOR:
M4778 BROADWAY, LLC

PROJ MGR: ZL
REVIEWED BY: ZL
CHECKED BY: VW
DESIGNED BY: SG
DRAWN BY: SG
SCALE: 1"=20'
DATE: March 2025
PROJECT NO. 41.0163310.10
REVISION NO.
FIGURE 9A
SHEET NO.

GZA-J:\Active 163300 to 163399\163310.10 – M44778 Broadway Remedial Closure Consulting\Drawings\GZA CAD\41.0163310.10 SMP.dwg [F12A] March 24, 2025 – 10:13am Selia.Gupta

P.E. STAMP

PHILIP GERALD CLARK
16 088422



SUBSURFACE PROFILE A-A'

GENERAL NOTES

1. SEE FIGURE 12A FOR BORING/WELL LOCATIONS.
2. VERTICAL DATUM REFERENCED TO THE NORTH AMERICAN VERTICAL DATUM OF 1988 (NAVD88).
3. ASML – ABOVE MEAN SEA LEVEL.
4. THE STRATIFICATION LINES BETWEEN BORINGS ARE INTERPOLATED BETWEEN WIDELY SPACED EXPLORATION LOCATIONS AND THUS REPRESENT THE APPROXIMATE BOUNDARIES BETWEEN SOIL TYPES. ACTUAL TRANSITIONS MAY VARY FROM THOSE SHOWN.
5. REFER TO THE BORING LOGS FOR ADDITIONAL INFORMATION.
6. GROUND SURFACE ELEVATIONS ARE BASED ON SURVEY CONDUCTED BY AREK SURVEYING PC ON APRIL 28, 2023. THE PROJECT DATUM IS ESTABLISHED AT 24.85' NAVD88.

LEGEND

⌖ SB–19 — INDICATES SOIL BOREHOLE DESIGNATION
2' SW — INDICATES DISTANCE AND OFFSET DIRECTION FROM PROFILE LINE

⊕ MW-1 — INDICATES MONITORING WELL DESIGNATION
47' SE — INDICATES DISTANCE AND OFFSET DIRECTION FROM PROFILE LINE

▽ OBSERVED WATER TABLE BASED ON GROUNDWATER GAUGING PERFORMED IN JANUARY, 2025.

☰ 0.020" SLOTTED PVC SCREEN

▨ BUILDING FOOTPRINT

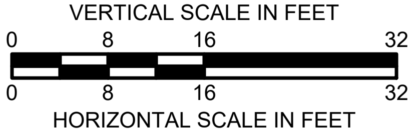
▨ CONCRETE SLAB

— MOISTURE BARRIER

— VAPOR BARRIER AND GEOTEXTILE

▨ STONE AND GEOTEXTILE

🟩 BROWN FINE SAND, TRACE SILT



NO.	ISSUE/DESCRIPTION	BY	DATE

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NEW YORK, NY 10034

SUBSURFACE PROFILE A-A'

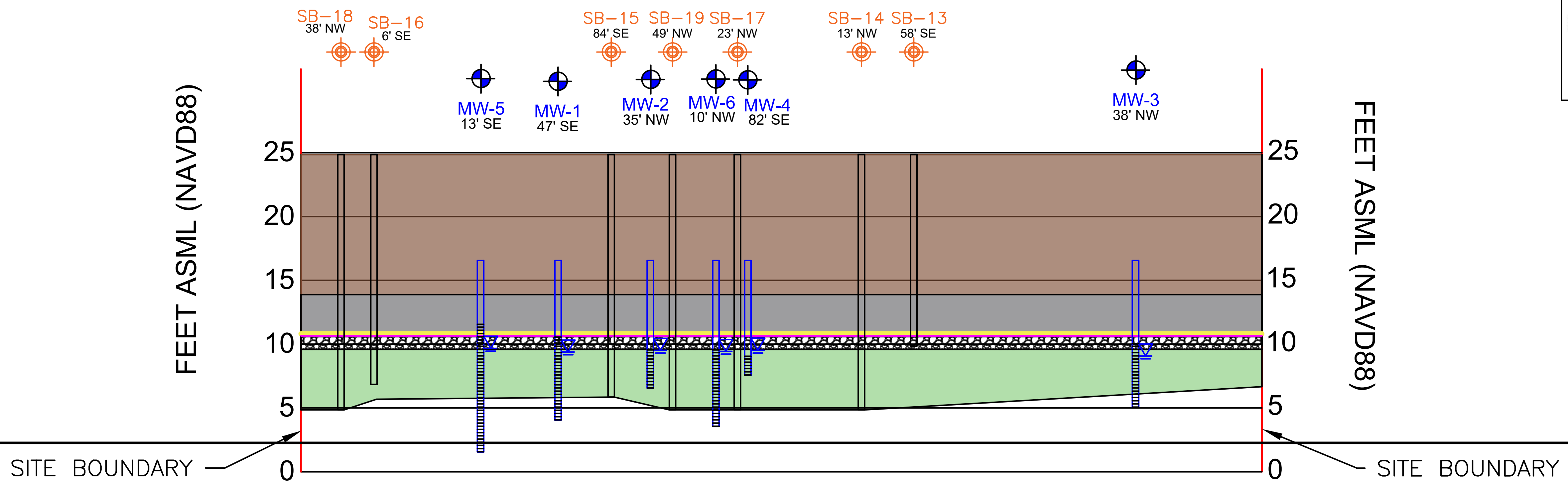
Appendix N

PREPARED FOR:
M4778 BROADWAY, LLC

PROJ MGR: ZL
REVIEWED BY: ZL
CHECKED BY: VW
DESIGNED BY: SG
DRAWN BY: SG
SCALE: 1"=20'
DATE: March 2025
PROJECT NO. 41.0163310.10
REVISION NO.
FIGURE 9B
SHEET NO.

P.E. STAMP

PHILIP GERALD CLARK
16 080422



SUBSURFACE PROFILE B-B'

VERTICAL SCALE IN FEET
0 5 10 20
0 5 10 20
HORIZONTAL SCALE IN FEET

GENERAL NOTES

1. SEE FIGURE 12A FOR BORING/WELL LOCATIONS.
2. VERTICAL DATUM REFERENCED TO THE NORTH AMERICAN VERTICAL DATUM OF 1988 (NAVD88).
3. ASML – ABOVE MEAN SEA LEVEL.
4. THE STRATIFICATION LINES BETWEEN BORINGS ARE INTERPOLATED BETWEEN WIDELY SPACED EXPLORATION LOCATIONS AND THUS REPRESENT THE APPROXIMATE BOUNDARIES BETWEEN SOIL TYPES. ACTUAL TRANSITIONS MAY VARY FROM THOSE SHOWN.
5. REFER TO THE BORING LOGS FOR ADDITIONAL INFORMATION.
6. GROUND SURFACE ELEVATIONS ARE BASED ON SURVEY CONDUCTED BY AREK SURVEYING PC ON APRIL 28, 2023. THE PROJECT DATUM IS ESTABLISHED AT 24.85' NAVD88.

LEGEND

⊕ SB–19 —— INDICATES SOIL BOREHOLE DESIGNATION
2' SW —— INDICATES DISTANCE AND OFFSET DIRECTION FROM PROFILE LINE

⊕ MW-1 —— INDICATES MONITORING WELL DESIGNATION
47' SE —— INDICATES DISTANCE AND OFFSET DIRECTION FROM PROFILE LINE

▽ OBSERVED WATER TABLE BASED ON GROUNDWATER GAUGING PERFORMED IN JANUARY, 2025.

☰ 0.020" SLOTTED PVC SCREEN

🟫 BUILDING FOOTPRINT

⬜ CONCRETE SLAB

— MOISTURE BARRIER

— VAPOR BARRIER AND GEOTEXTILE

▨ STONE AND GEOTEXTILE

🟩 BROWN FINE SAND, TRACE SILT

NO.	ISSUE/DESCRIPTION	BY	DATE

4778 BROADWAY
NEW YORK, NY 10034

SUBSURFACE PROFILE B-B'

Appendix N

PREPARED FOR:
M4778 BROADWAY, LLC

PROJ MGR: ZL
REVIEWED BY: ZL
CHECKED BY: VW
DESIGNED BY: SG
DRAWN BY: SG
SCALE: SEE SCALE
DATE: March 2025
PROJECT NO. 41.0163310.10
REVISION NO.
FIGURE 9C
SHEET NO.

GZA-J:\Active 163300 to 163399\163310.10 – M44778 Broadway Remedial Closure Consulting\Drawings\GZA CAD\41.0163310.10 SMP.dwg [F12C] March 24, 2025 – 12:30pm Selia.Gupta